Glen Canyon Dam Adaptive Management Program
Adaptive Management Work Group Meeting
February 28 and 29, 2024

Wednesday, February 28, 2024

Start Time: 9:30 AM Mountain Standard Time (MST)
Conducting: Wayne Pullan, Bureau of Reclamation, Acting Secretary's Designee to the Adaptive Management Work Group (AMWG) and AMWG Chair
Designated Federal Officer: Daniel Picard, Bureau of Reclamation
Recorder: David McIntyre, SeaJay Environmental LLC.
Facilitator: Terra Alpaugh, Kearns & West Inc.

Welcome and Administrative Updates

- Opening Remarks:
  Wayne Pullan (AMWG Chair) Reviewed accomplishments from 2023:
  - Motion passed to adopt the Nonnative Fish Strategic Plan. The Smallmouth Bass Rapid Response Charter was signed by the Bureau of Reclamation (Reclamation), the National Park Service (NPS), U.S. Geological Survey (USGS), and the U.S. Fish and Wildlife Service (USFWS).
  - The Glen Canyon Dam Adaptive Management Program (GCDAMP's) Tribal governments were awarded the Department of the Interior (DOI) Environmental Achievement Award last year.
  - April 2024 Reclamation initiated a 72-hour High Flow Experiment (HFE). Made possible by unique river conditions. It was put together over a brief time period.
  - The Flow Ad Hoc Group (FLAHG) was tasked to develop a proposal for addressing the HFE protocol. Proposal was passed by AMWG in August 2023.
  - Long-term Experimental and Management Plan (LTEMP) Draft Supplemental Environmental Impact Statement (SEIS) is not done. Currently taking public comments. Near-Term Colorado River Operations SEIS nearly complete. The Post-2026 EIS is underway.
  - At the Aug 2023 AMWG meeting we discussed issues with cavitation at the River outlet works at Glen Canyon Dam. Cavitation observed last year as a result of operations at low elevations. Low lake elevation concerns led to development of aspects of the Drought Contingency Plans (DCPs) in 2019. The 2019 Upper Basin DCP is premised on keeping Lake Powell from dropping below 3,525 feet. This was done through operations in the Drought Response Operations Agreement (DROA). In an April 2022 letter to the seven Basin States DOI warned that Glen Canyon Dam was not designed to operate for extended period solely through the outlet works and these operations increase risks to water delivery and potential adverse impacts to downstream resources. In Nov 2022 Reclamation initiated the 2007 Interim Guidelines SEIS to modify operating guidelines until we have new guidelines (Post 2026 EIS).
  - Reclamation is concerned that sustained use at this elevation will damage the outlet works and have adverse downstream effects (sediment scouring). There are Eight intake penstocks at elevation 3,490 and four river outlet works at elevation 3,370 at Glen Canyon Dam. This is the minimum intake elevation of the river outlet works. Currently at elevation 3,564. There are two areas of concern related to adverse effects to the pipes at the river outlet works. First is cavitation and thinning of the pipe wall. The second is

tailrace sediment scour. Sediment is churned up and carried back to dam which affects the tailrace of the turbines. No water is in the penstocks at 3,500 feet. Reclamation intends to avoid Lake Powell going below 3,500 feet for any sustained period.

- Reclamation is developing a technical memorandum that compiles all information, findings, and judgement. Will make it public in March 2024.
- One question is how do we incorporate this new guidance for Glen Canyon Dam into our National Environmental Policy Act (NEPA) efforts? LTEMP SEIS is a principal concern when determining when efforts resulting from the LTEMP SEIS can be implemented. Modeling assumptions assume there will be no HFEs at elevation 3,500. This incorporates reduced river outlet work capacity of any potential flow-based actions such as HFEs. These restrictions are considered in the LTEMP SEIS.
- One focus of this meeting is on the Triennial Work Plan (TWP). The AMWG makes recommendations to the SOI on TWP which runs from Fiscal Year (FY) 2025 to 2027. Goal is consensus recommendation on TWP. Reclamation needs to strike a resource balance between downstream resources and annual deliveries to the upper and lower basins.

Ed Keable (NPS) What is the schedule for bypass tube repair? **Nick Williams (BOR)** Construction is 4 to 6 months out. Will pause construction if outlet works are needed. Each outlet is an option. Can pause between options. It takes about 2 to 2.5 months per pipe to reline. This work will repair the current cavitation but will not resolve the cavitation issue.

Larry Stevens (GCWC) Concerns with TWP have to do with the uncertainties for smallmouth bass and climate change. **Wayne Pullan (AMWG Chair)** In looking at FY 25-27 TWP we'll have finished the LTEMP SEIS and be in some implementation phase. Likely we'll be operating under the Near-Term SEIS and developing the Post-2026 EIS. TWP will need to reflect research and applied science to capture these changes.

Sinjin Eberle (American Rivers) Given there will be some nearer term guidelines when this work is going on will that restrict the opportunity to have cool mix in the system? **Wayne Pullan (AMWG Chair)** We've taken this into account in the LTEMP SEIS. Doubt it will restrict temperature modulation unless we get to elevation 3,500.

Charlie Ferrantelli (State of Wyoming) Once construction is complete, is the intent to allow use of the bypass tubes at those elevations or is it just standard maintenance and repair? **Wayne Pullan (AMWG Chair)** Won't enhance capability of facility. Will have some operational restrictions. We will be taking actions to address cavitation and scouring but it is unknown what those actions are now.

Sara Price (CRCN) Is the evidence regarding the thinning of the walls from the analysis of former HFEs or other studies? **Wayne Pullan (AMWG Chair)** Prior to last HFE we were aware of cavitation damage. We did an inspection after last spring's HFE and saw new damage.

Sara Price (CRCN) What elevation was Lake Powell at for that HFE? **Wayne Pullan (AMWG Chair)** Lowest point was elevation 3,520 in March 2023, HFE was in April so above 3,520. The cavitation issue is from low head and low elevation. If operating at higher elevation and higher head it is not an issue. **Sara Price (CRCN)** But it was a concern at elevation 3,510? **Wayne Pullan (AMWG Chair)** It will be a concern at lower elevations, it was a concern in April last year at elevation 3,525. **Nick Williams (BOR)** Had not observed this in previous HFEs. January 2023 inspection discovered it. The 1965 memorandum noted

this previously. Reclamation didn't envision operating this facility at lower head. At elevation 3,550 the head is enough to overcome cavitation potential. The spring HFE showed cavitation and we repaired the damage found. Long duration operations like this will result in pitting and wearing through the metal itself.

Amy Haas (Colorado River Authority of Utah) Did we model elevation 3,500 specifically in the LTEMP Draft SEIS. **Wayne Pullan (AMWG Chair)** The changes in our guidelines were entered into our assumptions.

Wayne Pullan (AMWG Chair) The DROA talks about elevation 3,525, we thought it would be easier to maintain 3,525. Have narrowed it down in the event of bad hydrology and we need to operate closer to the bone. I need to act as Secretary of the Interior's Acting Designee in these meetings and not as Reclamation's Regional Director.

- Introductions and Determination of Quorum **Terra Alpaugh (Kearns & West)** Quorum was reached with 17 AMWG members represented.
- Approval of August 16 and 17, 2023, Meeting Minutes **Bill Stewart (BOR)** Previously meeting minutes were approved by this group. Under the Federal Advisory Committee Act (FACA) the meeting minutes need to be reported within 90 days. Minutes will be going out for review and will be sent to Acting Secretary's Designee for approval.
- Review of August Meeting Evaluation **Terra Alpaugh (Kearns & West)** 22 respondents. Tried to incorporate a number of inputs received in this meeting's agenda. Allow more time for discussion and reflection today and tomorrow on the TWP. The Grand Canyon Monitoring and Research Center (GCMRC) will provide more introductory context and summaries. Will cover other issues raised; tribal perspectives, update on the LTEMP SEIS, Interim Guidelines and Post 2026 EIS and Nonnative Fish Strategic Plan update.
- **AMWG Charter Bill Stewart (BOR)** Charter signed September 6, 2023, and good for two years. Will address it again this time next year.
- **Nominations and Appointments Bill Stewart (BOR)** Two AMWG nominees in process and we should be hearing on results of those. Jess Newton (alternate U.S. Fish and Wildlife Service [USFSW]) and Warren Turkett for the State of Nevada. Thirteen AMWG members terms will expire next year. Will ask for nomination packages in the Federal Register. We have five new Technical Work Group (TWG) appointments, Danielle Greene, State of Nevada, Scott McGettigan (Alternate State of Utah), Betsy Morgan (State of Utah), David Ward (USFWS), and Deborah Williams (2nd Alternate USFWS).
- **Action Item Tracking Report Bill Stewart (BOR)** Provided updates on the following:
    - Monitoring Metrics: Reclamation has been working on these for a while. Will be hearing today on the status of these with the intent to incorporate them in next TWP.
    - Ongoing efforts by DOI bureaus to identify high priority activities to support compliance with the Grand Canyon Protection Act (GCPA), National Historic Preservation Act (NHPA), Endangered Species Act (ESA), and NEPA.
    - Since August 2022 tracking five proposed actions: (1) Evaluate HFEs under low elevations/low flows; (2) Evaluation of downstream resource impacts under low elevation/low flows; (3) Continuation of Nonnative Fish Strategic Plan; (4) NEPA compliance for operational flexibilities to address nonnative fish; and (5) Planning to evaluate exclusion projects. Several of these are completed.
- **AMWG Logistics Tara Ashby (BOR)** August 2024 meeting will be at South Rim of the Grand Canyon. Three hotels are available with room blocks. First come / first served. Wants every entity to have at least one member first before opening to others.

Tribal Perspective

Jakob Maase (Hopi) PRESENTATION. 2023 Hopi Long Term Monitoring Trip was in the fall. In 2016 the NPS agreed with Tribes to provide beneficial use for taking of life of fish. Unclear how effective mechanical removal of fish is. Are there other options? Hopi are kind of okay with having nonnative vegetation species as they provide habitat for species and retain sand, but they also push back native species and hurt the water table. Like to replace with native plant species. Biggest issue is along the Little Colorado River (LCR). Noted that tamarisk has been cut back in areas. Is recreation in the Grand Canyon appropriate? Seen by Hopi in a negative light. Sites need off time. Graffiti at Havasupai Falls this year. Visitors need to be respectful. Like to have input on river guide contract. Archaeological sites are seen as healthier, however, South Canyon barren of artifacts. Unkar had collection piles and evidence of foot traffic. Minor erosion damage is being repaired. Hopi see archaeological sites as living things that have effects inside and outside the Grand Canyon. Great seeing humpback chub and sucker below the LCR. Still see threats, warm water levels, predators etc.…How long can we sustain this boom in population? Animal health is good, saw a lot of sheep and deer. Birds are healthy. Found several eagle nests below mile marker 13. Golden eagle heard also. Reptile health is good. Saw five snakes which is more than usual. Willow health healthier. Sad to hear about willow deaths near Diamond Creek. Marsh health healthier. Good monsoon season and snow melt. Nonnative reeds a concern. Salt Mine health has recovered. Insect health good. Most are dragonflies. Spring health is fantastic. Best since 2019. Vasey's spring had the most water since 2003. Ernie's Armpit is full of sand. Unsure of cause. Overall, the Grand Canyon is healthier. Biggest issues are climate change and water management.

Hopi got money from Reclamation to digitize old Canyon research and ethnographic research. Next river trip April 2024. Reviewing the LTEMP SEIS. Traditional Cultural Property documentation in review. New herpetological projects are in the works.

Q&A and discussion

Jim Strogen (FFI/TU)] In terms of protection of archaeological sites. Do the tribes educate river runners? **Jakob Maase (Hopi)** Tribes are not engaged in that, but a joint effort would likely help. The bigger issue is private trips vs. guided trips.
Jim Strogen (FFI/TU) What about having people at the take-off sites? **Jakob Maase (Hopi)** Lack of staff and distance make that hard.

Larry Stevens (GCWC) The impression that came about from 2000 to 2011 is that trout are the main predator of native fish which has been largely discounted. It's smallmouth bass and brown trout that are the bigger issue. Did the Tribal participants know this? These perceptions have changed a lot. **Jakob Maase (Hopi)** The Tribe knows it's more the smallmouth bass and brown trout.

Larry Stevens (GCWC) Virtually all phragmites are native. There is one clone of nonnative phragmites at Grand Canyon National Park (GCNP). **Ed Keable (GCNP)** GCNP talks to everyone at Lees Ferry before launch. Encourages everyone to be respectful and is part of guide training seminar. Hualapai also wants to participate. Thinks commercial operators are respectful as are most private trips. GCNP has recently built back up the law enforcement program. Trying to coordinate with Hualapai tribe on law enforcement efforts.

David Brown (GCRG) Being respectful is emphasized. At Havasu can access the river from the top. That site has resulted in a lot of discussion and avoidance by guides, but the concerns are legitimate. Guides go out of the way to ensure that people understand the history and importance to the tribes.

Joel Sanky (GCMRC) What's Earnie's Armpit? **Jakob Maase (Hopi)** Get there around Day 4. It's the river runners name for it. Has a Hopi name. Used to be pretty green with hanging foliage. Spring creates

dips. Usually pretty flowing but this year kind of dripping with no water on the bottom. **Larry Stevens (GCWC)** It's at mile marker 35 on the right side. It's also known as whale's armpit.

Basin Hydrology and Operations

Heather Patno (BOR) PRESENTATION. February 2024 has been wet through a lot of the basin except for the main stem of the Upper Colorado River (UCR) and parts of the Gunnison. Some precipitation has reached the San Juans. Additional precipitation is anticipated for the first week of March and the rest of March should be normal. March is make or break for hydrology. Snow water equivalent (SWE) has new links on the Natural Resources Conservation Service website. Beginning of SWE year was close to 2012 pattern but with a wet February SWE is closer now to 2020. SWE has been steady or increasing in high elevations. Weather is still uncertain even at this point and unknown the effect on runoff this year. 2024 could mirror 2020. Additional water released from Blue Mesa has been recovered. Min probable in January going below elevation 3,525 which triggers Drought Response Operations Agreement (DROA) monitoring. Changed in February so not in that any longer. March and April are when LTEMP experimental HFEs are possible. Fontenelle transformer replacement will be completed next month. August and September will have eight units available. Mid-October will start more annual maintenance. Dive team in forebay October 21 to 24. Releases lowered to 4,000 cubic feet per second (CFS) for that period. Additional planned maintenance in November for Units 1 and 2 and January / February for Units 3 and 4 and so on. Units 5 and 6 in June and July.

Alex Walker (BOR) PRESENTATION. Observed temp in forebay near Glen Canyon Dam. Temperatures at top of reservoir continue to cool and water continues to mix. Temperatures in early Jan are similar to last several years at 11 degrees Celsius (ºC). Downstream is normal with dissolved oxygen, temperature, conductance, and turbidity. This month changes to Glen Canyon Dam Water Quality Model. Cannot project as well now as we will be able to later in the year. New model by March 2024.

Q&A and discussion

Jessica Neuwerth (CRBC) Does the water quality model update address temperature or is it just water quality? **Alex Walker (BOR)** It includes temperature as well as other things like D.O. but temperature is key.

Jessica Neuwerth (CRBC) Snowpack looks about average, but inflows are in the 80% range, why is that? **Heather Patno (BOR)** Snowpack is looking at runoff. We are tracking below average for runoff because the beginning of year was dry, and we were closer to 2012 (very dry). Thus, looking at a below average year in spite of higher than average precipitation recently.

Larry Stevens (GCWC) Specific conductance of releases is gradually increasing. When does that become a management issue? **Alex Walker (BOR)** It is a long term question for us. Water quality group also deals with salinity control forums that look at salinity loading throughout the Colorado River basin. Unsure when this will become a concern. **Bryce Mihalevich (BOR)** Typical for this to increase over winter and fall in the summer. This is a normal pattern.

Jim Strogen (FFI/TU) October/November needing low releases for work below dam? **Heather Patno (BOR)** Dive Team scheduled Oct 21 to 24. One (1) day at 4,000 CFS but could be two days. **Jim Strogen (FFI/TU)** If we find temperatures and D.O. are low, can we adjust that release to avoid impacts to fish. **Heather Patno (BOR)** We can do our best to adjust. Dive team was originally proposed for April but shifted to notify the public. Want this done by end of 2024 for reporting purposes. Team is scheduled 6 months in advance, so it is tough to change.

Jim Strogen (FFI/TU) Who do you reference for those conditions. **Heather Patno (BOR)** Water quality group and internal discussions as well. Will continue notifications of current conditions.

Ed Keable (NPS) Please let us know as much as you can on the 4,000 CFS so we can let boaters know. Has GCMRC mapped aridification so that we understand where snowpack is being more or less absorbed in the ground? What areas are more aridified? **Heather Patno (BOR)** The Colorado River Basin Model has parameters and soil moisture parameters are for the entire basin. Changing aridification in the basin is considered. San Juans is the driest for soil moisture. Lots of uncertainty in these conditions. **Ed Keable (NPS)** It would help to see a map with aridification and precipitation to see where challenges are.

Kelly Burke (GCWC) How would the unexpected observed change in 2020 affect projections in 2024 if 2024 inflow aligns with 2020. **Heather Patno (BOR)** We were not prepared for 2020. We don't have quantified calculations. That's why our observed volume is close to the minimum probable.

David Brown (GCRG) When will the 4,000 CFS maintenance flows occur? **Heather Patno (BOR)** Between October 21 and 24. Will let everyone know exact days.

Lunch: Tribal Luncheon with Secretary's Designee

LTEMP Goals and Update on Performance

Helen Fairley (GCMRC) PRESENTATION. Last presentation on this topic to AMWG was August 2021. This requirement was originally identified back in 2016 as part of LTEMP Record of Decision (ROD). Wasn't started till the present Triennial Work Plan (TWP). Performance metrics are designed to compare the performance of the alternatives being considered at the time. It is unclear what the outcomes of the alternatives would be, e.g. using temperature as a proxy measurement for humpback chub. Have been operating under Alternative D (preferred alternative) for eight years. We can now measure outcomes directly since alternatives have been implemented. GCMRC was directed to work specifically with the eleven LTEMP goals. Monitoring is done for three reasons: 1) To determine effectiveness of decisions, 2) To see how the ecosystem is functioning and to see if there are trends to be aware of; and 3) For validation. Very focused on finding metrics to evaluate LTEMP in terms of the eleven goals. Metrics are a snapshot in time. Some metrics are very subjective which makes evaluating these challenging. Tribes don't feel that many of the metrics can be quantified, e.g. they are priceless. Still need to know how tribes feel these goals are being met. Plan is in March/April finalize the draft metrics and roll out as a dashboard in summer 2024.

Q&A and discussion

Brian Sadler (WAPA) What's the process to finalize the metrics? **Helen Fairley (GCMRC)** We know there are some outstanding issues. We feel like we should start putting it out there even if we don't have everything so we can get comments. Would include additional conversations with Tribes.

Brian Sadler (WAPA) What is the process to finalize? Are we doing an AMWG motion or what? **Helen Fairley (GCMRC)** I'll defer to Reclamation colleagues. **Wayne Pullan (AMWG Chair)** There is a lot of consensus and a couple areas (Tribal and Hydropower) that may need more time, particularly with Tribal concerns. Typical of western science to try and quantify nonquantifiable things. Tribes are willing to discuss. If Tribes conclude it's an area we should not try and measure, then that's okay. If we can, let's look at it, e.g. ethnographic surveys. Wayne wants AMWG to develop a set of metrics with high potential for consensus that can be acted on in the Feb 2025 AMWG meeting.

Larry Stevens (GCWC) Goals are goals and objectives are objectives and here they seem fused. If we have chosen the wrong metrics we'll be going astray, e.g. humpback chub monitoring. Like to see an analysis of how to tell if the metrics are appropriate or not. Can we test the efficacy of these metrics? **Wayne Pullan (AMWG Chair)** Would be wise to have that on our radar.

Kurt Dongoskie (Pueblo of Zuni) Wayne expressed a desire to integrate traditional knowledge in this program. How can we do that equitably? **Wayne Pullan (AMWG Chair)** Kurt could do a better job of that than I. Nothing should be prescribed. Need Tribal agreement and support. If that's not possible then we need to recognize that we will not be able to quantify this. Without quantification we need to place appropriate weight on those goals. **Jakob Maase (Hopi Tribe)** This is a fair approach.

Edward Wemytewa (Pueblo of Zuni) Tribes see the processes in a very different way than western science. I have permission from tribal council to present at the April meeting**.** Can articulate how they see water, aquatic creatures and plants and how they recognize degradation of an ecosystem of the Colorado River and the LCR. **Kurt Dongoskie (Pueblo of Zuni)** This program and Zuni traditional concerns don't necessarily mesh. Been dealing with the objection to lethal management actions that continue and are unresolved. Also dealing with relationships the Zuni have with greater than human life forms that exist in canyon. They are not commodities; they are life forms and sentient beings that the Zuni have a responsibility to. A program grounded in western science deals with this poorly. Traditional knowledge needs to be equal to western science. How will scientists start to take traditional knowledge and understanding of the relationship the traditional communities have with the ecosystems? Need to acknowledge this is a valid approach to managing the environment.

Leslie James (CREDA) Jakob's presentation really struck me. Those are the Hopi's metrics. That's what they monitor. Can we incorporate that work from the tribes into the broader discussion? More of a collaboration? LTEMP addressed eleven (11) goals, but this program does not have to be the ultimate arbiter of what falls under LTEMP or the GCPA. Let the Tribe bring the metric to the table. **Helen Fairley (GCMRC)** That's an approach we are talking about.

Erik Stanfield (Navajo Nation) Tribal coalition may or may not have more work to do. What's the real decision-making consequence of this? How formal will this be? If some metrics are seen as successful how does that influence the metric development? What does the process look like, is it recorded at the annual meeting? **Helen Fairley (GCMRC)** Main thing we're trying to do is comply with the LTEMP. LTEMP is trying to meet a bunch of different, fundamental objectives. Language in the LTEMP was a little confusing because we interchange goals and objectives. Ideal to have a snapshot of where we are on an annual basis. Some metrics only counted every 3 years, others shorter and others longer. **Rod Smith (DOI)** These are the objectives the LTEMP set forth. Could help us decide where to monitor, where to spend money? It's all in the spirit of implementing LTEMP. **Erik Stanfield (Navajo Nation)** Some of the goals have eight metrics and some have five. That provides a weight to some that others don't have. If we generate a lot of information on one goal and not on the other, it draws attention to the ones that are easier to quantify. Those that are more difficult to quantify get pushed down. Not balanced well. **Wayne Pullan (AMWG Chair)** If we leveraged these measures beyond what they really mean we might do things that are contrary to the limitations associated with this. **Rod Smith (DOI)** We are not going to have a plan where all eleven goals are perfect.

Larry Stevens (GCWC) In 2011 we came up with desired conditions that are similar to goals. Need to quantify those goals. **Wayne Pullan (AMWG Chair)** Optimal outcome is consensus that these measures meet that task. If we cannot do that then the work done between now and February will help in SOI decision.

2024 GCDAMP Annual Reporting Meeting Update – Part 1: Grand Canyon Monitoring and Research Center (GCMRC)

Helen Fairley (on behalf of Joel Sankey) (GCMRC) PRESENTATION. This area has been a homeland back for 9,000 years. Many sites are buried. Closure of Glen Canyon Dam has increased erosion. Two methods used to monitor cultural resources: 1) monitoring changes in two classifications – drainage evolution and fluvial sand connectivity and, 2) Changes in topography via LIDAR surveys. Movement of sand from river to uplands (sandbars) is being impeded by vegetation growth. Very few sites are directly connected to sand supply. Long term viability for these sites is poor. Two thirds of the sites are stable. The sites that have changed have become more degraded and disconnected from the sand supply. Twenty-seven sites get LIDAR coverage. Repeat HFEs or dropping flows would increase the sand supply to these sites. Unknown whether removing vegetation increases sand supply to archaeological sites. Initial vegetation management and LIDAR done back in 2019. There are other factors playing into this. Pilot study using LIDAR was done to monitor impacts to other archaeological sites, e.g. rock art sites.

Maria Dzul (GCMRC) PRESENTATION. Smallmouth bass and green sunfish are not an issue when lake elevations are high. When lake is lower, they come through. Warmer water also comes through, and they can reproduce. Model estimates smallmouth bass entrainment is pretty low annually. There was an uptick in 2022 (low lake elevation) and 2023 (bigger inflows). About 60 adults were entrained. From zero to five are anticipated to be caught during monitoring. 16ºC is when they reproduce. 2024 water temperature predictions are above 16ºC later in the year and then only slightly above so some potential for population growth. Modeling doesn't account for 12 Mile Sough. If it stays unmodified smallmouth bass could reproduce. 2022 prey items are from Glen Canyon Dam but prey items in 2023 from farther downstream. Brown trout data is 2017 to 2023. Increased a lot starting in 2017 but brown trout have stabilized since peak in 2020-2021. Low condition/slow growth in 2023. Decline due to combination of poor environmental conditions and incentivized harvest. AZGFD seeing uptick in brown trout and green sunfish at Lees Ferry. Fish assemblage shifting to warm water species. Rainbow trout are mainly older, fewer juveniles. Previous HFEs produced spikes in rainbow production but not in 2023. Rainbow trout growth varies seasonally. Could see population crash in next couple of years. Humpback chub being tracked using Juvenile Chub Monitoring (JCM) west. They are high in the LCR, JCM East and JCM West. The last eight years show stable/increasing population trend. 2023 good year for humpback chub. Adult abundance high near the LCR and in Western Grand Canyon.

Emily Palmquist (GCMRC) Maintaining native vegetation and wildlife habitat in a diverse, healthy, self-sustaining manner is done by answering three (3) questions: 1) What species do we have (cover and composition); 2) Why do we have them (Flow patterns, sediment, and climate); and 3) How can we change these patterns? Two broad concepts under the first question: how many plants are there and what species make up that community. Three (3) factors affect question 2: flow patterns, sediment, and climate (air temperature). The research in the first two questions feeds the third. Four (4) elements are linked together: 1) Annual monitoring; 2) Manipulative experiments in which certain factors are changed to see the result; 3) Use of evidence developed locally along with evidence from other parts of the western U.S.; and 4) Integrating this data to make management decisions. Plants responses to dam operations are related to temperature. Inundation tolerance of a species is predictable from habitat preference in the field, but not drought tolerance. Patterns seen in monitoring data can be replicated in the greenhouse. High/low flow seasonality has shaped the species composition. This analysis has been put into the webtool and the SEIS and make these rapid model predictions.

Lucas Bair (GCMRC) The economic costs of smallmouth bass flows research is a good example of an integrated model. This is not a financial assessment. Two-step process. Step 1 is to estimate future Glen Canyon Dam operations using the releases from May 2020 to Nov 2022. Step 2 is to estimate electricity

prices in the west. Used May 2020 to September 2022 electric price at the Palo Verde hub. Also used forward contracts for future delivery of energy. Comparing observed prices with forward contracts shows that forward contracts tend to overestimate prices. This was used to develop forecasts for economic costs of smallmouth bass flows for October 2022 and April 2023. $27M and $35M were the median cost.

Joel Sankey (GCMRC) Overflight remote sensing project in support of LTEMP. Grand Canyon has a rich archive of airborne remote sensing. Two (2) decades of high resolution multispectral imagery. 2021 overflight performed by Fugro. Next overflight in either 2025 or 2026.

2024 GCDAMP Annual Reporting Meeting Update – Part 2: Grand Canyon Monitoring and Research Center (GCMRC)

Lucas Bair (GCMRC) Slow start (approximately 100 fish per year) first couple of years. Incentive went from $25 to as much as $85 per fish. The number caught went up dramatically. Majority of fish were caught by just a few anglers. NPS ran out of money in winter of 22/23 and numbers went down. NPS has money again this year. Want to implement a bonanza in the spring. Covid affected people's behavior. Rainbow trout catch decreased per trip except during bonanzas. Catch per trip decreased due to the number of inexperienced anglers. Large incentives do increase catch per trip overall. Retention rate of anglers increased. For rainbow trout the catch per trip decreased due to unskilled anglers except bonanzas increased catch per trip. Retention rates decreased overall except during bonanzas. Overall program is not impacting rainbow trout fishery.

Paul Grams and David Topping (GCMRC) 28 million (M) metric tons of sand have been eroded from the system since 1963. A considerable amount of sand in the system is pre-dam. Core of many sandbars are pre-dam in nature. We have the sand mass balance for segments of Marble and Grand Canyon. If we determine sand is being eroded from the segment on an annual basis, we are just driving the sand bank account lower since pre-dam sand cannot be replaced. HFEs deposits sand at higher elevations. Upper Marble Canyon and West Central Grand Canyon are showing that. Some parts of the canyon are not showing that. Starting in 2012 when HFE protocol went into place the sand mass balance was positive and sand bar trends were positive. Further downstream to Lower Marble Canyon it's getting less clear. Unclear if the HFEs are working. Eastern Grand Canyon is getting sufficient sand deposition from LCR during summer of 2022 and winter of 2023. 2022 largest deposition of sand since 1993. If not for that would see a decline in sand. If you go farther downstream between Grand Canyon National, it's similar to Lower Marble Canyon but not seeing cumulative gains in high elevation sandbars.

All sandbars averaged together in Marble and Grand Canyon. Not all sandbars act the same way. 2023 HFE bumped up all types of sandbars. High balancing tier flows are getting rid of much of the work done by the HFE. Project B is used to check Project A. Within error they mostly agree. Goal is to accumulate sand and build sandbars. Upper and Lower Marble Canyon are in good shape. Eastern Grand Canyon is kind of on the fence. First flood showed sand amount was not what we wanted. In the HFE and LTEMP protocol we're doing well. Western Grand Canyon response to HFEs is in flux as data continues to be gathered. Project B is where most of the modeling is done.

Bridget Deemer (GCMRC) When Lake Powell elevation drops water quality conditions get more dynamic. As water elevation dropped there were higher peak temperatures in late summer and fall and lower D.O. The W2 water quality model has had difficulty making accurate predictions with lower elevations. Trying to get temperatures and conductivity right first. There is a D.O. module for W-2. The temperature issue is because the water release structure is pulling from greater depths of the lake. Historic profile data shows the standard deviation of temperatures at these greater depths is much higher than other places in the water column. This means we need to get mixing dynamics right in W2 to get the temperature correct. Evaporation coefficients were updated for the W2 model, which will help with how

surface heating and mixing are modeled. W2 has a wind shelter coefficient that needs to be reexamined. This model is performing significantly better than Reclamation's old model and Reclamation intends to adopt it. Newer models are closer to what's observed. Last couple of yeas unprecedented low D.O. levels. 2023 lower than 2005 both in level and duration. Anything below five (5) milligrams/liter (mg/liter) could have significant impacts on aquatic organisms.

Decomposition is a pathway for fueling the food web. Revisited a 1998 experiment in 2022. Want to know how decomposition has changed with changes in water quality. 10ºC warmer than 1998. 1998 there were lower mud snail densities. Higher phosphorus concentrations. Salt cedar was not affected in 1998 by beetles the way it is now. Predicted the biggest change in decomposition would be with salt cedar. Salt cedar rate more than double in 2022. No change in other leaf types. Decrease in phosphorus availability offset the temperature increase. About 50% of light traps have been processed. New species of caddis fly was detected. 46% of samples were processed from light traps. Big decrease in midges and caddisfly. Strong model support for positive effective bug flows where midges and caddis flies are captured.

Tom Gushue (GCMRC) Geospatial data analysis runs the gamut of all things GIS including field support, software, and training. Data management (Geospatial and Non-spatial) expanding to include Enterprise GIS and relational databases. Supports the fish monitoring database. Lake Powell Water Quality database published in 2022. Gold standard for where data resources need to be going. Very challenging with staffing. Need to hire database administrators and data scientists. Data Telemetry/Field Engineering/Internet of Things (IOT). Telemetry in Grand Canyon has been going on for 20 years and really started to take off. Can now link with Amazon Web Services. Huge growth area for natural resources monitoring. Other USGS science centers have helped with this.

Q&A and discussion
Larry Stevens (GCWC) Question on fisheries diet. 4% of smallmouth bass ate crayfish. Crayfish have not been detected in the Grand Canyon. Do you still have them? Any input on where they came from? **Maria Dzul (GCMRC**) Kate Bain had a limited sample size of six (6) fish that had crayfish. **Charles Yackulic (GCMRC)** They have been sent off to determine species identification. **Larry Stevens (GCWC)** That's a huge threat to the ecosystem and the tributaries downstream. **Brian Healey and Ryan Mann (AZGFD)** They have found northern and rusty crayfish in the far western Grand Canyon. Don't get a ton of them. Not certain about the ones at Lees Ferry.

Jim Strogen (FFI/TU) Any predictions on continued sustainability of Pearce Ferry Rapids as a barrier for nonnative fish. **Matt Kaplinski (GCMRC)** No. Just starting to look at elevation profiles through Pearce Ferry. Don't have a prediction of its demise. We have cameras on it. Going to do some elevation profiles and study it more intensely in the spring. We know it's been cutting down a bit in the last five years.

Larry Stevens (GCWC) Has the GCMRC library been integrated geospatially? **Tom Gushue (GCMRC)** Data holdings converted to digital a few years ago. **Larry Stevens (GCWC)** Can you create a geospatial library relating data collected to a geographic location. **Tom Gushue (GCMRC)** It would be awesome but a huge undertaking. Trying to resurrect the old spatial data and bring it into a modern format.

Sinjin Eberle (American Rivers) Regarding higher flow data and estimates of what it would cost, how accurate is that data. During FLAHG when we were discussing HFEs there was a lot of variability on this. **Lucas Bair (GCMRC)** Smallmouth bass flows are sensitive to energy prices but also to hydrology. Some flow experiments will be more expensive due to hydrology than others. Have not estimated uncertainty related to energy prices. What was presented today was just uncertainty related to hydrology.

David Brown (GCRG) Were other pricing hubs considered other than the Palo Verde hub**. Lucas Bair (GCMRC)** No, it was consistent with what was done with LTEMP.

Fiscal Year (FY) 25-27 TWP Priorities and Progress

Erik Skeie (Budget Ad Hoc Group [BAHG] Chair Presentation) Had five meetings since the beginning of February. Initial Draft is due March 17th to DOI. August is when AMWG sees it and then approved later in August. Budget is $12.5M. Project A database and website support has lacked funding in previous years. Project B is monitoring and research (sandbars). Project C is riparian vegetation monitoring and research. Project D is vegetation monitoring and archaeology. Project E is controls on ecosystem and productivity. Project F is aquatic invertebrate ecology. Project G is humpback chub population dynamics. Project X (New research project): Other native fish has been carved out of Project I and put into this project. Will be renamed. Project H is salmonid research and monitoring. May cancel Brown Trout early life stages studies. Project I is nonnative fish monitoring. Smallmouth bass modeling is new in Project I. Could also include other nonnative fish research like green sunfish. Project J is socioeconomics research. Project K is geospatial science, data management and technology. Project L is overflight remote sensing. Project M is leadership monitoring and research. Project N is hydropower monitoring and research.
Next BAHG meeting March 5 before initial draft TWP is due to DOI. Depends on feedback today and whether GCMRC wants to make changes.

Q&A and discussion
Andrew Schultz (GCMRC) Project M also has logistics involved. Been a major cost increase in logistics that will need to be addressed going forward.

Shana Rappaport (CRBC) What is the science advisor role in BAHG process? **Seth Shanahan (SNWA)** Science Advisor is used as another set of eyes on the TWP. Used in the next phase reviewing the full draft of the TWP.

Brian Sadler (WAPA) Shocking that there are a lot of added items. How do you prioritize this? Don't see we are stopping much. Not clear how you are prioritizing this. **Erik Skeie (BAHG Chair)** Working on prioritization exercise with Jeremy. This will help determine which of these new things will be funded.

Cliff Barrett (UMPA) Understood that Reclamation cannot be assigned to the AMWG, but Reclamation needs to coordinate with WAPA on doing economics studies on power. **Erik Skeie (BAHG Chair)** BAHG will need information on what this means. That's an outstanding question.

Larry Stevens (GCWC) In BAHG discussions we have emphasized the challenges of all these projects going on, but the program still looks like nothing is integrated, e.g. the suggestion to move towards a habitat based analysis for the riparian zone. The next three (3) years might be the opportunity to plan that complicated analysis vs launching into a whole suite of projects. Spending time in the planning process over the next 3 years seems like good idea.

Erik Skeie (BAHG Chair) Erik reviewed the specific questions they wanted feedback from the AMWG on.
Jakob Maase (Hopi) If there are crayfish issues needing to be investigated maybe we should develop a goal to work on that.

Larry Stevens (GCWC) Program review needs to take place in the next three (3) years. Not on anyone's budget. **Erik Skeie (BAHG Chair)** Has not been discussed. BAHG has not reviewed Reclamation's proposed budget yet. Will come up in March.

Larry Stevens (GCWC) Could engage citizen scientists in looking for important birds. Bald eagles not seen in 20 years. Golden Eagles are very important.

Jim Strogen (FFI/TU) We want to move towards taking the data and learning what we can and then applying it to solve problems, however, it's unclear who will fund it. **Erik Skeie (BAHG Chair)** Need to think about how this fits in.

Erik Stanfield (Navajo Nation) Can we expand the scope of mapping out the LCR. **Joel Sankey (GCMRC)** Yes that is a possibility. We do acquire some imagery of LCR, we could talk about what you want.

Leslie James (CREDA) Has anything been removed, or is this everything going on plus added items? **Erik Skeie, (BAHG Chair)** We removed brown trout early life stage studies. **Kim Dibble (GCMRC)** Noted that in Project I channel catfish monitoring in the LCR was removed.

Terra Alpaugh (Kearns & West) Are there subsequent conversations about cutting things out if they get too big? **Erik Skeie (BAHG Chair)** Much of that happens when this is turned into BAHG and TWG. Hope we know what the total budget will be by then.

Brian Healy and Bridget Deemer (GCMRC) We are making modifications to Project H (not 100% decided) and for Project E possibly removing budget for ISCO water quality sampling.

Public Comments
Lynn Hamilton (GCRG) Wanted to express to Jakob and everyone how distressed she is by the poor visitor behavior. River dates split between private trips and commercial trips. Have been trying to really develop respect for the cultural resources in the Grand Canyon. Commercial guides get lots of training, but this is something that needs to be addressed. For the guide training seminar, we are including indigenous speakers. Please join over March 30/31 at Hatch River Expeditions in Marble Canyon.

PUBLIC COMMENT: None
Meeting adjourned at 5:00 PM MST.

Thursday, February 29, 2024

Start Time: 8:30 AM MST
Conducting: Wayne Pullan, Bureau of Reclamation, Acting Secretary's Designee to the Adaptive Management Work Group (AMWG) and AMWG Chair
Designated Federal Officer: Kathy Callister, Bureau of Reclamation
Recorder: David McIntyre, SeaJay Environmental, LLC.
Facilitator: Terra Alpaugh, Kearns & West, Inc.

Welcome and Administrative

- **Introductions and Determination of Quorum**: **Terra Alpaugh (Kearns & West)** Roll call taken, and a quorum reached with 15 AMWG members represented.

Triennial Workplan (TWP) Day 1 Reflections

Wayne Pullan (AMWG Chair) There are a couple of misconceptions. First, the intention to protect elevation 3,500 was modeled in the LTEMP SEIS. We didn't talk about that as an absolute protection. Second, the issues with cavitation and sediment scour are being worked through. Doesn't mean we won't

use the river outlet works, just want to reduce the flow through them to avoid damage. **Nick Williams (BOR)** Reclamation is working off conservative estimates until more detailed modeling analysis is done. Once that data is available there will be clearer guidance on how to use the river outlets.

Bill Stewart (BOR) Bill reviewed the Reclamation side of the budget ($2.5M). Four projects. Projects A and B are administrative, Project C is more program management and ESA compliance, and Project D is cultural resources. Includes staff travel and public outreach. Funding allocated for stakeholder river trip.

Leslie James (CREDA) Has the vegetation management always been on Reclamation side, I thought it was on the USGS side. **Bill Stewart (BOR)** Reclamation pays NPS for the removal efforts. **Emily Palmquist (GCMRC)** NPS has always had a component on the Reclamation side. Project C has a line for GCMRC to assist Project D. GCMRC provides monitoring using remote sensing.
Terra Alpaugh (Kearns & West) Asked for other feedback on the TWP or anything else.

Jessica Neuwirth (CRBC) One priority for California is the smallmouth bass SEIS. Whatever plan we craft has to have a robust smallmouth bass monitoring plan. Need to be able to assess how the flows are working and if they are working. Need monitoring before, during and after.

Jim Strogen (FFI/TU) Currently there is no real effective method for monitoring smallmouth bass populations. Need a method in place to get those numbers.

Sara Price (CRCN) One of the reasons it is so critical to have money for monitoring is so we can have offramps. If we don't understand what's happening that is a problem. If there are problems need to be able to get in or get off.

Larry Stevens (GCWC) Can you describe the program review taking place at the end of the TWP?
Bill Stewart (BOR) In the LTEMP there is a statement that says after 10/1/2027 there will be a comprehensive review of LTEMP, and it ties back to monitoring metrics. Those need to be in place and show the trends since LTEMP started. Unclear if there is space in this TWP, maybe in the FY 28 TWP.
Larry Stevens (GCWC) Would help the research community to know what they are shooting for.

Heather Whitlaw (USFWS) Glad to hear this discussion on monitoring. Need clarity on what we are talking about. Need effectiveness monitoring including metrics around spawning and also survey/monitoring data on population response over time (before, during and after). It's two things. Are we meeting stated goals and are the treatments working (disincentive spawning)?

Wayne Pullan (AMWG Chair) When the smallmouth bass class of 2022 becomes reproductively viable could be a significant increase in the population. Will that happen in 2025 or 2026? That class will shape the invasion curve. To know how effective our actions are we need to measure against what happens if we don't do anything. Is that considered in the TWP?

Terra Alpaugh (Kearns & West) Yesterday additional funding was shown for smallmouth bass activity. Does that get to it?

Leslie James (CREDA) Is that Project I or are those activities interspersed among others? **Andrew Schultz (GCMRC)** Project I include new activities involving smallmouth bass. **Maria Dzul (GCMRC)** There are a lot of elements of Project I that do address smallmouth bass and potentially these flows. Difficult to estimate population abundance of fish you are removing. Precision is low. Unsure we can estimate anything based on removal alone. **Andrew Schultz (GCMRC)** Project I had the newest additions, and most were being responsive to the smallmouth bass.

Terra Alpaugh (Kearns & West) Do you think there is anything missing? When you report back at the annual reporting meeting will people be disappointed? **Andrew Schultz (GCMRC)** Couple of things we can do to track EDNA concentrations. Need to coordinate with GCMRC on the removal efforts so they can assist with that.

Heather Whitlaw (USFWS) At 1045 we're discussing smallmouth bass in more depth. I asked our folks if the nonnative fish strategic plan informed the TWP. Would have to fold in any SEIS ROD requirements. Right now, I think the Strategic Plan is the best we have for that coordination.

Erik Stanfield (Navajo Nation) How is the prioritization process happening? Like to be involved if possible. **Erik Skeie (BAHG Chair)** Prioritization process will happen in April after initial draft of TWP comes out. Jeremy and I tried to do that previously. Trying a new approach. Decision made by DOI.

Terra Alpaugh (Kearns & West) How do people get involved? **Erik Skeie (BAHG Chair)** If people want to be involved get with the BAHG members let Erik and Jeremy know and we'll get you involved.

Bill Stewart (BOR) This body will make the recommendation at the August AMWG meeting.

Larry Stevens (GCWC) Do we have models for prioritization decision making that would apply to this program that we can rely on? Any good ideas? **Erik Skeie (BAHG Chair)** I'm open to suggestions.

Christina Noftsker (NMISC) This has not been discussed at the BAHG but curious about 12 Mile Slough modifications and financing. **Terra Alpaugh (Kearns & West)** Being discussed in the nonnative discussion later today.

Wayne Pullan (AMWG Chair) Is there anything we're not thinking or talking about that might arise in the next 3 years? **Sara Price (CRCN)** Need to stay on task on a long term solution on nonnative fish. Need a permanent solution and need to discuss sooner than later. **Larry Stevens (GCWC)** Almost needs to run the program backwards. Program will be completed in 13 years. Need to know where we are headed with each program. Each element has its own trajectory, and we need to discuss it over the next three years, so we are ready for the 10 year review.

Jim Strogen (FFI/TU) Need to consider how to find ways to keep more water in Lake Powell so that some of these projects are less likely to occur. That involves conservation efforts from the states.

GCDAMP Tribal Liaison Update

Jamescita Peshlakai (GCDAMP Tribal Liaison) PRESENTATION Happy that tribal presentations are at the forefront of TWG and AMWG meeting. LTEMP Programmatic Agreement (PA) signed in 2017called for an annual meeting in April every year. No meeting from 2018 to 2021 due to staffing issues. First meeting in August 2022 and second in April 2023. Between April and August 2023, the Tribes indicated they would like a follow up at six months to prepare for annual meeting. Biannual meeting in October 2023. Third LTEMP PA meeting scheduled for April 8 and 9. Discussed the five tribal signatories to LTEMP PA. The Jan 2024 meeting was pushed to March 2024. River monitoring trips for FY23 were completed by each tribe.

Provided the tribes' calendar for meetings. Have new LTEMP SEIS cooperating agency letters from Hopi, Navajo, Zuni, and Hualapai. Havasupai Tribe are not part of LTEMP PA. Kaibab Paiute and Havasupai Tribe have not signed. Critical to get Havasupai Tribe letter since they live below the rim of the Grand Canyon. Both the Kaibab Paiute and Havasupai have new leadership. The 2021-2023 TWP had several activities budgeted for the tribes. Navajo Nation didn't have a project. Cultural sensitivity training

came to a halt in April 2023. Trying to get that moving again. Comes back to issues with U.S. government policies such as the removal of Native American children, not being allowed to practice traditional ways, etc. and then being asked to provide cultural metrics that are not part of this generation's memories. Need to think about what is shared for educational purposes and what can make sacred places vulnerable to desecration. Some funds from 2022 and 2023 need to be drawn down. Northern Arizona University Institute for Tribal Environmental Professionals has interns placed at USGS. River guides and tribal training are on hold right now. Ongoing projects include the nonnative fish memorandum of agreement (MOA), sediment study and cultural sensitivity training project. Tribes appreciate being involved in how to mediate the 12 Mile Slough and avoid impacts to wildlife. After slough is fixed what will we call it? Tribes would like a voice in this.

Operation Planning Updates – NEPA (Interim Guidelines SEIS, Post 2026, LTEMP SEIS)

Kathy Callister (BOR) PRESENTATION. Three NEPA projects are underway. The biggest difference among these is LTEMP SEIS is focused on sub annual flows and the other two projects focus on annual releases. Both the Near-Term SEIS and the LTEMP SEIS are focused on shorter term actions except for the High Flow Protocol in the LTEMP SEIS. The Post-2026 EIS is focused on 2026 and beyond. The Near-Term Operations Final SEIS anticipated in early March. ROD anticipated in April 2024. Coordinating with Tribes and Basin States on the Draft ROD. The Post-2026 EIS is in the alternative development phase. Hope to wrap that up in April 2024. Want to have a Draft EIS in December 2024. The LTEMP Draft SEIS Notice of Availability (NOA) was published Feb 9, 2024. Public comment period through March 25, 2024. The Final SEIS anticipated in May 2024. ROD anticipated in June 2024. Currently working through ESA and NHPA consultation.

Q&A and discussion

Brian Sadler (WAPA) When is deadline to submit alternatives? Answer is March. **Kathy Callister (BOR)** Earlier we have input the better, but we won't turn down qualitative input.

Nick Williams (BOR) Just energized last transformer bank at Glen Canyon Dam. All units will be available most of the time for the next several years.

Nonnative Strategic Plan Action Updates

Emily Young (Arizona Department of Water Resources [ADWR]); Melissa Trammell and Ed Keable (NPS); Bill Stewart (BOR) PRESENTATION

Emily Young (ADWR) Nonnative Fish Strategic Plan was developed by the Smallmouth Bass Ad Hoc Group (SBAHG). Came about from May 2022 TWG meeting. Goal is to develop alternatives that will interrupt spawning in the Colorado River. Alternatives presented in August 2022 meeting and followed up at Jan 2023 TWG and Feb 2023 AMWG. Cooperating Agencies in the Plan are USGS, USFWS, Arizona Game and Fish Department (AZGFD), and Reclamation. Need to do annual review prior to BAHG meeting. Not asking agencies to stop agency funded actions but to see if there are gaps to be addressed. A big issue with the Nonnative Fish Strategic Plan is how to get these actions going and how to reprioritize these actions. Will present SBAHG at next BAHG meeting on March 5, 2024.

Melissa Trammell (NPS) The Rapid Response Technical Team meets biweekly. GCMRC has developed a nonnative fish database. In 2023 multiple sampling trips at Lees Ferry and in the sloughs in addition to the chemical treatment August 2023 had additional trips beyond just the normal fish studying monitoring. A lot of sampling below Diamond Creek. Tributaries get less attention. NPS added a lot of effort on nonnative fish monitoring and removal due to new funding from Bipartisan Infrastructure Law (BIL) and the Inflation Reduction Act (IRA). NPS is doing boat electrofishing two weeks a month from May to

November. Glen Canyon National Recreation Area (GCNRA) staff captured over 1,000 smallmouth bass, mostly in Lees Ferry and in the sloughs. Many other nonnative fish species besides smallmouth bass; e.g. green sunfish, crappie, crayfish, walleye, and brown trout. Green sunfish have increased the fastest and the most, followed by smallmouth bass and then walleye. Walleyes get the biggest and can eat anything of any age. Still low on the invasion curve but creeping up. Rapid response is not enough to address the invasion curve for smallmouth bass and others. 2024 plans included increased efforts in the Paria Badger Rapids Reach, the sloughs, Lees Ferry, and tributaries. Rapid response focused on removal and not abundance estimation. However, sampling should be adequate to identify new locations, distribution, and relative abundance and whether reproduction is occurring and reproduction success. We are still seeing increases in nonnative fish and still in the rapid response phase. Need other sources for funding for mid- and long-term fixes.

Ed Keable (NPS) Gearing up for an active 2024 rapid response. Staffed up significantly and have more equipment and contracts. Hope to start in May in Glen Canyon and Grand Canyon. Look at chemical treatment also. Want to do electrofishing and nets and catch and relocate native fish before any chemical treatment. Will then assess need. Got the report last summer from Reclamation on the slough. Have formed an interdisciplinary team with staff from NPS units. Meeting regularly and talking to other agencies / experts. Actively looking at compliance paths and developing a work schedule. Need more information on project design. If a decision is made to move forward, we aim to construct in Fall 2024/ Early 2025 at the latest as long as Reclamation has funding. **Bill Stewart (BOR)** Couple weeks from having a design.

Q&A and Discussion
Heather Whitlaw (USFWS) Cannot afford to get higher on the invasion curve. Are we prepared if smallmouth bass or other nonnative fish become established in the LCR or other important tributaries? What's our plan? Sampling is good first start. **Ed Keable (NPS)** One of talking points Melissa had is that NPS has funding for the next 3 years, and we need funding for the future beyond that. **Leslie James (CREDA)** Encourage federal agencies to keep communication going with nonfederal partners. Lots of opportunities for nonfederal partners to weigh in and help financially.

Wayne Pullan (AMWG Chair) What are the difficulties and limitations in extrapolating from the fish we've captured to determine a total population. **Melissa Trammell (NPS)** Probably a question for GCMRC. If we really want to know what the numbers are we need to mark, capture and release. If looking at fish caught in main the channel, we're probably catching 10% of the total.

Drew Eppehimer (GCMRC) With removal efforts we can look at catch per unit effort for smallmouth bass. To fine tune abundance efforts mark, capture, and release is a method. NPS catch is being used by GCMRC to make estimates. **Jim Strogen (FFI/TU)** Are you looking at fish you have captured to determine where they come from, (entrainment versus reproduction) in the river? **Drew Eppehimer (GCMRC)** Different methods, kinships to determine which nests they come from or otolith to back calculate hatch dates which can inform this. Unknown what proportion are entrained vs spawned. Lack data on total abundance. **Charles Yackulic (GCMRC)** Regular monitoring of smallmouth bass over 150 mm has not changed dramatically but has seen increase in small smallmouth bass. That suggests while there is some entrainment going on now and, in the past, they are likely spawning. Not massive entrainment similar to what the model suggests. Caught two large smallmouth bass in 2022 and one in 2023 so it's not a substantial change. If we drop the elevation around 3,500 it is likely there will be more entrainment and a resultant population increase.

Wayne Pullan (AMWG Chair) Need to determine if level of entrainment justifies the expenditure for a curtain. Need to know what proportion survive entrainment. **Charles Yackulic (GCMRC)** Our model looks at rate of survival during entrainment. Fair amount of uncertainty, data is not based on smallmouth

bass. Literature is less certain about survival of small fish. **Drew Eppehimer (GCMRC)** Majority of the literature looks at trout species. Other specifics need to be accounted for.

Leslie James (CREDA) What is the silver bullet elevation level to prevent this? **Charles Yackulic (GCMRC)** Entrainment is an issue at elevation 3,525 but not the dominant issue, however, at elevation 3,510 or below, entrainment becomes a bigger issue. Other species likely being entrained at 3,525. Nonnative fish species found in Lake Powell exist at different depths. Walleye entrainment is likely happening at other elevations. Can still be an issue at elevation higher than 3,525. Need to be a lot higher to avoid temperatures that are not conducive to reproduction. Elevation of 3,560 in October would keep temperatures and reproduction down.

Jessica Neuwerth (CRBC) Looks like we're seeing spawning of smallmouth bass in early June in the slough. In the past we've not been able to disconnect the slough. What can we do this year to prevent reproduction this summer? **Melissa Trammell (NPS)** Going to try an experimental vegetation treatment to remove dense vegetation there. Flows will be lower this year than last year, which will help facilitate installation of a gill net. Hope to catch larger smallmouth bass to prevent spawning. Will be looking to remove adults. Planning on some snorkeling to identify nesting locations. Also looking at additional places in Lees Ferry where they might be spawning. **David Ward (USFWS)** Worried about the time frames. Lees Ferry slough will warm up in April and May and green sunfish are reproductive at 50 mm and can spawn multiple times a year. Caught 16,000 green sunfish last year. We have vast numbers of these fish that can utilize the Lees Ferry slough in April and May when it's warmer. **Jeff Arnold (NPS**) Customized block net will be placed at mouth, will have access to two electro fishing boats and will be intensively netting the slough. Will have 7 to 8 biologists this year as compared to two last year.

Larry Stevens (GCWC) All of these small fish feed on microcrustaceans. Don't know how much plankton comes through. Late summer is when these microcrustaceans reach super high numbers. Is there dietary data on the small fish being caught and are we monitoring their food sources coming through the dam? Particularly in late summer. **Charles Yackulic (GCMRC)** Couple of data streams that involve Phyto and zooplankton samples taken. In 2022 the number of zooplankton was much higher. ln 2023 was a bit less. Project E is looking hard at zooplankton and phytoplankton.

Larry Stevens (GCWC) Where are the walleye found in the Grand Canyon? If they are deep electroshocking won't be effective to detect them. Since they are established in the upper reaches of the river what do we know from the Upper Basin that could be applied here? **Melissa Trammell (NPS)** They are increasing in Upper Basin. Contributed to the declines of the Colorado Pike Minnow. They are abundant in the upper reaches of Lake Powell. Trying to catch them when they spawn. More vulnerable when spawning. Spawn in cooler temps and in main channel. They don't nest. **Larry Stevens (GCWC)** Habitat preferences in upper basin useful to look at.

Jim Strogen (FFI/TU) Given actions taken for smallmouth bass and the additional issues with green sunfish, walleye and striped bass are the actions take for smallmouth bass measures effective for these others or do we need additional actions. **Melissa Trammell (NPS)** Prevention of entrainment, cooling mix and the removal efforts will be good for other warm water nonnative fish but not for the walleye. The Upper Colorado River Basin Recovery Coordinator says to throw all our money at preventing the establishment of smallmouth bass and other nonnative fish like walleye. **Charles Yackulic (GCMRC)** Most of what we do for smallmouth bass is helpful for other species except walleye. More uncertainty with walleye. Are the individuals we've seen from entrainment or from spawning? Walleye has been below the dam for a couple of years in small numbers. Unknow origin. Cooler temperatures in January / February 2023 may have provided them a cue to spawn that was not there in 2022. Best solution is higher elevation. Summer cooling may not be effective for walleye.

Heather Whitlaw (USFWS) Julie Stahli in the Upper Basin is trying to get the word out that the real threat is smallmouth bass. Recommend we spend all our money on controlling that.

Jim Strogen (FFI/TU) Question on location of chemical treatments, is it hot spots or the slough. **Ed Keable (NPS)** Just the slough. **Jim Strogen (FFI/TU)** For monitoring at hot spots is the plan electrofishing mostly? **Melissa Trammell (NPS)** Have lots of different gear. Main stem electrofishing and backpack electrofishing, different nets, snorkels etc. Snorkels are just good for observation.

Bill Stewart (BOR) Reclamation Technical Services Center was hired to investigate various exclusion options. Reviewed variety of options. Presented to the TWG in 2022. Since then, a subject matter expert panel was formed to perform a deeper dive into these options. Draft Appraisal Report looked at thermal curtain and in-reservoir nets. More investigation is required. Need to look at the resident fish adjacent to the dam. The thermal curtain would span channel. Blocks warm water. Purpose to allow cool water to continue downstream. Near term steps are to finalize the draft report. Plan to start a bio fouling study. Also want to conduct temperature and total dissolved solids modeling and a value planning study.

Q&A and Discussion
Leslie James (CREDA) Will the report include costs? **Bill Stewart (BOR)** $25M installation costs. Doesn't include operations & maintenance (O&M). **Leslie James (CREDA)** Isn't the trade off what we're looking at? What's an endangered species worth? **Larry Stevens (GCWC)** We've spent more than $500M on humpback chub collectively. **Bill Stewart (BOR)** Need to ensure it works. Believe the things we do this year will tell us that. **Wayne Pullan (AMWG Chair)** O&M costs? **Bill Stewart (BOR)** Looking into that. Comes down to design. Bio fouling would inform that. Maybe doesn't need to be installed 24/7. Possibly remove when elevations are better.

Jim Strogen (FFI/TU) When would this be ready to go? **Bill Stewart (BOR)** Need to get through value planning first. There is a lot of planning that goes into this. For example, where to stage the 1,000 ft long net. There would be NEPA and then contracting. Then design. If in 4 years elevations are higher, we might not need it. Assume 1.5 years for NEPA and contracting is about 6 months. Best case estimate is 3-4 years. **Kathy Callister (BOR)** LTEMP SEIS not a good example for how quickly we can do NEPA?

Kelly Burke (GCWC) Question for Bill on the report and the options. Was there a discussion of combining several less effective things that can be brought on more quickly? **Bill Stewart (BOR)** Yes but almost everything involves the installation of something. It's almost as if all of these are in a similar time frame. Some not carried forward since we are talking long term. LTEMP SEIS is the mid-term solution and exclusion are a longer term solution. **Kelly Burke (GCWC)** What is the cost of ramping up conservation measures and approaches through these other planning processes we are engaged in? What are the cost benefit analysis of really accelerating those efforts that are outside the purview of AMWG? It's parallel to recognizing the cost of establishment of smallmouth bass far exceeds some of these shorter term costs.

Larry Stevens (GCWC) What about using the Colorado pike minnow and sterilized stripers to eat nonnative little fish. Bringing Colorado pike minnow back into the system is something everyone wants.

Ed Keable (NPS) Need to be clear that rapid response and slough channelization are a short term solution. Need all the tools we have to address this situation. NPS work is not a permanent solution.

Heather Whitlaw (USFWS) Why wasn't the deeper water withdrawal option explored more. Isn't Flaming Gorge doing that? **Bill Stewart (BOR)** Flaming Gorge has the selective withdrawal. Was looking at warming water but much higher priced relative to the thermal curtain. **Leslie James (CREDA)** The primary issue was concern about temperature. It was a one-way temperature control device and there

was a concern. **Heather Whitlaw (USFWS)** What does that mean? **Leslie James (CREDA)** At the time the USFWS was concerned about warming the water. **Nick Williams (BOR)** Flaming Gorge selective withdrawal is only to warm the water. When the reservoir was first filled, they went from perfect temperatures for recreational fishing to 4ºC year round. Selective withdrawal added in the 70s and it benefitted recreational fishing and some of the endangered fish. For Glen Canyon the temperature control device was underway in the early and mid-2000s, and we got 15/16ºC water in 2005. Suddenly started asking if we needed warm water or do we need cold water. The price tag by 2008 was $120M for two of the 10 penstock units.

Christina Noftsker (NMISC) Question on pilot study for the tucker trawl nets. **Jeremy Hammen (BOR)** Did pilot study a few weeks ago. Was a success. Going to require more weight to get into the right water column. Need to ensure we are sampling just entrained fish and not fish in that general area. Think we could get nets close to the dam to catch entrained fish. Need to decide if we should scale it up or not. Like to get hydro acoustics going up stream first. Current budget needs to pass before we move forward. **Cheyenne Ginther (HDR Engineering)** Is this Glen Canyon Dam Fish Escapement Draft Appraisal Report available for review yet? **Bill Stewart (BOR)** Give us a couple months.

Technical Working Group Chair Report

Seth Shanahan (TWG Chair) PRESENTATION TWG met twice since August 2023. June 2024 meeting may be pushed to July 10/11 or 17/18. This would allow TWG to hear from science advisors. Very excited to have the performance metrics document. Harder conversation will be developing the targets. Hearing from Socioeconomic AHG (SEAHG) we need to put parts of Project N into the Reclamation budget. Would like the SBAHG to meet more frequently. Currently shoe horning SBAHG into the BAHG process. Steering committee AHG (SCAHG) helps put all the agenda items together and aligns the interest of the TWG ahead of the meetings. Several experiments are upcoming in 2024. Are they all necessary? What are outcomes of the Spring HFE and what did we learn from last year? HFEs continue to make substantial sand deposits. How much sand export occurred based on high base flows over May / August? Can we retrofit Glen Canyon Dam to increase dissolved oxygen (D.O)? September air injection test to address low D.O. in Glen Canyon. Low D.O. is an issue for rainbow trout. No meaningful increase in D.O. observed during the test. Existing equipment is inadequate to increase D.O. TWG very interested in the brown trout incentivized harvest program. NPS have found money for a couple more years. Some evidence says this has worked. Research is being conducted on brown trout origin. Reviewed invasive fish research being conducted. Research useful to determine if smallmouth bass are spawning or coming in through entrainment. Slough is a big concern to the TWG.

Q&A and Discussion
Ed Keable (NPS) We have funding for this year and next, looking for more opportunities for funding.

Larry Stevens (GCWC) How bad is the D.O. situation. The summer months see lots of macrophyte vegetation that soaks up oxygen at night. Can make the D.O. level worse in zones where trout are feeding than in mid channel sensors. **Seth Shanahan (TWG Chair)** It's more complicated than one sensor placed in one spot. D.O. level variable. Thought it would be a problem this past year, but we didn't see the mortality we thought we'd see. More sensors would tell us more. **Larry Stevens (GCWC)** Cross sectional temperature profiling would get at that issue pretty easily. **Seth Shanahan (TWG Chair)** This issue comes up on the slough regarding temperature and D.O. and how it compares to the main stem.

Sinjin Eberle (American Rivers) Where is the Flow AHG? **Seth Shanahan (TWG Chair)** Don't have an active topic.

Potential Water Year 2024 Experiments

Jeremy Hammen (BOR) Presentation: Planning and Implementation (P&I) Team is made up of leadership and technical team members. They review information for running HFE and experimental flows. Try to get consensus on these and SOI makes final call. Fall HFE accounting period July 1 to Nov 30. Implementation period October to November. Need to hit certain triggers to do the HFE. Need a lot of sand load, six digits in metric tons, also need a positive value sand load balance. No fall HFE. Looking at a spring HFE and a proactive spring HFE for 2024. Different criteria for both. As trigger is approached review status and move forward in process. Spring HFE constraints are lack of sand and the sand they have is in the wrong spot. Not hitting triggers for proactive spring HFE either. Notifications have been made to tribes about possible HFEs. If we hit triggers likely happen April 15 to 22. Alternative flows are trout management flows and macroinvertebrate flows. Likely no LTEMP SEIS flows available this year.

Q&A and Discussion

Larry Stevens (GCWC) Don't want to forget the success of last year's spring HFE. Very positive effects across the board.

Stakeholder Updates

States:

- **Kristin Johnson (ADWR)** No update.
- **AZGFD -** Not present.
- **Jessica Neuwirth (CRBC)** No real update, waiting to see how the winter shakes out. Finalizing contracts under Bucket 1.
- **Michelle Garrison (CWCB)** Upper Colorado River Commission (UCRC) meeting next Monday to look at all projects. Significantly larger than last year in number of projects and estimated volume to be conserved. 2023 was a DROA release year and a recovery year rest of the time. Blue Mesa has recovered.
- **Christina Noftsker (NMISC)** Working on LTEMP SEIS comments. 20,000 acre feet (AF) of Jicarilla Apache water leased by Interstate Stream Commission for 10 years starting in 2023. Back in August 2023 reported they had released 15,000 AF on top of the spring peak release. Wanted to release 20,000 AF but only 15,000 AF possible due to channel restrictions. Released final 5,000 AF in September as augmenting base flows for recovery program. For 2024 targeting augmented base flows.
- **Sara Price (CRCN)** March very busy. Looking forward to seeing WAPA modeling results and the infrastructure report coming out in March. Also working on Lower Basin environmental compliance.
- **Amy Haas (Colorado River Authority of Utah)** Full recovery of all water previously released from Flaming Gorge in 2021 and 2022 was achieved yesterday. Anticipate reaching May 1 Flaming Gorge ROD target elevation. Upper division states will be releasing a four states alternative for modeling in response to the Post 2026 NEPA process. Focus is on Lake Powell and is consistent with Law of the River. Like to continue to have discussions with Lower Division states and want to get to a seven (7) state plan.
- **Charlie Ferrantelli (Wyoming)** System conservation pilot program has become more popular this year. Making it easier for people to participate. Last year had 64 projects and an estimated 38K AF of savings and this year almost doubled that in projects and 74K AF.

Tribes:

- **Jakob Maase (Hopi)** Received funding for an ethnographic project. Hiring docs with Human Resources. April 20 – 29 next river trip. Have hired new hydrologist who wants to get involved.
- **Hualapai Tribe** No one present.

- **Erik Stanfield (Navajo Nation)** LCR vegetation restoration project is large scale project, up to $5M, currently applying for funds. Focus on area from Cameron to Winslow. Lot of benefits for the Colorado River downstream and the Grand Canyon. Also submitting a project for funding under the cultural resources fund source related to birds and habitat and cultural values. Will complement some of the work GCMRC are doing. River trip in about 1.5 months. Invited two (2) NPS staff to join. Have done this with GCMRC in past.
- **Kurt Dongoskie (Zuni Tribe)** Ed was having trouble getting on. Defer to him so no report.
- **Daniel Bullets (Southern Paiute Consortium)** Annual River Trip June 8 to 17.

Nongovernmental Organizations (NGOs):
- **Sinjin Eberle (American Rivers)** Submitting comments on LTEMP SEIS. Working on technical alternatives for the Post 2026 EIS. The Webtool is very robust. Annual most endangered rivers report on April 16.
- **Larry Stevens (GCWC)** Wrapping up the Paria Beach restoration project March 29. River trip looking at reptiles and amphibian species of the river corridor May 23rd to help resolve long standing questions of biogeography about reptiles and amphibians.

Federal Power Purchasers:
- **Leslie James (CREDA)** Members are reviewing LTEMP SEIS and will be submitting comments. Will be submitting comments as an organization, but individual members will be submitting comments as well. Supply chain hit the renewable generation construction world hard. Solar and wind projects were delayed as costs went up. Priority for CREDA members is keeping lights on. We also want to express our sincere appreciation for Clayton Palmer who recently passed away. He worked for WAPA for 34 years. We often called him "Professor Palmer."
- **(UMPA)**. Not present.

Recreational Industry:
- **David Brown (GCRG)** Reviewing LTEMP SEIS. Guide training scheduled for March 30/31.
- **Jim Strogen (FFI/TU)** Native and wild trout conference sponsored by TU and AZGFD April 11. Film is about the Apache Trout recovery due to the White Mountain Apache Tribe, AZGFD, USFWS and other agencies.

Federal Agency Updates

USGS: Andrew Schultz New staff onboard. Mark Anderson is new deputy chief of GCMRC. Kim Dibble and Brian Healey are new scientists. Closer to getting new Center Director.

USFWS: Heather Whitlaw Fish and Wildlife Conservation Office is doing additional July main stem trip to seine backwaters to surveil smallmouth bass and to do mark/recapture study to improve humpback chub estimates in the Western Grand Canyon. This is in addition to regular September River trips. Also, in LCR Fish and Wildlife Conservation Office doing a second relocation of humpback chub above Chute Falls due to triggers being met. Ecological Services Office ramped up team and has created a Colorado River Branch. Have a supervisory biologist on staff Jess Guinn. Hired new staff person, Brittany Shows, also have Dan Leavitt. Also has Deb Williams, special assistant to the Regional Director, with funding from Reclamation. Most of our time is coordinating with Reclamation on the three NEPA docs. Doing the consultation and compliance.

Reclamation: Kathy Callister Working on the three NEPA EIS and the TWP. Pretty staffed up on adaptive management group. **Nick Williams (BOR)** Have an update on appraisal design and estimate for the low head hydro project. Value planning study completed in October 2022. Received stakeholder input on the alternatives developed. Moving forward with three alternatives: 1) The powerplant on the outlet

works (new powerplant), 2) Connecting the existing outlet works to existing powerplant and 3) the right abutment powerplant. This would be a tunnel around the right abutment of Glen Canyon Dam. Entirely new intake structure. Elevation to be determined and a new powerplant downstream of existing powerplant. Had some funding from a continuing resolution in 2022. Got us through the value planning study and the first two alternatives. Total funding $2.3M. Third alternative is going to need $1.6M more. Total cost to $3.9M. Timeline is late 2025 or possibly into 2026 before the entire effort done. Result would be an appraisal design and cost estimate for each alternative which could go into an appraisal study or might provide enough information to decide on next step. Next step is likely NEPA and then feasibility studies. That requires additional authority (Congressional) and more money. Appraisal design gives enough information to decide about moving ahead. In addition to looking at a powerplant this would have outlet works. Looking at how far into the deadpool storage to place intake. Looking at potential for moving sediment through that intake. Everything being learned about cavitation and limitations on outlet works is changing design considerations as we go into value planning study. Can't release as much water since they'll have same limitations with power generation as there are with the current river outlet works.
Wayne Pullan (AMWG Chair) Can you talk about Bucket 2 because it's restoration. **Katrina Grantz (BOR)** Have IRA funding for drought mitigation in the Colorado River Basin and $500M allocated to the Upper Basin and $125M to the System Conservation Pilot Program. The remaining amount would go to Bucket 2 which is long term conservation as well as ecosystem resiliency. Bucket 2 working both conservation and ecosystem resiliency together for that remaining amount of money and looking at options for what that program will look like. Meeting with interested parties and how they want the program structured. Want to finalize it so the ecosystem resiliency piece can be launched soon.
Wayne Pullan (AMWG Chair) There may be projects associated with our work that might be able to benefit from ecosystem funding.
Cassandra Reed (NPS) Could I get a link to info about the willow planting project? Larry Stevens will put a link to this in the chat.

NPS: Ed Keable Two new superintendents in the Colorado River Basin. Lake Mead and Arches Canyonlands. GCNP has launched a new program around climate change. Trying to educate ourselves and visitors on the effects of climate change on our parks.

BIA: Not present.

WAPA: Brian Sadler. Reviewing LTEMP SEIS. Want to ensure hydropower impacts are adequately described. Working with the National Renewable Energy Lab and Argonne National Lab on the analysis of the hydropower impacts. Close to submitting comments. Working on presentation to walk everyone through this analysis. Hopefully later in March. Invites coming.

DOI Solicitor's Office: Rod Smith: Been reporting since 2019 on the LTEMP SEIS lawsuit. Prevailed at the district court phase and in the appellate court phase. Now in the 9th circuit. Probably 6 to 8 months for an opinion, maybe as early as late summer.

USFWS: Heather Whitlaw Humpback chub recovery team working on species status assessment. Updating the 2002 recovery plan. Doing recovery implementation strategy.

Public Comment
Jen Pelz (Grand Canyon Trust) Thanked everyone. Two things that are interesting are Helen's presentation about the archaeological sites and the graph about the number of sites that are disconnected from their sand sites from 1973 to present is very dramatic. HFEs very important to that. Will be engaging on LTEMP SEIS. In the LTEMP SEIS, HFE and smallmouth bass flows need to be thought of in the larger context. Without water in Lake Powell none of this is possible. Encourage work toward a more sustainable system.

Lynn Hamilton (GCRG) Want to emphasize and second what Larry said about the importance of HFEs. Glad to see the HFE protocol will be changed regarding the sediment accounting periods and implementation windows through the LTEMP SEIS for the length of the LTEMP. We need water to do these. Real boon to have the HFE last spring. Game changer for recreational experience although the high flows that followed really knocked it back. Want to maintain the longevity of those deposits. Last, in September when flows dropped to 5K cubic feet per second it had devastating impacts on river runners. Need a lot of notice so guides can be prepared. Like Bureau to make an effort to notify everyone in advance of flow changes.

John Dillon (Grand Canyon River Outfitter's Association) He represents the 16 commercial outfitters that run river trips in the Grand Canyon. All 16 concessionaire contracts have been renewed and all 16 incumbents have been awarded. Some of the outfitters have been around since the 1920s/30s. Excited to be on water April 1st. Want to be available in any way. Particularly with regards to data gathering and observation. If we can be helpful, please let us know. HFE was amazing. Flows matter. Super job by Wayne and Ed Keable on communicating the changes in flows last years.

Closing Comments
Wayne Pullan (AMWG Chair) Now is a great time to be working on the Colorado River. Next AMWG meeting is May 15 and it's virtual. August 26/27 AMWG will be at the Grand Canyon. We'll have a TWP by then. We may be in construction at 12 Mile Slough. We made progress on Bucket 1 and 2. By then a couple of SEIS will be complete. We'll be working on alternatives for Post 2026 EIS, and we might be implementing smallmouth bass flows.

Meeting adjourned at 2:37 PM MST

Participants

AMWG Members, Alternates and Leadership

Amy Haas (State of Utah)
Bart Stevens (BIA)
Betsy Morgan (State of Utah)
Brian Sadler (WAPA)
Carrie Cannon (Hualapai Tribe)
Charlie Ferrantelli (State of Wyoming)
Christina Noftsker (State of New Mexico)
Cliff Barrett (UMPA)
Daniel Bulletts (Southern Paiute Consortium)
Daniel Picard (BOR)
Ed Keable (NPS)
Edward Wemytewa (Pueblo of Zuni)
Emily Zmak (State of Colorado)
Erik Stanfield (Navajo Nation)
Heather Whitlaw (USFWS)
Jess Newton (USFWS)
Jessica Neuwerth (State of California)
Jim Strogen (FFI/TU)
Kathy Callister (BOR)
Kelly Burke (GCWC)
Kevin Garlick (UMPA)
Kristin Johnson (State of Arizona)
Kurt Dongoske (Pueblo of Zuni)
Larry Stevens (GCWC)
Leslie James (CREDA)
Michelle Garrison (State of Colorado)
Richard M Begay (Navajo Nation)
Sara Price (State of Nevada)
Shana Rapoport (State of California)
Sinjin Eberle (American Rivers)
Warren Turkett (State of New Mexico)
Wayne Pullan (Acting Secretary's Designee, Reclamation)

Other GCDAMP Members and Interested Persons

Alex Pivarnik (Reclamation)
Alex Walker (Reclamation)
Andrew Schultz (GCMRC)
Becki Bryant (Reclamation)
Bill Persons (FFI/TU)
Bill Stewart (Reclamation)
Brian Healy (GCMRC)
Brian Hines (Reclamation)
Bridget Deemer (GCMRC)
Brittnee Shows (USFWS)
Cassandra Reed (NPS)
Cheyenne Ginther (HDR Engineering)
Christina Kalavritinos (DOI)
Clarence Fullard (Reclamation)
Dan Leavitt (USFWS)
Dani Greene (CRCN)
David Brown (GCRG)
David McIntyre (SeaJay Environmental)
David Ward (USFWS)
Deb Williams (USFWS)
Drew Eppehimer (GCMRC)
Jeff Arnold (NPS)
Jen Pelz (Grand Canyon Trust)
Jeremy Hammen (Reclamation)
Joel Sankey (GCMRC)
Josh Randall (CAP)
Kate Behn (GCMRC)
Katherine Tucker (Reclamation)
Kim Dibble (GCMRC)
Laura Tennant (NPS)
Lucas Bair (GCMRC)
Maria Dzul (GCMRC)
Mark Anderson (GCMRC)
Matt O'Neill (Reclamation)
Matthew Alinsod (Reclamation)
Melissa Trammell (NPS)
Michellesey Benally (Grand Canyon Trust)
Nick Williams (Reclamation)
Nicki Gibney (NPS)
Rob Billerbeck (NPS-GLCA)
Rodney Smith (DOI)
Ryan Mann (AZGFD)

Ed Gerak (Irrigation and Electrical Districts of AZ)
Elise Rumpf (USGS SBSC)
Elyssa Shalla (NPS)
Emily Omana Smith (NPS-GRCA)
Emily Palmquist (GCMRC)
Erik Skeie (CWCB)
Helen Fairley (GCMRC)
Jakob Maase (Hopi Tribe)
Jamescita Peshlakai (Reclamation)
Jan Balsam (NPS)
Ryan Randol (Reclamation)
Seth Shanahan (SNWA)
Shana Tighi (Reclamation – LC)
Tara Ashby (Reclamation)
Taylor McKinnon (Center for Biological Diversity)
Ted Rampton (CREDA)
Terra Alpaugh (Kearns and West)
Thomas Gushue (GCMRC)
Trevor Updyraff (WAPA)
Zachary Nelson (Reclamation)

Acronyms and Abbreviations

ºC – degrees Celsius
ADWR – Arizona Department of Water Resources
af – acre-feet
AGH – Ad hoc group
AMWG – Adaptive Management Work Group
AZGFD – Arizona Game and Fish Department
BAHG – Budget Ad Hoc Group
BIA – Bureau of Indian Affairs
BIL – Bipartisan Infrastructure Law
BOR – Bureau of Reclamation
CFS – cubic feet per second
CRBC – Colorado River Board of California
CRCN – Colorado River Commission of Nevada
CREDA – Colorado River Energy Distributors Association
CY- Calendar Year
CWCB – Colorado Water Conservation Board
DCP – Drought Contingency Plan
D.O. – dissolved oxygen
DOI – (U.S.) Department of the Interior
DROA - Drought Response Operations Agreement
EIS – environmental impact statement
ESA – Endangered Species Act
FACA – Federal Advisory Committee Act
FFI – Fly Fishers International
FLAHG – Flow Ad Hoc Group
FY – Fiscal Year
GCDAMP – Glen Canyon Dam Adaptive Management Program
GCMRC – Grand Canyon Monitoring & Research Center
GCPA – Grand Canyon Protection Act
GCRG – Grand Canyon River Guides
GCNP- Grand Canyon National Park
GCNRA-Glen Canyon National Recreation Area
GCWC – Grand Canyon Wildlands Council
HFE – High Flow Experiment
IRA- Inflation Reduction Act
JCM – Juvenile chub monitoring
LCR – Lower Colorado River
LTEMP – Long-term Experimental and Management Plan
maf -million-acre-feet
m/s – meters per second
mg/liter – milligrams per liter
MOA- memorandum of agreement
MST – Mountain Standard Time
NEPA – National Environmental Policy Act
NHPA National Historic Preservation Act
NOA – Notice of Availability
NGOs – non-governmental organizations
NMISC – NM Interstate Stream Commission
NPS – National Park Service
O&M – operations & maintenance
PA – Programmatic Agreement
P&I – Planning and Implementation
Reclamation – Bureau of Reclamation
ROD – Record of Decision
SAHG – Socioeconomic Ad Hoc Group
SBAHG – Smallmouth Bass Ad Hoc Group
SEIS – supplemental EIS
SOI – Secretary of the Interior
SWE – snow water equivalent
TU – Trout Unlimited
TWG – (GCDAMP) Technical Work Group
TWP – Triennial Work Plan
UCR – Upper Colorado River
UMPA – Utah Municipal Power Agency
USFWS – U.S. Fish & Wildlife Service
UCR – Upper Colorado River Commission
USGS – United States Geological Survey
WAPA – Western Area Power Administration