Independent Scientific Review Panel
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Step Review of MFWP's response to the ISRP's 2007 review of the revised Master Plan for the Sekokini Springs Isolation Facility, Hungry Horse Mitigation, Project #199101903

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Executive Summary

At the Council's August 8, 2008 request, the ISRP reviewed Montana Fish, Wildlife and Parks' (MFWP; Sponsor) response to our 2007 review of the revised Master Plan for the Sekokini Springs Isolation Facility (ISRP 2007-16). The revised Master Plan is intended to address release of westslope cutthroat trout produced at the Sekokini Springs Isolation facility as mitigation for operating the Hungry Horse hydropower facility. MFWP's response and ISRP's review were a condition of the Council's January 2007 decision that the Sekokini Springs step-review and planning effort proceed to final design.

The ISRP finds that sponsor's (MFWP) response meets scientific criteria (qualified).

Background

This document is the latest in a series of ISRP reviews of Montana Fish, Wildlife and Parks' (MFWP) Master Plan for the Sekokini Springs Isolation Facility (previously called the Sekokini Springs Natural Rearing Facility and Educational Center), Hungry Horse Mitigation, Project #199101903. The review history is described below to provide context, show progress made, and highlight some persisting and unresolved scientific issues with the Sekokini Springs program outlined within the Master Plan.

2005 ISRP Review
In 2005, the ISRP reviewed previous versions of the Master Plan and participated in discussions with the project sponsors regarding the ISRP's concerns over the scientific merit of specific program elements within the proposed project (see ISRP 2005-10, May 13, 20051 and ISRP 2005-4, February 4, 20052).

In the preliminary Master Plan review (ISRP 2005-4), the ISRP found that the Plan met criteria for mitigation. However, reviewers raised five interrelated sets of questions and concerns with the Plan's scientific basis that needed a response before the ISRP could offer a final recommendation. Those concerns related to 1) the efficacy of removing non-native threats (primarily other Oncorhynchus species or hybrids); 2) the effects on local adaptations and the historical levels and patterns of genetic-level variation caused by release and establishment of M012 fish; 3) uncertainty of structure and composition of hybridizing populations; 4) the

[1] Interim Reply: Combined Step Review for Sekokini Springs Natural Rearing Facility and Educational Center, Hungry Horse Mitigation, Project #199101903 (ISRP 2005-10, May 13, 2005): www.nwcouncil.org/library/isrp/isrp2005-10.htm
[2] ISRP Preliminary Review of Sekokini Springs Master Plan (ISRP 2005-4, February 4, 2005): www.nwcouncil.org/library/isrp/isrp2005-4.htm

efficacy of the "genetic swamping" approach; and 5) the overall thoroughness of the monitoring and evaluation (M&E) protocol.

In the review of the subsequent draft (ISRP 2005-10), several additional questions and potential inconsistencies emerged. These, along with a partially satisfactory response to previously raised concerns, led the ISRP to judge that the Master Plan failed to meet scientific criteria. Moreover, the logic pathway, including examination of alternatives, was not readily transparent. The ISRP recommended re-crafting the Master Plan toward a more exploratory project to rigorously test the proposed methods while in progress, rather than a broad implementation of artificial and captive production followed by assessment after the fact.

The latter review also resulted in the convening of a teleconference to provide sponsors and reviewers an interactive feedback loop to present additional information and seek common understanding of the proposed activities. The meeting notes from this teleconference are available on Council's Web site: www.nwcouncil.org/library/isrp/isrp2005-10.htm.

The issues identified, which were to be addressed in a full recasting of the Master Plan, included the need to:

1. clarify the intent and approach associated with choosing a geographical "nearest neighbor" population (and the relationship of such with a phylogenetic or phylogeographic neighbor),
2. clarify the intent and approach associated with "genetic" v. demographic swamping,
3. focus additional discussion on the merit of current and "enhanced" M012 brood line,
4. consider habitat improvement and direct translocation of brood or sub-adults from suitable sources as an alternative,
5. develop and structure a thorough Monitoring and Evaluation program, and,
6. recognize the time-sensitive urgency for moving forward smartly and quickly.

In June 2007, MFWP submitted a revised Master Plan to address the ISRP's concerns and the Council's Three Step Elements.

2007 ISRP Review

In our most recent review (ISRP 2007-16, October 23, 20073), we found that the revised Master Plan did not meet scientific review criteria. We noted that the project had evolved over the past two-plus years. Some portions of the Master Plan were strengthened or otherwise clarified in response to previous reviews or the teleconference (e.g., improved articulation of linkages to other related plans and activities). However, even with our ongoing examination of the project goals, actions proposed, measurable objectives, approaches and alternatives, we were unable to conclude that a transparent logic pathway or framework had been articulated to achieve the project's primary purpose to re-establish non-hybridized populations of westslope cutthroat trout in locations where existing hybridized populations threaten the status of adjacent, downstream non-hybridized populations because they are expanding their range. The proposed benefits to fish and wildlife continued to be largely descriptive rather than specific and quantifiable.

[3] Combined Step Review for Sekokini Springs Isolation Facility, Hungry Horse Mitigation, Project #199101903: www.nwcouncil.org/library/isrp/isrp2007-16.htm

Specifically, the plan did not establish what qualified as "success" or "failure," and it did not provide a timeline for determining project effectiveness. As a result, M&E was only broadly described and thus ill-defined relative to a specific set of measurable objectives. Consequently, the project and facility have an undefined period of operation.

Ultimately, we found that the Sekokini Springs Master Plan failed to provide sufficient information for us to conclude that the totality of actions proposed – from chemical removal of hybrid trout populations from lakes and streams (conducted under Hungry Horse Mitigation) through westslope cutthroat trout collection followed by either translocation or progeny production and release – was likely to succeed at re-establishing viable and persistent non-hybridized populations.

After considering our 2007 review, on January 15, 2008, the Council recommended that the Sekokini Springs Isolation Facility planning effort proceed to fulfilling its NEPA requirements and final design. The Council conditioned this decision that the sponsor respond to the issues raised in our 2007 report for review prior to submittal of final step-review materials (i.e., final Step 3 design and construction costs). Construction of the Sekokini Springs Isolation Facility will be dependent on Council approval of the final Step 3 submittal.

The Council highlighted the following ISRP concerns for MFWP's to address:

1. More thorough description of lakes that have been treated, chemically or mechanically, to remove non-native threats to the westslope cutthroat trout in the recent past, levels of success, multiple treatments that may be needed, and how actions are determined;
2. Additional detail of the genetic structure of the introgressed populations to better understand the chances for success of the removals;
3. The need for evidence of the success of using the M012 stock;
4. Additional concerns regarding the efficacy of "gene swamping";
5. M&E;
6. The need for a rotating basis for creating distinct local populations at the proposed facility;
7. Understanding the use of the facility to achieve program goals in a realistic time period.

ISRP 2008 Recommendation

Meets scientific criteria (qualified)

The tasks associated with developing within drainage strains of westslope cutthroat trout (WCT) to be used to reintroduce self-sustaining natural populations in treated high-mountain lakes in the South Fork Flathead River meets scientific review criteria. There are three qualifications to this recommendation.

1. Reintroducing fish into each of the treated headwater lakes (which are historically fishless), should occur only after confirmation that the hybrid/non-native population in each lake has been eliminated. This includes ensuring there are no fish remaining in inlet and outlet refuges.

One of the critical limiting factors in the success of this effort is whether or not the non-native, hybridized fish are actually removed. If they are not, then hybridization will likely recur and require repeating the treatment/stocking cycle. Data provided by the sponsor suggests to the ISRP that "swamping," either genetic or demographic, is not likely to contain the spread of hybrids and should not serve as a substitute for ensuring eradication of the upstream hybrid populations.

2. Montana Fish Wildlife and Park's (MFWP's) westslope cutthroat trout strain M012 should not be used to reintroduce trout to the headwater lakes if the opportunity exists for establishing a more appropriate and non-domesticated within-drainage strain, even if this means delaying the stocking schedule.

M012 is a generic, semi-domesticated westslope cutthroat trout strain. Once established in the lakes it is likely to emigrate and interbreed with remnant native populations homogenizing the highly diverse westslope cutthroat trout gene pool.

3. Monitoring and evaluation should focus on the primary purposes of the program: a) success of eradication of non-native and hybrid populations; b) success of establishing self-sustaining populations from reintroduction efforts; and c) evaluating the extent of hybridization within the tributary drainages following eradication and reintroduction. These have more direct and higher priority over evaluation of alternate fish rearing protocols.

ISRP 2008 Summary Comments

In terms of the improvements, the ISRP finds the sponsor's decision to delay stream-based chemical removals and focus attention on upstream isolated headwater lakes in the South Fork Flathead River above Hungry Horse Dam (the current source of threat in a westslope cutthroat trout stronghold) as a more amenable approach and first step to conserving within-species diversity for westslope cutthroat trout (WCT). Second, the sponsor plans to focus on the eventual deployment of four drainage-specific production stocks is more consistent with current thinking about intraspecific diversity and local adaptations. The sponsors have recognized that an important approach would be to translocate "unhybridized" locally adapted representatives from other portions of the same or adjacent watersheds depending on availability, accessibility, and genetic relatedness. These fish would be transferred directly as natural juvenile or adults into the treated lakes or indirectly as offspring produced from brood collected (at various life stages), matured in quarantine, and propagated at the Sekokini Springs facility. These modifications along with some summary information about and analysis of the composition of the hybrid populations has helped to more clearly provide some context for the project.

Still, there are parts of the responses provided where the ISRP challenges the scientific merit and, therefore, the rigor of the plan. The overall goals of the program (of which this project is a part) are for the sponsor (i.e., Montana Fish Wildlife and Parks; MFWP) 1) to remove the primary direct threat to WCT from hybridization with *Oncorhynchus* spp. – rainbow trout (RBT), Yellowstone cutthroat trout (YCT), or their hybrids – in their remaining core areas and stream habitats by eradicating non-native or hybrid fish in the headwater lakes; and, 2) to substitute propagated WCT for the eradicated populations in the affected headwater lakes to diminish future threats from interbreeding of migrants from the lakes with the downstream, locally-adapted, native stocks. The non-native and hybrid fish have a record of emigrating from the headwater lakes and affecting downstream aboriginal WCT populations. Ultimately, the first phase of the program to remove non-native fish by poisoning has been judged "Fundable-Meets Scientific Criteria" by the ISRP through the Hungry Horse Mitigation project. The second phase of the program contained within the Sekokini Springs Master Plan focuses on repopulating the headwater lakes with WCT, in a way that provides a unique recreational angling opportunity that is minimally threatening to aboriginal downstream WCT populations and that reduces the motivation for further unsanctioned re-introductions of RBT, YCT, or other non-native species if the lakes were reverted to their historical fishless condition.

One of the ISRP's remaining concerns is risk from, and the length of time for, the planned release of the M012 strain of WCT for restocking headwater lakes. These lakes are high elevation, formerly fishless lakes occurring above natural barriers, but spill into downstream habitats supporting persisting WCT populations within the aboriginal distribution of the species. A high level of inter-population genetic variation characterizes WCT. An absence of a strong stepping-stone pattern of within-species diversity among geographically proximal and connected populations confounds attempts to clearly identify an appropriate "nearest neighbor" for reintroducing fish in headwater lakes. The M012 strain, by all accounts, is a composite, semi-domesticated production strain that has been "certified" as having no rainbow trout (RBT) or Yellowstone cutthroat trout (YCT) genes. While this certification addresses the issue of hybridization with non-native species, it does not address the risk of downstream migrants homogenizing the WCT gene pool and diminishing or disrupting local adaptations. Likely, the initial considerations for constructing this strain did not envision or include a widespread role in restoration and conservation of intraspecific diversity. Thus, the timely deployment of the four newly developed strains based on the drainage-specific stocks is critical and requires appropriate facilities and capabilities.

Given the risk of interbreeding between dispersing M012 strain fish and downstream populations the ISRP does not recommend using this strain for restoration where more appropriate local sources can be developed.

A second remaining concern is the efficacy of "swamping" (formerly genetic swamping, now demographic swamping) as a demonstrably viable approach to reducing hybridization when removal of the existing hybrid parents is not 100 percent effective. In fact, the information provided by the sponsor indicates a mixed record of lowering the hybrid index or lowering non-native alleles by "swamping" (Leary et al. 2008). In many locations non-native alleles were reduced in abundance, but this measure has limited sensitivity in detecting or predicting

introgression. Ultimately, however, the fish are still hybrids. Continued focus on this approach (regardless of the genetic or demographic variety) detracts from the strategy to remove hybrid and non-native trout straying downstream to strongholds of aboriginal WCT and replacement with locally adapted west-slope cutthroat trout.

Another deficiency is that the production capacity of the Sekokini Springs facility is not established. It is not transparent how many fish or strains the facility can rear, so it cannot be judged whether the facility can achieve the goal of maintaining sufficient strains of trout for repopulating treated habitats. A schedule of fish rearing and stocking is provided, but a statement as to the capability of the facility to rear these fish is not made. The time frame it will take to refurbish the facility, collect fish to serve as broodstock, and produce juvenile trout for stocking is still missing. The sponsor states that the production capacity of the facility is unknown because it is untested. This is troubling. The facility had been used as a rainbow trout farm, the water supply should be well described by now, and Montana Fish Wildlife and Parks (and others) have experience rearing west-slope and other cutthroat trout. So, establishing reasonable rearing capacity in terms of the number of strains and juvenile production should be possible. These numbers should fit the stocking needs for repopulating the mountain lakes. It is of course likely that some problems will arise, and anticipation of these should be part of the project planning. There was a session on culturing inland *O. clarki* at the 2007 American Fisheries Society meeting in San Francisco because of the persistent challenges culturists' face maintaining and breeding these wild fish. The sponsors should consult such information, and confirm the extent that fish from this facility can meet their management needs.

The release schedule appears to propose that stocking is intended as a single series of three annual reintroductions. But, the sponsors acknowledge that 100% success will not be achieved. Realistic contingency planning for challenges in fish rearing, in the efficacy of removal efforts, and in the efficacy of establishing self-sustaining populations is not apparent. Based on all of these uncertainties, alternative strategies, such as follow-up treatments, should be described as these might affect breeding line rotation within the facility.

Another persisting concern is the potential to proceed with stocking fish before the effectiveness of chemical removal of the hybridized population is established. The sponsors acknowledge and other experiences beyond those of the sponsors indicate that such treatments are not always complete. Thus, confidence in the treatment's effectiveness demands adequate assessment to avoid moving to the restocking phase prematurely. To assess the effectiveness of recent treatments, the sponsors angled and/or set gill nets. While these methods have predictable efficiency for detecting adults or larger juveniles (depending on net gauge and mesh size and overall effort – which was not described), the detection efficiency for younger or smaller fish is lower. Moreover, the detection of adults or young in inlet and outlet areas (as potential treatment refuges) was not reported. Even with the risk of unauthorized stocking into treated lakes, the chances that treatment might be only partially effective begs the question as to whether delaying re-stocking for an extra year or two for a set of lakes followed by additional rounds of angling, gill net, or other monitoring might be warranted to more fully establish treatment effectiveness.

The Monitoring and Evaluation planning remains directed more at the effectiveness of propagation rather than assessing the program's post-release effectiveness at establishing self sustaining drainage-specific headwater populations and ensuring that no further introgression with RBT, YCT, or their hybrids is occurring. The monitoring proposes to evaluate hard vs. soft release, ER vs. CO (enriched v. conventional) rearing, size at release, stocking density, etc. The ISRP does not believe the evaluation of fish culture practices is needed. There are data from the basin that address this issue (such as the NATURES and similar rearing tests conducted by the Nez Perce Tribe and the Yakama Nation) and propagation of native inland cutthroat trout species is reasonably well developed. The success of the program is more likely to depend on the environmental suitability of the lakes and streams that are being stocked, and whether hybrids have been removed, than on alternative fish culture practices. The sponsors state that few studies have been reported for resident fish and especially WCT without reference or transparent review of those studies to justify this as a major M&E need.

On the other hand, the sampling approach to determine whether the stocked fish establish a reproducing population remains rather vague. Gill-netting would apparently be relied upon to evaluate whether stocked fish survive. There certainly will be an interest in whether released fish mature and reproduce. The sponsors will also need to better explain the tests for difference between phase II and phase III post-planting performance in naturalized vs. wild environment. It is not clear what the "naturalized" environment is or what is specifically referred to. For the proposed genetics work, the sponsors propose comparing Fst of the production lines to their parental brood sources (presumably for a suite of genetic markers). While applying Fst in this manner may provide some sense whether the diversity represented in the brood is "sampled" (in the sense of capturing the suite of alleles occurring in the brood source), it may not be an especially sensitive metric for testing whether a propagated population adequately resembles the source population. Contingency table tests (such as a bootstrapped Chi-square analog or other analytical approach) may prove more powerful and should be explored with a biometrician. Ultimately, a more thorough genetics monitoring approach needs to be designed. This includes assessing diversity at multiple points (brood, stocked-out progeny, resulting self-sustaining population, and the downstream, native population targeted for protection. The production and lake population genetic monitoring will provide assessment of the effectiveness of the production and stocking activities and the monitoring (before and periodically after stocking) of the downstream populations will provide assessment whether escapees are impacting (interbreeding with otherwise altering) the local native populations.

Finally, the sponsors provided written responses to specific issues raised in the ISRP's 2007 review as requested by Council. However, in various text in the response, MFWP suggest there is a revised Master Plan. For example in item 6 below the sponsor states: *In retrospect, the questions raised by ISRP regarding restoration activities in tributary streams have led MFWP to revise the Master Plan to instead focus on lakes scheduled for treatment to remove nonnative and introgressed populations. Restoration efforts in tributary streams have been removed from the current Master Plan.* The ISRP believes that the changes outlined in the response are substantial and that the version of the Master Plan reviewed by the ISRP in 2007 is not an appropriate document to guide the culture of westslope cutthroat trout in support of the 1999 Westslope Cutthroat Trout MOU and Conservation Plan or the South Fork Flathead River

Westslope Cutthroat Trout Project. The 2007 version of the Sekokini Springs Master Plan had a very different emphasis from the new approach indicated in the responses to the ISRP, and lake stock was only tangentially addressed in support of this effort (SFFR-WCT Project).

If the Master Plan has been revised, this ISRP review would have benefited from having access to it. The ISRP maintains its previous recommendation for an exploratory project to rigorously test the effectiveness of the proposed eradication and subsequent release of drainage specific stock as a strategy to conserve WCT diversity (genetic and adaptation) within and among drainages rather than a sweeping implementation of artificial production and release followed by post hoc assessments of whether resulting trout populations have a generic or general composite WCT phylogenetic identity in the lakes. The Sekokini Springs Master Plan should reflect this emphasis.

ISRP Comments on MFWP Reference Information

As reference, MFWP provided the following list and also answered each previous ISRP question (bulleted) in their response to our review. Our report outline below follows this MFWP response format. MFWP statements are in italicized font. ISRP 2008 comments are indented.

MFWP Reference Info:

The ISRP raised questions regarding the following:

•More thorough description of lakes that have been treated, chemically or mechanically, to remove non-native threats to the westslope cutthroat trout in the recent past, levels of success, multiple treatments that may be needed, and how actions are determined

Information on recently treated lakes is located in this response under the heading "Specific ISRP Concerns" on page 7, 8 and 9, and under the heading "Issues Remaining Re: Peer Review Questions for Three-Step Review" on pages 12 to 14. Additional information was provided in the federal DEIS on page D-4 and EIS that can be found on the WCT Conservation project web site: ***<http://fwp.mt.gov/r1/wctproject/backgroundinfo.html>***

> **ISRP 2008 Comment:** The 2004 draft EIS was prepared by BPA for actions to be taken by Montana Fish Wildlife and Parks with the approval of the Forest Service and funded by BPA and not specifically for this project. The relevant linkage to the Sekokini Springs Master Plan is not clear. For example, a simple word searching for "Sekokini Springs" or simply "Sekokini" in the 2004 draft EIS turned up no responses. A similar search for "M012" turned up nine responses. Interestingly, the 2004 draft EIS, on page 2-26 states: "*Restocking the lakes is not an action funded by BPA, but rather is the sole responsibility of MFWP. Restocking is discussed in this document because it is connected in part, to the actions proposed for funding by BPA."* Therefore, the relevance to the current approach in the plan is limited. Rather than simply citing this reference, the

sponsors should explicitly link these references to the current Master Plan if they are relevant.

•Additional detail of the genetic structure of the introgressed populations to better understand the chances for success of the removals

See page 9 and the attached document by Leary (2008).

ISRP 2008 Comment: The Leary et al. document does provide a valuable level of detail pertaining to the structure of the lake populations and the changes in the lake populations over time. This document should be summarized succinctly within the main body of the Master Plan. It is quite dense with details. The entire document should be included as an appendix because it is likely not widely available to the plan's audience.

• The need for evidence of the success of using the M012 stock

See bottom of page 7 and top of page 8.

ISRP 2008 Comment: Success of the M012 as a generic westslope cutthroat trout strain is adequately described in the response, but "success" at maintaining local variation as an indicator of local adaptation is not provided. Information on the effect of releasing M012 on the genetic structure and local adaptation of adjacent westslope cutthroat trout population is not likely available.

•Additional concerns regarding the efficacy of "gene swamping"

See page 9 and 10 of this response. Further information can be found in the DEIS beginning on page 2-30.

ISRP 2008 Comment: ISRP and sponsor's interpretations of the data and results of the hybrid index analysis differ from that offered by response. In fact, the information provided within the Leary et al. 2008 white paper indicates a mixed record of lowering the hybrid index or lowering non-native alleles. Moreover, each of these approaches appears to have limited sensitivity in detecting or predicting introgression. Ultimately, continued focus on the "swamping" approach (regardless of the genetic or demographic variety) detracts from the beneficial elements and strategy of the plan – that is, to remove the source(s) of threat from introgressed *Oncorhynchus* spp. straying downstream to current strongholds of aboriginal WCT and to replace these with locally adapted sources (within drainage) to diminish outbreeding risks, but also to create additional WCT strongholds.

•M&E

Under the heading "Monitoring Success Indicators", see pages 4-7 and tables 1 and 2 beginning on page 16.

> **ISRP 2008 Comment:** See the summary review comments.

• The need for rotating basis for creating distinct local populations at the proposed facility

See pages 15-19, including Tables 1 and 2.

> **ISRP 2008 Comment:** This information is presented as suggested in the response. However, previously stated concerns with M012 strain in the early (pending) restocking efforts along with uncertainty regarding the development of the drainage specific stocks suggests these are provisional targets rather than firm timelines for a rotation of local stock production. We appreciate the difficulty of this challenge and note that some slippage in time might be required. This should be addressed in the Master Plan revision.

•Understanding the use of the facility to achieve program goals in a realistic time period

See administrative objectives on page 2, biological objectives on pages 2 to 4.

> **ISRP 2008 Comment**: see previous ISRP comment.

Specific ISRP 2007 Concerns, MFWP Responses, ISRP 2008 Responses

Additional responses to ISRP questions are arranged according to the ISRP review 2007-16.

1. ISRP 2007-16 Comments: "On page 89 there is some discussion of experience with chemical treatment of lakes, but none with streams. This discussion needs to be more thorough in providing the number of lakes that have been treated in the recent past, what is the proportion of successful treatments, how often multiple treatments may be needed, and how these will be determined."

MFWP Response: Montana has used piscicides (mainly rotenone) to remove nonnative and hybrid trout populations from lakes and stream reaches since the 1950's. Rotenone has been widely tested and used and is approved for use as a piscicide by the Environmental Protection Agency and endorsed by American Fisheries Society. Since 1950, MFWP has completed over 130 rotenone projects in northwestern Montana. Projects in the South Fork Watershed included the complete eradication of rainbow trout and hybrids from the Jewel Lakes in the Jewel Basin Hiking Area, the complete removal of brook trout from Devine Lake in the Bob Marshall

Wilderness and eradication of hybrids from Tom Tom Lake. These treated lakes now contain self-sustaining WCT populations, a result of M012 WCT plants.

During the last decade, MFWP determined that treatments during late fall are the most effective and have the least effect on non-target organisms. Detailed descriptions of treatment protocols, locations and project-specific results document successful eradication of nonnative fish and hybrids from several water bodies (Grisak 2003; BPA EIS 2005). Our Hungry Horse Mitigation Program has completed rotenone projects in Lion, Rogers, Dollar, Whale, Tom Tom, Blue, Upper and Lower Martin lakes, and Black and Blackfoot Lakes to remove undesirable fish species (e.g. WCT hybrids, nonnative rainbow, yellow perch, pumpkinseed, northern pike or redside shiners). Gill net and angling surveys revealed that the rotenone treatments achieved a complete kill of the targeted fish species. For example, yellow perch and brook trout were eradicated from Rogers Lake, west of Kalispell. Today, Rogers Lake contains genetically pure M012 WCT and a self-sustaining genetic reserve of the beleaguered Red Rocks Lake arctic grayling. Genetically pure WCT populations were successfully reestablished in Whale, Tom Tom and Blue Lakes using M012 WCT. Illegally introduced northern pike and yellow perch were eradicated from the Martin Lakes and a popular WCT fishery exists today. Of these lakes, only in easily accessible Lion Lake, did illegal introductions of nonnative species (yellow perch, black crappie and white suckers) necessitate a future treatment.

All 21 mountain lakes mentioned in the Master Plan have natural barriers to prevent re-invasion from downstream sources (Grisak 2003) and, because the lakes are remote and the public is more aware of the impacts associated with illegal fish plants, these mountain lakes are presumed to be at low risk from illegal fish introduction by humans.

Prior to application of piscicides, project personnel inventory the aquatic community, including zooplankton, macroinvertebrates and amphibians. Analyses of post-treatment data on plankton, aquatic insects, and amphibians consistently indicated that relative abundance and species composition rebounded to pre-treatment levels within a year or two (Grisak 2003; Boyer et al. 2008a). Insects and zooplankton rebound rapidly after detoxification and provide food for the newly established WCT populations. Lab analyses of the toxicity of rotenone and antimycin indicated little to no impact to non-target amphibians (Grisak et al. 2007) at the concentrations used to remove trout. Slimy sculpin were not impacted by antimycin concentrations up to 4 μg/L and concentrations of 5-10 μg/L were insufficient to affect complete loss of sculpins during a typical 8-hour piscicide treatment. The response of sculpins to rotenone was similar to salmonid species (Grisak et al. 2007a), necessitating detoxification of rotenone downstream of treatment zones.

> **ISRP 2008 Comments:** The response to this question only partially addresses the concern expressed in the ISRP's review. The ISRP also asked about the effectiveness of eradication treatments in inlet and outlet streams associated with the lakes. Streams can be more difficult to treat due to complex habitat. Flow input from groundwater or tributaries also can provide toxicant-free refuge areas where the target fishes may survive the treatment (discussed in the recent ISAB report on non-native species). The authors note that natural barriers exist downstream from all the lakes proposed for treatment but

give no information regarding the length or characteristics of channel between the lake and barrier or whether or not the outlet stream above the barrier was sampled after treatment. The gill net and angling surveys conducted in the lakes after treatment only provide an indication of the effectiveness of the eradication effort; these sampling methods cannot definitively demonstrate absence of fish. Therefore, some fish may have survived in the lakes after treatment and could affect the re-introduced WCT. There is a good chance that not all of the undesirable fish were eradicated during the chemical treatment. Given that non-native fishes may have survived the treatment in the lake or streams, the possibility exists that these fish will interbreed with the re-introduced WCT. If this does occur, what will it mean relative to achieving the objectives of the project? Is it assumed that the number of WCT that will be introduced in the treated systems will be sufficient to swamp any genetic impact from fish that might have escaped the poisoning? The severity of this problem and its potential impact on achieving program objectives should be considered.

The sponsors do not mention treating stream reaches within the context of the Hungry Horse Mitigation Project. Within the 2004 BPA EIS for treating 21 lakes, there are several miles of treated stream (inlet or outlet) associated with each lake. A table with lakes, acreage, date treated, method of evaluation of success, etc. would have been helpful. The narrative was useful, but a complete picture is still not entirely clear.

The sponsors mention that slimy sculpins – a non-target species - are impacted by rotenone but not antimycin. This mention suggests that this species was a member of the native fish community at some of the sites selected for treatment. Will efforts be made to re-establish (either, passively or actively) slimy sculpins, along with the WCT, at the treated sites?

2. ISRP 2007-16 Comments: Does the current Master Plan present information on "… the composition and structure of introgressed populations… as to whether they are hybrid swarms (all or nearly all individuals are of hybrid origin) or a mixture (x% WCTs + y% RBTs + z% hybrids & introgressants)?" The ISRP stated that reviewers were unable to glean additional information on this subject and that this information would provide key insights about the chances of success from removals as well as key baseline information prior to treatment.

MFWP Response: MFWP has lab results from genetic sampling, including the percentages described above. We chose not to release these data because previously collected samples likely contained pure WCT from previous plantings (during the WCT swamping effort) and the percentages are subject to interpretation. Micro-satellite techniques can differentiate hybrid swarms and populations containing pure WCT and hybridized individuals from F1 or subsequent backcrosses (Boyer 2006; Boyer et al. 2008). Our ability to change the genetic structure of a given lake population is greatly enhanced by chemical treatment using piscicides to establish a new WCT population. If chemical treatment is successfully implemented and the genetic makeup of the original lake population is eradicated, the restored population, by design, will be 100% WCT.

ISRP 2008 Comments: The data in Leary et al. 2008 indicate that populations of trout from various streams and lakes are complex mixtures of subpopulations, not a single interbreeding unit (i.e., a hybrid swarm). If treated locations produce a complete kill, then reintroduction of non-hybridized individuals could remedy the hybridization problem. If, however, there are remnant pockets of individuals of a non-native taxa that survive in a refuge from treatment (in the inlets or outlets for example) and these then breed together, disperse downstream to interbreed with aboriginal westslope cutthroat, the success of replacement of hybrid with non-hybrid individuals will be less successful.

3. ISRP 2007-16 Comments: requested us to "…clarify why a greater number of local, drainage-specific stocks could not be constructed - ultimately because of the absence of suitable monophyletic stronghold populations."

MFWP Response: Although our goal is to replicate at least four within-drainage stocks by 2017, additional unique stocks can be developed after the initial populations become self-sustaining. Appendices F-I identified many monophyletic WCT populations in individual drainages throughout the Flathead Watershed that may be used as donor sources. These unique wild populations are generally small enough to warrant protective measures when individuals or gametes are removed for restoration actions elsewhere. The number of fish that can be safely removed from donor populations in a given drainage is a limiting factor. Replicating within-drainage stocks offers an alternative to M012 WCT when large numbers of progeny are needed to repopulate a lake. The M012 stock has been used statewide to create WCT populations for angling opportunity. M012 have initiated self-sustaining pure WCT populations Castle, Dollar, Seven Acres, Tom Tom, and Hall lakes in R-1 and Jim Lake in R-2 (MFWP Montana Fish Plants Data Base 2007). Development of within-drainage stocks is designed to conserve unique genetic stocks, and empirically relate local adaptations to measurable genetic differences.

ISRP 2008 Comments: The explanation that within-drainage stocks are an improvement over M012 from the perspective of conservation genetic biodiversity in westslope cutthroat trout is an important improvement in the Master Plan's approach. The number of within-drainage stocks, however, should be based on an interpretation of the number of lineages to protect and replicate, not simply on the rearing capacity of Sekokini Springs. The plan to repopulate originally fishless mountain lakes should be based primarily on WCT conservation needs rather than enhanced fishing opportunities. Allocation of Sekokini Springs rearing capacity should be based on meeting these conservation goals as a priority. This consideration may necessitate a rotation that will add time to the production cycle beyond 10 years.

4. ISRP 2007-16 Comments: "…in regard to the efficacy of the "genetic swamping" approach to restoring native biodiversity…a related concept of demographic "swamping" has been substituted (e.g., page 69). This approach suffers from a similar concern as the original genetic swamping in that as presented it is an intriguing hypothesis, but no summary data or references

are provided as to its overall efficacy as an effective measure to combat problems by the persistence of brook trout as competitors or RBT and introgressants as breeders following an incomplete eradication in targeted locations."

MFWP Response: Experimental stocking (i.e., genetic swamping) was initiated in 1983 as a strategy to replace non-native trout with WCT; however, this effort was discontinued after 20 years in an attempt to evaluate the reproductive success of stocked fish. Leary et al. (2006) assessed the effectiveness of swamping in six lakes that showed progressive progress toward purity. Temporal comparisons of genetic data collected over the last two decades showed that the proportion of westslope cutthroat trout alleles had progressively increased from zero, or near zero, to 0.75 up to 0.99. The biological and environmental factors that contribute to the success of stocking are not well understood. However, the authors suggested that some of this increase was due to hybridization and introgression with the stocked fish or replacement of fish in the lake with westslope cutthroat trout. Their results suggest that in small headwater lakes with limited spawning and juvenile rearing habitats, stocking juveniles can be an effective means of replacing introduced nonnative trout populations or hybrid swarms with westslope cutthroat trout. The swamping effort was terminated after 20 years, so it remains uncertain whether this technique could completely restore a WCT population. MFWP sampled these lakes again during 2007 (one generation since M012 WCT were last planted) to determine if swamping should continue in certain locations, possibly as an alterative to chemical treatment. The Fisheries Division is in the process of determining where swamping will be resumed based on these new data (Leary 2008). At the time of this writing, swamping will likely resume in George, Woodward, Pilgrim, Pyramid and upper Three Eagles lakes, which have been rescheduled for treatment late in the 10-year project to allow time to determine if WCT populations can be restored without the use of piscicides.

Other lakes did not respond as well to stocking of WCT. For example, although Wildcat, Lower Big Hawk, and Handkerchief lakes were stocked repeatedly and at high densities, the proportion of non-native DNA appears to have stabilized, suggesting that reproductive isolation between WCT and hybrids (i.e. inlet and outlet spawners or separate spawning tributaries with differing environmental conditions) is contributing to the persistence of non-native DNA in these lake populations. In these lakes, replacing non-native trout with WCT will require the use of piscicide. Success is the total eradication of a source of nonnative genes (e.g. from a headwater lake) and subsequent reestablishment of a genetically pure WCT population. The goal is to eliminate the continued contribution from sources of nonnative genes so that the spread of hybridization can be reversed. Replacing populations with native WCT will assure that downstream migrants are native, thereby putting in place a mechanism for reversing the existing trend of spreading hybridization and loss of WCT. If total eradication of a genetically introgressed population is not humanly possible in a given location, reducing the percentage of nonnative genes in a source population or reducing the number of fish spreading from a given source is a lesser success. If no actions are taken to remove these non-native headwater source populations, over time we expect the only remaining WCT populations to be those in streams isolated above migration barriers.

Note: there are no brook trout in South Fork Flathead drainage upstream of Hungry Horse Dam. The last brook trout were eradicated from Devine Lake by rotenone treatment.

ISRP 2008 Comments: The ISRP was provided with a document by Leary et al. 2008 – is this the document referred to by the sponsors (Leary et al. 2006)? If not, the sponsors will need to include a summary of the findings in the body of the Master Plan linking its relevance to the proposal. If the work is readily available, at least a citation is warranted; if not, inclusion as an appendix is needed. Regardless, the Leary et al. 2008 document provides a summary of the genetic analyses of the lakes across time. In fact, the information provided within this document indicates a rather mixed record of lowering the hybrid index or lowering non-native alleles. It should be noted that both of these indicators are limited in their sensitivity at detecting or predicting introgression. In several lakes genetic swamping was entirely ineffective, but in most there was a change in allele frequencies over time. In no case, however, was there complete elimination of alleles from non-native species. It appears that genetic swamping can probably reduce the rate at which non-native alleles would spread into westslope cutthroat trout populations.

It is not clear what the difference is between demographic and genetic swamping, other than the target population abundance will be reduced by management before WCT are reintroduced. It is likely that the outcome will be different from "genetic swamping." The ISRP encourages the MFWP staff to summarize the "genetic swamping" efforts in a peer-reviewed journal. Ultimately, continued focus on this approach (regardless of the genetic or demographic variety) detracts from the beneficial elements and strategy of the plan – that is, to remove the source(s) of threat from introgressed *Oncorhynchus* spp. straying downstream to current strongholds of aboriginal WCT and to replace these with locally adapted sources (within drainage) to diminish outbreeding risks, but also to create additional local WCT strongholds. Unless there is some critical element missing, there remains the likelihood that new hybrid assemblages (whether mixtures or true swarms) will be created where chemical treatment/removal is incomplete. Certainly the frequency of WCT alleles will increase relative to non-native ones, but given that *Oncorhynchus* hybrids typically exhibit high fitness, conversion to hybrid swarms is highly likely. Unless some information indicates that the restocked fish will segregate during breeding from any remnant population, a new hybrid swarm can be expected. For example, the sponsor state, "Their results suggest that in small headwater lakes with limited spawning and juvenile rearing habitats, stocking juveniles can be an effective means of replacing introduced nonnative trout populations or hybrid swarms with westslope cutthroat trout." This statement indicates a fairly detailed knowledge of the niche structure, relative food demands, and competition status of the non-native vs. WCT. If these data are available they should be explained.

5. ISRP 2007-16 Comments: "…Gordon Creek is identified in one section of the Master Plan as a source of parental fish to produce trout fry for restocking these lakes (page 53, section 4.3.1). However in section 4.3.2 Genetics and Fish Health Status of Donor Stock Streams (page 61), the

sponsors identify that samples from Gordon Creek collected in 2005 included hybrid individuals and that Gordon Creek was no longer being considered a potential source of parents. The sponsors identify that Doctor Lake will be tested to see if it can be used as a source to collect juvenile trout to rear at Sekokini Springs. These inconsistencies within the Master Plan need to be reconciled in any revision."

MFWP Response: Thank you for catching this inconsistency. MFWP continues to monitor potential donor populations and removes candidate populations from the list when introgression is documented. Regretfully, Gordon Creek can no longer be used as a donor population for developing a within-drainage stock for restoring headwater lakes in the Gordon Creek drainage. Expansion of hybrids was also discovered below the barrier falls in the Big Salmon drainage and a few hybrids were documented in Big Salmon Lake, attesting to the urgency to remove source populations from headwater lakes to protect the remaining WCT populations.

> **ISRP 2008 Comments:** The issue now seems to be resolved – no additional response required.

6. ISRP 2007-16 Comments: "Also, the Master Plan appears to choose streams for renovation more on their accessibility than on their strategic importance. For example, the plan proposes reintroduction in Abbott, Haskill, and Rabe creeks and Gooderich Bayou without providing a rationale for the selection of these sites or identifying the source population for translocation (except in the case of Haskill Creek which will involve a reintroduction from non-hybridized individuals isolated within Haskill Creek itself). Page 31 of the Master Plan indicates that Haskill Creek will be the source of the first genetic strain to be collected, reared, and spawned for reintroduction. The benefits to westslope cutthroat trout conservation from this renovation are not transparent and reinforce our uncertainty about the Plan's capacity to achieve the primary benefit of protecting the non-hybridized populations in the Southfork Flathead from colonization by hybrid individuals."

MFWP Response: The ISRP's point about selecting easily accessible streams for our initial experiments is well taken. Our rationale was to learn from easily accessible populations before progressing to more remote locations. In retrospect, the questions raised by ISRP regarding restoration activities in tributary streams have led MFWP to revise the Master Plan to instead focus on lakes scheduled for treatment to remove nonnative and introgressed populations. Restoration efforts in tributary streams have been removed from the current Master Plan.

> **ISRP 2008 Comments:** The issue now seems to be resolved – no additional response required. As a side note, however, here and elsewhere the sponsor indicates they will be revising the actual Master Plan. This revision should be reviewed as an integrated document and made the official version before final approval of the three step approval process.

Issues Remaining Regarding Peer Review Questions for Three-Step Review

In the text below, the Three-Step elements are bulleted, followed by the ISRP 2007 comments, MFWP responses in italicized font, and indented ISRP 2008 comments.

Attachment I: <u>Program Language Regarding Master Planning Requirements</u>

- measurable and time-limited objectives;

<u>ISRP 2007-16 Comments</u>: Objectives that are measurable and time-delineated are not explicitly stated. This remains a critical omission in the plan. See main body of Memo for specific comments.

MFWP response: The timeline and measurable objectives were provided earlier in this response.

> **ISRP 2008 Comments:** Annual production of fry for stocking into specific lakes is now provided. The schedule for collecting fry and rearing them to adults to serve as parents of the progeny for stocking is not provided. While the sponsor may not meet the proposed timetable for lake stocking, given some of the recommendations (not to mention technical challenges), it is important to present this information upfront.

- expected project benefits (e.g., gene conservation, preservation of biological diversity, fishery enhancement and/or new information);

<u>ISRP 2007-16 Comments</u>: The description of where secure enclaves of WCT could be established, however, as well as the strategy and time frame for reaching this objective is not specific enough within the Master Plan to establish benchmarks for performance or amendable to peer review.

MFWP response: Details in the federal EIS (BPA 2005) for the South Fork WCT Conservation project were cited and summarized in the Master Plan and map figures. Secure enclaves of WCT can be established (using M012 WCT or within-drainage stocks when available) in the 21 mountain lakes scheduled for treatment to remove nonnative or introgressed populations. Natural barriers downstream of the lakes prevent reinvasion from potential downstream sources. Our goal is to develop within-drainage stocks of WCT for use in specific lakes that have been scheduled toward the end of the anticipated 10-year lake treatment schedule (2012-2017).

> **ISRP 2008 Comments:** Some indication of the potential for non-native or introgressed fish present in inlet and outlet streams associated with the lakes to survive the treatment and contaminate the re-introduced WCT population should be considered. Streams tend to be more difficult to treat with fish toxicants than small lakes; large streams and those with complex channels or large flow contributions from groundwater or tributaries offer the greatest problems. If some of the lakes have substantial lengths of stream associated

with them, some additional post-survey sampling to ensure adequacy of the treatment in these streams might be advisable.

- alternatives for resolving the resource problem;

ISRP 2007-16 Comments: Thus, a deliberate and cautious approach is warranted to avoid potential pitfalls such as those being experienced currently with greenback cutthroat trout in Colorado.

MFWP response: Fortunately, WCT donor populations are more plentiful than currently available for Colorado greenback (see appendices F-I). MFWP has the M012 brood stock with a long history of genetic purity that is retested annually. If we act rapidly to develop within-drainage stocks, we still have the opportunity to conserve the remaining unique wild stocks in the South Fork Flathead Watershed.

ISRP 2008 Comments: The issue now seems to be resolved – no additional response required.

- rationale for the proposed project;

ISRP 2007-16 Comments: There is a sound rationale for the project based on some basic assumptions, but the specific actions and the manner of evaluation beyond the physical refurbishing of the Sekokini Springs facility is inadequate to evaluate whether the project could achieve its intended benefits. Specifically, there are no quantified goals – for example – securing WCT in X number of enclaves by 2020. Moreover, a timeline for production and meeting objectives is not described. This project may require 10-12 years to complete the cycle of eradication and repopulation, although this is not explicitly stated.

MFWP response: The timeline has now been aligned with the 10-yr WCT conservation project (2007-2017). Depending on experimental results, unique stocks developed at Sekokini Springs may be available for further experiments in lakes previously populated using M012 WCT. The stocking schedule and production plan for meeting project goals is provided in the section "production objectives, methods and strategies" below as part of the logic pathway.

ISRP 2008 Comments: The schedule for refurbishing the facilities, collecting juveniles, rearing them to spawning age, and producing eggs is not complete. It is difficult to believe that progeny will be available in 2012.

- the current (and planned) management of anadromous and resident fish in the subbasin;

ISRP 2007-16 Comments: To generate public support for using piscicides to remove hybrid populations the specific tasks need to be organized to minimize impacts to recreational activities.

This makes achieving the project benefits more difficult and less likely. For example, in locations with several lakes with hybrid fish populations that are producing fish that are colonizing down stream habitats, not all lakes will be treated in a given year, so fishing in the general vicinity will be maintained. This has the effect of maintaining the likelihood that hybrids will continue to colonize the stream after the initial effort to remove hybrids.

MFWP response: Concessions made to achieve public consent and affirmative RODs by BPA, USFS and MFWP for the WCT Conservation Project have indeed complicated implementation. Whereas certain adjacent stream reaches downstream of the treatment lakes may provide refugia for hybrids between staggered treatments, natural barriers isolate the lakes themselves, and portions of outlet streams immediately downstream of the lakes, from potential upstream reinvasion. The primary sources of hybrids and nonnative fish in mountain lakes and lake outlets can be removed and replaced with WCT, so that downstream escapement will be WCT. MFWP stated openly that it is humanly impossible to remove every hybridized individual. Our rationale is that hybrids remaining in certain stream reaches will be demographically swamped by WCT from reestablished upstream populations. Once the primary sources of nonnative trout are eliminated, natural selection should reduce genetic material that is incompatible with localized environmental conditions and reverse the current trend of hybrid expansion.

> **ISRP 2008 Comments:** The fact that not all of the undesirable fish can be eradicated by chemical treatment emphasizes the concern expressed in the ISRP's responses above that surviving non-native fish may impact re-introduced WCT. The potential for incomplete treatment will vary among the lakes depending upon lake size, the number, sizes and lengths of inlet and outlet streams and habitat complexity. Lakes that might present the greatest problems can be identified prior to treatment and more rigorous post-treatment surveys might be considered at these sites prior to releasing WCT.

- consistency of proposed project with Council policies, National Marine Fisheries Service recovery plans, other fishery management plans, watershed plans and activities;

ISRP 2007-16 Comments: The ISRP is aware that removal of hybrid individuals from Jewel Basin lakes is underway. The support the Sekokini Springs Isolation Facility provides for this effort is not adequately addressed in the Master Plan.

MFWP response: The Master Plan has been revised and our responses more clearly describe the support provided by Sekokini Springs for conserving unique genetic stocks of WCT as the species is restored in the headwaters of the South Fork stronghold. The Jewel Basin lakes, Black and Blackfoot will be repopulated with M012 WCT in 2008 because we have not developed any alternative WCT stocks. Our goal is to develop at least one within-drainage stock by 2012. In the future, we propose to evaluate infusing unique genetic material (through direct translocations or by wild donor sources) into populations that were reestablished using M012 WCT to avoid homogenizing restored populations.

> **ISRP 2008 Comments:** Here and elsewhere, it is implied that the Master Plan has been revised. The ISRP recommends that this synthesized revision, taking into account the

issues discussed here and previously, be reviewed prior to project approval. Using Sekokini Springs to support a very focused and experimental effort to reduce hybridization between native and non-native trout is an improvement over the Master Plans reviewed so far. The final Master Plan should ultimately have clear objectives that are consistent with the NPCC-FWP principles, have articulated logic pathways that include alternatives and end-points, robust design to achieve objectives, and appropriate M&E to permit assessment of effectiveness and to capture lessons learned for future actions.

- potential impact of other recovery activities on project outcome;

ISRP 2007-16 Comments: The effectiveness of the chemical eradication efforts in the 21 lakes will have a significant influence on whether this project can succeed. These efforts are critical to remove the primary direct threat to WCT. Moreover, the effectiveness of preventing re-colonization by hybrids or non-natives will influence the longer term prognosis. Thus, maintaining barriers (where feasible and appropriate) to re-colonization and preventing angler-based (illegal) transfers will be vital.

MFWP response: We agree. MFWP has successfully eradicated nonnative fish and hybrids from headwater lakes and replaced populations with genetically pure WCT in the South Fork Watershed (e.g. Jewel Lakes, Devine Lake and Tom Tom Lake). Natural barriers downstream of the 21 lakes targeted for treatment will prevent reinvasion of fish migrating from downstream sources (upstream sources will be treated with the lakes). Illegal introduction by humans remains a risk, although the remote location of the mountain lakes makes it difficult for the public to transfer live fish to the sites. Also, continuing public outreach regarding the danger of illegal introductions should increase the likelihood that persons transporting live fish on trails leading to the lakes would be reported to authorities and perhaps apprehended by enforcement personnel.

ISRP 2008 Comments: In a response to an ISRP comment above, the sponsors stated, "MFWP stated openly that it is humanly impossible to remove every hybridized individual". However, the response to the ISRP concern addressed here indicates that total eradication was achieved at some sites based on gillnet and angling sampling for adults in combination with genetic assessments. If this is the case, this needs to be more clearly presented. If not, then a clear description of what was done is warranted. Regardless, the statements seem to contradict each other.

Do the lakes where eradication was deemed successful share some characteristics (e.g., size, depth, number and size of inlet and outlet streams) that might help indicate where future efforts are most likely to succeed? Conversely, are there lakes where condition would suggest that eradication efforts might prove to be challenging? Some lake-specific consideration of the difficulties that might be encountered in achieving a sufficient level of kill to enable successful re-introduction of WCT would be useful.

Maybe the greatest benefit of the public outreach effort will be increased recognition of the objectives of the re-introduction effort by those people using the restored lakes. If they understand the goal, they may be less likely to engage in activities that would compromise success. The fact that the training may enhance the chances of apprehending those illegally releasing fish is also a positive aspect of the outreach effort but it would occur after the damage had been done.

Stocking levels of WCT do not seem to factor in the carrying capacity of the donor lakes or streams. If the eradication is as successful as they claim then perhaps carrying capacity is not an issue. However, as mentioned above eradication is unlikely to be 100% effective.

- production objectives, methods and strategies;

ISRP 2007-16 Comments: The production objectives are inadequate. The production capacity of facility and the number of stocks (strains) that can be developed over time is not presented. How the production plan can meet the overall management objectives for reintroduction of non-hybridized WCT is inadequate.

MFWP response: Total hatchery capacity cannot be determined at this time since it is a new, untested facility. The space occupied by fish being raised to maturity and the space for rearing progeny has not been allocated. Total capacity also depends on variables including pathogen load, accumulated stressors, water chemistry and quality. Also, while wild fish will be imported into Sekokini for isolation and spawning, the resulting eggs may be hatched and the progeny reared at other state facilities if there is insufficient space at Sekokini Springs to produce the numbers of fish needed for swamping or restoration stocking. These uncertainties depend on experimental rearing results as the program develops.

Establishing WCT in reclaimed lakes was calculated at an initial stocking rate of 100 fish per surface acre for three consecutive years (Table 1). Post-release monitoring of the reestablished populations is then used to revise future stocking levels, if needed to maintain each population. Estimated production objectives needed to meet the planting schedule largely depend on the number of donor fish that can be safely removed from the donor population, successful transportation to the isolation facility and subsequent hatchery survival resulting from various experimental rearing conditions. We have back-calculated production plans based on the planting schedule using assumptions of survival at each life stage from past experience raising wild WCT (Table 2). The draft Master Plan was revised to include experiments, outlined earlier in this response, which will refine our estimated production capacity for each unique stock (step 3).

After reconciling the planting schedule with the production schedule, we determined that Sekokini should seek to replicate unique donor populations from Big Salmon, Danaher, Doctor Lake and the A1 source in Youngs Creek. If any of these donor sources prove to be unattainable, we plan to substitute sources from our list of potential donor populations (Appendices F-I on the

previous draft Master Plan). Our rationale is that each unique stock must be developed and held at Sekokini Springs for at least 4 years. We plan to isolate stocks that are brought to the facility sequentially and held concurrently. Our near-term objective will be to locate any remaining aboriginal populations in the Big Salmon drainage for use in Lena and Necklace lakes. If we unable to locate suitable Big Salmon sources, we will replicate fish from the headwaters of Danaher Creek for use in lakes in the Big Salmon drainage. Aboriginal WCT in Doctor Lake will be examined see if those stocks contain sufficient genetic diversity for use in lakes in the Gordon Creek drainage (Koessler, Lick and George). The WCT population isolated above a barrier in Youngs Creek (called an A1 population) will be replicated to create secure enclaves in Upper and Lower Three Eagles lakes in the lower reach of the Grave Creek drainage (all other lakes in Grave Creek will have been stocked previously with M012s because no aboriginal WCT population exists in this drainage). This strategy will preserve the greatest genetic diversity in the restored WCT populations, given our logistic limitations and timeline for the project.

The Jore WCT stock is a privately owned, captive population historically derived from wild WCT populations that has been certified genetically pure and free of reportable pathogens by Montana. This stock was sampled using microsatellite techniques in July 2008 and will be placed on a genetic dendogram to determine its suitability for use in repopulating certain lakes scheduled for treatment prior to 2012, when the first unique stock is scheduled to be replicated at Sekokini Springs.

This project also presents an opportunity to plant unique stocks (or pooled stocks to increase genetic diversity) into existing M012 populations, and evaluate different stocks using measures of fish performance. Infusing wild genetic material into established populations can be accomplished using unique stocks developed at Sekokini Springs or direct transfers of fish from identified wild donor populations. For example, the Youngs Creek A1 source could be introduced to Pyramid Lake in the Youngs Creek headwaters (beginning in 2017). Pyramid Lake currently contains a slightly hybridized population that will have been swamped using M012 WCT beginning in 2009. Details regarding future fish plants will be determined as the project continues, depending on research results from experiments performed at Sekokini and subsequent monitoring in the receiving waters.

Table 1. Stocking schedule for the South Fork Flathead Drainage Westslope Cutthroat Trout Conservation Project. Initial lakes will be stocked with M012 WCT from Washoe Park State Fish Hatchery in Anaconda, MT. The use of Jore WCT depends on the results of genetic diversity testing to be conducted during summer 2008. The first within- drainage stock is scheduled for planting in 2012.

			Standard Stocking rates*			
	Start Year	Stock	1st year	2nd year	3rd year	Total
BLACK	2008	M012	5,000	5,000	5,000	**15,000**
BLACKFOOT	2008	M012	1,500	1,500	1,500	**4,500**
LOWER BIG HAWK	2009	M012	4,000	4,000	4,000	**12,000**
HANDKERCHIEF	2010	M012	5,000	5,000	5,000	**15,000**
MARGARET	2010	M012 or Jore	4,600	4,600	4,600	**13,800**
CLAYTON	2011	M012 or Jore	5,000	5,000	5,000	**15,000**
LENA	2012	Big Salmon or Danaher source	7,000	7,000	7,000	**21,000**
NECKLACE	2013	Big Salmon or Danaher source	3,000	3,000	3,000	**9,000**
WILDCAT	2014	M012, Jore, or Danaher source	4,000	4,000	4,000	**12,000**
LICK	2015	Doctor Lake	1,900	1,900	1,900	**5,700**
KOESSLER	2016	Doctor Lake	8,600	8,600	8,600	**25,800**
LOWER 3 EAGLES	2017	A1 Youngs Creek	1,000	1,000	1,000	**3,000**
UPPER 3 EAGLES	2017	A1 Youngs Creek	1,000	1,000	1,000	**3,000**
SUNBURST	2018	M012	14,000	14,000	14,000	**42,000**
				Total		**196,800**

*Stocking numbers are based on a density of 100 fish/acre

Resumed Swamping Strategy Stocking rates*						
PYRAMID	2009	M012, Youngs Ck A1 later	2,700	2,700	2,700	**8,100**
PILGRIM	2010	M012	9,000	9,000	9,000	**27,000**
WOODWARD	2013	Big Salmon or Danaher source	18,000	18,000	18,000	**54,000**
GEORGE	2014	Doctor Lake	36,000	36,000	36,000	**108,000**
				Total		**108,000**

**Stocking numbers for swamping are based on a density of 300 fish/acre

ISRP 2008 Comments: The statement that the capacity of the facility is unknown and that space for different life-stages of westslope cutthroat trout is not yet established is an issue that requires upfront analysis as it will define facility limitations and be the primary factor affecting the feasibility of the stocking schedule. The water available at the location determines the level of culture activity that can be accommodated, so it should be possible to generate an estimate for a facility's capacity. There were facility plans in the early Master Plans. Have these changed? Ultimately, the emphasis on supporting the lake rehabilitation program is a tractable improvement and logical "proof of concept" step over the earlier versions ISRP reviewed that was broader in scope. As a side-note: the total number of fish stocked under the "Resumed Swamping Strategy" should be 201,000, not 108,000.

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