United States Department of the Interior
U.S. GEOLOGICAL SURVEY
SOUTHWEST BIOLOGICAL SCIENCE CENTER
GRAND CANYON MONITORING AND RESEARCH CENTER
2255 NORTH GEMINI DRIVE, MS-9394
FLAGSTAFF, ARIZONA 86001
928 556-7094 Telephone
928 556-7092 Fax

June 22, 2007

TO: Glen Canyon Dam Technical Work Group Members

FROM: John Hamill, Chief, Grand Canyon Monitoring and Research Center

SUBJECT: GCMRC Response to Stakeholder Comments on the May 14, 2007, Draft Beach Habitat Building Flow (BHBF) Science Plan

Thank you for the comments on the subject Science Plan. In total, we received 189 comments from 12 reviewers. Responses are provided for those comments received by the June 8, 2007, comment deadline (Attachment 1). Approximately 65 of the comments were received after the comment deadline (Attachment 2). GCMRC will respond in writing to those comments following the TWG meeting. I am concerned that only a minority of AMP participants commented on the draft plan and that all the key issues may not have been identified.

Please note that we only responded to the comments that were scientific in nature and within the purview of GCMRC to address. Other non-technical comments should be addressed by the TWG, AMWG, and/or the Secretary's Designee, as appropriate.

Our presentation at the TWG meeting will focus the "major" comments or concerns which were raised by stakeholders. Depending on the outcome of these discussions, it may be appropriate to establish an ad hoc group to further review GCMRC's response to all the stakeholder comments, and report back to the TWG at its next meeting

I request that the TWG recommend to the AMWG that the WY08 hydrograph include the option of conducting a BHBF subject to (a) the sediment trigger being met, and (b) finalization of BHBF Science Plan and acceptance by the Secretary of the Interior. The TWG may also want to consider providing a recommendation on the budget implications of implementing a BFBF Science Plan in 2008.

I regret not being able to respond to all the comments for your review well in advance of the TWG meeting. We did our best given the large number of comments and other competing work activities.

Sincerely,

JOHN HAMILL
Chief, GCMRC

Attachments:
1. Comments received before June 8, 2007
2. Comments received after June 8, 2007

ATTACHMENT 1

Document Title _Science Plan for Future Experimental Beach/Habitat Building Flows Released from Glen Canyon

Document Date: _May 14, 2007_____

COMMENTS RECEIVED AFTER THE JUNE 8 COMMENT DEADLINE

Comment Number	Page	Line	Reviewer Name	Affiliation	Reviewer Comments (Be specific)	Identify Action Requested	Response Requested	GCMRC Response / Action Taken
1	General		Palmer	Western	The options considered by AMWG consisted of a "package" of actions and experiments. The purpose for packaging several things together was to achieve beneficial results for HBC while protecting or improving other resources. How a BHBF, as a stand-alone activity, fits into a broader experiment isn't known. The development of a draft science plan for a BHBF (s) is useful for its eventual inclusion into an LTEP, but we believe it must remain a draft document until it is incorporated into an LTEP. Western is reluctant to recommend a stand alone action. We must understand how it fits with actions/experiments in a "package" arrangement.		Y	
2	General		Palmer	Western	There are several policy issues embedded into the science plan that have not been addressed by the AMWG. In this draft of the science plan, the GCMRC has helped to identify these issues (although not specifically identifying them as policy issues). This draft therefore, can serve as the catalyst for an AMWG policy discussion. We believe this discussion should occur as part of completing the science plan. We will identify these policy issues specifically below.		Y	
3	General		Palmer	Western	There should be criteria to evaluate the success of a BHBF experiment. This is needed for the experiment as a whole, for the research questions and for the individual experimental studies.		Y	
4	General		Palmer	Western	The “tools” for high flow tests include Habitat Maintenance Flows (HMF) and load-following flows. The entire set of “tools” should be available for experimentation purposes to achieve management objectives.		Y	
5	General		Palmer	Western	As described in the ’96 GCD EIS and ROD, the purposes for the BHBF are related to camping beaches and backwater habitats. We believe that BHBFs may deposit sand where aeolian activity may redeposit this sand at cultural sites. However, this purpose is an effect of a BHBF tested for the primary purposes described above. Western doesn’t believe that the timing, magnitude or duration of a BHBF should be adjusted for its potential effects on cultural resource protection alone.		Y	
6	Gen		Henderson	GCNRA	Include a TOC to clarify organization			

	eral							
7	General		Henderson	GCNRA	Check references – some are included in text but missing in the literature cited section			
8	General		Henderson	GCNRA	Clarify years – work plans imply that projects are starting in '07 (true?). Consider using year 1 and year 2 rather than 2007 and 2008			
9	General		Henderson	GCNRA	Organization of budget tables sometimes inconsistent			
10	General		Henderson	GCNRA	Clarify the number of BHBF events being proposed. It is somewhat unclear whether GCMRC scientists are suggesting a 10-year test of concept or a one year test to predict whether a 10 year implementation would work			
11	General		Henderson	GCNRA	The SSQ reference numbers in the work plans are different for the same SSQ			
12	General		Henderson	GCNRA	The following four types of questions are used within the BHBF science plan: a. AMWG priority questions (page 11) b. Strategic Science Questions (presumably from the MRP) c. Working hypotheses (in the work plans) d. INs and EINs (in the work plans) An explanation is needed as to how each of these groups of questions relates to the work plans proposed			
13	General		Henderson	GCNRA	The fate of Glen Canyon should be discussed within the context of this BHBF work plan, i.e., what do we assume for this reach			
14	Proposed Experimental Study #6		Palmer	Western	Sediment has utility to the degree it creates habitat (especially for HBC). A significant science question related to this is: does a significant portion of the Grand Canyon HBC population utilize backwater habitats? It's possible that significant habitat for HBC is talus slopes. Answering this question may take considerable effort. However, if HBC numbers can be increase and/or if this HBC population can be recovered without adding/maintaining sediment-structured backwater habitats, this will significantly alter the utility of BHBFs as a management action. (When this is added, it would also be added to the summary table: Table 1.2).			
15	2	11	Palmer	Western	For sediment deposited by a BHBF to protect archaeological resources from erosion a "double coincidence" in special relations is required. First, sediment deposition needs to occur at or near an archaeological site. Second, wind patterns need be predominantly from the sediment deposit to the archaeological site. Ex ante, it seems as though this will only occur serendipitously. We would like this document to display or summarize the data related to sediment deposition from previous BHBFs as compared to the location of archaeological sites.			
16	2	5-15	Henderson	GCNRA	The justification for further BHBF testing should include recreation			

17	3	10	Palmer	Western	This primary science question should be modified to reflect the "big picture" goals. As written, this science question implies that one should explore operational regimes at the GCD until (and if) flows can be found that accomplish the stated goal independent of other GCD-affected resources. Even if such a flow were found, what utility would it have if it adversely affected other key resources? The science question should be worded so as to take this reality into account. The research that it prompts should also take this into account. For example: "Is there a "flow-only . . . that maintains key resources as described in the '96 GCD –EIS?" One might be tempted to respond that this question is for sediment only and therefore stands alone. However, this science question, as written, has already prompted GCMRC scientists and others to promote very restrictive release patterns to find the "flow" that answers this question. We believe that this question – and others pertaining to other resources – would better reflect the needed research if it added this.		Y	
18	4	19-35	Palmer	Western	This is a clear description of the "end game" for BHBF experimentation. Western believes that this is a policy issue. Specifically: the "repeated BHBF tests under multiple sand enrichment scenarios" for the purpose of "cumulative increases in systemwide sandbar area and volume over decadal time scales" should be considered in a policy venue.	AMWG discussion	Y	
19	4	25	Palmer	Western	The strategy of attempting to build sandbars through multiple BHBFs in an attempt to achieve "cumulative increases in systemwide sandbar area and volume over decadal time scales" is described as only being "feasible" if the "intervening power plant releases do not completely erode the sand deposited in sandbars" by the BHBF. While the science plan doesn't specify what degree of fluctuation is incompatible with this "strategy" and infers that this question is a subject of scientific exploration, we cannot ignore past statements and attitudes related to this. Repeatedly, in public presentations and conversations, GCMRC scientist have recommended very restrictive operations in order assure the success of the "strategy" described here. Specifically, in the science workshop held at GCMRC in April, one of the GCMRC sedimentaligists recommended steady flows and another; relatively steady, low volume releases in between BHBF tests. Western feels that very restricted fluctuations will be recommended by BHBF planners once a science plan is completed and the details of a specific plan are developed. We feel that significant restrictions on power plant fluctuations are incompatible with the "big picture" goals. To be more compatible with the "big picture" goals, we feel that the science plan specify an experiment in which BHBF tests are combined with fluctuating flows in order to conduct an experiment		Y	

					to see if sediment goals can be accomplished within the context of the "big picture" goals. This actually occurs in the project goal for Experimental Study 1.B. (page 21), where the goal is stated as "determination of the optimal BHBF hydrograph shape for a given sand-supply condition to achieve sandbar resource management goals, while minimizing negative impacts to other resources (e.g., hydropower)." To make this change, the key science question and the "strategy" will need to be modified. We provide more detail below.			
20	5	1-24	Henderson	GCNRA	Research/monitoring on past BHBF tests (specifically 2004) did not provide a comprehensive assessment of the size and specific location of channel deposits. This information is important to the NPS since it is the foundation for many resources and activities it manages (camping beaches, vegetation, fish habitat, cultural resources etc.), and should be mentioned			
21	5	21	Palmer	Western	The first sentence of this bullet is a finding. The second sentence is probably not so much a finding as it is a hypothesis.		Y	
22	5	23	Barger	Western	Insert the word temporarily between thereby and reducing		Y	
23	5	26	Palmer	Western	The new trigger is a characteristic of a policy-related issue. Based on the findings of the 2004 BHBF test, as described on page 5, an increase in sandbar total area volume occurred in the upper half of Marble Canyon. This would seem to be a positive finding for this reach. Since this reach was described in the '96 GCD –EIS as a "critical" reach for beaches, it may be that one or more of the BHBF "goals" was reached. The question remains regarding what the canyon-wide goals, if any, may be.	AMWG discussion/ decision	Y	
24	5	28	Barger	Western	Clarify what is meant by lesser tributaries. Since they are not gauged, please explain how this sediment is gauged.		Y	
25	5	41	Barger	Western	I don't support the statement that repeated experiments might occur more frequently. This implies that each time the trigger is met, there could be a BHBF. I see this as making a policy recommendation and this should be removed.		Y	
26	6	1	Barger	Western	The title does not reflect the discussion in this section.		Y	
27	6	17	Barger	Western	Change this to state, basin hydrology may affect releases.		Y	
28	7	46-end	Palmer	Western	The word "replication" as used here (and elsewhere in this document) is a mischaracterization. The word is accurate when used as a modifier to the phase"2004 hydrograph", but, the implication when it is used in this document is that GCMRC proposes to "replicate" the 2004 BHBF experiment. The BHBF experiment described herein is significantly different from the 2004 experiment. The main difference is that it is not described as a BHBF immediately following a "trigger" amount of sediment input. It recommends "conditioning flows" that may distribute new sediment inputs more evenly throughout the Grand Canyon. So, the		Y	

					experiment is this: can sediment inputs be retained and distributed canyon wide? If so, can a BHBF mobilize sediment canyon-wide and conserve it within the canyon (rather than transport most of it to Lake Mead)? Should new sediment inputs be exported out of the canyon between the time they are deposited and the time a BHBF is conducted, the BHBF experiment would not be implemented in a "locally sediment enriched" condition. We suggest that, beyond the description on this page, the document clarify, where relevant, the difference between the 2004 experiment and the one described in this document.			
29	9	Figure 1.2	Palmer	Western	The following should be added to this decision tree: - the first box includes only a sediment trigger. In fact, prior to another BHBF test, Western and Reclamation will need to assure that funds are available to cover electrical contractual obligations – a financial trigger. Also, a BHBF will need ESA compliance. We'd like to have that completed so that decision makers know what commitments of resources are required from the action agencies as mitigation and/or conservation measures prior to recommending a BHBF test – an ESA trigger. Perhaps these added triggers can be described as precursors to "following" the decision tree in Figure 1.2. In any event, they will need to be determined and added to the plan. - the lower left-size box should eliminate "changing intervening operations" (if what is meant is further restriction) and should add "increased peak magnitude, timing or hydrograph shape." - the second box should be changed to measure the changes in camping beaches and back-water habitats (see our comment below)			
30	10	13	Barger	Western	Give page references for linked elements.		N	
31	10	30 – 36	Palmer	Western	Reference is made to the '95 EIS. The ROD allows a BHBF only when a hydrological trigger is reached. This ROD restriction exists in order for BHBFs to be implemented in accord with legal restrictions. BHBFs have twice been tested in the past to test the utility of BHBFs as management actions to be implemented in under the ROD constraints. This restricts the timing of a BHBF to the "forecast" and "run-off" season. In line with our comment #1 (above), the policy issue is how the AMWG would (or would not) recommend a deviation from these criteria for testing purposes. For example, the "Cook-Moody" proposal, passed by the AMWG in 1998, recommended a test of a BHBF with a magnitude of 60 k cfs (when hydrologically triggered).	AMWG Discussion/ decision	Y	
32	10	15	Barger	Western	I believe that tamarisk is a big issue that does not appear to be addressed in this study. Larry had referenced that BHBFs can affect distribution of tamarisk seeds/ thus their proliferation.		Y	

33	11	8-38	Henderson	GCNRA	Not all the resources and questions listed are "priority" as specified in the MRP. Please clarify the title of Table 1.1 or modify table contents			
34	11	9-40	Henderson	GCNRA	In some instances the priority questions don't clearly translate into the questions asked or the projects proposed in Part 2. For example, specific questions are asked about the creation of near shore habitat (line 15-16), how BHBF flows affect the persistence of sandbars and backwater habitat (line 13), how a BHBF-changed food base would affect native fish (line 18), and effects on Kanab ambersnail (line 35) with no corresponding study plan recommended in Part 2. Further, I'm not sure that AMWG made some of them high priority. We clearly learned from the 2004 test that sediment can be conserved in certain areas, at least temporarily, by a BHBF following a tributary input (of a certain magnitude). We need to continue to test the needed magnitude of the trigger as well as how to better distribute tributary sand once it has been deposited into the Colorado River. But now that we know that sediment can be conserved, we need to know how this conserved sand stored as far as the specific location (along the river corridor as well as elevation) and amount (area/volume). Such information is crucial to managers to understand how effective conserved sand is at providing additional native-fish and vegetation habitat, open beaches available for camping/recreation, and conservation of archeological sites. Consider using remote sensing to accomplish this task		Y	
35	11	14	Barger	Western	I did not see any HBC studies identified in this plan. The last BHBF flushed out YOY.		Y	
36	11	28	Palmer	Western	An Economic and/or financial science question should be added. If the AMWG has none at this time, it would be important for the AMWG to adopt one.		Y	
37	13	Table 1.2	Palmer	Western	Sediment is an intermediate resource and has utility to the extent it accomplishes two things: 1) it maintains and/or increases camping beaches in critical reaches and 2) it maintains and/or increases backwater habitats. It may therefore be less than useful to have a focus on questions related to mass balance. This may or may not be the same as the "sandbar fate" study that is directed at eddy sandbars. If backwater habitats are a subset of eddy sandbars, we suggest evaluating whether a BHBF maintains or increases backwater habitats only. (to be clear, if a BHBF proves to "conserve" sediment inputs, but in locations that do not provide HBC habitat, we would suggest that the BHBF did not achieve the management objectives). This comment is in line with the AMWG science questions on page 11. We suggest that the focus of the	AMWG Discussion/decision	Y	

					gathering of data and the analysis be on the HBC questions.			
38	16		Barger	Western	I did not see these addressed in this plan. Where are the discussions for the KAS and cultural sites. I thought public outreach is done by USBR.		Y	
39	17	1	Henderson	GCNRA	A study is needed to determine the specific location and size (area/volume) of the sediment that might be conserved by the BHBF test (see 11 above). Such a study would serve as a foundation to determine the amount and location of backwater habitat, recreation beaches, in situ arch site preservation, invasive plant establishment, shifting of movement of major vegetation types etc		Y	
40	17	9	Barger	Western	For each study, please clarify the reasoning behind the duration.		Y	
41	17	20 - 25	Palmer	Western	Project goals: Sediment is an intermediate resource. The importance of sediment to managers is the "work" that sediment can do. The goals for this project should be to document: 1) the change in campable beach area and 2) the change in HBC habitat		Y	
42	17	37-39	Palmer	Western	Same comment as above regarding the strategic science question		Y	
43	18	11	Barger	Western	Please define Lagrarian		N	
44	18	45	Barger	Western	For each study for the section on INs, please incorporate them into the discussion of methods to show how each one will be met. Listing them at the end will not suffice.		Y	
45	20	1	Warren	Western	As I understand the task, this is an "off the self:" science plan. The cost table then, should not categorize the costs by specific fiscal year.		Y	
46	22	24	Henderson	GCNRA	How will the data collected as part of this study relate to the other BHBF deposits along the river corridor? This study will provide us a great deal of information about hydrological process (very interesting to scientists) but little information regarding the results of that process in the entire system (of interest to managers). Consideration should be given to balancing the needs of both groups			
47	25-30		Henderson	GCNRA	I question the amount of funding needed this project since, it seems, it could be easily folded into the existing/proposed site archeological site monitoring plan now under development. If sufficient sand is deposited in areas in the needed proximity (orientation/distance) to existing archeological sites, it would seem pretty logical (without study) that additional sand might be deposited. What is crucial is knowing whether the sand is deposited in the key areas. Neither this study nor the others will get at this issue since a comprehensive sand deposit study is not included in the work plan. However, even after you know where the sand is deposited it would seem that understanding whether this newly deposited sand is blown onto the sites could be easily added to the arch site monitoring program (now under development). A simple		Y	

					comparison between those sites affected by newly deposited BHBF sand and those not affected would show the effect of the BHBF. Further, by utilizing only select sites to study (as advocated by the author) it does not tell us much about the overall effect of BHBF sand on arch sites throughout the CRE. I would suggest using the funding allocated for the above study for the study recommended in 12 above			
48	25	36	Barger	Western	A BHBF of up to 45,000 cfs will not fill arroyos on sites since the sites are located at higher elevations. This needs to be clarified.		Y	
49	27	26	Barger	Western	The discussion of analog cameras at 28 selected sandbars and cultural sites is not well reflected in Table 1.C-1. It looks like there might be eight cultural sites. The site numbers need to be included.		Y	
50	27	29	Barger	Western	What is meant by "also be surveyed." Please clarify.		Y	
51	27	39	Warren	Western	We understand these instruments have already been deployed. This should be updated.		N	
52	27	40	Barger	Western	The sites are not listed anywhere, please list them by number/name.		Y	
53	28	15	Barger	Western	This was not done for both of these BHBFs. Please rewrite.		Y	
54	28	21-24	Barger	Western	This is a description of sandbars, not archaeological sites. Restoration of sandbars does not equal restoration of archaeological sites. Please rewrite this section.		Y	
55	30	22	Barger	Western	This comment applies to costs listed for each study. Please clarify what is meant by some of the titles in Funding History. For example, explain training needs, and why GCMRC salaries are not always included. If you do not include the salaries the real cost of the BHBF is under represented.		Y	
56	31		Henderson	GCNRA	It seems logical that open patches of ground would be more susceptible to pioneering plant establishment (invasive species being of most concern). Invasive establishment would be quite variable and dependant on further disturbance (elevation of the river) and seed availability. Knowing this, is this study intended to reaffirm this basic concept or quantify the amount of invasion within the entire corridor? It would seem that the first question to ask is how much (and where) additional bare sand (in ideal establishment zones) would be made available by the BHBF test for invasive establishment		Y	
57	32	21	Barger	Western	Please be consistent in your use of cfs.		N	
58	38	Figure 3.1	Warren	Western	- do the curves depend on the distance from the GCD? - please indicate some sense of the time scale on the X axis		N	
59	41		Henderson	GCNRA	Given the priority question posed on page 11 related to backwater habitat, a study is needed to specify where and how much of this habitat is created by the proposed BHBF testing. We already know that BHBFs can create backwater habitat it is now necessary to understand if there is sufficient amount created in the right locations to significantly affect HBC recruitment (of interest to mangers		Y	

60	45		Hendrson	GCNRA	Given that CPUE is a pretty coarse estimator of relative abundance of fish (rather than a population estimate), it would take a major change in population level to show up in a significant difference in CPUE and, therefore, many fish could be lost from the population (and move downstream) without being measured (of great interest to mangers).		Y	
61	49	42	Warren	Western	Replace “influences powerplant releases” with “water quality below the dam”		N	
62	50		Warren	Western	There are no strategic science questions or RINs associated with this experimental study.		Y	
63	52	11	Warren	Western	Similar to our ESA comment above, what is required of the NPS for permitting purposes should be worked out in advance so that decision makers know what the requirements are. In addition, logistical limitations need to be known in advance so that decision makers know if significant science activities will be suspended or lost as a result of the BHBF test.		Y	
64	67		Henderson	GCNRA	Given the recommendations by the science advisors and the questions by the AMWG, I would advocate adding a project to more fully understand how young HBC are affected by the BHBF high flows in the mainstem.		Y	
65	76	18	Henderson	GCNRA	Change C.1 to B.1			

ATTACHMENT 2

Document Title Science Plan for Future Experimental Beach/Habitat Building Flows Released from Glen Canyon Dam

Document Date: May 14, 2007

Comment Number	Page	Line	Reviewer Name	Affiliation	Reviewer Comments (Be specific)	Identify Action Requested	Response Requested	GCMRC Response / Action Taken
1	General		Kubly	BOR	We would appreciate it if GCMRC would consider setting up the document to better facilitate environmental compliance that will have to be done if the proposed action(s) is evaluated or implemented. For example, there are two durations of releases identified. The recommendation for 60 hrs seems equivocal, based largely on learning, and much less on differential effects on resources. The magnitude being considered seriously is only in the range of 41-45,000 cfs. Only a passing mention is given to higher releases "when Lake Powell storage is high…" What is the likelihood that this condition will occur in the timeframe this plan is expected to cover? Should it be given more attention? Higher experimental releases could be considered, although they would require a full reservoir and use of the spillways to conduct. Did GCMRC consider and reject higher releases, or were they not considered. Also, the sediment trigger does not consider other combinations of Paria and LCR inputs than are in the trigger. Was there consideration given to an experimental flow caused by a larger Paria input, say 1 mmt, with a smaller input from the LCR? Greater detail on what was considered and why other alternatives were rejected would improve the document.	Format, Consider Expansion of Actions	Y	A 60-hour, 41,000 cfs BHBF test was discussed at length during the SPG deliberations; as a result, it was the focus of this science plan for the next BHBF test. BHBF tests above 45,000 cfs are not feasible over the next several years owing to low reservoir stand and Glen Canyon Dam maintenance schedule. Regarding the modified sediment trigger, it is defined such that 1 million metric tons of sand from the Paria River and 0 input from the LCR does trigger a BHBF test. Please refer to Table A.2 for pros and cons of 30-hour vs. 60-hour duration for a future BHBF test. Please note that the GCMRC was directed by AMWG and DOI to develop an integrated science plan and not a compliance document; although we believe that much of the information provided here would assist in the development of compliance documents.
2	1	9	Werner	AZ	The stated purpose of the document is to identify monitoring and research activities to be conducted in the event of approval of a BHBF. Work needed for the physical sciences may link to the event more clearly than some of the biological work, such as for fish, which may require that certain efforts were ongoing to know baseline conditions and that other efforts will continue long enough to monitor effects. Integration of BHBF work into the Long Term Experimental Plan will be important. It is not clear that the biological work identified in this document would logically be conducted each time this plan was used as an "off the shelf" research and monitoring plan for a BHBF.	Consider	Y	This proposed research would be conducted in the next BHBF test and on the basis of the resulting additional planning would be conducted to determine what integrated studies would be needed during any additional, future tests.
3	1	12-14	James	CREDA	This sentence is not completely correct from a legal standpoint – suggest consistency with approved AMP documents	Substitute description from GCDAMP.G	Y	Paragraph suggested by reviewer: "An important part of that debate is the need to address the impacts to the downstream ecosystem resulting from the ongoing operation of Glen Canyon

						OV fact sheet on home page www.gcdamp.gov paragraph 2, description of Adaptive Management Program		Dam. To address this challenge, the Glen Canyon Dam Adaptive Management Program (AMP) was established in 1997 to provide for long-term research and monitoring of downstream resources. The scientific information obtained under the Adaptive Management Program is used as the basis for recommendations for dam operations and management actions." However, appropriate citations are in text. Thank you for this clarification.
4	2	7	Werner	AZ	The statement "In transferring sand to shorelines, BHBFs are known to form nearshore habitats, such as backwaters that structure the aquatic environment." should be supported by citations. This statement doesn't clearly track with one on p. 76 ln. 8.	Include citations to document what is "known".	Y	The citation for Goeking and others (2003) will be added to the science plan. This report provides an historical synthesis of backwaters in the pre- and post-dam era and concludes that such features typically result from floods when there is sand in the river system. As noted on p. 76 ln. 8, the specific value of these habitats to native fishes has not been documented.
5	2	8	Persons	AGFD	"such as backwaters that structure the aquatic environment" seems like a stretch. Don't the rapids, riffles and pools structure the aquatic environment? Perhaps say "such as backwaters that may serve as nursery areas for fish".	Reword	Y	Yes, it is true that the structure of the aquatic ecosystem is mostly controlled by the bedrock canyon features and coarser grained sediment deposits. However, sand bars also provide structure for nearshore habitats, albeit less stable ones, such as return current channels
6	2	9	Werner	AZ	Paper cited not in the main lit cited but on p 75 in App. A	check	N	Citation has been cited in main Lit Cited Section
7	2	9	Davis	CREDA	The Minckley and Meffe reference is missing from the References Cited. Also, this reference refers to small streams (Aravaipa Cr.) wherein flows of 2 orders of magnitude influenced native/non native diversity. The effect of large river high flows on diversity has not been fully fleshed out so citing this example as a way to justify higher flows is very premature.	The reference appears on pg. 75 but not in the earlier section at pg. 60 but should be.	Y	Citation has been cited in main Lit Cited Section This article was not cited as a "justification for higher flows", but rather in support of a hypothesis that needs testing, i.e., that high flows may disadvantage fish species not evolutionarily adapted to the Grand Canyon environment. That nonnative fish can be displaced by high flows in a small river suggests to us that it may also disadvantage nonnative fishes in a large river.
8	2	9	Knowles	FWS	Why not cite Korman et al. 2005? My interpretation of Minkley and Meffe 1987 and Meffe 1984 is that a flood of historical magnitudes (100 K cfs) would be needed to achieve similar effects in Grand Canyon, and any negative effects to nonnative trout from a ~ 45 Kcfs flood would be offset by compensatory survival (both points GCMRC also makes later in the document).	FYI	N	Thank you for the citation suggestion; we will consider. Please also see response to previous comment (7).
9	2	9	Persons	AGFD	Minckley and Meffe 1987 is not in lit cited.			Citation has been cited in main Lit Cited Section.
9b	2	11	Kubly	BOR	There are published studies and agency reports that document	Incorporate	N	Accepted.

					predation by non-native fish on native fish in Grand Canyon (and other rivers). Use of "thought to" is too equivocal for this relationship.	literature citations		
10	2*	11-13	Dongoske	CREDA	The process of aeolian sand transport as a mechanism for preserving archaeological sites is at best still a hypothesis – it has not been scientifically demonstrated. One preliminary study (Draut et al. 2005) was inconclusive that this is a preservation process operant in the Canyon. Additionally, there is no convincing scientific evidence that links the results of a BHBF with the proposed process of aeolian sand transport to archaeological sites. As a "science" organization, GCMRC should stop promoting speculative evidence as scientific fact.	Modify sentence to read that aeolian sand MAY be transported to archaeological sites, but that there is no conclusive scientific evidence to suggest that it acts as a preservation mechanism. This is still a hypothesis that is being tested.	Y	The original sentence is accurate as stated. The work of Draut and Rubin (2005, 2006, 2007) demonstrated that aeolian transport did in fact increase when a sand bar was created directly upwind of an archaeological site as a result of the 2004 BHBF, and when sufficient new sand bar area and volume was retained through the winter prior to the spring windy season. The same study also found that some newly formed bars did not contribute to increase sand transport to nearby archaeological sites, either because the bars were not appropriately situated relative to the predominant wind direction, or because the new bars did not survive the high fluctuating flow regime that followed the 2004 BHBF long enough to serve as a sand source. Draut and others (2005) also confirmed previous observations by Hereford and others (1993, 1996) that numerous sites in the CRE are blanketed with sand of aeolian origin, even though many of these same sites are situated in or on deposits of fluvial or colluvial origin. No one has ever claimed that aeolian processes are operant at every archaeological site in the CRE, nor that aeolian deposition uniformly benefits all archaeological sites, but there is certainly empirical evidence to substantiate the claim that aeolian processes have the potential to deposit sand on archaeological sites and thereby help to offset the ongoing erosion of archaeological deposits due to both wind deflation and rainfall runoff (See attached comments by Draut for more detail.) Clearly there is much more to be learned about how and where this process can contribute to archaeological resource preservation, hence the proposal to focus on this topic in relation to studying effects of BHBFs .
11	2	12	Berry	BOR	There has been a continuing reference in TWG/AMWG meetings to the beneficial effects of BHBF on archaeological resources. This is an untested hypothesis and should be treated as such. The artificial deposition of sand on intact or eroded deposits may, in fact have a deleterious effect on stratigraphic interpretation.	Rewrite to consider alternative/deleterious effects	Y	Archaeological site preservation is a stated goal of GCPA, the AMP, and Grand Canyon National Park, mechanisms that have the potential to help us achieve that goal by offsetting the loss of high elevation sand, backfilling gullies, and reducing

								rates of erosion at archaeological sites are viewed as being potentially beneficial. However, we also are fully aware that sand-ladened wind is a double-edged sword that can damage and destroy sites as well as help to preserve them (Waters 1992, pp. 196-197), and we agree that further experimentation is needed to fully evaluate the effects of BHBFs on archaeological resources. This is why we are proposing further study of aeolian transport of BHBF sediment in relation to cultural sites and why the proposed study is framed in terms of hypothetical statements (See pp. 26-27 for the working hypotheses concerning aeolian processes and their hypothesized effects.) If we can document and quantify the conditions and factors that promote sediment deposition and retention at higher elevations in the CRE in general, and at archaeological sites specifically, we can then systematically evaluate the extent to which these conditions and factors apply throughout the ecosystem, as well as the extent to which they achieve the stated goals of site preservation (or not). For this particular study, though, the immediate focus is on assessing the potential of BHBFs to create sand bars that can serve as source areas for sand replenishment at higher elevations in the CRE and on tracking the effects of newly formed or expanded sand bars in terms of changes in sediment transport rates at a sample of archaeological site where aeolian processes in the past have previously buried and helped to preserve them. With regard to the last part of this comment, we also agree in general that the more an archaeological site is altered after its initial formation, the more difficult it will be to interpret the archaeological remains; however, the unstated implication of this comment is that a site buried by aeolian sand will be more difficult to interpret than one that has been allowed to continue to erode unimpeded, an assumption with which we disagree. Finally, it should be noted that there is nothing “artificial” about sand being blown onto archaeological sites in the CRE; in fact, as

								documented by both Hereford and others (1996) and by Draut and others (2005), aeolian sand cover derived from pre-dam sediments is a common feature at many archaeological sites in the CRE. It is the paucity of sediment available for reworking by wind that is an artifact of modern dam operations, not the aeolian process.
12	2*	12	Davis	CREDA	The expectation that aeolian transport of sand may hold promise for protecting arch. sites from weathering and erosion is premature at best. You could as easily say such transport holds little promise for protection.	Review language to be sure statements are supported by facts.	Y	See response to Comments 10 and 11 above. The sentence in question reads, "Shoreline sandbar deposits that are built during BHBF tests are also sources of sand that can be transported by wind to areas upslope, which may protect archaeological resources from weathering and erosion." The sentence does not mention 'holding promise', only that sand deposited by BHBFs can be transported by wind to areas upslope (which was documented following the 2004 BHBF; Draut and Rubin, 2006, 2007) and that this "may" protect archaeological resources. Some archaeological sites are partially covered by aeolian sand but some are not (Draut et al., 2005; Draut and Rubin, 2007). At sites where aeolian sand does bury or has the potential to rebury cultural deposits, it is reasonable to state that this cover "may" constitute protection from weathering, therefore the original sentence appears to have been worded appropriately.
13	2	20	Werner	AZ	A paragraph on purpose for Appendix B would parallel the explanation of Appendix A. At present the linkage of Appendix B to the document is not clear.	Consider adding a paragraph.	N	Thank you for catching this. An additional sentence will be added to this section about content and purpose of Appendix B.
14	3	2	Persons	AGFD	appendix A = Appendix A	Simple fix	N	Noted.
15	3*	5	James	CREDA	Page 1, line 19 uses "conserve".	Replace "restore and maintain" with "conserve"	Y	We have now chosen to use the term "rebuild" in all instances in this science plan where "restore" or "conserve" were used.
16	3*	5	Davis	CREDA	Restoration of sandbars to meet levels seen after the extreme flooding of the early 1980's is a questionable goal.	A conservation goal needs to be quantified so we know what level to attempt to achieve.	Y	There is no mention of restoring sandbars "to meet levels seen after the extreme flooding of the early 1980's" on page #3, so we cannot respond.

17	3*	15	Davis	CREDA	I recall Jack Schmidt stating that maintenance of sand bars was unlikely using flow scenarios but that we may be only able to slow the rate of sand loss.		Y	The available data do not rule out that a "flow only" may result in maintaining sandbars. To date, testing of various flow options has been insufficient to make Davis' statement.
18	3*	15-24	James	CREDA	Scientists have "concluded"…"that is the only potential option"…yet, what else is needed to "fully" evaluate the approach? What constitutes completion, if "concluded" doesn't?		Y	See above comment. The wording seems clear. Scientists have concluded that more testing is required to answer the "flow only" maintenance of sandbars question.
19	3	18	Kubly	BOR	Since the proposed trigger for BHBFs is a combination of inputs from the Paria and LCR, do we presume these are the referenced "tributaries" in this sentence? If so, suggest clarification.	Clarify	N	Yes, the Paria and the LCR are the intended tributaries.
20	3*	33	Davis	CREDA	The results MAY have implications for native fish survival…..	Please restate based on current state of knowledge rather than speculation.	Y	Accepted
21	3*	33	Dongoske	CREDA	Is the term "cultural resource" here being used as a synonym for archaeological sites? Up to this point the argument has been made that BHBFs will benefit archaeological site preservation, not cultural resource preservation. Cultural resource is a broad category of which archaeological sites are a small subset. Please do not conflate the two.	Revise to read archaeological sites in all places where the term "cultural resource" is used		No. The term "cultural resource" as used here encompasses archaeological sites, TCPs, and native riparian vegetation of traditional importance to Native American tribes. We understand the distinction between cultural resources as a generic term encompassing archaeological sites, TCPs, and other culturally valued resources (which may or may not be National Register-eligible historic properties), and archaeological sites as a specific type of cultural resource.
22	3	38	Knowles	FWS	This is mostly a discussion of 2004 flood effects to bar size and arch resources. GCMRC had committed to also providing information on displacement of juvenile humpback chub and effects to physical habitat conditions for humpback chub. Some of this information is included later in the document, and we understand that some is forthcoming; we suggest you summarize this information here.	Edit	Y	Turbidity additions to the system from an LCR spate limited the ability to compare catch rates before and after the 2004 high flow test. We can state this in the text at this point.
23	3	39	Werner	AZ	A citation to a document should be included for DOI approval of triggering thresholds.	Include a citation to a document	Y	The only document that the newly revised sediment triggering thresholds are described in is the SPG document that GCMRC produced in 2006 on Experimental Options Assessment for Options A,A',B and C. The revised triggering threshold has not been approved by DOI at this time.
24	4	9-12	Davis	CREDA	The net transfer of sand into or out of eddies appear to be opposite results. Did the 2004 experiment yield desired results in Marble	The conclusion	Y	The sand budget for the period from July 1, 2004, through the November 2004 BHBF test was

					but then undesirable results in Grand? Does this mean the strategy may be good for preserving sediment in Marble but not for Grand?	should be put in terms of the net effect for the different reaches (e.g., sand bar total area increased in Marble but decreased in Grand		positive throughout Marble and Grand Canyons. This occurred because the enlargement of sandbars in upper Marble Canyon was much greater than the total loss of sand from sandbars downstream in lower Marble Canyons and Grand Canyons. This result suggests that if BHBFs occurred frequently enough (before the newly formed sandbars entirely eroded during intervening power plant releases), the style of the response of sandbars in upper Marble Canyon could propagate downstream resulting in greater gains in sandbar size throughout more of the CRE. Scientists cannot comment on "desirable results."
25	4	16	Persons	AGFD	Do you have any idea how much more sand than 800,000 to 1,000,000 metric tons will be required to achieve increases in total eddy-sandbar area and volume throughout all of Marble and Grand Canyons? Can you model how many metric tons are needed?	Clarify "more sand" if possible		All we know now is that more sand is needed than is typically supplied (i.e., the median input) by the Paria River in a year. The best way to achieve "more sand" is to follow each large input of tributary sand with a BHBF test. If the power plant releases between BHBF tests do not completely erode the sandbars built during each BHBF test, then a sequence of BHBF tests may result in incremental increases in sandbar area and volume throughout all of Marble and Grand Canyons.
26	4	39-44	Dongoske	CREDA	Here the document conflates archaeological sites with cultural resources –see comment above. The 2004 study demonstrated an increase in nearshore sand available for wind transport – suggest that it did not demonstrate that the alleged process is ubiquitously operant within the Canyon in preserving archaeological sites. Nor has it demonstrated that the distance and directional relationship between nearshore available sand and an archaeological site is one that is consistently active in preserving a site. It is counter-intuitive logic to suggest that wind deposited sand on an archaeological site will act to preserve that site because there wouldn't be sufficient compaction of the sand to resist subsequent wind and precipitation forces.	Change "cultural resources" to archaeological sites. Also, these two sentences need to be changed to reflect that just because nearshore areas of available sand increase as a result of a BHBF it does not mean that all these nearshore		This comment was made concerning the following sentences: "In terms of archaeological resources, earlier studies (e.g., Hereford and others, 1996; Draut and others, 2005) showed that many prehistoric cultural sites found in Grand Canyon are not only built on Colorado River flood deposits, but also are buried by windborne sand derived from river-deposited sediment that has helped to preserve them over time. Results following the 2004 BHBF test confirmed that high flows released under sand-enriched conditions can increase the nearshore source areas for windborne sand, leading to increases in the rate of sand transported toward some locations in Grand Canyon that contain cultural resources (Draut and Rubin, 2006). Increased sand transport by wind and backfilling of gullies and deflated areas with aeolian sand can potentially reduce the rate of erosion and increase the preservation potential of these sites." Please

						areas will be productive sources of sand for wind transport to archaeological sites. These two sentences are very misleading and need to be revised.		see response to Comment 21 above. We fail to understand how the sentences as currently written can be construed as inaccurate or misleading. Dongoske correctly notes that the Draut and Rubin (2006) study demonstrated an increase in nearshore sand available for wind transport locally after the 2004 BHBF. It is also correct to say our study did not demonstrate (and never claimed to demonstrate) this process as being ubiquitous throughout the canyon in preserving archaeological sites. We expect that increased windblown sand transport inland (as a result of BHBF tests) would occur mainly toward aeolian deposits of the MFS (modern fluvial sourced) type and anticipate that BHBF sand deposition would have little or no effect on RFS (relict fluvial source) aeolian deposits (Draut and Rubin, 2007). (See information on MFS and RFS deposits in the supplementary table from Draut.) Regarding the comment that "*It is counter-intuitive logic to suggest that wind deposited sand on an archaeological site will act to preserve that site because there wouldn't be sufficient compaction of the sand to resist subsequent wind and precipitation forces"*, it may be counter-intuitive, but the fact is that loose, aeolian sand has higher infiltration capacity that compacted soils and hence is typically better able to absorb precipitation, thereby reducing the amount of run-off erosion that typically erodes sites in the CRE. Supporting evidence for this statement is included in the recent work of Pederson et al. (2003, p. 76), who measured infiltration capacity of various types of ground covers in the CRE and noted that "Splitting bare ground into eolian and non-eolian subsets reveals that median infiltration of eolian sediment (0.037 cm/s) is six times higher that that of alluvium or colluvium (median = 0.006 cm/s) … reducing the relative amount of runoff eolian sand generates and increasing the amount it absorbs." Ultimately, the potential for preservation of

								sedimentary deposits is a function of the balance between erosional and depositional processes at any given site, so while it is true that cemented sand (in other words, sandstone) would resist erosion more efficiently than loose sand, a cover of loose sand is still going to provide more protection than no cover at all. If aeolian sand continues to be deposited (or undergoes no net loss due to wind deflation), and if less gully erosion takes place due to precipitation than the amount of deposition due to wind (or other mechanisms), depositional processes will prevail over erosive processes and the site will be preserved. If the opposite happens and erosion of sediment exceeds deposition of sediment (either due to rainfall-induced gully incision or because sediment-deficient wind strips sand off a site rather than depositing sand on it), then the site will not be preserved.
27	4*	41	Davis	CREDA	This is a potential result but the text states it as fact that windborne sand will lead to increases in sand.	Please restate the line based on facts not speculation.	Y	See response to Comments 10 and 11 above. The work of Draut and Rubin measured a nearly two-fold increase in the amount of sand transported under similar wind conditions at one location where a sand bar created by the 2004 BHBF was appropriately situated in relation to the archaeological site and a sizable portion of the new bar was retained over the winter to supply additional sediment for transport to the site during the spring windy season. This observation is a fact, not a hypothesis. Whether future BHBFs will result in similar effects occurring at other locations in the CRE needs to be determined through the study outlined in the BHBF science plan.
28	4	42	Berry	BOR	It is precisely the backfilling of gullies and deflated areas (should this eventually be demonstrated to occur) that has the potential to confuse stratigraphic interpretation. Gullying results in a "lag gravel" effect of artifacts; the mixing of artifacts, ecofacts and radiocarbon samples from different temporal horizons in multi-component sites. Covering such a palimpsest with sand leads to the false impression that these objects were, in fact, contemporaneous.	Rewrite to consider alternative/deleterious effects	Y	As the author of this comment correctly notes, gullying and other processes of surface erosion can mix artifacts derived from different stratigraphic layers, creating a "lag gravel" effect. Stopping or slowing surface erosion processes by blanketing the site with sand would therefore be more likely to improve our ability to interpret site stratigraphy in the future than if we allowed surface erosion to continue unabated. Regardless, aeolian processes have been affecting site formation in the CRE for as long as humans

								have been living along the river, so effects of aeolian processes are certainly not restricted to the post-dam era. Any archaeologist working in a geomorphically active landscape such as the Grand Canyon river corridor needs to be fully cognizant of the possibility that aeolian processes and post-depositional mixing of artifacts due to surface erosion may have occurred in the past. A well-trained sedimentologist or geomorphologist should be able to distinguish the difference between aeolian deposits covering an eroded site surface from the underlying matrix containing in situ archaeological deposits. In any case, aeolian deposition over an eroded site surface is not going to seriously hinder interpretation of a site that has already been heavily compromised by surface erosion, but it may in fact help to preserve the remaining in situ cultural deposits.
29	5	3	Davis	CREDA	Since the results of Paria sediment input followed by a BHBF are markedly different between the upper Marble reach & the rest of the CRE, we need a much better assessment of the potential trade offs so we know what will be gained or lost by doing a BHBF.	A best guess assessment of the trade offs between each reach so we will know what is gained or loss by a BHBF	Y	This comment is addressed above – see responses to comments 23-25.
30	5	8	Davis	CREDA	Why is it important to continue this scenario rather than the reverse? More resources and those of legal import are below Marble so why are we doing so much to help this area if by doing so it harms resources downstream? There is only vague reference to native fish survival, cultural resource protection and habitat enhancement yet no reference to sand protection to provide beaches for recreational boating.	Justification for sand preservation in Marble is missing. If the prime reason for sand protection & enhance-ment is beaches for boaters, then state it so we can make decisions for BHBFs based on real reasons.	Y	Current information suggests that humpback chub may have overwintered in the vicinity of rive mile 30, so establishment of more shallow, protected habitats through building of sand bars and backwaters may be of benefit to native fishes even in the Marble Canyon reach. If sand may be conserved, even in this limited reach for a limited time, it may be available for more habitat building at a later time. This is a real reason worth testing. Establishment and maintenance of beaches for humans would be an additional benefit if such high flows can be used for this purpose. Managers have not stated that Marble Canyon is not a priority for sand bar rebuilding. One of the objectives of a future test is to determine whether or not a more uniform sandbar rebuilding

								response is possible by allowing tributary sand time to redistribute more uniformly downstream before the BHBF test. In development of this science plan, the GCMRC assumed that sediment resources are important throughout the ecosystem.
31	5*	19-24	Dongoske	CREDA	fourth bulleted item: the second part of this bullet is sheer conjecture and should not be advanced as a result of the 2004 BHBF. Assumptions should not be advanced before they have been put to rigorous scientific testing.	Second sentence in this bulleted item should end after archaeological material. Delete the last part of this sentence.	Y	Following the 2004 BHBF, Draut and Rubin (2006) found that at 24.5 mile, where approximately half of the flood-deposited sand remained at the start of the windy season in spring 2005, sand-transport rates measured near the river were approximately double those in spring 2004. This increase in aeolian sand transport was attributed to the presence of additional sand deposited by the 2004 BHBF (see also Draut and Rubin, 2007) and was interpreted to indicate that sediment-rich BHBFs can increase windborne transport of sand toward "some locations" (24.5 mile being an example). At the same site, Draut and Rubin (2006) found that sand blown inland directly off of the 2004 BHBF deposit had fill in the lower part of a gully that had begun to incise the dune field containing archaeological material (see Fig. 25 of Draut and Rubin, 2006). We will rephrase the second sentence in that bulleted point to read: "Sediment-rich BHBFs can increase windborne transport of sand toward some locations in Grand Canyon that contain archaeological material, and can thereby reduce or inhibit gully erosion. It has been hypothesized that such a process would increase the preservation potential of these sites."
32	5	21	Berry	BOR	It is precisely the backfilling of gullies and deflated areas (should this eventually be demonstrated to occur) that has the potential to confuse stratigraphic interpretation. Gullying results in a "lag gravel" effect of artifacts; the mixing of artifacts, ecofacts and radiocarbon samples from different temporal horizons in multi-component sites. Covering such a palimpsest with sand leads to the false impression that these objects were, in fact, contemporaneous.	Rewrite to consider alternative/deleterious effects	Y	See response to Comment 28 above
33	5*	23	Davis	CREDA	The implications that gully erosion can be stalled by dam operations depositing sand in arroyos is speculative and unproven. Even if later found to be true, it may remain superfluous to the array of measures available and effective (and cost effective) in	The section should be written as supported by	Y	We know from both empirical observation and experimental studies that changes in gully gradient have the potential to change rates of gully incision. On the other hand, if gully

					preserving these sites.	facts rather than speculation.		infilling already had been "proven" to slow rates of erosion at archaeological sites, additional study of the effects of gully infilling on site erosion would not be needed. Gully infilling can be either direct or indirect, and as documented by Draut and Rubin (2006) at 24.5 mile, after the 2004 BHBF, windblown sand derived from the 2004 flood deposit filled in the lower part of a small gully that had begun to incise into the dune field, which prevented it (at least temporarily) from cutting down further and integrating with the river. In this case dam operations did not deposit the sand in the gully itself; but dam operations (the BHBF) deposited sand that was later (over the next year) transferred into the gully by wind. See photographs in Figure 25 of Draut and Rubin (2006). This is certainly not intended to be the last word on how BHBFs affect gullies; studying those processes further is one of the goals of project 1C outlined in the science plan.
34	5	23	Kubly	BOR	Is it known or hypothesized that gully erosion is reduced? The sentence seems to imply the former, but my understanding is that this is one of the hypotheses to be tested.	Clarify	Y	The answer is "Both". We have some empirical evidence (see comment above), but clearly more data is needed to more thoroughly and precisely evaluate the relationship between increased high elevation sand deposits and surface erosion rates, hence this is treated as a hypothesis to be tested through future study.
35	5	27	Kubly	BOR	Is there a document that contains the evaluation that led to the revision of sediment input trigger? If so, it should be referenced.	Clarify	N	The revised sediment trigger came from the SPG process and is described in the GCMRC's Experimental Options Assessment. A reference to this document will be added to the science plan here. The original sediment trigger is found in the 2002 EA and 2004 Supplemental EA.
36	5	28-38	Persons	AGFD	Under revised triggering criteria, is the likelihood of mining sand from the upper Marble Canyon (Paria) reach following a large LCR input advisable? Assuming sandbars and backwaters formed by eddy return current channels are desirable for humpback chub (HBC), would it be good to leave some of the sand (and backwaters) in the mainstem just downstream of the LCR following high LCR sand input rather than running a BHBF to park the sand above the daily fluctuation zone? Is this a trade-off analysis that managers need to do?		Y	We can reasonably hypothesize that when sand is moved above the daily high fluctuation zone some is also deposited below and remains there until displaced by subsequent flows, creating some backwater habitats for a limited time. This may be of value to native fishes. Additional testing with associated monitoring will help resolve some of these trade-offs. To some extent the reviewer is asking for goals that have not yet been established by managers.

					Where do we want the sand, and when?			Even though the greatest gains in sandbar size occurred in upper Marble Canyon. Large sandbars did form during the 2004 BHBF downstream from the LCR (especially at Carbon and Salt Mines). Large backwaters were associated with these new sandbars. Unfortunately, these sandbars were eroded rapidly with the onset of the 5,000-20,000 cfs fluctuations in January 2005.
37	5	34	Davis	CREDA	The rationale for discounting the LCR sand input is missing when, simultaneously, the claim is made that sand is vital to humpback mainstem habitats which are mostly downstream of the LCR.	Rationale for lower value for LCR sand input and higher value for Paria input when most chub habitat is downstream of LCR.	Y	The trigger is defined based on geography. Because the amount of sand in Marble Canyon is nonzero (and typically increases downstream) and the LCR is farther from the dam, the "value" of sand supplied near the top of the system (from the Paria) is higher. In other words, sand eroded from Marble Canyon must pass through all downstream reaches, and therefore, be available to be deposited in these downstream reaches.
38	6	Seasonal Timing Section	Kubly	BOR	This section purports to address biology and cultural resource considerations, but it is almost solely concerned with fine sediment.	Expand	Y	This section will be expanded to include some of the original information that was removed during editing so that more than fine sediment is discussed. Much of the original text was moved to Appendix A.
39	6	1	Knowles	FWS	The title of this section doesn't match the discussion content, which is focused on a rationale for timing, magnitude and duration of the BHBF based entirely on sediment and hydrologic limitations. We would like to see a discussion of timing of a BHBF in the context of the environmental biology of humpback chub (e.g. when is the best time relative to effects on spawning migration, larval/juvenile dispersal, food base, and are there any reasons why a 60 vs 45 k cfs flood or a 30 vs 60 hour duration flood would be more or less beneficial to humpback chub?	Edit	Y	This section will be expanded to include some of the original information that was removed during editing so that more than fine sediment is discussed. Much of the original text was moved to Appendix A.
40	6	2	Davis	CREDA	Optimal timing description only applies to the upper ½ of Marble yet the plan uses chub, cultural and other resources as its reasons for BHBFs.	Spilling & bypassing hydro to preserve sand in the upper ½ of Marble has not been adequately justified	Y	This section will be expanded to include some of the original information that was removed during editing so that more than fine sediment is discussed. Much of the original text was moved to Appendix A.

41	7	18	James	CREDA	Does this sentence imply that the only benefit of a 30-hour test is to "advance learning"? Experimentation should not be undertaken unless there is an anticipated improvement to resources, with a secondary benefit of "advancing learning".		Y	No, the 30-hour duration was deemed the minimum peak duration needed for data collection to evaluate the BHBF sediment responses.
42	7	32-36	Davis	CREDA	This sentence is not clear.	Reword sentence to better incorporate the message from sentence 4 of the previous para.		The sentence in question seems to follow clearly from the preceding paragraph.
43	7	37-39	James	CREDA	What is meant specifically by "normal dam operations" and "some period"? Please provide the citation tied to "sediment scientists now suggest".		Y	"Normal" dam operations is intended to refer to the 1996 ROD flows.
44	7	41	Davis	CREDA	The reason the eddy sandbars are critical in this reach and should be sustained (possibly at the sacrifice of those further downstream) is not given. If sandbars are all deemed "critical" then the BHBF should not be designed primarily to help the upper ½ of Marble.	Justification for using the term "critical" to describe sand bars in the upper ½ of Marble should be provided.	Y	Recent captures of young humpback chub that appear to have over-wintered in the vicinity of 30 mile suggests that humpback chub may be able to take advantage of protected habitats such as sand bars and backwaters in Marble Canyon Additional BHBFs may result in increases in sandbar size throughout more of the CRE than just upper Marble Canyon
45	7	42-46	Davis	CREDA	Quantification of what is optimal sandbar volume has not been done and we are left with the notion that simply 'more is better.' Conservation to some previous level is listed as a goal without definition.	A BHBF designed merely to produce more volume for sandbars in the upper ½ of Marble and why simultaneous effort for sand bars in the lower canyon is of lesser value should be better justified.	Y	Policy question. Definition of goals by managers would help resolve the reviewer's concerns because GCMRC could report gains and losses in relation to a target number. The only goal we currently have to work with is "more". This is true (as mentioned above) and has limited the scientists' in their evaluation of previous BHBF tests. The GCMRC agrees that management needs to better identify the resource objectives for sand bar rebuilding.
46	9	1	Persons	AGFD	"Are gains in eddy-sandbar area and volume meeting management objectives?" Without a way to answer this question, should we		Y	We agree that more definition on this topic of resource management objectives is needed and

					conduct BHBFs until the managers can better define management questions?			will assist scientists in their evaluation of BHBF responses in the future.
47	9	5	James	CREDA	See comment 2 above		Y	We have now chosen to use the term “rebuild” in all instances in this science plan where “restore” or “conserve” were used.
48	9	Fig 1.2	Kubly	BOR	GCMRC should give similar consideration to biological resource or habitat outcomes in setting up this decision tree.	Expand	Y	The reviewer makes a reasonable suggestion, but because of the substantial challenges associated with tracking native fishes and their habitat use the proposed projects have focused more on those challenges rather than on meeting as yet undefined goals.
49	10	10-13	Dongoske	CREDA	The only sociocultural element and objective related to the BHBF research is aeolian transport of sand to archaeological sites? What about other sociological and cultural issues that may be impacted negatively or positively by a BHBF? There appears to be a given assumption that all effects of a BHBF to sociocultural elements and objectives are beneficial.	Evaluation of some of the negative aspects of the BHBF to other sociocultural resources should be provided and is necessary in performing any trade-off analysis.		Due to financial constraints, not all issues of potential importance can be studied. The primary focus of future BHBF experiments is currently focused on determining whether there is a “flow only” option for sustainably rebuilding sand bars throughout the system and improving our understanding of how the conservation of sediment may ultimately translate into effects to other CRE resources, specifically backwater habitats, sand bars used as camping beaches, native riparian plants, and archaeological sites The potential negative consequences of BHBFs will be considered in conjunction with the compliance review process. Previously, however, it was determined by Bureau of Reclamation and NPS, in consultation with the AZ SHPO and the Advisory Council on Historic Preservation, that BHBFs up to 60,000 cfs would have either no effect, no adverse effect, or a beneficial effect for National Register-eligible cultural resources in the CRE (Letter from SHPO on file with BOR, see also Laralde and Balsom, 1996), so our assumption that most effects of BHBFs at cultural sites will be either neutral or beneficial seems warranted at this time.
50	10	21	Kubly	BOR	“Previous studies” should be cited. The integration of this work with existing funded food base research should be made more clear. How will the additional funding help to augment what is already being accomplished?	Add citations	Y	Current food base sampling (current AMP work plan) is inadequate to test the three hypotheses that are laid out in the BHBF research plan. The biomass and abundance of lower trophic levels will likely be reduced immediately following a BHBF. One hypothesis we hope to test is that the recovery of algal and invertebrate biomass and abundance following a BHBF is rapid and will

								occur in the weeks-months following the BHBF. The proposed BHBF food base sampling is more frequent (1, 3, 7, 14 days) and then monthly following BHBF...monthly sampling will be our regular food base sampling) than our regular food base sampling (i.e., once per month), which will allow us to characterize the rate of recovery of lower trophic levels (i.e., rapid or prolonged). In order to accurately characterize changes in invertebrate and algal productivity following the BHBF, our sampling must be frequent and comprehensive. Further, we proposed to measure novel indicators of invertebrate and fish growth rates (rna:dna ratios, phosphorus content) because we hypothesize that the post-BHBF algal community will be fast growing and might support higher rates of invertebrate, and ultimately fish, growth.
51	10	26	Knowles	FWS	We understand that GCMRC is preparing a report on the effects of BHBFS on fish habitat which will include recommendations for future research. We suggest that GCMRC consider incorporating additional monitoring to evaluate this to answer the question of how habitats are changed in the near term and long term (e.g. are nearshore habitats available to shelter humpback chub during the BHBF? how are nearshore habitats changed during and immediately after the BHBF? How are these habitats changed over time in months/years following a BHBF? What are the changes in the fish communities of these habitats over short and long time intervals? What are the differences in these communities in low water years with and without a BHBF?).	Edit	Y	GCMRC has received multiple requests for more biological studies associated with the BHBF. While there are some serious limitations to interpretation of fish monitoring data that will have to be considered, we propose to add a spring backwater seining project to monitor fishes and these habitats. Fish monitoring will be most productive when solar radiation is highest in late summer/early fall, but, in order to sample closer to the timing of the high flow event, we propose an additional backwater seining effort in late May/early June. We will develop an additional project proposal to add to this plan along these lines.
52	10	26	Kubly	BOR	Coupling sampling of native fish and backwaters that occurs 8-9 months after the BHBF is a real stretch in assigning any cause and effect relationship. Research on nearshore habitats and the effects of BHBFs needs to be more tightly coupled in time. We know very little about the temporal and spatial dynamics of these habitats or the communities that utilize them. Questions directed at these relationships should be paramount for the integration of physical and biological sciences, as is indicated by numerous differences of opinion among stakeholders and between managers and scientists. Yet, GCMRC proposes to relegate them to the back burner and cover them under existing monitoring. This level of investigation is insufficient.	Incorporate contemporary studies of the effects of the BHBF on nearshore native fish habitats. Begin to study seriously the temporal and spatial	Y	Please see response to comment 51

						changes that occur in these habitats and the communities that occupy them.		
53	10	28	Persons	AGFD	Revise, Yes response is desired. I would argue that backwater sampling data does not provide useful abundance data about fish using these habitats. It is useful presence/absence data, but the catch-per-unit-effort data is probably of little value in tracking status and/or trends. Backwaters can be very ephemeral and short lived. Their appearance and detection is highly dependent on river stage and daily and weekly to monthly fluctuation patterns. During the daily peak flow many backwaters are under water and are eddies, while during the daily low flow when more sand is exposed, backwaters are more abundant. Thus, as seen from a moving boat, if the trip is traveling on the low flow of the day, they will encounter more backwaters than if traveling on the high flow for the day. Also, a trip immediately after the shift in monthly volumes from August (high flows) to September (low flows) would see many more backwaters than during an August trip when daily flows are relatively high. I wish I better understood their importance to native fishes. It is possible that they are the worst possible place for native fish, but because we are able to sample them effectively with seines we catch fish. We need to be careful about making the assumption that because native fish are collected in backwaters those habitats are important to the life history of the species. I'm not sure how to best address this larger backwater question, but think we need to do so before we go down the path that backwaters will save native fish. The backwater issue keeps showing up in these plans, and I'm almost afraid to question it because some stakeholders seem to hold them sacred, but I think we should be very careful about assuming they are important to native fish. A project synthesizing backwater data and making recommendations for future research or monitoring might be in order, especially in designing a long term experimental plan. With that said, September seining trips are important for presence/absence data, and also may provide the opportunity to		Y	Please see response to comment 51

					collect more genetic samples from what appears to be a reproducing aggregation of fish between 30-mile and the LCR.			
54	10	29	Persons	AGFD	Is there a report detailing the backwater work? Who is the PI for this work?	Info.	Y	GCMRC is the PI for this work in FY 07. Contractor SWCA has been taking the lead in recent years and reports on that work are available.
55	10	36	Kubly	BOR	When did the effect of high flows on gravel transport in the Lees Ferry reach become a high priority research question? I do not recall such discussions at the TWG.	Provide justification for placing this research above that on native fish.	Y	Additional work outside of the BHBF framework needs to be conducted to fully address the reviewer's concerns. This proposal does not make a claim of prioritizing one resource over another; rather, it takes advantage of learning opportunities that will be available with such a test, which are most clearly the sediment transport questions.
56	11	3	Kubly	BOR	Provide more evidence that "current technologies and methods were found to be inadequate." Is there a report that documents this investigation? Perhaps GCMRC needs to let an RFP to determine whether there are other investigators who know of different technologies and methods?	Cite reports or document efforts	Y	Tracking the fate of small bodied, warm water fishes in cold, turbid water is a difficult exercise; we believe the reviewer has personal experience with such efforts. The difficulties in comparing catch rates before and after the 2004 high flow event are the exercise referred to here. GCMRC is pursuing approaches to better estimate fish habitat occupancy and humpback chub displacement (Appendix B), and modeling to improve our ability to draw conclusions about such events. We also propose that an RFP might yield novel approaches that could be helpful (assuming funding for such an effort could be identified).
57	11	8	Davis	CREDA	Are there to be priorities to answering these questions and would those same priorities weight implementation of management actions? Why does this plan not address all of these priority questions? For example, scientists continue to speculate on the advantages BHBFs will have for nearshore habitats for young chub but none of the proposed studies suggests addressing this question. Another is the effect of BHBF on native fish survival touted on pg. 3 as a high priority issue yet missing from the table of questions to be addressed.	The text should explain how all the listed questions in Table 1.1 are to be answered. At present, we are left to guess why some of these priority questions are not addressed.	Y	Please see response to comment 51.

58	11	8	Kubly	BOR	All these questions are AMWG priorities?	Identify where and when AMWG identified this set of questions as high priority. I recognize some, but not all.	Y	Table 1.1 needs to be re-titled to something like: scientific questions to be addressed in association with a high flow experiment. The title of Table 1.1 will be revised.
59	11	8, 28	James	CREDA	Table 1.1 lists SOME of the science questions identified by the AMWG. Please provide the document/action that determined which are priority—or alternatively, remove "priority" inference.			See response to comment 58 The caption to Table 1.1 will be revised
60	11	15	Knowles	FWS	The question "Do BHBFs result in creation of nearshore habitats (i.e. backwaters) that can offer physical benefits to humpback chub and other native fishes?" does not appear to be answered by the plan. We would argue that they do (see AGFD 1996 and Goeking et al. 2004) and that this plan should further study this phenomenon.	Edit	Y	Agree. Please see response to comment 51
61	11	26	Persons	AGFD	"Scientific Questions identified as a priority by the AMWG: RAINBOW TROUT. Are individual rainbow trout displaced from the Lees Ferry reach as a result of a BHBF? If so, do displaced rainbow trout return to the reach, or do they establish residence elsewhere?" Is this a high priority AMP question? Can you refer me to a document that identifies the high priority AMWG questions that this references? Is this the right question, and if so, is it the best way to try and answer the question?	Justify need for project.	Y	We believe that the proposed project provides valuable information to address the following: RIN 4.2.1. What is the rate of emigration of rainbow trout from the Lees Ferry reach? RIN 4.2.2. What is the most effective method to detect emigration of rainbow trout from the Lees Ferry reach? RIN 4.2.3. How is the rate of emigration of RBT from the Lees Ferry reach to below the Paria River affected by abundance, hydrology, temperature, and other ecosystem processes? Perhaps some reviewers will dispute the prioritization of this question; resolution would be up to TWG. It is important to remember the BHBF plan is a subset of all of the AMP projects; it is only those projects that would be conducted in conjunction with a high flow test. However, there are many disagreements in TWG meetings over whether or not rainbow trout in the LCR reach are from the Lees Ferry reach and it has been cited as a concern in association with a BHBF. This project takes advantage of a potentially unique opportunity in a manner that does not require extensive compliance efforts. If TWG determines that they do not want to know

								the fate of RBT during a BHBF we could withdraw this project, but we suspect this question is of interest to many members.
62	11	Table 1.1	Berry	BOR	How are the "scientific" questions regarding archaeological sites articulated with the ongoing treatment plan program for 151 sites in the Colorado River corridor? In particular, which sites will be singled out for monitoring before and after BHBFs. Are these sites already targeted for excavation or other mitigative measures in the treatment plan?	Rewrite to consider interaction with treatment plan activities	Y	Not sure what the first question is asking. The treatment plan is still in draft form, and no firm decisions have been made yet about which sites will be treated, how or when, so close articulation between the treatment plan and the BHBF science plan is not yet possible. Since this in a public document, specific site information is not provided; but it is available on a need to know basis. The list of sites to be evaluated with the BHBF experiment does not, to my knowledge, include any sites identified as a high priority for excavation in the ZCRE/USU treatment plan. Some of the sites to be evaluated for BHBF effects may be treated in the future by adding erosion control features, but monitoring of BHBF effects at these sites will not be compromised by this treatment approach and in fact, may enhance both the proposed study and treatment results by affording us an opportunity to evaluate the effectiveness of erosion control measures with and without a BHBF-enhanced sediment supply.
63	12	5-14	James	CREDA	What is the magnitude of "additional funding" required associated with "additional onsite contractors" and the addition of "technical staff"? Are those additional costs included in the program studies detailed in table 1.2?		Y	The costs associated with individual projects are projected to cover additional funding needs; that is why there is a budget associated with this BHBF plan that is above and beyond the standard AMP budget.
64	13-14	Table 1.2: C.2 & C.3	Dongoske	CREDA	Prior to studying the potential beneficial effects of aeolian sand transport in preserving archaeological sites, why not ask the question: what percentage of archaeological sites located within the CRE are in the appropriate distance and prevailing wind directional relationship with nearshore available sand to benefit from such a study? The plan as drafted is putting the cart before the horse. Even if it can be demonstrated that this hypothesized process is beneficial in preserving archaeological sites, there may not be enough archaeological sites that could benefit from it to make the effort and cost associated with substantiating this process worthwhile.	Please identify by site number which archaeological sites are in the appropriate distance and prevailing wind directional relationship to benefit from an increase in	Y	The question ("what percentage…") is a good one. Of the nine locations previously studied in detail by Draut and Rubin (which are not necessarily representative of all sites, or even of all sites where aeolian sediment is relevant), a third or more of the sites were determined to be associated with MFS aeolian sediment (with correct wind direction and distance downwind) such that it is likely some additional transport to the aeolian deposit in question would result from sediment-rich BHBFs : C:05:031, C:13:365, B:14:095, and possibly a fourth site, A:15:033 (if vegetation on the source-area sandbar was removed.) In addition, ongoing investigations have identified several other sites that appear to

						nearshore available sand and the subsequent aeolian transport of that sand. Also evaluate whether the cost associated with scientifically substantiating this preservation process is an efficient and effective use of funds.		be similarly situated with respect to sandbars and wind direction that might also possibly benefit from BHBFs: C:13:006, C:13:321, and G:3:072. We are not able to say with certainty how many other sites might also receive increased sand transport following a BHBF because we have not examined all sites in the CRE for evidence of aeolian transport (although a preliminary assessment of this is now underway in conjunction with the Cultural Monitoring R&D project) nor have we attempted to document wind directions at all locations in the canyon, (and we know that the dominant wind direction is not uniform throughout the canyon.) Obtaining a percentage of the **total** number of sites in the river corridor that might respond in this manner to a BHBF would require a much different and more involved study, but it is certainly one that could be conducted in the future if the AMP is willing to support this effort.
65	13	Table 1.2	Berry	BOR	$618,000 to monitor whether or not gully infilling occurs!!? This could easily be determined as an aspect of the extant monitoring program or in conjunction with the treatment plan for much less money.	Provide better integration with understanding native fish habitat changes from BHBFs	Y	The $618,000 is for measuring the effects of the BHBF on all fine-sediment-related resources, not just gullies The study of aeolian transport from sand bars created during a BHBF and gully infilling is only one component of this proposed interdisciplinary project. A large portion of Project 1.C (which in turn is part of Project 1) is focused on documenting and quantifying area, volume and grain-size of sediment deposited by a BHBF throughout the CRE. Other components of Project 1.C will evaluate how BHBFs affect the amount of sand stored in submerged eddies, and how they affect the amount of campable area at a sub-set of measured sandbars in the CRE. This project involves much more than just the study of aeolian transport and gully infilling at archaeological sites.
66	14	NA	Knowles	FWS	We are disappointed that there appear to be no efforts to integrate sediment research with fisheries research. There is evidence that the 30-mile and RM-65 mile backwaters grew in response to flood events (Goeking et al. 2004). We believe these to be important habitats for juvenile humpback chub, and anecdotal evidence indicates that juvenile humpback chub utilized the 30-mile backwater following the 2004 experiment (R. Van Haverbeke, FWS, pers. comm., 2006), which may have contributed to their	Edit	Y	Please see response to comment 51

					overwinter survival (M. Andersen, GCMRC, in litt. 2007). We understand that a report of the 2004 effects is forthcoming, but why isn't there a more direct effort to assess these effects than relying upon existing monitoring? Again, we would like to see an effort to evaluate the effects of the experiment on these habitats over the short- and long-term.			
67	14	Fish	Kubly	BOR	GCMRC's proposed studies are directed at second-level priorities in addressing rainbow trout questions, rather than concentrating on effects of BHBFs on native fish and native fish habitats. It appears the proposed studies are borne more of convenience of access and logistics than of priority considerations. Also, the portion of the budget for fish and food production pales in comparison with other project areas.	Provide better justification for why contemporary native fish and fish habitat studies are not being proposed. Seriously consider allocation of budget and review past biological opinions to determine likely research requests from FWS to satisfy biological opinion.	Y	Please see response to comment 51. We have not developed projects simply for convenience and logistics, though certainly such factors are considered. We have attempted to develop those projects which are most likely to yield meaningful results. We intend to develop an additional backwater seining project which will meet these criteria.
68	15		Davis	CREDA	The OTHER STUDIES section should state the Native/nonnative diversity project relates to riparian vegetation.	Change wording.	Y	Accepted
68b	15	native/ non	Werner	AZ	A "recruitment box" model[1] may be applicable. Timing of flows and available soil moisture may be as or more important than nutrients in native/non-native comp. See also discussion in Stromberg recent paper[2]	Review hypothesis/explain why the stated hypothesis is the correct one to test in this	Y	Very constructive comment; we will review suggested citations and consider for next iteration.

[1] Mahoney J.M. & Rood S.B. (1998) Streamflow requirements for cottonwood seedling recruitment- an integrative model. *Wetlands*, **18** 634-645.

[2] Stromberg J.C., Beauchamp V.B., Dixon M.D., Lite S.J., and Paradzick C. (2007) Importance of low-flow and high flow characteristics to restoration of riparian vegetation along rivers in arid south-western United States. (*Freshwater Biology*) **52**, 651-679. [contact J. Stromberg @ ASU for pre publication copy]

						circumstance.		
69	16	Public Outreach	Kubly	BOR	Public outreach is already funded through the POAHG. Why is additional funding required? Is the POAHG budget insufficient?	Justify public outreach need re: POAHG	Y	There purpose of this outreach effort is to mitigate potential negative impacts to boaters, anglers and other recreational interests by informing them in advance of the planned BHBF. We included specific funding for this outreach effort because we did not think that POAGH had considered this need in their budget planning. If POAGH would fund this outreach effort, we fully support it.
70	21	20	Davis	CREDA	How does this study help us to weigh the achievement of sandbar resource goals for other reaches? This is but one area of the canyon and as such, it will not tell us whether management goals are going to be met in other areas. This project is too limited to be of value in seeing if BHBFs help us achieve the AMP goal. It is largely duplicative of Project 1A that measures temporal/spatial sediment budgets throughout the canyon and can more broadly answer questions relative to the utility of BHBFs.	Drop Project 1B	Y	Project 1B is designed to help further our understanding of the dynamics of flow, sediment transport, and erosion/deposition in eddies during BHBFs. Therefore, this project is essential to "the achievement of sandbar resource goals for other reaches." The lower part of Marble Canyon was chosen for this study because this reach has many large eddies in which to make high-quality measurements and this reach was a transitional reach during the 2004 experiment (between more eddies gaining sand and more eddies losing sand). Given that during the next BHBF (perhaps the first in a series of BHBFs), this reach will also likely be transitional, we will likely gain much knowledge on under what conditions eddies gain sand and what conditions eddies lose sand.
71	21	42	Davis	CREDA	We see no basis for assuming that the development of predictive capabilities at this site (several eddies around RM 45) will have broad application. No discussion is provided on how these results would be applicable to the entire CRE or why we should assume they would be.	Provide a basis in the text for the assumption of predictive capabilities beyond the vicinity of RM45.	Y	A response was provided on this topic above. Physics applies everywhere. Therefore, collecting data to improve our ability to predict sandbar response with physically based numerical models will be broadly applicable.
72	23	23	Kubly	BOR	This section should be illustrating the links with effects of BHBFs on nearshore fish habitats, but this connection is not being made. We end up with a very general account of how it relates to biological studies, none of which are of native fish or their habitats. I think this is a missed opportunity.	Provide better integration with understanding native fish habitat changes from BHBFs	Y	Please see response to comment 51 This section is being revised to better reflect the fact that is will mostly determine eddy depositional rates related to sand bar building (or erosion) and is not intended to directly answer nearshore habitat questions directly.

73	24	6 11	Kubly	BOR	How are different ramp rates being evaluated by this project? How do the "simulation models" compare with CEQUAL-W2 and other models already in operation?	Answer	Y Y	The study of ramping rates is not part of this study, rather it is a study of eddy flow and sediment deposition processes and rates of deposition.
74	25	1	Mike Berry	BOR	Glad to see that the presumed benefits to archaeological sites are treated as a hypothetical in this project description (although not in most of the narrative text). However, the issue of preservation of archaeological sites may be moot in many instances because sites exhibiting erosion have been targeted for excavation or other treatment options under Reclamation's Section 106 compliance activities.	Rewrite in order to consider/explain program overlap	Y	We understand that BOR and NPS have come to an agreement about how to move forward with mitigating effects of dam operations and human visitation impacts at the most severely impacted archaeological resources within the CRE. While laudable, the implementation of a treatment plan for the most severely compromised resources in the CRE does not eliminate the AMP's charge to monitor and research effects of dam operations on cultural resources in the CRE and determine an optimal operating regime that includes consideration of how best to preserve the remaining cultural resources in the CRE for the benefit of future generations. Several lines of evidence indicate that mechanisms that restore or enhance storage of river-derived sediment at higher elevations within the CRE are needed to further the aims of this program with respect to archaeological site preservation and the protection of other culturally valued resources in the CRE, including camping beaches and sand-dependent native riparian species. Therefore, focusing additional research and monitoring on the processes that are most likely to restore or enhance sediment supplies at higher elevations in the CRE, especially in locations where they have a potential to replenish sediment cover at archaeological sites, is reasonable and prudent.
75	25*	26	Davis	CREDA	Although of scientific interest, we see little utility in studying aeolian transport. The AMP goal is to preserve and protect sand bars and, in that, there may be some dam effect and a measure of control. We have no control over wind. Knowing the degree to which aeolian transport at one sandbar or another contributes to arch. site protection or preservation does not and would not change the AMP goal to preserve and protect sand bars. Since Project 1A will ascertain longitudinal patterns of net erosion and deposition, it should supply all the necessary information to determine if BHBFs will meet the AMP goal of protecting and preserving sand bars.	Drop Project 1C		In addition to the AMP goal of sandbar protection, there is a legal mandate to achieve in-situ preservation of archaeological sites. We know that that the only way to preserve archaeological sites *in situ* (a stated priority goal of the AMP) is to maintain their physical integrity and stability. At a minimum, maintaining site stability requires that at least as much sediment is replaced as is being lost to surface run-off erosion and wind deflation. Since 1963, dam operations have re-structured the hydrologic regime of the river corridor below Glen Canyon Dam, effectively eliminating most

								of the natural mechanisms that formerly replenished sediment at higher elevations, while systematically depleting sediment reserves from lower elevations in the CRE (Topping and other, 2003.) Therefore, it stands to reason that mechanisms that promote sediment retention systemwide and replenishment at higher elevations, where the majority of archaeological sites are situated -- either through direct deposit of alluvium or secondary deposition by wind – in conjunction with mechanisms that reduce surface erosion, such as enhancing soil permeability or installing check dams, offer the best and probably the only realistic means for maintaining the integrity of archaeological sites in CRE. While it is true that managers have no control over wind, they do have control over the sand supply that wind has access to. Wind is not limiting aeolian sediment transport in the CRE (there is plenty of wind action in Grand Canyon!) but if sand is not available, no aeolian sand transport will occur. We are proposing to study the connections among changes in sand supply available for windborne transport (specifically, sand deposited by BHBF tests) and the resulting effects on erosion rates and preservation potential of archaeological sites. The study of aeolian transport rates is just one of several potential effects of BHBFs to be evaluated as part of Project 1C. The primary focus of Project 1.C is to document the size and extent of sand bars formed in response to a BHBF, then to ascertain how these bars affect campsites, backwaters, and archaeological sites. Project 1.A is focused on monitoring changes in suspended sediment prior to, during, and immediately following the BHBF. It will not measure the sediment deposited as a result of the BHBF; this is what Project 1C is designed to do.
76	25-30*	Study 1.C	Dongoske	CREDA	The scientific study of the relationship between sandbar building as a result of a BHBF and the preservation of archaeological sites is poorly defined. At this point, as the study is described, the	Please clarify and more effectively	Y	We disagree with this comment (see responses to other aeolian-related comments above and below.) In addition to using weather stations and

					results of this study will contribute little to our understanding of archaeological site preservation in the Canyon. Moreover, this study will not contribute to our ability to tease apart the effects of dam operations from those processes that are naturally occurring in archaeological site erosion or preservation. The funds associated with this project could be better spent elsewhere.	describe how archaeological site preservation (a management goal) will be measured and evaluated should aeolian sand be deposited on archaeological sites.		sand traps to monitor the movement of aeolian sand (which is a key part of "teasing apart the effects of dam operations from those processes that are naturally occurring), the evaluation of BHBFs will include topographic surveys at selected archaeological sites to measure changes in sediment cover and erosion features. Repeated topographic surveys are essential to documenting whether archaeological sites (or other features in CRE) experience direct deposition during the BHBF, subsequent inflation or deflation by wind, or increases/decreases in the size of gullies as a result of changes in available sand supply. Methods would be similar to those currently being used by scientists from Utah State University in conjunction with the USGS Menlo Park group (including ground-based LiDAR; standard topographic surveys involving total stations, while less costly, do not obtain the high-resolution ground coverage as ground-based LiDAR for detecting surface changes.) Surveys will be repeated at regular intervals at a sub-set of sites for several years in conjunction with annual monitoring efforts, to track effects of BHBFs over several seasons (such as inland transport of windblown sand) and to capture other landscape-altering events that impose additional changes on top of those induced by BHBFs.
77	26*	17-18	Dongoske	CREDA	It is unclear how this proposed study will provide credible data to inform on strategic science question 2.1.	Please be more specific in the explanation, because as this project's description reads the linkage between a BHBF and any benefit to archaeological site preservation appears to be at best	Y	The proposed study will be able to inform on how dam-controlled high flows do or do not result in condition changes that affect erosion rates at higher elevations in the CRE. Such condition changes may include increasing the supply of sand available for backfilling gullies and increasing precipitation infiltration capacity due to the addition of sand cover. As explained in the proposal, after the initial pre- and post-BHBF effects are thoroughly documented, longer-term effects of the BHBF will be tracked through continuing topographic measurements of site surfaces and gully thalwegs during routine monitoring.

						indirect and incidental. Moreover, tracking long-term preservation benefits, if they exist, at archaeological sites to establish the efficacy of the hypothesis does not seem to be included. The connection of the geologic study to the archaeology is not well described or defined.		
78	28	16, 23	James	CREDA	See comment 2 above.	Replace "restoration" with "conservation"	Y	We have now chosen to use the term "rebuild" in all instances in this science plan where "restore" or "conserve" were used.
79	28	20-24	James	CREDA	This sentence is very broad and could be excluded from this specific science plan. What are the target reach or reaches?		Y	Target reaches have not been specified by the management goals, although the focus of the 2004 BHBF test was on the upper 1/3 of the CRE.
80	28	Table 1.C-1	Dongoske	CREDA	Specifically describe which archaeological sites are being observed for the beneficial effects of aeolian sand transport. Also, describe the distance and directional relationship between the targeted archaeological site(s) and the nearshore sand bar and/or beach. This is vital information for evaluating this proposed study because otherwise it appears that the archaeological sites are incidental to the main focus of the study which would reduce the importance of this effort toward preservation.	Please identify by site number which sites will be studied. Also, identify the distance and directional relationship between the targeted	Y	Since this is a public document, we deliberately avoided including specific information about the sites and kept the location descriptions in this table very general to preserve confidentiality of archaeological site locations (as clearly stated in the table caption.) Specific site numbers and their relation to specific sand bars can be provided on a need-to-know basis. Please note that the aeolian transport study is only one component of this interdisciplinary project (see response to Comment 65), but this does not mean that it is "incidental" or "would reduce the

						archaeological site and the nearshore available sand.		importance" of this study in terms of improving our understanding of how BHBFs may affect the preservation potential of archaeological resources in the CRE.
81	29	18	Knowles	FWS	There is a lot of time between March and September. Can we monitor the fate of backwaters on a finer time scale (see comment 6)?	Question	Y	Please see response to comment 51
82	29	18	Kubly	BOR	As indicated previously, I question the value of surveys done 6 months after the BHBF when we know so little of the temporal dynamics of these habitats. What parameters and metrics will be measured to determine the extent to which observed changes are related to the effects of the BHBF?	Answer	Y	Please see response to comment 51
83	30	24	Berry	BOR	The table indicates that $493,200 will have been spent on this project by the end of FY07. How can this be true if we do not have a BHBF in FY07. Also, wasn't that funding approved by the AMWG for other aspects of the cultural program? Were these accomplished?	Explain the discrepancy between the approved AMWG budget for FY07 and this reallocation of funds to BHBF support.	Y	The FY07 budget figure was based on the assumption that completion of the science plan could allow a BHBF experiment to move forward during FY07. Funding for this project would be paid for from the experimental fund. There is no direct relationship between the proposed budget for this project and the FY07 work plan budget, nor are any re-allocations from one budget to another being contemplated.
84	31	22	Davis	CREDA	As a way to answer EIN 6.5.1, this project makes doubtful assumptions. The project has limitations in documentation that prevent its use in trying to see if BHBFs meet the goal of creating community changes in the CRE. Nearly 80% of the CRE is left out of the project and we question the value in extrapolation from one river reach, especially the reach closest to the dam, to the entire CRE. Expecting to establish a "flow-only operation that will rebuild sandbar habitats" would be difficult enough for one reach yet we need to know if there is one operation applicable to the entire CRE. This project is not broad enough to provide that level of information. Also, this project will not provide temporal information (influence of time of flooding on species ratios) nor distinguish between grain sizes downstream of LCR both of which may be critical to establishment of either native or nonnative plants.	Review the number of sites in the reach to see if they could be reduced and other sites downstream of LCR added to broaden the project's utility.	Y	The project will document whether community change occurs in the two habitats (bare ground vs. vegetated), and the direction of any community change (i.e., more natives, more exotics, or no change). This project cannot answer all riparian community dynamics questions, but is intended to provide information about patterns of community change and possible trajectories for community assemblages in association with a BHBF. Because of previous data collection locations there are correlations to the locations selected for study in this project. Because the vegetation transect project has established sites past the Little Colorado River we will exchange some of the proposed sites to those farther downstream to evaluate riparian and marsh communities' responses to a BHBF (there are some logistics and personnel costs implications to this change). Temporal information is covered in this project, because

								these plots are part of a proposed long-term monitoring approach for riparian vegetation. Annual surveys, as proposed for long-term monitoring, would be completed at these sites and could be compared with data since 2001, incorporating annual operations as well as managed high release in the analysis. The bare ground sites could also be surveyed in the year following the BHBF to collect additional data, but this would increase costs, so we do not propose.
85	33	31	Kubly	BOR	Compliments on the most detailed description of data analysis in the document. Still, providing the ANOVA table(s) and identifying the specific F-tests would improve the reader's ability to understand.	Provide the ANOVA table(s)	Y	We will identify the F tests in the next iteration of the plan.
86	34	14-19	Dongoske	CREDA	The plan does not appear to integrate other tribal program work on traditionally culturally important plants with work proposed in this plan. Unless such linkage is clearly demonstrated, this plan should not cite such linkage as product or benefit of this study.	Delete reference to Traditional Cultural Properties or resources of importance to Native Americans. Proactively develop a science program that equitably integrates Native American values and perspectives.	Y	We disagree with this comment. Tribes involved with the AMP have repeatedly called attention to native riparian plants as important culturally-valued resources that are central to the continuation of their cultural traditions, and several tribes have focused past research efforts on documenting the specific native species that are important to their culture and have also designed their monitoring efforts around tracking changes in the abundance of native riparian plants at specific sites in the CRE. This project takes an integrated, systemic approach (as opposed to a culturally-specific approach) to monitoring the responses of native vegetation to BHBFs, and as such, will provide valuable information about the factors and processes effecting the composition and abundance of culturally-valued native riparian species throughout the CRE that will benefit the interests of all tribes participating in the AMP. This information will be of interest and benefit to all tribes participating in the AMP.
87	36	22	Davis	CREDA	The project proposes to measure the affect of BHBF on fish but absent is any mention of the limitations on the project's ability to generate data on specific fish, including humpback.	Specify information will be collected to enable inferences about humpback to	Y	Please see response to comment 51 and Appendix B.

						at least begin addressing problems identified in Appendix B.		
88	36	36	Kubly	BOR	A connection could be made here between algal and invertebrate recovery rates, fish bioenergetics, and the frequency of BHBFs. Is this relationship being considered in the integration between sediment and biology?	Answer	Y	Aquatic food base project is addressing these suggestions through regular sampling regime.
89	37	36	Davis	CREDA	Inferring growth rates for fish should not be a 'one size fits all' approach owing to vast difference between fish diets. Food available for different fish species before, during and after a BHBF should be highly variable.	Provide more explanation about the specific way the project will avoid making broad statements about food availability when addressing the array of native and nonnative fish.	Y	The most direct way the reviewer's comments will be addressed is that only fish captured from this habitat will be modeled. Empirical data will be developed; in this way we hope to avoid addressing an overly diverse "array" of possible species.
90	37	37	Kubly	BOR	Are there cold-water stream examples that provide comparisons with the hot desert Sycamore Creek? Minshall studies perhaps?	Citations?		Additional clarification of this comment requested. The reviewer's point is not clear.
91	38	18	Davis	CREDA	Although trout K- factor is important to track, humpback may also be affected by a BHBF influence on food resources. Where does the K-factor for humpback come in during the BHBF project? Can we use a surrogate NA species? Also, are you looking at different life stages? As written, the project seems too limited to provide insight on fish other than trout and that limits its utility.	Consider finding a way to look at effect of BHBF on food resources for native fish species downstream of Lees Ferry. Appendix B gives some insight to the difficulties but the project should at least	Y	It is important to recall that this BHBF plan is a subset of all AMP monitoring and research. Ongoing food base and humpback chub monitoring should address this reviewer's concerns

						show how to begin to address these difficulties.		
92	38	Fig 3.1	Kubly	BOR	Couldn't you also have a hypothesis that presumes intense cropping, rather than flows, impedes senescence? Any idea of the extent to which the changes in the algal-macrophyte communities are due to biological control (cropping) as opposed to physical effects (flow)?	None		Aquatic food base project should address this reviewer's comment
93	41	1	Knowles	FWS	How will the experiment affect spawning and recruitment of humpback chub in the mainstem (30-mile) and at the LCR, and how will this be evaluated?	Add study?	Y	Please see response to comment 51. Ongoing, long-term monitoring of humpback chub population will also help address (Appendix B).
94	42	24	Persons	AGFD	I thought Project 4.a (RBT early life stage survival) fit well with ongoing studies by Josh Korman, but don't know yet if it is the best way to address BHBFs in the future. It would have been very convenient in 2007 because of the pre-BHBF data that exists. I'm not sure if this project will continue as a monitoring tool but if it does, the study as described can probably be pulled off the shelf and be ready to use. Does the project plan to use tags with a mortality signal? We don't understand the fate of fish that die in the reach, but suspect they become disoriented and drift downstream. If this were to happen with tagged fish would you be able to tell if the fish were dead or alive as they passed a downstream SUR station? If the smallest trout that can be tagged are approx. 100 mm (4 inches), will it answer the movement question for smaller fish? Is there a better way to do this? This seems like a good project to put out for bid to see if other options exist to answer the emigration question.	Consider soliciting other projects after clarifying need for project.	Y	Will review in next iteration in conjunction with reviewer to help address his concerns.
95	45	1	Persons	AGFD	4B Effects of BHBF on adult trout distribution. Is it a high priority AMWG question, or should we focus on looking at displacement of native fish (HBC) during a BHBF using sonic technology? Again, this looks like a good project to put out for bid, now that the rush to develop studies has slowed.	Please provide more justification for this project rather than a project to assess impacts of BHBF on native fishes?	Y	Some TWG members, including this reviewer, question whether any rainbow trout move from the Lees Ferry reach downstream. This project helps address these questions by testing whether any rainbow trout are displaced, helping with the development of future hypotheses
96	45	9-12	Persons	AGFD	Who will be the PI for this study?		Y	Now that Gwinn has resigned, will likely be Hilwig and/or Coggins.
97	45	29	Knowles	FWS	Juvenile humpback chub are thought to be killed, incapacitated, and disadvantaged by cold-water effects on swimming ability;	Edit	Y	Please see response to comment 51.

					intuitively, their ability to respond to flooding events may be compromised. You should provide a discussion of this effect in light of the 2004 experimental results (not necessarily here but somewhere in the document) and provide some means of evaluating this, even if its just replicating the hoop net surveys of the prior experiment.			
98	47	18	Davis	CREDA	A BHBF is triggered by rather sudden events and their prediction is uncertain so how much prior to a BHBF can these be inserted? If tags are inserted in anticipation of a BHBF but there is no BHBF trigger, when would we lose the tag transmitters?	The coordination of tag insertion with the uncertain likelihood of a BHBF should be discussed so we can see the risks associated with the project.	Y	We would have weeks to months, so such decisions could be made and field work mounted. Because of the relatively easy access, logistical concerns in the Lees Ferry are readily addressed. We propose implanting tags following the decision to conduct the BHBF
99	48	14	Davis	CREDA	We do not see this project directly answering this question, as stated, but it may help determine if emigration occurs.	Check text language.		We agree that this study does not fully answer the question, but believe the high flow test could provide some valuable information that would inform this question and perhaps lead to other informed hypotheses. We will check language as the reviewer suggests.
100	48	15-22	Persons	AGFD	I don't think 4B addresses the information needs (RIN 4.2.1, 4.2.2 and 4.2.3) about alleged emigration in a useful way. Isn't the big question "at what densities" do trout move downstream? We have good evidence that adult trout will not be displaced by a BHBF (1996 and 2004), and hints that small trout might be. We also have suggestions of downstream movement of young trout at high densities without BHBFs. I don't think a study around a BHBF will answer the bigger question about trout movement, I think we need a longer term approach to address the emigration question. We have resumed Floy tagging adult trout captured in the reach during monitoring activities, and over time that may provide movement data for adult trout. I'll repeat my earlier request to look at downstream movement from the Lees Ferry reach with coded-wire tagged stocked fingerling trout (perhaps sterile triploid fish). There are no projects to address this in the FY 2008 work plan. I think it will take several years to collect enough data to understand the	Provide justification for this project rather than another looking at the bigger question of alleged emigration.	Y	We don't think these studies in association with a BHBF will "answer the bigger question" either; this is one project among many. We also agree with the reviewer that a long term approach needs to be developed. Introducing a large number of newly stocked trout compounds the complexity and potentially confounds experimental results (not to mention political/policy/compliance concerns), but the TWG could continue to make the case for stocking if they so choose.

					relationship between trout density, flows, and any downstream movement. I think a long term approach will be a better way to address this question, rather than around BHBFs.			
101	48	15-22	Persons	AGFD	In the 2004 before and after BHBF studies, there were changes seen in HBC relative abundance (confounded by catchability issues) near the mouth of the LCR Would it be more useful to implant native fish or small fish near the LCR with sonic tags and track their movement?	Why not look at BHBF effects on native fish movement?	Y	Agree. Please see discussion in Appendix B that proposes this very approach.
102	48	31	Persons	AGFD	Budget (GCMRC salary) seems insufficient for this project. Can you clarify costs?	Clarify costs & who will do the work	Y	Because of the short time frame of this project, salary costs will be modest; however, we take the reviewer's suggestion and propose to add some funding to this line item. We will review costs with fiscal staff and edit.
103	50	12	Knowles	FWS	What potential is there for BHBFs to entrain fish from Lake Powell?	Edit?	Y	Unknown. Spring monitoring trip may capture such escaped fishes, assuming they survive transport through the dam.
104	52	1	Knowles	FWS	Add a section on compliance here; section 7 consultation will be necessary. We will need additional monitoring of humpback chub associated with the experiment, as discussed in comments below.	Edit	Y	We were not expecting that this is a compliance document, though believe that much of the information contained supports compliance efforts.
105	52	38	Davis	CREDA	The conduct and timing of the science trips are well known to the NPS by their participation on the AMWG. Also, how does the conduct of a BHBF during the winter non-motorized season fit with the NPS policy especially since 9 trips will be taken over a 3 month period?	It seems appropriate and feasible to routinely obtain such permits well in advance of any potential BHBF (6 weeks seems too tight) to allow NPS adequate time and avoid any delays.		May have to request exceptions to non-motor rules depending on timing.
106	66	38-40	James	CREDA	See also comment 3 above. How many times does a particular BHBF need to be performed to "confirm its effectiveness", if the 2004 test "did result in robust sandbar building in the reach (upper Marble Canyon)"?		Y	This question will need to be jointly discussed between scientists and managers on the basis of the 2004 test results, as well as after the next such test. Management will need to decide how much certainty is needed before future BHBFs can be implemented as managed actions. Scientists are still trying to determine that BHBFs under sand

								enriched conditions can lead to repeated sand bar building and maintenance, but the desired future conditions are still nebulous.
107	67 (see also page 70, line 11)	15	James	CREDA	It is unclear what the "proposed timing of future BHBF experiments" is. This section refers to "late March"; elsewhere there is reference to fall events. Are different event timetables associated with different resource impacts, and if so, it would be helpful to array those scenarios for the AMWG members to consider in trade-off analyses.		Y	This section will be revised to read "generally tied to late winter or early spring" instead of the reference to "late March."
108	67	30	Knowles	FWS	We are of the understanding that ongoing investigations by GCMRC are revealing the extent to which turbidity effects gear efficiency. We suggest that catch rate data may still be useful and should be collected.	Edit	Y	Even if the proposed occupancy modeling proves as valuable as promised, we will still need to monitor fishes with existing gear, providing the data the reviewer requests.
109	68	26-35	James	CREDA	Disagree that economic impact assessment has "not been conducted and can not be definitively determined with available information".	Suggest rewording as follows: Specific studies to assess the economic impacts of conducting future BHBF experiments need to be undertaken following determination of a specific experimental plan and timetable".	Y	The analysis completed in conjunction with the experimental flows option analysis in fall, 2006 was a financial impact analysis, not a complete economic analysis. Furthermore, the financial impact analysis that was completed was limited in breadth and scope, due to there not being sufficient specificity about the frequency or timing of proposed BHBFs for each option and with varying hydrological scenarios. Suggested rewording of the sentence appears reasonable.
110	68-69	General	James	CREDA	See comments below**		Y	These appear to be important issues for policy makers to consider and resolve.
111	69	3-7	James	CREDA	GCMRC has indicated its inability to assess "valuation" economics as part of a trade-off or cost-benefit analysis. Therefore, recommend removing "societal value" from line 5.		Y	GCMRC is fully prepared to secure the necessary expertise to conduct these types of analyses in the future, if this is recommended by the AMP.
112	71	NA	Knowles	FWS	Under "PROS" for "AMP RESOURCES" you have "Creation of backwater habitats used by native fishes" and "Mimics seasonal flood disturbance to the river ecosystem" We agree with both these statements, but there is little discussion and justification for/about them or foundational basis for additional testing in the	Edit	Y	Accepted. We will review the literature suggested by the reviewer and edit accordingly.

					plan. We suggest you add in sections on what is known about these concepts (including importance of backwaters to humpback chub, creation of backwaters from flood events, and importance of seasonal hydrographs to humpback chub biology - e.g. Goeking, 2004, AGFD 1996, Valdez and Ryel 1995, Converse 1998; see also Muth et al. 2000) and how this plan will improve our understanding of them.			
113	71	26-35	James	CREDA	Disagree that economic impact assessment has "not been conducted and can not be definitively determined with available information".	Suggest rewording as follows: Specific studies to assess the economic impacts of conducting future BHBF experiments need to be undertaken following determination of a specific experimental plan and timetable".	Y	Please see response to comment 109.
114	71	Table A.1	Dongoske	CREDA	Again, wind transported sand is identified as <u>will</u> result in archaeological site preservation – a scientifically unsubstantiated hypothesis that is being promoted as scientific fact and a benefit of BHBF.	Please reword to indicate the uncertainty in this result of a BHBF.	Y	OK, this will be changed to read "Possible preservation of some archaeological sites through secondary wind deposition."
115	71	Table A.1	Dongoske	CREDA	Another uncertainty that is missing from the AMP resources is the impact, positive or negative, of a BHBF on traditional cultural important biological and physical resources to Native American communities.	Why is this resource omitted from this table? This appears to be inconsistent with the claims made earlier about traditional cultural plants in the riparian	Y	The reference to Native and Nonnative Terrestrial Vegetation includes consideration of traditionally important plants, but we can certainly add another category specifically referencing TCPs.

						study. Please be consistent throughout the document when addressing resources and issues of importance to Native Americans.		
116	76	8	Knowles	FWS	AGFD 1996, Converse 1996, Valdez and Ryel 1995, and Chart and Lentsch 1999 all found that nearshore habitats are important to humpback chub and subject to changes due to flow. How will changes imposed by the current experiment affect these habitats? GCMRC should add a study, utilizing methods similar to these studies cited above, that analyze pre and post short-term and long-term effects of the experiment on these habitats and fishes that occupy them; this should also be done in relation to other flow regimes (daily, monthly).	Edit	Y	Additional backwater seining project proposed; please see response to comment 51. Please recall that the BHBF is a subset of all AMP projects; additional fisheries projects listed in Appendix B.
117	77-79	N/A	Knowles	FWS	Telemetry is a good idea and the concept of testing it first on rainbow trout to answer questions on dispersal makes sense. But the idea that you won't use standard capture techniques to test hypotheses of the effects of the experiment because catch rate does not always equal abundance seems esoteric. Catch rate data is nevertheless valuable data, and there is no other way at present to gain any understanding of the effects of flow on juvenile humpback chub. The new method suggested of using occupancy models sounds intriguing, but why not try it in this plan? If not yet fully developed, we ask that you rely upon existing methods.	Edit	Y	We remain concerned that this is not an esoteric, academic limitation, that catch rate can be so variable that it is meaningless, and then the great expense of obtaining it is wasted. We propose to emphasize the occupancy model approach, which, for future application, will still require the gathering of data before and after the flood event, so still requires the data collection requested by the reviewer.
118	79	8	Persons	AGFD	Specific recommendations for use of sonic tag technology will be prepared, reviewed, and distributed at least 120 days in advance. Can this be done in CY 2007 after the catfish sonic tag work? Does it need a BHBF to evaluate and learn to use the gear? I know this was put together in a hurry, but it seems that we have more breathing room now, and can consider other options.	Consider other options?	Y	Assuming 2007 work demonstrates promise we will develop a project to tag humpback chub in association with a BHBF much sooner than the minimum 120 days proposed. If necessary, a single project could be completed in this timeframe, however.
119	80	20	Knowles	FWS	We disagree that "impacts of fluctuating flows on humpback chub recruitment are not supported by the timing of decline in humpback chub abundance …" and ask that you elaborate on this statement with data and/or citations. There are numerous studies that support the strong implication that diel fluctuations have adverse effects on juvenile humpback chub, likely reducing survivorship, and therefore limiting recruitment (Stanford 1994,	Edit	Y	We will edit this statement. Reviewer's citations will be reviewed for assistance with preparing the new statement.

					Valdez and Ryel 1995, AGFD 1996, Converse 1996, Robinson et al. 1998, Chart and Lentsch 1999, Muth et al. 2000, Stone and Gorman 2006).			
120	80	33	Knowles	FWS	We acknowledge that there are difficulties and variability associated with using traditional methods of catch rate and mark-recapture to assess young humpback chub survivorship and recruitment, but these are the only methods currently available. We suggest that these methods be employed, and over a long-term period, to assess use of nearshore habitats by juvenile humpback chub and other fishes, including the effect of flow regime on these habitats.	Comment		Agree; we will add a spring seining project (see response to comment 51), despite the difficulties in interpreting these data. We also propose to begin modeling of value of near shore habitats.
121	81	1	Knowles	FWS	We agree that flows need to be evaluated over long timeframes; consistent monitoring of nearshore habitats, even using methods with high variance, would better evaluate changes in habitats due to flow and associated effects on juvenile humpback chub than no monitoring at all. [My mistake, there is the fall backwater sampling – why is there no mention of the results of this monitoring in relation to the plan?]	Comment		The additional backwater seining project we propose for the spring will include reference to the fall seining. Also, please see Appendix B and Table B.1 for mention of the fall seining.
122	82	30	Werner	AZ	Citation not in lit cited in App B but in lit cited for main body. Not clear why some are located in App B and some not.	check	N	Citation now noted in main body and App B

Note from Werner: I have reviewed comments submitted by CREDA and believe those comments warrant careful consideration.

[1] Mahoney J.M. & Rood S.B. (1998) Streamflow requirements for cottonwood seedling recruitment- an integrative model. *Wetlands*, **18** 634-645.
[2] Stromberg J.C., Beauchamp V.B., Dixon, M.D., Lite, S.J., and Paradzick, C. (2007) Importance of low-flow and high flow characteristics to restoration of riparian vegetation along rivers in arid south-western United States. (*Freshwater Biology*) **52**, 651-679. [contact J. Stromberg @ ASU for pre publication copy]

**Where reference is made to impacts to the hydropower RESOURCE (not "interest"), discussion is limited to "lost revenue generation opportunities". This is only part of the picture. At the AMWG meeting of December 5-6, 2006, there was discussion that centered around the following points, which should be incorporated into this assessment and considered in developing recommendations regarding a BHBF:

- The cost to power users resulting from bypass flows, subsequent power purchases to meet unmet contractual obligations, and possible rate increases that may result, place a significant, unanticipated burden on the Basin Fund and the power customers
- Costs of a BHBF may result in cash flow problems in the Basin Fund similar to those experienced in past years
- The ROD doesn't allow for a BHBF in other than hydrological trigger years (risk of spill years) except for experimental purposes (ROD/GCPA).
- Consideration should be given to inclusion of a "financial trigger" to be used in conjunction with a "sediment trigger" and a "hydrologic trigger".