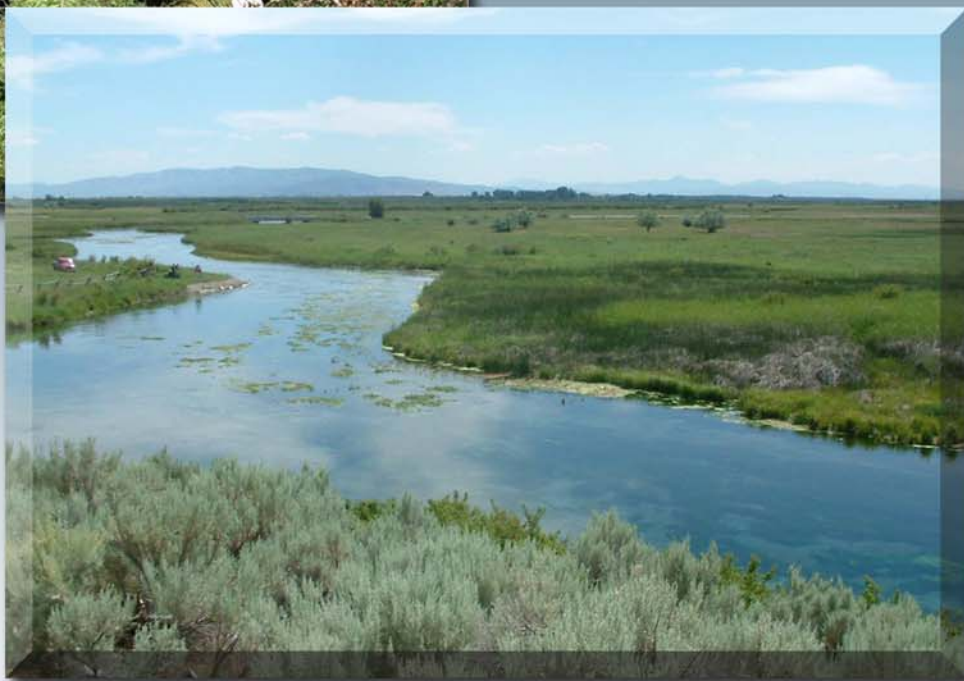


# Crystal Springs Fish Hatchery and Programs for Snake River Chinook Salmon and Yellowstone Cutthroat Trout

## Master Plan

*Volume 1: Master Plan*



*Prepared by*  
The Shoshone-Bannock Tribes  
Fort Hall, Idaho

March 2011

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**Crystal Springs Fish Hatchery and Programs for  
Snake River Chinook Salmon  
And Yellowstone Cutthroat Trout**

**Master Plan**

March 25, 2011

**Prepared by the Shoshone Bannock Tribes**

Fort Hall, Idaho

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## EXECUTIVE SUMMARY

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The Shoshone-Bannock Tribes (the Tribes) submit this Master Plan for the Crystal Springs Hatchery to the Northwest Power and Conservation Council to fulfill Step 1 of the Council's Step Review requirements for artificial propagation projects involving new construction and/or programs that will produce fish for reintroduction.

The Tribes have a long history of managing fish, wildlife and their habitat through a variety of government and Tribal funds; both within and outside the exterior boundaries of the Fort Hall Reservation. It is the obligation of the Tribes' Fish and Wildlife Department to protect, preserve and enhance fish, wildlife and their habitats in perpetuity for all Tribal members. This is pursued in partnership with a number of state and federal agencies to help achieve mutual resource goals and management objectives. Successfully implementing the proposed Crystal Springs Program will be achieved only by continuing this cooperation with agencies that include the Bonneville Power Administration, US Forest Service, Idaho Department of Fish and Game, US Fish and Wildlife Service, and NOAA-Fisheries.

The Crystal Springs program is designed to help restore two native fish species of cultural and economic significance to the Tribes: Chinook salmon (*Oncorhynchus tshawytscha*) and Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*). Restoration will occur in geographically distinct regions of Idaho. Chinook salmon produced at Crystal Springs Hatchery will be acclimated and released in the Yankee Fork and in Panther Creek, both tributaries to the upper Salmon River. Yellowstone cutthroat trout produced at Crystal Springs Hatchery will be released in various streams on or near the Fort Hall Reservation.

The proposed Chinook program is also designed to contribute to the recovery of the Snake River spring/summer Chinook Evolutionarily Significant Unit (ESU) by restoring a locally adapted hatchery and natural spawning population to the Yankee Fork and Panther Creek. While contributing to recovery is an important objective of the Tribes, regional efforts to recover the Major Population Group (MPG) have been largely directed at other systems in the upper Salmon. With other populations being the focus of species recovery, Yankee Fork and Panther Creek are suitable locations to establish populations that can support treaty-reserved tribal harvest, a very important Tribal program objective.

The Shoshone-Bannock Tribe's goal for its proposed Yellowstone cutthroat trout program at Crystal Springs Hatchery is to (1) conserve the Yellowstone cutthroat trout population on tribal lands, (2) increase the abundance and range of pure Yellowstone cutthroat trout, and (3) provide hatchery fish for tribal and non-tribal harvest, thereby reducing human impacts on this species. The program will implement a small-scale hatchery action to increase the distribution and abundance of Yellowstone cutthroat trout within a portion of the upper Snake River Basin. It is designed to produce fish that are as genetically and behaviorally similar to natural local populations as possible.

This Master Plan describes the proposed aquaculture programs and associated facilities for Snake River Chinook salmon and Yellowstone cutthroat trout. Although distinct biological requirements of each species necessitate some independent facility components, the Tribes believe that significant

efficiencies are possible by combining these programs through the use of shared facilities and operations. In summary, the proposed programs would:

- Develop hatchery facilities at the Crystal Springs site near the Fort Hall Reservation, with components that include process water systems, utilities, incubation facilities, rearing facilities, housing, administration and other support facilities, and effluent treatment facilities.
- Provide adult, trapping, holding and juvenile stress relief facilities at Yankee Fork and Panther Creek in the upper Salmon River subbasin

Implementing the proposed facilities and programs will enable the Shoshone-Bannock peoples to better meet their solemn obligation to protect, preserve and enhance native species of deep cultural significance to the Tribe.

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## ABBREVIATIONS AND ACRONYMS

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AHA	All “H” Analyzer
BKD	bacterial kidney disease
BLM	Bureau of Land Management
BPA	Bonneville Power Administration
CAFO	confined animal feeding operation
CFR	Code of Federal Regulations
cfs	cubic feet per second
C&S	ceremonial and subsistence (harvest)
CWT	Coded-wire tag
DPS	Distinct Population Segment
EA	Environmental Assessment
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ESU	Ecologically Significant Unit
fpp	Fish per pound
FWP	Columbia Basin Fish and Wildlife Program
HGMP	Hatchery Genetics Management Plan
HOR	Hatchery-origin
HOS	Hatchery-origin spawners
HSRG	Hatchery Scientific Review Group
ICTRT	Interior Columbia Technical Recovery Team
IDEQ	Idaho Department of Environmental Quality
IDFG	Idaho Department of Fish and Game
IDWR	Idaho Department of Water Resources
ISAB	Independent Scientific Advisory Board
ISRP	Independent Scientific Review Panel
LCFRB	Lower Columbia Fish Recovery Board
LSRCP	Lower Snake River Compensation Plan
M&E	Monitoring and evaluation
mm	millimeter
MOA	Memorandum of Agreement
MPG	Major Population Group

NEPA	National Environmental Policy Act
NOAA Fisheries	National Oceanic and Atmospheric Administration – Fisheries
NOR	Natural-origin
NOS	Natural-origin spawners
NPCC	Northwest Power and Conservation Council
ODFW	Oregon Department of Fish and Wildlife
pHOS	Proportion of hatchery fish present on the spawning grounds
PIT	Passive Integrated Transponder
PNI	Proportionate Natural Influence
pNOB	Proportion of Natural-origin Broodstock
RM	River mile
RME	Research, monitoring and evaluation
R/S	Recruit per spawner
SAR	Smolt-to-adult (SAR survival rate is measured from the point where a juvenile fish is released or captured to their return to the same point as an adult)
Tribes	Shoshone-Bannock Tribes
USFWS	U.S. Fish and Wildlife Service
USP	Upper Snake Province
VSP	Viable Salmon Population
YFCSS	Yankee Fork Chinook Supplementation Strategy

# 1. INTRODUCTION

---

The Shoshone-Bannock Tribes (the Tribes) are submitting this Master Plan for the Crystal Springs Hatchery to the Northwest Power and Conservation Council (NPCC or Council) to fulfill the Council's Step Review requirements for artificial propagation projects involving new construction and/or programs that will produce fish for reintroduction. The Bonneville Power Administration (BPA) funded preparation of this Master Plan through the Council's Columbia River Basin Fish and Wildlife Program (NPCC 2009) and the Fish Accords between BPA, the Tribes and Federal Columbia River Power System Action Agencies (2008).

The Crystal Springs program is designed to help restore two native fish species of cultural and economic significance to the Tribes, Chinook salmon (*Oncorhynchus tshawytscha*) and Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*). Restoration will occur in geographically distinct areas. Chinook salmon produced at Crystal Springs Hatchery will be acclimated and released in the Yankee Fork and in Panther Creek, both tributaries to the upper Salmon River. Yellowstone cutthroat trout produced at Crystal Springs Hatchery will be released in various streams on or near the Fort Hall Reservation.

The ancestors of the Shoshone and Bannock people now living on the Fort Hall Reservation ranged over great areas of what is now the inland northwestern United States and Canada, east into the Great Plains, and south and west into the Great Basin and Colorado Plateau. Tribal members are descendants from bands that were formerly based in the upper Snake River and Portneuf valleys, the Lemhi-Salmon River valleys, Boise and Payette River valleys.

Archaeological evidence shows that the entire Great Basin and Columbia Plateau supported established populations of hunter-gatherers. Typically, bands would form to take advantage of the various resource opportunities found in different areas, moving with the seasons. The bands of Shoshone and Bannock people named themselves after the principle food resources like the mountain-dwelling "*Tuka dika*" (sheep-eaters), "*Agai dika*" (salmon-eaters), "*kutshundika*" (buffalo-eaters) and "*Yambadika*" (root-eaters), and other bands. The various groups seem to have worked out of established camps they revisited year after year. Tribal oral history reiterates that ancestors of the Shoshone and Bannock peoples would base themselves in the Portneuf, Boise, Bruneau, Blackfoot, Lemhi, Weiser and Snake River Valley areas, wintering there and using it as a base for the remainder of the year while moving around a home range of hundreds or thousands of square miles with the season (Halliday and Chehak 1996).

The groups interacted with each other, through trading, intermarrying, and maintaining widespread family ties by extended visits. The Shoshone and Bannock languages are spoken throughout their aboriginal area and consequently there are many dialects of Shoshoni language. Nevertheless, all speakers of the Shoshoni language understand one another, creating a sense of community or nationhood that persists among the Shoshonean-speaking tribes and groups.

In the early 1700s, the Shoshone and Bannock ways of life were intensified by the presence of horses. Groups could travel farther, carry more weight and hunt more large game. Horses made it convenient to trade with plains, southwest, and coastal Indian tribes. Salmon fishing groups were able to trade for buffalo robes, elk and deer skins, while others traded buffalo meat or horses.

Tribal oral history and early written accounts indicate Shoshone and Bannock peoples were widely known, numerous, powerful and well-off.

Traditional harvesting methods are used to hunt fish, including spears, weirs, baskets and nets, with community and extended family groups moving to the waters where the salmon were running. The Snake River Basin was used extensively by the Shoshone and Bannock peoples to harvest anadromous fish resources during salmon runs.

After various treaty negotiations with the federal government and the Shoshone and Bannock peoples of Idaho, the Fort Hall Reservation was established by Executive Order on June 14, 1867. On July 3, 1868 the Fort Bridger Treaty affirmed the Reservation as a “permanent home” for the Shoshone and Bannock peoples for their “absolute and undeterred use and occupation.” In addition to affirming the Fort Hall Reservation as the permanent homeland for the Shoshone and Bannock people, the Treaty reserved rights including hunting, fishing, and gathering and services such as education and health care. Article IV of the Fort Bridger Treaty reserves the right to Tribal members to hunt and fish on “unoccupied lands of the United States.” Therefore, the Tribes’ interest in protecting, preserving, and enhancing fish and game resources extends far beyond Reservation boundaries. Today, descendants of the Lemhi, Boise Valley, Bruneau, Weiser and other bands of Shoshoni and Bannock reside on the Reservation and return to their aboriginal areas to exercise their treaty rights to hunt, fish, and gather on aboriginal lands. People today still fish where they have always fished, unless access is an issue or original sites have been inundated or blocked by hydroelectric operations. However, the salmon runs are harvestable in the upper Snake River drainage, particularly in the Salmon River subbasin.

One of the most basic powers of a sovereign people is the power to select their form of government. Pursuant to the 1868 Fort Bridger Treaty and the Indian Reorganization Act of 1934, the Shoshone-Bannock Tribes’ Constitution and Bylaws govern on and off Reservation treaty rights. The Constitution and Bylaws established the Tribe’s governing body – the Fort Hall Business Council – which acts as the Enterprise Board and oversees economic development on the Reservation. The formal Tribal government is divided into various departments to manage virtually every aspect of the Tribal business.

The Fort Hall Reservation, homeland of the Shoshone-Bannock Tribes, is located in the southeastern part of the State of Idaho. The ancestral lands of the Shoshone and Bannock people is known as “*Bia sogope*” and includes lands in the States of Montana, Idaho, Wyoming, Utah, Oregon, Washington, Nevada, California, south to the Plains and north into Canada. An 1867 Executive Order proclaimed 1.8 million acres for the Reservation; however in 1872, a survey error substantially reduced the original Reservation to 1.2 million acres.

The current Reservation occupies approximately 850 square miles (~544,000 acres) of land in parts of Bingham, Bannock, Power, and Caribou counties, Idaho. The Reservation is adjacent to Interstate 86 and Interstate 15 and the cities of Pocatello and Blackfoot are located on the southern and northern boundaries of the Reservation, respectively. The current Reservation boundaries have resulted from a series of cessations of the original boundaries. Ceded lands outside the current Reservation boundary include the communities of Lava Hot Springs, McCammon, Inkom, and Pocatello.

The Shoshone-Bannock Tribes have a long history of managing fish, wildlife and their habitat through a variety of government and Tribal funds; both within and outside the exterior boundaries of the Fort Hall Reservation. Both the Treaty signatories and subsequent Tribal leaders have recognized the significance of the right to procure subsistence resources from the unoccupied lands of the United States and the Fort Hall Indian Reservation; our permanent homeland. The Fish and Wildlife Department programs have been delegated the obligation to enhance those rights and the component resources on which they rely:

*The mission of the Shoshone-Bannock Tribes Fish & Wildlife Department is to protect, restore, and enhance, fish and wildlife related resources in accordance with the Tribes' unique interests and vested rights in such resources and their habitats, including the inherent, aboriginal and treaty protected rights of Tribes members to fair process and the priority rights to harvest pursuant to the Fort Bridger Treaty of July 3, 1868 (15 Stat . 673).*

Each of the Fish and Wildlife Department programs strive to implement projects that embody the overall policy directives of the Shoshone-Bannock Tribes. Effective fish and wildlife resource management requires dedication and adherence to sound ecological principles. The Tribes' Fish and Wildlife Department employ approximately forty full-time employees and up to sixty employees on a seasonal basis, who contribute to the respective objectives of the various fish and wildlife programs. In short, the Fish and Wildlife Department is charged with a solemn obligation to protect, preserve and enhance fish, wildlife and their habitats in perpetuity for all members of the Tribes; it is our belief that the proposed facilities will enable us to continue to meet that obligation for the future.

The Tribes' Fish and Wildlife Department has partnered with a number of federal agencies to help meet mutual goals and management objectives. As with a number of projects, success of the Crystal Springs Project will be achieved through close coordination with cooperating agencies like the Forest Service, Idaho Department of Fish and Game, US Fish and Wildlife Service, and NOAA-Fisheries. The Tribes' Fish and Wildlife Department also administers on the ground programs for the benefit of resident fish, big game, waterfowl, anadromous fish and their respective habitats. In addition to these daily program activities, the Fish and Wildlife Department administers several revenue programs that permit hunting and fishing on-reservation for members of the general public.

The proposed Chinook program is designed to contribute to the recovery of the Snake River spring/summer Chinook Evolutionarily Significant Unit (ESU) by restoring a locally adapted hatchery and natural spawning population to the Yankee Fork and Panther Creek. Viability criteria were not identified for either stream by the Interior Columbia Technical Recovery Team (ICTRT) or the Hatchery Scientific Review Group (HSRG). While contributing to recovery is an important objective of the Tribes, efforts to recover the Major Population Group (MPG) have been largely directed at other systems in the upper Salmon. With other populations being the focus of species recovery, Yankee Fork and Panther Creek are suitable locations to establish populations that can support treaty-reserved tribal harvest. In addition to meeting Tribal cultural and harvest objectives, broodstock for each of these programs would be obtained from within the MPG, accelerating the process of local adaptation and contributing to recovery.

The successful restoration of Chinook will depend on the Tribes' proposed program as well as implementation of habitat improvements. Significant water quality improvement measures have been completed at some former mine sites in the Yankee Fork, and the Tribes are engaged in

restoration activities in the Yankee Fork to address habitat limiting factors. Collaboration is also ongoing with the Trustees of the Blackbird Mine Settlement Agreement (Blackbird Mine Site Consent Decree, 1995, Consolidated Case No. 83-4179(R), US District Court- District of Idaho) to help bring population and habitat restoration goals to fruition in Panther Creek. When fully implemented, such complementary efforts will restore conditions that could sustain healthy populations of fish and wildlife to these watersheds.

The Shoshone-Bannock Tribe's goal for its proposed Yellowstone cutthroat trout program at Crystal Springs Hatchery is to (1) conserve the Yellowstone cutthroat trout population on tribal lands, (2) increase the abundance and range of pure Yellowstone cutthroat trout, and (3) provide hatchery fish for tribal and non-tribal harvest, thereby reducing human impacts on this species. The program will implement small-scale hatchery actions to increase the distribution and abundance of Yellowstone cutthroat trout within a portion of the upper Snake River Basin. It is designed to produce fish that are as similar in genetics and behavior as natural local populations.

This Master Plan describes the proposed aquaculture programs and associated facilities for Snake River Chinook salmon and Yellowstone cutthroat trout. Although distinct biological requirements of each species necessitate some independent facility components, the Tribes believe that significant efficiencies are possible by combining these programs through the use of shared facilities and operations.

## **1.1 NORTHWEST POWER AND CONSERVATION COUNCIL'S THREE-STEP REVIEW**

The NPCC is directed by the Northwest Power Act of 1980 to develop a program to protect, mitigate and enhance the fish and wildlife that have been affected by the federal hydropower projects in the Columbia River Basin. To help accomplish this, the NPCC has incorporated a three step review into its evaluation of projects requesting implementation funding. The step review links environmental reviews and funding to specific phases of project development and planning.

In Step 1, a conceptual project plan is developed. This is considered the preliminary, or feasibility, stage and is important in identifying all major components and elements as well as showing the initial layout of components at the proposed site and/or within the proposed plan. Conceptual designs and associated cost estimates are expected to have a variance (contingency) of plus or minus 35 to 50%. The concept of the proposed project is described in a master plan (this document) that is submitted to the NPCC for review. Approval of a master plan by the NPCC is accompanied by a notice to proceed to Step 2.

In Step 2, the proposed project is further refined and is submitted for environmental review under the National Environmental Policy Act (NEPA) —usually an environmental impact statement (EIS) or environmental assessment (EA). Step 2 is also known as the “progress review phase” when any major difficulties in the design and program are identified. More details are presented to assure that the project is economically viable, financially responsible and meets the intent and scope of the previous decision. Expected variance in cost estimates from Step 2 design to final design is plus or minus 25 to 35%. At this stage, any changes to the proposed project between Steps 2 and 3 should be minor. Approval of this phase by the NPCC allows the project proponent to proceed with Step 3.

Step 3 is the detailed/final design phase. At this stage, a detailed design review has been carried out and cost assumptions developed that represent the best available estimate of construction costs for the project. Final designs are formulated for all facilities, with an expected variance of plus or minus 10 to 15%. The NEPA review is finalized in this stage. Program, research, and monitoring and evaluation costs are also presented as final estimates.

## **1.2 DOCUMENT OVERVIEW AND ORGANIZATION**

This Master Plan describes two distinct aquaculture programs that will utilize a single new hatchery facility. The proposed programs are described in two volumes: Volume 1 is the Master Plan and Volume 2 contains supporting appendix material.

In Volume 1, Section 2 summarizes the proposed spring/summer Chinook programs and the Yellowstone cutthroat trout program. The Chinook programs are intended to supplement/restore populations in two Salmon River subbasin watersheds (the Yankee Fork and Panther Creek), while the cutthroat trout program will occur within the upper Snake River subbasin. Section 3 describes the environmental and social context within the Salmon River subbasin, including the relationship of the Chinook programs to other aquaculture efforts and to the guidance of the Salmon River subbasin plan. Section 4 presents details of the Chinook salmon programs in the Yankee Fork and Panther Creek, including biological objectives, alternatives considered, conceptual designs of the Crystal Springs Hatchery, proposed monitoring and adaptive management concepts, and consistency with scientific principles. The Master Plan then transitions to the upper Snake River subbasin, with contextual information about the subbasin presented in Section 5 and details of the Yellowstone cutthroat trout program presented in Section 6. Conceptual level cost estimates for all programs are presented in Section 7. The proposed programs are summarized in Section 8.

In Volume 2, supporting information is presented in eight appendices.

- Appendix A- Draft Hatchery Genetic Management Plan for the Yankee Fork Chinook Salmon Supplementation Program
- Appendix B- Draft Hatchery Genetic Management Plan for the Panther Creek Spring Chinook Salmon Program
- Appendix C- Draft Hatchery Genetic Management Plan for the Upper Snake River Yellowstone Cutthroat Trout Program
- Appendix D- Bioprogramming Reports and Hatchery Operations Schedule. This appendix includes two technical memoranda: Biological Criteria for Spring Chinook and Biological Criteria for Yellowstone Cutthroat Trout.
- Appendix E- Crystal Springs Hatchery Site Water Supply Report, providing initial investigative results of the water quality and quantity at the hatchery site.
- Appendix F- Memorandum of Agreement between Shoshone-Bannock Tribes, BPA, Corps of Engineers and the Bureau of Reclamation. This agreement, commonly called the Fish Accords, recommends implementing key elements of the proposed programs.

- Appendix G- Preliminary Design Drawings. The first section of this appendix presents preliminary designs for the Crystal Springs Hatchery. The second section presents the proposed Yankee Fork and Panther Creek facilities.
- Appendix H- Detailed Program Cost Estimates. This information supplements Section 7 of the Master Plan.
- Appendix I- Letter of Support. The Blackbird Mine Trustee Council provided a letter indicating support of the Chinook program component proposed in Panther Creek.
- Appendix J- Genetic Analysis of Chinook Salmon in Panther Creek. In a report prepared by the US Fish and Wildlife Service, the genetic origins of Chinook currently found in Panther Creek are assessed.

## **2. OVERVIEW OF THE PROPOSED SHOSHONE-BANNOCK AQUACULTURE PROGRAMS**

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In this section, we summarize the proposed spring/summer Chinook and Yellowstone cutthroat trout programs; more detailed descriptions of the programs are presented in Sections 4 and 6, respectively.

### **2.1 SUMMARY OF THE PROPOSED SNAKE RIVER CHINOOK PROGRAMS**

#### **2.1.1 Vision for the Chinook Programs**

Historically, the Shoshone and Bannock peoples harvested salmon and trout throughout the Columbia River Basin for subsistence. Annual salmon and steelhead runs in what are now Oregon, Washington, Idaho and Nevada provided harvest opportunities throughout the year. The Shoshone-Bannock Tribes continue to harvest anadromous fish under rights reserved by the Fort Bridger Treaty of 1868. Tribal fishing methods include the culturally important technique where tribal fishers actually hunt Chinook salmon in the stream using spears. Maintaining this type of fishery is a high priority for the Tribe.

Fishing opportunities for the Tribes have been severely constrained by depressed runs of salmon caused in large part by the detrimental effects of hydroelectric development and early overfishing in the lower Columbia River. Current salmon abundance in the Upper Salmon River basin is estimated at about 0.5% of historical runs. Recent harvest opportunities for Tribal members have only provided half a pound of salmon per tribal member compared to historical use of about 700 pounds per person. The Shoshone/Bannock Tribes therefore, seek to restore fishing opportunities for their peoples through Chinook salmon management programs in the Yankee Fork Salmon River and in Panther Creek. Restoration of these ceremonial and subsistence fisheries would be accomplished in a manner compatible with recovery and long-term sustainability of Chinook salmon in the upper Salmon River basin.

The Chinook programs proposed through this Master Plan are designed to focus the Tribes' primary Chinook harvest in Yankee Fork and Panther Creek and to continue elements of the Yankee Fork Spring Chinook Supplementation Strategy (YFCSS) that was initiated in 2008. These locations and populations have been identified by the Interior Columbia Technical Review Team (ICTRT), the

Hatchery Scientific Review Group (HSRG), NOAA-Fisheries and fishery co-managers as lower priority for recovery and sustainability of the Snake River Spring/Summer Chinook ESU. By focusing hatchery and harvest effects within these two watersheds, traditional tribal fisheries and fishing methods could be restored while at the same time, contributions could be made to recovery by establishing locally adapted hatchery and natural spawning populations of Chinook salmon in watersheds not currently priority targets for species recovery.

In developing these management programs and Master Plan, the Tribes have adopted three objectives:

- **Conservation Objective:** Contribute to recovery of Snake River Spring/Summer Chinook ESU by restoring populations of local spring/summer Chinook in Yankee Fork and Panther Creek
- **Harvest Objective:** Achieve a tribal harvest of about 1,000 spring/summer Chinook from Yankee Fork and 800 Chinook from Panther Creek
- **Cultural Objective:** Ensure that Shoshone - Bannock peoples can harvest salmon in Yankee Fork and Panther Creek by their traditional hunting methods as well as contemporary methods.

The Tribes will continue working to improve habitat conditions in watersheds throughout the upper Salmon River subbasin and to advocate passage improvements at hydroelectric dams to improve productivity of Chinook populations in the headwaters. In the long term, the ongoing and proposed tribal and co-manager monitoring programs will allow the Shoshone-Bannock Tribes to adapt their management plans to provide greater conservation benefits should other populations in the MPG fail to achieve their recovery goals, and if ecosystem and biological conditions allow.

### **2.1.2 Yankee Fork Program Component**

Yankee Fork spring/summer Chinook are at an extremely high risk of extinction, prompting the Shoshone-Bannock Tribes to undertake a multi-phase program to support the population. The Tribes' have three primary objectives for this program described in Section 2.1. A three-phase program is proposed to meet these objectives, integral to which is construction of the Crystal Springs Hatchery to provide needed production capacity. In the first phase, colonization, surplus adults and 200,000 smolts from Sawtooth Hatchery will be released annually (this is reflected in the current YFCSS). When these Chinook return as adults, a percent will be collected as broodstock for rearing at the Crystal Springs Hatchery. Phase 2, local adaptation, will be triggered when approximately 1,000 Chinook return to the Yankee Fork, the estimated population level needed to meet broodstock and natural escapement goals. Use of Sawtooth broodstock will be eliminated in Phase 2 and all broodstock will be collected locally. Tribal harvest in the Yankee Fork will be 1 to 8 percent when runs are less than 500 adults; harvest in excess of that may occur when both broodstock and natural escapement goals are met. If natural productivity rates reach sufficient levels, Phase 3, an integrated harvest program, may be implemented if established triggers are met. The program will be transitioned into an integrated harvest program following the guidelines of the HSRG (2004). This program is described in greater detail in Section 4.1.1.

### **2.1.3 Panther Creek Program Component**

The spring/summer Chinook program proposed for Panther Creek will recolonize habitat that was severely compromised by mining activities in the subbasin. Over the last decade, significant habitat restoration activities have resulted in documented observations of stray Chinook and various other aquatic species in Panther Creek, signaling the timeliness of the Tribes' proposed program. Three objectives have been identified by the Tribes for Panther Creek that are listed in Section 2.1 above. Achieving these objectives will be two-phased and will require new facilities. The proposed Crystal Springs Hatchery will produce from 200,000 to 400,000 Chinook smolts for reintroduction into Panther Creek. Broodstock for this program component will be collected at a new weir and holding pond where they will be held and spawned, and the eggs transported to Crystal Springs Hatchery. Phase 1 of the program, recolonization, will begin by releasing 1,500 surplus hatchery adults (source to be determined during preliminary design) to spawn in Panther Creek. As their progeny return and become adapted to this watershed, a portion of the adults will be collected, spawned, reared at Crystal Springs (Phase 2), and progeny will then be released back into Panther Creek to resume a natural life cycle. All other adult and juvenile releases from non-local stocks will then cease. When sufficient numbers of Chinook return to achieve broodstock and natural escapement goals, a significant tribal harvest will be implemented in accordance with the Tribal Resource Management Plan framework, which currently provides for a minimal ceremonial harvest of 1%, or three fish. Further details about the Panther Creek program component are provided in Section 4.1.2.

The success of the Yankee Fork and Panther Creek Chinook programs in achieving conservation, harvest and cultural objectives will be quantified by implementing a monitoring and evaluation program (see Section 4.6).

## **2.2 SUMMARY OF THE PROPOSED YELLOWSTONE CUTTHROAT TROUT PROGRAM**

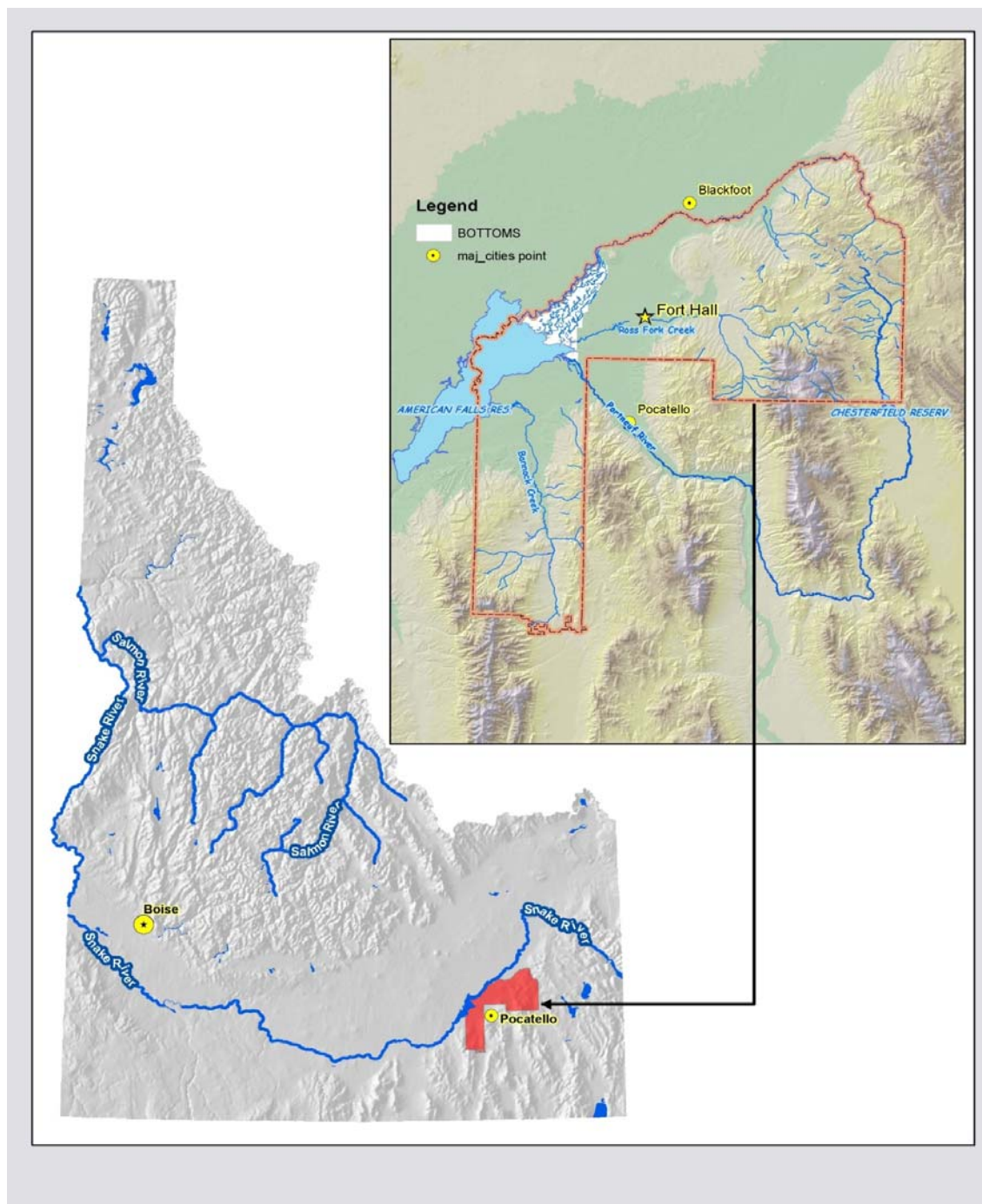
In contrast to the proposed Chinook salmon programs, the Yellowstone cutthroat trout program will be implemented entirely within and adjacent to the Fort Hall Reservation (Figure 2-1). The Shoshone-Bannock Tribes' vision for this program is to restore, enhance and protect this species that is of significant cultural importance to its members. The Yellowstone cutthroat trout program will target the Fort Hall Bottoms, a large wetland complex adjacent to the Snake River near its entrance to American Falls Reservoir (Figure 2-1), and the montane stream reaches within and adjacent to the Reservation. The Fort Hall Bottoms area provides an important fishery for both tribal and sport permit anglers.

The Shoshone-Bannock Tribes' goal for the Yellowstone cutthroat trout program is to (1) conserve the Yellowstone cutthroat trout population on tribal lands, (2) increase the abundance and range of pure Yellowstone cutthroat trout, and (3) provide hatchery fish for tribal and non-tribal harvest, thereby reducing human impacts on native components of the population.

The conservation objective of the program is to reintroduce genetically pure Yellowstone cutthroat trout into Spring Creek, a tributary to American Falls Reservoir (located on the Reservation), and in up to nine additional suitable tributaries located both on and off the Reservation (approximately 1,000 fry/fingerlings in each stream annually, totaling up to 10,000 fish) (see Table 6-1). This annual stocking, combined with continued habitat enhancement and annual monitoring, will contribute to

the success of the program over time and sustain this native species that is biologically adapted to these habitat conditions.

The harvest objective of the program is to produce 10,000 catchable-size Yellowstone cutthroat trout for harvest by tribal and non-tribal fishers who place a high value on this indigenous species. These fish would be released into streams designated for harvest.



**Figure 2-1. Fort Hall Reservation and location of Fort Hall Bottoms.**

Production needed to support this Yellowstone cutthroat trout restoration/supplementation program will occur at the Crystal Springs Hatchery. Genetically pure Yellowstone cutthroat trout strongholds will be identified from which donor stock will be collected (adults or juveniles)<sup>1</sup>. These donors will be reared in the hatchery until they are spawned and produce juvenile fish. The initial production goal is 10,000 fry/fingerlings for stocking in suitable streams both within and near the Fort Hall Reservation (primarily in the Fort Hall bottoms area). Collection of additional Yellowstone cutthroat trout will depend on the minimum number needed to sustain the brood (assumed to be several hundred fish). Captive hatchery brood will be replenished over time, i.e., older brood fish will be released into the wild and younger fish brought in to maintain the hatchery population and its genetic diversity.

Backwater from American Falls Reservoir transports hybrid trout onto Reservation waters. In order to expand the range of the existing population, suitable streams with very few or no Yellowstone cutthroat trout will be evaluated for potential fry/fingerling stocking. Weirs may be placed in locations that currently do not have hybrid populations (cutthroat–rainbow crosses) to prevent rainbow trout or hybrids from entering these areas.

The Tribes have expended considerable effort improving the habitat along the spring-fed streams in the Fort Hall Bottoms where reintroduction could occur. These efforts include streamside stabilization, grazing practice modifications, livestock fencing, enforcing fishing limitations, and other activities. In addition, the Tribes manage a very popular recreational fishery for Yellowstone cutthroat trout in the Fort Hall Bottoms, and issuing trout fishing licenses for non-tribal members is an important revenue source for the Tribe (see Section 6.1).

### **3. LOCAL AND REGIONAL CONTEXT FOR THE SALMON RIVER SUBBASIN PROGRAMS**

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Two distinct subbasins are associated with the proposed Crystal Springs Hatchery program, the upper Salmon River and the upper Snake River subbasins. Snake River spring/summer Chinook salmon would be collected from and released into the Yankee Fork and Panther Creek in the Upper Salmon subbasin. They would be incubated and reared at a new hatchery near American Falls Reservoir in the Upper Snake subbasin.

The Salmon River flows approximately 410 miles through central Idaho before joining the Snake River in lower Hells Canyon. Draining an area of 13,984 square miles, the Salmon River subbasin is one of the largest in the Columbia River (Figure 3-1). The Crystal Springs Hatchery is proposed to be constructed approximately 140 miles away in the upper Snake River subbasin, near Pingree, Idaho. This previously developed hatchery site is owned by the Bonneville Power Administration (BPA) and possesses a high quality artesian water supply suitable for fish culture.

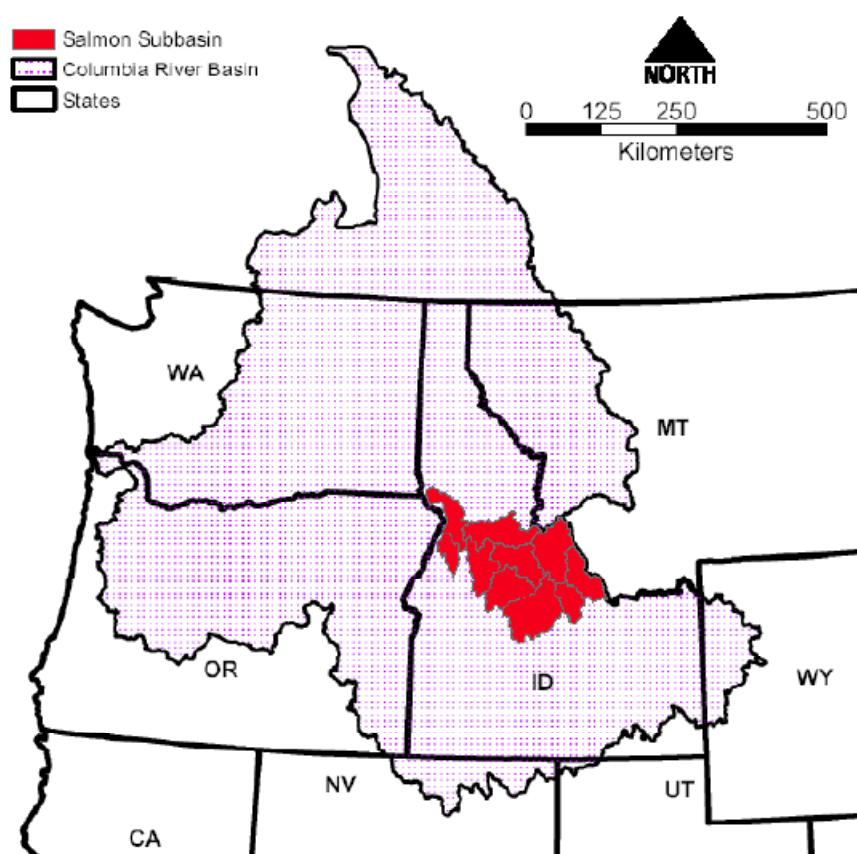
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<sup>1</sup> Currently, Ross Fork Creek, Mill Creek, and South Fork Ross Creek are known to support genetically pure Yellowstone cutthroat trout.

### 3.1 GEOGRAPHIC AND ENVIRONMENTAL CONTEXT

The Salmon River originates in the Sawtooth Mountains and flows 410 miles north and west to its confluence with the Snake River in lower Hells Canyon. The Salmon River is the largest tributary to the Snake River, and comprises 6% of the land area of the Columbia River Basin (Figure 3-1).

Public lands, including five wilderness areas, account for over 90% of the subbasin. These protected areas provide refuge for many species of fish and wildlife. Despite its small geographic contribution to the Columbia Basin, the Salmon subbasin provides more spawning area for anadromous fish than any other subbasin. To reach this habitat, a fish must travel over 800 miles and pass eight hydroelectric dams on the mainstem Columbia and lower Snake Rivers.



Source: Ecovista 2004

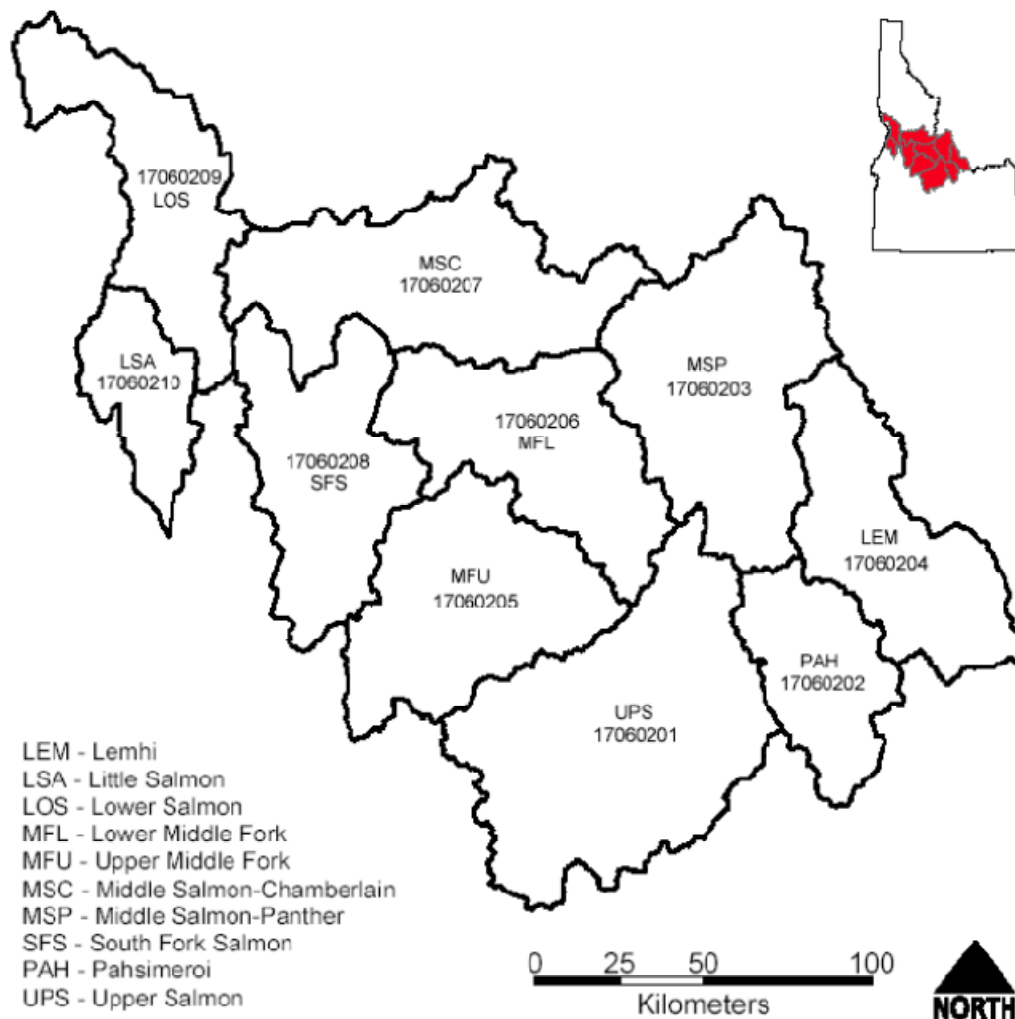
**Figure 3-1. Location of the Salmon subbasin within the Columbia River Basin.**

#### 3.1.1 Location

The Salmon River subbasin encompasses 10 watersheds in the northern Rocky Mountains of central Idaho. Most of the subbasin is characterized by moderate- to high-elevation mountain ranges and deeply cut valleys of the Salmon River Mountains. Elevations range from 12,661 feet on the summit of Mount Borah down to 2,165 feet at the mouth of the Salmon River.

The Upper Salmon watershed is the largest in the subbasin (Figure 3-2), draining an area of 1,550,777 acres. It contains 261 named streams, flowing 1,516 miles (IFWIS 2003). One of these is the Yankee Fork (Hydrologic Unit Code 17060201), which flows south 26 miles from its headwaters in the Challis National Forest (near Challis Creek Lakes, elevation 8,800 feet) to the Salmon River at River Mile (RM) 367.1 (elevation 6,000 feet). It has a drainage area of 195 square miles.

The Middle Salmon-Panther watershed (Hydrologic Unit Code 17060203) drains an area of 1,164,588 acres (Figure 3-2). It contains 136 named streams, flowing 1,205 miles (IFWIS 2003). The headwaters of Panther Creek originate near Morgan Creek Summit at an elevation of approximately 8,000 feet. From its headwaters, the creek flows in a north-northwesterly direction for 44 miles before entering the Salmon River at an elevation of approximately 3,200 feet.



Source: Ecovista 2004

**Figure 3-2. Major hydrologic units (watersheds) within the Salmon River subbasin.**

### 3.1.2 Climate

A broad gradient of climatic conditions occur in the Salmon River subbasin, from a prevalent Pacific maritime regime in the west, to a continental regime in the east. Cold winters and warm, dry summers characterize the Panther watershed. In the summer months, maximum average monthly temperatures reach the upper 80s°F, while in the winter months the minimum average temperatures can drop to less than 10°F (Table 3-1). Record temperatures have reached a high of 106°F in August and a low of -34°F in December (Idaho Climate Summaries 2005). The majority of annual precipitation occurs in May and June in the Panther watershed. The predominant form of precipitation occurs as snow with infrequent thunderstorms in the summer months. Annual precipitation averages 17.49 inches.

**Table 3-1. Average air temperature data for the Panther and Yankee Fork watersheds.**

Period	Average Maximum Temperature (°F)		Average Minimum Temperature (°F)	
	Panther Creek	Yankee Fork	Panther Creek	Yankee Fork
January	29.9	30.3	7.1	9.4
February	38.4	37.8	12.0	15.3
March	46.0	47.4	17.9	22.9
April	54.9	58.0	24.7	30.6
May	65.2	67.6	32.1	38.6
June	74.2	75.7	38.8	45.4
July	83.7	85.5	42.7	51.0
August	82.3	83.8	41.1	48.9
September	72.1	74.0	33.9	40.8
October	58.7	61.5	26.2	31.9
November	40.6	43.5	18.4	21.1
December	29.2	32.1	8.6	12.0
Annual	56.3	58.1	25.3	30.7

Source: Idaho Climate Summaries 2005.

Panther Creek and Yankee Fork values are based on data collected at Cobalt and Challis, respectively.

Record temperatures in Challis, Idaho, near the Yankee Fork, have reached as high as 103°F in July and August and as low as -34°F in December. Mean annual precipitation in the eastern portion of the Upper Salmon subbasin, including the Yankee Fork, is typically one-half the amount received in the west of the subbasin (Ecovista 2004). The Salmon River Mountains and the Sawtooth range create a rain-shadow effect, allowing only an occasional influx of moisture-laden winter air from the Pacific. The wettest months in the subbasin are May and June, with the driest months occurring during January through March (BLM 1998). Annual precipitation averages 7.40 inches.

Snowmelt patterns vary throughout the Salmon River basin and may cause significant runoff events in early spring through late summer. Snowmelt in the lower reaches of both Panther Creek and the Yankee Fork Salmon River begins in the early spring while snowmelt in the higher reaches occurs in early to mid-summer. The greater snow pack in the higher elevations causes larger stream flow discharge in the mid to late summer.

### 3.1.3 Geology, Soils and Land Types

Major alpine glacier systems formed several mountain ranges in the Salmon subbasin, including the broad U-shaped valleys that are prominent in the upstream portions of the Upper Salmon watershed. Also common throughout the subbasin are narrow, V-shaped valleys with steep side slopes and relatively narrow ridge systems.

Yankee Fork is located in the Lost River Valleys and Mountains Common Resource Area. This area is underlain by quartzite and carbonate-rich rocks (NRCS 2008). Highly erosive sand and clay-loam soils are typical. Gold was discovered in the area in the 1800s, 1930s and again in the 1950s, prompting settlements associated with various mining ventures. One of these ventures operated a large gold dredge from 1939 through 1942, and again from 1945 to 1954, completely re-channeling about six miles of the Yankee Fork from Jordan Creek to Pole Flats Campground, and the lower 1.5 miles of Jordan Creek and deposition of extensive unconsolidated dredge piles (Figure 3-3). This section of the river is wider and straighter than pre-dredging conditions, and the dredge piles remain sparsely vegetated, likely due to the lack of soil structure. The substrate has been severely altered and is now dominated by boulder and cobble with few spawning gravels. The historical floodplain can no longer be accessed and the natural riparian zone has been severely altered in the dredged reach of the Yankee Fork. Quality spawning habitat is still available in the upper reaches of the Yankee Fork and on the West Fork Yankee Fork.



**Figure 3-3. Dredge tailings adjacent to the Yankee Fork.**

Panther Creek is in the Southern Forested Mountain ecoregion of the Central Rocky Mountain Common Resource Area in the Idaho Batholith (NRCS 2008, McGrath et al 2002). This area is covered by droughty soils derived from granitic rocks. Geology in the Panther Creek watershed is

variable and patchy, with areas of Challis Volcanic and Precambrian Metaseds. There are numerous faults in the area related to the Trans Challis fault (SCNF 1993). Figure 3-4 shows a typical reach of Panther Creek.



Source: Don Ratliff

**Figure 3-4. Panther Creek.**

### **3.1.4 Hydrology**

The Salmon River subbasin is part of the Columbia River Basin hydrologic region. The only long term USGS gaging station in the vicinity of the Yankee Fork is on the Salmon River 63 miles upstream from the watershed outlet (Station 13296500, Salmon River below Yankee Fork near Clayton, ID). This gage measures runoff from 33% of the total subbasin drainage area (NRCS 2008). The average annual runoff is 707,100 acre-feet. A stream gage operated in the Yankee Fork for a relatively short period (1921-1949), near Clayton, Idaho (Station 13296000). In 2011 or 2012, a new gage is expected to be installed in Yankee Fork.

Flows in the Salmon River near its confluence with Panther Creek range between 2,000 and 17,000 cubic feet per second (cfs) measured near Shoup (IDEQ 2001). Panther Creek is the largest tributary in the Middle Salmon-Panther subbasin, contributing an average of 258 cfs, with a high flow of 3,000 cfs occurring every 10 years (Table 3-2). The Panther Creek watershed includes approximately 400 miles of perennial streams with flow patterns driven by snowmelt that peaks in May or June and is lowest in the fall and winter (SCNF 1993).

**Table 3-2. Flow statistics for Panther Creek, Yankee Fork and the Salmon River.**

Station Name	Station Number	Data Years	Average flow (cfs)	Minimum flow (cfs)	Maximum flow (cfs)
Salmon River at Salmon	13303500	1913-1916, 1919-1996	1,941	328	17,400
Panther Creek Near Shoup	13306500	1945-1978	258	22	2,850
Salmon River below Yankee Fork near Clayton, ID	13296500	1922-1992, 2000-2003	995	466	1,640

Sources: IDEQ 2001, IDEQ 2003

Stream flow regimes are typical of central Idaho mountain streams with peak flows in May or June from snowmelt. Daily peak flows usually occur during summer thunderstorms. Lowest flows are experienced in late summer through winter.

The majority of the Yankee Fork is classified as a Rosgen B-type channel (IDEQ 2003), described as sediment transport channels with a moderate gradient, sinuosity, width- to-depth ratio and entrenchment ratio. They occur in narrow, moderately sloping valleys and are dominated by riffles with occasional pools. Rosgen B-type channels usually have stable bottom material and are more dependent on riparian vegetation and large woody debris for stability.

Panther Creek and its tributaries are primarily Rosgen A-type channels (IDEQ 2001). A-type channels are referred to as sediment source channels and have high relief and are entrenched in steep mountain terrain. This type of channel has a low width-to-depth ratio and low sinuosity, with vertical pools and high debris flow potential. Many are intermittent and support little riparian vegetation.

### 3.1.5 Water Quality

The quality of the water in both the Yankee Fork and Panther Creek watersheds has been significantly affected by historic and contemporary mining activities. In both systems, remediation actions have improved conditions to a sufficient extent that measures to restore aquatic species are appropriate.

In the late 1930s, a large gold dredge was constructed on the Yankee Fork where it operated from 1939 through 1942, and again from 1945 through 1952. Approximately six miles of the mainstem Yankee Fork and the lower 1.5 miles of Jordan Creek were dredged, completely rechanneling these reaches of the Yankee Fork and depositing extensive unconsolidated dredge piles (see Figure 3-3). This section of the Yankee Fork is wider and straighter than it was prior to dredging. The substrate has been severely altered and is now dominated by boulder and cobble with few spawning gravels. The historic floodplain can no longer be accessed and as shown in the photo in Figure 3-3, the natural riparian zone has been severely altered.

In 1993, the Hecla Mining Company began construction of the Grouse Creek mine, three miles up Jordan Creek from the confluence with the Yankee Fork. This gold and silver mine began operating in 1994, but closed due to low metal prices in 1997, the same year it was placed on temporary suspension due to suspicion of toxic leakage. Operations were permanently suspended in 2000. The environmental impacts of this mine have been significant to both Jordan Creek and the Yankee

Fork. By the time Grouse Creek stopped operating in 1997, the mine had acquired over 250 water quality violations for toxic pollutants, including aluminum, copper, arsenic, selenium, silver, zinc, and cyanide. In 1999, concern over a release of cyanide and heavy metals from the Grouse Creek tailings impoundment, prompted the Forest Service to initiate a “time critical removal action” under the federal Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) program. In 2003, the Forest Service declared the mine site an “imminent and substantial endangerment.” Three remedial actions were identified: (1) capture and contain contaminants, (2) dewater tailings impoundment, and (3) reclaim and close the impoundment. Since then, contaminants have been captured and contained through a series of sumps and wells. Dewatering began in 2003, and by the end of 2007, approximately 1 billion gallons of water had been treated and discharged. Reclamation of the impoundment is expected to be completed by 2011.

Water quality in Panther Creek is highly influenced by the current and historical mining practices in the area. Since the 1800s, mining companies have extracted gold, copper, cobalt and other ores from Panther Creek and its tributaries. Since the early 1950s, activities at the Blackbird Mine (currently inactive) on a tributary to Panther Creek have resulted in extensive ground and surface water contamination by copper, cobalt and other heavy metals. These activities are blamed for the contamination of 26 miles of the Panther Creek watershed, which flows into the Salmon River. Another casualty was virtual elimination of the threatened spring/summer Chinook salmon from Panther Creek, which once provided viable spawning and rearing habitat.

In 1993, NOAA, the State of Idaho and the Forest Service collaborated on a Natural Resource Damage Assessment of the scope and scale of Blackbird Mine impacts. The assessment calculated that 200 adult Chinook salmon were no longer returning annually to Panther Creek due to the release of hazardous substances (this assessment factored in other sources contributing to the decline of anadromous fish populations). In 1994, EPA initiated a remedial investigation for site cleanup, after which a program was initiated to restore affected habitat and to compensate the public for mining impacts (see <http://www.darrp.noaa.gov/northwest/black/index.html>).

In 1998, Blackbird Creek (a major tributary to Panther Creek) was 303(d) listed for pH, metals, and sediment. Blackbird Creek also contains elevated levels of iron that may violate state water quality standards for toxic and deleterious substances (IDEQ 2001). Panther Creek downstream of Blackbird Creek was also 303(d) listed for metals in 1998. Since then, habitat conditions in Panther Creek have improved and now support natural reproduction and all life stages of anadromous and resident fish (EcoMetrix 2010).

### **3.1.6 Habitat and Biota**

#### **3.1.6.1 Fish**

The Salmon subbasin historically contained a number of native salmonids, including bull trout, westslope cutthroat trout, resident rainbow trout, mountain whitefish, Chinook salmon, and steelhead trout (Table 3-3). Spawning and rearing habitat supports steelhead trout, Chinook salmon, and sockeye salmon, although many of these populations have been in decline in the subbasin. Of the 26 native fish species found in the Salmon River subbasin, four salmonids are federally listed under the Endangered Species Act (ESA) (bull trout, spring/summer Chinook salmon, fall Chinook salmon, and steelhead trout) and one is listed as endangered (sockeye salmon). Other sensitive species in the subbasin include Pacific lamprey, redband trout, and westslope cutthroat trout. Several are described below.

**Table 3-3. Fish known to inhabit the Upper Salmon and Middle Salmon-Panther watersheds.**

Species	Origin <sup>a</sup>	Status <sup>b</sup>	Presence within Major Hydrologic Unit	
			UPSC <sup>c</sup>	MSP <sup>d</sup>
Arctic grayling ( <i>Thymallus arcticus</i> )	I	R	X	
Bridgelip sucker ( <i>Catostomus columbianus</i> )	N	C	X	X
Brook trout ( <i>Salvelinus fontinalis</i> )	I	O	X	X
Bull trout ( <i>Salvelinus confluentus</i> )	N	T	X	X
Chiselmouth ( <i>Acrocheilus alutaceus</i> )	N	C		X
Golden trout ( <i>Oncorhynchus aquabonita</i> )	I	R	X	
Kokanee salmon ( <i>Oncorhynchus nerka kennerlyi</i> )	I	O	X	
Lake trout ( <i>Salvelinus namaycush</i> )	I	R	X	
Largescale sucker ( <i>Catostomus macrocheilus</i> )	N	C	X	X
Leopard dace ( <i>Rhinichthys falcatus</i> )	N	U		X
Longnose dace ( <i>Rhinichthys cataractae dulcis</i> )	N	C	X	
Mottled sculpin ( <i>Cottus bairdi semiscaber</i> )	N	C	X	
Mountain sucker ( <i>Catostomus platyrhynchus</i> )	N	R	X	X
Mountain whitefish ( <i>Prosopium williamsoni</i> )	N	C	X	X
Northern pikeminnow ( <i>Ptychocheilus oregonensis</i> )	N	C	X	X
Pacific lamprey ( <i>Lampetra tridentate</i> )	N	S	X	X
Paiute sculpin ( <i>Cottus beldingi</i> )	N	U		X
Peamouth ( <i>Mylocheilus caurinus</i> )	N	U		X
Rainbow trout ( <i>Oncorhynchus mykiss</i> ) unknown origin	N	C	X	X
Rainbow x cutthroat trout hybrid	I	C	X	X
Redband trout ( <i>Oncorhynchus mykiss gibbsi</i> )	N	S	X	X
Redside shiner ( <i>Richardsonius balteatus balteatus</i> )	N	C	X	X
Shorthead sculpin ( <i>Cottus confusus</i> )	N	U	X	X
Smallmouth bass ( <i>Micropterus dolomieu</i> )	I	C		X
Sockeye ( <i>Oncorhynchus nerka</i> )	N	E	X	
Speckled dace ( <i>Rhinichthys osculus</i> )	N	C	X	X
Spring Chinook ( <i>Oncorhynchus tshawytscha</i> )	N	T	X	X
Summer Chinook ( <i>Oncorhynchus tshawytscha</i> )	N	T	X	X
Summer steelhead ( <i>Oncorhynchus mykiss</i> )	N	T	X	X
Torrent sculpin ( <i>Cottus rhotheus</i> )	N	C	X	X
Westslope cutthroat ( <i>Oncorhynchus clarki lewisii</i> )	N	S	X	X
White sturgeon ( <i>Acipenser transmontanus</i> )	N	O		X

<sup>a</sup>Origin: N = native, I = introduced

Source: Ecovista 2004

<sup>b</sup>Status: C = common, O = occasional, R = rare, S = sensitive, T = threatened, E = endangered, U = unknown.<sup>c</sup>UPS: Upper Salmon subbasin<sup>d</sup>Middle Salmon-Panther subbasin

### *Chinook Salmon*

Adult spring/summer Chinook salmon enter the Columbia River on their upstream spawning migration from February through March and arrive at their natal Salmon River tributaries from June through August. Spawning occurs in August and September. Juveniles exhibit a river-type life history strategy, rearing in their natal streams during their first summer before beginning their migration to the ocean in the following spring. After reaching the ocean as smolts, the fish typically rear two to three years in the ocean before beginning their migration back to freshwater (NOAA 2007).

Historically, it is estimated that thousands of spring/summer Chinook returned to the Yankee Fork. A number of factors led to their decline, and the population was classified as threatened in 1992. In response to the declining population, the Tribes implemented the Yankee Fork Chinook Salmon Supplementation Strategy (YFCSS) in 2006 with a goal of achieving long-term abundance of 2,000 returning adults. Abundance in recent years has been variable, ranging from 0 in 1995 to 1,935 adults in 2008 (Denny and Tardy 2010). Section 4.1.1 provides more information about the YFCSS and other programs in the Yankee Fork.

Chinook salmon in Panther Creek are classified as extirpated, but in recent years some use of Panther Creek and its tributaries has been documented. In their 2009 biomonitoring study in the Panther Creek watershed, EcoMetrix (2010) captured Chinook salmon fry at 13 sampling stations (located both upstream and downstream of the Blackbird Creek confluence). Chinook salmon fry densities were highest in the upper and upper-middle reaches of the stream (i.e., upstream and downstream of Blackbird Creek). Overall, EcoMetrix (2010) concluded these and other data collected from 2002 through 2009 supported the conclusion that Panther Creek now supports naturally reproducing Chinook salmon; however, these fish are likely of hatchery origin.

### *Steelhead/Rainbow Trout*

SNAKE RIVER steelhead, classified as threatened under the ESA, comprise two groups, an A- and a B-run, based on migration timing, ocean-age and adult size. A-run steelhead are thought to be predominately age-1-ocean, while B-run steelhead are thought to be predominately age-2-ocean. Steelhead enter fresh water from June to October and spawn the following spring from March to June. Emergence occurs early June to mid-July, depending on elevation. Snake River steelhead usually smolt at age-2 or age-3. Typically, steelhead reside in marine water for 1 to 3 years before returning to spawn (NOAA 2007).

Rainbow trout and steelhead were once widely distributed in the Salmon River subbasin; however the Panther Creek population of rainbows is low and somewhat limited, but is increasing with improvements in water quality. Wild steelhead still use tributary habitat in Panther Creek, including Owl and Clear creeks, for spawning (HSRG 2009- Panther Steelhead Pop report). In the Yankee Fork, steelhead have experienced a similar variable pattern as Chinook; however, rainbow trout are common and support a recreational fishery.

### *Sockeye Salmon*

The Snake River sockeye salmon ESU was listed as endangered 1991. The only extant sockeye population in the Snake River basin is in Redfish Lake. Historically, Alturas, Stanley, Pettit and Yellowbelly lakes may have supported independent populations. Significant programs to reintroduce sockeye have been undertaken for several years and are proposed to be expanded to

Pettit and Alturas lakes. Other lakes in the Snake River basin historically supported sockeye salmon populations, but are now considered extinct, including Wallowa Lake, Payette Lake, and Warm Lake (Waples et al. 1997).

Adult Snake River sockeye enter the Columbia River in June and July, migrate upstream through the Snake and Salmon rivers, and arrive at Redfish Lake in August and September. Spawning in lakeshore gravels peaks in October. Fry emerge in late April and May and move immediately into the open water of the lake where they feed for one to three years before migrating to the ocean. Snake River sockeye spend two to three years in the Pacific Ocean before returning to their natal lake to spawn.

Redfish Lake and other potential habitat for sockeye salmon are located upstream of the confluence of the Salmon River with both Panther Creek and Yankee Fork. Habitats in these watersheds are not used by sockeye salmon.

### *Bull Trout*

Bull trout are a species of char native to Nevada, Oregon, Idaho, Washington, Montana, and western Canada. Bull trout are patchily distributed at multiple spatial scales from river basin to local watershed, and individual stream reach levels. Due to widespread declines in abundance, bull trout were listed as threatened in Idaho in 1998, and listed throughout their range in the United States in 1999. On January 13, 2010, the USFWS proposed to revise its 2005 designation of critical habitat for bull trout, which includes a substantial portion of the Salmon River subbasin. A total of 5,045 stream miles are proposed as critical habitat in the Salmon River subbasin.

Yankee Fork and its tributaries have also been proposed as bull trout critical habitat (USFWS 2010a). Adult Chinook trapping conducted by the Shoshone-Bannock Tribes as part of the YFCSS program in 2008 resulted in the collection of 12 adult bull trout over an 11 week period. These fish ranged in size from 21 to 59 cm with an average length of 47.9 cm (Denny and Tardy 2010).

Panther Creek watershed has been proposed as a critical habitat for bull trout (USFWS 2010a). Most tributaries within the Panther Creek drainage contain bull trout. Exceptions include the lower Panther Creek below Deep Creek and Garden Creek.

### *Westslope Cutthroat Trout*

Westslope cutthroat trout have a known native range that includes the upper Missouri Basin downstream to Fort Benton, Montana, the headwaters of the Judith, Milk and Marias rivers, the upper Kootenay River above Libby, Montana, the entire Clark Fork drainage of Montana and Idaho, the Spokane River above Spokane Falls, and the Salmon and Clearwater drainages of Idaho.

Extensive introduction of hatchery-reared Yellowstone cutthroat trout has occurred in the range of westslope cutthroat trout, and hybridization has resulted. Widespread hybridization with introduced rainbow trout has also occurred (NatureServe 2010). This loss of genetic integrity, combined with degraded habitat, has led to a classification of “sensitive” for westslope cutthroat trout in Idaho. Globally, this species is “vulnerable” (NatureServe 2010).

Westslope cutthroat migrate upstream from lake and river habitats to spawn from March to July. Young typically spend 2 or 3 years in streams before migrating downstream to lake habitats. After 1

to 3 years in the lake, sexual maturation occurs, typically at age 4 or 5 and at lengths of 300 to 400 mm. An average maximum weight is about 1.5 kg.

### *Other Fish Species*

Other species present during IDFG fish surveys in Yankee Fork include whitefish, brook trout, redband trout, steelhead, and various species of sculpin (IFWIS 2010). For detailed life histories of other trout species found in the Salmon River, see Behnke (1992). For other freshwater species, see Scott and Crossman (1973).

Brook trout are found in the entire length of Panther Creek and some tributaries. Other species found in Panther Creek during IDFG fish surveys include longnose dace, whitefish, and various species of sculpin.

### **3.1.6.2 Wildlife**

The Salmon River subbasin supports a diversity of wildlife, including 389 vertebrate species, of which 32 are species of concern (Table 3-4). Federally listed species documented to occur in the Salmon subbasin are the Canada lynx, gray wolf, northern Idaho ground squirrel, and the bald eagle. Species of concern currently or historically in the area include the peregrine falcon, which was recently delisted, the grizzly bear, now extirpated from the subbasin, and the wolverine, which was petitioned for listing under the ESA. The greater sage grouse, pygmy rabbit, and yellow-billed cuckoo are all Candidate species present in the subbasin.

**Table 3-4. Documented occurrences of federally listed (Threatened or Endangered) and rare animals species within the Upper Salmon and Middle Salmon-Panther watersheds.**

Species/Guild	G-Rank/S-Rank <sup>a</sup>	Documented Occurrences	
		Upper Salmon	Middle Salmon/Panther
<i>Forest Carnivores</i>			
Fisher ( <i>Martes pennanti</i> )	G5/S1	3	3
Canada lynx ( <i>Lynx lynx</i> )	G5/S1/Threatened	26	19
North American wolverine ( <i>Gulo gulo luscus</i> )	G4T4/S2	39	10
<i>Small Mammals</i>			
California myotis ( <i>Myotis californicus</i> )	G5/S1?		2
Kit fox ( <i>Vulpes macrotis</i> )	G4/S1	1	
Long-eared myotis ( <i>Myotis evotis</i> )	G5/S3?	2	7
Long-legged myotis ( <i>Myotis volans</i> )	G5/S3?	2	7
Merriam's shrew ( <i>Sorex merriami</i> )	G5/S2?	1	
Pygmy rabbit ( <i>Brachylagus idahoensis</i> )	G4/S3	4	
Townsend's big-eared bat ( <i>Corynorhinus townsendii</i> )	G4/S2?		4
Western small-footed myotis ( <i>Myotis ciliolabrum</i> )	G5/S4?	2	10
Yuma myotis ( <i>Myotis yumanensis</i> )	G5/S3?	1	

Species/Guild	G-Rank/S-Rank <sup>a</sup>	Documented Occurrences	
		Upper Salmon	Middle Salmon/Panther
<i>Raptors</i>			
Bald eagle ( <i>Haliaeetus leucocephalus</i> )	G4/S3B,S4N	2	1
Northern goshawk ( <i>Accipiter gentilis</i> )	G5/S4	2	
Peregrine falcon ( <i>Falco peregrines anatum</i> )	G4/S1 Delisted 08/99	3	3
<i>Cavity Nesters</i>			
Black-backed woodpecker ( <i>Picoides arcticus</i> )	G5/S3	1	
Boreal owl ( <i>Aegolius funereus</i> )	G5/S2	1	3
Flammulated owl ( <i>Otus flammeolus</i> )	G4/S3B,SZN	1	13
Great gray owl ( <i>Strix nebulosa</i> )	G5/S3		1
Pygmy nuthatch ( <i>Sitta pygmaea</i> )	G5/S2S3	1	
Three-toed woodpecker ( <i>Picoides tridactylus</i> )	G5/S3?	5	
<i>Migratory Birds</i>			
Long-billed curlew ( <i>Numenius americanus</i> )	G5/S3B,SZN	1	
<i>Reptiles and Amphibians</i>			
Western toad ( <i>Bufo boreas</i> )	G4/S4	2	

<sup>a</sup> G-rank = global conservation ranking, S-rank = State conservation ranking.

Source: Ecovista 2004

### 3.1.6.3 Vegetation

Vegetation patterns vary with elevation throughout the Salmon subbasin, ranging from dry sagebrush/bunchgrass communities to typical western alpine flora. At lower elevations, steepness and aspect strongly influence the vegetation type.

South-facing exposures are typically bluebunch wheatgrass, curly-leafed mountain mahogany, rabbitbrush, and sagebrush in the Middle Salmon-Panther watershed. North-facing aspects can be timbered with ponderosa pine and Douglas fir as well as lodgepole and aspen or cottonwood. Throughout the watershed, lower elevation shrub-dominated communities are highly integrated with higher-elevation coniferous forest. There are no distinct lines between these two types of communities. High elevation forests in the Panther Creek watershed typically have Engelmann spruce, subalpine fir, whitebark pine, and limber pine (Table 3-5). Lodgepole pine gives way to Douglas fir at lower portions of the forest (IDEQ 2001). The alpine zone starts at elevations ranging from 9,500 to 10,000 feet. Open alpine meadows typically contain sedges, tufted hairgrass, bluegrass, American bistort, groundsel, fleabane, and geranium.

The dominant forest vegetation in the Upper Salmon watershed includes lodgepole pine/subalpine fir mix (USDA FS/BLM 1998). Abundance varies with elevation, with whitebark pine more locally abundant at higher elevations. Other conifers include limber pine and Engelmann Spruce (BLM 1998). Stands of Douglas fir become abundant at lower elevations, with almost pure stands on northerly aspects. Rocky Mountain juniper, limber pine, quaking aspen, and black cottonwoods are common in low elevation woodlands.

**Table 3-5. Estimated percentage composition of current vegetation cover types (more than 10% of basin) within the Upper Salmon and Middle Salmon-Panther watersheds.**

Current Vegetation Cover Type	Percent in Watershed	
	Upper Salmon	Middle Salmon-Panther
Basin and Wyoming big sagebrush	13	19
Douglas fir	8	29
Lodgepole pine	13	19
Mixed subalpine forest	13	8
Mountain big sagebrush	12	2
Subalpine pine	13	4

Source: Scott et al 2002.

## 3.2 SOCIOECONOMIC CONTEXT

### 3.2.1 Upper Salmon Watershed

The Upper Salmon Watershed lies within Custer County (population 4,077 in 2005). The largest community within the subbasin is the town of Challis, with a population of 853 in 2004 (IDC 2010). Challis is also the closest community to the Yankee Fork. Custer County ranks 38th among Idaho counties in population and third in area. The federal government owns over 93% of the county. Public lands are shared by the Sawtooth National Recreation Area (35%), the Salmon-Challis National Forest (34%), the Bureau of Land Management (BLM) Challis Resource Area (24%), and the State of Idaho (2%) (IDEQ 2003).

Mining and agriculture are the major industries, with trade, services and government providing the largest employment opportunities. Historically, cattle ranching, logging and mining have played important economic roles in the area economy. In the 1990s, a gold and silver mine operated on Jordan Creek, a tributary to Yankee Fork. After four years, it was temporarily closed due to low metal prices, and permanently closed in 2000 by the EPA after leaching hazardous chemicals into the environment. Today, very few mines operate in the subbasin and cattle ranching is the dominant economic activity. The number of farms in the county has increased from 1992 to 2002, but the average size decreased from 527 acres to 462 acres (IDC 2010). Grazing pressure has remained relatively constant for over 40 years, shifting over time from sheep to cattle. The effects of mining are highly apparent in six miles of the Yankee Fork where a gold dredge operated from the 1940s through 1952. This dredging reconstructed the main channel of the Yankee Fork and modified the channel substrate (see Section 3.1.5).

Recreation and tourism are important to the area. Both Stanley and Challis rely heavily on seasonal recreation. Activities such as whitewater rafting, boating, fishing, hunting, hiking, and camping are popular attractions. The area's geographic features, including Hells Canyon, Redfish Lake, and Borah Peak (the highest point in Idaho) also draw tourists to the region. Recreational pursuits include fishing, hunting, hiking, horseback riding, camping, backpacking, mountain biking, rock climbing, all

terrain vehicle use, and river rafting. Competition for limited recreational resources between different uses within this subbasin is also increasing.

### **3.2.2 Middle Salmon-Panther Watershed**

The Middle Salmon-Panther watershed is in Lemhi County (population 7,930 in 2006). The largest community is Salmon, with a population of 3,059 in 2006 (IDC 2010). Lemhi County ranks 31st among Idaho counties in population and 4th in area. Over 91% of the county is federally owned, largely in the Challis National Forest. Eight percent of the county is privately held, and State lands, split between endowment land and Idaho Department of Fish and Game land, make up the final 1% (IDC 2010).

Retail trade, farming, and construction are major industries in Lemhi County, with state and local governments the largest employers. Cattle ranching and tourism are significant industries in the county, and to a lesser extent, so are mining and forest products manufacturing. Historically, mining was a dominant economic activity. Today, mining has declined in the county, but disturbances related to mining operations still exist. Mines on Blackbird Creek, a tributary to Panther Creek, have operated since the late 1800s. Cobalt, silver and copper ore were extracted from underground and open pit operations. Contaminated soil, sediments and tailings were released from the mine site during high water flows and may continue today. Cleanup of the Blackbird Mine site is currently underway.

The town of Salmon serves as the whitewater recreation capital of the world. Rafters and kayakers launch trips here on the “River of No Return” Salmon River. Activities such as fishing, hunting, hiking, and camping are also popular attractions.

## **3.3 RELATIONSHIP OF THE CHINOOK PROGRAM TO SALMON RIVER SUBBASIN PLAN AND RECOVERY PLANS**

### **3.3.1 Salmon Subbasin Plan**

The Salmon Subbasin Plan (Ecovista 2004) was developed as part of the NPCC’s Columbia River Basin Fish and Wildlife Program to help direct BPA’s funding of projects in the Salmon subbasin that mitigate for damage to fish and wildlife caused by the development and operations of the Columbia River hydropower system. The overall vision for the subbasin plan is:

*“...a productive and sustainable ecosystem that is resilient to natural and human disturbance, with diverse, native aquatic and terrestrial species, which will support long-term sustainable resource-based activities and harvest goals, while managing the impacts and needs of a growing human population.”*

The plan’s guiding principles include:

- Respect, recognize, and honor all legal rights, legal authorities, jurisdictions and reserved treaty rights, including private property rights, while recognizing local culture and custom.

- Protect, enhance, and restore habitats to sustain and recover native aquatic and terrestrial species diversity and abundance with emphasis on the recovery and delisting of Endangered Species Act listed species.
- Foster ecosystem stewardship of natural resources, recognizing all components of the ecosystem, including the human component.
- Provide opportunities for local natural resource-based economies to coexist and participate in recovery of aquatic and terrestrial species.
- Promote and enhance local participation in, and contribution to, information and education, natural resource problem solving, and subbasin wide conservation efforts to promote understanding and appreciation of healthy and properly functioning ecosystems.
- Identify and prioritize opportunities to utilize resources to implement the Salmon Subbasin Plan, Pacific Northwest Electric Power Planning and Conservation Act, and local, state, federal, and tribal programs.
- Develop a scientific foundation to diagnose ecosystem problems, design, prioritize, monitor, and evaluate management to better achieve Plan objectives.
- Enhance species populations to healthy levels that support tribal treaty and public harvest goals.

The phased approach (strategies) outlined in the Yankee Fork and Panther Creek Chinook hatchery program (and the associated monitoring activities) would contribute to meeting a number of the biological objectives outlined in the Salmon Subbasin Plan. Specifically, the Chinook hatchery program would be consistent with the following:

Aquatic Objective 1A: Increase the number of naturally spawning adults to achieve recovery goals within 24 years (a timeline consistent with the NPCC's Fish and Wildlife Program) (see Table 3-6). This should amount to 4 to 6% smolt to adult returns (SAR) for spring/summer Chinook, and a minimum of 3% for fall Chinook as measured at Lower Granite Dam and in the tributaries.

Aquatic Objective 1B: Achieve abundance goals for the Salmon subbasin (through application of artificial propagation programs) (defined in Table 3-6). Minimize short- and long-term genetic, ecological, and life history effects on wild populations.

Aquatic Objective 3A: Address data gaps necessary to measure freshwater survival and productivity.

Aquatic Objective 3C: Address data gaps necessary to measure progress towards delisting and full recovery as identified in Table 3-6.

As noted in the Salmon Subbasin Plan, achieving the adult return objectives identified in Table 3-6 will require using artificial production programs to meet harvest augmentation goals, to enhance natural production, and to reintroduce historically present species. Hatchery and genetic management plans (HGMPs) will be used as guidelines to minimize potential genetic, ecological, or life history effects of hatchery fish on wild/natural populations. Monitoring and evaluation efforts will determine program effectiveness, identify potential risks, and provide the information needed

to adaptively manage the program. This Master Plan describes how hatchery production will be used to help achieve these objectives.

**Table 3-6. Future anadromous adult return objectives for the Salmon subbasin.**

Species	Goals	Long-term Adult Return <sup>1</sup>	Natural Spawning Component	Hatchery Broodstock	Treaty and Non-treaty Harvest Component
Spring Chinook	Future	119,000-128,000	>36,400 <sup>2</sup>	4,110 <sup>3</sup>	94,000 <sup>4</sup>
Summer Chinook	Future	60,200-126,000	>36,400	2,050	112,000
Fall Chinook	Future	5,000	2,100 <sup>5</sup> -2,500 <sup>6</sup>	Undefined	Undefined

<sup>1</sup> Long-term return objectives are derived from management plans as described in Appendix D, Appendix Table 4 of the Salmon Subbasin Plan. This table does not imply consensus by all management agencies but gives direction to managers who must work out the rehabilitation and recovery of each species and population over time through implementation of the subbasin plan.

<sup>2</sup> NMFS interim abundance delisting criteria (spring and summer Chinook salmon combined; A and B run steelhead combined).

<sup>3</sup> Future broodstock needs would likely change as a result of negotiations within the US v. Oregon process. The value shown is projected if the Sawtooth Hatchery were to be at its original LSRCP production design.

<sup>4</sup> Goals from 1990 Salmon and Steelhead Production Plan

<sup>5</sup> Estimate based on fall Chinook salmon spawning habitat quantification in the lower Salmon River (Nez Perce Tribe data).

<sup>6</sup> NMFS interim abundance target for fall Chinook salmon in the mainstem Snake River.

Source: Adapted from NPCC 2004.

### 3.3.2 Snake River Spring/Summer Chinook Draft Recovery Plan

Broad goals identified in Idaho's draft Salmon Recovery Plan are to achieve the recovery of Snake River spring/summer Chinook, sockeye and steelhead resources, ultimately providing self-sustaining, harvestable salmon populations that no longer require the protection of the Endangered Species Act. The plan embraces state and tribal goals for salmon recovery, the federal government's treaty and trust obligations to Native American tribes, and NOAA's obligations under the Magnuson-Stevens Fisheries Conservation and Management Act to provide sustainable fisheries (<http://www.idahosalmonrecovery.net/pdfs/>). The proposed Chinook program objectives are consistent with this draft recovery plan.

### 3.3.3 2008 Columbia Basin Fish Accords (Shoshone-Bannock Tribes)

The proposed Crystal Springs Hatchery Chinook program is consistent with the 2008 Columbia Basin Fish Accords, Memorandum of Agreement between the Shoshone-Bannock Tribes and FCRPS Action Agencies (2008 Fish Accords)<sup>2</sup>. Specifically, in planning and developing the Crystal Springs Hatchery and programs to out-planting fish into natural habitats, the Tribes will pursue required reviews and approvals, including the NPCC's 3-Step Process and ISRP review, will obtain NOAA and/or USFWS

<sup>2</sup><http://www.salmonrecovery.gov/Files/BiologicalOpinions/ShoBan-AA%20MOA%20FINAL%20PACKAGE.pdf>

review and approval as needed, coordinate with other co-managers in the state including the IDFG, and obtain any needed concurrence through the U.S. v. Oregon process. Priorities for, and the magnitude of production objectives, will be established by this Master Planning process and feasibility assessments. This Master Plan is intended to fulfill Step 1 of the NPCC 3-step process.

As defined in the 2008 Fish Accords, the objectives for the Crystal Springs Hatchery are: to increase the population of Snake River Chinook salmon while preserving the unique genetic characteristics of the ESU; develop a locally adapted Chinook brood for the Upper Salmon River, Panther Creek and the East Fork Salmon River<sup>3</sup>; develop a locally adapted brood for Snake River steelhead<sup>4</sup>; and, rear genetically pure strains of Yellowstone cutthroat trout.

The benefits of this program are also consistent with the 2008 Fish Accords, as Crystal Springs Hatchery will produce Snake River Chinook salmon smolts for release in critical habitat; Snake River spring/summer Chinook for the Tribes' supplementation program; and Yellowstone cutthroat trout for on- and off-reservation populations in the Snake River subbasin. Crystal Springs production will make an important contribution to achieving viable threshold populations for recovery in the Salmon River subbasin.

### **3.3.4 2008 FCRPS Biological Opinion and Idaho Fish Accords**

The 2008 FCRPS Biological Opinion (NOAA 2008) and the Idaho Fish Accords call for the acquisition of suitable hatchery rearing space to produce between 500,000 and one million full-term smolts annually for release to Salmon River subbasin waters. The program proposed in this Master Plan would achieve this objective and therefore is consistent with these two documents.

### **3.3.5 Shoshone-Bannock Tribes' Fish and Wildlife Department Supplementation, Monitoring, and Evaluation Program**

The program is intended to identify populations at immediate risk of extinction and develop artificial propagation strategies designed to significantly increase adult abundance. Research, monitoring and evaluation are completed to assess benefits and risks associated with each strategy. The program currently includes four supplementation projects, but additional projects may be developed if other populations are at high risk of extinction. Following the guidance of the Tribes' existing monitoring and evaluation plan, each supplementation project is assessed so that operations can be adaptively managed to optimize hatchery and natural production, minimize ecological impacts, and sustain harvest. The program has been underway for a number of years through funding from a variety of sources, most recently the Lower Snake River Compensation Plan.

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<sup>3</sup> This program will not release fish to the East Fork.

<sup>4</sup> While the 2008 Fish Accords indicate that steelhead would be produced at Crystal Springs Hatchery, the Tribes' proposed program does not include a steelhead program.

The Tribes' supplementation programs accomplish or are consistent with: (1) the anadromous fish production agreements outlined in the 2008 – 2017 U.S. v. Oregon Management Agreement (U.S. v. Oregon 2008); (2) objectives of the LSRCP and Idaho Power Company mitigation; (3) Tribal use of the resources; (4) implementation of the Tribes' Columbia Basin Fish Accord; (5) mitigation requirements within the NPCC's Fish and Wildlife Program; (6) objectives and tasks outlined in the Salmon Subbasin Plan (Ecovista 2004); (7) recommendations of the draft Snake River Salmon and Steelhead Recovery Plan (NOAA Fisheries and Office of Species Conservation 2006); (8) HSRG recommendations; (9) the USFWS hatchery review team recommendations; (10) the NPCC's Draft Monitoring Evaluation Research and Reporting Plan; and (11) the NPCC's 2006 Research Plan.

### **3.3.6 Idaho Department of Fish and Game's Fisheries Management Plan: 2007-2012**

The IDFG Fisheries Management Plan identifies three primary objectives for the Yankee Fork: (1) preserve Chinook and steelhead by harvest closures; (2) maintain and improve habitat and water quality; and (3) improve resident and anadromous fisheries in the system (IDFG 2007). Species conservation is the management objective and accordingly, harvesting Chinook is closed to all but the Shoshone-Bannock peoples. IDFG also coordinates with the Tribes to improve fish habitat and water quality, and explore the use of artificial propagation to re-establish naturally spawning Chinook salmon.

The Shoshone-Bannock Tribes have met with IDFG on two occasions to discuss the proposed Chinook programs for Yankee Fork and Panther Creek. IDFG personnel have stated that the Chinook programs proposed herein are consistent with their 2007-2012 Fisheries Management Plan.

For Panther Creek, the IDFG plan includes planting Chinook to encourage restoration of natural anadromous fish populations and continued habitat rehabilitation measures to mitigate for mining effects.

### **3.3.7 Lower Snake River Compensation Plan**

This cooperative hatchery program was authorized by Congress in 1976 to return salmon and steelhead to the Snake River Basin. It is intended to mitigate the impacts of the Corps' lower Snake River dams through hatchery production and by funding monitoring and evaluation studies that are conducted by multiple organizations, including the Shoshone-Bannock Tribes. The Sawtooth Fish Hatchery is an important facility in this program. It supports the Upper Salmon River spring Chinook salmon mitigation program, designed to provide escapement of 19,445 adults after a harvest of 77,800 Chinook. In addition, the Upper Salmon River A-run steelhead mitigation program is conducted here to provide escapement of 25,260 adults after a harvest of 50,520 steelhead. The ongoing YFCSS uses 23.5% of smolt rearing space at Sawtooth Fish Hatchery. YFCSS spawning, incubation, and juvenile rearing also take place at Sawtooth. The steelhead program uses adult holding, spawning, and egg incubation space at Sawtooth. Production commitments for the Upper Salmon River Spring Chinook program and the Upper Salmon River steelhead program are prioritized over the Tribes' YFCSS program; hence production space is not reliably available for this program.

### **3.3.8 Shoshone-Bannock Tribes' Snake River Policy**

The Tribes stress the importance of initiating efforts to restore the Snake River system and affected unoccupied lands to a natural condition. Article IV of the Fort Bridger Treaty of July 3, 1868, reserved the right to hunt on the unoccupied lands of the United States and the Tribes work diligently to ensure the protection, preservation and enhancement of those rights for future generations. The Tribes' management policies generally allow support of federal proposals that will improve or restore resource conditions. The Shoshone-Bannock Tribes Policy for Management of the Snake River Basin Resources states:

*The Tribes will pursue, promote, and where necessary, initiate efforts to restore the Snake River systems and affected unoccupied lands to a natural condition. This includes the restoration of component resources to conditions which most closely represents the ecological features associated with a natural riverine ecosystem. In addition, the Tribes will work to ensure the protection, preservation, and where appropriate-the enhancement of Rights reserved by the Tribes under the Fort Bridger Treaty of 1868 and any inherent aboriginal rights.*

The Tribes' Snake River Policy guides its management of natural resources. Under this policy, the Fish and Wildlife Department crafted a diversified management strategy of programs to protect and enhance populations of salmon and steelhead, and reintroduce populations to historical areas. One of the program objectives is to increase abundance of salmon and steelhead populations to meet Tribal conservation and harvest objectives. Specifically, four projects are aimed at supplementing fish populations in the Salmon River subbasin: (1) Yankee Fork Chinook Salmon Supplementation Program; (2) Chinook Salmon Egg Incubation Program; (3) Steelhead Smolt Program; and (4) Steelhead Streamside Incubation Program.

## **3.4 SALMON RIVER SUBBASIN - LOCAL AND REGIONAL HABITAT MANAGEMENT CONTEXT**

### **3.4.1 Fish Management and Recovery**

Recovery of the threatened Snake River Spring and Summer Chinook ESU requires viability of all Major Population Groups (MPGs) within the ESU. Viability of an MPG requires that all extant populations be maintained, with a portion being viable. The ICTRT recommended that for the Upper Snake River Chinook MPG, five populations must meet viability criteria for recovery of the MPG. The ICTRT recommended that these populations be Lemhi River, Pahsimeroi River, East Fork Salmon River, Upper Salmon River and Valley Creek.

Yankee Fork and Panther Creek are two of nine populations in the Upper Salmon River MPG, although the Panther Creek population is considered extirpated. In developing recovery strategies, neither Yankee Fork nor Panther Creek populations were deemed necessary for MPG and ESU recovery. Likewise, neither population was recommended by the HSRG to be an integral part of a recovery strategy. With other populations being the focus of species recovery, Yankee Fork and Panther Creek become good locations to establish populations that can support treaty-reserved tribal harvest by properly using artificial propagation.

## 3.4.2 Habitat

### 3.4.2.1 Yankee Fork

The Yankee Fork, a tributary to the Salmon River, historically supported a robust population of spring Chinook salmon. Use by Chinook salmon has declined dramatically since the mid-1960s (ICTRT 2006). Other fish species present in the Yankee Fork and its tributaries include steelhead, bull trout (*Salvelinus confluentus*), cutthroat trout (*Oncorhynchus clarki*), mountain whitefish (*Prosopium williamsoni*), and short head sculpin (*Cottus confuses*) (Tardy 2009).

Instream mining activities aggravated the tenuous status of salmon and steelhead in the system. In particular, gold dredging completely re-channeled the lower reaches of the Yankee Fork and the deposited extensive unconsolidated spoil piles, eliminating or degrading spawning and rearing habitat. Other mining activities have had significant effects on aquatic habitat as well. Grouse Creek mine, an open pit gold-silver mine adjacent to Jordan Creek, a tributary to the lower Yankee Fork, was closed permanently in 2000 after chemicals leached into the environment. Cyanide leaked from the mine's tailings facility into Jordan Creek at toxicity levels lethal to fish and harmful to humans. Cyanide levels have decreased to nontoxic levels, but decontamination of the site is ongoing.

Chemicals and channel structure were identified as having both the highest influence on habitat, and also the highest priority to be addressed. Floodplains, pool to riffle ratios, and decreased levels of large wood were cited as factors influencing degraded channel conditions (NPCC 2004).

The Yankee Fork has a long but intermittent history of out-of-basin, out-of-MPG stockings. Since 1977 over 2.9 million fry, smolts or adult spring/summer Chinook have been planted in the Yankee Fork originating from the Rapid, Salmon and Pahsimeroi rivers. Genetic samples collected from juveniles in the Yankee Fork appear to most resemble Rapid River stock (from out of MPG and listed ESU) (Shoshone Bannock Tribes 2010).

The proposed Yankee Fork Chinook salmon program would be closely tied to the 2008 Columbia Basin Fish Accord's ESA Habitat/Rehabilitation Project in the Yankee Fork. The goal of the ESA Habitat Restoration Project is to inventory, assess, plan and implement necessary actions to improve connectivity to critical habitat, to provide adequate water quantity and quality, and restore native vegetation to riparian areas for all life stages of anadromous and resident fish in the Salmon River subbasin (Shoshone-Bannock Tribes 2007). In addition, the Tribes are proposing a large scale nutrient enhancement program to increase freshwater productivity and corresponding growth rates and survival of salmon and steelhead in the subbasin using salmon carcass analogs, or, if not available, inorganic nutrients.

The proposed Yankee Fork program would also be consistent with the Salmon Subbasin Management Plan (Ecovista 2004). The vision underpinning this plan is to implement measures that will maintain "a productive and sustainable ecosystem which is resilient to natural and human disturbance, with diverse, native aquatic and terrestrial species, which will support long-term sustainable resource based activities and harvest goals, while managing the impacts and needs of a growing human population". The proposed program is also consistent with IDFG's 2007-2012 Fisheries Management Plan to use artificial propagation for re-establishing naturally spawning Chinook.

### 3.4.2.2 Panther Creek

Historically, Panther Creek and its tributaries provided spawning and rearing habitat for Chinook salmon, steelhead, resident trout, and mountain whitefish. In the late 1940s and early 1950s, the Chinook salmon run began to decline dramatically following development of the Blackbird Mine. Eventually the run was extirpated from the system.

Studies conducted in the late 1960s and 1970s identified rainbow trout, brook trout, cutthroat trout, and mountain whitefish in Panther Creek system. Rainbow trout were found more frequently than any other fish species. No fish were found in Blackbird Creek or Big Deer Creek, and fewer fish were found in Panther Creek below the confluence with Blackbird Creek than above the confluence. More recent studies have documented that most major tributaries within the Panther Creek drainage contain bull trout, with the exception of lower Panther Creek below Deep Creek and Garden Creek. Brook trout were found in the entire length of Panther Creek and in Moyer and Woodtick creeks (NPCC 2004).

The major factor limiting aquatic biota in these streams is poor water quality resulting primarily from contaminants released from the Blackbird Mine site (i.e., copper, cobalt, and other heavy metals).<sup>5</sup> However, water quality in Panther Creek has reportedly improved in recent years. This is likely due in part to actions taken at the site to reduce the amounts of metals released into Blackbird Creek, such as isolating waste rock piles from the creek flow and diverting several discharges to a wastewater treatment plant. Many of these actions are being implemented as a result of the \$60 million Blackbird Mine Settlement Agreement between the Environmental Protection Agency (EPA) and three large current and former mining companies (Noranda Mining, M.A. Hanna Co., and the Alumet Corporation). It should be noted that mining is an ongoing activity in the watershed. For example, a new cobalt mine is proposed on Deer Creek, a tributary to Panther Creek.

Biomonitoring studies conducted in the watershed in 2009 (EcoMetrix 2010) revealed much improved conditions. The benthic macroinvertebrate community showed good density and diversity relative to the mid-1990s, with variations in the watershed attributable to water temperatures and habitat conditions rather than metal levels in the water. Juvenile Chinook density data indicates that Panther Creek supports a naturally reproducing population. Overall conclusions of this study are that conditions in Panther Creek have fully recovered relative to those before 1990. Fish communities show no differences in density, biomass, condition, and growth in response to drainage from the Blackbird Mine site, and Panther Creek now supports all life stages of resident and anadromous salmonids.

Spawning surveys conducted from 2005-2009 show some adult Chinook returning to and spawning in Panther Creek. Their origin is unknown but is assumed to be the result of previous reintroduction efforts using South Fork stock from McCall Fish Hatchery. Genetic samples are reportedly being

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<sup>5</sup>Panther Creek drainage downstream of and including Blackbird Creek has been affected by chemical contamination and is under a U.S. Environmental Protection Agency supervised cleanup. Concerns upstream of Blackbird Creek include altered riparian habitat, increased sediment, and fish passage barriers (NPCC 2004, p. 3-28).

analyzed. Results of this analysis will help the Tribes determine the appropriate stock to use in the Crystal Springs program. If genetic analysis shows a unique population is established in Panther Creek, it is possible to begin the restoration efforts using that population as broodstock.

Like the Yankee Fork Chinook program, the proposed Panther Creek Chinook program would be closely tied to the 2008 Columbia Basin Fish Accord's ESA Habitat/Rehabilitation Project and would also be consistent with the Salmon Subbasin Management Plan (Ecovista 2004) and IDFG's Fish Management Plan.

### **3.4.3 Hatchery Programs**

#### **3.4.3.1 Yankee Fork**

In response to the declining Chinook salmon population in Yankee Fork, in 2008 the Shoshone-Bannock Tribes implemented a Chinook Supplementation Project in the Yankee Fork (YFCSS) to increase the number of adults returning to that system. The decision to supplement Yankee Fork Chinook resulted from a number of factors including: (1) an immediate need to prevent local extirpation; (2) the importance of the area as a tribal subsistence fishery and the need to achieve the tribal harvest objective of 1,000 adults; (3) the importance of recovering this populations and achieving the conservation objective of 500 spawners annually<sup>6</sup>; (4) the long history of introductions of out-of-basin stocks; (5) the proximity of a donor hatchery that could provide broodstock (i.e., Sawtooth Hatchery) to support a supplementation effort; and (6) regional support for the project.

This program uses two approaches: planting of surplus adults and release of smolts. The program uses excess adults from Sawtooth Hatchery that are released to spawning grounds above the Five Mile weir. Between 1,438 and 1,578 surplus adults were released in 2008 and 2009, respectively; no releases were made in 2010 due to lack of surplus fish. For smolt production, weirs are installed in early July and broodstock are collected for transport to Sawtooth (if of hatchery origin) or the West Fork Yankee Fork (if natural). In 2009, 49 returning Chinook and the hatchery plants produced 440 redds. In 2010, only natural returns are expected as no surplus hatchery fish were released in 2007; some of the returning adults will be allowed upstream but most will be taken to the East Fork Salmon River facility for holding and spawning. Releases in 2010 included 400,000 smolts: 50% were held for 2 nights in the acclimation ponds and 50% were direct-released in Jordon Creek (above the gold dredge). In 2011, 400,000 Sawtooth smolts are again proposed for release into the Yankee Fork.

The proposed Yankee Fork Chinook program at Crystal Spring Hatchery would be consistent with the Tribes' existing supplementation project in the Yankee Fork (the YFCSS)(Tardy 2010) by providing a consistent source of locally adapted spring Chinook broodstock and juveniles and would ultimately:

- Contribute to recovery of the Snake River spring/summer Chinook ESU by restoring a local Maintained population (see Section 4.0) of local spring/summer Chinook in Yankee Fork.
- Achieve a Shoshone-Bannock tribal harvest of about 1,000 spring Chinook in Yankee Fork

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<sup>6</sup> This objective is modified under this plan to return 1,000 spawners to the Yankee Fork.

- Ensure that the Shoshone-Bannock harvest in Yankee Fork can be achieved by traditional hunting or contemporary methods

#### **3.4.3.2 Panther Creek**

Chinook production in Panther Creek is a priority to the Shoshone-Bannock Tribes. South Fork Salmon River stock has been used in past efforts to reintroduce Chinook salmon here; however, this stock is from outside the MPG (Panther Creek is included in the Upper Salmon spring/summer Chinook MPG). To initiate this proposed program, other stocks are being evaluated. For example, Pahsimeroi stock is within the MPG and may be available; however, transferring adults poses a risk of amplifying whirling disease (*M. cerebralis*) that occurs in the Pahsimeroi drainage. The presence or absence of whirling disease in Panther Creek is unknown and sampling is proposed during Step 2 planning to determine its presence.

Similar to the Yankee Fork Chinook program, the proposed Panther Creek Chinook program would:

- Contribute to recovery of the Snake River spring/summer Chinook ESU by reintroducing and restoring a Maintained localized population in Panther Creek
- Achieve Shoshone-Bannock tribal harvest goal of 800 spring/summer Chinook from Panther Creek
- Ensure that Shoshone-Bannock tribal harvest in Panther Creek can be achieved by traditional hunting and contemporary methods

#### **3.4.4 Hydropower**

The Yankee Fork is a traditional Chinook salmon fishing area reserved for Shoshone-Bannock Tribal members under the Fort Bridger Treaty of 1868. Over the years, tribal fishermen have witnessed a significant decline in the number of fish being harvested in the Yankee Fork as well as in Panther Creek, which has been closely linked to the decline in productivity (Tardy 2009). One significant contributing factor is the number of dams that smolts and returning adults must pass to complete their life cycle (Schaller et al. 1999; Deriso et al. 2001). The construction of Lower Monumental (1969), Ice Harbor (1962), Little Goose (1970), and Lower Granite (1974) dams on the Snake River, and Bonneville, Dalles, McNary, and John Day dams on the Columbia River, all served to reduce the number of adults returning to the Yankee Fork and Panther Creek and the number of smolts successfully migrating to the ocean.

Since the completion of the federal hydropower system, the Corps of Engineers constructed fish passage facilities at all dams, which has increased both upstream and downstream passage survival (NOAA Fisheries 2008). The Biological Opinion (NOAA 2008) for the FCRPS identified operational trade-offs with survival improvements and also noted that mortality rates vary by facility. The BiOp includes potential biological triggers for conservation measures if listed populations fail to reach benchmark population levels. System improvements will continue over time, but it is uncertain how successful they may be in continuing to reduce dam-related mortality on spring Chinook. The proposed hatchery program will help mitigate dam effects on populations by increasing the number of juvenile fish leaving the system.

### 3.4.5 Harvest

#### 3.4.5.1 Yankee Fork Harvest Plan

This program will contribute spring/summer Chinook to fisheries in the Columbia, Snake and Salmon rivers before the adults return to the Yankee Fork. Modeling the proposed program using the All-H Analyzer indicates that these lower basin fisheries should harvest an average of 200 Chinook, while terminal harvest by the Shoshone/Bannock Tribe could average about 1,000 Chinook. Abundance-based harvest level guidance for hatchery programs is provided by the Draft Shoshone-Bannock Tribal Resource Management Plan 2010 (Table 3-7). Yankee Fork and Panther Creek will be managed in a similar fashion. Estimates using AHA indicate that the total annual harvest of Yankee Fork program Chinook could range from 635 to 3,760 salmon. Terminal sport harvest is currently limited by IDFG to the mainstem Salmon River and is therefore not anticipated in Yankee Fork.

**Table 3-7. Harvest management framework for hatchery programs in the Salmon River basin.**

Hatchery Program	Broodstock Goal <sup>1</sup>	Percent of Goal	Forecast	Harvest Rate	Harvest
Rapid River	2500	0-29.9%	<748		3
		30-49.9%	749-1248	3%	22-37
		50-76.9%	1249-1873	5%	62-94
		75-107.9%	1874-2698	8%	150-216
		108-139.9%	2699-3498	35% <sup>2</sup>	217-496
		>140%	>3499	50% <sup>3</sup>	>497
South Fork/McCall	1360	0-29.9%	<407		3
		30-49.9%	408-679	3%	12-20
		50-74.9%	680-1019	5%	34-50
		75-107.9%	1020-1467	8%	82-117
		108-139.9%	1468-1903	35% <sup>2</sup>	118-270
		>140%	>1904	50% <sup>3</sup>	>271
Pahsimeroi	600	0-29.9%	<179		3
		30-49.9%	180-299	3%	5-9
		50-74.9%	300-449	5%	15-22
		75-107.9%	450-647	8%	36-52
		108-139.9%	648-839	35% <sup>2</sup>	53-119
		>140%	>840	50% <sup>3</sup>	>120
Sawtooth	700	0-29.9%	<209		3
		30-49.9%	210-349	3%	6-10
		50-74.9%	350-524	5%	18-26
		75-107.9%	525-755	8%	42-60
		108-139.9%	756-979	35% <sup>2</sup>	61-139
		>140%	>980	50% <sup>3</sup>	>140

Source: Shoshone-Bannock Tribes 2010a

1. Broodstock goals were developed by the Salmon River co-managers and incorporated in the 2008 Salmon River Annual Operating Plan.

2. The 35% harvest rate applies only to portion of return greater than 108% of viability abundance objectives. If R = return and E = viability abundance objective, then catch =  $0.08(1.08E) + (0.35(R-1.08E))$ .

3. When abundance reaches >140% of the broodstock goal, the Tribes may elect to harvest 50% of the available surplus. Available surplus is defined by the number of adults not needed to meet broodstock goals.

As prioritized by this program, Tribal harvest will be secondary to a hatchery broodstock objective of 120 to 358 adults (depending on the program phase) and a minimum natural escapement objective of 500 adults. The ceremonial and subsistence (C&S) harvest objective for Tribal members in the Yankee Fork is an average of 1,000 spring Chinook. In years when the abundance of Chinook returning to Yankee Fork is less than 500 adults (after collection of hatchery broodstock), Tribal C&S harvest will be minimal, ranging from 1% to 8% of returning adults in accordance with the Tribes' sliding-scale harvest framework in their draft Tribal Resource Management Plan. After Phase II of the program is implemented, Tribal fisheries will be managed to harvest Chinook in excess of hatchery broodstock and natural escapement objectives.

Following cultural practices of the Shoshone and Bannock peoples, most or all of the terminal harvest in Yankee Fork will be by individuals using traditional hunting or contemporary methods. Traditional fish hunting methods include spears, weirs, baskets and nets. Such harvest would occur throughout the watershed. In years with larger terminal run sizes, tribal communal harvest may also occur at the weir. Such a communal harvest will depend on progress in Chinook salmon recovery and future natural productivity rates of Chinook populations in the upper Salmon River. A communal selective fishing could be employed if the Yankee Fork population were to be managed as a Contributing population for conservation purposes.

The Tribal Resource Management Plan (Shoshone-Bannock Tribes 2010a) that guides tribal harvest will be updated during Phase II of the Yankee Fork program, adapting to key monitoring data, new scientific information and the progress in Chinook recovery and sustainability.

#### **3.4.5.2 Panther Creek Harvest Plan**

The proposed program will also contribute spring/summer Chinook to fisheries in the Columbia, Snake and Salmon rivers prior to their returning to the Panther Creek. Modeling the proposed program using the All-H Analyzer indicates that these lower basin fisheries should harvest an average of 100 Chinook, while terminal harvest by the Tribes should average 400 to 1,000 Chinook depending on management options. As estimated using AHA, total annual harvest of Panther Creek program Chinook could range from 300 to 3,600 salmon. Terminal sport harvest is currently limited by IDFG to the mainstem Salmon River. Sport harvest could be expanded into lower Panther Creek with this program.

Tribal harvest will be subject to a hatchery broodstock objective of 214 adults and a minimum natural escapement objective of 500 adults. The C&S objective for the Panther Creek program is an average annual tribal harvest of about 800 spring/summer Chinook in Panther Creek. In years when the abundance is less than 500 adults (after collection of hatchery broodstock), tribal C&S harvest will be minimal, ranging from 1% to 8% of returning adults in accordance with the sliding-scale harvest framework in the Tribal Resource Management Plan. After Phase III of the program is implemented, tribal fisheries will be managed to harvest Chinook in excess of hatchery broodstock and natural escapement objectives. Tribal harvest practices in Panther Creek will be the same as described above for the Yankee Fork, including the potential for communal harvest.

The Tribal Resource Management Plan (Shoshone-Bannock Tribes 2010a) will be updated during Phase III of the Panther Creek program, with harvest objectives adapted based on key monitoring data, new scientific information and the progress in Chinook recovery and sustainability throughout the MPG and ESU.

### 3.4.6 Climate Change

The following discussion of climate change in the Columbia River Basin is largely adapted from *Climate Change Impacts on Columbia River Basin Fish and Wildlife* (ISAB 2007).

Warming of the global climate is unequivocal. Evidence includes increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global mean sea level. Eleven of twelve years (1995 -2006) rank among the 12 warmest years since 1850. The linear warming trend over the last 50 years ( $0.13 \pm 0.03^{\circ}\text{C}$  per decade) is nearly twice that for the last 100 years.

Climate records show that the Pacific Northwest has warmed about  $1.0^{\circ}\text{C}$  since 1900, or about 50 percent more than the global average warming over the same period. The warming rate for the Pacific Northwest over the next century is projected to be in the range of  $0.1\text{-}0.6^{\circ}\text{C}/\text{decade}$ . Projected precipitation changes for the region are relatively modest and unlikely to be distinguishable from natural variability until late in the 21st century. Most models project long-term increases in winter precipitation and decreases in summer precipitation. The changes in temperature and precipitation will alter the snow pack, stream flow, and water quality in the Columbia Basin in the following ways:

- Warmer temperatures will result in more precipitation falling as rain rather than snow
- Snow pack will diminish, and stream flow timing will be altered
- Peak river flows will likely increase
- Water temperatures will continue to rise
- These changes will have a variety of impacts on aquatic and terrestrial habitats in the Columbia Basin.

The Great Northern landscape, which includes much of the Salmon River subbasin, has already undergone observable environmental and ecological changes. Habitat and species that are tied to climate-related parameters (e.g., snow depth, snow-melt hydrology, snow-dependent water balance) in montane watersheds may already be experiencing effects of a changing climate (USFWS 2010a).

Several projections of the potential impact of climate change on cool and cold water fishes have been completed. One of these analyses suggests that temperature increases alone will render 2 to 7 percent of current trout habitat in the Pacific Northwest unsuitable by 2030, 5 to 20 percent by 2060, and 8 to 33 percent by 2090. Salmon habitat may be more severely affected, in part because these fishes can only occupy areas below barriers and are thus restricted to lower and warmer elevations within the region. Salmon habitat loss would be most severe in Oregon and Idaho, potentially exceeding 40 percent by 2090. Loss of salmon habitat in Washington would be less severe, with the worst case predicted to be about 22 percent by 2090. These estimates do not consider the associated impact of changing hydrology.

Increased frequency and severity of flood flows during winter can affect over-wintering juvenile fish and incubating eggs in the streambed. Eggs of fall and winter spawning fish, including Chinook, coho, chum, and sockeye salmon and bull trout, may suffer higher levels of mortality when exposed to increased flood flows. Warmer winter water temperatures also could accelerate embryo development and cause premature emergence of fry. Bull trout require very cold, headwater streams for spawning; therefore, a warming climate may disproportionately impact this species.

Recent projections of the loss of habitat suitable for bull trout in the Columbia Basin as a result of climate warming range from 22 to 92 percent.

Changes in mainstem flows due to hydropower operations are substantially greater than the natural runoff changes projected to be caused by climate warming in the 21st century. However, water temperature increases in the mainstem may affect Columbia River salmon in several ways. Water temperature increases will accelerate the rate of fall Chinook egg development (mainstem spawners), and lead to earlier emergence at a smaller average size than historically. Smaller sized fry are likely to have lower survival due to increased vulnerability to predators.

Changes in freshwater flow into the Columbia River estuary caused by climate change will be less than those caused by the hydropower system. Nonetheless, some changes in estuary habitats may occur.

Scientific evidence also strongly suggests that global climate change is already altering marine ecosystems from the tropics to polar seas. Physical changes associated with warming include increases in ocean temperature, increased stratification of the water column, and changes in the intensity and timing of coastal upwelling. These changes will alter primary and secondary productivity, the structure of marine communities, and, in turn, the growth, productivity, survival, and migrations of salmonids. Changing ocean temperatures may also alter salmon behavior, distribution, and migrations, increasing the distance to migrations from their home streams to ocean feeding areas. If salmon migrate farther to the north and/or food is less available, longer times may be required to reach maturity, delaying the usual times of adult migrations into coastal water and rivers.

As climate and streams warm, tributary habitats will become increasingly important because they usually provide the cool waters for salmonids and other cool-water species in a watershed. Ongoing habitat restoration efforts in the Yankee Fork and Panther Creek are consistent with tributary habitat restoration measures recommended in ISAB (2007) and will help to offset many of the negative effects of future climate change (on a local scale). Habitat improvement projects in the Yankee Fork may improve the natural river channel characteristics, floodplain function, hydraulic and sediment regimes, habitat connectivity, and aquatic habitat within the dredged reach. Restoring the Yankee Fork to more natural conditions will create a healthy, functioning riparian community providing numerous benefits to fish and wildlife (including reduced water temperatures and improved habitat connectivity). Expected outcomes would benefit salmonids through a healthy, functioning floodplain and riparian community, an increase in spawning and rearing habitat for salmonids, an increase in instream habitat diversity, and upslope stabilization. Measures being implemented in Panther Creek are also expected to improve habitat conditions and habitat connectivity in a way that would help to off-set future adverse effects associated with global climate change. As a result of these ongoing measures, climate change effects are not likely to alter critical river flows or other habitat attributes in a way that could significantly affect the success of the proposed Crystal Springs Hatchery program.

### **3.4.7 Population Growth**

The following discussion of population growth in the Columbia River Basin is adapted from *Human Population Impacts on Columbia River Basin Fish and Wildlife* (ISAB 2007b).

Population is growing in the Columbia River Basin, increasing in all four Basin states and the Province of British Columbia. Regional population growth is projected to continue at least through 2030, although the rate of growth is expected to stabilize or decline. Some rural areas are experiencing rapid population growth, especially those with recreational and scenic amenities. Central Oregon illustrates these changes. Deschutes County is the fastest growing county in Oregon, and Bend was recently identified as the sixth fastest growing metropolitan area in the nation.

Population density has also changed significantly in the past several decades. The highest densities of people in the Columbia River Basin live west of the Cascade Mountains along the I-5 corridor, a pattern that persisted from 1970-2000. In this same period, population density increased in and around the major urban areas in the basin (Portland–Vancouver, Spokane and Boise). Even more significant to fish and wildlife have been the increases in population densities in central Oregon (Bend–Redmond area) and central Washington (Yakima-Kennewick-Pasco-Richland area).

Population growth increases demand for land, water, and hydroelectricity which in turn generates greater pressure on fish and wildlife. Human development requires water for residential, irrigation, waste water assimilation, recreational, commercial, and industrial uses. Continued population growth will increase demand for these uses and heighten competition for limited water supplies. The effect of increasing water demand will be exacerbated by the effect of climate change on the quantity and temperature of summer stream flows in many subbasins. Limited controls over groundwater leave it vulnerable to intensified use.

Freshwater withdrawals for domestic and public uses are projected to increase by 71 to 85 percent by 2050. In the Canadian portion of the Okanagan Basin, per-capita water use is among the highest in Canada. Freshwater withdrawals for irrigation are projected to decline but will be more than offset by increases in withdrawals for public, domestic, industrial, and commercial uses. These increases will have significant implications for instream flow and for maintenance of riparian and aquatic habitats for fish and wildlife.

Urban development causes marked changes in the physical, chemical, and ecological characteristics of stream ecosystems. In most cases, these changes are detrimental to native aquatic biota, including salmonids. Exurban development (low density, semi-rural residential) has been the dominant settlement trend in the West since 1970, with a high proportion of homes built in areas of productive soils and proximity to water. The rate of exurban development appears to be increasing. This type of development tends to result in degraded habitat for fish and wildlife through direct habitat conversion and loss, alteration of habitat near roads and buildings, and fragmentation of habitats and landscapes. Exurban development has led to decreased species diversity, decreased abundance and local extirpation of some species, as well as increased conflict between wildlife and people.

Population density within upper Salmon River subbasin is extremely low and is not likely to increase dramatically within the next 50 years. The largest community within the subbasin is the town of Challis, with a population of 853. Stanley is the next most populous community with 97 people (IDC 2010). Public lands account for 93 percent of the upper Salmon River subbasin, with management shared by the Sawtooth National Recreation Area (35%), the Salmon-Challis National Forest (34%), the Bureau of Land Management (BLM) Challis Resource Area (24%), and the State of Idaho (2%) (IDEQ 2003). These publicly managed areas provide refuge for many species of fish and wildlife. Consequently, any adverse effects on aquatic resources associated with population growth in the

upper Salmon River subbasin are expected to be extremely limited and unlikely to negatively affect the Crystal Springs Hatchery programs.

## 4. PROPOSED SNAKE RIVER CHINOOK PROGRAMS

The Yankee Fork and Panther Creek spring/summer Chinook programs are being designed to achieve the conservation and harvest goals described by the Shoshone-Bannock Tribes for each population. Conservation goals for these two populations are consistent with and supportive of those recommended for the MPG and ESU by the ICTRT and HSRG. The programs have been developed through an alternatives analysis using the All-H Analyzer (AHA) model developed by the Hatchery Scientific Review Group (HSRG). The AHA model incorporates available life cycle information on habitat, harvest, hatcheries, and hydropower, then uses this data to evaluate a series of management alternatives. These alternatives are, in essence, working hypotheses of how the natural and hatchery components of a salmon population will respond to various actions. Using the AHA tool, the Tribes have explored the implications of alternative ways of balancing habitat, harvest, hatcheries and hydropower constraints. From these alternatives, a preferred approach is selected for design and implementation. The alternatives developed for both programs are described below in Sections 4.4.1 and 4.4.2. The preferred alternative for each program is presented in this section of the Master Plan.

Throughout this section, population designations are used that are derived from the Interior Columbia Technical Review Team (ICTRT) and the Lower Columbia Fish Recovery Board (LCFRB). These designations influenced how goals for the proposed Chinook program were developed. The ICTRT identify viability criteria for healthy populations (and ESUs) based on the Viable Salmon Population parameters. These designations are (1) Highly Viable, (2) Viable, and (3) Maintained. A complete description of each can be found at the following link: [http://www.nwfsc.noaa.gov/trt/trt\\_documents/ictrt\\_viability\\_criteria\\_reviewdraft\\_2007\\_body.pdf](http://www.nwfsc.noaa.gov/trt/trt_documents/ictrt_viability_criteria_reviewdraft_2007_body.pdf). The designation that currently applies to Chinook populations in the Upper Salmon subbasin is Maintained, defined by the ICTRT as:

*“Populations not meeting viability standards should be Maintained with (a) sufficient productivity so the overall MPG productivity does not fall below replacement (i.e., these areas should not serve as significant population sinks), and (b) sufficient spatial structure and diversity is demonstrated by achieving Maintained standards.”*

The LCFRB developed similar designations to describe populations based on their relative contribution to recovery goals and objectives. These designations are (1) Primary, of highest importance to recovery; (2) Contributing, of moderate importance to recovery; and (3) Stabilizing, of low importance to recovery. The HSRG adopted these terms and applied them to its recommendations for broodstock management and acceptable levels of hatchery influence for all Columbia Basin populations (see [www.hatcheryreform.us](http://www.hatcheryreform.us)). In this analysis, a Stabilizing and a Maintained population are considered equivalent in importance to recovery of the ESU and in this document, the ICTRT terms will be used.

The ICTRT also designated populations based on historical abundance alone (Very Large, Large, Intermediate, and Basic). Yankee Fork Chinook are designated as a Basic population (minimum of

500 spawners). Panther Creek Chinook are designated as an Intermediate population (minimum of 750 spawners); however, due to its extirpation and uncertainty about recovery of the habitat, 500 spawners was deemed an appropriate goal. These values were used to establish minimum natural escapement goals for both programs.

## **4.1 DESCRIPTION OF PROPOSED PROGRAM**

### **4.1.1 Yankee Fork Program Components**

In response to the declining Chinook salmon population in the Yankee Fork, the Shoshone-Bannock Tribes implemented a Chinook supplementation project in 2008 to increase the number of adults returning to the system (referred to as the Yankee Fork Chinook Supplementation Strategy, or YFCSS). This program is part of a larger project (Supplementation Project Number 2008-905-00) designed to determine the utility of supplementation as a potential recovery tool. Additional goals of this broader program are to assess the use of supplementation to augment natural populations, evaluate effects on survival and fitness, and track relative reproductive success. Plans are to compare the response of fish population over time in treatment (supplemented) vs. control (unsupplemented) streams. The Yankee Fork component is intended to restore spring Chinook to a level that ensures population persistence over time and provides harvest opportunities for tribal members. Adult Chinook salmon trapping for the YFCSS began in the Yankee Fork in 2008. Chinook from Sawtooth Hatchery were selected for reintroduction in Yankee Fork because this is the closest remaining Chinook population to Yankee Fork, is within the MPG, and has surplus and available fish in many years. Surplus adults (~1,500) from Sawtooth Hatchery were released here in 2008 and 2009, and in addition, approximately 480,000 eyed eggs (Sawtooth stock) were planted in 2009. Juvenile fish are produced at the Sawtooth Hatchery, transported and released to the Yankee Fork in April. In 2010, approximately 400,000 smolts (at 20 fpp) were released in the stream. Sawtooth Hatchery operations associated with the YFCSS program are described in greater detail in the Hatchery Genetics Management Plan (HGMP) presented in Appendix A. This draft HGMP includes the proposed Crystal Springs Chinook program component.

The current YFCSS depends entirely on the availability of space in the Sawtooth Hatchery. This creates conflicts with other Sawtooth Hatchery programs and results in some years when Yankee Fork production needs are not met (e.g., no surplus adults were available for stocking in 2010). This is one of the primary reasons that the Tribes are proposing to develop the Crystal Springs Hatchery, which will enable them to produce the juveniles and returning adults needed to achieve identified conservation and harvest objectives on a more consistent basis (Section 4.3). The proposed program will be operated to achieve the conservation, harvest and cultural objectives described in Section 4.3. To achieve these objectives, the Crystal Springs program will release up to 600,000 smolts yearly to the Yankee Fork.

The major facilities used to collect, hold, rear and release Yankee Fork spring Chinook are:

Pole Flat Weir – Pole Flat weir is located adjacent to Pole Flat Campground approximately 3.2 river miles upstream from the confluence with the Salmon River. The hydrologic unit code for the weir is 17060201. This weir is used to collect adult broodstock for the YFCSS project and is proposed to be upgraded to safely handle the number of fish to be contributed by the Crystal Springs program.

Yankee Fork Adult Holding/Juvenile Stress Relief Pond – A new adult holding facility is proposed upstream of Pole Flat in the vicinity of the confluence with Jordan Creek. It will also be used as a stress relief pond for juveniles that have been trucked from Crystal Springs. This location will be confirmed during the Stage 2 preliminary design phase of the project.

Five Mile Weir – Five Mile weir is located above Five Mile Creek approximately 13 river miles upstream from the confluence with the Salmon River. The hydrologic unit code for the weir is 17060201. Five Mile weir is used to collect adult broodstock for the YFCSS project and as an adult blocking weir when hatchery adults are outplanted for natural spawning. Annual installation of this weir is expected to be eliminated in the next decade.

Sawtooth Fish Hatchery – Sawtooth Hatchery is located on the upper Salmon River approximately 5.0 miles south of Stanley, Idaho. The hydrologic unit code for the facility is 17060201. Sawtooth Hatchery provides surplus adults, egg incubation, juvenile rearing facilities, and provides some long-term adult holding for the YFCSS project.

East Fork Salmon River Satellite Facility – The East Fork Satellite is located approximately 18 miles upstream of the confluence of the East Fork Salmon with the mainstem Salmon River. The hydrologic unit code for the facility is 17060201. The East Fork facility is used for YFCSS adult holding and spawning and may provide back-up holding capabilities for the Crystal Springs program component.

Crystal Spring Fish Hatchery– The proposed Crystal Springs Hatchery would be constructed 2.9 miles southeast of Springfield, Idaho. Crystal Springs will be used for Yankee Fork and Panther Creek egg-incubation and juvenile rearing.

The proposed programs will be implemented in two phases, with the possibility of a third phase depending on the success of habitat improvement projects in-basin and overall ESU recovery. Outlines of the actions proposed in each phase are listed below.

#### **4.1.1.1 Phase 1: Colonization**

In Phase 1, the existing YFCSS will continue to operate as described below:

- Outplant up to 1,500 surplus Sawtooth Hatchery adults to achieve a spawning escapement of 1,000 Chinook in the Yankee Fork. This high level is deemed appropriate to provide the spawners needed for juvenile production, ecosystem function, and minimal fish for Shoshone-Bannock tribal ceremonial and subsistence harvest.
- Acclimate and release 200,000 smolts produced at Sawtooth Hatchery using Sawtooth returns as broodstock.
- No PNI, pNOB or pHOS objectives will be applied to this phase. The HOR stray rate goal is less than five percent to areas outside of the Yankee Fork.
- Opportunities for tribal harvest will be 1 to 8 percent when the run is less than 500 (the minimum escapement for a Basic population). The harvest rate increases when the run size exceeds 500 adults, provided hatchery broodstock and natural escapement targets are achieved.

- Escapement priorities are (1) hatchery broodstock, (2) natural escapement, and (3) tribal harvest.
- To begin the transition to local broodstock, in 2012, 120 broodstock will be collected from the Yankee Fork for the Sawtooth Hatchery juvenile program component (goal of 200,000 smolts). The adults will be held at the East Fork Salmon River facility or the Sawtooth Fish Hatchery. Broodstock will be collected at random (HORs plus NORs).

The trigger signaling the transition to Phase 2 will be the total return of 1,000 spring Chinook (HORs and NORs) to the Yankee Fork and completion of the Crystal Springs Hatchery.

#### **4.1.1.2 Phase 2: Full Program Conversion to Locally Adapted Broodstock**

In Phase 2, the program will shift to the use of only locally returning adults for hatchery broodstock. The conservation objective is to achieve a Maintained population with a minimum of 500 naturally spawning adults. This population would be managed as a Stabilizing population for broodstock and the level of hatchery influence in the Yankee Fork<sup>7</sup>. The harvest and cultural objective is to produce 1,000 adults (HOR and NOR) for harvest by Shoshone-Bannock tribal fishers using traditional (spears) and modern harvest techniques. An outline of Phase 2 Chinook program components is presented below:

- Establish a minimum natural escapement objective of 500 fish; however, broodstock collection will be prioritized for returning adults (HORs would be used as required to achieve a minimum natural escapement goal of 500 fish)
- Terminate the outplanting of surplus Sawtooth Hatchery adults to the Yankee Fork and terminate the use of Sawtooth broodstock for this program
- Collect all Yankee Fork broodstock at the Pole Flat weir. Collect NORs and HORs at random (358 needed) over the entire migration run. Jacks will be incorporated into the broodstock at a rate determined to be appropriate.
- Adults will be held in the proposed Yankee Fork adult holding/juvenile stress relief ponds in the vicinity of the confluence with Jordan Creek, or at the existing East Fork Salmon River facility or at Sawtooth Hatchery.
- Release up to 600,000 smolts annually into Yankee Fork. Of these, 200,000 will be reared at the Sawtooth Hatchery and 400,000 at the Crystal Springs Hatchery.
- Monitor PNI, pNOB, pHOS and natural productivity rates.
- Maintain a hatchery-origin stray rate of less than 5 percent to streams outside of the Yankee Fork.
- Opportunities for tribal harvest will be 1 – 8 percent when the run is less than 500 adults. Harvest rates will increase for run sizes greater than 500 providing natural escapement and broodstock goals are achieved.

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<sup>7</sup> The HSRG has not established any PNI or pHOS criteria for a Maintained population.

#### 4.1.1.3 Phase 3: Develop Integrated Harvest Program Consistent with HSRG Criteria for a Contributing Population

Phase 3 is one possible long-term outcome if habitat improvements proposed in the upper Salmon River and in the FCRPS increase population productivity and abundance substantially over time. The Yankee Fork component of the Crystal Springs program will be operated as an integrated harvest program consistent with the following HSRG guidelines for a Contributing population:

- PNI > 0.5
- pHOS < 0.30
- Stray rate < 0.05 (to populations outside the Yankee Fork)

The trigger used to determine if Phase 3 would be implemented is:

- The 5-year running average NOR escapement to the Yankee Fork exceeds 750 adults

Once this trigger is met, the Shoshone-Bannock Tribes would consult with NOAA Fisheries to determine if managing Yankee Fork spring Chinook as a Contributing population is needed to meet recovery objectives for the Snake River Spring/Summer Chinook ESU.

Regardless of the need to achieve ESU objectives, elimination of the hatchery program would be considered if:

- The 5-year running average NOR escapement to the Yankee Fork exceeds 2,000 adults

With an average run-size of 2,000 NOR adults, the need for a hatchery program would be reconsidered because run-size would be sufficient to achieve all current conservation, harvest and cultural objectives. Continuation of the program might be warranted if harvest objectives are updated, particularly for tribal communal and sport harvest.

#### 4.1.2 Panther Creek Program Components

Currently there are no Chinook salmon hatchery programs operating in the vicinity of Panther Creek. Strays may potentially enter this system from programs supporting other populations, including the Salmon/Little Salmon spring Chinook (Rapid River Hatchery), Salmon/East Fork-South Fork Johnson Creek summer Chinook, Salmon/South Fork Salmon summer Chinook (McCall Hatchery), and the Salmon/Pahsimeroi summer Chinook (Pahsimeroi Hatchery) populations (HSRG 2008a). At times in the past (e.g., 2001), hatchery-origin adults have been released into Panther Creek (EcoMetrix 2010). Monitoring efforts since 2002 indicate that size of the Chinook population varies considerably from year to year (EcoMetrix 2010).

The spring Chinook hatchery program proposed for Panther Creek is new and will be implemented to accelerate re-colonization of habitat that was destroyed by historical mining activities in the basin. Over time, this habitat has been, and is continuing to be restored with an aggressive and closely monitored habitat improvement program.

The hatchery program is designed to achieve tribal conservation, harvest and cultural goals in Panther Creek. The Tribes' conservation objective is to achieve a Maintained local population in Panther Creek. The harvest objective is to achieve an annual harvest rate of 500 spring Chinook

adults in Phase 1 and 800 adults in Phase 2. To achieve these objectives, the program will be implemented in two phases that are described in the sections that follow.

Facilities proposed to culture fish for the Panther Creek program are:

Crystal Spring Fish Hatchery– Crystal Springs is proposed to be constructed about three miles southeast of Springfield, Idaho. This facility will be used for Chinook egg incubation and juvenile rearing.

Picket Weir- A new dual-purpose picket weir and trap will be installed in Panther Creek. Initially the weir will be used to prevent any planted adults from leaving Panther Creek and straying to other streams. It will also be used to collect broodstock.

Adult Holding/Juvenile Stress Relief Ponds –The facility will hold trapped adults and provide short-term stress relief for smolts reared at Crystal Springs Hatchery prior to release into Panther Creek. This holding facility is expected to be installed in proximity to the Panther Creek picket weir and trap.

#### **4.1.2.1 Phase 1- Colonization (expected duration 4-years minimum)**

In Phase 1, surplus spring Chinook (~1,500) will be released yearly to the stream (when available). The objective of this stocking program is to produce a minimum spawning population of 1,000 adults. The source of the broodstock is still in question; however, genetic samples have been taken from both juvenile and adult Chinook currently found in Panther Creek. These are being analyzed and the results may provide direction about appropriate broodstock. At this time, the alternatives for broodstock in Panther Creek are existing returning Chinook, Pahsimeroi stock, and South Fork Salmon River stock. A recommendation about which stock to use will be proposed in Step 2 of this planning process once all appropriate information is collected and analyzed.

When Crystal Springs is operational (in approximately four years), the facility will produce 400,000 yearling smolts that will then be transported to Panther Creek, calmed in a stress relief pond and released volitionally in the spring. Surplus hatchery adults of donor stock will still be released annually when they are available. These adults will be retained in Panther Creek by a newly constructed picket weir that will prevent planted adults from leaving the system and straying to other natural populations.

Harvest rates will range from 1 to 8 percent when the total adult run-size is less than 500 fish (hatchery plus natural-origin returns). Harvest rates will increase as run size exceeds 500 adults. A primary objective of Phase 1 is to maintain a minimum natural escapement of 500 adults whenever possible (the minimum for a Basic population).

#### **4.1.2.2 Phase 2: Full Program Conversion to Locally Adapted Broodstock**

The program will begin converting to locally adapted broodstock when adult returns (both natural and hatchery) to Panther Creek average 1,000 fish over a 4- to 5-year period.

At that time, surplus hatchery adults from outside the subbasin no longer will be stocked into the system unless average run size drops below 250 adults. Approximately 214 adults will be needed for hatchery broodstock for this propagation program. They will be collected randomly from Panther

Creek throughout the entire adult migration period. Jacks will be incorporated into the broodstock at rates determined to be appropriate.

The conservation objective is to achieve a Maintained population with a minimum natural escapement of 500 adults that would be managed as a Stabilizing population for broodstock and the level of hatchery influence. The harvest objective is to achieve an annual harvest of 800 Chinook adults.

Conservation objectives may be altered for the program in the future if a determination is made that an additional Viable (Contributing) population is needed to recover the ESU (see discussion in Section 4). Such a decision would not affect the activities and facilities required to implement Phase 1. Consultation with NOAA Fisheries will be triggered as follows:

*When the 5-year running average of NOR escapement in Panther Creek exceeds 750 adults, the Shoshone-Bannock Tribes will consult with NOAA Fisheries to determine if the conservation objective should be altered for this population.*

With an affirmative concurrence by NOAA Fisheries, the Panther Creek program will be converted to an integrated hatchery program designed to achieve PNI, pHOS and pNOB criteria for a Contributing population as recommended by the HSRG.

## 4.2 PROGRAM NEED AND JUSTIFICATION

### 4.2.1 Yankee Fork Program Components

Yankee Fork Chinook salmon are at an extremely high risk of extinction. The ICTRT (2007a) estimated the 10-year geometric mean adult abundance for Yankee Fork at 13 adults with productivity of 0.80 recruits/spawner (R/S). These abundance and productivity values are a result of degraded habitat conditions in the Yankee Fork and low juvenile and adult survival rates through the FCRPS. Improvements in both habitat condition and migration rates are expected over time; however, they may not fully be realized for many decades. Hatchery production is therefore needed to reestablish, develop local adaptation and conserve the genetic resources of this population while at the same time providing the fish needed to meet tribal treaty harvest rights. Unlike previous hatchery stocking efforts in the Yankee Fork, this program will provide consistent high quality smolt releases over time, is designed to achieve local adaptation, and will have sufficient monitoring in place to allow for adaptive management. Under this program, adults returning to Yankee Fork will be prioritized as listed in Table 4-1.

**Table 4-1. Priority and purpose of adults returning to Yankee Fork.**

Priority	Purpose	Number and Composition
1	Hatchery broodstock	358 (NOR + HOR) adults
2	Natural escapement	500 (HOR + NOR) adults
3	Harvest	1,000 (HOR + NOR) adults (average)

Estimates derived using the All H-Analyzer model indicate the proposed hatchery program will increase the abundance of spring Chinook in the Yankee Fork (Table 4-2). The assumptions used in modeling are presented in Table 4-3. Key results of the modeling analysis are:

- Average natural-origin spawner (NOS) escapement increases from 5 to 44 adults
- Average total natural escapement (HOS + NOS) increases from 15 to 508 adults
- Average total run size (HOR and NOR) of Yankee Fork-origin spring Chinook increases from 12 to 2,175 adults.

The population projections in Table 4-2 provide justification that the hatchery program will achieve identified conservation (natural escapement of 500 adults) and harvest (1,000 adults) objectives (see Section 4.3).

**Table 4-2. Number of adult spring Chinook produced in the Yankee Fork with and without the proposed Crystal Springs Hatchery program.**

Parameters	Number of Spring Chinook Adults Without Program			Number of Spring Chinook Adults With Program		
	Max	Min	Ave	Max	Min	Ave
Natural-origin spawning (NOS) escapement*	29	1	5	313	1	44
Hatchery-origin spawning (HOS) escapement	31	5	10	2,089	99	464
Hatchery-origin spawner (HOS) effective escapement (assumes 10% fitness loss)	24	4	8	1,644	80	371
Total natural escapement (NOS & all HOS)	60	7	15	2,402	99	508
Total harvest	35	1	6	3,770	626	1,189 (~1,000 in Yankee Fork)
Hatchery broodstock**	0	0	0	358	358	358
Surplus at hatchery	0	0	0	412	6	135
Total run-size (minus strays and imported broodstock)***	85	2	12	6,993	1,072	2,175

\*-Natural production estimate is based on an assumed adult productivity and capacity value of 1.45 and 600, respectively. Estimates were taken from the HSRG population report for the Yankee Fork (HSRG 2008b)

\*\* - The smolt-to-adult survival rate used for modeling hatchery-origin fish was that observed for the Sawtooth spring Chinook program (i.e., 0.29 percent).

\*\*\* - Sawtooth Hatchery strays that enter the Yankee Fork are not removed in calculating total run-size

**Table 4-3. AHA modeling assumptions for the Yankee Fork program.**

<b>Habitat</b>			
Adult NOR productivity (R/S)	1.45	Adult NOR capacity	600
<b>Hydropower</b>			
Juvenile survival rate through FCRPS	0.35	Adult survival rate through FCRPS	0.82
SAR of NOR	0.8%	SAR of HOR	0.29%
<b>Harvest</b>			
NOR harvest rate	54%	HOR harvest rate	54%
<b>Hatchery</b>			
pNOB	~6%	pHOS	89%
NOR brood number	~22	HOR brood number	~336
Hatchery adult recruits per spawner	4.0	PNI	0.6
<b>Total Juvenile Production- 600,000 smolts</b>			

Notes:

R/S: Adult recruits per spawner

SAR: Smolt-to-adult survival rate

NOR: Natural-origin adults

HOR: Hatchery-origin adults

pHOS: Proportion of the natural spawning population that consists of hatchery-origin adults

PNI: Proportionate natural influence

### 4.2.2 Panther Creek Program Components

Panther Creek Chinook were extirpated as a result of mining operations that severely degraded the quality and quantity of spawning and rearing habitat in the watershed, and because of the effects of the FCRPS on adult and juvenile migration survival to and from the ocean.

In the past decade, remedial actions have considerably improved Panther Creek habitat to the point where it is documented to support natural fish production. For example, recent studies report Chinook salmon and bull trout in most major tributaries within the Panther Creek drainage.

Rainbow and cutthroat trout are also found throughout the Panther Creek drainage (EcoMetrix 2010). Monitoring results summarized by EcoMetrix conclude that Panther Creek supports naturally reproducing Chinook and suggest that all fry observed since 2003 are the result of such natural spawning since no hatchery juveniles have been released to the stream.

With improved habitat comes the potential to restore Chinook to the Panther Creek using artificial production. The program is designed to provide conservation benefits by creating a Maintained population in the stream with a minimum of 500 natural spawners, managing it as a Stabilizing population for broodstock and the level of hatchery influence, while at the same time providing harvest opportunities to tribal fishers. Under this program, returning adults to Panther Creek will be prioritized as listed in Table 4-4.

**Table 4-4. Priority and Purpose of Adults Returning to Panther Creek.**

Priority	Purpose	Number and Composition
1	Hatchery broodstock	214 (NOR + HOR) adults
2	Natural escapement	500 (HOR + NOR) adults
3	Harvest	800 (HOR + NOR) adults (average)

AHA modeling indicates that the proposed hatchery program will increase the abundance of spring Chinook in Panther Creek. Expected numbers of HOR and NOR adults produced with and without artificial production, shown in Table 4-5, were derived by modeling the outcome of Phase 2 (see Section 4.1.2.2). The assumptions used in modeling are presented in Table 4-6. Key results of the modeling analysis shown in Table 4-5 are<sup>8</sup>:

- Average natural-origin spawner (NOS) escapement increases from 8 to 108 adults.
- Average total natural escapement (HOS + NOS) increases from 14 to 555 as more hatchery fish return to spawn naturally.
- Average total run size (HOR and NOR) of Panther Creek-origin spring Chinook increases from 98 to adults to 1,839 due to the release of 400,000 juveniles each year.

On average, 1,000 adults are expected to be captured in all fisheries, with 800 adults caught in Panther Creek. An additional 0 to 205 surplus adults will be captured at the weir and could count toward the harvest goal. Achieving the harvest goal will require that weir, netting and spearing operations remove 50 percent of the fish returning to the stream. This is a key uncertainty that will be evaluated as part of the monitoring program for Panther Creek.

**Table 4-5. Number of adult spring Chinook produced in Panther Creek with and without the proposed hatchery program.**

Parameters	Number of Spring Chinook Adults Without Program			Number of Spring Chinook Adults With Program		
	Max	Min	Average	Max	Min	Average
Natural-origin spawning (NOS) escapement*	39	2	8	576	13	108
Hatchery-origin spawning (HOS) escapement	18	3	6	1,716	163	448
Hatchery-origin spawner (HOS) effective escapement (assumes 10% fitness loss)	15	3	5	1,366	131	358
Total natural escapement (NOS & all HOS)	57	5	14	2,292	178	555

<sup>8</sup> It should be noted that the number of NOR returns to Panther Creek are estimated levels after some unknown period of natural recolonization and represent long-term habitat potential, not current returns.

Parameters	Number of Spring Chinook Adults Without Program			Number of Spring Chinook Adults With Program		
	Max	Min	Average	Max	Min	Average
Total harvest	47	2	10	3,259	515	1,006 (~800 in Panther Creek )
Hatchery broodstock**	0	0	0	214	214	214
Surplus at hatchery	0	0	0	205	0	68
Total run-size (minus strays and imported broodstock)***	98	1	19	6,028	876	1,839

\*-Natural production estimate is based on an assumed adult productivity and capacity value of 2.2 and 1,200, respectively. These estimates were taken from the HSRG population report for Panther Creek (HSRG 2008a)

\*\*- The smolt-to-adult survival rate used to modeling hatchery-origin fish was that observed for the McCall Chinook program (i.e., 0.32%).

\*\*\*- Strays that enter Panther Creek naturally are not removed in calculating total run-size

**Table 4-6. AHA modeling assumptions for the Panther Creek program.**

Habitat			
Adult NOR productivity (R/S)	2.2	Adult NOR capacity	1,200
Hydropower			
Juvenile survival rate through FCRPS	0.35	Adult survival rate through FCRPS	0.82
SAR of NOR	0.8%	SAR of HOR	0.32%
Harvest			
NOR harvest rate	54%	HOR harvest rate	54%
Hatchery			
pNOB	20%	pHOS	77%
NOR brood number	~42	HOR brood number	~172
HOR recruits per spawner	6.1	PNI	0.21
Total HOR Smolt Production – 400,000			

Notes:

R/S: Adult recruits per spawner

SAR: Smolt-to-adult survival rate

NOR: Natural-origin adults

HOR: Hatchery-origin adults

pHOS: Proportion of the natural spawning population that consists of hatchery-origin adults

PNI: Proportionate natural influence

### 4.3 BIOLOGICAL OBJECTIVES OF YANKEE FORK AND PANTHER CREEK PROGRAMS

The Yankee Fork and Panther Creek spring Chinook programs have the following conservation, harvest and cultural objectives:

**Cultural Objective:** Tribal members will have an opportunity to harvest Chinook using traditional hunting (spearing) and contemporary methods (i.e., weirs, hook-and-line, or nets).

**Harvest Objective:** The program will provide, on average, a minimum of approximately 1,000 adult spring/summer Chinook in the Yankee Fork and 800 adult spring Chinook in Panther Creek for harvest by the Shoshone Bannock Tribes.

**Conservation Objective:** The programs will contribute to the recovery of the Snake River spring/summer Chinook ESU by restoring a Maintained population, managed as a Stabilizing population for broodstock and the level of hatchery influence, of 500 locally adapted Chinook spawners in the Yankee Fork and 500 spawners in Panther Creek (a total of 1,000 fish).

Based on these objectives, the adult escapement priorities for the Yankee Fork will be as listed in Table 4-7.

**Table 4-7. Adult escapement priorities for the spring Chinook program by location.**

Adult Escapement Priority	Yankee Fork	Panther Creek
Hatchery broodstock	358 (NOR + HOR) adults	214 (NOR + HOR) adults
Natural escapement	≥500 (NOR + HOR) adults	500 (NOR + HOR) adults
Harvest	1,000 (NOR + HOR) adults	800 (NOR + HOR) adults

The Yankee Fork program component will be operated in two distinct phases, with the possibility of implementing a third phase if population productivity and abundance increases dramatically or turns out to be much higher than estimated. The phases are described in Sections 4.1.1 and 4.1.2. The success of the Yankee Fork and Panther Creek Chinook programs in achieving conservation, harvest and cultural objectives will be quantified by implementing a monitoring and evaluation program that is described in Section 4.6.

## 4.4 ALTERNATIVES CONSIDERED

### 4.4.1 Yankee Fork Alternatives

Four hatchery options were considered for the Yankee Fork spring/summer Chinook program. Each is briefly described below, along with an explanation of why the option was or was not explored further.

- Option 1: An adult outplant and 600,000 smolt program would transition to locally adapted broodstock to achieve a Maintained population status in the Yankee Fork
- Option 2: Adult outplant and 800,000 smolt program transitioning to locally adapted broodstock to achieve a Maintained population status
- Option 3: Adult outplant and smolt program transitioning to locally adapted broodstock to achieve Contributing population status
- Option 4: Eliminate hatchery production

Options 1 and 2 differ only in the total number of juveniles produced for the program. Option 1 would release 600,000 Chinook smolts in the Yankee Fork, while under Option 2, 800,000 would be released. Both would achieve a Maintained population status. Under Option 3, the conservation goal for the program is increased to produce a population that would be managed to achieve a Viable status (rather than Maintained) and would be managed as a Contributing population for broodstock and for the level of hatchery influence. Option 4 eliminates all hatchery production and releases to the Yankee Fork and therefore relies on natural production to achieve all objectives.

The options were evaluated using the All-H-Analyzer (AHA) model developed by the HSRG. The results of modeling work indicate that Option 1 will best meet the conservation, harvest and cultural objectives identified for the program (Section 4.4). A discussion of the modeling results for Options 2, 3, and 4, starting with Option 4, is presented below. AHA modeling results for Option 1, which is the preferred alternative, were discussed in Section 4.2.1.

#### 4.4.1.1 Option 4: Eliminate Hatchery Production

Under this option, no juvenile or surplus hatchery-origin adult Chinook would be released to the Yankee Fork. AHA modeling results for this alternative are shown in Table 4-8.

**Table 4-8. Option 4: Spring Chinook AHA modeling results for Yankee Fork.**

Parameters	Number of Spring Chinook Adults		
	Maximum	Minimum	Average
Natural-origin spawning (NOS) escapement*	29	1	5
Hatchery-origin spawning (HOS) escapement	31	5	10
Hatchery origin spawner (HOS) effective escapement (assumes 10% fitness loss)	24	4	8
Total natural escapement (NOS & all HOS)	60	7	15
Total harvest	35	1	6
Hatchery broodstock **	0	0	0
Surplus at hatchery	0	0	0
Total run-size (minus strays and imported broodstock)***	85	2	12

\*-Natural production is estimated from an assumed adult productivity and capacity value of 1.45 and 600, respectively. These estimates were taken from the HSRG population report for the Yankee Fork (HSRG 2008b).

\*\* - The smolt-to-adult survival rate used for modeling hatchery-origin fish was that observed for the Sawtooth spring Chinook program (i.e., 0.29%).

\*\*\* - Sawtooth Hatchery strays that enter the Yankee Fork are not removed in calculating total run-size

The number of natural-origin adults spawning naturally (NOS) in Option 4 is estimated to range from between 1 and 29 adults. The number of hatchery-origin fish spawning naturally averages 10 adults; these fish are strays from hatchery releases outside of the Yankee Fork. This run size is likely insufficient to maintain the population over time and is consistent with the ICTRT (2007b) conclusion that adult abundance is approximately 13 adults (geometric mean).

Because this option produced insufficient adults to meet conservation and harvest objectives, it was eliminated as an alternative.

#### 4.4.1.2 Option 3: Adult Outplant and Smolt Program Transitioning to Local Smolt Program to Achieve Contributing Population Status

The objective of Option 3 is to meet the conservation standard for a Contributing population (as defined by the HSRG for the level of hatchery influence) while still providing sufficient adults to achieve Shoshone-Bannock tribal harvest objectives. According to the HSRG, a Contributing population needs to achieve a proportion natural influence (PNI) value of  $> 0.5$ . This requires that a substantial number of natural-origin fish be used as hatchery broodstock and that the proportion of hatchery-origin fish on the spawning grounds (pHOS) be controlled. In short, the program would be an integrated program where the hatchery and natural components are managed as a single population. AHA modeling for Option 3 is presented in Table 4-9.

On average, this option produces 85 natural-origin spawners and 42 hatchery-origin spawners, considerably less than the 500 fish target escapement level. It should be noted that the ICTRT (2007a) indicates that the minimum abundance level for a spring Chinook population (Basic) is 500 natural-origin spawners; hatchery fish do not count toward this total.

The average number of fish harvested under Option 3 is estimated at 42 adults, of which approximately 39 would be taken in the Yankee Fork (based on a 10% terminal harvest rate).

Option 3 was rejected because current natural population productivity rates are insufficient to produce the adults needed to integrate the program and still achieve natural escapement and harvest objectives.

**Table 4-9. Option 3: Spring Chinook AHA modeling results for the Yankee Fork.**

Parameters	Number of Spring Chinook Adults		
	Maximum	Minimum	Average
Natural-origin spawning (NOS) escapement*	312	20	85
Hatchery-origin spawning (HOS) escapement	128	22	42
Hatchery-origin spawner (HOS) effective escapement (assumes 10% fitness loss)	81	18	33
Total natural escapement (NOS & all HOS)	440	44	127
Total harvest	136	18	42 (39 in Yankee Fork)
Hatchery broodstock**	20	20	20
Surplus at hatchery	184	23	53
Total run-size (minus strays and imported broodstock)***	765	88	226
Total juvenile release number	33,626		
Total adult release number	0		
PNI	0.59		
pHOS	28%		
pNOB	40%		

\*-The natural production estimate is based on an assumed adult productivity and capacity value of 1.45 and 600, respectively. These estimates were taken from the HSRG population report for the Yankee Fork (HSRG 2008b).

\*\* - The smolt-to-adult survival rate used to model hatchery-origin fish was that observed for the Sawtooth spring Chinook program (i.e., 0.29%).

\*\*\* - Strays that enter the Yankee Fork are not removed in calculating total run-size

#### 4.4.1.3 Option 2: Adult Outplant and 800,000 Smolt Program Transitioning to the use of Locally Adapted Broodstock to Achieve Maintained Population Status

Option 2 would be implemented in two phases. In Phase 1, the current program that releases 200,000 smolts and 1,500 adults each year would continue until the Crystal Springs Hatchery is operational. Upon completion, smolt production would be increased to 800,000 (using locally adapted broodstock) and surplus adults from Sawtooth Hatchery would no longer be released to the stream. AHA modeling results for this option are presented in Table 4-10.

AHA modeling results show that, on average, the natural escapement and harvest goals are achieved. However, to achieve the 800,000 smolt release number would require rearing densities at the Crystal Springs Hatchery that may be detrimental to fish survival. High density may increase stress to fish with an associated increase in the number and severity of disease outbreaks, especially Bacterial Kidney Disease (BKD). For these reasons this alternative was eliminated.

**Table 4-10. Option 2: Spring Chinook AHA modeling results for the Yankee Fork.**

Parameters	Number of Spring Chinook Adults		
	Maximum	Minimum	Average
Natural-origin spawning (NOS) escapement*	340	1	48
Hatchery-origin spawning (HOS) escapement	2,595	94	552
Hatchery-origin spawner (HOS) effective escapement (assumes 10% fitness loss)	2,051	76	441
Total natural escapement (NOS & all HOS)	2,935	94	599
Total harvest	4,956	834	1,573 (~1,300 in Yankee Fork)
Hatchery broodstock **	476	476	476
Surplus at hatchery	732	128	242
Total run-size (minus strays and imported broodstock)***	9,167	1,438	2,876
Total juvenile release number	800,000		
Total adult release number	0		
PNI	0.04		
pHOS	0.90		
pNOB	0.04		

\*-The natural production estimate is based on an assumed adult productivity and capacity value of 1.45 and 600, respectively. These estimates were taken from the HSRG population report for the Yankee Fork (HSRG 2008b).

\*\* - The smolt-to-adult survival rate used for modeling hatchery-origin fish was that observed for the Sawtooth spring Chinook program (i.e., 0.29%).

\*\*\* - Sawtooth Hatchery strays that enter the Yankee Fork are not removed in calculating total run-size.

The preferred Option 1 was assembled based on the modeling analysis of Options 2, 3 and 4. The results of AHA modeling for these options indicate that conservation, harvest and cultural goals could not be achieved without the continued use of hatchery production for releases to the Yankee Fork. The following can be concluded from the analysis:

- Population productivity and abundance is insufficient to achieve biological and cultural objectives with natural production only (Option 4). Poor habitat quality and quantity, combined with low juvenile and adult passage survival through the FCRPS result in a population that is unlikely to persist over time. These findings are consistent with those presented by the ICTRT (2007b).
- Results of AHA modeling of Option 3 shows conclusively that because of low natural population abundance and productivity, it was not possible to develop an integrated program designed to meet HSRG guidelines for a Contributing population, nor achieve a minimum NOR population size of 500 adults as required by the ICTRT for a Basic population.
- Modeling of Option 2 indicates that the release of 800,000 smolts would achieve all objectives; however, the size of the release would require hatchery rearing practices that would not be conducive to maintaining high in-hatchery survival rates.

For these reasons, Option 1 has been selected by the Shoshone-Bannock Tribe for the Yankee Fork, to be implemented in two phases, with the possibility of a third phase (see Section 4.1).

#### **4.4.2 Panther Creek Alternatives**

Three hatchery options were considered in developing the Panther Creek Chinook program:

- Option 1: Adult outplant and smolt program transitioning to a local smolt program to achieve a Maintained population status
- Option 2: Adult outplant and smolt program transitioning to a local smolt program to initially achieve Maintained population status; transitioning to a Contributing status if natural productivity warrants
- Option 3: No hatchery program

Based on the AHA analysis, Option 1 was selected as the preferred alternative as it best meets the conservation and harvest goals identified by the Tribes for Panther Creek Chinook. The results of AHA modeling for Option 1 are presented in Section 4.2.2 and are not repeated here. The results of AHA modeling for Options 2 and 3 are presented below, beginning with Option 3 (No Hatchery Program).

##### **4.4.2.1 Option 3: No Hatchery Program**

Under Option 3, a hatchery program would not be implemented for Panther Creek. Chinook production from the stream would depend on natural colonization from both NOR and HOR strays from other basins. The rate of colonization is unknown, but since few spring Chinook are present in the stream today (even after years of habitat rehabilitation efforts), the time frame is expected to be long.

The results of AHA modeling for this option, presented in Table 4-11, indicate that habitat available in the stream can support 14 adult Chinook. Because this option does not meet conservation (500 adult escapement) or harvest (1,000 adult) goals, the alternative was eliminated as not viable.

**Table 4-11. Spring Chinook AHA modeling results for Panther Creek Option 3.**

Parameters	Number of Spring Chinook Adults		
	Max	Min	Aver
Natural-origin spawning (NOS) escapement*	39	2	8
Hatchery-origin spawning (HOS) escapement	18	3	6
Hatchery-origin spawner (HOS) effective escapement (assumes 10% fitness loss)	15	3	5
Total natural escapement (NOS and all HOS)	57	5	14
Total harvest	47	2	10
Hatchery broodstock **	0	0	0
Surplus at hatchery	0	0	0
Total run-size (minus strays and imported broodstock)***	98	1	19

\*-Natural production estimate is based on an assumed adult productivity and capacity value of 2.2 and 1,200, respectively. These estimates were taken from the HSRG population report for Panther Creek (HSRG 2008a).

\*\* - The smolt-to-adult survival rate used for modeling hatchery-origin fish was that observed for the McCall Chinook program (i.e., 0.33%). Wild fish SAR was set at 0.8%.

\*\*\* - Strays that enter Panther Creek naturally are not removed in calculating total run-size

#### 4.4.2.2 Option 2- Adult Outplant and Smolt Program Transitioning to Local Smolt Program to Initially Achieve Maintained Population Status; Transition to Contributing Population if Natural Productivity Warrants

This option is the same as Option 1 except that management continues towards a Contributing population. The option would be implemented in three phases:

- **Phase 1:** Habitat colonization using surplus HOR adults
- **Phase 2:** Develop a locally adapted population using juvenile production
- **Phase 3:** Integrated harvest program operated to achieve contributing population status

To achieve the PNI (> 0.5) and pHOS (<0.30) criteria for a Contributing population, hatchery production could not be greater than 94,000 juveniles. The results of AHA modeling for this level of hatchery production (occurring in Phase 3) are presented in Table 4-12. It should be noted that the AHA results for Option 1 (described in Section 4.2.2) are identical for Option 2 outcomes in Phase 1 and Phase 2.

**Table 4-12. Spring Chinook AHA modeling results for Panther Creek Option 2 (Phase 3).**

Parameters	Number of Spring Chinook Adults		
	Max	Min	Ave
Natural-origin spawning (NOS) escapement*	1,237	120	338
Hatchery-origin spawning (HOS) escapement	555	96	181
Hatchery-origin spawner (HOS) effective escapement (assumes 10% fitness loss)	437	77	145
Total natural escapement (NOS & All HOS)	1,792	225	519
Total harvest	772	109	232
Hatchery broodstock **	50	50	50
Surplus at hatchery	203	11	47
Total run-size (minus strays and imported broodstock)***	2,813	382	845

\*-Natural production estimate is based on an assumed adult productivity and capacity value of 2.2 and 1,200, respectively. These estimates were taken from the HSRG population report for Panther Creek (HSRG 2008a)

\*\* - The smolt-to-adult survival rate used to model hatchery-origin fish was that observed for the McCall Chinook program (i.e., 0.33%). Wild fish SAR was set at 0.8%.

\*\*\* - Strays that enter Panther Creek naturally are not removed in calculating total run-size.

AHA modeling results indicate that the conservation objective of 500 fish would be achieved, but the harvest objective (800 adults) would not. Because the harvest objective was not obtainable, the Panther Creek program option was not selected for implementation.

However, in the future this option may be implemented if NOAA Fisheries determines that an additional Viable (Contributing) population is needed to recover the ESU and available habitat in Panther Creek is determined to be more productive than currently anticipated. Such a decision would not affect the activities and facilities required to implement Option 1. The trigger that will initiate consultation is as follows:

*When the 5-year running average of NOR escapement exceeds 750 adults, the Shoshone-Bannock Tribes will consult with NOAA Fisheries to determine if the conservation objective should be altered for this population.*

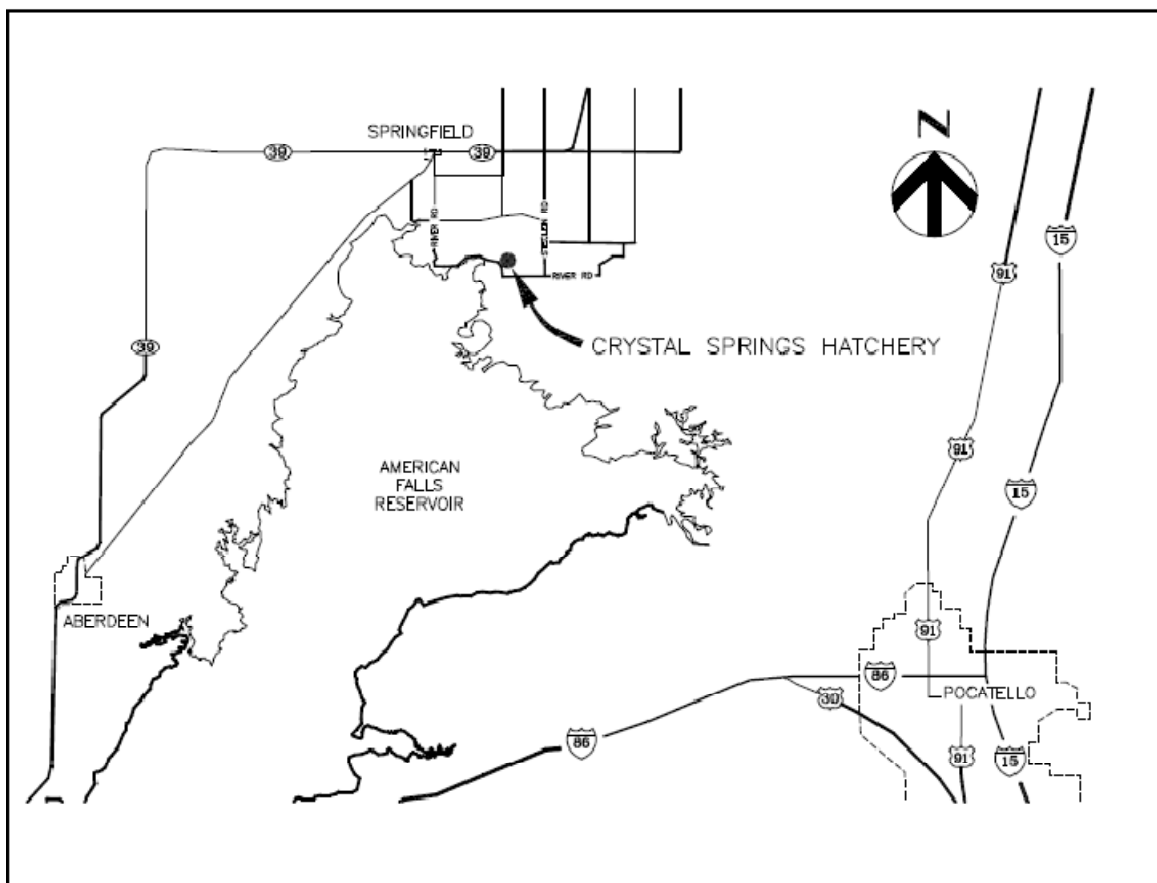
## **4.5 CONCEPTUAL DESIGN OF YANKEE FORK AND PANTHER CREEK PROGRAM FACILITIES**

### **4.5.1 Overview of Facilities**

The Shoshone-Bannock Tribes participate in the YFCSS program that is supported by a variety of facilities in the upper Salmon River watershed. Adult collection facilities for the supplementation program are located on the Yankee Fork. Broodstock are held at the Sawtooth and/or East Fork Hatchery facilities.

The spring/summer Chinook program component proposed on Panther Creek will require new facilities to collect local and hold broodstock and acclimate/release smolts. No facilities currently exist on Panther Creek.

The proposed Crystal Springs Hatchery will centralize spring/summer Chinook rearing in order to develop a locally adapted broodstock for both the Yankee Fork and Panther Creek and achieve the self-sustaining population goals described in Section 4.2 and 4.3. These proposed rearing facilities, described in more detail in Section 4.5.3 below, will be constructed at the site of a former commercial trout hatchery in Bingham County, near Pingree, Idaho. The former hatchery site, located on a nine acre parcel (Figure 4-1), includes a small hatch house building, several artesian wells that supplied water to the hatchery, some deteriorated outdoor concrete raceways, and a series of ponds that formed due to the discharged water from the wells. Immediately west of the former trout hatchery, BPA purchased a 10.7 acre parcel that is available for construction of new hatchery-related improvements if necessary.



**Figure 4-1. Location of proposed Crystal Springs Hatchery.**

A 24.7 cubic feet per second (cfs) water right was perfected by the former trout hatchery operations and will be used for the new Crystal Springs Hatchery. A preliminary review of water rights indicates that the existing water right is designated for beneficial use on the eastern parcel only. Any water use on the western parcel would require a formal water right transfer or new water right.

In addition to the hatchery facilities, this program includes improvements to the existing adult fish collection facilities near Pole Flat Campground on Yankee Fork, and adult holding/juvenile stress relief pond improvements along the Yankee Fork as well. The current condition of these sites and existing facilities is described in Section 4.5.2. Similar facilities will be required on Panther Creek at locations to be determined in Step 2 of the Council's process.

## **4.5.2 Existing Facilities**

### **4.5.2.1 Existing Adult Collection, Holding and Spawning Facilities**

The Shoshone-Bannock Tribes began operating adult fish facilities to manage Chinook salmon spawning on the Yankee Fork in 2008. The facilities consist of a temporary field station at Pole Flat Campground, and two removable picket weir-style adult fish traps. One trap is at Pole Flat Campground (RM 3.1), adjacent to the Tribes' field station, and the other weir is farther upstream (RM 13.4) near Five Mile Creek (see Figures 4-2 through 4-5). The adult trapping program operates under a temporary Special Use permit from the US Forest Service. Other adult collection facilities in the upper Salmon River watershed include the IDFG traps at Sawtooth Hatchery on the mainstem and a remote trap and spawning facility on the upper East Fork of the Salmon. Broodstock collected at the Pole Flat weir for the YFCSS program are typically held and spawned at the Sawtooth Fish Hatchery.

Pole Flat weir (Figures 4-3 and 4-4) is deployed by the Tribes in June when flows in the Salmon River drop below 2,400 cfs, and is operated through late September. The Five Mile weir (Figure 4-5) is of similar construction to the Pole Flat weir, and is deployed in June or July and operated through October.

The two traps consist of the following primary components:

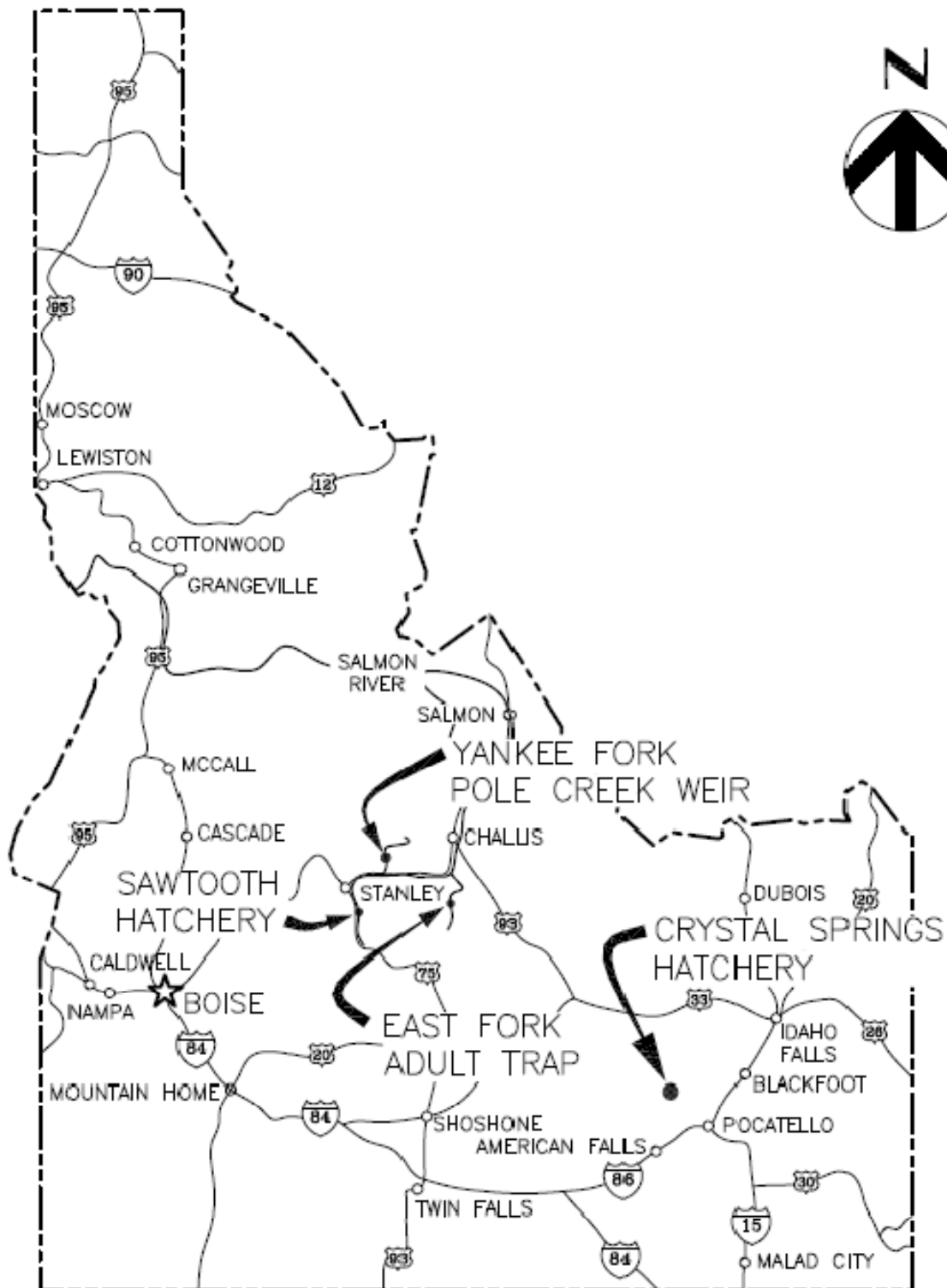
- Fixed weir constructed of round metal pickets supported by several counter-weighted tripods blocking the full width of the stream. Pole Flat weir is approximately 60 feet wide and has a maximum water depth of approximately 4.5 feet.
- A picket panel trap box with a two-foot-wide entrance channel near the left bank.
- Sand bags and plastic screen material to seal around the bottom and sides of the picket panels to prevent fish from bypassing the trap.

At both sites, natural-origin fish are passed upstream, and hatchery-origin fish (probably strays from Sawtooth), are collected and held as broodstock at the IDFG East Fork trap and spawning facility. The Five Mile weir is also used as a blocking device when surplus hatchery-origin adults are out-planted in upper Yankee Fork (above the weir) for natural spawning. Use of the Five Mile weir is expected to be phased out over the next decade.

The program also uses a rotary screw trap, placed just downstream of the Pole Flat weir, to monitor and enumerate juvenile spring Chinook and steelhead.

The Tribe is working with the Forest Service to obtain a parcel of land or a long-term operating agreement near Pole Creek Campground for the development of a permanent field station.

There are no existing collection, holding, or spawning facilities on Panther Creek.



**Figure 4-2. Location of existing facilities.**



**Figure 4-3. Pole Flat adult collection site – looking upstream.**



**Figure 4-4. Pole Flat adult fish collection site – from left bank.**



**Figure 4-5. Five Mile weir on the Yankee Fork – looking upstream.**

#### **4.5.2.2 Existing Hatchery Facilities**

The ongoing YFCSS program depends on incubation, early rearing and smolt production at Sawtooth Hatchery, which is operated by IDFG. The draft YFCSS HGMP and the Sawtooth Hatchery HGMP describe these facilities in detail. The Panther Creek program component has yet to be implemented; therefore there are no associated hatchery facilities. The Shoshone-Bannock Tribes currently do not operate any spring/summer Chinook hatcheries. They have, however, acquired an abandoned trout facility (Crystal Springs) in the Upper Snake subbasin that is proposed to be redeveloped for this program.

Topography of the Crystal Springs Hatchery site slopes gradually from higher ground on the north and west property boundary to a series of wetland ponds along the south and east boundaries. The ponds, which collect flow from artesian wells and potentially from subsurface flow, are connected by short channels extending from north to south. An existing 36-inch culvert conveys water from the ponds beneath a road, where it flows toward the Fort Hall Bottoms. A dilapidated hatch house on the north property line is fed by an artesian well and is linked to remnant concrete raceways with outfalls directly into the series of wetland ponds. The hatch house and concrete raceways associated with the abandoned trout hatchery are not serviceable (Figure 4-6). Furthermore, because they are located in wetland areas, they may be left in place if they do not interfere with the proposed improvements.



**Figure 4-6. Abandoned raceways at the Crystal Springs Hatchery site.**

#### **4.5.2.3 Existing Acclimation Sites**

The YFCSS program has out-planted smolts from Sawtooth Hatchery, using both direct releases to the Yankee Fork and short-term acclimation in existing dredge pond systems. The dredge ponds are a by-product of the gold dredging activities that occurred in the 1930s and 1950s in several miles of the Yankee Fork. In 1988, four different groups of acclimation ponds were connected (Pond Series 1 through 4) with channels that convey up to 5 cfs of diverted river water (Richards, Cernera, Ramey and Reiser 1992). The purpose of the project was to create off-channel early rearing habitat for anadromous fish including steelhead and spring Chinook. The project included flow control weirs and revegetation efforts as well. The Simplot Corporation holds a 5 cfs water right for flow diverted from the Yankee Fork through each pond complex. Flashboards are adjusted to regulate flow through the ponds. A site plan and description of this water right are provided in Appendix E.

Use of these ponds as acclimation facilities for hatchery fish is also described in published articles by Richards and Cernera (1989), and an evaluation conducted for BPA (Beschta, Griffith, and Wesche 1993).

Direct plants from Sawtooth Hatchery occurred most recently into Yankee Fork near the Jordan Creek confluence. There have also been experimental direct plants of smaller fish higher in the Yankee Fork, above the town of Custer (Richards and Cernera 1989). The YFCSS program does not presently include long-term or overwintering acclimation.

### 4.5.3 Proposed Facilities

#### 4.5.3.1 Adult Collection, Holding and Spawning Facilities

During site visits in the summer of 2010, the existing Pole Flat weir adult fish trap site was evaluated. The present weir is advantageously sited, relatively low in the Yankee Fork watershed, downstream of the major tributary streams and spawning habitat. It is also located on public land (USFS management), just downstream of the dredged reach that is largely in private ownership. For these reasons, the Tribes' propose to retain the adult collection function at or near the Pole Flat site.

The existing weir and temporary field station are on opposite sides of the Forest Service's heavily used Yankee Fork Road. At the weir site, the road is immediately adjacent and parallel to the top of left bank of the Yankee Fork (Figure 4-7).



**Figure 4-7. Pole Flat weir area.**

The onshore work area for the weir is on the opposite side of the road as the weir. This arrangement creates traffic and worker safety issues that need to be resolved as part of the proposed improvements. Two alternatives for adult trap improvements have been preliminarily evaluated in consultation with the USFS:

- Alternative 1: Shift the alignment of Yankee Fork Road 20 to 30 feet to the east. This would create a safe work area adjacent to the weir at the top of the left stream bank.
- Alternative 2: Move the weir approximately 400 feet upstream to an area where there is over 100 feet of forested land between the river and the road (Figures 4-8 and 4-9). A new looped access drive-through would be created, with a widened area for a permanent field station.

The USFS has expressed conceptual support for the proposed Alternative 1 improvements.



**Figure 4-8. Alternative Pole Flat weir site – looking downstream with present weir in background.**



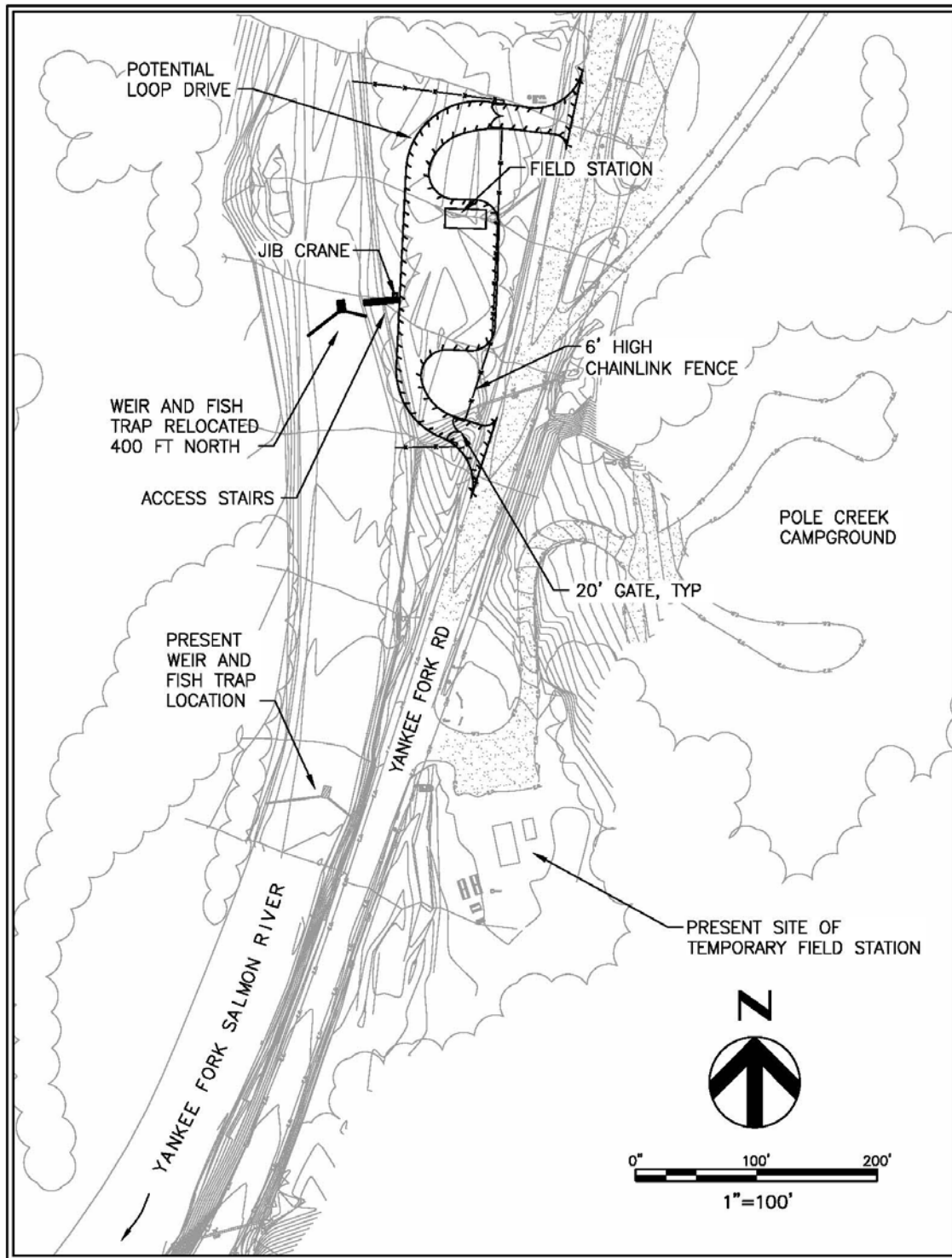
**Figure 4-9. Alternative Pole Flat weir site – looking upstream.**

Feasibility-level engineering analyses of both sites, displayed in Table 4-13, identify advantages and disadvantages of each alternative.

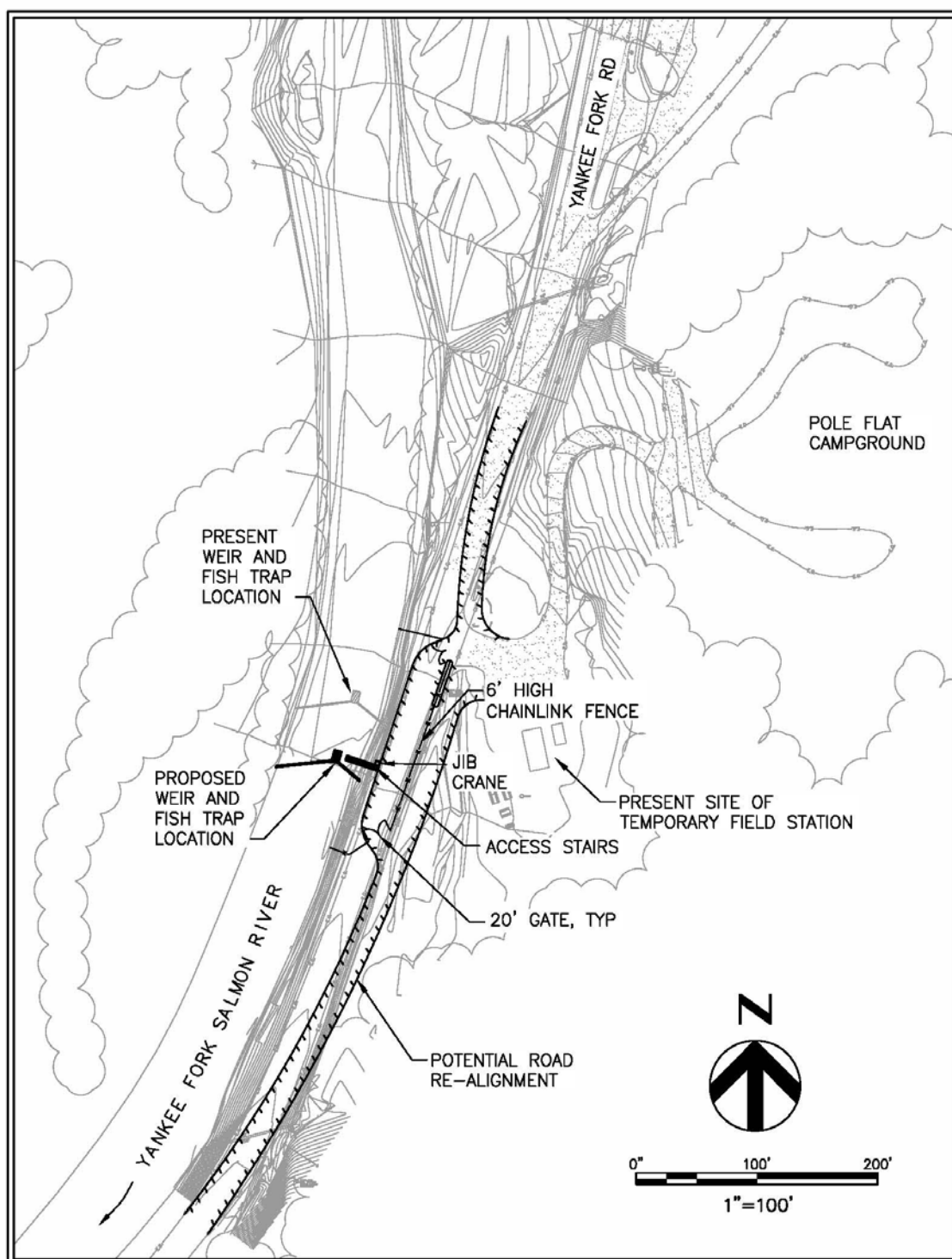
**Table 4-13. Yankee Fork adult Chinook collection site alternatives.**

Site	Advantages	Disadvantages
Existing Pole Flat weir site with USFS road realignment	<ul style="list-style-type: none"> <li>• Improvements would affect mostly previously disturbed areas</li> <li>• Greater stream depth at trap box</li> <li>• Stream has well defined thalweg close to left bank</li> <li>• Trap box can be located closer to land</li> <li>• Stream velocity is lower than upstream location</li> </ul>	<ul style="list-style-type: none"> <li>• Slope retaining structure may be required on east side of road if it is shifted into toe of slope north of campground entrance.</li> <li>• Sight distance along roadway may be reduced somewhat (depending on selected geometry at campground entrance road).</li> </ul>
Upstream weir site with new loop drive access	<ul style="list-style-type: none"> <li>• Larger space for field station is available adjacent to trap</li> <li>• Forest Service may prefer this alternative</li> <li>• This site is downstream of major tributaries and spawning habitat</li> </ul>	<ul style="list-style-type: none"> <li>• Significant disturbance of riparian zone required. An environmental assessment would be required.</li> <li>• Stream is shallower and has higher velocity compared to downstream location</li> <li>• Thalweg is near right bank, trap would be farther from left bank, making fish transport more difficult.</li> </ul>

Figures 4-10 and 4-11 show plan views of each alternative. These alternatives will be discussed by the Tribes and the Forest Service prior to selecting a preferred alternative.



**Figure 4-10. Conceptual design of proposed modifications to the existing Pole Flat weir and collection facilities.**



**Figure 4-11. Conceptual design of alternative upstream weir and collection facilities at Pole Flat.**

Preliminary consultation with the Forest Service indicates support for realigning the Yankee Fork Road and establishing permanent facilities at the current sites. Regardless of which weir alternative ultimately is selected, the Tribes are proposing to transfer adult fish from the trap to a new holding/juvenile stress relief facility to be sited higher in the watershed (see Section 4.5.3.10) in order to minimize trucking distances for broodstock holding. This will eliminate the cost of the river intake screens, piping, pumps, degassing and broodstock holding tanks from the improvements at Pole Flat. Additional modifications to the Pole Flat weir will be required for handling and sorting the larger number of fish estimated to be returning from this project. These improvements include installing a rock sill and safety cable across Yankee Fork at the weir location to allow the Tribes to deploy the weir earlier in the summer (during higher water levels) to capture fish in the early component of the run curve. Improved lighting and utility power will also be provided.

As a back-up measure, the Tribes may hold broodstock at the East Fork facility, as is currently done.

The Panther Creek program will require an adult collection/holding weir and short-term holding/juvenile stress relief facility similar to those described for the Yankee Fork. Figure 4-18 illustrates a non-site specific design for a combined broodstock trapping and holding facility and short-term juvenile stress relief facility. An appropriate site will be identified during the Step 2 preliminary design phase.

#### 4.5.3.2 Crystal Springs Hatchery

The proposed Crystal Springs Hatchery has been planned to produce up to 600,000 smolts for the ongoing YFCSS program and up to 400,000 smolts for the Panther Creek Chinook program, for a total production goal of 1.0 million smolts.

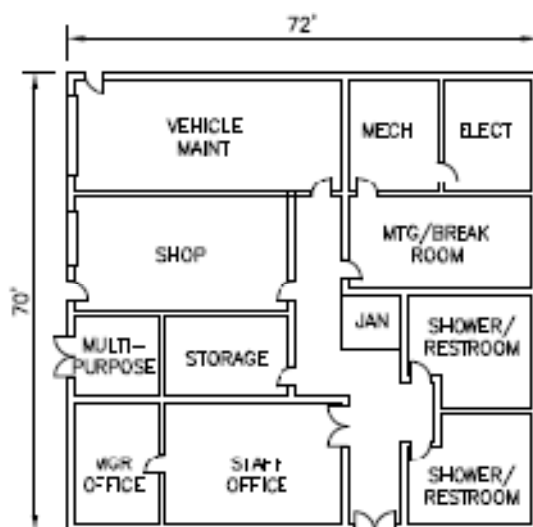
Space requirements for the fish production portion of the hatchery are derived from the bio-program and preliminary operations schedule that is documented in Appendix D. Table 4-14 identifies the major components of the hatchery used to develop preliminary site layouts and cost estimates. Each of these spaces is described in greater detail in the following subsections.

**Table 4-14. Crystal Springs Hatchery space planning.**

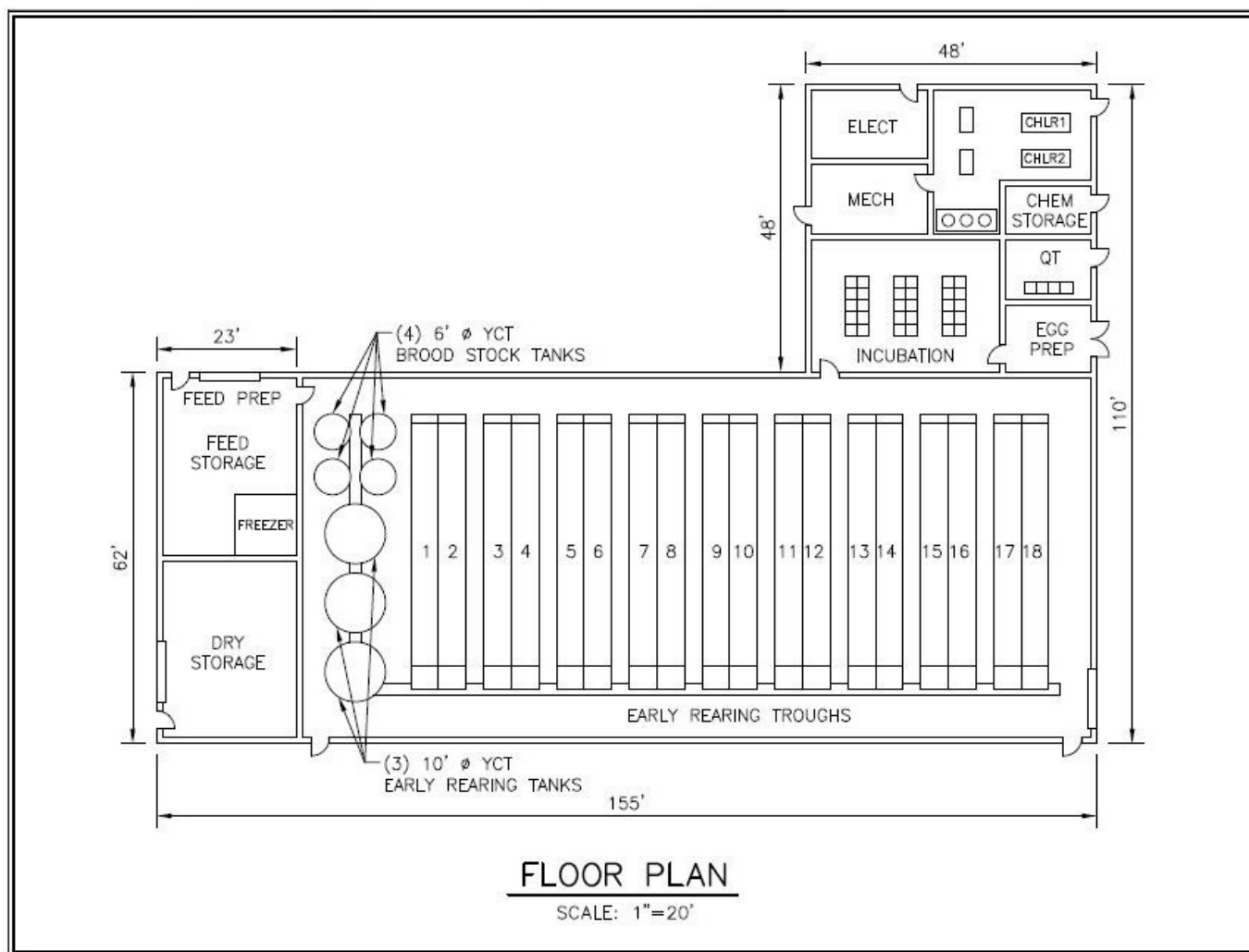
Function	Yankee Fork	Panther Cr.	Total Area
Hatchery Production Facilities			
Egg Receiving and Prep Area	Shared	Shared	150 SF
Incubation – 25 Stacks for Yankee Fork Component; 16 Stacks for Panther Component; 1 Stack for Yellowstone cutthroat trout	480 SF	320 SF	800 SF
Quarantine Room	Shared	Shared	100 SF
Early Rearing – 18 Troughs, 4'x40' x 2.5'deep, in pairs	3,840 SF	2,560 SF	6,400 SF
Flex Tank Area (Yellowstone cutthroat trout)			1,200 SF
Chemical Storage	Shared	Shared	150 SF
Water Treatment (Degassing and Chilling)	Shared	Shared	400 SF
Electrical Room	Shared	Shared	200 SF
Mechanical Room	Shared	Shared	200 SF
Dry Storage	Shared	Shared	600 SF
Feed Storage-Cool Room	Shared	Shared	600 SF
Walk-in Freezer	Shared	Shared	150 SF

Function	Yankee Fork	Panther Cr.	Total Area
Circulation / Interior Walls			1,000 SF
Hatchery Production Building Subtotal			11,900 SF
Outdoor Facilities			
Pumphouses – 4 @ 150 SF	Shared	Shared	600 SF
Outdoor Rearing 5 Ponds at 12,500 CF (25 ft x 100 ft x 5 ft deep)	23,520 SF	15,680 SF	39,200 SF
Effluent Treatment	Shared	Shared	2,000 SF
Circulation – included above	Shared	Shared	0 SF
Outdoor Facility Subtotal			41,800 SF
<b>Support Building – All Spaces Shared</b>			<b>Total Area</b>
Vehicle Storage/Maintenance			710SF
Shop			600 SF
Mechanical/Electrical Rooms			475 SF
Multi-purpose Room			150 SF
Manager's Office			150 SF
3 Staff Offices/Reception Area (open office)			500 SF
Conference/Break Room			400 SF
Mud Room/Janitor Closet			80 SF
Men's Restroom & Showers			300 SF
Women's Restroom & Showers			300 SF
Circulation / Interior Walls @ 10%			1,135 SF
Storage			240 SF
Support Building Subtotal			5,040 SF

Figures 4-12 and 4-13 present floor plans of the Crystal Springs Hatchery and office/shop building layouts, respectively. Figure 4-14 shows the overall conceptual site plan for the proposed hatchery improvements.



**Figure 4-12. Floor plan of Crystal Springs Hatchery office and shop.**



**Figure 4-13. Floor plan of proposed Crystal Springs Hatchery.**

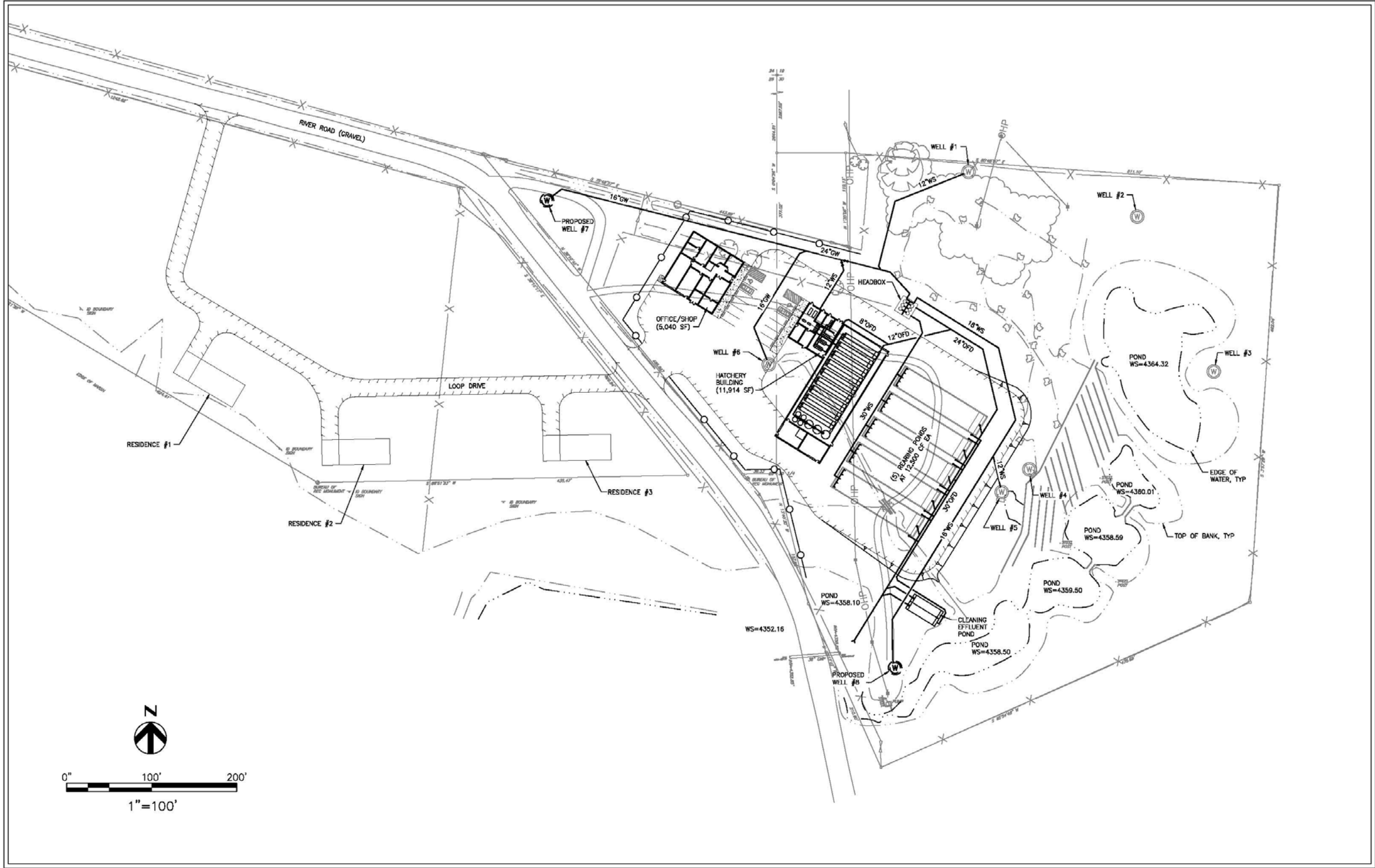


Figure 4-14. Conceptual site plan of Crystal Springs Hatchery improvements.

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### 4.5.3.3 Water Systems

Process water will be provided from a productive, confined artesian aquifer that underlies the project site. This aquifer has an approximately 45-foot-thick water-bearing stratum beginning at a depth of 200 feet below ground surface. As part of this Master Plan, aquifer explorations were conducted in October and November 2010 (see Appendix E). Pump testing was conducted to determine the capacities and characteristics of the six existing wells. To summarize the findings, large supplies of high quality groundwater are available; however, at least two new wells will be needed to deliver groundwater to points of use. Three of the existing wells (numbers 1, 5 and 6) have 12- to 16-inch casings and are proposed to be outfitted with pumps to supply the new hatchery. The other three wells have 8-inch casings with lower yield potential and are not recommended for hatchery supply purposes. Artesian pressure is sufficient to deliver some of the required flow to hatchery facilities without pumping. Obtaining the peak flow rates that are needed in the March and April (prior to out-planting smolts) will likely require pumping to deliver most of the supply. Appendix E provides additional information about the existing aquifer and the proposed process water system.

Due to the relatively small area of land available on the eastern parcel, the Tribe may pursue a water rights transfer to allow process water wells to be constructed on the western parcel. The need for a water right transfer will be evaluated further during the Step 2 preliminary design activities.

Water quality parameters important to hatchery operations were measured at Crystal Springs during aquifer testing in November 2010. Table 4-15 summarizes the key findings.

**Table 4-15. Well water quality at Crystal Springs.**

Parameter	Value
Average temperature (measured in 6 wells)	10.1°C
pH	6.9-7.6
Conductivity	537-574
Dissolved oxygen	5.9-6.3 mg/l
Dissolved nitrogen	107%

Because a trout hatchery previously operated at this site, the water supply is known to be well suited to fish production. The results of detailed water chemistry tests performed in November 2010 indicate that most water quality parameters are within established limits for salmonid culture. High test results for sulphur, magnesium, and nitrate will be investigated in more detail during the Step 2 design phase (see Appendix E). Likely primary water pre-treatment will include aeration/degassing in order to increase the dissolved oxygen content of the water to near saturation, reduce dissolved nitrogen to 100% or less, and reduce carbon dioxide to less than 1.0 mg/l.

Table 4-16 identifies the water budget in terms of peak monthly flows for both the Yankee Fork and Panther Creek programs. The peak flows for juvenile rearing are based on water turnover rates in the outdoor ponds, and can be adjusted by hatchery managers to track fish densities if desired (see Appendix E). An additional flow of up to 0.5 cfs will be provided for the Yellowstone cutthroat trout program as described in Section 6.4.

**Table 4-16. Projected peak monthly flows (in gallons per minute) by lifestage.**

Month	Incubation Flow		Early Rearing Flow		Juvenile Rearing Flow		Total Flow
	YF	PC	YF	PC	YF	PC	
January	123	82			3,740	3,740	7,685
February	123	82			5,610	3,740	9,550
March	123	82			5,610	3,740	9,550
April			213	142	5,610	3,740	9,705
May			397	264			661
June			626	418			1,044
July			926	617			1,543
August	123	82			1,870	1,870	3,945
September	123	82			1,870	1,870	3,945
October	123	82			3,740	1,870	5,815
November	123	82			3,740	1,870	5,815
December	123	82			3,740	3,740	7,685

YF = Yankee Fork Program

PC= Panther Creek Program

In order to achieve energy efficiency, flexibility and reliability in the water system design, the following factors need to be considered and discussed:

- **Elevation to which gravity flow artesian flow can be delivered.** The existing wells are widely spaced around the site as shown in Appendix G, Figure CS-1.1. Static water elevations under shut-in conditions range from 4392 to 4394 feet. The overflow outlet pipe elevation at the largest existing production wells (Well 6) is 4376.61 feet. Aquifer modeling indicates that artesian flow from selected wells will meet incubation and early rearing demands without pumping from May through July.
- **Aquifer productivity has been in decline for an extended period due to increased irrigation withdrawals and weather conditions.** Pump sizes and setting depths will be designed to accommodate these changing conditions.
- **Existing ground elevations.** The existing grade at the proposed hatchery building site is 4373 to 4374 feet, while the elevation at the proposed outdoor pond area is from 4369 feet on the south end to 4373 feet on the north end.
- **Dissolved oxygen and total gas pressure in the existing supply.** This will indicate to what degree oxygenation and degassing treatment will be required as a pre-treatment measure.
- **Groundwater elevations at the proposed building, raceway and effluent treatment pond locations.** Test pits for geotechnical investigations and to determine shallow groundwater depths will be conducted during Step 2, preliminary design.
- **Elevation of receiving waters for hatchery effluents.** The existing ponds below the proposed hatchery improvements have an approximate water surface elevation of 4360 feet. The invert

elevation of the proposed raceways and settling ponds will need to be at least two to three feet above this elevation to ensure gravity flow drainage.

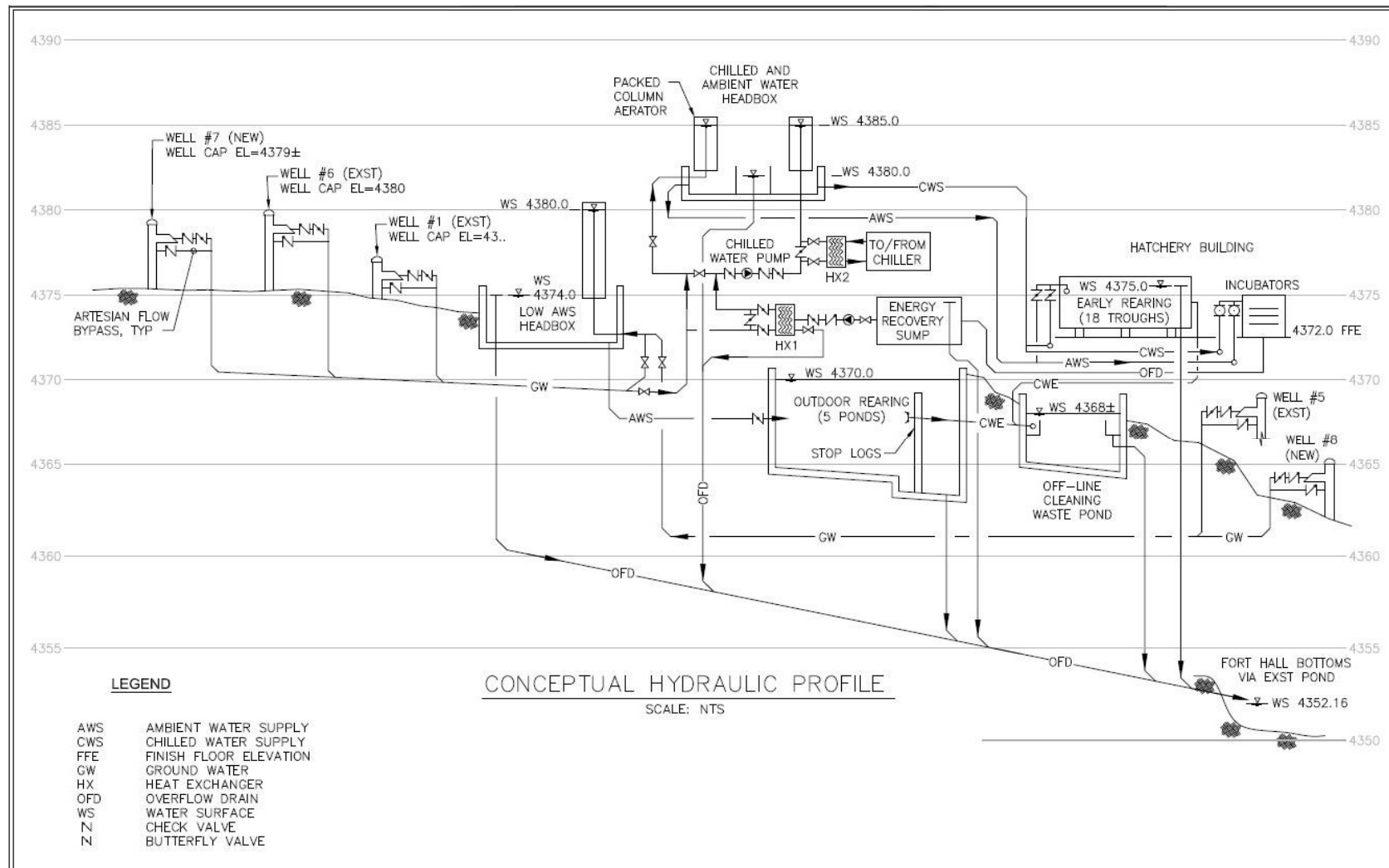
The conceptual hydraulic profile (Figure 4-15) shows the following key elevations:

- Static water elevation in artesian wells 4394 feet
- Water surface of proposed outdoor rearing ponds 4370 feet
- Floor elevation of proposed hatchery 4372 feet
- Incubator/early rearing water surface 4375 feet
- Hatchery headbox water surface elevation 4380 feet
- Incubation de-gas column water surface elevation 4385 feet
- Outdoor rearing de-gas column water elevation 4380 feet

These elevations will be refined during the preliminary design process to ensure that the hatchery water supply system is flexible, reliable and energy efficient.

Drawing CS-4 (Appendix G) illustrates the conceptual design of a water collection piping system that will deliver water from each well to a central hatchery headbox. The proposed collection system is configured in two separate pipelines: a south system that collects water from Well 5 (existing) and Well 8 (new), and a north system that collects water from Wells 1 and 6 (existing) and Well 7 (new). It may be feasible to run one of the pipelines in gravity flow artesian mode to supply the lower elevation raceway, while the other pipeline is operated in pumped mode to supply water to higher elevations for incubation or early rearing. The supply water will be treated with aeration/degassing units to raise the dissolved oxygen levels to near saturation and reduce dissolved nitrogen levels. The configuration of headboxes and aeration units will be studied and evaluated in future design phases.

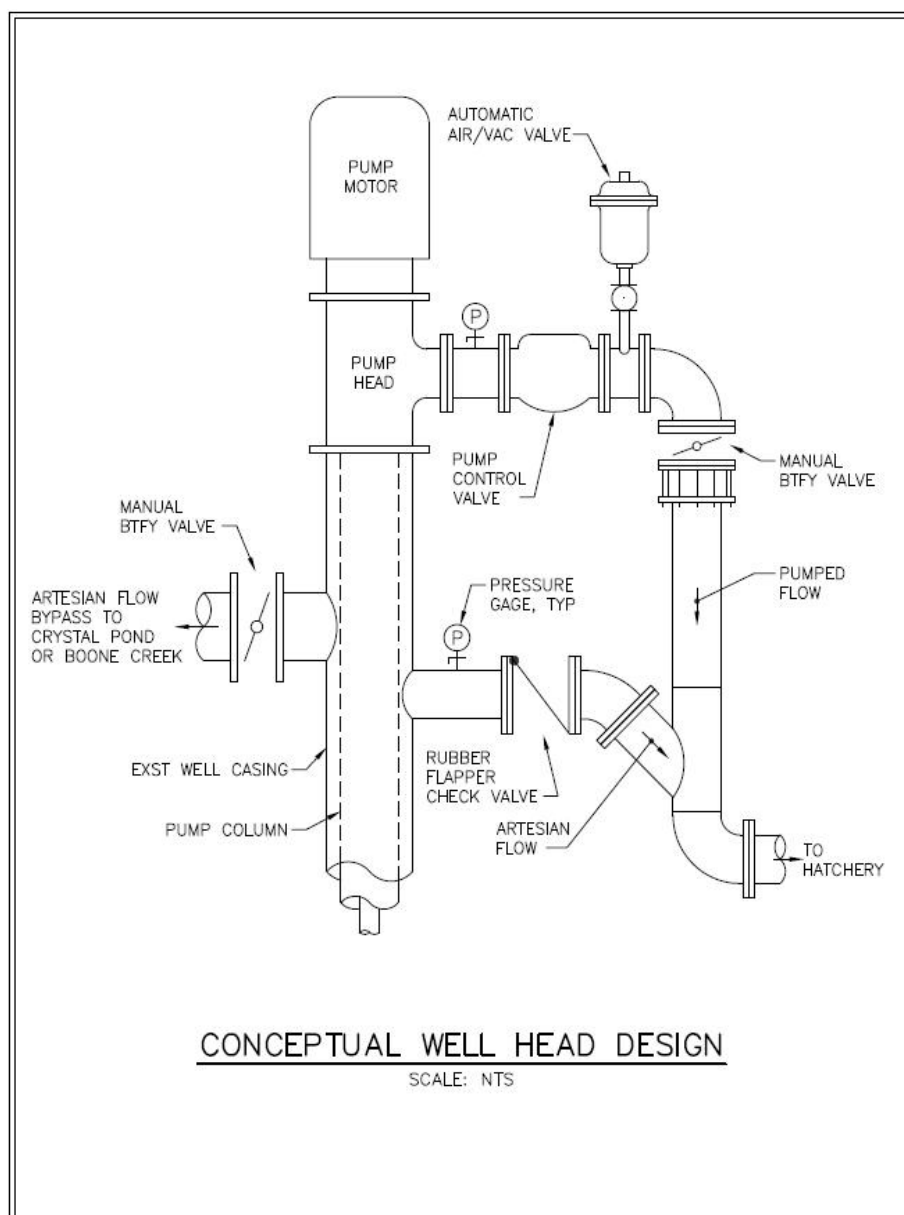
The biocriteria shown in Appendix D indicate that significant chilling of incubation water will be required to achieve fish development goals. To reduce chiller size and related power costs, an energy recovery system will be incorporated to pre-chill the incoming groundwater using the chilled effluent from the incubators.



**Figure 4-15. Crystal Springs Hatchery conceptual hydraulic profile.**

#### 4.5.3.4 Well Head Design

A unique well head design will be needed to deliver either pumped or artesian flow from each well. This is conceptually illustrated in Figure 4-16, showing a configuration of plumbing improvements at a typical well head. The existing water right requires that flow be measured at the points of diversion, potentially dictating that each well be metered to measure both artesian and pumped flows. Test pumping indicates that the wells tend to produce sand when the pumps are first started. Provisions will be included for temporary blow-offs to minimize the amount of sand that enters the system. General weather and freeze protection will be an important well head design consideration and several alternatives are being evaluated. Heated well houses, sub-surface pitless adapter units, and insulation with heat trace are under consideration.



**Figure 4-16. Proposed well head design.**

Preliminary investigations and predictions indicate that drawdown of the aquifer during pumping will be minimal, on the order of 30 to 40 feet. Friction losses in piping systems during peak flow periods and static lift to degassing units will add an additional 15 to 20 feet to pump head requirements. Low head, high volume pumps are proposed for up to five wells. During peak demand periods, three of the pumps will be normal duty, while the two remaining pumps will be on standby. Each pump for the new wells and the Well 6 pump will have a preliminary design point of approximately 3,600 gallons per minute, at 60 feet of total dynamic head. Pump motors will be in the 50 to 60 horsepower range to meet current aquifer conditions. These may be upsized by 10 to 15 horsepower to accommodate predicted declines in aquifer levels over the next 20 years. Pump motors will be equipped with soft starters, perhaps some with variable frequency drives and automatic controls. Each pump will be connected to a central emergency generator to reduce the risk of interruptions to the hatchery water supply.

#### **4.5.3.5 Incubation Facilities**

Eggs will be delivered to the Crystal Springs Hatchery in August through September from remote spawning facilities. After fertilization, eggs will be water hardened in iodophor and then loaded into heath tray incubators at 3,000 to 5,000 eggs per tray (each tray containing eggs from individual females). They will be maintained this way until the results of any disease screening are complete. Excess iodophor will be disposed of by land application or stored in a pump-out tank for periodic remote disposal.

Pathogen-free groundwater will be provided at a flow rate of 5 gallons per minute to each stack. A total of 41 stacks (25 for Yankee Fork and 16 for Panther Creek) will be supplied with 205 gallons per minute. A smaller separate quarantine incubation room will be provided for research and experimental egg handling operations. Both chilled and ambient groundwater will be provided to each incubator. It is anticipated that the supply water will be chilled to approximately 40° F for the duration of the incubation period, slowing fish development in order to achieve the target size by the release date.

A hard-piped chemical feed system will be used to deliver daily argentine or formalin treatments to each incubator stack to prevent fungus growth on the eggs. Overflow water from the incubators will fall through gratings into floor trenches that convey the water into the hatchery drain system. Adequate dilution flow will be maintained through the hatchery drain system avoid exceeding chemical concentration limits in the hatchery outfall.

#### **4.5.3.6 Rearing Facilities**

- Early Rearing: Beginning in March, swim-up fry will be transferred from the incubators into early rearing troughs located in a 60- by 132-foot room adjacent to the incubation area. The troughs illustrated in this Master Plan are 40-foot-long, 4-foot-wide and 2.75-foot-deep fiberglass vessels, configured in pairs, with narrow access aisles between each pair. Other styles of troughs will be evaluated during the preliminary design phase. Pathogen-free groundwater will be supplied to the upstream end of each rearing trough through a valved connection for flow control. Typical flow rates to each trough will be 84 gallons per minute (37 minute turnover), at an average temperature of 10° C. Each trough will have screens for segregating and retaining batches of fish, and stop logs or standpipes for water level control. A grated floor trench will run the length of the room at the downstream end of the troughs to collect overflow/drain water and route it into the hatchery drain pipe system. A cleaning waste

drain pipe will be routed inside the floor trench to collect and convey vacuumed cleaning wastes to an off-line settling basin.

- **Juvenile Fish Marking:** In late July to early August, the Tribes will transfer the juveniles from the early rearing troughs into the outdoor rearing ponds. The target size range for transfer is 150 to 200 fish per pound, which is large enough to mark/tag fish during the transfer process and reduce overall handling. A marking/tagging trailer will be mobilized and located in a paved area between the early rearing room and outdoor raceways. Temporary piping and fish pumping systems will be used to convey the young fish from the early rearing troughs into the marking/tagging trailer. After marking, temporary gravity flow piping will be used to transfer the fish into the outdoor ponds.
- **Outdoor Rearing:** The outdoor ponds used for juvenile rearing will be constructed of cast in place concrete, with inlet, outlet and intermediate screens to retain and segregate fish, and stoplogs to control water level. The bioprogram (see Appendix D) indicates that five ponds will be required to meet the production goal of one million smolts at 10 fish per pound. The ponds will be arranged in a row, with a 15-foot-wide access aisle between them. The rearing area of each raceway will be 100 feet long, 25 feet wide, with an average water depth of 5 feet, and a volume of 12,500 cubic feet. A 10-foot-long quiescent zone will be provided at the downstream end of each raceway to allow settleable solids to separate from the water column. The floor slab in front of the quiescent zone will have a recessed floor that can be used as a kettle during fish transporting operations.

Up to 1,870 gallons per minute of groundwater will be supplied through a manifold to the upstream end of each outdoor pond via a 12-inch valved connection (50 minute turnover). Water level in each pond will be controlled by stoplog weirs, positioned across the full width of the pond in order to reduce dead spots and provide good circulation. The overflow water from each pond will be piped into a common drain that discharges into the wetland ponds to the south. A separate cleaning waste vacuum piping system will be used to collect settled solids for each raceway and convey the concentrated wastes to an off-line settling pond.

#### **4.5.3.7 Hatchery Housing**

Three new residences are planned for full-time staff of Crystal Springs. The housing units will be three bedroom, 2 bath, approximately 1,800 square feet, plus a two car garage. Due to the limited amount of land available on the eastern parcel, the residences will be located on the western parcel.

#### **4.5.3.8 Administration and Other Support Facilities**

Administration facilities will consist of offices within the office/shop building. A 150-square foot manager's office and 350-square foot open office with partitions for support staff is planned. Support facilities in the shop/office building including a meeting/break room, mud room, restrooms and showers, chemical storage, multi-purpose room (lab), vehicle storage and maintenance, shop, and mechanical electrical rooms. Additional support facilities, including dry storage, feed storage/cool room, and walk-in freezer may be at the west end of the hatchery building.

#### **4.5.3.9 Utilities**

Utility system improvements needed for the Crystal Springs Hatchery include:

- Power: An overhead three-phase power line bisects the proposed outdoor pond area. These power lines will be re-routed as needed to accommodate the final locations of proposed improvements. A new pad-mounted transformer and three-phase underground electrical service will be provided to the new buildings and well pumps. The Tribe is investigating alternatives for incorporating renewable energy sources such as wind, solar, and low head hydropower into the design of the new hatchery.
- Communications: Phone and data service will need to be extended to the new hatchery building and residences.
- Potable Water: It may be possible to use one of the small artesian wells that served the abandoned trout hatchery as the potable water supply well. A well pump and pressure tank system will be installed to meet the higher pressure required to meet domestic water demands. Alternatively, a new domestic water well could be drilled, probably on the eastern parcel to provide water to the residences and hatchery facilities.
- Domestic Wastewater: Each of the new residences, the hatchery and office shop buildings will have a dedicated septic tank and drainfield.
- Stormwater: Run-off from the newly developed portions of the site will be directed into filter strips or bio-swales for treatment before discharging into the existing surface drainage systems. The capacity of the existing 36-inch culvert under River Road will be adequate to convey treated stormwater and hatchery effluent from the site.

#### **4.5.3.10 Juvenile Stress Relief Facilities**

Developing new juvenile stress relief site(s) on Yankee Fork and Panther Creek is a priority for Shoshone-Bannock Tribes. Much of the highest quality spawning habitat in the Yankee Fork is located upstream of the dredged reach (Richards and Cenera 1989), above the Jordan Creek confluence. It is desirable to release the hatchery-origin smolts as high in the watershed as possible since there is evidence that returning adults tend not to migrate above the acclimation site from which they were released (pers. comm., A. Appleby, DJ Warren & Associates, 2010).

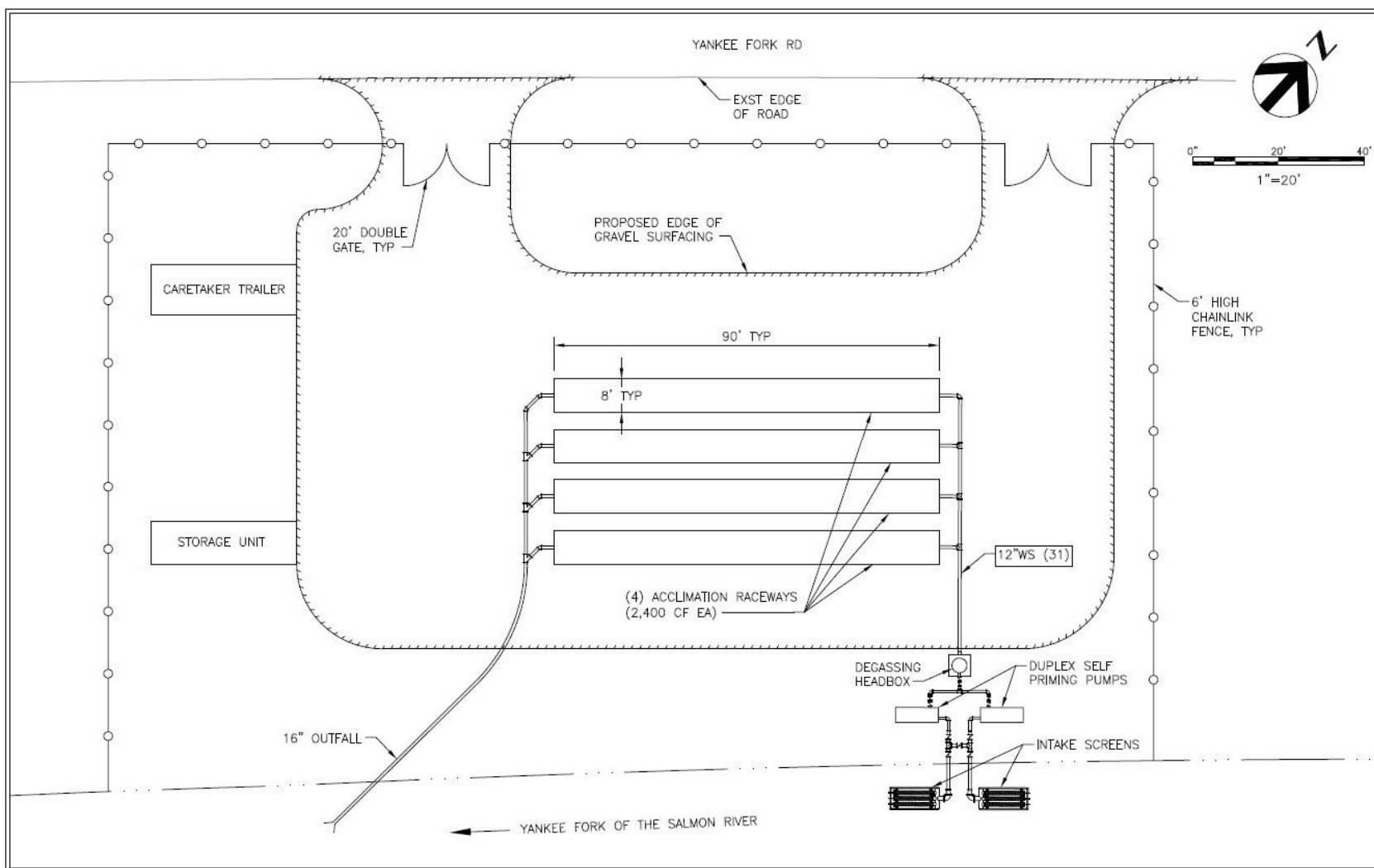
There are some access and water right challenges to overcome for the preferred stress relief reaches. The various off-channel ponds in the dredged reach suitable for holding juvenile fish are privately owned and may not be available unless agreements are reached with the land owner. Vehicle access to upstream sites in the late April out-planting period is variable; the Yankee Fork Road is plowed up to the Town of Custer, at approximately river mile 9.9. This leaves a 1.5-mile reach of Forest Service land between the Jordan Creek confluence and Custer that may be available and appears to be an ideal location for temporary juvenile and adult holding facilities. An alternative site, just upstream of the confluence with Jordan Creek, may also be suitable. Preliminary investigations indicate that it should be feasible for the Tribes to obtain a non-consumptive water right for diversion of Yankee Fork flow through the proposed ponds. Several potential sites will be investigated further during the Step 2 preliminary design phase.

For planning and budgeting purposes, a generic stress relief/adult holding pond design has been developed (Figure 4-17). Its primary components will be modular and portable, capable of deployment at various sites if necessary. The design includes portable fiberglass holding ponds (8 feet by 90 feet), a water supply system including intake screens, self-priming pumps, aeration head

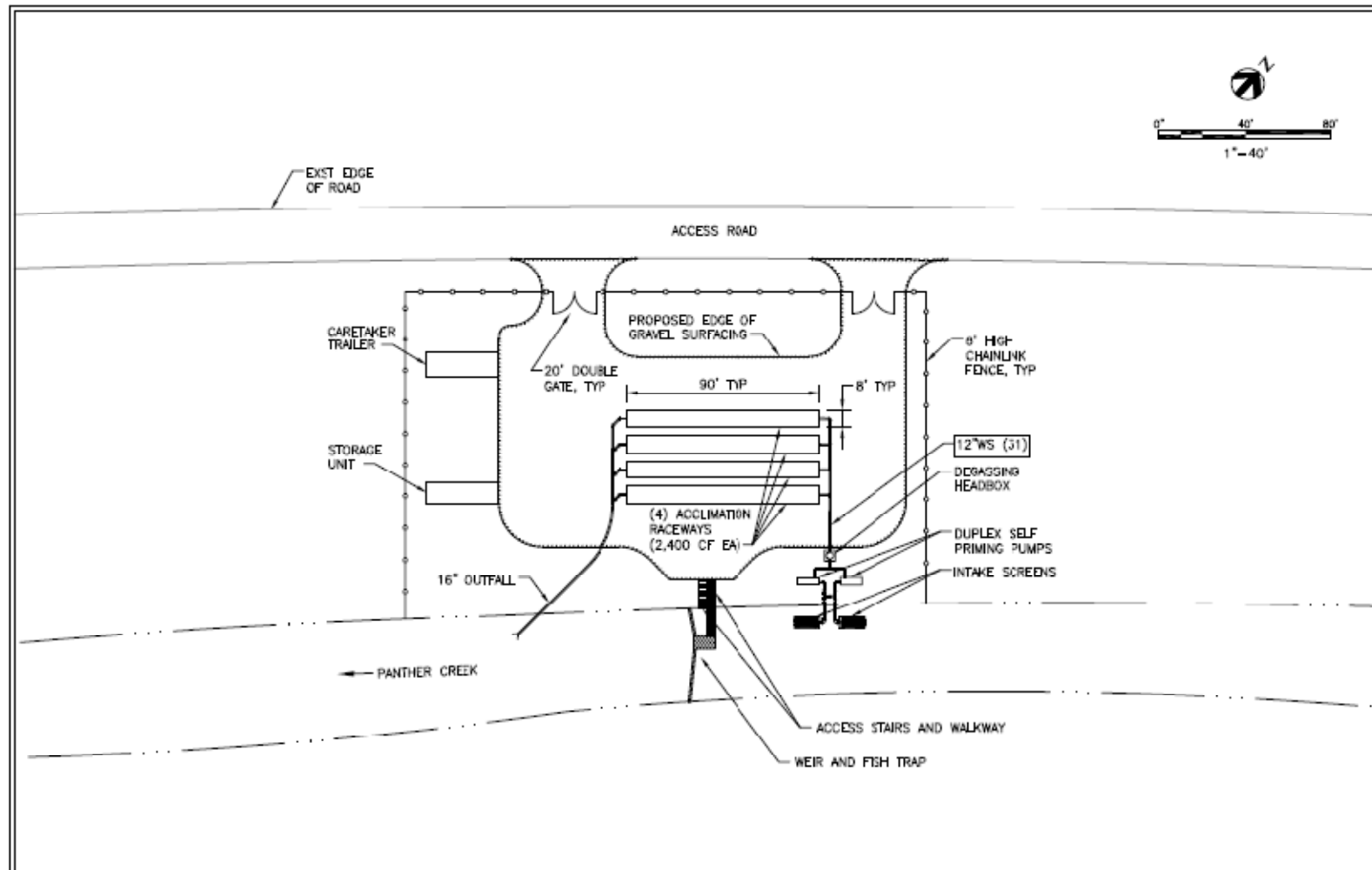
box, plastic delivery pipe, control valves, flow meters, low level alarms, and outfall/fish transfer pipes for both volitional and forced release of fish, and a ramp for off-loading fish from transport tanks into the ponds. A storage container for equipment and supplies and a travel trailer for an on-site caretaker when fish are on station are also included. Each pond will provide temporary holding for approximately 80,000 smolts. These stress relief ponds also will be used to hold adult fish collected at the Pole Flat Weir until they are ready to be spawned.

The Tribes may also experimentally use portions of Pond Series 1, (see Appendix G) as acclimation ponds. The outfall from this pond series is 0.25-mile upstream of the Pole Flat weir site, relatively low in the watershed. The upper ponds of the series are located on private property; only the downstream-most pond is on USFS property. If permission can be acquired, the primary improvements to these ponds will be to construct outlet control structures and perhaps some deepening and widening of the lower pond.

On Panther Creek, the Tribes are working with Forest Service to obtain a special use permit to install a weir and temporary juvenile and adult holding facility above the Clear Creek confluence. A non-site specific design, showing the major facility components, is provided in Figure 4-18. Up to 300 adult fish could be held at this site during the summer/fall broodstock collection period in addition to the short-term holding for smolt stress relief in April/May each year.



**Figure 4-17. Conceptual Yankee Fork stress relief pond site plan.**



**Figure 4-18. Conceptual Panther Creek weir and juvenile/adult holding site plan.**

#### **4.5.4 Development and Operation Schedules**

Planning level production and operations schedules for the proposed Crystal Springs Hatchery are based on the program described in Section 2 and the facilities described in Section 4. These schedules demonstrate how the target production of up to one million spring/summer Chinook salmon smolts will be achieved for the Yankee Fork and Panther Creek programs.

The primary biological variables used to prepare the preliminary operations schedule include water temperature (a species-specific condition factor for Chinook), density and flow indices. Water temperature is the primary determining factor in the development and growth rate of fish. The groundwater supply to be used for all stages of incubation and fish rearing will provide relatively constant year round water temperatures. A chilled water temperature of 4.5° C was assumed for the winter incubation period and 10° C was used for the early rearing and juvenile rearing periods. Based on these primary biological variables and the spring Chinook production goals, specific biocriteria were developed and form the basis of the preliminary operations schedule shown in Tables 2-1 and 2-2 of Appendix D. This schedule depicts water use by month and space requirements for each operational area of the fish culture process, including incubation, early start-up rearing and juvenile rearing in outdoor ponds.

The basis of the values used for bio-programming and the criteria used to formulate the operations schedule and water requirements are detailed in Appendix D.

The preliminary operations schedule covers a two-year period in order to understand and incorporate overlapping water requirements for juvenile fish (reared to a smolt stage) from two brood years on site at one time. A summary of the full operations schedule (the upper section of Tables 2-1 and 2-2 in Appendix D) shows the timing of incubation, early indoor rearing and juvenile outdoor rearing in ponds. The adult holding component of the program is an existing function that begins each August at off station facilities and runs continuously through the end of October. In summary, the functions proposed at Crystal Springs Hatchery will occur as follows:

- Egg incubation extends from mid-August through March
- Early rearing in indoor troughs begins in late March to April and extends through July
- Outdoor juvenile rearing begins in August and extends through the following April

The resulting water requirements are for a peak flow of 20.8 cfs (9,350 gpm) to the outdoor rearing facilities for a given brood year, and a concurrent demand of 0.8 cfs (355 gpm) for early rearing supply to the successive brood year in April of each year. Thus, the total peak demand for the spring/summer Chinook program is estimated to be 21.6 cfs.

## 4.6 MONITORING, EVALUATION AND RESEARCH OF SNAKE RIVER CHINOOK PROGRAM

The proposed monitoring and evaluation for the Chinook programs in the Yankee Fork and Panther Creek will focus on five areas:

- Determining if program conservation and harvest objectives are being achieved
- Ensuring that hatchery culture practices meet identified standards
- Quantifying hatchery fish performance as they migrate to and from the ocean
- Documenting hatchery-origin adult stray rates to other out-of-basin streams
- Tracking natural fish population abundance, productivity, life history diversity and spatial structure

The proposed monitoring program builds upon the monitoring and evaluation work currently being implemented to evaluate the YFCSS (RMECAT-00165 - Supplementation Projects Project Number: 2008-905-00). The existing monitoring and evaluation program has six tasks:

- Task 1. Assess out-of-basin factors affecting smolt outmigration
- Task 2. Calculate mainstem mortality
- Task 3. Develop smolt-to-adult return ratios
- Task 4. Estimate freshwater productivity
- Task 5. Estimate juvenile and adult abundance
- Task 6. Data analysis, reporting, and coordination

Under the YFCSS, the Tribes are measuring Yankee Fork productivity (treatment) for comparison with those of wild populations in Bear Valley Creek, Valley Creek and East Fork Salmon River (the control systems) as part of the Idaho Supplementation Studies. A description of the YFCSS program can be found at: <http://www.cbfish.org/Proposal.mvc/Summary/181>.

The major addition to the YFCSS monitoring and evaluation program proposed in this Master Plan is to evaluate harvest levels, hatchery culture practices, hatchery fish performance and HOR stray rates in comparison to other populations in the basin. The overall goal is to determine if program conservation and harvest objectives can be achieved in both Panther Creek and the Yankee Fork.

### 4.6.1 Ongoing and Proposed Monitoring and Evaluation Program Performance Standards and Indicators

A list of the performance standards and indicators proposed for the Chinook monitoring and evaluation program are summarized in Table 4-17. The expected method to determine if a standard has been met is also presented in this table. A more detailed monitoring and evaluation plan will be developed for the Step 2 submittal as required by the NPCC.

The benefits and risks to natural populations associated with the indicators are presented in Table 4-18. The indicators have been combined where possible to reduce redundancy in the table. For this analysis, it is assumed that achieving the indicator is considered a benefit; non-achievement is considered a risk.

**Table 4-17. Spring/summer Chinook hatchery program performance standards, indicators and monitoring and evaluation methods.**

Performance Standard	Indicator	Monitoring and Evaluation Methods
Program contributes to fulfilling tribal trust responsibility mandates and treaty rights, as described in the applicable agreements such as under U.S. v. Oregon and U.S. v. Washington.	<ul style="list-style-type: none"> <li>- Total number of fish harvested in tribal fisheries targeting this program</li> <li>- Total fisher days or proportion of harvestable return taken in tribal resident fisheries, by fishery</li> <li>- Tribal acknowledgement regarding fulfillment of treaty rights</li> </ul>	The Tribe will conduct harvest surveys in the Yankee Fork and Panther Creek. This information will be combined with work undertaken by the IDFG and others to determine total harvest rate.
Fish produced for harvest are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while avoiding over-harvest of non-target species.	<ul style="list-style-type: none"> <li>- Annual number of fish produced by this program caught in all fisheries, including estimates of fish released and associated incidental mortalities, by fishery</li> <li>- Annual numbers of each non-target species caught (including fish retained and fish released/discarded) in fisheries targeting this population</li> <li>- Recreational angler days, by fishery</li> </ul>	
Program addresses ESA responsibilities	ESA consultation(s) under Section 7 have been completed, Section 10 permits have been issued, or HGMP has been determined sufficient under Section 4(d), as applicable	HGMP and Section 7 permits will be submitted to NMFS for approval
Release groups sufficiently marked/tagged in a manner consistent with information needs and protocols to enable determination of impacts to natural and hatchery-origin fish in fisheries	<ul style="list-style-type: none"> <li>- Marking rate by type in each release group documented</li> <li>- Document the number of marks identified in juvenile and adult groups</li> </ul>	<ul style="list-style-type: none"> <li>- 100% of the hatchery fish will be coded-wire tagged</li> <li>- 15% will be marked with PIT-tags</li> </ul>
Fish collected for broodstock are taken throughout the return in proportions approximating the timing and age structure of the population	<ul style="list-style-type: none"> <li>- Manage temporal distribution of collected broodstock</li> <li>- Manage age composition of collected broodstock</li> <li>- Composition of broodstock (HOR and NOR)</li> </ul>	<ul style="list-style-type: none"> <li>- Fish for broodstock will be collected at random from the run at large (NOR and HOR).</li> <li>- Broodstock collection will occur at the weir</li> </ul>
Weirs do not impact access to spawning and rearing areas	<ul style="list-style-type: none"> <li>- Fish migrate rapidly past the structure</li> <li>- Large numbers of spawners are not observed downstream of weir</li> </ul>	<ul style="list-style-type: none"> <li>- Weir operators will observe fish behavior daily and report indications of delay to managers.</li> <li>- Spawning surveys will be conducted above and below the weir each week</li> </ul>

Performance Standard	Indicator	Monitoring and Evaluation Methods
Weir/trap operations do not result in significant stress, injury, or mortality in natural populations	<ul style="list-style-type: none"> <li>- Mortality rates in trap documented</li> <li>- Document pre-spawning mortality rates of trapped fish in hatchery or after release</li> </ul>	Weirs and Adult Holding facilities will continue to be operated in a manner that reduces mortality.
Life history characteristics of the natural and hatchery populations remain similar to the extent possible	Life history characteristics of natural and hatchery-produced populations are measured (e.g., juvenile dispersal timing, juvenile size at outmigration, adult return timing, adult age and sex ratio, spawn timing, rearing densities, growth, diet, physical characteristics, fecundity, egg size)	Tribal staff will continue to monitor juvenile and adult natural populations in the Yankee Fork (and Panther Creek). These same data will be collected at Crystal Springs for HOR fish.
Patterns of genetic variation within and among natural populations do not change significantly as a result of artificial production	Develop genetic profiles of naturally-produced and hatchery-produced adults	Genetic data will be collected on adults arriving at weirs and on the spawning grounds (i.e., carcasses)
Juveniles are released in natural acclimation areas to maximize homing ability to intended return locations	<ul style="list-style-type: none"> <li>- Location of juvenile releases</li> <li>- Length of acclimation period</li> <li>- Release type, whether forced, volitional, or direct stream release</li> </ul>	Juvenile acclimation sites are being developed for the program. The parameters listed will be collected and reported yearly.
Juveniles are released at fully smolted stage of development	Level of smoltification at release is documented	Fish will be examined for signs of smoltification (transparent fins, silvery appearance, lose of parr marks) prior to release
Juvenile fish migrate quickly out of the basin after release	Migration timing and survival to traps and Lower Granite Dam	15% of the juvenile HOR and NOR (variable rate) fish will be PIT-tagged and released
The artificial production program uses standard scientific procedures to evaluate various aspects of artificial production	Hatchery culture practices follow best management practices	<ul style="list-style-type: none"> <li>- Life stage survival rates, flow, rearing densities, mortality and disease will be monitored using standard hatchery practices.</li> <li>- Pathologist will sample fish for disease as needed throughout the culture period</li> </ul>
Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols.	Annual reports indicating level of compliance with applicable standards and criteria	
Releases do not introduce pathogens not already present in the local populations and do not significantly increase the levels of existing pathogens	Certification of juvenile fish health documented prior to release	

Performance Standard	Indicator	Monitoring and Evaluation Methods
Hatchery-origin adults do not stray and spawn with other populations	Stray rate is less than target value	Carcass and spawning surveys will be used to estimate HOR stray rates to other streams and populations
Smolt to adult (SAR) survival rates of natural-origin and hatchery-origin smolts are known	SAR of HOR ; SAR NOR fish	HOR and NOR fish will be coded-wire tagged and PIT-tagged to quantify smolt-to-adult return rates and total production. Data will be made available to regional data centers for analysis and storage.
Reproductive success of NOR and HOR spawning naturally (NOS and HOS) are known	Adult recruits per spawner(R/S) of HOR and R/S of NOR fish	Genetic analysis of returning adults from natural spawners will be used to quantify R/S values for both HOR and NOR
Increasing NOR abundance over time	Counts of NOR fish	NOR abundance will be tracked at weirs and on the spawning grounds through carcass surveys

**Table 4-18. Benefits and risks to natural fish associated with each monitoring and evaluation indicator.**

Indicator	Benefits and Risks
Broodstock composition, timing, structure similar to wild fish	<p>Benefit: Achievement ensures that the hatchery population reflects the characteristics of the natural population to the extent possible by including natural- origin fish as broodstock, collecting fish randomly throughout the entire portion of the run, and including jacks in broodstock.</p> <p>Risk: As these indicators less represent the natural population, the more divergent the two populations become, thereby reducing natural population productivity and diversity.</p>
Adult holding and spawning survival rate, and egg-to-fry-to-parr-to smolt survival rates for both HOR and NOR fish	<p>Benefit: Hatchery culture practices that maximize life-stage survival make the most efficient use of the resource and reduce the need to include additional NOR adults for use as broodstock (due to an increase of total brood).</p> <p>Risk: Low survival rates indicate poor hatchery culture practices. Because of this, the hatchery may be artificially selecting for genes/traits that are more conducive for survival in the hatchery rather than the natural environment.</p>
Mating protocols (percent jacks, percent males, pNOB)	<p>Benefit: Proper mating protocols ensure high fertilization rates (increase survival) and maximize genetic diversity of the broodstock. The use of jacks maintains genetic continuity between generations.</p> <p>Risk: Poor mating protocols may reduce genetic diversity and thereby reduce overall population productivity and reproductive success in the natural environment.</p>
Number and severity of disease outbreaks	<p>Benefit: Having fewer and less severe disease outbreaks reduces the disease risks that hatchery populations and operations pose to natural populations. This results in better natural population productivity, diversity and spatial structure as natural populations located close to the hatchery may be more impacted than those further away.</p> <p>Risk: Frequent and severe disease outbreaks reduce population productivity and require more natural- and hatchery-origin broodstock to produce a similar number of fish. Using more natural-origin fish in the hatchery reduces natural spawning escapement, which may reduce population productivity, spatial structure and diversity.</p>
Hatchery effluent quality	<p>Benefit: Achieving high quality hatchery effluent maintains water quality in the receiving stream. Good water quality is essential for the production of all fish species.</p> <p>Risk: Hatchery effluent that degrades water quality may decrease the survival and overall productivity of the natural population.</p>
Release timing, fish health, size and condition of released fish	<p>Benefit: Releasing healthy fish at the correct size and time increases overall survival and reduces the release numbers needed to achieve conservation and harvest objectives.</p> <p>Risk: Releasing fish that are too large/too small may result in increased predation/competition on natural fish populations or reduced survival of hatchery origin smolts. A mismatch between release timing and environmental conditions required for good survival may reduce overall hatchery performance.</p>
Smoltification level	<p>Benefit: Achieving proper physiological condition creates a fish that rapidly migrates to the ocean and is able to make the physical changes needed to enter the marine environment; resulting in increased survival.</p> <p>Risk: Releasing fish that are not ready to migrate results in these fish residing in the receiving streams where they compete with wild fish for food and space, reducing natural population productivity. If the hatchery fish are larger than wild fish, they may predate on these wild juveniles, decreasing their abundance.</p>

Indicator	Benefits and Risks
Smolt-to-adult return rate (SAR)	<p>Benefit: High SAR is an indicator that the hatchery is producing a high quality smolt able to survive in the natural environment from point of release to return as an adult. The higher the survival rates, the fewer hatchery fish that need to be produced to achieve conservation and harvest objectives. Decreased hatchery production reduces competition with the natural population, which may result in increased natural fish production.</p> <p>Risk: Low survival rates indicate that rearing practices are producing a fish of lesser quality. Hatchery production levels required to achieve conservation and harvest objectives may be higher than optimal and represent a risk to natural populations.</p>
Natural adult abundance	<p>Benefit: High natural adult abundance levels indicate that the population is healthy and has low risk of extinction. Abundance is an indicator of the need for a hatchery program. As natural production levels increase, conservation and harvest objectives can be met with less reliance on hatchery programs.</p> <p>Risk: Low natural abundance is indication that environmental conditions may be insufficient to maintain the population over time (high extinction risk). Hatchery production, with all of its inherent risks to natural populations, is needed to achieve conservation and harvest objectives.</p>
Adult run-timing (HOR and NOR)	<p>Benefit: For integrated programs, the run-timing of hatchery and natural runs should match, as this is an indicator that the two populations are expressing similar life histories, and that both are being exposed and adapting to the full range of environmental conditions present in the basin.</p> <p>Risk: A mismatch in run-timing between the two populations (HOR and NOR) indicate that hatchery practices are selecting for life histories dissimilar to those being expressed by the natural population. The two populations may become more divergent over time, resulting in greater genetic impacts to natural populations from hatchery fish spawning in the natural environment. This could include a loss in productivity, diversity and spatial structure.</p>
HOR straying	<p>Benefit: Good homing fidelity of HOR fish to the release site is important for eliminating the genetic risks hatchery fish pose to wild fish from interbreeding. The higher the homing fidelity, the lower the risk. High homing rates also ensure that broodstock are available for culture so that wild populations do not need to be excessively used to achieve production targets.</p> <p>Risk: High HOR straying rates may result in the population becoming more and more adapted to the hatchery rather than the natural environment. This makes the population less resistant or adaptable to environmental change and reduces population diversity.</p>
Reproductive success of NOR and HOR spawning naturally (NOS and HOS)	<p>Benefit: The reproductive success of both NOR and HOR fish in nature is an indicator of the ability of each to maintain themselves in a natural environment. The ideal conservation hatchery program should produce a fish with the reproductive success of a natural fish. This indicates that the two components of the population are virtually identical in their ability to reproduce themselves in the wild and that hatchery culture practices have been successful.</p> <p>Risk: Low reproductive success of hatchery fish, or decreasing productivity of natural-origin fish spawning with hatchery fish, may be indicative that the hatchery is having negative impacts on population productivity.</p>

## 4.6.2 Decision Management Framework

Management decisions will be based on the monitoring and evaluation program that is designed to determine if performance standards are being achieved and if identified management triggers have been reached.

### 4.6.2.1 Yankee Fork

A large portion of the monitoring and evaluation program is already in place in the Yankee Fork (Tardy 2009). For example:

- Adult weirs are operated to collect broodstock and monitor adult escapement
- Spawning and carcass surveys are conducted annually above and below the weir
- Natural juvenile production and run-timing is being collected at traps in the basin
- Genetic sampling of adults is conducted to determine reproductive success of NOR and HOR spawners

The results of this work will be used to determine if the following triggers have been achieved:

- **Trigger 1:** When the combined NOR and HOR adult run size to the Yankee Fork exceeds 1,000 adults, the program will begin converting to the use of locally adapted broodstock.

**Rationale:** A run size of 1,000 fish indicates that adult abundance is sufficient to allow some fish to be removed for broodstock without seriously affecting natural production.

- **Trigger 2:** When the 5-year running average NOR escapement to the Yankee Fork exceeds 750 adults, NOAA Fisheries will be consulted to determine if conservation goals should be altered.

**Rationale:** A run size of 750 NOR adults indicates that natural production potential may be higher than anticipated. Therefore, it may be possible to operate the program to be consistent with HSRG recommendations for a Contributing population. This action would occur if NOAA Fisheries was of the opinion that an additional Viable (Contributing) population was needed to achieve Snake River spring/summer Chinook recovery objectives.

- **Trigger 3:** When the 5-year running average NOR escapement exceeds 2,000 adults, the program will be eliminated.

**Rationale:** At an average run size of 2,000 NOR adults, there will be no need for a hatchery program because run size will be sufficient to achieve all conservation, harvest and cultural objectives.

### 4.6.2.2 Panther Creek

Panther Creek program management decisions will be based on monitoring and evaluation results, designed to determine if performance standards are being achieved and if identified decision triggers have been reached. Two decision triggers have been identified:

- **Trigger 1:** When the combined NOR and HOR adult run-size to Panther Creek exceeds 1,000 adults, the program will begin converting to the use of locally adapted broodstock.

**Rationale:** A run-size of 1,000 fish indicates that adult abundance is sufficient to allow some fish to be removed for broodstock without seriously affecting natural production.

- **Trigger 2:** When the 5-year running average of NOR escapement exceeds 750 adults, the Tribes will consult with NOAA Fisheries to determine if the conservation objective should be altered for this population.

**Rationale:** A run of 750 NORs exceeds NOAA's objective for a Basic population. Achieving a 750 fish value as an average over 5 years indicates that the population likely could be self-sustaining, as some individual run years would be higher than the average (750).

Weir and spawning counts of adult fish will be used to determine if the triggers have been achieved in Panther Creek.

### 4.6.3 Ongoing Research

Supplementation monitoring is on-going in Yankee Fork, as described above. With the approval of the Step 1 submittal, the Tribe will begin developing a detailed program to monitor fish production in this stream as well as Panther Creek.

Considerable biomonitoring is already in place in Panther Creek (EcoMetrix 2010). This work is an outcome of the Blackbird Mine mitigation process. EcoMetrix (2010) is monitoring habitat quality and quantity, stream temperature and water quality, benthic macroinvertebrate communities, and the fish community. This work will continue as spring Chinook are reintroduced into this stream. Researchers will then be able to track and document changes in stream habitat and communities over time, providing an interesting look at how a hatchery program affects the natural environment.

## 4.7 ADAPTIVE MANAGEMENT OF THE CHINOOK PROGRAMS

The proposed Chinook programs use management triggers based on adult abundance to confirm or alter program direction and objectives. If adult returns increase to the identified trigger levels, hatchery production may be reduced or eliminated all together. The program will thus adapt to the number of adults returning to each targeted subbasin.

### 4.7.1 Yankee Fork

Juveniles either will be released directly to the stream or held in ponds next to the stream channel prior to release. Each group will be marked/tagged using coded-wire tags so that they may be assigned to a release strategy as they return as adults. Stream surveys will be used to enumerate the tags and the results used to alter release strategies if the data so suggest. To determine the source of the difference in survival rates, a portion (15%) of the juveniles will be tagged with PIT-tags to measure adult and juvenile survival rates to Lower Granite Dam, through the FCRPS and the number collected/detected at weirs and hatcheries. This information could also be used to adapt release strategies.

#### **4.7.2 Panther Creek**

The number and origin of adults returning to Panther Creek will inform the Shoshone Bannock Tribes about what is possible from both conservation and harvest perspectives. For example, if NOR abundance is greater than expected, program focus may shift more to conservation. This may require that the monitoring and evaluation program expand to determine if performance standards such as PNI, pHOS and pNOB, critical to the success of a conservation program, are being achieved. Broodstock collection strategies would be altered to properly integrate the program, and the number of hatchery fish released may have to be altered to achieve pHOS objectives.

### **4.8 CONSISTENCY OF THE SNAKE RIVER CHINOOK PROGRAM WITH EIGHT SCIENTIFIC PRINCIPLES OF THE NPCC FISH AND WILDLIFE PROGRAM**

#### **4.8.1 Principle 1**

*“The physical and biological components of ecosystems together produce the diversity, abundance and productivity of plant and animal species, including humans. The combination of suitable habitats and necessary ecological functions forms the ecosystem structure and conditions needed to provide the desired abundance and productivity of specific species.” (NPCC 2000)*

Success of the Salmon River Chinook program is highly dependent on the quality and quantity of habitat available for each life stage of the target species. Human activities such as dredging, mining, construction of the FCRPS, harvest in and degradation of the Columbia River estuary have all contributed to the decline of this population. Analysis completed by the ICTRT (2007b) and the AHA presented in this report show that the population is in danger of being extirpated.

The Tribes’ commitment to this principle is demonstrated through ongoing efforts to protect and perpetuate native fish populations in the Salmon River subbasin. The NPCC, Corps of Engineers, BPA and other state, tribal and federal agencies are also working to improve Chinook survival rates in all habitats used by this species. While survival improvements are expected over time, these improvements will not accrue in full for many decades.

The program is designed to protect the remaining genetic resources of the Yankee Fork and Panther Creek populations by increasing their abundance and productivity through the use of artificial production. The chance of program success increases as the habitat that hatchery fish are released into improves. If habitat improves to a degree where conservation and harvest goals can be achieved with natural production only, the program would be eliminated.

The program will produce substantial harvest and conservation benefits. In addition, the increase expected in fish abundance will allow the Shoshone-Bannock Tribes to fish using traditional techniques such as the use of spears. These Tribes are hunters rather than fishers of spring Chinook. This hunting technique is culturally important to the Shoshone-Bannock peoples and the proposed program would allow this practice to continue in future generations.

The program also recognizes that using fish for broodstock adapted to the environment they are released in is likely to be more successful (higher abundance, productivity and diversity) than using fish from other streams. For this reason, Phase 2 of the program will only use spring Chinook returning to the Yankee Fork and Panther Creek as broodstock. This action will also help reduce the number of hatchery fish from the program that stray and spawn in other streams, which should improve the productivity of these populations.

#### **4.8.2 Principle 2**

*“Although ecosystems have definable structures and characteristics, their behavior is highly dynamic, changing in response to internal and external factors. The system we see today is the product of its biological, human and geological legacy. Natural disturbance and change are normal ecological processes and are essential to the structure and maintenance of habitats.” (NPCC 2000)*

Using spring Chinook returning to natal streams as broodstock will ensure that population structure and genetics are at least partially defined by the ever changing natural environment rather than by the hatchery. Habitat projects being implemented in the basin as part of other processes focus on the protection of the remaining high quality habitat and improvement of degraded conditions. Thus, the habitat we see in the basin today is anticipated to change over time. The hatchery program will respond to this change through the adjustment of its conservation and harvest goals. For example, as adult abundance increases to over 750 adults, the conservation goal for Yankee Fork may change to produce a population classified as Contributing by the HSRG. The same type of management trigger has been developed for Panther Creek (Section 4.6.2.2).

Monitoring activities described in Section 4.6 are designed to detect habitat and population changes over time, from time of release to return as adults. Spawning and juvenile surveys will be used to track natural production to see if performance objectives are being achieved and if population productivity is increasing or decreasing.

#### **4.8.3 Principle 3**

*“Ecosystems, landscapes, communities and populations are usefully described as hierarchies of nested components distinguished by their appropriate spatial and time scales. Higher-level ecological patterns and processes constrain, and in turn reflect, localized patterns and processes. There is no single, intrinsically correct description of an ecosystem, only one that is useful to management or scientific research. The hierarchy should clarify the higher-level constraints as well as the localized mechanisms behind the problem.” (NPCC 2000)*

The collapse of Salmon River spring Chinook was not caused by human impacts in this stream system alone. Human activities occurring from the estuary, through the Columbia River and into the Snake River basin have resulted in a tremendous decrease in the productivity and abundance of this population. To recover this population to levels that achieve human objectives will require that actions be taken locally, regionally and perhaps even globally if climate change effects are realized.

Principle 3 highlights the important multi-scale spatial and temporal nature of ecology. The Tribes agree that to ignore this condition is to contribute to the failure of fish and wildlife mitigation

projects. Although this Master Plan emphasizes actions to correct local problems, success of the programs will count on other entities continuing efforts to improve fish survival at a broader level. The program recognizes that because the human population continues to expand, expected benefits from some actions to improve fish productivity may not be obtained for decades, if at all. Therefore, the Snake River spring Chinook program uses management triggers based on abundance levels to determine when the program should be altered and new approaches to meeting objectives implemented.

Fish passage through the FCRPS is likely the highest level constraint reducing population survival. Approximately, 66 percent of juveniles and 18 percent of the adults migrating through the FCRPS are killed. While actions are being implemented by the Army Corps of Engineers to improve survival, the reality is that these dams provide inexpensive clean power to the region and create conditions that allow navigation from the ocean inland to Idaho; therefore, dam removal is unlikely.

#### **4.8.4 Principle 4**

*“Habitats are created, altered and maintained by processes that operate over a range of scales. Locally observed conditions often reflect more expansive or non-local processes and influences, including human actions. The presence of essential habitat features created by these processes determines the abundance, productivity and diversity of species and communities. Habitat restoration actions are most effective when undertaken with an understanding and appreciation of the underlying habitat-forming processes.”(NPCC 2000)*

Stream habitat in the Yankee Fork has been degraded by dredging and other mining and human activities. Habitat in Panther Creek also has been significantly compromised by mining. Both passive and active restoration efforts are being implemented to improve aquatic and terrestrial habitat in these watershed. These efforts are limited, however, to areas where landowners are willing to participate. When possible, restoration actions focused higher in the basin will be prioritized over downstream actions because the effect these actions on the stream channel may be observed for miles downstream. The programs will continue to look for opportunities to improve habitat that may be ripe for exploitation (e.g., important land parcels that may be put up for sale). For example, in the Panther Creek watershed, the Tribes are actively engaging with the Blackbird Mine trustees to identify opportunities to collaboratively restore habitat and the fishery.

#### **4.8.5 Principle 5**

*“Each species has one or more ecological functions that may be key to the development and maintenance of ecological conditions. Species, in effect, have a distinct job or occupation that is essential to the structure, sustainability and productivity of the ecosystem over time. The existence, productivity and abundance of specific species depend on these functions. In turn, loss of species and their functions lessens the ability of the ecosystem to withstand disturbance and change.” (NPCC 2000)*

Principle 5 emphasizes the importance of individual species as integral and necessary parts of functioning ecosystems and food webs. Spring Chinook provide an important source of marine derived nutrients to the stream systems of the Upper Salmon River subbasin. Their carcasses

provide nutrients that increase both primary and secondary production, which in turn produce larger numbers (and biomass) of native fish species that inhabit these same streams.

Marine-derived nutrients also fertilize riparian plant communities. Riparian plants provide shade which maintains suitable water temperatures for anadromous fish. The plants also return nutrients to the stream in the form of organic matter such as insects; increasing system productivity. Adult and juvenile Chinook also provide food for both aquatic and terrestrial species. Greater abundance of both life stages may help reduce predation rates on other ESA listed species such as steelhead and bull trout.

#### **4.8.6 Principle 6**

*“The diversity of species, traits and life histories within biological communities contributes to ecological stability in the face of disturbance and environmental change. Loss of species and their ecological functions can decrease ecological stability and resilience. It is not simply that more diversity is always good; introduction of non-native species, for example, can increase diversity but disrupt ecological structure. Diversity within a species presents a greater range of possible solutions to environmental variation and change. Maintaining the ability of the ecosystem to express its own species composition and diversity allows the system to remain productive in the face of environmental variation.” (NPCC 2000)*

Diversity within and among populations and species is the foundation of ecological processes and functions, and of population viability and persistence. The Tribes’ proposed program recognizes that using fish locally adapted to the stream they will be released into increases the chance of program success as these fish will best be able to withstand the environmental variation and changes observed in the watershed. Restoring spring Chinook to the Yankee Fork and Panther Creek also increases the productivity, abundance; diversity and spatial structure of the Snake River spring/summer Chinook ESU. Each of these populations may exhibit differences in traits such as juvenile and adult run-timing, age structure or spawn timing that results in higher survival rates in some years; thereby adding resiliency to the overall ESU.

The Crystal Springs Hatchery also plays a role in maintaining the population over time as well as providing some ecological benefits. The AHA analysis conducted for the two Chinook programs shows that more adults return to the basin with the program than without than will occur without the program. Hatchery adults returning to these watersheds provide nutrients to the streams after they spawn and die. The eggs they lay are also consumed by some native fish species.

#### **4.8.7 Principle 7**

*“The dynamic nature, diversity, and complexity of ecological systems routinely disable attempts to command and control the environment. Adaptive management — the use of management experiments to investigate biological problems and to test the efficacy of management programs — provides a model for experimental management of ecosystems. Experimental management does not mean passive “learning by doing,” but rather a directed program aimed at understanding key ecosystem dynamics and the impacts of human actions using scientific experimentation and inquiry.” (NPCC 2000)*

The Tribes are proposing a program that uses management triggers, based on adult abundance, to adaptively manage hatchery operations and production. As run-size increases, conservation objectives increase in scope and importance. The Salmon River Chinook program allows for the possibility of eliminating all hatchery production if the conservation and harvest goals can be achieved with natural production alone.

#### **4.8.8 Principle 8**

*“As humans, we often view ourselves as separate and distinct from the natural world. However, we are integral parts of ecosystems. Our actions have a pervasive impact on the structure and function of ecosystems, while at the same time, our health and well being are tied to these conditions. These actions must be managed in ways that protect and restore ecosystem structures and conditions necessary for the survival and recovery of fish and wildlife in the basin. Success depends on the extent to which we choose to control our impacts so as to balance the various services potentially provided by the Columbia River Basin.” (NPCC 2000)*

The Tribes’ responses to Principles 1 through 7 clearly show that human actions have been the dominant factor in the collapse of Salmon River spring Chinook. While some of these impacts are being mitigated, others are not. For example, the FCRPS is likely to remain in place at least through our life time. This means that we have some control over those factors reducing fish survival, but not all. One focus of the Tribes proposed program is to address and mitigate unnatural changes in the ecosystem. When combined with work by others (for example, habitat actions), this program will reduce human impacts to the ecosystem by:

- Protecting high quality habitat present in the watersheds while at the same time restoring degraded habitat
- Operating the hatchery in a manner consistent with HSRG recommendations when they apply
- Altering and/or eliminating hatchery production levels as goals become achievable with natural production
- Working with NOAA Fisheries, IDFG and other parties to achieve mainstem Columbia River juvenile and adult survival objectives and habitat improvements required in the FCRPS Biological Opinion (NOAA 2008)

### **4.9 LINK BETWEEN SNAKE RIVER SPRING CHINOOK PROGRAM AND OTHER PROJECTS AND ACTIVITIES**

As shown in Table 4-19, the measures proposed in this Master Plan are but one effort contributing to the protection and restoration of Snake River spring/summer Chinook in the Snake River Basin, specifically in the Yankee Fork subbasin. The measures in this table demonstrate that pursuing and achieving population-level and subbasin-level endstates through the Tribes’ proposed Chinook salmon aquaculture program will contribute to the biodiversity and ecological function required for successful restoration and resilience.

**Table 4-19. Other projects targeting habitat and Chinook population restoration in the Yankee Fork subbasin.**

Contractor	Title/Project No.	Purpose	Summary
IDFG, NPT, SBT, USFWS	Salmon Studies in Idaho Rivers-IDFG/ 1989-098-00	Artificial Propagation	The purpose of the ISS is to help determine the utility of supplementation as a potential recovery tool for imperiled stocks of spring and summer Chinook salmon in Idaho. Goals are to assess the use of hatchery Chinook salmon to restore or augment natural populations, and to evaluate the effects of supplementation on the survival and fitness of existing natural populations. The program operates in 30 streams throughout Idaho. The Yankee Fork is a "treatment" stream for this program.
NPT	Salmon Studies in Idaho Rivers-NPT/ 1989-098-02	Programmatic	Evaluates hatchery supplementation as a recovery/restoration tool for spring and summer Chinook salmon. Quantifies key population status and performance variables, including early life history and smolt-to-adult survival rates.
SBT	Salmon Studies in Idaho Rivers –SBT/ 1989-098-03	Programmatic	Evaluates various supplementation strategies for maintaining and rebuilding spring/summer Chinook populations in Idaho. Develops recommendations for the use of supplementation to rebuild naturally spawning populations.
IDFG	Idaho Natural Production Monitoring and Evaluation/ 1991-073-00	Artificial Propagation	The goal of the Idaho Natural Production Monitoring and Evaluation Project (INPMEP) is to understand and predict the population dynamics and associated controlling factors of wild and natural anadromous salmonids that spawn upstream from Lower Granite Dam (LGR). This is long-term research that originated in the 1980s to determine effectiveness of habitat mitigation for steelhead and spring/summer Chinook in Idaho. This project assesses population characteristics, survival, and productivity.
Idaho Office of Species Conservation	Idaho Watershed Habitat Restoration – Lemhi/ 2007-394-00	Habitat	Upper Salmon Basin Watershed Program is a partnership between the State of Idaho and BPA and has resulted in the successful implementation of numerous habitat improvement projects.
IDFG	Idaho Fish Screening Improvement/1994-015-00	Habitat	Provide management and operational support for a capital construction program dedicated to the protection of anadromous fish from loss in water diversions, improve fish passage at diversions for juvenile and adult anadromous fish, and improve stream flow conditions where possible.

Contractor	Title/Project No.	Purpose	Summary
SBT	Salmon River Habitat Enhancement/1994-050-00	Habitat	The Salmon River Habitat Enhancement (SRHE) project continues to monitor and evaluate the Yankee Fork Salmon River, East Fork Salmon River, and Upper Salmon in which SBT has sponsored habitat enhancement work to improve production of Chinook salmon and steelhead. To avoid duplication and increase information sharing, this project also seeks to coordinate activities among the involved entities and ensure tribal participation in these tasks. Evaluation of these systems to date shows that target goals established for fine sediment have been reached and responses from the biotic community have been favorable. The SRHE program proposes to continue ongoing M&E activities in the previously enhanced areas and begin analysis and feasibility studies for enhancement in new areas.
NPT	Listed Stock Chinook Salmon Gamete Preservation/ 1997-038-00	Artificial Propagation	The goals of the gamete preservation project are 1) to preserve and maintain salmonid population genetic diversity, 2) as an insurance policy against population collapse and extirpation, 3) for ongoing artificial propagation programs and 4) to preserve genetic material for future management options.
Custer Soil and Water Conservation District	Idaho Watershed Habitat Restoration - Custer District/ 2007-268-00	Habitat	Project scope is to implement high priority action items to maintain, enhance and restore fish habitat and fish passage in the priority stream segments of the Upper Salmon Basin area within administrative boundaries of Custer Soil and Water Conservation District. Projects developed under this contract include installing a riparian fence along 4.5 miles of the Upper Salmon near Stanley and riparian plantings in lower Stanley.
SBT	Yankee Fork Salmon River Restoration/ 2007-059-00	Habitat	The goal of the Yankee Fork Dredge Tailings Restoration Project is to restore natural river channel characteristics, floodplain function, hydraulic and sediment regimes, and aquatic habitat within the dredged reach of the YFSR, initially by redistributing dredge tailings piles from the floodplain. Restoring the YFSR, historically a major Chinook salmon producer, to natural conditions will create a healthy, functioning riparian community providing numerous benefits to fish and wildlife.
SBT	Supplementation Projects/ 2008-905-00	Artificial Propagation	The purpose of this project is to determine the utility of supplementation as a potential recovery tool. Our goals are to assess the use of supplementation to augment natural populations, evaluate effects on survival and fitness, and track relative reproductive success. The intent is to compare the fish population response over time in treatment (supplemented) vs. control (unsupplemented) streams and baseline data. Note that at the time of Master Plan filing, NPCC approval of this program appears likely, but has yet to be received.
IDFG	Genetic Evaluation of Chinook Salmon Supplementation in Idaho Rivers/ 2007-250-00	Programmatic	IDFG uses DNA analyses to quantify the relative reproductive success of Chinook salmon of various origins in ISS study streams. This will help determine the effect of "de facto" supplementation by hatchery strays in treatment and control streams.

Contractor	Title/Project No.	Purpose	Summary
IDFG	Spring Chinook Captive Propagation-Idaho/ 2007-403-00	Artificial Propagation	The ultimate goal of the IDFG Captive Rearing Program of Salmon River Spring Chinook Salmon is to maintain a minimum number of adults spawning in specific target streams annually. To achieve this goal, the program is testing the efficacy of the captive rearing conservation approach. Project activities are divided into two parts: 1) hatchery propagation and 2) spawning performance monitoring and evaluation. The success of the project depends on developing culture techniques to produce fish with proper behavioral, morphological, physiological characteristics to successfully interact with and breed with wild individuals. Field monitoring is used to document behavioral interactions, spawn timing, success of redds spawned by captive-reared individuals, and to determine if changes in culture technique result in desired changes in reproductive behavior or performance.
SBT	ESA Habitat Restoration/ 2008-903-00	Habitat	Contract will fund high priority habitat restoration/rehabilitation projects within the Upper Salmon Subbasin, Yankee Fork Subbasin, and Valley Creek, including removing the diversion on Elk Creek II.
SBT	Crystal Springs Planning and Operations/Maintenance/ 2008-906-00	Artificial Propagation	Crystal Springs Planning and Operations/Maintenance is an expense project designed to produce hatchery fish at the re-constructed Crystal Springs Hatchery site; develop a fish weir for collecting broodstock from the Yankee Fork Salmon River; and providing a commitment for long-term operations and maintenance funding to continue daily operations. The Project will develop all necessary planning documents, environmental compliance documents, permitting documents, and a strategic hatchery plan.

Notes: SBT-Shoshone-Bannock Tribes; NPT- Nez Perce Tribe

Source: [www.cbfish.org](http://www.cbfish.org)

The Idaho Supplementation Studies program (Project Nos. 1989-098-00 through 1989-098-03) is using the West Fork of the Yankee Fork as a control stream for the overall body of research taking place. The Tribes cooperate with the State of Idaho to operate and maintain a screw trap and to conduct redd counts in the West Fork.

The YFCSS program, initiated in 1998 through the LSRCP, is to receive 200,000 smolts annually from Sawtooth Hatchery, a LSRCP facility. This supplementation program is progressively related to the Crystal Springs Hatchery Program. Because this hatchery provides fish for a number of supplementation program components, the production level targeted for the Yankee Fork is not reliably available from Sawtooth. Production from Crystal Springs will reliably supply Chinook to the Yankee Fork, compensating for periodic Sawtooth shortfalls and expediting population restoration.

The ESA Habitat Restoration Project (Project No. 2008-903-00) is seeking to restore habitat affected by the historic dredge mining activities on the Yankee Fork. Other components of the restoration project are being implemented to enhance habitat for all life stages of salmon and steelhead.

The Salmon River Habitat Enhancement Project (No. 1994-050-00) is an independent program aimed at restoring affected habitat throughout the Salmon River subbasin. It emphasizes cost sharing when needed in the Yankee Fork. There are no projects planned in the current three-year work cycle.

The Salmon River Basin Nutrient Enhancement Program is a research-oriented project initiated in 2009 that uses salmon carcass analogs to mimic the deposition of marine derived nutrients and the Yankee Fork is one of the study streams. At this time, only research-level treatments are proposed on the Yankee Fork.

## **4.10 EXPECTED CHINOOK PROGRAM BENEFITS**

### **4.10.1 Yankee Fork**

AHA modeling of the proposed program indicates that it will increase the abundance of spring Chinook in the Yankee Fork (Table 4-2). Key results of the modeling analysis are:

- Average natural-origin spawner (NOS) escapement increases from 5 to 44 adults
- Average total natural escapement (HOS + NOS) increases from 15 to 508
- Average total run size (HOR and NOR) of Yankee Fork-origin spring/summer Chinook increases from 12 to 2,175 adults

The time frame over which these population levels may be achieved is uncertain, but is likely to take between one and two decades if assumptions used in the AHA modeling are correct.

The projected population numbers shown in Table 4-2 indicate that the Tribes' Crystal Springs Hatchery program will achieve identified conservation objectives (natural escapement of 500 adults), and harvest (1,000 adults) objectives (see Section 4.3).

Increased fish abundance in the Yankee Fork will add to the productivity, diversity, spatial structure of the Snake River Chinook ESU, as well as contribute to a healthier ecosystem. From a cultural perspective, increasing spring Chinook abundance allows Shoshone-Bannock Tribal members to continue their practice of harvesting adults using spears, a method used from time immemorial.

#### **4.10.2 Panther Creek**

The Panther Creek artificial production program will increase the abundance of spring/summer Chinook both in this stream and in the Snake River spring Chinook ESU. AHA modeling analysis indicates that the program will produce, on average, about 1,800 NOR and HOR adults (Table 4-5). These fish will be an important presence in this watershed that has been affected by significant human perturbations. In addition to ecosystem benefits, reintroducing Chinook salmon to Panther Creek will allow Shoshone-Bannock Tribal members to once again pursue traditional harvest practices in a watershed used by their ancestors. The Tribes' harvest objective of capturing 500 adults annually may require the use of more contemporary methods such as weirs and nets.

### **4.11 IMPLEMENTATION STRATEGIES RELATIVE TO CURRENT CONDITIONS AND DESIRED FUTURE CONDITIONS**

The proposed programs will use artificial production to supplement spring/summer Chinook population in the Yankee Fork and in Panther Creek. The use of artificial production to improve population abundance is consistent with the actions called for in the Salmon River Subbasin Plan (see Section 3.3) (Ecovista 2004). In addition, the approach also aligns with the Columbia Basin Fish and Wildlife Program (NPCC 2000) which states:

*"Artificial production can be used, under the proper conditions, to 1) complement habitat improvements by supplementing native fish populations up to the sustainable carrying capacity of the habitat with fish that are as similar as possible, in genetics and behavior, to wild native fish, and 2) replace lost salmon and steelhead in blocked areas."*

The Tribes also recognize that habitat quality and quantity in all phases of the species life cycle is important for achieving population objectives. For this reason, the Tribes will continue their work with the Army Corps of Engineers, IDFG, BPA and NOAA Fisheries to implement habitat improvement projects in the mainstem Salmon River and through the FCRPS (NOAA 2008). As part of the accord between the Tribes and BPA, \$2.0 million is allocated for habitat improvements and monitoring efforts in the Salmon River subbasin, using a strategy to continuously improve habitat to increase natural system productivity.

### **4.12 RELATIONSHIP TO REGIONAL HABITAT STRATEGIES**

The Chinook programs will be implemented in tandem with the habitat strategies being proposed by multiple parties in the Salmon River subbasin (see Table 4-19). The Salmon River Subbasin Plan (Ecovista 2004) presents an overall vision to create a productive and sustainable ecosystem that is resilient to natural and human disturbance, with diverse native aquatic and terrestrial species. Specific habitat objectives are presented in Section 3.3. These objectives were developed in response to the direction provided by the NPCC in the Columbia River Basin Fish and Wildlife Program (NPCC 2004).

## 4.13 SUBBASIN-WIDE RISK ASSESSMENT

### 4.13.1 Yankee Fork

Because Yankee Fork spring/summer Chinook have been nearly extirpated from the subbasin, and are already influenced by a myriad of previous hatchery releases, the risks of using artificial production to increase population abundance are deemed low. The risks of the program (specifically, domestication) will be further reduced by operating the program consistent with the HSRG principles that apply to each phase of the program.

Rearing facilities will be located outside of the anadromous zone. In this way, hatchery discharge effects will not occur on listed salmon populations. Similarly, any disease outbreaks at the Crystal Springs Hatchery will not pose a threat to listed species. Health protocols will be implemented to ensure that fish released into the Yankee Fork are healthy.

A potential risk of this program is that hatchery-origin fish may stray and spawn into areas outside of the Yankee Fork. Such colonizing may decrease the productivity of the natural population inhabiting these streams. Hatchery stray rates will be minimized by using broodstock locally adapted to the Yankee Fork. Juvenile hatchery fish will be released relatively high in the watershed or held for acclimation prior to release so that they imprint on the water signature of their natal stream. Historic and proposed release numbers are identified in the draft Yankee Fork Chinook HGMP (see Appendix A, Table 3).

A monitoring and evaluation program will estimate HOR stray rates in the Salmon River subbasin. Hatchery production will be reduced or operations altered (e.g., use of acclimation) if stray rates exceed five percent. To assist in this effort, all hatchery-origin fish will be marked with a coded-wire-tag. Stream and hatchery surveys will be used to detect and enumerate the tags.

### 4.13.2 Panther Creek

The risks associated with the Panther Creek program are considered quite low. Mining activities, combined with the development of the FCRPS, have extirpated spring/summer Chinook from this stream. Although some spawning by Chinook has been observed in recent years (14 redds in 2009), these spawners are likely the product of surplus hatchery adults planted by the agencies (EcoMetrix 2010).

One risk posed by the program is straying of hatchery fish outside of the target stream. Hatchery strays may spawn with other populations, reducing the productivity and abundance of the natural population. To address this risk, all hatchery fish are being marked with a coded-wire tag. Spawning and carcass surveys, as well as weir operations, will be used to determine the level of straying that occurs in the Salmon River subbasin. Additionally, 15 percent of the juveniles released will be PIT-tagged so that upon return as adults, they may be detected as they pass through the FCRPS, at weirs located in other basins and at hatcheries. If straying levels exceed 5 percent, hatchery production will be decreased or operations such as acclimation altered in an attempt to improve adult homing.

In Phase 1, the Pahsimeroi Hatchery is being considered as the source of the 1,500 adults to be outplanted to Panther Creek. However, the transfer of adults poses a risk of amplifying whirling disease (*M. cerebralis*), currently found in the Pahsimeroi drainage. The presence or absence of

whirling disease in Panther Creek is unknown and will be determined by sampling in the watershed. If whirling disease is present, the transfer of adults could proceed; if not, only gametes will be transferred. The latter step would slow reintroduction efforts because the Crystal Springs Hatchery will need to be complete before space is available to rear juveniles. Alternatively, another source of adult fish would need to be identified.

#### **4.14 CONSISTENCY OF YANKEE FORK PROGRAM NPCC ARTIFICIAL PRODUCTION POLICIES**

The Yankee Fork and Panther Creek spring/summer Chinook hatchery programs have been designed to be consistent with the NPCC's artificial production strategy and inherent recommendations. The ten artificial production strategies are presented below in bold italics, immediately followed by an assessment of the consistency of the proposed programs with the strategy.

***The purpose and use of artificial production must be considered in the context of the ecological environment in which it will be used.***

##### **Yankee Fork**

Historically, the Yankee Fork supported robust populations of native spring/summer Chinook. The Tribes consider the population to be functionally extinct, and it appears that a sustained reintroduction effort using a within MPG stock is an appropriate method to develop a locally adapted hatchery and natural spawning population that would contribute to recovery and meet tribal cultural and harvest objectives.

The Yankee Fork component of the Crystal Springs Hatchery program (see Section 4.1.1) is sized to help achieve the species recovery objectives identified by NOAA Fisheries by restoring a Maintained population of local spring/summer. The 2008 FCRPS Biological Opinion (NOAA 2008) and the Shoshone-Bannock Tribes 2008 Fish Accords call for the development of the Crystal Springs Hatchery and population improvement measures in the Yankee Fork. The program proposed as part of this Master Plan would achieve these objectives. The proposed program will provide a level of abundance that will maintain the ecological function Chinook salmon in the Yankee Fork. Fish will be released at a size (10 fpp) and condition that encourages rapid migration from the system, reducing competition and predation on wild fish. Additionally, as humans are a major component of the ecosystem, the program recognizes that anthropogenic impacts such as agriculture and power generation will continue indefinitely into the future. Thus, to achieve program objectives, the number of fish proposed to be released takes into consideration losses associated with these activities.

##### **Panther Creek**

Historically, Panther Creek and its tributaries provided spawning and rearing habitat for Chinook salmon, steelhead, resident trout, and mountain whitefish. However, in the late 1940s and early 1950s, the native Chinook salmon population began to decline and was eventually extirpated from the system following the development of the Blackbird Mine. In recent years, water quality has improved in Panther Creek due in part to actions taken to reduce the amount of metals released into Blackbird Creek. Recent spawning surveys show some adult Chinook returning to and spawning in Panther Creek. Their origin is unknown but has been assumed to be the result of the previous

reintroduction efforts using South Fork stock from McCall Fish Hatchery. Genetic samples will be analyzed to aid in determining the appropriate stock for the proposed program.

Given this evidence, it appears that a sustained reintroduction effort using a within MPG stock is an appropriate method to develop a locally adapted hatchery and natural spawning population that would contribute to recovery and meet tribal cultural and harvest objectives.

The size of the Panther Creek component of the Crystal Springs Hatchery program (200,000 to 400,000 smolts) is designed to help achieve the species recovery objectives identified by NOAA Fisheries by restoring a Maintained population of local spring/summer Chinook. These objectives are the same as those described above for the Yankee Fork program component.

***Artificial production must be implemented within an experimental, adaptive management design that includes an aggressive program to evaluate the risks and benefits and address scientific uncertainties.***

The Yankee Fork and Panther Creek hatchery program components will be developed around a detailed research, monitoring and evaluation program summarized in the HGMPs (Appendix A and B) that examine the phases of spring/summer Chinook life history, fish culture practices, and the quality and quantity of existing habitat to support both hatchery and natural production. This research, monitoring and evaluation program will continue as the hatchery program is shifted from a colonization program (Phase 1) to an established localized population (Phase 2) and potentially to an integrated harvest program, allowing the harvest of about 1,000 spring/summer Chinook in the Yankee Fork and a minimum of 500 spring/summer Chinook in Panther Creek (see Section 4.3). A description of the research, monitoring and evaluation plan being developed in conjunction with the proposed Crystal Springs Hatchery is presented in Section 4.6.

In addition, management triggers will be used to adjust hatchery production and goals over time. These triggers are based on adult returns to the target streams. The programs will be adapted based on Chinook returns and the productivity of the habitat.

***Hatcheries must be operated in a manner that recognizes that they exist within ecological systems whose behavior is constrained by larger-scale basin, regional and global factors.***

Factors outside the scope of the proposed program will continue to directly affect its success. The primary constraint affecting these populations and the programs is fish passage through the FCRPS. Additionally, varying ocean and mainstem habitat conditions will cause large fluctuations in adult returns to the basin. The Crystal Springs Hatchery program has been sized to account for these factors in order to ensure that population recovery goals are achieved in both watersheds (see Section 4.3). In addition, because ocean survival rates will vary, the programs have set priorities for treatment of adults returning to the target watershed: (1) broodstock, (2) natural escapement, and (3) harvest.

***A diversity of life history types and species needs to be maintained in order to sustain a system of populations in the face of environmental variation.***

Implementing the proposed program will accelerate recovery of Snake River spring/summer Chinook salmon in the upper Salmon River subbasin, ensuring that the species and the benefits it provides to the ecosystem are maintained. Adult Chinook carcasses (both natural-and hatchery-origin) will supply the nutrients that other aquatic and terrestrial species require to maintain healthy

population abundance levels. Furthermore, increasing natural fish escapement to historic spawning areas will result in the widest range of life histories possible given the habitat present. As more locally-adapted adults return to collection sites (and hatchery plants are phased out), it is expected that natural selection and local adaptation will increase the productivity of the population.

***Naturally selected populations should provide the model for successful artificially reared populations, in regard to population structure, mating protocol, behavior, growth, morphology, nutrient cycling, and other biological characteristics.***

The physical, demographic and behavioral (e.g., migration timing) characteristics of hatchery Chinook will be constantly monitored and compared to the natural population migrating to and from the system. These analyses will continue under all phases of the proposed aquaculture program and operations may be altered as the program evolves over time (based on the results of this monitoring and adaptive management). Broodstock collection and mating protocols will be designed to propagate fish from the entire run and will include natural-origin fish and jacks. Fish will be released in the spring during periods when smolt trapping indicates that wild fish are emigrating from the systems.

In Panther Creek, once a local population is established, all broodstock will be collected from Panther Creek using a weir. Outplanting either South Fork or Upper Salmon River-sourced hatchery broodstock will be discontinued.

***The entities authorizing or managing an artificial production facility or program should explicitly identify whether the artificial propagation product is intended for the purpose of augmentation, mitigation, restoration, preservation, research, or some combination of those purposes for each population of fish addressed.***

The primary goal of the Crystal Springs program is to contribute to recovery of Snake River spring/summer Chinook ESU by restoring a Maintained population of local spring/summer Chinook in the Yankee Fork and Panther Creek. As adult run sizes increase, the program will add a harvest objective to meet tribal treaty rights. More specific information on program goals and strategies is presented in Sections 4.2 and 4.3.

***Decisions on the use of the artificial production tool need to be made in the context of deciding on fish and wildlife goals, objectives and strategies at the subbasin and province levels.***

The proposed Yankee Fork and Panther Creek programs are designed to meet the fisheries management and ESA goals established by NOAA Fisheries for Snake River spring/summer Chinook salmon. Production limitations at the existing facilities (such as Sawtooth Hatchery) are hampering efforts to achieve these goals. Smolts produced at the Crystal Springs Hatchery would accelerate reestablishment of locally adapted anadromous adults that would be integrated into the hatchery broodstock and allowed to spawn naturally. Hatchery production is complemented by habitat actions proposed throughout the basin as part of subbasin and recovery planning that will not only improve the viability of Chinook, but also steelhead, bull trout and other aquatic species important to the ecosystem.

***Appropriate risk management needs to be maintained in using the tool of artificial propagation.***

The proposed Yankee Fork and Panther Creek spring Chinook programs will be operated consistent with the recommendations of the HSRG (2004). This will reduce genetic and ecological risks that the hatchery may pose to natural populations. Hatchery fish will be marked with coded-wire tags so returning adults can be readily identified at collection sites and on the spawning grounds. The existing research, monitoring and evaluation program will be enhanced (see Section 4.6) to monitor activities associated with this phased program.

***Production for harvest is a legitimate management objective of artificial production, but to minimize adverse impacts on natural populations associated with harvest management of artificially produced populations, harvest rates and practices must be dictated by the requirements to sustain naturally spawning populations.***

According to NOAA Fisheries (2008), the ocean fishery mortality on Snake River spring/summer Chinook is very low and, for practical purposes, assumed to be zero. Incidental take of Snake River spring/summer Chinook occurs in spring and summer season fisheries in the mainstem Columbia River that target harvestable hatchery and natural-origin stocks. The fisheries on harvestable runs were limited to ensure that incidental take of this ESA-listed species does not exceed a rate of 5.5 to 17%. The incidental take of natural-origin upriver spring/summer Chinook averaged 10.2% since 2001.

Harvest rates on spring/summer Chinook salmon will be consistent with the conditions of US v Oregon and levels dictated by the 2008 FCRPS Biological Opinion (NOAA Fisheries 2008). Harvest is a secondary objective of the Yankee Fork and Panther Creek programs and would average only 1 to 8% when the run is less than 500 adults (see Sections 4.2.1 and 4.2.2).

Additionally, tribal harvest rates will be established annually in response to the size of returning runs. This conservative approach to harvest will increase the likelihood that broodstock and natural escapement targets will be consistently met.

***Federal and other legal mandates and obligations for fish protection, mitigation, and enhancement must be fully addressed.***

Hatchery reform, continued hatchery production, and habitat protection and restoration actions are requirements of the 2008 FCRPS Biological Opinion (NOAA Fisheries 2008) and the Shoshone-Bannock Accords (Shoshone-Bannock Tribes and FCRPS Action Agencies 2008). All other relevant legal mandates for fish protection, mitigation and enhancement will be incorporated into the Yankee Fork and Panther Creek spring/summer Chinook programs.

## **4.15 COMPREHENSIVE ENVIRONMENTAL ASSESSMENT**

Under the NPCC Step-Review process for aquaculture facilities, project proponents are asked to describe the status of their comprehensive environmental assessment. Upon approval of this Step 1 Master Plan, the Shoshone-Bannock Tribes will initiate preparation of a detailed environmental assessment that meets the criteria of the National Environmental Policy Act (NEPA). This assessment will provide a foundation for compliance with a number of other environmental and

regulatory requirements. The discussion that follows provides an overview of the most significant environmental compliance steps to be undertaken during Step 2.

#### **4.15.1 National Environmental Policy Act**

The National Environmental Policy Act (NEPA) of 1969, as amended (42 USC 4321 et seq.), requires federal agencies to assess and disclose the effects of a proposed action on the environment prior to funding, approving, or implementing an action.

An Environmental Assessment (EA) that examines the environmental consequences of developing and operating the Crystal Springs Hatchery will be prepared to address NEPA requirements. This process will include public outreach to assist the Tribes in identifying key issues that should be addressed in the environmental analysis. As the primary funding entity, it is likely that BPA will be the lead federal agency for the NEPA effort, with cooperating agencies to be requested when the process is initiated.

#### **4.15.2 Endangered Species Act**

The Endangered Species Act of 1973, as amended (16 U.S.C. § 1531 et seq.), requires federal agencies to ensure that actions they authorize, fund or conduct are not likely to jeopardize the continued existence of any ESA proposed or listed species or their designated critical habitat.

Snake River spring/summer Chinook were listed as Threatened under the ESA in 1992 and reaffirmed in 2005 (57 Federal Register 14653). The ESU includes all naturally spawned populations of spring/summer-run Chinook salmon in the mainstem Snake River and the Tucannon River, Grande Ronde River, Imnaha River, and Salmon River subbasins, as well as 15 artificial propagation programs: the Tucannon River conventional hatchery, Tucannon River Captive Broodstock Program, Lostine River, Catherine Creek, Lookingglass Hatchery, Upper Grande Ronde, Imnaha River, Big Sheep Creek, McCall Hatchery, Johnson Creek Artificial Propagation Enhancement, Lemhi River Captive Rearing Experiment, Pahsimeroi Hatchery, East Fork Captive Rearing Experiment, West Fork Yankee Fork Captive Rearing Experiment, and the Sawtooth Hatchery spring/Summer-run Chinook hatchery programs.

Designated critical habitat includes all Columbia River estuarine areas and river reaches proceeding upstream to the confluence of the Columbia and Snake Rivers; and all Snake River reaches from the confluence of the Columbia River upstream to Hells Canyon Dam. Critical habitat also includes river reaches presently or historically accessible (except reaches above impassable natural falls [including Napias Creek Falls] and Dworshak and Hells Canyon Dams) to Snake River spring/summer Chinook salmon in the following hydrologic units: Hells Canyon, Imnaha, Lemhi, Little Salmon, Lower Grande Ronde, Lower Middle Fork Salmon, Lower Salmon, Lower Snake-Asotin, Lower Snake-Tucannon, Middle Salmon-Chamberlain, Middle Salmon-Panther, Pahsimeroi, South Fork Salmon, Upper Middle Fork Salmon, Upper Grande Ronde, Upper Salmon, and Wallowa. Critical habitat borders on or passes through the following counties in Oregon: Baker, Clatsop, Columbia, Gilliam, Hood River, Morrow, Multnomah, Sherman, Umatilla, Union, Wallowa, Wasco; the following counties in Washington: Asotin, Benton, Clark, Columbia, Cowlitz, Franklin, Garfield, Klickitat, Pacific, Skamania, Wahkiakum, Walla, Whitman; and the following counties in Idaho: Adams, Blaine, Custer, Idaho, Lemhi, Lewis, Nez Perce, and Valley (50 CFR 226.205, updated 2004).

## Biological Opinion

Section 7 of the ESA directs federal departments and agencies to ensure that actions authorized, funded, and/or conducted by them are not likely to jeopardize the continued existence of any federally proposed or listed species, or result in destruction or adverse modification of critical habitat for such species. Section 7(c) requires that federal agencies contact the USFWS and/or the NOAA Fisheries (the Services) before beginning any construction activity to determine if federally listed threatened and endangered species or designated critical habitat may be present in the vicinity of a proposed project. A Biological Evaluation/Assessment (BE/BA) must be prepared if actions by a federal agency or permits issued by a federal agency will result in construction and if the Services determine that threatened and endangered species may occur in the vicinity of a proposed project. The Service uses this document as the basis of a Biological Opinion that will outline criteria to ensure the project does not further jeopardize an endangered species. The Tribes will prepare a BA that addresses the potential effects of the aquaculture program on aquatic and terrestrial species.

The 2008 FCRPS Biological Opinion (NOAA Fisheries 2008) recommended mitigation for operational effects of the Snake River dams on Chinook. Measures recommended for Chinook include augmenting flows to the Upper Snake Projects and restoring habitat.

## Recovery Plan

NOAA Fisheries has established a plan to protect and restore salmon and steelhead in the Snake River subbasin of the Columbia River (NOAA 2007). A draft Recovery Plan for Snake River spring/summer Chinook in Idaho is available online for public review at <http://www.idahosalmonrecovery.net/>. The Recovery Plan states that for the Upper Salmon River MPG to meet the MPG-level viability criteria, a minimum of 5 of the 13 populations in the MPG must meet viable status. This assumes that four of the five populations classified as Very Large and Large would need to be included in the set of five viable populations. The Yankee Fork population has a Basic population size and complexity, and therefore has no bearing on the status of the MPG. Panther Creek is classified as an Intermediate population in size and complexity, but is technically classified as extirpated. Currently, the Upper Salmon River MPS does not meet MPG-level viability criteria.

### 4.15.3 Clean Water Act

Consistency of project construction and operation will be demonstrated with various regulatory programs under the Federal Water Pollution Control Act (Clean Water Act). The authority to review the programs for consistency with Section 401 is the responsibility of the Idaho Department of Environmental Quality (IDEQ). Section 404 of this act is administered by the Corps of Engineers. Effects of developing the proposed hatchery facilities on wetland habitat will be evaluated by the Corps, an effort that will require delineation of existing wetlands. Another Clean Water Act component is administered by the Environmental Protection Agency (EPA) is the National Pollution Discharge Elimination System (NPDES) permit for hatchery construction (and the associated Stormwater Pollution Prevention Plan). An additional NPDES permit will be required for hatchery operations if production reaches a regulated level.

#### **4.15.4 USFS Special Use Permit**

A 1988 Record of Decision adopting the Salmon National Forest Final Environmental Impact Statement and Land and Resource Management Plan, as amended, guides management of all National Forest System lands in the Salmon River subbasin. The Shoshone-Bannock Tribes are proposing to modify their existing fish collection facility adjacent to the Pole Flat Campground managed by the Forest Service. The Tribes may also consult with the Forest Service about potential juvenile stress relief/adult holding sites on the Yankee Fork and Panther Creek and will seek Special Use Permits for development and long-term use of these sites as well as the Pole Flat site or its alternative. This permit will include specific construction and operational standards and conditions to ensure that the modified facilities are consistent with Forest Service resource management objectives.

#### **4.15.5 National Historic Preservation Act**

Funding this project is considered an undertaking within Section 106 of the National Historic Preservation Act of 1966, as amended (P.L.89-665, 16 U.S.C. 470). Section 106 requires that every federal agency take into account how each of its undertakings could affect historic properties. Historic properties are districts, sites, structures and traditional cultural places that are eligible for inclusion on the National Register of Historic Places. As the lead federal agency, BPA will ensure that all necessary steps to evaluate potential effects on listed properties and as required by Section 106 are undertaken, including consultation with Tribes and the state regarding other cultural resource values.

#### **4.15.6 State Approvals**

Developing the proposed aquaculture facilities will require various regulatory approvals from State of Idaho agencies. The Tribes will lead this effort, which will be based on environmental and engineering analyses of potential project construction and operational effects. Permitting requirements will be verified during Step 2 planning and preliminary design; approvals sought during Step 3, final design.

### **4.16 HATCHERY AND GENETICS MANAGEMENT PLANS**

Draft HGMPs for the Yankee Fork and Panther Creek spring Chinook salmon programs are included in Appendix A and Appendix B, respectively.

### **4.17 HARVEST PLANS**

The Shoshone-Bannock Tribes exercise their rights to hunt for Snake River spring/summer Chinook under inherent rights and the Fort Bridger Treaty of July 3, 1868. The ceremonial and subsistence harvest objective for the Yankee Fork program is to enable Tribal members to harvest an average of 1,000 spring/summer Chinook annually from the Yankee Fork. The harvest objective for the Panther Creek program is to provide 800 Chinook annually.

The programs will also contribute spring/summer Chinook to fisheries in the Columbia, Snake and Salmon rivers prior to their returning to the Yankee Fork and Panther Creek. Modeling of the

proposed programs using the All-H Analyzer indicates that the lower basin fisheries would harvest about 200 Yankee Fork and 200 Panther Creek Chinook on average, while terminal harvest by tribal members could average about 1,000 Chinook from the Yankee Fork and 800 Chinook from Panther Creek.

Tribal harvest in each system will be subject to the returning run size. Terminal sport harvest is currently limited by IDFG to the mainstem Salmon River and is therefore not anticipated in either the Yankee Fork or Panther Creek. Following program priorities, significant tribal harvest will occur in the Yankee Fork after achieving a hatchery broodstock objective of 120 to 358 adults (depending on program phase) and a minimum natural escapement objective of 500 adults. In Panther Creek, hatchery broodstock objectives must be met (214 adults) and a minimum natural escapement of 500 adults reached before any significant harvest will be allowed (see Section 3.4.5)

In years when the abundance of Chinook returning to either system is less than 500 adults (after collection of hatchery broodstock), tribal ceremonial and subsistence harvest will be minimal, ranging from 1% to 8% of returning adults in accordance with the Tribes' sliding-scale harvest framework in their approved Tribal Resource Management Plan (Shoshone Bannock Tribes 2010a, Table 7). After Phase 2 of the Yankee Fork program is implemented and if the Phase 3 integrated harvest component of the Panther program is implemented, tribal fisheries will be managed to harvest Chinook in excess of hatchery broodstock and natural escapement objectives.

As estimated using the All-H Analyzer, the total annual harvest of Yankee Fork program Chinook (in all fisheries) could range from 635 to 3,760 fish. Harvest of Panther Creek Chinook could range from 515 to 3,259 fish.

Following the cultural practices of the Shoshone-Bannock peoples, most of the terminal harvest will be by individuals using traditional hunting methods, although contemporary methods may also be employed. This harvest would occur throughout the watershed. In years with larger terminal run sizes, tribal communal harvest may also occur at the weirs. Depending on the progress of Chinook salmon recovery and future natural productivity rates of Chinook populations in the upper Salmon River, the Tribes may communally harvest fish selectively at the weirs. Such communal selective fishing would be appropriate if the populations were to be managed as Contributing populations for conservation purposes or to evaluate escapement management options.

The Tribal Resource Management Plan that guides tribal harvest as approved by NOAA will be updated during Phase 2 of the Yankee Fork program and Phase 3 of the Panther Creek program. Tribal harvest will be adapted based on key monitoring data, new scientific information and the progress in Chinook recovery and sustainability.

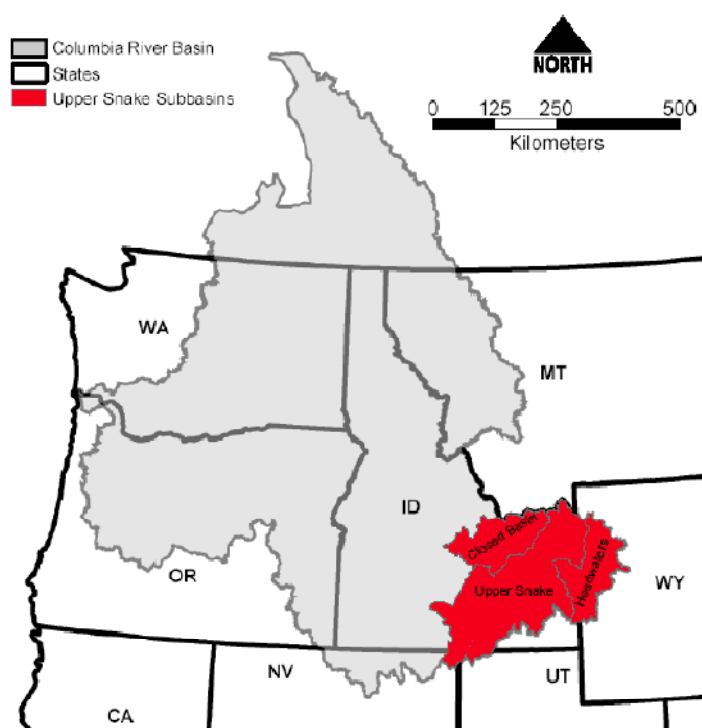
## 5. LOCAL AND REGIONAL CONTEXT FOR THE UPPER SNAKE RIVER SUBBASIN

### 5.1 GEOGRAPHIC AND ENVIRONMENTAL CONTEXT

The proposed Crystal Springs Hatchery will be located near Springfield, Idaho, in the Upper Snake subbasin. This is also the geographic region where the proposed Yellowstone cutthroat trout program will be implemented. The Snake River flows approximately 1,050 miles from its headwaters in Wyoming before joining the Columbia River at the Tri-Cities area of Washington. The Snake River is the largest and longest tributary of the Columbia River, draining 108,000 square miles. In the project area, the river is impounded to form the 58,000 acre American Falls Reservoir. Reservoir backwaters have influenced the naturally spring-fed Fort Hall Bottoms.

#### 5.1.1 Location

The Upper Snake is the uppermost province in the Snake River system encompassing an area within Idaho, Wyoming, Utah, and Nevada (Figure 5-1). The province includes the Snake River and all its tributaries from Shoshone Falls, Idaho, to the headwaters in Wyoming. The Upper Snake Province includes three subbasins: the Upper Snake, Snake Headwaters, and Closed Basin.



Source: NPCC 2004

**Figure 5-1. Location of the Upper Snake province and its three subbasins within the Snake River Basin.**

The Upper Snake subbasin includes the Blackfoot River, Portneuf River, and Henrys Fork watersheds and numerous tributaries across southeastern Idaho. The subbasin can further be broken down into 12 watersheds (Table 5-1).

**Table 5-1. Watersheds within the Upper Snake subbasin of the Upper Snake province.**

Watershed	Code	Hydrologic Unit Code (HUC)	State	Drainage area (miles <sup>2</sup> )	Number of Named Streams	Total Stream miles
American Falls	AMF	17040206	Idaho	2,913	136	624
Blackfoot	BFT	17040207	Idaho	1,097	141	611
Goose	GSE	17040211	Idaho/Utah/Nevada	1,119	215	692
Idaho Falls	IFA	17040201	Idaho	1,149	48	301
Lower Henrys Fork	LHF	17040203	Idaho/Wyoming	1,029	108	473
Portneuf	PTF	17040208	Idaho	1,329	300	1
Raft	RFT	17040210	Idaho/Utah	1,512	232	834
Teton	TET	17040204	Idaho/Wyoming	1,103	159	723
Upper Henrys Fork	UHF	17040202	Idaho/Wyoming	1,109	223	772
Upper Snake – Rock	USR	17040212	Idaho	977	39	216
Lake Walcott	LWT	17040209	Idaho	3,584	142	538
Willow	WIL	17040205	Idaho	649	82	380

The Crystal Springs Hatchery is proposed in the American Falls watershed, approximately 12 miles northeast of Aberdeen, Idaho, near where the Snake River flows into the American Falls Reservoir.

## 5.1.2 Climate

Climate in the Upper Snake region is influenced by prevailing southwesterly winds through the typically north-south oriented mountains, and varies with elevation. Elevations in the province range from 13,451 feet near the headwaters of the Snake River to 2,625 feet at Shoshone Falls. Continental climatic conditions prevail in the low-elevation valleys and plains; Pacific maritime-influenced climatic conditions prevail in the high-elevation regions.

In the Upper Snake subbasin, climate is semiarid due to the Cascade and Sierra mountains to the west and the Bitterroot and Rocky mountains to the north, which effectively block Pacific moisture. Average annual precipitation may vary from 50 to 150% of the mean (NPCC 2004). Precipitation is relatively evenly divided between cold winters and warm summers, but there is usually a large early-winter peak at higher elevations (Table 5-2). The vast majority of discharge in the province's streams is derived from snowfall at elevations higher than 6,234 feet (NPCC 2004).

Average annual air temperature in the subbasin ranges from 40 to 51°F. January and July are typically the coldest and warmest months (Table 5-2). During summer, temperatures in excess of 100°F are common (AgriMet 1994). Record temperatures have reached a high of 104°F in July and a low of -42°F in January (Idaho Climate Summaries 2005).

**Table 5-2. Temperature data for the Upper Snake Province.**

Period	Average Maximum Temperature (°F)	Average Minimum Temperatures (°F)	Average Total Precipitation (in.)
January	31.1	11.0	0.72
February	37.0	16.0	0.64
March	47.1	23.2	0.73
April	59.1	29.9	0.85
May	68.8	37.6	1.11
June	77.7	44.2	0.87
July	87.7	49.8	0.45
August	86.2	47.2	0.48
September	75.8	38.3	0.66
October	62.9	29.6	0.80
November	45.7	21.5	0.72
December	34.1	13.9	0.79
Annual	59.4	30.2	8.82

Source: Idaho Climate Summaries 2005

### 5.1.3 Geology, Soils and Land Types

Topography of the Upper Snake subbasin is generally tablelands with medium to high relief. The plains are hilly to mountainous, bisected by the steep-sided trench of the Snake River canyon.

Geology in the Upper Snake subbasin is characterized largely by basalt flows in the lowlands of the central and southern parts of the subbasin and by intrusive volcanic, sedimentary, and metamorphic rocks in the uplands and mountains to the north, south, and east. The oldest volcanic formations in the watershed are those associated with the Snake River Plain: a 50- to 70-mile-wide crescent of lava covering most of southern Idaho. Many of the soils in the area are alkalized, where salts and alkalis percolate to the surface then evaporate, leaving a whitish crust. This process has produced salty desert soils (or Aridisols) in many areas of the subbasin. In general, soils in the basin are 87% Aridisols and 13% Mollisols. Of these, about 35% are loess (calcareous silt transported by wind), while the remaining 65% are residuum (residual soil that is developed from the weathering of rock), colluviums (loose and incoherent deposits at the base of slopes or cliffs), and alluvium (deposits of silt or silty clay laid down during times of flooding) (NPCC 2004).

The Crystal Springs Hatchery is proposed on the Upper Snake River Plain within the Snake River Plain ecoregion (McGrath et al 2002). Typical land uses in this region include cropland, pastureland, cities, suburbs, and industries. Extensive surface-irrigated small grain, sugar beet, potato, and

alfalfa farming occurs. Frost-free season is shorter and crop variety is less than downstream regions of the Snake River.

### 5.1.4 Hydrology

Flows in the Snake River and its major tributaries are highly regulated by dams and diversions, developed primarily for agricultural and hydroelectric power generation. The major water impoundment in the subbasin is American Falls Reservoir, impounded by American Falls Dam. This is the largest reservoir in Idaho with a surface area of 56,055 acres at a pool elevation of 4,354.4 ft (IDEQ 2006). Its primary purpose is irrigation, and secondarily, power generation. Reservoir refill typically starts in October and continues through winter and early spring. Irrigation season begins in June and the reservoir is drawn down as outflow exceeds inflow. The hydrograph is now highly modified: spring flows are reduced while summer flows are increased for water delivery to downstream irrigators. Water fluctuations in the reservoir can vary widely depending on water year and irrigation demand. Flow is contributed to the reservoir from the Snake and Portneuf rivers and springs between Blackfoot and the Fort Hall Bottoms. Clear Creek and Spring Creek are two of the largest spring-fed systems on the Reservation that provide high quality spawning and rearing habitat (IDFG 2007). The Fort Hall Bottoms are located at the northeast end of the reservoir on Fort Hall Reservation, adjacent to the proposed hatchery site (Figure 5-2). This area is one of the largest reaches of intact, forested floodplain in the area, and it contains a rich diversity of animal and plant life (IDEQ 2006).



**Figure 5-2. Fort Hall Bottoms near the proposed Crystal Springs Hatchery site.**

### 5.1.5 Water Quality

Ninety-nine water bodies totaling 1,822 miles of stream in the Upper Snake Province are classified as impaired under the guidelines of 303(d) of the Clean Water Act (USEPA and IDEQ 1998, NPCC 2004). Over 1,300 miles of water quality-limited streams are found in the Upper Snake subbasin, totally approximately 20%, or 71 streams. The primary limiting factors are sediments, nutrients, flow alteration, and irregular temperatures.

In the American Falls subbasin there are thirteen active or pending National Pollution Discharge Elimination System (NPDES) permitted dischargers. Four of these are municipal, four aquaculture, four confined animal feeding operations (CAFOs), and one dairy operation. The cities of Shelley, Firth, and Blackfoot release their effluent directly into the Snake River and Aberdeen discharges to Hazard Creek/Little Hole Draw, which empties into American Falls Reservoir. Three of the aquaculture NPDES permits are held by the Crystal Springs Trout Farm<sup>9</sup> for former operations (Permit IDG130038 – Issued February 2000, expired September 2004). Indian Springs Fish Hatchery has one permit, but appears at present to not be in operation. American Falls Reservoir is the final disposition of Crystal Springs Trout Hatchery discharge, while the Snake River is the receiving body for Indian Springs discharge. Large CAFOs (1,000 animals or more) are required to have an NPDES permit, which dictates that they control their animal waste discharge. In the American Falls subbasin, these include: Snake River Cattle Company, Tom Anderson Cattle Company, Bragg feedlot, and Kerry Ward feedlot. The only dairy with an NPDES permit in the subbasin is the Alan Andersen dairy.

The entire water supply for the Crystal Springs Hatchery Facility will be from relatively shallow artesian wells (see Appendix E). Water quality of well water is assumed to be appropriate for rearing salmonids. There is potential need to aerate the well water supply; pure oxygen injection may be an approach to this problem.

### 5.1.6 Habitat and Biota

#### 5.1.6.1 Aquatic Species

Species composition in the Snake River subbasin has been affected by extensive habitat modification and deteriorating water quality from hydroelectric development, load-following effects of hydroelectric projects, water withdrawal and diversions, pollution, and introduced exotic species.

Over 40 native mollusk species live in the mainstem Snake River and adjacent springs (Bowler and Frest 1992, NPCC 2002). Two snails are known to occur in the Upper Snake province and are ESA listed: the California floater (*Anodonta californiensis*), and the Bliss Rapids snail (*Taylor conchaserpenticola*, Threatened) (NPCC 2004; pers. comm.. H. Osborne, Shoshone-Bannock Tribes, January 21, 2011).. These species are primarily limited to habitat below American Falls Dam.

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<sup>9</sup> Although similarly named, this site is owned by the IDFG and is located about 5 miles from the Crystal Springs Hatchery site owned by the Shoshone-Bannock Tribes. The IDFG is proposing to construct a sockeye hatchery that will operate under some renewed component of these existing NPDES permits.

The number of coldwater fish species native to the Upper Snake River is relatively small (Table 5-3). White sturgeon and rainbow trout do not migrate above Shoshone Falls but have been introduced to various waterways in the province.

**Table 5-3. Fish species present in the Snake River above Shoshone Falls.**

Common Name	Scientific Name	Origin <sup>a</sup>
<b>Sturgeon</b>		
White sturgeon	<i>Acipenser transmontanus</i>	I
<b>Trout</b>		
Mountain whitefish	<i>Prosopium williamsoni</i>	N
Yellowstone cutthroat trout	<i>Oncorhynchus clarki bouvieri</i>	N
Finespotted cutthroat trout	<i>Oncorhynchus clarki ssp.</i>	N
Rainbow trout	<i>Oncorhynchus mykiss</i>	I
Utah chub	<i>Gila atraria</i>	N
Leatherside chub	<i>Gila copei</i>	N
Longnose dace	<i>Rhinichthys cataractae</i>	N
Speckled dace	<i>Rhinichthys osculus</i>	N
Redside shiner	<i>Richardsonius balteatus</i>	N
Coho salmon	<i>Oncorhynchus kisutch</i>	I
Golden trout	<i>Oncorhynchus aguabonita</i>	I
Brown trout	<i>Salmotrutta</i>	I
Brook trout	<i>Salvelinus fontinalis</i>	I
Lake trout	<i>Salvelinus namaycush</i>	I
Arctic grayling	<i>Thymallus arcticus</i>	I
<b>Carp and Minnow</b>		
Carp	<i>Cyprinus carpio</i>	I
Grass carp	<i>Ctenopharyngodon idella</i>	I
Spot tail shiner	<i>Notropis hudsonius</i>	I
Fathead minnow	<i>Pimephales promelas</i>	I
<b>Catfish</b>		
Brown bullhead	<i>Ameiurus nebulosus</i>	I
Blue catfish	<i>Ictalurus fucatus</i>	I
Channel catfish	<i>Ictalurus punctatus</i>	I
<b>Sucker</b>		
Utah sucker	<i>Catostomus ardens</i>	N
Mountain sucker	<i>Catostomus platyrhynchus</i>	N
<b>Sculpin</b>		
Mottled sculpin	<i>Cottus bairdi</i>	N
<b>Livebearer</b>		
Mosquito fish	<i>Gambusia affinis</i>	I

Common Name	Scientific Name	Origin <sup>a</sup>
<b>Sunfish</b>		
Pumpkinseed	<i>Lepomis gibbosus</i>	I
Bluegill	<i>Lepomis macrochirus</i>	I
Smallmouth bass	<i>Micropterus dolomieu</i>	I
Largemouth bass	<i>Micropterus salmoides</i>	I
Black crappie	<i>Pomoxis nigromaculatus</i>	I
<b>Perch</b>		
Yellow perch	<i>Perca flavescens</i>	I
Walleye	<i>Stizostedion vitreum</i>	I

<sup>a</sup> N= native origin, I = introduced origin

Source: NPCC 2004

American Falls Reservoir is popular with anglers and boasts a fishery for rainbow, brown and cutthroat trout, in addition to crappie, yellow perch, whitefish, and bullhead and channel catfish (IFWIS 2010, IDEQ 2006).

The U.S. Geological Survey characterized fish assemblages in the upper Snake River Basin as part of their National Water Quality Assessment Program. Two sites were within the American Falls subbasin – Snake River near Blackfoot and Spring Creek near Fort Hall. Species common to both sites included Utah sucker, mottled sculpin, mountain whitefish, and rainbow trout. Common carp, longnose dace, and redband shiner were found only in the Snake River. The only species collected in Spring Creek (located in the Fort Hall Bottoms area) and not in the Snake River was cutthroat trout (Maret 1997).

### *Yellowstone Cutthroat Trout*

Yellowstone cutthroat trout were once widely distributed from the middle Columbia River Basin to the Northern Rocky Mountains. In the late-glacial period, redband trout invaded the middle Columbia River and replaced Yellowstone cutthroat trout through much of the Columbia and Snake rivers. The Yellowstone subspecies is now limited to the Snake River above Shoshone Falls, to the Yellowstone River drainage downstream to the Tongue River, and to two (now extinct) isolated populations in Waha Lake, Idaho, and Crab Creek, Washington (Behnke 1992). Above Shoshone Falls, the Yellowstone cutthroat trout is native throughout the Snake River system, except for waters between Jackson Lake and Palisades Reservoir.

The maximum age of Yellowstone cutthroat trout is variable and greatly influenced by environmental factors. Stream resident fish, typically found in the upper reaches of smaller streams, rarely live longer than three to five years and typically attain a size of nine to ten inches (Behnke 2002). Henry's Lake in Idaho, which is also home to a native lacustrine population of Yellowstone cutthroat, is very shallow and nutrient rich. These cutthroat grow faster, attaining a

maximum size of 24 inches and six pounds, with a lifespan of six or seven years (Behnke 2002). In the Fort Hall Bottoms area, adfluvial<sup>10</sup> Yellowstone cutthroat trout are also reported to grow to lengths exceeding 24 inches. Spawning of native Yellowstone cutthroat trout varies widely throughout their range. Spawning takes place in late winter through early summer; spawning peaks in March in the Fort Hall Bottoms area and in June in many higher mountain tributaries. The diet of most adults is almost completely fish.

Henry's Lake, upstream of the American Falls Reservoir, retains a dominant and abundant population of Yellowstone cutthroat trout; however, the majority of these may be rainbow trout and Yellowstone cutthroat trout hybrids. Yellowstone cutthroat trout persists in some Snake River tributaries, but has been replaced in others. For example, rainbow trout now dominates the Henry's Fork downstream of Henry's Lake, but the native cutthroat trout dominate the Teton Fork, its major tributary.

Most of what is known of the life history of Yellowstone cutthroat trout is based on the populations of Yellowstone Lake. These fish have been widely propagated and the majority of cutthroat trout used in fisheries management is based on this stock. For thousands of years, cutthroat trout evolved in Yellowstone Lake with only one other fish – the longnose dace (which is rare). This narrow evolutionary programming, combined with the highly stable environment of Yellowstone Lake, makes the Yellowstone cutthroat trout ill-adapted to successfully coexist with other fish species or to thrive in the unstable environments where it has been introduced.

Section 6 of this Master Plan provides details about the proposed Crystal Spring Hatchery Yellowstone cutthroat trout program.

### *Rainbow Trout*

Rainbow trout are native to the inland rivers of the western United States and much of the Rocky Mountains west of the continental divide. An adaptable species, the inland strain is now widely distributed beyond its historical range as a result of extensive stocking into lakes and streams.

Rainbow trout prefer cool water less than 70°F, although they can inhabit water with temperatures from 32°F up to 80°F. Growth of this species varies greatly, depending upon conditions such as water temperature, water chemistry, and food supply. Diet consists primarily of foods that are drifting on the surface, in the water column, or along the bottom of streams or lakes such as aquatic insects, amphipods, aquatic worms, and fish eggs. Occasionally they eat small fish. Rainbow trout normally spawn in the spring between February and June, depending on temperature and location. Fish mature at age 1 to 5, depending on their growth rate, but most mature at age 3.

Rainbow trout are not native to the Upper Snake River subbasin, but have been planted in many locations as sport fish (Behnke 2002). When present in the same area, rainbow trout regularly out-compete Yellowstone cutthroat trout. These species did not co-evolve, and sympatric populations of native Yellowstone fish and introduced rainbow trout are extremely rare. Both species are

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<sup>10</sup> Those fish that rear in the lake or reservoir environment and spawn in smaller tributaries.

present in the streams of the Fort Hall Bottoms. Yellowstone cutthroat trout in this area have a high level of hybridization with rainbow trout, and pure strains of Yellowstone cutthroat trout are becoming increasingly rare across their native range.

### *Utah Sucker*

The Utah sucker is native to the old Bonneville subbasin of Utah, Idaho, Wyoming, and Nevada. In Idaho, the species occurs in the Snake River system above Shoshone Falls, the Bear River drainage, and in independent drainages. The Utah sucker lives in a variety of habitats, including lakes, reservoirs, rivers, and creeks with slow to moderate current and a variety of temperatures. They spawn in the spring and females deposit eggs over gravel and sand. They are bottom feeders, taking both plant material and benthic organisms. Utah suckers were a common source of food for early settlers and tribes, but are seldom used for that purpose today. Some populations are in decline due to anthropogenic factors, including habitat destruction, water-flow diversions, migration barriers, chemical pollutants, and competition with non-native species.

The Utah sucker is present throughout the American Falls watershed, but does not experience much fishing pressure. This species may provide a large percentage of the diet of smallmouth bass and other game fish in American Falls Reservoir.

### *Mountain Whitefish*

Mountain whitefish are found in streams and lakes. In streams, they occur primarily in the riffle areas in summer, but prefer large pools or slow-moving runs during winter. Movement is dependent on feeding and spawning locations. Mountain whitefish may live up to 11 years of age. They generally become sexually mature when they are 3 or 4 years old. Spawning usually occurs in the fall, from September to December, depending on the elevation and latitude, when water temperatures are between 40 and 45°F. Spawning generally takes place on gravel substrates in stream riffles or on gravel shoals along beaches of lakes. Mountain whitefish spend much of their time near the bottom of streams and feed mainly on aquatic insect larvae. These fish have been an important food fish for humans and provide a variety of angling opportunities ranging from dry fly to spin fishing.

#### **5.1.6.2 Wildlife**

Wildlife species present in the Upper Snake province include big game species, native and nonnative game birds, waterfowl, and a larger number of nongame mammals, birds, amphibians and reptiles. Gray wolves (*Canis lupus*) inhabit the province. The Upper Snake and Snake Headwaters subbasins provide nesting areas for bald eagles (*Haliaeetus leucocephalus*) and peregrine falcons (*Falco peregrines*) and wintering habitat for trumpeter swans (*Cygnus buccinators*). The bald eagle (*Haliaeetus leucocephalus*), a delisted species, is also present in the Upper Snake province.

The wildlife species in the Upper Snake province that are listed under the Endangered Species Act include the grizzly bear (*Ursus actos horribilis*), and Canada lynx (*Lynx canadensis*). Also present in the province are experimental populations of the endangered whooping crane (*Grus americana*) and the endangered gray wolf. Other candidate species for listing include the wolverine (*Gulo gulo*), greater sage grouse (*Centrocercus urophasianus*), pygmy rabbit (*Brachylagus idahoensis*) and the yellow-billed cuckoo (*Coccyzus americanus*).

Ninety-seven mammalian species are present in the Upper Snake province, including several large predators. Nearly the entire Upper Snake province now supports gray wolves as a result of reintroduction in the 1990s. The Snake Headwaters subbasin supports grizzly bears, and mountain lions are distributed throughout much of the Upper Snake subbasin.

Over 274 bird species are known to reside or migrate through the Upper Snake province. Of this number, 27 are birds of prey. American Falls Reservoir and the Fort Hall Bottoms harbor wintering and migrating trumpeter and tundra swans (*Cygnus columbianus*), as well as snow geese (*Chen caerulescens*). Many species of birds can be found in the marshes and sage/shrub land around the hatchery site (Table 5-4).

**Table 5-4. Bird species known to be found near the Crystal Springs Hatchery.**

Species	Season, Abundance
<i>Geese, Swans and Ducks</i>	
American Widgeon	Resident, abundant
Barr Goldeneye	Summer, uncommon Winter, uncommon
Blue-winged Teal	Summer, uncommon
Bufflehead	Resident, common
Canada Goose	Resident, abundant
Cinnamon Teal	Summer, abundant Winter, rare
Com Goldeneye	Summer, rare Winter, abundant
Gadwall	Resident, abundant
Green-winged Teal	Summer, common Winter, uncommon
Mallard	Resident, abundant
Northern Pintail	Resident, common
Northern Shoveler	Summer, common Winter, rare
Ring-necked Duck	Summer, uncommon Winter/Migrant, common
Snow Goose	Migrant, common
Trumpeter Swan	Resident, uncommon
<i>Hawks and Eagles</i>	
American Kestrel	Resident, abundant
Bald Eagle	Resident, uncommon
Osprey	Summer, common
<i>Rails and Coots</i>	
Virginia Rail	Summer, common Winter, rare

Species	Season, Abundance
<i>Shorebirds</i>	
American Avocet	Summer, common
Black-necked Stilt	Summer, uncommon
Greater Yellowlegs	Migrant, common
Lesser Yellowlegs	Migrant, common
Long-billed Dowitcher	Migrant, common
<i>Other Species</i>	
Northern Shrike	Migrant/Winter, uncommon
White-crowned Sparrow	Resident, common
European Starling	Resident, abundant
Caspian Tern	Summer, uncommon
American Robin	Resident, abundant
Bohemian Waxwing	Migrant/Winter, common
Marsh Wren	Summer, abundant Winter, rare

Source: IFWIS 2010b

For a complete list of wildlife found in the Upper Snake province, see Appendix 1 in NPCC 2004.

### 5.1.6.3 Vegetation

Historic vegetative types in the Upper Snake subbasin were aspen, big sagebrush, and spruce-fir types. All three of these types of cover have declined through the years (47%, 42%, and 12% of their historic cover, respectively). Lodgepole pine types have increased to more than 1,100% of historic cover estimates. Agricultural lands comprise an estimated 23% of the current Upper Snake subbasin cover and represent a conversion of this proportion of historic vegetative cover and habitat, which were probably mostly shrub-steppe vegetation types (Table 5-5).

**Table 5-5. Percent representation of current vegetation cover types in the American Falls watershed.**

Vegetation Cover Type	Percent of Watershed
Agriculture	28
Aspen	1
Basin & Wyoming Big Sagebush	36
Low Sagebrush	1
Mountain Big Sagebrush	3
Perennial Grassland	5
Shrub-Dominated Riparian	1
Vegetated Lava	6
Warm Mesic Shrubs	1
Other	18

Source: Ecovista 2004

In 2010, five plant species in the Upper Snake province were listed as rare either globally (G rank 1-3) or at the state level (S rank 1-2) (Table 5-6). In addition, the Tribes report occurrences of Ute's Ladies Tresses (ESA listed as Threatened) in the Fort Hall Bottoms (pers. comm. H. Osborne, Shoshone-Bannock Tribes, January 21, 2011).

**Table 5-6. Rare vegetation found in the Upper Snake province.**

Common Name	Scientific Name	S Rank	G Rank
Iodine bush	<i>Allenrolfea occidentalis</i>	S1	G4
Meadow milkvetch	<i>Astragalus diversifolius</i>	S2	G2
Spreading gilia	<i>Ipomopsis polycladon</i>	S2	G4
Obscure phacelia	<i>Phacelia inconspicua</i>	S1	G2
Red glasswort	<i>Salicornia arubra</i>	S2	G5

Notes: G = Global; S = State. 1 = Critically imperiled; 2 = Imperiled; 3 = Vulnerable; 4 = Not rare, apparently secure; 5 = Abundant, secure.  
Source: IDCDC 2010

## 5.2 SOCIOECONOMIC CONTEXT

Prior to 19th century European immigration, two semi-nomadic Native American tribes, the Bannock and Shoshone peoples, inhabited regions now known as southeastern Idaho, northern Utah and Wyoming. The country along Snake River was important to them for its abundant natural resources, including water, game, fish, timber, berries and roots. Economic and subsistence activities varied by location, with the westerly bands relying more on salmon fishing than on bison hunting. Bison were hunted by groups using the Plains Indians' technique of flanking the herds on horses and shooting them with bows and arrows or rifles. Summers were spent collecting wild foods and hunting. Bands occupying territory of southwestern Idaho depended on the spring and fall salmon runs for most of their subsistence, but sometimes they took part in the Fort Hall bison hunt. Salmon was the principal food source below Shoshone Falls and in the western Idaho region. Salmon were speared from platforms in the streams or while wading, or were captured in weirs built across small streams and channels. Other fish species caught included sturgeon, suckers, perch, and trout (Every Culture 2010).

On July 3, 1868, the Eastern Shoshone and Bannock tribes concluded the Second Treaty of Fort Bridger. The treaty guaranteed the creation of reservations for the exclusive use and occupancy of the signatory tribes. Pursuant to this guarantee, in 1869, the Fort Hall Reservation was established. The Tribes agreed to the Treaty in part to establish a permanent home in the area where they traditionally wintered. The area was proximal to what is now called the Fort Hall Bottoms, and were known to hold a great quantity of small and large game and fishes.

The Fish Bulletin of the United States Fish Commission (Gilbert and Evermann 1895) stated "the occurrence of fishes, including trout, were abundant in (the Ross Fork)." Gilbert and Evermann met with the "Fort Hall Indians" who called the cutthroat trout Tsaabengwi, which means "good fish" in the Shoshone language. Other fish species collected on the survey were named by their appearance and the eating habits in the Shoshone language. For example, "Moo-gad-ee" or mugade, is the Utah sucker, or "one that eats by kissing rocks." Historical accounts report the importance of native fish species to the food supply of the tribes, specifically the cutthroat, or "good fish." Today, two other

primary traditional subsistence species, bison and salmon, have diminished. Tribes currently engage in farming, raising livestock, and other agriculturally enterprises, and are heavily involved with the mainstream economy.

### **5.2.1 Significance of Yellowstone Cutthroat Trout**

The Yellowstone cutthroat trout remains a culturally important species to the Shoshone-Bannock people. In this Master Plan, the Tribes are proposing a Yellowstone cutthroat trout production program at the Crystal Springs Hatchery with an initial production goal of 10,000 fingerlings and 10,000 catchable sized fish to be stocked in suitable streams both within and outside the Fort Hall Reservation. These initial production goals may be adjusted up or down depending upon project needs.

The proposed Yellowstone cutthroat trout program will provide the Shoshone-Bannock Tribes with a tool to aid their Yellowstone cutthroat trout restoration and enhancement program. A decline in Yellowstone cutthroat trout began in the mid- to late-19th century and has continued to the present. This decline is primarily the result of habitat degradation and the introduction of non-native salmonids. As described in Section 6.10, habitat restoration and enhancement actions are occurring on the Fort Hall Reservation and on federal, state and private lands.

Other direct actions are also being implemented to restore Yellowstone cutthroat trout to much of their historic range. These include removal of non-native species and planting pure strains of Yellowstone cutthroat trout into suitable underutilized or unoccupied habitat. Non-native species may be removed through a variety of methods, including direct removal, elimination of access to spawning habitat, sport fishing management actions, and genetic swamping (planting pure strains of Yellowstone cutthroat trout on populations of rainbow trout x Yellowstone cutthroat trout hybrids to provide a higher percentage of pure-strained Yellowstone cutthroat trout available for mating).

As discussed in Section 5.3 below, the restoration and enhancement program proposed by the Shoshone-Bannock Tribes is consistent with other programs being conducted by IDFG and federal land management agencies. There are several self-sustaining populations of Yellowstone cutthroat trout on the Fort Hall Reservation that will be used to develop broodstock for the proposed program. Populations are found in the upper reaches of several streams and in several spring creeks on the Fort Hall Bottoms. Even though most of the streams on the Bottoms have a high level of hybridization with rainbow trout, some pure strain Yellowstone cutthroat trout are found there and thought to be either temporally and/or spatially segregated from the hybrid populations.

### **5.2.2 Land Use, Management and Industries**

Most of the American Falls subbasin is within three counties: Bingham, Bannock, and Power. Bingham County ranks seventh among Idaho counties in population (44,051 people in 2006), and 12th in area (1,340,672 acres) (IDC 2007). The largest city in the area is Pocatello (in Bannock County), with over 50,000 residents. The population of the Shoshone-Bannock Tribes on Fort Hall Reservation is 4,824 (IDEQ 2006).

Land uses include crops, pasture, urban and suburban development, and industries. Agriculture, both irrigated and dryland, accounts for almost 40% of the land use in the American Falls subbasin. Privately owned lands have been the most affected by human development, primarily developed for

farming and ranching. Private landowners and the Bureau of Land Management control the majority of the land in the American Falls subbasin (Table 5-7). In Bingham County, 58.6% of the land is privately held.

**Table 5-7. Land ownership in the American Falls subbasin.**

Land Ownership	Area (acres)	Percentage
Bureau of Land Management	463,681	25.5
Bureau of Indian Affairs	329,768	18.1
Department of Energy	213,217	11.7
Private	66,865	36.4
State of Idaho	83,184	4.6
US Forest Service	8,628	0.5
Open Water (ownership not identified)	58,625	3.2

Major industries in the Upper Snake province are agriculture, services, retail trade, manufacturing, and government. Agriculture, largely dependent on surface water irrigation, predominates in the Upper Snake subbasin where potato and seed crops are grown. Livestock ranching and irrigated forage crops also make significant contributions to the agricultural economy. The main crops in southern Idaho are alfalfa and potatoes, and, to a lesser extent, apples, barley, beans, sugar beets, corn, hay, onions, pears, peas, prunes, and rye (IDEQ 2006). Tourism and outdoor recreation have been growing industries during the last fifteen years (NPCC 2004).

Most of the subbasin has been affected by human development, reducing fish and wildlife populations, habitat, and habitat linkage and connectivity. A relatively small portion (10%) of the subbasin is defined as protected area, mostly within the Idaho National Engineering and Environmental Laboratory (INEEL) and Craters of the Moon National Monument. The entire 569,600-acre INEEL is designated as a National Environmental Research Park, the largest representation of the shrub-steppe ecosystem in the western United States (Anderson 1999, NPCC 2004). The 714,727-acre Craters of the Moon National Monument consists of remote and largely undeveloped lava fields and shrub-steppe areas.

The state's largest water district, District 1, covers the entire Upper Snake subbasin above Milner Dam. American Falls Reservoir is the largest reservoir in this district, providing the most irrigation supply. Generating facilities at American Falls Dam produce 92 megawatts of power. In addition to irrigation, the Bureau of Reclamation provides water for Snake River/Columbia River flow augmentation to support threatened and endangered salmon and steelhead.

## **5.3 RELATIONSHIP OF YELLOWSTONE CUTTHROAT TROUT PROGRAM TO UPPER SNAKE RIVER SUBBASIN PLAN**

### **5.3.1 Draft Management Plan (Upper Snake Province)**

The proposed Crystal Springs Hatchery will be constructed within the geographic area assessed in the Draft Management Plan for the Upper Snake Province (CH2M Hill 2004), which includes the Snake River and its tributaries from Shoshone Falls, Idaho to its headwaters in Wyoming. The overall goal of the Upper Snake Province (USP) Plan is to protect, mitigate, and enhance aquatic and terrestrial habitats, species assemblages, and ecological functions in the USP over the next 10 to 15 years. The USP is designed to help direct project funding to the Upper Snake Closed, Snake Headwaters, and Upper Snake subbasins as part of the NPCC's Fish and Wildlife Program.

The proposed Yellowstone cutthroat trout program will release hatchery produced Yellowstone cutthroat trout into streams located within and near the Fort Hall Reservation, and will address a number of the hatchery related objectives outlined in the USP. Specifically, the proposed program will be consistent with the following biological objectives, rationale, and strategies outlined in the USP:

#### **Biological Objective:**

Protect, enhance, and restore genetic integrity of focal species (which include Yellowstone cutthroat trout) across its historic range, with a particular emphasis on the Fort Hall Bottoms.

#### **Rationale:**

Introductions of non-native rainbow trout have often resulted in hybridization with native Yellowstone cutthroat trout where these species co-occur in the USP. This hybridization has resulted in fragmented populations of pure strains of the native trout and reduced the genetic integrity of Yellowstone cutthroat trout in much of the USP. The Tribes are encouraged by regional efforts to reduce hybridization through various programs, including planting sterile rainbow trout for sport fisheries.

#### **Strategies:**

- a) Identify genetic strongholds of resident and migratory focal species (especially Yellowstone cutthroat trout) within the USP subbasins.
- b) Identify hybridization threats to (a)
- c) Evaluate hybridization risks with barrier removals
- d) Develop priorities within a cooperative restoration plan that protect and expand the distribution of (a) species (consider tribal subsistence).
- e) Implement high-priority projects from (d) that protect and expand the distribution of (a) species.
- f) Monitor and evaluate the effectiveness of (e) within the framework of (d).

- g) Monitor and evaluate the role of hatcheries as a tool for enhancing focal species in their present and historic range.

**Biological Objective:**

Improve survival of focal species in all life stages

**Rationale:**

This objective covers those biological needs for focal species not already addressed by other objectives.

**Strategies:**

- a) Identify and prioritize specific threats to focal species' survival.
- b) Develop priorities within a cooperative restoration plan to improve survival within and among focal species populations.
- c) Educate the public and interested parties on threats to focal species' survival and plan to implement high-priority projects.
- d) Implement (b)

Monitor and evaluate the effectiveness of (d) and modify, if necessary, within the framework of (b).

**Biological Objective:**

Increase focal species numbers to viable usable population according to the Title 36 mandate of the IDFG.

**Rationale:**

It is important to manage for numbers that are beyond minimum thresholds, and provide numbers that support the important economic contribution of fishing and related outdoor recreation to the rural economy of the USP.

**Strategies:**

- a) Develop and implement a public information program for rural communities of the Province and broader public regarding the importance of healthy fisheries to rural economies.
- b) Monitor and evaluate the distribution and population strength of focal species within the subbasins.
- c) Develop priorities within a cooperative restoration plan to maintain and improve focal species populations (consider tribal subsistence) within priority areas.
- d) Enlist support and involvement of rural communities for restoring and protecting viable fisheries.

- e) Implement high-priority projects within priority areas identified in (b).
- f) Monitor and evaluate the effectiveness of and modify, if necessary, within the framework of (b).

In addition to the above objectives, the USP recommends implementing numerous hydropower, irrigation, fish passage, water quality, and instream habitat measures needed to address Yellowstone cutthroat trout limiting factors in the Upper Snake River subbasin (CH2MHill 2004). While the proposed Crystal Springs Yellowstone cutthroat trout hatchery program would not directly address several of these anthropogenic impacts, ongoing habitat restoration efforts being implemented within and near the Reservation by the Shoshone-Bannock Tribes (in cooperation with IDFG and the USFWS) would help to achieve the overall USP goal to protect, mitigate, and enhance aquatic and terrestrial habitats, species assemblages, and ecological functions in the Upper Snake River Province over the next 10 to 15 years (CH2MHill 2004).

### **5.3.2 Shoshone-Bannock Tribes 2008 Columbia Basin Fish Accords**

The proposed Crystal Springs Hatchery program is also consistent with the goal of the 2008 Columbia Basin Fish Accords to restore, enhance, and protect Fort Hall Reservation streams and riparian areas so they can support native fish populations at historic levels (i.e., provide conditions to recover weak populations of focal species [native Yellowstone cutthroat] to self-sustaining levels on the Reservation by improving/enhancing habitat.

Specifically, the 2008 Fish Accords call for the development of the Crystal Springs Hatchery to rear Yellowstone cutthroat trout (in addition to Snake River spring/summer Chinook, Snake River steelhead and Snake River sockeye). As currently proposed by the Tribes, the program will produce approximately 10,000 fingerlings for stocking in suitable streams both within and outside the Fort Hall Reservation where trout are absent or of lower than anticipated abundance. In addition, a program of approximately 10,000 catchable size (10 inches) Yellowstone cutthroat trout is proposed to achieve harvest and culture goals identified by the Tribes. This program would complement the efforts of another Fish Accord project that implements habitat restoration actions on the Fort Hall Bottoms.

### **5.3.3 IDFG's Fisheries Management Plan: 2007-2012**

In 2007, IDFG published a management plan for fish species throughout Idaho (IDFG 2007). The goals of this management plan are to ensure the long-term persistence of the subspecies within its current range and to do so at levels capable of providing angling opportunities. Specifically, the plan describes the known status of Yellowstone cutthroat trout populations in Idaho within 13 Geographic Management Units (GMUs) with respect to abundance, trends, genetics, and an evaluation of existing threats. Finally, the plan presents IDFG management strategies and conservation actions based on habitat conditions, genetics, and population status.

While the Fort Hall Reservation was not considered in the IDFG plan (because it is within the jurisdiction of the Shoshone Bannock Tribes), the proposed Crystal Springs Hatchery Yellowstone cutthroat trout program would be consistent with the overall goals of the plan. It would also support IDFG's recommendation that stocking (translocating) native Yellowstone cutthroat trout could be used to restore populations in streams within their native range, and that evaluation of

restoration efforts should become a part of the long-term monitoring and assessment strategies for Yellowstone cutthroat trout management. (IDFG 2007).

### **5.3.4 Coordination with Other Entities, Program, and Projects**

In 2006, the USFWS announced that listing Yellowstone cutthroat trout under the Endangered Species Act was not warranted. Although the species has declined from historic levels, robust populations can be found throughout the historic range. There is broad interest in protecting this species, as evidenced by numerous conservation efforts by State, Federal, Tribal, local, and nongovernmental organizations.

In May 2000, a Memorandum of Agreement was signed by Montana Department of Fish, Wildlife and Parks, IDFG, Wyoming Game and Fish Department, Nevada Division of Wildlife, Utah Division of Wildlife Resources, Yellowstone National Park, Grand Teton National Park, and the U.S. Forest Service to define the shared goals and objectives for the conservation and restoration of Yellowstone cutthroat trout. These Agencies agreed to a goal: "Ensure the persistence of the Yellowstone cutthroat trout subspecies within its historic range. Manage Yellowstone cutthroat trout to preserve genetic integrity and provide adequate numbers and populations to provide for protection and maintenance of intrinsic and recreational values associated with this fish." The MOA presented seven objectives: 1) identify all existing populations; 2) secure and enhance conservation populations; 3) restore populations; 4) inform the public; 5) share data; 6) coordination; and 7) implementation. Both joint and individual efforts are being undertaken by the agencies.

#### **5.3.4.1 Federal Agencies**

Management of Yellowstone cutthroat trout by federal agencies (USFS, BLM, and the National Park Service) is generally confined to federal lands.

Most management actions carried out on USFS lands are integrated with the appropriate state fish management agency. In the Snake River Basin, the Inland Native Fish Strategy has been adopted by the USFS. In this region, Yellowstone cutthroat trout are managed by standards and guidelines for protection of biological integrity in watersheds. The Inland Native Fish Strategy has also been adopted by the BLM for the Snake River Basin.

Fisheries management in Yellowstone National Park for Yellowstone cutthroat trout include angling restrictions, increased harvest limits for non-indigenous species in waters where they are sympatric with the native cutthroat trout, and intensive gillnetting to reduce predation on Yellowstone Lake by lake trout. In 2005, a program was initiated to identify potential watersheds for reintroducing native Yellowstone cutthroat trout into the northern portion of the park.

#### **5.3.4.2 Montana**

In Montana, numerous conservation efforts have been completed and many are ongoing. These include habitat restoration projects, restoration or passage, increased water flows, water leases, and conservation easements to prevent destruction, modification, or curtailment of habitat or range. Regulation changes and collection permit procedures are ongoing to prevent over use for commercial, recreational, scientific, or educational purposes. Other actions include modifying relevant laws, rule, and policies, and angler outreach. Survey and Inventory efforts have been completed throughout most of the Yellowstone cutthroat trout range in Montana. A complete list

of conservation actions in Montana can be found online at: <http://www.fws.gov/mountain-prairie/species/fish/yct/archive>.

#### **5.3.4.3 Wyoming**

Management of the Yellowstone cutthroat trout subspecies has been an integral aspect of wild trout management by the Wyoming Game and Fish Department since the 1950s. Management focuses on genetic integrity, habitat management, recovery projects using selected stocks, education and outreach, and fishing regulations (WGFD 2005).

#### **5.3.4.4 Idaho**

The IDFG developed a management plan for the conservation of Yellowstone cutthroat trout (IDFG 2007). The goal of the plan is to provide a management framework to ensure the long-term persistence of the subspecies at levels capable of providing angling opportunities. It focuses on the current range of Yellowstone cutthroat trout in Idaho, and those parts of the historical range where restoration is practical. The plan includes status assessments of Yellowstone cutthroat trout populations in Idaho, including abundance, trends, and genetic status. It also describes each of 13 Geographic Management Units and describes appropriate management strategies for each (IDFG 2007).

#### **5.3.4.5 Tribes**

The Shoshone-Bannock Tribes have been performing large-scale, low-tech habitat restoration projects on the Fort Hall Reservation under the Fort Hall Resident Fish Program funded by the Bureau of Indian Affairs, the Shoshone-Bannock Tribes, and BPA. Restoration has been directed at stabilizing eroding banks, deepening and narrowing stream channels, and restoring diversity to the spring-stream biota. Recent work has included fencing projects, repair of streambanks through sloping, wetlands plugs, and enclosure fencing. Biological sampling includes fish population monitoring and biomass estimates in streams within the Fort Hall Bottoms and mountain streams. These efforts are ongoing and will enhance both habitat quality and knowledge of Yellowstone cutthroat trout, but do not include stocking efforts.

#### **5.3.4.6 American Falls Reservoir**

Management of the American Falls Dam and Reservoir may greatly affect Yellowstone cutthroat trout in the reservoir and Fort Hall Bottoms area because there is little or no opportunity to regulate water levels to enhance fish populations. Under current law, the upper Snake River system is operated primarily for irrigation and flood control functions. Minor changes in reservoir regulation to enhance the fishery may be possible, but would be unlikely to significantly affect fish populations (EDAW 1995). As part of the Resource Management Plan, two fishery objectives were identified that may affect Yellowstone cutthroat trout in the reservoir:

- **Objective:** Ensure that management decisions for conservation, use, and enhancement of land resources do not conflict with established water rights, storage contracts, or irrigation operational needs.

**Actions:** If feasible, implement with the consent of the spaceholders, reservoir operational adjustments which contribute to achieving fishery, endangered species, wildlife, and

recreational objectives while protecting water rights, reservoir storage rights, and irrigation operational needs.

- **Objective:** Encourage Idaho Power Company to research fish passage options and improve fish survival rates. Encourage IDFG to research which species and stocks of fish can better survive fluctuating conditions in the reservoir and the river downstream of the dam. Encourage coordination of the IDFG stocking and other fishery management efforts with involved agencies, organizations, and the Shoshone-Bannock Tribes.

**Actions:** Participate with other regional managing agencies and the State to explore potentials for storing more water in the American Falls Reservoir (particularly at the end of irrigation season, to provide over-winter fish habitat). Opportunities may include IDFG purchasing water from the upper Snake River reservoirs.

There is one general action item in the American Falls Wildlife Management Plan that may affect Yellowstone cutthroat trout:

- Construct impoundments and sub-impoundments at various tributaries/inflow sources around the reservoir and in the drawdown zone to improve wildlife habitat, enhance fisheries, promote wetlands and/or open water areas, increase biological diversity, and improve water quality in the reservoir area. Prepare site plans that address each project to determine topography, soil conditions, hydrology, and target species.

## 5.4 UPPER SNAKE RIVER SUBBASIN LOCAL AND REGIONAL HABITAT MANAGEMENT CONTEXT

### 5.4.1 Habitat

As discussed in USFS (2009), barriers to migration, reduced discharge, sediment deposition, groundwater depletion, streambank instability, erosion, increased water temperature, and pollution have all negatively affected Yellowstone cutthroat trout, especially in portions of their historical range that occur at lower elevations. Water diversions, in particular, have been identified as a significant factor in the decline of Yellowstone cutthroat trout in Idaho (IDFG 2007), and thousands are located in the current range of the subspecies.

Habitat in the streams located on and near the Fort Hall Reservation has been degraded by livestock grazing, American Falls Reservoir construction and operations, and the 1976 Teton Dam collapse. Cattle, bison, and horses have also been present on the Fort Hall Reservation since the early 1800s. Bank failures on Reservation streams are a serious problem affecting aquatic biota and have widened channels, reduced riparian vegetation and instream cover, increased summer water temperatures, and deposited fine sediment on critical spawning gravel (Moser 1999).

As described in Section 6.1.3, the Shoshone-Bannock Tribes are implementing a Habitat Restoration Program designed to restore, enhance, and protect Fort Hall Reservation streams so they can support native fish populations at historic levels. Restoration efforts have focused on stabilizing eroding banks, deepening and narrowing stream channels, and restoring diversity to the spring-stream biota with instream structures.

## 5.4.2 Hatcheries

Despite the apparently wide distribution of Yellowstone cutthroat trout in the upper Snake River subbasin, abundance estimates exceeding 2 million fish, and numerous pure or nearly pure populations in Idaho (and portions of adjacent states), Meyer et al. (2006) concluded that Yellowstone cutthroat trout were not safe from possible additional declines in abundance. The fact that nonnative trout occurred in all but two of the smallest GMUs, outnumbered Yellowstone cutthroat trout in seven GMUs, and were present in the majority of subpopulations, suggests that nonnative trout pose a clear threat to the long-term persistence of Yellowstone cutthroat trout in a number of drainages (Meyers et al. 2006).

Meyer et al. (2006) also noted that maintaining demographically viable subpopulations would seem to be the foremost need and should guarantee that genetic variability is maintained if reconnections or translocations from nearby pure populations are considered. Furthermore, IDFG (2007) concluded that stocking Yellowstone cutthroat trout in streams within the native range by translocating or transferring Yellowstone cutthroat trout from another adjacent stream can be an effective means of restoring the species (after assessing the level of risk for both the donor population and the receiving population).

With an initial goal to produce 10,000 fingerlings and 10,000 catchable sized fish for stocking in suitable streams, the proposed Crystal Springs Hatchery program would provide the Shoshone-Bannock Tribes with an additional tool to aide in their ongoing Yellowstone cutthroat trout restoration and enhancement program (Osborne 2009). As noted in Meyer (2006), there is an identified need to restore and enhance Yellowstone cutthroat trout over its entire historical range, and specifically the upper Snake River drainage. In addition, the catchable program is intended to increase harvest opportunities for both tribal and non-tribal fishers and to achieve tribal culture objectives for the Fort Hall Bottoms. Harvesting Yellowstone cutthroat is consistent with management goals identified in many other plans (see Section 5.3.3).

The restoration and enhancement program proposed by the Tribes (including the Crystal Springs Hatchery program) is consistent with other programs being conducted by IDFG and federal land management agencies. There are self sustaining, genetically pure sub-populations of Yellowstone cutthroat trout in streams located on the Fort Hall Reservation, and these populations would be used to develop local broodstock for the proposed Yellowstone cutthroat trout program. In addition, in streams containing both pure and hybrid Yellowstone cutthroat, fish will be collected and held for genetic analysis to determine parentage. Those determined to be pure Yellowstone cutthroat trout may be held for broodstock. The use of progeny from those fish identified as genetically pure will be restricted to stocking in streams with similar genetic profiles (if fish are present). In this way, the genetic variability of populations will be maintained.

Because American Falls Reservoir, located adjacent to the Fort Hall Bottoms, currently supports a fishery for rainbow, brown and cutthroat trout (IFWIS 2010, IDEQ 2006), and is stocked on an annual basis by the Idaho Power Company with approximately 56,000 triploid (sterile) rainbow trout, the locations of genetically pure Yellowstone cutthroat planting efforts need to be carefully considered. To eliminate sources of competition (and in some cases introgression) from adfluvial rainbow, brown, and hybrid rainbow x cutthroat trout, planting locations will be focused in stream reaches that are either naturally isolated from these populations or in streams that would contain weirs to

segregate pure Yellowstone cutthroat trout from non-native and hybrid populations found in the reservoir.

### **5.4.3 Hydropower**

Because Yellowstone cutthroat trout is a resident species and their native range is located upstream of Shoshone Falls, effects of mainstem Snake and Columbia river dams have only a limited effect on their distribution and overall abundance. For the population of Yellowstone cutthroat trout in the Fort Hall Bottoms, potential effects associated with hydropower/irrigation include competition and introgression associated with non-native species present in American Falls Reservoir, annual reservoir drawdown (resulting in increased predation, high temperatures, low dissolved oxygen, spawning disturbance and potential egg loss in the drawdown zone) (IDFG 2007). Rapid flooding and drafting of the reservoir in conjunction with seasonal freeze-thaw cycles is also a cause of streambank failures on lowland reservation streams. Negative effects from streambank failures include, but are not limited to: widened channels; a reduction in riparian vegetation and instream cover; increased summer water temperatures; and deposition of fines on critical spawning and rearing substrates (Osborne 2009).

### **5.4.4 Harvest**

All state, federal, and tribal agencies that have management authority for Yellowstone cutthroat trout currently manage the subspecies as sport fish (May et al. 2007). In many cases, however, conservation or preservation of Yellowstone cutthroat trout is the primary management goal, and angling receives secondary emphasis (Gresswell 2009). On the Fort Hall Reservation, the Tribes issue a limited number of fishing permits for non-tribal members and enforce strict catch-and-release regulations. Catch rates on the Bottoms have fluctuated from less than 0.4 to greater than 1.2 fish per hour (Figure 6-1) (Shoshone-Bannock Tribes 2010c). Overall, the quality of the Fort Hall Bottoms fishery is excellent, and can be compared to any blue ribbon stream in the state. .

### **5.4.5 Climate Change**

As discussed in Section 3.4.5, climate change may have a substantial effect on the persistence of salmon and trout, including Yellowstone cutthroat trout, in the Columbia River Basin as a result of complex behavioral responses to changes in temperature and precipitation and through the combined effects of these variables on the hydrological cycle (ISAB 2007; Gresswell 2009). Regarding Yellowstone cutthroat trout, changes in migration cues (flows and water temperatures) may decrease reproductive potential in allopatric situations, and when rainbow trout are present, introgression may increase (Henderson et al. 2000). The interactions among fishes that currently co-occur, or that reside in near proximity, may also change dramatically under altered climate scenarios; however, these interactions have not been investigated to date (Gresswell 2009).

Within and near the Fort Hall Reservation, the effects of future climate change on Yellowstone cutthroat trout are expected to be relatively minor, as the majority of the streams that are being targeted for restoration are spring fed systems. Of particular importance are streams in the Fort Hall Bottoms, a large wetland adjacent to the Snake River near its entrance into American Falls Reservoir. These streams are all spring fed, low gradient, and relatively short in length (Osborne 2009). In addition, habitat restoration efforts designed to improve riparian habitat and channel stability in many of these streams will help to offset the negative effects of future climate change,

such as increases in water temperature and peak flows. As a result, the effects of climate change are not expected to alter critical stream flows or other habitat attributes in a way that could significantly affect the success of this proposed program.

#### **5.4.6 Population Growth**

Unlike the upper Salmon River subbasin, the majority of the American Falls subbasin has been affected by human development. Most of the land area in the subbasin is in three counties: Bingham, Bannock, and Power. The largest city is Pocatello (in Bannock County), with over 50,000 residents. The population of the Shoshone-Bannock Tribes on the Fort Hall Reservation is 4,824 (IDEQ 2006). Land use in the subbasin includes cropland, pastureland, cities, suburbs, and industries. Agriculture, both irrigated and dry land, accounts for almost 40 percent of the land use. Road development and associated human uses negatively impact fish and wildlife populations, habitat, and habitat linkage and connectivity. A relatively small portion (10 percent) of the subbasin is defined as protected area, mostly within the Idaho National Engineering and Environmental Laboratory (INEEL) and Craters of the Moon National Monument (Anderson 1999, NPCC 2004). While population growth projections are not available for the American Falls subbasin, potential impacts to aquatic habitat associated with growth and development (within the next 50 years) would likely be mitigated by many of the same protection and enhancement measures that currently being implemented in the subbasin by the Shoshone-Bannock Tribes, USFWS, and IDFG. Because the proposed Crystal Springs Hatchery Yellowstone cutthroat trout program would produce fish for streams located within and near the Fort Hall Bottoms area, future population growth in the Columbia River basin is not expected to have a measurable effect on the potential success of this program.

## **6. PROPOSED YELLOWSTONE CUTTHROAT TROUT AQUACULTURE PROGRAM**

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### **6.1 DESCRIPTION OF PROPOSED YELLOWSTONE CUTTHROAT TROUT PROGRAM**

#### **6.1.1 Description of the Yellowstone Cutthroat Trout Program**

In addition to their proposed Chinook program, the Shoshone-Bannock Tribes are proposing to implement a Yellowstone cutthroat trout restoration/supplementation program at the Crystal Springs Hatchery. The initial proposed production goal is 10,000 catchable cutthroat trout (greater than 10-inches) to achieve harvest and 10,000 fry/fingerlings (up to 250 fpp) to achieve conservation benefits. Catchable trout will be released into streams to be managed for harvest, fingerlings to streams designated for enhancement or restoration (see below). The Tribes' long-term goals for this program are to (1) conserve the Yellowstone cutthroat trout population on tribal lands, (2) increase the abundance and range of pure Yellowstone cutthroat trout, and (3) provide hatchery fish for tribal and non-tribal harvest, thereby reducing human impacts on this species.

Broodstock for the program will come from streams with pure strains of Yellowstone cutthroat trout or by genetically sampling individual fish collected in streams with high levels of hybridization<sup>11</sup>. In 1999, pure populations of Yellowstone cutthroat trout were identified in Mill Creek and Ross Fork. Because this information is dated, tribal staff are currently in the process of collecting additional genetic samples in streams throughout the reservation. The results of this work will be used to determine which streams will be used as a broodstock source and candidate streams for re-establishing pure Yellowstone cutthroat trout.

The program will require between 100 and 200 adults to produce the juvenile release numbers identified for the program (fecundity varies widely by fish size). The results of genetic analysis will be used to develop a spawning matrix each year for use by hatchery staff during mating operations. The number of fish used for broodstock may change depending on what is learned about population structure in the targeted streams from on-going genetic and population abundance and life history field work. If substantial genetic differences are found between streams, then broodstock collection may need to be stream-specific. If this occurs, the actual number of fish used for broodstock may need to increase to prevent founder effects in the hatchery population. Prior to mating or releasing any fish to the environment, a genetic management plan will be developed for the program.

Captive hatchery broodstock will be replenished over time, i.e., older brood fish will be released to their native stream and younger fish will be brought into the hatchery to maintain the hatchery population.

Concurrently, the Tribes will investigate the feasibility of placing weirs in streams to protect existing populations from further hybridization. An active fish removal program will be considered for streams where the population consists of introduced species such as brook trout. Once the introduced species was eliminated, hatchery-origin pure Yellowstone cutthroat trout would be released to the stream.

### **6.1.2 Program Need and Justification**

In 1998, Yellowstone cutthroat trout were petitioned for listing as threatened under the Endangered Species Act. The USFWS determined that subspecies listing was “not warranted” in a 90-day finding (USFWS 2001) and a full status review finding (USFWS 2006). Yellowstone cutthroat trout are considered a Sensitive Species or Species of Special Concern by the U.S. Forest Service, the American Fisheries Society, and in all states (Idaho, Wyoming, Montana, Utah, and Nevada) that they inhabit.

The IDFG recently developed a Management Plan for the Conservation of Yellowstone Cutthroat Trout in Idaho (IDFG 2007). The goal of the plan is to provide a management framework to ensure the long-term persistence of the subspecies at levels capable of providing angling opportunities. It

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<sup>11</sup> Adult fish collected in streams with high hybridization rates will be transported and held at the hatchery. Fin-clips will be taken from each fish and genetically analyzed. Pure Yellowstone cutthroat trout will be used as broodstock, while hybrids will be transported and released back to streams targeted for high levels of harvest.

focuses on the current range of Yellowstone cutthroat trout in Idaho, and those parts of the historical range where restoration is practical.

Yellowstone cutthroat are culturally important to the Shoshone-Bannock Tribes and trout habitat restoration and enhancement actions have been, and are currently being implemented on Fort Hall Reservation lands and on federal, state and private lands (Osborne 2009). Removal of non-native species is being accomplished using a variety of methods. Some of the methods being employed include direct removal, elimination of access to spawning habitat, removal using fishing management actions, and genetic swamping by planting pure Yellowstone cutthroat trout on populations of rainbow trout x Yellowstone cutthroat trout hybrids.

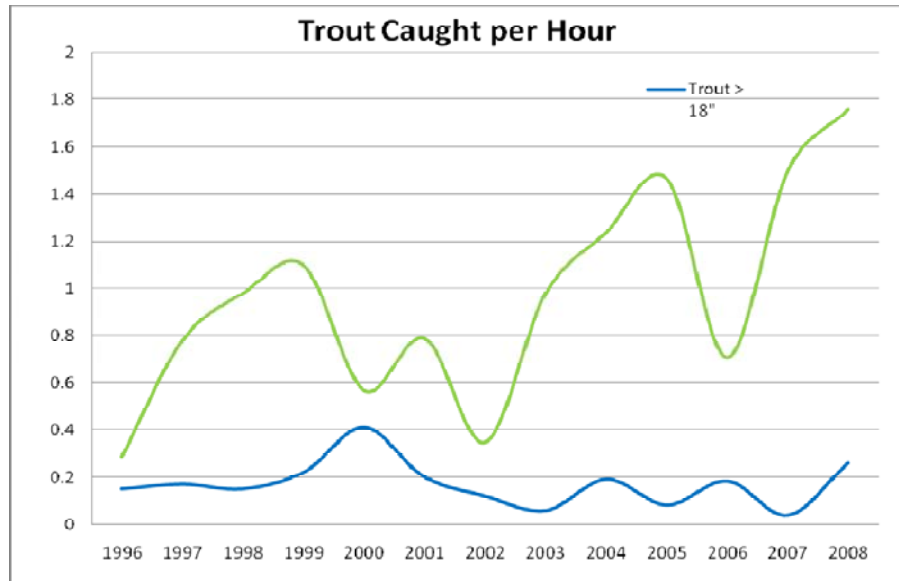
Even though most of the Yellowstone cutthroat trout present in the Fort Hall Bottoms area have a high level of hybridization with rainbow trout, some genetically pure Yellowstone cutthroat trout are found there and are thought to be either temporally and /or spatially segregated from the hybrid populations. Specifically, genetically pure strains are present in Ross Fork and Mill creeks<sup>12</sup> (Moser 1999). The genetically pure Yellowstone cutthroat trout present in these creeks (and possibly fish from other sources) will be used as broodstock for the Shoshone-Bannock Tribes' program. Genetic samples of fish populations in all Reservation streams are currently being collected to identify pure strains of Yellowstone cutthroat trout. The results of this work will be available in early 2011.

Yellowstone cutthroat trout inhabiting the Fort Hall Bottoms area are an important fishery for both tribal and sport permit fishers. The permit fishery provides a significant source of revenue for the Tribe because of the success rate and size of the fish caught. Since 1996, permit fishers have caught, on average, 0.2 eighteen-inch trout per hour of fishing (Figure 6-1). In this figure, the blue line shows the number of Yellowstone cutthroat trout caught per hour and the green line shows the number of fish that were greater than 18 inches. Releasing up to 10,000 catchable Yellowstone cutthroat trout each year will ensure that this sport fishery will continue in the future. Hatchery fish releases will also allow the Tribe to increase harvest rates (i.e., catch limits) by implementing regulations that allow fishers to retain marked hatchery fish while at the same time releasing unmarked Yellowstone cutthroat trout.

There is clearly an identified need for the restoration and enhancement of Yellowstone cutthroat trout populations over its entire historical range. The proposed program will provide the Tribes' with a valuable tool in their ongoing Yellowstone cutthroat trout restoration and enhancement program. After preliminary results are evaluated by the relevant managers, the Tribes may propose to use broodstock to supplement at risk populations in priority areas outside of the reservation boundaries.

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<sup>12</sup> A total of 22 streams were sampled during the 1999 genetics evaluation.



Source: Shoshone-Bannock Tribes 2010c

**Figure 6-1. Number (green line) and number over 18 inches (blue line) of Yellowstone cutthroat trout caught per hour during the non-tribal fishing season (1996-2008).**

### 6.1.3 History of the Yellowstone Cutthroat Trout Program

In 1992, the Fort Hall Bottoms Restoration Program, through cost-sharing with the BIA and BPA, began a series of large-scale, low-tech, habitat restoration projects on the Reservation. Restoration was directed at stabilizing eroding banks, deepening and narrowing channels, and restoring diversity to the stream environment. Restoration efforts were originally focused on Clear Creek, a heavily impacted stream on the Reservation. The Resident Fisheries Program has also directed efforts toward other streams, including Spring, Diggie and Big Jimmy creeks. The primary focus of the program has changed over time; in particular there is now less reliance on instream structures and more reliance on fencing and the natural channel healing processes (Moser 1999).

In addition to the above restoration efforts, the Tribes' have recently initiated (in September 2010) a comprehensive survey (and mapping effort) of the 34,000-acre Fort Hall Bottoms to more thoroughly describe the existing status of Yellowstone cutthroat trout. Specifically, this survey is designed to:

- Determine the distribution, relative abundance, and degree of Yellowstone cutthroat trout x rainbow trout hybridization in streams within the Bottoms area (i.e., further identify those areas that support pure strains of Yellowstone cutthroat trout and those that do not),
- Describe any remaining Yellowstone cutthroat trout limiting factors in the Bottoms area that would need to be addressed prior to supplementation,

- Identify those streams that could be isolated with weirs or those that are naturally isolated from areas containing hybrids or other non-endemic species (i.e., brook trout), and
- Determine the size and source of the Yellowstone cutthroat trout donor population needed for the planned hatchery supplementation program.

Currently, Spring Creek and other Fort Hall Bottoms streams that connect to American Falls Reservoir are known to contain rainbow trout, Yellowstone cutthroat trout, brown trout, Yellowstone cutthroat trout x rainbow trout hybrids, yellow perch, Utah suckers, mountain whitefish, mottled sculpin, Paiute sculpin, and common carp. Upland streams, including the Blackfoot and Portneuf rivers on the Fort Hall Reservation, contain rainbow trout, Yellowstone cutthroat trout, brook trout, mottled sculpin, redbreast shiner, speckled dace, longnose dace, mountain sucker, and Utah chub (NPCC 2002). Nonnative fishes were stocked on the Reservation until 1994 when the permit fishing programs goals shifted to natural production and catch and release angling for trophy trout. Past non-native hatchery outplantings included rainbow trout, brown trout, and brook trout (NPCC 2002).

## **6.2 BIOLOGICAL OBJECTIVES OF THE YELLOWSTONE CUTTHROAT TROUT PROGRAM**

The conservation objective of the program is to increase the abundance and spatial distribution of Yellowstone cutthroat trout on and near reservation lands. The harvest objective is to provide tribal fishers the opportunity to catch up to 10,000 hatchery-origin Yellowstone cutthroat trout in selected streams.

Measurable production and biological objectives associated with the proposed Crystal Springs Hatchery Yellowstone cutthroat trout program include:

- Collecting an adequate number of adult and juvenile Yellowstone cutthroat trout to begin a captive broodstock program
- Producing approximately 10,000 fry/fingerlings at up to 250 fish per pound annually for release into suitable streams both on and off the Reservation
- Producing approximately 10,000 catchable Yellowstone cutthroat trout annually at 3 fish per pound for release into suitable streams on the Reservation
- Increasing population spatial structure and abundance
- Harvesting 10,000 hatchery-origin Yellowstone cutthroat trout annually
- Making annual progress toward removing Yellowstone cutthroat trout x rainbow trout hybrids in streams with the greatest potential to support genetically pure Yellowstone cutthroat

- Annually monitoring Yellowstone cutthroat trout spawners in those streams that are targeted for enhancement and restoration (to determine fingerling to adult survival and overall spawner abundance)
- Annually monitoring Yellowstone cutthroat trout abundance in streams targeted for enhancement and restoration (to compare abundance with streams that currently support undisturbed populations of pure Yellowstone cutthroat trout in the region)
- Annually monitoring the change in the total number of streams supporting pure populations of Yellowstone cutthroat trout
- Continuing management actions that conserve high quality Yellowstone cutthroat trout spawning and rearing habitat in streams designated for protection

## **6.3 ALTERNATIVES CONSIDERED**

Alternatives considered in the developing the proposed Crystal Springs Hatchery Yellowstone cutthroat trout program included the following:

### **6.3.1 No Action**

Under the no action alternative, the existing genetically pure strain of Yellowstone cutthroat trout found within and near the Fort Hall Reservation would remain at risk due to continued hybridization with non-native rainbow trout. State and tribal fishery managers have expressed concerns about protecting this unique genetic legacy, and therefore, no action is considered an unviable option.

### **6.3.2 Rely on Habitat Improvements**

While habitat improvement measures currently being implemented on the Fort Hall Reservation have proven to be effective, increasing the abundance of the existing Yellowstone cutthroat trout population within its current range does not prevent further hybridization and would not expand the population beyond its current range.

### **6.3.3 Rely on Weirs to Control Rainbow Hybridization**

The use of weirs to prevent rainbow trout access into existing Yellowstone cutthroat trout spawning areas in lower reaches of streams as the sole means of controlling hybridization would be problematic and not very effective due to the periodic flooding of the lower reaches of streams in the area due to the changing water levels in American Falls Reservoir, which is primarily managed for irrigation and flood control. Weirs would only provide periodic isolation, and therefore, were not considered a viable, stand-alone option.

## **6.4 CONCEPTUAL DESIGN OF YELLOWSTONE CUTTHROAT TROUT FACILITIES**

### **6.4.1 Overview of Facilities**

The Yellowstone cutthroat facilities proposed under this Master Plan include small scale adult fish holding tankage for broodstock, one stack of incubation trays, and several round tanks for early rearing. These facilities will occupy space adjacent to the spring/summer Chinook incubation and early rearing spaces inside the proposed hatchery building. One of the large outdoor ponds will be used for final rearing of the catchable sized fish. The cutthroat program will also share water supply and drain systems with the salmon program.

### **6.4.2 Existing Facilities**

There are no existing facilities associated with this program.

### **6.4.3 Proposed Facilities**

The basis of design of the facilities described below is provided in the biocriteria spreadsheet and narrative in Appendix D.

#### **6.4.3.1 Adult Collection, Holding and Spawning Facilities**

Adult collection will consist of netting or trapping adult fish using portable systems that are not specifically identified or included in the capital funding for this project. Collected adults will be hauled to the proposed Crystal Springs Hatchery where they will be held, spawned and reared.

#### **6.4.3.2 Crystal Springs Hatchery**

The collected adult Yellowstone cutthroat trout will be held in four 6-foot-diameter fiberglass tanks. Selected fish will be spawned at a spawning table adjacent to the holding tanks. Adult fish that survive spawning will be held for two to three years and then released back to the wild and replaced with new adult fish as needed. Figure 4-13 presents a conceptual layout of the proposed hatchery building layout. Early rearing will be accomplished in three 10-foot-diameter round tanks. One of the outdoor rearing ponds will be used to rear up to 10,000 catchable fish to a size of 3 fish per pound for release annually.

#### **6.4.3.3 Water Systems**

The water budget for the Yellowstone cutthroat program includes 70 gallons per minute (gpm) for adult holding, 5 gpm for incubation, up to 140 gpm for early rearing, and 240 gpm for outdoor catchable size fish rearing. This volume of water is incidental to the supply system that will be developed for the Chinook program (described in Section 4.5.3).

#### **6.4.3.4 Incubation Facilities**

Incubation of up to 22,880 eggs will take place in a single half-stack of 7 hatch trays, loaded at less than 4,000 eggs per tray. The incubation stack will receive its water supply from the hatchery incubation head box. Chilled water will be available for controlling the development rate of the eggs.

#### **6.4.3.5 Rearing Facilities**

After hatch, fry will be transferred into three 10-foot-diameter fiberglass round tanks for early rearing. The tanks and water supply and drain systems will be sized to allow the Tribes to experiment with a variety of release sizes, from fry/fingerlings at up to 250 fish per pound, up to catchable adults for harvest at 3 fish per pound. More detailed information about the biocriteria is presented in Appendix D.

#### **6.4.3.6 Hatchery Housing, Administration and Other Support Facilities**

Housing, administration and other support facilities will be shared with the salmon programs at Crystal Springs Hatchery, described in detail in Section 4 above.

#### **6.4.3.8 Acclimation Facilities**

Fingerling or catchable size fish will be directly released into small streams after tempering during transport. No acclimation facilities will be provided.

### **6.4.4 Development and Operation Schedules**

Planning level production and operations schedules for the proposed Yellowstone cutthroat trout program at Crystal Springs Hatchery have been developed based on the program described in Sections 4 and 5 and the facilities described in Section 6.4. These schedules demonstrate how the target production of up to 10,000 fingerlings and 10,000 catchable size Yellowstone cutthroat trout will be achieved.

The primary biological variables used to prepare the preliminary operations schedule include water temperature (a species-specific condition factor for trout), density and flow indices. Water temperature is the primary determining factor in the development and growth rate of fish. The groundwater supply to be used for all stages of incubation and fish rearing will provide relatively constant year round water temperatures. A temperature of 10.1° C was assumed for the incubation, early rearing and juvenile rearing periods. Based on these primary biological variables and the trout production goals, specific biocriteria were developed and form the basis of the preliminary operations schedule shown in Table 3 of Appendix D. This schedule depicts water use by month and space requirements for each operational area of the fish culture process, including incubation, early start-up rearing and juvenile rearing in outdoor ponds.

The basis of the values used for bio-programming and the criteria used to formulate the operations schedule and water requirements are provided in detail in Appendix D.

The preliminary operations schedule covers a two-year period in order to understand and incorporate overlapping water requirements for juvenile fish (reared to catchable size) from two brood years on site at one time. A summary of the full operations schedule (the upper section of Table 1 in Appendix D) shows the timing of incubation, early indoor rearing and juvenile outdoor rearing in ponds. The adult holding component of the program is a year round element. A summary schedule of the functions proposed at Crystal Springs follows:

- Egg incubation will occur in April and May.
- Early (indoor) rearing for the fingerling program will occur in June and July.

- Early (indoor) rearing for the catchable program will begin in June or July and extend through the following April.
- Outdoor juvenile rearing will begin in April (after enough spring Chinook are transferred out to free pond space for the trout) and continue through July or early August, when the catchable size fish are out-planted.

The resulting water requirements show a peak flow of 0.54 cfs (240 gpm) to the outdoor rearing facilities for a given brood year, and a concurrent demand of 0.2 cfs (90 gpm) for broodstock holding and early rearing supply to the successive brood year in April of each year. The total peak demand is estimated to be 0.7 cfs.

## **6.5 RESEARCH, MONITORING, EVALUATION OF YELLOWSTONE CUTTHROAT TROUT AND PROGRAM ADAPTIVE MANAGEMENT**

### **6.5.1 Decision Management Framework**

The primary biological objective of the Yellowstone cutthroat trout program is conservation of the species in suitable streams within and near the Fort Hall Reservation. The first step of this process was initiated by the Tribes in 1999 with collection of genetic samples from cutthroat trout populations in all tributaries in the area. New genetic samples are being collected for analysis in 2011, the results of which will be used to determine if the primary management for the streams should be protection, enhancement, restoration or harvest. A description of the actions proposed for each of these four stream classification is presented below.

#### **6.5.1.1. Stream Classification: Protection**

**Definition:** Streams where pure populations of Yellowstone cutthroat trout currently exist, or hybridization is less than 20 percent (Protect).

**Management Approach:** These streams may provide the fish needed for broodstock for the program. In addition, surveys will be conducted in each stream to identify habitat limiting factors. Habitat improvement and protection actions will then be implemented that target these factors. Weirs will not be placed on these streams because hybridization rates are quite low or non-existent. The harvest policy for streams identified for genetic protection will be highly conservative. Fishing regulations may include, (1) closing the fishing season during spawning season, (2) requiring use of barbless hooks, (3) restricting size and catch, and (4) rotating yearly closures of the streams.

#### **6.5.1.2. Stream Classification: Enhancement**

**Definition:** Streams where the populations are less than 50 percent hybridized (Enhance).

**Management Approach:** This type of stream will be a candidate for hatchery releases of pure Yellowstone cutthroat trout, weir placement, and habitat improvement and protection actions. The decision to place a weir in the stream will be based on the physical conditions present at the mouth of the stream; primarily the slope and probability that American Falls Reservoir fluctuations would submerge the weir structure.

#### **6.5.1.3. Stream Classification: Restoration**

**Definition:** Streams where Yellowstone cutthroat trout have been eliminated or hybridization rate is greater than 50 percent and where actions (such as the construction of weirs) would create conditions where non-native species could be prevented from entering the stream (Restore).

**Management Approach:** These streams will be candidates for complete population restoration. The existing trout population may be eliminated through targeted harvest (fishing, electrofishing). A pure strain of Yellowstone cutthroat trout fingerlings will then be released to the stream. Prior to implementing any of these actions, studies will be undertaken to determine what caused Yellowstone cutthroat trout to be eliminated from the stream. If the underlying cause cannot be determined and corrected, then the stream would be managed for the species currently present. Catchable Yellowstone cutthroat trout may be released to provide harvest opportunities for tribal fishers.

#### **6.5.1.4. Stream Classification: Harvest**

**Definition:** Streams where the management goal is to achieve harvest objectives for sport and/or tribal fishers. These streams are devoid of Yellowstone cutthroat trout or have hybridization rates greater than 75 percent.

**Management Approach:** Catchable Yellowstone cutthroat trout will be released to these streams throughout the fishing season. Harvest regulations will be set in a manner that results in harvest rates greater than 90 percent. Habitat actions will only be implemented in harvest streams that flow into waters that support Yellowstone cutthroat trout.

#### **6.5.1.5 Classifications and Proposed Actions**

A summary of the classifications and proposed actions for each stream of interest is presented in Table 6-1. The management approach proposed for each stream is based on Yellowstone cutthroat trout genetic, habitat and population work completed in 1999 (Moser 1999). The data in this table will be updated in 2011 as new genetic and population information analyses are completed.

**Table 6-1. Summary of management actions for the proposed Yellowstone cutthroat trout program by stream.**

Stream	Percent Hybrid	Species	Management Classification	Broodstock Source	Fingerling Stocking	Catchable Cut Stocking	Non-Native Removal	Harvest Allowed (Tribal)	Harvest Allowed (Sport)	Investigate For Weir	Elev. (ft)
30-Day	NA	BRK	Restore		Yes	Yes	Yes	Yes	No		7400
Birch	Analysis Incomplete	HYB	Enhance		Yes	?		?			5200
Cold Creek	NA	NO FISH									5390
Garden Creek	NA	NO FISH									4800
Lower Moonshine	NA	SUC,DAC,RSS	Harvest			Yes		Yes	No		4800
Lower/Mid Jeff Cabin	NA	SUC,DAC,RSS	Harvest			Yes		Yes	No		5660
Portneuf/Chesterfield	NA	RBT,SUC,DAC	Harvest		Yes	Yes		Yes	Yes		5400
Upper Portneuf		CUT,DAC,SUC,RBT,	TBD						No	Yes	
Squaw Creek	NA	NO FISH									5076
Upper Portneuf	NA	DAC	Harvest			Yes		Yes	Yes		5685
Wood Creek	NA	NO FISH									5600
Mill	0%	CUT/BRK	Protect	Yes				Yes			7300
Ross Fork (including Lower Ross Creek)	0%	CUT/BRK	Protect	Yes				Yes		Yes	5700
West Fork Bannock	12%	HYB	Protect	Yes				Yes			5100
South Fork Ross	25%	HYB,BRK,SUC	Enhance		Yes		Yes				5500
Moonshine	29%	HYB	Enhance		Yes					Yes	4700
Little Toponce	38%	HYB	Enhance		Yes					Yes	6800
Big Jimmy (Fort Hall Bottoms)	50%	HYB, SUC	Restore		Yes			Yes	Yes		4300
Midnight	50%	HYB	Restore		Yes			Yes	Yes	Yes	5000
Spring (Ft. Hall Bottoms)	55%	HYB,SUC,RBT	Harvest	Yes		Yes		Yes	Yes	Yes	4380
North Toponce	73%	HYB	Harvest			Yes		Yes	Yes		7700
Rattlesnake	96%	HYB, SUC	Harvest			Yes		Yes	Yes		4300
Kinney Creek		HYB,SUC,RBT	TBD							Yes	
Clear (Ft. Hall Bottoms)	100%	HYB	Harvest		Yes	Yes		Yes	Yes	Yes	4300

## **6.5.2 Ongoing Research and Proposed Monitoring and Evaluation Programs**

Evaluations are ongoing by the Shoshone-Bannock Tribes to identify critical population strongholds and to collect genetic information on Yellowstone cutthroat trout in all streams on the Reservation. This information will be used to determine how each stream will be managed in the future (i.e., protection, enhancement or restoration). Monitoring and evaluation (M&E) activities will be designed to determine that the biological objectives for the hatchery and natural components of the population are being achieved. A more detailed monitoring and evaluation program will be developed in Step 2 of the Council's process.

### **6.5.2.1 Hatchery Population**

The biological objectives identified for the hatchery component of the population that will be monitored include the following:

- Ensure collection of an adequate number of adult and juvenile Yellowstone cutthroat trout to begin a captive broodstock program to minimize risk of founder effect and in-breeding depression.
- Ensure use of genetically pure strains of Yellowstone cutthroat trout to produce approximately 10,000 fingerlings annually for release into suitable streams to achieve conservation objectives to minimize risk of outbreeding depression and loss of genetic diversity.
- Ensure use of genetically pure strains of Yellowstone cutthroat trout to produce approximately 10,000 catchable Yellowstone cutthroat trout annually for release into suitable streams to achieve harvest objectives and to minimize risk of outbreeding depression and loss of genetic diversity.
- Externally mark all released hatchery fish for evaluation of various post-release life stage survival parameters and achievement of harvest objectives.

Hatchery staff will be responsible for monitoring all phases of hatchery production. The key attributes to be monitored are:

- Number of adults collected for broodstock
- Sex, age and fecundity of broodstock
- Compliance with genetically-based mating protocol
- Number of fingerlings and catchable yearlings reared and released to each stream
- In-hatchery survival rates by life stage
- Mark rate for all hatchery releases
- Compliance with NPDES permit(s)

### **6.5.2.2 Natural Population**

Natural production will be monitored and evaluated to determine if the following biological objectives are being met:

- Making annual progress toward removing Yellowstone cutthroat trout x rainbow trout hybrids in streams with the greatest potential to support genetically pure Yellowstone cutthroat trout
- Annually monitoring Yellowstone cutthroat trout spawners in those streams that are targeted for restoration or enhancement to (1) determine fingerling-to-adult survival and overall spawner abundance, and (2) compare abundance with streams that currently support undisturbed populations of pure Yellowstone cutthroat trout in the region
- Annually monitoring the change in the total number of streams supporting pure populations of Yellowstone cutthroat trout
- Developing and monitoring actions that protect high quality Yellowstone cutthroat trout spawning and rearing habitat in natal spawning and rearing areas
- Quantifying harvest rates and total number of hatchery- and natural-origin Yellowstone cutthroat trout caught in all fisheries

### **6.5.2.3 Protocols**

The frequency of population sampling will depend on the number of streams classified as needing protection versus enhancement and restoration. M&E activities in streams classified as needing protection will be less frequent than in the others in order to reduce sampling impacts on the population. If available, a couple of the protection streams will be identified as controls and will be sampled at the same frequency (using similar methods) as the treatment streams (i.e., streams classified as enhancement or restoration). Habitat conditions in the streams will be sampled using EPA's Generalized Random Tessellation Stratified (GRTS) method. This method is being used throughout the Northwest to document stream habitat quality and quantity over time (see [http://www.epa.gov/nheerl/arm/designing/design\\_intro.htm](http://www.epa.gov/nheerl/arm/designing/design_intro.htm)).

Monitoring will be integrated with the IDFG's broader-based conservation efforts to manage Yellowstone cutthroat trout so as to restore and ensure their long-term persistence at levels capable of providing angling opportunities (IDFG 2007).

### **6.5.3 Performance Standards and Indicators**

The performance standards and indicators for the Yellowstone cutthroat trout program are presented in Table 6-2.

**Table 6-2. Performance standards, indications and monitoring and evaluation methods for the Yellowstone cutthroat trout program.**

Performance Standard	Indicator	Monitoring and Evaluation Methods
Fish produced for harvest are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while avoiding over-harvest of non-target species.	<ul style="list-style-type: none"> <li>- Annual number of fish produced by this program caught in all fisheries, including estimates of fish released and associated incidental mortalities, by fishery</li> <li>- Annual numbers of each non-target species caught (including fish retained and fish released/discarded) in fisheries targeting this population</li> <li>- Recreational and tribal angler days, by fishery</li> </ul>	Creel surveys will be conducted in-season to determine harvest levels and rates by stream
Program addresses ESA responsibilities	<ul style="list-style-type: none"> <li>- ESA consultation(s) under Section 7 have been completed, Section 10 permits have been issued, or HGMP has been determined sufficient under Section 4(d), as applicable</li> </ul>	HGMP and Section 7 permits will be submitted to USFWS for approval
Release groups sufficiently marked/tagged in a manner consistent with information needs and protocols to enable determination of impacts to natural- and hatchery-origin fish in fisheries	Marking rate by type in each release group documented	100% of the hatchery fish will be externally marked. A subset of the marked fish will be examined for marks to ensure that mark rate exceeds 90% prior to release to the stream.
Fish collected for broodstock represent the characteristics of the wild population	<ul style="list-style-type: none"> <li>- Manage temporal distribution of collected broodstock</li> <li>- Manage age composition of collected broodstock</li> </ul>	Fish for broodstock will be collected at random from each stream
Weirs do not impact access to spawning and rearing areas	<ul style="list-style-type: none"> <li>- Fish migrate rapidly past the structure</li> <li>- Large numbers of spawners are not observed downstream of weir</li> </ul>	<ul style="list-style-type: none"> <li>- Weir operators will observe fish behavior daily and report indications of delay to managers.</li> <li>- Spawning surveys will be conducted above and below the weir each week</li> </ul>
Broodstock collection does not significantly reduce potential juvenile production in natural areas	Number of spawners of natural origin removed for broodstock.	Population surveys will be conducted in streams where broodstock are collected to ensure that broodstock removal constitutes less than 5% of the population

Performance Standard	Indicator	Monitoring and Evaluation Methods
Weir/trap operations do not result in significant stress, injury, or mortality in natural populations	<ul style="list-style-type: none"> <li>- Mortality rates in trap documented</li> <li>- Document pre-spawning mortality rates of trapped fish in hatchery or after release</li> </ul>	Weirs will continue to be operated in a manner that reduces mortality.
Patterns of genetic variation within and among natural populations do not change significantly as a result of artificial production	Develop genetic profiles of naturally-produced and hatchery-produced adults	Genetic data will be collected on adult and juvenile fish inhabiting each stream
The artificial production program uses standard scientific procedures to evaluate various aspects of artificial production	Hatchery culture practices follow best management practices	<ul style="list-style-type: none"> <li>- Life stage survival rates, flow, rearing densities, mortality and disease will be monitored using standard hatchery practices.</li> <li>- Pathologist will sample fish for disease as needed throughout the culture period</li> </ul>
Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols.	Annual reports indicating level of compliance with applicable standards and criteria	
Releases do not introduce pathogens not already present in the local populations and do not significantly increase the levels of existing pathogens	Certification of juvenile fish health documented prior to release	

## 6.6 CONSISTENCY OF YELLOWSTONE CUTTHROAT TROUT WITH EIGHT SCIENTIFIC PRINCIPLES OF THE NPCC FISH AND WILDLIFE PROGRAM

### 6.6.1 Principle 1

*“The physical and biological components of ecosystems together produce the diversity, abundance and productivity of plant and animal species, including humans. The combination of suitable habitats and necessary ecological functions forms the ecosystem structure and conditions needed to provide the desired abundance and productivity of specific species.”*

The program recognizes that habitat quality and quantity will play an important role in program success. This is why the Shoshone-Bannock Tribes will continue to implement habitat protection and improvement actions throughout areas suitable for Yellowstone cutthroat trout. Additionally, human impacts from harvest will be focused on areas that either support hybrid Yellowstone cutthroat trout populations or other species such as rainbow trout and brown trout. Very conservative fishing regulations will be put in place for those streams that support pure strains of Yellowstone cutthroat trout. This action should increase the size, fecundity and age structure of the populations, making them more abundant and productive.

### 6.6.2 Principle 2

*“Although ecosystems have definable structures and characteristics, their behavior is highly dynamic, changing in response to internal and external factors. The system we see today is the product of its biological, human and geological legacy. Natural disturbance and change are normal ecological processes and are essential to the structure and maintenance of habitats.”*

The program will protect, enhance and restore Yellowstone cutthroat trout populations in multiple streams in the area. These actions will reduce the chance that random natural events such as flooding, drought and slides will compromise the entire Yellowstone cutthroat trout population. An increase in Yellowstone cutthroat trout distribution will therefore make the population much more resilient to environmental change. Additionally, the program recognizes that past human actions such as the creation of American Falls Reservoir has produced conditions that are less favorable for the native Yellowstone cutthroat trout and more favorable to exotic species such as brown trout. Because the reservoir will be a long-term fixture in this landscape, the Shoshone-Bannock Tribes are looking at the use of weirs and other methods (i.e., direct removal) to exclude these exotic species from habitat needed for the survival of Yellowstone cutthroat trout.

### 6.6.3 Principle 3

*“Ecosystems, landscapes, communities and populations are usefully described as hierarchies of nested components distinguished by their appropriate spatial and time scales. Higher-level ecological patterns and processes constrain, and in turn reflect, localized patterns and processes. There is no single, intrinsically correct description of an ecosystem, only one that is useful to management or scientific research. The hierarchy should clarify the higher-level constraints as well as the localized mechanisms behind the problem.”*

Construction of American Falls, past hatchery fish stocking practices and human use of the resource has resulted in the current status of Yellowstone cutthroat trout on Shoshone-Bannock Tribes lands. Hatchery stocking and human impacts will be controlled or altered in the future to reduce their effects on this population. American Falls creates a high level constraint to the problem that can be somewhat mitigated by the use of weirs; however, it will continue to affect Yellowstone cutthroat trout for the foreseeable future. These impacts will be especially severe in the areas where reservoir fluctuations submerge important Yellowstone cutthroat trout habitat (i.e., the Fort Hall Bottoms area). In fact, this habitat is some of the most productive. Fish that reside in this area have access to nutrient-rich wetlands and the reservoir itself. Fish inhabiting this area are substantially larger than those found in higher elevation tributaries.

### 6.6.4 Principle 4

*“Habitats are created, altered and maintained by processes that operate over a range of scales. Locally observed conditions often reflect more expansive or non-local processes and influences, including human actions. The presence of essential habitat features created by these processes determines the abundance, productivity and diversity of species and communities. Habitat restoration actions are most effective when undertaken with an understanding and appreciation of the underlying habitat-forming processes.”*

The Shoshone-Bannock Tribes have been implementing habitat protection and improvement projects both within stream channels and in upland areas. It is recognized that what is observed in the stream is a reflection of habitat conditions in the entire watershed. Analyses of past data collected from riparian protection projects show the ability of Reservation stream ecosystems to heal naturally given time and removal of the causative agents, many of which are human induced (Moser 1999).

### **6.6.5 Principle 5**

*“Each species has one or more ecological functions that may be key to the development and maintenance of ecological conditions. Species, in effect, have a distinct job or occupation that is essential to the structure, sustainability and productivity of the ecosystem over time. The existence, productivity and abundance of specific species depend on these functions. In turn, loss of species and their functions lessens the ability of the ecosystem to withstand disturbance and change.”*

Gresswell (2009) reported that 42 bird and mammal species use Yellowstone cutthroat trout as a food source. The species thrives in cold harsh environments and therefore are an important food source for those bird and mammalian species that also inhabit these areas. A reduction in trout abundance and distribution can therefore reduce the abundance and distribution of other species important to the ecosystem and human environment. The proposed program will help to reverse the observed loss in Yellowstone cutthroat trout abundance and spatial distribution.

### **6.6.6 Principle 6**

*“The diversity of species, traits and life histories within biological communities contributes to ecological stability in the face of disturbance and environmental change. Loss of species and their ecological functions can decrease ecological stability and resilience. It is not simply that more diversity is always good; introduction of non-native species, for example, can increase diversity but disrupt ecological structure. Diversity within a species presents a greater range of possible solutions to environmental variation and change. Maintaining the ability of the ecosystem to express its own species composition and diversity allows the system to remain productive in the face of environmental variation.”*

The proposed program will assist in restoring Yellowstone cutthroat trout distribution over a wide range of streams ranging in elevation from 4,000 to over 7,000 feet. Because environmental conditions in these streams vary dramatically, the population inhabiting each will likely exhibit a different set of traits and life histories that allow them to thrive. The wider the distribution of the species, the more likely it can survive changing environmental conditions. This may be quite important as global climate change creates conditions wherein lower elevation streams are no longer able to support a cold-water species such as trout. Additionally, re-establishing and maintaining healthy populations at higher elevations could result in the development of species strongholds that are relatively immune from human impacts since such impacts are substantially reduced at higher elevations.

### **6.6.7 Principle 7**

*“The dynamic nature, diversity, and complexity of ecological systems routinely disable attempts to command and control the environment. Adaptive management- the use of management*

*experiments to investigate biological problems and to test the efficacy of management programs provides a model for experimental management of ecosystems. Experimental management does not mean passive "learning by doing," but rather a directed program aimed at understanding key ecosystem dynamics and the impacts of human actions using scientific experimentation and inquiry."*

As data are collected on current population status, the program will begin looking at experiments that may be implemented to test the efficacy of management programs. These tests will likely revolve around two problems: (1) hybridization with rainbow trout, and (2) dominance over and expulsion of Yellowstone cutthroat trout from streams by brook trout. Current management solutions to these problems involve high levels of human intervention such as continual harvest and species elimination, construction of barriers and even acceptance of the impacts. As the M&E program is developed in Step 2, experiments designed to test the efficacy of these solutions versus new approaches such as habitat restoration and manipulation may be possible.

### **6.6.8 Principle 8**

*"As humans, we often view ourselves as separate and distinct from the natural world. However, we are integral parts of ecosystems. Our actions have a pervasive impact on the structure and function of ecosystems, while at the same time, our health and well being are tied to these conditions. These actions must be managed in ways that protect and restore ecosystem structures and conditions necessary for the survival and recovery of fish and wildlife in the basin. Success depends on the extent to which we choose to control our impacts so as to balance the various services potentially provided by the Columbia River Basin."*

The harvest component of the program recognizes that the needs of both tribal and sport fishers must be met over time if conservation objectives are to be achieved. The hatchery fish will meet the harvest need by providing fish for consumption, while at the same time limiting impacts to the natural population if this pure strain of Yellowstone cutthroat trout spawns in the wild. Releasing large numbers of catchable fish into some streams will allow managers to reduce harvest impacts on important wild populations in others, thus protecting these populations from continued degradation. Implementing different management approaches based on stream classification also recognizes that some human impacts cannot be overcome. For example, American Falls Reservoir operations will continue to inundate key stream habitat, allowing rainbow trout to hybridize with Yellowstone cutthroat trout. Attempts to eliminate rainbow trout from these inundated streams is either physically not possible or the costs of the solution are prohibitive.

## **6.7 LINK BETWEEN YELLOWSTONE CUTTHROAT TROUT PROGRAM AND OTHER PROJECTS AND ACTIVITIES**

The measures proposed in this Master Plan are one of several efforts in the Upper Snake Province contributing to the protection and restoration of habitat for Yellowstone cutthroat trout. Other measures include trapping and tagging in the South Fork Snake River and habitat restoration on the Fort Hall Reservation.

The IDFG has a BPA contract to manage Yellowstone cutthroat trout spawning in South Fork Snake River tributaries (Project No. 2007-170-00, South Fork Snake River Yellowstone Cutthroat Trout

Recruitment and Survival Improvement). As part of this effort, IDFG operates fish trapping facilities on the four main spawning tributaries for cutthroat trout (Burns, Pine, Rainey and Palisades creeks). The intent is to conserve the genetic integrity of the population by collecting all upstream spawning migrants, and based on phenotypic examination, pass Yellowstone cutthroat trout upstream and remove rainbow and hybrid trout. This contract also funds PIT-tagging of Yellowstone cutthroat trout in the South Fork Snake River. By recapturing or re-observing these fish, IDFG hopes to estimate survival and growth rates, ascertain spawning site fidelity, spawning and tributary residence time, general movement patterns, and generate a river-wide population estimate of Yellowstone cutthroat trout. These activities take place upstream of the Tribes' proposed program and therefore, are not expected to have an effect on Yellowstone cutthroat trout in the Fort Hall Bottoms. The success of IDFG's South Fork Snake River program may provide guidance for future development and modifications of the Tribes' program.

The Shoshone-Bannock Tribes are currently funded by BPA to restore fluvial salmonid habitat that has been degraded by agriculture, irrigation, livestock grazing, and impounded and regulated river flows on the Fort Hall Reservation (BPA Project No. 1992-010-00, Fort Hall Habitat Restoration). These efforts are also complemented by a BIA Resident Fish Program and through funds allocated to the Fish and Wildlife Department by a Tribal revenue program. Through riparian planting, bank sloping, and placing log deflectors and fencing, stream banks are being restored and channel width decreased, which increases depth and velocities of aggrading stream segments and creates cleaner gravels for spawning and deeper refuge habitat for larger trout. Both native and hatchery Yellowstone cutthroat trout from the proposed program will benefit from the enhanced spawning habitat and refugia created under this contract.

As described in Section 5.3.1, the Upper Snake Province Management Plan lists the biological objectives within the province: to protect, enhance, and restore genetic integrity of focal species; improve survival of focal species in all life stages; and increase focal species numbers to viable usable populations. These projects individually address several of these objectives for the Yellowstone cutthroat trout focal species by assessing population structure and dynamics, and improving spawning habitat and conditions. The proposed Crystal Springs program will benefit from these programs both directly and indirectly, and will contribute to achieving the goals of the Upper Snake Province Plan.

## **6.8 EXPECTED PROGRAM BENEFITS**

The expected benefits of the Crystal Springs Yellowstone cutthroat trout program include the protection of a genetically pure stock of Yellowstone cutthroat trout in streams and wetlands within and near the Fort Hall Reservation, an increase in the distribution and abundance of this native stock, and the maintenance of a hatchery "reserve population" that will be available to help recolonize a local population should a stochastic event lead to their extirpation in a given area. Establishing and regularly monitoring Yellowstone cutthroat trout presence and abundance at a series of study sites will also help to address long-term trends in abundance and factors influencing those trends such as genetic introgression and direct competition with non-native species. In addition, the proposed hatchery program, in combination within ongoing habitat restoration efforts currently being implemented on the Fort Hall Reservation, will help maintain a popular catch and release recreational fishery that is an important source of income for the Shoshone-Bannock Tribes.

## 6.9 YELLOWSTONE CUTTHROAT TROUT IMPLEMENTATION STRATEGIES RELATIVE TO CURRENT CONDITIONS AND DESIRED FUTURE CONDITIONS

The proposed program focuses on small-scale hatchery actions required to increase the distribution and abundance of Yellowstone cutthroat trout within a portion of the upper Snake River subbasin, while at the same time providing harvest benefits to local fishers. The program is designed to produce fish that are as similar as possible in genetics and behavior to local natural populations. This approach is consistent with the Columbia Basin Fish and Wildlife Plan (NPCC 2009) primary artificial production strategy that states:

*“Artificial production can be used, under the proper conditions, to 1) complement habitat improvements by supplementing native fish populations up to the sustainable carrying capacity of the habitat with fish that are as similar as possible, in genetics and behavior, to wild native fish.....”*

While aquatic habitat within and near the Fort Hall Reservation has been adversely affected by livestock grazing, American Falls Reservoir construction and operations, the 1976 Teton Dam collapse, and by cattle, horse, and bison grazing since the early 1800s (see Section 5.4.1), most streams in the area remain relatively productive and support large numbers of native and non-native trout. The Tribes are currently implementing a Resident Fisheries Program designed to restore, enhance, and protect Fort Hall Indian Reservation streams so they can support native fish populations at historic levels (specifically Yellowstone cutthroat trout). Restoration efforts have focused on stabilizing eroding banks, deepening and narrowing stream channels, and restoring diversity to the spring-stream biota with instream structures and reducing upland impacts such as grazing.

As noted in Section D.2 of the 2000 Columbia River Basin Fish and Wildlife Program (NPCC 2000):

*“Where the habitat for a target population is absent or severely diminished, but can be restored through conventional techniques and approaches, then the biological objective for that habitat will be to restore the habitat with the degree of restoration depending on the biological potential of the target population. Where the target population has high biological potential, the objective will be to restore the habitat to intact condition, and restore the population up to the sustainable capacity of the habitat. In this situation, if the target population had been severely reduced or eliminated as a result of the habitat deterioration, the use of artificial production in an interim way is a possible policy choice to hasten rebuilding of naturally spawning populations after restoration of the habitat.”*

The Shoshone-Bannock Tribes’ long-term goal for its proposed Yellowstone cutthroat trout program at Crystal Springs Hatchery is to (1) preserve this genetic legacy and (2) enhance the population for tribal and non-tribal harvest (see Section 2.3). The desired future condition is to reintroduce Yellowstone cutthroat trout to Spring Creek (located on the Reservation), a tributary to American Falls Reservoir and in other suitable tributaries located both on and off the Reservation.

## 6.10 RELATIONSHIP TO HABITAT STRATEGIES

The habitat strategy for the proposed Yellowstone cutthroat trout program is consistent with those of the Columbia Basin Fish and Wildlife Plan (NPCC 2009). Aquatic habitat within the Fort Hall Reservation has degraded since exploration and settlement of the area in the mid 19th century. Streams have been negatively affected by livestock grazing, American Falls Reservoir construction and operation, and the 1976 Teton Dam collapse. Despite these impacts, most streams in the area remain relatively productive and support large number of native and non-native trout. The program will be operated consistent with the following NPCC strategy:

*“Where the habitat for a target population is absent or severely diminished, but can be restored through conventional techniques and approaches, then the biological objective for that habitat will be to restore the habitat with the degree of restoration depending on the biological potential of the target population. Where the target population has high biological potential, the objective will be to restore the habitat to intact condition, and restore the population up to the sustainable capacity of the habitat. In this situation, if the target population had been severely reduced or eliminated as a result of the habitat deterioration, the use of artificial production in an interim way is a possible policy choice to hasten rebuilding of naturally spawning populations after restoration of the habitat. Where the target population has low biological potential – for example, when downstream rearing conditions severely limit the survival of juveniles from a given spawning area – the objective will be to restore the habitat to intact condition and consider sustained but limited supplementation as a possible policy choice.”*

As described in Section 6.1, the Tribes are proposing a fingerling production program to preserve the genetic legacy of the Yellowstone strain of cutthroat trout and catchable-size program to enhance the population for tribal and non-tribal harvest; additional habitat measures are not proposed. Because population productivity and abundance potential is limited by the high hybridization rate Yellowstone cutthroat trout experience with rainbow trout, artificial production is an important tool to establish pure strains of trout in suitable streams. Eventually, as natural abundance increases and populations approach the habitat’s carrying capacity and become self-sustaining, managers would slowly phase out the captive broodstock program.

Degraded habitat in the Fort Hall area is, in large part, due to streambank failures. The Shoshone-Bannock Tribes have been working on large-scale, low-tech, habitat restoration projects to stabilize the eroding banks since 1992. Restoration efforts are improving Yellowstone cutthroat trout habitat, and these improvements are expected to increase population abundance, survival, migration, and reproduction over time.

The Upper Snake Province Plan states that opportunities for improving habitat conditions to improve Yellowstone cutthroat trout populations exist throughout the Upper Snake subbasin (CH2MHill 2004). The plan identifies three recommendations for habitat restoration in regard to Yellowstone cutthroat trout: (1) populations identified as core or conservation populations at low density are likely candidates for habitat restoration efforts; (2) future hybridization risk should be evaluated in relation to barrier removal projects; and (3) efforts to protect and enhance migratory populations of Yellowstone cutthroat trout should be prioritized, as this life history form is the most impacted throughout the subbasin. This depressed population has not been identified as a core or conservation population, but habitat restoration efforts are currently ongoing in the region.

Hybridization risks for this population will be abated by installing weirs to prevent non-native rainbow trout from returning to the spawning grounds. Both adfluvial and resident life histories are present in the American Falls subbasin (Osborne 2009); newly installed weirs and habitat restoration efforts should benefit fish from both life histories.

## 6.11 SUBBASIN-WIDE RISK ASSESSMENT

The primary risks associated with releasing hatchery-reared Yellowstone cutthroat trout into streams located within and near the Fort Hall Reservation include: continued hybridization with non-native rainbow trout, the potential degradation of local Yellowstone cutthroat trout spawning and rearing habitat, and illegal harvest or angler induced mortality of reintroduced fish. Risk management strategies designed to address these issues are presented in Table 6-3. Other risks include degradation of water quality of associated with hatchery effluent; however, these potential adverse effects would be addressed by TMDL and NPDES water quality permits.

There are no listed fish species present within and near the Fork Hall Reservation; therefore, no ESA-listed population would be affected by implementation of the proposed program.

**Table 6-3. Risk associated with the proposed Yellowstone cutthroat trout program and the proposed response actions.**

Concern	Response Action
Hybridization of Yellowstone cutthroat trout with non-native rainbow trout	<ul style="list-style-type: none"> <li>• Increase selective fishing pressure on rainbow trout.</li> <li>• Install weirs in lower reaches of selected streams identified for species conservation to prevent rainbow trout access into Yellowstone cutthroat trout spawning areas.</li> <li>• Release hatchery-reared fingerlings into habitat areas that do not support rainbow trout populations.</li> <li>• Captive broodstock will provide pure strains of locally adapted Yellowstone cutthroat trout fingerlings for release.</li> </ul>
Inadequate habitat for natural spawning of hatchery fish	<ul style="list-style-type: none"> <li>• Releases will be at sites located within the historical range of Yellowstone cutthroat trout and will be able to sustain a viable population.</li> <li>• Continue habitat restoration activities throughout the subbasin (as part of the Tribes' existing habitat restoration program).</li> </ul>
Illegal harvest or angler induced mortality of reintroduced fish	<ul style="list-style-type: none"> <li>• All areas targeted for Yellowstone cutthroat trout fingerling reintroduction (conservation) will be closed to angling until a viable population is established that could support some level of angling pressure. Hatchery adults released into tributaries will be available for harvest by tribal members.</li> </ul>

Concern	Response Action
Hatchery related genetic introgression	<ul style="list-style-type: none"> <li>Periodic genetic monitoring will evaluate the effects of the proposed program on pure Yellowstone cutthroat trout genetic diversity and allow the resource managers to make any needed adjustments to the program to eliminate this risk (i.e., following an adaptive management approach)</li> </ul>

## 6.12 CONSISTENCY OF YELLOWSTONE CUTTHROAT TROUT PROGRAM WITH NPCC ARTIFICIAL PRODUCTION POLICIES

The Crystal Springs Yellowstone cutthroat program is being designed to be consistent with the NPCC's artificial production strategy and inherent recommendations. The ten artificial production strategies are presented below in bold italics, immediately followed by an assessment of the consistency of the proposed program with the strategy.

- The purpose and use of artificial production must be considered in the context of the ecological environment in which it will be used.***

The proposed Crystal Springs Yellowstone cutthroat trout program is designed to assist in the recovery of this native species in streams located within and near the Fort Hall Reservation and to help support a popular catch and release angling opportunity for both tribal and non-tribal fishers. Streams targeted for supplementation historically supported native (genetically pure) Yellowstone cutthroat; however, over the past century, habitat degradation and the introduction of non-native species such as rainbow trout have resulted their decline throughout the majority of the upper Snake River Basin. Overall, this relatively modest adaptively managed supplementation program, combined with ongoing habitat enchantment measures being implemented by the Tribes (including non-native species eradication), is consistent with NPCC's policies regarding artificial production.

- Artificial production must be implemented within an experimental, adaptive management design that includes an aggressive program to evaluate the risks and benefits and address scientific uncertainties.***

The proposed Crystal Springs Yellowstone cutthroat trout program will be adaptively managed. This approach is necessary because the region has little experience with this type of conservation program. Accordingly, the program is being developed around a research, monitoring and evaluation program summarized in the HGMP (Appendix C) that examines the phases of Yellowstone cutthroat trout life history, fish culture practices, and the quality and quantity of existing habitat to support both hatchery and natural production (see Section 6.5.2). This research, monitoring and evaluation will continue as long as the hatchery program is found to contribute the overall objectives of the program described in Section 6.2.

- Hatcheries must be operated in a manner that recognizes that they exist within ecological systems whose behavior is constrained by larger-scale basin, regional and global factors.***

Factors outside the scope of the proposed Crystal Springs Yellowstone cutthroat trout program will continue to directly affect its success. However, larger scale, regional and global factors (such as mainstem hydropower operations and global warming) will have much less of an effect on Yellowstone cutthroat trout (compared to local salmon and steelhead populations). Specifically, the Shoshone-Bannock Tribes will continue to enhance aquatic habitat in the streams and wetlands located within the Reservation. As habitat conditions improve, the proposed cutthroat trout program may be modified through ongoing annual monitoring and adaptive management. As proposed, the initial Yellowstone cutthroat trout program at the Crystal Springs Hatchery has been conservatively sized to achieve program goals (see Section 6.1).

- ***A diversity of life history types and species needs to be maintained in order to sustain a system of populations in the face of environmental variation.***

Implementing the proposed program will enhance the distribution and abundance of native Yellowstone cutthroat trout in a portion of its historical range, ensuring that the species and the benefits it provides to the ecosystem are maintained. Over time, incorporating new native broodstock into the program from several streams will result in the widest range of life histories possible given the habitat present. As more locally-adapted (native) Yellowstone cutthroat trout begin to occupy the streams targeted for enhancement and restoration, it is expected that natural selection and local adaptation will increase the productivity of the population. As a result, program management may be adjusted over time as the natural population begins to rebound.

- ***Naturally selected populations should provide the model for successful artificially reared populations, in regard to population structure, mating protocol, behavior, growth, morphology, nutrient cycling, and other biological characteristics.***

The physical, demographic and behavioral characteristics of the hatchery-produced Yellowstone cutthroat trout will be monitored and compared to the naturally-produced populations within and near the Reservation. Hatchery spawn timing, incubation rates, and early rearing conditions will be designed to closely mimic the conditions in the streams from which the genetically pure broodstock are obtained.

- ***The entities authorizing or managing an artificial production facility or program should explicitly identify whether the artificial propagation product is intended for the purpose of augmentation, mitigation, restoration, preservation, research, or some combination of those purposes for each population of fish addressed.***

Initially, the primary goal of the fingerling program is the conservation and recovery of genetically pure Yellowstone cutthroat within and near the Fort Hall Reservation. As adult abundance increases, the program will make an important contribution to the catch and release angling objective for both tribal and non-tribal members to meet both cultural objectives and economic objectives associated with this fishery. The goal of the catchable juvenile program component is to augment the population in the Fort Hall Bottoms for cultural and subsistence harvest by tribal members as well as to provide additional harvest for non-tribal fishers. More specific information on program goals and strategies is presented in Section 6.1.

- ***Decisions on the use of the artificial production tool need to be made in the context of deciding on fish and wildlife goals, objectives and strategies at the subbasin and province levels.***

Yellowstone cutthroat trout fingerlings produced at the proposed Crystal Springs Hatchery will accelerate reestablishment of locally adapted adults that would both be integrated into the hatchery broodstock and allowed to spawn naturally. Hatchery production is complemented by habitat actions proposed throughout the Reservation as part of Tribes' recovery planning that will not only improve the viability of genetically pure Yellowstone cutthroat, but also other aquatic and terrestrial species important to the ecosystem.

- ***Appropriate risk management needs to be maintained in using the tool of artificial propagation.***

Selecting genetically pure captive brood from at least three streams in the area and rotating these fish out of the hatchery environment every 2 to 3 years (replacing them with new genetically pure Yellowstone cutthroat trout) and releasing juveniles for conservation purposes as fingerlings will minimize the amount of risk to the population from domestication. Catchable Yellowstone cutthroat trout will be released into streams designated for harvest only. These are streams that already have high hybridization rates and are affected by reservoir operations that continually seed the streams with rainbow trout.. A research, monitoring and evaluation program will be developed (Section 6.5) to monitor activities associated with the additional Yellowstone cutthroat trout fish production.

- ***Production for harvest is a legitimate management objective of artificial production, but to minimize adverse impacts on natural populations associated with harvest management of artificially produced populations, harvest rates and practices must be dictated by the requirements to sustain naturally spawning populations.***

Catchable trout will be planted in streams designated for harvest management. Recreational angling will initially be restricted in streams that are targeted for native Yellowstone cutthroat trout enhancement and restoration and in streams that will be used for broodstock collection. However, once the populations in these streams begin to meet identified density targets, selected streams would be opened for more liberal harvest regulations (catch and release angling, reduced bag limits). As discussed earlier in the document, issuing trout fishing licenses for non-tribal members in the Fort Hall Bottoms is an important revenue source and a very popular program. Trout populations in streams opened to angling will be monitored annually to evaluate the effects of the catch and release fishery on the distribution and abundance of the species. In streams targeted for the harvest component of the program, the annual harvest of Yellowstone cutthroat trout by tribal members will be carefully monitored to ensure harvest rates and practices do not jeopardize the long-term viability of the population.

- ***Federal and other legal mandates and obligations for fish protection, mitigation, and enhancement must be fully addressed.***

The proposed Crystal Springs Hatchery program is a requirement of 2008 Columbia Basin Fish Accords (Shoshone-Bannock Tribes and FCRPS Action Agencies 2008). As a component of these Accords, the Tribes seek to develop the Crystal Springs Hatchery to rear Yellowstone cutthroat trout

and Snake River spring/summer Chinook salmon. The goal is to produce Chinook smolts and smolt equivalents and Yellowstone cutthroat trout (fingerling and catchable-size juveniles). All other relevant legal mandates for fish protection, mitigation and enhancement will be incorporated into the program. The program is expected to provide harvestable levels of adult Yellowstone cutthroat trout.

## **6.13 COMPREHENSIVE ENVIRONMENTAL ASSESSMENT**

Under the NPCC Step-Review process for aquaculture facilities, project proponents are asked to describe the status of their comprehensive environmental assessment. Compliance steps for the Yellowstone cutthroat trout program will be the same as those for the spring/summer Chinook program, described in Section 4.15.

## **6.14 HATCHERY AND GENETICS MANAGEMENT PLAN**

The draft HGMP for the Yellowstone cutthroat trout program is included as Appendix C.

## **6.15 HARVEST PLAN**

As noted in Section 6.1.1, the Tribes' long-term goal for the Yellowstone cutthroat trout program is to (1) preserve the genetic legacy of the population, (2) expand the existing range of population, and (3) enhance the population for tribal and non-tribal harvest. While the first two priorities are focused on Yellowstone cutthroat restoration (through the proposed fry/fingerling release program), a tribal and non-tribal harvest of this sub-species will be supported through the proposed catchable juvenile component of the program.

Harvest will be allowed in streams designated for enhancement and restoration, but fishing regulations may be conservative. Such measures as allowing fishers to keep all hatchery-origin fish caught, but limiting the number of wild fish removed would be considered. The use of barbless hooks, catch and release, limited access and reduced bag limits may also be put in place to reduce harvest impacts. Tribal members will be allowed sufficient harvest to meet their subsistence needs.

Harvest in streams designated for protection would be sharply curtailed and highly regulated via Tribal regulations. Fishing regulations may include, (1) closing the fishing season during spawning season, (2) requiring that barbless hooks be used, (3) implementing restrictive size and bag limits, (4) catch and release only fisheries, and (5) closing streams to fishing on a rotating annual basis.

## **7. ESTIMATED COSTS FOR ALL PROGRAMS**

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Cost estimates for the Chinook salmon programs are presented in Section 7.1 and for the Yellowstone cutthroat trout program in Section 7.2. Collecting adults for broodstock and releasing juveniles from each program will occur in geographically distinct areas. Chinook salmon produced at the Crystal Springs Hatchery will be acclimated and released in the Yankee Fork and in Panther Creek, both tributaries to the Upper Salmon River. Yellowstone cutthroat trout produced at Crystal Springs Hatchery will be released in various streams on or near the Fort Hall Reservation. Though capital costs (construction and capital equipment) and operational costs (labor and direct expenses) at Crystal Springs overlap for both the Chinook and Yellowstone cutthroat trout programs, for planning purposes, estimated costs to construct and operate the proposed facilities are applied to each program. Generally, costs are allocated based on the planned pounds of production for each program. These assumptions are noted in each cost area presented for the proposed programs.

### **7.1 CHINOOK PROGRAMS**

This section provides conceptual costs for the proposed Yankee Fork and Panther Creek Snake River Chinook programs described in Sections 2 and 4 of this Master Plan.

#### **7.1.1 Approach to Cost Estimation**

##### **7.1.1.1 Basis of Estimates**

The cost estimates presented in this section are consistent with Council's Step Review, Step 1 Master Plan requirements (NPCC 2006). These conceptual costs are a planning baseline from which to refine costs, evaluate alternatives, and protect against budget expansion as the proposed project progresses through the preliminary (Step 2) and final design (Step 3) phases and implementation. The approach used in this Master Plan to estimate future costs for both operations and capital construction generally follows the principals for inflation and cost escalation described by the Independent Economic Analysis Board in their white paper on Project Cost Escalation Standards (NPCC 2007).

Cost estimates are provided for all program areas from FY 2010 through FY 2020. Construction costs can fluctuate significantly from year to year, as shown in the Engineering News Record (ENR) Construction Cost Index (<http://enr.com>), which has recorded costs since 1913. Since 1978, changes in annual national averages for construction costs have ranged from +11.6% in 1978 to -0.1% in 2009. The fluctuation range of average construction costs from 1997 through 2010 has been between -0.1% and +9.1%.

At the time this Master Plan was finalized, the construction industry was still experiencing a downturn; however, it is uncertain how various government programs and other market forces may affect costs over the life of the proposed project. Based on the historical information cited in the ENR, construction cost estimates for the Crystal Springs facilities have been escalated at about 3% annually to the proposed year of construction. Cost estimates for operations, maintenance, research, monitoring, and evaluation are escalated at 2% annually from FY 2010 through FY 2020. Although these types of costs tend to be more stable historically, the estimates may be high or low in any given year depending on the state of the economy, but, at this time, they are considered to

be reasonable. Signs of economic recovery are emerging; therefore, deferring or delaying portions of the project could dramatically increase implementation costs of the proposed facilities.

Crystal Springs cost estimates are based on the proposed programs and conceptual designs presented in Sections 2, 4 and 6. Cost estimates for land acquisition, facility planning and design, construction, capital equipment acquisition, and environmental compliance are presented for the proposed hatchery and adult capture and holding facilities (Section 4.5). Research, monitoring, and evaluation, as well as operations and maintenance, are also discussed (Sections 4.1 and 4.6). A tabular summary of project costs and a 10-year summary of all costs projected from FY 2010 through FY 2020 are provided in Section 7.1.1.4.

#### **7.1.1.2 Funding**

A Memorandum of Agreement (MOA) was reached by the Shoshone-Bannock Tribes, the BPA, U.S. Army Corps of Engineers, and the US Bureau of Reclamation regarding long-term funding of projects related to the “protection and recovery of salmon and steelhead listed under the Endangered Species Act ...” The MOA recognizes the Shoshone- Bannock Tribes as a “partner in pursuit of the protection and recovery of upper Salmon River listed evolutionarily significant units (ESUs).” “Long-term” funding indicates BPA funding for ten years. The parties to the agreement consider that its provisions are consistent with NPCC’s major project requirements and review. More information on the MOA as it relates to this project is found in Section 3.3.3 and Appendix F.

There are also funding allocations in the MOA that are documented under “Supplementation Projects”. For purposes of this plan, it is assumed that these funds will be used to support monitoring and evaluation of the proposed Chinook salmon programs.

#### **7.1.1.3 Cost Sharing with Other Organizations and Entities**

Cost sharing will be an important aspect of funding the proposed programs. Conceptual costs take into consideration the cost sharing that is occurring in current programs and that is expected to continue into the future.

Cost sharing includes both direct funding and in-kind support. Table 7-1 shows the cost sharing entities involved, including the Blackbird Trust, Lower Snake River Compensation Program (LSRCP) and IDFG. While these cash and in-kind contributions are not shown as direct deductions from the line item budgets presented in this document, they were considered when developing cost estimates if they potentially affected a cost area in the future. The Shoshone-Bannock Tribes understand that funding through LSRCP is Bonneville Power Administration funding but are reflecting the current and potential funds in this section as it will apply to the future programs.

**Table 7-1. Summary of potential cost sharing for the Crystal Springs Hatchery and programs for Snake River Chinook salmon.**

Funding Source or Organization	Date/Fiscal Year	Item or Service Provided	Cash or In Kind Contribution	Status	Amount
Blackbird Mine Consent Decree *	2012	Funds for modification and operation of a hatchery facility (\$1,076,419), design construction and operations of an adult fish trap (\$856,906) and construction and maintenance of two acclimation ponds (\$566,675).	Cash	Still Confirming, In Discussion	\$2,500,000
Lower Snake River Compensation Plan **	2011	For implementation of the Yankee Fork Chinook Salmon Supplementation Program (specific funding to IDFG for rearing Chinook at Sawtooth Fish Hatchery). These are BPA funds.	Cash/In Kind	Confirmed	\$145,857
Lower Snake River Compensation Plan ***	2011	For implementation of the Yankee Fork Chinook Salmon Supplementation Program. Funding for both O&M and M&E tasks and objectives. These are BPA funds.	Cash/In Kind	Confirmed	\$353,438
Mitchell Act Funds		The Shoshone-Bannock Tribes are pursuing options for the application of Mitchell Act funding for the Salmon River Chinook programs.	Cash	Not Confirmed	
				Total	\$2,999,295

Notes and Assumptions:

Estimated cost shares are accounted for in all budgets presented

\* Applies to production for Panther Creek

\*\* Estimate for O&amp;M costs for rearing Chinook at Sawtooth Hatchery (BPA funding)

\*\*\* Estimate of O&amp;M and M&amp;E tasks for Chinook rearing and release at Yankee Fork (BPA funding)

**7.1.1.4 Program Areas and Major Milestones**

Completing the Council's Three-Step process often requires three to five years. During this time, considerable planning, design, environmental compliance and analysis of alternatives will occur. A generalized list of program areas and a preliminary time line linking costs to planning; construction; capital equipment; environmental compliance; operations and maintenance; and research, monitoring, and evaluation is presented in Figure 7-1 for FY 2010 through FY 2020. A cost summary by program area is shown in Table 7-2. Cost estimates for the program are presented in the year in which they are expected to occur and are shown in Table 7-13; costs are escalated from FY 2010.

Program Area	Occurrence	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020
Planning and Design Step 1	One Time											
Planning and Design Step 2 (and Environmental Compliance)	One Time											
Planning and Design Step 3 (Final Design)	One Time											
Construction	One Time											
Program Equipment	One Time											
Land Purchases, Leases and Easements	One Time											
Annual Operations and Maintenance	Annual											
Monitoring and Evaluation	Annual											

**Notes & Assumptions:**

- Assumes proposed Step 2 and Step 3 funding is available on this schedule
- Assumes a design/build or modified design/build approach is utilized between Step 2 and Step 3
- Assumes construction starting in early 2012 (one year schedule is dependent on a Spring 2012 construction start)
- Assumes all proposed facilities and improvements are built in one construction season (during FY 2012 and early FY 2013)
- Assumes no major environmental compliance issues are identified beyond what is described in Table 7-8
- O&M expenditures will likely start during the last phases of construction (FY 2013) allowing for training and handoff of new facilities and equipment
- M&E expenditures will likely start after the last phases of construction (FY 2014)

**Figure 7-1. Crystal Springs Hatchery general timeline for key milestones and expenditures for Snake River Chinook salmon.**

**Table 7-2. Summary of key expenditures by program area for Snake River Chinook salmon.**

Program Area	Estimated Costs – Total	Estimated Cost – Yankee Fork	Estimated Cost – Panther Creek	Occurrence	Level of Certainty
Planning & Design Step 1 *	\$328,894	N/A	N/A	One Time	Contract to develop Step 1 Master Plan
Planning & Design Step 2 **	\$397,456	N/A	N/A	One Time	Placeholder (less than concept)
Planning & Design Step 3 ***	\$426,840	N/A	N/A	One Time	Placeholder (less than concept)
Construction (Crystal Springs Hatchery)	\$10,290,831	\$6,282,823	\$4,008,008	One Time	Concept (+/- 35% to 50%) (escalated to 2012 dollars)
Construction (Adult Trapping and Holding and Juvenile Acclimation)	\$2,858,972	\$1,344,121	\$1,514,850	One Time	Concept (+/- 35% to 50%) (escalated to 2012 dollars)
Program Equipment	\$691,736	\$421,959	\$269,777	One Time	Concept (+/- 35% to 50%) (escalated to 2013 dollars)
Environmental Compliance Step 2 (Permitting, EA, Other)	\$152,417	N/A	N/A	One Time	Concept (+/- 35% to 50%) Completed during Step 2 (2012 dollars)
Land Purchases, Leases & Easements ****	\$800,000	N/A	N/A	One Time	Expenditure complete (BPA purchased in 1998)
Annual Operations & Maintenance – Crystal Springs Fish Hatchery, Yankee Fork & Panther Creek	\$705,454	\$430,707	\$274,746	Annual	Concept (+/- 35%) (escalated to 2013 dollars)
Monitoring & Evaluation – Crystal Springs Fish Hatchery, Yankee Fork & Panther Creek *****	\$373,896	\$228,080	\$145,815	Annual	Concept (+/- 35%) (escalated to 2014 dollars)

**Notes and Assumptions:**

- \* Shows the actual contract figure for completion of a Step 1 Master Plan
- \*\* Shows an estimated placeholder cost estimate based on the conceptual construction cost
- \*\*\* Shows an estimated placeholder cost estimate based on the conceptual construction cost
- \*\*\*\* Shows the cost for purchase of the Crystal Springs Hatchery Site in 1998 by Bonneville Power Administration
- \*\*\*\*\* Monitoring and Evaluation includes annual tagging costs of over \$160,000
- Budget figures assume that work would proceed on the timeline shown in Figure 7-1

**7.1.2 Land Acquisition Costs**

The BPA acquired the Crystal Springs site in Bingham County, Idaho in 1998 for \$800,000 (Table 7-2). The site consists of two parcels; the first, a former hatchery site totals 9 acres and a second 10.7-acre parcel will be used if needed for hatchery facilities.

### **7.1.3 Planning and Design Cost Estimates**

The Tribe has solicited input from a range of experts during Step 1 conceptual planning in order to avoid significant design and program changes in later planning stages. The Tribe also sought to validate the program, design criteria, and cost estimates to the maximum extent possible through comprehensive early reviews. The Tribe intends to continue to solicit input and review by a team of knowledgeable individuals through the Step 2 and 3 processes.

#### **7.1.3.1 Step 1 Conceptual Planning and Design**

The total budget for the conceptual planning and design work is about \$329,000 (Table 7-2). About 90% of the total estimated cost has been applied to the Chinook salmon programs. This figure is based on a contracted amount to complete the Step 1 Master Plan and includes conceptual planning, engineering, development of the Step 1 Master Plan and ultimately responding to the NPCC and ISRP review of this Master Plan.

#### **7.1.3.2 Step 2 Preliminary Planning and Design**

The preliminary planning and design stage, intended to meet the Council's Step 2 requirements, is designed to identify any major difficulties or concerns with the program and facility designs. Step 2 design work should provide sufficient detail and specifics to assure that the intent and scope of Step 1 conceptual design work can be met and to further refine the cost estimates. Step 2 will refine scientific information, conduct environmental compliance and ESA reviews. In addition, the Shoshone-Bannock Tribes may implement value analysis (also known as value engineering) near completion of the Step 2 planning and design work.

A placeholder of \$397,000 has been identified for Step 2 preliminary planning, environmental compliance, site investigations and design. About 90% of the total estimated cost has been applied to the Chinook salmon programs. Initiation of this work is proposed in FY 2011 (Table 7-2). This budget includes costs for drilling test wells, surveying and other investigative geotechnical work. The budget may need further refinement depending on the outcome of the Step 1 Master Plan review process.

#### **7.1.3.3 Step 3 Final Planning and Design**

A placeholder of \$427,000 (Table 7-2) has been identified for the Step 3 final planning and design stage. It is anticipated that this work will begin in FY 2012. About 90% of the total estimated cost has been applied to the Chinook salmon programs. Refinement of the Step 3 planning and design budget will occur in Step 2 during development of the preliminary design.

The cost estimates provided for planning and design assume that facilities will be developed along the timeline shown in Figure 7-1. Should the program be delayed or implemented in phases, costs for planning and design could increase if facility designs, construction specifications and planning and design documents are performed in multiple packages. The proposed schedule will result in more cost effective planning and implementation for Step 2, Step 3, implementation of construction, and long-term program operations.

Step 3 is the final design review prior to construction. Development plans are advanced to a confidence level of +/- 10 to 15% and are ready for bid. A 100% cost estimate accompanies this submittal along with details on all operational plans.

The Tribes propose, and respectfully asks that the Council consider the following steps to accelerate post-Step 3 project implementation. Rather than contracting for construction following Step 3 approval (which can take up to a year for a major project), the Tribes propose to adopt a design/build approach at the completion of Step 2. A final construction contract would be negotiated at completion of the final design and Step 3 approval.

This approach would provide the most realistic construction cost estimate possible in Step 3. Because of having a contractor during the start of final design, it would also allow the Tribe and BPA to begin construction immediately after formal NPCC approval of Step 3 and the acquisition of necessary permits. This approach could compress the overall timeline for implementation, resulting in significant cost savings and reduced risk without altering the Council's requirements for Step 3 approval, while helping to ensure that these vitally needed new facilities are adequately reviewed and completed at the earliest possible juncture.

### **7.1.4 Capital Construction Cost Estimates**

Construction cost estimates are based on the conceptual-level design presented in Section 4.5. Due to the level of uncertainty, an approximately 20 to 25% contingency is applied to each construction cost area. Such a contingency is largely dependent on the number of uncertainties associated with the project and the amount of pre-investigation work completed. Estimated construction costs represent a maximum range that likely will be reduced during future planning stages through analysis of alternatives and elimination of many uncertainties.

#### **7.1.4.1 Probable Construction Costs**

The proposed Crystal Springs Hatchery has been planned to produce up to 600,000 smolts for the ongoing Yankee Fork Chinook program and up to 400,000 smolts for the Panther Creek Chinook program.

Construction cost summaries are included in Tables 7-3 through 7-6 with detailed estimates provided as Appendices H-1 through H-4. Details of this work are provided in Section 4.5. Figures 4-10 through 4-17 depict conceptual layouts for proposed facilities, which in addition to the hatchery facilities, include improvements to the existing adult fish collection facilities near Pole Flat Campground and Yankee Fork acclimation pond improvements. Similar facilities will be required on Panther Creek at locations to be determined in Step 2.

Proposed new Crystal Springs Hatchery components include process water systems, well head modifications, a head box, utility systems, incubation facilities, rearing facilities, housing, administration and other support facilities, and effluent treatment facilities.

Table 7-3 summarizes the estimated construction costs for each component of the Crystal Springs Hatchery. Tables 7-4 and 7-5 summarize estimated construction costs for both Yankee Fork and Panther Creek adult trapping and holding and juvenile acclimation. Table 7-6 provides a summary of all estimated construction costs for Crystal Springs Hatchery and Yankee Fork and Panther Creek facilities including the Crystal Springs Hatchery components allocated to the Yellowstone Cutthroat program. It should be noted that the estimated portion of the total costs for Yankee Fork production is \$7,600,000 and the estimated proportion for Panther Creek production is \$5,523,000. Costs are divided into major infrastructure and facility components and are based on the scope and conceptual descriptions presented in Section 4. Details of these estimates are found in Appendices

H-1 through H-4. The estimated construction cost for Crystal Springs Hatchery is \$ 10.3 million for the portion allocated to the Chinook salmon programs (out of a total construction cost of \$10.8 million). The estimated construction cost for the Yankee Fork trapping is \$488,000 and the Yankee Fork adult holding and juvenile stress relief facilities is \$856,000. Estimates do not include land purchase or lease (see Section 7.1.2). The estimated construction cost for the Panther Creek trapping is \$659,000 and Panther Creek adult holding and juvenile stress relief facilities is \$856,000. Construction estimates are based on conceptual design and include a contingency of about 20 to 25% to accommodate the level of uncertainty at this stage.

The Shoshone-Bannock Tribes propose to implement all components of the Crystal Springs Hatchery as a single project. The proposed components are relatively simple construction projects and phasing them over two years likely would increase overall costs. Costs presented in this section assume that all facility components are completed in one phase. Even with designs that allow for economical expansion of facilities, returning in future years to retrofit facilities will increase costs. The Shoshone- Bannock Tribes consider it critical that the project design that is implemented be directed at current and future program goals as described in this plan.

**Table 7-3. Estimated construction costs – Crystal Springs Hatchery.**

Description	Combined Totals	Yankee Fork Subtotal	Panther Creek Subtotal	Yellowstone Cutthroat Trout Subtotal
Process Water Supply to Head Boxes	\$1,217,548	\$706,178	\$450,493	\$60,877
Head Boxes, Chiller and Degassing	\$382,397	\$221,790	\$141,487	\$19,120
Site Work and Utilities	\$791,840	\$459,267	\$292,981	\$39,592
Process Water Distribution and Drains	\$209,870	\$121,725	\$77,652	\$10,494
Hatchery Building – 11,900 SF	\$2,785,044	\$1,615,326	\$1,030,466	\$139,252
Office/Shop Building – 5,040 SF	\$1,034,044	\$599,745	\$382,596	\$51,702
Outdoor Rearing – 5 Production Ponds	\$1,244,833	\$722,003	\$460,588	\$62,242
Effluent Settling Structure – Dual Cell	\$111,875	\$64,888	\$41,394	\$5,594
Hatchery Housing – New (3)	\$750,000	\$435,000	\$277,500	\$37,500
Construction Cost Subtotal	\$8,527,450	\$4,945,921	\$3,155,157	\$426,373
Inflation/Escalation to Mid-Point Construction *	\$9,124,372	\$5,292,135	\$3,376,017	\$456,219
Mobilization/Demobilization, General Conditions **	\$1,094,925	\$635,056	\$405,122	\$54,746
Subtotals	\$10,219,296	\$5,927,192	\$3,781,140	\$510,965
Taxes ***	\$613,158	\$355,632	\$226,868	\$30,658
Probable Total Costs (2012 Dollars)	\$10,832,454	\$6,282,823	\$4,008,008	\$541,623

**Notes & Assumptions:**

- Cost estimate in 2010 dollars
- \* Inflation/escalation at 3% to mid-point construction date of 2012 (7% total from 2010 to mid-2012)
- \*\* Mobilization/Demobilization: General Conditions include inflation/escalation at 3% to mid-point construction date of 2012 (7% total from 2010 to mid-2012)
- \*\*\* Taxes estimated at 6%
- Costs should be considered conceptual (+/- 35% to 50%)
- Costs are allocated based on approximate pounds of each program reared at Crystal Springs (Yankee Fork – 58%, Panther Creek – 37%, Yellowstone cutthroat trout – 5%)

**Table 7-4. Estimated construction costs – Yankee Fork and Panther Creek adult trapping.**

Description	Yankee Fork	Panther Creek	Total
Equipment	\$96,790	\$321,790	\$418,580
Site Work and Utilities	\$287,580	\$196,980	\$484,560
Construction Cost Subtotal	\$384,370	\$518,770	\$903,140
Inflation/Escalation to Mid-Point Construction *	\$411,276	\$555,084	\$966,360
Mobilization/Demobilization, General Conditions **	\$49,353	\$66,610	\$115,963
Subtotal	\$460,629	\$621,694	\$1,082,323
Taxes ***	\$27,638	\$37,302	\$64,939
Probable Total Cost (2012 Dollars)	\$488,267	\$658,996	\$1,147,262

**Notes & Assumptions:**

- Cost estimate in 2010 dollars
- Inflation/escalation at 3% to mid-point construction date of 2012 (7% total from 2010 to mid-2012)
- \*\* Mobilization/Demobilization: General conditions include inflation/escalation at 3% to mid-point construction date of 2012 (7% total from 2010 to mid-2012)
- \*\*\* Taxes estimated at 6%
- Costs should be considered conceptual (+/- 35% to 50%)

**Table 7-5. Estimated construction costs – Yankee Fork and Panther Creek adult holding and juvenile acclimation sites.**

Description	Yankee Fork	Panther Creek	Total
Process Water Supply and Drain Pipe/Valves	\$76,020	\$76,020	\$152,040
Tanks and Equipment	\$460,250	\$460,250	\$920,500
Site Work and Utilities	\$137,470	\$137,470	\$274,940
Construction Cost Subtotal	\$673,740	\$673,740	\$1,347,480
Inflation/Escalation to Mid-Point Construction *	\$720,902	\$720,902	\$1,441,804
Mobilization/Demobilization, General Conditions **	\$86,508	\$86,508	\$173,016
Subtotal	\$807,410	\$807,410	\$1,614,820
Taxes ***	\$48,445	\$48,445	\$96,889
Probable Total Cost (2012 Dollars)	\$855,855	\$855,855	\$1,711,709

**Notes & Assumptions:**

- Cost estimate in 2010 dollars
- \* Inflation/escalation at 3% to mid-point construction date of 2012 (7% total from 2010 to mid-2012)
- \*\* Mobilization/Demobilization: General conditions include inflation/escalation at 3% to mid-point construction date of 2012 (7% total from 2010 to mid-2012)
- \*\*\* Taxes estimated at 6%
- Costs should be considered conceptual (+/- 35% to 50%)

**Table 7-6. Summary of estimated construction costs.**

Estimated Construction Costs	Combined Totals	Yankee Fork Subtotal	Panther Creek Subtotal	Yellowstone Cutthroat Trout Subtotal
Crystal Springs Fish Hatchery *	\$10,832,454	\$6,282,823	\$4,008,008	\$541,623
Yankee Fork and Panther Creek – Adult Trapping	\$1,147,262	\$488,267	\$658,996	\$0
Yankee Fork and Panther Creek – Adult Holding & Juvenile Acclimation Sites	\$1,711,709	\$855,855	\$855,855	\$0
Probable Total Costs (2012 Dollars) **	\$13,691,426	\$7,626,944	\$5,522,858	\$541,623

**Notes & Assumptions:**

- Cost estimate in 2012 dollars and should be considered conceptual (+/- 35% to 50%)
- \* Costs are allocated based on approximate pounds of each program reared at Crystal Springs (Yankee Fork – 58%, Panther Creek – 37%, Yellowstone Cutthroat Trout – 5%)
- \*\* Inflation/escalation at 3% to mid-point construction date of 2012 (7% total from 2010 to mid-2012)
- The Shoshone-Bannock Tribes are pursuing other sources of funds to supplement construction costs.

**7.1.5 Program Equipment Cost Estimates**

Implementing the proposed program will require acquisition of new equipment, from office furniture and laboratory equipment to rearing and fish transport apparatus. Table 7-7 lists the potential types of equipment by functional area of the proposed operation and the probable costs. A conceptual budget of about \$691,000 (escalated from FY 2010 to FY 2013 when equipment would be needed) is included for capital equipment. Costs are allocated based on approximate pounds of fish to be reared for each program at Crystal Springs (Yankee Fork Chinook - 58%, Panther Creek Chinook- 37%, Yellowstone cutthroat trout- 5%). This estimate shows about \$422,000 allocated to Yankee Fork production and \$670,000 allocated to Panther Creek production.

**Table 7-7. Program equipment budget by facility/hatchery functional area for Snake River Chinook salmon.**

Description	Total Cost – Yankee Fork (FY 2013 Dollars)	Total Cost – Panther Creek (FY 2013 Dollars)	Total Cost (FY 2013 Dollars)
Office Equipment	\$3,194	\$2,042	\$5,236
Computers/Printers	\$7,187	\$4,595	\$11,782
Office Furniture and Cabinets	\$6,081	\$3,888	\$9,969
Communications Equipment	\$9,661	\$6,177	\$15,838
Housing Equipment and Furniture / Permanent Staff Housing	\$24,264	\$15,513	\$39,777
Housing Equipment and Furniture / Temporary Staff Housing	\$0	\$0	\$0
Shop Equipment	\$9,521	\$6,087	\$15,609
Buildings/Facilities Needs	\$4,116	\$2,631	\$6,747
Transportation	\$0	\$0	\$0
Water System Operation	\$1,904	\$1,217	\$3,122

Description	Total Cost – Yankee Fork (FY 2013 Dollars)	Total Cost – Panther Creek (FY 2013 Dollars)	Total Cost (FY 2013 Dollars)
Incubation	\$6,266	\$4,006	\$10,271
Fish Transport	\$127,154	\$81,295	\$208,449
Chinook Rearing at Hatchery	\$18,797	\$12,018	\$30,814
Chinook Rearing at Acclimation Ponds	\$12,470	\$7,972	\$20,442
Tagging	\$0	\$0	\$0
M&E Equipment	\$12,285	\$7,855	\$20,140
Technical/Lab Equipment	\$10,135	\$6,480	\$16,616
Disinfection Equipment (Other Disease and Pathology Needs)	\$3,378	\$2,160	\$5,539
Other	\$11,978	\$7,658	\$19,637
Renewable Energy Equipment	\$153,568	\$98,183	\$251,750
<b>Totals</b>	<b>\$421,959</b>	<b>\$269,777</b>	<b>\$691,736</b>

**Notes & Assumptions:**

- Costs shown in 2013 dollars; expenditures will occur in 2013
- Costs are escalated at 2% annually per the 2008 Memorandum of Agreement between the Shoshone-Bannock Tribes and the FCRPS Action Agencies (2008 Fish Accords)
- Costs should be considered conceptual (+/- 35% to 50%)
- Items are not duplicated in the capital construction and operating budgets
- Costs are allocated based on approximate pounds of each program reared at Crystal Springs (Yankee Fork – 58%, Panther Creek – 37%, Yellowstone cutthroat trout – 5%)

### 7.1.6 Environmental Compliance Cost Estimates

Developing the proposed Crystal Springs Hatchery will incur environmental compliance costs subsequent to this master planning stage. Compliance steps will include the National Environmental Policy Act (NEPA), a Biological Assessment under the Endangered Species Act, and other laws and regulations that are discussed in Section 4.15. As shown in Table 7-8, the estimated costs by potential permit or approval are approximately \$152,000. It is assumed that the majority of these costs would be incurred if only the Chinook programs were implemented. For this stage of planning, none of the environmental costs are specifically allocated to the Yellowstone cutthroat trout program.

**Table 7-8. Estimated cost of environmental compliance for Snake River Chinook salmon and Yellowstone cutthroat trout programs.**

Project Area/Permit/Requirement	Estimated Cost to Complete (2011 dollars)	Estimated Cost to Complete (2012 dollars)
Water Supply/Quality		
Groundwater Right (TBD)	\$5,150	\$5,305
NPDES General Construction Stormwater (EPA) and Storm Water Pollution Prevention Plan (SWPPP)	\$10,300	\$10,609
NPDES – Hatchery Discharge (EPA/IDEQ) (Under Statewide Aquaculture Permit)	\$7,210	\$7,426
Planning Approvals		
NEPA EA or EIS and Record of Decision	\$77,250	\$79,568

Project Area/Permit/Requirement	Estimated Cost to Complete (2011 dollars)	Estimated Cost to Complete (2012 dollars)
ESA Section 7 Compliance – Biological Opinion	\$10,300	\$10,609
Section 106 Cultural Resources Clearance	\$5,150	\$5,305
Wetland Delineation	\$8,240	\$8,487
USFS (Special Use Permit)	\$8,000	\$8,240
Water Rights Transfer	\$5,000	\$5,150
Construction		
Well Drilling Permits (two wells)	\$1,000	\$1,030
Joint Permit Application (Corps, IDL, IDWR, IDEQ)	\$6,000	\$6,180
Bingham County Commercial Building Permits	\$2,575	\$2,652
Bingham County Road Permits	\$1,545	\$1,591
Fugitive Dust Control (IDEQ)	\$258	\$266
<b>Totals</b>	<b>\$147,978</b>	<b>\$152,417</b>

**Notes & Assumptions:**

- Assumes majority of expenditures will occur in FY 2011
- Costs should be considered conceptual (+/- 35% to 50%)
- Concept completed during Step 2 (2011 dollars)
- Assumes these costs will be incurred for both Chinook and trout programs and will not change if portions of either program were changed

## 7.1.7 Operations and Maintenance Costs

The following sections present cost estimates associated with operations and maintenance of the proposed Chinook programs at Yankee Fork, Panther Creek and the Crystal Springs Hatchery. Costs are allocated based on approximate pounds of fish to be reared for each program (Yankee Fork - 58%, Panther Creek - 37%, Yellowstone cutthroat trout- 5%).

### 7.1.7.1 Annual Operating Costs

Operating costs for the proposed hatchery programs are shown in Table 7-9. Expenses include such items as payroll, utilities, vehicle leases, supplies, maintenance, some specific tagging expenses and potential subcontracted support services. This planning cost estimate includes the Yankee Fork, Panther Creek and Crystal Springs operations and maintenance costs. The Tribe estimates that the annual budget for operation and maintenance will be \$665,000. If this estimate is escalated from 2010 to 2013 dollars (the year that expenses begin to be incurred), operational costs would be about \$705,000 annually. Of this, about \$431,000 is allocated to Yankee Fork production and \$275,000 is allocated to Panther Creek production. It should be noted that the most significant portions of the operating expenses are labor, supplies (of which the majority is costs for fish food) and utilities. The figure provided for utilities incorporates the assumption that a significant amount of the water supplied is gravity flow which reduces annual pumping costs.

**Table 7-9. Annual operating expenses for Chinook salmon programs at Crystal Springs Hatchery, Yankee Fork and Panther Creek.**

Expense Area	Estimated Operations Costs (2010 dollars)	Estimated Operations Costs – Yankee Fork (2013 dollars)	Estimated Operations Costs – Panther Creek (2013 dollars)	Estimated Operations Costs (2013 dollars)
Payroll (Taxes, Benefits, Mark-ups)	\$372,898	\$241,642	\$154,137	\$395,722
Vehicles (Fuel, Oil, Maintenance, Mileage, Insurance)	\$15,200	\$9,847	\$6,282	\$16,130
Repairs and Maintenance (Site, Buildings, Equipment)	\$6,650	\$4,308	\$2,748	\$7,057
Rent and Lease (Equipment, Vehicles)	\$48,449	\$31,385	\$20,021	\$51,415
Program Supplies (Shop, Office)	\$7,125	\$4,615	\$2,944	\$7,561
Program Supplies (Lab, Water System, Eggtake, Incubation)	\$9,215	\$5,969	\$3,808	\$9,779
Program Supplies (Rearing and Release)	\$98,515	\$63,815	\$40,709	\$104,545
Program Supplies (Tagging, Tag Recovery)	\$0	\$0	\$0	\$0
Utilities (Electrical, Telephone)	\$79,769	\$51,672	\$32,963	\$84,652
Travel Costs (Mileage, Lodging, Per diem)	\$9,952	\$6,447	\$4,112	\$10,561
Education and Training	\$1,430	\$926	\$591	\$1,517
Subcontracts (Professional Fees, Testing, Sampling)	\$13,300	\$8,615	\$5,496	\$14,114
Facility Insurance	\$2,263	\$1,466	\$935	\$2,402
<b>Totals</b>	<b>\$664,765</b>	<b>\$430,707</b>	<b>\$274,746</b>	<b>\$705,454</b>

**Notes & Assumptions:**

- Full annual operating costs expected to start in FY 2013
- Estimated costs for existing operations program do not include M&E Costs
- Tagging costs are included as M&E cost estimates
- Costs are escalated from 2010 to 2013 at 2% annually per the 2008 Memorandum of Agreement between the Shoshone-Bannock Tribes & the FCRPS Action Agencies (2008 Fish Accords)
- Costs should be considered conceptual (+/- 35% to 50%)
- Costs are allocated based on approximate pounds of each program reared at Crystal Springs (Yankee Fork – 58%, Panther Creek – 37%, Yellowstone cutthroat trout – 5%)

**7.1.7.2 Projected Operating Expenses**

Operating expenses from FY 2010 to FY 2020 are shown in Table 7-10. The annual estimated costs for this period are provided for both Yankee Fork and Panther Creek production. It is expected that the facility would be constructed in FY 2012 and 2013 and operational costs would start to be incurred in FY 2013. Costs for operations and maintenance are escalated at 2% annually from FY 2010 through FY 2020. These types of costs tend to be more stable historically than construction cost.

**Table 7-10. Ten-year projected operating expenses Crystal Springs Hatchery, Yankee Fork and Panther Creek for Snake River Chinook salmon.**

Expense Area	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020
Payroll (Taxes, Benefits, Mark-ups)	\$372,898	\$380,356	\$387,963	\$395,722	\$403,637	\$411,709	\$419,943	\$428,342	\$436,909	\$445,647	\$454,560
Vehicles (Fuel, Oil, Maintenance, Mileage, Insurance)	\$15,200	\$15,504	\$15,814	\$16,130	\$16,453	\$16,782	\$17,117	\$17,460	\$17,809	\$18,165	\$18,528
Repairs and Maintenance (Site, Buildings, Equipment)	\$6,650	\$6,783	\$6,919	\$7,057	\$7,198	\$7,342	\$7,489	\$7,639	\$7,791	\$7,947	\$8,106
Rent and Lease (Equipment, Vehicles)	\$48,449	\$49,418	\$50,406	\$51,415	\$52,443	\$53,492	\$54,562	\$55,653	\$56,766	\$57,901	\$59,059
Program Supplies (Shop, Office)	\$7,125	\$7,267	\$7,413	\$7,561	\$7,712	\$7,866	\$8,024	\$8,184	\$8,348	\$8,515	\$8,685
Program Supplies (Lab, Water System, Eggtake, Incubation)	\$9,215	\$9,399	\$9,587	\$9,779	\$9,974	\$10,174	\$10,377	\$10,585	\$10,796	\$11,012	\$11,232
Program Supplies (Rearing and Release)	\$98,515	\$100,485	\$102,495	\$104,545	\$106,636	\$108,768	\$110,944	\$113,163	\$115,426	\$117,734	\$120,089
Program Supplies (Tagging, Tag Recovery)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Utilities (Electrical, Telephone)	\$79,769	\$81,365	\$82,992	\$84,652	\$86,345	\$88,072	\$89,833	\$91,630	\$93,462	\$95,332	\$97,238
Travel Costs (Mileage, Lodging, Per diem)	\$9,952	\$10,151	\$10,354	\$10,561	\$10,772	\$10,988	\$11,207	\$11,432	\$11,660	\$11,893	\$12,131
Education and Training	\$1,430	\$1,458	\$1,487	\$1,517	\$1,547	\$1,578	\$1,610	\$1,642	\$1,675	\$1,709	\$1,743
Subcontracts (Professional Fees, Testing, Sampling)	\$13,300	\$13,566	\$13,837	\$14,114	\$14,396	\$14,684	\$14,978	\$15,278	\$15,583	\$15,895	\$16,213
Facility Insurance	\$2,263	\$2,308	\$2,355	\$2,402	\$2,450	\$2,499	\$2,549	\$2,600	\$2,652	\$2,705	\$2,759
<b>Totals</b>	<b>\$664,765</b>	<b>\$678,060</b>	<b>\$691,621</b>	<b>\$705,454</b>	<b>\$719,563</b>	<b>\$733,954</b>	<b>\$748,633</b>	<b>\$763,606</b>	<b>\$778,878</b>	<b>\$794,455</b>	<b>\$810,345</b>
<b>Estimated Total – Yankee Fork</b>	<b>\$405,856</b>	<b>\$413,973</b>	<b>\$422,253</b>	<b>\$430,698</b>	<b>\$439,312</b>	<b>\$448,098</b>	<b>\$457,060</b>	<b>\$466,201</b>	<b>\$475,525</b>	<b>\$485,036</b>	<b>\$494,737</b>
<b>Estimated Total – Panther Creek</b>	<b>\$258,908</b>	<b>\$264,087</b>	<b>\$269,368</b>	<b>\$274,756</b>	<b>\$280,251</b>	<b>\$285,856</b>	<b>\$291,573</b>	<b>\$297,404</b>	<b>\$303,352</b>	<b>\$309,419</b>	<b>\$315,608</b>

**Notes & Assumptions:**

- Estimated costs are escalated at 2% annually in all operational areas per the 2008 Memorandum of Agreement between the Shoshone-Bannock Tribes and the FCRPS Action Agencies (2008 Fish Accords)
- Costs are allocated based on approximate pounds of each program reared at Crystal Springs (Yankee Fork – 58%, Panther Creek – 37%, Yellowstone cutthroat trout – 5%)

## 7.1.8 Research, Monitoring and Evaluation Costs

A conceptual framework for monitoring and evaluation will be designed to ensure that the programs achieve performance standards established for natural production and in-hatchery culture practices and operations (see Section 4.6 and 4.7). Additional information is provided in the draft HGMPs (Appendices A and B). These plans will be developed further in Step 2 of the three-step planning process. For planning purposes, conceptual costs are estimated for the research, monitoring and evaluation described in Section 4.6.

### 7.1.8.1 Annual Research, Monitoring and Evaluation Costs

Costs associated with monitoring and evaluation are summarized in Table 7-11. The Tribes estimate that this will require about \$345,000 annually. If escalated from 2010 to 2014 dollars (when costs would start to be incurred), expenses would be \$374,000 annually. It should be noted that over \$175,000 of the probable costs in 2014 are associated with coded wire-tagging and adipose clipping one million smolts. The Shoshone- Bannock Tribes will be refining how funding from other on-going programs that are currently gathering data will be applied to estimated needs for monitoring and evaluation for Yankee Fork and Panther Creek production.

**Table 7-11. Annual monitoring and evaluation expenses for Snake River Chinook salmon at Crystal Springs Hatchery, Yankee Fork and Panther Creek.**

Expense Area	Estimated Annual Expenses (2010 dollars)	Estimated Annual Expenses – Yankee Fork (2014 dollars)	Estimated Annual Expenses – Panther Creek (2014 dollars)	Estimated Annual Expenses (2014 dollars)
Payroll (Taxes, Benefits, Mark-ups)	\$125,430	\$82,820	\$52,948	\$135,769
Vehicles (Fuel, Oil, Maintenance, Mileage, Insurance)	\$8,687	\$5,736	\$3,667	\$9,403
Repairs and Maintenance (Site, Buildings, Equipment)	\$5,377	\$3,550	\$2,270	\$5,820
Rent and Lease (Equipment, Vehicles)	\$24,325	\$16,062	\$10,268	\$26,330
Program Supplies (Shop, Office, Lab)	\$7,031	\$4,642	\$2,968	\$7,610
Program Supplies (Tagging, Tag Recovery)	\$827	\$546	\$349	\$895
Utilities (Electrical, Telephone)	\$2,895	\$1,912	\$1,222	\$3,134
Travel Costs (Mileage, Lodging, Per Diem)	\$4,956	\$3,272	\$2,092	\$5,364
Education and Training	\$1,241	\$819	\$524	\$1,343
Subcontracts (Professional Fees, Testing, Sampling)	\$163,826	\$108,174	\$69,157	\$177,331
Postage, Dues and Subscriptions	\$828	\$547	\$350	\$896
<b>Totals</b>	<b>\$345,422</b>	<b>\$228,080</b>	<b>\$145,815</b>	<b>\$373,896</b>

**Notes & Assumptions:**

- Estimates shown in 2010 and 2014 dollars
- Costs are escalated from 2010 to 2014 at 2% annually per the 2008 Memorandum of Agreement between the Shoshone-Bannock Tribes and the FCRPS Action Agencies (2008 Fish Accords)
- Costs should be considered conceptual (+/- 35% to 50%).
- Costs are allocated based on approximate pounds of each program reared at Crystal Springs (Yankee Fork – 58%, Panther Creek – 37%, Yellowstone cutthroat trout – 5%)

### **7.1.8.2 Projected Research, Monitoring and Evaluation Costs**

Estimated research, monitoring and evaluation expenses from 2010 to 2020 are shown in Table 7-12 (escalated at 2% annually). The annual estimated costs for this period are provided for both Yankee Fork and Panther Creek production. It is expected that the facility would be constructed in FY 2012 and FY 2013 and monitoring and evaluation costs would start to be incurred in 2014.

### **7.1.9 Ten -Year Future Cost Summary**

Estimated costs to operate the Crystal Springs Chinook salmon programs for 10 years, from FY 2010 through FY 2020, are presented in Table 7-13. Estimated costs are summarized for both Yankee Fork and Panther Creek production including construction, program equipment, operations and maintenance and monitoring and evaluation. As stated in Section 7.1.1.4, costs for each program area are escalated to the year in which they are expected to occur. This summary assumes planning and implementation of new hatchery facilities will occur in 2010 through 2012.

As previously noted, cost estimates at this stage are conceptual. The Tribes will refine these estimates during the Step 2 and Step 3 planning phases. This 10-year estimated cost summary is designed to be a planning tool and will be updated as costs are refined.

**Table 7-12. Ten-year projected annual monitoring and evaluation expenses at Crystal Springs Fish Hatchery, Yankee Fork and Panther Creek for Snake River Chinook salmon.**

Expense Area	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020
Payroll (Taxes, Benefits, Mark-ups)	\$125,430	\$127,938	\$130,497	\$133,107	\$135,769	\$138,484	\$141,254	\$144,079	\$146,961	\$149,900	\$152,898
Vehicles (Fuel, Oil, Maintenance, Mileage, Insurance)	\$8,687	\$8,860	\$9,038	\$9,218	\$9,403	\$9,591	\$9,783	\$9,978	\$10,178	\$10,381	\$10,589
Repairs and Maintenance (Site, Buildings, Equipment)	\$5,377	\$5,485	\$5,594	\$5,706	\$5,820	\$5,937	\$6,055	\$6,176	\$6,300	\$6,426	\$6,555
Rent and Lease (Equipment, Vehicles)	\$24,325	\$24,812	\$25,308	\$25,814	\$26,330	\$26,857	\$27,394	\$27,942	\$28,501	\$29,071	\$29,652
Program Supplies (Shop, Office, Lab)	\$7,031	\$7,171	\$7,315	\$7,461	\$7,610	\$7,763	\$7,918	\$8,076	\$8,238	\$8,402	\$8,570
Program Supplies (Tagging, Tag Recovery)	\$827	\$844	\$860	\$878	\$895	\$913	\$931	\$950	\$969	\$988	\$1,008
Utilities (Electrical, Telephone)	\$2,895	\$2,953	\$3,012	\$3,072	\$3,134	\$3,196	\$3,260	\$3,325	\$3,392	\$3,460	\$3,529
Travel Costs (Mileage, Lodging, Per Diem)	\$4,956	\$5,055	\$5,156	\$5,259	\$5,364	\$5,472	\$5,581	\$5,693	\$5,807	\$5,923	\$6,041
Education and Training	\$1,241	\$1,266	\$1,291	\$1,317	\$1,343	\$1,370	\$1,398	\$1,426	\$1,454	\$1,483	\$1,513
Subcontracts (Professional Fees, Testing, Sampling)	\$163,826	\$167,103	\$170,445	\$173,854	\$177,331	\$180,878	\$184,495	\$188,185	\$191,949	\$195,788	\$199,703
Postage, Dues and Subscriptions	\$828	\$845	\$861	\$879	\$896	\$914	\$932	\$951	\$970	\$989	\$1,009
<b>Totals</b>	<b>\$345,422</b>	<b>\$352,331</b>	<b>\$359,377</b>	<b>\$366,565</b>	<b>\$373,896</b>	<b>\$381,374</b>	<b>\$389,001</b>	<b>\$396,781</b>	<b>\$404,717</b>	<b>\$412,811</b>	<b>\$421,068</b>
<b>Estimated Total – Yankee Fork</b>	<b>\$210,707</b>	<b>\$214,922</b>	<b>\$219,220</b>	<b>\$223,604</b>	<b>\$228,077</b>	<b>\$232,638</b>	<b>\$237,291</b>	<b>\$242,037</b>	<b>\$246,877</b>	<b>\$251,815</b>	<b>\$256,851</b>
<b>Estimated Total – Panther Creek</b>	<b>\$134,715</b>	<b>\$137,409</b>	<b>\$140,157</b>	<b>\$142,960</b>	<b>\$145,819</b>	<b>\$148,736</b>	<b>\$151,711</b>	<b>\$154,745</b>	<b>\$157,840</b>	<b>\$160,996</b>	<b>\$164,216</b>

**Notes & Assumptions:**

- Estimated costs are escalated at 2% annually in all expense areas per the 2008 Memorandum of Agreement between the Shoshone-Bannock Tribes and the FCRPS Action Agencies (2008 Fish Accords).
- Costs are allocated based on approximate pounds of each program reared at Crystal Springs (Yankee Fork – 58%, Panther Creek – 37%, Yellowstone cutthroat trout – 5%)

**Table 7-13. Ten-year summary of future costs for Snake River Chinook salmon, FY 2010 – FY 2020.**

Program Area	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
<b>A. Land Purchases, Leases and Easements</b>											
A.1. Land Purchases, Leases and Easements											
<b>B. Planning and Design</b>											
B.1. Step 1: Conceptual Engineering, Planning	\$328,894										
B.2. Step 2: Preliminary Engineering, Planning and Environmental Compliance		\$397,456									
B.3. Step 3: Final Engineering, Planning			\$426,840								
<b>C. Construction</b>											
C.1. Estimated Construction Costs – Total			\$6,574,901	\$6,574,901							
C.2. Estimated Construction Costs – Yankee Fork			\$3,813,472	\$3,813,472							
C.3. Estimated Construction Costs – Panther Creek			\$2,761,429	\$2,761,429							
<b>D. Program Equipment</b>											
D.1. Program Equipment - Total				\$691,736							
D.2. Program Equipment – Yankee Fork				\$421,959							
D.3. Program Equipment – Panther Creek				\$269,777							
<b>E. Environmental Compliance</b>											
E.1. Environmental Compliance		\$106,692	\$45,725								
<b>F. Operations and Maintenance</b>											
F.1. Crystal Springs Hatchery Programs				\$705,454	\$719,563	\$733,954	\$748,633	\$763,606	\$778,878	\$794,455	\$810,345
F.2. Crystal Springs Hatchery Programs – Yankee Fork				\$430,698	\$439,312	\$448,098	\$457,060	\$466,201	\$475,525	\$485,036	\$494,737
F.3. Crystal Springs Hatchery Programs – Panther Creek				\$274,756	\$280,251	\$285,856	\$291,573	\$297,404	\$303,352	\$309,419	\$315,608
<b>G. Monitoring and Evaluation</b>											
G.1. Monitoring & Evaluation Program					\$373,896	\$381,374	\$389,001	\$396,781	\$404,717	\$412,811	\$421,068

Program Area	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
G.2. Monitoring & Evaluation Program – Yankee Fork					\$228,077	\$232,638	\$237,291	\$242,037	\$246,877	\$251,815	\$256,851
G.3. Monitoring & Evaluation Program – Panther Creek					\$145,819	\$148,736	\$151,711	\$154,745	\$157,840	\$160,996	\$164,216
Total Estimated Capital Costs	\$328,894	\$504,148	\$7,047,467	\$7,266,638	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total Estimated O&M Costs	\$0	\$0	\$0	\$705,454	\$1,093,459	\$1,115,328	\$1,137,634	\$1,160,387	\$1,183,595	\$1,207,267	\$1,231,412
Total Estimated Costs	\$328,894	\$504,148	\$7,047,467	\$7,972,091	\$1,093,459	\$1,115,328	\$1,137,634	\$1,160,387	\$1,183,595	\$1,207,267	\$1,231,412

## Notes and Assumptions:

- A. Land Purchase, Leases & Easements (land purchase is completed). Land cost for the purchase of the Crystal Springs Hatchery site in 1998 by BPA.
- B.1. Step 1 Planning based on current expenditures to complete planning
- B.2. Step 2 Planning based on a percentage of estimated construction costs (escalated to FY 2011 dollars)
- B.3. Step 3 Planning based on a percentage of estimated construction costs (escalated to FY 2012 dollars)
- C. Estimated Construction Costs assumes 50% occurs in FY 2012 and 50% in FY 2013 (escalated from FY 2010 to mid FY 2012 dollars)
- D. Program Equipment, estimated lump sum for equipment items not shown in construction estimate (escalated from FY 2010 to FY 2013 dollars). Note: Equipment shown.
- E. Environmental Compliance Costs (assumes 90% of expenses occur in FY 2011 and 10% of expenses in FY 2012) (escalated from FY 2010 to FY 2012 dollars)
- F. O&M Cost Crystal Springs Hatchery Program (costs escalated at 2% annually from 2010 dollars per the 2008 Memorandum of Agreement between the Shoshone-Bannock Tribes and the FCRPS Action Agencies (2008 Fish Accords)). Assumes start-up in FY 2013.
- G. Monitoring & Evaluation Program (costs escalated at 2% annually from 2010 dollars per the 2008 Memorandum of Agreement between the Shoshone-Bannock Tribes and the FCRPS Action Agencies (2008 Fish Accords)). Assumes start-up in FY 2014.

## **7.2 YELLOWSTONE CUTTHROAT TROUT**

This section presents conceptual costs for the proposed Yellowstone cutthroat trout programs that are described in Sections 2 and 6 of this Master Plan.

### **7.2.1 Approach to Cost Estimation**

#### **7.2.1.1 Basis of Estimates**

The cost estimates presented in this section are consistent with Council's Step Review, Step 1 Master Plan requirements (NPCC 2006). These conceptual costs are a planning baseline from which to refine costs, evaluate alternatives, and protect against budget expansion as the proposed project progresses through the preliminary (Step 2) and final design (Step 3) phases and implementation. Yellowstone cutthroat trout program costs are based on the principles for estimating and inflation used for the Chinook programs (see Section 7.1.1.1).

The conceptual designs described in Sections 6 provide the foundation used to estimate the cost of the proposed Yellowstone cutthroat trout program. Estimates for land acquisition, facility planning and design, construction, acquisition of capital equipment, and environmental compliance are presented below for the proposed hatchery facilities. Estimated costs of research, monitoring, and evaluation, as well as operations and maintenance, are based on information described in Sections 6.1, 6.4 and 6.5. This program will incorporate best management practices for culture of Yellowstone cutthroat trout to avoid disease problems while still ensuring efficient operations and activities for each life stage of the cultured species. A tabular summary of program costs and a 10-year summary of all projected costs from FY 2010 through FY 2020 is provided in Section 7.2.1.4.

#### **7.2.1.2 Funding**

To meet the intent of the Tribes' MOA (see Section 7.1.1.2), this component of the project would include facilities at the proposed hatchery at Crystal Springs to produce up to 10,000 catchable Yellowstone cutthroat trout and to produce up to 10,000 fry for species conservation purposes. Yellowstone cutthroat trout are identified the Tribes' MOA in both the Crystal Springs Planning and Operations and Maintenance Project (BPA 200890600) and the Habitat Improvement Project for Fort Hall (BPA 1992011000). More information on the MOA, also referred to as the Fish Accords, is presented in Section 3.3.3 and Appendix F.

#### **7.2.1.3 Cost Sharing with Other Organizations and Entities**

Cost sharing will be important to funding the proposed Yellowstone cutthroat trout program. Cost sharing includes both direct funding and in-kind support. Table 7-14 shows the cost sharing entities involved. Currently the Bureau of Indian Affairs 638 Program and Shoshone-Bannock Tribal fishing permit revenues support portions of the monitoring and evaluation program. The main source of funding from BPA is Project 199201000, Habitat Improvement and Enhancement for Fort Hall (about \$285,000 annually). This project is identified in the MOA but is considered a cost share. While these cash and in-kind contributions are not presented as direct deductions from line item budgets presented in this document, they were considered when developing cost estimates if they potentially affected a cost area in the future.

**Table 7-14. Summary of cost sharing for Crystal Springs Hatchery and programs for Yellowstone cutthroat trout.**

Funding Source or Organization	Date/Fiscal Year	Item or Service Provided	Cash or In-Kind Contribution	Status	Amount
Bureau of Indian Affairs 638	Annual	Partial salary funding (40%) for 2 FTE and 4-6 temporary field techs.	Cash	Confirmed	\$90,000
Shoshone-Bannock Tribal Fishing Permit Revenue Program	Annual	On-the-ground low tech habitat restoration on the Fort Hall Bottoms and various reservation mountain streams.	Cash	Confirmed	\$36,000
BPA Substitution Funding – Project 1992-010-00	Annual	Partial salary funding (60%) for 2 FTE and 4-6 temporary field techs.	Cash	Confirmed	\$285,000
				Total	\$411,000

## Notes and Assumptions:

- Estimated cost shares are accounted for in all budgets presented

**7.2.1.4 Program Areas and Major Milestones**

As described in Section 7.1.1.4, considerable planning, design, environmental compliance and analysis of alternatives will occur over the duration of the Council's three-step review process. A generalized list of program areas and a preliminary schedule linking costs to planning; construction; capital equipment; environmental compliance; operations and maintenance; and research, monitoring, and evaluation is presented in Figure 7-2 for FY 2010 through FY 2020. A cost summary by program area is shown in Table 7-15. Cost estimates for the Yellowstone cutthroat trout program, escalated from FY 2010, are presented in the year in which they are expected to occur and are shown in Table 7-22.

Program Area	Occurrence	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020
Planning and Design Step 1	One Time											
Planning and Design Step 2 (and Environmental Compliance)	One Time											
Planning and Design Step 3 (Final Design)	One Time											
Construction	One Time											
Program Equipment	One Time											
Land Purchases, Leases and Easements	One Time											
Annual Operations and Maintenance	Annual											
Monitoring and Evaluation	Annual											

**Notes & Assumptions:**

- Assumes proposed Step 2 and Step 3 funding is available on this schedule
- Assumes a design/build or modified design/build approach is utilized between Step 2 and Step 3
- Assumes construction starting in early 2012 (one year schedule is dependent on a Spring 2012 construction start)
- Assumes all proposed facilities and improvements are built in one construction season (during FY 2012 and early FY 2013)
- Assumes no major environmental compliance issues are identified beyond what is described in Table 7-8
- O&M expenditures will likely start during the last phases of construction (FY 2013) allowing for training and handoff of new facilities and equipment
- Increased M&E expenditures related to Crystal Springs production will likely start after the last phases of construction (FY 2014)

**Figure 7-2. Crystal Springs Hatchery general timeline for key milestones and expenditures for Yellowstone cutthroat trout.**

**Table 7-15. Summary of key expenditures by program area for the Yellowstone cutthroat trout program.**

Program Area	Estimated Cost	Occurrence	Level of Certainty
Planning & Design Step 1 *	\$36,544	One Time	Contract to develop Step 1 Master Plan
Planning & Design Step 2 **	\$44,162	One Time	Placeholder (less than concept)
Planning & Design Step 3 ***	\$47,427	One Time	Placeholder (less than concept)
Construction	\$541,623	One Time	Concept (+/- 35% to 50%) (escalated to 2012 dollars)
Program Equipment	\$57,093	One Time	Concept (+/- 35% to 50%) (escalated to 2013 dollars)
Environmental Compliance Step 2 (Permitting, EA, Other) ****	\$0	One Time	Concept (+/- 35% to 50%) Completed during Step 2 (2012 dollars)
Land Purchases, Leases & Easements *****	\$800,000	One Time	Expenditure complete (BPA purchased in 1998)
Annual Operations & Maintenance – Crystal Springs Fish Hatchery	\$37,129	Annual	Concept (+/- 35%) (escalated to 2013 dollars)
Monitoring & Evaluation – Crystal Springs Fish Hatchery *****	\$417,880	Annual	Concept (+/- 35%) (escalated to 2014 dollars)

**Notes and Assumptions:**

- \* Shows the actual contract figure for completion of a Step 1 Master Plan
- \*\* Shows an estimated placeholder cost estimate based on the conceptual construction cost
- \*\*\* Shows an estimated placeholder cost estimate based on the conceptual construction cost
- \*\*\*\* Assumes these costs will be incurred for Chinook and will not change if trout program was changed; costs allocated to Chinook programs
- \*\*\*\*\* Shows the cost for purchase of the Crystal Springs Hatchery Site in 1998 by Bonneville Power Administration
- \*\*\*\*\* Existing budget for ongoing M&E is \$285,000 (BPA Project No. 1992-010-00). This cost is escalated from FY2010 to FY2013 at 2% annually. In FY2014 M&E costs are increased to cover M&E for the additional production from Crystal Springs.
- Budget figures assume that work would proceed on the timeline shown in Figure 7-2.

## 7.2.2 Land Acquisition Costs

The Yellowstone cutthroat trout program component would share facilities at Crystal Springs previously described for the Chinook salmon program component. Land acquisition costs are therefore the same as described in Section 7.1.2 above.

## 7.2.3 Cost Estimates for Facility Planning and Design

The Tribes have solicited input from a range of experts during Step 1 conceptual planning in order to avoid significant design and program changes in later planning stages. The Tribes also sought to validate the Yellowstone cutthroat trout program, design criteria, and cost estimates to the maximum extent possible through comprehensive early reviews. Input and review will be solicited from a team of knowledgeable individuals through the Step 2 and 3 processes.

### 7.2.3.1 Step 1 Conceptual Planning and Design

The total budget for Yellowstone cutthroat program conceptual planning and design work is estimated to be about \$36,000 (Table 7-15). Approximately 10% of the total estimated cost for Step 1 planning has been applied to this program. This figure is based on a contracted amount to

complete the Step 1 Master Plan and includes conceptual planning, engineering, and development of the Step 1 Master Plan and ultimately responding to the NPCC and ISRP review of this Master Plan.

#### **7.2.3.2 Step 2 Preliminary Planning and Design**

A placeholder of \$44,000 has been allocated to this program for Step 2 preliminary planning, site investigations and design to be initiated in FY 2011 (Table 7-15). This budget allocated costs for drilling test wells, surveying and other investigative geotechnical work. The budget may need further refinement depending on the outcome of the Step 1 Master Plan approval process.

#### **7.2.3.3 Step 3 Final Planning and Design**

Step 3 is the final design review prior to construction. Development plans are advanced to a confidence level of +/- 10 to 15% and are ready for bid. A 100% cost estimate will accompany this submittal along with details on all operational plans. A placeholder of \$47,000 has been identified for the Step 3 of the Yellowstone cutthroat trout program anticipated to begin in FY 2012 (Table 7-15). About 10% of the total estimated project cost has been applied to this program, an assumption that will be refined in Step 2 during development of the preliminary design. Because planning and development of the Yellowstone cutthroat trout program is integrated with the planning for the Chinook program, the Tribe proposes to adopt the design/build approach described in Section 7.1.3.3.

The cost estimates for planning and design assume that facilities will be developed along the timeline shown in Figure 7-2. This schedule will result in cost effective planning and implementation for Step 2, Step 3, implementation of construction, and long-term program operations.

### **7.2.4 Construction**

At this stage, construction costs have a high level of uncertainty, therefore an approximately 20 to 25% contingency is applied to each construction cost area. Such a contingency is largely dependent on the number of uncertainties associated with the project and the amount of pre-investigation work completed. Estimated construction costs represent a maximum range that are expected to be reduced during future planning stages through analysis of alternatives and elimination of many uncertainties.

The current estimate for capital construction is based on the descriptions of facilities and infrastructure provided in Section 4.5 and 6.4. The allocation of construction costs to the Yellowstone cutthroat trout program at Crystal Springs is based on the pounds of fish produced.

#### **7.2.4.1 Probable Construction Costs**

The proposed Crystal Springs Hatchery has been planned to produce up to 10,000 catchable size trout and 10,000 fry/ fingerlings. The proposed facilities include small scale adult fish holding tankage for broodstock, incubation trays, and several round tanks for fry and catchable rearing. These facilities will occupy space adjacent to the Chinook salmon incubation and early rearing spaces inside the proposed hatchery building. The cutthroat program will also share water supply and drain systems with the Chinook program.

Table 7-6 provides a summary of all estimated construction costs including the component of Crystal Springs allocated to the Yellowstone cutthroat trout program. Construction costs are calculated based on approximate pounds of each program reared at Crystal Springs (Yankee Fork - 58%, Panther Creek - 37%, Yellowstone cutthroat trout- 5%).

Table 7-16 summarizes the estimated construction costs for each component of the Crystal Springs Hatchery allocated to the Yellowstone cutthroat trout program. Costs are broken down into major infrastructure and facility components and are based on the scope and conceptual descriptions presented in Sections 4.5 and 6.4. Details of these estimates are found in Appendices H-1 through H-3. The estimated hatchery construction cost apportioned to the cutthroat trout program is \$542,000 (of the total \$10.8 million facility estimate). These estimated costs do not include land purchase or lease (see Section 7.1.2). The construction estimates are based on a conceptual design and include a contingency of about 20 to 25% to accommodate the level of uncertainty at this stage.

**Table 7-16. Summary of estimated construction costs for Yellowstone cutthroat trout program.**

Description	Yellowstone Cutthroat Trout Subtotal
Process Water Supply to Head Boxes	\$60,877
Head Boxes, Chiller and Degassing	\$19,120
Site Work and Utilities	\$39,592
Process Water Distribution and Drains	\$10,494
Hatchery Building – 11,900 SF	\$139,252
Office/Shop Building – 5,040 SF	\$51,702
Outdoor Rearing – 5 Production Ponds	\$62,242
Effluent Settling Structure – Dual Cell	\$5,594
Hatchery Housing – New (3)	\$37,500
Construction Cost Subtotal	\$426,373
Inflation/Escalation to Mid-Point Construction *	\$456,219
Mobilization/Demobilization, General Conditions **	\$54,746
Subtotal	\$510,965
Taxes ***	\$30,658
Probable Total Cost (2012 Dollars)	\$541,623

**Notes & Assumptions:**

- Cost estimate in 2010 dollars
- Costs should be considered conceptual (+/- 35% to 50%)
- Costs are allocated based on approximate pounds of each program reared at Crystal Springs (Yankee Fork – 58%, Panther Creek – 37%, Yellowstone cutthroat trout – 5%)
- \* Inflation/escalation at 3% to mid-point construction date of 2012 (7% total from 2010 to mid-2012)
- \*\* Mobilization/Demobilization: General conditions include inflation/escalation at 3% to mid-point construction date of 2012 (7% total from 2010 to mid-2012)
- \*\*\* Taxes estimated at 6%

## 7.2.5 Program Equipment Cost Estimates

Table 7-17 lists the potential types of equipment by functional area and the probable costs. A conceptual estimated of \$23,000 (escalated from FY 2010 to FY 2013, when equipment would be

needed) has been included for capital equipment associated with the Yellowstone cutthroat trout facilities and operation. Costs are allocated based on approximate pounds of fish each program will rear at Crystal Springs (Yankee Fork - 58%, Panther Creek - 37%, Yellowstone cutthroat trout- 5%).

**Table 7-17. Program equipment budget by facility/hatchery functional area for Yellowstone cutthroat trout.**

Description	Total Cost (FY 2010 Dollars)	Total Cost (FY 2013 Dollars)
Office Equipment	\$260	\$276
Computers / Printers	\$585	\$620
Office Furniture and Cabinets	\$495	\$525
Communications Equipment	\$786	\$834
Housing Equipment and Furniture / Permanent Staff Housing	\$1,975	\$2,094
Housing Equipment and Furniture / Temporary Staff Housing	\$0	\$0
Shop Equipment	\$775	\$822
Buildings/Facilities Needs	\$335	\$355
Adult Collection	\$20,000	\$21,200
Water System Operation	\$155	\$164
Incubation	\$510	\$541
Fish Transport	\$10,350	\$10,971
Cutthroat Trout Rearing at Hatchery	\$1,795	\$2,184
Cutthroat Trout Rearing at Acclimation Ponds	\$0	\$0
Tagging	\$0	\$0
M&E Equipment	\$1,000	\$1,060
Technical/Lab Equipment	\$825	\$875
Disinfection Equipment (Other Disease and Pathology Needs)	\$275	\$292
Other	\$975	\$1,034
Renewable Energy Equipment	\$12,500	\$13,250
<b>Totals</b>	<b>\$53,596</b>	<b>\$57,093</b>

**Notes & Assumptions:**

- Costs shown in 2010 and 2013 dollars
- Expenditures will occur in 2013
- Costs are allocated based on approximate pounds of each program reared at Crystal Springs (Yankee Fork - 58%, Panther Creek - 37%, Yellowstone cutthroat trout - 5%)
- Costs are escalated at 2% annually per the 2008 Memorandum of Agreement between the Shoshone-Bannock Tribes and the FCRPS Action Agencies (2008 Fish Accords)
- Costs should be considered conceptual (+/- 35% to 50%)
- Items are not duplicated in the capital construction and operating budgets

## **7.2.6 Environmental Compliance Cost Estimates**

As previously described in Section 7.1.6 and shown in Table 7-8, estimated costs related to environmental compliance total approximately \$152,000. It is assumed that the majority of these costs would be incurred with implementation of the Chinook salmon programs. For this stage of planning, none of the estimated environmental compliance costs are allocated to the Yellowstone cutthroat trout program.

## **7.2.7 Operations and Maintenance Costs**

The following sections present cost estimates associated with operations and maintenance of the proposed Yellowstone cutthroat trout programs at Crystal Springs Hatchery. Costs are allocated based on approximate pounds of fish each program will rear at Crystal Springs (Yankee Fork- 58%, Panther Creek - 37%, Yellowstone cutthroat trout- 5%).

### **7.2.7.1 Annual Operations and Maintenance Costs**

Operating costs for the proposed Yellowstone cutthroat trout programs are shown in Table 7-18. Expenses include such items as payroll, utilities, vehicle leases, supplies, maintenance, some specific tagging expenses and potential subcontracted support services. This planning estimate includes Crystal Springs operations and maintenance costs. The Tribes estimate that the annual budget for operations and maintenance apportioned to this program component will be about \$35,000 annually. When this estimate is escalated from 2010 to 2013 dollars (the year that these expenses would be incurred), operational expenses are about \$37,000 annually.

**Table 7-18. Annual operating expenses for the Yellowstone cutthroat trout program at Crystal Springs Hatchery.**

Expense Area	Estimated Operations Costs (2010 dollars)	Estimated Operations Costs (2013 dollars)
Payroll (Taxes, Benefits, Mark-ups)	\$19,626	\$20,827
Vehicles (Fuel, Oil, Maintenance, Mileage, Insurance)	\$800	\$849
Repairs and Maintenance (Site, Buildings, Equipment)	\$350	\$371
Rent and Lease (Equipment, Vehicles)	\$2,550	\$2,706
Program Supplies (Shop, Office)	\$375	\$398
Program Supplies (Lab, Water System, Eggtake, Incubation)	\$485	\$515
Program Supplies (Rearing and Release)	\$5,185	\$5,502
Program Supplies (Tagging, Tag Recovery)	\$0	\$0
Utilities (Electrical, Telephone)	\$4,198	\$4,455
Travel Costs (Mileage, Lodging, Per diem)	\$524	\$556
Education and Training	\$75	\$80
Subcontracts (Professional Fees, Testing, Sampling)	\$700	\$743
Facility Insurance	\$119	\$126
<b>Totals</b>	<b>\$34,988</b>	<b>\$37,129</b>

**Notes & Assumptions:**

- Full annual operating costs expected to start in FY 2013; costs should be considered conceptual (+/- 35% to 50%)
- Costs are allocated based on approximate pounds of each program reared at Crystal Springs (Yankee Fork – 58%, Panther Creek – 37%, Yellowstone cutthroat trout – 5%)
- Estimated costs for existing operations program do not include M&E Costs
- Tagging costs are included as M&E cost estimates
- Costs are escalated from 2010 to 2013 at 2% annually per the 2008 Memorandum of Agreement between the Shoshone-Bannock Tribes and the FCRPS Action Agencies (2008 Fish Accords)

**7.2.7.2 Projected Operating Expenses**

Operating expenses from FY 2010 to FY 2020 are shown in Table 7-19. It is expected that the facility will be constructed in FY 2012 and 2013 and operational costs will start to be incurred in FY 2013. Cost estimates for operations and maintenance are escalated at 2% annually from FY 2010 through FY 2020. These types of costs tend to be more stable historically than construction costs.

**Table 7-19. Ten-year projected operating expenses for the Yellowstone cutthroat trout program at Crystal Springs Hatchery.**

Expense Area	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020
Payroll (Taxes, Benefits, Mark-ups)	\$19,626	\$20,019	\$20,419	\$20,827	\$21,244	\$21,669	\$22,102	\$22,544	\$22,995	\$23,455	\$23,924
Vehicles (Fuel, Oil, Maintenance, Mileage, Insurance)	\$800	\$816	\$832	\$849	\$866	\$883	\$901	\$919	\$937	\$956	\$975
Repairs and Maintenance (Site, Buildings, Equipment)	\$350	\$357	\$364	\$371	\$379	\$386	\$394	\$402	\$410	\$418	\$427
Rent and Lease (Equipment, Vehicles)	\$2,550	\$2,601	\$2,653	\$2,706	\$2,760	\$2,815	\$2,872	\$2,929	\$2,988	\$3,047	\$3,108
Program Supplies (Shop, Office)	\$375	\$382	\$390	\$398	\$406	\$414	\$422	\$431	\$439	\$448	\$457
Program Supplies (Lab, Water System, Eggtake, Incubation)	\$485	\$495	\$505	\$515	\$525	\$535	\$546	\$557	\$568	\$580	\$591
Program Supplies (Rearing and Release)	\$5,185	\$5,289	\$5,394	\$5,502	\$5,612	\$5,725	\$5,839	\$5,956	\$6,075	\$6,197	\$6,320
Program Supplies (Tagging, Tag Recovery)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Utilities (Electrical, Telephone)	\$4,198	\$4,282	\$4,368	\$4,455	\$4,544	\$4,635	\$4,728	\$4,823	\$4,919	\$5,017	\$5,118
Travel Costs (Mileage, Lodging, Per diem)	\$524	\$534	\$545	\$556	\$567	\$578	\$590	\$602	\$614	\$626	\$638
Education and Training	\$75	\$77	\$78	\$80	\$81	\$83	\$85	\$86	\$88	\$90	\$92
Subcontracts (Professional Fees, Testing, Sampling)	\$700	\$714	\$728	\$743	\$758	\$773	\$788	\$804	\$820	\$837	\$853
Facility Insurance	\$119	\$121	\$124	\$126	\$129	\$132	\$134	\$137	\$140	\$142	\$145
<b>Totals</b>	<b>\$34,988</b>	<b>\$35,687</b>	<b>\$36,401</b>	<b>\$37,129</b>	<b>\$37,872</b>	<b>\$38,629</b>	<b>\$39,402</b>	<b>\$40,190</b>	<b>\$40,994</b>	<b>\$41,813</b>	<b>\$42,650</b>

**Notes & Assumptions:**

- Estimated costs are escalated at 2% annually in all operational areas per the 2008 Memorandum of Agreement between the Shoshone-Bannock Tribes and the FCRPS Action Agencies (2008 Fish Accords)
- Costs are allocated based on approximate pounds of each program reared at Crystal Springs (Yankee Fork – 58%, Panther Creek – 37%, Yellowstone cutthroat trout – 5%)

## 7.2.8 Research, Monitoring, and Evaluation

A conceptual description of the monitoring and evaluation program is presented in Section 6.5. This plan will be developed further in Step 2 of the three-step planning process. This section provides estimated conceptual costs for research, monitoring and evaluation associated with descriptions in Section 6.5.

### 7.2.8.1 Annual Research, Monitoring and Evaluation Costs

Costs associated with monitoring and evaluation are summarized in Table 7-20. Currently, monitoring and evaluation for the existing program is funded through BPA project number 199201000 at about \$285,000 annually. The Tribes estimate that the annual budget for monitoring and evaluation will increase to about \$418,000 annually when costs associated with Crystal Springs production start to be incurred in 2014.

**Table 7-20. Annual monitoring and evaluation expenses Crystal Springs Fish Hatchery for the Yellowstone cutthroat trout program.**

Expense Area	Estimated Annual Expenses (2014 dollars)
Payroll (Taxes, Benefits, Mark-ups)	\$328,571
Vehicles (Fuel, Oil, Maintenance, Mileage, Insurance)	\$7,610
Repairs and Maintenance (Site, Buildings, Equipment)	\$758
Rent and Lease (Equipment, Vehicles)	\$24,540
Program Supplies (Shop, Office, Lab)	\$3,301
Program Supplies (Tagging, Tag Recovery)	\$974
Utilities (Electrical, Telephone)	\$2,381
Travel Costs (Mileage, Lodging, Per Diem)	\$3,312
Education and Training	\$1,343
Subcontracts (Professional Fees, Testing, Sampling)	\$44,192
Postage, Dues and Subscriptions	\$896
<b>Total</b>	<b>\$417,880</b>

**Notes & Assumptions:**

- Estimates shown in 2014 dollars
- Existing budget for ongoing M&E is \$285,000 (BPA Project No. 1992-010-00). This cost is escalated from FY2010 to FY2013 at 2% annually. In FY2014 M&E costs are increased to cover M&E for the additional production from Crystal Springs.
- Costs should be considered conceptual (+/- 35% to 50%).

### 7.2.8.2 Projected Research, Monitoring and Evaluation Costs

Estimated monitoring and evaluation expenses from 2010 to 2020 are shown in Table 7-21. It is expected that the facility would be constructed in FY 2012 and FY 2013 and monitoring and evaluation costs associated with Crystal Springs production would start to be incurred in 2014. Cost estimates for monitoring and evaluation are escalated at 2% annually from FY 2010 through FY 2020.

**Table 7-21. Ten-year projected monitoring and evaluation expenses for Yellowstone cutthroat trout at the Crystal Springs Hatchery.**

Expense Area	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020
Payroll (Taxes, Benefits, Mark-ups)	\$224,090	\$228,572	\$233,144	\$237,806	\$328,571	\$335,143	\$341,846	\$348,683	\$355,656	\$362,769	\$370,025
Vehicles (Fuel, Oil, Maintenance, Mileage, Insurance)	\$5,190	\$5,294	\$5,400	\$5,508	\$7,610	\$7,763	\$7,918	\$8,076	\$8,238	\$8,403	\$8,571
Repairs and Maintenance (Site, Buildings, Equipment)	\$517	\$527	\$538	\$548	\$758	\$774	\$789	\$805	\$821	\$837	\$854
Rent and Lease (Equipment, Vehicles)	\$16,737	\$17,071	\$17,413	\$17,761	\$24,540	\$25,031	\$25,532	\$26,043	\$26,563	\$27,095	\$27,637
Program Supplies (Shop, Office, Lab)	\$2,252	\$2,297	\$2,343	\$2,389	\$3,301	\$3,367	\$3,434	\$3,503	\$3,573	\$3,645	\$3,717
Program Supplies (Tagging, Tag Recovery)	\$664	\$678	\$691	\$705	\$974	\$993	\$1,013	\$1,034	\$1,054	\$1,075	\$1,097
Utilities (Electrical, Telephone)	\$1,624	\$1,657	\$1,690	\$1,724	\$2,381	\$2,429	\$2,477	\$2,527	\$2,577	\$2,629	\$2,681
Travel Costs (Mileage, Lodging, Per diem)	\$2,259	\$2,304	\$2,350	\$2,397	\$3,312	\$3,378	\$3,446	\$3,515	\$3,585	\$3,657	\$3,730
Education and Training	\$916	\$934	\$953	\$972	\$1,343	\$1,370	\$1,397	\$1,425	\$1,454	\$1,483	\$1,512
Subcontracts (Professional Fees, Testing, Sampling)	\$30,140	\$30,743	\$31,357	\$31,985	\$44,192	\$45,076	\$45,977	\$46,897	\$47,835	\$48,792	\$49,767
Postage, Dues and Subscriptions	\$611	\$623	\$636	\$649	\$896	\$914	\$932	\$951	\$970	\$989	\$1,009
<b>Totals</b>	<b>\$285,000</b>	<b>\$290,700</b>	<b>\$296,514</b>	<b>\$302,444</b>	<b>\$417,880</b>	<b>\$426,238</b>	<b>\$434,762</b>	<b>\$443,458</b>	<b>\$452,327</b>	<b>\$461,373</b>	<b>\$470,601</b>

**Notes & Assumptions:**

- Existing budget for ongoing M&E is \$285,000 (BPA Project No. 1992-010-00). This cost is escalated from FY2010 to FY2013 at 2% annually. In FY2014 M&E costs are increased to cover M&E for the additional production from Crystal Springs.
- Estimated costs are escalated at 2% annually in all expense areas per the 2008 Memorandum of Agreement between the Shoshone-Bannock Tribes and the FCRPS Action Agencies (2008 Fish Accords)

### **7.2.9 Ten –Year Future Cost Summary**

Estimated 10-year costs for the Yellowstone cutthroat trout program from FY 2010 through FY 2020 are presented in Table 7-22. As stated in Section 7.2.1.4, costs for each program area are escalated to the year in which they are expected to occur. This estimated cost summary assumes planning and implementation of new facilities for Crystal Springs Hatchery would occur in 2010 through 2012.

As previously noted, consistent with Step 1 of the Council’s Three-Step process, cost estimates at this stage are conceptual. The Tribe will refine these estimates during the Step 2 and Step 3 planning phases. This 10-year estimated cost summary is designed to be a planning tool and will be updated as costs are refined.

**Table 7-22. Ten-year summary of future costs for Yellowstone cutthroat trout, FY 2010 - FY 2020.**

Program Area	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
<b>A. Land Purchases, Leases and Easements</b>											
A.1. Land Purchases, Leases and Easements											
<b>B. Planning and Design</b>											
B.1. Step 1: Conceptual Engineering, Planning	\$36,544										
B.2. Step 2: Preliminary Engineering, Planning and Environmental Compliance		\$44,162									
B.3. Step 3: Final Engineering, Planning			\$47,427								
<b>C. Construction</b>											
C.1. Estimated Construction Costs			\$270,811	\$270,811							
<b>D. Program Equipment</b>											
D.1. Program Equipment				\$57,093							
<b>E. Environmental Compliance</b>											
E.1. Environmental Compliance											
<b>F. Operations and Maintenance</b>											
F.1. Crystal Springs Hatchery Programs				\$37,129	\$37,872	\$38,629	\$39,402	\$40,190	\$40,994	\$41,813	\$42,650
<b>G. Monitoring and Evaluation</b>											
G.1. Monitoring & Evaluation Program	\$285,000	\$290,700	\$296,514	\$302,444	\$417,880	\$426,238	\$434,762	\$443,458	\$452,327	\$461,373	\$470,601
Total Estimated Capital Costs	\$36,544	\$44,162	\$318,238	\$327,905	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total Estimated O&M Costs	\$285,000	\$290,700	\$296,514	\$339,574	\$455,752	\$464,867	\$474,164	\$483,647	\$493,320	\$503,187	\$513,250
Total Estimated Costs	\$321,544	\$334,862	\$614,752	\$667,478	\$455,752	\$464,867	\$474,164	\$483,647	\$493,320	\$503,187	\$513,250

**Notes and Assumptions:**

- A. Land Purchase, Leases & Easements (land purchase is completed). Land cost for the purchase of the Crystal Springs Hatchery Site in 1998 by BPA is \$800,000.
- B.1. Step 1 Planning based on current expenditures to complete planning
- B.2. Step 2 Planning based on a percentage of estimated construction costs (escalated to FY 2011 dollars)
- B.3. Step 3 Planning based on a percentage of estimated construction costs (escalated to FY 2012 dollars)
- C. Estimated Construction Costs assume 50% occurs in FY 2012 and 50% in FY 2013 (escalated from FY 2010 to mid FY 2012 dollars)
- D. Program Equipment, estimated lump sum for equipment items not shown in construction estimate (escalated from FY 2010 to FY 2013 dollars)
- E. Environmental Compliance – Assumes these costs will be incurred for both Chinook and trout programs and will not change if portions of either program were changed
- F. O&M Cost Crystal Springs Hatchery Program (costs escalated at 2% annually from 2010 dollars per the 2008 Memorandum of Agreement between the Shoshone-Bannock Tribes and the FCRPS Action Agencies (2008 Fish Accords)) Assumes start-up in FY 2013.
- G. Monitoring and Evaluation program (existing budget for ongoing M&E is \$285,000 (BPA Project No. 1992-010-00). This cost is escalated from FY2010 to FY2013 at 2% annually. In FY2014 M&E costs are increased to cover M&E for the additional production from Crystal Springs.)

## 8. SUMMARY

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The programs described in this Master Plan reflect the vision of the Shoshone-Bannock Tribes for both the conservation and harvest of populations of Chinook salmon in the Yankee Fork and Panther Creek and populations of Yellowstone cutthroat trout in the vicinity of the Fort Hall Reservation. Over the last century, these once abundant species have declined as the ecosystems that support them have been altered. The Tribe is actively engaged in habitat restoration measures in the Yankee Fork and Fort Hall areas and is seeking to partner with other interests in restoring the aquatic ecosystem of Panther Creek. Such habitat efforts have progressed sufficiently to warrant more aggressive population enhancement measures in each of these watersheds.

Fundamental to population enhancement is development of the proposed Crystal Springs Hatchery. Ongoing Chinook population supplementation efforts in the Yankee Fork have been compromised by limited hatchery space and other programs being prioritized for access to this space. Developing a facility with sufficient space to independently rear offspring of fish that have returned to each targeted watershed is expected to significantly accelerate restoration of these populations. The Tribe is optimistic that the proposed decision management framework, in combination with the outlined monitoring and evaluation protocols, will successfully lead to the reestablishment of locally adapted Chinook populations in the Yankee Fork and Panther Creek, enabling tribal members to participate more fully in cultural and ceremonial harvests.

The Yellowstone cutthroat trout program at the Crystal Springs facility represents a very modest investment that capitalizes on many shared Chinook program operational components. Concurrent development of the Chinook and cutthroat trout facilities will result in very significant cost savings for the Yellowstone cutthroat trout program relative to independently constructing facilities at a later date. Resource requirements for the Yellowstone cutthroat trout program are also modest. For example, hatchery water supply requirements are minimal and will not exceed the available and permitted supply.

The reasonable scale of this proposed native resident fish program investment is expected to provide a number of significant benefits. A genetically pure population of Yellowstone cutthroat trout will be conserved and restored in streams and wetlands in and around the Fort Hall Reservation, increasing both their distribution and abundance. The proposed monitoring program will track long-term trends in abundance and factors such as genetic introgression within this population. Additionally, the combined benefits of habitat restoration and population enhancement will provide a culturally important on-reservation fishery to the Shoshone-Bannock Tribes, and will sustain the economically important public recreational fishery.

## 9. CITATIONS

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- AgriMet. 1994. Available at <http://www.usbr.gov/pn/agrimet/yearrpt.html>
- Anderson, J.E. 1999. The Idaho National Engineering Laboratory: an ecological treasure on the upper Snake River Plain. *Rangelands* 21:11-17.
- Behnke, R.J. 1992. Native Trout of Western North America. American Fisheries Society Monograph 6. Bethesda, MD.
- Behnke, R.J. 2002. Trout and Salmonids of North America. Free Press. New York, NY.
- Beschta, R.L., J. Griffith and T.A. Wesche. 1993. Field Review of Fish Habitat Improvement Projects in Central Idaho. Technical Report No. WWRC-93-18. Prepared for the Bonneville Power Administration, Portland Oregon.
- Bowler, P.A. and T.J. Frest. 1992. Snake River Mollusks: living fossils. *Idaho Wildlife* 12(1): 2-29.
- Bureau of Land Management (BLM). 1998. Challis Resource Area Proposed Land Management Plan and Final Environmental Impact Statement. Volumes 1 and 2. Bureau of Land Management, Upper Columbia-Salmon Clearwater Districts, Challis Resource Area.
- CH2MHill. 2004. Draft Management Plan-Upper Snake Province. Submitted to the Northwest Power and Conservation Council. December 2004.
- Denny, Lytle P. and Kurt Tardy. 2010. 2008 Yankee Fork Salmon River Adult Chinook Salmon Run Report October 2007-September 2008. Prepared for the USFWS Lower Snake River Compensation Plan. Boise, ID. Cooperative Agreement No. 141108J014. March 2010.
- Deriso, R.B., D.R. Marmorek, and I.J. Parnell. 2001. Retrospective patterns of differential mortality and common year-effects experienced by spring and summer Chinook salmon (*Oncorhynchus tshawytscha*) of the Columbia River. *Canadian Journal of Fisheries and Aquatic Sciences*. 58(12): 2419-2430.
- EcoMetrix. 2010. Biomonitoring Study: Panther Creek Watershed-2009. Prepared for the Blackbird Mine Site Group. Salmon, Idaho. July 2010.
- Ecovista. 2004. Draft Salmon Subbasin Management Plan. NPCC, Portland, Oregon.
- EDAW, Inc. 1995. American Falls Resource Management Plan. Bureau of Reclamation, Pacific Northwest Region. Boise, Idaho.
- Engineering News Record, McGraw Hill. 2008. Cost Indexes by City. Retrieved July 2008 from <http://enr.com>.
- Every Culture. 2010. Northern Shoshone and Bannock Tribes. Available at <http://www.everyculture.com/>.

- Gresswell, E. Robert, 2009. Yellowstone Cutthroat Trout (*Oncorhynchus clarkii bouvieri*) - A Technical Conservation Assessment. Prepared for the USDA Forest Service, Rocky Mountain Region Species Conservation Project. June 30, 2009.
- Hatchery Scientific Review Group (HSRG). 2004. Hatchery Reform: Principles and Recommendations of the HSRG. Long Live the Kings. Seattle, WA. April 2004.
- HSRG. 2008a. System-wide Report, Appendix E: Population Reports, Panther Creek Spring Chinook. Available online at: [www.hatcheryreform.us/](http://www.hatcheryreform.us/).
- HSRG. 2008b. System-wide Report, Appendix E: Population Reports, Yankee Fork Spring Chinook. Available online at: [www.hatcheryreform.us/](http://www.hatcheryreform.us/).
- HSRG. 2008c. System-wide Report, Appendix E: Population Reports, Panther Creek Steelhead. Available online at: [www.hatcheryreform.us/](http://www.hatcheryreform.us/).
- Henderson, R., J.L Kershner, and C.A. Toline. 2000. Timing and location of spawning by nonnative wild rainbow – implications for hybridization. North American Journal of Fisheries Management 20:584-596.
- Idaho Climate Summaries. 2005. Period of Record Monthly Climate Summary. Western Regional Climate Center. Available online at: <http://www.wrcc.dri.edu/summary/climsmid.html>. Accessed August 8, 2010.
- Idaho Conservation Data Center (IDCDC). 2010. Tracked Plants and Their Ranks – February 2010. Idaho Rare Plant Conference, Idaho Rare Plant Society, Idaho Conservation Data Center. Boise, Idaho. Available online at: <http://fishandgame.idaho.gov/cdc/plants/>.
- Idaho Department of Commerce (IDC). 2010. Idaho Community Profiles. Available online at <http://commerce.idaho.gov/business/socioeconomic-profiles/>. Accessed on September 17, 2010.
- Idaho Department of Environmental Quality (IDEQ). 2001. Middle Salmon River-Panther Creek Subbasin Assessment and TMDL. Idaho Department of Environmental Quality, 1410 North Hilton, Boise, Idaho. 114 pages.
- IDEQ. 2003. Upper Salmon River Subbasin Assessment and TMDL. January 2003. Idaho Department of Environmental Quality, 1410 North Hilton, Boise, Idaho. 232 pages.
- IDEQ. 2006. American Falls Subbasin Total Maximum Daily Load Plan: Subbasin Assessment and Loading Analysis. Idaho Department of Environmental Quality, Shoshone Bannock Tribes, U.S. Environmental Protection Agency. July 2006.
- Idaho Department of Fish and Game (IDFG). 2007. Fisheries Management Plan 2007-2012. Idaho Department of Fish and Game, Boise, ID. <http://fishandgame.idaho.gov/cms/fish/programs/fishplan>.
- Idaho Fish and Wildlife Information System (IFWIS). 2003. 1:100,000-scale hydrographs. Idaho Department of Fish and Game, Boise, Idaho. Accessed December 1, 2003.

- IFWIS. 2010a. Idaho Fishing Planner: Yankee Fork. Idaho Department of Fish and Game, Boise, Idaho. Available online at <http://fishandgame.idaho.gov/ifwis/fishingplanner/default.aspx/>. Accessed September 19, 2010.
- IFWIS. 2010b. Idaho Fishing Planner: American Falls Reservoir. Idaho Department of Fish and Game, Boise, Idaho. Available online at: <http://fishandgame.idaho.gov/ifwis/Fishingplanner/default.aspx/> Accessed August 30, 2010.
- Interior Columbia Technical Recovery Team (ICTRT). 2007. Viability Criteria for Applications to Interior Columbia Basin Salmonid ESUs. March 2007.
- ICTRT. 2006. Yankee Fork Salmon River Spring Chinook Salmon Population, Population Viability Assessment.
- Independent Science Advisory Board (ISAB). 2007. Climate Change Impacts on Columbia River Basin Fish and Wildlife. Prepared for the Northwest Power and Conservation Council, Portland, OR. May 2007.
- McGrath, C.L., A.J. Woods, J.M. Omernik, S.A. Bryce, M. Edmonson, J.A. Nesser, J. Sheldon, R.C. Crawford, J.A. Comstock, and M.D. Plocher. 2002. Ecoregions of Idaho (color poster with map, descriptive text, summary tables, and photographs). Reston, Virginia, U.S. Geological Survey (map scale 1:1,350,000).
- Maret, T.R. 1997. Characteristics of fish assemblages and related environmental variables for streams of the upper Snake River Basin, Idaho and western Wyoming. U.S. Geological Survey, 1993-95. Water Resources Investigations Report 97-4087, Boise, ID.
- May, B.E., S.E. Albeke, and T. Horton. 2007. Range-wide Status of Yellowstone Cutthroat Trout: 2006. Montana Fish, Wildlife and Parks. Helena, MT.
- Meyer, K.A., D.J. Schill, and J.A. Lamarsky. 2006. Status of Yellowstone Cutthroat Trout in Idaho. Transactions of American Fisheries Society 135: 1239-147.
- Moser, D. 1999. Fort Hall Resident Fish Program. Project No. 1992-01000. BPA Report COD/BP-32743-1. 34 pages.
- NOAA Fisheries. 2007. Draft Snake River Salmon and Steelhead Recovery Plan. Available for comment at: <http://www.idahosalmonrecovery.net/>.
- NOAA Fisheries. 2008. Endangered Species Act Section 7(a)(2) Consultation Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act, Essential Fish Habitat Consultation on Remand for Operation of the Federal Columbia River Power System: 11 Bureau of Reclamation Projects in the Columbia Basin and ESA Section 10 (a)(1)(A) Permit for Juvenile Fish Transportation Program (Revised and reissued pursuant to Court Order- NWF v. NMFS, Civ. No. CV 01-640-RE (D. Oregon)).
- Natural Resources Conservation Service (NRCS). 2008. Upper Salmon Hydrologic Unit Profile – 17060201. (Available online at: <http://www.id.nrcs.usda.gov/technical/watersheds.html/>)

- NatureServe. 2010. NatureServe Explorer: an online encyclopedia of life. Version 7.1- NatureServe, Arlington, VA. <http://natureserve.org/explorer>.
- Northwest Power and Conservation Council (NPCC). 2000. Columbia River Basin Fish and Wildlife Program. <http://www.nwcouncil.org/library/2000/2000-19/default.htm>.
- NPCC 2004. Upper Snake Province Assessment. Available online at <http://www.nwcouncil.org/fw/subbasinplanning/uppersnake/plan/assessment.pdf>
- NPCC. 2006. Three-Step Review Process. <http://www.nwcouncil.org/library/2006/2006-21.htm>
- NPCC. 2007. Project Cost Escalation Standards, Task 115. Independent Economic Analysis Board. NPCC document IEAB -2007-2. 16 pp.
- NPCC. 2009. Columbia River Basin Fish and Wildlife Program. <http://www.nwcouncil.org/library/2009/2000-19/default.htm>.
- Osborne, Hunter. 2009. Habitat Restoration/Enhancement Fort Hall Reservation 2008 Annual Report. Shoshone-Bannock Tribes. Fort Hall, Idaho.
- Richards, C. and P.J. Cernera. 1989. Dispersal and Abundance of Hatchery-reared and Naturally Spawned Juvenile Chinook Salmon in an Idaho Stream. North American Journal of Fisheries Management 9: 345-351.
- Richards, C. P.J. Cernera, M.P. Ramey and D.W. Reiser. 1992. Development of Off-channel Habitats for Use by Juvenile Chinook Salmon. North American Journal of Fisheries Management 12: 721-727.
- Ross, S.H. and C.N. Savage. 1967. Idaho Earth Science. Idaho Bureau of Mines and Geology Earth Science Series No. 1. 217 pp.
- Salmon-Challis National Forest (SCNF). 1993. Watershed Characteristics within Middle Salmon-Panther Subbasin. Salmon-Challis National Forest.
- Schaller, H.A., C.E. Petrosky, and O.P. Langness. 1999. Contrasting patterns of productivity and survival rates for stream-type Chinook salmon (*Oncorhynchus tshawytscha*) populations of the Snake and Columbia rivers. Canadian Journal of Fisheries and Aquatic Sciences 56: 1031-1045.
- Scott, W.B, and E.J. Crossman. 1973. Freshwater Fishes of Canada. Bull. Fish. Res. Board: 184: 1-996.
- Shoshone-Bannock Tribes, Bonneville Power Administration, US Army Corps of Engineers, and US Bureau of Reclamation. 2008. 2008 Columbia Basin Fish Accords Memorandum of Agreement between Shoshone-Bannock Tribes and FCRPS Action Agencies. November 7, 2008.
- Shoshone-Bannock Tribes. 2010a. Tribal Resource Management Plan for Snake River Spring/Summer Chinook salmon fisheries within the Salmon River Subbasin. Prepared for the NMFS-Pacific Northwest Region, Portland, Oregon.

- Shoshone-Bannock Tribes. 2010b. Draft HGMP for Yankee Fork Chinook Salmon Supplementation Project. Shoshone-Bannock Tribes, Fort Hall, Idaho. April 23, 2010.
- Shoshone-Bannock Tribes. 2010c. Draft Environmental Assessment for the Shoshone-Bannock Tribes' Integrated Resource Management Plan. Fort Hall, Idaho. January 26, 2010.
- Scott, J.M., C.R. Peterson, J.W. Karl, E. Strand, L.K. Svancara, and N.M. Wright. 2002. A gap analysis of Idaho. Final report. Idaho Cooperative Fish and Wildlife Research Unit, Moscow, ID.
- Tardy, Kurt A. 2009. Supplementation, Monitoring and Evaluation Program Annual Report 2008-2009. Shoshone-Bannock Tribes, Fort Hall, ID. December 2009.
- United States Fish and Wildlife Service (USFWS). 2010a. Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for Bull Trout in the Coterminous United States; Proposed Rule. Federal Register Vol. 75, No. 9. January 14, 2010.
- USFWS. 2010b. Great Northern Landscape Conservation Cooperative Implementation Plan. USFWS.
- USFWS. 2006. Status review of Yellowstone Cutthroat Trout. US Fish and Wildlife Service. Portland, OR.
- United States Forest Service (USFS). 1999. Salmon River Canyon Project. Draft Environmental Impact Statement. USDA Forest Service, Northern and Intermountain Regions, Nez Perce, Payette, Bitterroot, and Salmon-Challis National Forests. October 1999.
- USDA Forest Service/Bureau of Land Management (USFS/BLM). 1998. Upper Salmon Subbasin Review. Salmon-Challis National Forest, Challis BLM Resource Area, Sawtooth National Recreation Area. June 1998.
- Waples, Robin S., Paul B. Aebersold, Gary A. Winans. 1997. Population Genetic Structure And Life History Variability In *Oncorhynchus Nerka* From the Snake River Basin, Final Report to Bonneville Power Administration, Contract No. 1993BP05326, Project No. 199306800, 108 electronic pages (BPA Report DOE/BP-05326-1).
- Wyoming Game and Fish Department (WGFD). 2005. Wyoming Game Fish Department management activities for Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*). Wyoming Game and Fish Department, Fish Division, Casper, WY.

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The Shoshone-Bannock Tribes, March 2011

**Crystal Springs Fish Hatchery and Programs  
for Snake River Chinook Salmon  
and Yellowstone Cutthroat Trout  
MASTER PLAN**

