



HUNGRY HORSE DAM FISHERIES MITIGATION IMPLEMENTATION PLAN

**Prepared for
the Northwest Power Planning Council by:**

Montana Department of Fish, Wildlife and Parks

and

Confederated Salish and Kootenai Tribes



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TABLE OF CONTENTS

	<u>Page</u>
INTRODUCTION	1
BACKGROUND	1
Amendment 903(h) Hungry Horse Dam Resident	
Fish Mitigation	2
Loss Statement from Council Document 91-03	4
Clarification of Direction	4
Columbia Basin System Operation Review	8
Project Area	8
Process to Date	9
MITIGATION ACTIVITIES	10
Habitat Improvement	10
Goal Statement	10
Methods	11
Imprint Planting	12
Monitoring and Evaluation	13
Decision Point	13
Future Projects	14
Fish Passage	14
Goal Statement	14
Methods	14
Monitoring and Evaluation	14
Decision Point	15
Future Projects	16
Offsite Mitigation	17
Goal Statement	17
Methods	17
Monitoring and Evaluation	17
Decision Point	18
Future Projects	18

TABLE OF CONTENTS (Continued)

	<u>Page</u>
Hatchery Fish Production and Supplementation	19
Goal Statement	19
Planning Considerations	19
Genetic Considerations	20
Hatchery Facilities	24
Kokanee Test	25
Monitoring and Evaluation	25
Criteria for Determining Success of Kokanee Reintroduction	27
Enhancement of Native Species	28
Bull Trout	29
Westslope Cutthroat Trout	31
Decision Point	32
 BALANCE OF MITIGATION STRATEGIES	 32
 PROPOSED BUDGETS	 33
State Fish Hatchery Development	34
Creston National Fish Hatchery (NFH)	34
 COORDINATION WITH KERR DAM FISHERIES MITIGATION	 35
Background	35
Mitigation Coordination	36
Fish Production	36
Habitat Enhancement	36
Monitoring	36
Coordination with Hungry Horse Activities	36
 LONG-TERM MITIGATION BUDGET	 37
 IMPEDIMENTS TO PROGRESS	 38
 ADAPTIVE MANAGEMENT	 39
 LITERATURE CITED	 41
 APPENDIX A. Hungry Horse Mitigation Consultation Committee	 A-1
 APPENDIX B. Fishery Enhancement Project Criteria and Considerations	 B-1

LIST OF TABLES

	<u>Page</u>
Table 1. Habitat improvement sites identified during the 1992 field season	15
Table 2. Fish passage improvement sites identified as of FY92	16
Table 3. Potential offsite mitigation sites identified prior to the end of FY92	18
Table 4. Kokanee salmon hatchery production	26
Table 5. Experimental bull trout hatchery production	30
Table 6. Westslope cutthroat trout hatchery production	31
Table 7. Proposed budgets for Creston NFH and State Hatchery O&M by Federal fiscal years	33
Table 8. Proposed operational budgets for implementation of Hungry Horse Fisheries Mitigation Plan	37

LIST OF FIGURES

	<u>Page</u>
Figure 1. Fisheries losses associated with blocked (dams) and degraded fish habitat in the Flathead Drainage	6
Figure 2. Kokanee reintroduction - decision points and time frame	21
Figure 3. Native species restoration - decision points and time frame	22
Figure 4. Native species supplementation - decision points and time frame	23

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INTRODUCTION

In this document we present mitigation implementation activities to protect and enhance resident fish and aquatic habitat affected by the construction and operation of Hungry Horse Dam. This plan only addresses non-operational actions (mitigation measures that do not affect dam operation) described in the *Fisheries Mitigation Plan for Losses Attributable to the Construction and Operation of Hungry Horse Dam* (Mitigation Plan) submitted to the Northwest Power Planning Council (Council) in March 1991 and in accordance with subsequent Council action on that Mitigation Plan. Operational mitigation was deferred for consideration under the Columbia Basin System Operation Review (SOR) process. This document represents an implementation plan considered and conditionally approved by the Council in March of 1993.

BACKGROUND

The Mitigation Plan summarized fisheries losses detailed in other documents and presented a program to protect, mitigate and enhance fisheries and aquatic habitat resources affected by the construction and operation of Hungry Horse Dam. Development of the Mitigation Plan was consistent with Sections 903(a)(1-4) and 903(b)(1-4) of the Columbia River Basin Fish and Wildlife Program (Northwest Power Planning Council 1987) and the Upper Flathead System Fisheries Management Plan (Montana Department of Fish, Wildlife and Parks; Confederated Salish and Kootenai Tribes 1989).

The 1987 Fish and Wildlife Program called for the Montana Department of Fish, Wildlife and Parks (Department) and the Confederated Salish and Kootenai Tribes (Tribes) to present recommendations for further action regarding resident fish mitigation for Hungry Horse Dam by October 1989. We requested a one-year extension of that date to complete work with the Montana Power Company on the Kerr Dam relicensing process and for the Department to complete the quantitative biological model for Hungry Horse Reservoir and the Flathead River. We presented the Mitigation Plan to the full Council on March 14, 1991. This schedule allowed the time required to incorporate the results of our 14 month consultation/scoping process and the time required to link our biological models with Bonneville Power Administration's (BPA) power system models to illuminate resource tradeoffs.

To facilitate the formation of the Mitigation Plan, we formed a Consultation Group in January 1990, consisting of representatives from fish and wildlife resource agencies, utility groups, local government, fisheries and wildlife conservation groups, ecological conservation groups and others. Approximately 30 people, representing 24 entities, participated. This group helped the Department and Tribes to organize the issues, identify areas of agreement and disagreement, review fisheries losses and mitigation options and review aspects of the Mitigation Plan.

A series of three open houses were also held on Hungry Horse fisheries mitigation. Two drafts of the Mitigation Plan were reviewed by consultation group members, six scientists and three economists. We incorporated into the Mitigation Plan their comments and input from policy-makers and the Council's staff, before our March 1991 submission to the Council.

On May 11, 1991, the Council's staff produced a briefing paper (document 91-03) providing overall background on Hungry Horse Dam, the relevant provisions of the 1987 Fish and Wildlife Program language and a summation of the Mitigation Plan recommendations. On July 10, 1991, the Council entered into the rulemaking process to consider amendment of the 1987 Fish and Wildlife Program. Formal public hearings were held in the four Northwest states and the Council accepted comments on the Mitigation Plan through September 13, 1991. During this time period, the Council received sixty oral and/or written comments on the Mitigation Plan.

Amendment 903(H) Hungry Horse Dam Resident Fish Mitigation

On November 12, 1991, the Council voted unanimously to approve loss statements and mitigation actions for resident fish affected by Hungry Horse Dam. The Council approved recommended actions associated with the Mitigation Plan submitted by the Department and Tribes, thereby amending their 1987 Fish and Wildlife Program. Below is the actual program amendment, 903(h):

1. Resident fish loss estimates identified in the *Fisheries Mitigation Plan for Losses Attributable to the Construction and Operation of Hungry Horse Dam* prepared by Montana Department of Fish, Wildlife and Parks and the Confederated Salish and Kootenai Tribes are incorporated into the program.
2. Implementation Plans:
 - A. Montana Department of Fish, Wildlife and Parks and the Confederated Salish and Kootenai Tribes: Develop an implementation plan for Fiscal Year 1992. The plan should be limited to actions that address baseline data collection, fish passage over man-caused barriers, initiation of kokanee supplementation, offsite mitigation and onsite habitat improvements. Bonneville will fund the plan for up to \$230,000.
 - B. Montana Department of Fish, Wildlife and Parks and the Confederated Salish and Kootenai Tribes: Develop a long-term implementation plan limited to non-operation mitigation measures. The plan will include measurable mitigation objectives. Submit the plan to the Council for approval by August 1992.
 - C. Hatchery supplementation activities called for in the implementation plans initially will address kokanee only. Facilities for production of kokanee will be temporary and low cost. These facilities will be used to test the feasibility of increasing kokanee populations in Flathead Lake. If it is proven that kokanee populations can be significantly increased, then construction of permanent production facilities will be considered. Hatchery supplementation of other species will not be considered unless the kokanee experiment fails to fulfill the mitigation objective. This is not intended to preclude research activities aimed at development and refinement of supplementation techniques for westslope cutthroat trout and bull trout.

- D. Habitat improvement projects in the implementation plans will be consistent with maintenance of the genetic integrity of native fishes and protection of species that are endangered, threatened, or of special concern that occur in the improved or newly accessible habitat. This concern is critical where passage is considered over natural barriers.
3. Bonneville: Consult with the State of Montana and the Confederated Salish and Kootenai Tribes to explore alternative methods, including a trust agreement, for financing the long-term, non-operation mitigation features of the implementation plan. Cost share to fund aspects of the implementation plan will also be explored, especially for projects that mitigate the effects of non-hydropower caused problems (eg. man-caused passage barriers in reservoir tributaries, fencing of overgrazed riparian areas and sediment control projects). If the parties listed above reach agreement on a suitable method for financing, the method of financing will be returned to the Council for approval. Bonneville will fund the agreement upon approval.
 4. Bonneville, the Bureau of Reclamation and the Corps of Engineers: Consider operation measures proposed in the mitigation plan, except for construction of a temperature control structure at Hungry Horse Dam, in the System Operations Review process. Findings and recommendations from this process will be reported to the Council upon completion.
 5. Council: The determination of losses and appropriate measures contained in the mitigation plan assume that the operations of Libby and Hungry Horse dams will be conducted in accordance with current practices. Under current practices, (a) reservoir drawdown for power purposes is limited by Section 903(b)(1)(A) of the Council's fish and wildlife program to 85 feet at Hungry Horse and 90 to 110 feet at Libby, (b) reservoir drawdown for flood control is conducted in accordance with the assignments of project flood control responsibility in effect prior to the 1992 operating year, and (c) no drawdown of these reservoirs, other than operation drafting for the existing water budget, takes place for the purpose of increasing downstream flows to benefit salmon and steelhead. In the event that any significant changes to current practices are undertaken, reopen this determination for the purposes of setting appropriate drawdown limitations to ensure that the mitigation measures contained in the plan remain adequate and effective.
 6. Bonneville and the Bureau of Reclamation: Immediately begin actions to result in installation of a selective withdrawal structure at Hungry Horse Dam to allow for temperature control to benefit resident fish. Cost sharing for the structure should be explored.
 7. Appropriate parties: The Kerr and Hungry Horse dams mitigation programs will be coordinated so that measures taken under these programs are consistent. Operational features of these programs should be addressed in the System Operations Review. Coordination of non-operational features of these programs should be addressed in the Hungry Horse Dam resident fish fiscal year 1992 and long-term implementation plans.

Loss Statement From Council Document 91-03

Losses of migratory westslope cutthroat trout in the Flathead System caused by the construction of Hungry Horse Dam were estimated using a habitat-based approach. These estimates assumed streams with gradients of six percent or less were migratory cutthroat habitat; tributaries with gradients greater than six percent were assumed to be resident cutthroat habitat. Using this methodology, it was calculated that at least 65,500 migratory cutthroat juveniles were lost annually from Flathead Lake populations.

Estimates of losses of migratory bull trout caused by construction of Hungry Horse Dam are based on the portion of drainage area blocked, compared to the portion of habitat not blocked. By examining spawning runs it was possible to estimate how much of the run was eliminated by the construction of Hungry Horse Dam. Losses of approximately 2,000 bull trout spawners were estimated.

Losses of kokanee are based on reductions in reproduction caused by increased egg and fry mortality due to the operation of Hungry Horse Dam. Estimates of losses of adult kokanee amount to about 100,000 fish annually.

The Department and Tribes believe that all loss estimates are conservative because of the methodologies used.

Clarification of Direction

The Mitigation Plan presented to the Council in March 1991 was a delicate balance between the technical expertise of the Department and Tribes, the desires of the very diverse angling community found in the Flathead Drainage, and the opinions of a variety of other interest groups that were represented on the Consultation Group. The Mitigation Plan was worked out over 14 months of intense meetings.

The Council's passage of Amendment 903(h) made some changes in the March 1991 Mitigation Plan as presented to them. During the past year, the Department and Tribes have had the opportunity to reassess the specifics of both the original Mitigation Plan and Amendment 903(h) while incorporating new knowledge. As a result, this Implementation Plan is different from that Mitigation Plan. The mitigation objectives and strategies have not changed, however, specifics have.

The Council incorporated the losses for westslope cutthroat and bull trout and kokanee presented in the Mitigation Plan into their Fish and Wildlife Program. Amendment 903(h)(2)(C) refers to the mitigation objective which was one of the two objectives quoted from the Mitigation Plan:

"Non-operational

Not requiring changes in operations:

1. Replace lost annual production (minimum of 65,000 westslope cutthroat annually) from the inundated 43 miles of tributaries and 35 miles of South Fork Flathead River using a mix of habitat improvement, improvement in fish passage and hatchery production.
2. Replace lost annual production of 250,000 young bull trout in the lost stream sections using a mix of the above fisheries techniques.
3. Replace lost annual production of 100,000 kokanee adults initially through hatchery production and pen rearing in Flathead Lake, partially replace lost forage for lake trout in Flathead Lake."

Although the Council adopted these loss statements, Amendment 903(h) dictates a justifiably cautious and conservative approach to replacement of these resident fish losses. In Amendment 903(h), the Council directed that low-cost, temporary hatchery facilities be utilized for the kokanee test. Although this approach inherently allows for future management flexibility, present facilities are not adequate for the test, and capital dollars will be needed for facility upgrades.

In Amendment 903(h), the Council also directed that initially only experimental procedures be performed for westslope cutthroat and bull trout. Habitat and fish passage improvements for these native species, combined with kokanee supplementation, can only meet a portion of the losses. Because of the magnitude of habitat already lost (Figure 1) and the ongoing habitat modifications and expanding non-native fish populations, total reliance on self-sustainable native species may preclude full utilization of the Flathead System's potential. Therefore, it is likely that some level of future hatchery supplementation will be necessary for native species, if full mitigation is desired. Over the long-term, hatchery production will be required for imprint plants and offsite fish plants as well as possibly some level of salmonid supplementation. All hatchery operations will be guided by decision trees presented later in this Implementation Plan to ensure that they are cost-effective and biologically sound.

Since Amendment 903(h) was adopted by the Council, two additional factors have become apparent that are reflected in this Implementation Plan. It is not possible to obtain the necessary disease-free kokanee eggs to meet the goal of planting 10,000,000 kokanee fry in Flathead Lake. As an alternative, the Department and Tribes have decided to raise 1,000,000 kokanee to 6-8 inches for planting. This alternative will require only 2,000,000 eggs but should be equivalent to planting 10,000,000 kokanee fry. However, this alternative will require over-wintering the fish in the hatchery which greatly increases costs as reflected in the proposed hatchery budgets.

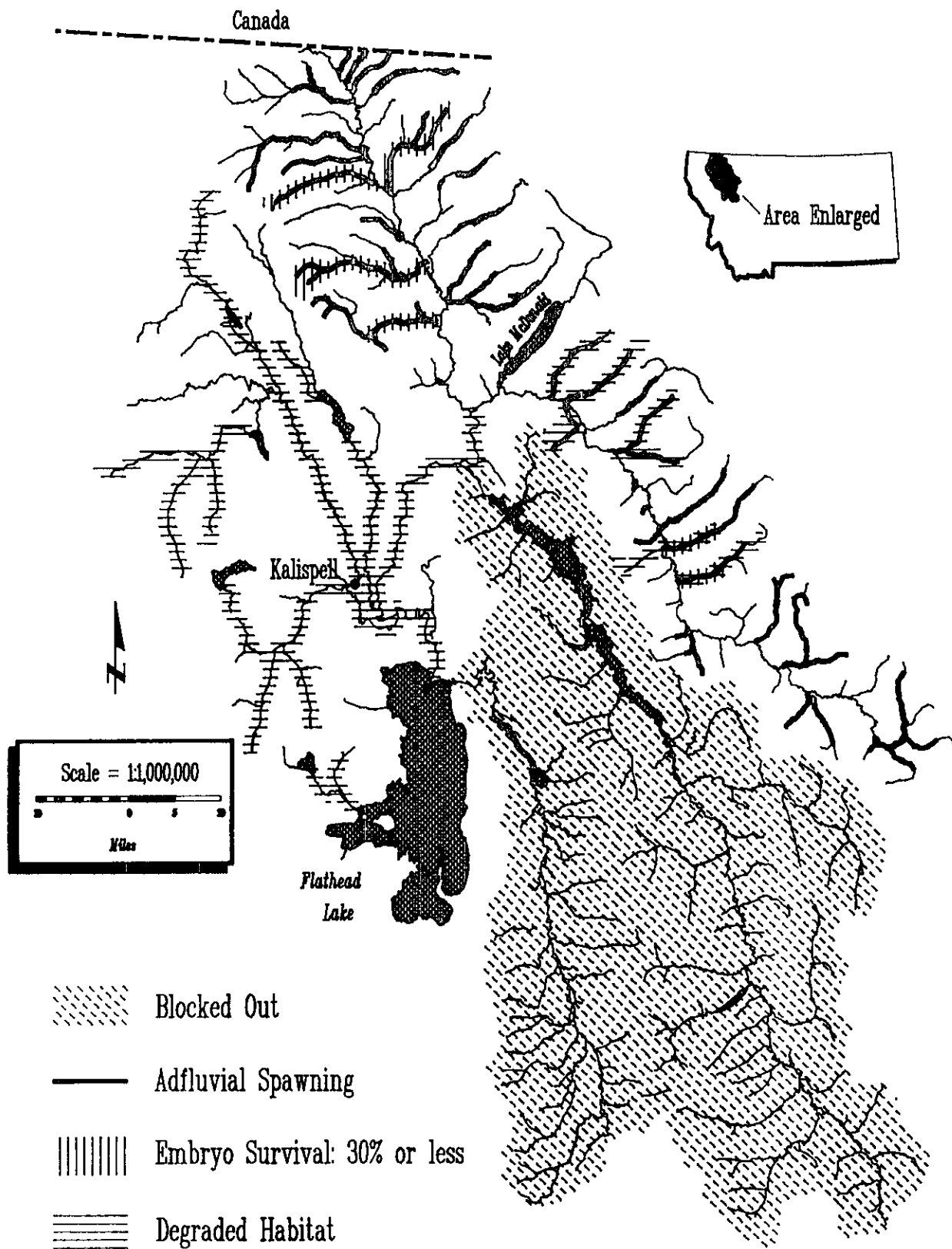


Figure 1. Fishery losses associated with blocked (dams) and degraded fish habitat in the Flathead Drainage.

At the same time, the Department and Tribes have had a year to further explore habitat improvement, fish passage and offsite mitigation project opportunities. Initial planning of habitat programs may be an obstacle to achieving goals stated in the 1991 plan for the first few years. It will require additional time and coordination with private and public entities involved to get these projects initiated. Once the program is in place, the Department and Tribes will be able to meet our previously stated goals. This too is reflected in the proposed budgets of the first few years. Our goal still remains to ultimately maximize mitigation achieved through habitat enhancement and fish passage.

On March 10, 1993, the Council conditionally approved this Implementation Plan by imposing nine conditions which further clarified amendment 903(h) and the mitigation activities contained within this Plan.

1. All new or expanded artificial propagation facilities used in implementing supplementation activities under the plan should be low-cost and temporary in nature.
2. The kokanee supplementation test will also include evaluation of increased fishing opportunities in nearby lakes that already have kokanee populations.
3. The plan's kokanee provisions will be reviewed by Bonneville's Scientific Review Group. This review should address consistency with the Regional Assessment of Supplementation Project with the Council's rule provisions calling for low-cost/temporary facilities, with the concept of adaptive management and other factors deemed appropriate by the group.
4. The Council endorses the creation of a hatchery management plan and genetic guidelines for addressing supplementation of native populations called for by the plan. These plans and guidelines, as well as any proposed supplementation experiments, will be reviewed by the Scientific Review Group for consistency with the Regional Assessment of Supplementation Project, the concept of adaptive management and other factors deemed appropriate by the group. This review should include an examination of the proposed numbers to be produced in relation to existing populations and egg supply.
5. The plan will be closely coordinated and remain consistent with the bull trout Endangered Species Act process as well as the bull trout management plan now being developed by fisheries managers in the State of Montana. Consultations concerning bull trout with the U.S. Fish and Wildlife Service should start before implementation of any bull trout aspects of the plan.
6. During the experimental phase of the supplementation activities involving native fish species, experiments will be designed to promote learning about supplementation techniques. The purpose of these experiments will not be to supplement harvest during this phase. In addition, these experiments should be designed to gain information that is of value to managing other native fish populations in the region.

7. The Council encourages the implementation of habitat improvement projects as a high priority under the proposed plan. Because it takes years to improve habitat, these activities should begin in earnest and include a watershed approach to ensure better investments. Also, consideration should be given to dedicating a higher percentage of the implementation budget to habitat improvement.
8. The Council calls for immediate actions to result in installation of the selective withdrawal structure at Hungry Horse Dam. In the interest of cost savings, the Council encourages the design process to look at existing technology in this area; especially the structures regularly used in Japan for temperature control at dams.
9. The Council requests that the implementors of the Hungry Horse plan provide a report annually on the status of implementation.

The differences between the Mitigation Plan and this Implementation Plan are a result of changing realities and conditions and constraints imposed by the Council. This is to be expected in any program that is trying to remain adaptive to current conditions.

Columbia Basin System Operation Review

Mitigation actions recommended in the Mitigation Plan that requested modification of dam operations, with the exception of selective withdrawal, were deferred for consideration under the SOR process as directed under 903(h)4.

The preliminary analysis is scheduled for completion during spring of 1993. A public review process will elicit written comment on the chosen alternatives.

Operational changes are necessary to protect previous mitigation accomplishments and assure success as we implement non-operational measures.

Project Area

This Implementation Plan is intended to mitigate for fisheries losses in the Flathead System due to the construction and operation of Hungry Horse Dam. Onsite project areas are considered to be those waters directly connected to the Flathead Lake and River System upstream from Kerr Dam and which support two-way movement of fish. Waters flowing into the South Fork Drainage upstream of Hungry Horse Dam and waters which could be reconnected to the System with mitigation projects will be considered onsite.

Offsite project areas are the remaining waters in the Flathead Drainage which are separated from the contiguous lake/river system by physical barriers or by lack of two-way movement of fish.

According to the 1991 Mitigation Plan, Hungry Horse Dam blocked migratory bull and westslope cutthroat trout from Flathead Lake from more than 40 percent of their historic spawning habitat (Figure 1). This critical spawning and rearing habitat upstream from the dam is now physically isolated. Of the remaining Flathead drainage, bull and westslope cutthroat trout are limited to spawning in 28 and 33 tributaries, respectively. Of these remaining suitable spawning areas, a third have been degraded by sediment input from land management practices reducing egg to fry survival to less than 30 percent. Some of the remaining spawning areas contain more fine sediment today than they did ten years ago due to poor land management (Flathead Basin Commission, 1991). Still another third of the remaining reaches have been invaded by non-native fish stocks, creating a risk of competition and genetic contamination (hybridization) in pure-strain native fish stocks. Some stream reaches have been blocked to fish passage by stream crossing structures. Although this Implementation Plan proposes to remedy as much man-caused habitat degradation as possible, it does not have the mandate nor resources available to mitigate past and continuing fisheries losses caused by poor watershed management. Land management entities (public and private) should be held accountable for fisheries losses caused by their activities. This Implementation Plan proposes habitat/fish passage enhancing measures throughout the Flathead River Drainage project area (excluding Canada) to reclaim lost fisheries potential, but it is not a cure-all for man's impacts on trout habitat. Cost-share and cooperative arrangements will be pursued where possible. The Department and Tribes will continue to contribute to a greater awareness of aquatic systems and fisheries health.

Process to Date

To facilitate the planning, implementation and budgetary decisions needed to proceed with mitigation activities, the Department and Tribes formed the Hungry Horse Fisheries Mitigation Implementation Group (Group). The Group is composed of three individuals; the fisheries managers from both the Department (Region One) and Tribes and a representative from the U.S. Fish and Wildlife Service (Creston Fish and Wildlife Center). The Group's first task was to address program measure 903(h)(2)(A). We finalized an implementation plan with BPA for fiscal year 1992 addressing baseline data collection, initiation of kokanee supplementation, offsite mitigation and on-site habitat improvements.

The Implementation Group recognized the importance of the Consultation Group in the formation of the Mitigation Plan submitted to the Council and decided to continue this public process during the long-term implementation phase of Hungry Horse fisheries mitigation. The consultation group was reassembled, streamlined in such a way to provide the full range of opinions without having unnecessary duplication of membership and renamed the Hungry Horse Fisheries Mitigation Consultation Committee (Consultation Committee). This plan reflects the combined efforts of the Consultation Committee, the Implementation Group and other representatives of the public and governmental agencies. Throughout the Hungry Horse mitigation planning and implementation, the Department and Tribes have made every effort to incorporate the ideas and comments of a wide range of publics. This commitment will continue through the life of the mitigation effort via the Consultation Committee, public meetings, newsletters, newspaper, radio and television and other outreach techniques.

The Group established a Fish Production Coordinator (FPC) position as a high priority in accomplishing the mitigation objectives. During this planning period, the FPC efforts will concentrate on kokanee production, assessment of the population genetics of native species, consultation with experts in the field of native species restoration and participation in the development of conservation/recovery plans for bull and cutthroat trout. Kokanee egg procurement from Montana, out of state and mitigation brood egg sources will be a high priority for the FPC. The FPC will facilitate the timely design and construction of hatchery facility upgrades needed to achieve full production of yearling salmon for the test.

The Fish Production Coordinator will also work cooperatively with the Implementation Biologist, who will be responsible for coordinating fish passage, habitat enhancement, offsite mitigation and monitoring aspects of the mitigation program. These two positions will have the responsibility to see that the program works operationally (field level) and to recommend adaptive changes in program direction to the Group. The FPC will be dependent upon expertise and manpower available to the Implementation Biologist for monitoring of spawning bull trout, assistance in egg taking, fish population assessments, planting site evaluations, fish marking and many other tasks. Likewise, the Implementation Biologist will depend upon the FPC for the highest quality hatchery fish possible considering disease, genetic and behavioral factors to be placed at selected sites. The success of the overall program depends on closely coordinated efforts by both these positions.

As described above, this Implementation Plan has changed relative to the Mitigation Plan as the Group has adapted to changing realities and newly acquired information. During FY92 it became apparent that chronic kokanee egg shortages would prevent attainment of the goal of annually releasing 10,000,000 kokanee fry for the kokanee test. This goal was modified to the equivalent goal of releasing 1,000,000 yearling kokanee which is presently attainable. However, production of yearling kokanee will be more expensive than original estimates in the Mitigation Plan. The recovery of native species will require additional work prior to the initiation of imprint plants such as the development of recovery plans, assessment of population genetics and detailed investigation of rearing techniques (including disease control). The initial stages of habitat enhancement, fish passage and offsite mitigation will proceed more slowly than originally thought as agreements with public and private landowners are reached.

MITIGATION ACTIVITIES

Habitat Improvement

Goal Statement

To provide the necessary environmental factors for the long-term successful reproduction, rearing of juveniles, security cover, food abundance and growth of fish species in onsite treatment areas. To provide through natural recruitment and self-sustaining populations for replacement of the maximum proportion of numbers of fish identified in the loss statement.

Because fishes require suitable habitats for natural production throughout all life stages, the Department and Tribes will continue to strongly advocate and support habitat protection and restoration on private and public lands. Although it must be recognized that the ultimate watershed health lies in the hand of the owners and managers of those lands, the Department and Tribes have mechanisms in place to facilitate good watershed management practices.

The Department and Tribes have worked closely with the Flathead Basin Commission to monitor sediment accumulation in streams throughout the Flathead Drainage. Monitoring activities have provided documentation and improved compliance in the voluntary Best Management Practices (BMP) program. BMP audits have led to a greater awareness of riparian protection and sediment control. Stream protection on private land is enforced through the 310 permitting process and jointly administered by the Department and local Conservation Districts. Governmental activities within the streambeds are strictly regulated by the 124 permitting process administered by the Department. The Tribe enforces similar stream protection through their Aquatic Lands Conservation Ordinance. Greater awareness of stream health and enforcement of stream preservation and protection acts have led to improvements in land management practices within the basin.

Methods

Habitat improvement provides long-lasting benefits. The most common strategy is to protect the riparian or streamside vegetation. A healthy riparian area provides woody debris for security cover, habitat and food for insect production and spawning gravel deposition. The canopy creates shaded areas to maintain cool water temperatures. Streamside vegetation traps sediments produced from adjacent land areas so that spawning gravels remain clean and productive. This can be accomplished by fencing or revegetating the stream course.

Spawning substrate for trout and salmon may be embedded with fine sediments, or of insufficient quantity to fully seed available rearing habitat with juvenile fish. Treatment may involve agitation of embedded gravels to remove silts and fine sands or the installation of artificial spawning structures. Both techniques will remain functional longer if sediment sources are reduced or eliminated through BMPs and ongoing cooperative riparian restoration programs. Where sediments gradually accumulate, agitation may be necessary every few years until the streambanks stabilize. The Department is currently assessing existing mechanical devices used in the Pacific Northwest for cleaning gravels.

Another common method involves placing large rocks, woody debris or man-made structures in the stream to accelerate water velocities, create pools for winter fish habitat, sort streambed materials, create overhead cover and/or reduce stream width. Woody debris and cobble substrates also provide habitat for insects and other food items.

Similarly, lake or reservoir habitat can be improved by revegetating areas subject to water fluctuations. Wooden cribs, slash structures or artificial substrates can be added to enhance fish security cover or habitat for prey organisms.

Depending on the original condition of the waterbody, benefits from habitat improvement projects may not be evident for several months to several years. Once benefits are forthcoming, however, improved conditions can be maintained with very little effort or expense. The rate of vegetative growth and hydrologic processes dictate the speed of habitat recovery.

Imprint Planting

Imprint planting of genetically correct eyed eggs or fry may be necessary to establish self-supporting migratory fish populations in areas of habitat or access improvement. The Council's program amendment 903(h)(2)(C) stated, ". . . Hatchery supplementation of other species will not be considered unless the kokanee experiment fails to fulfill the mitigation objective. This is not intended to preclude research activities aimed at development and refinement of supplementation techniques for westslope cutthroat trout and bull trout." Experimental activities must consider measure 903(h)(2)(D), "Habitat improvement projects . . . will be consistent with maintenance of the genetic integrity of native fishes and protection of species that are endangered, threatened, or of special concern that occur in the improved or newly accessible habitat . . ." The design of our experimental imprint plan will be consistent with these measures.

The hatchery program will adapt current supplementation techniques, as well as develop new methods to recover westslope cutthroat and bull trout within the remaining or reclaimable range of the species. Supplementation practices will avoid negative changes in natural populations (Allendorf and Ryman 1987, Winans 1989), and interspecific interactions that can reduce growth and survival when hatchery plants are superimposed on wild stocks (Vincent 1987). Loss of genetic variation has been associated with decreased fecundity, survival, growth and food conversion efficiency and physical deformations (Kincaid 1983, Leary et al. 1985). Valuable lessons learned during massive hatchery recovery programs in the Columbia Basin (Waples et al. 1990, Steward and Bjorn 1990, Miller et al. 1990, Hilborn 1992, Meffe 1992 In Press) can be used to direct hatchery supplementation practices.

It is our intent to use previous experiences and remain abreast of state-of-the-art techniques to assure the greatest benefit to the fisheries. Such an approach will require restoration or reclamation of quality habitat and increased carrying capacity to provide long-term support for the additional fish. Monitoring of hatchery and wild stocks for genetic drift, viability, growth and survival must be ongoing to assess the effectiveness of supplementation techniques. Our emphasis for native species will be to establish new spawning runs in restored stream habitats.

As stated in the 1991 Mitigation Plan, we will plant hatchery juveniles and eggs experimentally to test relative success in the following order of priority:

1. Imprint planting in blocked areas that will be reopened;
2. Imprint planting in habitat improvement sites;

3. Supplementation of juveniles or eggs in areas with low populations.

Indirect evidence and observations indicate that imprint planting can initiate spawning runs in areas which do not contain a population of wild or naturally spawning fish. Establishment of a run is further enhanced when the hatchery fish are genetically similar to natural stocks (Miller 1992). Supplemental plants will be evaluated to minimize genetic impacts on weak stocks.

Monitoring and Evaluation

The timing of imprinting will be investigated by the thyroxine concentration method (Scholz et al. 1992). Once the fish become established in the treatment area, it is important to determine how many returning adults attempt to spawn elsewhere. If fish do not imprint on the water source, the ability of surviving adults to return to the stream may be impaired and straying can occur. This could be significant where adjacent tributaries contain valuable genetics stocks which should remain isolated from fish in the treatment area. In addition to conventional marking techniques, planted trout fry will be implanted with a miniature coded wire tag in their snout to determine survival to adulthood, condition and homing of hatchery fish.

Habitat assessments in each stream will be compared to the relative success, survival and growth, of the imprinted stocks. By monitoring limiting factors that control the success of imprint planting at several locations over time, we can refine estimates of stream carrying capacity. Key habitat features, as linked to juvenile survival and growth, can be enhanced.

The Department and Tribes will attempt to relate changes in habitat to changes in land use as well as to our habitat restoration efforts. Stream habitat will be evaluated using the standard Department methodology (MDFWP 1983) or a modified Hanken and Reeves (1988) method to provide compatible data. Sediment surveys will be observational or, if high resolution is necessary, sediment coring and sieve analysis will be applied. Sediment sources will be surveyed and targeted for future abatement. Stream discharge will be measured using standard USGS techniques. Electrofishing mark-recapture or two pass estimates, or snorkel estimates will be used to assess fish populations, relative abundance, growth, food habits and condition factors. Spawning surveys will assess the presence or absence of adfluvial spawners. Migrant trapping techniques to estimate runs is labor intensive and so will be used infrequently at selected sites.

Decision Point

Habitat characteristics in index streams which contain healthy populations of targeted fish species will be assessed for consistent features (eg. pool-riffle-run ratios, cover, substrate and food supply). We will attempt to mimic these conditions using established habitat improvement techniques in treatment areas. Periodic inspection of previously improved stream reaches will be used to determine success of treatment methodologies. When the desired habitat characteristics are achieved, migrating and rearing populations will be estimated and applied to the loss statement. Treatments which fail to enhance habitat or produce an increase in fish standing stocks or spawning runs of the target species will be modified or discontinued. Where treatments are successful, the reasons for success will be noted and applied to other sites.

Future Projects

During FY92, most effort was directed at identifying potential project sites and establishing landowner and interagency contacts for future projects (Table 1). Most projects initially identified benefitted westslope cutthroat trout so more emphasis will be placed in the future on identifying potential bull trout projects. The narrow habitat requirements of bull trout and the extent of habitat degradation in the drainage may make this a more difficult task.

Fish Passage

Goal Statement

To reclaim spawning and rearing habitat that has been isolated or lost to the Flathead River System because of man-made or natural barriers and to achieve fish production to offset a portion of stated losses. These efforts will be consistent with the maintenance of genetic integrity in fish species and protection of plant and animal species that are endangered, threatened or of special concern that occur above and below a passage barrier.

Methods

Passage techniques for ladders, culverts and natural barriers have been summarized (Bell 1991). Fish passage can result in immediate returns if the desired migratory fish are available to pioneer the newly opened habitat. Usually, however, site specific conditions will demand additional actions that slow the process. Preliminary data collection, permits, environmental assessment documents, and design and budgeting procedures require that work begins as much as a year or two in advance of the actual application of the technique. All passage projects require electrophoretic analysis of fish species above and below the barrier, and a species diversity survey. In many cases, chemical rehabilitation to remove undesirable species or genetic stocks is necessary before the barrier can be removed. Imprint planting of genetically correct eyed eggs or fry may be necessary to establish a self-supporting migratory population. Cost effectiveness analysis will be used to evaluate various passage techniques.

Monitoring and Evaluation

Fish passage will be evaluated using standard migrant trapping techniques to estimate upstream migration runs and downstream emigration of juveniles. This technique is labor intensive and so will be employed infrequently at selected index streams before and after treatment. Stream rearing fish will be evaluated using standard population assessment techniques. Imprint fry will be identified using oxytetracycline marks, finclips, fluorescent pigment injections or coded wire tags depending on the estimator utilized.

Table 1. Habitat improvement sites identified during the 1992 field season.

Project Name	Site Description	Objective	Treatment [#]
Hay Creek	Trib. to North Fork	bull trout reproduction	B, P, T, Y
Coal Creek	Trib. to North Fork	bull trout reproduction	A, B, C, V, Y
Big Creek	Trib. to North Fork	bull trout reproduction	A, B, C, V, Y
Stoner Creek	Trib. to Flathead Lake	westslope cutthroat reproduction	A, B, C, F, M, P, R, S, V
Dayton/Ronan Creeks	Trib. to Flathead Lake	westslope cutthroat reproduction	A, B, C, F, M, P, R, S, V
Taylor's Outflow	Trib. to Flathead River	westslope cutthroat reproduction	A, B, C, F, P, V
Elliott Creek	Trib. to Flathead River	bull trout and westslope cutthroat reproduction	A, S
Mill Creek	Trib. to Flathead River	westslope cutthroat and kokanee spawning	C, F, P, S
Brenneman and Siderius sloughs	Sloughs on the Flathead River	create kokanee and westslope cutthroat spawning stream, improve emigration	B, P
Hungry Horse Spawning	Three tributaries to Hungry Horse Reservoir	westslope cutthroat reproduction	A, B, P, V

[#] A = agitation of gravels to remove silt
 B = bank stabilization
 C = addition of security cover
 F = fencing of riparian zone
 M = maintenance of minimum flows - landowner agreement
 P = pool formation and channel maintenance
 R = rotenone rehabilitation
 S = artificial spawning structure
 T = installation of gravel trap
 V = plant vegetation in riparian zone
 Y = control high runoff yield through better land management

Barriers or impediments will be evaluated using species specific criteria for fish motility relative to velocity and jumping ability. Discharge will be evaluated at critical locations (eg. falls or culvert) using standard USGS flow measurement techniques. Head differentials will be measured using standard surveying practices.

Decision Point

Once passage has been reopened, periodic assessments of migration, rearing, age structure, condition factor and size at emigration will be related to stream characteristics. Estimates of recruitment to the receiving waters will be applied to the loss statement.

If fish passage fails to occur at a site, flow measurements will be repeated during the migration period. Unacceptable velocities or jumping distances will be modified to within the range of the target species' physical tolerance. Other reasons for failure to initiate passage include absence of returning adults or low juvenile density. Population problems will be addressed through habitat decision points. Examination of successes and failures will influence future site selection and treatment methodology. Sites will be monitored for at least three years after the first expected return of adult spawners.

Future Projects

During 1992, efforts were devoted to onsite inspections, species assessments and the planning of future projects (Table 2). As new opportunities to open fish passage to blocked or under-utilized habitat are discovered, they will be added to this list. A Memorandum of Understanding between the Department, Forest Service, Bureau of Reclamation and the Flathead Basin Commission to improve passage at Hungry Horse tributaries was developed to facilitate cost-sharing. A revised final document was routed for signature.

Table 2. Fish passage improvement sites identified as of FY92.

Priority	Project Name	Site Description	Objective	Treatment ^{a/}
	Hay Creek	Trib. to North Fork	bull trout passage	E, G, T
	Stoner Creek	Trib. to Flathead Lake	westslope cutthroat passage	L, R
	Taylor's Outflow	Trib. to Flathead River	westslope cutthroat passage	A, G, L, R, V
	Hungry Horse Passage	Two tributaries to Hungry Horse Reservoir	westslope cutthroat passage	G, J, M, P, Q

- ^{a/}
- A = agitation of gravels to remove
 - E = electrophoretic analysis
 - G = improve gradient/channel form
 - J = create jump pool
 - L = create fish ladder
 - M = imprint plant desired fish species
 - P = pool formation and channel maintenance
 - Q = enlarge culvert to handle flows
 - R = rotenone rehabilitation
 - T = trap gravels for removal
 - V = plant vegetation in riparian zone

Offsite Mitigation

Goal Statement

To improve the fishery resource of waters within the Flathead Drainage which are not directly linked via water flow and fish migration to the contiguous Flathead Lake/River System. This effort will increase the diversity of angling opportunities, expand the range of species of special concern and create reserves for genetically distinct sub-populations of existing fish species. Improved fishing opportunities in areas adjacent to the contiguous Flathead System can redirect harvest and angling pressure from sensitive recovery areas.

Methods

Offsite mitigation often utilizes the chemical rehabilitation of closed basin lakes or streams and subsequent re-establishment of a desired species assemblage. It also includes supplementation of isolated populations, habitat improvement to improve conditions in existing fisheries and development of brood lakes or genetic reserves.

Brood lakes provide a source of mature fish for future egg collections. Genetic reserves can serve as sources of specific genetic stocks or, where natural reproduction is possible, additional viable populations can be created and protected to increase the range of species of special concern.

Immediate benefits to fishing opportunities and fish production can be gained through chemical rehabilitation. Rotenone kills gill-breathing organisms by impeding the transfer of oxygen across gill membranes. The substance is non-toxic to non-gill breathing amphibians, reptiles and birds. Fish killed by rotenone are safe for consumption by fish-eating scavengers or predators. Rotenone naturally breaks down within two to three weeks or it can be chemically detoxified.

A licensed applicator must be at the site. Projects require an Environmental Assessment, Water Quality permit, a public comment period which may involve public meetings and a Decision Notice.

In areas where non-native species have become established and eradication is not possible or desirable, efforts will improve fish densities, growth and condition factors. Opportunities exist to create or enhance diversified angling opportunities in closed basin areas. Efforts will focus on established populations requiring habitat enhancement. Species introductions will require environmental assessment and will be considered on a site by site basis. Some offsite areas will be stocked with native species from experimental hatchery operations.

Monitoring and Evaluation

Enhanced fish populations will be monitored using standard electrofishing and netting survey techniques. Evaluations will consider increases in the density, growth, genetic diversity or

percent species composition of gamefish. Increases in angler use will be measured using onsite creel surveys, the Department statewide mail creel survey and angler preference/satisfaction surveys.

Decision Point

Habitat enhancement efforts will be visually inspected with snorkel or SCUBA surveys. Post-treatment population surveys will determine the degree of success of chemical rehabilitation projects. If the species intended for eradication persists after the initial treatment, a second treatment may be applied. Seasonal trapping of migrant species may be effective in other cases where a total kill is not obtained. Some sites may require repeat treatment every 10 to 20 years as undesirable species become re-established. Persistent treatment failure or illegal introductions will constitute a termination of treatments at the specific site.

Future Projects

Personnel conducted inspections at several offsite locations including Lion Lake and Halfmoon Lake near Lake Five. Landowner contacts and scoping of local anglers was begun to develop a list of future mitigation sites (Table 3). As new opportunities for offsite projects are identified, they will be evaluated and ranked and placed on the list as deemed appropriate.

Table 3. Potential offsite mitigation sites identified prior to the end of FY92. Prioritization was not established pending site assessment and public comment. We will use ranking criteria in this implementation plan (Appendix B).

Project Name	Site Description	Objective	Treatment [#]
Halfmoon Lake	near Lake Five	improve sport fishery	B, C, D, P, V
Rogers Lake	Highway 2 West	improve sport fishery	C, P, R
Lion Lake	near H.H. Dam	improve sport fishery	P, R
Smith Lake Rearing Pond	near Whitefish Lake	improve sport fishery, rear westslope cutthroat	M, W

- [#]
- B = install barrier
 - C = install fish cribs or security cover, wood, rock or synthetic
 - D = dredge access or remove organic material
 - M = maintenance of existing passage facility
 - P = plant with desired species
 - R = rotenone - total rehabilitation
 - W = secure water rights
 - V = vegetation to stabilize shoreline

Hatchery Fish Production and Supplementation

Goal Statement

To develop long-term, self-sustaining populations of fish to replace approved losses caused by Hungry Horse Dam that cannot be recovered through fish habitat or passage improvement. Initial efforts are primarily aimed at kokanee salmon supplementation in Flathead Lake. Additional efforts will be directed toward various developmental and research tasks for bull and westslope cutthroat trout. Disease-free status will be maintained in hatchery products for use in the fisheries enhancement program. These efforts will strive to maintain maximum genetic variability and protect local adaptations necessary for survival under natural conditions consistent with those exhibited by wild stocks. Basin-specific genetic stocks may be needed to reduce or eliminate negative interactions with existing wild, self-reproducing populations.

Planning Considerations

The Mitigation Plan identified hatchery production of kokanee, bull and westslope cutthroat trout as necessary mitigation tools to recover Flathead Lake fish populations and to provide fish for restocking chemically rehabilitated lakes and stream habitat improvement/fish passage areas. Implementation of the hatchery supplementation portions of this Implementation Plan are based on the Council's response to comments on the Mitigation Plan, program measure 903(h) and the following assumptions:

1. Approximately 2.0 million kokanee salmon eggs will be provided to Creston National Fish Hatchery annually, beginning in Fall 1993, to supplement the Flathead Lake salmon fishery.
2. BPA will provide engineering expertise and services for designing temporary and low cost hatchery upgrades and design of a bull trout isolation and rearing facility beginning October 1, 1992.
3. BPA will provide funding for necessary hatchery upgrades and facility construction.
4. BPA will provide the necessary funds for the Creston National Fish Hatchery to correct nitrogen supersaturation and effluent water quality problems beginning October 1, 1992.
5. Species specific recovery plans will be drafted for westslope cutthroat and bull trout.

From a planning perspective, the hatchery production program can be broken into two distinct sections: supplementation and native species restoration. The kokanee test is the first step in supplementation efforts. Figure 2 describes how the Department and Tribes will proceed with the supplementation portion of the hatchery program. For the first five years, beginning in fall of 1992, the FPC will attempt to obtain 2,000,000 disease free kokanee eggs for hatching and

rearing at Creston NFH. These will be planted in Flathead Lake as 6-8 inch juveniles during the spring and summer months when their chance of survival is the greatest.

As indicated in Figure 2, the fate of the plants will be closely monitored utilizing annual acoustic and gill net surveys as well as periodic angler surveys. During the five year test period, we will accumulate sufficient information to determine whether the plants were successful, thereby dictating future hatchery operations and facility upgrades. If the population begins to show evidence of natural reproduction supplementation will, of course, be scaled back. Incorporating the principles of adaptive management, the criteria for determination of success may be modified by the Department, Tribes and Consultation Committee during the test period.

During the period of the kokanee test, there will be an ongoing experimental hatchery program to refine culture techniques for bull trout and provide hatchery fish for native species restoration (Figure 3). All program work of this nature will adhere strictly to the evaluation process outlined in the decision tree (Figure 3). It is imperative that this work move forward during the next five years so that all options are readily available after the kokanee test.

If the kokanee test is not successful, the Group will then evaluate the supplementation of native species (Figure 4). The Group will make decisions about hatchery supplementation based on the species enhancement plans, success of ongoing habitat and fish passage restoration efforts, implications for population genetics, predation and other biological and social issues. If the evaluation indicates that onsite supplementation with native species is not likely to succeed, this effort will continue to focus on offsite areas only. If success appears likely, the Group will proceed as outlined in Figures 3 and 4. The numbers, size and species of fish needed will ultimately determine which hatchery facilities will be used, upgraded or constructed for longer term hatchery production goals.

Genetic Considerations

The genetic characteristics of a given fish population, in concert with the environment, determine the quality and longevity of the fishery resource. The long-term utility of genetic variation is that it allows fish populations to adapt to changing environmental conditions. The genetic diversity of a population is a finite resource that, with improper management, can be lost.

When the South Fork and Swan drainages were isolated from the Flathead system by dam construction, portions of bull trout and cutthroat trout genetic interchange were lost. Establishing new populations of bull trout and cutthroat using fish from these areas through supplementation might alter the genetic characteristics of the Flathead stock. The overriding principle that will be used throughout the Flathead River Basin supplemental fish stocking program is that every action will be based on its genetic implications. It must be clear that all fish being stocked are expected to become reproductively active. This will require a very specific propagation plan for each species, and documentation of the specific methods to be used. A critical reference to this action will be the handbook "U.S. Fish and Wildlife Service Inland Salmonid Broodstock Management (Erdahl, 1993)."

Figure 2. Kokanee Reintroduction - decision points and time frame.

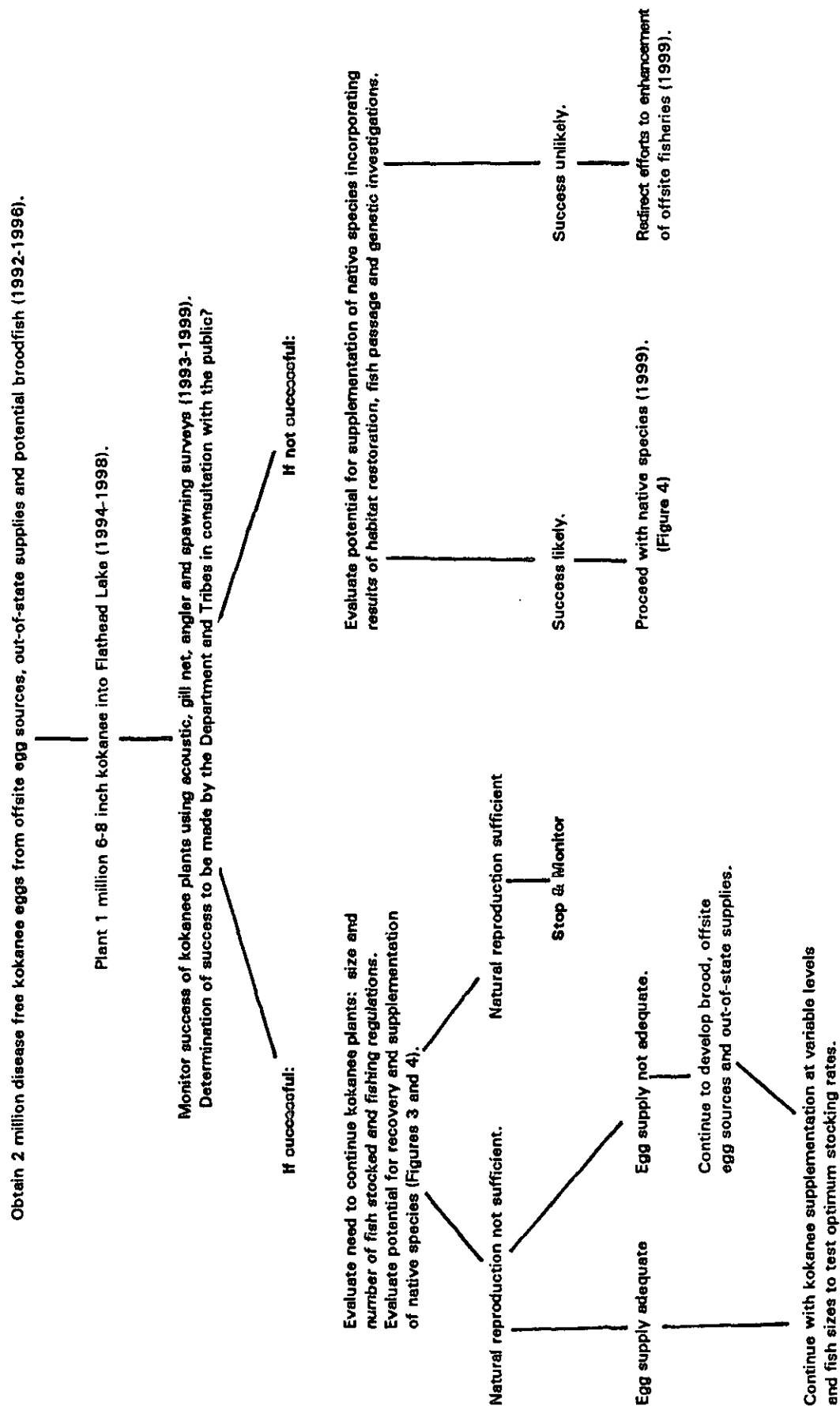


Figure 3. Native Species Restoration - decision points and time frame.

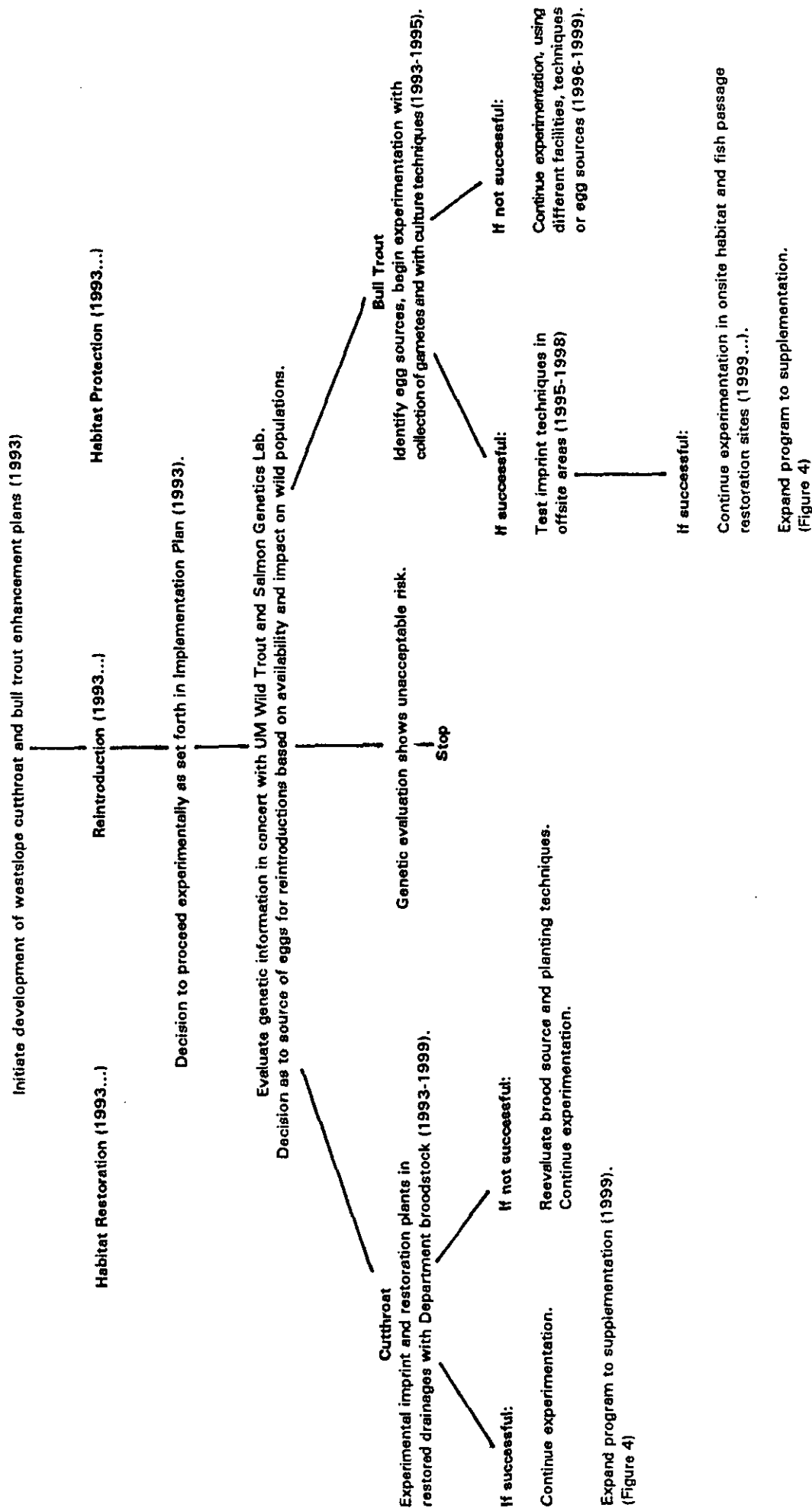
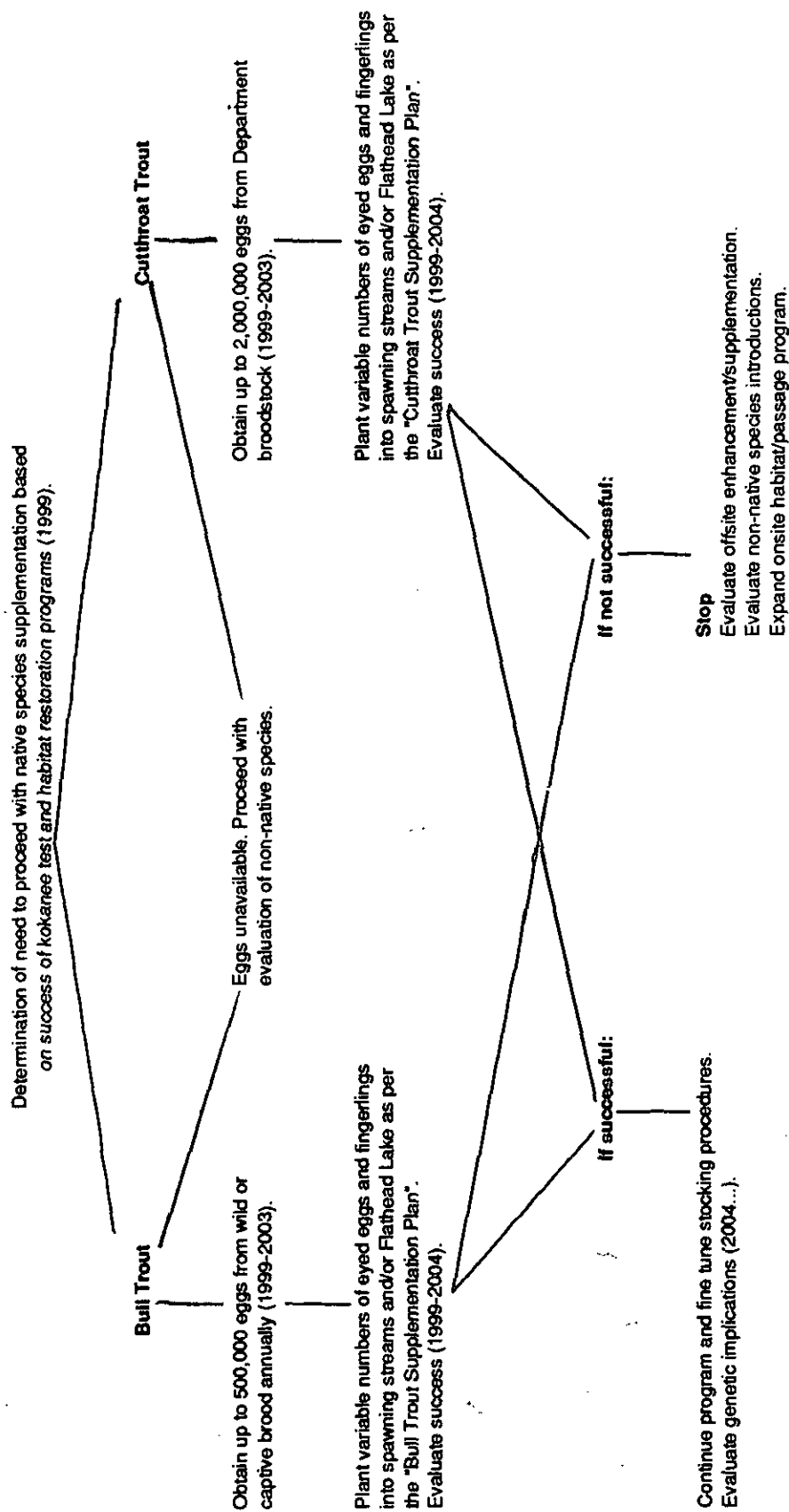


Figure 4. Native Species Supplementation - decision points and time frame.



It will be necessary to collect baseline genetic data where none currently exists. This effort will focus on bull trout and westslope cutthroat trout and will be coordinated with the University of Montana Wild Trout and Salmon Genetics Lab. The type of data needed include allozyme analysis and possibly other methodologies. Only through this process can fisheries biologists and fish culturists possibly understand what actions are necessary to restore these fisheries.

There is no substitute for long-range planning in an effort to conserve genetic variation. All management practices must be evaluated based on their genetic impact prior to adoption as part of the hatchery procedure. The "Broodstock Management Handbook" together with the most recent literature and consultations with experts in the field will be used in development of the plans and all aspects of stock management.

Hatchery Facilities

Three different sites are available for fish culture activities directed toward meeting mitigation objectives.

Creston National Fish Hatchery (NFH) is located on the east side of the Flathead Valley and is owned and operated by the U.S. Fish and Wildlife Service. Creston has 48 outside raceways in 4 banks. The hatchery building has 16 tanks and 25 troughs for egg incubation and early rearing. Several outbuildings provide shop facilities and storage for fish food, vehicles and equipment.

Creston NFH receives 18,000-20,000 gallons per minute (gpm) of water from springs at the head of Mill Creek. A dam provides the head for a gravity water flow system. Water temperatures vary from 38°F to 51°F seasonally.

Fish production capacity at Creston NFH greatly exceeds the potential capacity of local state hatchery facilities. Problems at Creston NFH include structural safety problems with the dam, nitrogen supersaturation in the water supply which can cause stress and mortality in fish, poor effluent water quality at full production and general aging of the facility.

Somers State Fish Hatchery (SFH) is located on the west shore of Flathead Lake south of Somers. The facility consists of a hatchery building with 40 raceways for incubation and rearing. The site is 2.6 acres. Water is supplied by a spring 1/2 mile west of the hatchery and piped by gravity to the hatchery. The Department has purchased the spring source and is developing the water collection facility. Flows can range up to 1,000 gpm with an average temperature of 48°F and a range of 36°-60°F seasonally. Lake water can also be pumped into the hatchery to provide flow supplementation and temperature regulation. Lake water temperatures range from 32°-65°F seasonally. Salmon have been pen reared in the lake at Somers.

The Somers hatchery was built in 1913 and is structurally unsound. The small hatchery site may limit the size of future development.

Rose Creek Hatchery Site lies just south of Creston NFH and is owned by the Department. The site is 20 acres with no facilities other than a capped artesian well developed by the Department. The well will provide 2,000 gpm of water at 52°F year round. The drainage system for the area would need to be developed to handle increased discharges.

Kokanee Test

The Mitigation Plan established a loss of approximately 100,000 adult kokanee as a result of the operation of Hungry Horse Dam. The Mitigation Plan established a fish hatchery production goal of 10,000,000 kokanee fry (2½") for a five year period as a "test" to determine if the Flathead Lake fishery could be restored to a level to provide the mitigation goal of 100,000 adults. In order to carry out this test, approximately 12,000,000 kokanee eggs would be needed each year. It has become apparent that such a large number of eggs are not available and may not become available in a dependable manner in the near future. Therefore, the Group and their Consultation Committee have determined that a legitimate test of reestablishing Flathead Lake kokanee, and achieving the mitigation goal of 100,000 adult kokanee, could be accomplished by supplementing Flathead Lake with 1,000,000 yearling size (six-eight inch) kokanee for five successive years. In the spirit of "adaptive management" it is felt this change in the proposed mitigation action will have a greater chance of success in accomplishing the mitigation goal and will be a more timely and cost effective test. This change in supplementation plans from fry to yearling size fish does not necessarily rule out future fry plants, especially if an abundance of kokanee eggs becomes available.

Nonetheless, kokanee egg availability is still a potential limiting factor to successfully completing the test. Given this uncertainty, several thousand kokanee will be retained as test brood fish to see whether they can provide eggs for the mitigation test (Table 4). If production goals are met, the "kokanee test" should be completed in FY98.

Monitoring and Evaluation

Kokanee 6 to 8 inches in length will be stocked by methods and in locations that have the greatest likelihood of success. Marks will be employed to assess planting strategies, movement patterns and origin.

Field monitoring will begin approximately one month after release. Kokanee recovered from the initial plant will provide survival estimates. Recaptures will be sought with gill nets, from angler creel and by evaluating stomach contents of predators (primarily lake trout). Hydroacoustic surveys and associated ground truthing with gill nets and trawling will be used to assess shifts in relative species abundance and distribution. A comparison between age/growth, time of sexual maturity and condition factor of marked and unmarked kokanee will be used to assess differences between hatchery and naturally reproduced fish.

Table 4. Kokanee hatchery production.

	Time Frame in Federal Fiscal Years (Oct. 1 - Sept. 30 of Subject Years)						
	FY92	FY93	FY94	FY95	FY96	FY97	FY98
Eggs received at Creston	900,000 ^{1/}	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	
Fry held till next year	300,000	1,200,000	1,200,000	1,200,000	1,200,000	1,200,000	
Yearlings planted in Flathead Lake	0	250,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
Broodstock Option to Augment Egg Supply							
Fry held for brood	10,000	10,000	10,000	10,000	10,000		
Yearlings held for brood	0	5,000	5,000	5,000	5,000	5,000	
2 year olds held for brood	0	0	3,000	3,000	3,000	3,000	3,000
3 year olds held for brood	0	0	0	2,500	2,500	2,500	2,500

^{1/}Fish numbers will not total the number of eggs because of mortality losses.

Survival estimates based on the number of returns from the first outplant in 1993 will determine the number of kokanee sub-adults needed for a successful evaluation. If no kokanee from the initial outplant are recovered, managers will repeat the experiment during FY94 with approximately 1,000,000 6-8 inch marked kokanee. This will constitute the first year of the test.

Spawning adults will be assessed enroute to spawning areas. Visual inspection in known staging areas will determine presence or absence of adults. Where present, adults will be sampled to examine the relative abundance, condition and fecundity of wild vs. hatchery stocks.

The basin-wide creel census conducted for one year during 1992 and 1993 may be repeated on a smaller scale during 1998 to evaluate the effect of kokanee supplementation on angler success. Hydroacoustic and gill net sampling will be repeated annually to assess kokanee population structure.

Provided that kokanee become established in detectable numbers, we will attempt to concentrate spawners in quality spawning habitat. This can be accomplished by "imprinting" the swim up fry on a water source (eg. Mill Creek water at Creston Hatchery) or an inert synthetic chemical.

Drip stations containing the imprint scent can be strategically placed to concentrate fish for natural reproduction, egg taking or survival estimation.

If kokanee spawners return to known spawning sites, efforts will be made to protect and enhance natural reproduction. River spawners will be protected by non-power constraints on Hungry Horse Dam which limits maximum discharge to 4,500 cfs from October 15 through December 15. Spawning success will be evaluated with drift nets at points along the river corridor along with annual redd counts.

Criteria for Determining Success of Kokanee Reintroduction

Success of the kokanee reintroduction program can be measured by a number of statistical parameters. Some discussion of the historical status is necessary to put those values into perspective. In a year-round 1981-1982 creel census study of Flathead Lake anglers caught kokanee averaging 12.3 inches in length at a rate of 1.6 fish per hour (Graham and Fredenberg 1983). An estimated 496,000 kokanee were harvested comprising 92 percent of the total fish harvest from the lake. Over 70 percent of the total boats, and a similar proportion of the estimated 605,000 angler hours (168,800 trips) were expended by anglers specifically pursuing kokanee. In addition, in August-October of 1981, anglers harvested about 77,000 kokanee from the lower Flathead River (Frendenberg and Graham 1983). An estimated 131,534 kokanee survived to spawn in fall, 1981.

With this perspective, it must be pointed out that "success" is a relative term and determining success of the Flathead kokanee reintroduction effort is predicated upon a complex balance between angler catch rates, fish size, total harvest, angler pressure and return to creel of outplants. In addition, the contribution of kokanee to the Flathead Lake food web and the potential reestablishment of wild spawning runs will be mitigating factors. If kokanee reintroduction efforts are successful it will take some time for anglers to reestablish successful angling patterns, and for harvest to increase as year classes are added. It is also likely that if the fishery remains solely dependent on hatchery fish we will see dramatic year-to-year fluctuations in angler success, since the entire fishery will be dependent on only two age classes of fish (Ages 2 and 3).

With the foregoing considerations, we would propose that the kokanee supplementation program be considered initially successful if it establishes a fishery by 1998 that produces statistical values roughly equivalent to about 25 percent of 1981-1982 levels. These standards would include:

1. Post-stocking survival of 30 percent of planted kokanee one year after stocking.
2. Yearling to adult kokanee survival of 10 percent (100,000 adult salmon).

3. Annual kokanee harvest of 50,000 or more fish; this would equate to at least 5 percent of stocked fish being returned directly to the creel.
 - A. A catch rate of 0.5 fish per hour for anglers specifically pursuing kokanee.
 - B. Average length of harvested kokanee 11 inches or longer.
 - C. Fishing pressure directed at kokanee of 100,000 angler hours or more (25,000+ trips).

As the stocking program is fine-tuned, angler tendencies are refined, and natural reproduction begins to contribute (a major unknown variable), then these target levels would be expected to rise.

Mitigation/Enhancement of Native Species

The enhancement of native species is not confined to the Flathead system. Westslope cutthroat and bull trout populations throughout Montana are being actively protected and development of management plans is scheduled to proceed in the next two years. The development of management plans will provide a statewide framework within which enhancement in the Flathead can proceed. In all likelihood the management plans will include, among other measures, habitat protection, habitat restoration and reintroduction of native fishes (see Figures 3 and 4). Within this context, this Implementation Plan describes enhancement of native species in the Flathead system.

Increased fish passage to previously blocked areas, habitat improvement and removal of non-native species may be key components of native species enhancement. Imprint planting into these newly available habitats may be an important component of enhancement. Unless the desired fish stock is available to pioneer treatment areas, development of a natural spawning run may be precluded, for example, by establishment of another species and resulting competition.

The first step in the process of native fish enhancement through imprint planting will involve an assessment of the population genetic structure within the Flathead drainage (see Figures 3 and 4). If the genetic variation between populations is small, it may be possible to utilize a wild or captive broodstock as a source for eggs and fry to be used in imprint plants. Before that decision is made the Group would need to evaluate the impact of the necessary egg take on the existing populations.

If, on the other hand, the variation between populations is large, it will be necessary to use small lots of eggs collected from the wild and raised in the hatchery until they are imprint planted to restore and reintroduce native species. This will require investigation into methods of collecting and rearing small lots of eggs. It will also require that the Group identify populations that can withstand the egg requirements for this initial development of methods.

When the methods for rearing have been developed, it will be necessary to work on proper methods for planting. The time and location of planting will be critical to successful imprinting and survival of the eggs and/or fish. The initial attempts at imprint plants should be made in offsite areas to ensure that there is no genetic mix with existing populations. These initial, experimental plants will be monitored to assess their success.

Once successful rearing and planting techniques have been developed, we can collect eggs from genetically appropriate populations for imprint plants within the interconnected Flathead System. The selection of appropriate populations as contributors of gametes will be done in consultation with the Wild Trout and Salmon Genetics Lab at the University of Montana.

The success of these plants will be closely monitored. If after several generations it is determined that the imprint plants are not working and/or the existing populations are continuing to decline due to habitat degradation on public and private owned/managed lands, it may be appropriate to develop a broodstock as a reserve of native species genes. This brood could be used in future enhancement efforts.

Bull Trout

Program measure 903(h) stated that research activities aimed at development and refinement of supplementation techniques for bull trout could proceed during the "kokanee test" period. It will be necessary to develop a source of bull trout eggs and young fish to determine the timing of imprinting and test supplementation techniques in stream reaches treated by the habitat improvement/fish passage program. Preliminary results of such tests would be available near the end of the "kokanee test" period.

The Mitigation Plan established a loss due to Hungry Horse Dam of approximately 2,000 adult bull trout which correlates to a goal of 250,000 young (six-to-eight inch) bull trout destined for Flathead Lake. The Group is committed to implementing any experimental bull trout supplementation program in a genetically correct manner. A genetic inventory of existing stocks using electrophoresis shall begin immediately. Geneticists will be consulted during the development of the enhancement plan. Wild stocks will be used as the egg source for this program which dictates that a new and separate facility will have to be developed for disease isolation and incubation and rearing considerations. Management of the wild brood fish and egg taking operations in tributary streams will be somewhat labor intensive, but necessary in order to preserve the genetic integrity of Flathead drainage bull trout stocks. An estimate of existing wild populations will be necessary to evaluate the number of eggs that can be removed from spawning adults without damaging the native population. It may be feasible to develop a captive brood using captured juvenile fish.

The estimated number and age of bull trout to be present at the bull trout isolation facility are presented in Table 5. These eggs will be taken from wild broodfish as per the "Field Guide". The initial egg collection will be dedicated to the imprint timing experiment.

Table 5. Experimental bull trout hatchery production.

	Time Frame in Fiscal Years (Oct. 1 - Sept. 30 of Subject Years)						
	FY92	FY93	FY94	FY95	FY96	FY97	FY98
Eggs taken to hatchery ^{1/}	0	20,000	20,000	150,000	200,000	200,000	200,000
Fry on hand	0	0	12,000	12,000	90,000	120,000	120,000

^{1/}Numbers are preliminary pending development of a bull trout enhancement program (Figure 3).

Additional eggs will be held for future coded wire tag implants to assess imprint planting success. A cooperative arrangement with Eastern Washington University to determine the timing of bull trout imprinting will require bull trout to be held from egg fertilization through swim up and early juvenile development. Egg and fry samples taken at biweekly intervals will be analyzed for thyroid hormone levels which peak at the time of imprinting. To conduct fish sampling at a precisely known age/size, the facility must be able to hold incubating eggs and developing juveniles for the duration of the test.

Like cutthroat, it is believed that bull trout imprinting may occur at or near the period of juvenile emigration, at approximately three years of age. If this is true, imprint planting may be accomplished using larger fish. If, however, bull trout imprint upon swim up, as is the case with kokanee, fingerling outplants may fail to imprint on the receiving waters. This could lead to greater incidence of pioneering by returning adults which could jeopardize the genetic integrity of adjacent stream populations and make follow-up assessments nearly impossible. To assure these problems do not develop, the imprint test would require artificial imprinting of the hatchery fish using inert synthetic chemicals. The same chemicals would then be supplied to the imprint stream via drip station, when the imprinted hatchery fish were scheduled to return as adults to spawn. The size of fish at the time of imprinting is critical to coded wire tagging operations. Present technology requires that fish be at least 50 mm ($\approx$ 2 inches) to enable successful tagging. Options for tag placement at this size is limited to the nose. If the fish can be held to a larger size before marking, alternative tagging locations (eg. cheek, adipose fin or skin) can be employed. Differing tag locations can be used to identify the source of the fish without sacrificing the individual for tag extraction. Hatchery stocks released early, or eyed egg implants could be recaptured at a larger size in the natal stream for marking, but this method introduces uncertainty as to the age and source of the fish (eg. a wild juvenile of the same size could be mistakenly marked as a hatchery fish or vice versa). Therefore, unless the source of the fish can be assured under field conditions, it is preferable to hold the fish in the hatchery until marking and subsequent release.

A comparison of marked hatchery imprints to unmarked (or differently marked) natives in a control area will allow for evaluation of hatchery stock success and degree of straying. Incidence of marked juveniles in predator stomach contents will provide qualitative information on the importance of the "predator trap".

These projections depend on BPA providing engineering assistance beginning October 1, 1992, and providing construction funds October 1, 1993. It may be possible to experimentally take an initial 20,000 bull trout eggs from the wild in September or October 1993 and hold those eggs to test spawning and rearing techniques. At the same time, planning for construction of isolation facilities should be proceeding. If construction monies are not available by October 1, 1994 then production figures in Table 5 would need to be shifted to the next fiscal year.

Westslope Cutthroat Trout

The Mitigation Plan established a loss due to Hungry Horse Dam of approximately 65,000 young (six-to-eight inch) westslope cutthroat trout destined for Flathead Lake. The preferred method of mitigating for this loss would be establishment (or reestablishment) of naturally reproducing populations of cutthroat trout in restored tributary streams. These populations would in turn provide outmigrating young fish to Flathead Lake. The establishment of new or larger populations through habitat enhancement methods and imprinting of young cutthroat trout is an experimental approach that will take many years to achieve the mitigation goal. Research activities aimed at development and refinement of supplementation techniques for cutthroat trout could proceed during the "kokanee test" period. Accordingly, we plan to experimentally supplement Flathead Lake populations through imprint plants and small experimental direct plants of larger fish. This supplementation experiment will be aimed at determining the optimum age and size of planted fish for survival and growth of cutthroat trout in Flathead Lake.

Hatchery supplementation of westslope cutthroat trout will be conducted initially using the Department's existing broodstock at Anaconda State Fish Hatchery as a base. Mitigation needs for cutthroat trout eggs will initially be provided by the Department with mitigation dollars providing partial funding for existing broodstock rearing. By FY97, natural production from habitat enhancement projects and imprint plants should start reducing demands on the hatchery system. Table 6 shows the expected number and age of cutthroat trout to be produced for mitigation. Some westslope cutthroat will have to be reared in the state hatchery system due to present space limitations.

Table 6. Westslope cutthroat trout hatchery production.

	Time Frame in Federal Fiscal Years (Oct. 1 - Sept. 30 of Subject Years)						
	FY92	FY93	FY94	FY95	FY96	FY97	FY98
Eggs ^{1/}	60,000	180,000	180,000	260,000	260,000	200,000	160,000
Fry for planting (habitat enhancement streams)	30,000	50,000	70,000	100,000	100,000	70,000	50,000
Offsite plants	0	40,000	20,000	30,000	30,000	30,000	30,000

^{1/}Numbers are preliminary pending development of a westslope cutthroat enhancement program (Figure 3).

Decision Point

If direct supplementation is not required after the kokanee test, and after evaluation of other mitigation programs (eg. habitat enhancement), the experimentally cultured native species will be redirected to offsite areas. Near the end of the "kokanee test" the Group will make decisions relative to what species of salmonid (kokanee, bull or cutthroat trout) will be used to continue Hungry Horse fisheries mitigation and what species will be used to accomplish Kerr Dam mitigation. Although mitigation goals in the Hungry Horse Plan could require hatchery production of all three species, Kerr Dam mitigation goals could be accomplished with any one or a mixture of species. If the Group selects cutthroat trout as a species for mitigation production, a small hatchery expansion to hold a local broodstock to be used exclusively for mitigation egg production would be appropriate.

BALANCE OF MITIGATION STRATEGIES

Rapid returns and long-term investments can be realized simultaneously by implementing a combination of mitigation tools. This was recognized by the contributors to the March 1991 Mitigation Plan. Operational strategies were deferred to the Columbia Basin System Operation Review for final consideration.

The habitat, fish passage and hatchery portion of the plan are co-dependent. Imprint planting to initiate spawning runs has received wide support for reestablishing fish populations in improved areas. Chemically rehabilitated sites can be rapidly repopulated using genetically evaluated disease free hatchery stocks. Hatchery fish planted in rehabilitated offsite lakes can create angling opportunity and redirect harvest and pressure from sensitive onsite areas that are being recovered as well as serving as genetic reserves. The survival of hatchery outplants is largely dependent on the availability of habitat to support critical life stages, appropriate water quality and food supply. This is especially important if we are to avoid conflicts with wild, self-reproducing stocks.

Initially, the balance of hatchery expenditures will be shifted toward kokanee production to assure adequate numbers for a scientifically sound test of the kokanee reintroduction program. Experimental supplementation of native species will involve imprint planting and development and improvements in culture techniques, consistent with maintaining genetic variability and disease free status.

Habitat and fish passage will initially focus on identifying future projects and improving conditions for wild reproducing stocks and eradicating non-native species in onsite areas that threaten to increase their range in the contiguous river system. Many areas can be greatly improved simply by fencing the riparian area or removing point sources of sedimentation by revegetating problem areas. This will maximize short-term gains with low cost treatments. Larger scale or long-term enhancement techniques (eg. artificial spawning structures, security cover structures, point bars, fish ladders) will be applied in only a few locations each year so that new technologies can be tested and modified as needed, before proceeding full scale.

Offsite rehabilitation projects are highly visible and produce immediate results. Some lakes should be rehabilitated and replanted with a desirable species assemblage to provide new angling opportunities while anglers wait for long-term projects to come to fruition. However, as stated in the Mitigation Plan, this activity remains the lowest priority.

The balance of short- and long-term benefits can be maintained through a combination of the above mitigation tools. By focusing on species assemblages rather than individual species we can improve and protect a diversity of angling opportunities. Each year we should mitigate past damages, enhance existing aquatic resources, create new fisheries opportunities and protect our most healthy ecosystems.

PROPOSED BUDGETS

The initial fish production effort during the kokanee test period is heavily weighted toward kokanee, with more than 90 percent of the fish production budget (O&M) being directed to that goal (Table 7). Bull trout production costs are projected to be relatively low and constant during the planning period. Costs for bull trout egg procurement and overall bull trout program direction and quality control will be largely borne within the FPC budget. Cutthroat trout production costs will also remain relatively low and constant during the planning period because a relatively small number of fish are needed for the experimental program. Approximately \$1,000 per year will be allocated to support the Department hatchery operations.

Proposed hatchery upgrades and future construction projects and associated budgets will be refined by BPA engineering estimates. Initial bull trout hatchery construction projects will be needed to facilitate the test or experimental development of the bull trout program. Once the decision point is reached in the kokanee test, it may be necessary to initiate some hatchery upgrades and/or expansions.

Table 7. Proposed budgets for Creston NFH and State hatchery O&M by federal fiscal years.

	Time Frame in Federal Fiscal Years (Oct. 1 - Sept. 30 of Subject Years)						
	FY92 ^{1/}	FY93	FY94	FY95	FY96	FY97	FY98
Kokanee	60,000	169,000	220,000	220,000	220,000	220,000	220,000
Bull Trout	---	0	10,000	15,000	20,000	20,000	20,000
Westslope Cutthroat Trout	---	2,000	3,000	3,000	3,000	3,000	3,000
Total	60,000	171,000	233,000	238,000	243,000	243,000	243,000

^{1/}Costs are in 1991 dollars.

A feasibility analysis of available hatchery sites will be conducted by the Fish Production Coordinator and BPA engineers prior to any construction. The analysis will determine what combination of sites and facilities will optimize fish production capacities as well as meet the environmental requirements of each species. Long-term supplementation plans will be prepared to estimate production requirements.

State Fish Hatchery Development

The Somers State Fish Hatchery is in need of major renovation and the Rose Creek site is essentially undeveloped, as previously noted. Development of the sites would be determined in the previously noted hatchery feasibility analysis. The State would cost-share renovation activities at Somers.

Bull trout culture requires cold incubating temperatures and a natural thermal cycle for up to three years for successful rearing of juveniles. A small bull trout rearing facility will be needed to assure complete disease separation of bull trout from fishes and/or diseases that may be present at existing facilities. The lack of an isolation facility is the primary limiting factor in development of an experimental bull trout program and bull trout timing of imprint experiments.

An imprint timing experiment on westslope cutthroat trout is presently underway through a cooperative arrangement with Eastern Washington University, Washoe Park State Fish Hatchery and the Implementation Biologist. Hatchery rearing of juvenile cutthroat is required for the same reason as noted for bull trout. Planned imprint planting experiments on cutthroat using wire tags would best be served by Somers State Hatchery since, unlike Creston, live fish can be received at the site. Again, this requires an upgrade of the main hatchery facility to assure a natural thermal cycle and modern rearing facilities.

In the future, production capacity may also be needed at state facilities to maintain kokanee plants in brood lakes such as Lake Mary Ronan and to provide overflow capacity beyond Creston NFH for production of westslope cutthroat and bull trout. The actual date of fish production initiation would be determined by facility availability and completion of species recovery plans.

Creston National Fish Hatchery (NFH)

Nitrogen degassing of the Creston water supply may be the most critical non-operational mitigation need for construction monies for the entire implementation plan. The Creston NFH has long been known to have a somewhat moderate nitrogen gas supersaturation problem associated with its water source. Trout egg incubation and rearing of small trout has not experienced significant problems at Creston NFH in the past. However, survival problems with small kokanee (shortly after hatching) occurred in early 1992 at Creston when the first attempt at rearing salmon took place. Short term emergency measures were taken to alleviate the problem on two raceways. In FY93 degassing columns with oxygen injection were installed by BPA to service 24 of the facility's 48 raceways. The Group recommends that all means

available be used to secure BPA funding early in FY94 to solve this problem in the other 24 raceways.

Raceway covers are needed for existing facilities at Creston. Indications from kokanee hatchery managers as well as research from other salmonid hatcheries show better survival, condition and performance of fish produced with shaded environments during rearing. In order to give the kokanee test every benefit of the doubt, the Group feels this state of the art technique should be supplied.

It may be necessary to expand raceway capacity of the Creston Hatchery to accommodate full production of kokanee as well as brood and/or production of native species. At the present time the Creston water supply is not being used to maximum capacity and as the program expands it is anticipated another bank of raceways could be added. As with the state hatchery developments, these plans are all subject to restructuring pending analysis of the system by the BPA engineers and Fish Production Coordinator.

A effluent treatment system will be needed by January 1994 to treat the water effluent leaving Creston NFH. Once full kokanee production of 1,000,000 yearlings (plus other ages and species of fish) is reached, Creston NFH will be producing record high levels of fish biomass at the facility. As with any biological production, waste products increase with the amount of biomass produced. This means that water quality considerations in Mill Creek and the Flathead River must be addressed as a consequence of producing large numbers of mitigation fish.

The U.S. Fish and Wildlife Service (Service) has scheduled a major reconstruction of Mill Pond Dam through its Dam Safety Office. This project will assure the long term safety and reliability of the dam and the Creston NFH water supply. The Service has a long term commitment to maintaining the Creston facility as a functional hatchery dedicated to whatever fish production needs the Group may request.

COORDINATION WITH KERR DAM FISHERIES MITIGATION

Background

On July 17, 1985, the Federal Energy Regulatory Commission (FERC) issued a joint 50-year operating license for Kerr Dam, located at the outlet of Flathead Lake, to both the Confederated Salish and Kootenai Tribes and Montana Power Company (MPC). As part of this joint license, MPC submitted the Kerr Project Mitigation and Management Plan (MPC 1990) for review and approval by FERC. This plan proposed remedial measures to reduce the operational impacts of Kerr on the fish and wildlife resources in Flathead Lake and the lower Flathead River.

On June 22, 1990 when the MPC plan was filed with FERC, it contained three agency letters of support from Mr. Galen L. Buterbaugh, Regional Director, U.S. Fish and Wildlife Service; Mr. K. L. Cool, Director, Montana Department of Fish, Wildlife and Parks; and Mr. Michael T. Pablo, Tribal Council Chairman, Confederated Salish and Kootenai Tribes.

Because Kerr Dam is within the exterior boundaries of the Flathead Indian Reservation, Section 4(e) of the Federal Power Act stipulates that the Secretary of the Interior has the opportunity to require additional conditions on the operator of the dam for protection of Reservation resources. These recommended 4(e) conditions are to be formulated by the U.S. Department of Interior. FERC will not rule on the MPC Plan until these 4(e) conditions are received.

During the fall of 1990, four separate Motions to Intervene were filed with FERC relating to their deliberations on the MPC plan. Two motions dealt with future operations of the dam, whereas the other two dealt with shoreline erosion concerns.

As of the preparation of this Implementation Plan, there has been no ruling by FERC on the Motions to Intervene nor have 4(e) conditions been submitted to FERC by the Secretary of the Interior.

Mitigation Coordination

Fish Production

The 1990 MPC plan allowed for upgrading the incubation and early rearing facilities at Creston NFH. This upgrade would also allow for the remodeling of existing hatchery buildings as well as rehabilitation of existing raceways. Annual operating expenses for the Creston NFH to produce replacement salmonids for Flathead Lake was also provided. Appropriate species production was not defined, however fry production was defined.

Habitat Enhancement

Funds were provided for annual habitat enhancement and rehabilitation activities to improve aquatic habitats for fishes in Flathead Lake and the upper Flathead River. These activities were also to include improving angler access and public information on harvest and fish ecology.

Monitoring

An annual monitoring program was also projected for Flathead Lake. Costs were to include two full time monitoring personnel with a small annual operating budget.

Coordination with Hungry Horse Activities

The above mentioned mitigation activities reflect annual payments made by MPC to mitigate the ongoing operations of Kerr Dam. Mitigation dollars may be deposited annually into an interest bearing account and drawn upon by the Department and Tribes as needed. This type of a financial arrangement allows the Department and Tribes decision and financial flexibility within and between mitigation activities.

Fish production activities will need to be closely coordinated between the Kerr and Hungry Horse programs. In actuality, they will be considered as a single program. The interest bearing account will allow for cost savings, financial growth and appropriate expenditures at crucial decision points.

The above mentioned mitigation activities are now uncertain, pending rulings by FERC on the Motions to Intervene and 4(e) conditions, if any.

LONG-TERM MITIGATION BUDGET

Table 8 presents 7-year budget estimates for all program measures. Budget estimates will be refined through time as experimental procedures more clearly define the cost of each action. Total costs for FY93 and FY94 do not match BPA projected budgets. Discussions are underway as noted under "Impediments to Progress." Likewise, long-term budgets are increased from original budget estimates to reflect higher hatchery production cost estimates as previously discussed.

Budgets are currently being negotiated annually with BPA. The intent is to eventually establish a long-term funding mechanism.

Table 8. Proposed operational budgets^{1/} for implementation of Hungry Horse Fisheries Mitigation Plan.

	<u>Time in Federal Fiscal Years</u>						
	FY92	FY93	FY94 ^{1/}	FY95	FY96	FY97	FY98
Habitat Improvement	22,000	109,800	224,910	219,173	219,173	219,173	219,173
Fish Passage	10,000	49,000	59,670	59,670	59,670	59,670	59,670
Hatchery Production	110,000	254,000	405,068 ^{2/}	410,805 ^{2/}	416,543 ^{2/}	382,118	382,118
Monitoring and Evaluation	143,000 ^{2/}	166,300 ^{2/}	169,830 ^{4/}	146,880	146,880	146,880	135,405
Offsite Mitigation	15,000	9,300	27,540	26,393	26,393	26,393	26,393
Total Operations	300,000	588,400	887,018	862,920	868,658	834,233	834,233

^{1/}All FY94-98 costs are in 1994 dollars

^{2/}Higher costs for Flathead Lake/River creel

^{3/}Includes \$30,000 per year for BPA engineering assistance

^{4/}Includes \$30,000 for bull trout electrophoretic genetic analysis in FY94 and \$10,000 annually thereafter

IMPEDIMENTS TO PROGRESS

BPA funding limitations in FY92 (\$300,000) and FY93 (\$500,000) have affected the rate in which mitigation projects can be implemented. Full scale funding under the 1991 Mitigation Plan was estimated at \$650,000 in 1990 dollars (inflationary adjustments will have to be made in future budgets).

Hatchery limitations have caused a delay in the kokanee recovery test. Nitrogen supersaturation problems at Creston NFH have caused higher than expected mortality in juvenile kokanee. Degassing was completed for one-half of the hatchery in FY93 and must be expanded to the full facility as soon as possible in order to reach full production and assume high quality products.

Kokanee egg sources were at an all time low during 1991. Supplementation programs throughout Montana were cut back to the most critical locations. Production was likewise reduced for use in Hungry Horse Mitigation. Adequate egg numbers were obtained from Colorado in 1992 but this source can not be relied upon. Efforts must continue to develop local egg sources and the mitigation program must assist that effort.

Controversial mitigation components included hatchery supplementation and fish passage improvements into historically fishless waters. Concerns included the genetic integrity of native species, the possible displacement of wild stocks by hatchery fish, disease introduction and effects of fish introductions on other plant and animal species. Amendment 903(h) reflected the mixed support for these mitigation strategies. This Implementation Plan has attempted to honor the intent of the Council directive.

Of critical concern to the hatchery systems is the language in Amendment 903(h)(2)(C) which states ". . . Facilities for production of kokanee will be *temporary and low cost (emphasis added)* . . ." The Implementation Group is concerned that temporary facilities may not be low cost, especially when dealing with rectifying water quality problems. As was demonstrated by the nitrogen saturation problem at Creston, local hatchery facilities are in need of basic updating. Even at pre-mitigation production levels, hatchery facilities should be improved to state-of-the-art technology to assure the best possible genetic variability, health and condition for outplanting.

Selective withdrawal of water from various temperature layers behind Hungry Horse Dam can reproduce the natural temperature regime in the Flathead River. Extensive analysis and public scoping lead to Amendment 903(h)(6), which directed BPA and BOR to ". . . *Immediately begin actions to result in installation of a selective withdrawal structure at Hungry Horse Dam to allow for downstream temperature control to benefit resident fish (emphasis added)*." A technical brief on selective withdrawal is available from the Department. Although this concept received wide support and a Council directive called for its construction, very little progress has occurred to date. Initially, funding is needed for the final blueprint design and construction plans. A congressional appropriation and/or cost sharing strategy is required for construction. Until selective withdrawal becomes a reality, sudden temperature changes and low summer temperatures in the Flathead River will continue to limit food production and fish growth.

Kerr Dam fisheries mitigation is an unresolved issue. As of the preparation of this Implementation Plan, there has been no ruling by FERC on the four Motions to Intervene nor have 4(e) conditions been submitted to FERC by the Secretary of the Interior. Therefore, the Group can not be sure that mitigation measures outlined in the 1990 MPC plan will be implemented as proposed.

ADAPTIVE MANAGEMENT

Enough uncertainty exists in the science of species recovery that success is dependent on the ability to change course as new information becomes available. Monitoring and evaluation of experimental treatments provides managers with insight to modify or discontinue mitigation measures. Adaptive management is of paramount importance to successful implementation of this Plan.

In this document, we have described data-based management actions which were developed based on the current state of knowledge in species recovery; some methods are as yet experimental. Procedures will be evaluated quantitatively and compared to scientific literature so that success or failure can be demonstrated. New techniques will be applied on a small scale to evaluate their effectiveness before expanding applications to full scale.

Habitat enhancement techniques have received wide review in the literature. Personnel have attended workshops at which researchers and managers from throughout the Pacific Northwest discussed the most recent developments on the topic. Periodic attendance at workshops and scientific forums will assure that field applications of newly evolving techniques continue. Comparison of techniques employed under varying field conditions will further refine the methodology to attain the most cost effective results. Assessment of pilot programs and development of new devices for habitat reconstruction is, and has been, a continuing priority by the cooperating agencies.

Fish passage improvement techniques developed throughout the region have been examined for use under local conditions. Some methods such as culvert baffles and gabion structures for jump pool construction have changed little over time. Steep pass structures and fish ladders have been reviewed in recent documents resulting in refined modifications for site-specific applications. Our efforts to date under implementation have focused on one site which was selected because of its small size and noncontroversial effects on native plant and animal species. Future efforts will respond to evaluation of existing Forest Service passage structures, current literature and monitoring of hydraulic conditions and fish migrations. Our initial efforts will focus on simple maintenance or replacement of existing culverts based on the criteria set forth in this document.

Offsite mitigation, where chemical rehabilitation techniques are used, has a proven history of successfully establishing a viable fishery. Scientific literature addressing inter- and intra-specific interactions provides a source for selecting the correct number, size and relative abundance of fish species. The Department has made a practice of collecting and maintaining insects and

crustaceans for reestablishment in the waterbody after detoxification. Documentation of pre-treatment conditions is important to assess the success of the rehabilitation and to reestablish a diversified food web.

Hatchery supplementation techniques are being reassessed in the current literature. In this Implementation Plan we established a basic tiered approach for reestablishing the fisheries resource. The American Fisheries Society has placed strict guidelines for maintaining or establishing genetic variability and disease-free status in hatchery stocks for outplanting. Current literature contains documentation of the effect of hatchery stocks on wild self-reproducing populations. The controversial nature of hatchery supplementation demands constant vigilance on the part of hatchery personnel and resource managers to use state-of-the-art techniques and apply this important recovery tool with caution. Hatchery and field examinations of outplant to assess survival, behavior, condition factor, disease and genetic drift must accompany experiments in supplementation. This is especially true in the contiguous Flathead Drainage. Experiments exhibiting high levels of uncertainty should be conducted in closed basin, offsite areas.

Where failure of mitigation measures is demonstrated, modification or discontinuation is warranted. The timeline for this decision process is dependent on the specific mitigation tool. Generally, evaluation requires one complete life cycle of the species, beginning when the treatment is fully accomplished.

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APPENDIX A

Hungry Horse Mitigation Consultation Committee

HUNGRY HORSE MITIGATION CONSULTATION COMMITTEE

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APPENDIX B

**Fishery Enhancement Project
Criteria and Considerations**

Montana's Fisheries Mitigation Guidelines

In addition to our own management plans and those of other cooperators, the Fish and Wildlife program has been guided by the standards in Section 4(h) of the Act.

As a result of these two influences, Montana's fisheries mitigation guidelines are to:

- Protect, mitigate and enhance biological production in the affected waters;
- Emphasize natural fish production and habitat whenever possible;
- Mitigate with artificial propagation to enhance fish populations and provide recreation when full mitigation of natural production is not possible;
- Emphasize mitigation for designated species of special concern such as westslope cutthroat or bull trout where appropriate;
- In the Flathead System mitigate in conjunction with the Confederated Salish and Kootenai Tribes, as specified in the Fisheries Management Plan; and
- Emphasize cooperation with power/water management interests in determining reservoir operations and mitigation.

Species Considerations

The "kokanee test" has received the highest priority with efforts toward hatchery supplementation. Additionally, habitat and spawning passage projects will focus on fish species depending on the current stability of local populations. At the present time, two native species of special concern face an uncertain future in the Flathead Basin, another popular fishery for an introduced species crashed in 1986. Ranking by species at the time of this writing for habitat and passage projects is as follows:

1. Bull Trout. A species of special concern, bull trout are an indicator species of pristine aquatic conditions. Annual surveys of habitat quality and spawning redd counts have shown an alarming decline in recent years. A status report is being compiled for this species in Montana.
2. Westslope Cutthroat Trout. A species of special concern, this form of cutthroat is sensitive to habitat quality. The species has been reduced to less than ten percent of its original range. Present status in the Flathead Basin appears to be stable or declining slowly.

3. Kokanee. This non-native introduced species historically provided an exceptional summer-time fishery and outstanding fall migration runs which provided a snagging fishery and important food source for bald eagles. The fishery declined dramatically in recent years due to the combined impact of the construction and operation of hydroelectric dams, angling harvest, lake trout predation, and the introduction of mysis shrimp.

Habitat Improvement Project Ranking

1. Evaluation of watershed stability regarding likelihood of continued degradation of improvement reach.
2. Cost effectiveness and species considerations.
3. Streams that flow directly into Flathead Lake and have the shortest migratory distance.
4. Streams tributary to the main stem Flathead River.
5. Streams tributary to the North, Middle and South forks of Flathead River.

Fish Passage Project Considerations

- Prior to opening passage, fish stocks above and below the barrier will be examined to assess the species assemblage, relative abundance and genetic integrity of native stocks.
- Historically fishless waters will remain isolated unless passage is deemed desirable through an appropriate environmental assessment process which will focus on plant and animal communities within the affected area.
- Genetically pure fish stocks protected from contamination by a barrier shall remain isolated unless the threat of contamination is eliminated.
- Barriers will remain intact if removal of said barrier will expand the range of non-native or undesirable fish species.

Fish Passage Project Ranking

1. Cost effectiveness evaluation of habitat gained per unit cost (dollars per mile, for example).
2. Passage blocked by a newly created natural barrier (eg. landslide, impassable debris jam, migrating head cut, etc.).

3. Historic passage was blocked by a man-made structure.

- A. Structure requires simple maintenance
- B. Structure requires modification
- C. Structure must be repositioned
- D. Structure must be replaced

4. Passage historically blocked by natural barrier.

Barriers to be removed will be ranked by the quantity of spawning and rearing habitat upstream and the expediency of repairing the blockage.

Chemical Rehabilitation Project Ranking

Priority will be given in the following order:

- 1. Onsite areas where an introduced species has potential to expand its range and threatens native stocks through hybridization and/or competition.
- 2. Areas where an introduced species can not naturally expand its range yet has potential to reduce the abundance or genetic integrity of native species at the site.
- 3. Areas in which an introduced species is not expanding its range, yet its presence is reducing fishing opportunities or fish production potential.
- 4. Areas where total rehabilitation is not possible, yet site specific (eg. shoreline, headwater, weed bed . . .) or seasonal application of rotenone may be used periodically to adjust the fish community toward a more desirable species assemblage.