Glen Canyon Dam Adaptive Management Work Group Meeting
February 15-16, 2017

See the last page for abbreviations and their meanings.

Summary of Actions Taken

- Motion to Approve the August 24-25, 2016, Meeting Minutes.
  Moved by Chris Harris, seconded by Larry Stevens, passed by unanimous voice vote pending a minor edit offered by Mr. VanderKooi.

- The Charter Ad Hoc Group recommends that AMWG recommend renewal of the AMWG Charter by the Secretary with changes as noted in the attached.
  Moved by Steve Wolff, seconded by Chris Harris, passed by unanimous voice vote.

- The AMWG believes that in moving forward with any new actions to manage brown trout (BT) in the Lees Ferry reach of the Colorado River, it would be beneficial to work to develop a plan based on the most up to date information and that has involvement from interested members of the AMWG. Accordingly, the AMWG requests that the Secretary of the Interior direct the National Park Service and the Grand Canyon Monitoring and Research Center and request the Arizona Game and Fish Department to organize and facilitate a workshop among scientists, managers, tribes, and interested stakeholders to address: (1) the root causes of the increases in BT, (2) the risks associated with an expanding BT population to a quality rainbow trout fishery in Lees Ferry and the recovery/conservation of humpback chub and other native fish down river, (3) the pros and cons of different experimental and management options to address those risks including but not limited to mechanical removal, trout management flows, and the current High Flow Experiment protocol, (4) the research needs to support more informed decisions moving forward, and (5) management recommendations for minimizing the negative effects of brown trout. Management recommendations should take into consideration expressed tribal concerns regarding the taking of life. Results from the workshop, and any recommended actions based on them, should be reported to the TWG and presented to the AMWG at the August 2017 meeting.
  Moved by John Jordan, seconded by Larry Stevens, passed by consensus.

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February 15, 2017 **Start Time**: 9:30 a.m.
Conducting: Brent Rhees, Secretary's Designee's Alternate
Facilitator: Mary Orton, The Mary Orton Company, LLC
Recorder: Linda Whetton, Reclamation

Meeting Attendees

Welcome and Administrative. Mr. Rhees welcomed the members and general public. A quorum was determined. Approval of August 24-25, 2016 Meeting Minutes. Pending one edit, the minutes were approved by consensus (see actions taken, first page). Mr. Stevens reminded the group that Mr. Perry Shirley had suggested inviting the Navajo Nation tribal elders to an AMWG meeting and asked if anything had been done. Mr. Rhees said there have been some internal discussions but with Perry's retirement, this item was put on hold. However, he has asked Ms. Rinkevich and Ms. Pasqual to keep track of this.
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- Action Item Tracking Report - Dr. Grantz. The CAHG action item will be closed after Ms. Callister's report today. The other two actions will be addressed in the future now that the LTEMP ROD is in place.
- Ms. Balsom introduced Ms. Lehnertz, new superintendent at Grand Canyon National Park. Ms. Lehnertz has been with the Park for about five months. Prior to that she served as the superintendent at Golden Gate National Recreation Area and previous to that was deputy superintendent at Yellowstone National Park.
- AMWG Reappointments: Steve Spangle (member) and Kirk Young (alternate) from USFWS.
- TWG Member Appointments: Carlee Brown (Colorado); Ryan Mann (AZGFD); Ken Hyde (NPS/GLNRA); and Chris Budwig (FFF/TU).
- Mr. VanderKooi introduced Mr. Moran, who started working for GCMRC in November 2016 as the deputy chief. He previously worked at the USGS Nevada Water Science Center for 10 years and prior to that was in South Dakota with the USGS National Water Quality Assessments Program.

Charter Ad Hoc Group (CAHG) Update – Ms. Callister. The CAHG was reconvened to review the AMWG Charter in preparation for its renewal before August 2017. They reached consensus on many things and also sought advice from the DOI Solicitor's Office. The members discussed the report and the concerns expressed by some members relative to not taking out the Desired Future Conditions and referencing the LTEMP goals. Other members of the CAHG didn't want to make significant changes out of respect for the incoming Secretary's Designee who may wish to revise the Charter. Responding to a request from Ms. Kartha, the CAHG's meeting notes will be provided with the revised charter to the Secretary. A motion was passed with a recommendation to the Secretary on the Charter (see actions taken, first page).

LTEMP – Overview of the ROD and What it Means for AMWG, Dam Operations, and GCDAMP Priorities – Dr. Grantz. The Long-Term Experimental and Management Plan (LTEMP) ROD is Interior's decision on the LTEMP EIS and defines how Glen Canyon Dam will be operated for the next 20 years using the Preferred Alternative. The ROD states that the goals and objectives of the LTEMP are consistent with those of the GCDAMP and the identified resource goals. Dr Grantz noted that implementation of LTEMP monthly releases began on January 1, 2017, with LTEMP ramp rates and daily fluctuations to be phased in no later than October 1, 2017. Spring HFEs may take place after Sep. 30, 2019, and Low Steady Flows after October 1, 2027 if conditions defined in the EIS occur. Reclamation, in consultation with WAPA, will make specific adjustments to daily and monthly release volumes during the water year to adjust to changing hydrology and operations while not affecting the annual release volume. Reclamation is near completion on the Programmatic Agreement, which includes Section 106 compliance.

Lees Ferry Trout Fishery Status – Mr. Jordan said Mr. Cantrell (AZGFD) and Ms. Gunn would make presentations.

Mr. Cantrell stated AZGFD's goal to "maintain and enhance a Blue Ribbon Trout Fishery at Lees Ferry …" hasn't been realized and the four objectives of that goal have failed in their expectations. Since 2011, people have been concerned with RBT impacting HBC downstream. He expressed that a model created by Mike Yard indicates the RBT migrate at very low rates downstream to areas occupied by HBC thus limiting their negative impacts on HBC. He also expressed concern that Brown Trout may have severe negative impacts on the fishery. Literature suggests BT are seasonal migrators. AZGFD recommends immediately offramping the fall HFEs until more is understood about BT and any relationship to fall HFEs. He suggested

holding a BT management workshop to address: (1) the root causes of the increases in BT, (2) the risks associated with an expanding BT population to a quality RBT fishery in Lees Ferry and the recovery/conservation of humpback chub and other native fish down river, (3) the pros and cons of different management options to address those risks, and (4) the research needs to support more informed decisions moving forward.

Ms. Gunn (via telephone) said the Lees Ferry Trout Fishery can't be maintained as a blue ribbon fishery and businesses have suffered. In the past, their lodge operated year-round but with the high flows, they've suffered negative economic impacts, as have other Marble Canyon businesses. She expressed that fall floods scour the river and push the scour up on the beachesand that they don't see any growth coming back on the beaches. She said it's not reasonable for owners to close their businesses for two weeks while HFEs are being run. She questioned what it would it take to consider stocking fish.

Mr. Jordan said that even though there's been encouraging news of increased HBC distribution and abundance in the mainstem, the discouraging news is the increased abundance of BT in Lees Ferry. He noted that the goal of a high quality RBT fishery at Lees Ferry is not consistent with a BT population increase. He mentioned that a lot has been learned recently about RBT movement, while much less is known about BT movement including their threat to HBC and RBT. Mr Jordan noted that the revised triggers for HBC in the LTEMP BO and BA call for non-native mechanical removal of fish at the LCR only as a last resort and, as a result of declining HBC. He relayed that at the Annual Reporting Meeting (ARM), it was disclosed that BT concerns have led to DOI agency consideration of mechanical removal throughout Lees Ferry. Mr Jordan expressed that the consideration originated largely from internal discussions that excluded collaborative participation from stakeholders and interested agencies. Mr Jordan noted that it is within the LTEMP framework of adaptively managing dam operations and other management experiments that the Lees Ferry trout fishermen offer the following motion for consideration:

> *The AMWG believes that before moving forward with any new actions to manage brown trout (BT) in the Lees Ferry reach of the Colorado River, it would be beneficial to work to develop a plan based on the most up to date information and that has involvement from interested members of the AMWG. Accordingly, the AMWG requests that the Secretary of the Interior direct the National Park Service, and request the Arizona Game and Fish Department, to organize and facilitate a workshop among scientists, managers, tribes, and interested stakeholders to address: (1) the root causes of the increases in BT, (2) the risks associated with an expanding BT population to a quality rainbow trout fishery in Lees Ferry and the recovery/conservation of humpback chub and other native fish down river, (3) the pros and cons of different management options to address those risks, and (4) the research needs to support more informed decisions moving forward. The workshop should also review the efficacy of the current High Flow Experiment protocol in light of new scientific information and how it could be modified to allow for more frequent Spring HFEs to conserve sediment and enhance biological resources in the Colorado River below Glen Canyon dam. Results from the workshop, and any recommended actions based on them, should be reported to the TWG for consideration in development of the Triennial Work Plan and presented to the AMWG at the August 2017 meeting.*

Comments included the following

- Mr. VanderKooi said that while there are many strong opinions, the scientists are not in agreement as to whether BT are creating a crisis situation. However, they do support a basin-wide approach. He noted the cautionary tale of what has happened in the Upper

Basin over the last 10-20 years, where warm water non-native fish have entered and run rampant.

- WAPA expressed concern about a potential impact to the HBC and perhaps a jeopardy opinion.
- The Upper Basin recovery program has had to re-balance the entire program to address non-native predation on native fish.
- The Hopi tribe expressed concern about a large-scale killing activity in the Grand Canyon, and noted that holding a workshop would allow for more planning for cultural resource compliance.
- California comes at this from a perspective of compliance with the ESA. And asked whether AZGFD could develop a timeline with respect to actually taking some sort of management action?
- NPS representatives noted that the Grand Canyon National Park's Comprehensive Fisheries Management Plan gives the NPS direction consistent with commitments made in the LTEMP ROD, and addressesthreats in the system. The plan is inclusive of DOI and the stakeholders so there is the opportunity to move forward collaboratively It was noted that the Program may need to exercise caution until direction is received from the new Administration.
- Concern was expressed about competing timelines for a workshop, considering the TWG meetings in April and June. Is there sufficient time to conduct a workshop and provide information by the June TWG meeting? We also have to consider preparation for presentations for the AMWG in August.
- Mr. Dongoske (on the telephone) said the letter from the Governor of Zuni contains wording that encourages due recognition and consideration of Native American concerns regarding management actions that include euthanasia. He suggested adding something to the motion about the Tribal concerns for the taking of life.

The motion was revised on screen during discussion. Mr. Jordan proposed the motion and Mr. Stevens seconded the motion. Hearing no objections, the motion was passed by consensus (see the language on page 1 under actions taken).

Basin Hydrology and 2017 Dam Operations – Mr. Davidson. On January 1, 2017, the Upper Basin snow water equivalent was 121% of median. By January 26, it was 167% of median with a total average seasonal accumulation of 97%. As of yesterday, February 13, the basin was at 159% of median, so the winter season is off to a good start. Lake Powell is 46% full. The April to July 2017 forecasted inflow for Upper Basin reservoirs ranges from 120% to 168% of average, with Lake Powell forecasted at 134%. The 2017 operating tier was set in August 2016 as the Upper Elevation Balancing Tier with an initial release of 8.23 maf and the possibility of an Apil adjustment to balancing releases of 8.23-9.0 maf, or equalization releases of >8.23 maf. Based on January 2017 modeling, the minimum, most, and maximum probable inflow scenarios project an April adjustment to balancing releases and an annual release volume of 9.0 maf for water year 2017. Reclamation is using the LTEMP monthly release patterns to guide monthly release volumes through the end of the water year. Because some monthly releases had already been pre-scheduled, the monthly release volumes for the remainder of the water year may not exactly match the LTEMP monthly volumes in a 9.0 maf year; however, the general pattern will be adhered to as closely as possible and reasonable. During February and March 2017, three hydropower units will be offline

Technical Work Group Chair Report – Mr. Shanahan thanked the TWG Steering Committee AHG members for their assistance in preparing for meetings, and gave the following highlights from the October 2016 and January 2017 TWG meetings:

- In-depth discussions occurred on a potential Fall 2016 HFE and concerns with Green Sunfish.
- Lucas Bair provided economic value results for Grand Canyon whitewater floaters and Glen Canyon angler values.
- The TWG received a report about the recent increases in BT detections in Glen Canyon and the efforts led by the resource management agencies—NPS, AZGFD, and Reclamation—to manage the impacts of this species on humpback chub and rainbow trout.
- The TWG was tasked in August 2016 to review the FY17 budget to determine if the LTEMP ROD required any budget changes. The ROD stated that research and monitoring projects already underway would proceed through their completion. TWG reviewed the FY17 Budget and determined that no changes were needed.

GCDAMP Triennial Budget and Work Plan Process. Due to time constraints, this item was postponed. It will be added to the May 24, 2017 (webinar) meeting agenda.

GCDAMP Wiki Update – Mr. Ellsworth. The GCDAMP Wiki site was established in 2012 for the purpose of gathering information and creating a history of the program in a user-friendly format. Numerous stakeholders contribute to the site and its content is constantly increasing. There are links to other GCDAMP stakeholder websites. The wiki site is organized in such a way for people to find, utilize, and store information from the GCDAMP. People are encouraged to upload information and to use the training modules. He demonstrated the functionality of the website.

Knowledge Assessment Update – Mr. Shanahan. In planning for this year's Knowledge Assessment, an effort was made to simplify the information and make it accessible so that anyone could quickly understand the status of any resource.. A parallel process to address the differences between resource topics and tribal cultural values in a respectful manner was attempted, but was not achievedHe noted, however that, good conversations with the tribal representatives occurred and a path forward for integrating the tribal perspectives into knowledge assessments overall was identified.

Dr. Braun. There are three core bodies of information on the eleven resource topics being assessed:

1. Status and trends for resources central to an adaptive management program.
2. The key external factors that are affecting the condition of that resource.
3. The strength and direction of those effects, and what is the expectation for how these actions will affect the resources of concern.

Critical certainties and uncertainties will be identified based on expert confidence. There is an information structure to provide something standardized. For each measure, the expert teams assessed status and trends, drivers and constraints, and the strength and direction of effect, known or expected, of the experimental management actions. A series of spreadsheet tools were developed to support the work, using consistent terms and definitions. The expert teams were also encouraged to provide a rationale, including citations as appropriate, for recommendations. All teams are expected to return their edits by March 8 with a final report from the SAEC to the TWG is expected by March 15.

2017 GCDAMP Annual Reporting Meeting Update - Mr. Moran.

- Project 2: How GCD operations affect flows, water quality, sediment transport, and sand budgets in the CRE. GCMRC uses the Duration Curve Tool, which models user interaction for some data that's continuously monitored. There are different areas of erosion in the river. The 2004 and 2008 HFEs revealed erosion in Upper and Lower Marble Canyon and Eastern Grand Canyon, but no change in Western Grand Canyon. The flood hydrograph of each of the 2016 HFEs showed different responses.
- Project 3: Ongoing data collection, processing, storage, and analysis of sandbars and sediment dynamics. The total sandbar volume seems to be declining even after the most recent event, and it is speculated that higher balancing flows likely caused more erosion than previous years. Post-2016 HFE data revealed net deposition at 9 sites, erosion at 2 sites, and no net change at 3 sites. Progress is being made towards a process-based model for sandbar response.
- Project 4: Connectivity along the Fluvial-Aeolian Hillslope Continuum. Most archaeological sites are located above the HFE stage throughout Grand Canyon, so during HFEs, these sites are above the water. To preserve the sites, there are two options: (1) Flood and bury sites with larger, sediment-rich HFEs, or (2) Rely on wind to move sediment from sandbars to cover sites. LIDAR surveys in Glen Canyon revealed there was net erosion in upper Marble Canyon, lower Marble Canyon, and east central Grand Canyon. There was net deposition in eastern Grand Canyon and west central Grand Canyon.
- Project 13: A bioeconomic model to identify the cost-effective management strategy for removal of RBT and achieving HBC population goals. The model indicates that using between one and two removals is optimum with respect to cost effectiveness. Ongoing research on HBC will identify the importance of parameter uncertainty in prioritization of monitoring and research. Additional management options and associated costs, such as trout management flows, will be considered to improve HBC survival.

Mr. VanderKooi provided the following updates:

- Project Element 11.1: Ground-based Vegetation Monitoring. Results reveal that Glen Canyon has the highest total foliar cover and woody cover. Woody cover is notably high in Glen Canyon, on sandbars in Marble Canyon, and on channel margins in Eastern Grand Canyon. Foliar cover remains relatively stable in this short time frame. Method comparisons were made to determine the best technique of measurement.
- Project 12: 2016-17 photo matching and analysis of change. Thirty-five panoramas were matched from the 1923 Birdseye Expedition. Tamarisk, an invasive riparian shrub, occupies the most area of all riparian vegetation species in the canyons. The tamarisk shrub is preyed upon by tamarisk beetle, which was introduced in this region in 2009.
- Aquatic Foodbase Conceptual Model. Results from the 2008 spring HFE revealed low-quality prey (worms and mudsnails) decreased while high-quality prey (insects and Gammarus) increased. In post 2012-2016 fall HFEs, invasive mudsnails are becoming dominant while the numbers of insects in drift remains low. There were higher concentrations of invertebrate drift back to 2012, but it dropped in 2014. This also coincides with a decline in HBC condition factor and decline in RBT abundance. The variable flows and daily times in hydropower production may be influencing aquatic insects. The timing of midge egg laying is consistent with observations of greatest midge abundance at sites where flows are low at dusk. This supports the hypothesis that daily flow variation limits aquatic insects that lay eggs along river margins and supports the rationale for testing bug flows.
- Humpback Chub Updates. There are higher numbers of HBC in the Little Colorado River but annual spring abundances of HBC are lower in the Little Colorado River. Overall, fish are widely disbursed throughout the system. Low spring abundance of Colorado River HBC is

likely due to substantially smaller proportions of adults moving into the LCR in 2015 and 2016. It appears the adult fish population is relatively stable; they are robust fish and can undergo a lot of adversity. Juvenile HBC survival in the Colorado River study reach is variable regardless of flow and is negatively related to increased RBT abundance.

- Rainbow Trout Updates. The system is food limited, there are higher mortality rates for larger size classes, then a period of low abundance of trout. In 2016, more fish were back in the system. Rainbow trout densities remain highest in Glen Canyon and the upstream third of Marble Canyon, and lowest downstream of the confluence with the Little Colorado River. The effects of Fall HFEs on RBT growth in Glen Canyon show spring and summer growth lower after 2012 and 2013 HFEs, but higher after the 2014 HFE. Growth was positive in the fall interval after no HFE in 2015 and even greater in the fall interval after the 2016 HFE, indicating no consistent effect on trout growth during HFE intervals.
- Brown Trout. BT removal using electrofishing occurred in the mainstem Colorado River near the confluence with Bright Angel Creek in early February 2016. The removal effort was scheduled for February 2016 to avoid conflicts with a potential November 2015 High Flow Experiment (which did not occur) and associated logistical constraints. Because of the interest in BT, Lucas Bair and Jeff Muehlbauer developed surveys that they'll be sending to scientists to get their opinions on this issue. The first survey asked about causes and the second requested possible solutions.

Public Comment: None

Adjourned for the day: 4:25 p.m.

February 16, 2017 **Start Time**: 8:30 a.m.
Conducting: Brent Rhees, Secretary's Designee's Alternate
Facilitator: Mary Orton, The Mary Orton Company, LLC
Recorder: Linda Whetton, Reclamation

Welcome and Administrative. Mr. Rhees, Alternate for the Secretary's Designee, welcomed the members and general public. A quorum was determined and introductions made.

Estimating Non-Use Values for Alternative Operations of the Glen Canyon Dam: An Inclusive Value Approach – Dr. Jenkins-Smith. The results of an integrated research program that developed a replicable, multi-stage protocol for estimating non-use values for proposed alternatives of the Glen Canyon Dam (GCD) were presented. Based on the options developed in the draft LTEMP DEIS, the study evaluated the net non-use value difference between the DEIS "preferred alternative" (Alternative D) and the current operational program (Alternative A/No Action) for the GCD. The researchers found that non-use values for continuing current operational patterns at the GCD substantially outweigh those for the proposed preferred alternative, whether measured as a simple non-cost referendum or through estimates of household willingness to pay (WTP). A conservative estimate of median household WTP for continuing the current pattern of GCD operations is $20.19 per year. Estimated median WTP to change dam operations as described for the DEIS preferred alternative is $0.43 per year. The net household WTP to continue current dam operations is thus $19.76. Mr. Jenkins-Smith recommended the AMWG look at what broadly matters to people and what can be identified by looking systematically at the full array of information that people provide about what they care about, as well as the reasons for their decisions. All those different dimensions should get some attention so better estimates of the changes expected when dam operations are altered.

Stakeholder's Perspective – Grand Canyon Wildlands Council – Dr. Stevens. The Grand Canyon Wildlands Council (GCWC) was founded in 1999 to preserve and protect the natural ecosystems and native species in the Grand Canyon Ecoregion (GCE). The Council is affiliated with the Wildlands Network and is engaged in regional conservation of the Colorado Plateau and Colorado River. GCWC's vision is to ensure safe havens and safe passages for all the Grand Canyon ecoregion's native wildlife by applying scientific conservation principles across spatial and social scales in the GCE; conducting basic and applied scientific studies to further understanding of the distribution, diversity, and condition of GCE biota and ecosystems; and providing scientific and policy advisement, insight, guidance, and direct assistance to resource stewards, including all levels of society. Some of their goals include developing collaborative partnerships, providing effective management of physical resources, restoring HBC and other species to their full range, and restoring three riparian habitat sites in Glen Canyon.

Science Advisors' Program Update – Dr. Braun. The Science Advisors Program was relaunched in FY 2016 after a hiatus which included a transfer of administration from the GCMRC to Reclamation and the hiring of Sound Science LLC by Reclamation to serve as the program's new Executive Coordinator. The Science Advisors Program (SAP) is responsible for carrying out independent, external reviews of topics vital to the mission of the AMP.

- Fiscal Year 2017 tasks include advise/support TWG Knowledge Assessment, develop the SAP 3-year plan, review the draft TWP for TWG, complete the SAP charter, and rebuild the SAP archive.
- Possible Independent Review Panel topics for FY2018-20 include brown trout dynamics (status, causal factors, etc.), incorporating tribal cultural values into GCDAMP management considerations, socioeconomic valuation of non-hydropower resources and impacts, and a

"Lake Mead to Lake Powell" perspective on the Glen-Marble-Grand Canyon aquatic ecosystem.

Action Item: AMWG members are invited to send feedback and ideas to Linda Whetton concerning potential Science Advisors Program and other Independent Review Panel activities to include in the in the Triennial Work Plan and Budget for FY 2018-2020. Linda will forward your responses to Katrina Grantz (Reclamation), Scott VanderKooi (GCMRC), David Braun (Science Advisors Program), and Seth Shanahan and Shane Capron (TWG). DUE DATE: Wednesday, March 15, 2017.

FY 2018-20 Triennial Budget and Work Plan – Dr. Grantz. Past memos from Anne Castle and Jennifer Gimbel were used in developing the Triennial Budget and Work Plan (TWP). In addition, DOI Secretary Sally Jewell stated at the LTEMP ROD signing in December 2016 that the "GCDAMP priorities include the management and experimental actions, mitigation and environmental commitments, and research and monitoring identified in the LTEMP FEIS and ROD." She reviewed the timeframe for getting to a budget recommendation in August 2017 and presented the proposed budget breakdown:

Allocation	Fiscal Year (millions of dollars[1])			
	2017	**2018[2]**	**2019[2]**	**2020[2]**
Reclamation (~20%)	2.11	2.2	2.23	2.25
GCMRC (~80%)	8.8	8.82	8.91	9
Total	10.92	11.03	11.14	11.25
[1]Values rounded [2]Assuming 1% CPI				

Mr. Shanahan said another way to look at the budget is to consider the "non-priorities." He presented the results from the TWG budget brainstorming session held on January 26 and outlined the BAHG activities for February and March. A draft TWP will be prepared for the April 20-21 TWG meeting.

Action Item: AMWG members are invited to send feedback and ideas for the Triennial Work Plan to Linda Whetton, who will forward your responses to Katrina Grantz (Reclamation), Scott VanderKooi (GCMRC), David Braun (Science Advisors Program), and Seth Shanahan and Shane Capron (TWG).

GCDAMP Administrative History Project Update – Dr. Hirt. In late 2016, the GCDAMP Administrative History Project began and will continue for the next four years. At least thirty oral histories of key program participants will be conducted. Information from those oral interviews will be incorporated into a dedicated website and administrative history. The website will archive the oral histories and also provide access to additional research data, reports, publications, audio and video interviews of program participants, and other sources of information from the program over time. This will not be a comprehensive AMP library; rather, it will be a searchable database of the most important historical and contemporary information on the program and an archive of all the materials cited in the administrative history and the website. It will be presented in an easily accessible and explorable web platform suitable both for experts and the public. Assisting Dr. Hirt will be Jen Sweeney, a graduate student who will help in writing the histories; Josh McFadyen, a historian who specializes in historical digital history; and Mark Deboe who will be spearheading the website portion of this project.

Joint Tribal Liaison Report – Dr. Rinkevich. Since her last report in August, the following has occurred:

- The Tribal Synthesis Project is being developed and will include a day and a half workshop of Western Hemisphere Indigenous Groups for the purpose of promoting knowledge and experience among participants from Canada, Brazil and the United States. They will share ideas with regard to programs linked to hydroelectric dams.
- At the last tribal luncheon, Ms. Gimbel suggested the tribes write a letter to the new Secretary's Designee to share their key issues about this program. Dr. Rinkevich read excerpts from the letter.
- Two ARM presentations were: (1) Kinship to the Canyon: Hualapai Stories of Success by Carrie Cannon. She shared the importance of educating the youth on plants and their uses and also teaching them how to make soap. (2) Zuni Associative Values Project film project. This was well received by those at the ARM and should be shown at the next AMWG Meeting. It will be distributed to schools and libraries. It was funded by Reclamation for mitigation of adverse effects in the Canyon.

Analysis of Water Losses and Impacts to the Grand Canyon Ecosystem of the "Fill Mead First" Proposal – Dr. Schmidt. The Fill Mead First proposal of the Glen Canyon Institute (http://www.glencanyon.org/glen_canyon/fill-mead-first) has been widely reported as an alternative strategy for allocating reservoir storage between Lake Powell and Lake Mead. Although the concept has been discussed from legal, administrative, and policy perspectives, there have been few publicly available analyses of the natural science issues associated with water losses and impacts on the Grand Canyon ecosystem. Dr. Schmidt completed such an analysis in 2016 and released a report through the Utah State University Center for Colorado River Studies (https://qcnr.usu.edu/wats/colorado_river_studies). The results of this analysis shed light on how water storage rules for Lake Powell and Lake Mead affect the Grand Canyon ecosystem and its future. It should be noted that this document was widely read and reviewed, and Dr. Schmidt met with Reclamation multiple times to make sure the data was accurately captured.

The Fill Mead First (FMF) plan would establish Lake Mead reservoir as the primary water storage facility of the mainstem Colorado River and would relegate Lake Powell reservoir to a secondary water storage facility to be used only when Lake Mead is full. The plan has three phases:

- Phase I – reduce storage in Lake Powell to minimum power pool elevation (3490 feet above seal level [asl]).
- Phase II – reduce storage in Lake Powell to dead pool (3370 feet asl).
- Phase III – drill new diversion tunnels and fully drain Lake Powell.

Implementation of Phase I of FMF would allow the flow regime of the Colorado River in Grand Canyon to be more natural, but only if hydropower generation does not follow daily and weekly demands. Implementation of Phase II of FMF would unavoidably create a less natural flow regime**.** A natural flow regime is likely to exist most of the time if Phase III of FMF were implemented. Phase I or Phase II would not change the existing condition of fine-sediment deficit that exists in Grand Canyon today, because water released from a partially-drained Lake Powell in Phase I or Phase II would be devoid of fine sediment. Impacts to the aquatic and riparian ecosystem, including to the existing population of endangered humpback chub, are potentially significant and would have to be monitored and managed adaptively. Assuming that movement of reservoir water into groundwater storage surrounding Lake Mead is small – an estimate suggested by water balance calculations but not yet verified by independent measurements of ground-water flow at wells – the projected water savings by implementing FMF would be less than ~0.05 million af/yr (~50,000 af/yr). Under FMF, reduced storage and

reduced evaporation in Lake Powell is approximately matched by increased evaporation from Lake Mead.

Dr. Schmidt emphasized that now is the time to initiate new measurement programs of losses at Lake Powell and Lake Mead so that future policy discussions have access to less uncertain data regarding evaporation and groundwater storage.

Public Comments: None

Adjourned: 2:50 p.m.

Upcoming Meetings:

- May 24, 2017 – AMWG Webinar
- August 23-24, 2017 – Flagstaff, Arizona (THIS IS A CHANGE IN DATE)

Respectfully submitted,

Linda Whetton
Bureau of Reclamation
Upper Colorado Region

Key to Glen Canyon Dam Adaptive Management Program Acronyms

ADWR – Arizona Dept. of Water Resources
AF – Acre Feet
AGFD – Arizona Game and Fish Department
AIF – Agenda Information Form
AMP – Adaptive Management Program
AMWG – Adaptive Management Work Group
AOP – Annual Operating Plan
ARM – Annual Reporting Meeting
ASMR – Age-Structure Mark Recapture
BA – Biological Assessment
BAHG – Budget Ad Hoc Group
BCOM – Biological Conservation Measure
BE – Biological Evaluation
BHBF – Beach/Habitat-Building Flow
BHMF – Beach/Habitat Maintenance Flow
BIA – Bureau of Indian Affairs
BO – Biological Opinion
BOR – Bureau of Reclamation
BWP – Budget and Work Plan
BT – Brown Trout
CAHG – Charter Ad Hoc Group
CAP – Central Arizona Project
GCT – Grand Canyon Trust
CESU – Cooperative Ecosystems Studies Unit
cfs – cubic feet per second
CFMP – Comprehensive Fisheries Management Plan
CMINS – Core Monitoring Information Needs
CMP – Core Monitoring Plan
CPI – Consumer Price Index
CRBC – Colorado River Board of California
CRAHG – Cultural Resources Ad Hoc Group
CRCN – Colorado River Commission of Nevada
CRE – Colorado River Ecosystem
CREDA – Colorado River Energy Distributors Assn.
CRSP – Colorado River Storage Project
CWCB – Colorado Water Conservation Board
DAHG – Desired Future Conditions Ad Hoc Group
DASA – Data Acquisition, Storage, and Analysis
DBMS – Data Base Management System
DOE – Department of Energy
DOI – Department of the Interior
DOIFF – Department of the Interior Federal Family
EA – Environmental Assessment
EIS – Environmental Impact Statement
ESA – Endangered Species Act
FACA – Federal Advisory Committee Act
FEIS – Final Environmental Impact Statement
FRN – Federal Register Notice
FWS – United States Fish & Wildlife Service
FY – Fiscal Year (October 1 – September 30)
GCD – Glen Canyon Dam
GCES – Glen Canyon Environmental Studies
GCT – Grand Canyon Trust
GCMRC – Grand Canyon Monitoring & Research Center
GCNP – Grand Canyon National Park
GCNRA – Glen Canyon Nat'l Recreation Area
GCPA – Grand Canyon Protection Act
GLCA – Glen Canyon Nat'l Recreation Area
GRCA – Grand Canyon National Park
GCRG – Grand Canyon River Guides
GCWC – Grand Canyon Wildlands Council
GSF – Green Sunfish
HBC – Humpback Chub (endangered native fish)
HFE – High Flow Experiment
HMF – Habitat Maintenance Flow
HPP – Historic Preservation Plan
IG – Interim Guidelines
INs – Information Needs
KA – Knowledge Assessment (workshop)
KAS – Kanab Ambersnail (endangered native snail)
LCR – Little Colorado River
LCRMCP – Lower Colorado River Multi-Species Conservation Program
LTEMP – Long-Term Experimental and Management Plan
LTEP – Long Term Experimental Plan
MAF – Million Acre Feet
MA – Management Action
MATA – Multi-Attribute Trade-Off Analysis
MLFF – Modified Low Fluctuating Flow
MO – Management Objective
MRP – Monitoring and Research Plan
NAU – Northern Arizona University (Flagstaff, AZ)
NEPA – National Environmental Policy Act
NHPA – National Historic Preservation Act
NNFC – Non-native Fish Control
NOI – Notice of Intent
NPCA – National Parks Conservation Association
NPS – National Park Service
NRC – National Research Council
O&M – Operations & Maintenance (Reclamation Funding)
PA – Programmatic Agreement
PBR – Paria to Badger Creek Reach
PEP – Protocol Evaluation Panel
POAHG – Public Outreach Ad Hoc Group
Powerplant Capacity = 31,000 cfs
R&D – Research and Development
RBT – Rainbow Trout
RFP – Request for Proposal
RINs – Research Information Needs
ROD Flows – Record of Decision Flows
RPA – Reasonable and Prudent Alternative
SA – Science Advisors
SAEC – Science Advisors Executive Coordinator
Secretary – Secretary of the Interior
SCORE – State of the Colorado River Ecosystem
SHPO – State Historic Preservation Office
SOW – Statement of Work
SPAHG – Strategic Plan Ad Hoc Group
SPG – Science Planning Group
SSQs – Strategic Science Questions
SWCA – Steven W. Carothers Associates
TCD – Temperature Control Device
TCP – Traditional Cultural Property
TEK – Traditional Ecological Knowledge
TES – Threatened and Endangered Species
TMC – Taxa of Management Concern
TMF – Trout Management Flows
TWG – Technical Work Group
UCRC – Upper Colorado River Commission
UDWR – Utah Division of Water Resources

USBR – United States Bureau of Reclamation
USFWS – United States Fish & Wildlife Service
USGS – United States Geological Survey
WAPA – Western Area Power Administration
WY – Water Year

(Updated: 3/1/2017)