ATTACH 1a

Draft Review Comments on:
Trinity River Restoration Program Integrated Assessment Plan
Version 0.9 – November 1, 2006

By

Science Advisory Board:

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1.0 Introduciton

We appreciate the opportunity to review Part 1 of the Integrated Assessment Plan prepared by numerous authors. It is an important and large step for the Program in its assessment of how effective management actions are achieving Program goals and objectives, and the document reflects this accordingly. The report was provided to us on November 2, and we reviewed the document before a collaborative meeting in Weaverville the week of November 27. During our review, we considered the IAP as a stand-alone document in context to the Record of Decision, our knowledge of the Trinity River and other rivers in general, and in some cases, supporting documents such as the Flow Evaluation Report, the Conceptual Model, and conversations with Program staff and participants.

Via a letter from the Program, we were asked to do the following:

1. Are the proposed assessments clearly identified as addressing and evaluating the strategy outlined in the TRFE, ROD, and/or assessing overall Program goals?
    a. Are all necessary (core) assessments included in the IAP?
    b. Are any assessments not clearly linked to the strategy and therefore give the appearance of being unnecessary or low priority?
        i. Is each assessment core to the TRFE or ROD?
        ii. Is the rationale and logic included to justify each assessment as core?
        iii. Does the science justify each assessment as core?

2. Are high priority (core) assessments identified?
3. Are high priorities for integration amongst the assessments identified?
4. Have we adequately described a process for 'science based assessments and monitoring'?
5. Does this part of the IAP fulfill its stated purpose?
6. What are your recommendations as the SAB:
    a. Regarding Part 1
        i. Proposed next steps of the IAP outlined in this letter.
        ii. Changes we can make within one week (pre-TMC meeting)
        iii. Changes we need to make before reconvening on Part 2
    b. For completing Part 2
    c. Timely implementation of scientific rigor into the assessment process.

This draft covers most of the above and concentrates on items 1 and 4.

2.0 General Comments on IAP Report

There is no discussion of experimental design in the IAP and this is a critical missing element. A better understanding of system response can only be obtained by measuring key variables (e.g. smolt production) across a range of contrasting 'treatments' (e.g. improved vs. degraded habitat). The IAP focuses solely on the 'what' and 'why' for the measurement aspect of this equation but should also include discussion on the treatment component. The central hypothesis in the ROD is that habitat (flow, temperature, and physical habitat) limits salmonid production in the Trinity River. The 'core' experiment is to compare fish production (e.g. smolts and pre-fishery returns) prior to restoration with production measured during/after restoration. However, within this core experiment it is desirable to determine which restoration elements are most important. For example, if elevated water temperatures have a much bigger influence on production than physical habitat, hydrographs would be readjusted relative to the current regime to optimize temperatures, rather than to meet both temperature and alluvial attribute objectives.

The IAP must provide better definition of the core experiment and clearly identify the scope for experimentation within this core. Hydrographs are adjusted on an annual basis to meet specific objectives. This 'tinkering' may speed the rate of habitat and population recovery, but only if the operating model (mental or computer) is correct. Tinkering, which may reduce experimental contrast, may therefore also limit the extent and rate of learning. For example, adjusting the hydrograph to optimize water temperatures reduces water temperature variation thereby reducing the ability to quantify the effects of water temperature on salmonid mortality and growth. Tinkering year-after-year can produce a bewildering array of treatments. Obtaining reasonable inference about the benefits of the TRRP will require some temporal replication, i.e., repeated application of similar treatments across years or seasons. Substantial tinkering reduces the extent of replication and therefore our ability to learn about system response. At some point, tinkering reduces a well-planned Adaptive Management experiment to a trial-and-error approach where the rate of learning is severely reduced. The IAP must therefore develop rules or criteria that define the extent of tinkering that will be allowed, and rules that define when information is sufficient to justify tinkering.

The experimental design for site restoration should also be specified in the IAP. Is the design simply to build as many sites as quickly as possible, or will a staged-approach be used? The latter might delay the rate at which 40 rehabilitation sites are completed, but might provide more or higher quality habitat in the long run. To what extent will physical habitat restoration efforts focus on restoring alluvial attributes as opposed to engineering habitat? The former approach might involve creating many simple rehabilitation sites in clusters as opposed to building fewer larger or more highly designed sites. Like the temperature example, these decision will depend on how much the TRRP thinks it knows, which in turn influences its value on learning vs. speeding the rate of channel evolution (assuming mental or computer operating models used for site design and to predict channel change are correct).

The IAP should couch the current 'core' experiment in the broader conceptual model (ref. conceptual model document). The central hypothesis in the ROD is that habitat limits natural salmonid production. Alternate hypotheses are production is limited by combined low marine survival and excessive harvest, or excessive hatchery production. Evaluating the alternate hypotheses that harvest rate or hatchery releases limits production would require socially expensive and painful experiments, and given harvest objectives for the program (objective 5), it is logical to first test the habitat hypothesis. That is, can habitat improvements result in higher adult returns under current harvest and hatchery regimes? Chapter 2 of the IAP should include a brief discussion on the three primary hypotheses (habitat, harvest, hatchery), briefly outline the experiments to test them (a combination of the ROD experiment, and harvest and hatchery reductions), and then rationalize the decision to first test the habitat hypothesis. By doing this, the TRRP will acknowledge that hatchery and harvest management are key actions that are within the domain of the program even if they choose not to alter current regimes (or recommend changes) until the central ROD hypothesis is evaluated.

The process of adaptive environmental assessment incorporates the use of dynamic models as an intellectual device to help people clarify issues, communicate effectively about shared concerns, and explore objectively the consequences of alternative policy options. The value of modeling in fields like biology has not been used to make precise predictions, but rather to provide clear caricatures of nature against which to test and expand experience (Walters 1986). There are a number of examples in the IAP that clearly show confusion on this issue. We provide two examples to make this important point:

1. "Previous studies showed that primary fry rearing habitat for Chinook salmon, coho salmon, and steelhead in the Trinity River was limiting these populations." (page 3, lines 30-31). This is incorrect. SALMOD was used to articulate the hypothesis that rearing habitat was limiting production. That hypothesis will now be tested empirically through a long-term Adaptive Management experiment. The model did not show anything, it simply provided clear articulation of a habitat hypothesis.

2. "Both simulation models and empirical models/analyses will be used to clarify he cause-effect chains by which management actions affect fluvial processes." (p. 8, lines 5-7). Cause-and-effect relationships can only be determined empirically based on measurements taken under strongly contrasting treatment conditions, ideally with replication. Models summarize our guesses about how a system works and models are rejected if they are not consistent with the data. You can never prove a model, simply reject ones that are not inconsistent with observations (Oreskes 1994, Walters 19987, 1997).

We suggest that careful attention be given to terminology throughout the IAP. The common use of restoration as a verb is ambiguous and should be restricted to the reference to restoring the fish to pre TRD levels as stated in the ROD. Even this is better

stated as recovery of the fish populations. There is much confusion among the various publics and decision-makers over the use of "restoration". The National Research Council (1996) defined restoration as "the return of the form and function of an ecosystem to its pre-disturbance condition". The NRC further defined rehabilitation as: "used primarily to indicate improvements of a visual nature to a natural resource; putting back into good condition or working order". The Instream Flow Council (2004) defined rehabilitate as "to bring about changes in management that allows the physical and biological processes of a stream, river or lake to function in a more natural way in order to achieve or more closely approximate a condition of dynamic equilibrium or balance." It was primarily this distinction of rehabilitation from restoration that led to the adoption of the terminology of "rehabilitation sites" in the TRFE. In most places in the IAP's Objective and Sub-Objective statements the wording of "restoration" should be replaced with "increase" or "improve" when addressing habitat, and "recover" when addressing fish and wildlife populations.

Although there are several system-wide estimates and a census may be tempting, it is rarely as efficient as a well-designed sample. Subjectively choosing "represenative areas" and expanding these to a population level is not scientifically defensible. Such an approach may be valuable and efficient for understanding process, and many ecological relationships have been discovered this way, but external validity beyond the observed areas or entities to the general population depends on judgment alone. When measuring resources for assessment purposes, sampling design should consider the nature of the objective, because design determines cost and precsion. Important factors are: effect size (difference due to management), using permanent versus temporary sampling units (plots, transects, etc.), the population of interest, identification of listing units to choose from, and sample type (simple random, stratified random, ratio estimators, systematic, etc.).

The larger the effect size of interest, the smaller the sample needed for a given level of precision or sampling error. Most assesments do not have a target effect size firmly in mind, but an informal one is necessary to keep sample sizes reasonable. Many program assessments track change (e.g., increase habitat by 500%) rather than a condition (e.g., 62000 chinook). Each type of assessment (change versus condition) has its own optimum sampling approach: where detecting change is the primary objective, a repeated measures approach (permanent plots) is usually more efficient than independent samples. Statistical test choice depends on Whether sample units are independent or not, but a valid assumption about independence is not always straightforward. Keep the population of interest in mind, and choose listing units accordingly. Listing units are entities that could be selected and their total count comprises the make up the total sampling frame, but they are are not necessarily the population itself. For example, the number of alder stems along the Trinity River may be the population of interest, but all potential plots laid out of the treed area is the sampling frame. In this case, plots are selected from the total list of plots, not the trees. Cost savings and valid expansions depend on choice of listing unit type and sample type. Finally, replication in regards to experimental treatment is important for detecting changes. One of the most common abuses in science is pseudoreplication. Identifying true replicates is not always obvious. We recommend consultation with a statistician when planning sampling and analysis.

When redrafting the IAP, we suggest the initial section for each objective or sub-objective be structured in the following way: 1) state the key hypothesis (and supporting hypotheses if necessary); 2) identify the key performance measure related to the hypothesis; 3) make a prediction about how the performance measure will respond to a management action or change in the system based on the hypothesis; and 4) identify the comparison that will be made to test the hypothesis. In addition, references to the literature should be used to support statements that are not intuitively obvious. There are numerous unsupported statements in the IAP. The literature can also be a source for hypotheses, but also refute pre-conceived, apparently plausible hypotheses, thus reducing naiveté and wasted efforts.

The Trinity River Restoration Program is one of the most important watershed and fisheries restoration efforts taking place in the US and worldwide. However, the potential of the program to restore salmon and steelhead populations is highly uncertain. This is a common theme among many large-scale restoration efforts. In order for the program to be successful it must first recognize the full extent of uncertainty. Close attention to experimental design and a rigorous monitoring program will be required. More importantly, key decision makers must be flexible, willing to compromise on occasion, and work collaboratively to maximize learning and deliver the best possible science. Walters (1997) reviewed 25 substantial Adaptive Management experiments in riparian and coastal ecosystems; only seven of these resulted in relative large-scale management experiments such as what is underway on the Trinity River. Only two of these experiments were considered well planned and implemented to a sufficient extent that there was a reasonable potential for learning. Thus to date, most Adaptive Management programs have failed. Walters (1997) concluded that the main reason for this poor record is because: "Research and management stakeholders have shown deplorable self-interest, seeing adaptive-policy development as a threat to existing research programs and management regimes, rather than as an opportunity for improvement". We encourage TRRP partners to avoid these pitfalls and develop an IAP that describes informative experiments and monitoring metrics so significant learning can occur.

3.0 Sediment Transport and Channel Morphology

3.1 Objective 1: Restore fluvial processes that create and maintain habitat Required to achieve fish, riparian vegetation, and wildlife production goals

The first objective of the IAP concerns management activities designed to the restoration fluvial processes in the Trinity River that will create and maintain a channel morphology and substrate sufficient to support the fish, riparian vegetation and wildlife production goals. In the initial paragraph, it is stated that " A foundation hypothesis is that increasing and maintaining coarse sediment storage in the mainstem Trinity River, combined with channel rehabilitation and improvements in the flow regime will create and maintain complex channel morphology". The assessment coarse sediment storage in the mainstem Trinity River is developed in detail in the first sub-objective 1.1. The focus on coarse sediment storage seems to miss the mark. The net accumulation of coarse sediment in a particular reach over some interval of time will not necessarily involve or promote a geomorphically complex channel. In discussing the sub-objective, it becomes apparent that the assessment of coarse sediment storage refers, specifically, to only those particles larger than ¼ inch, but small enough to be entrained and transported by flows provided for by the ROD. Particles larger than about 6 inches in diameter are not transported to any appreciable degree by even the largest ROD flows and currently make up a few to several percent of the bed material. Tributary inflows and bank erosion will continue to supply additional particles larger than 6 inches to the Trinity River. The long-term accumulation of large, immobile particles in the bed material of the Trinity River would be detrimental to the goal of restoring an alluvial channel. Even a net increase in the quantity of mobile, coarse sediment within a given reach will not guarantee an alluvial channel, because the accumulated material may be deposited within the subsurface bed material and unavailable more transport.

We suggest that the sub-objective 1.1 be revised to "Achieve and sustain a long-term mean transport of coarse sediment throughout the 20 mile reach below Lewiston Dam of several thousand ton per year". The transport of an appreciable quantity of sediment in the range of particle sizes that compose a river bed is the essence of an alluvial channel and will construct a more diverse and complex channel. Accordingly, we propose that the focus of sub-objective 1.1 be to determine the annual quantity of bed particles, ¼ to 6 inches in diameter, transported at selected cross sections rather than the determination of the change in storage within sub-reaches. Although a shift in focus, practically speaking, the required activities for the objective assessment are essentially the same. As proposed in the IAP, the transport or flux of coarse sediment in to and out of selected reaches would be determined by sampling and the change in storage determined by difference. The proposed reaches and sediment sampling locations appear to be appropriate and sufficient.

The revised focus for sub-objective 1.1 on the long-term mainstem transport rate rather than changes in coarse sediment storage does simplify the need to quantify tributary contributions of coarse particles. A general understanding of the magnitude of

tributary coarse sediment inputs to the mainstem will be helpful in managing the gravel augmentation program, ie. to determine the frequency, location and quantity of material. Calculating changes in reach storage would require much more accurate estimates of tributary contributions, especially from the upstream tributaries whose mean annual contributions are roughly the same order of magnitude as the mainstem transport.

The proposed assessment strategy involves both the direct sampling of sediment transport rates as will as changes in topography determined from repeated LIDAR surveys. We appreciate that periodic resurveys of the channel topography using LIDAR will probably be required for other elements of the TRRP, especially the various flow routing models, and, therefore, the information needed to calculate volumetric changes in channel storage would be available. Although there have been similar attempts at topographic differencing by other investigators, we are not aware that any of these efforts have succeeded over a broad geographic scale. Uncertainities in the collection and analysis of LIDAR acquired topography are still large compared to the net accumulation or depletion of sediment in an extensive reach over a period of a few to several years in all, but the most extreme cases.

Reestablishing an alluvial channel for the Trinity River through the 20-mile reach below Lewiston Dam is an essential goal of the TRRP as outlined in the TRFE and ROD. Accordingly, direct measurement of coarse sediment transport at selected cross sections in this reach is a core priority. Appreciable transport of coarse sediment will only occur for a few days during those years with normal, wet and extremely wet precipitation as defined in the ROD. Therefore, while essential, the measurements would be for relatively brief periods and not every year. It is important to recognize that the channel of the Trinity River will be altered over the next 10 to 20 years by a variety of actions, the return of sediment transporting flows, gravel augmentation, and bank rehabilitation sites, and that the period of adjustment will be a few decades. During this period of adjustment the quantity and particle size distribution of sediment transported by a given discharge at a given location will change. Therefore, we anticipate that it will be necessary to continue the sediment monitoring activities for some time.

As described above, restoration of a spatially, complex channel morphology in the mainstem Trinity River that will create and maintain the required aquatic and riparian habitat is one of the fundamental goals of the program as outlined in the ROD. Sub-objective 1.2 of the IAP proposes a strategy to describe progress towards of a complex, channel morphology. The assessment approach has been carefully developed, and appears to be sufficient to achieve the required information. Indeed, it appears that significant progress towards a map of geomorphic features from Lewiston Dam downstream to the confluence of the North Fork Trinity River has already been completed. As noted in our discussion of aquatic habitat, a map of channel geomorphic features will provide an ideal base on which to record, compile and analyze aquatic habitat information. Mapping of the existing channel features should be completed. The proposed revision of the geomorphic map every 3 to 5 years or after periods of significant high flow appears adequate. In addition, it is proposed that detailed site specific maps of geomorphic features be developed as needed, especially to evaluate the

success of bank rehabilitation projects. We believe that repeated, site specific geomorphic map will be an appropriate and cost-effective, assessment tool for these projects.

The creation and maintenance of a complex, channel morphology is an essential goal for the recovery of aquatic habitat in the Trinity River. Accordingly, periodic assessment of progress towards this goal is a core priority. A suitable approach exists and the tasks can be complete at a reasonable cost.

Sub-objective 1.3 concerns the reduction of relatively fine sediment in the bed material of the mainstem Trinity River. In the past some tributaries have supplied large quantities of sediment smaller than ¼ inch in diameter to the Trinity River. Reduced duration and magnitude of high flows following the construction of Lewiston Dam has also promoted the accumulation of relatively fine sediment. Past efforts in the affected watersheds appear to have significantly reduced the contribution of fine sediment to the mainstem Trinity River. Furthermore, the ROD flow regime will substantially increase the transport of this material. Some observers believe that the percent of fine sediment in the river bed has decreased significantly in recent years. A comprehensive survey to determine the longitudinal distribution of the fraction of sediment smaller than ¼ inch in the Trinity River, however, has not been completed in many years. A range of opinions have been expressed concerning whether or not a problem exists. In addition, the occurrence and biological impact of fine sediment in gravel-bed rivers have been studied extensively over the past 20 years. It would be worthwhile to resurvey the fraction of fine sediment in the mainstem river bed.

An evaluation of fine sediment supply and transport is complicated by the range of particle sizes involved, and their mode of transport. There are, in fact, two fine sediment fractions and associated problems that need to be considered. Particles smaller than about 1 mm will be transported suspended within the water column. The accumulation of particles smaller than 1 mm in the subsurface bed material reduces inter-granular flow permeability and can inhibit the development of fish eggs. Conversely, sediment particles from 1 to 8 mm (1/4 inch) in diameter are transported primarily as bedload, that is, rolling and saltating over the river bed. These somewhat coarser particles do not have as great an effect on the permeability of the bed material as the smaller particles. They do, however, accumulate and fill pockets between the much larger surface particles, and can reduce fry rearing habitat. Given the difference in transport mode and biological impact, we suggest that the two fractions be considered and assessed separately, even though the TRFE study lumps them together.

Determining the annual mainstem flux of fine sediment into and out of selected reaches using sampled suspended and bedload transport rates will be a manageable task, however, determining tributary contributions and changes in bed storage will be difficult. A substantial portion of the sediment transported by tributary channels occurs during relatively brief periods that are unpredictable and hard to sample unlike mainstem sediment transport. Considerable effort and expense would be required to determine tributary fine sediment contributions to the mainstem.

Separate approaches to determine the quantity of fine sediment in the river bed surface and subsurface are proposed in the IAP. Relatively large spatial variations and the considerable length of channel that needs to be surveyed greatly complicates the effort. We agree that changes in fine sediment storage on and within the river over time should be assessed. Developing a cost-effective and reliable field method, however, will be a significant challenge.

4.0 Fish Habitat

3.2 Objective 2: Increase quality and quantity of habitat for all freshwater life stages of anadromous salmonids

Focus on direction of change (increase in habitat area and quality) not on determining a specific target. TRFE analyses estimated an increase in suitable fry and juvenile Chinook habitat of 3-4X over the entire river from the dam to the North Fork would be necessary to achieve a 2X increase in pre-smolt production. This was simply an initial target that was felt to be necessary in order to lead to a measurable increase in smolt production. That is, an increase greater than 2X of the outmigrant index would be necessary before defensible statements could be made about increased production. That should be considered only as a starting floor for habitat improvement. Conceptually orders of magnitudes changes (increases) may occur over time as the TRRP management actions are fully implemented. As empirical measures of salmon fry and juvenile movement, growth and survival, emergence, and movement out of the upper reaches is collected, the SALMOD model could be calibrated and improved as an indicator of production. When updated to the point of reasonable agreement between model output and empirical measures SALMOD could be used along with cohort reconstruction to better understand the linkage between habitat dynamics (weekly temperature and discharge related hydraulic changes down the river) and smolt growth, movement and survival.

Habitat models are better used to understand the influence of annual flow releases on the extent and duration of changes in habitat suitability through time and space. Expected increases in habitat as a result of the combined TRRP management actions driving fluvial processes could be thought of as the trajectory of change and simply measured as increments of change over time. Detailed habitat measures at river sites targeted for rehab work could provide a crude estimate of before and after consequences of mechanical activity at a site. Changing the cross-sectional configuration of the river channel within the habitat model can provide a means for comparing relative differences among potential designs for channel works. This may be useful for eliminating some designs as being immediately detrimental in terms of suitable juvenile habitat. However these models can provide even more useful indicators of habitat change evolving from the immediate change resulting from site design and construction.

As is true for the physical habitat analyses the temperature component of dynamic habitat analyses is better used in comparing proposed alternative flow scheduling releases to eliminate those that may have an undesirable influence on incubation, emergence and growth or survival of salmon young-of-year. Alternatively the model could be used to define temperature treatments with varying degrees of contrast (degree day accumulation over the growing period for fry and juvenile salmonids). Over time more confidence may be gained in running the SALMOD model with the actual temperatures experienced over a given year. Comparing model output with empirical measures of emergence timing, movement, growth and survival of juvenile salmon should lead to model acceptance or rejection... The population model is most useful for illustrating the accumulated knowledge of the salmon life history during the freshwater phase and for calculation of

numbers and size of emigrating pre-smolts as an adjunct to the screw trap-derived indices.

In summary, major emphasis should not be on use of habitat and fish production models for predictions but rather as a way of illustrating the accumulated empirical measures of fish habitat use, movement, growth, etc. Illustration of differences between and among years (after the fact) may prove useful for informing others by use of time series comparisons for different water year types, alternative reservoir release patterns, etc.

3.2.1 Increase and maintain salmonid habitat

When redrafting the IAP for each sub-objective include an initial paragraph similar to paragraph 15 under section 3.3.4 (sub-objective 3.4). This paragraph should briefly describe the habitat objective as related to the TFRE and ROD followed by the purpose and expectations and/or hypothesis.

Strategy

Steps 1, 2 & 3 should rewritten to distinguish between relatively easy and cost effective measures to be applied at shorter time intervals (1 to 3 yrs) and serve as indicators of change vs. more complex approaches applied to understand habitat dynamics with updates at longer time intervals of 5-10 years.

Briefly outline the utility of system wide descriptors such as aerial photos, geomorphic and mesohabitat maps that can be repeated at shorter interval (i.e., annually) as well as more detailed analytical approaches for dynamic habitat analyses that require a stratified sampling scheme and updates after significant changes in channel geometry.

Describe how the relatively quick and inexpensive measures illustrate change (or lack thereof) and serve to trigger the need for updating the more detailed descriptors for understanding the habitat dynamics (time series analyses).

Step 4. Quantify and simulate habitat change over time and space.
Use quantitative habitat analyses to illustrate the degree of change in suitable habitat for selected salmonid life stages at intervals down the river. Habitat time series (weekly or daily time steps) for different water year types and alternative flow release schedules can can be useful for understanding the degree of expansion and contraction of suitable habitat over time (both short term: weeks and months, and for longer time intervals: several years) and space (at selected points down the stream corridor). Update habitat suitability models similar to those used in the TFRE and improve or replace as data collection, monitoring, and model comparisons indicate (see Section 3.2.2).

Step 5. Provide quantitative habitat analyses input to population models
Update SALMOD and explore possible use of other dynamic population models.

The discussion of analytical methods should reference the SAB April 4, 2006 review for ideas relative to ongoing methods comparisons. It is important that the empirically based

habitat suitability models as used in the TFRE be updated and improved in order to cover the 300-1500 cfs range in discharges released from the dam. These habitat models should incorporate the most relevant habitat suitability criteria for all life stages of the salmonid species of interest. Only after rigorous comparison and documented verification that alternative approaches (e.g., EHM, LIDAR based 2D hydraulics) perform equally well or better than the 1D hydraulics based suitability methods should the dynamic suitability models be replaced. Peer reviewed study design and results must provide the basis for model replacement.

The reference to geomorphic reaches in Table 3.2.1 needs to be revisited when considering a stratified random sampling scheme for the detailed habitat analyses. The fishery biologists should work with the geomorphologists in developing an appropriate sampling scheme starting with geomorphology maps of the river. Random replicates of each geomorphic unit (meso-habitat) found within the larger physiographic reaches, such as transverse bars, pools, side channels, etc. may give a better representation for extrapolation than use of one continuous "representative sample reach" covering a complex of geomorphic units (meso-habitats). The "targets" and habitat estimates identified for Step 2 could be better expressed as amount and proportion of habitat area among life stages (spawning, rearing, adult holding etc.) assuming different levels of escapement and seeding. Quantifying habitat change for different treatments as well as system-wide quantification of the extent of change over longer time intervals will provide valuable evidence in support (or not) of the TFRE/ROD strategy of creating suitable habitat via fluvial processes.

Proposed Space and Time Frames

Priority issues to address (Items 1 through 6)
Irregardless of the outcomes from method comparisons an initial stratified random sampling scheme will be necessary for updating the habitat suitability models for reference to the pre-TRRP full implementation and for input to SALMOD. As stated above this could be replaced at a future date based upon documented and peer reviewed evidence that other methods are more reliable, cheaper, etc. and provide the needed salmonid life stage vs. discharge relations longitudinally down the river length.

Therefore the priority issues include updating the habitat suitability models to improve upon the TRFE analyses and provide a quantitative baseline (reference condition) from which to measure the degree of change following TRRP management actions, to serve as a basis for comparison with other methods, and to provide input to SALMOD.

Item 5: Identify the potential for habitat improvements based on geomorphic and hydrological conditions. This would identify the potential for habitat improvement (increases and trajectory of change) based on geomorphic and hydrologic metrics.

Item 6: Estimating the amount of habitat change that different rehabilitation designs may potentially produce could be a vehicle for collaboration with RIG personnel in evaluating alternative project designs. One filter for selection of cost effective designs would be to

examine potential impacts to suitable habitat along with the potential for initiating channel migration (widening, etc.) (Items 1-6 on page 30)

3.2.2 Confirm that created habitat is being utilized

Priority Issues to Address
The first of the two questions posed does a good job of describing the test of habitat model output with field observations of fish utilization (presence vs. absence). A brief description of the statistical test as described by Thomas and Bovee (1993) should be included here and perhaps an illustration of fish distribution and simulated habitat suitability from recent habitat analyses on the Klamath River.

Data collected for Question 2 may prove useful in evaluating alternative rehabilitation project designs as referred to above under Step 4 of Section 3.21.

For the comparison of actual fish locations when testing the different models it is critical that the simulated unusable habitat polygons be included as well as the usable polygons (suitable, marginal and unsuitable). The statistical analyses involve comparison of observed vs. expected values and chi-square tests over the strata of useable, marginal and unusable polygons throughout the sample reach. Similar model testing can (and should) be done in complex reaches outside the rehab project areas where a change in habitat usability is anticipated over different discharge levels

A third bullet should be added. Modify habitat models by incorporating improved understanding of habitat suitability and fish utilization. Consider the habitat suitability criteria as "calibration knobs" in the habitat models that can be modified to improve model output fit with observed fish distribution. After a few iterations of such calibration the model output should be considered useful (verified) or rejected.

Integration Approaches and Challenges

Item 1. Linkage to implementation
Do not place much emphasis on "specific predictions of expected outcomes". Dynamic habitat models rather are most useful for interpolation and extrapolation of habitat quality and quantity estimates beyond the discharge(s) at which the model input was measured. These are not meant for predictions into the future but rather for comparison of habitat quality and quantity for different discharge levels or rehabilitation designs.

Item 2. Mapping
The coordination of mapping efforts among disciplines is essential and should start with the geomorphic maps of the entire river corridor of concern and from that overlay fish habitat maps, etc. A sampling scheme for the fish habitat and riparian/wildlife should originate from a collaborative effort in identifying physiographic reaches (segments) that would be sampled. Where detailed field measurements are required by different disciplines focus on joint data collection if possible.

Item 3. Smolt Production

Provide cross reference to Sections 3.3 and 3.4 here

Core Assessments for Section 3.2

1. Prepare geomorphic maps of the entire river down to the North Fork. Coordinate with the fish and riparian/wildlife groups to overlay mesohabitat/geomorphic units and develop a stratified random sampling scheme for on the ground detailed habitat measurements. Determine an appropriate method for expansion from replicated sample site to larger physiographic reaches.

2. Redefine, by further sub-division, the physiographic reaches. The present division into 6 physiographic reaches appears to be too coarse. Stratified sampling and expansion within reaches needs to be statistically defensible.

3. Select easily measured indices of geomorphic change, such as length of thalweg and stream edge as descriptors of channel change and analyze for possible correlation with fish population measures (density trends, estimated outmigrants, etc.).

4. Update habitat suitability models by use of most recent habitat suitability criteria from Klamath and Trinity Rivers. Using a refined sampling scheme from 1 & 2 above, resurvey and measure habitat sites to accommodate dynamic simulations over the full range of discharges from 300 to 11,000 cfs.

5. Describe selected simple and detailed habitat metrics and determine frequency of field data collection needs for updating (annually, 5+ years, after major changes, etc.).

6. Complete the comparison of habitat models including tests with field observations of fish distribution at three or more discharge levels. Submit the results for outside peer review.

7. Update SALMOD using the latest version of the software and habitat output from suitability models.
8. Link SALMOD with the new version of the river temperature model.

5.0 Objective 3: Restore and Maintain Natural Production of Anadromous Fish Populations

The introduction to Section 3.3 needs to be more specific. We appreciate that Chapter 3 of the IAP makes no attempt to prioritize or filter any assessments. However, the introduction of 3.3 takes this to an extreme: "..the program must quantitatively assess population sizes, survival and mortality at all life-stages of naturally produced anadromous fish with sufficient accuracy to make informed decisions."[1] It is not necessary to monitor all life stages for all species to determine whether a fish population response to habitat improvements has occurred. Furthermore, even with unlimited funding it likely can't be done given logistical constraints. At best TRRP may be able to estimate the abundance for a few life stages for a few species. In a subset of these cases where reliable estimates of juvenile migration rates are determined, it will be possible to estimate mortality rates between two sample periods. We suggest that the introduction begins with a statement that smolt and adult returns will be the key life stages used to monitor population response to habitat and flow treatments, and that intermediate life stages will be useful for establishing cause-and-effect relationships and key limiting factors. Selection of species and life stages to monitor will depend on their utility for addressing key hypotheses, initial hypotheses about which life stages are most limiting, and the species prioritization.

It is unclear whether the order of species identified in the introduction reflects their priority for assessment. This was clarified in Section 3.5 (beginning p. 43, line 42). Text in the introduction of Section 3.3 concerning species prioritization should be replaced with the text from Section 3.5. There is no need to repeat this prioritization in Section 3.5.

The paragraph on hatcheries (p. 33, line 10) describes their potential impact on productivity of natural spawners but there is no mention of whether it will be addressed in the IAP document. Either delete this paragraph or relate it to Sub-Objective 3.3. If the paragraph is kept, a similar paragraph describing the harvest management issue should be included. The introduction section should end with a road-map describing how sub-objectives 3.3.x fit together (e.g. a few sentences expanding on the relevant portion of Fig. 2.2).

Sub-Objective 3.1: Increase reproductive success of anadromous spawners

The title of this sub-objective is confusing. Reproductive success refers to the number of adult fish that return (prior to any fishing) per spawner, that is, the product of fecundity, sex ratio, and survival from cradle-to-grave. This sub-objective relates only to reproductive success from adult river entry until fry emergence. A more accurate title for this sub-objective would be "Increase spawning, incubation, and emergence success". As mentioned in our introductory comments, each section should be structured using a hypothesis-prediction-test format. The hypothesis described in the ROD relative to this

[1] Survival rate is equivalent to one minus the mortality rate so there is no need to use both survival and mortality in the same sentence.

sub-objective is that increasing the spatial extent over which spawning occurs will improve egg-fry survival by reducing redd superimposition and the effects of intraspecific competition among fry immediately following emergence. If the extent of spawning habitat is increased and utilized we would expect to see an increase in the egg-to-fry (measured shortly after emergence) survival rate. The secondary hypothesis is that current spawning distribution is limited by the availability of spawning habitat. If this hypothesis is correct, we would expect to see an increase in the spatial distribution of spawning as the amount of spawning habitat is increased.

It may be worth describing alternative hypotheses in the IAP and whether the current assessment strategy will be able to distinguish among competing hypotheses. For example, an alternative hypothesis with respect to spawning distribution is that spawning habitat is currently not limiting and the highly aggregated spawning distribution below Lewiston Dam occurs because the majority of spawners originate from the hatchery and are homing back to the location where they were reared and released.

We do not support measurements of egg viability, redd permeability, and fry emergence survival rate (via redd capping). Such measurements are time consuming to make and would be very costly considering the large sample size required to provide a representative assessment of the quality of incubation environments. The statement "Assessments of redd permeability and fry emergence survival could be conducted in areas likely to be impacted by fine sediment inputs,..." suggests a possible misunderstanding about the effect of sampling strategy on scientific inference. It is already well established that incubation mortality will be higher if gravel permeability is reduced by fine sediment. No need to reinvent the wheel. A reach-wide, representative assessment of incubation mortality would be useful but will not be attained by taking detailed measurements at a few locations that have obvious fine sediment problems as suggested in the text. A much more feasible and representative metric would be to evaluate the temporal change in the ratio of the newly emerged fry to the spawning escapement. To accomplish this, areas where escapement and redds are enumerated must coincide with areas where the density of newly emergent fry is determined (via electrofishing or incline plane traps).

Sub-objective 3.2: Increasing rearing and outmigration success of anadromous fish

A central hypothesis of the TRRP is that increasing the quality and quantity of fry and juvenile habitat will increase the number and size of outmigrating smolts and improve their condition. Increased size, improved condition, and changes in migration timing will in turn lead to better estuarine and early marine survival rates and ultimately to an increase in the number of returning adults. These hypotheses will be tested by:

1. Evaluating the correlation between annual trends in available habitat (physical, water temperature) and the abundance and quality of smolts measured near the confluence of the North Fork and Klamath

(Weitchpec) Rivers. This analysis assumes that spawning escapement does not limit smolt production.

2. Evaluating the correlation between habitat and residuals from the spawner-to-smolt relationship. This analysis would account for the effects of density dependent survival. Note that it can only be done for the upper 40 miles where escapement and smolt production estimates are spatially coincident and for species where escapement for the entire run is determined (e.g. currently not possible for steelhead or coho above the North Fork).

3. Evaluating the correlation between the survival rate of smolts between the North Fork and Weitchpec trapping sites and water temperatures. This would require a coordinated marking effort among trapping locations, and probably increases in the number of marks applied at the North Fork site and the total catch at the Weitchpec site (to recover a sufficient number of marks).

4. Evaluating the correlation between habitat and the size, condition, and timing of emigration at the North Fork and Weitchpec sites. The assumption behind this analysis is that larger smolts in better condition will have higher estuarine and early marine survival rates. The extent to which changes in migration timing influence subsequent survival rates is uncertain but the hypothesis should be specified in the IAP if migration timing is used as a performance metric (e.g. early migration results in higher survival rates for fish due to cooler water temperatures in the Klamath River).

There was very little description or rationale for the Lower Klamath River and Estuary smolt sampling program. These data might be useful for determining whether increased production of smolts from the Trinity River results in a higher number of smolts leaving the estuary, or whether high water temperatures in the Klamath River, disease or negative competitive interactions with Klamath fish limit the response of Trinity River fish to habitat improvements. Please provide a hypothesis-prediction-test for this issue and identify priority and integration issues. The TRRP should invest in the Lower Klamath River and Estuary sampling program only if:

1. the origin of smolts caught in the Klamath estuary (Klamath vs. Trinity) can be determined (perhaps based on otolith microchemistry or growth patterns, e.g., Zang et al. 1995); or

2. reliable annual estimates of outmigrants from the Klamath are available along with estimates from the Trinity. In this case the proportion of Klamath vs. Trinity smolts could be estimated based on the ratios of fish leaving each system.

We do not agree with the rationale for measuring fry abundance presented in the IAP (p. 34, line 21-25). The experimental design outlined in the ROD is to provide as much habitat as possible within the constraints of water availability and the site rehabilitation budget (see comments on Section 3.2). Even if one could reasonably determine "fry carrying capacity" this information is not needed as the scope of the habitat creation has already been defined. The purpose of a fry program should be to provide:

1. an estimate of fry production by reach which will be compared to the number of redds (or escapement) to determine reach-wide egg-fry survival rates;

2. to provide a system-wide description of density, broad habitat use and movement patterns, and growth (length-at-age) above the confluence of the North Fork;to compare distributions of natural- and hatchery-origin fry and juveniles to evaluate competitive interactions and to comare the relative density and condition of fish in rehabilitation sites relative to other parts of the mainstem; and
4. as an alternate method for estimating salmonid production in the event that smolt production estimates from Rotary Screw Trapping (RST) are highly biased or imprecise. The efficacy of the current smolt outmigrant trapping program has not been determined.

With regards to priority issues and challenges, the SAB felt VERY STRONGLY that the reliability of the RST estimates of outmigrant numbers and run timing must be determined immediately. Contractors must deliver reports detailing the methodology and results of trapping. Results must include estimates of total run size over the annual trapping periods and well as estimates of outmigrant run size by time strata within years (i.e., run timing). The analysis must be conducted for all Chinook, steelhead, and coho and stratified by size- or age-class. Estimates of hatchery population size should be compared to actual releases. Uncertainty estimates for all reported values must be provided. The draft report prepared by Green et al. (2004) provides a reasonable example of what should be produced. However the analysis we recommend should span at least seven years to provide a good baseline estimate (e.g. 2000-2006). We recommend that the Hoopa, Yurok, and USFWS jointly hire an expert in mark-recapture analysis to aid them in their assessment and that the same analytical methods and reporting structure are used for both trapping sites. Ideally, the analysis would also include a simulation component to evaluate the efficacy of changing trapping and marking efforts, to evaluate the effects of reducing effort in the case of budget limitations, and to provide recommendations for improving current estimates.

The SAB does not support continued collection of RST data until the existing information has been thoroughly analyzed to determine the bias and precision of outmigrant estimates. The analysis we suggest is critical to determine if the current program is adequate, or whether additional trapping and marking is required to meet accuracy and precision objectives. We understand that funding is limited and this request is beyond current contract requirements. If funding in 2007 is not available to support this assessment, we suggest that trapping efforts in 2007 be substantially reduced and resources reallocated to complete the assessment (including peer-review and workshop

presentation) well in advance of the 2008 field season (e.g. fall 2007). The analysis should be a highly collaborative effort among senior biologists from the Hoopa Valley and Yurok tribes, the USFWS, TRRP, and an external mark-recapture expert. The cost and time for the analysis should not be underestimated. It involves synthesis of 6-7 years of historical data into a readily accessible electronic format, multiple workshops (review of estimates and training on mark-recapture analysis), preparation of draft and final reports, and presentations at a final workshop.

Sub-objective 3.3: Investigate impacts of predation, competition, and genetic interactions between hatchery and natural anadromous fish.

This section does a good job of briefly summarizing the potentially negative effects of Trinity River Hatchery (TRH) operations on the productivity of naturally-spawning fish. Based on assessment of hatchery impacts in other systems (Berejikian and Ford. 2004), impacts of the TRH are potentially very significant given:

1. the high likelihood of negative competition interactions due to releases of approximately 5,000,000 chinook and 800,000 large steelhead smolts at the upper limit of anadromous habitat in the mainstem.

2. the high likelihood of considerable introgression of divergent hatchery and wild genomes resulting from long-term use of hatchery-origin broodstock and the high proportion of hatchery-origin fish spawning in the mainstem.

The most informative way of determining the extent of hatchery impacts on natural reproduction would be to conduct an Adaptive Management experiment where the number or hatchery releases was substantially reduced as recommended for the Klamath River by the National Academy of Sciences (NRC 2004). Alternatively, competitive interactions could be reduced by releasing fish near the Trinity-Klamath confluence. As TRRP does not control hatchery operations, and reductions in releases or changes in release locations will likely cause severe reductions in harvest over the short-term, it seems reasonable to first test the hypothesis that flow and habitat restoration will increase the number of naturally produced fish under the current hatchery regime. If this does not occur, a logical next step might be to reduce hatchery production or change the release location to determine if this increases natural production. These broad experimental design decisions should be summarized in Chapter 2 of the IAP.

Given the likely current experimental scenario that does not change hatchery production, inferences from competition/predation studies focused on the effects of hatchery operations on natural reproduction will probably be weak. It may be possible to evaluate hatchery effects by tracking within-season changes in competition and predation before, during, and after major hatchery release periods. Inferences from genetic studies may also be quite weak even in the event that hatchery production is reduced in the future. Gene flow between natural- and hatchery-origin fish is high because a large proportion of fish spawning in the mainstem Trinity River are hatchery-origin fish (e.g. typically > 60% of fall-run Chinook in recent years, Sinnen et al. 2006). It is therefore unlikely that

differences in the frequency of neutral alleles between hatchery- and natural-origin fish would be found. However, the hypothesis that fish spawning at downstream locations are spatially isolated from a hatchery-origin fish is certainly possible and could be evaluated relatively inexpensively. It also seems reasonable to monitor the segregation of spring and fall as changes in flow influence adult in-river migration timing and therefore have the potential to influence the extent of hybridization among races.

There is likely wide variation in the feasibility and inferences of hatchery-focused performance measures. The ratio of hatchery- to natural-origin spawners is reliably estimated and is a key component for evaluating program success. This metric is of course only possible if hatchery fish are marked, hence it is logical that TRRP contribute to the cost of marking fish at TRH. Comparing fitness of hatchery- and wild-origin spawners has been made in a limited number of cases (see review by Berejikian and Ford 2004) based on determining the pedigree of returning fish (identifying whether their parents were natural- or hatchery-origin or both), however it is very unlikely that such a study is feasible for the Trinity River. One would basically have to take a DNA sample from all hatchery broodstock and all fish at the Willow and Junction City weirs. Even if this was done, failure to find differences in reproductive success (returns per spawner) does not imply that TRH operations have not altered the fitness of the original wild population as the fitness of natural-origin spawners could already be degraded by introgression in previous generations. Examination of differences in the frequency of neutral alleles between spring and fall Chinook and for spawners at upstream and downstream locations is feasible and likely relatively inexpensive and may have management utility. Evaluation of competitive interactions between wild and hatchery origin-fish would be possible through field surveys of fry and parr before, during, and after major release periods. Predation rates could be directly measured over these periods via tethering experiments (Biro et al. 2003 and 2004).

Sub-Objective 3.4 Increase natural production of anadromous salmonids by providing suitable adult holding and spawning temperatures and suitable thermal regimes for outmigrating smolts

This section is clearly written and documents the key temperature-related hypotheses and required analyses. There is however one fairly significant inconsistency that relates to experimental design. The IAP authors clearly acknowledge the uncertainty on the impacts of elevated water temperatures on pre-spawn mortality, egg viability, and smolt survival and health. However, to provide a meaningful assessment in the field, variation in temperature regimes among years will be required. It will be difficult to reduce uncertainty about temperature effects if the extent of temperature variation is purposefully reduced to meet 'compliance' water temperature objectives. As mentioned in Section 2 of our report, the IAP should describe the extent of water temperature experimentation that will be conducted.

There is no mention of evaluating water temperature effects for fish that reside in the mainstem Trinty (coho, steelhead, yearling Chinook) over the summer. This should be

assessed (e.g. field comparisons of growth in years with warm vs. relatively cool water temperatures).

The TRRP should consider using oxygen isotope ratios (O^{16}:O^{18}) in otoliths of returning fish or smolts captured in the Klamath Estuary to understand the temperature-morality relationsip. The temperature history of individual fish can be reconstructed to within 1^0C based on an analysis of the chemical composition of the otolith (Thorrold et al. 1997; Hoie et al. 2003). The basis for temperature reconstructions is that oxygen incorporated into carbonates (such as the otolith) includes both of the major stable isotopes (^{18}O and ^{16}O). Normally, one would expect them to be deposited in equilibrium with their concentration in the water. However, there is a physical fractionation due to temperature at the time of deposition, such that the proportion becomes increasingly depleted as temperature increases. As a result, if the ^{18}O:^{16}O in the ambient water is known, and if the ^{18}O:^{16}O in the otolith can be measured, the temperature regime that the fish was exposed to can be calculated. With the recent development of computer-controlled otolith micromilling devices, small regions of the otolith (~ 50 μm in width) can be sampled and assayed, thus providing temporal resolution on the order of a week (Campana 1999).

Objective 4: Restore numbers of naturally produced salmon and steelhead to pre-TRD population levels in the Trinity River.

This is a clearly written section that requires little comment. There are a few very important issues that are identified and need to be resolved in the IAP.

1. Perhaps the most important metric for the TRRP is the residuals from the spawner-to-smolt relationship at the North Fork RST site. Chinook are priority species, yet the escapement estimate for fall Chinook at the Junction City weir does not include the late component of the run. Extending operation of the fence through the entire fall Chinook adult migratory period should be a top funding priority.

2. Steelhead and coho have much longer freshwater residency relative to fall Chinook and are will therefore potentially show a greater positive response to temperature and habitat improvements. Although it is likely that reasonable estimates of steelhead smolt production at the North Fork trapping site can be obtained (Green et al. 2004), there is no estimate of winter/spring steelhead adult run size. A spawner-to-smolt analysis for steelhead is therefore not possible, forcing the TRRP to assume that steelhead escapement does not limit smolt production. It will be important to determine the feasibility and cost of estimating total steelhead escapement.

The methodology for using hatchery releases as a control to measure the relative success of naturally-produced stocks briefly described in the text needs to be expanded.

The comment on p. 43 (line 18) implies that altering the number of hatchery releases will change the ratio of natural- to hatchery-origin spawners. It is of course true that if hatchery releases are reduced and natural production remains constant the ratio of natural-to-hatchery origin fish will increase. A better metric would be the number of naturally-produced adult returns to the Trinity River, computed as the natural-to-hatchery ratio at the fence times the total escapement. This metric would not be sensitive to changes in the number of hatchery fish released and is more directly related to TRRP objectives.

Objective 5: Facilitate dependent tribal, commercial, and sport fisheries' full participation in the benefits of restoration via enhanced harvest.

This section clearly establishes the linkage between harvest management and TRRP goals. Estimating the catch of Trinity River salmon and steelhead is an important component of run reconstruction and is therefore necessary to calculate the performance measures for objective 4. Thus, TRRP should provide some support for data collection and analysis to determine the number of fish that have been harvested.

Returns of naturally-produced salmon and steelhead to the Trinity River will be determined by escapement in the previous generation (i.e. extent of 'seeding'), freshwater habitat conditions (flow, temperature and physical habitat), wild-hatchery interactions, estuarine and marine survival rates, and harvest rate. The central hypothesis in the ROD is that habitat (flow, temperature, and physical habitat) limits salmonid production in the Trinity River and is therefore the key determinant of the number of returning fish. An alternate and credible hypothesis is that adult returns are currently limited by low escapements due to the combined effects of excessive harvest and low estuarine/marine survival rates. There is not sufficient evidence to reject this non-habitat hypothesis. Thus, if the TRRP is serious about the Adaptive Management component of the program, they must reserve the right to provide advice on harvest, regardless of whether that advice will be accepted by the Pacific Fisheries Management Council (PMFC) that are ultimately responsible for regulation. As many of the TMC members sit on the PMFC, and the Hoopa Valley and Yurok tribes are entitled to 50% of the harvest, it seems hard to imagine that recommendations on harvest from the TRRP would be completely ignored.

Failure of the TRRP to recognize their role in advocating for specific harvest rates strains the credibility of the Adaptive Management component and may severely compromise the programs ability to assess the benefits of the recommended ROD experiment. Consider a future scenario where habitat improvements result in the desired restoration of alluvial river attributes specified in the ROD, flows are generally sufficient to meet water temperature objectives, but the number of salmon and steelhead returning to the Trinity River is low due to the combined effects of excessive harvest and reduced marine survival. Restoration efforts might be working, but it won't be possible to document the benefits based on smolt production or adult returns. In this case, it is hard to imagine that the TMC and TRRP would not strongly advocate for a reduction in harvest rate to determine the effectiveness of habitat restoration efforts and for conservation reasons.

The interaction between the hatchery program and harvest rates should also be recognized. The large number of hatchery releases support an extensive fishery resulting in a higher harvest rate on naturally-produced spawners than would probably occur in the absence of hatchery production. Thus the hatchery program is potentially a double-edge sword, reducing productivity of natural spawners through genetic and ecological interactions, and by increasing the fishing mortality rate.

Identification of Core Assessments

1. Estimate number of naturally-produced adults for fall and spring Chinook, coho, and steelhead at Willow Ck. and Junction City. This requires both escapement and harvest estimates.
2. Estimate outmigrant run size, timing, and condition at the North Fork and Weitchpec trapping sites.
3. Estimate broad-scale fry distribution and abundance above the North Fork.
4. Estimate number and distribution of redds above the North Fork.
5. Investigation of effects of hatchery releases on the productivity of natural spawners with an emphasis on ecological impacts (predation and competition).

6.0 Riparian

Objective 6: Establish and maintain plant communities that support fish and wildlife

General comments

The problem statements are well defined and are largely supported by the Record of Decision. The ROD statement about "significant restoration of pre-dam riparian conditions along the Trinity River" (page 24, paragraph 2) may conflict with the overall strategy of the fisheries component of the ROD and Trinity River Restoration Program. Taken literally, restoration of riparian vegetation and wildlife is an expected benefit of fish restoration rather than a clear objective. The Flow Evaluation Alternative guiding the Program does not include the very high discharges that occurred before the Trinity River damming, and accordingly, the channel and flood plain dynamics will likely be different (less) under the Program actions than under pre-dam conditions.

Compared to pre-ROD implementation, ROD-prescribed flows and gravel augmentation are expected to increase post-dam channel and flood plain dynamics, but likely not to pre-dam levels. The objectives in the IAP apparently recognize this possibility by not tying amounts of riparian vegetation to pre-dam amounts, what ever they may have been. The IAP objective is to simply "promote healthy riparian vegetation" (page 45, line 42) but it is not clear in the IAP how much riparian vegetation is desirable for fish and wildlife habitat needs. In contrast, wildlife (see next section) and fish objetives use pre-dam amounts as desired levels.

Sub-objective 6.1: Maintain diverse riparian communities on different geomorphic surfaces via natural successional processes and plantings

While the overall objective in the IAP is to promote riparian vegetation, the sub-objective aims to maintain it. Although both terms are vague and not measurable, they still have different enough meanings. The present, short-term aspect of maintenance is related to replacing vegetation lost during site rehabilitation projects. Although there may not be enough information now to specify long-term desired levels of riparian vegetation, using both "promote" and "maintenance" will make refining the assessment difficult, because promotion can not occur indefinitely and eventually, some desired level is needed to know when promotion stops and maintenance begins. Despite this conflict in terms, the lack of desired amounts (composition, area, quality, etc) are mentioned as issues to address in the IAP. Essentially, the mapping effort serves as inputs to wildlife habitat modeling and accounting for losses in site rehabilitation projects.

The performance measures would be obtained via mapping vegetation. Given the general purposes of Objectives 6 and 7 (wildlife), mapping is a reasonable way to proceed and some map purposes are proposed that would guide the effort. However, details need to be

worked out to define mapping units that would be associated with assessment purposes; this is acknowledged in the issues section.

Sub-objective 6.2: Prevent riparian encroachment that restricts alluvial processes and degrades aquatic habitat quality

Berm development under post-dam, pre-ROD flows motivates this objective, and the strategy to prevent or at least detect encroachment is vigilant because even young woody plants near the low flow channel are expected to be resistant to removal by streamflow under the ROD. Encroachment detection is part of the mapping effort in sub-objective 6.1, and the main strategy for this sub-objective is process-based. The primary question is how can encroachment be limited.

Detection and process are theoretically related. Typically, the active channel is defined by the lower limits of perennial vegetation (Hedman and Osterkamp 1983, Hupp and Osterkamp 1985), and the streamward spread of vegetation is a natural process. The boundary of the active channel shifts with flow regime. After large floods, vegetation rapidly retreats and then spreads streamward and reaches an equilibrium during several seasons with low to modest flows. The equilibrium boundary is likely determined by the low flows, not high, yet the Program seems to rely on high flows to define (or maintain) the equilibrium boundary. There is some confusion about active channels and vegetation in the IAP where a potential performance measure is "area of exposed bars within the active channel with established vegetation" (page 48, lines 47 to 48). Does this approach use a definition of what the "active channel" is that's independent of vegetation? Is there some notion that exposed bars should not have vegetation on them?

The only hypothesis regarding encroachment is that "woody vegetation older than three years old cannot be removed under the ROD flow regime"(page 48, line 4). The next sentence rejects the hypothesis, deems older woody vegetation is needed for the aquatic system, and presents a series of potential factors that could determine near-channel vegetation conditions. The IAP seems to acknowledge the evolution of the Program's opinion on encroachment beyond the vertical scour approach to removing young woody plants.

Encroachment has broader implications: if young woody plants are generally, truly resistant to flows under the ROD, then long term maintenance of habitat via flows is in jeopardy. But objectives related to the Program's action to reinitiate fluvial processes could also assess encroachment, because less encroachment follows from a more active channel. The channel complexity objective (1.2) can incorporate encroachment on this assessment's spatial scale, which seems to be broader than the site-by-site approach used for detecting encroachment in the past and in the IAP (page 49, line 6). The encroachment assessment (6.2) may well be incorporated into the channel complexity assessment (1.2). If monitoring reveals that complexity does not increase and encroachment does, then detailed investigations into encroachment process is more warranted. Encroachment and channel simplification were outcomes under post-dam,

pre-ROD flows, but the amount of new channel complexity, particularly from high flows and gravel augmentation, should indicate the level of encroachment and possibly motivate detailed studies on encroachment processes.

A firmer understanding of fish use in flooded, vegetated areas (including at low flow) should refine the encroachment problem. In other words, let fish "draw the line in the gravel" rather than a preconceived notion on where that line should be. Has much of the Program's experience relied on simple channel narrowing at sites that may not be prone to bank scour regardless of vegetation? The IAP acknowledges that undesirable encroachment needs to be defined (page 48, lines 30 to 33, page 49 line 4), and presents some desirable (gently sloping bars devoid of vegetation) and undesirable (vegetated berms) examples (page 48, line 40). There should be guidance in the literature or from Trinity River fish use-data to define undesirable combinations of vegetation, topography, and water depths and velocities. For example, complex bar topography with woody vegetation may be better fish habitat than a simple bar without vegetation. It is difficult to detect something if you don't know what it is. Coordination between vegetation and fish assessments should help solve this problem.

Wildlife

Objective 7: Restore and protect wildlife habitats and restore wildlife populations to a level approximating that which (sic) **existed pre-TRD.**

General Comments

The problem statements are well-defined and are largely supported by the Record of Decision if restoration is interpreted as an objective, or an expected benefit arising from fish management. It was difficult to find justification for riverine bird assessment in the ROD. As with the riparian vegetation assessment, the statement in the ROD about "significant restoration of pre-dam riparian conditions along the Trinity River" may also conflict with the overall strategy of the fisheries component of the ROD and Trinity River Restoration Program. Besides the pre-and post-dam flow contrast mentioned in the Riparian general comments, there may be temperature conflicts. The pre-dam channel below Lewiston may have been warmer in late summer than under ROD flows that manage temperature for cold-water salmonids. Neither the ROD or IAP are clear about what "riparian conditions along the Trinity River" are being "restored". With fish, the approach is to transfer important conditions that were lost above the dam to the reaches below the dam, as well as retaining important conditions below the dam to provide a mix of habitats for species that used both reaches before damming. Regarding wildlife, perhaps the above-dam habitats would serve as a more appropriate reference for wildlife that lived there. Although the channel and vegetation conditions may be mimicked below the dam under the ROD, the temperature regime of salmonids may not be appropriate for warm-water reptiles (western pond turtle) The warm-water species may have thrived in the below-dam reaches before damming, but ROD flow and temperature regimes may create stresses for warm-water species (particularly temperature). Increased channel

complexity may provide cool and warm temperature regimes depending on local velocity and depths, but there is no assessment of local temperatures in various channel types as they (hopefully) form under the Program.

For terrestrial riparian wildlife, flood plain vegetation structure (horizontal and vertical) is likely a primary wildlife habitat factor. The IAP will use pre-dam conditions as a reference for wildlife habitat, but it is not clear if above- or below-dam reaches (or both) will be used.

The proposed over-all assessment strategies and rationale for wildlife mentions that western pond turtle and Foothill yellow-legged frog have shown negative responses (population declines?) to channel morphology and flow dynamics since dam construction. The ROD Program actions will not restore the likely pre-dam temperature regime to the below-dam reaches, and even if expected changes in channel morphology and vegetation under the ROD are favorable to turtles and frogs, there still should be some attention on temperature regimes in the IAP to test whether it will be a limiting factor.

Sub-objective 7.1: Enhance quality and maintain quantity of riparian bird nesting and foraging habitats to maintain bird populations as restoration is implemented.

The first assessment under this sub-objective estimates riparian bird habitat that existed pre-dam and pre-ROD. Bird populations are then estimated from the estimates using statistical models. Beyond the issues related to above-or below-dam reaches mentioned above, there is a potential problem in estimating vertical structure from aerial photographs. Vertical structure (foliar layers, trunk decay levels, branch sizes, etc.) are important avian habitat features (MacArther and MacArther 1961, Bottorff 1974, Scott et al. 2003) Perhaps historic ground-based photographs could refine the vertical structure within types visible on aerial photographs. The length of the pre-dam period is not defined, and the dam influence is not the only contrast in habitat in recent times. Gold mining also altered the channel and flood plain, for example.

The retrospective estimate could reveal that riparian vegetation abundance or structure differed between the pre-dam period and post-dam, pre-ROD period. If so, which period will be the reference for the ROD implementation? The IAP mentions a decision regarding recovery targets for riparian bird populations that would depend on the historic habitat estimates, but no decision rule is provided even though the decision may profoundly impact management actions and assessments.

The second assessment under sub-objective 7.1 carries on from the first by estimating abundance, species diversity, or productivity under ROD implementation. Such estimates will be compared to targets derived using the previous assessment. Beyond the broader issues of reference areas and reaches, the assessment approach appears reasonable at the very general level it is presented. Some references for the statistical models would be helpful so that one would know whether they were available or to be developed, and how reliable they are.

Sub-objective 7.2:Enhance quality and maintain quantity of riverine bird nesting and foraging habitats to maintain bird populations as restoration is implemented.

This assessment will track habitat changes along with target species abundance and productivity. The targets for bird abundance mirrors bird behavior: that is, the target flies along with changes in river and riparian conditions rather than being fixed on a reference or desired level (page 52, lines 19 to 21). Of course population or habitat targets are rarely absolute and fixed over time, but as written, "targets" for riverine birds has a looser than usual connotation.

Loose targets don't preclude sampling for the purposes of the ROD (if it indeed includes riparian birds as a purpose), and much of the reason for loose targets may be less understanding of bird abundances. By definition, riverine birds rely on aquatic resources and thus interact with fish in positive or negative ways.

Productivity will be assessed using age ratios (page 52, line 23), but precise terms should be used in this context. We suspect that development classes such as eggs, juveniles, adults will be used in the ratios rather than an age metric such as weeks or years.

Sub-objectives 7.3 to 7.5

These sub-objectives incorporate habitat and demography of western pond turtles and Foothill yellow-legged frogs. Much of it parallels the assessments for riparian birds.

In general, the assessment descriptions for wildlife are relatively short compared to salmonids, but one would expect similar complexities in assessments. Their efficacy is difficult to judge with the given information.

Sub-objective 7.6: Determine whether additional native riparian or aquatic associated wildlife
(other than birds and current target species) are affected by Program management actions?

This sub-objective is open ended for potential species, but considers only bull frogs in the assessments which are in the trial stage. Assessments for other potential species are apparently in the very early developments stage, and there is not much to say about it.

Core Assessments for Riparian and Wildlife Resources

The following priority list is based on an assessment's connection to the primary management action in the ROD (fish habitat creation, temperature management, and fish stock increases), justification in the ROD, integration with other assessments, and apparent efficacy. The list is taken from Table 2.1 of the IAP.

Assessment	Purpose	Priority	Reasons
6.1	Characterize the state of riparian vegetation on different geomorphic surfaces at multiple spatial scales	1	Integration with wildlife habitat assessments, moderate connection to ROD, legal compliance
6.2	Predict and monitor the effects of management actions on the state of riparian vegetation near the channel margin	10	Incorporate with 1.2
7.1a	What amount of riparian bird habitat was available pre-TRD and pre-implementation of Program actions?	2	Moderate connection to ROD, basic understanding of system
7.1.b	Has abundance, species diversity, or productivity of riparian birds changed?	5	Low connection to ROD, unclear efficacy
7.2	Has abundance or productivity of riverine birds changed?	9	Unclear connection to ROD, low apparent efficacy
7.3	Has habitat quality and quantity and/or population abundance, distribution, or reproductive success for FYLF changed?	3	High connection to ROD
7.4	Has diversity of aquatic and terrestrial habitats for WPT changed?	4	High connection to ROD
7.5	Has WPT recruitment changed?	6	High connection to ROD, apparent low efficacy
7.6a	Has implementation of Program actions created or increased aquatic and/or terrestrial habitats for invasive wildlife species, e.g., Bullfrog, that are potentially detrimental to fish and riverine or riparian associates?	7	Vague, open-ended
7.6b	What methods could most reliably detect changes in nontarget, native wildlife species?	8	Exploratory

7.0 Peer Review and RFPs

In reference to Policy Issue #4, "Process for peer review and RFP's", we agree that the IAP should outline a peer review process for "rehabilitation, monitoring and study designs as well as proposals and reports". Such a process applied across the board should be encouraged in order to assure accountability, documentation and scientific credibility for the overall TRRP.

As outlined in Appendix B "A proposal for an RFP based Science Process..." the drafting of "statements of work" and use of Expert Review Panels in developing RFPs is to be encouraged. Proposals submitted in response to specific RFP's should be reviewed by an Independent Review Panel with a written response as to why (or why not) a proposal is acceptable in response to an RFP (this may include scoring and ranking criteria). The proponents of the proposal should in turn respond to the review as to how they may adjust the proposal to address the peer review concerns.

As was stated during Day 2 of the IAP review there are two important elements of a peer review: 1) focus on the relevance of the proposal; and 2) the timing and quality of the deliverables. Insist on timely delivery of progress reports and peer review of final reports. Without documentation throughout the life of the TRRP, institutional knowledge will be lost along with any assurance of continuity. This is of particular concern as staff turnover within groups and agencies occurs.

The concern over the language from the Trinity River Mainstem Fishery Restoration EIS/EIR, October 2000 stating that "all monitoring and studies will be awarded through a competitive process using RFP's and independent outside review panels" is where TMC policy should focus. Not all scopes of work need to be submitted for competitive bids from outside entities. The TMC should determine which are to be so, and identify those that are more appropriate for interagency or tribal MOAs. In any case all proposals should respond to statements of work in RFP form with subsequent review as outlined above.

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