

**Glen Canyon Dam Adaptive Management Work Group Meeting  
August 26-27, 2015**

**August 26, 2015**

**Start Time:** 9:30 a.m.

**Conducting:** Jennifer Gimbel, Principle Deputy Assistant Secretary for Water and Science

**Facilitation:** Mary Orton, The Mary Orton Company, LLC

**Committee Members/Alternates:**

Charley Bullets, So. Paiute Consortium (phone)  
Tom Buschatzke, State of Arizona  
Chris Cantrell, Arizona Game and Fish Department  
Kerry Christensen, Hualapai Tribe  
Jayne Harkins, State of Nevada  
Leslie James, CREDA  
Sam Jansen, Grand Canyon River Guides  
Lynn Jeka, Western Area Power Administration  
John Jordan, Int'l Fed. of Fly Fishers/Trout Unlimited  
Chip Lewis, Bureau of Indian Affairs  
John McClow, State of Colorado  
Eric Millis, State of Utah

David Nimkin, National Parks Conservation Assoc.  
Don Ostler, State of New Mexico  
Daniel Picard, U.S. Bureau of Reclamation  
Steve Spangle, U.S. Fish and Wildlife Service  
Tanya Trujillo, State of California  
Dave Uberuaga, National Park Service (GRCA)  
Steve Wolff, State of Wyoming  
Mike Yeatts, The Hopi Tribe  
VACANT, Navajo Nation  
VACANT, Pueblo of Zuni  
VACANT, San Juan Southern Paiute Tribe

**Committee Members Absent:**

James deVos, Arizona Game & Fish Department  
Loretta Jackson-Kelly, Hualapai Tribe  
Leigh Kuwanwisiwma, Hopi Tribe

Ted Rampton, UAMPS  
Larry Stevens, Grand Canyon Wildlands Council

**USGS/Grand Canyon Monitoring and Research Center**

Lucas Bair, Economist  
Kyrie Fry, Communications & Outreach Coordinator  
Paul Grams, Program Manager

Dave Lytle, Director, SBSC  
Scott VanderKooi, Chief, GCMRC

**Interested Persons:**

Adam Arellano, WAPA  
Melinda Arviso-Ciocco, Navajo Nation (phone)  
Mary Barger, U.S. Bureau of Reclamation  
Cliff Barrett, UAMPS (phone)  
Rob Billerbeck, National Park Service  
David Braun, Sound Science LLC  
Chris Budwig, Trout Unlimited  
Peter Bungart, Hualapai Tribe (phone)  
Shane Capron, WAPA/TWG Vice Chair  
Lori Caramanian, DOI  
Bill Chada, U.S. Bureau of Reclamation  
Jennifer Crandell, CRC/Nevada  
Marianne Crawford, U.S. Bureau of Reclamation  
Kevin Dahl, National Parks Conservation Assoc.  
Crystal Dean, WAPA  
Deborah Dixon, State of New Mexico  
Kurt Dongoske, Pueblo of Zuni  
Lesley Fitzpatrick, U.S. Fish & Wildlife Svc (phone)  
Kevin Garlick, CREDA  
Todd Gaston, U.S. Bureau of Reclamation  
Ed Gerak, CREDA  
Maude Grantham Richards, Tri-State G&T/CREDA  
Katrina Grantz, U.S. Bureau of Reclamation  
Jessica Gwinn, U.S. Fish & Wildlife Service  
Martha Hahn, NPS/GRCA  
John Hamill, Int'l Federation of Fly Fishers, TU  
Lynn Hamilton, Grand Canyon River Guides

Paul Harms, State of New Mexico  
Chris Harris, State of California (phone)  
Brian Healy, National Park Service (phone)  
Beverley Heffernan, U.S. Bureau of Reclamation  
Vineetha Kartha, State of Arizona  
Robert King, State of Utah (phone)  
Glen Knowles, U.S. Bureau of Reclamation  
Ted Kowalski, State of Colorado  
Jane Lyder, National Park Service  
Lisa Meyer, WAPA  
Jessica Neuwerth, State of California  
Brent Rhees, U.S. Bureau of Reclamation  
Dr. Sarah Rinkevich, DOI Joint Tribal Liaison  
Brian Sadler, WAPA  
Seth Shanahan, SNWA  
Stacey Smith, U.S. Bureau of Reclamation  
Robert Snow, DOI/Solicitor's Office  
Bill Stewart, Arizona Game & Fish Department  
Rosemary Sucec, NPS/GLCNRA  
Justin Tade, DOI/Solicitor's Office  
Pat Tease, U.S. Bureau of Reclamation  
Shana Tighi, U.S. Bureau of Reclamation  
Camille Touton, DOI  
Jason Tucker, U.S. Bureau of Reclamation  
Bob Unnasch, Sound-Science, LLC  
Tim Vigil, WAPA  
Chris Watt, U.S. Bureau of Reclamation

Jeff Woner, CREDA

**Recorder:** Linda Whetton, USBR

**Welcome and Administrative.** Ms. Gimbel welcomed the members and general public. Introductions were made of Bill Chada (new archeologist with Reclamation) and Camille Touton (DOI Counsel). Lori Caramanian has accepted a position with the FWS Solicitor's Office in Denver; Ms. Touton will fill her position. A roll-call was taken and a quorum established. Mr. Peter Bungart (Hualapai Tribe) and Mr. Kurt Dongoske (Pueblo of Zuni) will represent their respective members but will not have voting rights at this meeting.

- Approval of May 28, 2015, Meeting Minutes. **Motion (proposed by Jayne Harkins and seconded by Steve Wolff) to approve the minutes of the May 28, 2015 meeting as written.**  
This motion was approved by consensus.
- Action Item Tracking Report (**Attachment 1**). Two items will be closed: Outreach efforts were made to the Havasupai Tribe to join the AMWG and they declined to be official members; and the deadline passed for technical questions regarding hydropower modeling .
- Progress on Nominations and Reappointments
  - New AMWG Member: Daniel Picard (Reclamation)
  - New AMWG Alternates: Chris Cantrell (AGFD), Meghann Olson (Southern Paiute Consortium), and Brian Sadler (WAPA)
  - Reappointed AMWG Members: Charley Bullets (Southern Paiute Consortium) and Larry Stevens (Grand Canyon Wildlands Council)
  - Reappointed AMWG Alternates: Garry Cantley (BIA), Beverley Heffernan (Bureau of Reclamation) Robert King (State of Utah), , and Mike Yeatts (Hopi Tribe)
  - Clarification made that Kevin Dahl is TWG member and Dave Nimkin is TWG alternate representing NPCA.
- New GCMRC Chief – Mr. Scott VanderKooi was selected for the position vacated by Dr. Jack Schmidt.
- Recognition of Dr. Dave Garrett – Ms. Gimbel said Dr. Garrett did a wonderful job as the Executive Director for the Science Advisors and asked if anyone would consider proposing a motion to recognize his contributions to the GCDAMP.

**Motion (proposed by Don Ostler, seconded by Lynn Jeka) to consider a motion honoring Dave Garrett.**

This motion was approved by consensus. Specific language will be provided at tomorrow's meeting.

- Update on Science Advisor Contract – Reclamation awarded the SA contract to Sound Science LLC, an independent group of advisors based out of Boise, Idaho. Dr. David Braun will serve as the executive director and coordinate assignments. He introduced himself and said he is keenly aware of the complex history of the program, the role that scientific investigations play in the adaptive management process, and the need for transparency.
- AMWG Charter Renewal – The charter was signed and filed on August 24, 2015. Some editorial changes were made and a redline/strikeout version will be sent to the AMWG.
- Commemorating Jason Thriot – Ms. Gimbel described Jason as the AMWG's best cheerleader with his positive attitude and willingness to serve in the program. He was chair of the Public Outreach AHG and was responsible for creating and managing the GCDAMP "wiki" website. Ms. Harkins said she appreciated all his efforts and the work he did for the State of Nevada. He was passionate about the AMWG and was looking forward to working on the administrative history of the program. She thanked everyone for their thoughts and care to his family and the Colorado River Commission of Nevada. A moment of silence was observed. Ms. Gimbel thanked Ms. Kartha for setting up a fundraiser with the Diamondbacks Baseball Team to help support the Thriot Children Memorial Fund. An card to his family was sent around the room for signatures, with an envelope for donations to the family. A round of applause was given.

**FY 2016 Budget and Work Plan (Attachment 2 = AIF and PPT)** – Mr. Glen Knowles. The budget is in the second year of a three-year fiscal budget. The three-year budget was approved in August 2014, and the AMWG is requested to approve the second year again to meet federal regulations. The proposed budget for FY16 is \$11,077,616 with Reclamation's portion at \$2,180,075 and GCMRC at \$8,897,541. Carryover funds from Reclamation's portion of the budget may be used to address the problem of green sunfish in Glen Canyon. Mr. VanderKooi reported that GCMRC's overhead rates are lower than projected as a result of GSA renegotiating their leases. The current estimate for GCMRC moving into their new buildings is 2017 or later. The longer the delay, the lower the rates will be. Mr. Capron said the

TWG reviewed the budget and is recommending the AMWG approve the FY16 budget. He referenced the draft budget motion on the AIF.

**Motion (proposed by Chris Cantrell, seconded by Eric Millis): AMWG recommends to the Secretary of the Interior for her approval the Final FY 2015-17 Triennial Budget and Work Plan from the Bureau of Reclamation and the Grand Canyon Monitoring and Research Center as recommended by AMWG August 28, 2014, for implementation in FY 2016, with a FY 2015 corrected CPI of 1.7% and corrections to the GCMRC overhead rates.**

This motion was approved by consensus.

**Basin Hydrology and 2016 Hydrograph (Attachment 3a = AIF and PPT) – Ms. Katrina Grantz.** Storage is 94% of average for Lake Powell. Most of the inflow was from snowmelt from the April-July timeframe. Projections are made for the next water year in August and the most-probable inflow forecast is 88% of average. There's a lot of uncertainty at this point with a minimum probable of 59% to a maximum of 156%. In addition, there is a 10% chance it could be higher and a 3% chance it could be lower. The probable minimum, the most probable, and the probable maximum release projections are all under the Upper Elevation Balancing Tier. The first two scenarios show 9.0 maf releases with a projected April shift to Balancing. The Probable Maximum shows a 11.4 maf release with a projected April shift to Equalization. Depending on the April 24-month study projections through the end of the water year, it will be determined whether there is an adjustment to balancing releases, whether to stay at 8.23, or whether there will be equalization releases. If it is dry between now and April, there's a chance that an adjustment will not be made to the balancing releases. If it is wet between now and April, there's a chance that they would not move to balancing but would have equalization releases.

Dam Maintenance Schedule. Ms. Grantz reviewed the dam maintenance schedule through WY2016. Ongoing maintenance is required at the dam and Reclamation works closely with WAPA in scheduling to ensure water can be moved during turbine downtimes. Seven units must be available to conduct an HFE.

2016 Annual Hydrograph Background. Mr. Snow reminded the group that passage of a hydrograph is grounded in the Grand Canyon Protection Act which passed in 1992 and specifically stated that the Secretary would "adopt criteria and operating plans separate from and in addition to those specified in section 602(b) of the Colorado River Basin Project Act of 1968." Beginning January 1, 1972 and yearly thereafter the Secretary transmits a report to Congress and the Colorado River Basin States describing the actual operation under the adopted criteria for the preceding compact water year and the projected operation for the current year.

Ms. Kartha said the TWG was initially presented with WY 2016 hydrograph at its April 2015 meeting and their discussions focused mainly on sediment transport. The Basin States had raised concerns with the proposed WY2016 hydrograph, primarily regarding Oct, Nov, and Dec volumes, and how it differed from a standard MLFF release pattern, and the effect these volumes could have on the determination of annual volumes. As a result, additional language was added to the hydrograph motion for the June TWG webinar which read, "Monthly release volumes proposed in this hydrograph will not affect operating tier determination for Lakes Powell and Mead under the 2007 Interim Guidelines." The WY2016 hydrograph was recommended to the AMWG unanimously by the TWG for recommendation to the Secretary of the Interior. She also clarified that the original Agenda Item Form (AIF) had an error in the text of the motion to approve the hydrograph. A new AIF was distributed with the superfluous paragraph removed.

Ms. Grantz presented the proposed hydrograph for 2016 and said there are three targeted months of consideration. In June, August and September great attention is paid to the volumes particularly for release and hydrology. If the annual release ends up being less than 9.0 maf, the releases for June would be 600-650 kaf, 800 kaf in August, and 600 kaf in September. As the annual volumes increases, so must the release volumes in order to get all the water out within the water year. The proposed hydrograph recommends slight decreases in June, August, and September from what would typically be

done. That water needs to go somewhere to keep the annual volume the same so there will be slight increases in December, January and July.

**Motion (proposed by Tom Buschatzke, seconded by Lynn Jeka): AMWG recommends to the Secretary of the Interior for her approval the WY2016 Hydrograph for Glen Canyon Dam.**

- **Annual Release Volumes** will be determined by the 2007 Interim Guidelines and shall be reviewed and adopted through the normal annual operating plan process (in consultation with the Basin States as appropriate).
- **Monthly Release Volumes** are anticipated to shift depending upon: (1) the projected Annual Release Volume, (2) power plant capacity, and (3) the magnitude of a potential High Flow Experiment.
- **Monthly Release Volumes** may vary within the targets identified below. Any remaining monthly operational flexibility will be used for existing power production operations under the Modified Low Fluctuating Flow (MLFF) alternative selected by the 1996 ROD and contained in the 1995 FEIS and in compliance with all applicable NEPA compliance documents (HFE EA, NNFC EA, 2007 Interim Guidelines). Monthly release volumes proposed in this hydrograph will not affect operating tier determinations for Lakes Powell and Mead under the 2007 Interim Guidelines.

**Release objective for June is:**

600 to 650 kaf for annual releases below 9.0 maf  
800 kaf for annual releases of 9.0 maf to less than 9.5 maf  
900 kaf for annual releases of 9.5 maf to less than 10 maf  
Greater than 900 kaf for annual releases 10 maf and greater

**Release objective for August is:**

800 kaf for annual release below 9.0 maf  
900 kaf for annual releases of 9.0 maf to less than 10 maf  
Greater than 900 kaf for annual releases 10 maf and greater

▪ **Release objective for September is:**

600 kaf for annual releases below 9.0 maf  
700 kaf for annual releases of 9.0 maf to less than 10.0 maf  
800 kaf or greater for annual releases of 10.0 maf or greater; up to power plant capacity for high equalization releases

**Monthly Release Volumes** will generally strive to maintain 600 kaf levels in the shoulder months (spring and fall) and 800 kaf in the December/January and July/August timeframe.

Additionally, the Bureau of Reclamation will continue to apply best professional judgment in conducting actual operations and in response to changing conditions throughout the water year. Such efforts will continue to be undertaken in coordination with the DOI/DOE agencies and in consultation with the Basin States as appropriate, to consider changing conditions and adjust projected operations in a manner consistent with the objectives of these parameters as stated above and pursuant to the Law of the River.

This motion was approved by consensus.

**Lees Ferry Recreational Trout Fishery Management Recommendations (Attachment 4)** – Mr. Jordan. The National Park Service Comprehensive Fishery Management Plan (CFMP) Environmental Assessment for the Colorado River between Glen Canyon Dam and Lake Mead was published in May 2014. The intent of the CFMP is to maintain a thriving native fish community within Grand Canyon National Park and a highly valued recreational trout fishery in the Glen Canyon National Recreation Area. The AMWG recreational fishing representation and the angling community, with the cooperative participation of the Arizona Game and Fish Department, recognized that provisions of the CFMP for both the recreational trout fishery and the fishery as a whole would benefit from more detailed proposed actions. As a result, those entities developed the Lees Ferry Recreational Trout Fishery Management Recommendations, and they hope that they will be adopted to fit within the CFMP.

While the report offers 15 recommendations, he focused on the three major issues: (1) aquatic food base, (2) excessive recruitment of young trout, and (3) water temperatures. The recommendations will benefit humpback chub, riparian wildlife species, hydropower production, sand conservation, and archaeological site preservation. They would like to have their recommendations evaluated by GCMRC and have a discussion with the TWG.

Because a draft motion wasn't included in the pre-meeting materials, Ms. Gimbel asked for a motion that the AMWG would consider the Lees Ferry motion. If that passes, then the motion would be considered tomorrow.

**Motion (proposed by Chris Cantrell, seconded by Kerry Christensen): The AMWG will consider a motion on Fish Management Recommendations.**

This motion was approved by consensus.

**Non-Market Values for Alternative Operations of Glen Canyon Dam Panel** – Mr. Lucas Bair introduced the panel members: Michael Hanemann, Arizona State University; Holly Doremus, UC Berkeley Law; John Duffield, University of Montana; and Hank Jenkins-Smith, University of Oklahoma.

- Nonmarket Values and Glen Canyon Dam (**Attachment 5a**) – Dr. Hanemann. The key to think about is demand and supply. Demand has to do with what something is worth to people while supply has to do with what it costs them to obtain it. Valuation addresses demand. Non-market valuation measures in monetary terms the value people place on items they may care for, regardless of whether those items are supplied through a market. Non-market valuation employs the same two concepts of value as market valuation, and subsumes market-valuation as a particular case. Hydropower and recreation (fishing, boating, etc.) are market values at Glen Canyon Dam. Non-market values at Glen Canyon Dam include preservation of an iconic area in a natural condition. He noted that the program has made much progress since the August 2010 hydropower panel he participated in. He noted his conclusions at that time were that the GCDAMP has made more progress in monitoring camping beaches than visitor experience. The current plan lacks a way to tie changes in flows to recreational and cultural values. It is not consistent with any meaningful form of adaptive management and cannot withstand sustained scrutiny. He said he hoped there had been improvement since then.
- Laws, Values, and Water Management Decisions (**Attachment 5b**) – Dr. Doremus. She described public values in the sense of our commitments, what we think is right or wrong in terms of what should do, not how much we would accept for pay to be able to consume something. Public decisions, including decisions about how we manage our public resources, are supposed to be reflect and connect to our societal values. Values are often contested, difficult to prioritize, and difficult to quantify which pose a number of challenges. Those challenges are dealt with in legislative ways (i.e., Endangered Species Act), by benefit-cost analyses, agency discretion, overlaying mandates, and water management decisions, all of which have advantages and disadvantages. She noted in any case, key questions to be answered include how should trade-offs be evaluated, particularly if there does not appear to be a comfortable metric across competing preferences.
- Glen Canyon Dam Operations: Passive Use Valuation History and Current Efforts (**Attachment 5c**) – Dr. Duffield. There are connections between ecosystem structure and function, services, policies, and values. He presented data from a study on annual values associated with alternative dam operations which indicated that consumer values would be more successful and reliable in a legal context if it followed a public referendum. It showed that if the dollar amounts were higher, people were inclined to take issues more seriously.
- Non-Market Values in Complex Coupled Systems: Theoretical Considerations and Pilot Study Results (**Attachment 5d**) – Dr. Jenkins-Smith. His presentation reviewed coupled human/natural systems (CHANS) and emphasized that people need to look at the diversity of stakeholders' values and then apply it to a GCD pilot study done by his group in 2014. They replicated the Welsh 1995 GCD study in order to compare variations and introduced alternative dimensions of value. The results of the 1995 study were almost identical to the same questions asked during the 2014 study. Additional questions allowed for respondents to indicate a negative value for changes in dam operations, and added preservation of rural ways of life to the mix, finding that many indicated preferences for the status quo. He noted in conclusion that structuring alternatives as a reference choice between two options allows respondents to consider

bundles of distinct value attributes, in contrast to the Welsh et al. study on a single proposal for changing dam operations. Specifically, it allowed for expression of “willingness to pay” to retain the current operations.

### **Stakeholder’s Perspective and HFE Effect on Beaches – The View from the Camp (Attachment 6)**

– Mr. Sam Jansen.

- Stakeholder Perspective – The Grand Canyon River Guides was created in 1988 as an educational and environmental organization. Its mission is to protect the Grand Canyon, set the highest standards for the river profession, celebrate the unique spirit of the guide community, and provide the best possible river experience. The organization provides a river guide training seminar, a yearly training river trip, and a fall rendezvous, and publishes the Boatman’s Quarterly Review. The guides worked with other groups and were instrumental in writing the Grand Canyon Protection Act. More information can be obtained from their website: <http://www.gcrq.org>.
- HFE Impact on Camping Beaches – The Adopt-A-Beach program was implemented in 1996 after the first historic “flood flow.” It’s a program that allows volunteer guides to keep close tabs on changes to the recreational resource – camping beaches in Grand Canyon. For people to enjoy and spend time in the canyon, they need camping beaches. The ideal camping beach is big, flat, accessible, in the right location, unoccupied, beautiful, and one of many. Often there are problems finding a good beach to camp since they’ve been shrinking since the dam was put in. Changes over time that have been noted: degraded parking, loading and unloading; cutbanks; vegetation encroachment; human impacts; and wind scour/deposition. The guides take pictures to document the changes and produce an annual report. A “campsite viewer” link has been linked to GCMRC’s website:  
<http://www.arcgis.com/home/item.html?id=f8dc5d198f254710997dc1fb1bf064cc>

**Public Comments:** None

**Adjourned:** 4:37 p.m.

## Glen Canyon Dam Adaptive Management Work Group Meeting

**August 27, 2015**

**Conducting:** Jennifer Gimbel, Acting Secretary's Designee

Start Time: 8:04 a.m.

**Facilitation:** Mary Orton, The Mary Orton Company, LLC

### **Committee Members/Alternates:**

Charley Bullets, So. Paiute Consortium (phone)  
Tom Buschatzke, State of Arizona  
Chris Cantrell, Arizona Game and Fish Department  
Kerry Christensen, Hualapai Tribe  
Jayne Harkins, State of Nevada  
Leslie James, CREDA  
Sam Jansen, Grand Canyon River Guides  
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David Nimkin, National Parks Conservation Assoc.  
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VACANT, San Juan Southern Paiute Tribe

### **Committee Members Absent:**

James deVos, Arizona Game & Fish Department  
Loretta Jackson-Kelly, Hualapai Tribe  
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### **USGS/Grand Canyon Monitoring and Research Center**

Lucas Bair, Economist  
Kyrie Fry, Communications & Outreach Coordinator  
Paul Grams, Program Manager

Dave Lytle, Director, SBSC  
Scott VanderKooi, Chief, GCMRC

### **Interested Persons:**

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Melinda Arviso-Ciocco, Navajo Nation (phone)  
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Rob Billerbeck, National Park Service  
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Jessica Gwinn, U.S. Fish & Wildlife Service  
Kurt Dongoske, Pueblo of Zuni  
Martha Hahn, NPS/GRCA  
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Lynn Hamilton, Grand Canyon River Guides  
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Beverley Heffernan, U.S. Bureau of Reclamation  
Vineetha Kartha, State of Arizona  
Robert King, State of Utah (phone)  
Glen Knowles, U.S. Bureau of Reclamation  
Ted Kowalski, State of Colorado  
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Jason Tucker, U.S. Bureau of Reclamation  
Bob Unnasch, Sound Science LLC (phone)

Tim Vigil, WAPA  
Chris Watt, U.S. Bureau of Reclamation

Jeff Woner, CREDA

**Recorder:** Linda Whetton, USBR

**Welcome and Administrative.** Ms. Gimbel welcomed the members and general public. She made the following announcements:

- Leslie Fitzpatrick (USFWS), who has worked on issues important to the program for many years, will retire after 37 years of federal service.
- Martha Hahn (alternate for NPS) will retire in October.
- Lori Caramanian (Deputy Assistant Secretary, DOI) will be moving to Denver to accept a position with the FWS Solicitor's Office. She has worked with the AMWG for the past six years and will continue to work on the LTEMP EIS.

Members were reminded to complete the Meeting Evaluation Form at the conclusion of today's meeting.

Ms. Gimbel invited the two motions that the group had agreed yesterday to consider.

**Motion (Proposed by Don Ostler, seconded by John McClow):** The Adaptive Management Work Group formally recognizes the longstanding and significant contributions of Dr. L. David Garrett to the Glen Canyon Dam Adaptive Management Program (GCDAMP) in many different capacities, including first chief of the Grand Canyon Monitoring and Research Center (1996-1999) and the Executive Coordinator of the Science Advisors (2001-2013). Dr. Garrett has significantly helped the GCDAMP to address the many complex science and operational issues associated with Glen Canyon Dam and the Grand Canyon National Park and environs. The AMWG wishes to express our sincere thanks to Dr. Garrett and our warmest wishes for his happy and successful future. At the request of the Secretary's Designee, the group approved this motion unanimously.

**Motion (proposed by John Jordan, seconded by Kerry Christensen):** The AMWG requests the Secretary's Designee direct GCMRC to conduct a technical review of the Lees Ferry Recreational Trout Fishery Management Recommendations and report its findings to the TWG; and directs the TWG to evaluate the GCMRC review at its October 2015 meeting, and report its findings to AMWG at its February 2016 meeting.

This motion was approved by consensus.

**Action Item:** GCMRC will conduct a technical review of the Lees Ferry Recreational Trout Fishery Recommendations and report its findings to the TWG at their October 2015 meeting. The TWG will make a report to the AMWG at its February 2016 meeting.

**Havasu Creek Translocation Update (Attachment 7)** – Ms. Martha Hahn. Translocations of juvenile Humpback Chub from the Little Colorado River to other Colorado River tributaries within GRCA is one option proposed to attempt to establish a second population in Grand Canyon, as well as to meet NPS mandates for species conservation and contribute towards goals and objectives within the CFMP. Based on the Rich Valdez report in 2000, it was decided to begin translocation in Havasu Creek because it was more promising for the spawning population. The work began in May 2011 and to date, 1650 HBC have been translocated. Ms. Hahn noted the following positive indicators based on their monitoring:

- The chub have survived.
- Abundance is increasing.
- Translocated chub have been caught in the mainstem, sometimes over multiple years.
- Annual growth is as good or better as that documented in the Little Colorado River.
- Ripe males and females have been captured.
- 2013-2015 young-of-year and untagged two-year-olds have been captured, indicating they are reproducing in Havasu Creek.

**Basin Fund and Revenue Overview (Attachment 8)** – Ms. Lynn Jeka. Congress created the Colorado River Storage Project (CRSP) through the Colorado Storage Project Act of 1956. The Act authorized the Secretary of the Interior to construct, operate, and maintain the CRSP and participating projects. In the same Act, Congress authorized a separate fund in the Treasury of the United States to be known as the Upper Colorado River Basin Fund. Fifty-nine years later, the Western Area Power Administration’s CRSP Management Center works collaboratively in partnership with the Bureau of Reclamation to generate and market power from the CRSP Project, Collbran, Seedskadee, Dolores and Rio Grande projects (marketed together as the Salt Lake City Area Integrated Projects) and deliver it to firm electric service customers. With a total investment of \$2.375 billion, 11 power plants, 24 generating units, and 2,325 miles of transmission lines, CRSP and Reclamation provide clean, reliable, wholesale electric service to 130 wholesale customers in the west including 53 Native American tribes. The service territory spans Arizona, New Mexico, Nevada, Colorado, Utah, Texas and Wyoming. Responsibilities between Reclamation and Western are as follows:

Reclamation	Western
Owns, operates, and maintains dams and power plants	Owns and operates the transmission system infrastructure
Water management (reservoir management, irrigation, flood control, and water compact deliveries)	Supports grid reliability (regulation and reserve capacity)
Generates power which is delivered to Western at the plant transformers	Western markets, schedules and delivers energy to long term firm electric service customers
	Rate setting and repayment of project debt to U.S. Treasury from revenue
Joint responsibility for support for environmental activities related to CRSP and participating projects	

The following responses were captured from questions raised:

- *The Colorado River Salinity Control Forum deals with salt concentrations throughout the basin. It’s funded 75% from appropriations and 25% from power revenues, with 15% from power revenues paid by the upper basin and the other 85% paid by the lower basin.*
- *The prevailing rate charged to customers is comparable to what is purchased. The rates depend on the market and vary whether buying off peak at night or on peak during the day. Current power prices are between \$25-35 a megawatt hour. Contracts are negotiated with the customers and they receive a contract rate of delivery. It’s then estimated how much will be needed from generation and that’s called sustainable hydropower. If you have a 100 megawatt contract and 90 megawatts of that is sustainable through hydropower, then the other 10 megawatts is used to sell the rights on their transmission lines. On our transmission lines they paid for as part of their rate, so we’ll go out and buy that additional power for them and put it on the system for their use. That’s the flow through. If there is a 100 megawatt contract and the sustainable hydropower is set at 90 but the dam can only deliver 80, WAPA has to firm up to 90. They have the right to ask us to buy on their behalf from being generator like Tri-State Generation, etc., to use that little gap between sustainable hydropower in the contract amount to move their own power across our lines because they paid for it.*
- *A Memorandum of Agreement (MOA) was entered into a number of years ago among the Upper Colorado River Basin states, BOR, CREDA and is used for a variety of operation needs and costs associated with lining ditches or repairing variable speed pumps, basically projects that were unfunded but that were tied directly to the CRSP purposes.*
- *With an 7.48 maf release year, a tremendous strain is put on the basin fund. At \$65 million a year we can’t have many 7.48 in a 5-year rate period. Reclamation and WAPA have done an excellent job controlling costs and the current rate has been in place for 7 years to they’ve been able to maintain a very stable rate for the customers.*
- *John Jordan – From what you shared, it sounds like there must be some restraints or something that block you into always a net buyer of power. It would seem to me that if you’re controlling the contract rates, can you explain the good news we were in that seller and buyer which would then result in benefits to your customers. Are you constrained by regulations or rules that say that you have to sell a certain amount of power, whether that blocks you into most of the time to buy additional power to have enough power available to customers?*
- *Congress sets the power rate to ensure that farmers and irrigators have the water that they need to raise their crops at a price that makes the food affordable for the rest of the country. There’s been a very clear risk shift over time about how the customers obtain what power is needed to have that obligation to serve.*

*That obligation to serve is really pretty good because the non-profit entities are their recipients by law. If people move into their service area, they have to have those systems that are in place to provide that power.*

**Lake Mead Issues and Lower Basin Shortage Preparedness** – Mr. Buschatzke, Ms. Trujillo, and Ms. Harkins. To prepare for possible shortages in the Lower Basin and to guide Colorado River operations during low reservoir conditions, water delivery operations are described and contemplated in the 2007 Interim Guidelines. A shortage condition is determined when insufficient mainstream water is available to satisfy 7.5 million acre-feet of annual consumptive use in the Lower Basin states. A key factor for determining annual operations is the amount of storage (as measured by water elevation) in Lake Mead. Three factors that significantly affect the water levels in lakes Powell and Mead are: (1) the hydrology of the Colorado River, such as the amount of precipitation that falls within the basin and the resulting runoff that flows into the river and reaches the reservoirs, (2) Colorado River water use, such as the amount of water needed for agricultural and urban purposes in both the Upper and Lower Basins, and (3) Colorado River reservoir operations. The Colorado River Basin is now likely experiencing the lowest 16-year period in the observed historical record dating back over 100 years. Lake Mead annual outflow is about 1.2 maf more than the annual inflow. The result is an imbalance that causes Lake Mead to drop by 12 feet or more every year when there is a “normal” release of 8.23 maf from Lake Powell. Lake Mead elevation has fallen approximately 126 feet from 2000 to the end of 2014, bringing it closer to elevations critical to a shortage determination.

- Arizona – Shortage Preparedness (**Attachment 9a**) – Mr. Buschatzke. The Colorado River supplies approximately 40% of Arizona’s water needs. The remaining needs are met through use of other surface water supplies. If a shortage is declared on the Colorado River, Arizona bears the brunt of the reductions, with the Central Arizona Project taking most of the reductions. Arizona has been proactively building resilience and implementing innovative water management strategies to secure and manage its other water supplies. Arizona’s Groundwater Management Act is the most far-reaching groundwater management regulatory framework in the United States. Arizona’s engagement in collaborative long-term planning and comprehensive strategies has allowed water providers and private entities to store water supplies underground to reduce their vulnerability to shortage. Collectively, Arizona has stored over 8 million acre-feet (more than 2.5 trillion gallons) of water. The Arizona Department of Water Resources, along with other stakeholders such as the CAP, continue to work with the other Colorado River Basin States, Mexico and federal partners to implement proactive measures that will reduce the near-term risks of drought as well as address the long-term imbalances between supply and demands on the Colorado River system.
- Lake Mead and Lower Basin Shortage Preparedness (**Attachment 9b**) – Ms. Jayne Harkins. Lake Mead is currently at 37% of capacity and lake elevation is projected to decrease this summer to levels not observed since Lake Mead was filled. Reclamation modeling predicts continued decreases in lake elevations and a near equal probability of a Lower Basin shortage in 2017. If lake surface elevations continue to decline, there are risks of losing the ability to access and pump water. Design and construction of a new intake and pumping station are underway and when completed will have the ability to pump water at a depth of 860 feet. Lower water levels in Lake Mead have reduced the amount of potential energy generated at Hoover Dam. When lake elevations are high, more energy is produced from the weight (or head) of the water pushing through the turbines. Decreased power production often causes customers to purchase power on the open market at higher costs. At lower elevations, turbines run less efficiently and can cause operational issues. Reclamation believes that power can be generated to an elevation of 950 feet with less efficiency, but there is some uncertainty of operations at these low elevations. The physical and chemical properties of water released from Glen Canyon Dam can influence Lake Mead. Temperature and salinity between the river and lake can dictate the depth at which the water inserts itself into the lake. Water inserted at the top layer can reinforce stratification and lead to less oxygenated conditions. Increased sediment delivery that reaches the water intakes can impact water treatment costs.
- California Water Issues (**Attachment 9c**) – Ms. Trujillo. California has been experiencing unprecedented, multi-year drought with record-low snowpack in the northern California Sierra-Nevada Mountains, exacerbated by record-high temperatures. As a result of well below-average precipitation, the water supply for urban and agricultural contracts from the California State Water Project and federal Central Valley Project has been severely diminished over the past three years. Over 500,000 acres of irrigated land has been fallowed within California during each of the past three years due to lack of water. During these exceptionally dry years, the Colorado River provides a very important component of the water supply for over 19 million people in southern California in addition to providing water to irrigate over 800,000 acres of farmland. Their agency was created 75 years ago. Since 2003, California has reduced its average use of

Colorado River water by 800,000 acre-feet per year. Over \$2 billion has been invested in conservation efforts by California agencies. There are strong incentives for California to continue its efforts to coordinate with the other Basin States, federal agencies, and partners in Mexico through implementation of Minute 319 and potential successor agreements in efforts to bolster the strength of the Colorado River System, prevent Lower Basin shortages, improve water use efficiencies, and increase the amount of water stored in Lake Mead.

**Tribal Liaison Report (Attachment 10)** – Dr. Rinkevich and Ms. Jackson-Kelly reported on their recent activities:

- They had a very productive meeting at the Pueblo of Zuni two weeks ago regarding consultation on the LTEMP EIS process. Reclamation agreed to share copies of biological assessments and biological opinions with the Zuni and other tribes. The Zuni understand the AMP but do not agree with everything the DOI agencies do. They feel the DOI agencies are beginning to understand that the taking of life in the Grand Canyon is unacceptable and are glad they've stepped back from those actions.
- Sarah and Loretta attended the 29<sup>th</sup> Annual Southwest Native American Fish and Wildlife Society Conference in August and were able to network with others of similar interests and programs.
- The Tribally Led Integrated Stakeholder River Trip was held July 17-27, 2015 for the purpose of exchanging western science values and Native American perspectives. Participants conducted outreach and education for the Grand Canyon Youth Program, observed backwater fish seining and collecting fish data, and gained greater understanding of tribal concerns and values.
- Ms. Jackson-Kelly thanked those who participated in the river trip and continued describing some of the activities. At River Mile 31 in South Canyon Charley Bullets conducted an interpretation of the petroglyph writings. The Paiute acknowledge that rock writings are like a family book or genealogy.
- River Trip participants offered the following reflections on their experience:
  - *It was a remarkable experience. Learning the details of the tribal cultural resources was extremely valuable. All the tribal representatives took a great deal of time and energy to explain things. It was a unique experience in terms of getting those explanations from them. We had a virtual college professor assembly there (Larry Stevens, Sam Jansen, Scott VanderKooi, Brian Healy, Martha Hahn) and they're all committed to the canyon and are experts in their fields. Sam is a great guitar player. We learned a tremendous amount. (McClow)*
  - *It was a time to make new friendships and nurture old ones. I gained a real feeling for the spirituality of the place. Charley Bullets was a great speaker and he sang a lot of traditional songs. They taught us a couple of games. The wildlife was wonderful. Thanks to Loretta and Sarah for herding these cats in and out of the canyon safely. (Spangle)*
  - *I've been on the river four times but the depth and scope of what was there became more apparent to me. Participating with this group and others provided a way to understand the unique and special quality in this place. We spend time in these meetings talking about quantitative things – money, science, and trying to measure all that – but I think the element of the cultural and spiritual values that were reflected on the trip gave a whole different dimension to what's at stake. It's important to honor, respect, and understand that. This group had the opportunity to better understand the need to protect this place. (Nimkin)*
  - *I want to thank Sarah and Loretta for a fantastic opportunity. Everybody stepped up and everyone was present there. I thought it was tremendous. (Jansen)*
  - *In order to experience the full effect of the environment that you're experimenting with, I think a trip is always good. The camaraderie – talking and laughing, the cold, and all the elements of the ecosystem – help people experience it on a one-on-one basis. You're in the greatest canyon of them all. One of the highlights of the trip is that you truly don't know the person you're sitting next to at an AMWG meeting until you're sitting on a boat next to them. You truly do not know how much they appreciate who they represent, what they represent, and the knowledge they can share. You get to share the traditional ecological knowledge that the tribes have for the canyon (Bullets)*

**GCMRC Science Updates (Attachment 11a)** – Mr. Scott VanderKooi.

**Rainbow Trout and Humpback Chub Updates** – The Little Colorado River Confluence is the place where most spawning occurs. Many fish move in and out so there's a lot of observation occurring. Humpback Chub results:

- 2015 spring abundance estimate of 150-199 mm fish in the Little Colorado River was 921 (95% CI, 756 to 1,086)
- 2015 spring estimates of adult fish > 200mm in the Little Colorado River was 3,078 (95% CI, 2,597 to 3,559), considerably lower than recent years. Potentially due to early run timing, skipped spawning, or population decline.

- 2015 spawning run timing was similar to 2014. Lower number of detections could be due to skipped spawning or population decline.
- Lower condition factor observed in 3 of last 4 trips monitoring humpback chub in the mainstem Colorado R. near the LCR confluence. This supports the hypothesis of skipping spawning due to less energy available to devote to reproduction.

#### Rainbow Trout Natal Origins Study Sampling Design:

- Considerable declines in abundance in all reaches over the September 14 – January 15 interval. January and April 15 estimates downstream of LCR are below the non-native fish control trigger.

Integrated Tribal/Stakeholder Trip Fish Sampling – A baited hoop net was set at midday on July 20 for approximately 45 minutes at RM 61.5, which resulted in two rainbow trout with one recapture (originally tagged on 4/16/2015 at RM 63.4); and four humpback chub and three recaptures (original tagging dates of 9/21/2002 - 12.9 years at large; 10/2/2001 - 13.8 years at large; and 5/21/1989 - 26.2 years at large)

Gold King Mine Release – On August 5, there was an accidental release of approximately 3 million gallons of acidic, metal-rich mine wastewater into Cement Creek. By August 6, the plume had reached the Animas River. Reclamation responded by doubling the flow out of Navajo Dam on the San Juan River. By August 19, the traces of metal (aluminum and iron) in the San Juan River that had peaked 12-24 hours after plume was detected had returned to background levels. According to the Departments of Environmental Quality for the States of Colorado, Utah, New Mexico, and Arizona, the observable increase in metals from the mine posed minimal threat to drinking water, recreation, fish and wildlife, and agriculture even at peak concentrations. The metals deposited in Lake Powell will likely be covered by San Juan River sediment. A high sediment load and long reservoir residence time (approximately 7 years) should reduce downstream effects. The Environmental Protection Agency has come under a lot of criticism and has posted an incredible amount of information on their website. The states have also updated their websites.

- *Mr. Cantrell reported that AZGFD will continue to take baseline information and the other states are doing 1-month, 6-month, and 1-year monitoring to see if any of the metals show up or there are any declines in invertebrate populations.*
- *Mr. McClow said there are hundreds of mines like the Gold King Mine in and around Durango on the Animas River and everytime there is a heavy rainstorm, the Animas River gets a little bit yellow. Local agencies felt this spill wasn't as remarkable and people in Durango were more alarmed with the press coverage.*
- *Mr. Millis said Utah's Attorney General visited the site and that by the time the spill got into Utah, there wasn't that much concern.*
- *Ms. Dixon stated the New Mexico's municipalities get water from the Animas River and there were immediate concerns about people losing their agriculture and not being able to irrigate in time to keep it viable. The spill provided a good opportunity to improve communications with the EPA and other state representatives.*

Reclamation increased releases from Navajo Dam by 4,000 acre-feet and Mr. Rhees said the primary interest was the San Juan Recovery Program endangered species. The second week after the spill the EPA reached out to DOI for assistance. Reclamation offered to do a forensic review of what happened onsite and assisted with water quality and water sampling. Reclamation had done superfund work in the late 1980s and some expertise was provided from the Denver Technical Service. Reclamation will prepare a report within 60 days.

Green Sunfish in Glen Canyon – On July 6, Arizona Game & Fish captured 43 green sunfish at -12 mile in Glen Canyon. Agencies discussed the issue on August 4 and the following day, NPS gave approval to Reclamation and other agencies to conduct up to three removal efforts. The tribes were notified on August 7. The first removal effort occurred August 12-14 and resulted in 954 green sunfish captured. They will be preserved and delivered to the Pueblo of Zuni eagle aviary. The second removal trip is set for August 27-29. One troubling aspect of the removal effort was that over the first three passes of electrofishing by boat, the numbers caught increased each time. Usually, if the population is being significantly removed, the numbers will decrease each pass.

Sandbar and Sediment Update (Attachment 11b) – Dr. Paul Grams. During low flows, sand supplied by tributaries (like the Paria River) accumulates on bed and in eddies. High flows redistribute sand to build sandbars (beaches).

- Each of the HFEs in the past three years has resulted in sandbar deposition. They continue to erode in following six to twelve months. Ten months after HFEs, the bars are still larger than before the 2012-2014 period.

- Sand mass balance is computed for six reaches between Lees Ferry and Lake Mead. The first three years of the flood protocol has consisted of large sand inputs and relatively low dam releases. Floods built sandbars AND sand accumulated in the channel. Following high flows, sand erodes from beaches. Inputs between July 1 and August 25, 2015 are insufficient to trigger a fall 2015 HFE. The Paria would need 100 kilotons to plan for a fall HFE.

**Long-Term Experimental and Management Plan EIS (Attachment 12)** – Mr. Glen Knowles. The Cooperating Agency Draft EIS, Volume I was released on June 29, 2015. The Appendices, Volume 2, was released on July 31, 2015. A Public Draft EIS will be completed by the end of calendar year 2015. Next Steps:

- September 30, 2015 - Cooperating Agency comment deadline
- October 2015 - Biological Assessment
- December 2015 – Public Draft EIS
- January/February 2015 – Public Meetings
- March 2016 – Biological Opinion
- May 2016 – Final EIS and Record of Decision

Mr. Jordan asked how the public reviews could be done with incomplete modeling results. Mr. Knowles said the analysis was completed and peer review of the models were done consecutively. Currently there is a process in place for peer review of both the methods and analysis of the models.

Mr. McClow requested that discussion of the Draft EIS be added to the February 2016 AMWG meeting agenda. Ms. Caramanian added that the AMWG could also consider making a recommendation to the Secretary on a preferred alternative.

**Public comments:**

Lynn Hamilton (Grand Canyon River Guides) – I enjoyed hearing Sam’s talk about the river trip. It breathes the life of Grand Canyon back into the room. Even seeing pictures of Grand Canyon is so valuable. I’m thrilled you had an AMWG river trip and that it was such a great success. You learned a lot, came together as a group, and appreciated the resources. It occurs to me that 2016 will be the centennial of the NPS and it will be the 20th year of the ROD. If you’ve been on the river, picture in your mind a place that resonated for you or you learned something that opened your eyes as never before. We’re here to protect those values.

**Farewell to Members:** Ms. Gimbel thanked Lori for her assistance with the program and wished her well in Denver. Steve Spangle presented Lori with a buck knife (for use on future river trips since she didn’t have one). Reclamation gave her a Serena Supplee print. Brent Rhees expressed appreciation for Lori’s help on the LTEMP EIS and from Dave Lytle for all the work she did on behalf of the USGS. Mr. Uberuaga commended Lori for her leadership. Ms. Caramanian said working on GCDAMP issues has been the best six years of her life. Next year she’ll recognize 20 years as a federal employee. She has enjoyed working with Jennifer and Anne and learned so much about Western water law. She said the Colorado River is about relationships, building trust, and finding common ground with people who have different missions. The canyon is a place where you restore your soul.

Mr. Uberuaga thanked Martha for her years of federal service and contributions to the National Park Service. She will be honored by NPS staff back at the office. Martha said she’s gained inspiration to be resourceful and has applied that to her new “net zero” home as she plans to do her part to conserve resources.

**Wrap-Up and Adjourn:** Ms. Jennifer Gimbel thanked everyone for their attentiveness and participation.

**Adjourned:** 2:40 p.m.

**Next AMWG Meeting:**

(Tu-W) February 24-25, 2016  
Embassy Suites Phoenix-Tempe  
4400 S. Rural Road

Tempe AZ 85282

Respectfully submitted,

Linda Whetton  
Bureau of Reclamation  
Upper Colorado Region

## **Summary of Actions Taken**

The following actions were approved by consensus during this meeting, with the exception of the motion to honor Dr. Garrett, which, at the request of the Secretary's Designee, was approved unanimously:

- AMWG approves the minutes of the May 28, 2015 meeting as written.
  - AMWG agrees to consider a motion honoring Dave Garrett.
  - AMWG recommends to the Secretary of the Interior for her approval the Final FY 2015-17 Triennial Budget and Work Plan from the Bureau of Reclamation and the Grand Canyon Monitoring and Research Center as recommended by AMWG August 28, 2014, for implementation in FY 2016, with a FY 2015 corrected CPI of 1.7% and corrections to the GCMRC overhead rates. Passed by consensus.
  - AMWG recommends to the Secretary of the Interior for her approval the WY2016 Hydrograph for Glen Canyon Dam.
    - Annual Release Volumes will be determined by the 2007 Interim Guidelines and shall be reviewed and adopted through the normal annual operating plan process (in consultation with the Basin States as appropriate).
    - Monthly Release Volumes are anticipated to shift depending upon: (1) the projected Annual Release Volume, (2) power plant capacity, and (3) the magnitude of a potential High Flow Experiment.
    - Monthly Release Volumes may vary within the targets identified below. Any remaining monthly operational flexibility will be used for existing power production operations under the Modified Low Fluctuating Flow (MLFF) alternative selected by the 1996 ROD and contained in the 1995 FEIS and in compliance with all applicable NEPA compliance documents (HFE EA, NNFC EA, 2007 Interim Guidelines). Monthly release volumes proposed in this hydrograph will not affect operating tier determinations for Lakes Powell and Mead under the 2007 Interim Guidelines.
    - Release objective for June is:
      - 600 to 650 kaf for annual releases below 9.0 maf
      - 800 kaf for annual releases of 9.0 maf to less than 9.5 maf
      - 900 kaf for annual releases of 9.5 maf to less than 10 maf
      - Greater than 900 kaf for annual releases 10 maf and greater
    - Release objective for August is:
      - 800 kaf for annual release below 9.0 maf
      - 900 kaf for annual releases of 9.0 maf to less than 10 maf
      - Greater than 900 kaf for annual releases 10 maf and greater
    - Release objective for September is:
      - 600 kaf for annual releases below 9.0 maf
      - 700 kaf for annual releases of 9.0 maf to less than 10.0 maf
      - 800 kaf or greater for annual releases of 10.0 maf or greater; up to power plant capacity for high equalization releases
    - Monthly Release Volumes will generally strive to maintain 600 kaf levels in the shoulder months (spring and fall) and 800 kaf in the December/January and July/August timeframe.
- Additionally, the Bureau of Reclamation will continue to apply best professional judgment in conducting actual operations and in response to changing conditions throughout the water year. Such efforts will continue to be undertaken in coordination with the DOI/DOE agencies and in consultation with the Basin States as appropriate, to consider changing conditions and adjust projected operations in a manner consistent with the objectives of these parameters as stated above and pursuant to the Law of the River.
- The AMWG will consider a motion on Fish Management Recommendations.
  - The Adaptive Management Work Group formally recognizes the longstanding and significant contributions of Dr. L. David Garrett to the Glen Canyon Dam Adaptive Management Program (GCDAMP) in many different capacities, including first chief of the Grand Canyon Monitoring and Research Center (1996-1999) and the Executive Coordinator of the Science Advisors (2001-2013). Dr. Garrett has significantly helped the GCDAMP to address the many complex science and operational issues associated with Glen Canyon Dam and the Grand Canyon National Park and environs. The AMWG wishes to express our sincere thanks to Dr. Garrett and our warmest wishes for his happy and successful future.
  - The AMWG requests the Secretary's Designee direct GCMRC to conduct a technical review of the Lees Ferry Recreational Trout Fishery Management Recommendations and report its findings to the TWG; and directs the TWG to evaluate the GCMRC review at its October 2015 meeting, and report its findings to AMWG at its February 2016 meeting.

## Key to Glen Canyon Dam Adaptive Management Program Acronyms

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