Sekokini Springs Natural Rearing Facility and Educational Center Master Plan

Prepared by:
Montana Fish Wildlife & Parks

Prepared for:
Bonneville Power Administration

September 2004

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September 2004

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Acknowledgements

The Sekokini Springs Natural Rearing Facility and Educational Center is funded by the Bonneville Power Administration through the Hungry Horse Dam Fisheries Mitigation Program. BPA has purchased the facilities (previously a private trout farm) on land owned by the U.S Forest Service, and has funded the installation of a gravity water routing system, spring caps to protect the small hatching facility against disease contamination, and new siding for the hatchery building.

Field research and construction leadership were provided by Jeff Lammerding and John Wachsmuth of Montana Fish, Wildlife & Parks and Beth Burren and Fred Flint of the U.S. Forest Service. A sensitive plant survey was conducted by Maria Mantas of the U.S. Forest Service. Technical advice was provided by Brad Shepard, Mark Deleray, Scott Rumsey, Clint Muhlfeld, Rob Snyder, Gary Bertellotti, George Kirsch, Jim Peterson and Tom Weaver of Montana Fish, Wildlife & Parks.

We appreciate the technical assistance provided by the U.S. Bureau of Reclamation with special thanks to Jeff McLaughlin and Jeff Peterson who provided funding for design of the spring caps and plumbing system, and a grant for the interpretive pathway. Personnel from the US Fish and Wildlife Service's Creston National Fish Hatchery, Don Edsall and Gar Holmes devoted many hours to studying the survival and growth of westslope cutthroat reared on the Sekokini Springs water sources.

Executive Summary

Westslope cutthroat trout (WCT) populations in the Flathead Subbasin have declined in recent decades due to a loss of spawning and rearing habitat, hybridization with rainbow trout, genetic introgression with Yellowstone cutthroat trout, and competition with introduced species. The current distribution of WCT in Montana has been reduced to less than 39 percent of its total historic range, and genetically pure populations are estimated to remain in only 9 percent of their native range in Montana (Shepard et al. 2003). Westslope cutthroat are listed as a Fish Species of Special Concern by the state of Montana and a sensitive species by Region I of the U.S. Forest Service. Additionally, although recently determined by the U.S. Fish and Wildlife Service to lack sufficient evidence for listing, in 1997, WCT were petitioned for coverage under the Federal Endangered Species Act, as amended.

In an effort to aid in the recovery of genetically pure WCT populations in the Flathead River drainage and to increase the abundance of WCT in their historic range, the Bonneville Power Administration purchased the existing Sekokini Springs facility (formerly used as a private trout farm on land owned by the U.S. Forest Service), to raise and release wild WCT. This proposed WCT natural rearing facility at Sekokini Springs is considered part of the Hungry Horse Mitigation Program, and would be operated by Montana Fish, Wildlife and Parks (MFWP). This facility will conserve local populations of genetically pure WCT and restore genetic diversity throughout the Flathead Watershed. MFWP plans to restore wild WCT within their historic range using a variety of tools including habitat protection and restoration, modified dam operation strategies, harvest regulations and the appropriate use of hatcheries.

In addition to providing background information about WCT in the Flathead Subbasin, this Master Plan describes methods by which Montana Fish, Wildlife & Parks intends to accomplish WCT recovery using a variety of techniques to increase their abundance while promoting genetic diversity. The Sekokini Springs site would provide created ponds and channels for rearing genetically pure donor fish whose progeny would be released to targeted restoration streams throughout the Flathead Subbasin. The site would also provide an isolation area within which wild spawners could be held for collection of milt to be infused into the state's existing WCT broodstock (MO12). An additional component of the proposed facility would include an educational center intended to promote public awareness and the conservation of native species, particularly the WCT. As part of this educational component, fish viewing windows and gazebos would be installed to allow observations of fish in a setting that intends to mimic their natural environment.

Chapter 1. Introduction

This project is part of the Hungry Horse Mitigation Program (HHMP) funded by Bonneville Power Administration (BPA). In 1991, the *Fisheries Mitigation Plan for Losses Attributable to the Construction and Operation of Hungry Horse Dam* (Mitigation Plan) was prepared by Montana Fish, Wildlife, & Parks (MFWP) and the Confederated Salish and Kootenai Tribes (CSKT) (MFWP and CSKT 1991). This Mitigation Plan provided the Northwest Power and Conservation Council (NPCC; formerly Northwest Power Planning Council (NWPPC)) with documentation of fisheries and habitat losses associated with construction and operation of Hungry Horse Dam (HHD) and a flexible strategy to mitigate for those losses. It addressed six specific program measures identified in the 1987 Columbia Basin Fish and Wildlife Program and subsequent program amendments. NPCC approved the loss statement, including annual fisheries losses of 250,000 juvenile bull trout (*Salvelinus confluentus*) and 65,000 migratory westslope cutthroat trout (WCT, *Oncorhynchus clarki lewisi*) from the Flathead Lake populations. In addition, an estimated 175,483 adfluvial WCT juveniles were lost in tributary reaches of the Hungry Horse Reservoir (HHR) and Flathead Lake due to construction and operation of the HHD (Table 1-1 and Table 1-2). The Mitigation Plan also identified 77 miles (124 kilometers (km)) of critical, low gradient spawning and rearing habitat in streams that were inundated and lost when HHR filled.

Table 1-1. Estimated Number of Adfluvial Cutthroat Juveniles Lost (standing stock) by Stream Order and Gradient Categories (for gradients less than six percent) in Tributary Reaches inundated by Hungry Horse Reservoir (lost to all spawning adults and rearing juveniles).

Stream order	Gradients (%)	Number of reaches	Length (meter)	Average number of WCT per 100m (mean)	Total calculated loss (# of fish)
2	0.4 - 1.8	4	4,770	22.7	1,083
2	2.2 - 2.6	2	4,004	56.9	2,278
2	2.8 - 3.6	5	5,370	77.6	4,167
2	4.0 - 5.8	8	5,108	31.6	1,614
3	0.6-0.6	1	8,692	22.3	1,938
3	2.6-3.8	9	9,384	25.4	2,384
3	4.3-5.9	5	4,096	43.4	1,778
4	0.9-0.9	1	3,956	5.2	206
4	2.0-3.5	4	12,874	13.5	1,738
Total		39	58,254		17,186

Source: Fisheries Mitigation Plan for Losses Attributable to the Construction and Operation of Hungry Horse Dam (1991)

Table 1-2. Estimated Number of Adfluvial Cutthroat Juveniles Lost (standing stock) by Stream Order and Gradient Categories (for gradients less than six percent) in Tributary Reaches above full pool (includes upper South Fork drainage) lost to spawning and rearing fish from Flathead Lake but available to spawners from Hungry Horse Reservoir.

Stream order	Gradients (%)	Number of reaches	Length (meter)	Average number of WCT per 100m (mean)	Total calculated loss (# of fish)
2	1.5-1.5	1	877	22.7	199
2	2.2-2.3	4	9,739	56.9	5,541
2	2.8-3.8	7	13,905	77.6	10,790
2	3.9-5.9	32	79,047	31.6	24,979
3	0.7-1.0	2	10,916	22.3	2,434
3	1.1-1.4	2	9,898	38.9	3,850
3	1.7-2.2	8	51,918	62.9	32,656
3	2.6-4.0	20	86,468	25.4	21,963
3	4.1-5.9	20	62,865	43.4	27,283
4	0.3-0.6	8	38,963	5.2	2,026
4	1.1-1.3	5	40,337	24.0	9,681
4	1.7-4.8	13	68,778	13.5	9,285
5	0.6-0.8	3	53,220	14.3	7,610
Total		125	526,931		158,297
Grand Total Table 1-1 and 1-2					175,483

Source: Fisheries Mitigation Plan for Losses Attributable to the Construction and Operation of Hungry Horse Dam (1991)

The *Hungry Horse Dam Fisheries Mitigation Implementation Plan* (Implementation Plan) was developed by MFWP and CSKT, adopted by the NWPPC in 1993, and funded by BPA. The Implementation Plan describes specific measures to protect and enhance resident fish and aquatic habitat affected by Hungry Horse Dam that do not require changes in Hungry Horse Dam Operation. Additional measures requiring operational changes were addressed separately (Marotz et al. 1996, 1999; Marotz and Muhlfeld 2000). The hatchery portion of the HHMP is transitioning to experimental culture of native species as directed by the Mitigation Plan and the Implementation Plan. The NPCC approved the plans and amended their Columbia Basin Fish and Wildlife Program (Measure 10.3A, NWPPC 1994).

A decision tree in the Implementation Plan directs the cooperating agencies to experiment with artificial propagation of native species to facilitate species restoration. Work at the Sekokini Springs site addresses artificial propagation of WCT. The site offers a unique combination of a small hatchery facility and pond habitat suitable for rearing native WCT in a controlled naturalized environment.

1.1 The Purpose of the Master Plan

The purpose of the Sekokini Springs Natural Rearing Facility and Educational Center and this Master Plan is to aid in the recovery of genetically pure WCT populations in the Flathead River drainage by increasing abundance of WCT in their historic range. This recovery can be accomplished using a variety of techniques to increase abundance of WCT and maintain genetic diversity. The Sekokini Springs site will provide rearing areas for donor fish whose progeny (as eyed eggs or juveniles) will be released to targeted restoration streams. Additionally, the site will provide isolation facilities within which wild spawners can be held for collection of milt for infusion into the existing state broodstock (MO12) to introduce additional genetic complement. The educational component of the project will promote the conservation of native species and provide the public with information on WCT and the overall mitigation program.

Westslope cutthroat populations have declined due to loss of spawning and rearing habitat, hybridization with rainbow trout (*O. mykiss*; RBT), genetic introgression with Yellowstone cutthroat trout (*O. clarki bouvieri*; YCT) and competition with introduced species (MFWP and CSKT 1991; Hitt 2002; Leary et al. 1998). The distribution of WCT was previously determined been reduced to less than 10 percent of its total historic range with unhybridized WCT populations remaining in only 2.5 percent of their native range in Montana (Liknes and Graham 1988). The species is listed as a Fish Species of Special Concern in Montana and, in 1997, WCT was petitioned for listing under the Federal Endangered Species Act of 1973, as amended (ESA). The U.S. Fish and Wildlife Service (USFWS) determined, at the time of petitioning, that listing was not warranted. However, in 2002, the USFWS was court-ordered to reevaluate this finding (see Section 2.1.1 for more details). The most recent status review indicated that WCT in Montana currently occupy 39 percent of their historic range and genetically unaltered population represent 9 percent of their former range (Shepard et al. 2003). This project was designed to mitigate for damages caused by the construction and operation of HHD and to aid in the restoration of WCT populations to help eliminate the need to list WCT under ESA in the future.

1.2 History of Sekokini Springs Facility

Sekokini Springs was formerly a private trout farm that propagated RBT for purchase by private pond owners. The site was not secure and unintentionally released RBT into the Flathead River where they hybridized with the native WCT population. Evidence suggests that RBT escaped intermittently for nearly 40 years (B. Marotz, MFWP, personal communication, January 24, 2003). The HHMP first leased the site to remove all RBT from the facility. After removing trout from the water source and performing a comprehensive analysis for fish diseases, the State fish health specialist listed the Sekokini Springs water source as safe from fish pathogens to allow for experimental culture of WCT. The onsite facilities were purchased by BPA on the U.S. Forest Service (USFS) property and a no-cost special use permit was secured for the use of the site.

Experimental hatching and rearing of WCT took place from 1997 through 1999 by personnel from the USFWS Creston National Fish Hatchery (CNFH). A small number of individuals were also reared onsite in 2001. Approximately 90,000 eyed eggs (M012 WCT) were transferred from the Washoe Park Trout Hatchery, to the Sekokini Springs facility where they were hatched and reared. Approximately 40,000 fingerling WCT (designated pure strain M012 brood source) were reared to assess the water source at Sekokini Springs (B. Marotz, MFWP, personal communication, 2003). The water source follows a natural annual flow and temperature regime that successfully raised WCT with an exceptional condition factor (Don Edsall, USFWS, personal communication). Fish were reared with automatic feeders and limited human interaction, and were outplanted to closed basin lakes.

1.3 Program Goals and Benefits

Initially, the goal of the program is to establish a successful “nearest neighbor”, genetically pure, eyed egg or fish source from donor populations. These pure source stocks will be used to reestablish wild populations in historic habitats of the Flathead River system that are presently vacant or reconditioned by habitat improvements or through removal of introduced or genetically hybridized/introgressed populations. This process will be dynamic in that new donor fish will be collected annually. As the program progresses, additional populations, from a variety of donor streams throughout the Flathead River subbasin, will be used to increase genetic diversity into outplanted streams. This goal is consistent with recommendations for genetic conservation of WCT (Leary et al. 1998) that suggests the translocation of fish or gametes from genetically pure populations from either the nearest neighbor population or a population inhabiting habitats most similar to those of the proposed restoration streams. In addition to providing pure genetic sources, the Sekokini Springs facility will have the capacity to isolate and hold wild spawners for milt collection for infusion into the state’s MO12 captive broodstock.

The WCT population in the Flathead subbasin will benefit by increasing the number of wild, genetically pure spawning populations. The Sekokini Springs Natural Rearing Facility will provide a facility to protect and enhance local stocks of pure WCT for restoration actions throughout the Flathead subbasin, and provide a facility that can isolate wild fish for enhancement of the MO12 hatchery population.

Although the practice of stocking adults in inland waterbodies has shown to be extremely successful (Hilderbrand 2002), this practice was eliminated from consideration because the goal of this program is not simply to stock streams but to initiate wild runs of individuals that are hormonally imprinted to those restoration streams in which they hatched or were transplanted as subyearlings. Evidence suggests that adults do not imprint on streams and therefore may stray if stocked in recipient streams that are not isolated by barriers. Straying increases the potential for introgression with RBT and YCT.

1.4 Relationship to Other Plans, Programs and Projects in the Region

Projects under the Hungry Horse Mitigation Plan are closely tied to accomplish overall goals of the Northwest Power and Conservation Council’s (NPCC) Columbia Basin Fish and Wildlife Authority Program. Objectives are designed to complement or co-sponsor work of associated projects and address specific problems limiting native fish stocks, including WCT, in the Flathead Basin. Mitigation projects by MFWP and CSKT have parallel charges and have worked cooperatively on several objectives during recent years. Sekokini Springs is a component of BPA project 199101903, which addresses fishery losses caused by the construction and operation of Hungry Horse Dam in the Flathead Basin. This project implements habitat restoration, fish passage improvement, off-site mitigation and monitoring pertaining to Hungry Horse Mitigation and includes enhancement and restoration at numerous tributaries in the basin. In association with this effort, BPA project 199101901 included both stream restoration projects and monitoring of waterbodies within the Flathead Basin to verify responses of native fish communities, including WCT, to Hungry Horse Dam mitigation measures.

Recently, the MFWP published the "South Fork Flathead Watershed Westslope Cutthroat Trout Conservation Program" (Grisak 2003). This program discusses methods by which numerous lakes will be chemically treated to eliminate non-native trout and introgressed WCT from historical WCT habitat. Progeny produced at the proposed Sekokini Springs facility will be outplanted into several of these lakes, in addition to several streams, upon confirmation that the lakes are devoid of non-native trout or introgressed WCT.

The Flathead River Native Trout Project is currently using radio-telemetry to identify seasonal location and movements of lake trout (*Salvelinis namaycush)*, bull trout, and WCT in the drainage. Personnel will build on the previous database to produce a biological layer to overlay on the physical framework of the Instream Incremental Flow Methodology (IFIM) study. Physical aspects of the IFIM project were directly contracted by BPA (project 199502500). This project evaluates the effects of flow fluctuations from the HHD on fish habitat, predator prey interactions, sediment deposition and fish migrations. Coordination with biological sampling is essential to complete the river model. Concurrent with population monitoring in the Flathead River tributaries, personnel are evaluating RBT and cutthroat trout interactions (genetic introgression, overlap in timing and location of spawning, etc.) in cooperation with the University of Montana.

Integrated Rule Curves (IRCs) developed for the Flathead subbasin have influenced flood control and power operations at Hungry Horse Dam. IRCs are used as a tool to balance the requirements of hydropower generation and flood control with the needs of resident and anadromous fish.

MFWP often benefits from the Streamnet project 3874700 Geographic Information Services (GIS) Unit. This GIS support group integrates Geographic Positioning System (GPS) locations and provides layers for land ownership, land use, species distribution, etc. that assist in creating detailed watershed maps. These maps are essential in planning projects and have allowed detailed analysis of the Flathead System and native trout species.

Because CSKT manages the south half of Flathead Lake and tribal lands encompass the lower Flathead Drainage, MFWP and the USFWS cooperate on several inter-jurisdictional projects with the tribe. These include all monitoring, Subbasin Planning, and management activities involving Flathead Lake and certain tributary streams. Dayton Creek restoration is one ongoing project that has been collaboratively designed with CSKT and several other groups. In the preliminary watershed assessment, MFWP completed basin-wide fish distribution and abundance surveys, installed thermographs, completed maps using MFWP's GIS support system, and made some of the initial landowner contacts.

Many of the projects include cost-shares and collaborative efforts with other agencies. For example, the BOR's Technical Assistance Program is used when engineering support is needed on projects; including the Hay Creek, Crossover Wetlands Project, Star Meadows Ponds and Wetlands Project and Sekokini Springs. MFWP also frequently co-sponsors projects with the

USFS when projects occur on land that they manage. Examples include the completed culvert improvements on HHR tributaries, Griffin Creek fencing project, and the Lion Lake chemical rehabilitation. In the Emery Creek restoration project, MFWP, Flathead National Forest, Trout Unlimited, the National Fish & Wildlife Foundation and Flathead Common Ground (a consensus building group made up of environmental, timber management, multiple-use, and agency representatives) were involved. The fish passage and stream restoration on Paola Creek is also a cooperative project among the USFS, and the National Fish & Wildlife Foundation. Other groups that have routinely cooperated on projects include local conservation districts, Montana Conservation Corps, Montana Department of Natural Resources and Conservation, and the U of M Flathead Biological Station. The Flathead Biological Station has collected useful water quality, invertebrate, and other ecological data throughout the Flathead Lake and River system. MFWP has incorporated these data, the expertise of station personnel, and contracted studies in past and current projects. In 1999, MFWP initiated a graduate study examining interactions of RBT and cutthroat trout. The results of this study indicate that hybridization between RBT and WCT is progressing upstream in tributaries within the Flathead River system, will be utilized in identifying appropriate recipient streams from Sekokini Springs.

1.5 How to Use the Master Plan

The NPCC has specific requirements for the contents of a Master Plan (Table 1-3). Specifically, the NPCC requires discussion regarding the program goals and objectives, expected benefits, impacts, alternatives, historical information and other information deemed necessary for program proponents and reviewers to make decisions.

Table 1-3. Requirements for NPCC Master Plans

In accordance with Section 7.4B of the Fish and Wildlife Program (NWPPC 1994) this Master Plan addresses: •project goals; •measurable and time-limited objectives; •factors limiting production of the target species; •expected project benefits (e.g., gene conservation, preservation of biological diversity; fishery enhancement, and/or new information); •alternatives for resolving the resource problem; •rationale for the proposed project; •how the proposed production project will maintain or sustain increases in production; •the historical and current status of anadromous and resident fish in the subbasin; •the current (and planned) management of anadromous and resident fish in the subbasin; •consistency of proposed project with Council policies, National Marine Fisheries Service recovery plans, other fishery management plans, watershed plans and activities; •potential impact of other recovery activities on project outcome; •production objectives, methods and strategies; •brood stock selection and acquisition strategies; •rationale for the number and life-history stage of the fish to be stocked, particularly as they relate to the carrying capacity of the target stream and potential impact on other species; •production profiles and release strategies; •production policies and procedures; •production management structure and process; •related harvest plans; •constraints and uncertainties, including genetic and ecological risk assessments and cumulative impacts; •monitoring and evaluation plans, including a genetics monitoring program; •conceptual design of the proposed production and monitoring facilities, including an assessment of the availability and utility of existing facilities; •cost estimates for various components, such as fish culture, facility design and construction, M&E, and O&M.

1.6 Where to Find More Information

- U.S. Department of Agriculture (USDA) Forest Service Special-Use Permit for Sekokini Springs Facility issued to the Montana Fish, Wildlife and Parks (Appendix A)
- Memorandum of Understanding and Conservation Agreement for Westslope Cutthroat Trout (*Oncorhynchus clarki lewisi*) in Montana (MFWP 1999)
- Draft Flathead Subbasin Summary (CSKT and MFWP 2001) and Flathead Subbasin Plan (CSKT and MFWP 2004)
- Water Temperature and Temperature Units, Sekokini Springs Natural Fish-Rearing Project – Progress Report: July 23, 1997 – March 31, 1998 (Appendix C)
- Montana Fish, Wildlife & Parks Hatchery and Genetic Management Plan – Resident Fish Edition for the Sekokini Springs Natural Fish Rearing Facility (Appendix J)
- Fisheries Mitigation Plan for Losses Attributable to the Construction and Operation of Hungry Horse Dam (MFWP and CSKT 1991)
- Hungry Horse Dam Fisheries Implementation Plan (MFWP and CSKT 1993)
- Hungry Horse Dam fisheries mitigation 1992-93 biennial report (MFWP et al. 1994)
- 1993-94, 1995, and 1996 kokanee stocking and monitoring reports (Deleray et al. 1995, Hansen et al. 1996, Carty et al. 1997)
- Hungry Horse Mitigation: aquatic modeling of the selective withdrawal system at Hungry Horse Dam, Montana (Marotz et al. 1994)
- Model development to establish integrated operational rule curves for Hungry Horse and Libby Reservoirs, Montana (Marotz et al. 1996)
- Fish passage and habitat improvement in the upper Flathead Basin (Knotek et al. 1997)
- Fish and habitat monitoring in the upper Flathead Basin (Deleray et al. 1999),
- Seasonal distribution and movements of native and non-native fishes in the upper Flathead River system (Muhlfeld et al. 2000)
- Status Review for Westslope Cutthroat Trout in the United States (USFWS 1999)
- South Fork Flathead Watershed Westslope Cutthroat Trout Conservation Program (Grisak 2003)
- Hybridization Between Westslope Cutthroat Trout (*Oncorhynchus clarki lewisi*) and Rainbow Trout (*O. mykiss*): Distribution and Limiting Factors (Hitt 2002)
- Mitigation for the construction and operation of Libby Dam: Annual Report 2000 (Hoffman et al. 2002).
- Determination of Fishery Losses in the Flathead System Resulting From the Construction of Hungry Horse Dam (Zubik and Fraley 1986)
- Genetic Conservation of the Westslope Cutthroat Trout in the Upper Missouri River Drainage (Leary et al. 1998)

Information from these and other pertinent documents is summarized in the Master Plan.

1.7 Organization of the Chapters

This Master Plan contains the information necessary for the NPCC, program proponents and others to make informed decisions regarding the proposed Sekokini Springs Natural Rearing Facility program.

- Chapter 2 describes the need for the program
- Chapter 3 describes the proposed alternative and alternatives considered
- Chapter 4 contains a description of the current and planned production procedures and policies for the program
- Chapter 5 contains life history and other technical information for Flathead River westslope cutthroat trout
- Chapter 6 describes the factors limiting natural production of Flathead River westslope cutthroat trout
- Chapter 7 contains the references used to prepare this document
- Chapter 8 contains a list of acronyms and a glossary
- Appendices provide technical support documents for the proposed program

Chapter 2. Need for the Project and Consistency with Existing Plans and Agreements

2.1 Need for Action

Seventy seven miles (124 km) of high quality, low gradient spawning and rearing habitat were lost due to inundation when Hungry Horse Reservoir filled (Zubik and Fraley 1986). The dam was completed in September 1952, and is operated for flood control and power production. The dam eliminated access to about 42 percent of the traditional spawning grounds in the South Fork for westslope cutthroat and bull trout. Erratic flow releases further eliminated wetland habitat and left shorelines barren of riparian vegetation.

In total, habitat degradation and fish passage barriers have eliminated nearly 60 percent of the habitat once available to native westslope cutthroat and bull trout in the Flathead watershed upstream of Flathead Lake (Fraley et al. 1989). The HHMP goal is to partially mitigate these habitat losses by protecting remaining habitat, and by restoring and reconnecting damaged habitats. In certain areas, there is a need to reestablish pure populations of WCT in the restored habitat.

As part of the Hungry Horse Dam mitigation program, the Sekokini Springs Natural Rearing Facility and Educational Center Project is planned as a multiphase project to promote the conservation of native, genetically pure WCT. The goal of the project is to preserve the genetic integrity and wild behavioral traits of WCT in the Flathead Subbasin and to aid in the restoration of WCT in their historic range within the Flathead Subbasin. The educational component of the project will promote the conservation of native species and provide the public with information on WCT and the overall mitigation program.

The Sekokini Springs site will be used in the restoration of WCT in the Flathead Drainage by preserving and replicating pure genetic stocks from donor populations within the Flathead Watershed to preclude potential listing under the ESA. Wild juveniles from endemic donor populations would be raised in created natural rearing habitat at the site to preserve behavioral traits and provide gametes for reestablishing F1 (first generation) progeny in selected areas where the species has been impacted or extirpated. The site will also conserve remnant populations that are threatened by nonnative species or environmental damage.

2.1.1 Status of Westslope Cutthroat Trout in Montana

In Montana WCT populations occupy a small percentage of their historic range (MFWP and CSKT 2000; Liknes and Graham 1988). The species has been listed as a Fish Species of Special Concern in Montana and a sensitive species by Region I of the USFS. In 1997, WCT was petitioned for listing under the ESA. In 1998, the USFWS determined that listing was not warranted at the time of petitioning. In response to an October 2000 lawsuit filed by petitioners claiming the USFWS was arbitrary and capricious in its “not warranted for listing” decision, on March 31, 2002, a federal court ordered that the USFWS must re-evaluate its “not warranted” finding. The USFWS was given 12 months for this re-evaluation of whether to list the WCT as a threatened species due to threats from hybridization (Grisak 2003). The re-evaluation of whether or not to list the WCT was published August 7, 2003 (FR 68 46989-47009). The reconsidered findings included a new status review for the species (Shepard et al. 2003) and concluded that the WCT is actually more abundant in its historic range than indicated in the 1999 status review. Genetically unaltered WCT currently occupy 9 percent of their historic range in Montana (Shepard et al. 2003). Therefore, the USFWS determined, again, that the WCT is not warranted for listing at this time.

Nonnative species or environmental damage in some locations threatens remnant populations of genetically pure WCT, creating a need to conserve the genetic integrity and diversity of the species. Genetic inventories of existing stocks of WCT have revealed that hybridized/introgressed populations in headwater lakes are threatening pure populations downstream. Lake rehabilitation has been initiated as one way to remove this threat to pure native stocks.

Recent studies have determined hybridization of WCT and RBT has occurred in 55 and 56 percent of sites studied at the North and Middle forks of the Flathead River, respectively. Temporal comparisons of these results indicate that hybridization has spread upstream within North Fork tributaries since 1984 (Hitt 2002).

2.1.2 Flathead River

The Flathead River is a major tributary of the Columbia River whose drainage encompasses 5,399,040 acres (13,576 km^2) in northwest Montana (Deleray et al.1999; Figure 1). Principal tributaries of the Flathead River are the North Fork Flathead, Middle Fork Flathead, South Fork Flathead, Stillwater, Swan and Lower Flathead rivers; and Flathead Lake. Historically, WCT are believed to have occupied all of the streams and lakes to which they had access in the Flathead River Subbasin (MFWP 1998). The Sekokini Springs facility is located near the mainstem Flathead River, within which genetically pure WCT abundance has shown a steady decline in recent years (CSKT and MFWP 2001). Genetic introgression and competition with nonnative trout species has also been documented in tributaries of the Flathead River Subbasin (Hitt 2002). Although the State's captive brood stock is available to reestablish WCT in many areas, a source of genetically pure WCT from "nearest neighbor" wild sources within the Flathead River Subbasin is desired to replace certain populations locally.

Detailed information regarding Flathead River WCT life history is presented in Chapter 5.

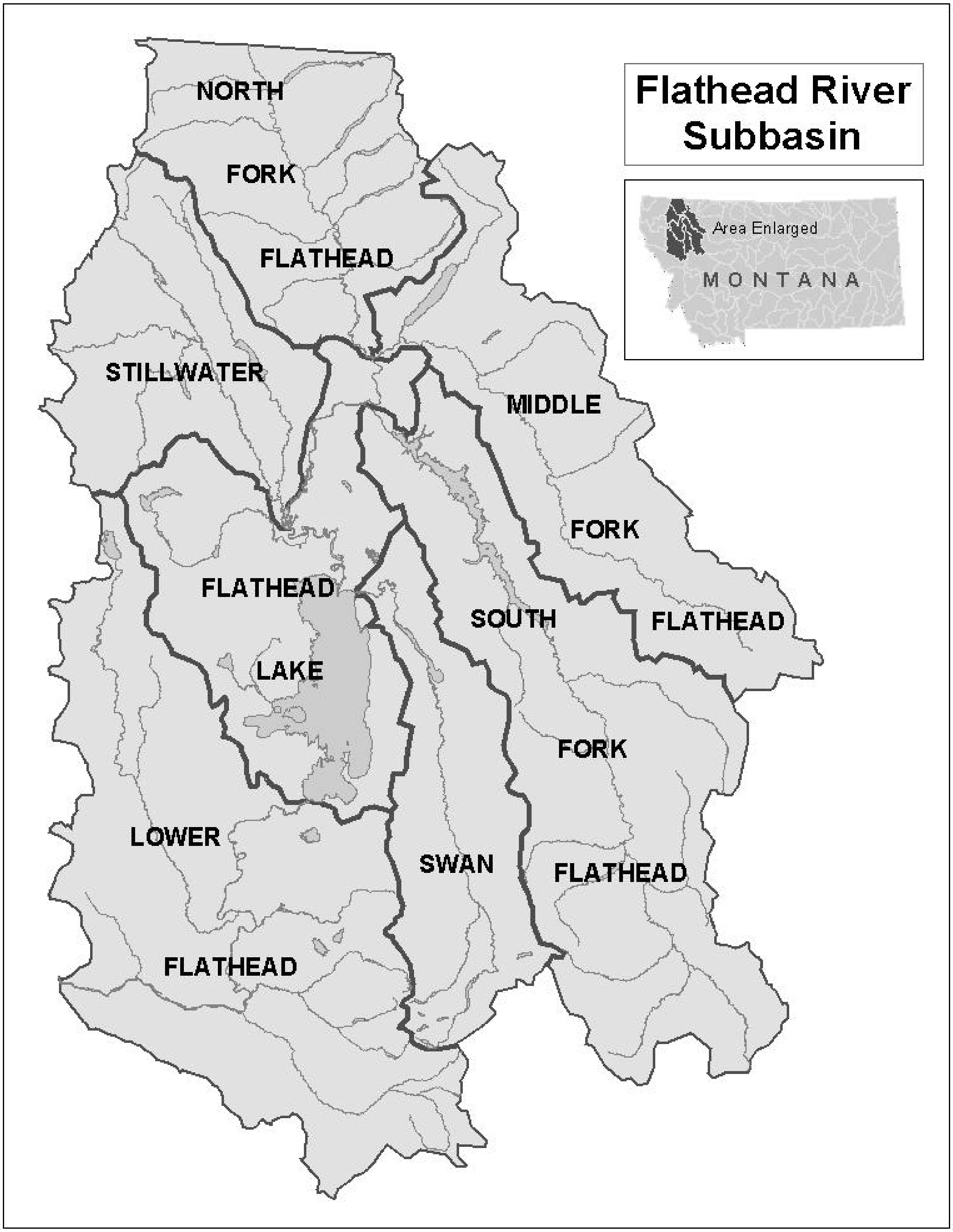


Figure 1. Location of the Flathead River Subbasin and Major Tributaries

2.1.3 Biodiversity and Productivity

As part of the Flathead Subbasin Planning process, fisheries and land management authorities assessed the quality of habitat throughout the watershed. The group used the Quality Habitat Assessment model (QHA) and data on the historic and current distribution of WCT and genetic purity. WCT have declined within their historic range in the Flathead River and its tributaries due to habitat degradation, barriers to fish migrations and negative interactions with nonnative fish species. Remaining populations of genetically pure WCT tend to occur in areas that are cold, nutrient poor, and isolated from nonnative fish species by natural or man-caused barriers. Restoration actions completed by the HHMP have increased spawning runs and increased the number of redds in previously blocked areas. Natural mortality of adults during the spring spawning run most likely contributes to river nutrient levels and nitrogen content.

2.1.4 Residents of Montana Harvest Needs

In addition to the need for preservation of natural resources, including rivers and native species, sport fishing is vital to Montana's economy. Results from the 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation indicate that anglers, 16 years old and older spent over $292 million on fishing expenses in Montana during 2001 (U.S. Department of Interior et al. 2003). Based on 1997 angling estimates, the recreational fishery is worth $4.65 million in direct expenditures to the local economy (MFWP and CSKT 2000). Over two-thirds of those expenditures were made by nonresident anglers. That spending, in turn, resulted in a total economic impact of an estimated $300 million, providing an estimated 5,800 Montana residents with jobs. Additionally these revenues provide necessary funds for educational programs that encourage an understanding of aquatic riparian ecosystems for all citizens (MFWP brochure). Although Montana's current WCT angling policy is one of catch and release, anglers continue to fish for this species, contributing to the fishery-related economy in the form of equipment sales and rentals, fish licenses, etc.

In addition to economic and educational values that fisheries provide for Montana residents, fishing and hunting are part of the lifestyle of residents and are cultural activities that need to be preserved.

2.1.5 The Confederated Salish and Kootenai Tribe's Need

The southern half of Flathead Lake lies within the Flathead Reservation of the CSKT, a sovereign nation, composed of members from the Salish, Pend d'Oreille, Kalispel and Kootenai Indians. Native fish have been historically significant to the survival of the native people in the Flathead Nation, and are an integral part of their spiritual and cultural lives.

Although CSKT harvest would likely benefit from increased WCT production, the facility is outside of CSKT reservation borders and the Tribe would not participate in facility management. The CSKT is a collaborator on the Hungry Horse Mitigation Plan, and has been consulted during the initial planning of this project.

2.1.5.1 Fish to Fulfill Treaty Rights

The Hellgate Treaty guaranteed the Tribes the "exclusive right of taking fish in all streams running through or bordering" the Reservation. Several court decisions have affirmed the Tribes' jurisdiction over fisheries management in the portion of Flathead Lake that lies within Reservation boundaries.

2.2 Existing Plans, Agreements and Best Available Science

2.2.1 Goals and Objectives for the Hungry Horse Mitigation Program

The goal of the HHMP is to mitigate fisheries losses attributable to the construction and operation of Hungry Horse Dam. Council approved fisheries losses include 65,000 juvenile WCT annually, to be restored using a combination of habitat restoration, dam operation changes, harvest management and experimental hatchery techniques.

2.2.2 Consistency with Conservation Agreement for WCT

The goal for this project, the restoration of WCT is historic ranges of the Flathead River Subbasin using genetically pure indigenous stocks, is consistent with the Westslope Cutthroat Trout Conservation Agreement [1999, Memorandum of Understanding (MOU)], which states the following:

> *The management goal for westslope cutthroat trout in Montana is to ensure the long-term, self-sustaining persistence of the subspecies within each of the five major river drainages they historically inhabited in Montana (Clark Fork, Kootenai, Flathead, upper Missouri, and Saskatchewan), and to maintain the genetic diversity and life history strategies represented by the remaining local populations.*

A primary objective of the MOU is to protect all genetically pure (100 percent of tested individuals, through genetic analysis, show no evidence of hybridization or introgression with other species or subspecies) WCT populations to ensure the long-term persistence of the species within their native range. Within the Flathead River Subbasin, the native range of WCT consists of at least two geographically separate interconnected metapopulations, each occupying at least 50 miles (80.5 km) of connected habitat (MFWP 1999). The goal of the MOU is to ensure that population aggregates persist, with at least one of the local populations remaining viable for a period of more than 10 years (2-3 generations of fish). Once a population becomes viable, monitoring at a frequency of at least once every 10 years must be done to document its persistence. According to the Conservation Agreement, each tributary that supports WCT, regardless of length, is considered a population.

2.2.3 Consistency with Landscape Approach to Artificial Production

The Sekokini Springs facility will focus on rearing WCT in an environment that incorporates elements of the natural environment and that attempts to maintain wild behavioral traits while preserving the genetic integrity of various populations throughout the Flathead Subbasin.

Several components of the facility reflect the theoretical concepts presented in a recent publication by Williams et al. (2003) entitled "Integrating artificial production with salmonid life history, genetic, and ecosystem diversity: a landscape perspective." The paper presents ways of managing artificial production activities from an ecosystem approach, integrating the needs of the target species during and after release from the production facility. The Sekokini facility is in line with the Landscape Approach (LA) in that its design and rearing environment is consistent with the surrounding ecosystem and its attributes. For example, rearing units have been designed as ponds, with natural substrate and cover in the littoral zone that mimicks the natural environment. The site has stream environments upstream and downstream of the rearing ponds that will be restored to conditions in local reference streams. In addition, natural feed will be used to supplement diets, overhanging vegetation will mimic riparian shading habitat, and artesian spring sources provide an annual thermal regime that is similar to WCT streams in nature. These methods will attempt to minimize domestication, producing fish that are as genetically and ecologically similar to wild WCT as possible.

In line with recommendations of the LA, the Sekokini Springs natural rearing facility is not a traditional broodstock production facility in which fish are mass-produced, and the success of the facility will not be measured on the number of fish that are released. Only limited numbers of fish will be reared at the facility, each lot representing a unique genetic strain from wild donor populations throughout the Flathead Subbasin. Once fish (or eyed eggs) are stocked, in numbers not surpassing the natural carrying capacity of streams that are targeted for WCT recovery, MFWP intends to monitor the success of these stockings based upon the reproductive success of outplanted juveniles using the most recent otolith, or other, marking techniques.

The Sekokini Springs facility will operate congruously with WCT restoration actions undertaken by the HHMP and fish populations replicated at the facility will be released into habitat historically occupied by WCT. These habitats include areas recovered through habitat and passage improvements or through the eradication of non-native species. Facility managers and the MFWP will continue to perform genetic studies on WCT in Flathead Subbasin streams to determine the most appropriate locations for recovery and enhancement of 100% pure WCT populations.

Chapter 3. Proposed Alternative and Other Alternatives

3.1 Criteria Used to Develop and Screen Alternatives

During initial project development, including the formation of goals and objectives for the WCT restoration program, co-managers, including members from MFWP, USFWS, and CSKT, determined that the following criteria are key ingredients to establishing a facility that will meet the needs of recovery efforts for the WCT:

- Facility must have access to an isolated groundwater source that varies in temperature over the year (to allow for fish pathogen-free incubation, rearing and otolith marking)
- Facility must have the option of natural-rearing to produce a parental generation that closely resembles naturally-reared counterparts; natural rearing includes substrate and cover that mimics the natural environment, natural thermal exposure and photoperiod, low density rearing and natural supplemental feed
- Facility must allow for educational opportunities that allow viewing of WCT in a natural setting

3.2 Alternatives

Two alternatives were considered for meeting the program needs:

- Use of the Washoe Park Trout Hatchery - State's MO12 captive broodstock
- Develop the Sekokini Springs site (Proposed Alternative)

3.2.1 Use of the Washoe Park Trout Hatchery - State's MO12 Captive Broodstock

A new hatchery building and public education center, consisting of an aquarium with a "living stream," has made the Washoe Hatchery (shown in Figures 2 and 3) one of the leading aquaculture educational facilities in the state. The hatchery has variable water temperatures from two spring water sources and from two wells with different water temperatures, and has the capability of mixing the water sources to get a wide range of temperatures. With the exception of a natural-rearing environment, the Washoe Park Trout Hatchery meets the screening criteria for the proposed program, although it is located over 200 miles (322 km) from the Flathead Subbasin. Although natural rearing techniques are not currently utilized at the existing facility, it is likely that facilities could be modified, if necessary, to meet screening objectives. The facility currently does not have the capacity to isolate unique genetic strains from specific donor populations in the Flathead Watershed.

The genetic composition of captive WCT broodstock (MO12) reared at the Washoe Park Trout Hatchery was established with the first spawn of captive WCT in 1983/84 (Grisak 2003). The parental stock included 4,600 genetically pure WCT collected from 12 streams in the South Fork Flathead and 2 tributary streams to the Clark Fork River. On-going genetic testing of the MO12 stock confirms that it is genetically variable and has no introgression. While genetic diversity is ideal, the MO12 stock had not been infused with wild gametes until 2003 and the existing strain is primarily a captive broodstock derivative.

Figure 2. Washoe Park Trout Hatchery (photo source: www.bigstack.com).

Leary et al (1998) suggest that MO12 broodstock could be used to supplement populations throughout the state if wild gametes are introduced into the broodstock. Because live fish cannot be transported into Montana state hatcheries, gametes or milt are the preferred options for infusion of new genetic material (M. Sweeney, MFWP, personal communication, March 4, 2003). In 2003, MFWP collected milt from wild males in Quintonkon and Deep Creeks (South Fork Flathead River) for infusion into the Montana captive broodstock (MO12) held at Washoe Park Trout Hatchery. Wild males were temporarily held in isolation (separate water source) at Sekokini Springs. Although these source populations have a history of pathogen-free status through disease testing, all male fish were sacrificed for additional disease testing after milt was collected. This milt collection strategy will occur again in 2004 and intermittently throughout the life of the Sekokini Springs project, when co-managers determine there is a need for additional infusion of wild genes into the state's captive broodstock.

Although geneticists have designated the MO12 broodstock as suitable for use in WCT restoration throughout the state of Montana, especially in waters previously planted with MO12s, geneticists also recognize the value of replicating genetically distinct WCT populations to preserve diversity across the historic range (B. Marotz, MFWP, personal communication, March 5, 2003). As identified in the Conservation Agreement (MFWP 1999) each tributary that supports WCT regardless of length constitutes a population, and all genetically pure populations are to be protected. Exclusive use of the MO12 stock will not achieve this objective.

Figure 3. Westslope cutthroat trout in natural habitat at Washoe Park Trout Hatchery (photo source: www.bigstack.com).

3.2.2 Use Sekokini Springs site (Proposed Alternative)

The Sekokini Springs facility will be used to establish varying sources of genetic material to restore populations with different genetic complements than the MO12 stock. These stocks will be reared to avoid domestication using a variety of rearing techniques including: native substrate, floating cover, submerged structures, and natural feed supplementation in rearing ponds utilized to rear donor fish and F1 juveniles. The intent is to produce fish that are as similar to their wild counterparts as possible. The Sekokini Springs facility will be innovative by incorporating natural rearing environments, to the extent possible, and enhancing WCT populations through rearing of multiple unique genetic populations over time.

3.3 Proposed Alternative

The proposed alternative will modify the existing hatchery facilities at the Sekokini Springs site for use as a WCT experimental rearing and isolation facility. Modification of the existing facilities will make it possible to meet the goals of this project, including assisting with the conservation of WCT. The program goal for the Sekokini Springs Natural Rearing Facility is to provide genetically pure WCT following the nearest neighbor concept for stocking of restored or newly reconnected habitat. Anticipated production numbers for the Sekokini Springs program are presented in Table 3-1. To assess the potential for the Sekokini Springs facility to successfully rear WCT, experimental trials were conducted with the MO12 stock of WCT in 1997-1999 and 2001. The result of experimental rearing of WCT has successfully demonstrated, over several seasons, that the water sources at Sekokini Springs are suitable for an experimental conservation rearing program.

Table 3-1.Anticipated Production of Westslope Cutthroat Trout at Sekokini Springs by Life-stage.

Production Stage Criteria	Parameter	Number
Number of juveniles to collect per population	up to 1,000	
Juvenile survival to spawn	67%	
Fish health sampling	60	
Number of juveniles surviving to spawn	630	
Ratio of males to females	1:1	
Number of females	315	
% spawn at age 3	37%	115
% spawn at age 4	59%	185
% spawn at age 5	63%	200
Fecundity per female		
age 3	500	57,500
age 4	1,000	185,000
age 5	1,200	240,000
Number of green eggs produced	482,500	
Green to eyed egg survival	65%	
Total eyed egg production per population	313,625	
Eyed egg distribution by Stocking Program		
RSI's	25%	78,406
Artificial Redds	20%	62,725
Smolt Release	55%	172,494
Number of eyed eggs surviving to fry		
RSI's	60%	47,044
Artificial Redds	10%	6,273
Smolt or Imprint fingerling release program	75%	129,371
Number of fry surviving to 4 inch smolt for release	85%	109,965
Assumptions: Production for each population will occur over 3 years assuming fish will mature between age 3 and 5. Fecundity based on MO12 for age 3 and 4 (Sweeney 2003 pers. comm.), age 5 estimated. Ratio males to females based on MO12 (Sweeney 2003 pers. comm..). Age at maturity estimated based on combination of MO12 observations and wild population information (Gresswell 1988). Survival to spawn based on MO12 (Sweeney 2003 pers. comm.). Egg, fry and smolt survival based on MO12 (Sweeney 2003 pers. comm.).		

The Sekokini Springs site was chosen for the native species recovery program because the site offers a unique combination of fish pathogen free spring water sources, land area for developing natural habitat for onsite restoration work, areas for incorporation of educational components, and existing infrastructure.

Sekokini Springs can provide an isolation facility (separate effluent management) to hold wild fish until they can be tested for fish pathogens and genetic purity. The site contains four artesian springs of two distinct water temperatures that afford the opportunity for rearing native trout under varying water temperature regimes and for otolith marking.

Initially, one genetic strain of pure WCT will be collected, reared and spawned for reintroduction to habitats that are currently being restored and rehabilitated to remove non-native brook trout (Haskill Creek Project).

3.3.1 Sekokini Springs Site Investigations and Conceptual Design

Site Characteristics

The Sekokini Springs site is located in Flathead County about 10 miles (16.1 km) northeast of Columbia Falls, Montana (T. 31 N., R. 19 W., Sec. 17, Hungry Horse, Montana Quadrangle). The site is located on 10.446 acres of USFS managed land in the northern part of Flathead County between Bad Rock Canyon just east of Columbia Falls and the town of West Glacier. Access to the site is from the west by the North Fork and Blankenship Roads and from the east by State Highway 2 and Blankenship Road (Figure 4). State Highway 2 is the primary route to Glacier National Park with upwards of 1 million people per year traveling through the area to the park. A private road turns south, crosses an adjacent landowner's property for approximately 0.1 miles (0.15 km), and then enters the project property managed by the USFS.

This site has been extensively modified by past land use practices and has been operated as a private trout farm for over 40 years, as supported by a Department of Agriculture water right held for the site dated February 14, 1955. The existing system of ponds, outlet structures, piping and linear ditches were apparently constructed by the previous owner to support trout farm operations. Existing site improvements consist of nine excavated earthen ponds, two sediment ponds, a hatchery building and associated infrastructure. Several of the existing ponds are presently drained, while others maintain a relatively stable water surface elevation. The water surface elevation in most of the ponds is controlled by outlet structures, which use wooden dam boards for control.

Land Ownership

A Special-Use Permit has been issued to the MFWP for the purpose of "maintaining and operating a fish hatchery with the necessary approved buildings: including the residence contained within the hatchery building, water transmission lines, and internal road system." This permit will expire on December 31, 2007. MFWP has a recorded easement for the access road across the private property dated April 22, 1998 (Appendix A). The site included in the special use permit does not have frontage on the Flathead River. The current permit excludes the strip of land between the river and the site acreage. This permit will be revised to include the site usages as proposed in this Master Plan.

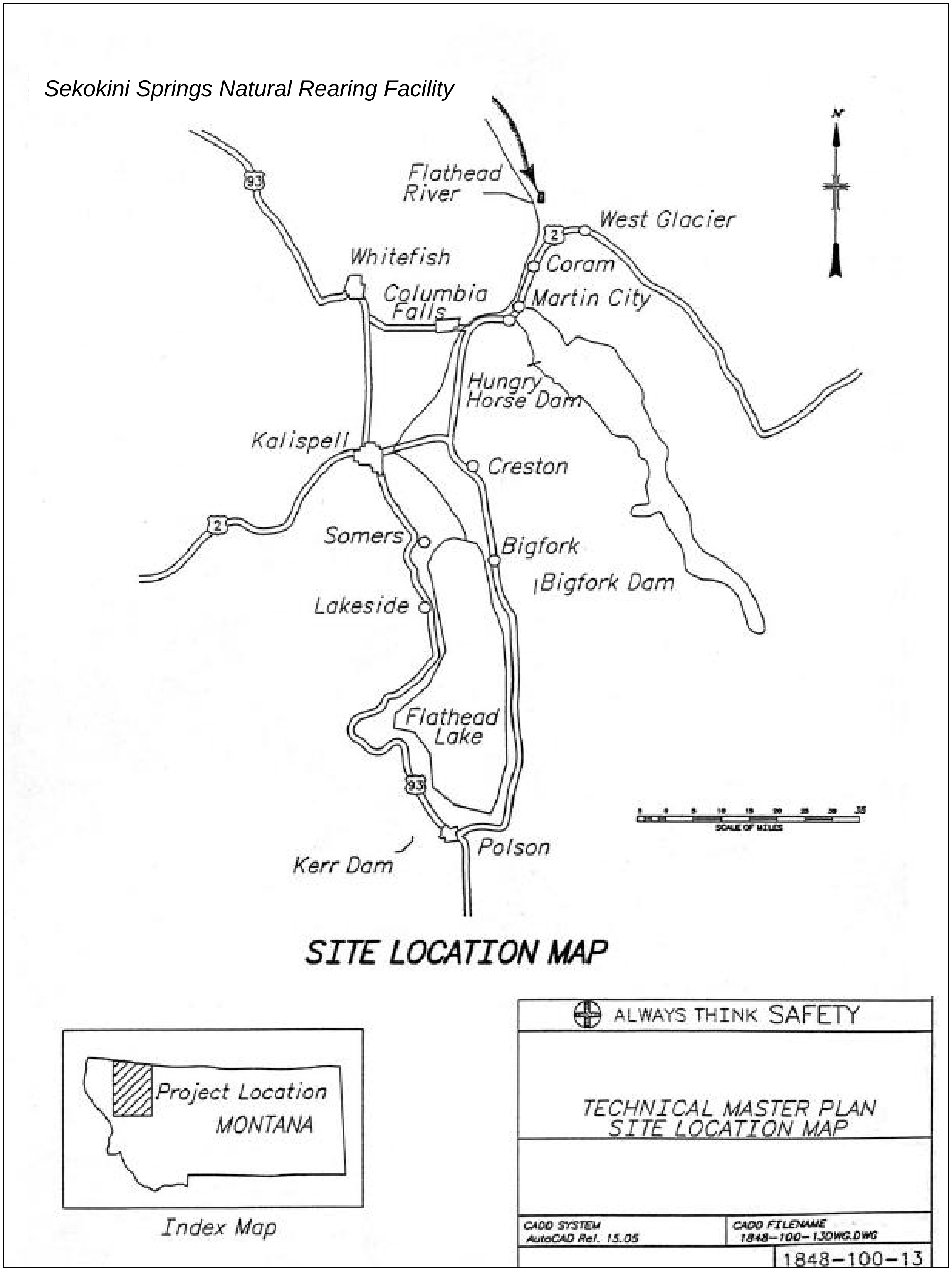


Figure 4. Sekokini Springs Site Location Map

River Designation

The Flathead River corridor is designated as a wild and scenic river under the 1968 federal Wild and Scenic Rivers Act. There are three levels of protection for rivers under the law. Rivers or sections of river may be designated as wild, scenic, or recreational areas. This particular reach of the river is protected as a recreational river corridor, which affords protection but still allows for site improvements to be made as long as there is minimal visual impact. An informal meeting was held with the USFS on the site and there were no objections voiced concerning visual impacts.

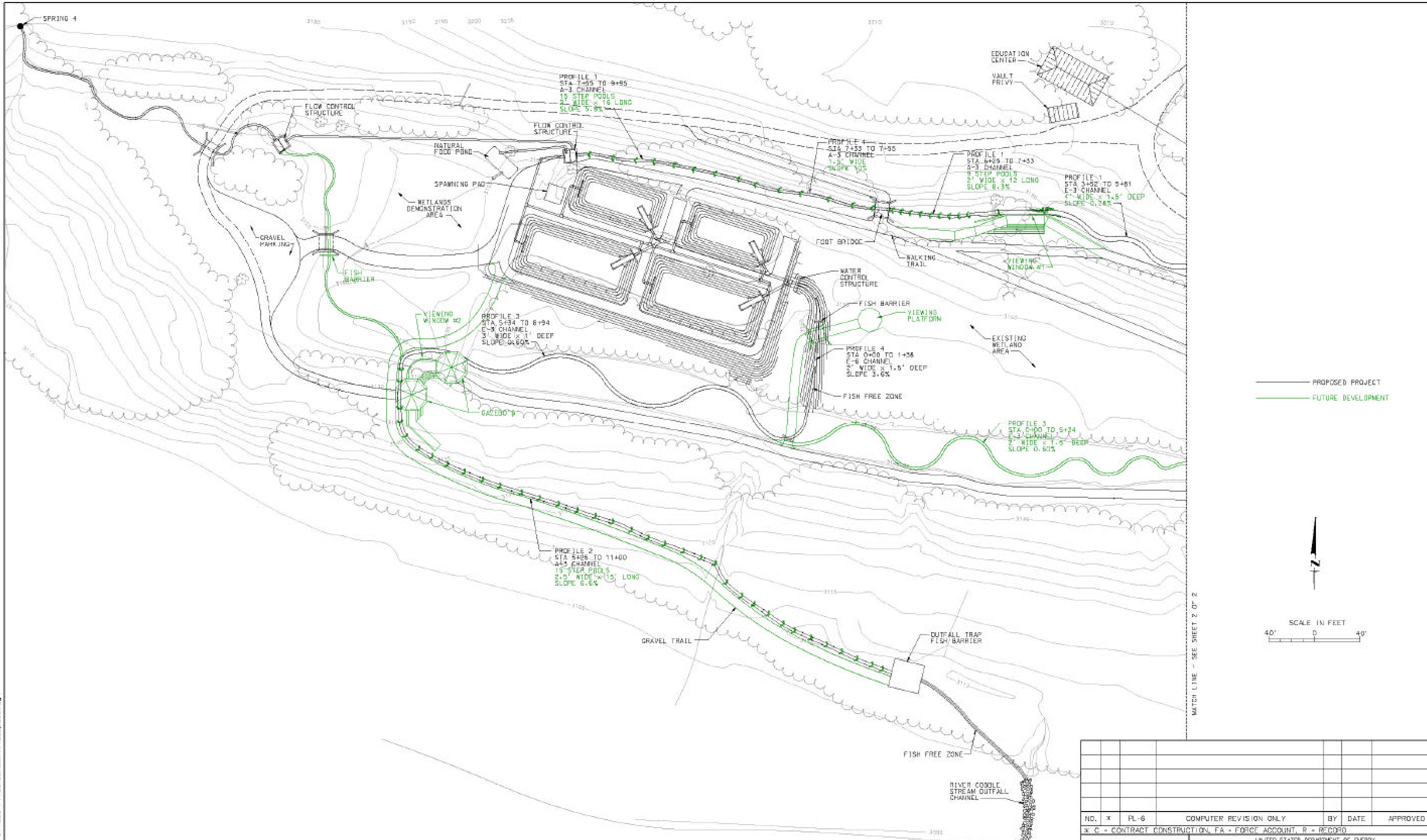
Groundwater Supply and Current Use Pattern

Four natural springs occur on the subject property. Springs 1, 2 and 3 are located near the existing hatchery building and the fourth spring is located in the northwest corner of the site (Figure 5A & 5B). Geologic studies conducted in support of the proposed project indicate that the general trend of both surface and groundwater flows appears to be from the kettle lakes (glacially formed, deep, spring fed lake) located northeast of the site at elevations 3,265 to 3,256 feet (ft), towards the Flathead River located along the southwest side of the subject property at 3,100 ft in elevation. The on-site springs daylight at an approximate elevation of 3,200 ft. Springs 1, 2 and 3 have been capped using pre-cast concrete collector boxes with valves and overflow pipes. Springs 1-3 have been captured into spring boxes, and plumbing from the springs to the hatchery building has been installed. A naturally eroded bypass channel carries the remainder of flows to the settling pond and then through pipes to erosion channels that lead to the Flathead River. Spring 4 will be utilized to feed the constructed creek reach (Profile 2) from a point where the stream channel heads down gradient to the river (Figure 5A).

The combined flows from springs 1-3 vary seasonally between 0.75 and approximately 6 cubic ft per second (cfs). Water flow for the proposed facilities from springs 2 and 3 are estimated at 4 cfs**.** Estimated flow from spring 4 ranges from .25 to 2.0 cfs. Once the facility is operational, flows from the springs will be routinely monitored.

Water quality samples taken on November 1, 2001, showed that all measured parameters are below levels known to be harmful to fish (Appendix B).

Water temperatures for the four springs that flow onto the site were measured between July 23, 1997 and March 31, 1998 (Appendix C). Springs 2, 3 and 4 showed seasonal fluctuation, with high temperatures in July/August and declining throughout the sampling period (Figure 6). Spring 4 demonstrated a much more erratic fluctuation in temperature than the other springs. Seasonal fluctuation varied as much as 22 degrees (F). Spring 1 was the most stable with only a 3 degree (F) fluctuation recorded. Spring 1 did show a warming trend from July into January that did not occur with the other springs (Figure 6).



NO.	*	PL-6	COMPUTER REVISION ONLY	BY	DATE	APPROVED

* C = CONTRACT CONSTRUCTION, FA = FORCE ACCOUNT, R = RECORD

DSGN JDN
DRWN SLS/ACB
CHKD JDN
REVW
CNCR
APPR
PLOT DATE $DATE$

UNITED STATES DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION
HEADQUARTERS, PORTLAND, OREGON

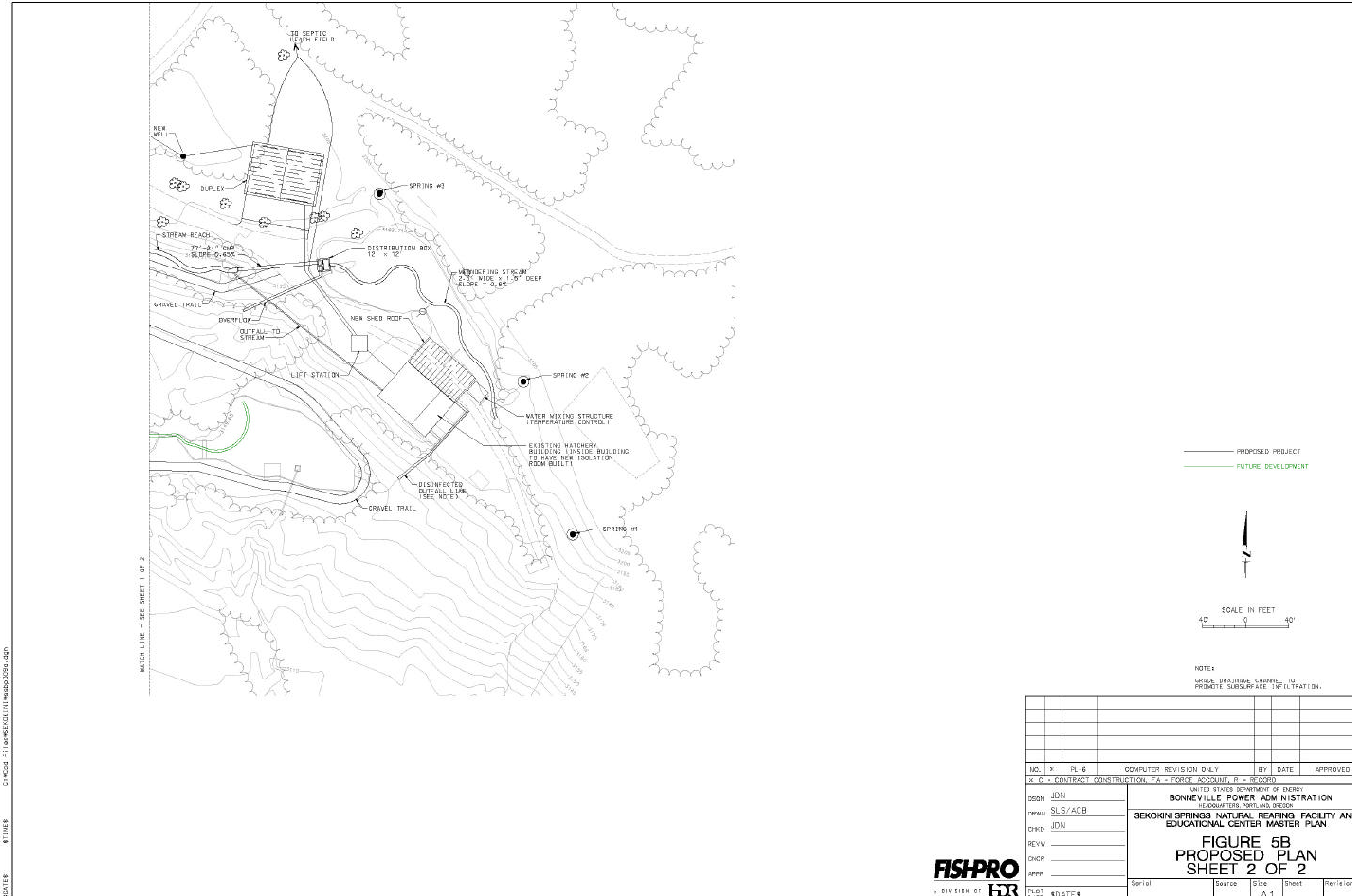
SEKOKINI SPRINGS NATURAL REARING FACILITY AND EDUCATIONAL CENTER MASTER PLAN

FIGURE 5A
PROPOSED PLAN
SHEET 1 OF 2

Serial	Source	Size	Sheet	Revision
		A1		

FISHPRO
A DIVISION OF HDR

$DATE$ $TIME$ C:\Cad Files\SEKOKINI\sdbp009.dgn


TO SEPTIC LEACH FIELD
NEW WELL
DUPLEX
SPRING #3
STREAM REACH
77'-24" CMP SLOPE 0.65%
DISTRIBUTION BOX 12' x 12'
WANDERING STREAM 2-6' WIDE x 1.5' DEEP SLOPE = 0.8%
GRAVEL TRAIL
OVERFLOW
OUTFALL TO STREAM
NEW SHED ROOF
LIFT STATION
SPRING #2
WATER MIXING STRUCTURE (TEMPERATURE CONTROL)
EXISTING HATCHERY BUILDING (INSIDE BUILDING TO HAVE NEW ISOLATION ROOM BUILT)
DISINFECTED OUTFALL LINE (SEE NOTE)
GRAVEL TRAIL
SPRING #1
MATCH LINE - SEE SHEET 1 OF 2
PROPOSED PROJECT
FUTURE DEVELOPMENT
N
SCALE IN FEET
40' 0 40'
NOTE:
GRADE DRAINAGE CHANNEL TO PROMOTE SUBSURFACE INFILTRATION.
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UNITED STATES DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION
HEADQUARTERS, PORTLAND, OREGON
SEKOKINI SPRINGS NATURAL REARING FACILITY AND EDUCATIONAL CENTER MASTER PLAN
FIGURE 5B
PROPOSED PLAN
SHEET 2 OF 2
Serial | Source | Size A1 | Sheet | Revision
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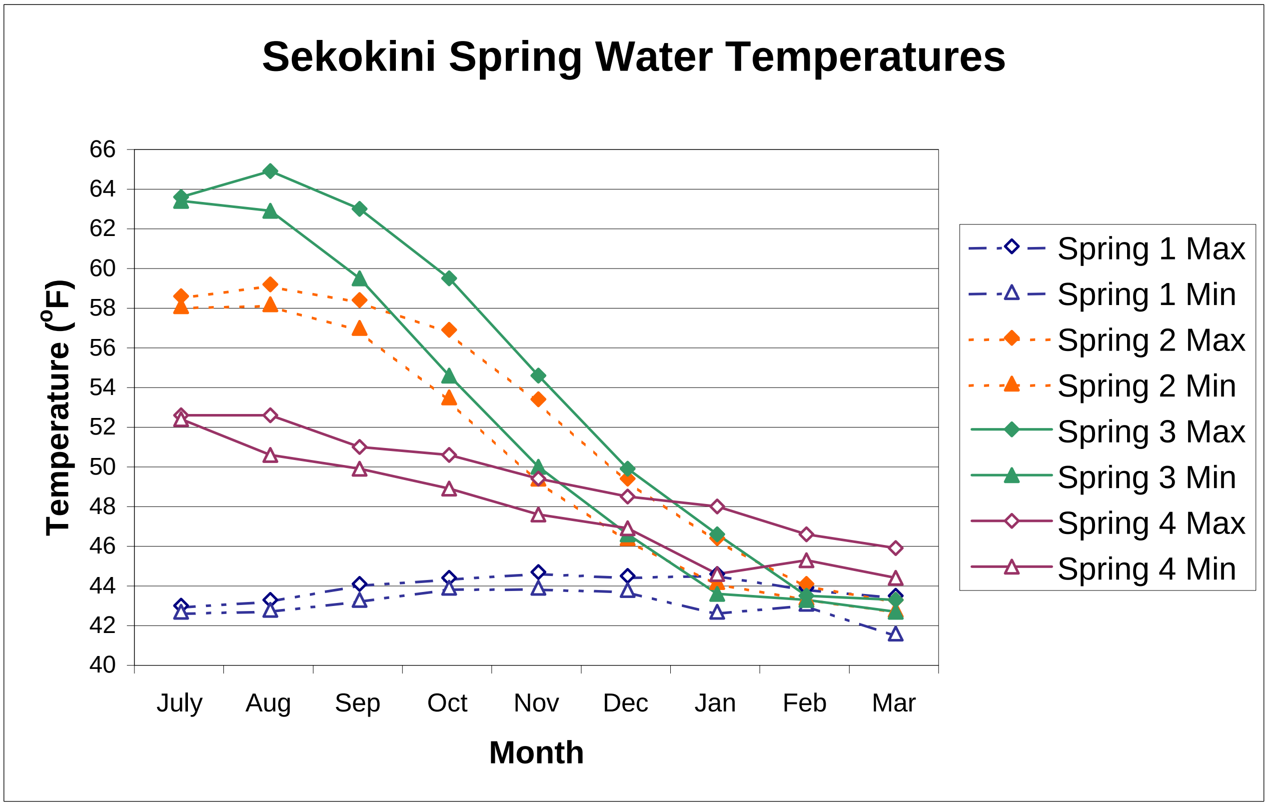


Figure 6. Sekokini Springs Maximum and Minimum Mean Daily Water Temperature Data by Month - taken between July 23, 1997 and March 31, 1998.

Water rights at Sekokini Springs are held by the Department of Agriculture, dated February 14, 1955.

Topographic and Geological Considerations

Glacial features such as moraine ridges, kettle lakes, and pothole topography are located northeast and upslope from the site. The site occurs at the southern end of a primarily flat, elongated river terrace about three-quarters of a mile long and one-half mile wide and is located approximately 80 to 100 ft above the present river level. The topography of the site consists of a series of river terraces (benches) that have been cut into older glacial debris. Slope angles range from 25 to 50 degrees. Generally the slopes are stable.

The geologic units exposed at the site consist of a thin veneer of forest soil covering a shallow thickness of alluvium overlying a great thickness of glacial debris. The soil is composed of silty fines, fine sand, and organic matter. The alluvium is composed of an unconsolidated, heterogeneous mixture of hard subrounded to rounded sand, gravel, and cobbles deposited by the river. The alluvium was derived in part from reworked glacial debris and in places may be up to 50 ft thick (Johns 1963). The glacial debris is composed of a heterogeneous mixture to crudely layered clay to silty, bouldery glacial till and thinly bedded, fine-grained lacustrine deposits. The thickness of the glacial debris could be several hundred feet at the site.

A BOR geologist conducted general site-specific geologic studies during the summer of 1999 and a short report was issued to MFWP and others. That report indicated general acceptability of the site for the proposed work and is attached in Appendix D. An additional geotechnical investigation on use of the site and evaluation of the global stability of the site and subsurface conditions in the vicinity of the planned structures was prepared by NTL Engineering and Geoscience (2003) and is attached in Appendix E. The NTL report suggested the use of impermeable liners in ponds and stream channels to prevent surface water infiltration that could increase saturation and downslope movement.

Vegetation

The subject property is situated at an elevation of approximately 3,200 ft. Habitat types found on the site include upland coniferous forest, forest openings, forested wetland and riparian/floodplain areas. A majority of the site has been previously disturbed by hatchery construction and maintenance activities. Disturbed areas have been colonized by many non-native, weedy species.

Four separate site surveys have been conducted by USFS botanists to determine the potential extent of threatened, endangered and sensitive plant species. Site surveys were conducted on June 8, 1994, September 15, 1999, June 22, 2000 and July 10, 2002 (Waggy and Mantas 2002a; 2002b). No sensitive plant species were observed in areas proposed for project activities. However, three sensitive species, mountain moonwort (*Botrychium montanum*), poor sedge (*Carex paupercula*) and kidney-leaved violet (*Viola renifolia*), are known to occur within five miles of the subject property. Waggy and Mantas (2002a) noted that construction of the Sekokini Springs facility "may impact individuals and habitat but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species" regarding poor sedge and kidney-leaved violet. Determination of proposed action impacts to moonwort (*Botrychium*) species may require additional surveys due to the difficulty in surveying for this species group and the uncertainty of their habitat requirements (Waggy and Mantas 2002a). In addition to the sensitive plant surveys, a subsequent biological assessment was prepared for two federally-threatened plant species, water howellia (*Howellia aquatilis*) and Spalding's catchfly (*Silene spaldingii*). The USFS determined in their biological assessment that these species and their required habitat types are not present in the project area and that the proposed project would have no effect on the listed plant species or potential habitats (Waggy and Mantas 2002b).

Upon acceptance of this Master Plan, a detailed noxious weed management plan will be prepared by the USFS, with assistance from MFWP. Noxious weeds are present in large numbers in previously disturbed areas around the ponds and buildings. A noxious weed control program would be implemented according to the Flathead County Weed District and will be comply with provisions of the USFS special use permit.

Wetland Characterization

Wetlands are unique ecological systems that are transitional between terrestrial and aquatic environments. Wetlands are defined as those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Jurisdictional wetlands are subject to Section 404 of the Clean Water Act as administered by the U.S. Army Corps of Engineers.

Preliminary wetland determinations were made using vegetation, hydrology, and soils conditions observable at the time of the site visit (November 5th and 6th, 2002). A formal wetland delineation was not performed as part of the investigation. Previous site alterations with regard to utilization of spring flows and associated pond construction have resulted in the formation of wetland conditions throughout much of the site. All of the existing ponds and channels are characterized by wetland plant communities, although in some of the ponds hydrophytic (wetland) plant species are limited to the perimeter of the pond.

An additional wetland was noted in the central portion of the site, in an area that was relatively undisturbed by trout farm operations. This forested wetland is located between the proposed rearing ponds and the existing, high gradient overflow channel located just west of the hatchery building. Pools of standing water and saturated soils were noted within this area during the site investigation. This area is considered to have a higher potential for sensitive plant species than much of the rest of the site (Waggy and Mantas 2002a). The project was designed to minimize the amount of wetland impacts and potential impacts to sensitive plant species in this forested wetland.

Threatened and Endangered Species

The Sekokini Springs site is used at certain times by grizzly bears which are listed under the ESA. Bald eagles, currently listed as threatened under the ESA, also frequent the site. No ESA listed fish species occur at the site. A survey for ESA-listed plant species occurred in the summer of 2002 (Waggy and Mantas 2002b). Results of this survey indicate that no ESA-listed species or required habitat types are present in the project area and that the proposed project would have no effect on the listed plant species or potential habitats in the vicinity of the project.

3.3.2 Evaluation of Existing Facility

The existing facility consists of a pre-engineered metal building containing incubation and rearing units, nine natural earth trout ponds, and two sediment ponds. Several structures, including living quarters, one open-sided wood storage shed and four cement fish tanks were removed. The pond system has not been fully utilized in recent years. Several of the existing ponds are drained and terrestrial vegetation has become established in the area. Some ponds have partially filled with sediment and most pond structures have crude outlets using dam boards for water level control. All of these structures are in poor condition or have failed. The sediment ponds are fitted with concrete outlet controls that have screened culverts leading to erosion channels draining toward the Flathead River.

The existing steel building was built in 1979 and is 42 ft wide by 60 ft long with 16-foot walls and a concrete floor. Forty feet of the building is used for rearing fish and the remainder, formerly a living area, is being converted to office and storage space. The hatchery area has a 12-foot by 12-foot fiberglass overhead door and one standard steel door for walk through access.

The building has been restored with new metal siding and roof, and the interior walls are insulated. This area has not been fully wired or plumbed. Outside of the main buildings, on each side of the overhead door, are two metal sheds with concrete floors attached to the main structure. Both sheds are 10 ft by 15 ft with a ceiling height of about 10 ft. The shed on the northeast corner is accessed from the main building and was used as an incubation room. The shed on the southeast corner is accessed by a steel walk through door on the outside and is used for storage.

The state hatchery division has donated fourteen fiberglass tanks and associated plumbing to replace the original four cement fish tanks that were pre-fabricated septic tanks with outlets on the bottom for drainage. The tanks were plumbed to allow mixing of the flow from spring sources 1, 2 and 3, so that water temperatures can be varied inside the hatchery building.

Upgrades of the existing facility are not complete. Additional improvements to electrical wiring and communications systems (phone and computer) must be made to accommodate the proposed WCT program.

3.3.3 Conceptual Design

The proposed alternative will modify existing structures and construct new facilities and rearing habitat for a conservation-based production program for genetically pure mainstem Flathead River WCT (Figure 5A and 5B). A number of site elements have been identified as "Future Development", these mainly include the stream-channel improvements that will create habitat within the water conveyance channels (Figure 5A&B highlighted in green). Two portions of the trail system and viewing windows are also included as "Future Development". Some of the proposed site improvements may be completed through separate efforts and funding. These "future" elements of the site development were selected as they are considered not essential to establishing fish rearing on-site, but are a component of the educational facilities that are necessary to meet the objectives of this project.

The proposed alternative will require:

- Construction of new incubation facilities in the existing hatchery building
- Modification and conversion of two existing earthen ponds into four donor fish and juvenile rearing ponds
- Construction of a concrete pad near the rearing ponds for a spawning area
- Construction of educational trails, and associated interpretive signage, that are compliant with the Americans with Disabilities Act (ADA)
- Construction of a trap/fish barrier at the outfall stream reach to prevent fish from escaping in to the Flathead River or entering the facility from the river (approved by USFS - Wild and Scenic River designation, requiring Special Use Permit modification)
- Construction of an education facility, parking area and USFS approved vault privy
- Construction of a new duplex for personnel, including a drinking water supply well and septic field, sited per input from USFS
- Upgrade electrical service to site, if necessary
- Installation of a pre-fabricated storage facility
- Addition of a new shed roof extension

- Construction of a water control structure on an existing drained pond to restore wetland conditions
- Installation of a false attraction weir within the kettle for each brood pond to aid in colleting broodfish

Future Development components:
- Construction of an overlook on the lower stream at an oxbow bend
- Creation of two viewing structures, one on an upper stream riffle pool section and another at the two level viewing gallery
- Construction of a wetland area access path and viewing platform
- Construction of a natural-type stream habitat, beginning near the existing hatchery building and ending at the Flathead River; the alignment will minimize site disturbance and the stream bed will be lined with an impermeable material, as necessary, to prevent seepage

Facility Components

Spring Collectors and Associated Piping

The three spring collectors installed in April 2001 consist of 4-foot diameter precast concrete sections similar to sewage manholes. The average height of the structures is about 6 ft. They have a 4-inch thick concrete lid with a steel manhole cover and ring for access and cleanout. The spring water is collected through a series of 3/4 inch holes in the side of the structure. There are a total of about 80 holes to collect the spring flow. The outflow leaves through two pipes. The first is located about 18 inches off the floor and is 6-inches in diameter. The 6-inch diameter pipe supplies flow to the hatchery building and will be used intermittently. The second outlet is located about 4 ft off the floor of the structure and is 8-inches in diameter. This pipe is only about 15 ft in length on average and delivers all flow not required by the hatchery back to the existing channel created by the original spring.

The piping runs from the spring collectors to the hatchery building. All pipe is 6-inch diameter and is buried at a depth of 4 ft to allow winter operations. The piping goes under the foundation of the building and come up through the floor near the northeast corner of the building.

No aeration or degassing of the spring water is likely necessary based on the successful demonstration of rearing WCT at the Sekokini Spring site. Dissolved oxygen (DO) levels will be monitored to insure that natural aeration is occurring on-site.

Residence, Office Space, and Maintenance Buildings

A duplex residence is proposed for hatchery personnel. The duplex will be accessed from an existing road and positioned to overlook the hatchery building. The location was selected for security at the site and visual distance from the river corridor. The residence will be sided with rustic earth tones with asphalt shingles to blend with the natural surroundings. The home will be heated with propane and constructed to incorporate passive solar technology. A domestic well is proposed to serve potable water to the residence and the hatchery building. The well may also be piped to a spigot at the educational facility to provide a source of potable water. The placement of the septic system will be located at a sufficient distance from surface and ground waters.

Office space is available within the existing hatchery building. Up to four separate offices may be included at the site. The total number will depend on the extent and type of work going on in the hatchery building throughout the year. The hatchery building will include a bathroom. Septic service for the hatchery building will be via a lift station to the septic tank and leach field installed for the residence. Wet lab may be included if they are needed for research activities.

Maintenance and storage facilities will be required at the site. Current plans call for some storage at the hatchery building, potentially a prefabricated storage shed, and additional limited storage under one of the gazebos. All storage areas will be designed for bear-proof food storage. The maintenance portion of the building will likely be a pole type structure for storage of vehicles, lawn mowers, and bulky spare parts.

Incubation Facilities

Standard incubation trays that allow for egg lot segregation will be utilized. Eggs from up to four females may be held in one tray. These trays will be supplied by a combination of water from Springs 1 – 3, depending upon the temperature desired for incubation. Spring 1, the coldest spring with an average temperature around 43° F (6.1°C), will be used for otolith marking to aid in the identification of individuals for program Monitoring and Evaluation (M&E) activities, and to blend with springs 2 and 3 which are warmer. Eggs will be treated with formalin to prevent fungal infections. Discharge of incubation water will be piped out of the incubation room, and discharged subsurface. This procedure should effectively disinfect the incubation effluent and preclude the introduction of fish pathogens to surface water sources.

Indoor Rearing

Indoor rearing facilities will need to meet a number of requirements of the facility. An isolation area will need to be created that allows for wild fish to be held until spawning or disease testing is completed. These fish will be required to be physically separated from any on-site fish. The hatchery building will be divided and circular rearing units installed to hold these fish. These fish will be brought on station to obtain gametes for the MO12 broodstock, or to establish the donor population on site. The remainder of the indoor rearing area will be utilized by mature donor fish prior to spawning and for fry from the incubation room, either prior to stocking in to streams or until transfer to rearing ponds on site.

Fourteen fiberglass tanks (2 x 14 feet) are available in the hatchery building. These are plumbed to allow mixing of the flow from spring sources 1, 2 and 3, so that water temperatures can be varied during rearing. These tanks will be utilized for fry rearing.

The circular tanks will be installed in the isolation area and in the “production” area of the hatchery building. These tanks will be utilized to hold adult fish until spawning or in the isolation area wild juveniles that are collected for donor fish each year, or wild adult gamete donors for MO12 infusion. The effluent from these tanks being utilized in the isolation area will be discharged subsurface away from the created stream system and ponds to avoid any potential contamination of the other rearing areas.

Donor Fish Conditioning Ponds and Juvenile Rearing Pond

Four ponds are proposed for the Sekokini Springs facility. Three of these ponds would be used to rear donor fish to maturity for spawn collection. Each pond would contain different collection year groups of the same genetic stock. The fourth pond could be used to rear fry hatched at Sekokini Springs for release as fingerlings.

The water supply for the rearing ponds would be provided from springs 1-3. Spring 4, the coldest of springs, surfaces adjacent to the lower bench and flows southwest could be used to regulate summer water temperatures if needed. When Spring 4 is not needed to supplement ponds, flow will be directed to the lower stream reach. The flow available from the upper three springs averages about 3.0 cfs but varies seasonally by + or - 50 percent. It might be necessary at times to use up to 80 percent of the water from the upper springs to adequately supply the conditioning/rearing ponds.

Water supply for the ponds will be routed from the created stream channel (Profile 1) to a screened diversion structure. The diversion structure will prevent upstream or downstream movement of fish. Each pond will be fed independently through a piping array from the diversion structure. This water supply distribution will ensure that fish pathogen transmission will not occur between ponds from the water supply. The distribution system will also allow for controlling the water supply to individual ponds when some are not being used at full capacity, or are off-line for cleaning or maintenance.

Ponds may be irregularly shaped and will have variable side slopes (3:1 and 4:1), or configured with some or all near vertical sides (helps to limit predation) created through the use of "ecology" blocks, possibly graded with a benched area to provide a variety of depths, mimicing natural environments. A concrete channel may be installed to run through the middle of the ponds to allow for more effective cleaning. Simulating a natural environment will encourage the development of “wild” behavioral traits similar to their naturally-reared counterparts. The goal of utilizing semi-natural rearing is to produce healthy natural-type donor fish, and juveniles that are as similar to wild fish as possible.

One component of semi-natural rearing is the use of natural substrate, consisting of gravels, rock or cobble that match the color of the substrate of streams to which the fish will be released. The Sekokini Springs facility will use rearing ponds that are lined with an impermeable layer, and substrate that mimics that of natal streams. The use of natural or artificial woody debris, floating and submerged logs and large rocks for cover will be incorporated. A portion of the pond, roughly 25%, will be deeper and devoid of obstacles. When it is required that fish be removed from the ponds, the water level will be drawn down forcing the fish into the deeper area where the lack of in-water structures will allow them to be netted or otherwise captured. Predation netting may be installed over the ponds if losses to aerial predators are excessive. In addition, other methods may be necessary to prevent predation by small mammals, such as river otters. Electric fencing may become necessary if otters become a problem.

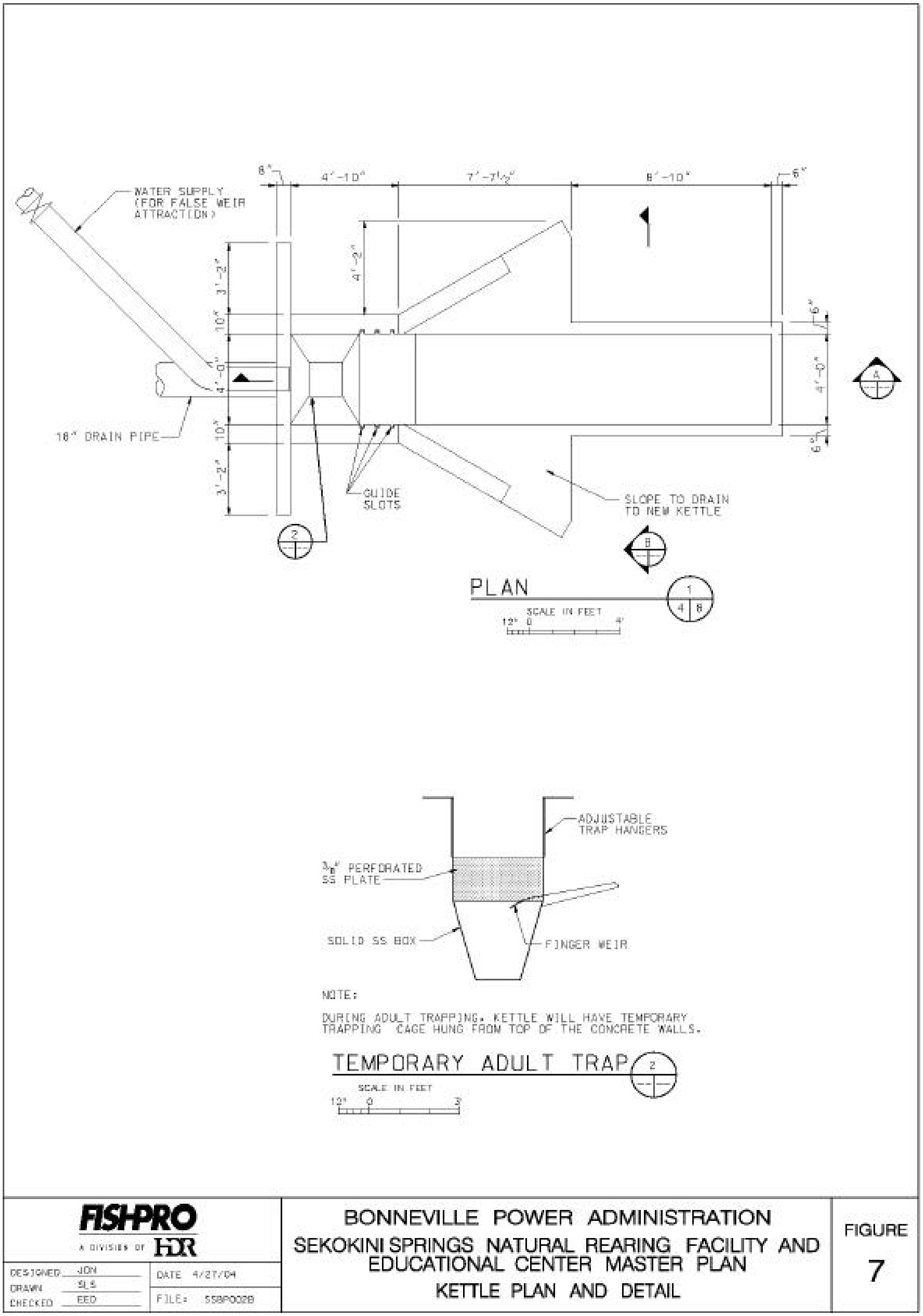
Because grizzly bears frequent the area, all food storage must be in sealed “bear-proof” containers.

Natural Feed Cultivation Pond

Commercial fish feed will likely be used for primary feeding, but it is desired to introduce other natural foods to simulate natural foraging behavior and provide natural nutritional sources. To provide supplemental feeding of fish with macroinvertebrates, an on-site food cultivation pond is proposed. Insects and macroinvertebrates can be seined and placed into ponds to allow for natural food supplementation.

On-site Donor Fish Collection

Upon maturation, likely at ages 3-5, donor WCT will be ready for spawning. Migratory behavior will be stimulated by the use of a false attraction weir at the kettle for each pond Figure 7. This weir will act to simulate a current and attract fish to a trap structure within the kettle. Kettles may also provide another method of collection. The water level in the ponds can be drawn down and fish collected in the kettle for sorting. Mature fish will be moved from the kettle to either temporary holding tanks located adjacent to the ponds where they will be held until spawning. A concrete pad will be constructed adjacent to the donor fish ponds for use as a spawning area. A temporary shelter may be placed on the pad during spawning operations.


WATER SUPPLY (FOR FALSE WEIR ATTRACTION)
18" DRAIN PIPE
GUIDE SLOTS
SLOPE TO DRAIN TO NEW KETTLE
PLAN
SCALE IN FEET
ADJUSTABLE TRAP HANGERS
3/8" PERFORATED SS PLATE
SOLID SS BOX
FINGER WEIR
NOTE:
DURING ADULT TRAPPING, KETTLE WILL HAVE TEMPORARY TRAPPING CAGE HUNG FROM TOP OF THE CONCRETE WALLS.
TEMPORARY ADULT TRAP
FISHPRO
A DIVISION OF HDR
DESIGNED JDN
DRAWN SLS
CHECKED EED
DATE 4/27/04
FILE: 55BP002B
BONNEVILLE POWER ADMINISTRATION
SEKOKINI SPRINGS NATURAL REARING FACILITY AND EDUCATIONAL CENTER MASTER PLAN
KETTLE PLAN AND DETAIL
FIGURE
7

Outfall Trap/Fish Barrier Structure

The trapping/barrier structure will be constructed with a concrete foundation and a structural steel frame. The trap will be located near the bottom of the proposed type-A channel leading from the bench to the Flathead River. The structure will be located behind a screen of trees so that it is not visible from the mainstem Flathead River to comply with the Wild and Scenic River Act requirements. The primary purpose of this structure is to provide a barrier to prevent the escape of WCT from Sekokini Springs into the Flathead River and to prevent potential upstream migration of adults of all species from the river into the facility. It is anticipated that nonnative rainbow trout and hybrids residing in the Flathead River will be attracted to the outfall water from Sekokini Springs. The outflow channel downstream of the trap will be constructed of large native cobble substrate unsuitable for spawning.

The primary component of the structure will be a trap box and v-notch weir. The structure will occupy less than a 20 foot by 20 foot area straddling the constructed stream. The trap box will be large enough to hold fish safely for about 24 to 48 hours and would be checked regularly by MFWP personnel.

Stream Channels

Base stream channels will be constructed in Phase 1 of the project. The stream habitat enhancement features will be created in the "Future Development" phase. The stream channel design process employed the principles and practices of Rosgen's "Applied River Morphology," (1996). The Rosgen method emphasizes stream classification into eight categories from "A" to "G" based on channel slope, shape and patterns, with further subclassifications of "1" to "6" determined by the size of materials making up the channel substrate. Once classification has been established, the Rosgen design method requires that the stream channel be compatible with local terrain and materials. Rosgen designs use naturally occurring sediments, stone, vegetation and woody debris for channel configuration, stream bank protection, hydraulic control and habitat creation. The stream channel areas will serve as educational displays with viewing windows to observe fish and aquatic habitat. These stream displays along with accompanying signage will educate the public in the importance of WCT and other native aquatic species, the value of the aquatic environment and the need to maintain various forms of habitat.

The stream channel types chosen for Sekokini Springs are "A and E" type and will occur in one of four Profiles. A and E stream types were chosen because of locally available materials for streambed composition (river cobbles and glacial till) and to mimic local streambed composition. Generally, A-type channels occur in steeper gradients and E-type channels occur in areas of broad meanders with shallow slopes. Additionally, sections of the stream channels are proposed to disconnect the rearing facility from the Flathead River to serve as a "no fish zone" where WCT escapees can be collected, and fish are prevented from entering the facility from the river.

- Profile One will contain A3 and E3 channels up to the control structure near the proposed donor/juvenile fish ponds and the wetland demonstration area. This Profile will provide habitat for WCT that will function as educational exhibits, showing the species in a more natural setting. These fish will not be utilized as broodstock.

- Profile Two will contain A3 channels to the outfall/trap structure.

- Profile Three will contain a variety of E-type channels, and a short section of A3 as the stream channel moves downslope to a lower terrace.

- Profile Four will be the designated “no fish zone” where escapees from the donor/broodfish or rearing ponds will be collected. The channel type for Profile 4 will likely be an E-type channel.

The A-type channels on the steeper slopes (4% to 7.9%) will have a slight meandering pattern, and will have a step-pool configuration, with a pool occupying each step down. In a step-pool arrangement, pool length is proportional to pool width, based on the steepness of the channel slope. Each pool will have a weir-like rock structure on the downstream end that will control the water level in the pool. The rock structures will be placed on geotextile fabric to provide enhanced stability and to help control flow through the structures. The stream sections with high gradients will have resting pools. The resting pools have been designed to be twice the size of other pools in a section.

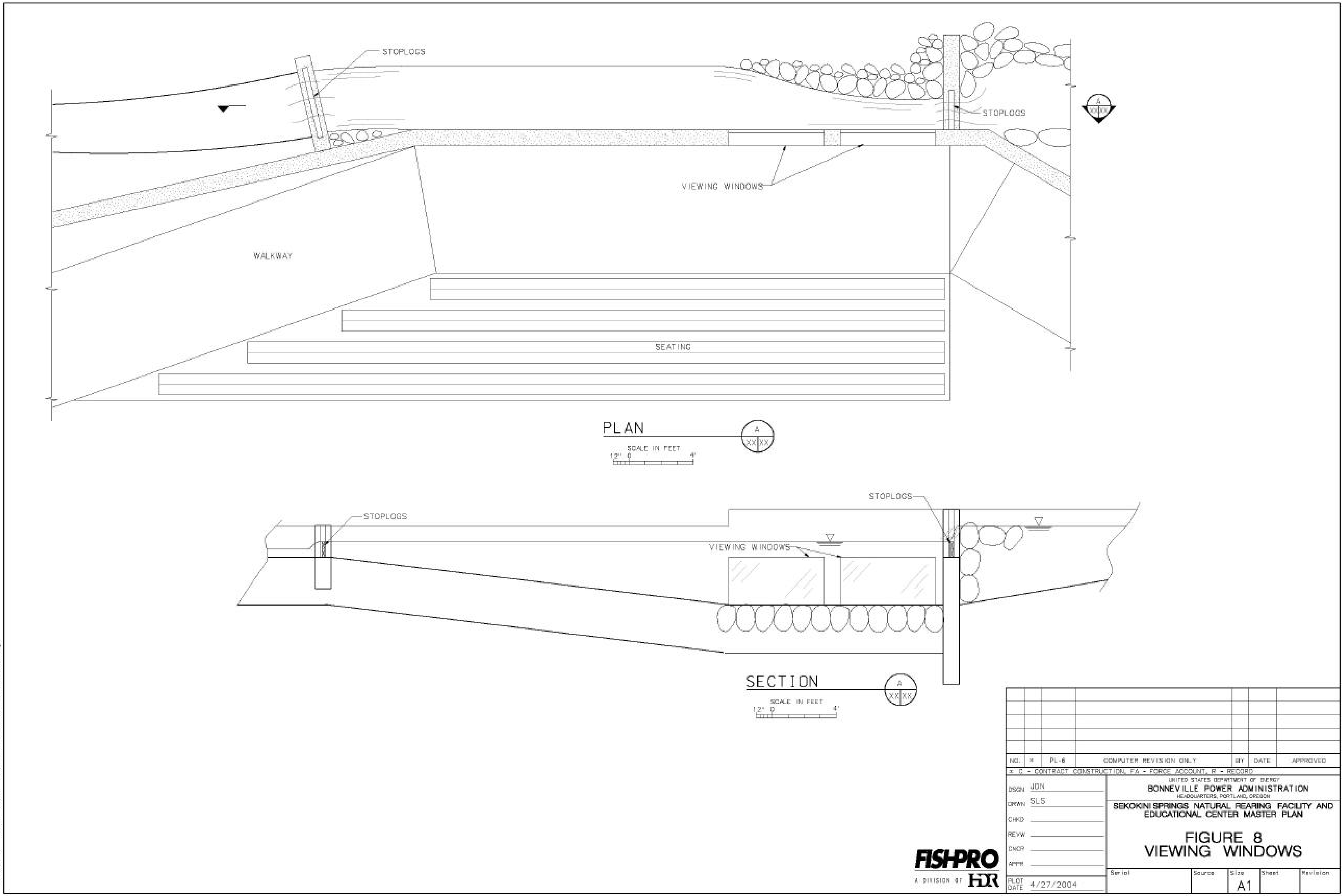
The E-type channels on the flatter slopes are typified by broad meanders, typically traversing a bed width of 15 to 20 ft on slopes from 0.6% to 1.4%. Water will move more slowly through these sections, and it may be desirable during final design to add fish habitat structures for diversity and aesthetics.

The substrate type of “3” for all fish bearing stream channels was chosen based on the geology report, composition of other streams in the area, and economics. The geology report listed river deposits and glacial till as the predominate materials at Sekokini Springs, so channels would have a high proportion of cobble sized material to other constituents and would mimic existing terrain. In the Rosgen method, degraded streams are restored to a state similar to others in the area. While the Sekokini Springs stream will be newly created, mimicking local streams will help to create a natural appearance and provide appropriate habitat. Finally, most of the streambed materials will have to be excavated elsewhere and hauled to the site. Costs from a local gravel company showed higher rates for sand and small gravels than for cobbles. Profile Four will be composed of substrate type “6”, a silt/clay dominated area.

An outfall and fish trap structure will be designed to prevent fish from entering or leaving the Sekokini facility and will be placed the downstream end of Profile 2 approximately 120 ft from the margin of the Flathead River. Downstream of the trap structure discharge water will flow in a created naturalized outlet stream. Because of the Wild and Scenic Status and Recreational River Designation, the trap structure will be “hidden” from view and only native materials will be used to create a natural stream outlet to the river. The channel will be constructed of river rocks and other local materials and will be built during low water to a point at about the normal high water line during August/September. No in-water work is proposed for the outfall structure. At least 4 to 6 ft of path needs to be left next to the constructed stream to allow foot access to the river entrance. After floods and other weather-related events, a certain amount of hand maintenance will likely be required at the mouth of the stream.

Viewing Windows

There will be two fish viewing windows, installed below the waterline, will serve as educational tools for observation of WCT in a natural setting (Figure 5A). To increase viewing opportunities, a plunge pool or some other high quality habitat will be located near the windows to encourage WCT use of the immediate areas. One window will be located along Profile One. The other window will be located at the confluence of Profiles Two and Three. Figure 8 depicts a conceptual plan for the viewing windows.


STOPLOGS
STOPLOGS
VIEWING WINDOWS
WALKWAY
SEATING
PLAN
SCALE IN FEET
SECTION
STOPLOGS
STOPLOGS
VIEWING WINDOWS
SCALE IN FEET
UNITED STATES DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION
SEKOKINI SPRINGS NATURAL REARING FACILITY AND EDUCATIONAL CENTER MASTER PLAN
FIGURE 8
VIEWING WINDOWS
DSGN JDN
DRWN SLS
PLOT DATE 4/27/2004
A1
FISHPRO
A DIVISION OF HDR

Wetlands and Wetland Viewing Platform

Existing ponds located to the west of the rearing/donor fish ponds will be maintained to serve as wetland demonstration and education areas. Removal of noxious weeds and functional enhancement will be necessary to rid the ponds of exotic species that have invaded the wetlands' perimeters. Water levels should be maintained within these areas to assure that wetland plant species are provided with adequate water for their survival.

A wetland viewing platform is proposed adjacent to Profile 4 to allow viewing of an extensive skunk cabbage-dominated wetland and fringe wetlands. The platform would be accessed via a walkway that spans the fish escape barrier at the "no fish zone." This platform would serve as an additional educational component to enhance visitors' understanding of the local environment and to better understand the complexity and interaction of terrestrial and aquatic habitats.

To decrease costs associated with this structure, the local Boy Scouts have volunteered to provide materials and labor (B. Marotz, MFWP, personal communication, January 24, 2003).

Trails, Public Access and Educational Facilities

Public access is an important component of the facility and it is expected that nearly all areas of the site will be available to the public. The "footprint" for the proposed trail system and interpretive sites is shown in Figure 5. The trails will follow existing access roads and berms along the constructed stream channels. The paths will be constructed of packed, crushed gravel or roadmix to allow all weather access. The high slope of most of the site will make handicapped access to all of the site difficult, however, a large portion of the facility will be made available to all the public in accordance with ADA and other pertinent regulations mentioned elsewhere in this Master Plan. The trails will begin at the upper bench area across the access road from the spring distribution box. The trail will follow the stream channel downslope to the lower bench where the ponds will be constructed. A viewing window is planned along this upper stream reach. An alternate trail connecting to an existing road/path will be constructed downstream of the viewing window. This trail will provide a gentler slope to allow ADA access to the lower area. A path and viewing platform extending towards the forested wetland area will also be constructed. Where the stream channel forms an oxbow and begins the decent downslope to the river another viewing window with two gazebo structures is planned. This area is anticipated to be a gathering place where interpretive talks can be conducted. These same trails will also provide maintenance access to the various stream sections. Interpretive signs and informational materials will be spaced around the site featuring various topics such as the WCT conservation program, lifecycle of fish, habitat restoration, water conservation, wetlands, geology, and the characteristics of streams.

Construction of the viewing windows and gazebos will occur in the "Future Development" phase, following the hatchery building and base stream channel construction. Prior to construction of the trail systems, specific plans will be made available to the USFS for review and comment. Designs for trails and handicapped facilities will be done under the supervision of or reviewed by accessibility specialists at BOR or by others on contract to BPA or MFWP.

An educational facility will be provided in a new building near the access road. This structure will face the access road and present an attractive, natural facade of stripped log construction with a cathedral ceiling. The building will be sized to accommodate approximately 75 people, with an open-sided design, and will be outfitted with picnic tables. Vault privies will be provided adjacent to the proposed educational facility. Other infrastructure will include parking, outdoor lighting around the building, and signage at the site and on the main access roads. All these improvements will conform to USFS guidelines.

Material Sources

The creation of the stream channel habitat will require a substantial amount of fill material. Fortunately, some adequate fill material will be generated on site and can be stockpiled in designated areas for later use or placed directly where required. These materials will be typical of that used for construction of embankments or roadbeds. The fill material should be free of organic debris. Top treatment can consist of agricultural loams as well as sands or silts. The existing sloughs will need to have all deposited sediments and organics removed prior to placement of fill materials. This organic material can be used to top-treat disturbed areas that will be stabilized with vegetation. River rock and bedding gravel required for construction of the streambed above the liner will be purchased from local suppliers.

3.3.4 Probable Opinion of Cost, Construction Schedule and Budgeting

An opinion of probable costs for construction of the facilities is shown in Table 3-2. Some repairs and remodeling to the hatchery building have already been accomplished by MFWP.

Construction Schedule

The proposed Sekokini Springs Natural Rearing Facility is to be funded and constructed over a period of 5 years. Modifications to existing structures were completed in 2001 and 2002. Annual construction efforts are described in Table 3-3. These efforts have been programmed based upon the priority of need and available funding for MFWP to successfully complete the mission of the project. The highest priority is to remodel the hatchery building, developing water conveyance channels and construct the ponds so that fish rearing can be initiated. The "Future Development" phase to create stream channel habitat and viewing windows will occur as funding is available. Should funding be accelerated, higher prioritized elements of the project may be completed sooner than scheduled.

Table 3-2. Initial Opinion of Probable Construction Costs.

Item	Notes	Phase 1	Future Development
Site Work		$60,500	
Utilities		$15,000	
Duplex Residence	1	$288,250	
Educational Facility	1	$41,000	
Vault Privies	2	$22,000	
Hatchery Modifications	1	$50,000	
Temperature Control / Mixing Structure	1	$20,000	
Base Channel Improvement, Profile "1"		$159,451	
Additional Channel, Profile "1" Development Budget			$92,600
Base Channel Improvement, Profile "2"		$58,305	
Additional Channel, Profile "2" Development Budget			$208,107
Base Channel Improvement, Profile "3"		$40,916	
Additional Channel, Profile "3" Development Budget			$49,873
Base Channel Improvement, Profile "4"		$4,421	
Additional Channel, Profile "4" Development Budget			$5,672
Larger Ponds		$200,000	
Smaller Ponds		$130,000	
Piping		$250,000	
Total Construction Costs		$1,339,843	$356,252
Contingency (25%)		$334,961	$89,063
Total Construction with Contingency		**$1,674,804**	**$445,315**
Design and permitting @ 15%		$251,221	$66,797
Construction Management @ 7%		$117,236	$31,172
Subtotal Additional Costs		**$368,457**	**$97,969**
Project Cost Phase 1		**$2,043,261**	
Project Cost Future Development			**$543,284**

Notes:
1 - Cost figure provided by Montana Wildlife & Parks Department of Fish
2 - Cost figure provided by US Forest Service

Table 3-3. Construction Schedule for Proposed Sekokini Springs Natural Rearing Facility

Year	Construction Action	Details of Action	Action Function	Completed
2001	Hatchery building modifications	• Garage door installation • Repairs to make building water-tight and rodent-tight • Eaves expanded to prevent snow accumulation against exterior walls • Flashing installed	• Upgrades allow for improved hatchery building operations and maintenance	X
2004	Additional hatchery building modifications	• Add extended roof over driveway • Finish office walls • insulate exterior walls • repair internal walls • rewire offices • equip with phone, fax and intercom • install wet lab, kitchen and lavatory (pending approval of septic lift station, tank and drainfield)	• improvements will allow use of facility during construction • overall, improvements are necessary to house hatchery manager and personnel	Internal and External wall work complete
2005	Modify two existing ponds to create four rearing ponds	• drainage designed to allow the surface elevation at each of four ponds to be controlled independently • four ponds will be completed and stabilized with native vegetation • the stream channel will be equipped with a bi-directional fish barrier to prevent WCT from escaping and Flathead River fish from entering ponds	• allows for rearing of unique genetic stocks of pure WCT • allows for rearing of donor stocks and juveniles to be planted for WCT recovery	
2006	Create base channels for water conveyance and stabilize streambed at former head pond	• construct the base channels for spring water supply stabilized within existing meander pattern	• provide water to the four rearing ponds • stabilization necessary to prevent blow outs and sedimentation	
2007	Improve existing trail	• The existing trail provides construction access to the channel. Trail will be improved incrementally as the channel is being restored	• Allows for access to the lower bench and ponds	

Year	Construction Action	Details of Action	Action Function	Completed
2006	Develop hatchery building outfall pipe to stream channel and separate discharge to subsurface infiltration	• Outflow pipe will connected to the stream channel to utilize overflow or water from pathogen free rearing • Disposal of waste water from isolation incubation or rearing	• Will allow outfall of water from indoor rearing to be utilized in the rearing ponds • Will reduce the potential of introduction of fish pathogens from wild sources	
2006	Construct storage facility		• Provides secure outdoor storage for maintenance equipment, etc.	
2006	Construct residence	• Designed to blend with the scenery • Will include latest energy-saving technology	• Allows for on-site personnel year-round	
2006	Construction of waste septic disposal system		• For the office and proposed hatchery residence(s)	
2006	Drill a domestic well and install water piping	• Near proposed residence	• For the office and proposed hatchery residence	
2006	Upgrade electrical service	• To the residence, if necessary	• Allows for year-round use	
2007	Install initial interpretive exhibits	• Featuring water conservation, native fish recovery, on-site wildlife and botanical features	• Allows for educational opportunities	
2007	Complete educational facility	• Develop parking area, restrooms and classroom	• Enhances educational opportunities • Allows for site tours by school groups and the public	
Future Development			•	
2006	Create Rosgen stream channels	• creation of Rosgen type E stream course with a type A cascade	• allows for a more natural appearance	
2006	Restore linear ponds	• Under dry conditions, linear ponds extending downslope from the upper bench would be restored • Create Rosgen type A channel with cascade • Channel would continue downslope to connect to the four ponds • Stabilize bank along stream course and create fish viewing window	• Provides natural-looking pond connection • Allows convenient site for fish-viewing window #1	
2006	Creation of additional stream channels	• Creation of new channels within existing linear ponds on the bench • Creation of a new channel to the Flathead	• Allows for natural-looking stream channel surrounding rearing ponds to Flathead River and restores hydrologic connection	

Year	Construction Action	Details of Action	Action Function	Completed
		River	to river	
2007	Creation of fish-viewing window #1	• Window to be placed in a large pool at the foot of the type A cascade	• Allows for educational opportunities and fish viewing	
2007	Creation of fish-viewing area #2 and gazebos	• Viewing area will have two levels to allow viewing fish from above and below the water level		
2006	Creation of a type E channel to connect to type A that flows into the Flathead River	• Constructed inside the existing linear ponds in preparation for connection with the proposed type A Rosgen channel to the Flathead River		
2006	Creation of the type A Rosgen channel to connect to the Flathead River	• Constructed from the last of the existing type E channel downslope to connect to the Flathead River • This section of the channel will include the fish barrier/trapping facility	• Type A channel accommodates steep terrain • Fish trap would prevent fish escapes from the facility and monitor fish accessing the effluent stream from the river	
2007	Repair erosion gullies	• Rehabilitate gullies created by past blowouts of ponds	• Reduces chances of erosion and sedimentation to newly constructed streams	
2008	Finalize improvements to trails	• Add educational signage and exhibits • Allow wheelchair access and educational opportunities	• To allow for foot access to the streams and ponds • To comply with ADA regulations	
2006-2008	Revegetate impacted areas with native vegetation	• planted with native riparian vegetation	• allows for a more natural landscape and lower maintenance	
2008	Complete interpretive exhibits	• Featuring water conservation, native fish recovery, on-site wildlife and botanical features	• Allows for educational opportunities	

Chapter 4. Proposed Production Program

4.1 Program Components

The proposed Sekokini Springs facility will incorporate two conservation strategies into the program. The first component is the collection of juveniles from donor streams for production of an F1 population to be outplanted into restoration streams and lakes. The second component is the collection of milt from wild spawners for infusion of genetic material into the state's existing WCT captive broodstock (MO12 stock). These components are described below.

Juvenile Donor Stock Collection- Creation of F1 Generation from Local Stock Conservation Strategy

There are two options for collection of a donor stock at the Sekokini Springs facility. The preferred option is to collect juvenile WCT from local streams that have been genetically tested and determined to contain WCT that are 100 percent genetically pure. The donor populations would also be required to have a history of fish pathogen testing, and a negative record for pathogens of concern. The alternate option is to collect gametes from wild spawners.

If juvenile collection does not allow for the appropriate number of donor fish required for the program, the alternative option, collecting gametes from wild spawners, may be considered. Because the program necessitates collection every year and access issues make gamete collection difficult, juvenile collection is preferred for the establishment of a nearest neighbor stock. The pros and cons of collecting juveniles vs. gametes are listed in Table 4-1.

Table 4-1. Donor Stock Collection: Juvenile vs. Gamete Collection Strategies

Life Stage at Collection	Pros	Cons
Gametes from spawning adults	• State code prohibits transfer of fish to hatcheries (gametes only for genetic infusion) • Adults can be collected throughout spawning run, increasing genetic diversity	• Only available in uppermost reaches • Access issues (snow) during spawning period • May impact donor population due to handling stress and harrassment • May not be efficient collection method since WCT get ripe at different periods • Longer time frame to obtain F1 generation
Juveniles	• May be reared to maturity at Sekokini Springs and cross fertilized to increase genetic diversity • Sekokini Springs is an experimental facility, not a state hatchery, so wild juveniles can be imported for rearing] • Opportunity to cull a subset of desired individuals • Access is not an issue since wild juveniles can be collected all summer • Less impact to donor population from collection actions	• More costly to rear juveniles to maturity • Potential for domestication – won't affect genotype, but may affect wild behavioral traits.

Milt Collection - Infusion of New Material into MO12 Stock Conservation Strategy

The Sekokini Springs facility will be used to hold wild spawners for collection of genetic material. This genetic material, in the form of milt from spawning males, will be infused into the state's MO12 captive broodstock. The infusion of new genetic material into the captive broodstock is considered to be an important component of WCT conservation to increase the genetic diversity of the state's stock (Leary et al. 1997, 1998; Grisak 2003). Because the transfer of live fish to hatcheries is prohibited in the state of Montana, milt is the best option for infusion. Milt is preferred for this activity since it is the easiest to obtain and the collection is less disruptive to wild runs. The collection of gametes is a difficult task, as shown in Table 4-1, this activity will take place only when genetic infusion is deemed necessary by managers of the MO12 stock and not on an annual basis.

Infusion of new genetic material into the MO12 stock, although part of this Master Plan, is separate from establishing the nearest neighbor stocks. The Sekokini Springs facility was utilized in 2003 to infuse wild gametes into the MO12 broodstock for the first time since the stock was established in 1983 – 1984.

4.2 Rationale for Choosing Donor Stocks

The recommendations of the WCT Conservation Committee would be followed for conservation of WCT into presently unoccupied historic habitats, or restored habitat. The following is an excerpt from Leary et al. (1998):

> *Based on the assessment of genetic variation by Leary et al. (1997), the Committee [WCT conservation committee] suggests that any genetically pure source of WCT could be used* (for restoration), *as long as it is capable of providing at least 50 fish, ideally at least 25 females and 25 males (Allendorf and Ryman 1987). Since there is presently a relatively high level of uncertainty concerning which donor sources might be best adapted for any particular environment, we suggest that either of the following two alternatives are viable and, if tried, their success needs to be monitored and evaluated:*
>
> 1) *Translocation of fish or gametes from existing populations which are abundant enough to withstand loss of at least 50 fish…translocated gametes should be incubated at the restoration site to maximize the potential for local adaptation. Translocation could be used to replicate a WCT population as a genetic reserve. Translocations would likely occur from either the nearest population [based on genetic dendrograms of stock relatedness] or a population inhabiting habitats most similar to the proposed restoration site.*
> 2) *A captive WCT brood could be used for restoration, provided that this captive brood has an appropriate amount of genetic diversity.*

Based on these recommendations, donor sites were selected that contain 100% genetically pure WCT in habitats that are as similar to proposed recipient streams as possible. Donor fish would be collected yearly as the goal is not to create another captive broodstock, per se, but several genetically unique stocks to be outplanted into vacant or restored habitats. Juveniles WCT, collected as donor fish, would be held until maturity to provide a source of F1 gametes (eyed eggs) or fingerlings.

The donor population will be monitored to assure that juvenile (or gamete) collection does not impact that population.

4.3 Donor Fish Collection

The following discussion details collection methods for the program.

4.3.1 Collection Sites and Descriptions

Juvenile Donor Stock Collection- Creation of F1 Generation from Local Stock Conservation Strategy

Preliminarily, the following streams have been identified as juvenile donor fish collection locations (Figure 9):

- Haskill Creek
- Danaher Creek
- Gordon Creek

Haskill Creek - Haskill Creek is a 8 mile (12.9 km) long tributary of Whitefish River, which flows from the north into the Flathead River. Both brook trout (*Salvelinus fontinalis;* BKT) and WCT are considered common residents from river mile 0 to 7.2 (Rkm 0 to Rkm 11.6), with WCT common throughout the remainder of the tributary. Haskill Creek is classified as moderate in terms of fisheries resource values. Haskill Creek is currently the focus of a WCT recovery effort to "rescue" a remnant pure population of WCT that has been invaded by BKT (MFISH 2002).

Youngs Creek – Young Creek, a tributary to the South Fork Flathead River, is approximately 21.4 miles (34.5 km) in length and contains 14 tributaries. The creek is located in the Bob Marshall Wilderness area. Bull trout are abundant seasonally in the lower 17.9 miles (28.8 km). Mountain whitefish are common in the lower 6.1 miles (9.8 Rkm) and rare in the upstream reach to mile 14.6 (23.5 Rkm). Westslope cutthroat trout are abundant, year-round residents throughout lower 17.7 miles (28.5 km) of the creek. An isolated genetically pure population of westslope cutthroat trout (designated an A1 donor population) has been located above a barrier in Youngs Creek. The entire creek is classified as outstanding in fisheries resource value (MFISH 2002).

Danaher Creek - Danaher Creek, a tributary to the South Fork Flathead River, is approximately 21.1 miles (34 km) in length and contains 12 tributaries. The creek is located in the Bob Marshall Wilderness area. Bull trout and mountain whitefish are common through river mile 8.9 (Rkm 14.3) and rare throughout the upstream length of the creek. Slimy sculpin are also common in the lower reaches of the creek. Westslope cutthroat trout are abundant, year-round residents throughout the creek. The entire creek is classified as outstanding in fisheries resource value (MFISH 2002).

Gordon Creek - Gordon Creek, a tributary to the South Fork Flathead River, is approximately 18.7 miles (30.1 km) in length and contains eight tributaries, including Elk, Gabe, Cardinal, Shaw, George, Doctor, and Lick creeks, as well as an unnamed tributary. Bull trout are abundant below Rkm 23.5, with incidental occurrence from river mile 14.6 to 16.5 (Rkm 23.5 to 26.6). Mountain whitefish are common below river mile 5.9 (Rkm 9.5) and rare upstream. Westslope cutthroat trout are abundant through river mile 14.0 (Rkm 22.5), with WCT x YCT hybrids present upstream to river mile 16.5 (Rkm 26.6). Through river mile 16.5 (Rkm 26.6), Gordon Creek was classified as outstanding in terms of fisheries resource value (MFISH 2002).

In addition to Haskill, Danaher and Gordon creeks, those waterbodies presented in Appendices G-J that contain 100 percent genetically pure WCT populations could also be used as donor streams. Figure 10 depicts streams that are known to contain genetically pure WCT. For initial program start up, only one stream would be used for juvenile collection for the first three years. This will ensure that all fish in the rearing ponds are from the same genetic stock. Upon maturation and spawning of the first set of collected juveniles, ponds will become available for an additional genetic stock.

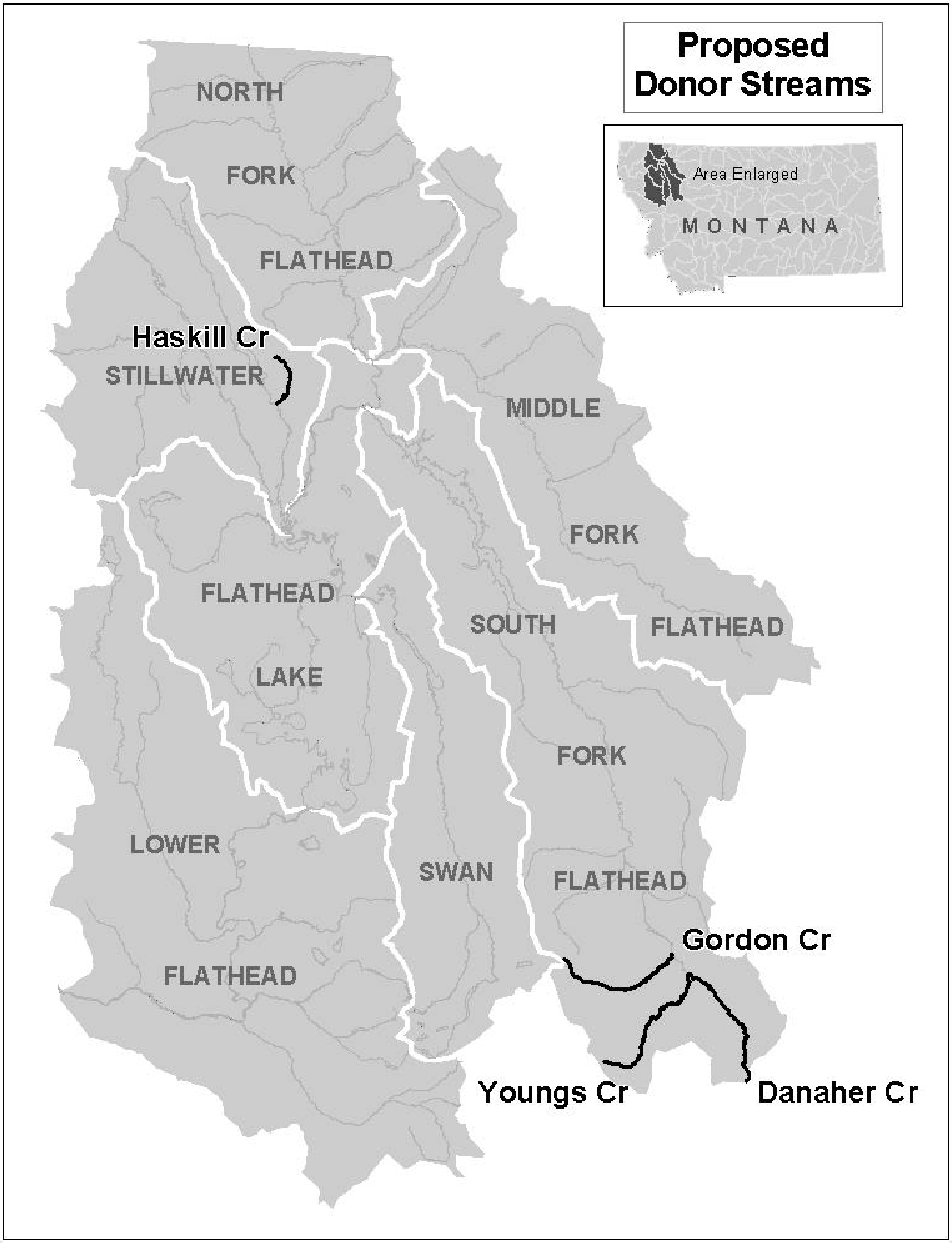


Figure 9. Locations of Potential Donor Streams: Haskill, Danaher, Youngs and Gordon Creeks.

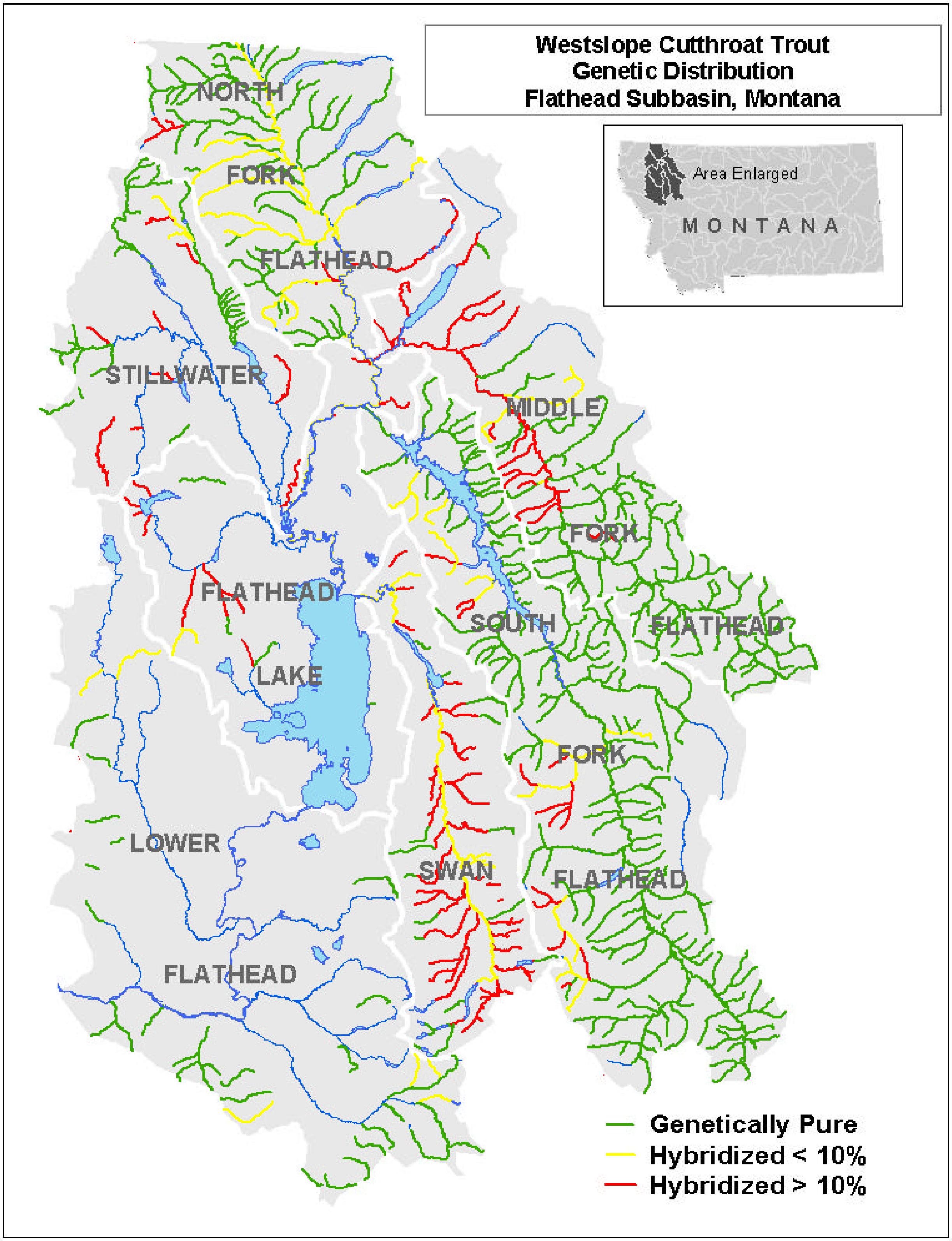


Figure 10. Location of Genetically Pure and Hybridized WCT Populations in the Flathead Subbasin.

Milt Collection - Infusion of New Material into MO12 Stock Conservation Strategy

MFWP and co-managers collected milt from wild spawning males found in genetically pure populations in Deep and Quintonkon Creeks, both tributaries to the South Fork Flathead in 2003 (Figure 11). Wild spawners were collected and spawned in an isolation facility in the hatchery building at Sekokini Springs. In the future, gametes from female spawners may also be collected.

Quintonkon Creek - According to the Montana Fisheries Information System (MFISH; 2001), Quintonkon Creek is a tributary to Sullivan Creek, which then drains into the South Fork Flathead. Quintonkon Creek is approximately 9.5 miles (15.3 km) in length with three tributaries: Rock Creek at river mile 2.1 (Rkm 3.4), Posy Creek at river mile 5.0 (Rkm 8.0) and Red Owl Creek at river mile 5.8 (Rkm 9.3). WCT occupy the entire stretch of the creek. Due to the presence of WCT and bull trout, the entire stretch of river is considered a NPCC Fisheries Protected Area with an outstanding fisheries resource value (NWPPC 1994; MFISH 2001). Within the first 5 river miles (8 Rkm), the WCT population has been characterized as having both resident and fluvial/adfluvial populations with abundant numbers of individuals. From river mile 5 to 9.5 (Rkm 8.0 to 15.3), the WCT population is characterized as abundant, with year-round residents occupying the reach. MFWP collected population data in 1987. This collection effort determined that the creek's habitat quality was good and population estimates suggest a density of 29 individuals per 492 ft (150m). Stream channel data indicate that bank vegetation is primarily in the form of coniferous trees with fair subsurface cover (MFISH 2001).

During 1983 and 1984, as part of the effort to establish the state's first WCT captive broodstock, 150 and 365 WCT, respectively, were collected from Quintonkon Creek.

Deep Creek – Deep Creek is a second order tributary of the South Fork Flathead River. It is approximately 4.8 miles (7.7 km) in length with one tributary, Ruby Creek, located at river mile 2.4 (Rkm 3.8) (MFISH 2002). Data from 1986 (Zubik and Fraley 1986) indicate a WCT density of 51.1 juveniles per 328 ft (100 m). Portions of Deep Creek salmonid habitat were impacted by the Hungry Horse Reservoir. It is believed that WCT occupy the entire stretch of the creek.

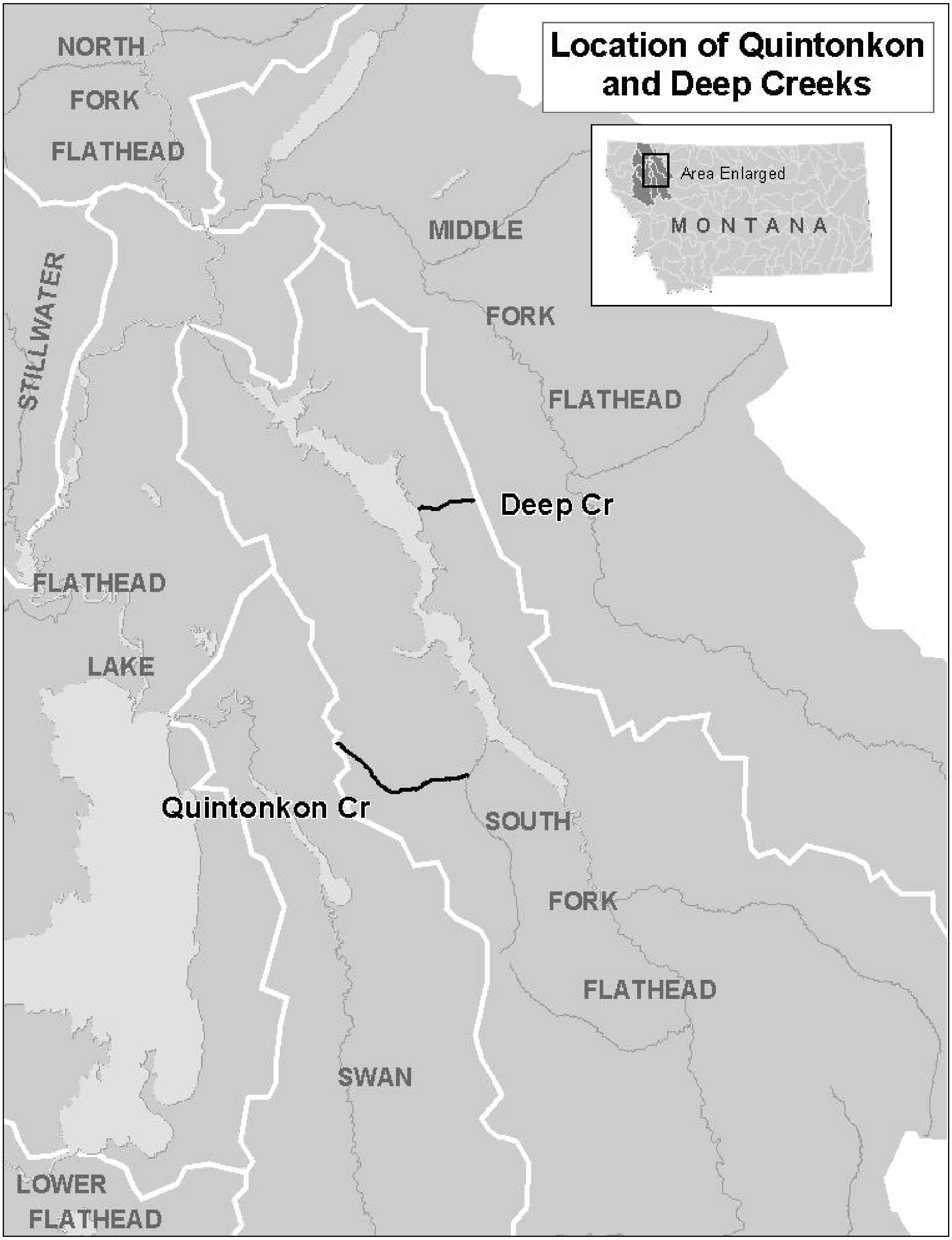


Figure 11. Location of Deep and Quintonkon Creeks

4.3.2 Genetic Information

General Information on WCT Genetics

Genetic testing performed on WCT in different basins within Montana included numerous samples from the Missouri River and Columbia basins. Testing revealed little genetic variation between WCT from the Missouri and Columbia basins (Leary et al. 1998). Instead, most (64.95 %) of the total amount of genetic variation detected was attributed to genetic differences among fish within samples, 33.8 % to differences among samples within basins, and only 1.3 % to genetic differences between samples from the Columbia and Missouri River basins.

Genetics of Flathead River

Juveniles will be collected from genetically pure WCT populations in headwaters of the North, Middle and South Forks of the Flathead River, with the exception of Haskill Creek, which is a tributary to Whitefish River. Individuals from genetically pure populations possess alleles at all diagnostic loci for alleles characteristic of only that taxon (Leary et al. 1998). Discussion of the individual drainages and genetic composition within those drainages follows discussion of the North, Middle and South Forks of the Flathead River.

North Fork Watershed

The North Fork Flathead River watershed encompasses 609,280 acres (243,742 hectares), of which 47.1% is USFS land, 44.6% is National Park Service (NPS) land, 3.1% is owned by the state of Montana, and 5.2% is either private or owned by other public entities (USFWS 1999). In the watershed, stocks of genetically pure WCT occupy 67.4 miles (108.4 km), within 27 stream reaches. Stocks that are 99.9 to 90.0% pure occupy 69.2 miles (111.4 km); stocks that are <90% pure occupy 37.5 miles (60.3 km); and stocks in the remaining 311+ miles (500+ km) of stream reaches remain untested for genetic composition (USFWS 1999; Shepard et al. 2003). Within the watershed, Marnell et al. (1987) identified the following lakes and associated tributaries as genetically pure: Akokala, Cerulean, Quartz, Lower Quartz, Middle Quartz, and Trout. These findings have been confirmed by recent genetic analyses, with the exception of Trout and Cerulean creeks, which have not been recently tested. In addition to these streams, recent data indicate that Bowman Creek, Canyon Creek, Dead Horse Creek, Depuy Creek, Huntsberger Lake, Moran Creek, Nasukoin Creek, Red Meadow Lake, Tepee Creek and Yakinikak Creek also have populations that are genetically pure. Additionally, portions of the following waterbodies are genetically pure: Big, Coal, Colts, Cyclone, Hay, Kletomus, Logging, McGinnis, Moose, and Skookoleel creeks (MFWP unpublished data, 2003; Appendix F).

Among the total 444 miles (714.5 km) of stream occupied by WCT stocks, 266 miles (428.1 km) of stream have stocks that are considered abundant; stocks in the remaining 178 miles (286.5 km) of stream are considered rare. Of the total linear amount of stream habitat known to be occupied by WCT in the North Fork Flathead River watershed, 81.9 % lies on lands administered by federal agencies (USFWS 1999). Data from the Interior Columbia River Basin Ecosystem Management Project (ICBEMP) indicate WCT stocks are strong or predicted strong in four hydrologic unit code (HUCs); depressed or predicted depressed in 31 HUCs; and absent or predicted absent in the one remaining HUC. Within that portion of the watershed that lies in Glacier National Park, genetically pure WCT naturally inhabit 10 lakes that have a total surface area of 2,407 acres (963 hectares) (Marnell 1988).

Middle Fork Watershed

The Middle Fork Flathead River watershed encompasses 727,680 acres (291,072 hectares) (USFWS 1999). Land ownership in the Middle Fork Flathead watershed is 51.1 % USFS, 46.0 % National Park Service, and 2.8 % private and other public entities (USFWS 1999). In the watershed, stocks of genetically pure WCT occupy 55.6 miles (89.4 km); stocks that are 99.9 to 90.0% pure occupy 15.8 miles (25.5 km); stocks that are <90% pure occupy 9.6 miles (15.5 km); and stocks in the remaining 435 + miles (700+ km) of stream (131 stream reaches) remain untested genetically (USFWS 1999; Shepard et al. 2003). Within the watershed, Marnell et al. (1987) identified the following lakes and associated tributaries as genetically pure: Avalanche, Lincoln, Lower Howe, Lower Isabel, Snyder, Upper Howe, and Upper Isabel. However, recent genetic testing indicates that Lincoln Creek is no longer pure. The remainder of genetically pure streams, as determined by Marnell et al., have not been recently tested. Recent genetic analysis also indicates the following waterbodies contain genetically pure WCT: Bear, Challenge, Cox, Ole, Park, Pinchot and Tunnel creeks, and Almeda, Bergsicker, Cup, Dickey, Elk and Scott lakes (MFWP unpublished data 2003; Appendix G).

Among the total 471 miles (758 km) of stream occupied by WCT stocks, 246 miles (395.9 km) of the stream have stocks that are considered abundant; stocks in the remaining 225 mile (362.1 km) of stream are considered rare. Of the total linear amount of stream habitat known to be occupied by WCT in the Middle Fork Flathead River watershed, 94.1 % lies on lands administered by federal agencies (USFWS 1999). Data from the ICBEMP indicate WCT stocks are depressed or predicted depressed in 41 HUCs and absent or predicted absent in the one remaining HUC. Within that portion of the watershed that lies in Glacier National Park, genetically pure WCT naturally inhabit 10 lakes that have a total surface area of 2,940 acres (1,176 hectares) (Marnell 1988).

South Fork Watershed

The South Fork Flathead River watershed is considered to be the last remaining stronghold of WCT in Montana (Leary et al. 1997) and encompasses 1,077,760 acres (431,104 hectares) (USFWS 1999). Land ownership in the South Fork Flathead watershed is 97.5 % USFS and 2.5 % private and other public entities (USFWS 1999). The upper two-thirds of the South Fork Flathead drainage lie entirely within the Bob Marshall Wilderness Area. In the watershed, stocks of genetically pure WCT occupy 218 miles (350.5 km) in 89 stream reaches; stocks that are 99.9 to 90.0 % pure occupy 54.5 miles (87.7 km); stocks that are < 90.0 % pure occupy 10.6 miles (17.0 km); and stocks in the remaining stream reaches remain untested genetically (USFWS 1999; Shepard et al. 2003). Among the total 609 miles (980.1 km) of stream occupied by WCT stocks, 559 stream miles (899.6 km) have stocks that are considered abundant; stocks in the remaining 50 miles (80.5 km) of stream are considered rare. Of the total linear amount of stream habitat known to be occupied by WCT in the South Fork Flathead River watershed, 97.4 % lies on lands administered by federal agencies (USFWS 1999). Data from the ICBEMP indicate

WCT stocks are strong or predicted strong in 51 HUCs and depressed or predicted depressed in the remaining 22 HUCs.

Appendix H presents the results of genetic analyses of the South Fork drainage, including those waterbodies that were identified to contain 100 percent genetically pure WCT populations (MFWP unpublished data, 2003).

Genetics and Fish Health Status of Donor Stock Streams

<u>Juvenile Donor Stock Collection- Creation of F1 Generation from Local Stock Conservation Strategy</u>

Appendix I presents genetic analysis data for streams throughout the North, Middle and South Forks of the Flathead River. Waterbodies identified to contain 100 percent pure WCT may be used for WCT collection. At this time, Haskill, Danaher and Gordon creeks have been identified as specific creeks from which juvenile WCT will be collected for donor stock.

One-hundred percent genetically pure WCT occupy only a portion of Haskill Creek, primarily in the upper-most reaches. As shown by genetic analysis, the genetic purity of WCT in the lower reaches of the creek is approximately 98.2 percent, with the remaining 1.2 percent contributed by RBT (B. Marotz, MFWP, personal communication, May 6, 2003; MFISH 2002). Currently, managers plan to recover the genetics of the remaining pure population for reestablishment after limiting factors, including the presence of BKT and degraded habitat, have been eliminated. Preliminary plans are to "rescue" the pure WCT, rearing juveniles at Sekokini Springs while restoration activities proceed. Upon completion of BKT removal and the establishment of barriers to prevent re-invasion by BKT and RBT, F1 progeny would be released back into Haskill Creek (B. Marotz, MFWP, personal communication, May 6, 2003). Fish health testing is scheduled for fall 2003.

Westslope cutthroat trout from Youngs and Danaher creeks were analyzed allozymically in 1989 and found to be 100 percent pure (MFISH 2002). Disease sampling indicated that the creeks were free from reportable pathogens (B. Marotz, MFWP, personal communication, May 6, 2003). Because these creeks have been tested for fish pathogens and contain pure WCT, they will be targeted as donor streams, following Haskill Creek.

Gordon Creek WCT were analyzed allozymically in 1989 and found to be 100 percent pure (MFISH 2002). Deoxyribose Nucleic Acid (DNA) testing performed in 2001 for Gordon Creek WCT confirmed that fish within the lower portions of this stream are 100 percent pure WCT (MFISH 2002). Fish health testing will be completed prior to juvenile collection.

South Fork Flathead tributaries of Youngs, Danaher and Gordon creeks have been reported to contain fish that are significantly different from the existing MO12 state broodstock (R. Leary letter to B. Shepard Montana Cooperative Fishery Research Unit dated May 16, 2002). Fish from these creeks could therefore be used to establish a unique donor population at Sekokini Springs. There are, however, inherent difficulties in collecting these fish and pack horses or helicopter (with the permission of the USFS) would be required.

Milt Collection - Infusion of New Material into MO12 Stock Conservation Strategy
Quintonkon and Deep creeks, both located within the South Fork Flathead were utilized in 2003 for the collection of milt from wild spawners. Fish pathogen testing indicated both creeks were free of pathogens of concern and the wild milt was used successfully to fertilize MO12 eggs of the state's broodstock.

Quintonkon Creek - According to 1983 electrophoretic genetic testing results conducted independently by Huston and Leary, the WCT population is considered 100% genetically pure (MFIS 2001). Allozymic testing confirming these results was funded by MFWP in 2002 (B. Marotz, MFWP, unpublished data, May 6, 2003).

Deep Creek – According to 2003 allozymic genetic analysis by Robb Leary, Deep Creek has been identified as containing 100 percent pure WCT (B. Marotz, MFWP, personal communication, May 6, 2003; MFISH 2003).

4.3.3 Collection Methodologies

Juvenile Donor Stock Collection- Creation of F1 Generation from Local Stock Conservation Strategy

Juveniles will be randomly selected from previously described donor populations through electrofishing or downstream trapping. The timing of collection would be based on access, and likely would occur in July and August when the weather would allow access to collection streams.

Capture of juveniles can be accomplished when spawning adults are absent from the stream, thus eliminating risk to the spawning population. Juveniles would be transported to Sekokini Springs in an insulated hatchery tank with oxygenation. Incremental removal of a subset of the natural population will provide a random selection from the available genetic material, while protecting the remaining wild population.

Milt Collection - Infusion of New Material into MO12 Stock Conservation Strategy

Mature male spawning WCT would be collected from Quintonkon and Deep creeks through electrofishing methods. Individuals collected from Quintonkon would be transferred via helicopter, while individuals collected from Deep Creek would be transferred via haul truck to be held and spawned at Sekokini Springs. Those individuals would likely be sacrificed following spawning activities.

For the collection of milt to infuse into the MO12 stock, the program goal is to collect up to 60 mature males from each donor stream. This can be accomplished over several years to avoid removing more than 50 percent of spawning males each year. In the future, if gametes from males and females are collected, the program goal is to obtain gametes from at least 25 females and 25 males, collected over the spawning period. No more than 25 percent of the females would be removed from the donor population in any given year.

4.3.4 Proposed Number of Juveniles Collected

No more than 25 percent of the juvenile population in a given reach will be collected for donor stock. If the number of juveniles within a population decreases, as evidenced through monitoring and evaluation procedures (population estimation through electroshocking assessments), less fish will be removed, or collection will cease. A precipitous decline (>25%) in a donor population from one year to the next would necessitate a cessation of juvenile collections. It is likely that fish from adjacent stream reaches will occupy the collection reach, so lasting impacts to the donor populations are not anticipated (B. Marotz, MFWP, personal communication, May 6, 2003). Once a given donor population has been successfully used to plant appropriate recipient stream(s) or lake(s), that donor stream will no longer be used for juvenile collections. Juveniles will then be collected from the next donor stream on the list.

The specific number of juvenile donor fish to be collected is dependent upon several factors, one of which is the estimated mortality rate of wild donor fish as they acclimate to conditioning ponds. The estimated mortality rate was assumed to be similar to that which occurred during the establishment of the state's existing MO12 captive broodstock. To establish that stock, approximately 4,600 fish were collected, of which approximately one-third of the wild fish died before they were acclimated to the hatchery environment (Grisak 2003). Based on these numbers, the mortality rate for captured wild juveniles is estimated to be approximately 33%. The fish collected for the MO12 stock were not separated by age class or size and were reared in conventional concrete raceways and fed commercial feed (M. Sweeney, MFWP, personal communication, March 4, 2003). At Sekokini Springs fish will be reared in earthen ponds at low densities and the use of supplementary natural food will occur. It is hoped that the mortality rate experienced by the MO12 program, or less can be obtained. If this occurs, fish collection numbers would be reduced in subsequent years.

Other factors that contribute to the number of juveniles to be collected include the relative abundance of juvenile WCT within the donor populations (Table 5-4), the carrying capacity of the proposed recipient streams and known survival percentages of various life-stages of reared WCT.

It is estimated that up to 1,000 individual juveniles (ages 1 and 2) will be removed from a given donor population/genetic stock each year (based on a percentage of the population estimated through electrofishing estimates, not to exceed 25 percent of the donor population).

4.3.5 Juvenile/Adult Holding

Juvenile Donor Stock Collection- Creation of F1 Generation from Local Stock Conservation Strategy

Approximately sixty individuals, or a number determined by the MFWP fish health specialist to be sufficient, from each lot will be sacrificed for disease testing before the fish are moved from the isolation facility (circular holding tanks in the hatchery building) to the outdoor ponds.

If disease testing results are positive for a reportable fish pathogen, fish will be removed from the facility and all equipment will be sanitized. The source population will be removed from the list of possible donor populations.

Juveniles collected for donor stock will be reared to maturity within the rearing ponds. Because wild WCT demonstrate variable growth rates among individuals in a population, collected juveniles would not be separated by size. Such a separation could lead to "hatchery grading" or the inadvertent selection for specific traits (B. Marotz, MFWP, personal communication, May 6, 2003). Feeding will be a combination of commercial fish feed and natural feed. Demand feeders will be utilized to minimize the interaction with humans.

Milt Collection - Infusion of New Material into MO12 Stock Conservation Strategy

Adults collected for milt collection will be held in at isolation facility within the hatchery building.

4.4 Sekokini Springs Facility Operations

4.4.1 Spawning

Juvenile Donor Stock Collection- Creation of F1 Generation from Local Stock Conservation Strategy

Collected juveniles will be reared to maturity within ponds that hold each collection year/genetic stock. Upon maturation, a false attraction weir (incorporated within the kettle structure), or kettle will be used to collect maturing adults from the conditioning ponds (Figure 7). A false weir will provide a migration path for the mature component of the population. These fish, following their instinct to migrate to spawning areas, will ascend the weir and be collected in the trap area. These fish will then be spawned adjacent to the ponds (a temporary spawning shelter will be placed on the concrete pad provided for this action). Mature fish will not be transferred to the hatchery building. An alternative method for adult collection will be to draw down the pond and collect fish within the kettle and sorted for ripeness.

Females will be live spawned and sperm from two males, one as a primary source and one as a "back up" would be used to fertilize each egg lot. Sixty fish will be kill-spawned and fish pathogen samples will be collected.

The following priorities have been established by facility managers for the use of semen during fertilization:

- Fresh semen (milt) would be used whenever possible. Recycled males may be used when low numbers of broodstock are available. Hormone injections of gonadotrophin may be used on males 7-10 days prior to the date females are expected to be ripe.
- Cryopreservation may be necessary if male and female wild adults do not become ripe simultaneously.

Prior to fertilization, each male's sperm would be checked for motility immediately before combination of gametes. Surplus milt would be cryopreserved and held for future use, or sent to a hatchery for infusion into the MO12 broodstock.

Milt Collection - Infusion of New Material into MO12 Stock Conservation Strategy

Adults collected for milt collection will be captured randomly during the migration period. Fish would be transported to Sekokini Springs for holding until they spawn. Milt will be collected from ripe males and transported in individual containers with oxygen, and on ice to the hatchery facilities producing the MO12 stock.

Milt from excess males for the F1 Generation Conservation Strategy may be infused into the State's MO12 captive broodstock upon approval of the State Hatchery Manager and Fish Health Specialist (B. Marotz, MFWP, personal communication).

4.4.2 Disposition of Donor Fish (Post Spawning)

Juvenile Donor Stock Collection- Creation of F1 Generation from Local Stock Conservation Strategy

Once collected donor juveniles have matured and spawned, spawned-out fish will be transferred to isolated fishing ponds, placed in the created stream channels at the site, used for fertilizer or donated to food banks. Transfer to isolated fishing ponds and the created channels must ensure that there will be no escape or accidental release of these fish. Non-controlled release of fish could result in hybridization of those individuals with RBT or introgression with genetically non-pure WCT individuals, which is counterproductive to program goals. Carcasses will not be returned to natal streams for nutrient enhancement.

Milt Collection - Infusion of New Material into MO12 Stock Conservation Strategy

Adults collected for milt extraction will be sacrificed and pathogen tested (B. Marotz, MFWP, personal communication, May 6, 2003) to ensure that fish pathogens are not transported to the captive populations and the associated hatcheries.

4.4.3 Incubation and Release Strategies at Sekokini Springs

Incubation will involve the use of tray type stack incubators, located within the hatchery building. Incubation trays can be divided and have the capacity to hold eggs from up to four adult pairs under segregated conditions. Trays will be supplied primarily by fish pathogen-free spring water from Springs 2 and 3, each of which averages about 60°F (15.6°C), and from the cold water from Spring #1, which provides water averaging 44°F (6.7°C). Variable temperatures available from the spring sources will allow for otolith marking.

Fertilized eggs will be disinfected during water hardening with an iodophor solution. No detrimental effects to WCT eggs have been demonstrated from this practice with exposure levels up to 125 mg/L for 30 minutes during water hardening (Pravecek and Barnes 2003). Eggs will be treated with formalin to prevent fungal infection.

Anticipated egg survival rates from green egg to eyed eggs, and eyed eggs to fry at the Sekokini Springs facility will be based on those experienced at the Washoe Park Trout Hatchery. Survival from green egg to eyed egg was 65-75%, and eyed egg to fry was 75-85% (J. Pravecek, MFWP, personal communication, February 24, 2003).

It is hypothesized that a spike in thyroxin hormone is associated with the time in which juvenile salmonids store the long-term memory required to imprint on their natal water source, enabling individuals to return to their natal tributaries as adults (Scholz et al. 1992; Dittman et al. 1996). The imprinting mechanism in WCT is poorly understood, although preliminary measurements indicate that thyroxine spikes occur around hatch and during swim-up (Tilson et al. 1994). The authors recommended that the study be repeated with more frequent sampling during incubation and continued through smoltification. It is thought that another spike may occur at smoltification.

In order to test which of these hormone spikes are important to the homing of WCT, two types of release strategies will occur in the program. F1 progeny will be outplanted as eyed eggs or as imprint fingerlings (juveniles released prior to the age at which they would emigrate from their natal tributary). Individuals from both strategies will be otolith-marked or scale-marked for future identification. Otolith marks may be created using thermal treatment (Schroder et al. 1996) or stabile elements (Snyder et al. 1992; Thresher 1999; Gillanders 2001; Wells et al. 2003). A few fish from each treatment will be sacrificed upon emergence to assure marks can be detected. Similar research on MFWP's Libby Mitigation program showed that otolith marks applied by cold temperature must be repeated several times to produce identifiable marks. Other otolith marks using strontium chloride or barium appear to be more easily identifiable.

Fish from both release strategies will be sampled annually in the rearing tributary using electrofishing population census to monitor age-specific survival and growth. Fish recaptured at larger size during subsequent surveys will be marked again using Passive Integrated Transponder (PIT) tags. Migrant traps and PIT tag detectors will be used to compare age and size at emigration from each source. Provided that the study fish survive in sufficient numbers to detect as spawning adults, we plan to install remote PIT tag detection stations to assess the degree of homing, or straying, of each release strategy to determine which thyroxine hormone spike, or both, are important to the homing mechanism in this species.

Incubation Through Early Rearing at Sekokini Springs

The first of these strategies will involve incubation, hatch and early rearing at the Sekokini Springs facility. Eggs will be incubated, hatched and subsequently placed into an on-site rearing pond and held until they are outplanted as fingerlings into a recipient stream. It is believed that these fish will experience one hormone spike at Sekokini Springs as swim-up fry and one as they emigrate from their "new natal water". It is anticipated that these fish will not smolt at Sekokini Springs since they will be released prior to the age of emigration.

Fry will be removed from incubator trays 5 days before swim-up and placed in fiberglass troughs (10 ft by 1 ft by 0.5 ft) receiving 8 gallons per minute (gpm) from the same water source. After fish are on feed and they reach roughly 1 inch (25 mm) in length, they will be moved to the outdoor rearing pond. This will occur in approximately July. A majority of the pond area will be designed to simulate "natural fish habitat" with the use of natural woody debris (overhead and submerged), overhead cover, a deeper pool area and large rocks for cover.

Incubation to Eyed-Egg Stage at Sekokini Springs

The second rearing strategy will incubated eggs on-site to the eyed egg stage. Otolith marking may occur during this period. Standard shocking methods will be used to cull non-viable eggs, and eyed eggs will be transferred to Remote Site Incubators (RSIs) or artificial redds to be located within the target streams. The resulting fish will be introduced to their "natal" streams as eyed eggs, producing a fish that experience two hormone spikes in the wild.

The use of RSIs for WCT incubation within Montana has shown to be successful with 70 – 75% survival rates (Hoffman et al. 2002). Because RSIs will be "outplanted" during late spring/early summer, there should be no potential for freezing of the systems. Eyed eggs will incubate in the recipient stream water and fry will emerge directly from the RSI. It is anticipated that the fry will rear in the recipient stream for up to four years (most WCT emigrate by age three) before emigrating from their natal tributary.

Substrate within target streams for artificial redds should contain a low percentage of fine sediments based on evidence from Weaver and Fraley (1993), which showed "a significant inverse relationship between fry emergence success, as measure by fry emergence traps, and the percentage of substrate materials less than 6.35 mm in diameter.". Artificial redds will be constructed mechanically or hydraulically to create an egg pocket where eyed eggs are deposited, gently buried and allowed to emerge naturally.

4.4.4 Outplanting into Restoration Streams

All fish planted from Sekokini Springs will be marked (e.g. fin clips, otolith, fluorescent pigments or chemical markers). Because there is limited information on appropriate stocking densities into streams and tributaries (M. Sweeney, MFWP, personal communication, March 4, 2003), fish from Sekokini Springs will normally be released to targeted recovery streams at a density not to exceed the maximum density of wild trout in a comparable stream order, gradient and flow range (Zubik and Fraley 1986). Experiments to examine stocking densities and determine the appropriate stocking levels may occur. Target streams to be stocked include previously fishless and degraded habitats within the historic range of WCT that have been recently recovered, or vacant habitats that have been blocked to fish passage by man-made obstacles. To be considered for stocking, all target streams must be absent of WCT, YCT and RBT, or isolated from wild spawners to minimize the expansion of introgressed or hybridized stocks in the Flathead Watershed.

As currently proposed, fish will be released into streams shown in Table 4-2. Figure 12 shows the location of potential restoration streams in the Flathead Basin. In addition to these streams, Logan Creek may receive outplants once BKT and RBT have been successfully eradicated.

Table 4-2. Potential Restoration Streams and Characteristics

Target Restoration Creek	Characteristics[1]
Abbott Creek	• Tributary of Flathead River (mainstem) • 4.5 miles, resident WCT in all • Contains two tributaries: South Fork Abbot Creek at River Mile (RM) 0.89 and Abbot Creek Trib #1 at RM 1.81 • Moderate fisheries resource value • 1994-95 data indicated genetically pure; 2000 data indicate new introgression • RBT introgression is moving upstream in this system (Hitt 2002) • MFWP currently removing a RBT hybrid swarm[2] • Upstream barrier installed in 2003 to block RBT spawning
Haskill Creek (also a donor stream)	• Tributary of Whitefish River – also will serve as donor stream upon complete eradication of BKT; Genetically pure WCT may be transferred to areas from which BKT and RBT are to be removed[2] • 8.0 miles with resident WCT from RM 4.3 to 5.4 • Moderate fisheries resource value • 2001-02 Paired Interspersed Nuclear DNA Element (PINE) genetic testing from 25 WCT from RM 4.8-4.9 indicates 1.8% introgression with RBT
An unnamed tributary located across the Flathead River from Sekokini Springs	• Radio tagged RBTxWCT hybrids observed ascending tributary during spawning period • Although tributary has marginal fisheries value, it is a potential source of RBT and hybrids • Risk evaluation ongoing
Swanson Creek (trib to Shepard Creek)	• USFS currently removing BKT and attempting to establish wild runs of WCT[2]
Gooderich Bayou	• Spring source tributary to Flathead River • Source of naturalized run of RBT and RBTxWCT hybrids • Upstream barrier installed fall 2003 to prevent RBT spawning • Genetically pure WCT adults planted above barrier 2003 remained in spring slough habitat • Scheduled for annual plant of 250 pure WCT, will assess natural reproduction

[1] MFISH 2001
[2] B. Marotz, MFWP, personal communication, May 6, 2003

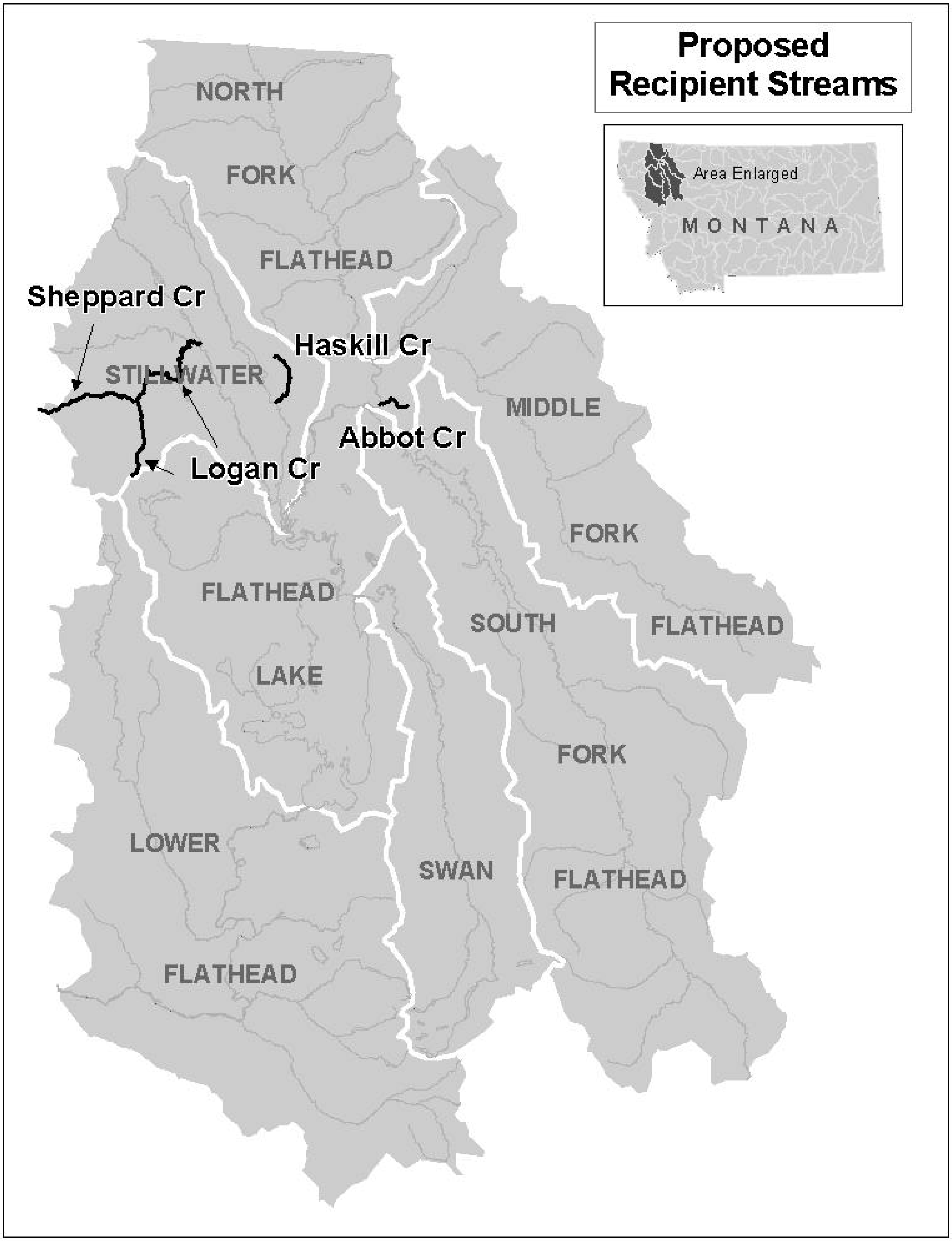


Figure 12. Location of Potential Restoration Streams

Additional sites within the Flathead River basin will be chosen for target releases as the program progresses. Experimental BKT removal programs may create restoration opportunities for WCT introduction in the future. Target streams should be as similar as possible to donor streams in terms of habitat, gradient, order and aspect to ensure the suitability of recipient streams to WCT.

In addition to the proposed restoration streams, in conjunction with the *South Fork Flathead Watershed Westslope Cutthroat Trout Conservation Program* (Grisak 2003), gametes and juvenile fish produced at Sekokini Springs may be used to aid in the restoration of genetic reserves in closed basin lakes. One component will involve replicating pure populations to restore populations where non-native fish or genetically introgressed populations were removed. Another component will infuse wild genes to lakes previously planted with MO12 WCT.

Imprint planting (F1 progeny outplanted as fingerlings prior to the age at which they would emigrate from their natal tributary) is consistent with the 1991 Hungry Horse Dam Mitigation Plan. The plan suggests the experimental planting of hatchery juveniles and eggs to test the relative success in the following order of priority:

- Imprint planting in blocked areas that will be reopened
- Imprint planting in habitat improvement sites
- Supplementation of juveniles or eggs in areas with low populations (MFWP and CSKT 1993) Note: Supplementation of existing WCT populations was subsequently discontinued. Instead, MFWP is attempting to increase low populations using passage and habitat improvements. MFWP still considers genetic "swamp-out" of hybridized populations using introductions of genetically pure WCT potentially beneficial under certain situations in headwater lakes (Huston 1998).

Imprint planting can initiate spawning runs in areas that do not contain a wild or naturally spawning population of fish (Miller et al. 1990).

In order to maintain existing genetics of natural populations within these systems, no fish from the Sekokini Springs facility will be introduced into waters containing genetically pure populations, classified by Leary et al. (1990) as A1 populations. A1 populations are those that are rated 100 percent genetically pure based on electrophoretic testing of at least 25 individuals from the population. The ultimate goal is to use members of the A1 population for donor stock collection.

4.4.5 Rationale for Number and Life History Stage at Release

With the exception of one stream-stocking event that occurred after a fire in a tributary system (M. Sweeney, MFWP, personal communication, March 4, 2003), the state of Montana has not and does not presently stock streams with WCT. Therefore, there is no model to predict the number of fish needed to be released into target streams to achieve a self-sustaining population. To determine the number of eggs and yearlings to outplant, co-managers relied on data from Zubik and Fraley (1986). These researchers developed a method to estimate the number of juveniles present in streams based on habitat, stream order and gradient (Table 4-3). These estimates have been used to predict stocking densities for outplanted eggs and juveniles as shown in Table 4-3. Proposed annual fish release levels (maximum number) by life stage and location are shown in Table 4-4.

Table 4-3. Mean WCT estimates per 100m of stream for juveniles greater than 75mm by stream order and gradient categories for tributary reached to the North, Middle and South Forks of the Flathead River (Zubik and Fraley 1986).

Stream Order	Gradient (%)	Mean Estimate
2	1.2 - 1.9	22.7
2	2.0 – 2.7	56.9
2	2.8 – 3.8	77.6
2	3.9 – 6.9	31.0
2	7.0 – 12.3	18.8
3	0.5 – 1.0	22.3
3	1.1 – 1.6	38.9
3	1.7 – 2.2	62.9
3	2.3 – 4.0	25.4
3	4.1 – 5.3	43.9
3	5.4 – 17.0	19.2
4	0.4 – 1.0	5.2
4	1.1 – 1.6	24.0
4	1.7 – 4.2	13.5
5	0.2 – 1.8	14.3
Mean		31.9

Table 4-4. Proposed WCT Stocked/Release from the Sekokini Spring Natural Rearing Facility.

Location	Life Stage	Stocking/ Release Method	Maximum Number	Release Date	Where released (RM)
Abbot Creek (Once RBT removed)	Eyed Eggs	RSI's		May	
		Artificial Redds	100,000		3-5
	Fingerlings	Direct Release	2,000	June – July	3-5
Haskill Creek (Once RBT/BKT removed)	Eyed Eggs	RSI's	20,000	May-June	6-8
		Artificial Redds	20,000	May	6-8
	Juveniles	Direct Release		June – July	6-8
Unnamed tributary to Flathead River (Survey ongoing)	Eyed Eggs	Artificial Redds	20,000	May-June	1-1.5
	Juveniles	Direct Release		June – July	1-1.5
Mountain Lakes South Fork Flathead WCT Conservation Project	juveniles	Direct Release	100 per acre	July-Sept	Lake center
Swanson Creek (once BKT removed)	Eyed Eggs	Artificial Redds	20,000	May-June	1.0
	Juveniles	Direct Release	400	June – July	0.5-1
Gooderich Bayou	Juveniles and spent adults	Direct Release	250 annually	Aug-Sept	1.0
Restored or reconnected tributary habitat	Fingerlings	Direct Release	50,000 (as available)	June – July	Treatment area

Historically, MFWP has stocked WCT artificial redds in closed-basin lake systems. These redds are usually stocked with approximately 1,500 eggs per redd and the number of redds per stream varies according to the number of naturally-occurring redds within a healthy stream of the same order. The usual range of artificially-created redds has been between 30 and 60 per reach. Using electroshocking sampling, the number of resulting juveniles can be estimated and future plants adjusted to achieve desired densities.

The use of RSIs for WCT incubation within Montana has shown to be successful with 70 – 75% survival rates (Hoffman et al. 2002). Because RSIs will be "outplanted" during late spring/early summer, there should be no potential for freezing of the systems. RSIs will be stocked at up to 10,000 eggs per container, although lower densities are preferred.

4.4.6 Measures of Success

Adult returns will determine the most successful release strategy. Once fish become established in an area, it will be important to determine how many returning adults attempt to spawn elsewhere. If fish do not imprint on the water source, the desire of surviving adults to return to the stream may be impaired and straying may occur.

4.5 Fish Health Management

The Fish, Wildlife and Parks fish health management project has tested fish reared at the Sekokini Springs site for pathogens since 1995. Annual inspections for the period 1995-1998 were conducted on fish held by the previous owner of the facility. The most recent inspection at this facility was conducted March 25, 2002. In this inspection 60 cutthroat trout and 60 Arctic grayling (*Thymallus arcticus)* being reared at Sekokini Springs were tested for bacterial and viral pathogens, in addition to *Myxobolus cerebralis*, the parasite responsible for whirling disease (MFWP lab number 020027). No pathogens were detected during this inspection. No pathogens of concern were detected during any of these inspections. All lab results are available from the MFWP fish health laboratory in Great Falls (Contact Jim Peterson, MFWP Fish Health Coordinator).

4.5.1 Stocking Inspection Requirements

Annual fish health inspections will be conducted at the Sekokini Springs facility, as they are at all Montana state fish culture facilities. However, instead of lot-by-lot testing conducted during a single inspection, periodic testing will be done at various times of the year depending on what fish are present at the facility. For example, young-of-the-year wild fish collected from wild populations will be tested at 4 inches in length. They will be tested again at sexual maturity. Fingerlings in the hatchery building will be tested prior to stocking.

Fish health inspections will include testing for all salmonid pathogens of concern as specified in the Administrative Rules of Montana (ARM 12.7.502). These pathogens include the following eight disease organisms:

*Infectious Hematopoietic Necrosis Virus (IHNV)
*Infectious Pancreatic Necrosis Virus (IPNV)
*Viral Hemorrhagic Septicemia Virus (VHSV)
**Oncorhynchus masou* Virus (OMV)
**Renibacterium salmoninarum*
**Aeromonas salmonicida*
**Yersinia ruckeri*
**Myxobolus cerebralis*

No fish may leave the Sekokini Springs facility until testing is completed, a fish-pathogen -free status is determined and a fish health inspection report is issued. Inspections will be conducted by the MFWP fish health project. Testing will be conducted using procedures established by the American Fisheries Society (AFS), Fish Health Section (FHS) in the AFS/FHS Bluebook, Suggested Procedures for the Detection and Identification of Certain Finfish and Shellfish Pathogens, 2003 Edition.

If a pathogen of concern is detected during any fish health inspection at the Sekokini Springs facility, the facility will immediately be placed under quarantine as specified in the MFWP Fish Health Policy. A meeting of the MFWP Fish Health Committee will be convened in order to develop an appropriate course of action. Actions may include removal of infected fish or disinfection of the entire facility, depending upon the pathogen detected and the risk to the facility and Montana's fishery resources. MFWP's Fish Health Policy will be followed regarding initiation and removal of a quarantine.

4.5.2 "Importation" Requirements – fish/eggs into Sekokini Springs Facility

All fish and eggs transported from any stream, lake, fish culture facility or any source to the Sekokini Springs facility must be from a source, which has a history of pathogen testing and found free of the salmonid pathogens of concern (See additional discussion under Pathogens of Particular Interest below). Little, if any, health history exists for many of the waters from which wild cutthroat trout or eggs will be collected. Therefore it is likely very little will be known about the health status of stocks selected for donor sources. Limited health testing will be conducted on fish from each donor source prior to collection of fish, regardless of the known health history of the water. Testing will be limited in many waters due to the availability of suitable fish for testing. MFWP will attempt to sample a suitable number of fish from each donor population to obtain a reasonable confidence of detecting fish pathogens, if they are present. Generally, MFWP will attempt to sample a minimum of 60 fish, 4 inches or larger. A sample size of 60 fish will result in a 95% confidence of being able to detect a fish pathogen, assuming as few as 5% of the fish in the population are infected with the pathogen (AFS/FHS Bluebook, attribute sampling table.) If 60 fish are not available due to limited population size, less fish may be tested. A donor stream will not be selected unless a minimum of 15 four inch or larger fish can be health tested and determined pathogen-free prior to collection of fish for transfer to Sekokini Springs. Fifteen fish is not enough to establish reasonable confidence of pathogen detection. However, this number is felt to provide an idea of the pathogen risk associated with donor waters. If no pathogens are detected, fish may be moved from the donor water to the Sekokini Springs facility.

MFWP prefers collecting fish from donor streams for which an established health history over several years is available. However, few of these waters exist. The risk inherent to moving live fish increases with fish from waters with little or no health history.

In the case of eggs taken to the facility, the parent stock from which the eggs are collected must have been pathogen tested prior to the eggs being taken to Sekokini Springs. These eggs must be held in isolation in the Sekokini incubators until results of the parental health inspection are received indicating no pathogens of concern were detected. Effluent from the incubators will be piped out of the building and run into the ground. No effluent from egg incubation will be allowed to enter any of the Sekokini ponds. The eggs will remain in the incubators until the health testing from the adults is completed. If a pathogen is detected in the health samples collected from the adult fish from which eggs were collected, the eggs will be destroyed before they hatch. Note: The level of testing of adults will be determined at the time of spawning based on the number of fish in the donor stream. Generally, a minimum of 60 fish, or 100% of the contributing adults from which eggs are collected, will be tested at the time of egg collection.

There will be many times when juvenile fish may have to be collected for transport to Sekokini Springs from a source which can not be adequately health tested. However, regardless of the health history of the donor fish, all wild fish collected and taken to the Sekokini Springs facility will be held in tanks, which are isolated from all other fish at the facility until they are a minimum of four inches. At four inches a representative 60-fish sample will be health tested. If no pathogens of concern are detected in these samples, the fish may be moved to the lower rearing ponds. In addition, there may be times when eggs will be collected for transport to Sekokini Springs from sources where adequate testing of the parent stock is not possible. In these cases, the fish or eggs must be held in isolation at the facility, until such time that adequate health testing can be conducted on the fish (four inch minimum size.) A minimum sample of 60 fish, representative of the collection lot, must be tested and determined to be pathogen of concern negative prior to transfer to the rearing ponds.

While no pathogens of concern have ever been detected at the Sekokini Springs facility, it must be emphasized that the potential to import pathogens exists every time fish or eggs are collected from a wild source and transported to the facility. For this reason inspection of representative fish at all donor sources, and annual inspections of the Sekokini Springs facility is essential.

4.5.3 Pathogens of Particular Interest:

Viral pathogens (IHNV, IPNV, VHSV, OMV). Fish or eggs will not be collected from any donor population where any of these viruses are known to occur. If any virus is detected in fish after being taken to the Sekokini Springs facility, the facility will be placed under quarantine and the fish will be destroyed.

Myxobolus cerebralis. The whirling disease parasite has been present in Montana waters since 1994 and is present in the Flathead River drainage, having been detected in the Swan River and several tributaries to the Swan River, and in Mission Creek and Crow Creek, below Flathead Lake. The parasite has not been detected in the upper Flathead River or any of the main forks of the Flathead River above Flathead Lake. However, as of printing of this plan, the parasite has been detected in over 120 different waters in Montana, and it is expected to continue to spread (J. Peterson, MFWP, personal communication, 2004).

Renibacterium salmoninarum is the bacteria which causes bacterial kidney disease (BKD). This bacteria is known to occur in many waters across Montana. It has resulted in fish losses at fish hatcheries, but clinical disease has not been observed in the wild. It is important to discuss in the Master Plan because this bacteria may be present at low levels in donor fish, from which eggs will be collected for transport to Sekokini Springs. It is also of interest because this bacterial fish pathogen is known to be transmitted with eggs. MFWP requires *R. salmoninarum* testing of all stocks from which eggs are collected. Testing required by MFWP is the fluorescent antibody test (FAT). While other testing methods may be more sensitive than the FAT test, MFWP relies on the FAT procedure to detect medium and high range infections. Fish which test positive for *R. salmoninarum* using the FAT test will not be considered as egg sources for Sekokini Springs.

Aeromonas salmonicida and *Yersinia ruckeri* (type 1). *Aeromonas salmonicida* is known to occur in various waters in the Flathead drainage. Donor stocks are tested for these bacterial pathogens. Live fish infected with either of these pathogens will not be allowed to enter Sekokini Springs. Since these bacterial pathogens are not known to be egg-transmitted, properly disinfected eggs from parents infected with either of these organisms may be transported to Sekokini Springs with approval of the MFWP Fish Health Coordinator. Note: all eggs which are taken into the Sekokini Springs facility must be thoroughly disinfected with iodophor disinfectant prior to entering the facility. Eggs will be water hardened in an iodophor solution at the time of fertilization. A 100 mg/L solution of povidone iodine will be used for this process. Eggs will be water hardened in this solution for 30 minutes. This will be done at the time and place of fertilization. External disinfection of eggs will be conducted prior to eggs entering the Sekokini Springs hatchery building. It is anticipated this will be done in the parking lot behind the building. External egg disinfection will be conducted at a concentration of 100 mg/L for 10 minutes. At times, green eggs may need to be collected for fertilization at Sekokini Springs. These eggs will also be water hardened in iodophor as described above. If this process takes place inside the hatchery building, special care must be taken to avoid contamination of the hatchery facility.

4.5.4 Gamete Collection for Westslope Broodstock Development - Infusion of New Material into MO12 Stock Conservation Strategy

One of the primary objectives of the Sekokini Springs project is collection of gametes for incorporation into the MO12 WCT broodstock. In order to accomplish this, wild fish may be taken to Sekokini Springs for egg or sperm collection. Prior to collecting these fish from the wild, health testing will be conducted as described above for wild fish collection. Once at the facility, these wild fish will be treated the same as wild fish brought to the facility for rearing. They will be taken to the wild fish tanks, where gametes will be collected. After collection of gametes, these fish will be sacrificed for health testing.

4.5.5 On-site Fish Health Monitoring

The MFWP Fish Health Coordinator shall be responsible for determining sampling protocol and time of inspection. The MFWP Fish Health Coordinator will schedule all inspections at the facility with the Sekokini Springs facility manager. Fish health inspections conducted prior to collection of fish or eggs from wild sources will be coordinated with the MFWP Fish Health Coordinator, regional staff responsible for management of waters from which fish will be collected, and the Sekokini Springs facility manager. Collection and transfer of fish in specific situations, which do not meet the requirements of this section, must be approved by the MFWP Fish Health Committee prior to transfer.

The following on-site inspections will be conducted:

- Wild fish brought to Sekokini Springs will be health tested at 4 inches (60 fish)
- Mature spawning fish at Sekokini Springs will be health tested at the time of spawning (Minimum of 60 fish or 100% of spawning adults)
- Fingerlings will be health tested prior to being stocked back into the wild (60 fish)
- Other testing at Sekokini Springs may be conducted as necessary.

An on-site fish culturist will monitor fish health at the facility. All fish health problems or unusual symptoms or mortality will be immediately reported to the MFWP Fish Health Coordinator. Fish health management will be consistent with MFWP fish health policy, Pacific Northwest Fish Health Protection Committee (PNFHPC) Model Program, Integrated Hatchery Operations Team (IHOT) policies, and Montana laws (87-3-209), ARM 12.7.502-12.7.504. Equipment used at the hatchery will be disinfected with chlorine, iodophor or other approved disinfectant between uses.

4.6 Captive Broodstock Option

Although Montana’s captive brood stock is available to reestablish WCT in many areas, a source of genetically pure WCT from “nearest neighbor” wild sources within the Flathead watershed is needed to replace certain populations locally. There are no plans to maintain a captive broodstock at the Sekokini Springs facility.

4.7 Monitoring and Evaluation Activities

MFWP is pursuing and under contract to complete investigations in support of the Mitigation Plan. A number of these activities will involve assessments of WCT populations and the eggs or fish provided by the Sekokini Springs facility. The M&E portions of MFWP’s BPA contract workplan and proposals will provide detailed plans for M&E efforts that will link to this proposed action. Some specific actions for the Sekokini Springs facility are detailed below.

Development of a Hatchery Genetic Management Plan is on-going by MFWP. The draft document in presented in Appendix J.

Monitoring and evaluation activities for the facility will include genetic monitoring to verify the genetic makeup of fish collected. To differentiate WCT from RBT, YCT or introgressed forms, genetic sampling may involve protein electrophoresis, paired interspersed nuclear DNA element – Polymerase Chain Reaction (or PINE marker) method or various mitochondrial DNA marker techniques. Samples would be analyzed by the Montana Wild Trout and Salmon Laboratory at the University of Montana, Missoula or suitable laboratory.

Releases from Sekokini Springs will be monitored over time to determine which strategy is most cost effective for reestablishing a wild population. Successful restoration of wild spawning runs in tributaries to the Flathead River can be assessed by migrant trapping, redd surveys and population estimation before and after fish/egg stocking into restored or reconnected habitat. Upstream spawning migrations into restored and reconnected streams will be sampled using migrant traps or remote PIT tag detectors. Spawners will be examined for physical tags or microelemental signatures in calcified fish tissues (Wells et al. 2003). MFWP is also researching a non-lethal sampling methodology that uses DNA analysis of fin tissue and minerals incorporated in fish scales to determine their natal stream or origin (Muhlfeld et al. in review). Spawning success will be assessed through standard redd counts. Progeny will be assessed using 492 ft (150 m) electrofishing reaches and standard population estimates.

Fish from both release strategies (eyed eggs and imprint fingerlings) will be sampled annually in the rearing tributary using electrofishing population census to monitor age-specific survival and growth. Fish recaptured at larger size during subsequent surveys will be marked again using Passive Integrated Transponder (PIT) tags. Migrant traps and PIT tag detectors will be used to compare age and size at emigration from each source. Provided that the study fish survive in sufficient numbers to detect as spawning adults, we plan to install remote PIT tag detection stations to assess the degree of homing, or straying, of each release strategy to determine which thyroxine hormone spike is important to the homing mechanism in this species.

Donor streams will be monitored to determine whether the population is impacted by removing 25 percent of juveniles. Mark-recapture population estimates will be performed using standard electrofishing techniques prior to or during juvenile collections. Ad fluvial populations will be sampled before or after the spring spawning run to avoid migratory fish. Fish density (fish / 150 m stream length) will be used to estimate the length of stream required to provide the appropriate number of juveniles for collection. The sampling reach will be recorded using GPS coordinates. One year following juvenile collection, the population in the sampling reach will be surveyed for comparison. The timing of samples will be consistent seasonally. Initially, donor streams will be sampled annually to assess trends in juvenile densities and annual variation. Some proposed donor streams are designated index streams that are monitored annually as part of a juvenile population assessment conducted by MFWP. Past data from the index streams provide a measure of natural annual variation. When fish populations decline beyond the known annual variation in reference streams, juvenile collections will be terminated until survey results indicate that the population has rebounded to previous levels. Annual sampling of donor populations will be used to assess rates of population recovery after juvenile collections cease. Sampling in a given stream will end after the population rebounds to previous levels.

During monitoring and evaluation efforts (and collection activities), extreme care will be taken when applying electrofishing for collection of WCT. Dwyer et al. (2001) applied three methods of electroshocking to juvenile WCT to analyze effects from this method of fish collection. Fish were sampled 110 and 250 days post treatment. It was found that juvenile WCT (mean weight of 172 grams) exposed to electroshocking were negatively affected, as measured by weight gain and presence of spinal injuries. The authors express the need for caution when sampling small populations, where individuals may be of great importance, using electroshocking equipment (Dwyer et al. 2001). MFWP has responded by using Smith-Root electrofishing systems specifically designed to reduce injury in fish by using 300 volt pulsed DC at 30 Hz frequency at a pulse rate of 8 ms.

All non-native species (e.g. RBT) or apparently hybridized or introgressed individuals collected during M&E efforts will be held for transport to a closed-basin “put and take” children’s fishing pond called Dry Bridge Slough on South Woodland Drive, Kalispell, Montana.

Experimental plants of marked eyed eggs or fry will be assessed using various marks determined by the longevity of the marks and the intent of the assessment. Short term marks (e.g. oxytetracycline, fin clips or fluorescent pigments) will be used to assess rearing survival in the natal tributary and emigration rates. Migrant class (age at which fish emigrate from tributaries) can be determined using growth checks on scales, or through known intervals between the time of marking and subsequent emigration. Long term marks, including pit tags, pigment dyes, and stable isotope marks on calcified tissues must be used to assess the origin of returning adults. Condition factor and incremental growth from scales and/or otoliths will be used to describe the health of individual fish relative to the proposed rearing strategies i.e.: eyed egg (RSIs or artificial redds), or fingerling imprint plants.

Experimental microprobe ablation and mass spectrometry techniques will be used combined with stream-specific water chemistry to "finger print" fish and their origin. An understanding of the origin of wild fish and F1 progeny from Sekokini Springs can help to assess the effectiveness of various techniques for reestablishing self-sustaining runs.

MFWP is also planning a controlled experiment at Sekokini Springs to assess the persistence of elemental markers (Sr, Sr stable isotopes, Ba, Mn and Mg) on fish scales. These marks will be at concentrations observed naturally in the environment that have proven to be quite accurate in assigning fish to their natal tributary. Unfortunately, the marks apparently "reset" over time, so researchers need to determine how long the marks actually last. Once that is known, recently emigrated fish can be used for future assessments. All this work will help researchers track fish once in the wild. Also, all wild fish are naturally marked by their environment, so researchers can determine the relative contribution from various streams, or changes in recruitment resulting from various mitigation actions.

4.7.1 Fish Culture Monitoring

Fish culture monitoring activities will consist of documenting facility operational practices including evaluation of the following:

- Monitoring fish health
    - collection of mortalities (saved for biological analysis)
    - daily observation of behavior
- Fish rearing records (as can be collected without excessive handling to the fish)
    - survival by life stage
    - growth rates
    - feed consumption
    - feed conversion
    - condition factor
- Document release data
    - location
    - number
    - size at time of release

Chapter 5. Life History and Management Background of Westslope Cutthroat Trout

5.1 Description of the Flathead River System

The Flathead Subbasin is located in northwestern Montana and the southeastern corner of British Columbia, Canada. The subbasin is the most northeastern drainage of the Columbia River and encompasses almost six million acres (two million four hundred thousand hectares). Tributaries originate in Glacier National Park, the Bob Marshall Wilderness, and Canada. The mouth of the river is located at Paradise, Montana. The mainstem Flathead River begins at the confluence of the North and Middle Forks near Coram, Montana and flows southerly for 55.4 miles (89 km) where it enters the north end of Flathead Lake. This river is a sixth–order stream and flows predominantly through agricultural and forested lands of the Flathead Valley. The Sekokini Springs facility is located along the mainstem Flathead River, upstream of its confluence with the South Fork (Muhlfeld et al. 2000; Figure 13).

Within the U.S.'s portion of the subbasin, approximately 1.9 million acres (760,000 hectares) are protected and approximately 210 miles (338 km) of river are federally designated as Wild and Scenic with a recreational Outstandingly Remarkable Values (ORV; Table 5-1; CSKT and MFWP 2001). The Sekokini Springs site is located within an area classified as a recreational ORV under the Wild and Scenic Act.

Table 5-1. Flathead River Subbasin National Wild and Scenic Rivers

Flathead River Segment	Location	River Mile (River kilometer)	Classification
North Fork	U.S./Canada border to Camas Bridge	40.7 (65.5)	Scenic
	Camas Bridge to Middle Fork	17.6 (28.3)	Recreational
Middle Fork and Upper Mainstem	Headwaters to Bear Creek	46.6 (74.9)	Wild
	Bear Creek to South Fork	54.1 (87.0)	Recreational
South Fork	Headwaters to Spotted Bear River	51.3 (82.5)	Wild
	Spotted Bear River to Hungry Horse Reservoir	8.8 (14.1)	Recreational

Source: Flathead River Subbasin Summary (2001); Zackheim 1983

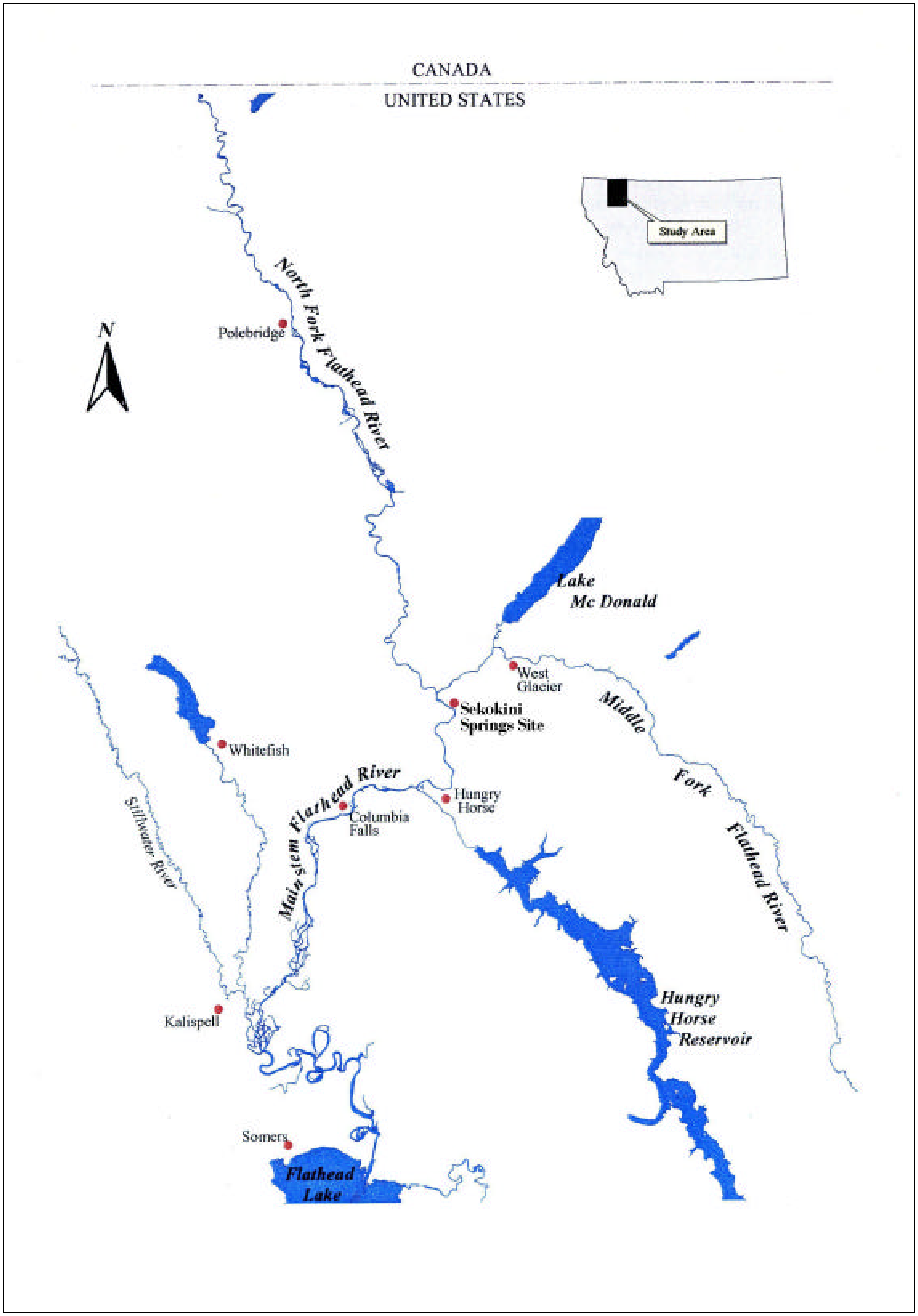


Figure 13. The Upper Flathead River Drainage Area including Flathead Lake and the Mainstem, North, Middle, and South Forks of the Flathead River.

There are ten native species and twelve introduced species in the Flathead system (Fraley et al. 1989; Montana Fisheries Information System, Helena 2003). Table 5-2 lists native species and Table 5-3 lists exotic fish species and the dates they were introduced.

Table 5-2. List of Native Fish Species currently found in the Flathead System

Common Name	Scientific Name
Bull trout	*Salvelinus confluentus*
Westslope cutthroat trout	*Oncorhynchus clarki lewisi*
Mountain whitefish	*Prosopium williamsoni*
Pygmy whitefish	*Prosopium coulteri*
Longnose sucker	*Catostomus catostomus*
Largescale sucker	*Catostomus macrocheilus*
Northern pikeminnow	*Ptychocheilus oregonensis*
Peamouth	*Mylocheilus caurinus*
Redside shiner	*Richardsonius balteatus*
Sculpin spp.	*Cottus spp.*

Sources: Hanzel 1969; Alvord 1991; Deleray et al. 1999

Table 5-3. List of Non-Native Fish Species Currently Found in the Flathead System

Common Name	Scientific Name	Date Introduced
Lake trout	*Salvelinis namaycush*	1905
Lake whitefish	*Coregonus clupeaformis*	1890
Kokanee	*Oncorhynchus nerka*	1916
Yellow perch	*Perca flavescens*	1910
Northern pike	*Esox lucius*	1960s
Arctic Grayling	*Thymallus arcticus*	1927
Rainbow trout	*Oncorhynchus mykiss*	1914
Brook trout	*Salvelinus fontinalis*	1913
Yellowstone cutthroat trout	*Oncorhynchus clarki bouveiri*	1924
Largemouth bass	*Micropterus salmoides*	1898
Pumpkinseed sunfish	*Lepomis gibbosus*	1910
Black bullhead	*Ameiurus melas*	1910

Sources: Hanzel 1969; Alvord 1991; Deleray et al. 1999; Fraley et al. 1989

Note: In addition, Fathead Minnow (*Pimephales promelas*) was discovered in Beaver Lake circa 1999 and are now a self sustaining population. One illegally introduced female Walleye (*Stizostedion vitreum*) was captured and removed from a Flathead River slough by MFWP personnel in 2000 (apparently stocked in late 1990's). Black Crappie (*Pomoxis nigromaculatus*) were illegally introduced to Blanchard Lake circa 1997 and are now self reproducing.

5.2 Life History and Population Biology of Westslope Cutthroat Trout

Westslope cutthroat trout are a subspecies of interior cutthroat trout (*Oncorhynchus clarki*) that were once the dominant trout over a historic range in the U.S. that included western Montana, central and northern Idaho, and a small portion of northwestern Wyoming (Liknes and Graham 1988). WCT are native to the Flathead drainage, which is one of the most important remaining strongholds for the species (Deleray et al. 1999). In many of the headwater streams, WCT are the only fish present. Westslope cutthroat trout using the mainstem of the Flathead River have diverse life history strategies, which makes it difficult to assess the status of populations because individual fish of one life history are generally not visually distinguishable from those of another life history. Determining population status for this species is difficult due to the timing of seasonal migrations and overlapping habitat use by representatives of the different life histories.

Three life history strategies are exhibited by WCT in the Flathead watershed: resident, fluvial, and adfluvial. The resident form completes its entire life cycle solely in headwater tributaries to all three Flathead River forks (Deleray et al. 1999). Migratory forms of WCT grow to maturity in the river (fluvial) or lake (adfluvial) before returning to their natal streams to spawn (Liknes and Graham 1988; Fraley et al. 1989).

Fluvial fish spawn in tributaries where the young live for up to four years. Approximately 60% of WCT emigrate from their natal tributaries to Hungry Horse Reservoir at age III (May et al. 1988). Upon maturation, fluvial fish migrate to the Flathead River. Fluvial WCT are found primarily in the mainstem of the South Fork above Meadow Creek Gorge, and portions of the Middle Fork.

Adfluvial fish, like the fluvial form, spawn in tributaries where the young live for up to four years and then migrate to Flathead Lake. Adfluvial WCT generally occur in the lower South Fork of the Flathead up to Meadow Creek Gorge and in the Middle and North forks of the Flathead River. Additionally, adfluvial WCT use the mainstem river and North and Middle Forks as a migratory corridor. Adults migrate to and from spawning tributaries from early winter through summer, while juveniles migrate from rearing streams toward Flathead Lake from early summer through winter (Shepard et al. 1984; Liknes and Graham 1988). As winter approaches, some WCT begin long downstream migrations to avoid unsuitable temperatures. Where adequate overwintering habitat is available, some WCT exhibit a sedentary behavior. These sedentary fish are often young juveniles that are small enough to find suitable habitat within the gravels of a streambed (Muhlfeld et al. 2000; Liknes and Graham 1988).

5.2.1 Timing

Westslope cutthroat trout males attain sexual maturity beginning at age 2 and are usually all mature by age 4. Females begin to mature at age 3 and most are mature by age 5 (Downs et al. 1997). WCT within the Flathead River basin attain sexual maturity at age 4 and older (Liknes and Graham 1988). Resident and migratory WCT spawn in May and June in small and intermediate-sized tributaries. Juvenile WCT emerge from the spawning redds in June and July, depending on time of spawning and water temperature. Most of the migratory WCT leave the tributaries as juveniles at two or three years of age, primarily during June and July.

Repeat spawning varies greatly in Montana, from 0.7% of the spawning population in Young Creek (May and Huston 1975) to 24% of the spawners in Hungry Horse Creek (Huston 1972).

5.2.2 Distribution

Within the Flathead River basin, approximately 5,582 miles (8974 km) (33.9%) of the estimated 16,466 miles (26,472 km) of historic stream habitat have been surveyed for WCT. Among those stream miles surveyed, WCT have been documented in 4,174 miles (6711 km) of the stream (74.8%) (USFWS 1999). Liknes and Graham (1988) suggest that WCT are still present in 85% of their historic range in the Flathead River basin. Spawning is likely in all tributary headwaters that are accessible to the species. The Middle Fork of the Flathead River downstream from the wilderness boundary contains mostly adfluvial cutthroat. The Middle Fork upstream of the wilderness boundary and possibly the North Fork from Polebridge to the Canadian border contain primarily fluvial cutthroat (Fraley et al. 1989).

Estimates of juvenile WCT densities from the North, Middle and South Forks of the Flathead River are shown in Appendix K. Population estimates for juveniles >2.95 inches (75mm) for donor streams is shown in Table 5-4.

Table 5-4. The reach, stream order, gradient and juvenile WCT estimates (> 2.95 inches (75mm)) for Specific Reaches of Donor Stock Collection Streams (Milt and Juvenile Collections Combined).

Drainage	Stream	Reach	Stream Order	Gradient (%)	WCT Juveniles per 100m
South Fork	Deep Creek[1]	1	2	9.6	51.1
	Youngs[1]	1	3	0.8	22.3
	Quintonkon[1]	2	3	2.3	27.2
	Gordon Creek[1]	1	4	0.4	4.9
	Danaher Creek[1]	1	5	0.7	19.6
Whitefish River (tributary to Flathead)	Haskill	Unknown	Unknown	Unknown	Unknown

[1] Zubik and Fraley 1986

5.2.3 Age Composition

Shepard et al. (1984) estimated maximum ages of 7 for WCT inhabiting waters of the Flathead River/Lake subbasin. Age composition likely varies from year to year within the Flathead River. Pooled scale information from all forks of the River (251 samples analyzed) indicates that WCT exhibit the mean lengths shown in Table 5-5, which correspond with age:

Table 5-5. Westslope cutthroat trout lengths and corresponding age classes

Mean length In inches (mm)	Estimated age
2.2 (55)	1
3.9 (100)	2
5.7 (146)	3
7.6 (194)	4
9.9 (251)	5
11.9 (301)	6

Source: Shepard et al. 1984

Downs et al. (1997) stated that length is a better predictor of sexual maturity than age in WCT. Using the age-to-length ratios presented in Table 5-5, estimated cutthroat trout numbers from a 1986 South Fork study indicate that approximately 86 percent of the population was less than 10.5 inches (254 mm) in length. This suggests that most fish in the South Fork are less than four years old. Mid-sized, 10.5 to 12.0 inches (254 – 305 mm, or age 4 and 5 fish) WCT comprised roughly 10 percent of the population, while large fish (> 12 inches (305 mm)) averaged only four percent of the population (Deleray et al. 1999). Estimates from the Middle Fork in 1994 indicate that small fish (< 10 inches (254 mm)) comprised approximately 98 percent of the total population for that year (Deleray et al. 1999). Snorkel estimates from the 1990s are consistent with those findings. The majority of fish within the Flathead River system appear to be less than four years of age (Deleray et al. 1999). These findings focused only on river and tributary systems where young adfluvial fish hold and rear until they emigrate to lakes. Therefore, these studies give no indication as to adult survival and abundance.

5.2.4 Sex Ratio

Spawning populations of WCT tend to have a high ratio of females to males. Studies from three Montana waters and one Idaho stream yielded a 3.4:1 ratio of females to males (Liknes and Graham 1988). However, in isolated headwater populations in Montana, Downs et al. (1997) documented an average of 1.3 males per female. Washoe Park Trout Hatchery in Anaconda reported that sex ratios of WCT are typically 1:1 (P. Suek, MFWP, personal communication, 2003).

5.2.5 Fecundity

Fecundity is associated with age and size where larger fish tend to produce more eggs.
Estimated average fecundity of Flathead River naturally produced WCT appears to be approximately 500 eggs per female (fecundity increases in the hatchery setting as shown from WCT at the Washoe Park Trout Hatchery, Anaconda, MT. J. Pravecek, MFWP, personal communication, 2003). Year 3 females have an average fecundity of 500 – 700 eggs per female and year 4 fish have an average fecundity of 1,000 – 1,200 eggs per female (J. Pravecek, MFWP, personal communication 2003). Published accounts suggest that WCT fecundity is slightly higher than for other subspecies and varies from 1,000 to 1,500 eggs for females with a mean length of 14 inches (355 mm) and mean weight of 1.1 pounds (0.5 kg) (Roscoe 1974; Liknes and Graham 1988).

5.2.6 Egg Incubation

WCT require an average of 1,100 accumulated daily temperature units (DTU) to develop into free-feeding fry (Lake Chelan Emergent Fry Study. Chelan County PUD. 2000). Eggs deposited in May through June will produce emergent fry in June through July, depending on the time spawning and water temperatures. Washington Department of Fish and Wildlife (WDFW) biologists (2002) suggest an optimum incubation temperature of 55°F (12.7°C).

5.2.7 Juvenile Rearing

Juvenile WCT rear in natal streams and generally emigrate downstream at age 2 or 3 (Shepard et al. 1984). According to Liknes and Graham (1988), age 1 outmigrants may also be abundant downstream of spawning tributaries. Shepard et al. (1984) suggest that some juvenile WCT may move out of natal streams, overwinter in adjacent rivers, and then migrate to a lake. Juvenile emigration may also occur at early ages during the fall (Bjornn and Mallet 1964; May and Huston 1974, 1975), which may indicate a lack of overwintering habitat in upstream tributaries. Those juveniles that do not move from natal areas for overwintering may move into crevices in the substrate (Liknes and Graham 1988).

5.3 Historical and Current Fisheries Management

5.3.1 Historical Harvest Management

MacPhee (1966) found that WCT are highly vulnerable to angling, which is thought to be a contributing factor to their decline. Over time, angling limits for WCT have become much more restrictive. Downs et al. (1997) state that mature males, in particular, are especially susceptible to angling, which may explain skewed sex ratios. Angling for cutthroat trout is catch-and-release, except for the Middle Fork Flathead and the Great Bear Wilderness, and South Fork tributaries and lakes upstream of Hungry Horse Reservoir and the Bob Marshall Wilderness, where it is legal to harvest three fish less than 12 inches. (Table 5-6). Since the early 1970s, additional harvest management protection has been afforded to WCT as managers developed a policy of not planting exotic fish species in areas where they would compete with native species. One exception to this is kokanee salmon that have been planted throughout the Flathead River system until the mid-1990s. Additionally, since 1982, a policy has restricted the use of non-native fish in private ponds connected to the Flathead Lake and River system (MFWP and CSKT 2000).

Table 5-6. Historic and Current Angling Limits for Westslope Cutthroat Trout in the Flathead Lake and River System

Year	WCT Catch Limit
1959	10, or 10 pounds and 1 fish
1982	5
1984	5 (only 1 over 14 inches (356 mm) in River)
1986	5 (only 1 over 14 inches in River)
1990	2 in Lake, 5 (only 1 over 14 inches in River)
1992	2 in Lake, 5 (only 1 over 14 inches in River)
1994	2, only 1 over 14 inches
1996	2, only 1 over 14 inches
1998	Catch and Release only (except where wilderness limits apply and lakes other than FHL)

Source: MFWP and CSKT 2000

Tribal Harvest Management

The Tribes' *Fisheries Management Plan for the Flathead Indian Reservation,* adopted in 1987 and amended in 1993, is guided by three basic assumptions: (1) the Tribes are committed to managing their fisheries resources using the services of a professional staff and employing professional management techniques; (2) the Tribes wish to manage their fish stocks to provide fish for food, recreation, or Tribal commercial purposes consistent with their potential habitat; and (3) the Tribes wish to manage fisheries to maintain the current species composition found in reservation waters. An exception is where bull trout and pure strain WCT are found, they will have priority over non-native species. The plan also describes tribal policy on the introduction of non-native aquatic organisms, stocking, and procedures for developing regulations and management strategies.

State of Montana Harvest Management

Currently, there is no allowable harvest in the contiguous Flathead River system. The state of Montana has implemented a mandatory catch and release regulation for WCT in the Flathead River system. Wild runs established by this project in Flathead River tributaries will be protected by the mandatory catch and release.

Harvest of WCT (5 daily and 10 in possession) is currently allowed in lakes and standard Montana regulations apply to lake systems. These regulations do not include Flathead Lake where WCT harvest is catch and release only. Proposed regulations for the 2004 through 2007 fishing season limit the catch of WCT to three daily and in possession for streams, rivers, lakes and reservoirs in the Western District, within which the Flathead Subbasin occurs. However, proposed regulations in Flathead Lake still maintain catch and release only for WCT.

The offspring of wild WCT reared at Sekokini Springs will primarily be used to initiate wild spawning runs in restored or reconnected habitat. Once spawning runs are established, harvest will be controlled through fishing regulations. Most onsite areas are regulated for mandatory catch and release fishing, until such time as populations increase enough to sustain harvest. Surplus fish will be reared to maturity and then outplanted in closed-basin lakes to provide angler harvest as part of Montana's Family Fishing program. Additionally, surplus fish could be outplanted into lakes being chemically rehabilitated as part of the WCT conservation program. This strategy will speed the recovery time of rehabilitated lakes, and provide recreational fishing opportunities immediately after treatment.

5.4 Production Management

5.4.1 Early Production Efforts

Historically, the MFWP first attempted to establish a WCT brood program in 1952 with fish captured from Big Salmon Lake and reared at the Jocko River State Trout Hatchery, the Hamilton Hatchery and Libby Hatchery. This attempt proved unsuccessful because biologists believed these fish were WCT-RBT hybrids. A second attempt occurred in 1954 when fish were taken from various Hungry Horse Reservoir tributaries and initially reared at the CNFH and then transferred to the Anaconda hatchery. After several hatcheries were closed, the remaining broodstock were stocked and the programs ended. In 1965, the Jocko River hatchery reared fish from the Hungry Horse Creek and Emery Creek. Hatchery practices likely caused a loss of genetic variation within these stocks and they proved undesirable (Leary et al. 1990).

5.4.2 HHMP Program Overview

The goal of the HHMP is to mitigate fisheries losses attributable to the construction and operation of Hungry Horse Dam. Council approved fisheries losses include 65,000 juvenile WCT annually, to be restored using a combination of habitat restoration, dam operation changes, harvest management and experimental hatchery techniques. The objectives of the Sekokini Springs facility are therefore consistent with the HHMP.

5.4.3 Westslope Cutthroat Reintroduction and Supplementation Program

The present broodstock was founded in 1983, mainly from fish collected from the South Fork Flathead River tributaries above Hungry Horse Dam and two populations in the Clark Fork drainage. These stocks were found to be genetically pure and are reared in several hatcheries throughout the state, in association with various tribal, state and federal agencies. These facilities include the Flathead Lake Salmon Hatchery, Murray Springs Trout Hatchery, Jocko River Trout Hatchery and the CNFH. The MFWP maintains the captive WCT M012 broodstock at Washoe Park Trout Hatchery in Anaconda, MT and rearing facilities throughout the state. Stocking efforts aim at providing and improving recreational fishing and meeting Tribal obligations.

Chapter 6. Limiting Factors

6.1 Types of Limiting Factors

Limiting factors within the Flathead River subbasin vary depending on the location of the waterbody within the subbasin. Limiting factors that are applicable to portions of the Flathead River subbasin include the following:

- Altered Hydrograph
- Floodplain Alterations – includes bank instability and floodplain restrictions
- Non-native Species Interactions
- Fragmentation of Habitat
- Human/Wildlife Conflicts
- Sedimentation
- Temperature Changes
- Artificial Production

6.1.1 Altered Hydrograph

Hydropower-related discharge fluctuations on the South Fork and upper mainstem of the Flathead River have resulted in a wider zone of water fluctuation, or varial zone (nearshore habitat), which has become biologically unproductive (Hauer et al. 1994). Reduction in natural spring freshets due to flood control has reduced the hydraulic energy needed to maintain the river channel and periodically resort river gravels. Collapsing riverbanks caused by intermittent flow fluctuation and lack of flushing flows have resulted in sediment buildup in the river cobbles, which is detrimental to insect production, fish reproduction, food availability, and security cover. Changes in the annual hydrograph for the lower Flathead River cause the normally vegetated varial zone to become abnormally inundated. This does not allow riparian vegetation to exist where it normally would. The area between the high and low water levels has become a largely unvegetated varial zone dominated by silt, cobbles and rock. Deciduous and mixed deciduous/coniferous vegetation has moved toward a conifer-dominated vegetative community due to the curtailment of naturally high flows during spring runoff, for flood control, and abnormal flow fluctuations caused by electricity generation. Studies have also shown that constant fluctuation in water levels and flows have not allowed a stable enough situation for vegetation to become established (Mackey et al. 1987; Mack et al. 1990, Hansen and Suchomel 1990).

6.1.2 Floodplain Alterations

Channelization, road fill, bank armoring and other encroachments along stream segments have narrowed channels and limited meander inside floodplains. This has created shorter channels, steeper gradients, higher velocities, loss of bank storage and aquifer recharge capacity, streambed armoring, and channel entrenchment. In impacted stream reaches, even minor flood events have often resulted in significant channel deterioration. Erosion has increased, and the number of pools and the extent of riparian cover has decreased. The changes have lowered the quality and quantity of fish and wildlife habitat.

6.1.3 Non-Native Species Interactions

Non-native species now threaten the diversity and abundance of native species and the ecological stability of ecosystems in the subbasin. Illegal (intentional) and unintentional introductions of non-native fish species have set up negative inter-species competition with native fish. Non-native RBT and YCT have also hybridized with native WCT. The introduction of RBT and YCT, and predation by nonnative lake trout in Flathead Lake has had adverse effects on native WCT.

6.1.4 Fragmentation of Habitat

Fish migrations have been blocked by human caused barriers, including road culverts, dewatered stream reaches, dams, and irrigation diversions (Morton 1955; Read et al. 1982; Weaver et al. 1983). These blockages fragment river reaches and result in less habitat available to fish that utilize affected stream reaches.

6.1.5 Human/Wildlife Conflicts

Increasing numbers of humans in sensitive wildlife habitats has led to an increasing number of human/wildlife conflicts. For example, humans continue to introduce non-native fish and other nuisance aquatic species that impact native species restoration efforts, and illegal harvesting of WCT most likely occurs in many areas. Land use practices, including road and house construction, irrigation withdrawals and recreational uses of river systems has also contributed to declines in WCT population abundance.

6.1.6 Sedimentation

Logging activities, road building, residential development, and agricultural practices have increased the amount of fine sediments entering streams. Fine sediments accumulating in spawning substrates reduce egg-to-fry survival (Weaver and Fraley 1993). In some areas sedimentation has reduced natural reproduction to the point that it is insufficient to fully seed available rearing habitat with juvenile fish. Pools and rearing habitat have become clogged with sediment, reducing the productive capacity of the stream. Indirect effects of sediment include loss of invertebrate populations due to loss of habitat and food sources. This loss is significant because aquatic insects compose a large percentage of the WCT diet, especially during spring and early summer, before terrestrial insects and zooplankton become the dominant prey.

6.1.7 Temperature Changes

The removal of riparian vegetation, especially trees and overhanging shrubs, has changed stream water temperatures, making the water warmer in the summer and colder in the winter. These changes have interfered with fish migration, spawning and survival, and have generally degraded the quality of stream habitats for native fish and other aquatic life. This, in turn, has affected the food base for the many wildlife species that feed on aquatic organisms.

6.1.8 Artificial Production

Currently, Montana's hatchery system does not supply fish to rivers and streams. The Sekokini Springs facility will enable propagation of genetically unique strains for initiating "wild" spawning runs in streams scheduled for native species restoration where native WCT have been extirpated and replicate stocks that are threatened by habitat degradation or nonnative fish species after limiting factors are eliminated.

The progeny of wild fish produced by this program will be available for stocking certain lakes that are proposed for treatment by the South Fork Flathead Watershed Westslope Cutthroat Conservation Project. Nonnative rainbow trout and genetically introgressed cutthroat trout populations will be removed using rotenone or antimycin and replaced with genetically pure westslope cutthroat trout from the state's captive M012 brood stock or nearest neighbor stocks reared at Sekokini Springs.

The closed-basin lakes that are planted through this program provide alternative fisheries to meet public demands for harvest and partially offset fishing bans or reduced limits enacted for native species recovery. This program may indirectly benefit native species recovery by redirecting harvest away from sensitive recovery areas in the contiguous Flathead watershed.

6.2 Habitat Studies, Assessments and Planning Efforts

Habitat studies and planning efforts were addressed in Section 1.4. The state of Montana has initiated a modified IFIM project on the Flathead River to calibrate simulations of hydraulic conditions (stage/discharge and velocities, etc.) and fish habitat from HHD to Flathead Lake at various discharges from HHD (Muhlfeld et al. 2000). An optimization program is scheduled for development to allow managers to assess tradeoffs between the requirements of reservoir and riverine biota, when conflicts occur between reservoir operation and river flow limits. MFWP and CSKT monitor the effects of dam operation in HHR and the Flathead River and its tributaries. Daily flow data can be examined using the IFIM model to determine the area of the channel affected by dam operation. Radio telemetry was used to study habitat selection by fish species and life cycle phase. Results were used to calibrate the IFIM model to assess species-specific and lifecycle effects.

Numerous fish passage and habitat projects have been completed in the Flathead River subbasin. These include the establishment of an extensive monitoring program, installation and operation of selective withdrawal at HHD, offsite lake rehabilitation and the development of IRCs for HHD. IRCs are used as a tool to balance the requirements of hydropower generation and flood control with the needs of resident and anadromous fish. Highlights include work on Hay Creek, where more than 11.2 miles (18 km) of bull trout and WCT spawning/rearing habitat was reconnected to North Fork Flathead River by redefining the channel in a braided reach that was subject to seasonal dewatering. Hay Creek flows reached the North Fork during the fall bull trout spawning period in 1995-98. Seven fish passage projects in tributaries to HHR, proposed since 1954, were completed in 1997. In total, these projects expanded available adfluvial WCT spawning and rearing habitat in HHR by 11.5 miles (18.5 km). Adfluvial WCT have spawned upstream of all culverts that were replaced or improved through 1997. Bull trout colonization has also been documented on 6 of 7 streams upstream of the former barriers.

Several components of the Taylor's Outflow project were completed in 1994-98, including reconstruction of 1.9 miles (3 km) of spawning and rearing habitat and connection (fish passage) to the mainstem Flathead River. Projects at Taylor's Outflow, Big Creek, and in the HHR drawdown zone have helped to develop biotechnical approaches for riparian restoration. In 1998, construction was completed at the Crossover Wetlands site, a pilot project designed to increase productivity in the reservoir drawdown zone.

A stream naturalization project in the lower portion of Emery Creek was completed in the fall of 2000. Cooperators included MFWP, USFS, National Fish & Wildlife Fund and Trout Unlimited. The stream was degrading due to road encroaching on the floodplain which caused bank erosion, channel braiding and prevented transport of alluvium. The project restored the structural and functional integrity of the stream channel and will provide spawning habitat and much needed deep water habitats necessary for overwintering young trout.

Offsite, lake chemical rehabilitations have been extremely successful in establishing popular fisheries, creating genetic reserves, directing fishing pressure away from recovering stocks, and eliminating sources for new illegal introductions. Fishing pressure on Lion Lake (treated in 1992) nearly doubled after treatment and has the highest pressure per acre of 509 lakes in northwestern Montana. Devine Lake treatment removed the threat posed by introduced BKT on native trout populations in the wilderness. Similar success has occurred on recent rehabilitation projects at Bootjack, Murray, Dollar, and Little McGregor Lakes. In 1999 Hubbart Reservoir and Hidden lakes were also treated to remove an illegally introduced and stunted perch population. The lake was stocked with RBT and kokanee salmon in 2000. In this case, RBT were used because the species can recolonize Hubbart reservoir from Bitterroot Lake upstream. Downstream trout movement is effectively eliminated by the dam and lethal water temperatures in the discharge stream, so there is no threat to native fish species. Angling records indicate Hubbart Reservoir can provide in upwards of 3000 angler days per year when at peak production.

In 1999, Hungry Horse Mitigation launched a program to reduce the threat of competition and hybridization that non-native species pose to the Flathead's native trout constituent. High altitude lakes in the North, Middle and South Fork drainages were inventoried and a database was developed to track stocking history, angler use, genetic composition, etc. Lakes having exotic fish populations were prioritized and the restoration program commenced with the treatment of two lakes. Following public review and comment of the Montana Environmental Policy Act Environmental Assessment Whale Lake in the North Fork Flathead drainage was treated and thus eliminated the only known exotic trout population in that drainage that lies outside of Glacier National Park. Likewise, Tom-Tom Lake in the South Fork drainage was treated. The project is expected to continue by treating 2-3 lakes per year until this threat is reduced or eliminated. A 10 year program to eliminate the sources of hybrid fish in the South Fork Flathead drainage is currently the subject of a draft environmental impact statement (DEIS) by BPA

(Grisak 2003).

A summary of habitat improvement projects that have been completed or are proposed to be implemented in the Flathead River basin are listed in Table 6-1.

Table 6-1. Habitat Improvement Projects in the Flathead River Subbasin

Project Name	Project Description	Project Goal	Location	Project Participants
Elliot Creek Enhancement	Artificial spawning channel and WCT stocking ; attempt to eradicate BKT	Provide additional WCT spawning and rearing habitat	Elliot Creek flows into the Flathead River upstream of Flathead Lake	MFWP
Big Creek Sedimentation Control	Sedimentation control; riparian revegetation	Improve former WCT spawning and rearing habitat	Big Creek, a tributary to the North Fork Flathead River	MFWP, USFS, American Timber Co., F.H. Stolze Land and Lumber Co.
Hay Creek Enhancement	Sedimentation control, riparian enhancement	Reconnected habitat that was blocked by subsurface flow to open spawning channels; reduce fine sediments; increase streambank stability	Hay Creek, a tributary to the North Fork Flathead River	MFWP, BOR, and private landowners
Taylor's Outflow Restoration	Habitat improvement, instream and riparian; Passage improvements; attempt to eradicate BKT	Installed fish ladder to allow fish passage to provide additional WCT spawning and rearing habitat; improved habitat in degraded creek	Taylor's Outflow, a small creek that flows into the Flathead River near Columbia Falls	MFWP, private landowners
HHD Fisheries Mitigation Program	Culvert replacements and sediment source surveys	Improve fish passage for bull trout and WCT	Streams: Felix, Murray, Harris, N. Logan, McInernie, Margaret, Riverside	MFWP, BOR, USFS
Slash Pile Installation in HHR	Install slash piles by anchoring pine tree tops	Measure benthic insect production and availability to WCT	HHR	MFWP
HHR Revegetation and Riparian Enhancement	Riparian enhancement	Improve water quality, reduce erosion, increase insect production, establish healthy native plants	HHR	MFWP
Willow Survival Experiments	Native willow enhancement	Determine if HHR drawdown zone can be revegetated with water tolerant plants	HHR and Emery Bay	MFWP, BOR, USFS
HHR off-site Mitigation	Attempted eradication of non-native fish species	Improve WCT habitat, reduce competition with BKT	Lion Lake, Rogers Lake, Bootjack Lake	MFWP
Coolwater Fisheries Enhancement	Increase shoreline and submerged cover	Increase habitat availability for cool water fish species	Echo Lake, Halfmoon Lake	MFWP, local sportsmen groups, Burlington Northern
Fish Passage in Paolo and Tunnel creeks	Remove or replace culverts	Improve fish passage	Paola and Tunnel creeks, tributaries to Middle Fork Flathead	MFWP

Project Name	Project Description	Project Goal	Location	Project Participants
Sullivan Creek Drainage	Sediment source survey	Improve water quality	Sullivan Creek watershed	MFWP, USFS
Hungry Horse Wetlands Project	Restore/create wetland habitat	Increase aquatic invertebrate production	Upper end of HHR	MFWP, BOR, USFS
Dayton Creek Habitat Improvements	Habitat improvements	Reduce bank instability problems; increase average depth and increase pool and riffle habitat to increase WCT habitat	Dayton Creek, tributary to Flathead Lake	MFWP, CSKT
Griffin Creek Fencing Project	Install fences	Improve habitat by eliminating grazing in riparian zone	Griffin Creek, stream in Stillwater River drainage	MFWP
Lake Rehabilitation	Eradicate fish non-native species	Increase habitat available to WCT and bull trout	Skyles Lake, Spencer Lake, Murray Lake, Dollar Lake, Little McGragor Lake and Hubbar Reservoir	MFWP
Stoner Creek Improvement	Habitat and fish passage improvement	Improve habitat for WCT	Stoner Creek, tributary to Flathead Lake	Kerr Mitigation Coop
Whale Lake Rehabilitation	Eradicate non-native fish species	Provide increased habitat for WCT	Whale Lake, tributary to the North Fork Flathead	MFWP
Tom-Tom Lake Rehabilitation	Eradicate non-native fish species	Provide increased habitat for WCT	Tom-Tom Lake, tributary to the South Fork Flathead River	MFWP
Emery Creek Improvements	Reconstruct 2 km of stream that had been channelized by road, re-vegetate streambanks	Increase streambank stability to reduce sedimentation and improve WCT habitat and migration corridor.	Emery Creek, a tributary to Hungry Horse Reservoir	MFWP, USFS, Trout Unlimited, National Fish and Wildlife Fund
CSKT Focus Watershed Program	Habitat improvement projects	Provide increased habitat for bull trout and WCT	Dayton Creek, east and south forks of Valley Creek, Marsh Creek, Post Creek, Mission Creek, DuCharme Creek, the Little Bitterroot River and Jocko River	CSKT in coordination with the Flathead Basin Commission, Bull Trout Restoration Team, Conservation Districts of Lake, Lincoln, Sanders and Flathead counties; NRCS, Montana Watercourse, Montana Watershed Inc.

Source: Knotek et al. 1997; Fredenberg et al. 1999.

6.3 Demographic Risk

Demographic risk is defined as the risk of extinction due to factors that contribute to population growth and decline. These factors include smolt-to-adult return rates, birth and death rates, and immigration and emigration rates. Smaller populations have higher risks of extinction because chance plays a greater role in determining individual survival and breeding success. Based on habitat degradation, genetic introgression and hybridization with other species in addition to declining population trends, managers of WCT in Montana have determined that the Flathead River WCT populations are at moderate risk of extirpation.

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Chapter 8. Glossary and Acronyms

Acronyms

ADA	Americans with Disabilities Act
AFS	American Fisheries Society
ARM	Administrative Rules of Montana
BKD	Bacterial kidney disease
BKT	Brook trout
BOR	Bureau of Reclamation
BPA	Bonneville Power Administration
cfs	cubic feet per second
CNFH	Creston National Fish Hatchery
CSKT	Confederated Salish and Kootenai Tribes
DEIS	Draft Environmental Impact Statement
DNA	Deoxyribose Nucleic Acid
DTU	Daily Temperature Units
DO	Dissolved Oxygen
ESA	Endangered Species Act
F1	First filial generation
FAT	fluorescent antibody test
FHS	Fish Health Section
ft	Feet or Foot
GIS	Geographic Information Services
GPS	Global Positioning System
HHD	Hungry Horse Dam
HHMP	Hungry Horse Mitigation Program
HHR	Hungry Horse Reservoir
HUC	Hydrologic Unit Code
ICBEMP	Interior Columbia River Basin Ecosystem Management Project
IFIM	Instream Flow Incremental Methodology
IHOT	Integrated Hatchery Operations Team
IHNV	Infectious Hematopoietic Necrosis Virus
IPNV	Infectious Pancreatic Necrosis Virus
km	kilometers
LA	Landscape Approach
m	meter
M&E	Monitoring and Evaluation
MFISH	Montana Fisheries Information System
MFWP	Montana Fish, Wildlife & Parks
MOU	Memorandum of Understanding
NPS	National Park Service
NWPPC	Northwest Power Planning Council
NPCC	Northwest Power and Conservation Council

OMV	*Oncorhynchus masou* Virus (OMV)
ORV	Outstandingly Remarkable Values
PIT	Passive Integrated Transponder
PINE	Paired Interspersed Nuclear DNA Element
PNFHPC	Pacific Northwest Fish Health Protection Committee
QHA	Quality Habitat Assessment model
RBT	Rainbow Trout
Rkm	River Kilometers
RM	River Mile
RSI	Remote Site Incubators
USDA	United States Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
VHSV	Viral Hemorrhagic Septicemia Virus
WCT	Westslope Cutthroat Trout
YCT	Yellowstone Cutthroat Trout

Technical Terms

Acclimation. Allowing fish to adjust to environmental variables. Older hatchery practices resulted in high mortalities because the young fish were released directly from the hatchery, without a chance for them to adjust to the natural stream environment. Acclimation is a process which is used to allow the fish to gradually adjust to a more natural environment.

Acclimation site. Sites at which young fish are held in artificial ponds to allow them to imprint to that they return to that place to spawn.

Anadromous. A species reared in fresh water, lives in the ocean for part of the life cycle then returns to fresh water to spawn.

Anthropogenic. Relating to human impact on nature.

Broodstock. Fish that will be spawned to create hatchery stock.

Carrying capacity. The maximum number or biomass of fish that could potentially be supported by a given habitat, as determined by prevailing physical, chemical, and biological conditions.

Cumulative impact. Cumulative impacts are created by the incremental effect of an action when added to other past, present, and reasonably foreseeable future actions.

Domestication selection. Natural selection for traits which affect survival and reproduction in a human-controlled environment.

Empirical. Based on observation or experience.

Escapement. Fish that are allowed to spawn naturally.

Evolutionarily significant unit. A population or group of populations that is considered distinct (and hence a "species") for purposes of conservation under the ESA. To qualify as an ESU, a population must: (1) be reproductively isolated from other conspecific populations; and (2) represent an important component in the evolutionary legacy of the biological species.

Extirpated. To destroy completely.

Eyed-eggs. Life stage of a fertilized egg between the time the eyes become visible and hatching occurs.

Facility. Fish culture facility used for incubation and rearing of salmon and steelhead.

Fluvial. Migrating between smaller streams and larger rivers.

Fry. Juvenile salmonid life stage following absorption of yolk sac.

Genetic drift selection. The result of a small representative sample size of a population contributing to the next generation; genetic drift can cause reduced fitness.

Heterozygosity. In an individual that has two different chromosomes for a gene.

Homing. navigational behavior that guides species during migrations.

Imprinting. Term refers to the process where a fish records long-term memory of the chemical nature of its natal tributary, so that it can relocate the stream as a spawning adult. The exact timing of imprinting is believed to coincide with chemical changes and axon development in the fish's brain (for example, a sudden increase in thyroxine hormone concentration).

Inbreeding depression. Reduced fitness caused by inbreeding.

Indigenous. Occurs naturally in an area or environment.

Introgression. Loss of, or changes in, population identity including loss of diversity among populations, characteristics of adaptation with populations, or of other evolved features of genetic organization (may occur through crossbreeding or inadvertent effects of artificial selection).

Lotic. Of, or relating to moving water.

Metapopulations. A set of partially isolated populations belonging to the same species

Naturally reproducing. Adult fish spawning in a stream or river regardless of how parents were spawned, specifically if spawned at a hatchery.

100-year floodplain. That portion of a river valley adjacent to the stream channel which is covered with water when the stream overflows its banks during a 100-year flood event. A 100-year flood event is one that has a 1 in 100 chance of happening in any given year.

Outplant. Outplanting is the process by which artificially propagated fish are released into a natural system.

Pathogen. A disease-causing agent.

Piscivorous. Fish eating.

Population. A group of individuals of a species living in a certain area.

Population viability. The overall condition and long-term probability of survival of the fish population.

Predation. The harm, destruction, or consumption of a prey organisms by an animal predator.

Production. Number of individuals produced from a natural environment or fish culture facilities.

Race. A group of individuals within a species, forming a permanent variety; a particular breed.

Raceway. Holding area or rearing facility for juvenile or adult salmonids in a hatchery.

Redd. A fish spawning depression and egg mound or “nest” created in stream sediments by spawning salmonids as they dig a pit to remove fine sediments, then bury their fertilized eggs with clean gravel. The depression and hump forces oxygenated water to flow through the incubating eggs.

Reproduction. The process of forming new individuals of a species by sexual or asexual methods.

Resident. Present year round (not migratory).

Resident Fish. Term used to describe fish that do not migrate to the ocean, used to differentiate interior fish species from anadromous (sea run) fish.

Riparian habitat. The zone of water-adapted vegetation which extends from the water’s edge landward to the edge of the vegetative canopy. Associated with watercourses such as streams, rivers, springs, ponds, lakes, or tidewater.

Salmonid. Belonging to the family salmonidae, i.e., salmon, trout, steelhead, whitefish.

Sensitive species. Those plants and animals identified by the Regional Forester for which population viability is a concern as evidenced by significant current or predicted downward trend in populations or density and significant or predicted downward trend in habitat capability.

Smolt. Juvenile salmon undergoing metamorphosis into a saltwater fish, usually during the downstream migration period.

Smoltification. The physical and chemical process in which salmonid parr undergo as they prepare to migrate downstream and enter salt water.

Species. A group of interbreeding individuals not interbreeding with another such group; similar, and related species are grouped into a genus.

Species of special concern. Native species that are either low in number, limited in distribution, or have suffered significant population reductions due to habitat losses.

Steelhead. The sea going rainbow trout, reclassified as a Pacific salmon in 1989.

Stock. A distinct management of genetic unit of fish.

Subbasin. Subdivision of a larger drainage basin. The drainage or catchment area of a stream which along with other subbasins make up the drainage basin of a larger stream.

Substrate. The material comprising the bed of a stream.

Supplementation. The use of artificial propagation in the attempt to maintain or increase natural production while maintaining the long-term fitness of the target population, and while keeping the ecological and genetic impacts on non-target populations within specified biological limits.

Varial Zone. An area of wider water fluctuation caused by alterations of the hydrograph

Wild fish. A fish that has not spent any part of its life history in an artificial environment and are the progeny of naturally-reproducing salmon regardless of parentage.