GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM
TECHNICAL WORK GROUP MEETING
APRIL 13-14, 2021
FINAL MEETING MINUTES

Start Time: 9:00 AM Pacific Daylight Time (PDT)
Conducting: Seth Shanahan, Technical Work Group (TWG) Chair
Meeting Recorder: Carliane Johnson, SeaJay Environmental LLC

Welcome and Administrative

- **Introductions and Determination of Quorum (16 members) [Seth Shanahan, Southern Nevada Water Authority (SNWA) and SNWA/TWG Chair]** Quorum was reached with at least 16 TWG members or their alternates in attendance.
- **Adoption of Prior Meeting Minutes** [**Seth Shanahan, SNWA/TWG Chair]** No revisions received on the January meeting minutes, which were adopted without objection.
- **Next Meeting Date(s): June 16-17, 2021 (webinar).**
- **Ad Hoc Group Membership and Updates [Seth Shanahan, SNWA/TWG Chair]** No revisions received on the Ad Hoc list; **[Craig Ellsworth, Western Area Power Administration (WAPA) and Budget Ad Hoc Group (BAHG Chair)]** The Administrative History Ad Hoc Group (AHAHG) will reconve soon to review work done by Paul Hirt.
- **Review Action Items, Motions, and Votes Form [Seth Shanahan, SNWA/TWG Chair]** The Action Items list was reviewed. **[Brian Healy, National Park Service (NPS) – Grand Canyon National Park (GCNP)]** Reported that green sunfish were present in the Colorado River pre-dam; see Woodbury, A.M.,1959, *Ecological Studies of Flora and Fauna in Glen Canyon*. **[Mark Wimer, Grand Canyon Monitoring & Research Center (GCMRC)]** Responses have been received on the Annual Report items, which will be sent out soon.
- **Update on Program Funding [Lee Traynham, Bureau of Reclamation (Reclamation)]** In the Energy and Water Appropriations bill for Fiscal Year 2021 (FY21), there is language to transfer approximately $11 million of hydropower revenues to the Glen Canyon Dam Adaptive Management Program (GCDAMP). The program received funds earlier this year from the Continuing Resolution, and more was received last week, which is going to GCDAMP partners now. No issues are anticipated for full funding in FY21. Expect to be in a similar position in FY22 but the President's budget has not been posted yet. A reduction in hydropower revenues, potentially half of current levels, is anticipated in FY23. **[Seth Shanahan, SNWA/TWG Chair]** What is the reason for FY23 reduction? **[Lee Traynham, Reclamation]** GCDAMP funding from WAPA is non-reimbursable in their power rate; however, they can claim a credit with the U.S. Treasury against their repayment of debt from building the power facilities. Over time, this amount of debt has been shrinking and there is less credit to be claimed. The concern is that FY23 is when there may be challenges to sustain the power revenues for GCDAMP. There are also new challenges to the Basin Fund related to reimbursable costs and whether WAPA can recover those costs. This is a separate issue. **[Shane Capron, WAPA]** WAPA believes $12.5 million is sustainable from these non-reimbursable sources over the next ten years starting in FY23.

- **NPS Vegetation Plan Update** [DOWNLOAD] **[Rob Billerbeck, National Park Service (NPS)]** The NPS is currently addressing reviewer comments received on the vegetation plan for the Long-term and

Experimental Management Plan (LTEMP). NPS will be working with GCMRC to create this as a living document that will be updated each year.

- **Update on Activities Impacted Due to COVID-19 Restrictions [Clarence Fullard, Reclamation]** Reclamation's Salt Lake City office is still on maximum telework, which will continue. **[Mark Wimer, GCMRC]** GCMRC has not had to cancel any field trips so there are not any impacts to work getting done. Staff are not in the office except with special permission. **[Brian Healy, NPS-GCNP]** GCNP has gotten most of its field work done except for the Little Colorado River humpback chub monitoring and the spring Havasu trip. Most staff also continue to telework. **[Ken Hyde, NPS-Glen Canyon National Recreation Area (GLCA)** GLCA is working to get agreements with tribal youth crews. NPS is still limited on use of volunteers, but things are starting to ease a bit. **[Peter Bungart, Hualapai Tribe (Hualapai)]** The Hualapai are fully back to work with some restrictions in the community. Most staff are vaccinated and are still following COVID protocols. **[Erik Stanfield, Navajo Nation (Navajo)]** A lot of the government offices are open, but travel is still restricted. There are still some small clusters of infections. **[Jakob Maase, Hopi Tribe (Hopi)**. The Hopi Reservation is in Phase I reopening.
- **Update on Monitoring and Research Trips to Occur From Today Until Next Meeting [Mike Moran, GCMRC]** [DOWNLOAD] This table shows field trips that have occurred or are planned from January 1 through June 2021.
- **Updates on Items of Interest That Are in Consideration for Implementation Before Next TWG Meeting [Clarence Fullard, Reclamation]** A "sources sought" notice has been published. A contract is anticipated by the end of FY21 third quarter.

TWG Vice-Chairperson Election Due to Mid-Year Vacancy and Announcement of Clarence Fullard as Reclamation Vice-Chairperson

[Seth Shanahan, SNWA/TWG Chair] Announced that Clarence Fullard is Reclamation's TWG Vice-chair.

[Steve Wolff, State of Wyoming] Motion to elect **Michelle Garrison, Colorado Water Conservation Board (CWCB)**, as TWG Vice-Chairperson by consensus. **[Peggy Roefer, Colorado River Commission of Nevada (CRCN) and Flow Ad Hoc Group (FLAHG) Chair]** Seconds that nomination. No objections; motion passes.

Fiscal Year 2 Budget Discussion and Consideration of Directing the BAHG to Develop Budget Prioritization Criteria for the TWG

[Seth Shanahan, SNWA/TWG Chair] There is a requirement to start discussing budget procedures in April during which the BAHG and TWG will consider potential changes to Year 2 of the Triennial Budget and Work Plan (TWP) based on criteria listed in Section 2.7. One of the justifications to make changes is scientific. This is the first year of the budget with data that has been collected but not yet analyzed. There could also be Administrative justifications in which new information might be received about assumed costs to the budget. **[Lee Traynham, Reclamation]** [DOWNLOAD] Reclamation's budget does not change much from year to year. Potential adjustments may involve shifting funds such that funds not spent in FY21, might carry over into FY22. There are also emerging issues that may require revisions to the TWP and other items are flagged for awareness. Project C.8 (Vegetation Treatment) will have an increase in its budget, but this is part of the existing TWP, so no adjustment is needed. A lot of the cultural resources work goes to tribal partners and some savings might be found in D.1 and D.2 elements because a Cultural Resources Officer has not been filled yet. "Unfunded and Partially Funded Proposals" are projects in FY22 that the TWG might consider if funding is available.

Q&A and discussion

[Ken Hyde, NPS-GLCA] With current projections at Lake Powell there may be warm water issues that will bring fish passage issues to the forefront. That could be a big factor next year. **[Peter Bungart, Hualapai]** What is status of the Tribal Liaison? **[Lee Traynham, Reclamation]** It is on the regional list of vacant positions that will go out soon for advertisement and selection. **[Peter Bungart, Hualapai]** What about those unspent funds for the Tribal Liaison or Regional Archeologist position? **[Lee Traynham, Reclamation]** There is more flexibility with the archaeologist funds. If money is available, Reclamation will consider whether to use it for third-party support to implement the programmatic agreement. There is less flexibility with the Tribal Liaison position because that funding comes from appropriations via the five U.S. Department of Interior (DOI) agencies, which would require discussions with those agencies.

[Mike Moran, GCMRC] [GCMRC FY22 Budget Overview] GCMRC's FY22 request is $9.24 million. By comparison, FY21 request was $9.83 million and FY23 is $9.13 million. The Lake Powell Water Quality Project is funded through Reclamation but not through the GCDAMP. Still have one more year of budget for that; however, this is the last year under the current five-year agreement. Overhead rates, which affect funding for science projects, will rise from 14% in FY21 to 22% in FY22, and up to 28% in FY23 because of the new building. Without the new building, the historic overhead rates were around 14% to 16%.

Q&A and discussion

[Peggy Roefer, CRCN and FLAHG Chair] Does Reclamation plan to extend the contract for Lake Powell water quality monitoring? **[Lee Traynham, Reclamation]** Yes, the Water Quality group has committed to those discussions with GCMRC and has every intent to continue. **[Peggy Roefer, CRCN]** When out on the river during the experimental flow, heard from many experts that the Juvenile Chub Monitoring-West was important. How do we get that funded again for the third year? **[Scott VanderKooi, GCMRC]** It is a priority. There was a TWG motion on the approved TWP that prioritized carryover funding to support Juvenile Chub Monitoring-West in FY23. The savings in the overhead rate might be used to support that work. **[Brian Healy, NPS-GCNP]** Charles' presentation during the Annual Report Meeting suggested there might be efficiencies gained from the Lees Ferry monitoring that could be shifted to Juvenile Chub Monitoring-West. Is there any progress on that? **[Scott VanderKooi, GCMRC]** There are opportunities but have not made a lot of headway. **[Kim Dibble, GCMRC]** Have had two discussion with Arizona Game and Fish Department (AZGFD) but have not yet found a way to combine those two programs. **[Ryan Mann, AZGFD]** It is important to point out there are different objectives for those programs with different things being studied. **[Seth Shanahan, SNWA/TWG Chair]** Is the trade off to support Juvenile Chub Monitoring-West when combining projects? [Ryan Mann, AZGFD] Yes, the tradeoff would be shifting of the funds from one program to the other. **[Seth Shanahan, SNWA/TWG Chair]** What about the additional TRGD site? **[Kim Dibble, GCMRC]** GCMRC had discussions about getting a second TRGD site in FY23. These were two separate topics.

[Seth Shanahan, SNWA/TWG Chair] The second part of this topic is for BAHG to arrange a call to develop a recommendation for the TWG to consider. **[Craig Ellsworth, WAPA/BAHG Chair]** The BAHG is looking for input on how best to prioritize different elements in the TWP. **[Seth Shanahan, SNWA/TWG Chair]** There are two topics. One is to develop a recommendation on Year 2 of the budget. Second item relates to Craig's comment about budget prioritization by the June TWG meeting in time to send a

recommendation for the Adaptive Management Work Group's (AMWG's) August meeting. [*No objections to charging the BAHG to look at the Year 2 budget and make a recommendation at the June TWG meeting.]*

[Seth Shanahan, SNWA/TWG Chair] The other, longer-term discussion is to address the potential for a 50% reduction of funds in FY23. Now that the TWG is in between budget cycles, can the BAHG come up with priority criteria that the TWG can use for the next TWP? [*No objections.*]

[Lee Traynham, Reclamation] Regarding prioritization, the federal agencies will also be looking at this from a risk assessment standpoint as to what Reclamation needs to do to stay in compliance with its obligations. This will feed into the BAHG process as to what is most effective. **[Craig Ellsworth, WAPA/BAHG Chair]** BAHG needs to work in tandem with Reclamation on this.

Update on Hydrology, Operations, and Water Quality Conditions

[Heather Patno, Reclamation] [DOWNLOAD] Monthly- and seasonal-to-date precipitation have been very dry (50-70% of average). Same with the seasonal snow conditions. The Snow Water Equivalent peaked on March 30, which was about a week earlier than normal. This year's cumulative runoff is similar to 2002, the driest year on record. The April 24-month study will be published on April 15. Reclamation has initiated its Drought Response Operations Agreement (DROA) with formal notifications in January 2021 with low reservoir conditions predicted in the 24-Month Study minimum probable continuing into February and March. These projections initiate enhanced monitoring and coordination with monthly meetings. The minimum and maximum probable model analysis will be run monthly as DROA occurs during the months when the minimum and maximum probable modeling runs are typically not provided. The Lake Powell end-of-year projected elevation of 3,550 feet would be the lowest seen since 1969 when the dam was filling. The most recent low occurred in 2005 when it was at 3555 feet. This would put Lake Mead in a Level 1 shortage condition in Water Year 2022, the first time it would be declared under the 2007 Interim Guidelines. The low flow event for the apron repair was successful.

[Jeremiah Drewel, Reclamation] The modeled projections of temperatures in Lake Powell to the penstock show a fall temperature peak of 16.5^{o} Celsius using initial conditions made in December. The model will be updated with March baseline data to better reflect fall temperatures. Kim Dibble's river temperature model will be used from now on because it is more accurate for western Grand Canyon. **[Kim Dibble, GCMRC]** The model is based on and improves some of the inputs from the Wright model. It is more of an exponential decay function. **[Charles Yackulic, GCMRC]** The key to this new model is that it projects slightly less warming during later months.

Q&A and discussion

[Mike Moran, GCMRC] Is there an explanation for the low dissolved oxygen in March? **[Jeremiah Drewel, Reclamation]** It is always low below the dam and there was probably mixing. **[Robert Radtke, Reclamation]** The colder winter water will flow along the bottom and then it will push up the water when it gets closer to the dam. That hypoxic water should not get up to the Penstock. **[Mike Moran, GCMRC]** Does that mean there is not full mixing of water in the winter? **[Robert Radtke, Reclamation]** That is correct. It is deep enough, and the turnover does not happen. It has happened, but it is rare. **[Jim Strogen, FFI/TU]** Does the low dissolved oxygen happen during years of decreasing flow? Is this going to be an increasing concern? **[Jeremiah Drewel, Reclamation]** Above the dam, it happens during above

average flow that entrains the water; at the Penstock, it happens during low flow. **[Robert Radtke, Reclamation]** The probability of this happening increases with normal to high inflows. With resuspension of sediment, oxygen demand increases from the inflow of water, which creates that slug of hypoxic water. When the reservoir level drops and sediment is exposed, the potential is increased with any inflow that resuspends this sediment. **[Jim Strogen, FFI/TU]** Should there be an action plan for low dissolved oxygen events? **[Jeremiah Drewel, Reclamation]** Low dissolved oxygen coming out of the Penstock is a relatively short event. **[Ryan Mann, AZGFD]** The risk is a huge mortality event for trout even during short durations. **[Kirk Young, United States Fish & Wildlife Service (USFWS)]** How far downstream does it take for oxygen to recover? **[Charles Yackulic, GCMRC]** Badger Rapid. **[Ted Kennedy, GCMRC]** The zone of red (less than 5 milligrams per liter (mg/l)) only lasts for a couple of miles and then it is fully oxygenated once the water hits the rapids.

Progress on Evaluating Temperature Control Methods: Results from a Technology Search

[Connie Svoboda, Reclamation Technical Service Center (TSC)] [presentation available upon request] This presentation is focused on temperature control of reservoir release flows. New ideas for temperature control are needed to reduce costs and better meet objectives. The consulting firm, yet2, was hired to review all possible methods, and prioritize the more promising technologies, which were highlighted in the presentation. Next steps include having local staff consider technologies that make sense for their specific dams.

Q&A and discussion

[Ken Hyde, NPS-GLCA] Have to consider quagga mussels, which is already having an impact on the gates above the penstock. They will clog any pipe and attach to anything. **[Connie Svoboda, TSC]** That is why local staff need to provide input on what makes sense in a certain area. The slide deck from yet2 is available by email request. **[Leslie James, CREDA]** Did the search also include a cost element? **[Connie Svoboda, TSC]** There was no cost element considered in the report – just ideas. **[Peggy Roefer, CRCN/FLAHG CHAIR]** Anything that mixes the water column in front of the Glen Canyon Dam will increase the salt dramatically. **[Connie Svoboda, Reclamation]** Destratification might be desired in certain areas, but it is not the goal for most of Reclamation's large dams. **[Ted Kennedy, GCMRC]** Were there any use cases on aeration in tailraces below dams to fix an oxygen problem? **[Connie Svoboda, Reclamation]** Don't know the answer to that. That sounds like a way to avoid some of the other problems. **[Seth Shanahan, SNWA/TWG Chair]** Is this the final work product for this fiscal year? **[Connie Svoboda, Reclamation]** Yes, the contract is completed. It would be worth thinking about how these techniques might apply to Glen Canyon Dam but there is nothing further at this point. **[Clarence Fullard, Reclamation]** Staff had a call with operations to discuss the outcome of the technology search. Still considering what the next steps might be. **[Lee Traynham, Reclamation]** It is a big, expensive and challenging problem to resolve. To make the case for any of these technologies, the goals needs to be refined. The options also need to be considered in conjunction with the USFWS as part of the LTEMP requirements. A risk assessment might need to be updated with respect to temperature. **[Kirk Young, USFWS]** There have been mixed messages with LTEMP regarding both heating and cooling. Both humpback chub and razorback sucker have been resilient to cold temperatures although still harmful. There are benefits to warmer water, but it would be a problem if that brings in more non-native species.

There is a window of opportunity now with the infrastructure bill, which means figuring out the next steps now to develop a proposal. **[Seth Shanahan, SNWA/TWG Chair]** Recommends that the TWG continues to track this and get periodic updates from USFWS and Reclamation.

Distribution and Impacts of Benthic and Hyporheic Anoxia on the Colorado River Ecosystem Downstream From Glen Canyon Dam

[Courtney McDaniel, State University of New York College at Brockport (SUNY)] [DOWNLOAD] Benthic & Hyporheic Anoxia (BHA), occurs in the riverbed sediments that are potentially important habitats for invertebrates. It is not uncommon in stagnant waters such as swamps and bogs due to decomposition, but it had not been documented in flowing regions before this study. BHA soils were found to encompass about 30 river kilometers. The BHA was especially prevalent in the tailwaters reach from Glen Canyon Dam to Lees Ferry, and primarily in slow-moving waters where there was a lot of aquatic vegetation. Full details are in the presentation.

Q&A and discussion

[Peter Bungart, Hualapai] Have you considered a study in the Western Grand Canyon with warmer, shallower waters that are more turbid? **[Courtney McDaniel, SUNY]** This is of interest to Larry who may follow up on that. **[Mike Horn, TSC]** Was change in BHA due to aeration that increased circulation, which changes the microbial community? Is there a way to determine effects from oxygen levels versus the bubbler increasing circulation? **[Courtney McDaniel, SUNY]** Would bet it has to do with circulation assuming that extra water flow gets down to the benthic layer. It might not be due to the introduction of oxygen. **[Pilar Wolters]** Was the *Chara* alive in the study? If it were just harvested from the river, wouldn't it be decomposing during the experiment, using up the dissolved oxygen? **[Courtney McDaniel, SUNY]** This is something that was considered. Tried to remove it with the roots. There was decomposition and may have caused more of that. BHA might not have developed as quickly in a growing mat. **[Ryan Mann, AZGFD]** How prevalent is this in other tailrace systems? **[Courtney McDaniel, SUNY]** It has not been documented before below a dam. In other systems, there was scouring below the bedrock. This would be interesting to look into. **[Bill Davis, CREDA]** Prior to 1990, there used to be *Cladophora*, but now it is *Chara*, and the flow has changed. Could this be affecting the BHA? **[Courtney McDaniel, SUNY]** The growth form might have an effect but if it is simply decomposition, then it would not change. It would be interesting to look at BHA development between *Cladophora* versus *Chara*. **[Seth Shanahan, SNWA/TWG Chair]** What is the magnitude of this problem as it relates to other limiting factors in the system? **[Courtney McDaniel, SUNY]** The only aspect is its effect on aquatic invertebrates. The study also looked at amphipods, which were not negatively affected. The only data collected showed an effect on mayfly, which are not found in the mainstem of the Colorado River. **[Craig Ellsworth, WAPA/BAHG Chair]** It seems that all the macroinvertebrates in the system are tolerant to low dissolved oxygen. It unknown if BHA limits food base production.

Consideration of Developing a Low Dissolved Oxygen Response Plan if Concentrations are Projected to Warrant Concern in 6-Months

[Seth Shanahan, SNWA/TWG Chair] There is a general concern about the species which might be affected by low dissolved oxygen and goals that need to be achieved. One possible approach to this

issue is to develop a threshold level that triggers a monitoring activity to determine over a certain timeframe what needs to be addressed in a response plan.

Q&A and discussion

[Craig Ellsworth, WAPA/BAHG Chair] A 6-month timeframe might be too short. **[Ryan Mann, AZGFD]** Explain more what was meant about point source and water quality from the dam? Discharges must still meet water quality standards. **[Seth Shanahan, SNWA/TWG Chair]** The issue is not whether water quality standards could be exceeded. It is whether dams are point source discharges that are regulated so that if water passing through exceeds a standard, they would be responsible to achieve that standard. Dams are not sources of a point source discharge; this is a flow-through process. **[Peggy Roefer, CRCN/FLAHG CHAIR]** For example, if there was a point source discharge standard for temperature, then there would be a mixing zone. A pipe is a point source, while dams are not. Below Hoover Dam, Lake Mojave is segmented because it is a cold-water fishery only to a certain point. **[Jim Strogen, FFI/TU]** Is there an opportunity to study this further, maybe with an Ad Hoc committee? **[Seth Shanahan, SNWA/TWG Chair]** The intent is to set up a trigger to conduct the planning six months before a projected threshold value of concern is reached. There is still debate about how much of a problem it might be. **[Kelly Burke, Grand Canyon Wildlands Council (GCWC)]** Supports the development of a plan and to be more prepared to understand the actions that could be taken. **[Clarence Fullard, Reclamation]** Reclamation is currently working on an agreement with the TSC to conduct a "state of practice" investigation to synthesize what others are doing. Questions remain about how big of a risk this is. More information is needed before considering mitigation technologies. There is an unfunded budget line item on dissolved oxygen, but this is a timely issue to address. **[Brian Healy, NPS-GCNP]** Are there documented dissolved oxygen fish kills during those dips that were seen in the past? **[Ryan Mann, AZGFD]** Anglers have observed fish kills but it is difficult to monitor because these events can be rapid. A bigger concern is a slug of low dissolved oxygen that could cause larger mortality than has occurred on the past especially with dropping reservoir levels and increasing temperature. **[Peggy Roefer, CRCN/FLAHG CHAIR]** Can the fish leave? Lake Mead had a low dissolved oxygen event with 30 miles of anoxic waters in its upper reaches, but there was not a big fish kill. What happens during these events? **[Mike Horn, TSC]** TSC did work in Reclamation's Canyon Ferry reservoir in Montana with historically low dissolved oxygen over the summers. It was found that the fish move 9-10 miles downstream until oxygen increased in the fall. **[Ryan Mann, AZGFD]** If there is a rapid decline in dissolved oxygen, that is a mechanism for high fish mortality. Would like to think they can avoid these conditions, but there is enough evidence from other kills that this can cause mortality below the dam. **[Scott VanderKooi, GCMRC]** Seen situations with rapid low dissolved oxygen that fish cannot seem to escape. The fish might not know where to go especially if conditions come on quickly. **[Bill Davis, CREDA]** Aquatic insects have tolerances around 5 mg/l, and can be affected too, if they are incubating eggs during a low dissolved oxygen event. **[Ryan Mann, AZGFD]** It might also change species composition with shifts in the aquatic food base. Brown trout are more tolerant and might be able to fill a niche that rainbow trout cannot. **[Bill Persons, FFI/TU]** Low dissolved oxygen fish kills were seen in the Lees Ferry Reach during 2005-2006. Even with gauges in place now, it is still hard to document a fish kill if people are not there to observe them. It will show up in the fishery later. **[Seth Shanahan, SNWA/TWG Chair]** This topic is not to try to figure out what to do, but to define a trigger, such as "in the next six months, dissolved oxygen concentrations are projected to reach 5 mg/l or below," which would lead to the start of a plan. Reclamation is already moving in this direction. **[Jim Strogen, FFI/TU]** Why wait to enact a plan? **[Kelly**

Burke, GCWC] Since Reclamation already has these plans underway, can we make a plan on how to get updates and review their information? Are there impacts to dam facilities from either mitigating from low oxygen or from these slugs of water directly? **[Bill Persons, FFI/TU]** Reclamation tried to run the turbines more slowly to entrain more oxygen, but that lead to a cavitating impact on the bearings. **[Shana Rapoport, Colorado River Board of California (CRBC)]** If a water body is listed as impaired, is there still a requirement that it needs to be addressed even if the dam is not listed as a source? **[Seth Shanahan, SNWA/TWG Chair]** That is possible. Impairment is a state listing under Section 303(d) of the Clean Water Act. It is possible to have a water body listed as impaired for some water quality standard (such as temperature or low dissolved oxygen) that does not implicate the dam as the source or requires it to do something to change that impairment. **[Peggy Roefer, CRCN/FLAHG CHAIR]** It is important that the group understands this discussion on impairment is hypothetical and not fact. **[Seth Shanahan, SNWA/TWG Chair]** Based on the discussions, the action is for the TWG to be actively engaged in Reclamation's process on this issue with the goal of TWG to develop a plan.

Discussion About Possible Experimental and Management Actions That May be Implemented in the Next 12 Months and Any Budgeting Issues

[Clarence Fullard, Reclamation] [DOWNLOAD] Refer to the list of flow actions for FY21. This includes the apron repair that recently concluded and the remote sensing overflights that will start over Memorial Day weekend. The LTEMP experiments will be back soon during the fall accounting window. Reclamation is currently drafting a white paper on the state of the science for trout management flows, which is not being considered for this year. Bug flows are not recommended in FY21, but additional steps are planned.

[Mike Moran, GCMRC] [DOWNLOAD] While still technically within the implementation window for a spring high flow experiment (HFE), probably need several hundred thousand metric tons of accumulated sand to do a spring HFE. Upper Marble Canyon is in a deficient condition. The deposition is better in Lower Marble Canyon, but still four times below what is desired for an HFE. A contract is in place for the upcoming Remote Sensing Overflight.

Q&A and discussion

[Brian Healy, NPS-GCNP] The Leadership Team's decision on the bugs flows was surprising. **[Clarence Fullard, Reclamation]** The intent was to report on the status of the tech team calls. It did not end up in a recommendation. The Planning Team's technical memo will go to the Leadership Team for the Secretary to make a decision. **[Lee Traynham, Reclamation]** The Leadership Team has not met yet. **[Brian Healy, NPS-GCNP]** There would be more gained by doing it again this year either as a reduced experiment or a full experiment. **[Mike Wimer, GCMRC]** GCMRC also felt it was a worthwhile experiment to continue. **[Ryan Mann, AZGFD]** AZGFD supported the bug flow experiment, but had abstained from a vote due to costs and timing. **[Brian Healy, NPS-GCNP]** NPS was hoping there would be additional discussions on a scaled back experiment with basin funds. **[Lee Traynham, Reclamation]** The Planning Team needed to make its recommendation to meet the May 1 implementation deadline. There will be space for NPS and USGS to document those reasons in the memo. **[Peter Bungart, Hualapai]** Supports the bug flow experiment. **[Kelly Burke, GCWC]** What about the Science Advisor to look at this experiment, which was a line item in the budget? **[Lee Traynham, Reclamation]** There was no standard procedure on how to evaluate. The ideas were for 1) GCMRC to develop a synthesis report on information collected to date

and 2) for the Science Advisor panel to help interpret the results. This is a new process with respect to LTEMP experiments and how to respond to the results. **[Peggy Roefer, CRCN/FLAHG CHAIR]** Do both of those things have to happen before another bug flow is considered? **[Lee Traynham, Reclamation]** That is not a requirement, but it is a recommendation from the Planning Team to help the group be in a better position for next year. The Science Advisor could be tasked with this prior to those deliberations next spring. **[Leslie James, CREDA]** There has been a significant change in just the last few months. Hydrology has not improved, and market conditions are two to four times higher than when the bug flow experiment was first discussed. The estimated purchase power is now $50-60 million versus $12 million previously. These circumstances are outside the control of GCDAMP, WAPA, and Reclamation. **[Craig Ellsworth, WAPA/BAHG Chair]** WAPA continues to see an increase in the spread between peak and off-peak prices, which increases the cost of the experiments. WAPA will share its updated cost estimate with Lee to decide whether to include that in the report.

Panel Discussion – Are There Important Resource Outcomes That Might be Expected From a Potential 7.48 Million Acre-Feet Release Year in WY2022 and Are Current Plans Sufficient to Capitalize on This Potential Learning Opportunity?

[Craig Ellsworth, WAPA/BAHG Chair (panel organizer)] [presentation available by request] This presentation is a reflection of the last 7.48 MAF release that occurred in 2014, which included the crash of rainbow trout, expansion of brown trout, cancellation of the 2015 HFE, skip spawning, decline of razorback suckers, etc. From a biological standpoint, a high release year can negatively affect temperature and dissolved oxygen, which will affect the trout fishery and then recreation (angling). In a low release year, there are also concerns about water quality, low nutrients, and temperature.

[Bill Persons, IFF/TU] What did the scientists say about good learning opportunities for monitoring during a low volume year? **[Charles Yackulic, GCMRC]** We should not expect similar responses from the ecosystem as occurred in 2014 because this was coming out of a boom time when almost all fish populations were doing very well. A lower volume also contributed to phosphorus loading. When looking closer at a fine scale changes, warmer temperatures are seen during the years when there are low elevations with high inflows. The concern is in the Western Grand Canyon. **[Craig Ellsworth, WAPA/BAHG Chair]** Recommends sharing the slides and keeping this as an agenda item at the next meeting. **[Peggy Roefer, CRCN/FLAHG CHAIR]** The rapid at Pearce Ferry is not as extreme as it has been, which might cause trouble. **[Ryan Mann, AZGFD]** AZGFD will be monitoring there next week and can provide an update at the June TWG.

Public Comment on Day 1:

None.

Adjourned at 3:50 PM PDT

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Day 2: April 14, 2021
Start Time: 9:03 AM PST
Conducting: Seth Shanahan, TWG Chair
Meeting Recorder: Carliane Johnson, SeaJay Environmental LLC

Welcome and Administrative

- **Introductions and Determination of Quorum** **[Seth Shanahan, SNWA/TWG Chair]** Quorum reached.

- **Monitoring Metrics Status Update** **[Lee Traynham, Reclamation]** The LTEMP Record of Decision (ROD) required DOI to develop monitoring metrics to track progress of the LTEMP goals. This effort is reflected in the current TWP and Reclamation funding for staff. The focus to date has been on defining "metrics" and determining the objectives. The intent is to develop a tool that will be used to describe past efforts and current actions toward LTEMP goals. Monitoring metrics are not quantified targets. This is likely a three-year effort. Criteria will also be established. There will be opportunities for the TWG and AMWG to engage in the discussions once GCMRC has made more progress on the metrics. **[Helen Fairley, GCMRC]** [Defining Monitoring Metrics presentation] The LTEMP goals, which have been defined, are the "targets" and may have specific guidance, but some will need significant input from stakeholders. This effort is to define the LTEMP metrics for tracking "success." Need to be cautious about long-term data streams (i.e., whether they are most effective for future monitoring) and any data gaps. Will seek TWG input at the June meeting and plan to have a review draft by fall 2021.

  Q&A and Discussion

  [Seth Shanahan, SNWA/TWG Chair] Is there an opportunity to review a list of metrics that are already being reported on while the more complete list is being developed? **[Lee Traynham, Reclamation]** There are some good indicators being discussed now that can be implemented as metrics. GCMRC is currently doing this with their inventory. Reclamation has recommended GCMRC pilot some of the metrics in the Annual Report. **[Helen Fairley, GCMRC]** It is anticipated that by fall 2021, there will be a good list on what the scientists consider to be good metrics although there may be gaps. **[Seth Shanahan, Reclamation]** Requests this be an action item. Are you also reaching out to other experts? **[Helen Fairley, GCMRC]** GCMRC will be doing that, but it has not been done yet. **[Seth Shanahan, Reclamation]** The ROD directs that metrics be developed for the objectives, while the TWG has been looking at the goals. Are the objectives being considered? **[Helen Fairley, GCMRC]** A lot of those objectives are not of a scientific nature and that would need to be discussed. That might be more appropriately handled by Reclamation. An update will be provided at the June TWG meeting. **[Kelly Burke, GCWC]** Suggests that the Desired Future Conditions (DFCs) and their quantification could be used alongside the development of the metrics. **[Lee Traynham, Reclamation]** The quantification target will be a separate issue for the future. The DFCs will inform

that discussion once the metrics are in place. **[Ben Reeder, Grand Canyon River Guides (GCRG)]** How do we quantify Cultural Resources? **[Bill Davis, CREDA]** What product is the TWG going to review in June? This is a difficult subject that the TWG has been dealing with for a long time. Would like to see the information before the TWG meeting in June. **[Helen Fairley, GCMRC]** Materials may not be ready before the meeting. The desire is to get feedback on the basic approach, the draft criteria, and whether there are additional criteria that need to be considered. **[Lee Traynham, Reclamation]** The June TWG meeting will be used to present the approach and criteria with time for TWG members to provide feedback. **[Mark Wimer, GCMRC]** This is going to be a multi-step process and there will be additional opportunities for input over time. **[Seth Shanahan, SNWA/TWG Chair]** TWG members can also attend and get more detail from the Steering Ad Hoc Committee, which is in discussion on this topic. The LTEMP put the DFCs aside for the goals, but there is historical value in using the DFCs to support development of the metrics. **[Leslie James, CREDA]** Aren't the DFCs part of the LTEMP environmental impact statement (EIS)? There are differing viewpoints and the DFCs were accepted by the Secretary at the time. **[Seth Shanahan, Reclamation]** The DFCs were not a part of the EIS; they informed the EIS and were used to get to the goals.

- **Incentivized Harvest Program Implementation Update** **[Ken Hyde, NPS-GLCA]** Have now finished five months of the Incentivized Harvest Program (November 11 through March) with 200 fish turned in, averaging 20 anglers per month catching about 40 fish per month. Getting a lot of information about the anglers, where they are coming from, and what motivates them. A quarter of the fish caught (about 50) were in the 18-24-inch range so spawning brown trout are being removed. April will be a month-long brown trout bonanza with bonuses paid for every third fish (an extra $50). Three passive integrated transponder (PIT) tags were turned in during the first week of the bonanza with bonuses paid (an extra $50 for the PIT tags and $300 for the sonic tags). The angler who turns in the most fish will get a $500 bonus. The numbers are still low so these bonuses might help show which ones provide the biggest incentive. There might be another bonanza from mid-November through January during the spawning period. In March, the reward was $33 per fish, which will continue through this summer and fall. Another $100,000 was added to the existing funding. This will cover three years of the program and then will assess if additional measures are needed to go to a long-term Incentivized Harvest Program.

  Q&A and Discussion

  [Leslie James, CREDA] Was there a press release on the bonanza that can be distributed? **[Ken Hyde, NPS-GLCA]** Yes, will send the flyers and the press release. **[Kelly Burke, GCWC]** There is a lot of interest in the bonanza, but how can we get the anglers interested in that area? **[Ken Hyde, NPS-GLCA]** AZGFD posted information about the bonanza on April 1. Any angler that turns in pictures of brown trout and fishing video will also be rewarded. These will be used on social media to promote the program.

- **Trout Report from Lees Ferry** **[Ryan Mann, AZGFD]** [Lees Ferry Spring Monitoring] This is data from the most recent Lees Ferry monitoring conducted in March. The reduced capture rate of rainbow trout (65.6%) was the lowest reported since 1990 when monitoring was standardized. The rate of

brown trout (32.7%) is more related to the reduced numbers of rainbow trout rather than an increase in brown trout numbers, but both numbers are of concern.

Q&A and Discussion

[Jim Strogen, IFF/TU] Will brown trout fill this void and what is the best way to manage this shift? **[Ryan Mann, AZGFD]** Hard to say. There may be other factors that are limiting to brown trout. There is optimism about the number of rainbow trout adults that are still in the system and there is hope that the 2020 spawning event is different. That will be monitored this summer. **[Peggy Roefer, CRCN/FLAHG CHAIR]** Why was spawning unsuccessful in 2019? **[Ryan Mann, AZGFD]** Can't say it was unsuccessful because it is not tracked well. It might have been more an issue related to recruitment. **[Charles Yackulic, GCMRC]** Tools are being developed to assess spawning and fish condition, which suggest there was sufficient eggs. It should have been an average year based on the phosphorus model. The most likely factor was due to increased predation by brown trout. **[Ryan Mann, AZGFD]** Triploids would be the ones stocked for the fishery, which would not contribute to spawning. A compensatory response to the increase in brown trout might be to ensure there are sufficient population numbers of rainbow trout. **[Bill Persons, FFI/TU]** Are rainbow trout being tested for presence of whirling disease? **[Ryan Mann, AZGFD]** Don't think testing has occurred for years, but there has also not been a reason to be concerned. **[Ryan Mann, AZGFD]** Large adult brown trout survive at high rates and any removal would potentially help reduce spawning. **[Brian Healy, NPS-GCNP]** Probably the best thing to do in the short term is increase the number of anglers targeting brown trout.

LTEMP Biological Opinion Conservation Measures – Triggered Activity Status and Review of the Triggers

[Kerri Pedersen, Reclamation] [DOWNLOAD] The Tier 1 Action Initiation Trigger has been hit for subadult humpback chub in the mainstem Juvenile Chub Monitoring reach. Tier 2 actions will be triggered if Tier 1 actions are not successful. A meeting occurred in February to identify additional conservation action. The consensus was to focus on least invasive options; for example, moving fish above Chute Falls.

Q&A and discussion

[Seth Shanahan, SNWA/TWG Chair] What are the numbers of translocations occurring now and the likely first next step? **[Kirk Young, USFWS]** One translocation is done above Chute Fall each year that targets 300 young-of-year fish. There are various translocations outside the Little Colorado River. Also considering a translocation of Year 1 fish (an additional 600 or more) that would be done in May. Poor recruitment occurred from 2016-2018 that is likely the cause of the trigger. There was also an increase in recruitment during 2019 and 2020, but they have not moved out of the Little Colorado River. These are the ones that should be targeted to increase the numbers above Chute Falls. **[Shana Rapoport, CRBC]** Has there been any new knowledge since the biological opinion was finalized? **[Kirk Young, USFWS]** Yes; there is more understanding of the skip spawning dynamics in the Little Colorado River, and have also determined the net benefit of the Chute Falls translocations. **[Charles Yackulic]** Also understand now that adult survival and that some fish are harder to catch. However, recruitment has been lower than thought, which means that recovery may be less than expected. **[Jim Strogen, FFI/TU in**

chat] Will that review and possible adjustment of the triggers be a USFWS decision, or will that come through GCDAMP for a decision? **[Lee Traynham, Reclamation]** DOI will retain decision-making responsibility, but information is being shared to elicit feedback from GCDAMP. **[Jim Strogen, FFI/TU]** Will translocation success in other streams be a factor in changing the triggers or will it remain based on Little Colorado River numbers? **[Kirk Young, USFWS]** The Little Colorado River is still the center of humpback chub in the Grand Canyon, and the most resilient, long-term population. It will likely remain prominent in all future triggers. The other populations are a recent phenomenon and will need to be looked at. **[Seth Shanahan, SNWA/TWG Chair]** For supplementary information on brown trout, see the presentation that Charles Yackulic gave at the Annual Reporting meeting in January.

The Colorado Pikeminnow Reintroduction Feasibility Study

[Kirk Young, USFWS] [Conservation/Recovery of Colorado pikeminnow in Grand Canyon biological feasibility presentation] The Colorado pikeminnow is currently restricted to the upper basin, but they were historically throughout all the larger river systems of the Colorado River basin. A first phase draft report is planned for stakeholder review in spring 2021. **[Kim Dibble, GCMRC]** Phase II of the study will focus on assessing the feasibility of reintroduction into Grand Canyon. The system still has high hydro-peaking flow regimes and other events such as the recent spring disturbance flow. Conditions were assessed as to their benefits and uncertainties to Colorado pikeminnow.

Q&A and discussion

[Bill Davis, CREDA] What might be the effects of Colorado pikeminnow reintroduction to other species such as razorback sucker and bonytail chub? **[Kevin Bestgen, University of Colorado]** Humpback chub, bonytail chub and Colorado pikeminnow have all co-evolved in the same habitat. Colorado pikeminnows are considered a low threat to humpback chub compared to non-native, invasive species. **[Ben Reeder, GCRG]** Could re-introduction of Colorado pikeminnow help curb growth of brown trout? **[Kirk Young, USFWS]** The expert panel felt that population level impacts to humpback chub and others was unlikely due to their co-evolution and it is/was not observed as an issue in the upper basin where they can co-occur at times. That needs to be explored further. **[Kelly Burke, GCWC]** How would modeling changes in habitat might also need to be considered compared to changes in climate? **[Kim Dibble, GCMRC]** The actual differences in temperature would only slightly change due to climate. The reaches are already warm. The sense of urgency is to investigate the trend of declining populations in the upper basin and impacts from non-native species. **[Kirk Young, USFWS]** The risk to Colorado pikeminnow would be the same if Grand Canyon warmed extensively. This warming trend might have less of an effect than the reservoir levels. **[Bill Davis, CREDA]** Are the factors affecting the decline of Colorado pikeminnow in the upper basin sufficiently lacking in the lower basin to support the idea that introduction would be successful? **[Kevin Bestgen, University of Colorado]** The largest problem in the upper basin is non-native fish predators (smallmouth bass and walleye), which correlates with the decline of recruitment. The absence of these non-native predators in Grand Canyon is likely the largest reason such an introduction might be successful. **[Seth Shanahan, Reclamation]** What are the next steps for stakeholder review this fall? **[Kim Dibble, GCMRC]** First round of comments from the science panel and steering committee are being reviewed now. A second draft will be sent back to them in early May. Will probably have a report available around July for stakeholder review with a 30-day timeframe. ACTION: TWG members should contact Kim if they are interested in reviewing so she knows how many to expect. A final report will be available this winter. **[Seth Shanahan, SNWA/TWG Chair]** This study is within the

NPS comprehensive fish management plan action alternatives. Is this also an independent pursuit with the NPS? **[Kirk Young, USFWS]** This study is an overlay of the comprehensive management plan and some of the status changes that have occurred to look for redundancies in which USFWS can also participate in the recovery of this species.

Spring Disturbance Flow – Initial Reports from the Field

[Daniel Evans, Arizona Water Science Center] This low flow event helped to verify the accuracy of the Lees Ferry water gauge. Video will be available upon request once finalized.

[Ted Kennedy, GCMRC] [Spring Disturbance Flow Initial Reports from the Field] This presentation is part of the Project O.1 work and the river trip in March. No sediment transport was seen by the second day of the low flow. This was also an opportunity to do benthic sampling that helped to qualify the light trap data. Did not see any evidence of widespread fish stranding. Low flow could also be an effective ecological tool in the drying of cobble habitat, which can get covered in blue green algae and clay.

Q&A and discussion

[Peggy Roefer, CRCN/FLAHG CHAIR] It was amazing to see how much sand there was because the water was lower. Fish seemed to know to leave the backwater as the level was receding. Were the cleaned spots on the cobble bar spawning substrate? **[Ted Kennedy, GCMRC]** It may be appropriate substrate for humpback chub spawning. **[Craig Ellsworth, WAPA/BAHG Chair]** The substrates really did change in that section and it was really clear water. **[Kirk Young, USFWS]** How many humpback chub were encountered in the seining? **[Peggy Roefer, CREDA]** None. **[Ted Kennedy, GCMRC]** A trip report will be prepared. The benthic invertebrate data will take longer. **[Pilar Wolters, USFWS]** The time of year also makes a difference in how populated the backwaters are. Temperature data show the sloughs are a lot colder than the mainstem. This might be why the backwaters were not as populated. **[Ted Kennedy, GCMRC]** It was probably too cold for native fishes. **[Jim Strogen, FFI/TU]** What do you attribute to the abrupt substrate type changes at Parashant? **[Ted Kennedy, GCMRC]** Not sure that was happening. There were large caddis flies at River Mile 199 but don't know if that was due to substrate change. **[Bill Persons, FFI/TU]** Did you see any evidence of stranded rainbow trout on cobble bars in the Lees Ferry reach? **[Ken Hyde, NPS-GLCA]** NPS did not see any stranding except scuds in the cobble bar all around the Lower Slough at River Mile -12. Only caught a few small carp and trout in the lower slough along with quite a few big carp, brown trout (10), and a few rainbow trout while electrofishing and netting.

Macroinvertebrate Oviposition Habitat Selectivity and Egg-Mass Desiccation Tolerances: Implications for Population Dynamics in Large Regulated Rivers

[Craig Ellsworth, WAPA/BAHG Chair] [DOWNLOAD] This is a presentation of a paper by Scott Miller from the Department of Watershed Sciences at Utah State University and co-authors. WAPA provided funding for the study and is involved in ensuring that the Flaming Gorge tailwater fishery remains in a good condition. Bugs showed a preference for large, emergent rocks. Three of the four taxa studied prefer edge habitat versus open water. This pattern holds true on artificial substates too.

Q&A and discussion

[Bill Davis, CREDA] Why is there such a difference in the large numbers of *Hydropsyche* seen in Flaming Gorge that are not in Grand Canyon. **[Ted Kennedy, GCMRC]** It might be that the average depth in Grand Canyon is much greater than at Flaming Gorge. There are other possibilities, such as temperature.

Discussion of the Anticipated Scope of the Forthcoming Bug Flow Evaluation Document

[Ted Kennedy, GCMRC] [DOWNLOAD] This presentation shows key findings and caveats of bug flows. The costs of conducting the experiment increased over time largely because of the purchase power costs. The plan is to synthesize the information into a draft manuscript by January.

Q&A and Discussion

[Bill Davis, CREDA] Will there be any between-year comparisons with temperature to see whether that contributed to egg success? Has low oxygen impacted egg laying? **[Ted Kennedy, GCMRC]** Yes, will look at environmental drivers, some of which has been done. The stronger variable appears to be sediment load rather than water temperature or dissolved oxygen. Dissolved oxygen is generally not an issue, with that occurring in 2019, but it generally happens later in the fall after most egg laying has happened. **[Peggy Roefer, CRCN/FLAHG CHAIR]** Can turbidity and bug flows be teased apart? **[Ted Kennedy, GCMRC]** It may not be possible to disentangle that based on the data on hand. It could be both. **[Seth Shanahan, SNWA/TWG Chair]** Are all the data going to be available to do that analysis by January? **[Ted Kennedy, GCMRC]** Yes, this will also include the drift data, which will be completed by end of summer and included in the January synthesis. However, data from 2021 may not be part of that synthesis. **[Seth Shanahan, SNWA/TWG Chair]** There is value in looking at this year's response when not having a bug flow experiment. What is needed to get that done? **[Ted Kennedy, GCMRC]** Jeff Muehlbauer is leaving this week and was the person who did much of the analysis. The drift river trip data is the top priority for the lab to complete, followed by the light trap data. The key pieces through 2021 should be part of that analysis. **[Peggy Roefer, CRCN/FLAHG CHAIR]** One of the suggestions from the Tech Team was to have the science advisor review this before there was another bug flow. Is that possible especially if there is a change to the months to implement bug flow? **[Ted Kennedy, GCMRC]** January was chosen to give time for the Science Advisor Panel to review by March, which would then allow time for the Tech Team to meet. **[Clarence Fullard, Reclamation]** It would be good to have that input from the science advisors, but it would not hold up the process to get the Tech Team's involvement around February or March. **[Seth Shanahan, SNWA/TWG Chair]** The findings would be uncertain if the science advisor's review is not done by next spring; however, information should be available by January to consider alternative months for the experiment. **[Ted Kennedy, GCMRC]** One approach would be to redesign the experiment around the potential for gross primary productivity (GPP) benefits. There is a strong humpback chub growth link to GPP. This would mean dropping turbid months (July and August) and adding clearer water months with high light availability (March/April and September/October). Another approach is the H lever that is seen between the weekend flow and the weekday minimum. **[Shane Capron, WAPA]** The focus was initially on increased production of midges and blackflies. Didn't get these results as expected but are seeing other things that are leading to other interesting experiments. For example, if GPP is being assessed, that could be done in different months. The H lever probably does not matter because it was designed to assess effects on desiccation. If it is a different mechanism, these things might not matter. This is the reason for a pause in the experiment. There are now three

new variables that were not known before: sediment and turbidity, GPP, and whether low flows are a trigger for emergence, which impacts timing. It is important to now tease those out and be very specific about how this relates to the next experiment. **[Brian Healy, NPS-GCNP]** If there is a modified experiment this year, with bugs and GPP as the variables, the objectives are still consistent with the ROD and it would not be a completely new experiment. **[Ted Kennedy, GCMRC]** The overarching goal of bug flows was to increase the food base. Now seeing other connections that weren't appreciated. If GPP is the focus, then it would be better to have a lower H lever (H1 or H -750) and that might change the design. **[Shane Capron, WAPA]** If the mechanisms that matter are designed into the experiment, then this can be optimized to reduce costs. **[Brian Healy, NPS-GCNP]** Is there sufficient time to process data for this year to include it in the synthesis to matter what the decision is on bug flows? **[Ted Kennedy, GCMRC]** Can probably have 2021 light traps, but the drift river trips take longer and will be a priority. **[Jessica Neuwerth, CRBC]** Will the science advisor panel hinge on the synthesis report? **[Ted Kennedy, GCMRC]** Yes, there will be a synthesis report and a presentation as part of that panel. Requests for Clarence to have the science advisor take this on in November. **[Josh Korman, Ecometric]** Regarding the experimental design, there are multiple things that affect trout growth. It will take more than three years of bug flows to tease out bug flow effects from the multiple factors that affect trout growth. It would be good to have this discussion with the science advisory panel about what is a realistic time to resolve this question.

Discussion of Emerging Issues and Request for Agenda Items for Next Meeting

[Seth Shanahan, SNWA/TWG Chair] Emerging items are as follows:

- Need to track dissolved oxygen triggers and exceedances.
- The Colorado pikeminnow report.
- The budget items will include the BAHG's recommendation in June on the Year 2 budget and then there will be some urgency to start developing criteria for future years.
- Provide a status update on Reclamation's low dissolved oxygen response plan.
- The monitoring metrics plan.
- The presentation to discuss a 7.48 MAF release year at the June meeting.
- The Chair and Vice Chair election will occur during the June meeting.
- There is continuing interest in getting updates on the Pearce Ferry rapid as a fish barrier. There are concerns about brown trout and rainbow trout catch in the Lees Ferry area.
- By June, the overflights will have been completed and an update could be provided.

[Kelly Burke, GCWC] When would results be discussed on the apron repair work when the flow was increased to 20,000 CFS? **[Ted Kennedy, GCMRC]** The crew at Lees Ferry found lots of quagga mussels and New Zealand mud snails in the drift samples, which indicates that high flows served to export undesirable invertebrates. More will be shared at future meetings. **[Clarence Fullard, Reclamation]** To clarify, Reclamation is not planning to undertake a response plan for dissolved oxygen. It will be a synthesis and risk assessment. **[Seth Shanahan, SNWA/TWG Chair]** What was heard from the TWG members is that this approach is not enough. Will plan a call between TWG and Reclamation to discuss this further. **[Kelly Burke, GCWC]** From an emerging issues concern, GCWC is interested in getting an

update on changes to the Bald Eagle Act. Also interested in having Kurt Dongoske present any additional thoughts regarding tribal perspective.

Public Comment on Day 2:

None.

Adjourned at 2:39 PM PDT

Attendees

TWG Members and Alternates

Cliff Barrett, UMPA
Peter Bungart, Hualapai Tribe (Alternate)
Kelly Burke, GCWC (Alternate)
Carrie Cannon, Hualapai Tribe
Shane Capron, WAPA
William "Bill" Davis, CREDA
Craig Ellsworth, WAPA (Alternate)
Michelle Garrison, CWCB (Vice-chair)
Jessica Gwinn, USFWS (Alternate)
Paul Harms, State of New Mexico
Brian Healy, NPS-GCNP (Alternate)
Ken Hyde, NPS-GLCA
Leslie James, CREDA (Alternate)
Jakob Maase, Hopi Tribe
Ryan Mann, AZGFD
Craig McGinnis, ADWR (Alternate)
Jessica Neuwerth, CRBC
Bill Persons, FFI/TU
Ben Reeder, GCRG
Peggy Roefer, CRCN (Alternate)
Seth Shanahan, TWG Chair and SNWA
Jim Strogen, FFI/TU
Steve Wolff, State of Wyoming
Kirk Young, USFWS

USGS/GCMRC Staff

Lucas Bair
Bridget Deemer
Kimberly Dibble
Daniel Evans
Helen Fairley
Paul Grams
Ted Kennedy
Amy Metcalf
Teo Melis
Michael Moran
Joel Sankey
Kurt Schonauer
Scott VanderKooi
Mark Wimer
David Ward
Charles Yackulic

Reclamation Staff

Tara Ashby
Jeremiah Drewel
Clarence Fullard
Mark McKinstry
Heather Patno
Kerri Pedersen
Robert Radtke
Dave Speas
Connie Svoboda
Lee Traynham

Interested Persons

Kevin Bestgen, Colorado State University
Scott McGettigan, State of Utah

Richard Begay, Navajo Nation
Rob Billerbeck, NPS
Daniel Bullets, Kaibab Band of Paiute Indians
Kevin Bulletts, University of Arizona
Kevin Dahl, NPCA
Martina Dawley, Hualapai
Daniel Evans, Arizona Water Science Center
Courtney McDaniel, State University of New York College at Brockport (SUNY)
Sinjin Eberle, American Rivers
Alicyn Gitlin, Sierra Club
Sky Hedden, AZGFD
Amanda Hilton, University of Arizona, School of Anthropology
Carliane Johnson, SeaJay Environmental
Tildon Jones, USFWS
John Jordan, FFI/TU
Josh Korman, Ecometric
Kevin McAbee, USFWS
Betsy Morgan, State of Utah
McKenna Murray, State of Utah
Amy Ostdiek, State of Colorado
Don Neff
Bill Persons, FFI/Trout Unlimited
Sara Price, CRCN
Shana Rapoport, CRBC
Ted Rampton
Brandon Senger, Nevada Department of Wildlife
Gene Seagle, NPS
Erik Skeie, State of Colorado
Emily Omana Smith, NPS-GRCA
Erik Stanfield, Navajo Nation
Gary Tallman, Northern Arizona University
Melissa Trammel, NPS
Pilar Wolters, USFWS

Abbreviations

ADWR - Arizona Department of Water Resources
AZGFD – Arizona Game and Fish Department
AMWG – Adaptive Management Work Group
BAHG – Budget Ad Hoc Group
BHA - Benthic & Hyporheic Anoxia
CFS - cubic feet per second
CRBC - Colorado River Board of California
CREDA – Colorado River Energy Distributors Association
CWCB - Colorado Water Conservation Board
CRCN – Colorado River Commission of Nevada
DFCs - Desired Future Conditions
DROA - Drought Response Operations Agreement
DOI – Department of the Interior
EIS - Environmental Impact Statement
FFI – Fly Fishers International
FLAHG – Flow Ad Hoc Group
FY – fiscal year
GCWC—Grand Canyon Wildlands Council
GLCA - Glen Canyon National Recreation Area
GPP - gross primary productivity
HFE – High Flow Experiment
LTEMP – Long-Term Experimental and Management Plan
MAF – million acre-feet
mg/l - milligram per liter
NPS – National Park Service
PIT - passive integrated transponder
PDT – Pacific Daylight Time
Reclamation – Bureau of Reclamation
ROD - Record of Decision
SNWA – Southern Nevada Water Authority
TSC - Technical Service Center
TU - Trout Unlimited
TWP – Triennial Budget and Work Plan
TWG – GCDAMP Technical Work Group

GCDAMP – Glen Canyon Dam Adaptive Management Program

GCMRC – Grand Canyon Monitoring & Research Center

GCNP – Grand Canyon National Park

GCRG - Grand Canyon River Guides

UMPA – Utah Municipal Power Agency

USFWS – United States Fish & Wildlife Service

USGS – United States Geological Survey

WAPA – Western Area Power Administration