		KARUK TRIBE COMMENTS	
Page	**¶**	**Reviewer Comment**	**Change to Report Text or Response to Comment**
Big picture		*There is no recognition that increased winter/spring flows could scour fine sediments and result in reduced populations of aquatic macrophytes and therefore improved summer DO and pH conditions. Higher flows could also direct (i.e. in addition to effects on substrate) reduce macrophytes by dislodging/destabilizing them. Yes, water temperature is the primary water quality impairment, but if there will be flow and geomorphic studies conducted they should be designed so that results will also be useful for addressing the other important water quality issues.*	Agree. These general comments were incorporated into the latest Draft Plan in response to your more specific comments below.
Big picture		*Water temperatures for summer rearing are critically important limiting factor for coho salmon, but there does not appear to be a proposal in the plan for basin-wide mapping of thermal refugia. Places to look for and map potential micro-scale thermal refugia would be: diffuse springs, hyporheic flows at downstream ends of meander bend gravel bars (and side channels), and below beaver ponds. A thermal infrared survey of the Shasta River was conducted by Watershed Sciences in 2004 for the development of the Shasta River TMDL, this can be utilized to identify possible thermal refugia habitats,* *Watershed Sciences LLC. 2004. Aerial Surveys using Thermal Infrared and Color Videography Scott River and Shasta River Sub-Basins. Performed under contract for U.C. Davis and the NCRWQCB. Watershed Sciences, Corvallis, OR*	Agree. These general comments were incorporated into the latest Draft Plan in response to your more specific comments below.
Big picture		*Lack of focus on surveying/mapping the factors that create the physical habitat structure/complexity required by coho salmon. The slow-water habitats with complex cover favored by coho salmon for both summer and winter rearing are formed by obstructions: large wood and beaver dams (Pollock et al. 2004, Reeves et al. 1989). There should be a basin-wide mapping of where these features are located (or at least, it should be integrated in with other studies). The plan does propose excellent studies for assessing how to restore riparian forests which will be the future source of large wood; however, the potential role that beavers could play in coho restoration does not received sufficient emphasis in the plan. An assessment of the factors limiting beaver populations (e.g. is it human predation, lack of riparian forests, channelization, etc.) should also be conducted. In terms of cost-effectiveness for coho recovery, increasing beaver populations merits higher prioritization in the study plan.* *Pollock MM, Pess GR, Beechie TJ, Montgomery DR. 2004. The importance of beaver ponds to coho salmon production in the Stillaguamish River basin, Washington, USA. North*	These general comments were incorporated into the latest Draft Plan in response to your more specific comments below.

		American Journal of Fisheries Management 24:749–760. *Reeves GH, Everest FH, Nickelson TE. 1989. Identification of physical habitats limiting the production of coho salmon in western Oregon and Washington. US Forest Service General Technical Report PNW 245.*	
19		It is unclear if/how the list of the 27 life-history tactics is sorted. The table would be improved by grouping in some logical order (i.e. by species or spawning area), or if there is already a logical order, then explain it)	Changed the ordering in Table 5 – first mainstem then tributaries from top of basin -
)21		Somewhere in the "3. Contemporary Streamflow And Habitat Conditions In The Shasta Basin", please list/cite the most recent CDFG Shasta River reports (even though they focus mostly on fish monitoring rather than habitat): Chesney D. and M. Knechtle. 2010. Shasta River Chinook and Coho Salmon Observations in 2009-2010 Siskiyou County, CA. Chesney D. and M. Knechtle. 2011. Shasta River Chinook and Coho Salmon Observations in 2010-2011 Siskiyou County, CA. Chesney, W.R., C. Adams, W.B. Crombie, H.D. Landendorf, S. Stenhouse, and K.M. Kirkby. 2009. Shasta River Juvenile Coho Habitat & Migration Study. Available from: http://www.klamathriver.org/Documents/CDFG-Juvenile-Coho-2009.pdf Daniels, S.S., A. Debrick, C. Diviney, K. Underwood, S. Stenhouse, and W.R. Chesney. 2011. Final Report Shasta and Scott River Juvenile Salmonid Outmigrant Study, 2010, P0710307.	Included as recommended in Section 3.6.1.
29		The pH objectives should also be mentioned. While the Shasta River is not officially listed as pH-impaired, the pH objective of 8.5 is exceeded in portions of the Shasta River mainstem during the summer months (for example, see graphics in Appendix A of the Shasta TMDL).	Addressed in your other comments.
29-30		Regarding the "Water Quality Standards" section The region-wide (including Shasta River) dissolved oxygen objectives are currently in the process of being revised by the NCRWQCB, although the revision is moving slowly (several year process) and it not complete yet. It would probably be good to end this section with a sentence like "The NCRWQCB's region-wide (including Shasta River) dissolved oxygen objectives are currently in the process of being reviewed/revised, so may change in upcoming years (http://www.swrcb.ca.gov/northcoast/water_issues/programs/basin_plan/dissolved_oxygen_amendment.shtml)."	Recommended additions made under "Water Quality Standards"
32	4	Regarding the "Livestock Exclusion Fencing from Riparian Zone" section. Is the Mattson (2007) *Effectiveness Monitoring Year End Report for 2007 and Final*	Agree. Changed to the 2008 reference.

		Report (Draft 11/30/07) document cited an older version of the following 2008 document (if so, should the citation be updated?), or is a completely separate: Mattson K. 2008. Effectiveness Monitoring of Restoration Projects in the Shasta Basin. Prepared for the Shasta Valley Resource Conservation District by Ecosystems Northwest, Mt. Shasta, CA. 31p plus appendices. Available online at: http://www.ecosystemsnorthwest.com/pdf/Effectiveness%20Monitoring%20Shasta%20without%20appendices.pdf	
36	10	This is somewhat awkward wording: "Both these reaches provide abundant Chinook and Coho salmon, and steelhead spawning and rearing habitat, and are key to recovering several salmon and steelhead LHTs." Suggested revision: "Both these reaches provide abundant spawning and rearing habitat for Chinook and Coho salmon, and steelhead, and are key to recovering several salmon and steelhead LHTs."	Editorial changes made.
42-43		In Section 5 of page 42, it is stated: "Study Plan Element #2: Instream Flow Studies" whereas on page 43 in section 5.2, it is stated "Study Plan Element #2: Physical Habitat Assessment for High Priority LHTs" The titles should be standardized, because they are the same sections.	Yes. Using "Physical Habitat Assessment for High Priority LHTs"
46	1	Regarding "Do thermal refuges exist in upper Parks Creek, Willow Creek, Little Shasta River, Yreka Creek, and other tributaries for summer Coho and steelhead rearing? Are there temperature barriers preventing fish from reaching these thermal refuges?" - What about mainstem refugia (the sentence only mentions trib refugia)? - This is posed in the report as a key question, but the proposed studies do not appear to address it, is that intentional (or an oversight, or prioritization)? Note: "Task 8B1 Assess Coho Rearing in the Upper Shasta River" does address mapping of thermal refugia in the Upper Shasta, but not the tribs. - Recommendation: a survey/inventory of the locations of thermal refugia that is accessible (or potentially accessible) to coho salmon should be a high-priority study. Places to look for and map potential micro-scale thermal refugia would be: diffuse springs, hyporheic flows at downstream ends of meander bend gravel bars (and side channels), and below beaver ponds. Begin with a review of the Watershed Sciences LLC. 2004 document cited above as well as Chesney et al. 2009.	Short sub-section added at end of Task 3-1 for water temperature monitoring at inventoried thermal refugia. Editorial changes include mainstem refugia.
46	2	Regarding: "Are the salmonids that utilize summer thermal refuges surviving?" - This is posed in the report as a key question, but the proposed studies do not appear to address it, is that intentional (or an oversight, or prioritization)? - Refer to Chesney et al. 2009 for existing information on juvenile salmonid survival in the Shasta River Basin.	"Survival", as used here, is presence at summer's end. Until limited recovery occurs, the absence of juvenile coho would not adequately measure the usefulness of these specific habitats. However, thermal refuges might be some of the first locations where increasing juvenile abundance might be seen (certainly in the Canyon). Section 8B1 was slightly modified to make the intent clearer that thermal refugia should be

			monitored for juvenile coho.
46-48		Regarding the section "Task 3.1: Expand Water Temperature Data Collection and Develop Temperature Models" - While all parts of this section relate to better understanding water temperature conditions, it seems like actually this section contains 3 separate sub-tasks, and maybe should be split up: o Water temp monitoring at river, tribs, springs. This is long-term trend monitoring (i.e. to track if conditions are getting better/worse), and protocols for monitoring will be relatively straightforward. o Tailwater monitoring: this is more a special study, and will need different protocols. For example, tailwater is not constantly on (it cycles on/off) and it is important to know when it is off because otherwise it is difficult to differentiate between air temps and water temps when looking at the resulting data. o Develop water temperature models: There is very little information presented on the ways in which the existing temperature model needs to be improved; some justification should be provided if this task stays in the plan. What are the goals of this sub-task? Is it to better predict existing conditions? Future conditions? Unimpaired conditions? Is the idea to tweak internal model parameters (heating coefficients, etc.) or is to get better model inputs (mapping groundwater inputs, riparian shade, etc.). Or is it basically just to run new scenarios (i.e. different flows) in the existing model? Note: since a model already exists, this might be better referred to as "refine" or "improve", not "develop". o Our recommendation would be to develop a model that evaluates how to maximize temperatures in locations were suitable temperatures exist. Exploring changes in points of diversion as well as re-using tailwater rather than returning it to the creek thereby reducing the need for extraction of cleaner water for irrigation would be feasible projects leading to improved water quality for salmonids.	Seems fine to me as is.
48	7	Regarding the <u>DO and Nutrients</u> section: pH should be listed as an additional parameter of concern. While the Shasta River is not officially listed as pH-impaired, the pH objective of 8.5 is exceeded in portions of the Shasta River mainstem during the summer months (for example, see graphics in Appendix A of the Shasta TMDL).	Agree. A similar version of your text included under Task 3.2 introduction.
48	7	In the <u>DO and Nutrients</u> section, mention should be added regarding the role that inadequate scour and flushing flows play in promoting the excessive growth of aquatic macrophytes (aquatic plants) than degrade DO and pH conditions. For example, see discussions of scour in the Shasta TMDL including this except from page 7-5: "Regional Water Board staff believe that such reductions in aquatic vegetation	Attenuated peak streamflows are an issue not adequately addressed in the Plan. Of first priority, the mainstem channel upstream of the Parks Creek confluence has accumulated fine sediment that now dominates the aquatic/riparian ecosystem. Fine sediment blankets vegetation, creating potential DO problems and eliminating important 'scud' habitat for rearing

		standing crop, and associated reductions in photosynthetic and respiration rates, are achievable in the Shasta River. In the field, the mechanisms that would result in these reductions include… Increased flushing flows to scour the channel of accumulated fine sediments that promote the establishment and proliferation of rooted aquatic macrophytes." Higher flows could also directly (i.e., in addition to effects on substrate) reduce macrophytes by dislodging/destabilizing them. Research is needed regarding how pulse flows or other changes to the hydrologic regime could be used to scour fine sediments and aquatic macrophytes, thereby improving water quality. This should be integrated in with the geomorphic and flow studies proposed in the plan.	juvenile salmonids. Peak flows below Dwinnell Dam are briefly addressed in the Big Springs Complex IFN report; CDFG did arrange a pulse flow though post-monitoring was insufficient. At the other end of the river, Shasta Canyon also is highly affected by aquatic vegetation. From panoramic photographs beginning in 2007 through 2011, the absence of a 'big' flood has allowed clear encroachment of sedge clumps into many bench and point bar locations. The observation that encroachment is occurring so rapidly implies that past flood peaks have been at least partially effective at curtailing encroachment. We are skeptical that bigger flood peaks through the valleybottom (e.g., below the Big Springs confluence) will significantly scour-out macrophytes. But other important geomorphic processes will need higher peak flows. Although there is much more to say, the Plan was revised to include specific investigations regarding as you recommended. Refer to p.48 for text added.
49	5	The discussions of "Integration with other tasks" for water quality should mention how the geomorphic and flow studies could contribute to understanding of how scour could be used to reduce macrophyte growth.	Agree. Text added as recommended.
48	8	Regarding the <u>Pesticides and Herbicides</u> section: It is good to see pesticides mentioned as a potential issue (this is often overlooked), but this paragraph should be re-written to include more up-to-date information and more specifics. Here are some suggestions/info/comments for revising the section: There are no specific steps proposed for assessing the potential impact of pesticides on salmonids on the Shasta River sub-basin (it is just mentioned as general topic of concern). It seems like a logical first step would be the query/summarize the detailed information available in the geo-referenced publically-accessible pesticide use databases to determine which pesticides are used in the sub-basin that have potential toxicity to salmonids or aquatic macroinvertebrates. Then if any seem particularly significant, further investigations such as the collection/analysis of water samples or farmer/applicator interviews could be conducted. This statement seems out of context: "More than 50 pesticides are used by refuge farmers (Snyder-Conn 1997)", because the "refuge" area referred to is not defined until later in the paragraph ("Klamath Basin Wildlife Refuge waters"). As a result of a lawsuit filed under the Endangered Species Act against EPA (Washington Toxics Coalition, et al. v. EPA) a federal judge issued a ruling in 2004 to establish buffers adjacent to certain "salmon-supporting waters" in Washington,	Agree. Additional text and table was added to this section.

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<td>Oregon and California for applications of 34 pesticides with potential to harm salmon (http://www.epa.gov/espp/litstatus/wtc/maps.htm). A query of the California Department of Pesticide Regulation (CDPR) California Pesticide Information Portal (CalPIP, http://calpip.cdpr.ca.gov/main.cfm), indicates that at least 11 of these 34 pesticides were applied in Siskiyou County in 2010 (county-level queries are much simpler to do in the database than queries by watershed):
<table>
<tr><th>Chemical Name</th><th>Pounds Applied in Siskiyou County, 2010</th></tr>
<tr><td>Captan</td><td>5,793</td></tr>
<tr><td>Chlorothalonil</td><td>4,960</td></tr>
<tr><td>Metribuzin</td><td>3,862</td></tr>
<tr><td>Pendimethalin</td><td>1,982</td></tr>
<tr><td>Methomyl</td><td>777</td></tr>
<tr><td>Malathion</td><td>725</td></tr>
<tr><td>Chlorpyrifos</td><td>716</td></tr>
<tr><td>Diuron</td><td>575</td></tr>
<tr><td>Propargite</td><td>369</td></tr>
<tr><td>1,3-Dichloropropene</td><td>363</td></tr>
<tr><td>2,4-D</td><td>344</td></tr>
</table>
A web-based interactive map of pesticide usage is available at: http://www.ehib.org/tool.jsp?tool_key=18</td>
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<td>Regarding “The SVRCD and AquaTerra have been implementing a monitoring plan approved by the NCRWQCB as part of their tailwater assessment…”
The monitoring plan should be cited (assuming that since it is “approved” there should be a document that can be cited). Is it the same as this document, or is it something else (if is separate, seems like a good idea to cite both):
Aqua Terra Consulting. 2011. Shasta River Tailwater Reduction Plan. Prepared for the Shasta Valley Resource Conservation District by Aqua Terra Consulting, Mt. Shasta, CA. 32 p. Available online at: http://svrcd.org/wordpress/wp-content/uploads/2012/01/Tailwater-Reduction-Plan_9_11.pdf</td>
<td>The reference has been added as you provided.</td>
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<td>49</td>
<td>3</td>
<td>Regarding “At the very minimum, the mouth of the Shasta River within the vicinity of the USGS gage should be monitored, with data being integral to implementation of the Shasta River TMDL and future implementation of the Klamath River TMDL.”
- The Karuk Tribe is already collecting nutrient samples and running a</td>
<td>Agree. Text changes made accordingly for the sentence noted. We recommend year-round monitoring.</td>
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		continuous multi-probe data logger (temperature, DO, pH, and conductivity) at the mouth of the Shasta River. We therefore recommend that the text be revised to mention this existing effort, recommend that it be continued, and note that it is not necessary for another entity to collect the same data at the same location. Note: the Karuk Tribe's multi-probe is operated for only part of the year (May-October?) so if winter/spring data is desired then another entity may need to collect additional data (probably water temperature only, as it is unlikely that pH and D.O. conditions are adverse that time of year). - "future implementation" should be changed to "implementation" because the Klamath River TMDL has been approved and implementation has begun.	
52	1	Discussions of riparian planting experiments note that "This assessment may require detailed investigations of groundwater, soil chemistry, plant phenology, and dependence of riparian recruitment on the unimpaired hydrograph (particularly winter floods and spring snowmelt hydrograph components)." It might be better to rephrase this is "a more natural hydrograph" rather than "the unimpaired hydrograph".	Agree. Changes made accordingly as recommended.
52	3	Regarding: "Action Plan Appendix E contains 'Recommended Interim Riparian Reserve Widths for the Shasta River Watershed.' This should be revised/clarified to be: "The Shasta TMDL Action Plan Appendix E...'	Corrected and moved to second paragraph in Task 4.1 introduction.
52	3	It is recommended to put a paragraph break between the second and third sentences in the "Task 4.1: Establish Riparian Recovery Goals and Target Conditions" section (i.e. before "This task will…"), to separate the task description from the NCRWQCB background information. As currently worded, it is somewhat confusing whether "this task" refers to Task 4.1 or the upcoming NCRWQCB Stream and Wetland System Protection Policy.	The NCRWQCB reference was moved to its own paragraph in Task 4.1 introduction.
57	1	Regarding: "Barrier information should be catalogued in a GIS database, such as the database already developed by CalTrout and the SVRCD" Yes, it is a good idea to leverage existing databases. What about the statewide California Fish Passage Assessment Database (http://nrm.dfg.ca.gov/PAD/), should it be mentioned here?	Good idea. Included in Section 5.5 Study Plan Element #5 just above Table 10.
58	3	Typo: "principsl"	Corrected.
59	1	Regarding: "Page 59: "The Little Shasta River also has beaver dams that should be evaluated for beneficial water temperature effects and provision of high quality Coho salmon habitat, as well as for their potential to prevent adult migration in the fall." The idea to study the effects of beaver dams in the Little Shasta River is good, but	As an initial step evaluating/demonstrating the benefits (and drawbacks, e.g., partial barriers to upstream adult migration) of beaver dams in Little Shasta River would generate additional efforts elsewhere in the Basin, particularly that overall Plan funding likely will be limited.

		should be expanded basin-wide, as there are additional beaver dams outside the Little Shasta River. For example, here are some excerpts from Chesney et al. 2009: "HIG 5 had the best rearing habitat for juvenile coho of any site in the Shasta River mainstem study reach. Features included an abundance of woody debris and vegetation for cover, and a nearly complete canopy cover over the river of water birch and alder trees. An abandoned Beaver dam 350 feet downstream of HIG 5 has created a pool over 500 feet long. Water velocities were slow enough for the fish to easily hold their position in the channel while food drifted to them. Because the site is directly downstream of Clear Springs, it had the lowest MWMT of all of the mainstem sites (20.52° C)." "Two beaver dam impoundments also existed in this reach during the study. The first, located below HIG 5 (RM 36.8), was in place upon first access to the property and appeared abandoned throughout the study. The second, located below HIG 3 (RM 36) was erected in the fall of 2008, and drastically altered the habitat for several hundred yards upstream of it. What had existed as riffle-pool type habitat with marginal woody debris became pond type habitat with submerged woody debris. Coho were observed in schools of approximately 20 to 100 throughout the fall and winter of 2008/2009 in these pond habitats." Chesney, W.R., Adams, C.W.B, Crombie, H.D. Landendorf, Stenhouse S., and K.M. Kirkby. 2009. Shasta River Juvenile Coho Habitat & Migration Study. Available from: http://www.klamathriver.org/Documents/CDFG-Juvenile-Coho-2009.pdf	
59	4	The section on "Integration with other tasks" should mention how the geomorphic studies could contribute to understanding of how scour could be used to reduce macrophyte growth and improve water quality.	Agree. See text added.
65		Regarding "Task 8B1: Assess Coho Rearing in the Upper Shasta River" This task should add mention of beaver dams as a priority habitat type to target for habitat surveys.	Agree. Beaver Dams included in Task 8B1.
73		The Mattson (2007) citation is listed out of alphabetical order	Corrected
31		On the reduction of coarse sediment and bed mobility due to Dwinnell, re: spawning gravel augmentation efforts "habitat benefits diminished since the bulk of augmented spawning gravel has dispersed downstream (McBain & Trush 2010)." How has gravel been disbursed when flows provide so little energy in such a flat reach? Could gravel be buried under accumulations of organic material? Would pulse "flushing flows" from Dwinnell serve to remove accumulations of organic material that could be smothering gravels suitable for spawning? (Similar question appears on page 60). Also in regard to effects of Dwinnell Dam on downstream habitat, some current information suggests that beavers in the Shasta use a lot of driftwood in their dam	Above Parks Creek confluence, the mainstem channel is highly impacted by fine sediment deposition, including spawning gravel habitat. The need for removing fine sediment, accomplished by releasing peak flows from Dwinnell Dam, has been noted in this Plan. The problem of gravel supply still remains. A peak flow might be devised that transports fine sediment but not the gravel. However, good spawning habitat is not simply the presence of gravel. Mobile depositional features provide good spawning habitat. Gravel text clarified in Study Plan.

		construction. Along with the recognized effect of reduced bed mobility, what is the effect of Dwinnell in capturing driftwood of all sizes from reaches upstream of the dam thereby reducing structural cover downstream? Given the lack of consensus on historical riparian condition as well as known problems with recent riparian planting efforts, it seems like the contribution of upstream forests to LWD structure in the valley reach could have been historically important.	Wood and beaver management text added to Study Plan Element 4, including a Wood Management Strategy (Task 4.4.)
39		"(1) provide appropriate snowmelt hydrographs in April and May for most water years, and into mid-June for wet water years, as these events are necessary for channel/riparian maintenance, sediment transport, and river productivity." As well as supporting these ecological functions, snowmelt provides direct benefits to fish by inundating shallow water fry habitat as well as providing habitat and an adequate migration route for emigrating smolts. Providing adequate fry habitat in April and May could delay their entry into the Klamath, reducing their exposure to infectious actinospores when they are most abundant in the Klamath. Mimicking snowmelt driven flows is arguably the single most beneficial management action that could be taken to improve habitat quality and fish production at a critical time of year.	Refer to Section 4.2 Recommendation #2. (first paragraph) for additional text on snowmelt benefits for consideration in IFN studies.
44		I agree this is an important component for coho recovery. I am concerned how developing HSC by direct observation limited to just the Shasta River will look when the fish observations may be limited to sub-optimal habitats in such a degraded system. I am concerned that fish are often observed in discrete areas because other areas are lethal, not because the area in which they are observed is ideal habitat	Agree. See text changes/additions in Task 2.2 *Study Methods*
43		Why are there two titles for Study Element # 2 ?? In the Study Plan Element header on page 42 its refered to as **Instream Flow Studies** and then is titled **Study Plan Element #2: Physical Habitat Assessment for High Priority LHTs.** Smolts survival studies are needed in the Shasta. Smolt survival during migration is a known problem for coho salmon in the Shasta. Studies by Chesney and Adams of Cal Fish and Game have shown significant mortality can occur at the reach scale.	Corrected. Used "Physical habitat assessment …" Agree. Text identifying smolt survival studies and smolt-to-adult return probabilities included in Section 5.9 Study Plan Element #9.
		YUROK TRIBE COMMENTS	
page	**para**	**Comment**	**Response**
Intro		*The purpose of the Study Plan is unclear. What is the overall goal? Complete recovery? Moving in the right direction? Sustainable harvest? The report introduction seems to switch back and forth between describing itself as a plan to gather information necessary to "move Shasta Basin salmonid populations toward recovery" and figuring out and describing the actions themselves. Presumably, this is a study plan intended to lead to the development of information that can support effective restoration actions and strategies which, if implemented, will "move Shasta*	The Plan's goal recognizes dual purposes: (1) obtain data/insight into what will need evaluation before taking action and (2) begin doing what clearly needs doing now. We stress (2) given the current status of the anadromous fishery, particularly that of coho salmon population. Perhaps we have not emphasized (2) sufficiently. Oftentimes considerable funds and time are expended on quantifying the obvious or less

		Basin salmonid populations toward recovery". The document introduction needs to be very clear about what goal it is trying to accomplish, and it is not so much at this time.	important tasks that delay critical actions. For example, quantification of HSC criteria may take 2 years or longer. Another would be an extensive basin-wide LWD inventory. Both are important, but can be addressed economically and swiftly to expedite recovery actions now.
Methods		*The methods are fairly clear. However, the concept of "life history tactics" is a central concept in the study plan, and it is not made clear how the LHT's were derived or how they were organized. Are the LHT's documented? Are they hypothesized?* *The LHT's that are described appear to be plausible, but is there any hard evidence of which ones actually exist? Is there evidence of their current importance (in terms of contribution to the population). The point here is not to criticize the LHT approach, which appears to have some promise, but rather to be very clear whether these are <u>actual</u> LHT's verified with data, or <u>hypothesized</u> LHT's which may or may not exist.*	LHTs were not hypotheses. High priority LHTs for recovery were recommended through several discussions and meetings with agencies experienced with the Shasta Basin anadromous salmonid populations. The next level of priority LHTs likely will require a stepwise selection process. However, this process will rely on having additional data needs met, particularly annual thermographs developed from temperature modeling as well as preliminary population modeling results.
Discussion and recs		1. *It is difficult to judge whether the recommendations for further study are appropriate due to the unclear text in the introduction and the "Purpose of the Study Plan" section. It appears that the authors of this plan, along with their collaborators (RCD, etc) have assumed two things, yet they are not stated explicitly* a. *The study results will be used for a wide variety of efforts, including ESA, CESA, TMDL, CDFG code regulations, and… others? Therefore necessarily the studies themselves are broad and inclusive, rather than focusing on a single species;* *Because there is much at stake depending on the results of these studies, it is assumed that they must be rigorous and very exhaustive, which drives costs upward. This is not necessarily a bad thing, but it should be noted that it what is at stake that drives the depth of study necessary.*	Noted.
1		It seems relevant that coho salmon are considered functionally extinct from the basin (this having occurred very recently) and that there is serious discussion of emergency reintroduction of this species to the basin. There was a workshop on this topic on February 16 and 17 of this year that brought fisheries scientists, geneticists and local stakeholders together for discussions on whether or not to pursue this strategy and if so, how. The discussion does not convey how serious the situation with coho salmon has become in the Shasta River Basin.	The term 'functionally extinct' would need careful definition by NMFS/CDFG before using in this Plan. However, the introduction could do a considerably better job of emphasizing the need for immediate actions for coho salmon. A short third paragraph will be added to the Introduction.
4	1,2	*"A study plan must be constructed that will guide discrete restoration actions and strategically implement timely instream flow recommendations using the best available science."* (last sentence of paragraph 1) "*The study plan must identify the scientific information needed to guide and prioritize actions that will move Shasta Basin salmonid populations toward recovery.*" (paragraph 2)	As commented earlier, the Plan has both purposes.

		These two sentences are contradictory. The first one says that the study plan itself will guide discrete restoration actions and… instream flow recommendations. The second one says that the study plan must identify information needed to guide and prioritize actions… The plan, in this section of the document, needs to figure out what its purpose is. See comment below for suggested wording for clarification.	
4	1	Recommend starting this section by re-wording last sentence in paragraph 1: "*This study plan is intended to guide the development of scientific information relevant to the Shasta River Basin that will allow for effective implementation of discrete restoration actions and strategic implementation of timely instream flow recommendations using the best available science.*" (this is a re-wording of the last sentence in paragraph 1). The current wording is vague and confusing, and makes it sound as if some future study plan should do these things. It also presents two different views of the purpose of the plan (see comment above). I assume that what the author meant is that <u>this</u> study plan will accomplish these objectives, not some future study plan.	The Plan goal has been redrafted to reflect your concerns and stress dual expectations.
4	1	Recommend shortening section on purpose into a single paragraph that clearly states the purpose of the document, then adding a new subsection the talks about the process (RCD reviewing relevant information, etc.).	The paragraph was shortened. The Plan is the process.
4	1	Recommend moving characterization of the complexity of the Shasta River, etc. to the introduction, and focusing on purpose.	The 'characterization' was unnecessary and eliminated.
8	4	The unimpaired hydrograph work in this document is a significant contribution to the current understanding of the Shasta River.	Future analyses should keep the integrity of annual hydrographs (whether impaired or unimpaired) intact through any analyses, but especially the IFN studies.
17	2	The LHT section would benefit from a clear discussion of how these LHT's were derived. Are they hypotheses? Is there data to support their existence? Is there any evidence that certain ones are more important (i.e. abundant) than others? I think the development of these is an important concept, but am seeking clarity on exactly 1) what they are (hypotheses versus actually observed tactics), and 2) how they were derived, and 3) how they are organized.	LHTs are not hypotheses. Yes there are data to support the LHTs identified (e.g. Chesney et al. (2010) documents juvenile coho rearing and migration within the Shasta Basin), but these data were not presented as LHTs nor were these data synthesized into recommendations. High priority LHTs for recovery were recommended through several discussions and meetings with agencies experienced with Shasta Basin anadromous salmonid populations. Perhaps an early task for the proposed broad-based technical advisory group will be a formal selection process for confirming/potentially-revising the high priority LHTs identified.
23		Discussion of impaired hydrograph should include discussion of extreme hourly fluctuations observed in recent years at both USGS gages. This is a problem that is missed when analyzing daily average data.	This is a task (i.e., the discussion) left to future study plan refinements. However, we agree that hourly data (most notably water temperatures) must be considered.

23	Figure 13	These figures are extremely helpful in understanding the current status of the Shasta River in terms of hydrologic function. They are clearly presented.	Noted. Future IFN studies need to establish streamflow thresholds related to specific processes and habitat needs that can be overlaid onto these annual hydrographs.
41	2	Recommend adding new study section that focuses on the linkage between the Klamath River and the Shasta River. Coho from the Shasta River have been found using PIT tag readers in various locations downstream, and the Shasta River screwtrap indicates that during certain years, 100,000 Chinook fry per day are entering the Klamath River and presumably completing the rest of their life cycle there. It is probable that coho salmon from the Shasta River are rearing in lower Klamath River tributaries during the winter, making these habitats important to Shasta River coho salmon.	At this stage of the review, we are not prepared to research/add another section. Evaluating smolt success, with the provision of distinguishing (e.g., estimating lengths in developing smolt-to-adult return curves recommended in the Plan) early juvenile rearing from smolt/pre-smolt outmigration should be considered in scale analyses of returning adults, then comparing these results to the outmigrant data collected annually by CDFG in the Shasta Canyon.
42	Task 1.1	Study plan should specify what timestep hydrologic water balance model should be (daily? Hourly? Monthly?), OR should be clear on the ultimate purpose of the model so the TWG can specify what timestep would work for this effort OR should direct the TWG to specify uses and therefore the timestep needed. The cost and difficulty of data acquisition can vary substantially depending on the timestep. For example, during the summer in recent water years, the lower Shasta River has had substantial hour to hour variation, sometimes changing flow by over 100% in the span of a few hours. It may not be necessary to model to an hourly timestep, because it may be possible to add a post-processing subroutine that further parses out model result to a finer timestep.	A key to assessing ecosystems and biological/ecological processes and their instream flow needs is to incorporate hydrological variability. Daily average streamflows are instrumental in accomplishing this difficult task, made only more difficult if not possible at less resolution (e.g., monthly streamflows). Hourly streamflow fluctuation has been long recognized as important ecologically, but has not been well-incorporated into IFN studies. Where hourly streamflows are needed, relying on empirical data may be the best strategy. However, water temperature modeling might require hourly streamflows. At this stage of planning, modeling daily average streamflows was recommended. Several text changes were added to Task 1 to emphasize daily average streamflows.
43	Study 5.2	The study objective is to develop physical habitat assessments for high priority LHT's. However, it is unclear what LHT's would be given priority over other LHT's, and by what criteria. Also the title of this task should be changed to more clearly reflect its focus on instream flow needs.	The listed high priority LHTs should be the focus of IFN investigations many of which overlap spatially, e.g., smolts and pre-smolts passing through the Canyon.
45	5.3	The focus of the study appears to be to identify what management actions can be taken to obtain "optimal" temperatures (see question 1). However, a more appropriate question would be how to return temperatures to a more normative state. Some locations in the Shasta Basin (i.e. the canyon reach) may be impossible to bring to "optimal" standard, which is based on fish physiology rather than physical characteristics of the basin. The capabilities and goals of a temperature improvement effort deserve much careful thought.	We used 'optimal' to conform with current usage by many agencies. However, optimums do not exist in nature when there are many species with different temperature demands. For example productive benthic macroinvertebrate productivity can thrive on somewhat cooler water temperatures than the juvenile salmonids that prey on them. A bioenergetics model has the advantage of not requiring threshold temperatures, but rather relies on continuous temperature responses from daily average or hourly temperatures (e.g., computed from a specific growth model).
46	1	Although thermal refugial areas are pointed out in this question, it is not followed up to any extent with studies that 1) identify important thermal refuge areas, and 2) help	Both these "follow-ups" would result from actions recommended in the Plan. The modeled population

		shed light on how these areas contribute to LHT's or the overall health of the salmonid populations in the Shasta River Basin.	contribution of thermal refugia will be difficult to do, but may be pivotal in recommending instream flow releases/bypasses for Parks Creek and upper mainstem Shasta River (above the Parks Creek confluence).
49	5.4	This section would benefit with a discussion linking riparian habitat characteristics with fish habitat, and ultimately fish populations. It is fairly intuitive that increased riparian shading can lead to lower water temperatures, but it is less obvious how riparian forest habitats create fish habitat, and also the interplay between beavers, riparian health and fish habitat.	Additional text was added to Section 5.4 (just after the questions listed) including more LWD functions.
50	4	The study plan authors appear have already made the conclusion that what the Shasta River needs is more riparian forest, and this comment is simply intended to ask the authors to expand upon that concept, or if necessary to direct a study toward it.	Study Plan Element #4 addresses these concerns, though maybe not to the specificity desired.
49-54		Study plan lacks discussion of exploration of management options to improve riparian management health. In particular, the Nature Conservancy property offers an opportunity to explore options other than complete exclusion fencing, such as stubble height management, and the use of riders (cowboys) to keep cattle away from riparian areas and to put them on better and more productive forage away from watercourses. It may not be feasible to fence all areas of the stream from cattle.	Noted. The Plan provides sufficient direction such that the actions recommended would be considered.
63	5.8	The authors appear to have missed the most important question with regard to salmonid (and other) populations, and that is "Which LHT's are the most successful, and why?" along with its companion question, "Of the LHT's that are <u>potentially recoverable</u> (presumably identified with help of temperature, habitat and other studies identified elsewhere in the document), which ones would be the most successful (i.e. have the most potential to contribute to recovery), and how can we get these LHT's back?" Having introduced the concept of LHT's, the authors abandon the concept in the population studies!!	LHTs were not abandoned. Addressing LHTs associated with the Big Springs Complex, the mainstem channel through the Shasta valleybottom, and Shasta Canyon did not require population modeling warranting a population model before beginning implementation. A water temperature model will be more important, initially, than a population model in recommending timely recovery actions.
63	5.8	The authors are apparently unaware of the near-total collapse of the Shasta River coho populations and the serious and ongoing discussions between the RCD, CDFG and other entities about the real possibility of an emergency captive-rearing or other emergency tactics to preserve the genetics of the few coho that are left in the Shasta River. This topic is very germane to the recovery of Shasta River Basin salmonid populations and should be included. Although the workshop occurred after this draft was issued for review, discussions have been occurring for almost a year at this point. Even a placeholder to adopt the recommendations of the coho working group would be preferable to skipping the subject entirely.	Identified concern added to Introductory third paragraph.
63	5.8	Genetic studies of any kind or even a discussion of these studies is generally absent from this study plan.	We considered this a task led by NMFS.
85	4	I believe that much more thought needs to be given to this subject, considering how important it is to guiding management actions and study designs. Bioenergetic principles indicate that the effect of a given temperature to an individual salmonid	This concern is embodied in the high priority LHTs recommended. A bioenergetics approach may be more desirable (if picking one or the other to do first, though both

		can vary greatly depending on the food resources available to that individual and the presence (or absence) of other stressors, such as predators, or lack of cover, or disease. Therefore, I believe that the heterogeneous thermal nature of the Shasta River can be utilized (using thermal refugia counts, or by carefully noting when fish crowd into cool water spring areas) and this kind of information can be used to come up with field-based temperature criteria for the Shasta River salmonid populations. This should be a task given to the TWG for consideration, and should be pulled up into the temperature and/or fisheries study section of the document.	need a good water temperature model) that a population model in evaluating the feasibility/needs of high priority LHTs. However, such an approach also requires a goal, such as a targeted growth response (e.g., a minimum steelhead smolt length).
Most pages		The word "coho" is not capitalized, because unlike "Chinook" it does not refer to a specific people or other proper noun. Common names for fishes are not capitalized.	Agree, changes made to text

Page	Karuk and Yurok Tribe comment topic	D. Webb response	M&T Response
Big pic	beavers	While beavers are clearly important in many streams, and I have not read the referenced docs, I suspect that they may not apply well to the bulk of the mainstem Shasta where beavers are common but disinclined to build dams because (apparently) water depths are already adequate without dams. Instead they tunnel into the banks for their dens. The tribs and Shasta above the Parks Creek confluence are more conventional in terms of likely beaver functionality.	Added a bullet in Section 5.4 to address this issue, as well as some additional text in Section 5.5
48	Aquatic macrophytes and low DO	RWQ completely missed the role aquatic macrophytes play in the Shasta in both stripping nutrients and providing substrate for inverts to feed upon, thereby forming the basis for the spectacular food chain found there. Recommendations for macrophyte removal should be considered with caution. At the same time, the long-term absence of flow mediated disruption was in part (and poorly) offset by major disruption by livestock. Riparian fencing has largely eliminated the	Good points, additional text added to Task 3.2

		livestock disruption, but nothing has replaced the flow disruption still missing. My opinion is that over time we will suffer from excessive stability as a result, and for that reason deviate from natural conditions with unknown consequences.	
48	Aquatic macrophytes and low DO	My impression is that we might do well to re-evaluate the role of rooted macrophytes and DO in the Shasta to be sure they are indeed having the effect postulated in the TMDL and that nothing else (like free floating algae) are not more responsible for DO sags than originally identified.	Added to Task 3.2
48	Encroachment in Shasta Canyon	Interpretations of changes in vegetation in the Shasta Canyon need to be tempered by site specific knowledge of the major changes in land uses occurring there over time, most notably the major disruptions resulting from small scale mining that removed most accumulated sediments from the entire canyon in the mid to late 1800's, followed in ~ the 1940's by intensive overgrazing by livestock which ended in 1992. Most of the visible changes now underway began immediately after grazing ceased in 1992. There have been some reasonably high flows since them, but they made little long-term difference in the trajectory as far as I could tell. Regardless of the above, gravels in the Shasta generally can be seen to suffer from lack of mobility and consequent fine sediment build-up.	Text added in Section 5.6
48	Pesticide usage	This topic continues to be a concern, especially to those at a distance. Given that pesticides are used, and that mortality has occurred in the	Agree that the KBWR reference has little relevance to the Shasta, so that paragraph was deleted. Additional clarification added in Task 3.2 for the

		past, the possibility of major accidents cannot be discarded as a future possibility. On the other hand, the periodic investigations into the topic don't seem to show any problems on an ongoing basis. Under those circumstances it would seem most prudent to have some kind on ongoing season-long sampling/screening as a way to identify if any transient events are occurring so as to establish some basis for concern for the apparently stochastic events likely (at present) to create problems. As to sources of info on pesticide use, the state level info comes from the Siskiyou County Ag Commissioner's office, which can also provide the location of usage down to the section level, allowing a better estimation of the need for concern in the Shasta watershed. Most pesticides are used on higher value crops than are found in the Shasta Valley. Using county-wide data biases interpretation for the Shasta Valley since usage there will be lower than either Tule Lake or Scott Valley both of which focus on higher value crops. Regardless, any reference to pesticide usage by Klamath Basin Wildlife Refuge farmers has no relevance to usage in the Shasta Valley.	stochastic events, as well as the need to refine the county-wide application to that specifically along the Shasta River corridor
57	Fish passage	The Calif Fish passage database for the Shasta Valley is so flawed that use of it should be viewed as a negative in terms of understanding the watershed. Perhaps there is a way to ground-truth it, but no one seems inclined to do so and agree to changes.	The text says our local list of barriers should be coordinated with the database, so the intent was one way (our better information should be provided to the database to improve it, rather than us depend on the database on the Shasta

31	Gravel supplementation	To the best of my knowledge, no gravel replacement was done after initial installation ~ 1984 in the Shasta Canyon until summer of 1995 when gravel was added to Slide Hollow. That addition was apparently entirely lost in the winter of 1995-6 due to high flows. Gravel was again added there in 1996 or 7 I think, and some still remains stockpiled there. Periodic flood flows are sufficient to move and remove gravels in the canyon. My opinion is that over time the most mobile gravels in the canyon have been winnowed out, leaving pockets of gravel that move only poorly (i.e. don't provide the mobile conditions noted as needed) except during floods when they move too much and are lost to the Klamath. Physical constraints on Dwinnell's outlet structures may make flushing flows of adequate magnitude impossible unless timed to match natural high flow events.	Agreed, existing text has description of historic gravel augmentation story, so no changes in text made
31	Woody debris and beavers	Off hand it seems like a lot of focus on secondary issues—if the water is either absent or too hot, having a bunch of beaver dams won't change anything. So far, coho usage is limited in summer to cold areas regardless of the quality of the cover. That won't change until there are more cold areas to choose from with variable conditions so they can pick their preferences. As you no doubt know, you will need to triage study effort so as to focus on what needs to be addressed first, and not let an overly broad study result in nothing being investigated adequately.	Agreed. On the prioritization, this study plan implies that the study elements are the prioritized list, but does not prioritize and sequence amongst the study plan elements. We added a paragraph at the beginning of Section 5 explaining this, concluding with a recommendation that the first order of business for the TWG is to prioritize and sequence these elements.
End of			

comments on Tribal comments			