Budget Comments and Meeting Notes for June 14-15, 2016 TWG Meeting
Revised June 9, 2016

BAHG Call Notes May 31, 2016 (2-4 p.m. MDT)
BAHG Chair: Shane Capron
Participants: Jan Balsom, Cliff Barrett, Dr. David Braun, Kathleen Callister, Marianne Crawford, Kurt Dongoske, Helen Fairley, Leslie James, John Jordan, Clayton Palmer, Seth Shanahan, Larry Stevens, Rosemary Sucec, Scott VanderKooi, Kurt Dongoske, Kirk Young, David Rogowski, Robert King, Craig Ellsworth, Joe Miller, Paul Harms, Peggy Roefer

Continued on June 8, 2016 (2-4 p.m. MDT)
BAHG Chair: Shane Capron
Participants: Linda Whetton, Cliff Barrett, Mike Yeatts, Vineetha Kartha, Kirk Young, David Rogowski, Kevin Dahl, Kathy Callister, John Jordan, David Braun, Rosemary Sucec, Bill Chada, Jessica Neworth, Scott Vanderkooi, Leslie James, Joe Miller, Helen Fairly, Joel Sankey, Clayton Palmer, Randy Seaholm,

Notes May 31: The following contains notes in red for each agenda item. We were able to make it part way through our list of items but will need to meet again next week. When these notes are sent out we will also provide a doodle poll for another 2 hour call next week. We also identified that we will spend more time on the next call reviewing projects not funded or partially funded in 2016 and what funds may be available for 2017 to better understand if money is available for projects like the trout monitoring and an expanded Science Advisor budget, for example. There were a number of additional budget needs identified and a number of questions about current expenditures. DOI will work to prepare tables for this discussion for the next call.

Notes June 8: Reclamation did provide an updated table for this call and Kathy Callister was able to have a few minutes to describe it and it is attached here. After review of the issues described below we believe the BAHG has reached agreements with DOI and GCMRC on the major budget issues, however some issues remain controversial and may come up again at the TWG (e.g., Project 4, budget items in Appendix 4). However, the following document provides discussion and resolutions on the following items. Unresolved fully is the extent of the proposed Science Advisor budget for 2017 and the funding available to support that work. There appears to be some available funding on the Reclamation side, but the extent will not be fully understood until the TWG meeting. GCMRC was able to find funds to support the continued fish work that had been underfunded, and expects the fishery PEP review will provide further guidance on some of the monitoring trips in question such as the juvenile chub monitoring (JCM). Both GCMRC and Reclamation agreed to bring revised 2017 budget tables to the TWG for review and recommendation to AMWG.

Attachments: GCMRC response on Project 4, Reclamation budget tables.

From	Comments
Kurt Dongoske CRAHG	5/17/16: The Experimental Fund has $569,507.00 for FY17, if that is not expended it is carried over to the Native Fish Conservation Contingency Fund. Is this written in stone or can a percentage of the carryover be requested for cultural resource activities? The CRAHG believes that it makes sense to be able to use some of the experimental funding for cultural work. It looks like there will be more than 1.6 million in the Native Fish Contingency Fund; is this amount in anticipation of the 2016 carryover or does it also 2017 Experimental Funds? The CRAHG would also like to know if any of 2016 Experimental Fund was used for experimental purposes or will it all be carryover? #from what we think we all understand, none of the experimental fund was used for fisheries activities this year, so it should be intact and BOR will provided updated numbers at the next call to confirm where we are today. • The CRAHG would like to know the status of the $250,000.00 allocated for Acoustic Flow Meters but was never used. BOR believes that was spent, about 245k, they will follow up. • Tribal Synthesis project (D.2.5) – CRAHG would like to know the status of this project. Will Reclamation be issuing an RFP or can the CRAHG assist Reclamation in designing the scope of work? The CRAHG requests an update on this project because there is $50,000.00 allocated for 2016, but no new

information on this project. #This project was under the BOR budget, but was never implemented. Money could be used to fund the TEK project with the SA program, similar proposed workshop and review could address this, additional conversation needed and Dr. Braun will follow up with DOI and tribes to see if this is a possible avenue to fund the SA project and to begin this work, unclear if the SA project would take the place of this project or whether further work would be needed.

- Annual integrated river trip (D.2.6) – CRAHG wants to know if this integrated river trip will be planned for FY17. If not, can the funds be reprogrammed? CRAHG recommends that this issue should be discussed among the tribes about the need for a 2017 integrated river trip. Currently, it appears as though a 2016 integrated river trip will not happen; if so, those funds need to be reallocated. #Not implemented in 2016, 16 funds may be available for other purposes, 17 funds are already in the budget and is expected there will be a trip in 17.
- Reclamation's funding of Project 4 (D.2.3) - This project examines deposition of aeolian sand from HFE-created sand bars on historic properties within the area of potential effect of future dam operations. The primary objectives of element 4.2. are to draft and implement a monitoring plan that meets requirements for monitoring effects of dam operations to cultural resources relative to the National Historic Preservation Act and Grand Canyon Protection Act. Given that Reclamation is currently in the process of drafting a new Programmatic Agreement (PA) should this project continue to be funded if it ultimately does not meet the needs of compliance as defined in a new PA. The CRAHG believes that GCMRC's role in complying with any of the stipulations that will come out of the new PA needs to be determined soon because any monitoring of cultural resources under the NHPA or the GCPA will be funded through this program. The continuation of developing a monitoring program that does not include assessing historic property integrity is a serious concern for the CRAHG. The question of continuing to fund a monitoring program that in the end does not meet the compliance needs of Reclamation should be a serious issue for the BAHG. According to the work plan, the draft monitoring plan will make a recommendation of the sample of archaeological sites that should be monitored, but stakeholders (presumably including the BOR, NPS, SHPO, ACHP and tribes) will need to work very closely with GCMRC in year 1 of the project to come to agreement on the monitoring protocol and set of sites that is ultimately monitored. CRAHG would like to know from GCMRC if the stakeholders have been meaningfully consulted on the selection of sites to be monitored? #There was a meeting last summer to review the workplan and the sites. We integrated the discussion below on Aeolian sand research here as well. It is complicated by the fact that the project is part of a larger piece of work looking at much more than Aeolian sand and this is the last year of the 3 year project with most of the funds going to wrap the project up. The question will be whether to continue the research/monitoring into the next workplan, and thus the group agreed that this discussion would be best to have this fall/winter on whether this component of the monitoring should continue into the 18-20 workplan once we have a new PA in place.

  From Kurt Dongoske on June 7: Vineetha and Shane – I still have serious reservations about continuing to fund project 4 in FY17 especially since the recent USGS publication suggests to me that they are documenting and quantifying geomorphological processes that have been operant in the Grand Canyon for millions of years, regardless of the presence of a dam or not. Unfortunately, I can't be on the conference call of the BAHG tomorrow to present my position, but want the both of you to be aware of my position. We are spending close of a ½ million dollars to monitor natural processes with very little, if any, useful information coming back to the stakeholders. This continued funding of this project needs to be seriously debated among the stakeholders in a venue that is not a conference call.

  Bill Chada: Arizona SHPO asked not to include Aeolian sand in description of APE. APE needs to tie to project not a side process such as Aeolian sand. Leslie and Mike both articulated concerns for the project, progress of PA and LTEMP, and that we are in a between area right now. Randy, depends on how much beach building will occur, because the wind will do what it will. We will create sand bars as we can, so this seems too indirect. Program has limited funds, thus is this the right work to be doing (Leslie)? Randy brought up additional issues that need to be discussed before the next workplan is

	implemented, and additional discussion was had regarding the monitoring plan being developed, and Scott mentioned that it will need to be updated as LTEMP is finalized. *BAHG decided not to make changes to the project for 2017, that it can continue and complete, but that a comprehensive review/discussion will occur before moving forward with the next workplan. Kurt was not at the BAHG meeting to voice further concern but we recognize that he, or other TWG members may disagree and ask for changes in 17. • GCMRC's Project 12 is a project to evaluate historical changes in the distribution of plants significant to tribes, and some tribes are formally cooperating in this effort. Which tribes are "formally cooperating" in this project and what was the outcome of the tribal meeting with GCMRC about this project at the last AMWG meeting? #Scott: recommended they take this off line with GCMRC and the tribes to discuss. • What is status of Tribal TEK project (Reclamation budget) and was any funding used in 2015 or planned to be used in 2016? #Pilot for last year, changes in staffing and they still want to continue the project, and would like to proceed. So we will see what progress can be made, or whether there will be funds available from this project not being implemented during the 16 workplan. • How much funding was used for Non-Native Fish removal consultation in 2015? Could some of this funding or carryover, if it exists, be used to work on resolving issues with the old NNFR MOA/LTEMP PA and the fact that live fish removal is no longer a viable mitigation measure? #tribes want to stay involved in this, there was funding set aside to revisit nonnative fish MOA, further conversations to find out exactly what was spent and done on this. • What is the status of the $20,000.00 to support tribal NRHP nomination funding in 2015 and if there is remaining funding can it be carried forward? #GC listed as TCP, need to follow up? #probably not spent, follow up needed.
Randy Seaholm (WAPA 3)	5/20/16: Attached is a spreadsheet containing changes we would like to see made to the FY 17 budget and related documents. We have not suggested specific dollar amounts to allow some latitude in reallocating funds once our comments have been addressed. Briefly our proposed changes and reasoning are as follows. #Generally discussed the first two, but after looking at the details we understand the concept but need more input from Randy on his specific issues for this budget cycle, we suspect he is raising concerns that may be more ready for discussion for the next budget cycle, these are important concepts to remember. 1. A project first and foremost must fit within the laws that govern the allocation, appropriation, development and exportation of the waters of the Colorado River Basin. No project should be included that seeks to alter or misinterpret any of those laws. There is a New Project, T6 in Appendix 4 of the FY 2015-17 Budget document dealing with equalization that has been suggested but not funded. We believe this proposed project is clearly outside this criterion and should be completely removed from the documents. 2. Any project should be confined to the Colorado River Ecosystem and specifically to understanding how dam operations could be modified to benefit both power and downstream resources. Since the maximum release from the dam for purposes of the GCAMP is 45,000 cfs, projects should be focused on resources at or below this flow level. Projects above this flow level should be funded from sources other than GCAMP funds. We would further suggest that studies that go outside the CRE into other river basins or involve work above Lake Powell or below Lake Mead not be considered and if so, absolutely done with funds other than GCAMP. This would be consistent with funding guidance provided early on in the program but which has since become lost or blurred over time. 3. Projects should not overlap or consider work that cannot reasonably benefit resources within the CRE in GCNP or GCNRA. Towards this end the aeolian sand studies in our estimation, while they may be interesting, are not going to provide a useful tool or information that will benefit the GCAMP. Wind

	does what wind will do. Furthermore, a lot of the sand conservation work, plus the current vegetative monitoring program, which includes identifying the impacts of HFE's on vegetation, make aeolian sand studies unnecessary. If aeolian sand studies continue outside funding should be obtained, GCAMP funds should not be used. The GCAMP funds freed up could help advance some of the fishery projects that Arizona Game and Fish mentioned as underfunded. #see comment above for Aeolian sand discussion. **(WAPA 3) Criteria for Review: Scientific requirement or merit** **Subject: Aeolian Sand Project** Please identify the need to continue *Project 4.1. Quantifying connectivity along the fluvial-aeolian-hillslope continuum at landscape scales* in FY17. The TWP identifies the primary objective of this project is to explain how connectivity along the fluvial-aeolian-hillslope continuum varies spatially throughout the river corridor and to determine if this connectivity has changed during the recent decades of restricted power plant operation and the occurrence of controlled floods. A recent paper published by Collins et al. 2015 in Earth Surface Processes and Landforms concludes that "aeolian deposition, even with anthropogenic forcing via fluvial sand-bar building high flow dam releases, was found to be generally insufficient to offset the effects of precipitation-induced gullying." Please identify the need of spending $252,600 in FY17 to continue studying aeolian deposition resulting from the 2012 HFE Protocol when the latest findings regarding this project indicate that this mechanism does not occur with the frequency or magnitude to offset precipitation-induced erosion of archeological sites below Glen Canyon Dam. #same as above
Bill Stewart TAHG **(WAPA 1)** **(WAPA 2)**	5/17/16: TAHG, as requested in the April 22 email below we have been tasked to provide input on the FY17 budget/workplan to the BAHG by tomorrow. The only feedback I received was from Chris Budwig and his concerns were either already being addressed in the current work plan or should be brought up with the new work plan. The only other item the BAHG should address in the FY17 work plan is the shortage of funding for project 9.1 (Lees Ferry monitoring). Funding for project 9.1 drops from $212,700 in FY16 to $76,900 in FY17. As my last hurrah before I depart from AZGFD, I suggested we make the following recommendation to BAHG. #group discussed the larger issue of underfunding and the timing of the PEP review being a bit late. There is scientific disagreement on best approaches for sampling, but GCMRC acknowledges that additional funding is needed to cover the trout monitoring identified here as well as the other associated projects that was being supported in part by the Natal Origins project (see below). Scott Vanderkooi will work with staff to come up with a plan using carry over and other money to try to make these projects whole for 17, so that we have time to do the PEP review this summer and fall and evaluate how best to proceed for the 18-20 workplan. This was the last subject we made it to. Day 2: Scott, money has freed up, enough for 3 trips for the JCM, monitoring for both rainbow trout abundance and humpback chub abundance. Detail is a bit uncertain, but will take form a bit more after the PEP review. For project 9.1, money was retained, but moved into 2 other places, money is still there in the budget and will continue (concurrence by Rogowski). The TAHG requests that the BAHG recommends to increase funding in the FY17 budget for Lees Ferry Rainbow Trout monitoring (project 9.1) to levels similar to FY15 and FY16. This project supports the long term (25 years) Rainbow Trout monitoring efforts that are the basis for the Lees Ferry recommendations and includes the warm water non-native surveillance in Lees Ferry. Funding for project 9.1 as identified in the triennial work plan is as follows: FY15: $180,900 FY16: $212,700 FY17: $76,900

A suggested location to consider drawing funds to support this project could come from the native fish conservation contingency fund. This seems appropriate particularly as it relates to the warm water non-native surveillance element of this project. If others on the TAHG want to chime in please do so.

(WAPA 1) Criteria for Review: New initiatives
Subject: Lees Ferry trout fishery monitoring project
The FY17 budget for *Project 9.1 Lees Ferry RBT; monitoring, analysis, and study design* does not contain any funding for Logistics or for Cooperators (non-USGS). Please specify what monitoring will and will not be conducted on the Lees Ferry trout fishery in FY17 and whether this will provide uninterrupted coverage in the long-term monitoring of the fishery and limit our understanding of how dam operations affect this fishery.
Table 1. FY15-17 budget for *Project 9.1 Lees Ferry RBT; monitoring, analysis, and study design.*

	Salaries	**Travel & Training**	**Operating Expenses**	**Logistics**	**Cooperators (non-USGS)**	**USGS Cooperators**	**USGS/SBSC Burden**	**Total**
FY15	$41,100	$0	$0	$12,900	$115,000	$0	$11,900	$180,900
FY16	$62,300	$2,500	$0	$12,900	$115,000	$0	$20,000	$212,700
FY17	$60,400	$0	$0	$0	$0	$0	$16,500	$76,900

From: Craig Ellsworth 5/19/16:

(WAPA 2) Criteria for Review: New initiatives
Subject: Natal Origins and associated projects
Please provide an update on the status of the Fish PEP and how this will affect research and monitoring projects relating to the Natal Origins, Juvenile Chub Monitoring, and the other associated projects identified in the TWP. How will the conclusion of Natal Origins (Project 9.2) in FY16 affect the projects identified below (see Table 2)? How will data collection be accomplished for these projects in FY17 since they were reliant on the Natal Origins project for logistical support? How will the funding obligated for these projects be utilized in FY17 if no field data is collected? What work is reliant on the recommendations made in the Fish PEP before proceeding forward? What is planned in FY17 to meet juvenile chub and nonnative fish monitoring obligations to satisfy the requirements in the BO regarding compliance for the HFE and nonnative fish control protocols?
Informational excerpts from the TWP:

> Page 316: *This research project (Natal Origins; Project 9.2) also provides the logistical framework to support the fieldwork necessary for a number of other study projects, these include several project elements in Project 9 "Understanding the Factors Limiting the Recruitment, Population Size, Growth, and Movement of Rainbow Trout in Glen and Marble Canyons", Project Element 7.2., "Mainstem monitoring of native and nonnative fishes near the LCR confluence -Juvenile Chub Monitoring" (as per USDOIa 2011), and Project Element 5.2. "Linking invertebrate drift with fish feeding habits." Owing to the extensive tagging effort in this study, other research studies are possible which allow for greater collaboration between these research studies. Currently the NO project provides the logistical framework for data collection and some of the analysis as part of the JCM project (see Project Element 7.2) and other research elements proposed addressing the underlying mechanisms for trout growth and possible movement (see Project Elements: 5.2.2, 9.2, 9.3, 9.4, 9.7, 9.9, and 9.10).*
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> Page 275: *As with the Natal Origin Research project, the Juvenile Chub Monitoring project (Project 7.2) is scheduled to be completed by the end of FY2016. This leaves a significant data gap in outlying*

years for information on juvenile humpback chub as required by the Biological Opinion for Glen Canyon Dam operations including high flow experiments and nonnative fish control (USFWS 2011). To avoid this gap, a transition of the Juvenile Chub Monitoring project from a research focus to a monitoring effort needs to occur while maintaining a robust multi-gear, multi-pass mark-recapture effort necessary to generate reliable survival estimates of these young fish. We propose that GCMRC and its cooperators collaboratively develop a plan for this transition and include it among the topics to be reviewed by the fisheries program protocol evaluation panel (PEP; see Project Element 8.3). The new monitoring project will begin in FY2017 following review and implementation, as appropriate, of the PEP's recommendations by GCMRC.

Table 2. FY 17 obligations in the TWP for Natal Origins (Project 9.2) and other projects tied to the Natal Origins project for logistical support.

5.2.2. Continue Natal Origins drift monitoring in Glen, Marble, and Grand Canyons	$157,300
5.2.3. Link drift at Natal Origins Project transects to channel bed shear stress	$30,000
7.2. Mainstem monitoring of native and nonnative fishes near the LCR confluence - Juvenile Chub Monitoring	$181,900
9.2. Detection of RBT movement from upper Colorado River below GCD (Natal Origins)	$370,300
9.3. Exploring the mechanisms behind trout growth, reproduction, and movement in Glen and Marble Canyons using lipid (fat) reserves as an indicator of physiological condition	$0
9.4. Comparative study on the feeding morphology of drift feeding fish	$92,200
9.7. Application of a bioenergetics model in a seasonally turbid river	$66,000
9.9. Contingency Planning for High Experimental Flows and Subsequent Rainbow Trout Population Management	$98,500
9.10. Examining the Effects of High Flow Experiments on the Physiological Condition of Age-0 and Adult Rainbow Trout in Glen Canyon	$5,100
Total FY17 obligation	**$909,100**

John Jordan Fly Fishers

5/30/16

Issue One: HFE Hiatus Study with report and HFE reporting

There have been three sequential fall HFEs preceding this past fall's hiatus, which was only due to the green sun fish problem. From the 2012 start of sequential fall HFEs there has been a decline bordering a collapse of the trout fishery. The cause(s) behind that decline are not clearly understood but appear to have some relationship with the available aquatic food base. The opportunity has been presented, which may not soon again occur to evaluate the impact on the aquatic food base (AFB) of a break in HFEs. We have some answers of what happens to the AFB with fall after fall HFEs but we don't know what changes occur in the AFB when the river has the opportunity to recovery from repetitive HFEs. This is an issue that equally impacts the native and nonnative fisheries.

The October 24, 2014 Final Recommendation to Implement a Fall 2014 High Flow Experiment at Glen Canyon Dam, Page 15, Section 6, VI POST HFE-REPORTING AND FEEDBACK includes:

"Reclamation committed in the HFE EA and FONSI to provide reports on effects of HFEs conducted in a given year. If the Leadership Team decides to conduct a fall 2014 HFE, the Technical Team will coordinate to report

initial findings at the 2015 Glen Canyon Dam Adaptive Management Program (GCDAMP) Annual Reporting Meeting on January 27-28, 2015 in Phoenix.

Members of the Technical Team will schedule additional meetings as necessary and will also report ongoing findings at meetings of the GCDAMP Technical Work Group and Adaptive Management Work Group. Reclamation also has a commitment to provide an annual monitoring report to the FWS Arizona Ecological Services Office (AESO) in compliance with the 2011 Biological Opinion; this report will also include a summary of effects of HFEs conducted under the protocol……. Reclamation will use the monitoring information and feedback from AESO and the MOA signatories to inform monitoring for future HFEs, and to design and implement any measures necessary to address any adverse effects that may occur due to future HFEs.

There are two similar commitments in the HFE Protocol FONSI that Reclamation will address in 2015 if a 2014 HFE takes place. The first is to undertake a review in 2014 of the first two years of implementation of the HFE Protocol through a workshop with scientists to assess what has been learned. This commitment is part of the FWS 2011 Biological Opinion on the HFE Protocol. The second commitment, from the HFE Protocol FONSI, is to conduct a comprehensive review of the HFE Protocol after multiple events (at least 3) have occurred, with GCDAMP stakeholders, to document and standardize planning tools and information sharing approaches as part of the implementation of the HFE Protocol. As a result of consultation with FWS, Reclamation will combine these two commitments, and, if a fall 2014 HFE occurs, will conduct a workshop in 2015 with GCDAMP stakeholders to evaluate the results of the first three HFEs, and will complete the a written report of the HFE Protocol findings and biological opinion reporting results in 2015. "

Additionally the October10, 2012 USFWS Spangle Memo, ….Monitoring Components for November 2012 High Flow Experiment, second last paragraph includes:

"….We understand that preparing these reports….is a complex process. However, it is important that the findings from this monitoring be available to us prior to any subsequent fall HFE events taking place…."

The request is for a FY 17 Work Plan amendment to provide a timely report to the TWG to be followed by a written report, utilizing existing research product, comparing the AFB in the years following multiple sequential fall HFEs and the year(s) after a fall without an HFE and including, to the extent possible, the causative elements for substantive differences. Additionally the request is that the first three year comprehensive review for stakeholder evaluation, as committed to in the October 24, 2014 Final Recommendation, be provided. And, that the review include a comparative analysis of the pre sequential HFE food base and the post sequential food base and the resultant impact of substantive differences on the fishery.

Jordan: HFE workshop Feb. last year (Feb 2015, added an extra day for the workshop), no mention in agenda and minutes, but this was clarified later that it was captured and was an added day after the AMWG meeting. Number of ppts in heading of the workshop. Ted Kennedy gave a ppt on foodbase, this could possibly be updated in response. Scott: a report could be developed, from TK and his group, but also from Yard and Korman related to the natal origins study with a lot of useful information, including bioenergetics. No modification to the workplan is necessary, they will plan to put this report together as part of the 2017 workplan but completion would not be expected until the end of the fiscal year. The TWG will be expecting some level of presentation on these topics at the January annual reporting meeting in preparation to the development of the 2018-20 workplan.

Issue Two: Temperature Driven Fishery Concerns

Temperatures are a primary driver for the well-being and health of native and non-native fish communities in Glen, Marble and Grand Canyon, yet currently there is no capability to affect release temperatures from Glen Canyon Dam (GCD). The recently completed USBR Water Supply and Demand

	Study for the Colorado River Basin suggests that Lake Powell elevations will likely decrease in the future as a result of increased water demands, drought, and climate change. Lower Lake Powell elevations will lead to warmer water release from GCD, which could lead to invasions of warm water fishes and other invasive species into the Marble and Grand canyons. There is clear evidence from the upper Colorado River basin that such an invasion would have a devastating impact on humpback chub and other native fishes in the Colorado River below GCD (Tyus and Saunders 2000). **The request** is for a FY 17 Work Plan amendment to provide: (1) The resumption by August 2016 of Real Time Lake Powell Temperature Profile Data Feed to GCMRC and AZGFD which might present early warning of GCD outflow temperatures of concern for the native and cold water nonnative fisheries below GCD. (2) An estimate/appraisal of the capability/capacity of using By Pass Tube releases to effect sufficient reduction of GCD release temperatures to preserve the rain bow trout fishery in the Lees Ferry reach from temperature caused mortality including By Pass Tube(s) release rates and durations (volume) that would be required and also including an appraisal of the impacts of this action on other resources. (3) An estimate of the capability/capacity of By Pass Tube releases to alleviate/avoid reductions in dissolved oxygen, which might impact the rainbow trout fishery in the upper Lees Ferry reach. Joe Miller spoke to the issue, and Scott mentioned that BOR is taking on the monitoring program themselves. GCMRC continues forebay monitoring quarterly. In the dam, and downstream, there continues to be monitoring devices and those are still in place. Typically the data has been provided to Bill V., we have access to that data, but need to move staff around to do that work. No long term solution is in place at this point. Real time info also with the Lees Ferry gage. Randy: key points needed for DO and temperature issues, at what point do impacts start to occur with trout (DO & temp)? When should emergency notifications happen? Scott: elements of this request are largely engineering issues. We understand water quality impacts, but how to operate the dam, that is largely a BOR question. Rough zone running of the generators is problematic for DO augmentation as occurred in the past. Scott: look at the gage at Lees Ferry, you can see the effects of HFEs (bypass tube use) on temperature and DO. Reclamation will consider this issue when Katrina returns and get back to the TWG/BAHG at the TWG meeting. Randy mentioned the issues and concerns with use of the bypass tubes for non-experimental or emergency concerns. We're looking to BOR for guidance on what activities are possible to consider and explore for DO and temp actions.
Craig Ellsworth (WAPA) 5/19/16:	**(WAPA 4) Criteria for Review: Scientific requirement or merit** **Subject: Non Market Value Study for Water and Power** The Center for Energy, Security and Society (CESS) at the University of Oklahoma is a collaboration with the Department of Energy's Sandia National Laboratory. WAPA has been researching the non-market value of hydropower and working with scientists at this center. Independently, the center is expert in assessing attitudes and opinions. WAPA suggests a collaborative effort between CESS and GCMRC as part of *Project 13.2 Tribal Values and Perspectives of Resources Downstream of Glen Canyon Dam*. An economic trade off model that supports better GCDAMP may be informed by an approach recently taken by Dr. David Brookshire for water and resource decision making in the United States. For *Project 13.3. Applied Decision Methods for the Glen Canyon Adaptive Management Plan*, WAPA suggests the addition of a "Brookshire-type" model developed and calibrated for the GCDAMP by Dr. Brookshire working with the other scientists specified for this project. Clayton: 13.2, modest change to incorporate information from other approaches that have been utilized. 13.3 involves potentially modifying models and changing models being used. Clayton has talked to Lucas and he is open to discussions. SEAHG also discussed this, and talked more about 13.3 but applies to 13.2 and the SEAHG was supportive of these interactions. SEAHG should follow up on this, and work with Lucas to change the work, some of the modeling done could create some savings potentially. Mike Yeatts, asked that if major changes to 13.2 it will need to be approved by the tribes, but Clayton and Leslie agreed the proposal is for minor changes to the project, but the point is still valid and changes will be coordinated, if they occur. Randy, thinks that these projects may be going beyond the authority of the GCPA, and we talked about an agenda item to cover these in vs. out topics at the October TWG meeting.

Leslie James, 6/3/16	Scott, I wanted to write in to clarify what I was inartfully asking about on the BAHG call. I understand there are several elements of the project 4, not just the Aeolian work. I think it would be helpful for the next BAHG call for us to understand how much and what type of work is remaining on this element for FY17 and how much funding is required for that to be completed; is there any funding available from what is currently allocated vs. what may be needed? Lastly, what are the ramifications if some or all of the FY17 tasks under this element at not completed? Thanks, Leslie Response was provided by GCMRC in a separate document from Scott Vanderkooi. The BAHG appreciates the work that GCMRC staff put into the thoughtful response.
Shane Capron	4/21/17: **TWG/BAHG:** We are following up on our budget process items from our April TWG meeting. This is to reach a TWG budget recommendation at our June TWG meeting in Salt Lake City. In another email next week we will provide a revised budget process paper for your review and comment. Please provide input to the doodle poll for a BAHG meeting, send in budget issues (if you have any), and be prepared to discuss the FY 2017 budget in June. Initial budget issues due: **May 18**. Please provide to Linda Whetton and Shane Capron (BAHG Chair) your initial budget items for the FY 2017 budget and work plan that you would like to discuss at the BAHG. Please review the "criteria for review" below and identify which of the following categories your request falls into, and a short rationale for why you think your request has merit. BAHG meeting: week of **May 31-Jun 3**, 3 hour call. Linda will include a doodle poll, please provide your input to that poll by **April 29**. We will review results and send out call in information. Anyone is welcome to join the BAHG discussions. CRAHG: per the TWG request, please review the FY 2017 budget and work plan and provide your input to the BAHG. TAHG: per the TWG request, please review the FY 2017 budget and work plan and provide your input to the BAHG based on your revised charge from the April TWG meeting. TWG meeting: June 14-15. Consider BAHG budget recommendation and make a recommendation to AMWG on the FY 2017 budget and work plan. From our budget protocol guidance: **2.7 Criteria for Review and Revisions of the Year-three Budget and Work Plan** In order for the TWP process to be successful in reducing the administrative burden on the GCMRC, Reclamation, and the GCDAMP, it must have clear criteria for making changes to the year-three budget. The burden of an appropriate rationale for proposing a change falls upon the proposer to make a persuasive argument. The following criteria will be used by GCMRC, Reclamation, and TWG in making recommendations to AMWG on changes to the year-three budget and work plan: • Scientific requirement or merit: New information gained during the implementation of monitoring and research projects may result in a need to alter methods, scope, or timelines in the work plan or substantially alter or eliminate a project. This is a science need based on the experience of implementing an already approved project. This does not represent a shifting

	priority, but a scientific learning process which results in needed modifications to carry out the goals of the Program. • Administrative needs: Administrative or programmatic changes may occur within the time-frame of an approved TWP. Examples might include the mitigation of an impact resulting from ESA or tribal consultation, a change in the "overhead" charges of a federal or state agency, a significant reduction of the balance of the Colorado River Basin Fund, or a failure to secure NPS permits for work in the Grand Canyon. As soon as an administrative event occurs that affects the TWP, GCMRC (or relevant agency – such as DOI) will notify the TWG. • New initiatives: New initiatives or modifications to projects that may or may not be based on a scientific merit must be vetted through DOI. DOI will consider whether to direct GCMRC/BOR to work on these new initiatives or whether to consider them during the next full budget cycle. Given that the budget will likely be fully accounted for, direction on where to locate the funds within the current budget will be requested from DOI.

Response on Project 4 from GCMRC

Table 1. The FY17 Project 4 budget will pay for the following

Personnel	**Sub Total pre-burden***	**Total pre-burden**
Joel Sankey (50 % of annual salary)		
Helen Fairley (50 % of annual salary)		
Amy East (27 % of annual salary)		
Joshua Caster (100 % of annual salary)		
Alan Kasprak (73 % of annual salary)		
Keith Kohl (8 % of annual salary)		
	$376,000 (total personnel)	
Publishing	$8,000	
Travel for Sankey, Fairley, East, Caster, Kasprak	$14,000	
Logistics (1 river trip)	$30,000	
Supplies, Software & Equipment Maintenance	$26,000	
		$454,000

*Subtotals rounded to the $1000

Budget Justification (note that this is written by Joel Sankey and Helen Fairley in response to the Budget Comments from Randy Seaholm[1], Kurt Dongoske[2], and Craig Ellsworth[3])

The current Project 4 and its predecessors from the past decade, (please see recent USGS Professional Paper https://pubs.er.usgs.gov/publication/pp1825, and Project 4 bibliography in the FY15-17 workplan) have demonstrated that portions of the landscape above the stage of contemporary high flows (e.g., >45,000 CFS) are affected by geomorphic processes occurring in the active river channel as well as by geomorphic processes that link the active channel with higher elevation areas. Some locations along the river valley margins that have high connectivity to the active river channel include aeolian dune fields and archaeological sites. These areas are affected either directly or indirectly by the fluvial geomorphic processes of the Colorado River and therefore are directly or indirectly affected by operations of Glen Canyon Dam. We realize that this is a potentially controversial topic for some stakeholders because it highlights ways in which management actions that affect the active river channel also affect the environment outside of the active river channel.

Because of this work, the staff of Project 4 were commended during FY15 and FY16 by DOI, including the office of the ASWS, BOR, and NPS, for providing timely and relevant scientific information in support of their discussions about the Area of Potential Effect from Operations of Glen Canyon Dam. This past work, and ongoing work in Project 4, also address questions previously raised by the Hopi Tribe as to whether and in what respects erosion of their ancestral sites is being aggravated by effects from dam operations. If Project 4 were to be cut from the budget in 2017, USGS would no longer be able to meet the needs of many stakeholders nor provide timely and relevant science in support of important ongoing discussions that are relevant to all stakeholders. It would be particularly rash and untimely to cut this project in the last year of the Triennial Workplan (2017) considering that many issues surrounding the APE have yet to be decided, and refinements of previous decisions about which areas of the landscape outside of the active river channel to include in the APE are still under discussion.

Project 4 evaluates the roles of proposed flow and nonflow management actions for enhancing connectivity of sediment between the active river channel and valley margins. It seeks to more fully

understand how vegetation growth in the New High Water Zone has affected sand availability and deposition and erosion patterns at cultural sites. In FY17, work will specifically examine the potential role of experimental flows in addition to and including floods (HFEs) for enhancing connectivity and will evaluate the potential role of vegetation removal for enhancing future connectivity between the current active channel and the former active channel of the Colorado River, where many significant cultural sites are located. Deliverables planned from this work are manuscripts that will be published in high impact peer-reviewed journals. Craig Ellsworth[3] questioned the need for this work in FY17 in light of the publication by Collins et al. (2015) in the journal Earth Surface Processes and Landforms. In referencing one sentence from the conclusions ("aeolian deposition, even with anthropogenic forcing via fluvial sand-bar building high flow dam releases, was found to be generally insufficient to offset the effects of precipitation-induced gullying."), two other important conclusions of the work are not acknowledged. These conclusions are: 1. "ample evidence for aeolian deposition" exists "when coupled with upwind fluvial sand supplies", and 2. "fluvially-connected aeolian deposition is a time-dependent process, the outer limit of which may extend for many years". Our goals in FY17 are important and relevant because we aim to extend the work of Collins et al. (2015) in order to quantify whether experimental flows such as consecutive (e.g., annual) HFEs, as well as nonflow actions like vegetation removal at sites with high potential connectivity, are viable strategies for maintaining or restoring the trajectory of long term sand retention in the system. Importantly, our work will extend the length of our datasets to allow us to examine the effects of the current and ongoing HFE protocol in an adequate timeframe.

Concurrently with work described above, Project 4 is developing a monitoring plan to evaluate the efficacy of future operations in achieving the protection and improvement goals for cultural resources specified in GCPA. Development of this plan has proceeded with consultation and review from stakeholders, including DOI agencies, WAPA, CREDA and the tribes. The Project 4 monitoring protocols are designed to track how future flow (i.e., dam operations) and non-flow management actions (e.g., riparian vegetation removal) affect the condition of archaeological sites located in the river corridor downstream of Glen Canyon Dam. GCMRC intentionally designed this program to focus on effects of geomorphic processes that are influenced by dam operations or other non-flow actions which may be implemented during the next 20 years as part of LTEMP, with a specific focus on documenting whether and how they affect the physical condition of archaeological sites. The National Park Service at Grand Canyon National Park and Glen Canyon National Recreation Area and the Hopi, Hualapai, Navajo, Kaibab Southern Paiute, and Zuni tribes also have programs to monitor cultural resource sites and related resources of interest. Some of these monitoring programs assess visitor impacts that can change the National Register eligibility of historic properties, or they focus on monitoring intangible values associated with Native American Traditional Cultural Properties, which differs from the GCMRC focus on quantifying effects of geomorphic processes on the physical condition of (primarily) register-eligible archaeological sites. Ultimately, the assessment of effects to the National Register significance of historic properties is a value-based judgment call that is not appropriate for USGS scientists to make. However, the information on physical condition and the processes creating those conditions that is being produced by GCMRC through the Project 4 monitoring program will directly inform management decisions made by other DOI managers about whether and to what degree and in what respects dam operations affect the integrity of National Register eligible properties. The intention of GCMRC is to not duplicate other ongoing monitoring efforts but to complement them, and where possible, enhance the scientific foundation upon which future management decisions will be made.

The GCMRC is cognizant that aspects of their monitoring will have significant and differing relevance to resource managers and stakeholders of the Glen Canyon Dam Adaptive Management Program. For example, some aspects of GCMRC's monitoring program will be relevant to National Historic

Preservation Act requirements implemented under a new Programmatic Agreement, for which the Bureau of Reclamation has lead responsibility. The monitoring undertaken by GCMRC will be useful for evaluating whether and how dam-controlled flows implemented under the LTEMP affect the condition of National Register eligible historic properties in lower Glen and Grand Canyons. As such, the Bureau of Reclamation and other signatories to the PA may wish to highlight within the PA the specific reasons why monitoring is being done and the specific monitoring questions and data interpretations within GCMRC's monitoring plan that are relevant to their stated requirements. Beyond the PA, the monitoring program we are implementing is directly responsive to the monitoring information requirements specified in GCPA, i.e., for evaluating how well the AMP is meeting the requirements of the Grand Canyon Protection Act related to protecting and improving the condition of archaeological sites and other cultural resources such as landscape-scale TCPs.

In FY15, GCMRC distributed drafts of the monitoring plan and consulted with DOI agencies and all other stakeholders during multiple meetings (please see the timeline below). FY16 was the first year of implementing the new plan. Monitoring activities planned for FY17 include one river trip to collect additional monitoring data, and the dissemination of a monitoring report to stakeholders documenting the results of the monitoring in 2016 and 2017 (i.e., under the current Triennial Workplan). To properly evaluate this new monitoring program requires more than two years of data collection, particularly if we want to understand meaningful trends in resource condition. Nonetheless, stakeholders will have an opportunity to help determine the fate of GCMRC's monitoring program when the next workplan is developed.

Finally, please note that GCMRC staff continues to be receptive to constructive comments from stakeholders to improve the value and utility of our monitoring program. If any stakeholder believes that important sites or attributes have been overlooked and should be included in the monitoring plan, GCMRC would be happy to discuss all recommendations and have frank and constructive conversations about how to refine GCMRC's monitoring program to further improve its scientific credibility and utility to decision makers, managers and stakeholders.

Monitoring plan consultation and review timeline:

- June 23rd 2015. Met with Grand Canyon NPS and BOR to discuss monitoring plan. (Mary Barger, Jan Balsom, Helen Fairley, and Joel Sankey participated). NPS and BOR recommended that we draft a very short outline of our proposed monitoring plan and then meet with BOR and NPS staff again to review.
- July 6th 2015. Emailed plan outline and site list to BOR and NPS stakeholders and organized a meeting for review and discussion. (email with outline was sent to Mary Barger, Janet Balsom, Rob Billerbeck, Glen Knowles, Rosemary Sucec, Nathaniel Baker, Jennifer Dierker, Ellen Brennan, Bill Chada, Helen Fairley, Scott VanderKooi, Joshua Caster, Amy East)
- July 16th 2015. Met with NPS and BOR to discuss and review their comments on the outline. (Mary Barger, Bevereley Heffernan, Jan Balsom, Jen Dierker, Ellen Brennan, Jane Rodgers, Joel Sankey, Helen Fairley, and Joshua Caster participated). Recommended next step was to organize a meeting to include all other stakeholders in the discussion and review process.
- August 21st 2015. Held a meeting with webinar to review the monitoring plan outline. The following were invited (Helen Fairley, Joshua Caster, Bill Chada, Beverley Heffernan, Ellen Brennan, Janet Balsom, Charley Bullets, Ora V. Marek-Martinez, Sarah Rinkevich, Peter Bungart, Leslie James, Mike Yeatts, Kurt Dongoske, Loretta Jackson-Kelly, Jennifer Dierker, Jane Rodgers, Mary Barger, Glen Knowles, Scott Vanderkooi, Dave Lytle, Rob Billerbeck, Charles Lewis,

Rosemary Sucec, Nathaniel Baker, Kirk Young, Ann Howard, Mary-Ellen Walsh, John Eddins, Reid Nelson, Leigh Kuwanwisiwma, Rick Wessel.

- October 7th 2015. Emailed a complete draft of the monitoring plan to all stakeholders. Based on the follow-up email recommendation of stakeholders, scheduled a webinar to discuss the monitoring plan in conjunction with DOI presentation of their progress on PA and APE work. Plan was emailed to the following: Bill Chada, Beverley Heffernan, Ellen Brennan, Janet Balsom, Charley Bullets, Ora V. Marek-Martinez, Sarah Rinkevich, Peter Bungart, Leslie James, Mike,Kurt Dongoske, Loretta Jackson-Kelly, Jennifer Dierker, Jane Rodgers, Mary Barger, Glen Knowles,Rob Billerbeck, Charles Lewis, Rosemary Sucec, Nathaniel Baker, Kirk Young, Ann Howard, Mary-Ellen Walsh, John Eddins, Reid Nelson, Leigh Kuwanwisiwma, Rick Wessel, Lisa Meyer, Helen Fairley, Joshua Caster, Amy East, Scott Vanderkooi, David Lytle
- November 30th 2015. DOI LTEMP Meeting "NHPA APE cultural site development" via phone and webinar. We presented our monitoring plan in conjunction with the DOI and BOR presentation of their progress on PA and APE work
- December 3rd 2015. Participated in the DOI "Meeting with Tribes and Arizona SHPO and ACHP" to entertain follow-up questions to our presentation of the monitoring plan
- To date we have received and incorporated written comments from the following for the document we sent out on October 7th, 2015: NPS-Grand Canyon, NPS-Glen Canyon, WAPA, Zuni.

Budget comments provided by Randy Seaholm, Kurt Dongoske, and Craig Ellsworth are repeated below:

[1]Budget comment from From Randy Seaholm (5/20/16):
Attached is a spreadsheet containing changes we would like to see made to the FY 17 budget and related documents. We have not suggested specific dollar amounts to allow some latitude in reallocating funds once our comments have been addressed. Briefly our proposed changes and reasoning are as follows. 1. A project first and foremost must fit within the laws that govern the allocation, appropriation, development and exportation of the waters of the Colorado River Basin. No project should be included that seeks to alter or misinterpret any of those laws. There is a New Project, T6 in Appendix 4 of the FY 2015-17 Budget document dealing with equalization that has been suggested but not funded. We believe this proposed project is clearly outside this criterion and should be completely removed from the documents. 2. Any project should be confined to the Colorado River Ecosystem and specifically to understanding how dam operations could be modified to benefit both power and downstream resources. Since the maximum release from the dam for purposes of the GCAMP is 45,000 cfs, projects should be focused on resources at or below this flow level. Projects above this flow level should be funded from sources other than GCAMP funds. We would further suggest that studies that go outside the CRE into other river basins or involve work above Lake Powell or below Lake Mead not be considered and if so, absolutely done with funds other than GCAMP. This would be consistent with funding guidance provided early on in the program but which has since become lost or blurred over time. 3. Projects should not overlap or consider work that cannot reasonably benefit resources within the CRE in GCNP or GCNRA. Towards this end the aeolian sand studies in our estimation, while they may be interesting, are not going to provide a useful tool or information that will benefit the GCAMP. Wind does what wind will do. Furthermore, a lot of the sand conservation work, plus the current vegetative monitoring program, which includes identifying the impacts of HFE's on vegetation, make aeolian sand studies unnecessary. If aeolian sand studies continue outside funding

should be obtained, GCAMP funds should not be used. The GCAMP funds freed up could help advance some of the fishery projects that Arizona Game and Fish mentioned as underfunded.

[2]Budget comment from Kurt Dongoske (5/17/2016)
Reclamation's funding of Project 4 (D.2.3) - This project examines deposition of aeolian sand from HFE-created sand bars on historic properties within the area of potential effect of future dam operations. The primary objectives of element 4.2. are to draft and implement a monitoring plan that meets requirements for monitoring effects of dam operations to cultural resources relative to the National Historic Preservation Act and Grand Canyon Protection Act. Given that Reclamation is currently in the process of drafting a new Programmatic Agreement (PA) should this project continue to be funded if it ultimately does not meet the needs of compliance as defined in a new PA. The CRAHG believes that GCMRC's role in complying with any of the stipulations that will come out of the new PA needs to be determined soon because any monitoring of cultural resources under the NHPA or the GCPA will be funded through this program. The continuation of developing a monitoring program that does not include assessing historic property integrity is a serious concern for the CRAHG. The question of continuing to fund a monitoring program that in the end does not meet the compliance needs of Reclamation should be a serious issue for the BAHG. According to the work plan, the draft monitoring plan will make a recommendation of the sample of archaeological sites that should be monitored, but stakeholders (presumably including the BOR, NPS, SHPO, ACHP and tribes) will need to work very closely with GCMRC in year 1 of the project to come to agreement on the monitoring protocol and set of sites that is ultimately monitored. CRAHG would like to know from GCMRC if the stakeholders have been meaningfully consulted on the selection of sites to be monitored?

[3]Budget comment from Craig Ellsworth (5/20/2016)
Please identify the need to continue Project 4.1. Quantifying connectivity along the fluvial-aeolian-hillslope continuum at landscape scales in FY17. The TWP identifies the primary objective of this project is to explain how connectivity along the fluvial-aeolian-hillslope continuum varies spatially throughout the river corridor and to determine if this connectivity has changed during the recent decades of restricted power plant operation and the occurrence of controlled floods. A recent paper published by Collins et al. 2015 in Earth Surface Processes and Landforms concludes that "aeolian deposition, even with anthropogenic forcing via fluvial sand-bar building high flow dam releases, was found to be generally insufficient to offset the effects of precipitation-induced gullying." Please identify the need of spending $252,600 in FY17 to continue studying aeolian deposition resulting from the 2012 HFE Protocol when the latest findings regarding this project indicate that this mechanism does not occur with the frequency or magnitude to offset precipitation-induced erosion of archeological sites below Glen Canyon Dam.

Reclamation - Adaptive Management Program Budget Summary

6/8/2016 13:02

includes labor and contract data through end of May 2016

		Category	2016 TWP (FY15 3.0%, FY16 3.0%)	2016 TWP (FY15 1.7.0%, FY16 0.0%)	FY 16 Funding Assigned	FY16 Commitments	Delta between 2016 TWP and Assigned
A	**Adaptive Management Work Group**		**$ 391,370**	**$ 375,185**	**$ 316,677**	**$ 274,152**	**$ 58,508**
A.1	Adaptive Management Work Group Costs (only ERD)	Labor	$ 202,425	$ 194,054	$ 194,054	$ 151,425	$ 0
A.2	AMWG Member Travel Reimbursement	Other	$ 16,159	$ 15,491	$ 15,491		
A.3	AMWG Reclamation Travel	Other	$ 16,580	$ 15,894	$ 15,984		$ (90)
A.4	AMWG Facilitation Contract	Contact	$ 81,943	$ 78,554	$ 82,215	$ 82,215	$ (3,661)
A.5	Public Outreach	Labor	$ 64,945	$ 62,259		$ -	$ 62,259
A.6	AMWG Other	Misc	$ 9,318	$ 8,933	$ 8,933	$ 14,058	$ (0)
B	**Technical Working Group**		**$ 176,597**	**$ 169,294**	**$ 41,017**	**$ 47,775**	**$ 128,277**
B.1	TWG Costs	Labor	$ 100,799	$ 96,630	$ 96,630	$ 31,804	$ (0)
B.2	TWG Member Travel Reimbursement	Other	$ 23,743	$ 22,761	$ 22,761		
B.3	TWG Reclamation Travel	Other	$ 16,381	$ 15,704	$ 15,704		
B.4	TWG Chair Reimbursement/Facilitation	Contract	$ 33,012	$ 31,647	$ -	$ -	$ 31,647
B.5	TWG Other	Other	$ 2,662	$ 2,552	$ 2,552		$ 0
C	**Reclamation Administration**		**$ 816,939**	**$ 783,155**	**$ 336,661**	**$ 47,775**	**$ 446,494**
C.1	Administrative Support for NPS Permitting	Contract	$ 140,046	$ 134,254	$ 140,046	$ 140,046	$ (5,792)
C.2	Contract Administration	Labor	$ 46,723	$ 44,791	$ 44,791	$ 2,109	$ (0)
C.3	Science Advisor Contract	Contract	$ 77,250	$ 74,055	$ 151,824	$ 112,622	$ (77,769)
C.4	Experimental Fund	Contract	$ 552,920	$ 530,054	$ -	$ 530,054	$ 530,054
C.5	Installation of Acoustic Flow Meters	Contract	$ -	$ -	$ -	$ -	$ -
C.6	Native Fish Conservation Contingency Fund (No funding identified in TWP for FY16)	Contract	$ 1,110,894	$ 1,064,953	$ -	$ -	$ 1,064,953
C.6.6.2	*Aggregation recruitment*	*Contract*	$ -	$ -	$ -	$ -	$ -
C.6.6.3	*Monitoring mainstem aggregations with PIT tag antennas (pilot)*	*Contract*	$ -	$ -	$ -	$ -	$ -
C.6.6.6	*Direct mainstem augmentation of humpback chub*	*Contract*	$ -	$ -	$ -	$ -	$ -
C.6.7.3	*July LCR juvenile HC marking to estimate production and outmigration*	*Contract*	$ -	$ -	$ -	$ -	$ -
C.6.7.6	*Potential for gravel substrate limitation for HC reproduction in the LCR*	*Contract*	$ -	$ -	$ -	$ -	$ -
C.6.7.7	*Evaluate CO2 as a limiting factor early life history stages of HC in the LCR*	*Contract*	$ -	$ -	$ -	$ -	$ -
C.6.7.9	*Dev of a non-lethal tool to assess physiological condition of HC in the CR/LCR*	*Contract*	$ -	$ -	$ -	$ -	$ -
D	**Cultural Resources**		**$ 1,296,401**	**$ 1,242,789**	**$ 1,592,931**	**$ 576,915**	**$ (350,143)**
D.1	Cultural Resources Program Management	Labor	$ 139,307	$ 133,546	$ 133,546	$ 61,464	$ (0)
D.2	Cultural Resources Work Plan	Contract	$ 515,000	$ 493,702	$ 456,004	$ 391,004	$ 37,698
D.2.1	Long-term Monitoring Program for Terrestrial and Submerged CR	*Contract*	$ 145,000	$ 139,004	$ 139,004	$ 139,004	$ (0)
D.2.2	Zuni Associative Values	Contract	$ 30,000	$ 28,759	$ 65,000	$ -	$ (36,241)
D.2.3	Support for GCMRC's Project 4	Contract	$ 150,000	$ 143,797	$ 157,000	$ 157,000	$ (13,203)
D.2.4	TEK Ecological Restoration Project	Contract	$ 100,000	$ 95,865	$ 95,000	$ 95,000	$ 865
D.2.5	Tribal Synthesis	Contract	$ 50,000	$ 47,932	$ -	$ -	$ 47,932
D.2.6	Annual Integrated River Trip: An Exchange of Values and World-Views	Contract	$ 30,000	$ 28,759	$ -	$ -	$ 28,759
D.2.7	Nonnative Fish Removal Consultation	Contract	$ 10,000	$ 9,586	$ -	$ -	$ 9,586
D.2.8	Tribal Preparation of Paperwork for DOE of Grand Canyon to NR	Contract	$ -	$ -	$ -	$ -	$ -
D.3	Integrated Tribal Resources Monitoring	Contract	$ 167,094	$ 160,184	$ 124,447	$ 124,447	$ 35,737
D.4	Tribal Participation in the GCDAMP (5 tribes at $95,000) -appropriated funds	Grant	$ 475,000	$ 475,000	$ 422,930	$ -	$ 52,070
							$ -
	Total Without USGS (Reclamation Only)		**$ 2,681,307**	**$ 2,570,422**	**$ 2,287,286**	**$ 946,616**	**$ 283,136**
U	**USGS - GCMRC**		**$ 10,928,700**	**$ 10,476,746**	**$ 9,029,760**	**$ 9,029,760**	**$ 1,446,986**
U1	Lake Powell and Glen Canyon Dam Release Water-Quality Monitoring		$ 310,500	$ 297,659			
U2	Stream Flow, Water Quality, and Sediment Transport in the Colorado River Ecosystem		$ 1,452,000	$ 1,391,953			
U3	Sandbars and Sediment Storage Dynamics: Long-term Monitoring and Research at the Site, Reach, and Ecosystem Scales		$ 1,425,900	$ 1,366,932			
U4	Connectivity along the fluvial-aeolian-hillslope continuum: quantifying the relative importance of river related factors that influence upland geomorphology and archaeological site stability		$ 562,900	$ 539,621			
U5	Foodbase Monitoring and Research		$ 631,900	$ 605,768			
U6	Mainstem Colorado River Humpback Chub Aggregations and Fish Community Dynamics		$ 708,600	$ 679,296			
U7	Population Ecology of Humpback Chub in and around the Little Colorado River		$ 1,708,600	$ 1,637,941			
U8	Experimental Actions to Increase Abundance and Distribution of Native Fishes in Grand Canyon		$ 226,500	$ 217,133			
U9	Understanding the Factors Determining Recruitment, Population Size, Growth, and Movement of Rainbow Trout in Glen and Marble Canyons		$ 1,102,100	$ 1,056,523			
U10	Where does the Glen Canyon Dam rainbow trout tailwater fishery end? - Integrating Fish and Channel Mapping Data below Glen Canyon Dam		$ 152,100	$ 145,810			
U11	Riparian Vegetation Monitoring and Analysis of Riparian Vegetation, Landform Change and Aquatic- Terrestrial linkages to Faunal Communities		$ 551,700	$ 528,885			
U12	Changes in the Distribution and Abundance of Culturally-Important Plants in the Colorado River Ecosystem: A Pilot Study to Explore Relationships between Vegetation Change and Traditional Cultural Values		$ 86,400	$ 82,827			
U13	Socioeconomic Monitoring and Research		$ 356,900	$ 342,140			
U14	Geographic Information Systems (GIS) Services and Support		$ 219,900	$ 210,806			
U15	Administration		$ 1,432,700	$ 1,373,451			
	Total With USGS		**$ 13,610,007**	**$ 13,047,168**	**$ 11,317,046**	**$ 9,976,376**	**$ 1,730,122**

DRAFT - SUBJECT TO ADDITIONAL UPDATES