# Glen Canyon Dam Adaptive Management Program

# Technical Work Group: Budget Ad Hoc Group

Conference Call #5, March 23, 2017 – Meeting Notes

## Attendees

The following people identified themselves as being on the call.

Lucas Bair, GCMRC

Janet Balsom, NPS

Shane Capron, WAPA and BAHG chair

Kerry Christensen, Hualapai

Marianne Crawford, Reclamation

Craig Ellsworth, WAPA

Helen Fairley, GCMRC

Paul Grams, GCMRC

Katrina Grantz, Reclamation

Paul Harms, New Mexico

Brian Healy, NPS

Dawn Hubbs, Hualapai

Leslie James, CREDA

Vineetha Kartha, Arizona

Ted Kennedy, GCMRC

Ryan Mann, AGFD

Michael Moran, GCMRC

Jessica Neuwerth, California

Joel Sankey, GCMRC

Randy Seaholm, Colorado

Dave Topping, GCMRC

Scott Vanderkooi, GCMRC

Mike Yeatts, Hopi

The following people were not on the call:

Melinda Arviso-Ciocco, Navajo Nation

Cliff Barrett, UAMPS

Carlee Brown, Colorado

Chris Budwig, Anglers

Kathleen Callister, Reclamation

Kurt Dongoske, Zuni

Christopher Harris, California

John Jordan, Anglers

Don Ostler, New Mexico and Wyoming Clayton Palmer, WAPA

Jenny Rebenack, NPS

Ben Reeder, GCRG

Peggy Roefer, Nevada

Dave Rogowski, AFGD

Seth Shanahan, TWG Chair

Chris Schill, USGS

Larry Stevens, GCWC

Rosemary Sucec, NPS

Kirk Young, USFWS

Mary Orton of The Mary Orton Company, LLC attended as facilitator and note-taker.

Shane reminded the group that at this meeting, they would hear presentations from Grand Canyon Monitoring and Research Center (GCMRC) on sediment, socioeconomics, and cultural resources, and from Reclamation on their budget. Ted Kennedy would also spend some time to revisit the funding question on the foodbase project.

## Cultural Resources

Joel Sankey gave an overview of the research and monitoring in what was Project 4 in the last work plan. They will evaluate how flow and non-flow resources affect cultural resources on archeological sites. He said there would be a focus on the effects of dam operations on Holocene terraces throughout Grand Canyon. Another focus will be on the effects of vegetation management required by the Long Term Experimental Management Plan (LTEMP) Record of Decision (ROD).

They plan to continue monitoring topographic geomorphic changes of individual dune fields and archeological sites through LIDAR, surveys, and topographic surveys with drones (if permitted). While they will apply the classification system to archeological sites, that work will not be updated during this work plan.

For vegetation management, they are interested in using the tools noted above, especially remote sensing, to identify sites where would make sense for National Park Service (NPS) to target vegetation removal to free up sand to be moved by aeolian processes to cover archeological sites. They will rank potential sites in terms of their relative potential or importance. They also plan to use survey and change detection methods, and other new methods, to monitor and evaluate the outcome or effectiveness of the vegetation removal, by collecting data before and after the treatment. They will work in close collaboration with NPS and tribes.

Another element will be to update the analysis of dam-related geomorphic changes of channel and terrace banks in the Glen Canyon National Recreation Area (NRA), for the most part using existing remote sensing channel mapping data. They plan to update the paper Paul Grams published in 2007.

The tribes expressed an interest to work with GCMRC on dam effects and long-term erosion rates, and the erosion potential from all geomorphic processes, on Holocene terraces throughout the system.

Another element is based on Alan Kasprak’s work that was reported at the Annual Reporting Meeting (ARM). He used the channel mapping and remote sensing data of sand on channel beds and above in aeolian dune fields, and used historical data of hydrograph and remote sensing of vegetation, to analyze how vegetation encroachment and changes in the flow regime affected the availability of sand for aeolian transport. He completed this for Lower Marble Canyon and he will do this for other reaches where there are similar classifications.

Finally, they plan to develop web mapping from a new geomorphic change detection tool. They will use survey data, per river reach, to attribute geomorphic processes to those changes. They think it would be useful and plan to turn it into a web-mapping framework for the GCMRC webpage.

They will also be doing outreach under the auspices of the riparian vegetation monitoring and research under the ROD, as well as for cultural resources. Outreach efforts will include the tribes and members of the Grand Canyon National Park and Glen Canyon archeological staff.

Shane opened up the meeting for questions and discussion.

* Is the primary purpose of the vegetation removal for aeolian transport or for the benefit of camping beaches?
	+ Joel: There are four purposes of vegetation removal noted in the ROD:
1. Vegetation encroachment at campsites.
2. Replacing non-native species with native species (planting).
3. Freeing up sand for aeolian transport for the benefit of cultural areas.
4. Addressing arrowweed.

The project I described is #3. However, there are sites where we could address several goals with one action.

* How are the projects you are coordinating with the tribes different from those you are coordinating with NPS?
	+ Joel: Vegetation management is a non-flow action conducted by the land management agency, which is NPS or tribes. We are offering to monitor before and after in order to measure the effectiveness of the treatment. We might also recommend promising sites, and we have existing baseline data to show how topography or the sediment budget changes over time. In addition, Glen Canyon NRA and the tribes have expressed interest in having a better understanding of how dam operations affect the erosion of Holocene terraces. We are equipped to study, analyze, and collect data, and inform you on these issues.
* Please describe how important aeolian transport is for preserving cultural sites. It seems there were just a few sites in one study that were affected by aeolian transport.
	+ Joel: That is not the appropriate study from which to extrapolate to all sites. The researcher focused on only a small number of sites, some of which were affected by wind processes. Thirty of the 356 sites in the wind classification are in the category of best-case scenario to receive windblown sand. There are dozens more with vegetation that precludes transport. We are focusing here because this vegetation management work is noted in the ROD, and because there are many sites where targeted removal could make a difference.
* So the point of the work is to determine how vegetation removal could increase sites receiving sand?
	+ Joel: Yes. Also, the work will be accomplished under the ROD, so we would evaluate its effectiveness.
	+ Helen: More vegetation will be removed with the tamarisk beetle, which could change the dynamics for many sites that receive sand from wind processes. The question is: to what extent do dam operations limit the availability of sand to be transported to sites?
* Hopi is pushing for this broader understanding of the relationship between sand availability and dam operations. Our focus is on archeological sites on Holocene terraces, which is a small sample of the ecosystem. Looking more broadly, and independent from archeological sites, this will help us understand how dam effects can affect erosion rates. Looking at archeological compliance, we will measure changes and see if high flows have any effect at all.
* Have you thought about how to determine what actually can be affected by dam operations, and do we need to separate the research between the Colorado River Ecosystem (CRE) and the rest of the canyon? Also, regarding the aeolian transport of sand, do we know whether operations at the dam can create the sandbars valued by recreation? My thought is that much could be done before getting so far into this project that you cannot discern what operation is affecting what resources.
	+ Joel: With regard to your first question, we are very conscientious and careful about focusing research and monitoring on the effects of dam operations. A linkage has been clearly shown between the transport of sediment from sandbars rebuilt from certain flows and downwind dune fields. What we know about the erosion of terraces relative to dam operations is in Glen Canyon, where we’ve shown with our LIDAR work that those terraces will erode immediately following controlled floods if there is a quick drop of water level. We can use this landscape-scale remote sensing to identify other cut-banks and terraces throughout the canyon that might be similarly affected by those processes.

With regard to your second question, I imagine NPS would do this work at a small number of sites when it is first implemented in year one. Based on all the data we’ve collected and the analysis we have done, we can recommend 10 to 30 sites where it would make sense to try the vegetation removal. We know sandbars there have responded to floods and that large vegetation barriers exist.

* Have you talked with recreational interests? How does this fit in with pattern of sandbars they want to see for river trips? Have you looked at the overlap with these sites?
	+ Joel: To date we have talked with NPS and the tribes. We would need to approach vegetation research and monitoring from the point of view of the four reasons for vegetation management under the ROD. We need to have some kind of workshop or work group to identify where we can get double or triple benefit for the various resources: campsites, cultural sites, aeolian dune fields, tamarisk removal sites, and maybe even planting native species.
* Do the tribal representatives feel they are getting a good balance between mitigation and identification required under Section 106 on the one hand, and work on aeolian sand transport on the other?
	+ Mike Yeatts: The question about whether aeolian processes are happening under current dam operations is important. The current situation cannot be viewed as a comprehensive method for mitigation of erosion at archeological sites under the Programmatic Agreement (PA). It’s possible vegetation management will help. Beyond that, with the finalization of the PA and discussions on the Triennial Work Plan (TWP), I think we will get back to monitoring work that has lapsed at archeological sites and determining whether there are impacts. We can also get back to the mitigation of adverse effects we have identified over the last 15 to 20 years. We’ve been lacking on some of the compliance mitigation aspects, but this is not the fault of GCMRC; they are not the responsible agency.
* Joel: Can you explain the table of potential project ideas the tribes sent us yesterday?
	+ Mike Yeatts: The impetus was the BAHG discussions. Looking at the table that Shane distributed, we realized that the tribal representatives hadn’t discussed our overall vision for the cultural program. We developed a list of brainstormed projects among tribal representatives and others. We haven’t yet discussed it with the broader group. I sent it out yesterday to the PA group to get feedback before sending it to the Cultural Resources Ad Hoc Group. Some of the things Joel reported on were from these discussions.
	+ Kerry: Hualapai mostly agrees with what Mike said. We didn’t think the aeolian transport project was important, but with the potential for vegetation management it might become important process. We don’t agree that GCMRC is not responsible for Section 106 compliance. GCDAMP is responsible for compliance for ESA, and the whole program is partly responsible for Section 106 compliance.
	+ Katrina: As the agency that takes action under LTEMP and funds GCMRC, Reclamation’s main goal is to ensure compliance with Section 106, including actions by GCMRC, through the PA and the eventual Historic Preservation Plan.
	+ Scott: GCMRC is committed to compliance with Section 106. Reclamation is the action agency and we work with them through interagency agreements.

## Foodbase Project Funding

Ted Kennedy reminded the group that he had presented on the new foodbase project at the last BAHG meeting. This was in follow-up to GCMRC work Western Area Power Administration (WAPA) funded on invertebrate assemblages in the lower Colorado River, below Davis and Parker dams. Dam operations there could be characterized as extreme load following; however, there are robust caddisfly populations—almost to a nuisance level where they are considering removal efforts. This was counter to GCMRC’s earlier findings in which they identified hydropower production in general and load following specifically as the primary cause of the poor health of invertebrate assemblages. He said they are looking for funding to continue this work, including from the AMP, Multi-Species Conservation Program (MSCP), and other sources, as studying these populations of caddisflies could benefit the managers. Understanding their life histories could inform the management of those populations, also inform the program on invertebrate assemblages for Grand Canyon.

Shane invited questions and discussion.

* I’m glad you are talking with MSCP about funding; I believe you should be coordinating with them. A joint proposal would be helpful, from my perspective. Regardless of funding, are you looking at trying to take caddisflies and move them to Glen Canyon reach? That is, would the funding be for reintroduction of extirpated species? We would not be in favor of that idea.
	+ Ted: WAPA funded some studies on this subject in the upper and lower basins. One objective was to identify potential candidates for reintroduction, and this might be a good candidate. I would hesitate moving insects around without more information. These are a native species, but relocation is a big step. That is something on our radar, but we are far from developing a proposal advocating that. That would be coordinated with NPS.
* If this is funded, there needs to be consultation with Colorado River Indian Tribes and the Mohave Tribe, along with AMP tribes.
* I appreciate you thinking about this, even though it challenges your earlier paper.
* You might want to also talk with Bullhead City and Arizona Game and Fish Department for funding.

## Socioeconomics

Lucas Bair presented on socioeconomics monitoring and research. He said that he had developed two categories of proposed work with the help of the Socioeconomics Ad Hoc Group (SEAHG).

1. Social and economic survey research.

Two activities in the proposed TWP are important due to the proposed experiments in the LTEMP ROD.

* 1. Commercial whitewater guide survey. Based on conversations with stakeholders, GCMRC proposes to interview guides about their recreational experience, including what attributes are important to them under different flow regimes. This will add insight into how dam operations influence recreation activities, and refine understanding of dam operations and attributes important to this group.
	2. An extension of Project 13.2, initiated this fiscal year, which is an evaluation and assessment of tribal preferences for resources downstream of the dam. GCMRC is developing surveys through workshops with tribes that would evaluate their preferences for and values of downstream resources. This qualitative information will give the program a better understanding of tribal perspectives for these resources.

There are other lower-priority projects, including non-market economic surveys of commercial whitewater boaters, backpackers, and day users. These are groups the AMP and SEAHG have identified as accessing the river and having preferences about their experience. They learned by surveying anglers that their preferences are stable over time. Dam operations don’t impact some of these groups’ preferences, so they are a lower tier of importance. This may come up later if conditions change.

1. Applied decision scenario analysis.
	1. Build on and use what GCMRC learned in the recreation surveys of boaters and anglers to update Reclamation’s model to evaluate experiments proposed in the LTEMP and understand how seasonal timing affects anglers and boaters.
	2. Update information on how anglers and boaters spend money in the region. The flow experiments can impact angler participation and spending. There is an opportunity to learn from those in the area who commercially benefit from the anglers about the regional economic impact of how LTEMP experiments occur, including their timing and how they are organized.
	3. Build on the bio-economic modeling and scenario analysis work GCMRC is currently doing. This model, reported on at the last ARM, was used to evaluate rainbow trout (RBT) management strategies in relation to humpback chub (HBC) goals. GCMRC proposes to build on this model to evaluate the most efficient way to learn about HBC populations, including aspects like survival and recruitment, and to minimize the need to manage RBT at the Little Colorado River (LCR). GCMRC is building that model to evaluate tradeoffs, efficacy, and costs compared to RBT removals at the LCR. This also supports evaluating and assessing LTEMP experiments and thinking more systematically about translocations.
	4. Modeling regarding the RBT removal trigger, and how to increase efficiency and effectiveness of management actions like trout management flows and other experiments.
	5. Building on existing modeling that GCMRC, NPS, Argonne, and others are doing based on recent work by the University of Oklahoma and including what was done in the LTEMP EIS. GCMRC proposes to formally look at the conceptual model to identify research priorities and how they can better standardize and identify how things would fit together, looking at LTEMP experiments. He emphasized that this work is focused on building on existing studies and work, updating information, while focusing on LTEMP experiments.

Shane invited questions and discussion.

* As you go through these evaluations, can you differentiate between previous dam operations and new experiments? Can you separate impacts of the dam and focus solely on the impacts of experiments?
	+ Lucas: Yes, I feel confident that is possible with our modeling. With survey research and more formal modeling, the focus is to refine and pay attention to operations specifically including LTEMP proposed experiments.
* If the anglers’ survey shows that their opinions tend to be stable, why are we supporting additional survey work?
	+ Lucas: Because some of the data used to support the LTEMP assumptions is dated, so we thought it would be important to include more current survey work.

## Sediment

Dave Topping said he was proposing to continue the ongoing monitoring with a few minor changes. The focus will be more on evaluation of LTEMP flows and the interpretive products will be different. This project collects basic measurements of stage, water elevation, discharge, water quality, and sediment transport data in the CRE at a number of sites along Colorado River and tributaries. It also develops the sand budget for six different reaches. He works closely with Reclamation on triggering and design of high flow experiments (HFEs) each year, and gathers the data in the sand budgets to evaluate HFEs as they occur. The monitoring has shown that there have been some differences in response to the HFEs over the last few years.

The AMP funds are largely used to gather basic monitoring data that are used by all the other projects funded through the AMP. A small component of the AMP funding is used for interpretive work. He noted that AMP funds provided for the monitoring stations cover only 70% the network costs; other funding sources are Bureau of Land Management, USGS, and the State of Arizona.

This year, there are three elements to the project.

1. Stream gaging to measure river stage and discharge in the river and tributaries.
2. Water quality measurements, every 15 minutes, of dissolved oxygen, temperature, and other metrics at six mainstem sites. GCMRC also supplies logistical support for water chemistry measurements, including nutrients, paid for by other sources in places such as Diamond Creek and Lees Ferry.
3. Sediment transport and budgeting, the biggest element of the project, collects and analyzes sediment transport measurements. The data are used to help determine when triggers are met for HFEs and for constructing the mass balance sand budget that informs scientists and managers of the effects of dam operations on the CRE. These mass balance budgets are useful because when increases indicate there is more sand, more sand is available for deposition during HFEs. He noted there have been sustained losses of sand as a function of dam operations.

This monitoring is designed to evaluate the effects of any dam operations, so they are not proposing any major changes. As LTEMP flows occur, they will break out those flows individually and be able to give updates about those flows and impacts on sediment.

* Should we identify in the TWP how much outside funding is part of your project?
	+ Dave: This will be included in the TWP. We are also taking advantage of data collected by other agencies for stream gaging and water quality.
* Help me understand, now that DOI has made decisions on dam operations for 20 years through LTEMP, what recommendations this program might make to the Secretary on dam operation. Are there opportunities where decisions have been made and some data gathering may not be so important? Have these LTEMP decisions given us opportunity to refocus funds, or does everything have to go forward?
	+ Dave: If you want to know the impacts of LTEMP flows, then you do need to collect these data. You won’t get it from a model. It’s a balancing act between what you are willing to pay for and the information you want to have. We try to keep this project to the point where you can evaluate all the operations. The project has gotten less expensive, even though the costs haven’t changed. The net costs have decreased because less overhead has been applied to the project.

Paul Grams reported on an extension of Project 3 from the previous work plan, which is annual sandbar monitoring with remote cameras for daily analysis. They are proposing some changes in research elements along with some phasing from research to implementation or dropping some elements. They have made progress on how to analyze the data in an automated way. This year or next, they will be reporting on some sandbars monthly from remote cameras; how many will depend on the quality of the images. They have also rebuilt the database that supports sandbar monitoring data on the Web, and they continue to make advances there.

The other monitoring component is long-term sediment storage monitoring, also known as the channel mapping project. They repeatedly collect maps of river segments between Lees Ferry and Phantom Ranch, which provides a long-term perspective on sand storage in a spatially explicit way, which is not possible with sediment transport monitoring. When Dave talks about sand loss in eastern Grand Canyon and National Canyon to Diamond Creek, the next question is, what does that mean for sandbars? What are the implications for long-term operations? By doing the repeat maps, they can evaluate where changes in storage have occurred and use those data to better provide managers and stakeholders with information on how change in sediment storage will affect future high flows and the ability to build sandbars.

What will we want to know in 20 years when LTEMP is winding down? If we want to know the effect on sand resources and storage in Grand Canyon, this project will provide that information. We proposed over the three years to conduct repeat maps in lower Marble Canyon and eastern Grand Canyon, and expand the time period to 10 years. These were originally done in 2010 and 2011. They will have 3-5 years interval between maps. They are also discussing mapping Diamond Creek to Pearce Ferry; NPS is interested in this reach because of dropping lake levels and erosion. The Hualapai are also interested in navigation here. GCMRC can include modeling how potential management actions might affect that river segment.

The other project elements are as follows:

* Continue development of modeling tools for predictive response of sandbars. A publication is coming regarding grouping sandbar sites, examining the relationship between site characteristics, site behavior, and riparian vegetation expansion. This would be useful to the riparian vegetation project and would involve empirical and statistical sandbar modeling.
* Pilot flume studies looking at sandbar response. These would be lab experiments to evaluate how different flow regimes, hydrograph shapes, and downramp rates result in different sandbar characteristics that affect longevity and shape.
* Workshops planned in the near term:
	+ Workshop with the Hualapai Tribe on Diamond Creek work.
	+ Workshop with stakeholders and/or scientists on LTEMP flow experimental actions. There is almost unlimited research that could be done to evaluate those experiments, and GCMRC wants to consider what is best to do and how. They might want to include some contingency funding for this.

Shane invited questions and discussion.

* You mentioned the potential need for contingency funding. If we do an extended duration fall HFE, we will need to monitor, in real time, the efficacy of the extended times to ensure we are getting continued deposition on beaches and locations with the longer duration.
	+ Paul: We are not used to making decisions during an event. Are you suggesting that we turn the water off if we are not getting certain results?
* No, it would be monitoring to see if we get continued deposition or if we have net erosion.
	+ Dave: My project could used to modify the releases on the fly, but it would probably be too difficult from a dam management point of view.

Dave Topping said that with regard to ramping rates, depending on what happens in HFEs and daily operations, GCMRC has the ability to measure sand transport at 15-minute intervals, so they can test different ramping rates and see the impacts. It would not cost anything extra to collect those data.

Paul added that they have had some success experimenting with sonar to measure sand thickness. There are some limitations, and they cannot use it everywhere, but it does work in many places. This will help them improve estimates of total sand storage during this work plan.

## Reclamation

Katrina gave a high level overview of the Reclamation budget, and noted it would have the same general elements as before:

* AMWG management, travel, facilitation.
* Public outreach.
	+ This includes public affairs, overall website maintenance, and publications.
	+ This is proposed to be a similar amount as before.
* TWG will have similar costs for travel and chair reimbursement or facilitation
* Reclamation administrative costs include
	+ NPS permitting
	+ Contract administration
	+ Science Advisors Program contract
		- This will probably increase.
	+ Experimental fund
		- They are considering collaboration on experiments to make sure there is enough funding for additional monitoring, the experimental fund, and the native fish contingency fund.
	+ New conservation measures under the LTEMP Biological Opinion (BO)
		- Over the next three years there are required new actions under the BO, including new technology for fish passage and a Temperature Control Device for warming or cooling.
	+ Cultural resources
		- Reclamation’s highest priority here is to ensure Section 106 compliance, including monitoring, reporting, and getting the Historic Preservation Program in place.

Katrina offered to meet with the BAHG again to give more detail on the Reclamation budget. The group agreed that questions could be brought up at the TWG meeting.

The meeting adjourned.