COLORADO RIVER BOARD OF CALIFORNIA
770 FAIRMONT AVENUE, SUITE 100
GLENDALE, CA 91203-1068
(818) 500-1625
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October 2, 2014

REVISED
NOTICE OF REGULAR MEETING OF THE
COLORADO RIVER BOARD

NOTICE IS HEREBY GIVEN pursuant to the call of the Chairperson, Dana B. Fisher, Jr., by the undersigned Executive Director of the Colorado River Board of California that a regular meeting of the Board Members is to be held as follows:

Date:	Wednesday, October 15, 2014
Time:	1:30 p.m.
Place:	Executive Conference Room 1514 Los Angeles Department of Water and Power 111 North Hope Street Los Angeles, CA 90012 Tel: (213) 367-2166; FAX: (213) 367-1131

The Colorado River Board of California welcomes any comments from members of the public pertaining to items included on this agenda and related topics. Oral comments can be provided at the beginning of each Board meeting; while written comments may be sent to Mr. Dana B. Fisher, Jr., Chairperson, Colorado River Board of California, 770 Fairmont Avenue, Suite 100, Glendale, California, 91203-1068.

An Executive Session may be held in accordance with provisions of Article 9 (commencing with Section 11120) of Chapter 1 of Part 1 of Division 3 of Title 2 of the Government Code and in accordance with Sections 12516 and 12519 of the Water Code to discuss matters concerning interstate claims to the use of Colorado River System waters in judicial proceedings, administrative proceedings, and/or negotiations with representatives from other states or the federal government.

Requests for additional information may be directed to: Ms. Tanya M. Trujillo, Executive Director, Colorado River Board of California, 770 Fairmont Avenue, Suite 100, Glendale, CA 91203-1068, or 818-500-1625. A copy of this Notice and Agenda may be found on the Colorado River Board's web page at www.crb.ca.gov.

A copy of the meeting agenda, showing the matters to be considered and transacted, is attached.

Tanya M. Trujillo
Executive Director

attachment: Agenda

Regular Meeting
COLORADO RIVER BOARD OF CALIFORNIA
Wednesday, October 15, 2014
1:30 p.m.

Los Angeles Department of Water and Power
Executive Conference Room 1514
111 North Hope Street
Los Angeles, CA 90012

AGENDA

At the discretion of the Board, all items appearing on this agenda, whether or not expressly listed for action, may be deliberated upon and may be subject to action by the Board. Items may not necessarily be taken up in the order shown.

1. Call to Order

2. Welcome by Los Angeles Department of Water and Power

3. Opportunity for the Public to Address the Board (Limited to 5 minutes)
   As required by Government Code, Section 54954.3(a)

4. Administration
   a. Consideration and Approval of the Minutes of the Meeting held September 10, 2014 **(Action)**

5. Colorado River Basin Water Reports
   a. Reports on current reservoir storage, reservoir releases, projected water use, and forecasted river flows
   b. State and Local Water Reports

6. Update regarding the 2014 California Drought

7. Review and Adoption of Resolution in Support of Proposition 1 **(Action)**

8. Presentation regarding Lower Colorado Water Supply Project Applications **(Action)**

9. Staff Reports regarding Colorado River Basin Programs
   a. Update regarding Basin States Drought Contingency Planning efforts
   b. Review status of the Colorado River Basin Water Supply and Demand Study
   c. Review status of the implementation of Minute 319
   d. Review status of the Salinity Control Forum, Workgroup, and Advisory Council
   e. Review status of the Glen Canyon Dam Adaptive Management Work Group and Long-Term Experimental Management Plan EIS
   f. Review status of the Lower Colorado River Multi-Species Conservation Program

10. Announcements/Notices

11. Executive Session

An Executive Session may be held by the Board pursuant to provisions of Article (commencing with Section 11120) of Chapter 1 of Part 1 of Division 3 of Title 2 of the Government Code and Sections 12516 and 12519 of the Water Code to discuss matters concerning interstate claims to the use of Colorado River system waters in judicial proceedings, administrative proceedings, and/or negotiations with representatives from other states or the federal government.

12. Other Business

a. Next Board Meeting: November 19, 2014
Time and location details to be provided
Coachella Valley Water District
Steve Robbins Administration Building
75-515 Hovley Lane East
Palm Desert, CA 92211

Minutes of Meeting
COLORADO RIVER BOARD OF CALIFORNIA
Wednesday, September 10, 2014

A Meeting of the Colorado River Board of California (Board) was held in the Vineyard Room, of the Holiday Inn Ontario Airport, 2155 East Convention Center Way, Ontario, California, on Wednesday, September 10, 2014.

Board Members and Alternates Present

Stephen Benson
Dana Bart Fisher, Jr., Chairman
Franz De Klotz
Glen Peterson
David Pettijohn
Bud Pocklington
Jack Seiler
Michael Touhey
Doug Wilson
Jeanine Jones, Designee
Department of Water Resources

Board Members and Alternates Absent

James Hanks
Henry Kuiper
James McDaniel
John Powell, Jr.
Christopher Hayes, Designee
Department of Fish & Wildlife

Others Present

Steve Abbott
Tim Blair
Robert Cheng
Dan Denham
Andrew Fisher
Christopher Harris
Bill Hasencamp
Michael Hughes
Lisa Johansen
Lori Jones
Paul Jones
Tom Levy
Lindia Liu
Kara Mathews
Jan Matusak
Jessica Neuwerth
Thang (Vic) Nguyen
Autumn Plourd
Angela Rashid
Jack Safely
Tina Shields
Ed Smith
Gary Tavetian
Tanya Trujillo
Joseph Vanderhorst
Mark Van Vlack
Jolene Walsh
Jerry Zimmerman

CALL TO ORDER

Chairman Fisher announced the presence of a quorum and called the meeting to order at 10:10 a.m.

OPPORTUNITY FOR THE PUBLIC TO ADDRESS THE BOARD

Chairman Fisher asked if there was anyone in the audience who wished to address the Board on items on the agenda or matters related to the Board. Hearing none, Chairman Fisher moved to the next agenda item.

ADMINISTRATION

Approval of Minutes of the August 13, 2014 Colorado River Board Meeting

Chairman Fisher asked if there was a motion to approve the August 13, 2014 minutes. Mr. Pettijohn moved that the minutes be approved, seconded by Ms. Jones. By unanimous support, the August 13, 2014, meeting minutes were approved.

COLORADO RIVER BASIN WATER REPORT & DROUGHT UPDATE

Colorado River Basin Water Report

Executive Director Tanya Trujillo reported that the drought in California and the Colorado River System continues to persist. As of September 2, 2014, the water level at Lake Mead was at 1,081.66 feet with 10.15 million acre-feet (maf) of storage, or 39% of capacity, while the water level at Lake Powell was at 3,605.84 feet with 12.32 maf of storage, or 51% of capacity. The total System active storage as of September 1st was 30.21 maf, or 51% of capacity, which is almost 400,000 acre-feet (af) more than one year ago when the System storage was at 50% of capacity. As of September 2, 2014, the Upper Colorado River Basin reservoirs, other than Lake Powell, ranged from 64% to 97% of their capacities.

Ms. Trujillo reported that Lake Mead has come up a little and is no longer at its lowest level since it was initially filled. The Water Year 2014 precipitation to date is 102% of average and the forecasted inflow into Lake Powell is 95% of average. There was above average precipitation in most areas in the basin in July and August.

Ms. Trujillo provided an overview of the current drought conditions within California and in the West. The September 2, 2014 U.S. Drought Monitor Map indicates that the Western U.S. is still experiencing widespread drought. Within the Colorado River Basin, with the exception of Wyoming and Colorado, drought conditions continue to be severe. Fifty-eight percent of California continues to be in the Exceptional Drought category (the most severe drought category) with no relief in sight.

2015 Draft Annual Operating Plan

Ms. Trujillo gave an update on the development of the 2015 Annual Operating Plan (AOP). The third consultation meeting was held in Las Vegas on September 4, 2014. The August 24-month study has been completed and it is anticipated that U.S. Bureau of Reclamation (Reclamation) will release 9 maf from Lake Powell in 2015. The release is projected to start at 8.23 maf then increase to 9 maf after an April assessment. The current projections indicate that the Normal or Intentionally Created Surplus (ICS) Surplus Condition is projected as the Lower Basin's operating tier. Full delivery is projected to occur from Lake Mead to the Lower Basin contractors and no shortage is anticipated in 2015. The latest projections indicate that there is a 36% chance of the first level shortage in the Lower Basin occurring in 2016. Basinwide hydrology will be closely monitored and Reclamation will continuously update these projections. The AOP will be finalized by December 2014.

Ms. Trujillo showed a graph illustrating the variability in the Lake Powell unregulated inflows from 1964 to present, including those forecasted for 2015. From year 2000 to present, most of the inflow levels have been below average. For the AOP, Reclamation performs modeling projections based on the Minimum Probable, Most Probable, and Maximum Probable scenarios. For the August 2014 Most Probable scenario, the inflow level is projected to be a little below average at 10.15 maf.

State and Local Reports

Board Member Jeanine Jones reported that statewide reservoir storage is currently at approximately 58%. There has been little precipitation recently and it would be in October or November before any is expected to occur in Northern California.

The Legislature recently passed a bond measure that would be Proposition 1 for the November ballot. The measure, upon voter approval, would enact the Water Quality, Supply, and Infrastructure Improvement Act of 2014. Also, a legislative groundwater bill pending the Governor's signature would create a framework for local and regional groundwater management.

Board Member Glen Peterson of the Metropolitan Water District of Southern California (MWD) asked if the Colorado River Board (Board) could take a position on the upcoming Water Bond. Counsel Gary Tavetian offered to evaluate this direction further and get back to the Board.

Mr. Peterson reported that MWD's combined reservoir storage (531,723 af) as of September 1st is at 51%. The total water deliveries to member agencies as of end of July is 1.2 maf compared to a total average delivery to date for the same period of 1.13 maf.

Mr. Peterson explained that water consumption in southern California has started to decline due to the effect of MWD's advertising and conservation programs. MWD has

removed more than 600,000 square feet of turf and it will be offering $2.00 per square foot of turf removal in future multi-million dollar incentive programs.

California Drought Update

Ms. Trujillo reported that most of California is still at the same level of Exceptional Drought category per the U.S. Drought Monitor maps. As of July, mandatory conservation measures were imposed throughout California for outdoor water uses. In September, the State Water Resources Control Board (Water Board) released a notice indicating that urban suppliers had reduced water use by 7.5% versus the reports from last year. Turf removal programs in Southern California have recorded 2.5 million square feet and 4.7 million square feet of turf removal from residential and commercial properties, respectively, which equates to about 82 football fields. Mr. Peterson added that at MWD's last Board meeting, it was reported that about 380 acres of turf had been removed and it is expected that these acreage would increase significantly.

Ms. Jones said that the Water Board will take further actions on water conservation. The Water Board will refine its survey to water agencies in order to collect more specific data related to savings on a gallons per capita basis. The Governor's Drought Task Force will be meeting on September 11, 2014 to get an update on the progress made by the Water Board. Another major activity is related to social service assistance in primarily agricultural communities impacted by the drought in the San Joaquin Valley. Food banks, financial and housing assistance, etc. have been provided to farm workers affected by the agricultural water cutbacks.

Presentation by Paul Jones, General Manager, Eastern Municipal Water District

Paul Jones, General Manager of Eastern Municipal Water District (EMWD), gave the Board a presentation on his agency's allocation-based rate structure which was implemented in 2009. Mr. Jones gave an overview of EMWD and its service area. EMWD was established in 1950 and serves approximately 750,000 people in seven cities in southwestern Riverside County. EMWD has approximately 137,000 service connections and 18,000 acres of active agriculture with about 11,000 acres irrigated by recycled water.

Mr. Jones explained that 44% of EMWD's local water supply comes from ground water wells, a Brackish Water Desalination Program and recycled water. Most of the groundwater basins consist of brackish water. The recycled water comes from the regional waste water treatment plants, which is currently recycling 100% of the outflow. Regarding EMWD's desalination program, Board Member Stephen Benson asked whether the desalination plant had a brine disposal line. Mr. Jones responded that brine is discharged via a 72-mile brine line to the Pacific Ocean which was constructed pursuant to a Joint Powers Authority, which EMWD is a member. Further, Mr. Jones reported that 56% of EMWD's supply is imported, with 30% from the Delta, 11% from the Colorado River and 15% from raw water from both the Colorado River and the Delta. Mr. Jones added that a limited supply of State Water Project water, which is provided by

MWD, has forced EMWD to increase its Colorado River water supply to 40%. Mr. Jones explained that increasing the supply of Colorado River water has been aided by EMWD's proximity to MWD's conveyance system. Consequently, this has allowed MWD to continue to deliver water to service areas that are solely dependent on State Water Project and cannot get Colorado River water.

Mr. Jones explained to the Board that the foundation of EMWD's Water Use Efficiency Program is its allocation-based rate structure, which creates a budget for each individual customer, based on reasonable needs and efficient use of water. In addition, the rate structure includes a tiered pricing system that compels customers to stay within their allocation or risk sharply increasing water rates. Each customer account is individualized, based on indoor and outdoor needs. The indoor water budget is based on the number of occupants in the household. To calculate outdoor irrigation EMWD uses data gathered from aerial infrared photogrammetry, evapotranspiration and field verifications. The rate structure also considers conservation factors and use variances for specific land uses such as nursing homes or equestrian facilities. Regarding the structure of the tiered rates, Mr. Jones reported customers that stay within their allocation buy water in Tier 1 and Tier 2, which is $1.73 per unit for indoor use and $3.16 per unit for outdoor use, respectively. If a customer is over their allocation they are subject to Tier 3, which is categorized as "Excessive" and represents use up to 50% in excess of their indoor and outdoor use will be charged $5.66 per unit. Customers using in excess of 50% and more are categorized as "Wasteful" and charged $10.36 per unit. Bill adjustments and considerations are made for customers that have excessive water usage due to leaks and EMWD will charge for the excessive use at a Tier 2 rate. Mr. Jones added that in order to capture EMWD's fixed costs and buffer against declining revenues due to conservation, customers are charged a fixed rate. Mr. Jones noted that rate structure was fair, as it rewarded customers with lower water bills if they used water efficiently and remained within their allocation or higher bills for customers that used water excessively.

Mr. Jones reported that the economic effect of the rate structure was evaluated by the Water Science and Policy Center at University of California at Riverside in a three-year study. Researchers found that average prices rose less than 4% a year under the allocation based rate structure. Additionally, researchers found that if EMWD used a flat rate structure, rates would have had to increase by 34%. Mr. Jones noted that that controlling for the effects of the economic downturn and inflation, water use was reduced by a minimum of 15%. In addition, the allocation based rate structure generated annual water and energy cost savings of $11 million and $3 million, respectively. Mr. Jones concluded that the allocation-based rate structure encouraged efficient use, communicates the value of water, identifies wasteful use of water, energy and water cost savings and has demonstrated a minimum water use savings of 15%.

Responding to a question from Board Member Alternate Bud Pocklington regarding how EMWD evaluates indoor and outdoor use, Mr. Jones stated that residential occupants are asked to report the current numbers of occupants in the home. Responding to a similar question regarding evaluating number of occupants in a household by Board Member Doug Wilson, Mr. Jones added that customers receive reminders in their billing

statements to update the size of their current households. Mr. Jones added that the data is also used to calculate a variable sewer rate which encourages customers to be honest about the size of their household. Regarding outdoor use, Mr. Jones stated that aerial photogrammetry which provides an infrared overlay is used in conjunction with a GIS database of parcel sizes to compute the irrigated area.

Mr. Pocklington asked how the public has reacted to the new rate structure, which was implemented in 2009. Mr. Jones responded that the reaction from the public has been positive. Adding that, initial customer service call volume was great and EMWD ran a parallel billing system to help customers get accustomed to the new system. Regarding EMWD tier structure, Board Member Stephen Benson asked whether agricultural customers used the same structure. Mr. Jones responded that EMWD has very few agriculture customers that use potable water. Agricultural customers using recycled water are not subject to the allocation. Rates for recycled water vary from $100 per acre foot to $380 per acre foot.

Board Member Jeanine Jones stated that recent drought mitigation efforts such as turf removal have negatively impacted the health of shade trees by reducing watering to trees. Ms. Jones added that the death of shade tree conflicts with California's energy conservation efforts. Mr. Jones responded that new developments within EMWD service area encourage the planting of trees. Mr. Jones noted that consumption of water goes down substantially with the presence of trees and this is factored into the allocation for newer landscaping and developments.

Board Member David Pettijohn remarked that Mr. Jones gave an excellent presentation and that the Los Angeles Department of Water and Power (LADWP) has a similar allocation based rate structure that uses data for occupants per household, lot size and temperature zone. Mr. Pettijohn added that LADWP is currently working on developing a similar Tier 3 and Tier 4 structure. Responding to question from Mr. Pettijohn regarding EMWD's GPCD calculation, Mr. Jones responded that EMWD used the State's methodology for SB x7-7, the State's water conservation mandate to reduce water use by 20% by 2020.

Mr. Jones concluded the presentation by responding to a question from an audience member regarding rate structures for commercial and industrial customers. Mr. Jones that explained data for commercial and industrial users is empirical and not as refined as residential customers. There are basic allocations for commercial users that evaluate landscape area which use separate meters, as well as land use type and the square footage.

COLORADO RIVER BASIN PROGRAM REPORTS

Ms. Trujillo introduced Ms. Jessica Neuwerth as the new Board staff member. As the new environmental scientist, Ms. Neuwerth looks forward to working with the Board.

Colorado River Basin Water Supply and Demand Study

Ms. Trujillo explained that the Basin Study project is currently in the Phase 1 of the Next Steps process. Ms. Trujillo reminded the Board that the Basin Study report was completed in December 2012 and for the past year-and-a-half, the workgroups have been working on Phase I reports to document the next steps. A consolidated report is anticipated to be issued in November of this year. There are three workgroups, the Municipal and Industrial Water Conservation and Reuse Workgroup, co-chaired by MWD, the Agricultural Conservation, Productivity, and Water Transfers Workgroup, co-chaired by the Imperial Irrigation District (IID), and the Environmental and Recreational Flows Workgroup, which does not have a California co-chair but whose meetings are attended by Board staff. The Phase I draft reports from the Agricultural Conservation, Productivity, and Water Transfers Workgroup and the Environmental and Recreational Workgroup are currently in review, while the Phase I draft report from the Municipal and Industrial Workgroup is anticipated to be out this week. A more detailed update on what each of these reports include will be given at the next Board meeting. Ms. Trujillo reported that the Coordination Committee, which reviews the progress of the Workgroups, is scheduled to meet on October 1, 2014.

Minute 319 Implementation

Ms. Trujillo reported that an interim initial report on the effects of the pulse flow is expected to be available within the next month and she will circulate the report once it becomes available. Ms. Trujillo reported that there is some initial tree growth in some of the riparian areas, and the next step is to evaluate the effects of base flows that will be used to target tree growth in certain areas that have been developed as a result of the initial pulse flow.

Ms. Trujillo reported that the workgroup established to concentrate on the Rosarito Desalination Project has continued working in a binational process with Mexico. The workgroup is waiting to hear back from Mexico on some more definitive plans as to the possibility of a direct delivery across the border to the San Diego area or the development of an exchange mechanism so that contractors on the Colorado River could contribute funding towards the development of the Rosarito Desalination Plant in exchange for Mexico agreeing to reduce its Colorado River water deliveries. Both concepts still have a long way to go in terms of design, construction and permitting and to develop the legal and bi-national mechanisms to make the exchange work.

Ms. Trujillo reported that the Hydrology Workgroup continues to meet to continue Mexico's education process on the tools we use in the United States to evaluate our drought conditions, to operate our system, to move water from the Upper Basin to the Lower Basin, and to explain how our shortage and surplus provisions have been developed. The Mexican representatives have participated in the AOP workshops and have been trying to become familiar with the measures and programs that we have in the U.S. The Mexican representatives are trying to communicate their own ideas to us as

well. It is an on-going process of trying to learn how to speak the same hydrologic language with our Mexican counterparts. Additional workgroup meetings are planned in September and Ms. Trujillo will report back on any progress made in those meetings.

Mr. Wilson asked for a list of the members of the workgroups. Ms. Trujillo replied that it is a complex matrix of membership but entities within the Basin States are eligible to participate in the workgroups so it is a matter of interest and expertise. For example, the San Diego County Water Authority is interested in the development of the Rosarito Desalination project, and IID is interested in the workgroup relating to the All American Canal's potential connection between Mexico and the U.S. for emergency purposes. Ms. Trujillo added that a more detailed update on how each workgroup is comprised will be provided at a later meeting. Ms. Trujillo added that the workgroup meetings are scheduled based on the availability of both U.S. and Mexican participants. She noted that the International Boundary Water Commission (IBWC) is in charge of setting up the meetings and documenting the progress because all of the work is done in the context of the binational Minute that helps implement the treaty between the two countries on Colorado River water deliveries.

Mr. Benson added that the All American Canal connection is still in the discussion phase right now. Ms. Trujillo explained that all the issues being discussed in all of the workgroup meetings are under discussion in both in the U.S. and Mexico. She added that it is a slow and long process. Minute 319 took five years to negotiate and the Minute itself is a five-year pilot project. Mr. Benson added that Mexico has not yet started filing the paperwork to request funding for the bi-national projects. Ms. Trujillo explained that one of the project components of Minute 319 involves financial contribution from U.S. agencies, including MWD and IID, in exchange for rehabilitation of canal linings or fallowing programs in Mexico that would result in water generated for the U.S., and we have not yet seen any firm proposal from Mexico on what projects they would like to use the funding for. Ms. Trujillo added that we are a year-and-a-half into Minute 319 and are hoping to make progress.

Salinity Control Forum, Work Group, and Advisory Council

Ms. Trujillo reported that the Salinity Control Forum's Work Group is meeting during the end of September 2014 in Salt Lake City, Utah. One of the issues that is being finalized is the draft Triennial Review of Water Quality Standards for Salinity (Review) for the period 2014 through 2017. It is a review required by the Clean Water Act and is developed on a routine basis through the Salinity Control Forum in coordination with each of the state's water quality agencies. Ms. Trujillo reported that the Board staff has been working with the Regional Water Quality Control Board on the process to finalize and get State approval of the Review when it is completed. The Board is also working to make sure the draft Review will reflect the most up-to-date standards. The next Salinity Control Forum and Advisory Council meetings will take place in late-October in Santa Fe, New Mexico. More thorough reports on the Paradox Valley Unit Injection Well Replacement Environmental Impact Study (EIS) process that Reclamation is contracting

to do various elements of that EIS are expected after the meetings. Mr. Peterson asked for a report on the alternatives being developed for the Paradox Valley Unit Injection Well Replacement EIS. Ms. Trujillo replied that the Board will be giving a status update on that at the next Board meeting.

Glen Canyon Dam Adaptive Management Work Group and Long-Term Experimental and Management Plan EIS

Ms. Trujillo reported that the Technical Work Group of the Glen Canyon Dam Adaptive Management Work Group (AMWG) met in the last week of August to review and approve the final draft of the triennial budget, which is going to fund work from the U.S. Geological Survey (USGS) Grand Canyon Science Group for continued monitoring and technical science efforts in the Grand Canyon area for 2015 to 2017. Reports on basin-wide hydrology from Reclamation and updates on topics such as the status of some of the endangered fish populations in the Upper Colorado River Basin region were also heard at that meeting. Ms. Trujillo reported that although the AMWG is a federal advisory committee, which is supposed to be working on limited-term projects, AMWG has been in existence for 20 years and not winding down in terms of the need to implement the Grand Canyon Protection Act, which was adopted in 1992 and requires the federal agencies to balance complicated competing needs that exist within the Grand Canyon area. The competing needs include tribal issues, endangered species issues, world-class trout fisheries, rafting needs, and of course water deliveries and power generation.

Ms. Trujillo reported that the AMWG is still in the process of developing a recommendation on whether Reclamation will release a fall high-flow experiment, which will be dependent on the availability of a sufficient level of sediment in the higher reaches of the Colorado River below Glen Canyon Dam. An update on Reclamation's projections for that possibility is expected within the next month or so. The high-flow experiment has to be balanced against power generation impacts and water supply delivery issues.

Ms. Trujillo reported that the Basin States and their science advisors continue to work with the Reclamation and the Park Service on the development of the Long-Term Experimental and Management Plan EIS. The Basin States developed a proposed alternative two-and-a-half years ago and have been in discussion with the Interior management team since then to modify some of the proposals in the development of a consensus-based hybrid alternative. Additional meetings are planned next week with the Interior team to continue the discussion for a final proposed alternative for that EIS process.

Mr. Benson asked whether the Long-Term Experimental and Management Plan covers the Grand Canyon stretch, from Glen Canyon Dam down to the top of Lake Mead. Ms. Trujillo noted that a map will be provided to clarify the geographical coverage of that program at the next meeting.

Lower Colorado River Multi-Species Conservation Program

To address the recent discovery that the Lower Colorado River Multi-Species Conservation Program (LCR MSCP) had been underfunded during Fiscal-Years 2011 through 2014, Ms. Trujillo reported that the California representatives have developed a plan with Reclamation and Arizona and Nevada to be able to pay back the underfunding amount such that California will be paying exactly the amount that should have been paid without any additional penalty.

Ms. Trujillo explained that Board staff Christopher Harris will take the lead on drafting a comment letter to the Board's member agencies in response to U.S. Fish and Wildlife Service on its proposal to designated critical habitat for the threatened yellow-billed cuckoo species. Ms. Trujillo reported that there is a workgroup meeting on September 24, 2014 in Las Vegas, Nevada. Updates on the proposed Hualapai settlement and the Planet Ranch acquisition, a proposed Indian water rights settlement within Arizona, are expected at the workgroup meeting.

Announcements/Notices

Ms. Trujillo reported that Anne Castle has announced that she is resigning her position as the Assistant Secretary for Water and Science at the Interior effective the end of September. Ms. Trujillo reported that Ms. Castle and Mike Connor are the two longest tenured political appointees within the Department of Interior. There has been no announcement yet as to whether there will be an interim person acting or whether the President will nominate a person for the Assistant Secretary position.

Ms. Trujillo reported that Estevan Lopez is currently waiting for Senate confirmation on his nomination for the position of Commissioner of Reclamation, the position left vacant by Mike Connor moving up to be the Deputy Secretary of the Interior. Mr. Lopez will be moving from New Mexico to Washington D.C. effective October 1, 2014, and will be placed in an interim capacity at DOI if he is not confirmed prior to October 1, 2014.

Ms. Trujillo reported that Larry Walkoviak has announced his retirement as the Regional Director for the Reclamation's Upper Colorado Region effective October 3, 2014, and no replacement has been announced for that position.

Ms. Trujillo reported that an event has been planned for September 27, 2014 to celebrate the 50th anniversary of the Glen Canyon Dam in Page, Arizona. Secretary of the Interior Sally Jewell is anticipated to speak at the event. There is an open invitation for anyone who wants to attend the celebration. Ms. Trujillo reminded the Board that Proposition 1 is on the ballot for November.

Ms. Trujillo updated the Board on the Navajo Nation v. Department of the Interior litigation. The Navajo Nation has requested leave to amend some of the claims that have been dismissed by the court. A response to that motion is due on Friday, and

the court will have to decide whether to stick with its prior order dismissing the claims or to allow the tribe to amend its claims. Steve Abbott of the Coachella Valley Water District (CVWD) added that the challenge is that the Navajo Nation wants to go forward with concern the Interim Surplus Guidelines and the coordinated operations but the challenge to the Implementation Agreement EIS, which supported the Quantification Settlement Agreement (QSA) has been dropped.

Ms. Trujillo reported on a study that came out last week by the Pacific Institute relating to the Salton Sea. The study headline indicates that failures to address impacts associated with the Salton Sea will have very expensive consequences. The study was funded by Reclamation and involved input from agencies including Imperial Irrigation and CVWD.

Ms. Trujillo announced that the next meeting of the Colorado River Board will be held on Wednesday, October 15, 2014, to be hosted by LADWP. Ms. Trujillo reported that a morning tour will be available to the Board's members and staff, and the official meeting will start after lunch at the LADWP facilities. Mr. Pettijohn added that the tour will be at the Los Angeles Aqueduct Filtration Plant in the Sylmar area, adjacent to the MWD Joseph Jensen Treatment Plant. The tour participants will see the cascades where water comes in through the LADWP aqueduct system and how LADWP interacts with MWD's system out there. LADWP Deputy Senior Assistant General Manager Marty Adams, who will be taking over for Jim McDaniel next year, will be leading the tour. Ms. Trujillo added that a recommendation of nearby hotels for out of town participants will be circulated.

Ms. Trujillo proposed to move the November Board meeting from the day after Veteran's Day, November 12, 2014, to the subsequent Wednesday, which would be November 19, 2014. The November Board meeting will be hosted by CVWD with a similar schedule of a tour in the morning and the official meeting in the afternoon.

Adjournment

With no further items to be brought before the Board, Chairman Fisher asked for a motion to adjourn the meeting. Upon the motion of Mr. Pettijohn, seconded by Mr. Benson, and unanimously carried, the meeting was adjourned at 11:33 a.m. on September 10, 2014.

Oct 06, 2014

LOWER COLORADO WATER SUPPLY REPORT

River Operations

Bureau of Reclamation

Questions: BCOOWaterops@usbr.gov

(702)293-8373

http://www.usbr.gov/lc/region/g4000/weekly.pdf

CURRENT STORAGE	PERCENT FULL	Content 1000 ac-ft (kaf)	Elev. (Feet above mean sea level)	7-Day Release (CFS)
LAKE POWELL	51%	12,336	3606.04	9,900
* LAKE MEAD	39%	10,149	1081.66	9,300
LAKE MOHAVE	89%	1,613	639.84	11,300
LAKE HAVASU	93%	576	447.80	7,800
TOTAL SYSTEM CONTENTS **	50%	30,097		
As of 10/05/2014				
SYSTEM CONTENT LAST YEAR	50%	29,868		

* Percent based on capacity of 26,120 kaf or elevation 1219.6 feet.

** TOTAL SYSTEM CONTENTS includes Upper & Lower Colorado River Reservoirs, less Lake Mead exclusive flood control space.

Salt/Verde System	50%	1,161		
Painted Rock Dam	0%	0	530.00	0
Alamo Dam	6%	56	1089.94	15

Forecasted Water Use for Calendar Year 2014 (as of 10/06/2014) (values in kaf)

NEVADA	235	
SOUTHERN NEVADA WATER SYSTEM		208
OTHERS		27
CALIFORNIA	4,370	
METROPOLITAN WATER DISTRICT OF CALIFORNIA		900
IRRIGATION DISTRICTS		3,364
OTHERS		106
ARIZONA	2,762	
CENTRAL ARIZONA PROJECT		1,597
OTHERS		1,166
TOTAL LOWER BASIN USE		7,368
DELIVERY TO MEXICO - 2014 (Mexico Scheduled Delivery + Preliminary Yearly Excess[1])		1,526

OTHER SIGNIFICANT INFORMATION

UNREGULATED INFLOW INTO LAKE POWELL - OCTOBER FINAL FORECAST DATED 10/01/2014

	MILLION ACRE-FEET	% of Normal
PRELIMINARY OBSERVED WATER YEAR 2014	10.380	96%
OBSERVED APRIL-JULY 2014	6.923	97%
SEPTEMBER OBSERVED INFLOW	0.511	125%
OCTOBER INFLOW FORECAST	0.750	146%

	Upper Colorado Basin	Salt/Verde Basin
WATER YEAR 2015 PRECIP TO DATE[2]	69% (0.3")	15% (0.1")
CURRENT BASIN SNOWPACK	NA (NA)	NA (NA)

[1] Delivery to Mexico forecasted yearly excess calculated using year-to-date observed and projected excess.

[2] Precipitation values may vary significantly from week-to-week this early in the water year.

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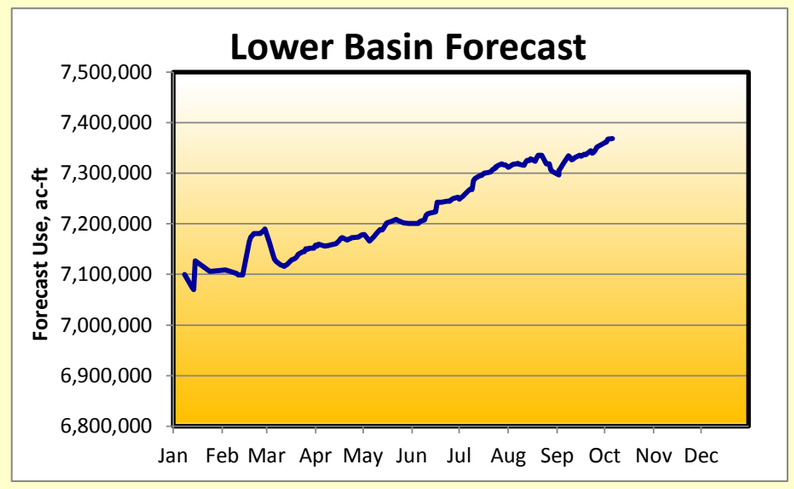
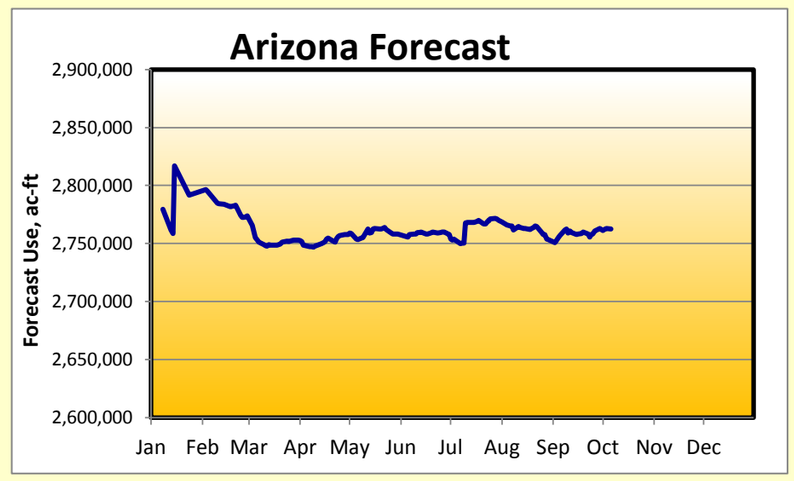
U.S. BUREAU OF RECLAMATION
LOWER COLORADO REGION
PROVISIONAL CY2014

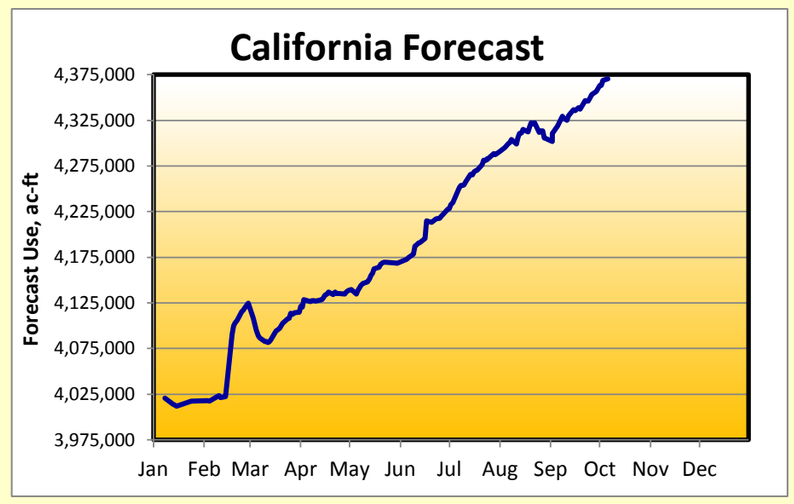
ARIZONA, CALIFORNIA, NEVADA, MEXICO
FORECAST OF END OF YEAR CONSUMPTIVE USE
FORECAST BASED ON USE TO DATE AND APPROVED ANNUAL WATER ORDERS [1]
(ACRE-FEET)

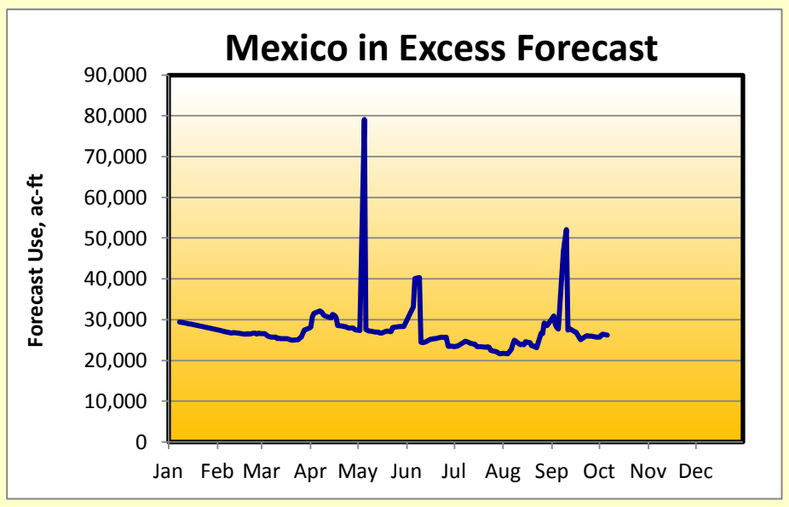
WATER USE SUMMARY	Use To Date CY2014	Forecast Use CY2014	Approved Use [2] CY2014	Excess to Approval CY2014
ARIZONA	2,227,664	2,762,412	2,790,734	-28,322
CALIFORNIA	3,784,959	4,370,259	4,057,609	**312,650**
NEVADA	182,022	235,255	300,000	-64,745
STATES TOTAL [3]	6,194,645	7,367,926	7,148,343	**219,583**
MEXICO IN SATISFACTION OF TREATY (Including downward delivery)	1,332,967	1,526,179	1,500,000	**26,179**
TO MEXICO AS SCHEDULED	1,313,885	1,500,000		
MEXICO IN EXCESS OF TREATY	19,082	26,179		
BYPASS PURSUANT TO MINUTE 242	111,248	149,536		
TOTAL LOWER BASIN & MEXICO	7,638,860	9,043,641		

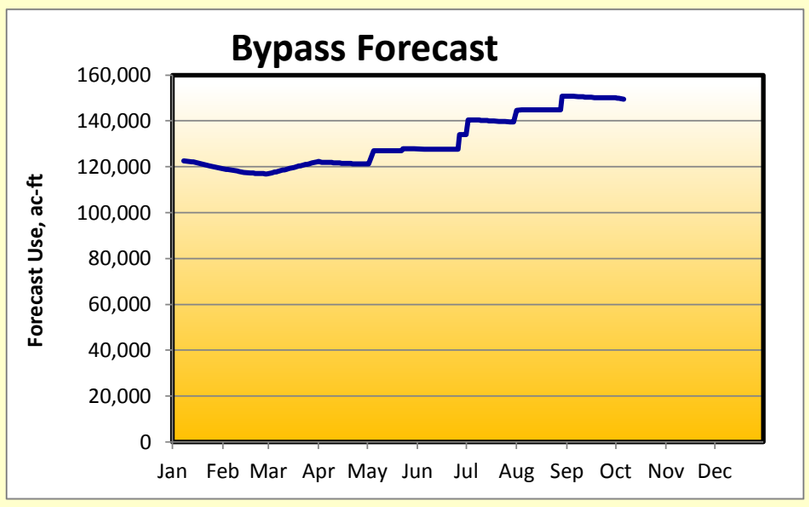
1/ Incorporates Jan-August USGS monthly data and 80 daily reporting stations which may be revised after provisional data reports are distributed by the USGS. Use to date estimated for users reporting monthly and annually.
2/ These values reflect adjusted apportionments. See Adjusted Apportionment calculation on each state page.
3/ Includes unmeasured returns based on estimated consumptive use/diversion ratios by user from studies provided by Arizona Department of Water Resources, Colorado River Board of California, and Reclamation.

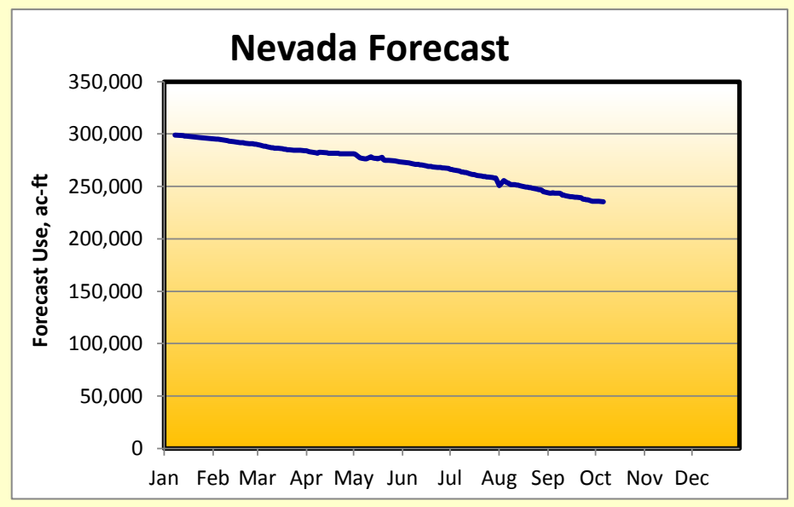


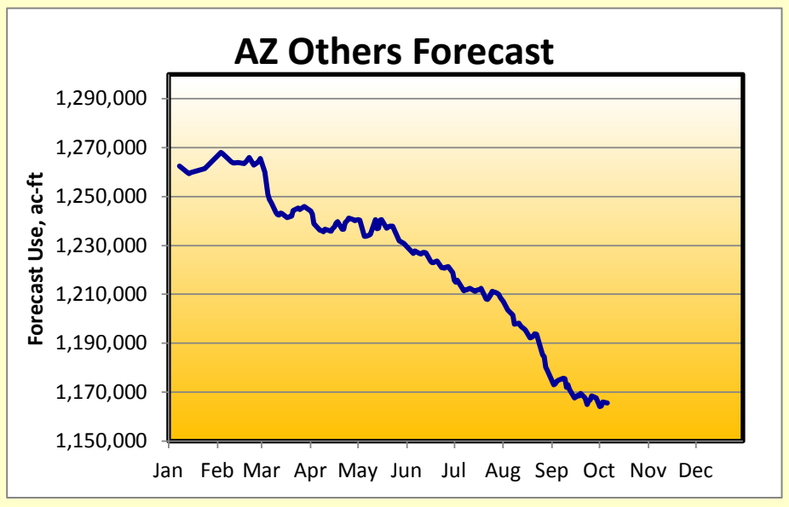


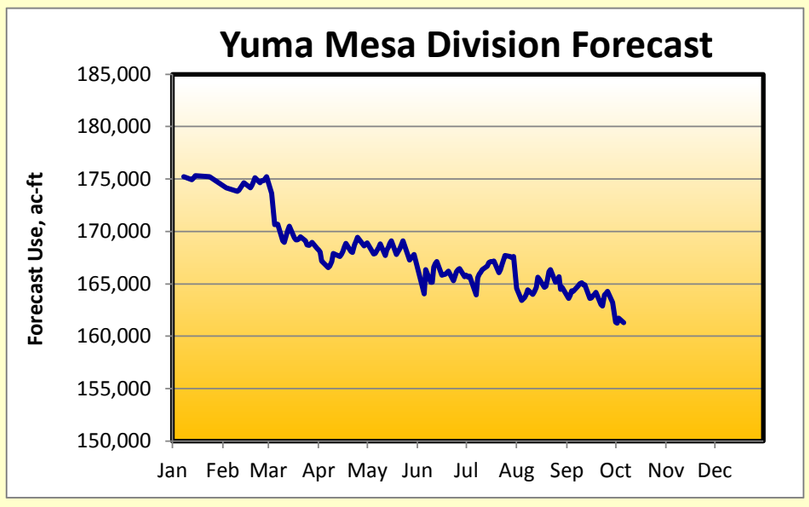


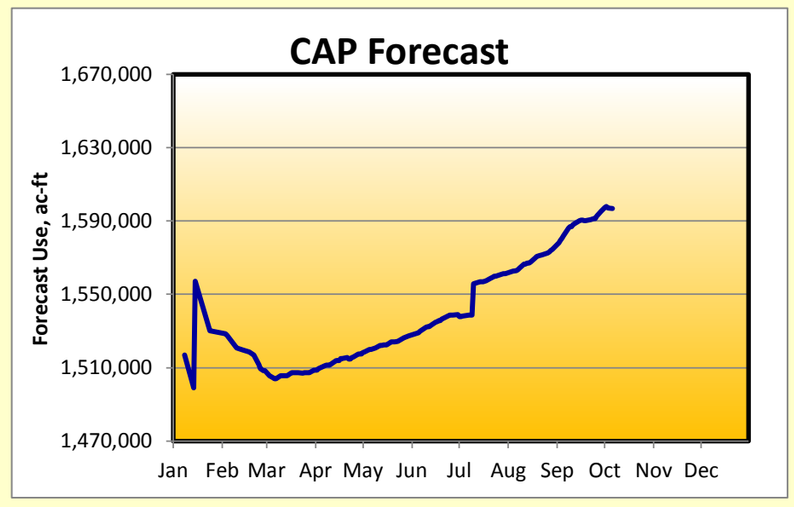


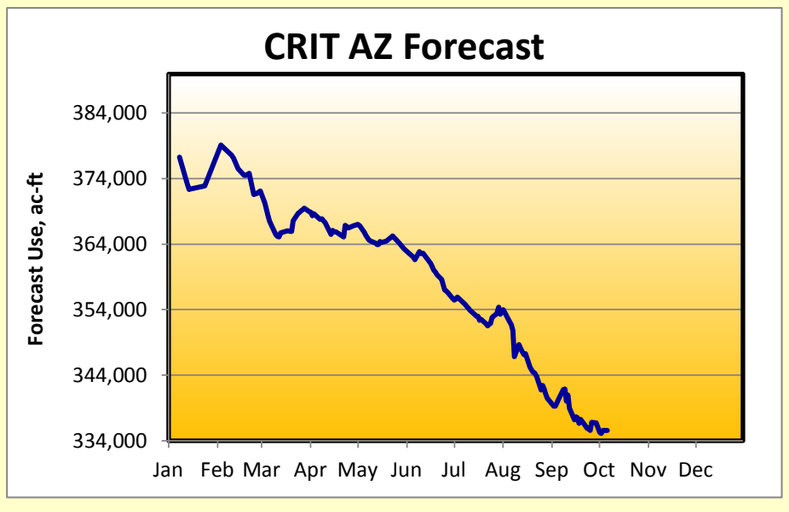


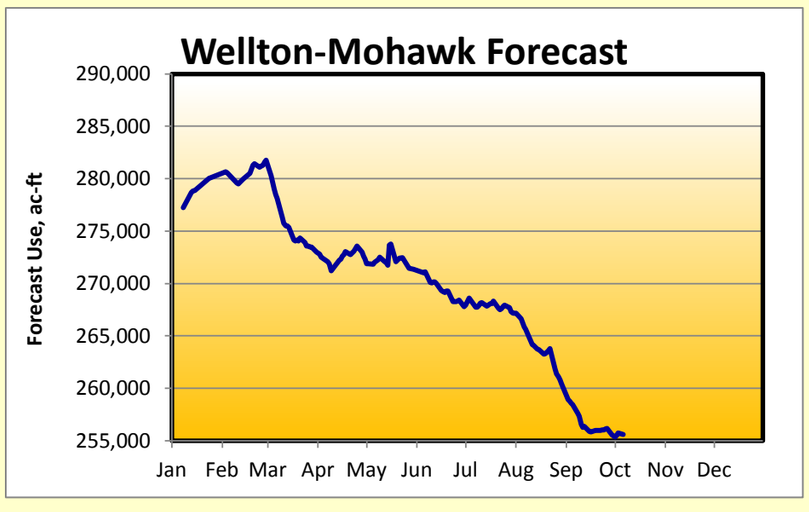


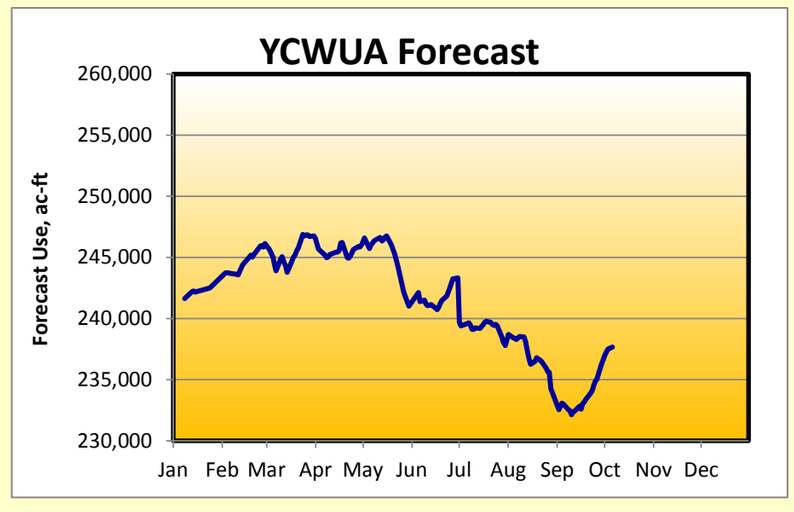












Graph notes: Jan 1 forecast use is scheduled use in accordance with the Annual Operating Plan's state entitlements, available unused entitlements, and over-run paybacks. A downward sloping line indicates use at a lower rate than scheduled, upward sloping is above schedule, and a flat line indicates a use rate equal to schedule. Lower priority users such as CAP, MWD, and Robt.B.Griffith may adjust use rates to meet state entitlements as higher priority use deviates from schedule. Abrupt changes in the forecast use line may be due to a diversion schedule change or monthly updating of provisional realtime diversions.

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LOWER COLORADO REGION
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NOTE:
- Diversions and uses that are pending approval are noted in *red italics*.
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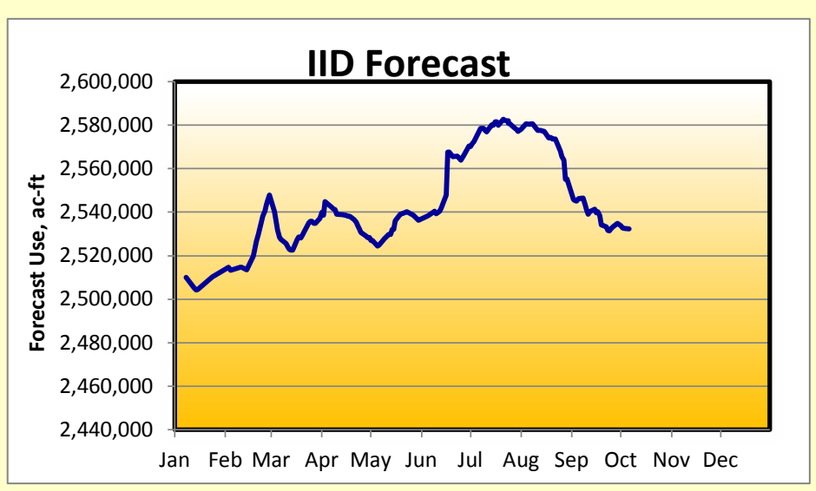
CALIFORNIA WATER USERS
FORECAST OF END OF YEAR CONSUMPTIVE USE
FORECAST BASED ON USE TO DATE AND APPROVED ANNUAL WATER ORDERS
California Schedules and Approvals
Historic Use Records (Water Accounting Reports)

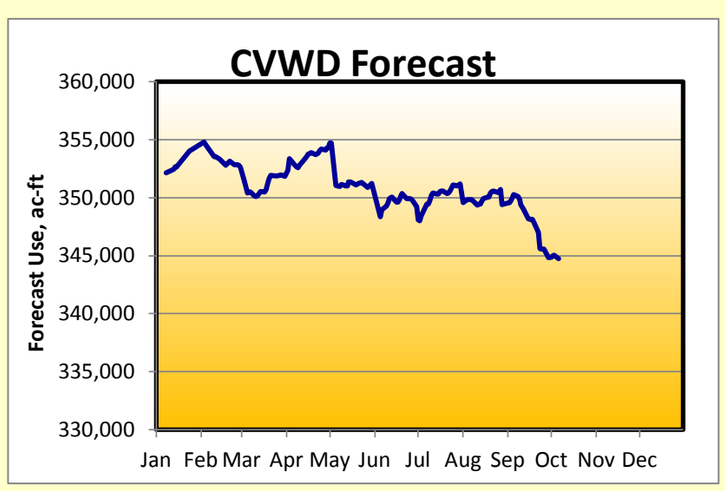
WATER USER	Use To Date CY2014	Forecast Use CY2014	Estimated Use CY2014	Excess to Estimated Use CY2014	Diversion To Date CY2014	Forecast Diversion CY2014	Approved Diversion CY2014	Excess to Approved Diversion CY2014
CALIFORNIA PUMPERS	1,653	1,959	1,959	---	2,953	3,499	3,499	0
FORT MOJAVE INDIAN RESERVATION, CA	6,780	7,555	8,996	---	12,602	14,041	16,720	-2,679
CITY OF NEEDLES (includes LCWSP use)	1,630	1,931	1,931	0	2,295	2,720	2,720	0
METROPOLITAN WATER DISTRICT	868,725	899,932	546,660	---	871,021	902,969	549,763	---
COLORADO RIVER INDIAN RESERVATION, CA	2,906	3,444	3,444	---	4,987	5,909	5,909	0
PALO VERDE IRRIGATION DISTRICT	389,294	424,386	454,108	---	798,212	954,115	994,500	-40,385
YUMA PROJECT RESERVATION DIVISION	48,532	57,432	47,886	---	79,570	101,928	102,700	-772
YUMA PROJECT RESERVATION DIVISION - INDIAN UNIT	---	---	---	---	37,189	47,631	49,100	-1,469
YUMA PROJECT RESERVATION DIVISION - BARD UNIT	---	---	---	---	42,381	54,297	53,600	**697**
YUMA ISLAND PUMPERS	4,198	4,974	4,974	---	7,596	9,001	9,001	0
FORT YUMA INDIAN RESERVATION - RANCH 5	570	675	675	---	1,030	1,221	1,221	0
IMPERIAL IRRIGATION DISTRICT	2,122,300	2,532,386	2,544,150	-11,764	2,104,325	2,534,926	2,645,857	---
SALTON SEA SALINITY MANAGEMENT	58,402	90,000	90,000	0	60,851	97,761	93,451	---
COACHELLA VALLEY WATER DISTRICT	279,254	344,738	352,000	-7,262	290,768	359,543	366,370	---
OTHER LCWSP CONTRACTORS	549	650	650	---	857	1,016	1,016	0
CITY OF WINTERHAVEN	58	69	69	---	88	104	104	0
CHEMEHUEVI INDIAN RESERVATION	108	128	128	---	9,570	11,340	11,340	0
TOTAL CALIFORNIA	3,784,959	4,370,259			4,246,725	5,000,093	4,804,171	

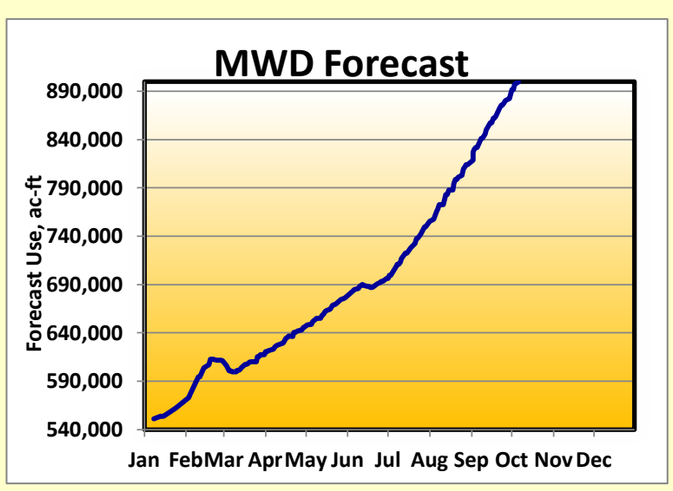
CALIFORNIA ADJUSTED APPORTIONMENT CALCULATION	
California Basic Apportionment	4,400,000
Payback of IOPP Overrun (IID)	-117,391
Intentionally Created Surplus Water (IID)	-25,000
Creation of Extraordinary Conservation ICS (MWD)	-200,000
Total State Adjusted Apportionment	4,057,609
Excess to Total State Adjusted Apportionment	312,650

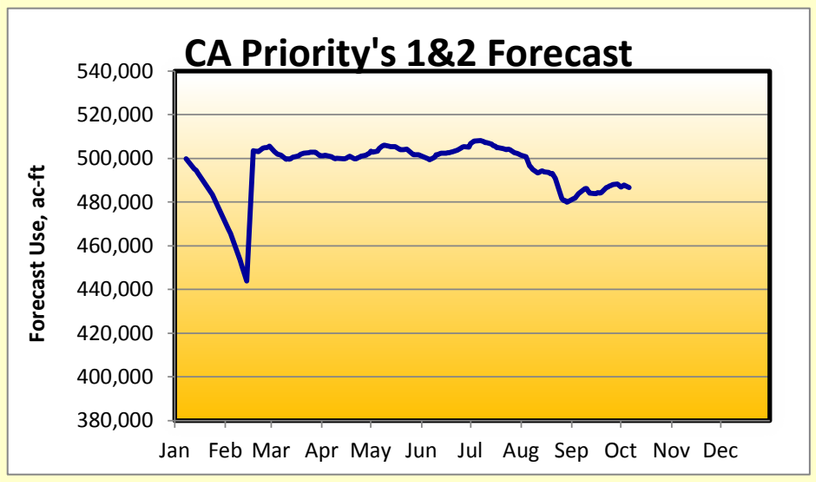
ISG ANNUAL TARGET COMPARISON CALCULATION	
Priorities 1, 2, 3b Use (PVID+YPRD+Island+PVID Mesa)	486,792
MWD Adjustment	-66,792
Total California Agricultural Use (PVID+YPRD+Island+IID+CVWD)	3,363,916
California Agricultural Paybacks	117,391
Misc. PPRs Covered by IID and CVWD	14,500
California ICS Creation (IID ICS)	25,000
Total Use for Target Comparison [1]	3,454,015
ISG Annual Target (Exhibit B)	3,455,000
Amount over/(under) ISG Annual Target	-985

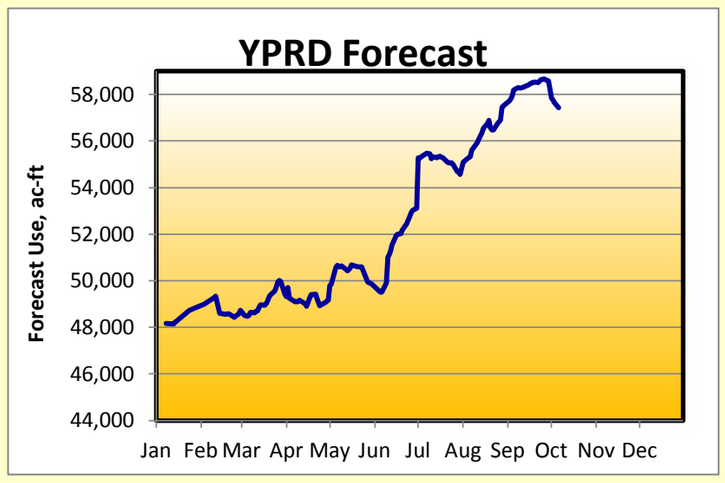
NOTES: Click on California Schedules and Approvals above for incoming diversion schedules and approvals.
1/ Includes MWD Adjustment, Californnia Agricultural Use and Paybacks, IID-CVWD covered PPRs, and taking out the MWD-CVWD Exchange

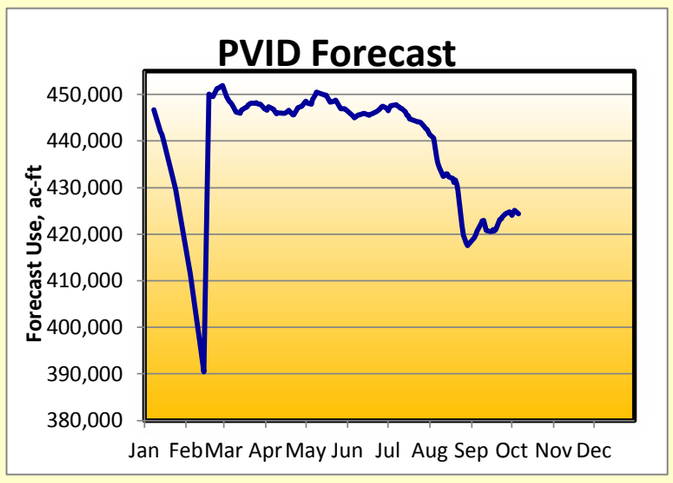












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U.S. BUREAU OF RECLAMATION
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ARIZONA WATER USERS
FORECAST OF END OF YEAR CONSUMPTIVE USE
FORECAST BASED ON USE TO DATE AND APPROVED ANNUAL WATER ORDERS
Arizona Schedules and Approvals
Historic Use Records (Water Accounting Reports)

WATER USER	Use To Date CY2014	Forecast Use CY2014	Estimated Use CY2014	Excess to Estimated Use CY2014	Diversion To Date CY2014	Forecast Diversion CY2014	Approved Diversion CY2014	Excess to Approved Diversion CY2014
ARIZONA PUMPERS	15,107	17,902	17,902	---	23,374	27,698	27,698	0
LAKE MEAD NRA, AZ - Diversions from Lake Mead	126	144	144	---	126	144	144	0
LAKE MEAD NRA, AZ - Diversions from Lake Mohave	150	187	187	---	150	187	187	0
DAVIS DAM PROJECT	1	1	1	---	46	54	54	0
BULLHEAD CITY	4,284	6,206	8,523	---	6,394	9,261	12,720	-3,459
MOHAVE WATER CONSERVATION	418	495	495	---	623	738	738	0
BROOKE WATER LLC	177	210	210	---	268	317	317	0
MOHAVE VALLEY IDD	16,070	20,715	22,617	---	29,759	38,361	41,883	-3,522
FORT MOJAVE INDIAN RESERVATION, AZ	31,898	36,410	42,120	---	59,071	67,426	78,000	-10,574
GOLDEN SHORES WATER CONSERVATION DISTRICT	201	238	238	---	301	357	357	0
HAVASU NATIONAL WILDLIFE REFUGE	4,368	4,732	3,563	---	34,206	38,471	41,820	-3,349
LAKE HAVASU CITY	6,225	8,172	9,083	---	10,041	13,181	14,650	-1,469
CENTRAL ARIZONA PROJECT	1,238,082	1,596,912	1,528,908	---	1,238,082	1,596,912	1,528,908	
TOWN OF PARKER	301	352	359	---	674	857	935	-78
COLORADO RIVER INDIAN RESERVATION, AZ	296,869	335,524	376,964	---	518,813	614,533	662,402	-47,869
EHRENBURG IMPROVEMENT ASSOCIATION	206	244	244	---	289	343	343	0
CIBOLA VALLEY IRRIGATION DISTRICT	14,305	16,951	16,951	---	20,006	23,707	23,707	0
CIBOLA NATIONAL WILDLIFE REFUGE	10,752	12,741	12,741	0	17,342	20,550	20,550	0
IMPERIAL NATIONAL WILDLIFE REFUGE	2,208	2,616	2,616	0	3,565	4,224	4,224	0
YUMA PROVING GROUND	376	464	550	---	376	464	550	-86
GILA MONSTER FARMS	3,734	4,629	5,244	---	6,317	8,075	9,156	-1,081
WELLTON-MOHAWK IDD	220,403	255,588	278,000	-22,412	316,747	388,011	424,997	
CITY OF YUMA	11,743	15,260	16,452	-1,192	19,659	25,919	26,358	-439
MARINE CORPS AIR STATION YUMA	1,047	1,349	1,718	---	1,047	1,349	1,718	-369
UNION PACIFIC RAILROAD	25	31	24	---	37	48	48	0
UNIVERSITY OF ARIZONA	471	534	536	---	471	534	536	-2
YUMA UNION HIGH SCHOOL DISTRICT	270	283	148	---	349	366	200	**166**
DESERT LAWN MEMORIAL	39	46	46	---	56	66	66	0
NORTH GILA VALLEY IDD	9,432	10,781	12,384	---	37,642	49,209	51,963	-2,754
YUMA IRRIGATION DISTRICT	30,925	37,557	42,991	---	54,906	68,974	76,600	-7,626
YUMA MESA IDD	97,845	112,944	119,077	---	161,933	199,093	217,488	-18,395
UNIT "B" IRRIGATION DISTRICT	17,412	20,248	20,408	---	23,938	30,186	33,450	-3,264
FORT YUMA INDIAN RESERVATION	1,178	1,396	1,396	---	1,814	2,150	2,150	0
YUMA COUNTY WATER USERS' ASSOCIATION	189,457	237,662	241,118	---	276,371	360,758	383,000	-22,242
COCOPAH INDIAN RESERVATION	1,351	2,641	6,599	---	1,368	3,351	10,055	-6,704
RECLAMATION-YUMA AREA OFFICE	208	247	247	---	208	247	247	0
RETURN FROM SOUTH GILA WELLS								
TOTAL ARIZONA	2,227,664	2,762,412	2,790,804		2,866,369	3,596,121	3,698,219	
CAP	1,238,082	1,596,912				1,596,912		
ALL OTHERS	989,582	1,165,500	1,261,896			1,999,209	2,169,311	
YUMA MESA DIVISION, GILA PROJECT	138,202	161,282	250,000	-88,718		317,276		

ARIZONA ADJUSTED APPORTIONMENT CALCULATION	
Arizona Basic Apportionment	2,800,000
Payback of IOPP overruns - (Cocopah and Beattie)	-266
CAGRD/YMIDD Pilot Conservation Program [1]	-9000
Total State Adjusted Apportionment	2,790,734
Excess to Total State Adjusted Apportionment	-28,322
Estimated Allowable Use for CAP	1,626,545

1/ CAWCD has agreed to forebear 9,000 acre-feet during phase one of the study, during which time CAGRD will refine the estimate of the actual conservation yield of the program.
NOTES: Click on Arizona Schedules and Approvals above for incoming diversion schedules and approvals.

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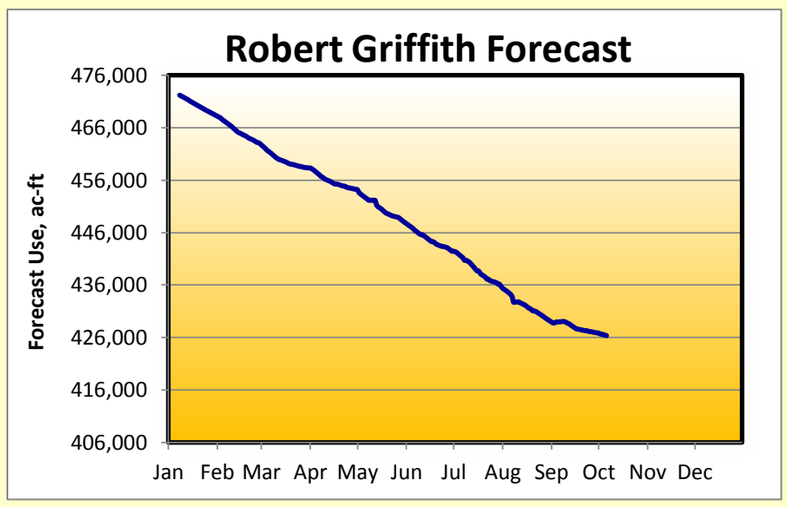
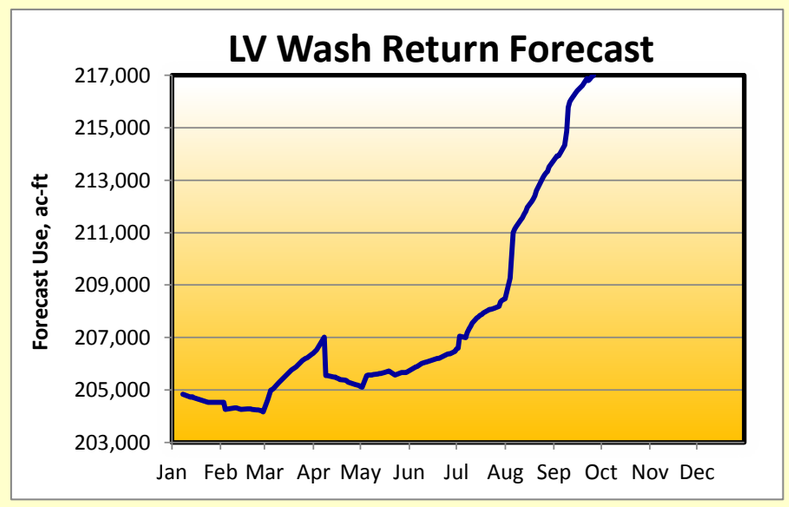
NEVADA WATER USERS
FORECAST OF END OF YEAR CONSUMPTIVE USE
FORECAST BASED ON USE TO DATE AND APPROVED ANNUAL WATER ORDERS
Nevada Schedules and Approvals
Historic Use Records (Water Accounting Reports)

WATER USER	Use To Date CY2014	Forecast Use CY2014	Estimated Use CY2014	Excess to Estimated Use CY2014	Diversion To Date CY2014	Forecast Diversion CY2014	Approved Diversion CY2014	Excess to Approved Diversion CY2014
ROBERT B. GRIFFITH WATER PROJECT (SNWS)	325,974	426,327	473,360	-47,033	325,981	426,335	473,360	-47,025
LAKE MEAD NRA, NV - Diversions from Lake Mead	348	451	568	---	348	451	568	-117
LAKE MEAD NRA, NV - Diversions from Lake Mohave	127	174	224	---	127	174	224	-50
BASIC MANAGEMENT INC.	4,883	6,640	8,208	---	4,883	6,640	8,208	-1,568
CITY OF HENDERSON (BMI DELIVERY)	12,234	14,468	15,878	---	12,234	14,468	15,878	-1,410
NEVADA STATE DEPT. OF FISH & GAME	8	11	12	-1	319	401	300	---
PACIFIC COAST BUILDING PRODUCTS INC.	653	863	928	---	653	863	928	-65
BOULDER CANYON PROJECT	34	40	40	---	61	72	72	0
BIG BEND WATER DISTRICT	1,808	2,445	2,062	---	3,483	4,719	4,961	-242
FORT MOJAVE INDIAN TRIBE	1,677	2,113	3,685	---	2,503	3,154	5,500	-2,346
LAS VEGAS WASH RETURN FLOWS	-165,724	-218,277	-204,964	---				
TOTAL NEVADA	182,022	235,255	300,001	-47,034	350,592	457,277	509,999	-52,823
SOUTHERN NEVADA WATER SYSTEM (SNWS)	160,250	208,050				426,335		
ALL OTHERS	21,772	27,205				30,942		
NEVADA USES ABOVE HOOVER	178,537	230,697				449,404		
NEVADA USES BELOW HOOVER	3,485	4,558				7,873		

Tributary Conservation & Imported Intentionally Created Surplus	
Total Requested Tributary Conservation Intentionally Created Surplus	37,000
Total Requested Imported Conservation Intentionally Created Surplus	9,000
5% System Cut for Creation of Intentionally Created Surplus	-2,300
Total Intentionally Created Surplus Left in Lake Mead	43,700

NEVADA ADJUSTED APPORTIONMENT CALCULATION	
Nevada Basic Apportionment	300,000
Excess to Total State Adjusted Apportionment	-64,745





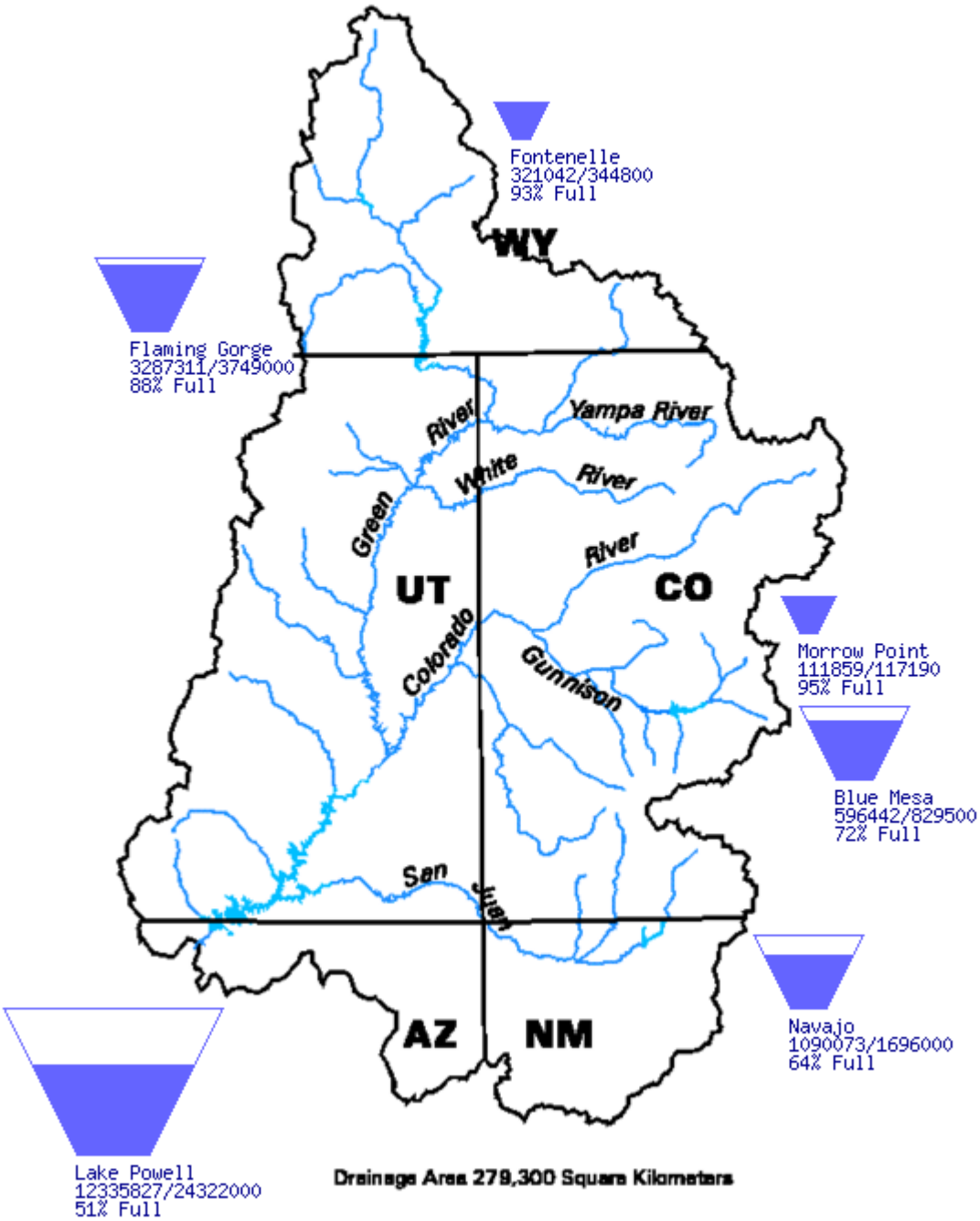
NOTES: Click on Nevada Schedules and Approvals above for incoming diversion schedules and approvals.

Upper Colorado Region Water Resources Group

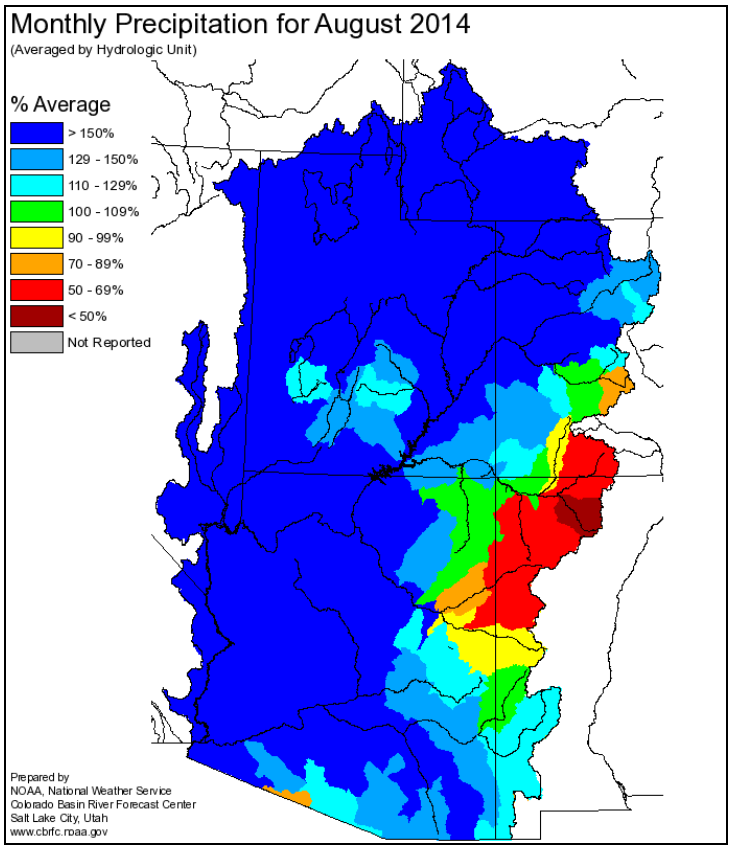
River Basin Tea-Cup Diagrams

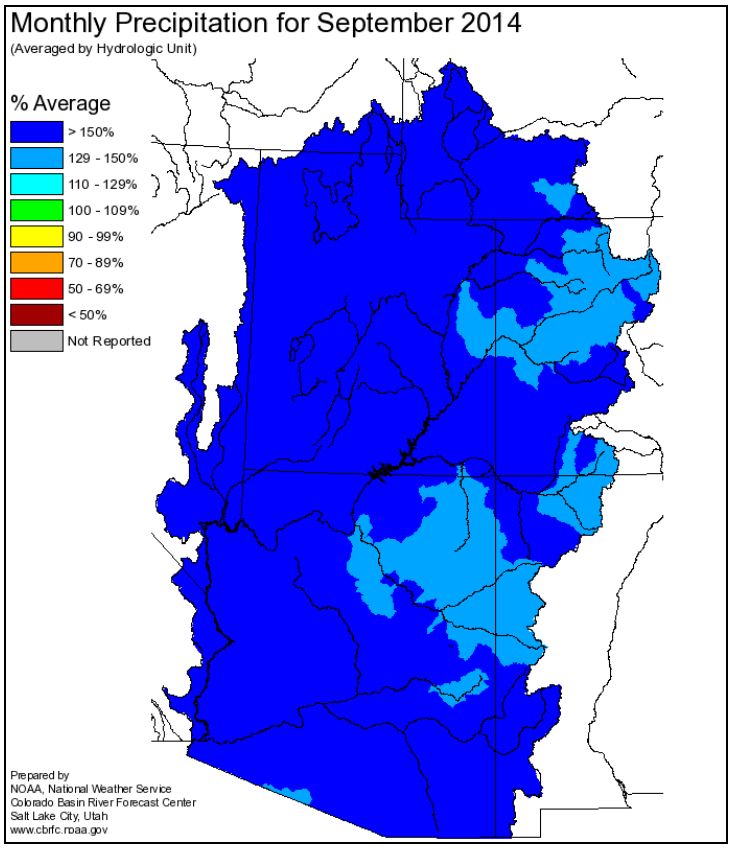
Data Current as of:
10/05/2014

Upper Colorado River Drainage Basin

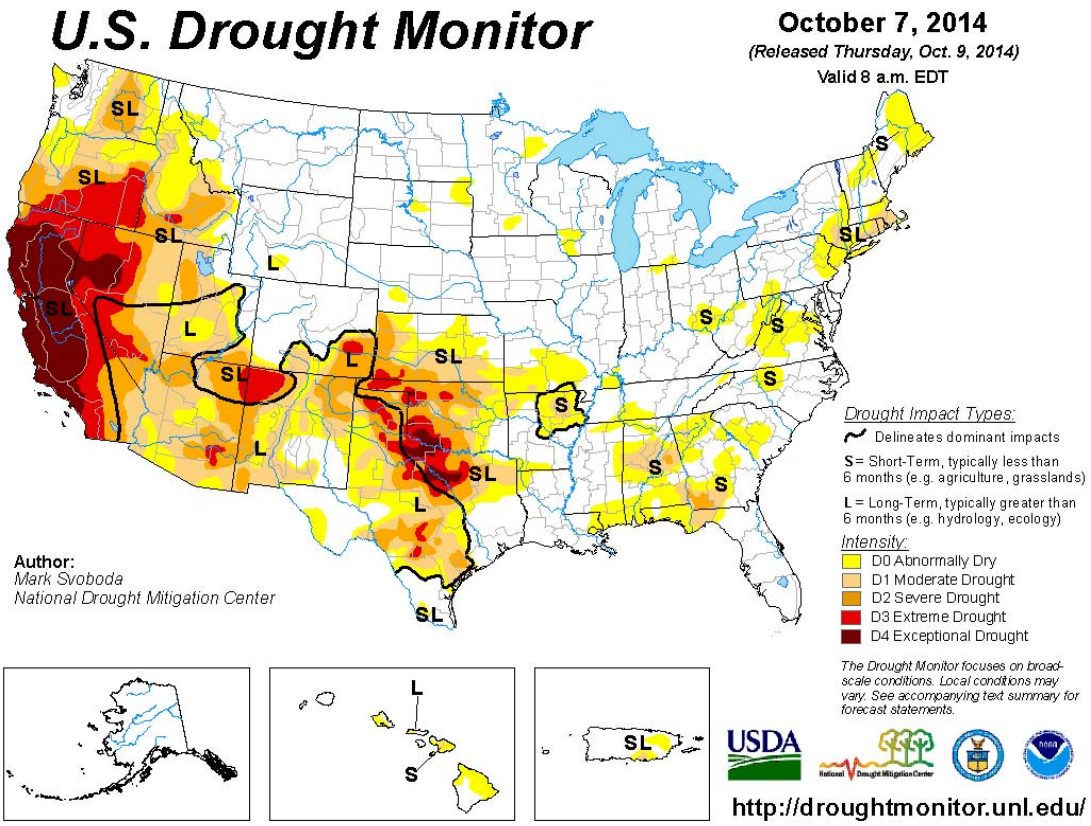


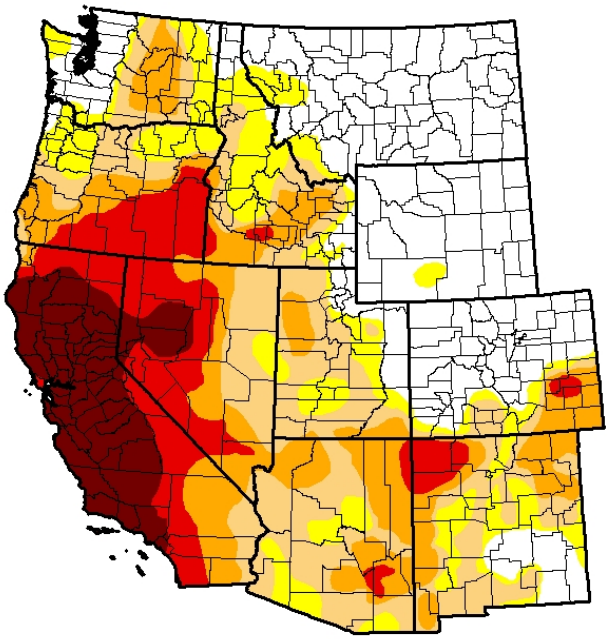
NOAA National Weather Service Monthly Precipitation Maps for August and September 2014





USDA United States Drought Monitor Map





U.S. Drought Monitor
West

October 7, 2014
(Released Thursday, Oct. 9, 2014)
Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	31.51	68.49	55.52	35.65	19.95	8.90
Last Week 9/30/2014	31.48	68.52	55.57	35.65	19.95	8.90
3 Months Ago 7/8/2014	31.10	68.90	60.50	47.95	23.73	6.04
Start of Calendar Year 12/31/2013	22.20	77.80	51.44	31.11	7.75	0.63
Start of Water Year	-	-	-	-	-	-
One Year Ago 10/8/2013	27.44	72.56	56.86	32.69	5.34	0.63

Intensity:
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

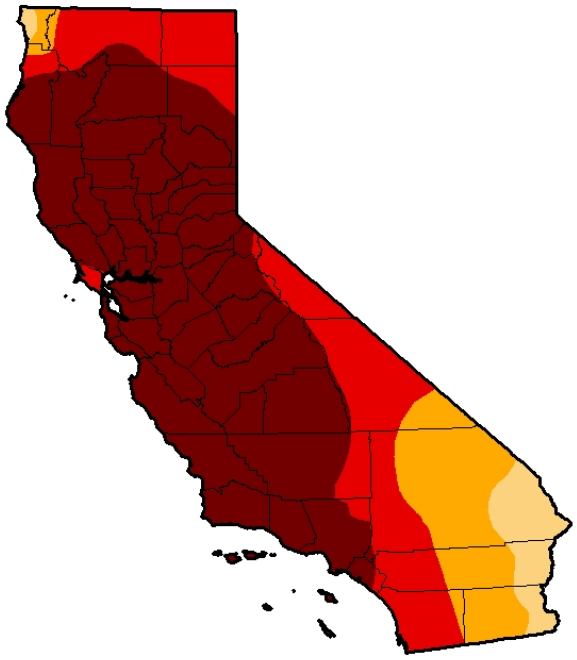
Author:
Mark Svoboda
National Drought Mitigation Center

USDA

http://droughtmonitor.unl.edu/

U.S. Drought Monitor

California



October 7, 2014

(Released Thursday, Oct. 9, 2014)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	100.00	95.04	81.92	58.41
Last Week 9/30/2014	0.00	100.00	100.00	95.04	81.92	58.41
3 Months Ago 7/8/2014	0.00	100.00	100.00	100.00	78.97	36.46
Start of Calendar Year 12/31/2013	2.61	97.39	94.25	87.53	27.59	0.00
Start of Water Year	-	-	-	-	-	-
One Year Ago 10/8/2013	2.52	97.48	95.95	84.12	11.36	0.00

Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

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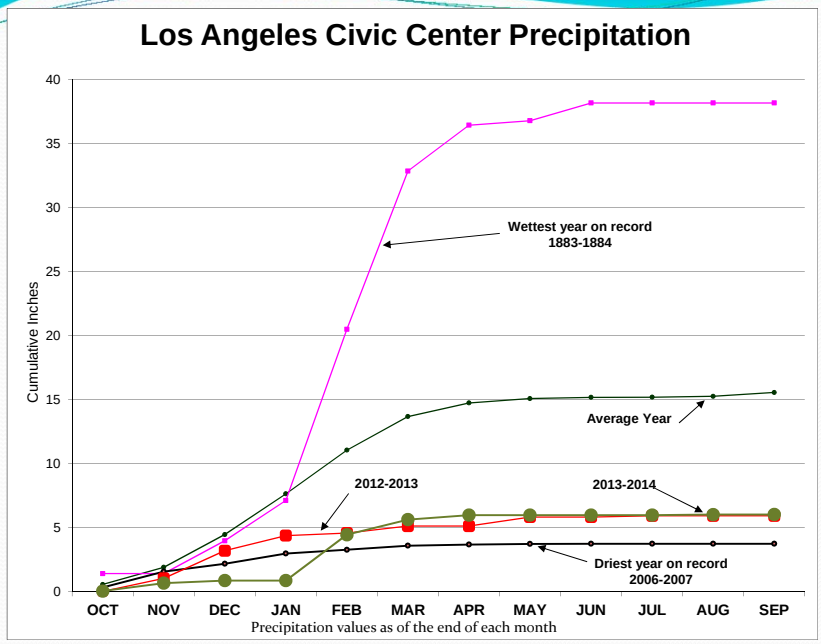
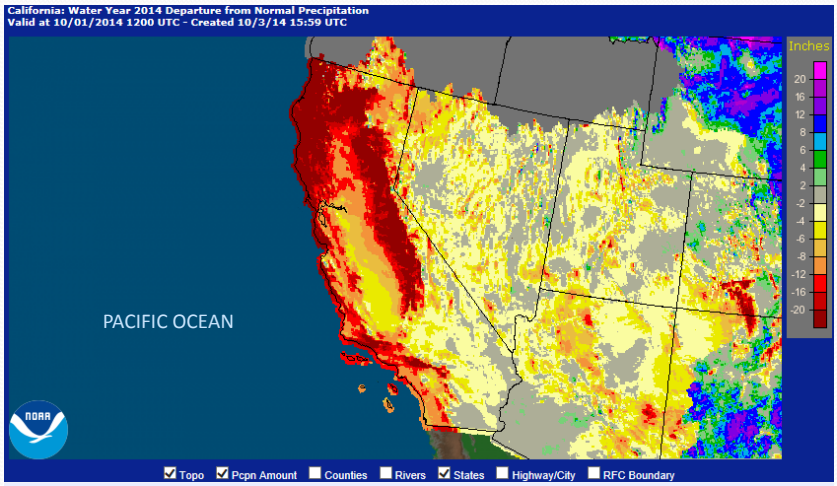


Precipitation at Six Major Stations in Southern California

From October 1, 2013 to September 30, 2014

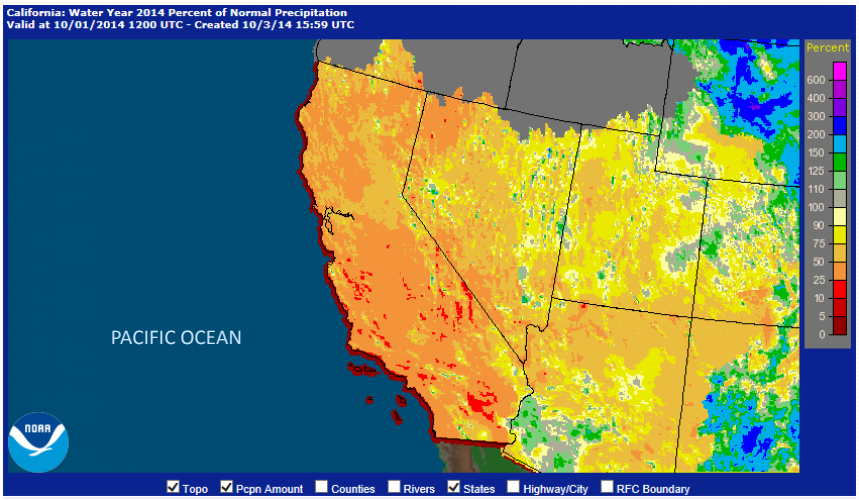
Station	Precipitation in inches Sep	Oct 1 to Sep 30	Average to Date	Percent of Average
San Luis Obispo	0.00	5.36	22.44	24%
Santa Barbara	0.00	6.51	17.78	37%
Los Angeles	0.01	6.04	15.36	39%
San Diego	0.00	3.22	10.15	32%
Blythe	0.11	1.58	3.81	41%
Imperial	0.07	2.57	2.83	91%

Water Year 2013-2014: Departure From Normal Precipitation



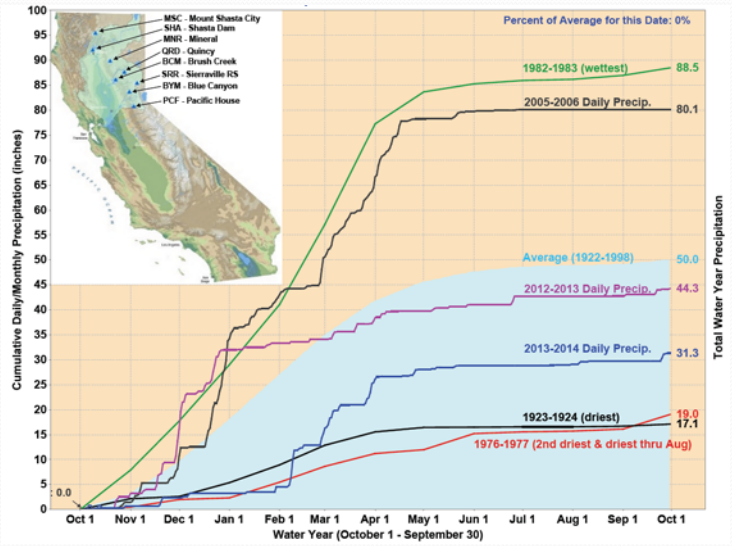
National Weather Service –Advance Hydrologic Prediction Center
http://water.weather.gov/precip/

Water Year 2013-2014: Percent of Normal Precipitation



National Weather Service –Advance Hydrologic Prediction Center
http://water.weather.gov/precip/

Northern Sierra Precipitation-8 Station Index



California Data Exchange Center
http://cdec.water.ca.gov/cgi-progs/products/PLOT_ESI.pdf

Statewide Summary of Water-Year Data

Water Year	Precipitation (233 Stations) % of avg.	Runoff (31 Rivers) % of avg.	Res. Storage (155 Reservoirs) % of avg.	Sacto. Riv. Run-off * (MAF)
2009-10	110	90	105	15.9
2010-11	135	145	130	15.1
2011-12	75	60	95	11.8
2012-13	80	60	80	11.9
Comparison of Water Year Data as of Sep 30				
2012-13	80	60	80	12.2
2013-14	55	35	60	7.5

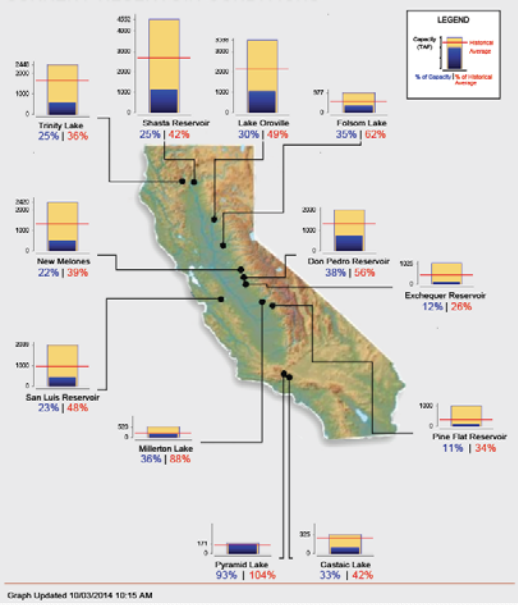
* The Sacramento River Run-off is the sum of the unimpaired water year flow from the Sacramento River above Bend Bridge near Red Bluff, Feather River inflow to Oroville, Yuba River at Smartville, and American River inflow to Folsom. The average annual run-off is 18.4 MAF.

Comparison of SWP Water Storage

Reservoir	Capacity	2013 Storage (acre-feet) As of September 30	2013 Storage (acre-feet) % of Cap.	2014 Storage (acre-feet) As of September 30	2014 Storage (acre-feet) % of Cap.
Frenchman	55,475	28,135	51%	19,661	35%
Lake Davis	84,371	52,813	63%	45,097	53%
Antelope	22,564	17,839	79%	16,701	74%
Oroville	3,553,405	1,633,290	46%	1,075,538	30%
TOTAL North	3,715,815	1,732,077	47%	1,156,997	31%
Del Valle	39,914	33,552	84%	34,374	86%
San Luis (DWR)	1,062,180	280,598	26%	216,308	20%
Pyramid	169,901	166,961	98%	167,933	99%
Castaic	319,247	284,946	89%	108,741	34%
Silverwood	74,970	72,063	96%	70,714	94%
Perris	126,841	72,570	57%	54,966	43%
TOTAL South	1,793,053	910,690	51%	653,036	36%
TOTAL SWP	5,508,868	2,642,767	48%	1,810,033	33%

State Water Project Projected Deliveries:
As of May 30, 2014, the Table-A allocations for 2014 is 5%

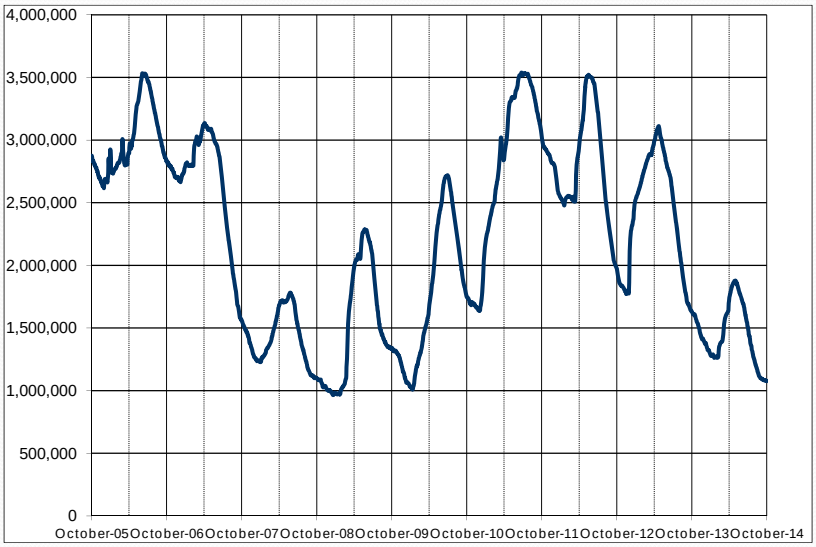
Current Reservoir Conditions

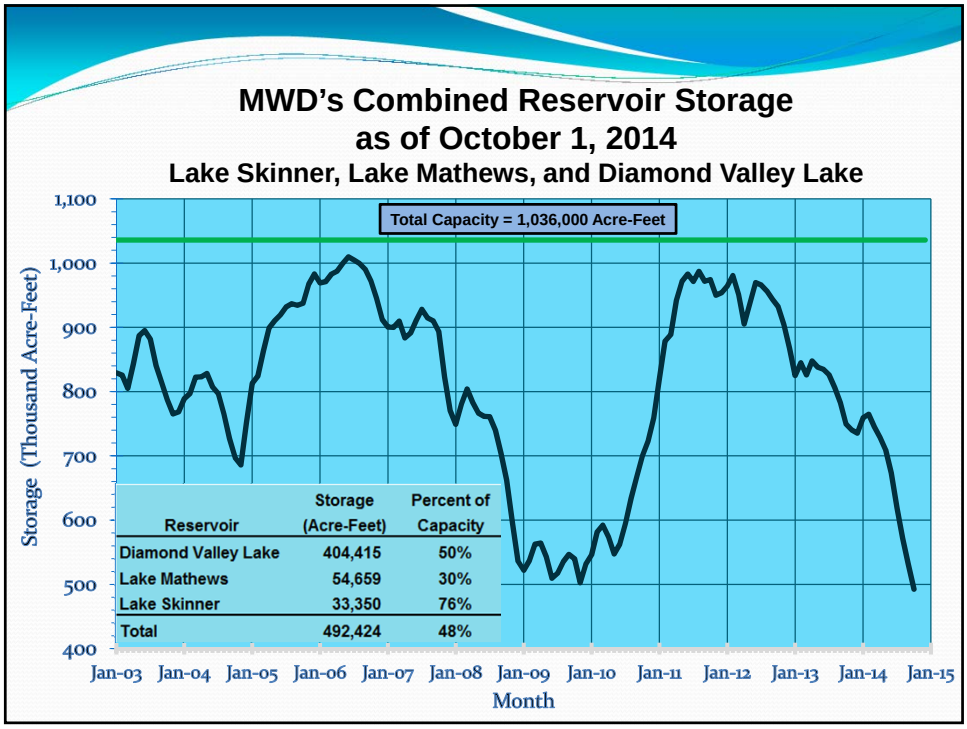


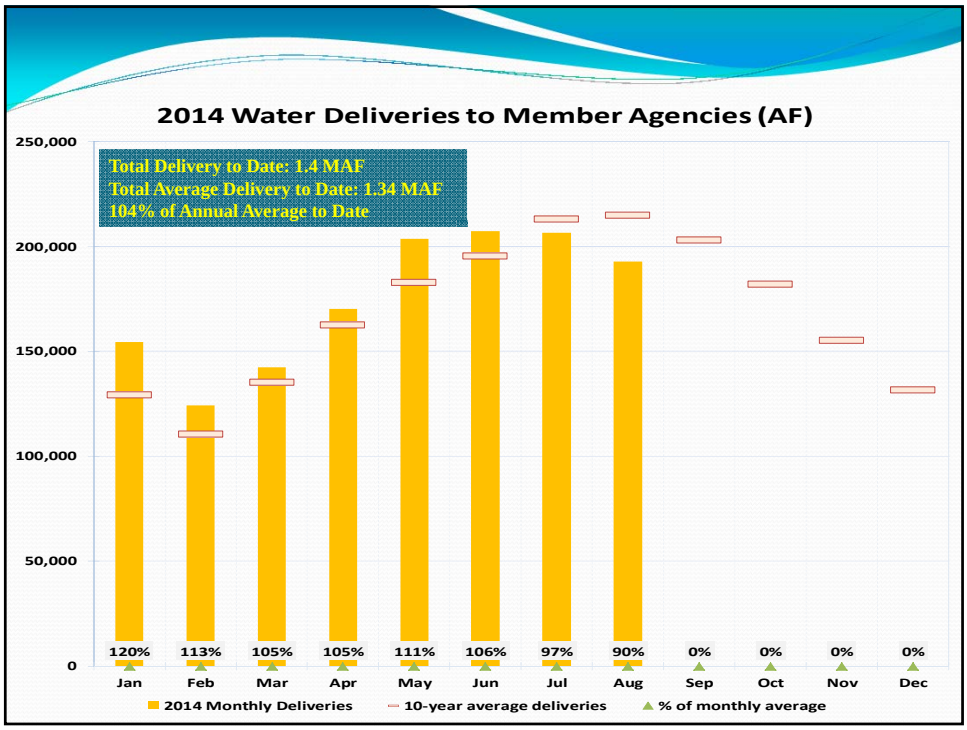
http://cdec.water.ca.gov/cdecapp/resapp/getResGraphsMain.action

Oroville Storage (acre-feet)

October 1, 2005 – September 30, 2014




MWD's Combined Reservoir Storage
as of October 1, 2014
Lake Skinner, Lake Mathews, and Diamond Valley Lake
Total Capacity = 1,036,000 Acre-Feet
Storage (Thousand Acre-Feet)
1,100
1,000
900
800
700
600
500
400
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Month
Reservoir | Storage (Acre-Feet) | Percent of Capacity
Diamond Valley Lake | 404,415 | 50%
Lake Mathews | 54,659 | 30%
Lake Skinner | 33,350 | 76%
Total | 492,424 | 48%


2014 Water Deliveries to Member Agencies (AF)
Total Delivery to Date: 1.4 MAF
Total Average Delivery to Date: 1.34 MAF
104% of Annual Average to Date
250,000
200,000
150,000
100,000
50,000
0
120%
113%
105%
105%
111%
106%
97%
90%
0%
0%
0%
0%
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2014 Monthly Deliveries
10-year average deliveries
% of monthly average

Bi-Weekly Drought Brief
Monday, September 29, 2014

CURRENT CONDITIONS

Fire Activity: CAL FIRE has responded to 5,038 wildfires across the state since January 1, burning 90,731 acres. This year's fire activity is above the year-to-date average of 4,036 wildfires on 86,987 acres. CAL FIRE responded to over 100 new wildfires last week, including the Happy Camp Complex in Siskiyou County, which has burned more than 132,700 acres with 94% containment, and the King Fire in El Dorado and Placer Counties, which has burned nearly 97,000 acres with 89% containment.

Governor's Executive Order: On Wednesday, September 17, Governor Jerry Brown declared a state of emergency for El Dorado and Siskiyou counties due to the effects of the King and Boles fires, which have burned thousands of acres, destroyed homes and other structures and damaged critical infrastructure. This proclamation provides relief for residents affected by the fires by waiving fees to replace documents such as driver's licenses and birth certificates.

Governor Brown also waived the one-week waiting period for unemployment, and has encouraged the Franchise Tax Board and Board of Equalization to ease any administrative processes where appropriate for individuals and businesses impacted by the wildfires.

Reservoir Levels (% capacity): Reservoir Levels as of September 25 remain low, including: Don Pedro 39%; Exchequer 12%; Folsom Lake 36%; Lake Oroville 31%; Millerton Lake 35%; New Melones 22%; Pine Flat 12%; San Luis 22%; Lake Shasta 26%; and Trinity Lake 25%. An update of water levels at other smaller reservoirs is also available.

Vulnerable Water Systems: The State Water Board's Drinking Water Program is providing technical and funding assistance to several communities facing drinking water shortages, and is monitoring water systems across the state to determine if new support is needed. As of this week, a total to date of over $11.7 million has been identified for specific emergency drinking water projects out of $15 million appropriated in March for this purpose.

Recent Precipitation: Significant precipitation fell over the past week in Northern California. Precipitation totals (in inches) from Tuesday, September 23 through Friday, September 26:

- **Crescent City**: 2.88"
- **Arcata:** 2.70"
- **Willits:** 0.88"
- **Sawyers Bar:** 2.12"
- **Hoopa:** 2.28"
- **Camino:** 0.86"
- **South Lake Tahoe:** 0.18"
- **Quincy:** 0.96"
- **Weed:** 2.29"
- **Shasta Dam:** 3.08"
- **Sacramento:** 0.37"
- **Redding:** 2.48"
- **San Francisco:** 0.51"
- **Stockton:** 0.59"
- **Oroville:** 0.51"
- **Modesto:** 0.30"

** This rainfall will have minimal effect on California's drought conditions, and reservoir water levels will remain largely unchanged. Due to low water supplies from the two previous dry years, California remains in drought conditions. **

KEY ACTION ITEMS FROM THIS WEEK

- **Governor Brown Issues Executive Order to Assist Households with Water Shortages:** On Friday, September 19, Governor Jerry Brown issued an executive order aimed at making funds available under the California Disaster Assistance Act (CDAA), and waives advertising and competitive bidding requirements to purchase water for the protection of health, safety and the environment. The order also prohibits price gouging in times of emergency, and streamlines assistance to households that rely on domestic wells or small water systems that are currently without drinking water.

- **Historic California Drought Linked to Global Warming:** A new study released on Monday, September 29, by Stanford University climate scientists states that the conditions contributing to the historic drought in California are "very likely" linked to human-caused climate change. The study was published as a supplement to this month's issue of the Bulletin of the American Meteorological Society which is one of the most comprehensive studies to investigate the link between climate change and California's ongoing drought.

- **New Report Predicts Climate Change Will Significantly Impact California's Central Valley:** On Monday, September 22, the Department of the Interior released the Sacramento-San Joaquin Basins Climate Impact Assessment that provides an overview of the current climate and hydrology over the entire Central Valley including the Sacramento, San Joaquin and Tulare Lake basins. The study also evaluates how projected climatic and hydrologic changes could impact water availability, management and demands while analyzing impacts of future urban growth and changes in land-use within the Central Valley.

- **DWR Opens Public Comment Period for Funding Proposed Drought Projects:** On Tuesday, September 23, the Department of Water Resources (DWR) announced its' recommendations for allocating the $200 million grant funds to 23 Integrated Regional Water Management Groups (RWMGs) for at least 110 projects and programs to alleviate the impacts of the current drought and improve regional drought preparedness. The expedited funding of the grants is made possible through the $687.4 million package of drought-response legislation signed by Governor Jerry Brown in March.

- **TUCP Order Changes Approved by the State Water Board:** On Wednesday, September 24, the State Water Board adopted an order that responds to objections and denied petitions for reconsideration of the Delta Temporary Urgency Change Petition (TUCP) Order that was approved earlier this year.

  The newly adopted order upholds the findings in the Delta's previous TUCP order, denies the petitions, and increases the evaluation and reporting required of the Department of Water Resources and United States Bureau of Reclamation. These additional requirements will help the state prepare for another dry year and will increase public transparency of the information used to support changes in state and federal water project operations.

- **State Water Board Discusses Delta Diverters Allegations:** On Wednesday, September 24, the State Water Board held a workshop to discuss allegations of the Department of Water Resources and US Bureau of Reclamation that delta diverters are illegally taking stored project water that is released to repel salinity and meet export conditions. The Board is considering the workshop input to determine what short and long term steps can be taken to address the long standing and complex issues included in these allegations.

- **State Water Board Denies Deer Creek Diversion Reconsideration:** During the September 24 State Water Board meeting, the Board adopted an order denying a challenge to the May 2014 emergency regulations and subsequent Curtailment Order for Deer Creek, tributary to the Sacramento River. This tributary was identified by the Department of Fish and Wildlife as a high-priority for fish protection during the drought. The emergency regulations and Curtailment Order required minimum flows during the spring and the fall to allow fish passage.

- **Emergency Food Aid, Rental and Utility Assistance**: The California Department of Social Services (CDSS) has provided to date over 269,100 boxes of food to community food banks in drought-impacted counties. Approximately 218,385 boxes of food have been picked up by 113,488 households. By this Friday, October 3, an additional 10,440 will be delivered to six counties. Local food banks continue to target this food aid to residents most impacted by the drought.

  The non-profit group La Cooperativa continues to distribute the $10 million state-funded emergency rental assistance to impacted families and individuals across counties most impacted by the drought. As of Thursday, September 18, the Department of Housing and Community Development (HCD) has reported that a total of $5,336,890 is committed; and $3,685,355 in funds has been issued to 2,614 applicants in 20 counties.

  The Department of Community Services and Development (CSD) has created a $600,000 program to help families pay their water bills. This program targets families through 10 agencies that are experiencing “exceptional” drought. As of Friday, September 19, CSD has reported that a total of $64,868 has been issued to 581 households.

  CSD has also implemented a $400,000 Migrant and Seasonal Farmworker (MSFW) drought assistance program, in coordination with the California Human Development (CHD), Central Valley Opportunity Center (CVOC), Center for Employment Training (CET) and Proteus, which provides assistance in employment training and placement services to individuals impacted by the drought. As of Friday, September 19, 67 clients are enrolled in employment training programs, 6 clients have obtained employment, and 53 clients are receiving employment support services. CSD has also reported that a total of $136,833 has been spent to assist participants in completing training employment programs.

- **Drought Toolkits Used to Raise Drought Awareness in Communities Vulnerable to Water Shortages:** On Saturday, September 20, the Home Depot store in Madera hosted an event to increase water conservation awareness in Madera County and distribute 3,000 drought toolkits to households experiencing or vulnerable to water shortages in disadvantaged communities throughout the County.

Home Depot donated a total of 30,000 drought toolkits and approximately 17,000 toolkits have been distributed to communities experiencing or vulnerable to water shortages in Fresno, Kern, Tulare, Madera, Tuolumne, Butte, Shasta, Tehama, Modoc, Humboldt, Siskiyou, Trinity, Colusa and Sacramento Counties. The remaining 13,000 toolkits will be distributed by mid-October.

- **Sacramento-Area Agencies Reduce Water Use by 20% or More in August:** The Regional Water Authority (RWA) announced on Thursday, September 18, that 14 of the water providers it represents have accomplished impressive water savings of at least 20% or more in August 2014, as compared to last August's numbers.

- **Joint Water and Energy Conservation Messaging Toolkit Released:** Save Our Water and Energy Upgrade California launched a collaborative messaging effort this month to spread the word about conserving both water and energy. A messaging toolkit offering the public tips on ways to save both resources – indoors and outdoors – is available at www.saveourh2o.org and at www.energyupgradeca.org.

- **Water Saving Tips Promoted Across the State:** The state's newly improved water conservation website, SaveOurWater.com, is promoting the "Don't Waste Summer" campaign. This campaign provides a new conservation tip each day for the 100 days of summer. Supporters can sign up for daily email tips, and share Save Our Water's Twitter and Facebook feeds for this public awareness campaign.

- **Open Burn Ban in Affect across the State:** Open burning continues to be prohibited on 31 million acres of land across the state due to the burn ban that CAL FIRE has directed through the coordination of its unit chiefs. This ban on open burning in state responsibility areas (outside of cities and towns) reduces wildfire danger amidst extremely dry conditions.

- **Drought Response Funding:** $687 million in state drought funding that was appropriated in March through emergency legislation continues to advance toward meeting critical needs. Over $61 million of this funding addresses emergency water needs, food aid and housing assistance to drought-impacted communities. Nearly $21 million of those funds are already in communities providing assistance and additional funds are being readied as drought impacts worsen. Nearly $625 million of the emergency funds appropriated in March came from sources dedicated to capital improvements to water systems. Since March, state agencies have expedited grant approvals, getting over $21 million immediately allocated to grantees that were pre-approved for certain projects. As planned in March, the next $200 million of expedited capital funding will be awarded this fall, with the remaining $250 million granted by mid next-year. State government has also appropriated tens of millions in funding to CAL FIRE over its typical budget to enable staffing-up fire crews much earlier this fire season.

- **Governor's Drought Task Force:** The Task Force continues to meet daily to take actions that conserve water and coordinate state response to the drought.

Local Government

- **Local Emergency Proclamations**: A total of 58 local Emergency Proclamations have been received to date from city, county, and tribal governments, as well as special districts:

- **25 Counties:** Glenn, Inyo, Humboldt, Kern, Kings, Lake, Madera, Mariposa, Mendocino, Merced, Modoc, Napa, Plumas, Santa Barbara, San Bernardino, San Joaquin, San Luis Obispo, Shasta, Siskiyou, Sonoma, Sutter, Trinity, Tulare, Tuolumne, and Yuba.

- **13 Cities:** City of Willits (Mendocino County), City of St. Helena (Napa County), City of Calistoga (Napa County), City of American Canyon (Napa County), City of Santa Barbara (Santa Barbara County), City of Montague (Siskiyou County), City of Live Oak (Sutter County), City of San Juan Bautista (San Benito County), City of Lodi (San Joaquin County), City of Portola (Plumas County), City of Ripon (San Joaquin County), City of Rio Dell (Humboldt County), and City of West Sacramento (Yolo County).

- **8 Tribes:** Hoopa Valley Tribe (Humboldt County), Yurok Tribe (Humboldt County), Tule River Indian Tribe (Tulare County), Karuk Tribe (Siskiyou/Humboldt Counties), Sherwood Valley Pomo Indian Tribe (Mendocino County), Yocha Dehe Wintun Nation (Yolo County), Cortina Indian Rancheria (Colusa County) and Kashia Band of Pomo Indians of the Stewarts Point Rancheria (Sonoma County).

- **12 Special Districts:** Brooktrails Township (Mendocino County), Lake Don Pedro Community Services District (Stanislaus County), Placer County Water Agency (Placer County), Twain Harte Community Services District (Tuolumne County), Carpinteria Valley Water District (Santa Barbara County), Meiners Oaks Water District (Ventura County), Mariposa Public Utility District (Mariposa County), Goleta Water District (Santa Barbara County), Montecito Water District (Santa Barbara County), Tuolumne Utilities District (Tuolumne County), Mountain House Community Service District (San Joaquin County), Nevada Irrigation District (Nevada County).

- **Water Agency Conservation Efforts**: The Association of California Water Agencies (AWCA) has identified several hundred local water agencies that have implemented water conservation actions. These water agencies are responding to the drought by implementing conservation programs, which include voluntary calls for reduced water usage and mandatory restrictions where water shortages are worst.

- **County Drought Taskforces:** A total of 30 counties have established drought task forces to coordinate local drought response. These counties include: Butte, Glenn, Humboldt, Imperial, Kern, Kings, Lake, Madera, Mendocino, Merced, Modoc, Monterey, Napa, Nevada, Orange, Placer, Plumas, Sacramento, San Francisco, San Joaquin, San Luis Obispo, San Mateo, Santa Barbara, Siskiyou, Stanislaus, Sutter, Tehama, Tulare, Tuolumne, and Yolo.

- **Tribal Taskforce:** A total of 2 tribes have established drought task forces to coordinate tribal drought response. These tribes include: Hoopa Valley Tribe (Humboldt County), and Yurok Tribe (Humboldt Counties).

DROUGHT RELATED WEBSITES FOR MORE INFORMATION

Drought.CA.Gov: California's Drought Information Clearinghouse

State's Water Conservation Campaign, Save our Water
Local Government, Drought Clearinghouse and Toolkit

California Department of Food and Agriculture, Drought information
California Department of Water Resources, Current Water Conditions
California Data Exchange Center, Snow Pack/Water Levels
California State Water Resources Control Board, Water Rights, Drought Info and Actions
California Natural Resources Agency, Drought Info and Actions
State Water Resources Control Board, Drinking Water, SWRCB Drinking Water Program
California State Water Project, Information

U.S. Drought Monitor for Current Conditions throughout the Region
U.S. Drought Portal, National Integrated Drought Information System (NIDIS)
National Weather Service Climate Predictor Center
USDA Drought Designations by County CA County Designations
USDA Disaster and Drought Assistance Information USDA Programs
U.S. Small Business Administration Disaster Assistance Office: www.sba.gov/disaster

RESOLUTION
of the
COLORADO RIVER BOARD OF CALIFORNIA
in Support of Proposition 1
The Water Quality, Supply and Infrastructure
Improvement Act of 2014

WHEREAS, the Colorado River Board of California is authorized by law to protect the rights and interests of the State of California, its agencies and citizens, in the water and power resources of the Colorado River System; and

WHEREAS, California is in a severe, multi-year drought and faces challenges associated with aging infrastructure, climate variability, population growth and other factors; and

WHEREAS, the Legislature has approved and Governor Brown has signed the Water Quality, Supply and Infrastructure Improvement Act of 2014, which will appear as Proposition 1 on the November 4, 2014 ballot and would provide much-needed funding to advance a statewide comprehensive water plan to secure our water future; and

WHEREAS, if approved by voters, the measure would provide $7.545 billion in bond funding for new surface and groundwater storage projects, projects to increase regional water reliability, sustainable groundwater management and cleanup projects, water recycling, water conservation, watershed protection and safe drinking water; and

WHEREAS, Proposition 1 includes potential benefits for entities within California who utilize water from the Colorado River, including funding to support the implementation of the Quantification Settlement Agreement; and

WHEREAS, Proposition 1 allocates $22.5 million in funds for the benefit of the Colorado River Basin hydrologic region, which includes the Coachella, Imperial, Palo Verde, and Yuma Valleys; and

NOW, THEREFORE, BE IT RESOLVED, that the Colorado River Board of California formally supports Proposition 1, the Water Quality, Supply and Infrastructure Improvement Act of 2014 on the November ballot.

THE FOREGOING RESOLUTION is approved and adopted by the Colorado River Board, this 15th day of October 2014.

_____
Dana B. Fisher, Jr., Chairman

Association of California Water Agencies
Since 1910
ACWA
Leadership • Advocacy
Information • Service

WATER BOND 2014
THE TIME IS NOW

Proposition 1 – The Water Quality, Supply and Infrastructure Improvement Act of 2014

Fact Sheet

The Water Quality, Supply and Infrastructure Improvement Act of 2014 is a $7.545 billion general obligation bond measure set for the November 2014 ballot. If approved by voters, the measure would provide funding for new surface and groundwater storage projects, regional water reliability, sustainable groundwater management and cleanup, water recycling, water conservation, watershed protection and safe drinking water, particularly for disadvantaged communities.

Proposition 1 is the product of more than five years of discussions and negotiations among state lawmakers, stakeholders and others to craft a responsible bond measure to fund needed investments as part of a statewide comprehensive water plan for California. The measure was approved by the Legislature and signed by Gov. Jerry Brown on Aug. 13.

Supported by a broad coalition of water, business, conservation, labor and agriculture organizations, the $7.545 billion bond replaces an $11.14 billion measure previously slated for the November ballot.

Key Funding Areas

Surface and Groundwater Storage - $2.7 billion

- Continuous appropriation for above-and below-ground water storage projects.

Regional Water Reliability - $810 million

- Integrated regional water management: $510 million.
- Stormwater capture: $200 million.
- Water conservation: $100 million.

Safe Drinking Water - $520 million

- Leverages federal funds for safe drinking water and clean water programs and for disadvantaged communities.
- Small Community Wastewater Program: $260 million.
- Drinking Water Public Infrastructure: $260 million.

Water Recycling - $725 million

• Statewide water recycling projects and activities.

Groundwater Sustainability - $900 million

• Prevent and reduce groundwater contaminants: $800 million.
• Provide sustainable groundwater management planning and implementation: $100 million.

Watershed Protection, Ecosystem Restoration, State Settlements - $1.495 million

• Conservancies: $327.5 million.
• Wildlife Conservation Board: $200 million (restoration of flows).
• Department of Fish and Wildlife: $285 million (out of Delta, no mitigation on BDCP).
• Department of Fish and Wildlife: $87.5 million (in-Delta with constraints).
• State settlement obligations including CVPIA: $475 million.
• Rivers and Creeks: $120 million.

Statewide Flood Management - $395 million

- Statewide flood management projects and activities: $100 million.
- For Delta levee subvention programs and Delta flood protection projects: $295 million.

General Provisions

- Funding eligibility requires urban or agricultural water management plans and compliance with 2009 Water Conservation Act.
- Bay Delta Conservation Plan neutral.
- Protects existing water rights and reaffirms area of origin protections.

KAMALA D. HARRIS
Attorney General

State of California
DEPARTMENT OF JUSTICE

RONALD REAGAN BUILDING
300 SOUTH SPRING STREET, SUITE 1702
LOS ANGELES, CALIFORNIA 90013

Public: (213) 897-2000
Telephone: (213) 897-2639
Facsimile: (213) 897-2802
E-Mail: gary.tavetian@doj.ca.gov

September 22, 2014

Tanya Trujillo
Executive Director
Colorado River Board
770 Fremont Avenue
Suite 100
Glendale, California 91203-1068

RE: Colorado River Board's Ability to Endorse Proposition 1

Dear Ms. Trujillo:

At the last meeting of the Colorado River Board (CRB), board members briefly discussed the wisdom and legality of endorsing California's Proposition 1. This letter will discuss my findings pertaining to the legality of doing so.

Based on my own research, as well as my consultation with the Resources Agency and the Governor's Office (Legal Affairs), I have concluded that the CRB may make such an endorsement, although its activity must be strictly limited in one significant respect: The CRB may not expend any monetary resources to take its position.

The first area of inquiry is whether the CRB's enabling statute permits it to advocate a position on Proposition 1. The Water Code allows CRB to:

> . . . confer with representatives of other States in the Colorado River Basin, representatives of the United States, and others concerning problems and measures relating to the development of the Colorado River Basin, the use of the water of the Colorado River System, and the protection of the interests of the State and of the Unites States, and shall negotiate respecting such problems and measures and discuss the same and formulate and recommend to the Governor and the Legislature measures, agreements, and legislation deemed for the benefit of the State and the United States.

(Water Code, § 12532.) The Water Code also states, "The commissioner shall do and perform all other things deemed necessary or expedient to carry out the purposes of this part." (*Id.*, § 12533.) Based on those two statutes, it seems reasonable to conclude the CRB may take a position in support of Proposition 1 if Proposition 1 has an impact on the uses of Colorado River water.

The second area of inquiry is to determine whether it is permissible under the law for an agency or board such as the CRB to take a position on a ballot measure. It is. (See *Vargas v. City of Salinas* (2009) 46 Cal.4th 1.) In *Vargas*, the California Supreme Court concluded that a governmental entity is not precluded from "publicly expressing an opinion with regard to the merits of a proposed ballot measure, so long as it does not expend public funds to mount a campaign on the measure." (*Id.*, at p. 36.) That case affirms its prior decision in *Stanson v. Mott* (1976) 17 Cal.3d 206.

California's statutory law is also clear that public entities may not expend public funds to campaign for a measure. Government Code section 8314, subdivision (a) states, "It is unlawful for any elected state or local officer, including any state or local appointee, employee, or consultant, to use or permit others to use public resources for a campaign activity, or personal or other purposes which are not authorized by law." "Public resources" is broadly defined to mean "any property or asset owned by the state or any local agency, including, but not limited to, land, buildings, facilities, funds, equipment, supplies, telephones, computers, vehicles, travel, and state-compensated time." (Gov. Code, § 8314, subd. (b).) Government Code section 8314, subdivision (b)(2) states that campaign activity does not include "the incidental and minimal use of public resources, such as equipment or office space, for campaign purposes."

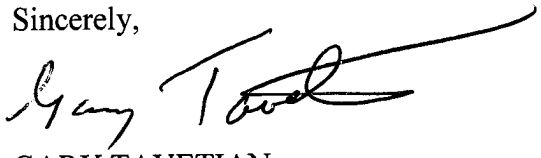
The Supreme Court in both *Vargas and Stanson* also specified that if a governmental entity is going to disseminate any information pertaining to the ballot measure (as opposed to campaign for a ballot measure), it has an obligation to present unbiased information only, discussing both the pros and cons. It cannot disseminate information to directly or indirectly take only one side of the issue.

Finally, I communicated with the Legal Affairs section of the Governor's Office and counsel for the Resources Agency. Both agreed that the CRB could state its position on Proposition 1. However, counsel for the Resources Agency stated that it would not encourage the CRB to take a political position but would not object to it. Counsel did state that the Resources Agency does prohibit departments under it such as the Department of Water Resources from taking political positions. Counsel distinguished those departments from boards that have independently selected board members.

Ultimately, the CRB appears to have the authority to endorse Proposition 1. But the limitations on such an endorsement are substantial. It cannot expend money other than incidental costs to take such a position. Merely taking a position at a board meeting does involve costs, such as the cost of renting the meeting room and the costs for the board members to attend the meeting, but those costs likely fall into the category of "incidental expenses" because the CRB would be expending those costs irrespective of whether it expressed an opinion on Proposition 1. And if the board is going to disseminate information as to the benefits of Proposition 1, it should also present the opposing side as well.

Please contact me should you have any questions.

Sincerely,



GARY TAVETIAN
Supervising Deputy Attorney General
Natural Resources Law Section

For KAMALA D. HARRIS
Attorney General

RESOLUTION
of the
COLORADO RIVER BOARD OF CALIFORNIA
Regarding
Potential Applicants to Receive
Lower Colorado Water Supply Project Water
2014-2

WHEREAS, the United States Congress, on November 14, 1986, enacted the Lower Colorado Water Supply Act (P.L.99-655) (amended through P.L. 109-103), to authorize the construction and operation of the Lower Colorado River Water Supply Project (Project) to provide a limited amount of Colorado River water to be made available on an exchange basis to entities in California, whose lands are located adjacent to the Colorado River, and who either do not have any, or do not have a sufficient, contractual entitlement to use Colorado River water; and

WHEREAS, the City of Needles has agreed to assume the administrative responsibility for Project beneficiaries in San Bernardino County, Riverside and Imperial Counties; and

WHEREAS, the Colorado River Board provides recommendations to Reclamation regarding the eligibility of non-federal applicants to receive Project water; and

WHEREAS, the Colorado River Board on September 14, 2001, notified owners of property within the Colorado River flood plain and/or the accounting surface as delineated by the U.S. Geological Survey in California of the availability of Project water; and

WHEREAS, the staff of the Colorado River Board on October 15, 2014, submitted a list of additional eligible applicants to the Board for its recommendations;

NOW, THEREFORE, BE IT RESOLVED THAT the Colorado River Board hereby recommends subcontracts for Project water be offered to those applicants listed on the attachment and directs the Executive Director to forward the applications to Reclamation with its recommendation with the following provisos:

(1) These applicants appear to be eligible to receive Project water, as shown in the attached table and summarized below:

County	Numbers of Parcels	Current Use (AF/YR)	Future Use (AF/YR)	Total (AF/YR)
San Bernardino	4	37	TBD (future application)	37
Imperial	1	1	3	4
Total	5	38	3	41

(2) At the time a subcontract is prepared, the annual quantity of water to be diverted, consumptively used, and returned will be refined to specify quantities of water to be reported in accordance with Article V in the Consolidated Decree in *Arizona v. California, et al.* entered March 27, 2006, (547 U.S. 150 (2006));

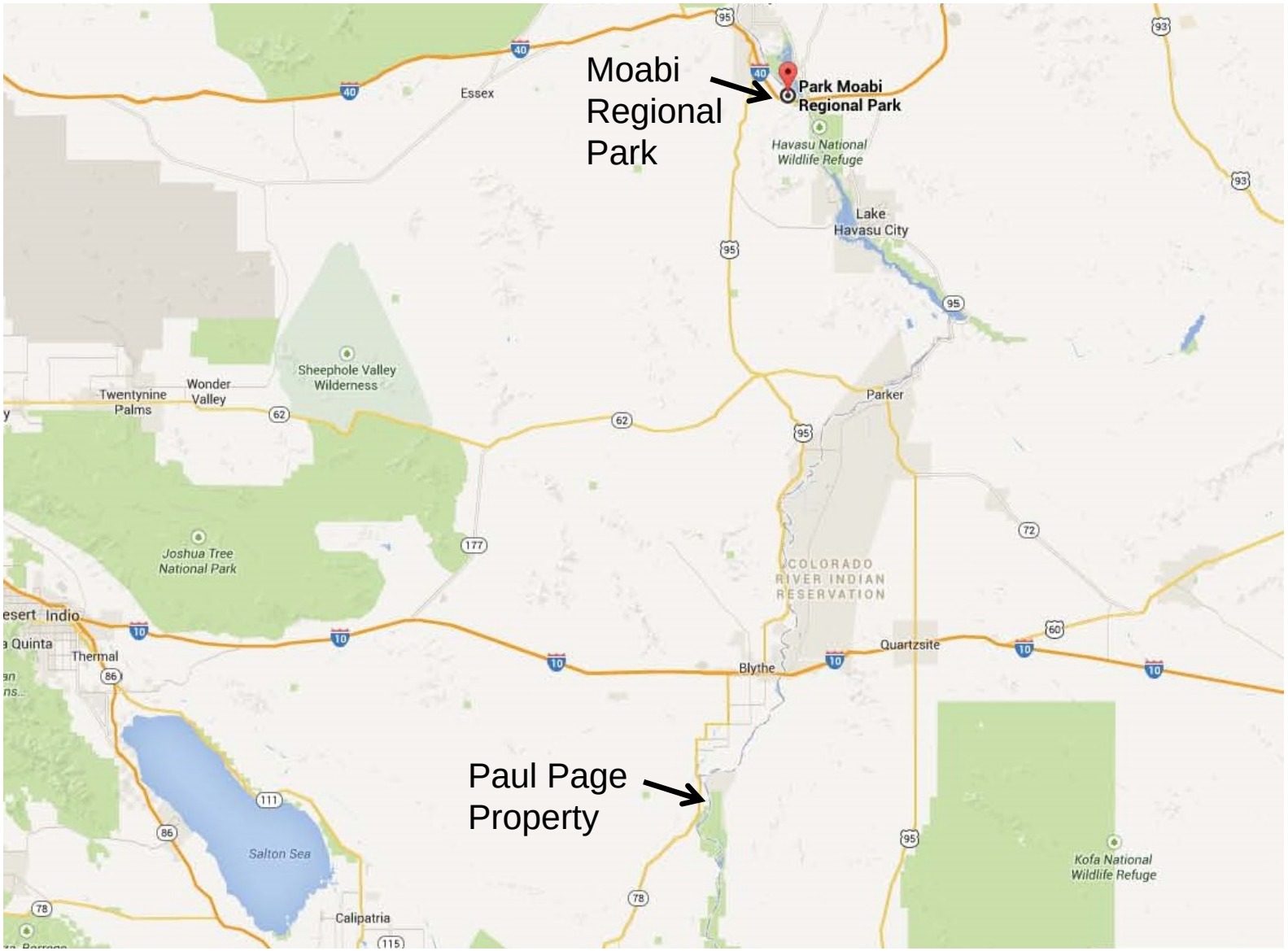
(3) Reclamatizon should include provisions in the subcontract that the water to be put to reasonable beneficial use within a ten-year period of time, subject to renewal for another ten-year period.

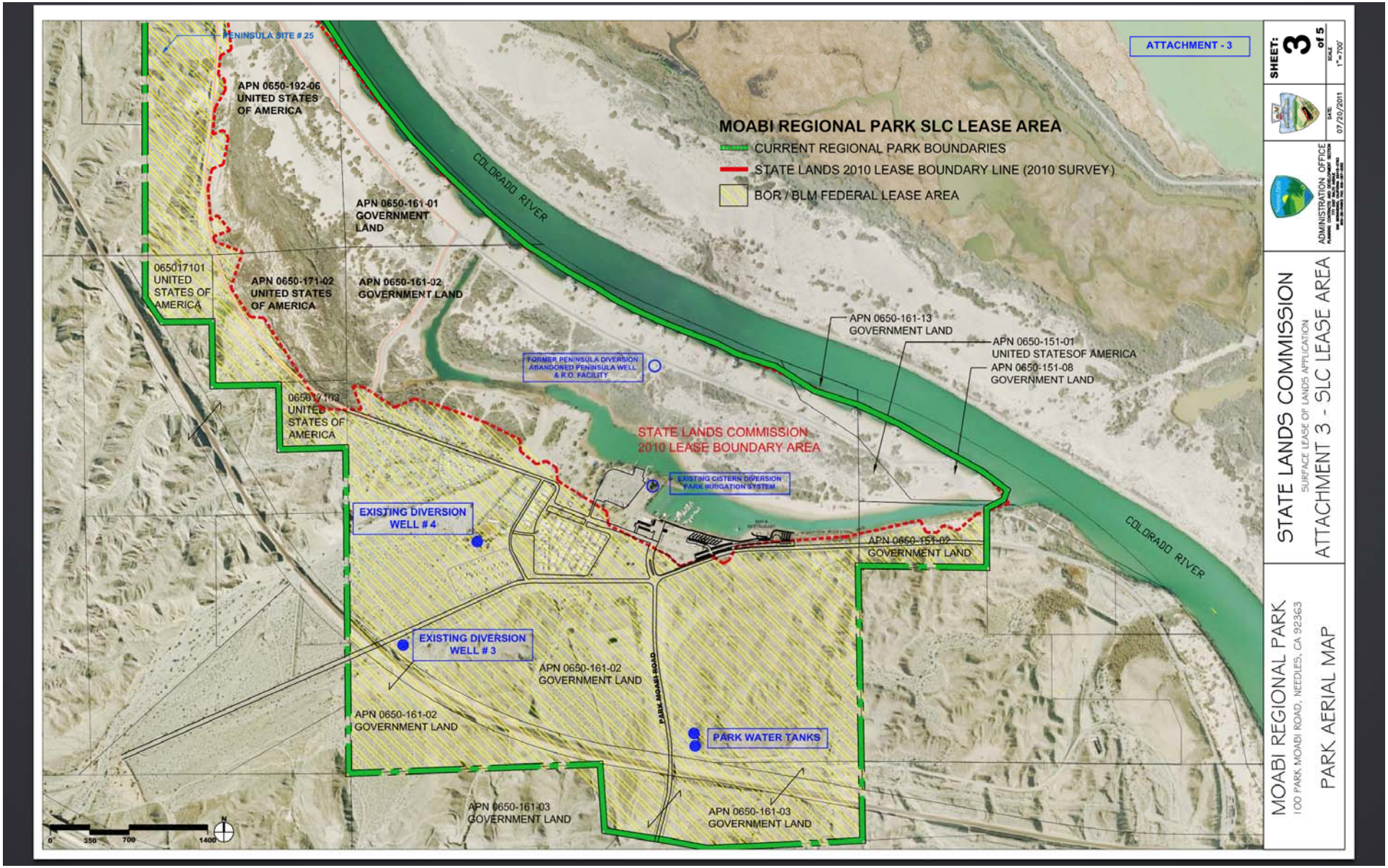
THE FOREGOING RESOLUTION is approved and adopted by the Colorado River Board, this 15th day of October 2014.

_____

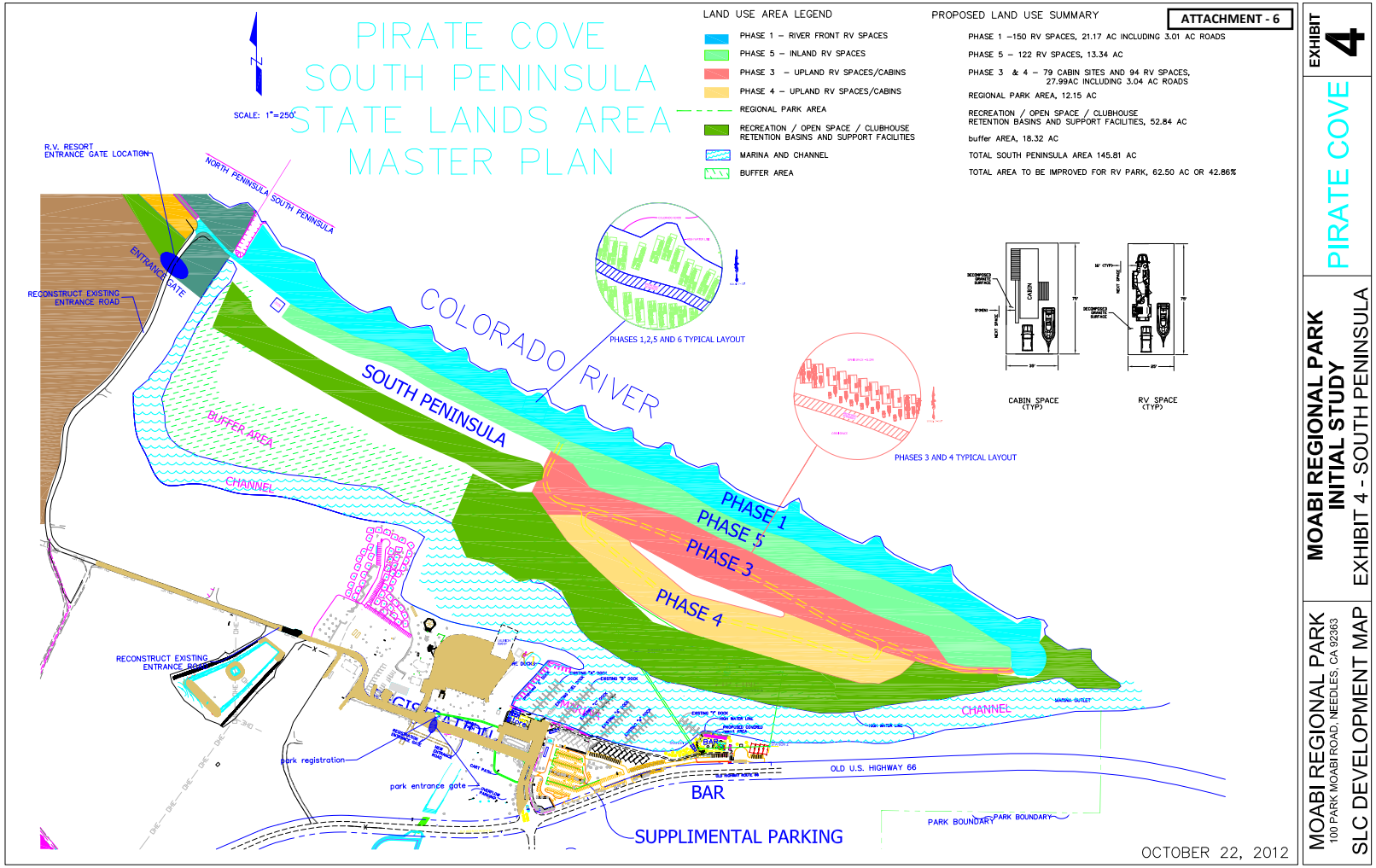
Dana B. Fisher, Jr., Chairman

APPLICATIONS FOR LOWER COLORADO WATER SUPPLY PROJECT WATER LOCATION MAP

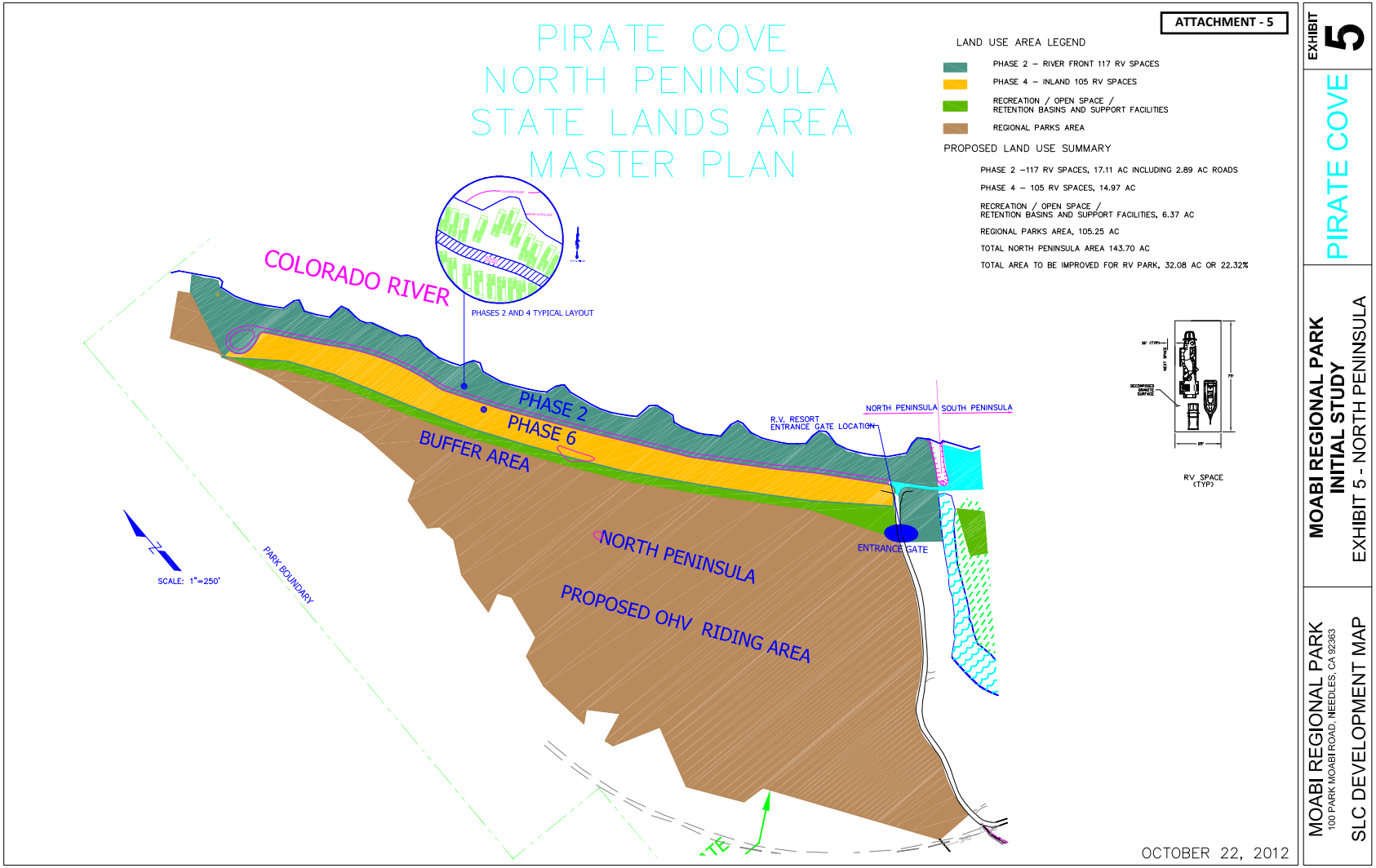




AREA MAP – Moabi Regional Park



EXPANSION PLAN – South Peninsula



EXPANSION PLAN – North Peninsula

LOWER COLORADO WATER SUPPLY PROJECT SUMMARY-
Moabi Regional Park

- Applicant: San Bernardino County Regional Parks Department

- Project Description: The San Bernardino County proposes to expand and upgrade its existing RV campsites and planned recreational facilities. Application is only for Phases 1 and 2 that cover the river front RV spaces. Phases 3 through 6 will complete the Master Plan for the park expansion. Future expansion of the park would require an additional LCWS application.

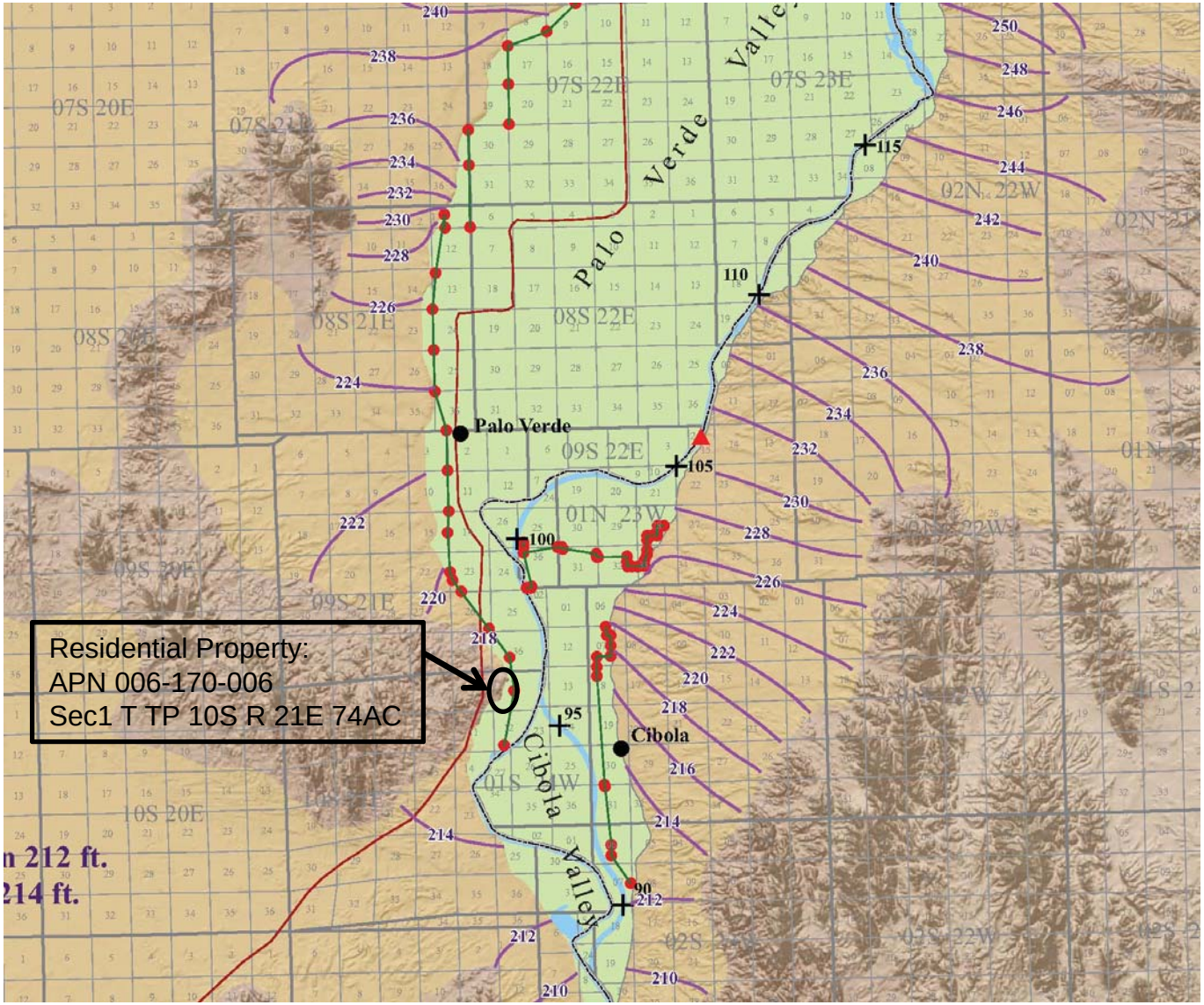
- Project Location/Place of Use: Moabi Regional Park is located 12.3 miles southeast of the City of Needles in San Bernardino County, California.

- Point of Diversion of Colorado River Water: Three existing wells with an average production of 85 AFY are capable of providing water to the entire park which is located on both federal and state land. All existing wells were installed by the County. No new wells will be installed as part of this application (Phases 1 and 2) but it is anticipated that they would be required in future expansion.

- Purpose of Use: Recreational

- Quantity of Water Requested: 37 AFY. TBD for future use as part of future application(s). The essence of this application is to segregate water use between federal and state land.

- CRB staff recommendation: Staff recommends approval of this application and for Reclamation to enter into a subcontract.



AREA MAP – Mr. Paul M. Page's property

LOWER COLORADO WATER SUPPLY PROJECT SUMMARY-
Mr. Paul M. Page

- Applicant: Paul M. Page
- Project Description: Private well for single family home
- Project Location/Place of Use: 74-acre lot in Imperial County
- Point of Diversion of Colorado River Water: One existing non-pumping well located on the southeast corner of the lot. No new wells will be installed as part of this application.
- Purpose of Use: Residential
- Quantity of Water Requested: 1 AFY to be used within the next calendar year. 3 AFY for future use.
- CRB staff recommendation: Staff recommends approval of this application and for Reclamation to enter into a subcontract.

United States Department of the Interior

BUREAU OF RECLAMATION
Lower Colorado Regional Office
P.O. Box 61470
Boulder City, NV 89006-1470

IN REPLY REFER TO:

LC-4400
WTR-4.00

VIA OVERNIGHT MAIL

Interested Parties (See Enclosed List)

Subject: Funding Opportunity for Voluntary Participation in a Pilot System Water Conservation Program (Pilot Program)

Dear Ladies and Gentlemen:

The purpose of this letter is to inform you of the opportunity to participate in the recently developed Pilot Program for Colorado River System Water conservation and encourage your organization's participation.

On July 30, 2014, the Bureau of Reclamation and four municipal entities, the Metropolitan Water District of Southern California, the Central Arizona Water Conservation District, the Southern Nevada Water Authority, and Denver Water (Parties) entered into Agreement No. 14-XX-30-W0574 for a Pilot Program for Funding the Creation of Colorado River System Water Through Voluntary Water Conservation and Reductions in Use (Funding Agreement). Under the Funding Agreement, the Parties will fund up to $11 million for a Pilot Program to conserve Colorado River System water for storage in Lakes Powell and Mead. The Funding Agreement can be viewed on Reclamation's website at: http://www.usbr.gov/newsroom/docs/2014-07-30-Executed-Pilot-SCP-Funding-Agreement.pdf.

Over the next 2 years, the Pilot Program will seek projects and provide funding to develop short-term pilot projects that keep water in Lakes Powell and Mead through temporary, voluntary, and compensated conservation mechanisms. If the Pilot Program proves to be successful, it could be part of a broader suite of programs to be implemented if elevations in Lakes Powell and Mead approach critical levels.

Reductions in Colorado River water use in the municipal and industrial (M&I) and agricultural sectors may be achieved through, among other approaches, system efficiency improvements, changes in practices that reduce Colorado River water use, new or enhanced water conservation programs, and temporary agricultural land fallowing. We are seeking pre-proposals (up to two pages) for water demand reduction projects from agricultural and M&I entitlement holders that will allow for conserved water to remain in storage to help offset declining reservoir levels.

You are invited to consider and submit a pre-proposal describing any conservation opportunity that can be implemented by your organization. Successful pre-proposals should include a project description, proposed conservation amount and verification method, approximate time frame for

startup, project duration, and amount of funding requested; pre-proposals must meet Pilot Program requirements which are enclosed with this letter.

Given that Pilot Program funding is limited in the lower Colorado River basin to $8.25 million, the Parties will rank and select pre-proposals on the basis of how well they meet Pilot Program requirements and selection criteria. Implementation of selected Pilot Program projects could begin as early as fall 2014 or in calendar year 2015. The remaining funds, at least $2.75 million, are anticipated to be used to implement short-term pilot projects in the upper Colorado River Basin.

During the past 15 years, the drought in the Colorado River Basin has resulted in a substantial decrease in Lake Powell and Lake Mead storage. Since 2000, Colorado River System storage has decreased from 95 percent to 51 percent of capacity. Reclamation's long-term planning model indicates a 36 percent probability of a shortage in the lower Colorado River basin as early as 2016, and increases to a 68 percent probability in 2018. Given declining reservoir levels, Reclamation, the Colorado River Basin States, and water agencies within the Colorado River Basin States are actively working together and discussing proactive strategies to mitigate the impacts of the ongoing drought.

If your organization is interested in participating in the Pilot Program, please mail your pre-proposal by November 17, 2014, to Mr. Steven C. Hvinden, Chief, Boulder Canyon Operations Office, at the address below:

Mr. Steven C. Hvinden
Chief, Boulder Canyon Operations Office
Bureau of Reclamation
Lower Colorado Regional Office
P.O. Box 61470
Boulder City, NV 89006-1470

If you have questions regarding the Pilot Program, please call Mr. Hvinden at 702-293-8414. If you need assistance, please use the TTY Federal Relay System number at 800-877-8339.

Sincerely,

Terrance J. Fulp, Ph.D.
Regional Director

Enclosures - 2

cc: See next page.

cc: Ms. Tanya M. Trujillo
Executive Director
Colorado River Board of California
770 Fairmont Avenue, Suite 100
Glendale, CA 91203

Mr. Michael Lacey
Director
Arizona Department of Water Resources
3550 North Central Avenue
Phoenix, AZ 85012

Jayne Harkins, P.E.
Executive Director
Colorado River Commission of Nevada
555 East Washington Avenue, Suite 3100
Las Vegas, NV 89101

Mr. Jim Lochhead
CEO/Manager
Denver Water
1600 West 12th Avenue
Denver, CO 80204
(w/encl to each)

Mr. John Entsminger
General Manager
Southern Nevada Water Authority
1001 South. Valley View Blvd, MS 480
Las Vegas, NV 89153

Mr. David V. Modeer
General Manager
Central Arizona Water Conservation District
23636 North 7th Street
Phoenix, AZ 85080

Mr. Jeffrey Kightlinger
General Manager
Metropolitan Water District of Southern California
700 North Alameda Street
Los Angeles, CA 90012

Enclosure 1

Interested Parties List

Honorable Edward D. Smith
Chairperson
Chemehuevi Indian Tribe
1990 Palo Verde Drive
Havasu Lake, CA 92363

Honorable Sherry Cordova
Chairwoman
Cocopah Indian Tribe
14515 South Veterans Drive
Somerton, AZ 85350

Honorable Wayne Patch, Sr.
Chairman
Colorado River Indian Tribes
26600 Mohave Road
Parker, AZ 85344

Honorable Timothy Williams
Chairman
Fort Mohave Indian Tribe
500 Merriman Avenue
Needles, CA 92363

Mr. Larry Voyles
Director
Arizona Game and Fish Department
5000 West Carefree Highway
Phoenix, AZ 85086

Ms. Vanessa P. Hickman
State Land Commissioner
Arizona State Land Department
1616 West Adams Street
Phoenix, AZ 85007

Mr. Richard Prinster
Manager
Beattie Farms Southwest
1551 Mammoth Drive
O'Fallon, MO 63366

Mrs. Mary Youmans and
Mr. Russell Youmans
Managers
Beattie Farms Southwest
3025 Northwest Firwood Place
Corvallis, OR 97330

Mr. Toby Cotter
City Manager
City of Bullhead City
2355 Trane Road
Bullhead City, AZ 86442

Mr. David V. Modeer
General Manager
Central Arizona Water Conservation District
23636 North 7th Street
Phoenix, AZ 85024

Mr. Robert Mullion
President
Cibola Valley Irrigation and Drainage District
63522 River Road
Cibola, AZ 85328

Mr. Greg Wilkinson
City Administrator
City of Yuma
1 City Plaza
Yuma, AZ 85364

Mr. Robert Dunn
Manager
Gila Monster Farms
3720 South Avenue 17E
Yuma, AZ 85365

Honorable Herman Honanie
Chairman
Hopi Tribal Council
123 Main Street
Kykotsmovi, AZ 86039

Mr. Mark R. Clark
Manager
Mohave Valley Irrigation and Drainage District
1460 East Commercial Street
Mohave Valley, AZ 86446

Mr. Jack Rayner, Jr.
Manager
Rayner Ranches
P.O. Box 100
Ehrenberg, AZ 85334

Mr. Bryan Knight
Manager
Unit B Irrigation and Drainage District
15875 South Avenue A
Somerton, AZ 85350

Mr. Tom W. Davis
Project Manager
Yuma County Water Users Association
3800 West County 15th Street
Somerton, AZ 85350

Mr. Michael Schlehuber
District Manager
GSC Farm, LLC
3550 North Central Avenue, Suite 1115
Phoenix, AZ 85012

Mr. Charlie Cassens
City Manager
Lake Havasu City
2330 McCulloch Boulevard North
Lake Havasu City, AZ 86403

Mr. Frank Ferguson, III
President
North Gila Valley Irrigation and Drainage District
1405 West 16th Street, Suite A
Yuma, AZ 85364

Ms. Lori Wedemeyer
Town Manager
Town of Parker
1314 11th Street
Parker, AZ 85344

Mr. Elston K. Grubaugh
Manager/Secretary
Wellton-Mohawk Irrigation and Drainage District
30570 Wellton-Mohawk Drive
Wellton, AZ 85356

Mr. Rex Green
Manager
Yuma Irrigation District
9510 Avenue 7E
Yuma, AZ 85365

Mr. Patrick Morgan
Manager
Yuma Mesa Irrigation and Drainage District
14329 South 4th Avenue
Yuma, AZ 85365

Mr. Jim Barrett
General Manager
Coachella Valley Water District
85-995 Avenue 52
Coachella, CA 92236

Mr. Ed Smith
General Manager
Palo Verde Irrigation District
180 West 14th Street
Blythe, CA 92225

Mr. John Entsminger
General Manager
Southern Nevada Water Authority
1001 South Valley View Boulevard, MS 480
Las Vegas, NV 89153

Mr. Mark Paris
President/CEO
Basic Water Company
875 West Warm Springs Road
Henderson, NV 89011-4063

Mrs. Peggy Ogram and Mr. William Ogram
Owners
c/o Gila Valley Farms
4260 East County Eight Street
Yuma, AZ 85364

Mr. Rick Daniels
City Manager
City of Needles
817 Third Street
Needles, CA 92363

Mr. Kevin Kelley
General Manager
Imperial Irrigation District
333 East Barioni Boulevard
Imperial, CA 92251

Mr. Jeffrey Kightlinger
General Manager
Metropolitan Water District of
Southern California
700 North Alameda Street
Los Angeles, CA 90012

Honorable Keeny Escalanti, Sr.
President
Quechan Indian Tribe
350 Picacho Road
Winterhaven, CA 92283

Mr. Paul Linker
President
Ehrenberg Improvement Association
50078 Ehrenber Parker Highway, Suite 110
Ehrenberg, AZ 85334

Mr. Mark Jessen
Member
JRJ Partners, LLC
P.O. Box 5569
Yuma, AZ 85366-5569

Maureen Rose George, P.C.
Attorney
Law Offices of Maureen Rose George
2000 McCulloch Boulevard North, Suite B
Lake Havasu City, AZ 86403

Mr. Thomas Sockwell
Chairman
Mohave Water Conservation District
4266 San Felipe Road
Bullhead City, AZ 86429

Mr. Jake Lenderking
Water Resources Manager
EPCOR Water Arizona, Inc.
2355 West Pinnacle Peak Road, Suite 300
Phoenix, AZ 85027

Ms. Susanna Eden
Assistant Director
Research Center
University of Arizona
350 North Campbell
Tucson, AZ 85719

Mr. Ruben Balderas
President
Fort McDowell Yavapai Nation
P.O. Box 17779
Fountain Hills, AZ 85269

Mr. Peter S. Yucupicio
Chairperson
Pascua Yaqui Tribe
7474 South Camino De Oeste
Tucson, AZ 85746

Ms. Stacy Vergano
Cha Cha, LLC
c/o Premier Management Company
P.O. Box 9116
Bakersfield, CA 93389-9116

Mr. Ron Derma
General Manager
Bard Water District
1473 Ross Road
Winterhaven, CA 92283

Mr. Lenny Ordway
Office Manager
PABCO Gypsum (A Division of PABCO
Building Products, LLC)
8000 E. Lake Mead Boulevard
Las Vegas, NV 89156

Mr. Louis J. Manuel, Jr.
Chairman
AK-Chin Indian Community
42507 West Peters and Nall Road
Maricopa, AZ 85138

Mr. Gregory Mendoza
Governor
Gila River Indian Community
P.O. Box 97
Sacaton, AZ 85147

Mr. Mike Byrd
Water Resources Manager
Salt River Pima-Maricopa
Indian Community
10005 East Osborn Road
Scottsdale, AZ 85256

Mr. Terry Rambler
Chairman
San Carlos Apache Tribe
P.O. Box 0
San Carlos, AZ 85550

Mr. Selso Villegas
Director
Water Resources Department
Tohono O'odham Nation
P.O. Box 837
Sells, AZ 85634

Ms. Louise Lopez
Tribal Chairwoman
Tonto Apache Tribe
Tonto Apache Tribe Reservation No. 30
Payson, AZ 85541

Mr. Thomas Beauty
Chairman
Yavapai-Apache Nation
2400 West Datsi Street
Camp Verde, AZ 86322

Pilot System Conservation Program (Pilot Program)
Requirements for the Lower Division States
Pursuant to Agreement No. 14-XX-30-W0574, Dated July 30, 2014

Purpose:

To achieve a voluntary, measurable reduction of consumptive use of Colorado River System water to increase storage in Lake Mead to benefit the Colorado River System. The conserved Colorado River System water will not accrue to the benefit or use of any individual Colorado River water user.

Selection:

For this solicitation, the Parties including the Metropolitan Water District of Southern California, the Southern Nevada Water Authority, the Central Arizona Water Conservation District, Denver Water, and the Bureau of Reclamation will jointly select proposals for inclusion in the Pilot Program based on factors provided in subarticle 5.5 of the Funding Agreement. Please submit a pre-proposal of up to two pages that includes the following information:

- Project description;
- Amount of Colorado River System water to be conserved either per year or over the life of the proposed project;
    - Provide supporting information or methodology for the estimated reduction in consumptive use;
    - Describe how Reclamation would verify the reduction in consumptive use;
- Amount of time required to implement the conservation project and the project duration;
- Estimated cost per acre-foot of conserved water;
- Description of how your organization will ensure that the conserved water will reduce your approved water order and through third party consents or forbearance agreements will remain in Lake Mead; and
- Any additional information that would be helpful in understanding your organization's pre-proposal.

Other Information:

Reclamation's annual Colorado River accounting and water use report will serve as the basis for documenting a participant's achieved water conservation yield.

A participant will be required to execute a System Conservation Implementation Agreement (Implementation Agreement) with Reclamation which will provide the terms and conditions for design, implementation, monitoring, and evaluation of the Pilot Program project and compensation to the participant.

A participant must be in compliance with applicable Federal, State, and local environmental, cultural, and paleontological resource protection laws and regulations throughout the term of the Implementation Agreement.

By entering into an Implementation Agreement, the participant grants access to Reclamation to perform periodic on-site inspections of the Pilot Program project(s) to verify compliance with the Implementation Agreement.

Contacts: Crystal Thompson, Central Arizona Project, (623) 869-2138, Travis Thompson, Denver Water, (303) 628-6700, Scott Huntley, Southern Nevada Water Authority, (702) 249-4453, Bob Muir, Metropolitan Water District of Southern California (213) 217-6930, Rose Davis, U.S. Bureau of Reclamation, (702) 293-8421

October 8, 2014

U.S. Department of the Interior and Western municipal water suppliers developing water conservation projects as part of a landmark collaborative agreement

Basin municipalities and federal government take action to protect the Colorado River

Faced with the increasing probability of shortage on the Colorado River, municipal water providers in Arizona, California, Nevada and Colorado, and the Bureau of Reclamation are implementing a landmark Colorado River System Conservation program.

Beginning today, Reclamation is soliciting water conservation project proposals from Colorado River entitlement holders in Arizona, California, and Nevada. At a later date, water users in the Upper Basin will be invited to participate in this unique agreement.

Central Arizona Project, Denver Water, the Metropolitan Water District of Southern California, Southern Nevada Water Authority and Reclamation are providing up to $11 million to fund new Colorado River water conservation projects. The projects are intended to demonstrate the viability of cooperative, voluntary projects to reduce demand for Colorado River water. The program is soliciting project proposals from agriculture, and municipal and industrial Colorado River water entitlement holders.

“This partnership demonstrates our commitment to find solutions in meeting the future challenges we face in water supply and demand,” said Reclamation’s Lower Colorado Regional Director Terry Fulp. “Our goal is to put in place a suite of proactive, voluntary measures that will

reduce our risk of reaching critical reservoir levels. This pilot program is a good first step toward reaching that goal and, depending upon its success, could be expanded in the future."

For more than a decade, a severe drought unprecedented in the last 100 years has gripped the Colorado River, reducing water levels in storage reservoirs throughout the Basin and increasing the risk of falling to critically low water levels. In July, reservoir levels in Lake Mead dipped to the lowest level since Hoover Dam was filled in 1937.

"A decade ago, municipal and agricultural agencies in California came together to help the state permanently reduce its use of Colorado River water. The goal of this latest effort is to develop new basin-wide partnerships to expand conservation activities during this historic drought for the benefit of all Colorado River water users," said Jeffrey Kightlinger, general manager of the Metropolitan Water District of Southern California.

"With shortage looming on the Colorado River, CAP, with its partners, is taking immediate steps to protect Arizona's Colorado River supply. The goal of this unique program is to develop new conservation programs from municipal, industrial, and agricultural water users from across the seven states which share the river," said Pam Pickard, Board President, Central Arizona Project. "The program saves water in Lake Mead and Lake Powell for the benefit of all Colorado River water users and promotes a healthy river system."

All water conserved under this program will stay in the river system, helping to boost the declining reservoir levels and protecting the health of the entire river system. The municipal agencies and the federal government agree that collaborative action is needed now, to reduce the risk to water supplies, hydropower production, water quality, agricultural output, and recreation and environmental resources across the entire Colorado River basin. The Colorado River and its tributaries provide water to nearly 40 million people for municipal use, and the combined metropolitan areas served by the Colorado River represent the world's 12th largest economy, generating more than $1.7 trillion in Gross Metropolitan Product per year.

This first call for proposals is for Lower Basin parties. Upper Basin proposals will be requested in the future.

"We are pleased to see the momentum established in the lower basin. We look forward to a similar process starting soon in the upper basin with our partners along the Colorado River, including The Colorado Cattlemen's Association, Colorado Farm Bureau, Colorado River District, Southwestern Water Conservation District, The Nature Conservancy and Trout Unlimited. Together, we will identify and fund pilot programs that demonstrate the viability of cooperative, voluntary compensated means to reduce water demand," said Jim Lochhead, CEO Denver Water.

Reclamation is currently requesting project proposals for 2015 and 2016 funding allocations. The due date for the responses to the solicitation is November 17, 2014. Following the two-year period, Reclamation and the municipal agencies will evaluate the effectiveness of the conservation projects funded by this program and determine if the successful programs could be expanded or extended to provide even greater protection for the Colorado River system.

"Managing the Colorado River requires a cooperative and concerted effort between diverse stakeholders, and this pilot program furthers that collaboration and provides another tool we can use in response to the drought," said John Entsminger, General Manager, Southern Nevada Water Authority. "This program is the mechanism for developing a wide array of adaptable and scalable conservation projects to provide real benefit to the overall river system."

###

Colorado River Basin Study – Next Steps

Coordination Team Meeting

October 1, 2014; 10:00 AM – 3:00 PM PDT

Telluride Conference Room, Crowne Plaza DIA Convention Center,
15500 E 40th Ave., Denver, CO 80239

Phone: 877-954-5985**;** Participant: 4668491

AGENDA

10:00 – 10:15 Welcome and Introductions

10:15 – 10:30 Overview of Phase 1 Reporting Approach and Schedule

10:30 – 11:30 Status of M&I Conservation and Water Reuse Workgroup Chapter

11:30 – 11:50 Environmental and Recreational Flows Workgroup Chapter

11:50 – 12:15 Agricultural Conservation, Productivity, and Water Transfers Workgroup Chapter

12:15 – 12:45 Lunch

12:45 – 2:15 Phase 1 Report Outline and Key Messages

2:15 – 2:30 Phase 1 Report Schedule

2:30 – 2:45 Other Updates

2:45 – 3:00 Next Steps and Wrap Up

INTERNATIONAL BOUNDARY AND WATER COMMISSION U.S. AND MEXICO
BINATIONAL MEETING ON INTERNATIONAL PROJECTS ON THE COLORADO RIVER

DATE: September 26, 2014
LOCATION: USIBWC Field Office - 2225 Dairy Mart Road, San Ysidro, CA
TIME: 09:00 AM – 1:00PM

AGENDA

09:00 AM – 10:30 AM

1. Pilot Project (Revolucion Canal Lining)

- Welcome and Introductions
- Update on Final Design and Construction Timing
- Update on Funding Need Timing
- Discussion on Conversion Timing
- Next Steps

10:30 AM – 11:00 AM

2. Alamo Canal Regulating Reservoir

- Status Update

11:00 AM – 12:00 PM

3. Binational Desalination Plant Project in Rosarito, B.C.

- Welcome and Introductions
- Final Matrix Analysis
- Update on Mexico's Preferred Approach
- Discussion
- Next Steps
-

12:00 PM -1:00 PM

4. AC–PB0 Connection (All American Canal Turnout)

- Welcome and Introductions
- White Paper Updates from Mexico
- U.S. Comments on White Paper
- Update from Mexico on Canal Capacity in Mexico
- Report-out from IID on Board Discussions
- Proposed Study
- Next Steps

THE PARADOX VALLEY UNIT

A significant component of the Colorado River Basin Salinity Control Program

SUMMARY

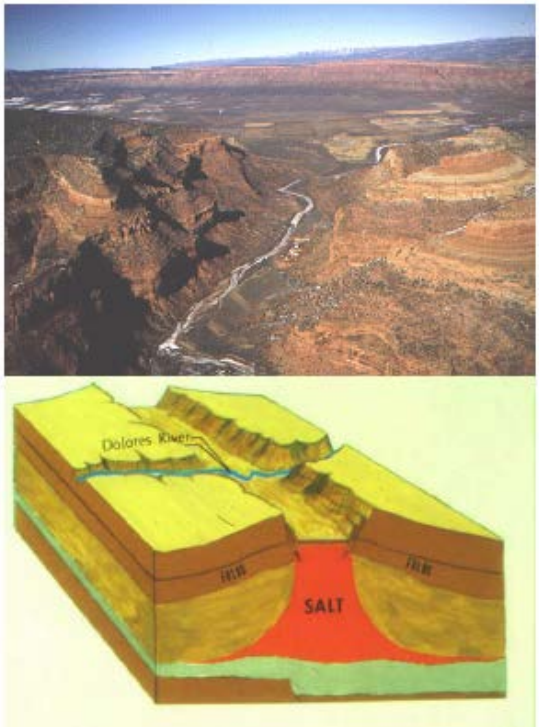
The Paradox Valley Unit (PVU), a series of brine collection wells and a deep injection disposal well, is a critical component of the Colorado River Basin Salinity Control Program (Program). The PVU prevents approximately 100,000 tons of salt from entering the waters of the Colorado River Basin each year, providing just under 10 percent of the total salinity control implemented in the Colorado River Basin. It is estimated that the PVU's injection well could have as few as three to five years of operating life left due to increasing wellhead pressure. Additionally, injection induced seismic events could further shorten the operational life of the PVU injection well. Failure of the existing PVU is projected to increase salinity levels in the Colorado River by 9-10 mg/L at Hoover Dam. This would increase economic damages to agricultural, municipal, and industrial entities by approximately $24 million annually. Failure of the PVU would also increase the likelihood of exceeding water quality standards. The Bureau of Reclamation (Reclamation) is currently working on an Environmental Impact Statement (EIS) that evaluates long-term solutions to the current PVU. Unfortunately, under the current NEPA schedule, the final Finding of No Significant Impact (FONSI) or Record of Decision (ROD) will not be published until the winter of 2017-2018. This time frame may surpass the life of the existing PVU injection well. Accordingly, the Colorado River Basin Salinity Control Forum (Forum) members are very concerned and support additional congressional funding for Reclamation to expedite the EIS process as quickly as possible.

Paradox Valley, Colorado. View looking northwesterly towards the La Sal Mountains, Utah. The Dolores River cuts across (perpendicular to) the valley near its middle. The brine collection wells are along the Dolores River in the center of the valley. The deep well injection facility is behind the cliff in the Dolores River canyon on the center left of the photo.

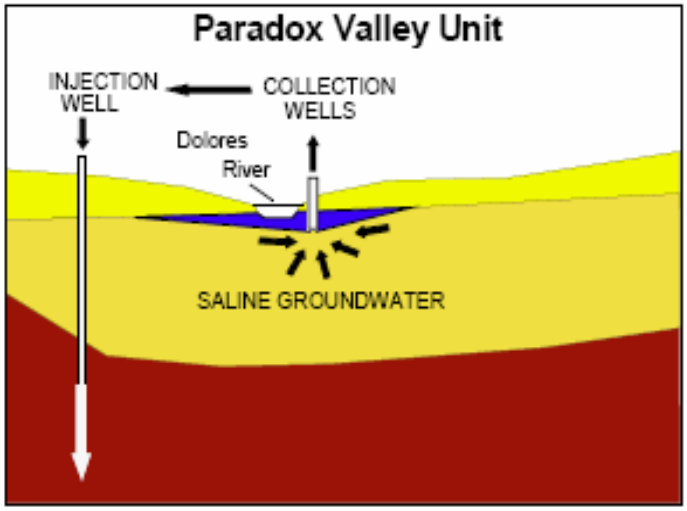
BACKGROUND

The PVU, which is operated by Reclamation, is an integral component of the Program. The PVU is located along the Dolores River (a tributary to the Colorado River) in the Paradox Valley in Montrose County, Colorado. The Paradox Valley is a collapsed salt anticline which developed as deeply buried salts flowed upward, doming up the valley. These salts were then partially dissolved and the overlying bedrock collapsed forming the valley.

The PVU is an original unit authorized by Congress as part of the Colorado River Basin Salinity Control Act (P.L. 93-320) in 1974. It was constructed as part of the Program's effort to meet federal water quality standards under the Federal Water Pollution Control Act, as amended. Shallow groundwater in the Paradox Valley is one of the most concentrated sources of salinity (approximately 260,000 mg/L) in the Upper Basin. The PVU was designed to intercept shallow saline groundwater (brine) before it discharges to the Dolores River. Constructed in the late 1980s and early 1990s, the PVU is comprised of a brine collection well field, a brine treatment facility, and a 16,000-foot deep injection well, along with associated roads, pipelines and electrical facilities.



Aerial photo and schematic showing the collapsed salt anticlinal structure which created the Paradox Valley and its salt issues.



Schematic of PVU operations including shallow collection wells and deep well injection.

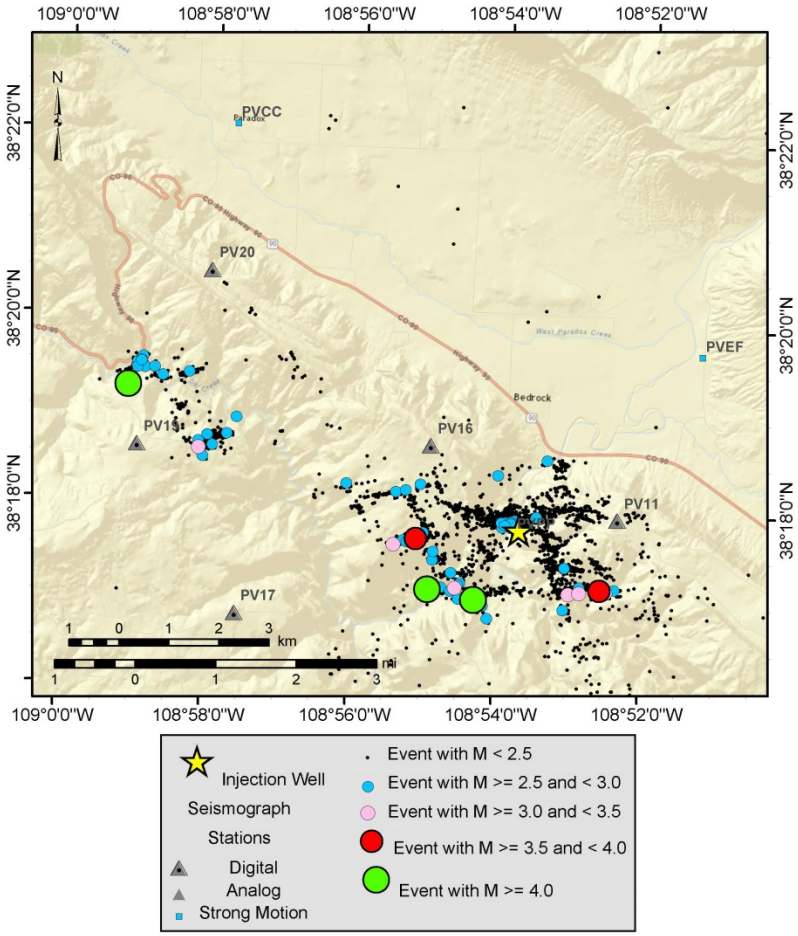
Under normal operations, the PVU injects about nine to ten million gallons of brine per month, or about 100,000 tons of salt per year. To put that number in perspective: 100,000 tons of dried salt would fill a football field about 40 feet high. Absent the PVU, the brine would otherwise enter the Dolores River and then the main stem of the Colorado River, significantly degrading its water quality. The PVU currently provides about 10 percent of the total salinity control on the Colorado River at a cost of approximately $60 per ton.

CONCERN

The PVU's existing deep injection well is nearing the end of its viability. The wellhead injection pressure has been increasing steadily towards the maximum permitted injection pressure of 5,350 psi. The permitted pressure was increased from 5,000 psi in 2006 when Reclamation was given approval from EPA to modify the Underground Injection Control permit. In 2010, it was estimated that this could be exceeded in three to five years, reducing the efficacy of the injection well. In 2013, the injection rate was reduced from 230 gpm to 200 gpm, which reduced the wellhead injection pressure. Not considering other factors that could affect the life of the well, this decrease in pressure will extend the projected utility of the well to some degree. The other remaining features of the PVU, which constitute about half of the overall investment, are not affected by the wellhead injection pressure and are projected to be operable for many years.

An additional concern that has become critical to continued operations is the increased seismic activity caused by years of long-term fluid injection into the underlying formation. Prior to the construction of PVU, the Paradox Valley was fairly aseismic. Since initiation of operations, the valley has experienced thousands of earthquakes, with an average of more than 100 earthquakes each year. Most of these are small. In recent years, Reclamation scientists have been particularly concerned about the rate and magnitude of seismic activity occurring farther away from the well and toward the community of Paradox, Colorado.

On January 24, 2013, an M_L 4.4 earthquake struck near Paradox, Colorado causing minor damages. Consistent with its Emergency Action Plan, Reclamation immediately shut down PVU. Reclamation's Emergency Action Plan identifies contacts, responsibilities, and actions to be taken should there be an emergency.



Location and magnitude of Paradox seismic events. Modified from Reclamation's *Draft Technical Memorandum TM-86-68330-2013-12* dated March 2013.

During this shutdown, Reclamation evaluated the seismic event and studied operational options. After three months it was determined to reinitiate operations with the following two major changes: 1) shutdown periods would change from bi-annual to weekly, and 2) the injection rate would change from approximately 230 gpm to 200 gpm. These operational changes have decreased the rate of pressure buildup and likely reduced the short-term potential for further earthquakes, but have also reduced the amount of salt removed each year. As long-term injection continues, pressures will again rise, eventually requiring further reductions to avoid the risk of damaging earthquakes. A long-term replacement disposal alternative is urgently needed.

IMPACT OF FAILURE

Salinity in the Colorado River causes economic damages to water users in the Lower Colorado River Basin. Economic modeling shows several hundred million dollars per year of economic damages to agricultural crops, water utilities and municipal water suppliers, the commercial and industrial sectors, and residential household appliances which use Colorado River water. If the PVU were to become inoperable, absent the development of another alternative to remove the salt load, salinity levels in the Dolores River would increase by more than 700 mg/L. In the Lower Basin, the TDS of the Colorado River would increase by 9-10 mg/L in just a few years, causing damages to increase by approximately $24 million annually. Moreover, the loss of the PVU injection well will increase the probability of exceeding water quality standards.

DEVELOPMENT OF ALTERNATIVES

To address the crucial need to develop a long-term replacement solution to the PVU injection well, Reclamation is preparing an EIS under which it is currently evaluating: 1) the siting and construction of a second deep-injection well, 2) creation of evaporation ponds, or 3) other new technology alternatives (so far unidentified). Reclamation published its EIS Scoping Report in January 2013 after several years of conducting preliminary studies with experts in geology, exploration, geophysics, drilling, seismicity, injection wells and operational activities. As part of the EIS process, further analysis is being conducted and Reclamation is working closely with the U.S. Fish & Wildlife Service, U.S. Bureau of Land Management, State of Colorado, Montrose County, Colorado, and the Paradox Valley community to evaluate a pilot evaporation pond. The pilot evaporation pond project is described in Reclamation's 2013 EIS Scoping Report.

Reclamation does not anticipate completing alternative impact analyses before July of 2016, nor having a final NEPA document before the fall of 2017. This means a final FONSI or ROD will not likely be published before the winter of 2017-18. The most significant hindrance to its completion is the availability of sufficient funding for each of the identified alternatives to be appropriately analyzed.

FORUM'S POSITION

Loss of the Paradox Valley Unit's injection well presents real concerns to the Colorado River Basin Salinity Control Program. The Colorado River Basin Salinity Control Forum members, comprised of representatives from the Colorado River Basin States, feel strongly that this unit must remain operational in order for the States to meet their water quality obligations and avert economic damages in areas like Las Vegas, Los Angeles, San Diego, Phoenix, Tucson, Yuma and the Imperial and Coachella Valleys. The Forum members, Reclamation, other federal agencies, scientists, and consultants are all in agreement that an alternative to the existing deep-well injection unit is needed to ensure that its failure does not cause salinity levels to increase in the Colorado River, leading to unacceptable increases in economic and physical damages. The analysis and construction of alternatives is essential to avoid the risk of increased seismic activity at or near the town of Paradox. While the EIS is currently underway, the time frame for its completion may surpass the life of the injection well. Furthermore, no contingency or emergency plan or alternative is being pursued outside of the current EIS process to replace this essential facility. For these reasons, the Forum members would like Reclamation 1) to complete the EIS process as soon as possible (sooner than the current schedule) and 2) to maintain a viable Emergency Action Plan. The Forum Members support Reclamation's efforts and pledge their assistance to ensure sufficient funding exists for Reclamation to accomplish these paramount tasks.

Photos and schematics used in figures courtesy of the U.S. Bureau of Reclamation

COLORADO RIVER BASIN SALINITY CONTROL FORUM

The Colorado River Basin Salinity Control Forum was created by the seven Colorado River Basin states in 1973 to act as a common voice for the states on salinity matters and to coordinate with federal agencies in the implementation of the Program. Forum membership consists of appointees from each of the governors of the Colorado River Basin states and includes water quantity and water quality agency leads and representatives from major water user organizations.

Don A. Barnett
Executive Director

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Colorado River Basin SALINITY CONTROL FORUM

Updated October 6, 2014

United States Department of the Interior

OFFICE OF THE SECRETARY
Washington, DC 20240

DECISION MEMORANDUM FOR THE SECRETARY

To: Secretary

From: Anne J. Castle SEP 2 9 2014
Secretary's Designee, Glen Canyon Dam Adaptive Management Work Group
Assistant Secretary – Water and Science

Subject: Report and Recommendations from the Glen Canyon Dam Adaptive Management Work Group (AMWG) Meetings Held on February 19-20, 2014, May 27, 2014, and August 27-28, 2014.

Introduction

The Glen Canyon Dam AMWG is a Federal advisory committee chaired by a designee of the Secretary of the Interior. I am the current designee. The AMWG provides advice and recommendations to the Secretary relative to the operation of Glen Canyon Dam and the actions of the Glen Canyon Dam Adaptive Management Program (GCDAMP) and reports to the Secretary through the Secretary's designee.

Members of the AMWG are appointed by the Secretary with representation from the Colorado River Basin states, tribal nations, environmental and recreational groups, and power interests. The Department of the Interior (Department) agencies participating in the AMWG include the U.S. Fish and Wildlife Service (FWS), National Park Service (NPS), Bureau of Indian Affairs, Bureau of Reclamation (Reclamation), and the U.S. Geological Survey (USGS). Western Area Power Administration is also represented.

Background

The AMWG held three meetings in 2014. The first was a 2-day in-person meeting on February 19-20, 2014, in Tempe, Arizona. The second was a 3-hour webinar on May 27, 2014. The third was a 2-day in-person meeting on August 27-28, 2014, in Flagstaff, Arizona. The meetings were well attended and positive. This memorandum contains a summary of issues discussed, actions taken, and recommendations to you.

February 19-20, 2014, Meeting:

The AMWG held a 2-day in-person meeting on February 19-20, 2014, in Tempe, Arizona. The following key items were discussed:

1. Panel on the Potential Effects of Long-Term Drought on Colorado River Operations. Water managers throughout the Colorado River Basin have been working to develop strategies for the long-term implications of climate change for the basin through collaborations such as the recently completed Reclamation Colorado River Basin Water Supply and Demand Study. The partners in the study, as well as other stakeholders, initiated the "next steps" process that is looking into the potential for municipal conservation, agricultural conservation, transfers, a focus on environmental and ecosystem flows, and how those things can be melded together to create a strategy that will address the anticipated range of future inflows into the system, as well as the resulting effects of that range of flows. A diverse panel of people and agencies involved in this process provided their perspectives on the issues facing the basin and the potential solutions: Ms. Katrina Grantz, Reclamation; Mr. Eric Kuhn, Colorado River District; Ms. Jayne Harkins, Colorado River Commission of Nevada; and Dr. Jack Schmidt, USGS Grand Canyon Monitoring and Research Center (GCMRC).

2. Long-Term Experimental and Management Plan Environmental Impact Statement (LTEMP EIS) Update. Reclamation and the NPS as joint lead agencies continue to work with various stakeholders and cooperators in developing the LTEMP EIS. The co-lead agencies, with assistance from Argonne National Laboratory, and working with the cooperating agencies, have defined 12 resource goals, 33 performance metrics, and 6 alternatives. Dr. Mike Runge from the USGS, a nationally recognized expert in structured decision-making, is working with stakeholders to undertake a swing-weighting exercise as part of the work of the EIS.

May 27, 2014, Webinar:

In order to conserve costs, the AMWG has been holding webinars when possible. The May webinar/conference call focused on the following issues:

1. Hydrology and Hydrograph for Fiscal Year (FY) 2015 – Reclamation is forecasting a most-probable release of 9.0 million acre-feet (maf) from Lake Powell to Lake Mead in FY 2015. The proposed hydrograph is similar to FY 2014, with a focus on sediment conservation in the late summer and fall.

2. Triennial Budget and Work Plan – The program will move from a 2-year to a 3-year budget and work plan cycle. Reclamation and the GCMRC are developing a comprehensive and ambitious work plan for FYs 2015-17.

3. Southwest Biological Science Center Facilities and Overhead – Due to aging buildings that do not meet current needs, the GCMRC will have to move into a new facility by 2017. This will cause a substantial increase in the facility overhead rate from 3.8 to 19.9 percent. The GCMRC will have to reduce expenditures on monitoring and research for several years to absorb these costs.

4. Glen Canyon Dam LTEMP EIS – A workshop was conducted March 31-April 2 with stakeholders to present the results of modeling and analysis of the six LTEMP

alternatives, including a swing-weighting exercise to facilitate stakeholder involvement in the decision-making process. By all accounts the workshop and follow-up webinars were a success and the swing-weighting results were informative, although not all stakeholders chose to participate.

August 27-28, 2014, Meeting:

This meeting was held in Flagstaff, Arizona. The following issues were discussed:

1. FYs 2015-2017 Budget and Work Plan – Reclamation and the GCMRC drafted a triennial budget and work plan for FYs 2015-2017. The level of detail and caliber of science provided in the GCMRC work plan (and the coordination with stakeholders as the plan was developed) was extraordinary and many stakeholders expressed their thanks for the work that went into the document. The members discussed and passed the following motion by consensus:

   The AMWG recommends the FY 2015-2017 Triennial Budget and Work Plan from Reclamation and the GCMRC, as presented at the August 27-28, 2014 meeting, to the Secretary for approval.

2. Water Year 2015 Hydrograph – The 2014 hydrograph that prescribes operation of Glen Canyon Dam worked very well at retaining sediment inputs high in the system in anticipation of a possible high flow experiment. A very similar strategy is proposed for the 2015 water year to facilitate a high flow release if sediment and other resource conditions are appropriate. The AMWG discussed the Department/Department of Energy (DOE) proposed hydrograph and passed the following motion by consensus:

   The AMWG recommends to the Secretary for her approval the Department/DOE Proposed Hydrograph for Water Year 2015 as follows:

   - **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) powerplant capacity, and (3) the magnitude of a potential High Flow Experiment (HFE).**

   - **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 Record of Decision and contained in the 1995 Final EIS and in compliance with all applicable National Environmental Policy Act of 1969 compliance documents (HFE and Non-Native Fish Control Environmental Assessments, 2007 Inspector General).**

- **Release objective for June is:**
  - **600 to 650 thousand acre-feet (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 of 10 maf and greater.**

- **Release objective for August is 800 kaf.**

- **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 powerplant 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 timeframes.**

- **Additionally, 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 Department/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.**

3. Planning for a Potential 2014 HFE – The HFE Protocol process provides for substantial collaboration and coordination among Reclamation, GCMRC, NPS, and GCDAMP stakeholders, and has been further refined now that two HFEs have been completed under the HFE Protocol in 2012 and 2013. Many beaches have shown improvement since the HFE Protocol was implemented in 2012 and no adverse impacts to endangered humpback chub or other important resources have been identified. Based on the current status of resources, a 2014 HFE will likely be recommended if there is sufficient sediment input in the fall (which appears likely based on current conditions). Currently in excess of 109,000 tons of sand have entered the system from the Paria River. A minimum of approximately 200,000 tons are needed to conduct a 2014 HFE.

4. Glen Canyon Dam LTEMP EIS Update – The joint lead agencies, Reclamation and the NPS, are working to craft a hybrid alternative based on the best aspects of the six alternatives under consideration for the operation of Glen Canyon Dam. Based on initial analyses, the draft hybrid alternative is projected to perform better than no action on important resource goals including sediment conservation and native fish including endangered humpback chub. It is the goal of the Department to develop the hybrid alternative into a consensus preferred alternative for the draft EIS. The EIS will also include a robust climate change analysis. The public draft of the EIS is planned for release in January 2015.

5. AMWG Discussion on Issues, Concerns, and Challenges – The AMWG members held a brainstorming session during which various stakeholders discussed a broad range of issues they believe should be considered for the future direction of the GCDAMP. Individual members identified specific ideas that the member viewed as important for the Secretary to consider. During the discussion it was recognized that some of these ideas are likely to have legal, policy, or other ramifications, and would require further analysis. Key ideas discussed (in no particular order) include: (1) a need for greater focus on resource improvement and restoration versus prioritizing research and monitoring; (2) a need to work outside of Grand Canyon in other parts of the Colorado River Basin to consider status of resources and approaches more holistically and basin-wide to address high priority needs; (3) the AMWG should develop a more detailed "second tier" of the Desired Future Conditions; (4) the AMWG should update its foundational documents; (5) the AMWG should work harder to incorporate tribal values into the GCDAMP; (6) the GCDAMP should work towards the big pay-offs to get the most "bang for the buck," both in Grand Canyon and basin-wide; (7) the AMWG should work with the FWS to evaluate whether the Grand Canyon population of humpback chub is eligible for delisting as an endangered species; (8) the AMWG works best with strong leadership and should look to expand membership basin-wide in the future; (9) hydropower is a renewable, green energy source, and the AMWG should recognize that constraints on hydropower may result in additional carbon dioxide emissions from replacement energy sources; (10) the AMWG should develop ways to directly consider climate change; (11) the AMWG should incorporate in its thinking the fact that water deliveries from Lake Powell are essential to maintaining the economy, including agricultural and municipal and industrial uses; and (12) while the important work of the GCDAMP proceeds, there are important legal issues in dispute between and among the seven states that share the Colorado River and continued diligence should be undertaken not to inadvertently or prematurely trigger conflicts and controversies among the states (particularly in this time of extended and historic drought in the basin).

6. The departure of Mr. Larry Walkoviak, Ms. Ann Gold, and Dr. Jack Schmidt – Mr. Larry Walkoviak retired from Federal service on September 3, 2014. He was appointed Regional Director of Reclamation's Upper Colorado (UC) Region in September 2007, and has served as the AMWG Secretary's Designee alternate since 2010. In his more than 35 years of Federal service, all with Reclamation, Mr. Walkoviak has served in numerous positions and places around the west for Reclamation. His dedication and leadership, as well as his calm and warm personality and thoughtfulness, will be sorely missed by both Reclamation and the GCDAMP.

   Ms. Ann Gold also retired from Federal service on September 3, 2014. She has been a Deputy Regional Director for Reclamation's UC Region since November 2007. With over 30 years of Federal service, Ms. Gold began her career with the Soil Conservation Service, and worked for the Forest Service and Bureau of Land Management, prior to moving to Reclamation's Upper Colorado Region in 1983. Ms. Gold has been a Special Assistant to Reclamation's Deputy Commissioner for Policy, Administration and Budget, and also served as the UC Region's Human Resource Officer. She has played a key role in many important AMWG accomplishments including the completion of the GCDAMP

desired future conditions and revisions of the AMWG charter, and has always been a perceptive voice in AMWG deliberations.

Dr. Jack Schmidt is leaving his position as Chief of the GCMRC to return to being a professor in stream geomorphology at Utah State University. In his short tenure as the Chief of the GCMRC since 2011, he has made tremendous efforts to increase the scientific credibility and standing of the GCMRC and to ensure clear and transparent communication of GCMRC results to stakeholders and policymakers. Dr. Schmidt's efforts to integrate the water quality, sediment, biology, and cultural program areas, to focus projects and programs on the key resource issues and questions facing the program, and his ability to inspire and propel his staff to develop new methods of delivering science to support dam operations, has been remarkable. The FY 2015-2017 GCMRC Budget and Work Plan is by far the most advanced to date, an accomplishment that is a testament to his leadership, and which has been unanimously heralded by the members of the AMWG and the Science Advisors. Dr. Schmidt's efforts to make much of the water quality and sediment monitoring done by the GCMRC available in real time on the internet have resulted in one of the most advanced science center websites in the world. His tenure may have been short, but it transformed the GCMRC.

The AMWG works very hard to provide you with informed recommendations concerning the operations of Glen Canyon Dam, and has consistently been collegial and positive in its working relationships. The Department has been very fortunate to have such tremendous staff and stakeholders during my tenure as the Secretary's Designee. I am honored to have had the opportunity to chair this group and to have been a part of the work they have done.

Recommendation

The AMWG brings a wealth of dedication, passion, and knowledge to help guide our efforts to appropriately manage the operations of Glen Canyon Dam. The group makes it possible for the Secretary to consider multiple views about how to protect downstream resources and to reach an appropriate balancing of interests on river operations. The Department agencies and my staff and I work very closely with the AMWG to ensure good dialogue and informed and practical recommendations to you. The two recommendations forwarded to you from the AMWG meeting in August 2014 were adopted by consensus. I recommend you approve both recommendations, and the Department agencies will then work to carry them out.

The attached approval document is provided for your consideration.

cc: Principal Deputy Assistant Secretary, Fish, Wildlife and Parks
Assistant Secretary, Indian Affairs
Acting Director, U.S. Geological Survey
Acting Commissioner, Bureau of Reclamation
Director, U.S. Fish and Wildlife Service
Director, National Park Service
Director, Bureau of Indian Affairs

Assistant Director, Wildlife Management, Arizona Game and Fish Department,
5000 W. Carefree Highway, Phoenix, Arizona 85086-5000
Attention: Mr. James deVos

Bureau of Indian Affairs, 2600 N. Central Avenue, 4th Floor, Phoenix, Arizona 85004
Attention: Mr. Chip Lewis

Department of Energy-WAPA, Western Area Power Administration,
150 E. Social Hall Avenue, Suite 300, Salt Lake City, Utah 84111
Attention: Ms. Lynn Jeka

The Hualapai Tribe, PO Box 310, Peach Springs, Arizona 86434
Attention: Ms. Loretta Jackson-Kelly

Director, Cultural Preservation Office, The Hopi Tribe, PO Box 123,
Kykotsmovi, Arizona 86039
Attention: Mr. Leigh Kuwanwisiwma

National Park Service, Grand Canyon National Park, PO Box 129,
Grand Canyon, Arizona 86023
Attention: Mr. David Uberuaga

Executive Director, Department of National Resources, Navajo Nation, PO Box 4950,
Window Rock, Arizona 86515
Attention: Mr. Tony Joe

Pueblo of Zuni, PO Box 339, Zuni, New Mexico 87327
Attention: Mr. Gerald Hooee, Sr.

San Juan Southern Paiute Tribe, PO Box 2656, Tuba City, Arizona 86045

Southern Paiute Indian Consortium, HC 65 Box 2, Fredonia, Arizona 86022
Attention: Mr. Charley Bulletts

Field Supervisor, U.S. Fish and Wildlife Service, Arizona Ecological Services
Office, 2321 W. Royal Palm Road, Phoenix, Arizona 85021-4951
Attention: Mr. Steve Spangle

Arizona Department of Water Resources, 3550 N. Central Avenue,
Phoenix, Arizona AZ 85012
Attention: Mr. Tom Buschatzke

Executive Director, Colorado River Board of California, 770 Fairmont Avenue,
Suite 100, Glendale, CA 91203-1068
Attention: Ms. Tanya Trujillo

Upper Gunnison River Water Conservancy District, 210 West Spencer, Suite B,
Gunnison, Colorado 81230
Attention: Mr. John McClow

Colorado River Commission of Nevada, 555 E. Washington Avenue, Suite 3100,
Las Vegas, Nevada 89101-1048
Attention: Ms. Jayne Harkins

New Mexico Interstate Stream Commission, PO Box 25102,
Santa Fe, New Mexico 87504
Attention: Mr. Scott Verhines

Interstate Streams Division, State Engineer's Office, 122 W. 25th Street,
Cheyenne, Wyoming 82002
Attention: Mr. Steve Wolff

Director, Division of Water Resources, 1594 W. North Temple,
Salt Lake City, Utah 84114
Attention: Mr. Eric Millis

Grand Canyon Wildlands Council, PO Box 1315, Flagstaff, Arizona 86002
Attention: Mr. Larry Stevens

Grand Canyon River Guides, 453 W. Mulberry Drive, Phoenix, Arizona 85013-4349
Attention: Mr. Sam Jansen

National Parks Conservation Association, 307 West 200 South, Suite 5000,
Salt Lake City UT 84101
Attention: Mr. David Nimkin

Colorado River Energy Distributors Association, 10429 S. 51st Street, Suite 230,
Phoenix, Arizona 85044
Attention: Ms. Leslie James

Utah Associated Municipal Power Systems, 155 N. 400 W., Suite 480,
Salt Lake City, Utah 84103
Attention: Mr. Ted Rampton

Federation of Fly Fishers, 4510 E. Joshua Tree Lane, Paradise Valley, Arizona 85253
Attention: Mr. John Jordan

Deputy Regional Director, Upper Colorado Region, U.S. Bureau of Reclamation,
125 S. State Street, Salt Lake City, Utah 84138
Attention: Acting Ms. Jennifer Faler

Regional Director, Upper Colorado Region, U.S. Bureau of Reclamation,
125 S. State Street, Salt Lake City, Utah 84138
Attention: Acting Mr. Brent Rhees

Adaptive Management Work Group Alternates
Technical Work Group Members and Alternates
(via e-mail)

United States Department of the Interior

OFFICE OF THE SECRETARY
Washington, DC 20240

DECISION MEMORANDUM FOR THE SECRETARY

From: Anne Castle SEP 2 9 2014
Secretary's Designee, Glen Canyon Dam Adaptive Management Work Group
Assistant Secretary – Water and Science

Subject: Report and Recommendations from the Glen Canyon Dam Adaptive Management Work Group (AMWG) Federal Advisory Committee Meetings held on February 19-20, 2014, May 27, 2014, and August 27-28, 2014

I. RECOMMENDATION

The AMWG brings a wealth of dedication, passion, and knowledge to help guide our efforts to appropriately manage the operations of Glen Canyon Dam. The group makes it possible for the Secretary to consider multiple views about how to protect downstream resources and to reach an appropriate balancing of interests on river operations. The Department of the Interior (Department) agencies and my staff and I work very closely with the AMWG to ensure good dialogue and informed and practical recommendations to you. The two recommendations forwarded to you from the AMWG meeting in August 2014 were adopted by consensus. I recommend you approve both recommendations, and the Department agencies will then work to carry them out.

II. SECRETARY'S DECISION

X APPROVE
___ DISAPPROVE

SEP 3 0 2014
Date

Secretary

RECLAMATION

Managing Water in the West

Fall 2014 HFE Planning

Glen Knowles
Bureau of Reclamation

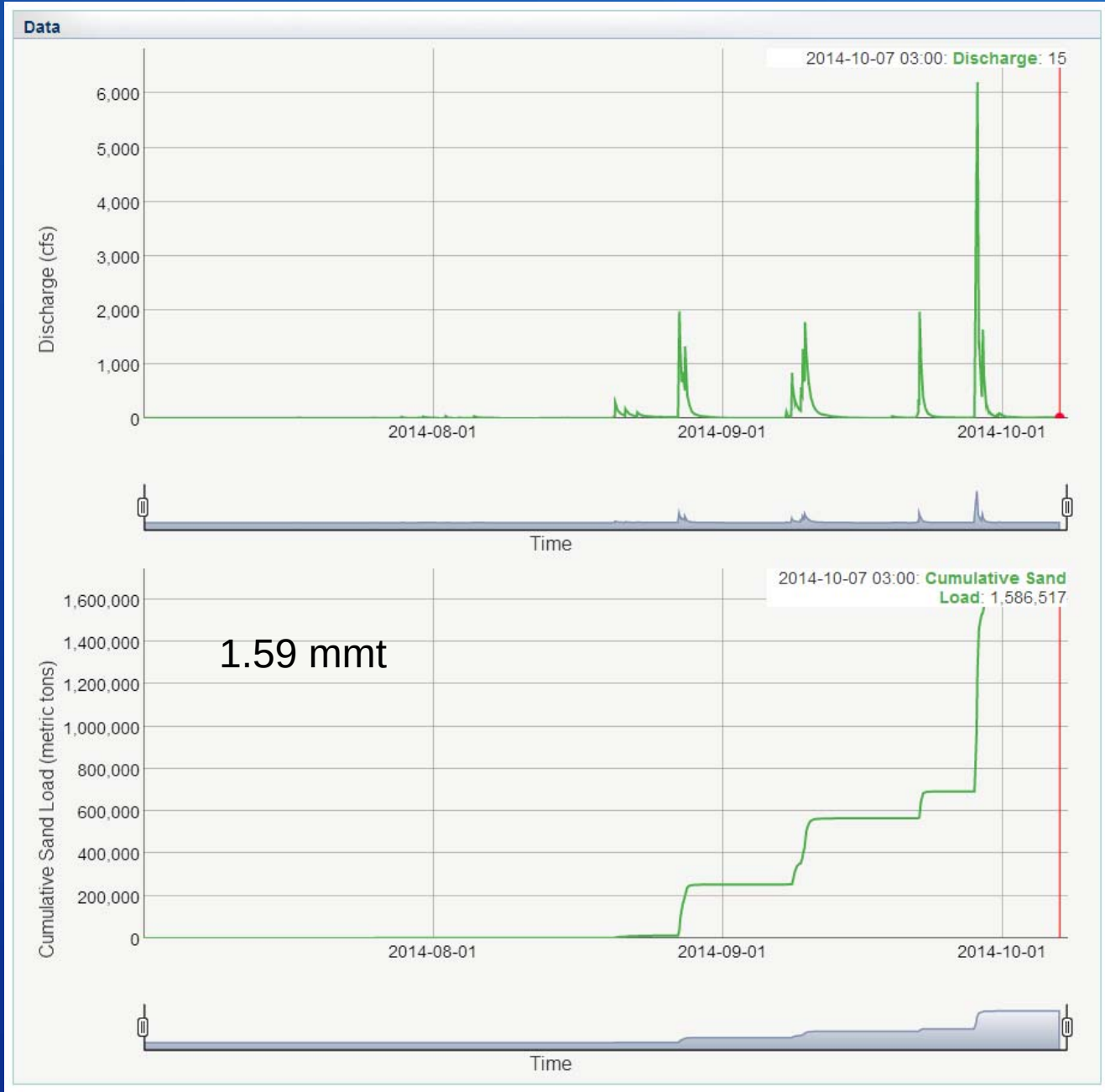
Basin States
October 7, 2014

U.S. Department of the Interior
Bureau of Reclamation

Current conditions from the GCMRC web page as of Oct. 7

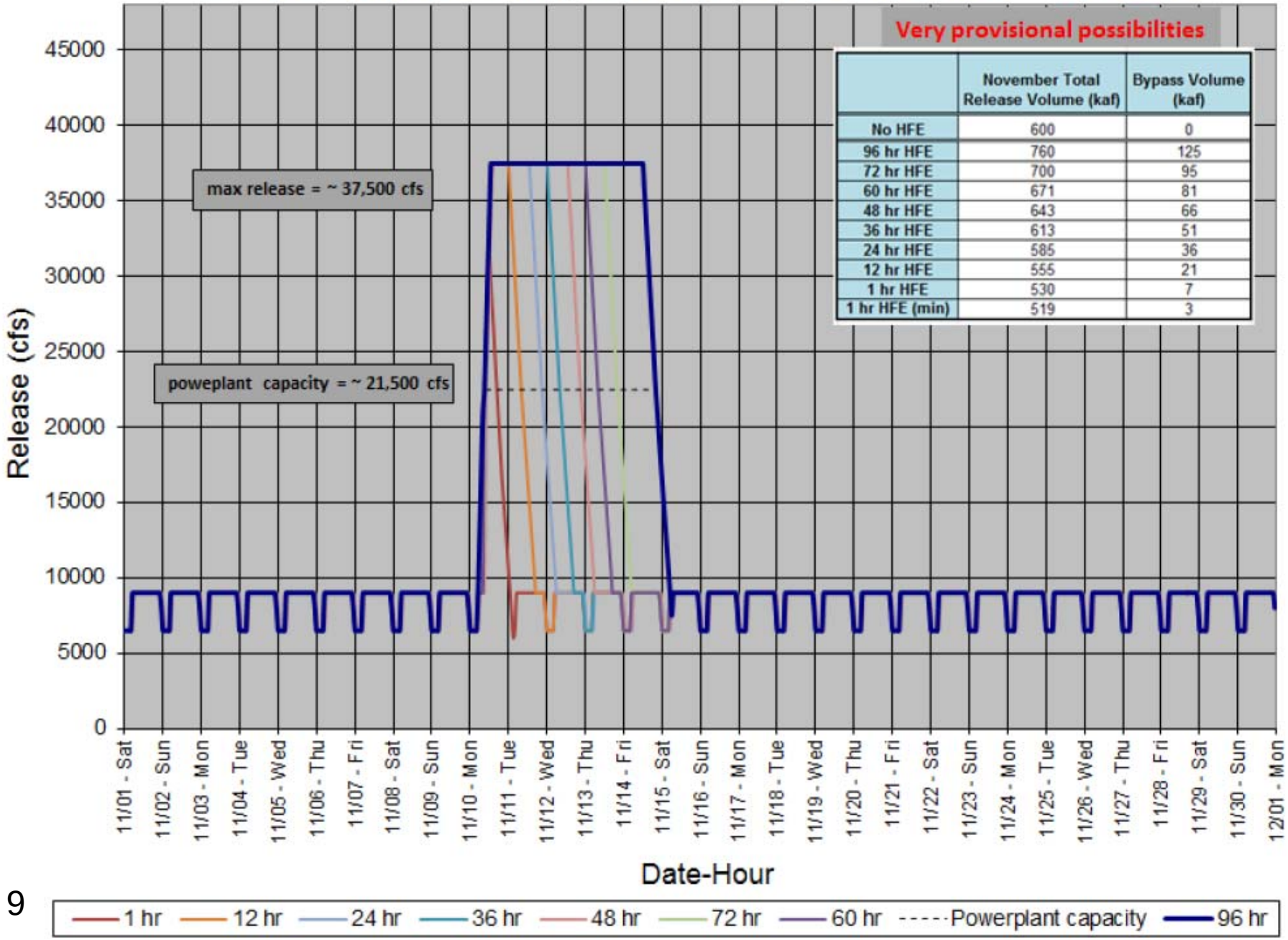
Paria River at Lees Ferry discharge since July 1

Paria River at Lees Ferry cumulative sand load since July 1



RECLAMATION

Glen Canyon Dam Possible HFE Release Patterns



Very provisional possibilities

	November Total Release Volume (kaf)	Bypass Volume (kaf)
No HFE	600	0
96 hr HFE	760	125
72 hr HFE	700	95
60 hr HFE	671	81
48 hr HFE	643	66
36 hr HFE	613	51
24 hr HFE	585	36
12 hr HFE	555	21
1 hr HFE	530	7
1 hr HFE (min)	519	3

2014 HFE Summary and Next Steps

1. Resource conditions support a 2014 HFE
2. 37,500 cfs for 96 hours, early-mid Nov. 2014
3. Timing TBD, week of Nov. 9
4. 30-day HFE MOA letter has gone out
5. TWG Webinar Oct. 17 11am-1pm mdt
6. Leadership Team meeting week of Oct. 20
7. US Fish and Wildlife Service report in December
8. If an HFE occurs in FY 2014, convene a workshop to review results of first 3 HFEs in 2015

AUTHENTICATED
U.S. GOVERNMENT
INFORMATION
GPO

FEDERAL REGISTER

Vol. 79 Friday,
No. 192 October 3, 2014

Part V

Department of the Interior

Fish and Wildlife Service

50 CFR Part 17

Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Western Distinct Population Segment of the Yellow-billed Cuckoo *(Coccyzus americanus);* Final Rule

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R8– ES–2013–0104; 4500030113]

RIN 1018–AY53

Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Western Distinct Population Segment of the Yellow-billed Cuckoo (Coccyzus americanus)

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Final rule.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), determine threatened status under the Endangered Species Act of 1973 (Act), as amended, for the western distinct population segment (DPS) of the yellow-billed cuckoo (*Coccyzus americanus*), a species located from the western portions of the United States, Canada, and Mexico. This final rule implements the Federal protections provided by the Act for this DPS.

DATES: This rule is effective November 3, 2014.

ADDRESSES: This final rule is available on the Internet at *http://www.regulations.gov* and at the Sacramento Fish and Wildlife Office at *http://www.fws.gov/sacramento/*. Comments and materials received, as well as supporting documentation used in the preparation of this rule, will be available for public inspection, by appointment, during normal business hours at: U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office, 2800 Cottage Way, Room W–2605, Sacramento, CA 95825; by telephone 916–414– 6600; or by facsimile 916–414–6712.

FOR FURTHER INFORMATION CONTACT: Jennifer Norris, Field Supervisor, Sacramento Fish and Wildlife Office (see **ADDRESSES**). If you use a telecommunications device for the deaf (TDD), call the Federal Information Relay Service (FIRS) at 800– 877–8339.

SUPPLEMENTARY INFORMATION:

Executive Summary

Why we need to publish a rule. Under the Endangered Species Act, a species may warrant protection through listing if it is endangered or threatened throughout all or a significant portion of its range. Listing a species as an endangered or threatened species can only be completed by issuing a rule. On October 3, 2013, we published in the **Federal Register** a proposed rule (78 FR 61621) to list the western DPS of the yellow-billed cuckoo (hereafter referred to as western yellow-billed cuckoo). This rule finalizes our determination for listing the western yellow-billed cuckoo.

The basis for our action. Under the Endangered Species Act, we can determine that a species is an endangered or threatened species based on any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence.

We have determined that the western yellow-billed cuckoo meets the definition of a threatened species and is likely to become endangered throughout its range within the foreseeable future, based on the immediacy, severity, and scope of the threats to its continued existence. These include habitat loss associated with manmade features that alter watercourse hydrology so that the natural processes that sustained riparian habitat in western North America are greatly diminished. Loss and degradation of habitat has also occurred as a result of livestock overgrazing and encroachment from agriculture. These losses are exacerbated by the conversion of native habitat to predominantly nonnative vegetation. Habitat loss results in the additional effects associated with small and widely separated habitat patches such as increased predation and reduced dispersal potential. This threat is particularly persistent where small habitat patches are in proximity to human-altered landscapes, especially agricultural fields, resulting in the potential for pesticides to poison individual western yellow-billed cuckoos and reduce their prey base.

What the rule does. We are making a final listing determination regarding the western distinct population segment of the U.S. population of the yellow-billed cuckoo pursuant to the Endangered Species Act. This species occurs in the western United States, Canada, and Mexico. The western U.S. States include Washington, Idaho, Montana, Oregon, California, Nevada, Wyoming, Utah, Colorado, Arizona, New Mexico, and Texas. This document adds the western DPS of the yellow-billed cuckoo (*Coccyzus americanus*) as a threatened species to the List of Endangered and Threatened Wildlife (50 CFR 17.11(h)).

Peer review and public comment. We sought comments from independent specialists to ensure that our determination is based on scientifically sound data, assumptions, and analyses. We invited these peer reviewers to comment on our listing proposal. We also considered all other comments and information we received during the three open comment periods. We have considered and incorporated any pertinent information from all comments and information we received into this final rule. See the **Summary of Comments and Recommendations** section, below, for a summary of comments we received on the proposed listing.

Previous Federal Actions

On October 3, 2013, the proposed rule to list the western yellow-billed cuckoo as a threatened species under section 4 of the Act (16 U.S.C. 1531 *et seq.*) was published in the **Federal Register** (78 FR 61621). This rule finalizes the Federal action for this species. For additional information on previous Federal actions for the western yellow-billed cuckoo, please see the 12-month petition finding (66 FR 38611; July 25, 2001) and proposed listing rule (78 FR 61621; October 3, 2013).

We proposed critical habitat for the western DPS of the yellow-billed cuckoo on August 15, 2014 (79 FR 48547).

Background

In this section of the final rule, it is our intent to discuss only those topics directly relevant to the listing of the western yellow-billed cuckoo as a threatened species. Please refer to the proposed listing rule for the western yellow-billed cuckoo for detailed background and species information (78 FR 61621; October 3, 2013).

Species Information

The yellow-billed cuckoo (*Coccyzus americanus*) is a member of the avian family Cuculidae and is a Neotropical migrant bird that winters in South America and breeds in North America. Yellow-billed cuckoos spend the winter in South America, east of the Andes, primarily south of the Amazon Basin in southern Brazil, Paraguay, Uruguay, eastern Bolivia, and northern Argentina (Ehrlich *et al.* 1992, pp. 129–130; American Ornithologists' Union (AOU) 1998, p. 247; Johnson *et al.* 2008b, pp. 18–29). The breeding range of the entire species formerly included most of North America from southeastern and western Canada (southern Ontario, Quebec, and southwestern British Columbia) south throughout the continental United States to the Greater Antilles and

STATE OF CALIFORNIA B THE NATURAL RESOURCES AGENCY EDMUND G. BROWN, JR., Governor

COLORADO RIVER BOARD OF CALIFORNIA
770 FAIRMONT AVENUE, SUITE 100
GLENDALE, CA 91203-1035
(818) 500-1625
(818) 543-4685 FAX

October 8, 2014

Public Comments Processing, Attn: FWS-R8-ES-2013-0011
U.S. Fish and Wildlife Service Headquarters
MS:BPHC
5275 Leesburg Pike
Falls Church, Virginia 22041-3803

Re: Comments of the Colorado River Board of California on the Proposed Rule Designating Critical Habitat for the Western Distinct Population Segment of the Yellow-billed Cuckoo

To Whom It May Concern:

The purpose of this letter is to provide comments from the Colorado River Board of California (Board) to the U.S. Fish and Wildlife Service (USFWS) on the proposed rule designating critical habitat for the western distinct population segment of the threatened yellow-billed cuckoo (YBC) published in the *Federal Register* on August 15, 2014 (79 *FR* 48548-48652; August 15, 2014). The Board is established under California law (California Water Code section 12500 *et seq.*) for the purpose of protecting the rights and interests of the State of California in the water of the Colorado River system. The Board includes representatives from local California agencies holding contracts with the Secretary of the Interior for water and/or hydropower derived from the Colorado River system. The Board and its represented agencies participate in and provide funding for the long-term implementation of the Lower Colorado River Multi-Species Conservation Program (LCR MSCP), and have an interest in the proposed rule designating critical habitat for the YBC along the Lower Colorado River. The LCR MSCP is celebrating its 10th year of successful implementation and serves as a model for other habitat conservation programs throughout the West. The Board's comments are primarily associated with the proposed designation of YBC critical habitat within the current planning area of the LCR MSCP.

The Board supports the USFWS's proposal to exclude of certain areas within the LCR MSCP planning area from the critical habitat designation as noted in the proposed rule's "Areas Considered for Exclusion by Critical Habitat Unit", Table 3 (pages 48572-48573), but as shown below, the Board asserts the excluded areas should be expanded to cover the entire LCR MSCP planning area, including the areas designated as National Wildlife Refuges and areas within, or adjacent to, the operational full-pool of Lake Mead. The additional exclusions proposed by the Board are entirely consistent with the actions taken by the USFWS in connection with the designation of critical habitat for the southwestern willow flycatcher (78 *FR* 344-534, January 3, 2013), a similar LCR MSCP covered species. Failure to exclude the additional areas

recommended by the Board from the proposed critical habitat designation for the YBC will result in an inefficient and inconsistent operation of the LCR MSCP and could undermine its continued successful implementation.

Proposed Yellow-Billed Cuckoo Critical Habitat Designation within the Planning Area of the Lower Colorado River Multi-Species Conservation Program

The YBC is included among the LCR MSCP's twenty-six covered species, and many of the LCR MSCP habitat and species conservation measures are intended, in large part, to address the long-term needs of the YBC within the LCR MSCP planning area along the Lower Colorado River. Specifically, through LCR MSCP implementation, 4,050 acres of native riparian habitat (i.e., Goodding's willow, Fremont cottonwood) and 1,320 acres of honey mesquite will be established and maintained along the Lower Colorado River for the YBC.[1] According to the terms and conditions of the LCR MSCP, this YBC habitat will be in large patches, at least 25 acres in size. To date, 2,589 acres of YBC habitat have been established through the LCR MSCP, and 460 acres of this restored habitat have been established on Havasu and Cibola National Wildlife Refuges[2].

Additional research, management, monitoring, and protection of YBC and habitat from fire, nest predators, and brood parasites will continue through the life of the LCR MSCP. The development of YBC habitat will continue to occur along the reach of the Lower Colorado River from Lake Mead to the Southerly International Boundary with Mexico within the planning area of the LCR MSCP. In addition to the creation and subsequent management of YBC habitats within the LCR MSCP planning area, provision has been made in the LCR MSCP Habitat Maintenance Fund to provide $25,000,000 to be used to ensure the maintenance of existing YBC habitat along the Lower Colorado River outside of existing LCR MSCP-designated habitat restoration and species conservation areas."[3]

The LCR MSCP Implementation Agreement signed by all participating entities on April 2, 2005, including the USFWS, was intended to obviate the need for future listings and critical habitat designations for the twenty-six species currently covered under the LCR MSCP Habitat Conservation Plan (HCP) and Biological Opinion, including the YBC. The Implementation Agreement incorporates by reference the USFWS "No Surprises and Assurances" policy

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[1] Lower Colorado River Multi-Species Conservation Program, Volume II: Final Habitat Conservation Plan, Section 5.7.14 Yellow-Billed Cuckoo, December 2004, http://www.lcrmscp.gov/publications/hcp_volii_dec04.pdf.
[2] Lower Colorado River Multi-Species Conservation Program, Final Implementation Report, Fiscal Year 2015 Work Plan and Budget, Fiscal Year 2013 Accomplishment Report, U.S. Bureau of Reclamation, June 2014, http://www.lcrmscp.gov/workplans/imp_2015.pdf.
[3] Lower Colorado River Multi-Species Conservation Program, Volume II: Final Habitat Conservation Plan, Section 7.1.10 Existing Habitat Maintenance, December 2004.

included in the non-federal permittees Section 10(a)(1)(B) incidental take statement and permit.[4] Exclusion of the LRC MSCP planning area from the critical habitat designation for the YBC is completely consistent with the prior actions taken by the USFWS in connection with the program.

As noted above, it would be contrary to the interests of the LCR MSCP to exclude the non-federal portions of the LRC MSCP planning area as critical habitat for the YBC but include the federally managed lands within the same program planning area. The participating federal agencies do not receive the benefits of the "No Surprises and Assurances" policy afforded the non-federal LCR MSCP participants under Section 10 of the ESA, and the proposed designation of critical habitat for the YBC on federal lands, particularly those managed by the USFWS National Wildlife Refuge (NWR) system within the planning area of the LCR MSCP, may cause the U.S. Bureau of Reclamation (Reclamation) to have to re-initiate an ESA Section 7 consultation with the USFWS. A comprehensive Biological and Conference Opinion covering Reclamation's routine Lower Colorado River operations and maintenance activities, including implementation of the LCR MSCP, was issued by the USFWS in early-2005.[5] Re-consultation because the refuge lands were included within the critical habitat designation could cause an increase in LCR MSCP implementation costs and could delay implementation activities, especially those related to the establishment of the 4,050 acres of YBC habitat.

As the USFWS is aware, significant habitat and species conservation measures and activities have already been undertaken on NWR lands along the Lower Colorado River pursuant to long-term implementation of the LCR MSCP. As part of long-term program implementation, Reclamation has land-use agreements with the USFWS that have resulted in the restoration of significant blocks of cottonwood-willow and honey mesquite habitat on lands managed by the USFWS at Havasu, Bill Williams River, Cibola, and Imperial NWRs. Reclamation and its contractors continue to actively monitor avian presence/absence and habitat quality parameters on these restored native riparian habitat patches on NWR lands as part of the LCR MSCP long-term monitoring, research and adaptive management program. To ensure the continued effective implementation of the LCR MSCP, the federal refuge areas within the LCR MSCP planning area should be excluded from the YBC critical habitat areas along with the non-federal lands covered by the same program.

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[4] Lower Colorado River Multi-Species Conservation Program, Endangered and Threatened Species—Incidental Take—Permit (TE-086834-0), U.S. Fish and Wildlife Service, April 4, 2005, http://www.lcrmscp.gov/publications/sect_10_permit.pdf.

[5] Biological and Conference Opinion on the Lower Colorado River Multi-Species Conservation Program, Arizona, California, and Nevada (AESO/SE 02-21-04-F-0161), U.S. Fish and Wildlife Service, March 4, 2005, http://www.lcrmscp.gov/publications/biol_opinion_mar05.pdf.

Proposed Critical Habitat Designation within the Operational Full-Pool of Lake Mead

Another area of concern with the proposed rule is that areas within, or adjacent to, the operational full-pool of Lake Mead do not appear to be excluded from the critical habitat designation by the USFWS. The geographic description of the area being proposed for critical habitat designation in "Unit 11: AZ-3 Lake Mead; Mohave County", does not indicate its relationship to the operational pool of Lake Mead at its full-pool water surface elevation of 1,221 feet above mean sea level. It is not clear whether the proposed critical habitat is adjacent to Lake Mead above the full-pool 1,221 foot elevation, or whether some of the proposed critical habitat is located within the operational pool of the reservoir.

Terrestrial habitat that becomes established within the operational pool of an active reservoir like Lake Mead is highly ephemeral and subject to periodic desiccation and inundation as reservoir levels rise and fall in accordance with releases from upstream reservoirs and smaller tributary side inflows. As an example, in 2011, Lake Mead's water surface elevation rose approximately forty (40) feet; reflecting runoff and inflows from an above-average year and reservoir equalization requirements between Lakes Powell and Mead. In 2012 and 2013 though, the water surface elevation in Lake Mead declined a total of nearly thirty (30) feet due to downstream releases and the effects of the continuing drought conditions in much of the southwestern United States.[6] Based upon the "Law of the River," Reclamation has legal obligations for water storage and delivery and power generation that strictly limit its control over Lake Mead water surface elevations. Consequently, the proposed critical habitat designation for the YBC should exclude the area below the operational full-pool of Lake Mead at its maximum water surface elevation of 1,221 feet above mean sea-level.

Conformance with Final Rule Designating Critical Habitat for the Southwestern Willow Flycatcher

The two examples of additional areas that should be excluded as critical habitat are completely consistent with the USFWS's exclusion of areas designated as critical habitat for the southwestern willow flycatcher (78 *FR* 344-534, January 3, 2013), another LCR MSCP covered species. On page 48573 of the proposed rule, the USFWS states that the "...areas used by the flycatcher and western yellow-billed cuckoo overlap in several areas in the southwestern United States and management actions for the flycatcher often benefit the western yellow-billed cuckoo." The Final Rule designating critical habitat for the southwestern willow flycatcher provided a detailed rationale for excluding all of the lands within the LCR MSCP planning area, including the conservation storage space of Lake Mead, all of the lands on USFWS Lower Colorado River NWRs, Tribal lands, and other federal lands (Final Rule, pages 416-418). This rationale is summarized in the following paragraph from the Final Rule—

[6]http://www.usbr.gov/lc/region/g4000/hourly/mead-elv.html

> "We have determined that the benefits of excluding the LCR MSCP planning area along the LCR within the States of Arizona, California, and Nevada from the conservation space of Lake Mead to Mexico (and a small portion of the lower Bill Williams River in Arizona) from the designation of critical habitat on all Federal, State, tribal, and non-Federal lands outweigh the benefits of inclusion, and will not result in the extinction of the flycatcher." (Final Rule, page 417)

For the reasons stated above, and in conformance with the final rule designating critical habitat for the southwestern willow flycatcher, the "Areas Considered for Exclusion by Critical Habitat Unit" as specified in Table 3 (pages 48572-48573) should include the entire 914,200-acre LCR MSCP planning area and off-site conservation areas from critical habitat designation under Section 4(b)(2) of the Endangered Species Act. This modification would specifically exclude the area from the operational full-pool elevation of Lake Mead (water surface elevation 1,221 feet above MSL) downstream to the Southerly International Boundary with Mexico and the specific Units, or portions of those Units, (i.e., Units 7, 8, 11; and those portions of Unit 9, 12, 73, and 76) that fall within the LCR MSCP planning area. Exclusion of these areas from designated YBC critical habitat will foster the continued successful implementation of the LCR MSCP and future habitat restoration activities and species monitoring, protection and conservation measures for the YBC along the Lower Colorado River from Lake Mead to the Southerly International Boundary with Mexico.

The Board appreciates the opportunity to provide comments associated with the proposed rule designating critical habitat for the YBC. Please feel free to contact me at (818) 500-1625, if you have any questions or require additional information regarding these comments.

Sincerely,

Tanya M. Trujillo
Executive Director

Cc: Mr. John Swett, Program Manager, U.S. Bureau of Reclamation, LC-8000

OFFICE OF THE SECRETARY
U.S. Department of the Interior

www.doi.gov
News Release

U.S. Department of the Interior and State of California Release Draft Desert Renewable Energy Conservation Plan for Public Review

Comprehensive Blueprint to Guide Responsible Renewable Energy Development, Conserve Key Landscapes

09/23/2014

Contact us
Richard Stapler (California Natural Resources Agency), 916-653-9402

PALM SPRINGS, Calif. – U.S. Secretary of the Interior Sally Jewell and Secretary of the California Natural Resources Agency John Laird today released an innovative landscape-level draft renewable energy and conservation plan covering more than 22 million acres in the California desert, marking a major milestone in federal and state efforts to cut carbon pollution, create jobs, develop clean domestic energy and conserve and protect ecological and cultural resources.

The draft Desert Renewable Energy Conservation Plan (DRECP) is a landscape-scale blueprint that is the result of an extensive public participation process, which included collaboration among the U.S. Bureau of Land Management (BLM), U.S. Fish and Wildlife Service (FWS), California Energy Commission (CEC) and California Department of Fish and Wildlife (CDFW) and other stakeholders. The public will have until January 2015 to provide additional comments on the draft plan, which includes lands in Imperial, Inyo, Kern, Los Angeles, Riverside, San Bernardino and San Diego counties.

“The President’s Climate Action Plan calls for expanding clean, domestic energy on public lands to create jobs and cut carbon pollution,” said Secretary of the Interior Sally Jewell. “The draft plan released today will help provide effective protection and conservation of the California desert important for wildlife, recreation, cultural preservation and other uses, while encouraging streamlined renewable energy development in the right places. This is a strong and innovative blueprint that shows how federal and state agencies can collaborate to meet conservation and energy objectives on a landscape-scale while providing certainty to developers. I look forward to additional public input on the draft plan.”

“Although the release of this draft plan is a milestone reached after years of collaboration and stakeholder input, we expect the draft plan to benefit from robust public participation,” said Secretary of the California Natural Resources Agency John Laird. “Public input is a critical part of the process and will help us develop the best possible final plan.”

The draft DRECP proposes to protect areas in the California desert important for wildlife, recreation and other uses while streamlining permitting in areas appropriate for siting of solar, wind and geothermal energy projects and associated transmission. The plan presents six alternative approaches for meeting renewable energy and conservation goals through 2040. Each alternative proposes a different conservation design and configuration of lands available for streamlined renewable energy permitting. The plan also includes an analysis of the potential environmental impacts of these alternatives.

The draft plan has three key components that support the goals of the DRECP:

- The BLM’s Land Use Plan Amendments would designate renewable energy development areas and promote conservation of wildlife, cultural, and recreational values in other areas, including by expanding

National Conservation Lands, across the 10 million acres of public lands in the planning area.
- The FWS's General Conservation Plan would allow the FWS to streamline the permitting process for renewable energy applicants on non-federal lands that agree to comply with the terms and conditions of the General Conservation Plan.
- CDFW's Natural Community Conservation Plan would identify and provide for the regional or area-wide protection of plants, animals, and their habitats, while allowing compatible and appropriate economic activity.

The public comment period will run through January 9, 2015. A recorded informational webinar to help the public navigate the DRECP documents will be available on Friday, September 26 at www.drecp.org and will be broadcast on October 9, 2014, at BLM, FWS and CDFW offices throughout the DRECP planning area. Formal public meetings will be held in late October and early November throughout the DRECP planning area and surrounding population centers. Future meetings will be announced at www.drecp.org. For instructions on how to submit written comments, view informational webinars, see meeting details and to sign up to receive email notifications, please visit www.drecp.org. Comments may also be submitted in person at the aforementioned public meetings.

The President's Climate Action Plan outlines a wide array of actions his administration is taking using existing authorities to reduce carbon pollution, increase energy efficiency, expand renewable and other low-carbon energy sources and strengthen resilience to extreme weather and other climate impacts. As part of the plan, announced in June 2013, the president directed the Interior Department to approve at least 20,000 megawatts of renewable energy capacity on the public lands by 2020.

Interior has permitted 52 utility-scale renewable energy projects since 2009 as part of a Department-wide effort to advance smart development of renewable energy on our nation's public lands. Together, the wind, solar and geothermal projects could support more than 20,000 construction and operations jobs and generate about 14,157 megawatts of power to communities across the West, or enough to power nearly 4.8 million homes. Seventeen of these renewable energy projects have been approved in the DRECP planning area which could generate about 4,800 megawatts, or enough to power more than 1.5 million homes.

The DRECP planning effort was also called out as an early 'Sign of Progress' in the Department of the Interior's strategy for advancing landscape-scale mitigation policies and practices. That strategy, released in April 2014, describes the key principles and actions necessary to shift from project-by-project management to consistent landscape-scale, science-based management of the lands and resources for which the Interior Department is responsible.

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U.S. Department of the Interior

www.doi.gov
News Release

Secretary of the Interior Jewell Celebrates 50th Anniversary of Power Generation at Glen Canyon Dam

09/27/2014

Contact us
Matthew Allen, 801-524-3774

PAGE, Ariz. – Today, at a ceremony on the crest of Glen Canyon Dam, Secretary of the Interior Sally Jewell joined other officials and dignitaries to kick off a celebration marking the 50th anniversary of power generation at Glen Canyon Dam.

“At the 50th anniversary of Glen Canyon Dam, we are not just standing at crest of this dam – we are standing at a crest of history in the West,” Secretary Jewell said. “Glen Canyon Dam harnessed the power of the Colorado River to open the West to millions of people by providing for their water and power needs. Today we celebrate the triumphs and sacrifices of the people and communities that made this immense undertaking possible.”

Secretary Jewell thanked the people and the community who have supported Glen Canyon from the early days of construction and the continuation of operations today including Facility Manager Jason Tucker, who oversees the operation of the dam for the Bureau of Reclamation and Todd Brindle, Superintendent of Glen Canyon National Recreation Area. She also praised Assistant Secretary of Water and Science Anne Castle, who is leaving Interior at the end of the month for new ventures, for her outstanding work with Reclamation, National Park Service and other Interior agencies on adaptive management of the Colorado River Basin.

In addition to Secretary Jewell, other guest speakers included, Assistant Secretary Anne Castle, Mayor of Page Bill Diak, Colorado Energy Distribution Association Executive Director Leslie James, as well as Former President of the Colorado Water Users Association Ron Thompson.

“The Colorado River has always been known for its superlatives – the most volatile supplies, the most iconic landscapes, the most dammed, the most litigated, and recently, the most threatened,” remarked Assistant Secretary Castle. “Collectively, we need to make this river, this basin, this economy, one that will endure into the future and ensure that our children and grandchildren will be able to enjoy the same benefits and gifts that this river has provided to all of us. Operation of Glen Canyon Dam that is based on sound science and that balances a complex set of interests has been and will continue to be key to that sustainable future.”

Glen Canyon Dam is a key unit of one of the most extensive and complex river resource developments in the world, providing vital water storage and power generation for the west. It allows the Upper Colorado River Basin States of Colorado, New Mexico, Utah and Wyoming to utilize their share of the Colorado River while providing the required delivery of water to the lower basin states of Arizona, California and Nevada.

Situated on the Colorado River in northern Arizona, near Page, Glen Canyon Dam is the second highest concrete-arch dam in the United States—710 feet above bedrock, second only to Hoover Dam, which stands at 726 feet. The structure impounds Lake Powell, the second largest man-made reservoir in the United States. The powerplant began generating clean, renewable hydropower on September 4, 1964. The inexpensive electricity generated by this facility contributes to the renewable energy footprint in the western United States and has contributed to the modernization of hydroelectric power that exists today and will continue into tomorrow.

Today Lake Powell can store nearly two years of the Colorado River's average annual flow, helping mitigate the current drought; moreover, the powerplant produces 5 billion kilowatt hours of hydroelectric power each year – enough electricity to help supply the power needs for 5.8 million customers. It would take 2.5 million tons of coal or 11 million barrels of oil to generate the same amount of hydropower that Glen Canyon provides every year using clean, renewable hydropower. The many hundreds of miles of shoreline at Lake Powell provide opportunities for hiking, camping, swimming, boating and fishing. Glen Canyon Dam and the adjacent Carl B. Hayden Visitor Center annually host nearly one million people on guided tours.

"Glen Canyon Dam, its Powerplant and Lake Powell are critical components of Reclamation's Colorado River Storage Project," said Lowell Pimley, Acting Commissioner for the Bureau of Reclamation. "We are proud that this facility has and will continue to generate clean renewable hydropower, regulate the flow of the Colorado River, store water for multiple beneficial uses, help reclaim arid and semi-arid lands, provide flood protection and offer prime recreation opportunities to millions of Americans."

The celebration continued after the ceremony with tours of the dam and powerplant, an antique car show, several displays related to power generation and water use from federal, state, and local partners. A special presentation by the Navajo tribe allowed visitors to see traditional Navajo dance. Additionally, at the event a video was premiered that was created by local Page High School students in collaboration with Reclamation titled, "I am Glen Canyon."

For more information on the event or on Glen Canyon Dam and Powerplant, please contact Reclamations Upper Colorado Regional Public Affairs Officer Matthew Allen at 801-524-3774 or mrallen@usbr.gov.

<< Previous
Secretary Jewell, Attorney General Holder Announce $554 Million Settlement of Tribal Trust Accounting and Management Lawsuit Filed by Navajo Nation

Next >>
Secretary Jewell, Director Jarvis Announce Nine New National Historic Landmarks Highlighting America's Diverse History and Culture

Celebrating 50 Years of Power Generation at Glen Canyon Dam

Saturday, September 27, 2014

You're invited to join us in celebrating the 50th anniversary of power generation at Glen Canyon Dam

12:00 p.m. – 4:00 p.m.

Secretary of the Interior Sally Jewell will be the keynote speaker at this community event to be held on the crest of the dam

Complimentary dam tours will be available

Refreshments and entertainment will be provided by city of Page partners

Standard security screening with picture identification will be required

RECLAMATION Managing Water in the West

Summer 2014
Research and Development Office
Newsletter 2014-04

The Knowledge Stream

Hydropower and Renewable Energy Issue

Research and Development Office Renewable Energy Research Coordinator

Erin Foraker joined the Research and Development Office (Research Office) in October 2012 as the Renewable Energy Research Coordinator. In this position, Erin directs the Research Office's renewable energy research program, which focuses on improving maintenance practices of hydropower systems, improving reliability and efficiency for hydropower generation, improving safety, and researching opportunities for other renewable energy generation within Reclamation.

Erin holds a Bachelors of Science in Mechanical Engineering from the University of Memphis and a Masters in Business Administration from the University of Denver, with over 20 years of power industry experience.

—continued on page 9

Erin Foraker, Renewable Energy Research Coordinator, served as principal editor for this issue.

In this issue. . .

Generating electricity from falling water dates back to 1879 when the first hydroelectric plant was built at Niagara Falls. Reclamation's first hydropower facility began generating electricity in 1909 at the Theodore Roosevelt Dam in Arizona. Today, Reclamation's fleet of 53 powerplants generate over 40 million megawatt hours of renewable energy yearly, enough to power 3.5 million homes.

As the Nation seeks to reduce its generation of greenhouse gases, Reclamation's renewable hydroelectric power becomes even more valuable. But getting the most power out of our aging powerplants, while maintaining the operational flexibility needed to provide environmental water releases, and also help to accommodate increased amounts of wind and solar generation in the power grid, is not easy. As part of the national power grid, Reclamation's plants supply ancillary services, energy, and capacity to help keep the overall system balanced.

This issue of *The Knowledge Stream* highlights research aimed at helping Reclamation meet the Nation's changing energy needs by improving the safety, efficiency, and capacity of our hydroelectric plants. These projects range from detecting cavitation on our turbine runners, to reducing noise at Reclamation's facilities, to understanding how our facilities are impacted as more wind and solar generation is brought into the power grid.

We also examine ways to augment Reclamation's hydropower fleet, for example, by testing hydrokinetic turbines in Reclamation canals and studying the potential benefits from adding pump storage capacity to our system. All this and more, inside!

Curt Brown, Chief of Research

A new turbine runner being installed at the Judge Francis Carr Powerplant in California, part of the Central Valley Project, with two 85 megawatt generators, prior to the unexpected cavitation damage (see Research Update on page 32). Note worker in bottom left for scale.

About *The Knowledge Stream. . .*

The Knowledge Stream is the Bureau of Reclamation's Research and Development Office's quarterly newsletter bringing you news and information on Reclamation research and science: projects, events, innovation, results, publications, and more.

Help Us Write *The Knowledge Stream*: Send Us Your Content and Ideas

We welcome and encourage content from our readers. Please send your Recent and Upcoming Events, Innovation Around Reclamation, or any other content ideas to: research@usbr.gov.

Regional Science and Technology Coordinators Contact Information

Whether you are a regional researcher, Reclamation partner or customer, or just have an idea for a project that can help your region, the Regional Science and Technology Coordinators can help you with your research ideas, proposals and projects.

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Print Options and Instructions

This document is designed to be read either electronically via PDF or printed in color or black and white. Please forward it to your colleagues and friends.

You have three options for printing parts or all of this document:

1. Print individual Research Updates on one sheet of paper, double-sided.
2. Print the whole document double-sided, corner stapled on 8.5- x 11-inch paper.
3. For magazine-style, instruct your print professional to print the whole document double-sided, head-to-head, saddle-stitched on 11- x 17-inch paper.

Your suggestions for improvements are always welcome. Please email them to jakervik@usbr.gov.

Thanks,

Jake Akervik, Communication and Information Systems Coordinator,
Research and Development Office

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Research Updates

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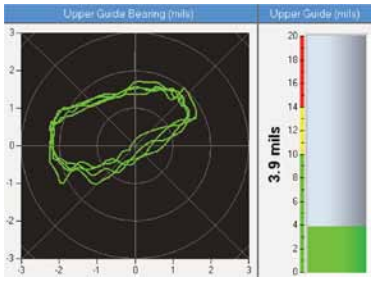
Safe and Grounded *"The primary purpose of personal protective grounding is to provide adequate protection against electric shock causing death or injury to personnel while working on deenergized lines or equipment. This is accomplished by limiting exposure voltages at the worksite to a safe value if the line or equipment is accidentally energized."* Phil Atwater, Electrical Engineer Retired Reclamation employee www.usbr.gov/research/docs/updates/2014-07-grounded.pdf	16
Making Reclamation Powerplants a Quieter Place *"This Voodoo noise control stuff really works!"* Bob Hotze, Green Springs Powerplant Foreman Reclamation's Pacific Northwest Region www.usbr.gov/research/docs/updates/2014-08-noise.pdf	18
Testing and Verifying Rope Access Anchors *"This research into life safety anchors helps Reclamation continue to develop safe practices and protocols for rope access maintenance and inspection of inaccessible features on Reclamation structures."* Shaun Reed, Mechanical Engineer Reclamation's Technical Service Center www.usbr.gov/research/docs/updates/2014-09-rope.pdf	20
Validating and Improving Models for Power Systems *"This research is helping Reclamation become more efficient in obtaining higher quality data and validating models to save a significant amount of money and resources."* James Zeiger, Manager, Power Systems Analysis and Control Group Reclamation's Technical Service Center www.usbr.gov/research/docs/updates/2014-10-validate.pdf	24
Signal to Noise: Analyzing Generator Performance and Reliability *"This research is helping to provide Reclamation with cutting edge tools used for generator control system testing and generator plant model generation/ validation."* Kyle W. Clair, Electrical Engineer Reclamation's Technical Service Center www.usbr.gov/research/docs/updates/2014-11-signal.pdf	26

Bulletin Title, Quote, and Website	Page
 **Keeping Track of the Generator's Condition** *"This open-source software code works with a wide variety of data acquisition equipment including off-the-shelf data acquisition systems, specialized monitoring systems, and other computer systems. Hydrogenerator condition monitoring saves time and money, while improving the reliability of hydropower."* Nathan Myers, Manager, Hydropower Diagnostics and SCADA Group Reclamation's Technical Service Center www.usbr.gov/research/docs/updates/2014-12-monitor.pdf	28
Catching Problems Early: Predicting Shear Pin Failures With Acoustic Emission Sensing and Analysis *"The ability to predict some shear pin failures would be advantageous. Replacement of shear pins would no longer be a "hurry-up-and-react" situation resulting in forced outages. Instead, shear pins could be replaced during planned outages. While this process may not predict all failures, even finding one or two could save millions of dollars in damaged equipment."* Russell Anderson, Reliability Program Analyst Reclamation's Power Resources Office www.usbr.gov/research/docs/updates/2014-13-shear.pdf	30
Detecting Cavitation to Protect and Maintain Hydraulic Turbines *"Besides predicting and reducing the damaging effects of cavitation, this research could reduce the hazards employees are exposed to during cavitation repairs. Cavitation is very damaging and requires extensive corrective maintenance to repair. Any steps that can be taken to reduce cavitation would be beneficial."* Russell Anderson, Reliability Program Analyst Reclamation's Power Resources Office www.usbr.gov/research/docs/updates/2014-14-cavitation.pdf	32
How Much Does it Cost to Start/Stop a Hydrogenerator? *"Reclamation is being called upon more frequently to start and stop units to support grid reliability, but the tools and methods available to understand the costs of these start/stops have been lacking. The development of this cost model will provide great value to Reclamation by delivering more reliable start/stop costs through a more user-friendly process."* Mike Pulskamp, Renewable Energy Program Manager Reclamation's Power Resources Office www.usbr.gov/research/docs/updates/2014-15-start-stop.pdf	36
Hydrokinetic Demonstration Results to Date and Path Forward *"A well-developed numerical model will be a useful tool for both private developers and water system owners to help determine if and where a hydrokinetic device could be deployed without impacting existing water delivery operation, before any installations are made."* Josh Mortensen, Hydraulic Engineer Reclamation's Technical Service Center www.usbr.gov/research/docs/updates/2014-16-hydrokinetic.pdf	38

Upcoming Events

The list of events below is intended for informational purposes only and does not necessarily constitute an endorsement by Reclamation. These events may be of interest to the science, research, and related communities and are not necessarily hosted by Reclamation. Find our most recent list of events at:

www.usbr.gov/research/events.

National Hydropower Association (NHA)—NHA Southwest Regional Meeting

September 8 - 10, 2014 | Golden, Colorado

NHA presents the NHA Southwest Regional Meeting. Based on new incentives and increased interest in renewable energy, the United States hydropower industry is primed for growth. Numerous opportunities are available to expand the region's hydropower base, while at the same time providing responsible environmental stewardship of the region's rivers. Additional meeting information:

www.hydro.org/news-and-media/events/details/nha-southwest-regional-meeting/

NHA—Hydropower Finance Summit

October 2, 2014 | New York, New York

This exclusive 1-day event brings together key leaders in the hydropower and financial sectors. Sessions examine project opportunities, financing options, and growth forecasts for the Nation's largest renewable energy resource. Additional summit information:

www.hydro.org/news-and-media/events/details/hydropower-finance-summit/

NHA—Hydraulic Power Committee Fall Retreat

October 6 - 8, 2014 | Holyoke, Massachusetts

This 3-day meeting will focus on hydro operations, dam safety and security, and best practice sharing. The retreat is open to all NHA member companies and invited guests, including owners and operators of hydro projects and service and equipment providers. Additional retreat information:

www.hydro.org/news-and-media/events/details/nha-hydraulic-power-committee-fall-meeting-3/

Midwest Hydro Users Group—Fall Regional Meeting

November 12 - 13, 2014 | Wausau, Wisconsin

The Midwest Hydro Users Group will be holding their annual fall regional meeting, an owners-only meeting, and a full membership meeting. Additional meeting information:

www.midwesthug.org/activities.html

Renewable Energy World Conference & Expo North America 2014 Conference

December 9 - 11, 2014 | Orlando, Florida

With an unwavering history, the Renewable Energy World Conference & Expo North America is returning for its ninth year and will provide the perfect venue to gather and exchange information about the latest in technology, opportunities, and funding in today's changing world. The conference and expo will also, once again, be co-located with Power Generation Week, providing networking opportunities with more than 20,000 professionals and key decisionmakers.

The Renewable Energy World Conference & Expo North America is recognized as the leading platform for information exchange, networking opportunities, and new business development covering all sectors in renewable energy and hot topics such as large-scale

— continued

— continued

renewables, distributed generation, utility integration, renewables and the global market, and innovative energy partnerships. Additional conference and exhibition information: www.renewableenergyworld-events.com/index.html

The Northwest Hydroelectric Association (NWHA)—Workshops, Tour, Annual Conference, and Seminar

NWHA provides a regional voice for the hydropower industry, representing the needs of its membership since 1981. NWHA is dedicated to the promotion of the region's waterpower as a clean efficient energy, while protecting the fisheries and environmental quality that characterize the Northwest Region.

The NWHA technical workshops and seminars offer the engineers, electricians, mechanics, operators, and technicians servicing the hydroelectric industry a forum to discuss and learn about the arts and issues of their work, which is fundamental to the Northwest Region quality of life.

2014 Small Hydro Workshop
September 4 - 5, 2014 | Sisters, Oregon
See www.nwhydro.org/events_committees/low_impact_hydro_workshop.htm

2014 Fall Workshop & Tour
October 29 - 30, 2014 | Spokane, Washington
See www.nwhydro.org/events_committees/regional_meeting.htm

2015 Annual Conference
February 17 - 19, 2015 | Portland, Oregon
See www.nwhydro.org/events_committees/AnnnualConference.htm

2015 Technical & Operations Seminar—Machines, Maintenance, and Management: Keeping Hydro Facilities Up and Running
May 7 - 8, 2015 | Hood River, Oregon
See www.nwhydro.org/events_committees/tech_operations_conference.htm
Additional NWHA information: www.nwhydro.org/default.htm

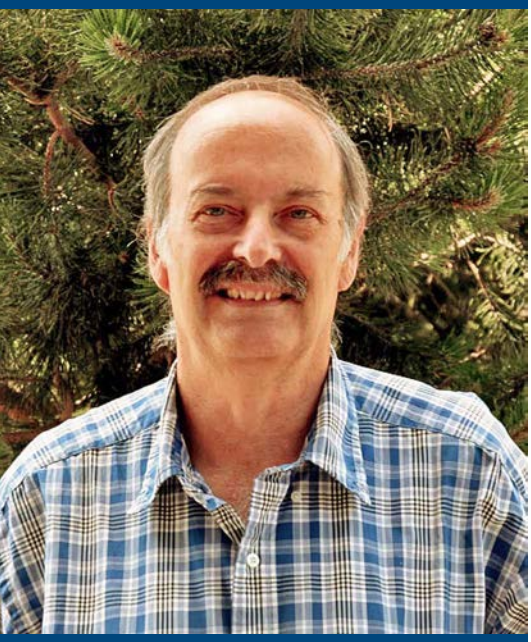
The Association of State Dam Safety Officials (ASDSO)—Dam Safety 2014 Conference

September 21 - 25, 2014 | San Diego, California

ASDSO's annual conference is one of the leading conferences in the United States (U.S.) dedicated to dam safety engineering and technology transfer. The conference and field trips continue to be the annual event to showcase dam safety in the U.S., with over 1,050 industry professionals expected to attend.

This year's field trip is to the University of California-San Diego (UCSD) Large Outdoor Shake Table Facility. UCSD's large outdoor shake table is the largest facility of its kind in terms of footprint and payload capacity of any in the world.
Additional conference information:
www.damsafety.org/conferences/?p=8faca187-a4b0-406d-b9d6-f71c8ba9d192

Featured Faces



John Germann

www.usbr.gov/research/projects/researcher.cfm?id=1969

John Germann, Mechanical Engineer, B.S.

John Germann is a mechanical engineer in the Mechanical Equipment Group in Reclamation's Technical Service Center. He has 33 years of experience with Reclamation as a mechanical engineer performing operation, maintenance, and rehabilitation of hydromachinery.

John grew up in rural eastern Wyoming and spent his youth working on local ranches. He graduated from the University of Wyoming in 1978 with a Bachelors of Science in Agricultural Engineering. After college, John worked in Kansas City, Missouri, for Farmland Industries, where he designed fertilizer plants. In 1980, he again moved west and worked briefly as a mechanical engineer for a consulting engineering firm in Cheyenne, Wyoming.

John started work for Reclamation in 1981 as a mechanical engineer in the Eastern Colorado Area Office (ECAO) in Loveland, Colorado. For 21 years, he provided engineering assistance and services to the power and pumping plants' maintenance sections. During that time, John served for 1 year as ECAO's Acting Chief of Engineering and 1 year as the Great Plains Region's mechanical engineer in the now nonexistent Lower Missouri Regional Office.

Currently, John provides mechanical engineering services to Reclamation facilities, focusing on providing improved maintenance and repair practices. These tasks include unit turbine/generator alignment, machine dynamic behavior (vibration) testing and analysis, balancing, governor adjustments, unit commissioning, and general mechanical engineering consultation. John develops, writes, and updates Reclamation mechanical technical maintenance standards, procedures, and practices documents. In addition, he frequently participates as a team lead and reviewer in power operation and maintenance facility reviews of power and pumping plants.

John Germann field testing at Judge Frances Carr Powerplant, California.

John has conducted numerous research projects as part of Reclamation's Science and Technology Program. At the present time, he has two active research projects: 1) "Detecting Cavitation to Protect and Maintain Hydraulic Turbines" (see Research Update on page 32), which focuses on exploring cavitation detection techniques in powerplant turbines and developing effective monitors to assist powerplant operators so that they can avoid operating generators in cavitation zones; and 2) "Predicting Shear Pin Failures With Acoustic Emission Sensing and Analysis" (see Research Update on page 30), which has the goal of developing a better shear pin failure detector for use in hydroelectric turbines. John hopes both projects will result in significant cost benefits to the power hydrogeneration provider.

John has been married to his lovely wife, Jacqueline, for 20 years. They live near Fort Collins, Colorado, where John spends weekends working on the property. Both John and his wife have a passion for canines. They have numerous dogs, as well as rescue dogs, which enjoy romping on the 20 acres where they live. Jacqueline is a psychotherapist and uses several of the dogs as therapy dogs within her work. Both John and Jacqueline are active in the English Setter Club of Greater Denver. Over the years, they have raised several champion English Setters.

Jim DeHaan, Senior Electrical Engineer, B.S., M.S., P.E.

Jim DeHaan is a senior electrical engineer for the Hydropower Diagnostics and SCADA Group in Reclamation's Technical Service Center. He has 23 years of experience in the electric power field. His present responsibilities include research and field testing in the areas of large rotating machine testing and diagnostics, power apparatus testing and diagnostics, hydroplant condition monitoring, electric power safety, and specialized power system instrumentation development. Jim has a Bachelors of Science in Electrical Engineering from Dordt College, as well as a Masters of Science in Electric Power from Iowa State University. He is a Registered Professional Engineer and a senior member of the Institute of Electrical and Electronic Engineers (IEEE).

In 1991, after obtaining his master's degree, Jim began working for Reclamation in the Electric Power Branch, where he has remained for the last 23 years. During his career at Reclamation, Jim has authored or co-authored over 30 technical papers for external publication and well over 100 field trip technical reports. In addition, he co-authored two Facilities Instructions, Standards, and Techniques (FIST) manuals: FIST 3-8, *Operation, Maintenance, and Field Test Procedures for Protective Relays and Associated Circuits* and FIST 5-1, *Personal Protective Grounding for Electric Power Facilities and Power Lines*. Jim also co-authored Design Standards No. 12, *Synchronous Generator, Motor and Generator/Motor Field Tests*, Chapter 1, "Plant Testing." He holds two patents: 1) High Current Measurement System Incorporating an Air-Core Transducer, and 2) Flexible Printed Circuit Magnetic Flex Probe.

During the first part of his career, Jim assisted and led research related to the application of Personal Protective Grounds (PPGs). PPGs are used to ground deenergized equipment and circuits after a clearance is in place to ensure that the equipment remains grounded during hands-on work. The research measured the actual voltages that a worker could be exposed to across a PPG during an accidental reenergization.

For these field tests, PPGs were placed on actual powerplant equipment, and this equipment was then energized. Power system fault current flowed through the grounds, and voltages were measured at the location where worker contact to the bus was probable during maintenance work. According to the tests, exposure voltages were two to three times higher than would be predicted by calculating the voltage drop just across the PPG. The additional voltage resulted from the geometry of the PPG related to the position of the worker. Mathematical methods to calculate this voltage were then developed. This information, along with the new method to calculate worker exposure voltages, has recently been incorporated in IEEE Standard 1246, *IEEE Guide for Temporary Protective Grounding Systems Used in Substations*.

Jim DeHaan configuring machine condition monitoring at Grand Coulee Powerplant, Washington.

Currently, Jim is leading a research effort to develop and implement a hydrogenerator condition monitoring system to monitor turbine generator vibration and perform other beneficial uses. The system is currently installed on more than a dozen generators at various Reclamation powerplants, with more sites scheduled in the future.

More information on PPGs, IEEE Standard 1246, and hydrogenerator condition monitoring can be found on pages 16, 28, and 42.

Jim DeHaan

www.usbr.gov/research/projects/researcher.cfm?id=13

—continued (from page 1)

"Erin Foraker, Renewable Energy Research Coordinator"

Prior to joining Reclamation in June 1999, she worked at the Tennessee Valley Authority in the Hydro Modernization Program and Fossil Power Engineering at the Allen Fossil Plant.

Prior to joining the Research Office, Erin worked in both Reclamation's Hydroelectrical Research and Technical Services Group and the Power Resources Office.

She has also served as chairperson and as a representative on several power industry committees.

Hydropower 101 and Research

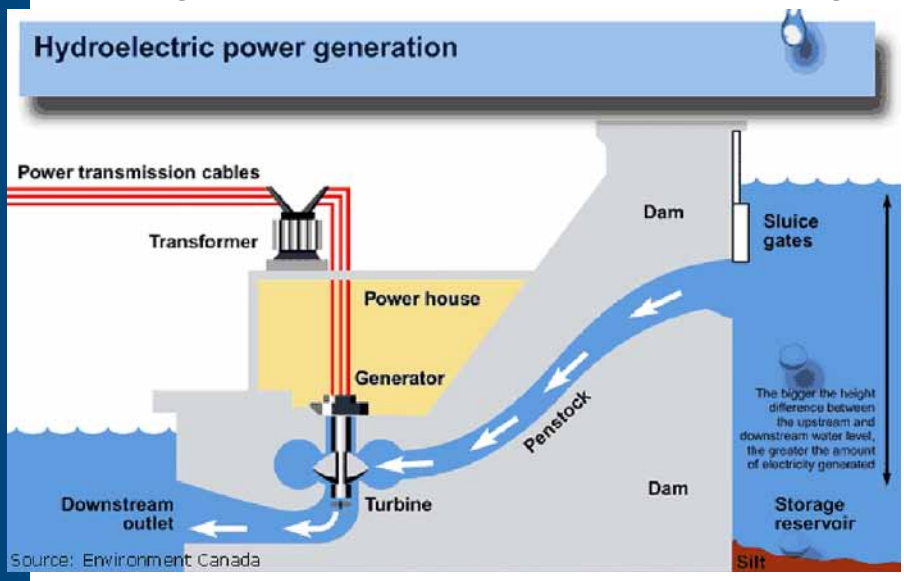
"Hydroelectricity is a renewable, non-polluting energy. It does not cause any greenhouse gas emissions or produce any toxic waste. It currently represents almost 20 percent of global electrical capacity and has development potential of three times its current level. While the investment required and the human and environmental impact weigh heavily on large dam-building projects, the future seems promising for small hydro."

Planete-energies.com
An initiative by Total

www.planete-energies.com/en/planete-energies-en-100000.html

Hydropower 101

As the primary research and development arm of Reclamation, the Science and Technology Program evaluates potential technical advances in renewable generation as well as opportunities for improved safety, efficiency, capacity, and energy savings. Reclamation works with an array of external partners, including the National Renewable Energy Laboratory (NREL), U.S. Department of Energy National Laboratories, Electric Power Research Institute, Center for Energy Advancement and Technological Innovation, academia, and other research-based organizations.



Source: Environment Canada (www.ec.gc.ca/eau-water/) through the U.S. Geological Survey's Water Science School website at: http://water.usgs.gov/edu/.

How Hydropower Works

Hydropower, also called hydroelectric power, is produced by the force (or gravity) of falling water, usually stored in a reservoir behind the dam. The dam creates a "head" or height from which water flows. A pipe (penstock) carries the water from the reservoir to the turbine. The fast-moving water pushes the turbine blades, something like a pinwheel in the wind. The water's force on the blades turns the rotor, the moving part of the electric generator. The coils of wire on the rotor sweep past the generator's stationary coil (stator), producing electricity, and then the water continues to flow downstream to meet other needs.

View of power lines running from the Grand Coulee Powerplant, Washington.

The electricity produced is then delivered to where it is needed—our homes, schools, offices, and so on. Dams are often in remote locations, so power must be transmitted to its users via vast networks of transmission lines and facilities. All the electricity made at a powerplant comes first through transformers, which raise the voltage so it can travel long distances through powerlines. Transformers on poles (or buried underground, in some neighborhoods) further reduce the electric power to the right voltage for appliances and use in the home.

Other Resources of Renewable Energy

Non-hydroelectric renewable energy resources include wind, solar, and geothermal. Wind and solar resources are a clean, carbon emission-free source of renewable energy, but they are also intermittent. Reclamation's primary objective is to deliver water and power within existing project authorities, contracts, and other the water management constraints associated with its projects. With this water, Reclamation generates power and strives to optimize this power to deliver low-cost, reliable energy to its power customers.

The Role of Research

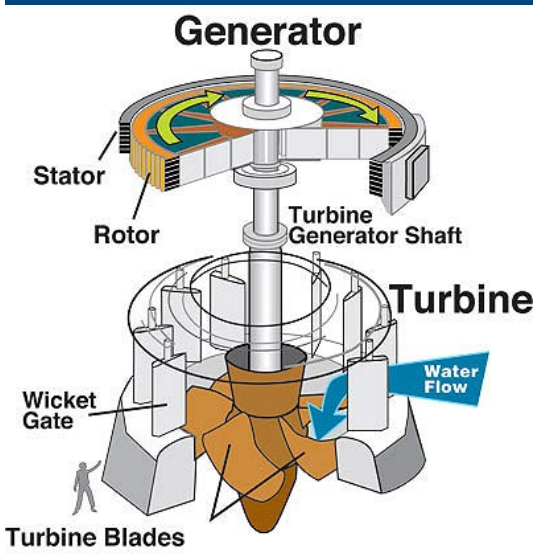
Researching new technologies and adapting industry technologies to Reclamation's unique facilities is vital for providing hydropower that can integrate into an increasingly complex power grid and meet future demands within a changing system. Reclamation's research projects:

- **Help powerplants last longer.** Machine condition monitoring can help powerplant operators understand the best operating ranges, monitor equipment, lengthen service life, and better predict failures. This contributes to more effective maintenance—which, in turn, means less downtime and fewer outages. See the "Powerplant Performance and Reliability" section starting on page 22 in this issue.

- **Optimize operations.** Even a tiny increase in operational efficiency can save millions of dollars. Determining how to operate each generator in each powerplant to respond to the power needs can help Reclamation deliver the most energy for the least cost. Moreover, integrating solar and wind energy into the power grid impacts the way hydropower plants are operated, so Reclamation has been investigating the impacts that increased starts/stops and other changes to operations associated with these resources have on our hydropower units. See the "Powerplant Performance and Reliability" and "Renewable Energy" sections starting on pages 22 and 34, respectively, in this issue.

- **Improve safety.** Safety is a paramount concern, and Reclamation is continually seeking ways to make operations safer. Reclamation is identifying the primary noise hazards and investigating ways to mitigate these to protect the hearing of its workers. The Hydropower Diagnostics and SCADA Group in Reclamation's Technical Service Center is investigating ways to improve arc flash detection and interruption on certain systems in Reclamation powerplants, as well as transferring the technology that has been developed into industry standards. See the "Safety" section starting on page 16 in this issue.

- **Find new opportunities for renewable energy.** Reclamation works with other Federal and non-Federal agencies and organizations to support and streamline renewable generation development. For example, Reclamation is working with NREL to identify opportunities for solar and wind energy on Reclamation lands. Reclamation is also working with private industry to test and improve hydrokinetic turbine technologies and the impacts these technologies may have on Reclamation's canal systems and infrastructures, while maintaining its water and power deliveries. See the "Renewable Energy" section starting on page 34 in this issue.



Source: U.S. Geological Survey's Water Science School website at:

http://water.usgs.gov/edu/.

More Information

For more information on hydropower/hydroelectric power basics or how hydropower/hydroelectric power works see:

http://energy.gov/eere/water/hydropower-basics

or

http://water.usgs.gov/edu/wuhy.html

Watch the "Energy 101: Hydropower/Hydroelectric Power" video (also referenced on page 44 in this issue) at:

http://energy.gov/eere/water/hydropower-basics

or

www.youtube.com/watch?feature=player_embedded&v=tpigNNTQix8

Policy Direction

As technology and demands for power and water use evolved over the last 100 plus years, Reclamation has adapted to these changes to take advantage of new technologies to help meet the Nation's water and energy needs. Today, Reclamation owns and operates 53 hydroelectric plants with over 14,600 megawatts of installed capacity and ranks as the second largest producer of hydroelectric power in the U.S. by generating over 40 billion kilowatt hours of energy each year.

Reclamation's Sustainable Energy Strategy

Reclamation contributes to the Administration's priorities on renewable energy in many ways, including generating more renewable energy, reducing Reclamation's energy use, and supporting the integration of wind and solar technologies into the United States (U.S.) electric grid. These activities are administered through several Reclamation programs throughout Reclamation.

In 2013, Reclamation published a *Sustainable Energy Strategy*, a policy document that details Reclamation's commitment to:

- Increase sustainable renewable energy production and development
- Promote and implement activities that reduce energy consumption

This strategy offers a framework for Reclamation to respond efficiently to its customers' needs and to strategically plan for the future of renewable power development and production in the Western U.S.

Operating Environment

Reclamation's role in renewable development, including hydropower production, must balance multiple—and sometimes even conflicting—objectives. For example, Reclamation must consider several factors, including: individual project authorities; Federal, state, and local laws; permitted land uses; environmental constraints; and other contractual obligations related to flood control and water and power management. Reclamation can build on its history of generating renewable hydropower from projects with multiple operational and legal obligations, and this expertise can provide a foundation for supporting further renewable development that includes both hydropower and non-hydroelectric renewable energy.

Robert V. Trout Hydropower Plant, developed in a partnership with the Northern Colorado Water Conservancy District, at the Reclamation Carter Lake outlet.

Renewable energy has been expanding rapidly over the last decade, and this growth is largely being driven by state-mandated Renewable Portfolio Standards and concerns over climate change. Reclamation can play a significant role in encouraging and supporting ongoing renewable development. For example, Reclamation can promote developing new renewable energy on Reclamation lands and facilities. However, increases in renewable resources can also create unique challenges for electric grid and powerplant operations.

Wind and solar resources are a clean, emission-free source of renewable energy, but they are also intermittent. The Federal hydropower system can help provide balancing reserves to stabilize the electric grid, but Reclamation's primary objective is to deliver water within the water management constraints of each watershed.

Mission and Objectives

Reclamation's Power Resources Office coordinated the development of the *Sustainable Energy Strategic Plan* and worked with various Reclamation offices, including the Research and Development Office (Research Office), Policy and Administration Office, and the regions. This strategy serves as a roadmap where activities occur throughout Reclamation, draws attention to past accomplishments, introduces a long-term strategy for Reclamation's future activities, and identifies the Sustainable Energy Mission:

Building on a century of agency experience in providing renewable, clean, reliable, and affordable hydropower, Reclamation seeks to facilitate the development, production, and integration of renewable energy in an environmentally and economically sound manner in the interests of its water and power customers and the American public alike.

An additional 1.5 million megawatt-hours of renewable energy could be generated through hydropower at existing Reclamation sites.

To do this, Reclamation will:

- Make sound business decisions
- Collaborate with power marketing agencies, other Federal agencies, customers, Indian Tribes, state entities, and other stakeholders

Six long-term strategic objectives were developed to further Reclamation's Sustainable Energy Mission. These objectives are to:

1. Increase renewable generation from Reclamation projects.
2. Facilitate non-Federal development of renewable energy projects.
3. Increase energy savings and conservation at Reclamation projects.
4. Support integration of variable non-dispatchable renewable resources into the U.S. electrical grid.
5. Increase benefits of renewable energy through technological innovation.
6. Improve management efficiencies related to the implementation of renewable energy and energy savings projects.

Several supporting activities have been identified for each strategic objective. Many of these activities are supported by multiple offices within Reclamation. The Research Office does support many of these activities with its directed Renewable Energy Research Program.

More Information

More information on the *Sustainable Energy Strategy* can be found at:

www.usbr.gov/power/Reclamation%20Sustainable%20Energy%20Strategy%20.pdf

Policy Direction

"Through collaboration and partnerships with other Federal agencies, the hydropower industry, the research community, and numerous stakeholders, these [MOU] agencies have been able to succeed in the majority of their efforts."

Memorandum of Understanding for Hydropower, Two-Year Progress Report, April 2012

Memorandum of Understanding for Hydropower

Reclamation has a long and successful history of generating renewable, clean, reliable, and affordable hydropower. As the power operating environment has evolved over the past century, Reclamation has adapted, leveraging new technologies and partnerships to meet the Nation's water and energy needs.

To promote reliable, affordable, and environmentally sustainable hydropower, the U.S. Department of the Interior (through Reclamation), the U.S. Department of Energy (DOE) (through the Office of Energy Efficiency and Renewable Energy), and the Department of Army (through the U.S. Army Corps of Engineers) entered into a *Memorandum of Understanding for Hydropowe*r (MOU), signed on March 24, 2010.

The MOU provides for a long-term, collaborative working relationship, prioritizing similar goals and aligning ongoing and future renewable energy development efforts between the three agencies. The MOU agencies identified 13 high-level goals to address issues ranging from enhancing sustainable hydropower development and improving environmental performance to assessing the effects of climate change on hydropower operations. The high-level goals are supported by 17 action items, which include activities related to hydropower resource and integrated basin-scale opportunity assessments, renewable energy integration and energy storage, and improving the regulatory process.

In April 2012, the MOU agencies published a *Memorandum of Understanding for Hydropower, Two-Year Progress Report* (Two-Year Progress Report), which detailed progress made on action items and identifies opportunities for future activities. Some of the two-year accomplishments are :

Jo-Ellen Darcy, Assistant Secretary of the Army for Civil Works; Steven Chu, Secretary of Energy; and Ken Salazar, Secretary of the Interior signing the MOU on March 24, 2010.

- Hydropower resource assessments, identifying 370 megawatts of potential hydropower at existing Reclamation dams and conduits
- A climate change assessment, evaluating the effects and risks associated with climate change on water supplies available for Federal hydropower generation
- A basin-scale opportunity assessment, identifying opportunities to increase hydropower and environmental performance in the Deschutes Basin
- The Advanced Hydropower Technology Development funding opportunity announcement, offering financial assistance to non-Federal projects that develop and demonstrate innovate hydropower technologies
- The Two-Year Progress Report also identifies future MOU activities, including opportunities to address aging infrastructure concerns and to develop new generation through research and demonstration of advanced technologies

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The MOU agencies have continued these actions, and are drafting a *Phase II Action Plan* that identifies MOU priorities and action items for the next 2 years. In addition to reaffirming MOU agency commitments to sustainable hydropower, the *Phase II Action Plan* provides updates on ongoing action items and introduces new action items. New action items build off of the accomplishments thus far and include, among others:

- Quantifying ancillary services available from hydropower assets
- Quantifying reliability and cost impacts of operational changes and technology deployments for hydropower assets
- Developing best practices guidance manuals for hydrokinetic canal testing

In general, phase II priorities address the major issues facing both Federal hydropower and the broader hydropower industry. Phase II priorities include:

- Analyzing hydropower systems
- Developing technology and testing performance
- Addressing environmental issues
- Sharing information

The *Phase II Action Plan* is expected to be published by the end of fiscal year 2014.

More information

MOU:
www.usbr.gov/power/SignedHydropowerMOU.pdf

Two-Year Progress Report:
www.usbr.gov/power/hydropower-mou/HydropowerMOU.pdf

More information on the MOU and Two-Year Progress Report can be found on Reclamation's Power Resources Office website at: www.usbr.gov/power/.

Additional information on the MOU can be found on the Federal Memorandum of Understanding for Hydropower website at: http://en.openei.org/wiki/Federal_Memorandum_of_Understanding_for_Hydropower

Turbinator hydroturbine, a new low-head modular hydropower technology, to be installed by Earth by Design at the 45 Mile Site on the North Unit Main Canal in Bend, Oregon. The 45 Mile Site project is funded through the Advanced Hydropower Technology Development Funding Opportunity Announcement (FOA). The FOA (jointly funded by Reclamation and DOE through the MOU) provided funding (nearly $17 million) in 2011 to demonstrate new hydropower technologies.

In total, 16 projects received FOA funding, three on Reclamation's infrastructure. The three projects are being developed by Earth by Design, Percheron Power, and Natel Energy. Earth by Design will demonstrate a new low-head modular hydropower technology on North Unit Main Canal, 45 Mile Site; Percheron Power will install the Nation's first Archimedes Hydrodynamic Screw hydropower system on the South Canal, Drop 2; and Natel Energy will deploy and test a scaled-up version of the modular Schneider Linear hydroEngine on the North Unit Main Canal, Monroe Drop.

RECLAMATION Managing Water in the West

Summer 2014
Research and Development Office
Bulletin 2014-07

The Knowledge Stream

Research Update

Safe and Grounded

Ensuring deenergized equipment is adequately grounded while maintenance work is being performed

Bottom Line

The placement of temporary grounds with respect to the location of the electrical work being performed can greatly influence how effective grounding is at protecting workers from being shocked or killed during an accidental energization. This research examines various factors that influence grounding effectiveness and provides equations to calculate safer grounding placement.

Better, Faster, Cheaper

Providing more accurate methods to calculate the effectiveness of safety ground cables in limiting worker exposure voltage during an accidental energization is critical to safely protecting workers.

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Problem

Worker safety is paramount in hydropower and other utility work, particularly as work often times requires direct contact with deenergized high-voltage equipment and transmission lines. High-voltage equipment and transmission lines need to be deenergized, placed on a clearance, and safely grounded with temporary personal protective ground (PPG) cables prior to performing maintenance. But determining what constitutes a safe level of grounding and how ground cables should be configured is a difficult question.

Grounding deenergized high-voltage equipment and power lines during maintenance or construction activities is critical for worker safety. This is usually done by applying PPGs according to the utility's procedure to create a safe work zone. However, in practice, many of these procedures tend to underestimate the maximum voltage a worker would be exposed to during an accidental energization of the equipment.

Solution and Results

The Hydropower Diagnostics and SCADA Group in Reclamation's Technical Service Center (TSC) has been testing different grounding methods used in the electric industry. The research looked at measuring the actual voltages that a worker could be exposed to across a PPG during an accidental energization. The field tests involved installing PPGs on deenergized powerplant equipment or transmission lines. The PPGs were then intentionally energized and the resultant currents in the PPGs, and the resultant exposure voltages at locations where worker contact with energized equipment was probable, were monitored.

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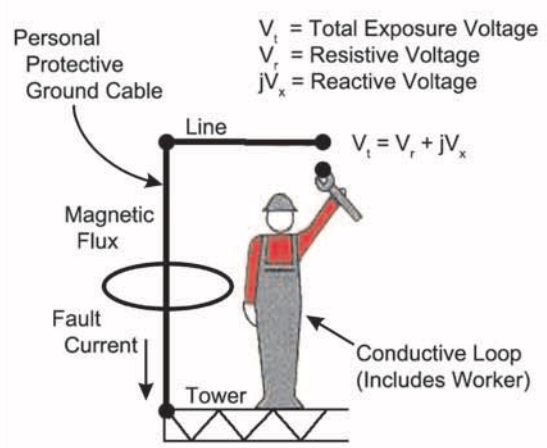
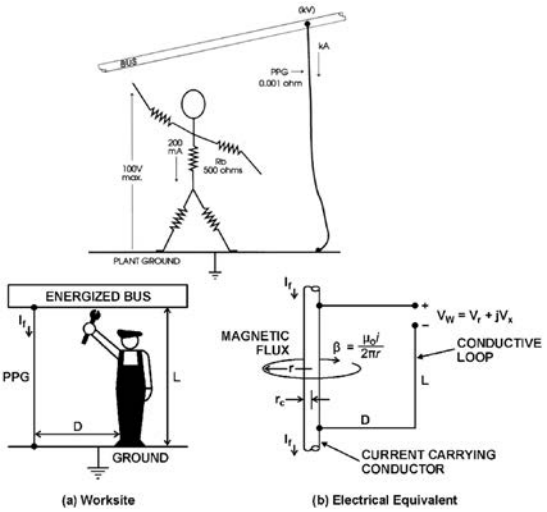


Inductive ground loop principle.



Reclamation's grounding principles.

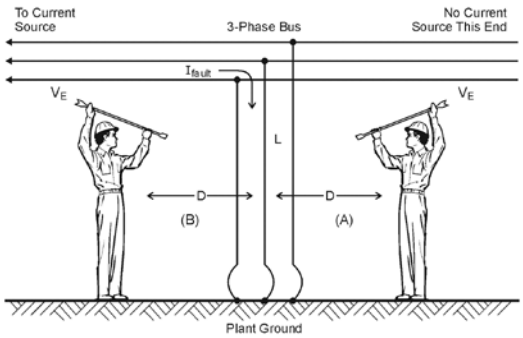


Illustration of worker relative to protective grounds.

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The field testing found that the exposure voltages were 2 to 3 times higher than what would be predicted by calculating the voltage drop just across the PPG. The additional voltage was the result of the geometry of the PPG in relationship to the position of the worker.

Historically, the PPG cable resistance was placed in parallel with the worker's body to calculate worker exposure touch voltage and the resultant current through the body if the grounded worksite was accidently energized. The PPG cable resistive voltage drop resulting from the power system fault current was the key factor in determining worker touch voltage.

However, the field testing demonstrated that the PPG cable reactive voltage drop often is a significant component of the worker touch voltage. Reactive voltage is developed due to the magnetic induction around the PPG that is produced by the flow of current in the PPG. This magnetic induction inherently produces a reactive voltage drop at the worksite due to the loop that is formed between the PPG cables and a worker. Therefore, the PPG cable resistance and reactance should both be considered for realistic worker exposure touch voltage evaluation.

Following these field test data, the recorded information was analyzed and the effect of the reactive voltage drop was then incorporated into Reclamation's Facility Instructions, Standards, and Techniques (FIST) manuals. FIST 5-1, *Personal Protective Grounding for Electric Power Facilities and Power Lines*, provides PPG procedures that enable Reclamation workers to perform their duties within a safe working environment.

To further expand on the field test data and to better predict expected worker exposure voltages, mathematical methods to calculate the worker exposure voltages were developed that include both the resistance and reactive components. Six temporary protective grounding scenarios were modeled to illustrate the effect that magnetic induction has on worker exposure voltage when a worksite is accidentally energized. The Hydropower Diagnostics and SCADA Group also participated with the Institute of Electrical and Electronic Engineers (IEEE) Standards Association to incorporate these findings into IEEE standards. The latest edition of IEEE Standard 1246, *IEEE Guide for Temporary Protective Grounding Systems Used in Substations* incorporates Reclamation's research findings.

Workers working on high power transformer lines.

"The primary purpose of personal protective grounding is to provide adequate protection against electric shock causing death or injury to personnel while working on deenergized lines or equipment. This is accomplished by limiting exposure voltages at the worksite to a safe value if the line or equipment is accidentally energized."

Phil Atwater
Electrical Engineer, retired Reclamation employee

Collaborators

Reclamation:

- **Hoover Powerplant**
- **Grand Coulee Powerplant**

Western Area Power Administration

Future Plans

Continue to inform the power industry through guides such as IEEE Standard 1246 and through publishing additional papers on these new mathematical models to predict worker exposure voltages.

More information

www.usbr.gov/research/projects/detail.cfm?id=5446

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RECLAMATION Managing Water in the West

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Bulletin 2014-08

The Knowledge Stream

Research Update

Making Reclamation Powerplants a Quieter Place

Reducing noise in Reclamation's powerplants by implementing advanced engineering controls

"This Voodoo noise control stuff really works!"

Bob Hotze
Green Springs Powerplant Foreman, Reclamation's Pacific Northwest Region

Bottom Line

Long-term exposure to high noise levels can cause noise-induced hearing loss, worker fatigue, and other problems, thus increasing safety risks. Reducing noise levels through the use of engineering controls significantly mitigates those risk factors.

Better, Faster, Cheaper

Reducing noise levels in powerplants will result in a significantly reduced incidence of noise-induced hearing loss in Reclamation workers, thus avoiding degradation of their quality of life as well as reducing workers' compensation claims.

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Problem

Noise is often overlooked as a hazard at powerplants—and everywhere else—because there are no obvious indicators of acute or chronic exposure. Yet repeated exposure to loud noises can cause hearing loss or other noise-related problems, thus significantly affecting a worker's quality of life. Exposure to high noise levels over the course of a workday can also result in worker fatigue and decreased performance and increase the risk of safety incidents.

Solution

This Reclamation Science and Technology Program research project researched and developed a pilot program in three Pacific Northwest (PN) Region powerplants. Reclamation has partnered with the Office of Naval Research (ONR) and their contractor Noise Control Engineering, LLC (NCE) of Billerica, Massachusetts, on this research project. NCE has been involved with ONR for a number of years, working on a major program to reduce hearing loss and other damages for troops on warships.

Application and Results

Reclamation put the noise-induced hearing loss program's technology to use in the following Reclamation powerplants by determining noise levels with advanced measurement techniques and designing appropriate, cost-effective engineering controls: Green Springs Powerplant in southern Oregon, Roza Hydro Electric Powerplant in the Yakima Valley in eastern Washington, and Chandler Hydro Electric Powerplant, southeast of Prosser, Washington.

Panel installation at the Roza Hydro Electric Powerplant.

Green Springs Powerplant was the first powerplant to complete the installation, with dramatic results. Before this installation, noise levels in the penstock area during powerplant operation were 90.3 A-weighted decibels (dB[A])—about a train whistle at 500 feet. Sound absorption treatment was installed in the turbine pit, high transmission loss panels were hung in the pit opening, and sound absorption panels were mounted on the wall in the penstock area. This reduced levels in the penstock area by 16 dB and in the control room by 10 dB (and, as decibel levels are logarithmic, this basically cut the noise level in half). These engineering controls in the Green Springs Powerplant significantly reduced overall noise levels in the powerplant. Now, except for the turbine pit, all levels in the powerplant area are below 85 dBA—about a telephone dial tone level. For the turbine pit, appropriate hearing protection should be worn.

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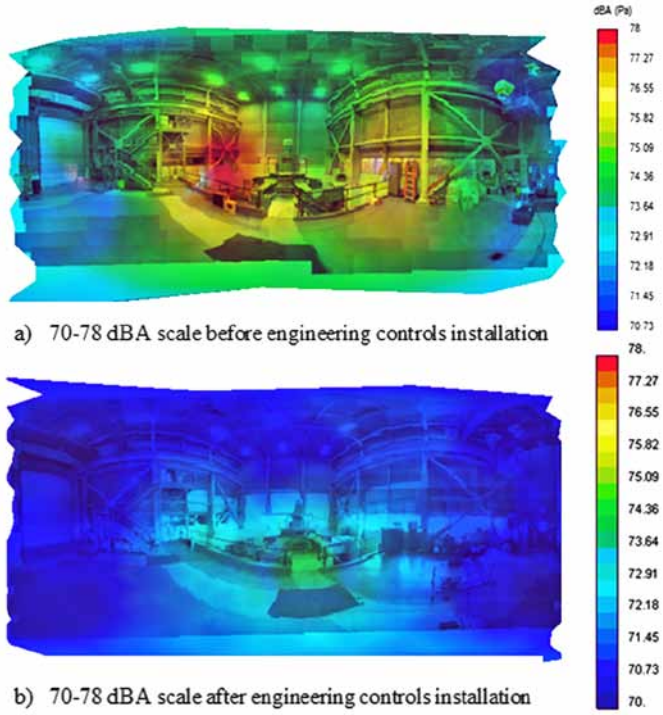
The table below shows noise levels in Green Springs Powerplant before and after controls.

Location	Noise levels before controls were installed (dBA)	Noise levels after controls were installed (dBA)
Turbine pit	101.4 (a jack hammer at 32 feet)	98.7 (a circular handsaw at 3 feet)
Penstock area	90.3 (an angle grinder outside at 3 feet)	74.5 (a passing car at 25 feet)
Control room	80.6 (very loud traffic noise at 25 feet)	70.6 (close to a main road by day)
Cooling water levels	86.6 (2-stroke chainsaw at 2 feet)	78.4 (un-silenced wood shredder at 2 feet)

Each powerplant is a little different, and thus it is important to tailor the type of controls to the type of noise sources. At the Roza Hydro Electric Powerplant, two large cooling fans that blew air directly through openings in one of the walls were found to be a major source of high noise levels. This was verified through the use of an advanced measurement technology called an acoustic array, which takes a three-dimensional picture of a room and then overlays the sound sources on top of the picture to verify the source of the noise. To reduce the noise from these cooling fans, silencers were designed and installed. The figure below shows the acoustic array results before and after the installation. Note the acoustic "hot spot" in the top figure that disappears after the installation. Sound absorption panels and a special spray-on material on the cooling ducts were also installed, which reduces the vibration of the ducts and keeps energy from this vibration from radiating as noise into the powerplant. Noise levels were reduced by 5 to 7 dB, and now all areas on this level fall below the 85 dBA target.

Installing controls at the Chandler Hydro Electric Powerplant also reduced noise levels by 3 to 5 dBA, to get below the target 85 dB(A). Because much of the noise was due to a direct path of energy from generator cooling slots, in addition to damping material on the ducts and absorption panels on the walls, it was necessary to install sound absorption barriers that block this direct path.



a) 70-78 dBA scale before engineering controls installation

b) 70-78 dBA scale after engineering controls installation

Future Plans

Because of the success of this pilot program, a number of other plants are being targeted for installation of these noise reduction engineering controls. Measurements have already been taken at seven other Reclamation powerplants and appropriate engineering controls, where necessary, are being considered for installation. This new research helps Reclamation take the steps necessary to assure that noise does not harm its workers.

Collaborators

Reclamation:

- **Safety and Health Office**
- **PN Region, Yakima Field Office**
- **Green Springs Powerplant**
- **Roza Hydro Electric Powerplant**
- **Chandler Hydro Electric Powerplant**

Office of Naval Research:

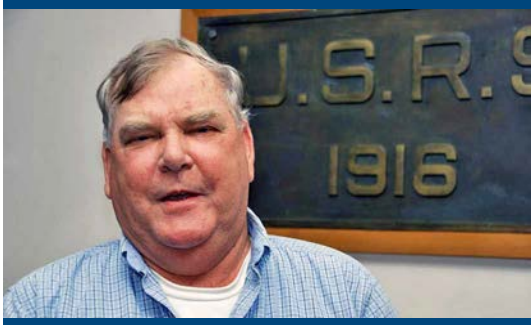
- **Noise Control Engineering, LLC**

More information

www.usbr.gov/research/projects/detail.cfm?id=6433

Previous Research Update at:

www.usbr.gov/research/docs/updates/2012-28-noise-exposure-powerplants.pdf



Thomas (Tom) Glover is a Power Systems Supervisor for the Yakima Field Office in Reclamation's Pacific Northwest Region. Prior to working for Reclamation, Tom oversaw maintenance and rehabilitation projects at the U.S. Army Corps of Engineers' hydropower facilities. Since Tom has been at Reclamation, he has overseen Roza, Chandler, and Green Springs Powerplants projects. Tom was instrumental in the testing of these engineering noise control technologies.

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RECLAMATION Managing Water in the West

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The Knowledge Stream
Research Update

Testing and Verifying Rope Access Anchors

Making sure concrete anchor bolts perform safely for rope access technicians

Bottom Line

This research tested concrete anchor bolts and identified and verified "best practices" for their use in the field.

Better, Faster, Cheaper

Providing general guidelines to aid the experienced rope access technician to more effectively build safe anchor systems. Investigating safe anchor systems improves Reclamation's ability to conduct safe rope access work on its aging infrastructure.

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Problem

Workers use rope access to access structures, geologic features, or other inaccessible locations that cannot be accessed by "normal" means. These rope access technicians pin their lives on these ropes as the primary means of support, positioning, and safety protection to ascend, descend, and traverse a location while suspended in a specially designed harness.

Ropes are anchored to a surface and must support the worker, weight of the rope, and anything attached to the rope. The Occupational Safety & Health Administration (OSHA) mandates that life safety anchors must be capable of supporting a 5,000-pound (lb) static load (OSHA CFR 1926.502).

Concrete anchor bolt while holding the OSHA weight limit (5,000-lb static load).

Reclamation personnel frequently use a variety of anchor types, and often use anchor bolts installed in concrete or rock. Using these anchors safely relies on the experience and judgment of a rope access technician for proper assembly and installation. Concrete anchor bolts have been studied extensively, but still they are one of the most mysterious forms of anchoring and, therefore, contain a certain amount of risk. The strength and condition of the concrete at Reclamation's aging structures are unknown. Moreover, there are no general guidelines to preparing and using these anchors, so verifying that the anchor bolts are installed correctly can also be difficult.

Epoxy anchor bolt failure by pulling out of its hole until the concrete shear cone ruptures.

Solution and Results

This Reclamation Science and Technology Program research project investigated the various anchors Reclamation's Rope Access Team use. To mitigate the risk of uncertainty in the substrate and to verify the installation of the anchor, proof load tests were conducted to evaluate an anchor bolt before it is put into use. Criteria were also developed for the acceptable use of anchor bolts.

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Two categories of concrete anchor bolts were tested: adhesive-type anchors and mechanical-type anchors. Each type of system has distinct advantages and disadvantages and was expected to be susceptible to different installation errors. Furthermore, both types of systems are commonly used at Reclamation and, therefore, merited testing. To simulate potentially common installation mistakes that might be expected during field installations, various installation defects were tested. To simulate relatively weak and stronger concrete, two concrete mix designs were used. Results showed that:

- Pull testing ½-inch Powers, Hilti Kwik, and Redhead bolts to 5,000 lbs had little or no effect on the performance of the bolts. Therefore, proof load testing to relatively low loads of 1,100 lbs (approximately 5 kilonewtons) as recommended by Reclamation rope access guidelines seems unlikely to weaken the anchors.

- Many of the anchor configurations tested were not strong enough to meet the 5,000-lb static load requirement specified by OSHA and the Society of Professional Rope Access Technicians (SPRAT) guidelines. When using these configurations, anchors should always be used in load-sharing pairs that achieve the minimum requirement of 5,000 lbs. Great care should be taken with load-sharing anchor bolts with less than a 5,000-lb strength. Due to the angle of pull on load-sharing bolts, two 4,000-lb anchor bolts may add up to be less than a 5,000-lb anchorage.

- Even if an anchor meets the 5,000-lb requirement, the failure mechanism may provide an added measure of safety if it fails gradually by pulling out of its hole instead of failing catastrophically (i.e., bolt fracture).

The final report provides details on anchor configurations and specific recommendations for using concrete anchor bolts for rope access at Reclamation's facilities. These findings will be incorporated into the *Reclamation Rope Access Guidelines Manual* (soon to be renamed "Bureau of Reclamation Rope Access Safe Practices").

Future Plans

Reclamation's Rope Access Team continues to work on testing safety equipment to help improve safety standards. Further testing needs include:

- Testing concrete anchor bolts for other defects and to produce additional data points for determination of statistical significance, or to evaluate other types of anchor bolts as they enter the market.

- Researching existing structural supports (such as I-beams) to obtain specific examples of various configurations currently employed within Reclamation's Rope Access Team.

- Testing more configurations of vehicle anchors and developing Lock-Out, Tag-Out procedures to ensure the vehicle is properly protected against any kind of tampering. Test procedures should also be created to dynamically test vehicles as anchors using drop tests based on the preliminary static testing of vehicles as anchors.

"This research into life safety anchors helps Reclamation continue to develop safe practices and protocols for rope access maintenance and inspection of inaccessible features on Reclamation structures."

Shaun Reed
Mechanical Engineer, Reclamation's Technical Service Center

More information

www.usbr.gov/research/projects/detail.cfm?id=6390

Anchor testing configuration. A hydraulically actuated ram is connected through a clevis rod and quick linked to the anchor. Threaded rods provide height and level adjustment.

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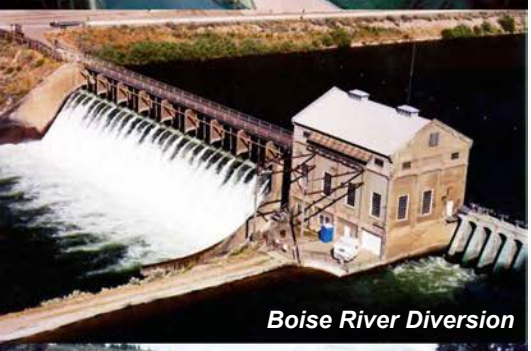
Powerplant Performance and Reliability

Black Canyon

Palisades

Minidoka


Boise River Diversion

Anderson Ranch

Getting the Most Out of Reclamation Hydropower Plants

A common rule of thumb is to operate each similar unit in a powerplant equally. This meets generation and flow requirements. However, this does not provide the absolute best methods for ensuring that each drop of water creates as much power as possible and that powerplants operate efficiently in the bewildering array of factors (peak power needs, waterflow requirements, operation and maintenance schedules, etc.). Sophisticated algorithms can take all of these factors into account without sacrificing unit reliability and find the best way to operate. Getting the most power, or optimization, can save millions of dollars—even a 1 percent increase in efficiency among Reclamation's non-optimized powerplants can save $3.57 million per year.

Reclamation has been researching power optimization since the early 2000s. The T2, Waterview2000, and Acres optimization systems have been compared, as well as Reclamation's own optimization system. Waterview2000 has been demonstrated at Grand Coulee Powerplant (providing an extra 421,700 megawatt hours [MWh] of power annually) and Reclamation's system at Yellowtail Powerplant (a smaller plant providing an extra 8,700 MWh of power annually). This research allowed Reclamation to gain valuable experience with optimization systems and provided the experience and knowledge to move forward with the current efforts of its Power Resources Office. A Reclamation Science and Technology Program research project is developing new and modern algorithms to answer questions such as the "economic dispatch problem" (how to get the highest water-to-power efficiency in a plant without turning a unit on or off) and the "unit commitment problem" (determining the most efficient generation solution for a plant that includes unit status changes) (see www.usbr.gov/research/projects/detail.cfm?id=3906). Although this is not quite ready for "prime time," these algorithms provide a promising future for efficient optimization.

In the meantime, Reclamation's Power Resources Office is working on a decision support system to help plant operators know how to optimize generation at a glance. This system consists of a powerplant optimization algorithm and a user interface to provide input and to get operational recommendations. The system connects to a supervisory control and data acquisition (SCADA) system to obtain real-time plant information. The optimization system is modular, so if better algorithms are ready for use, they can be "swapped out" easily. Reclamation's Technical Service Center adapted an optimization algorithm from the U.S. Army Corps of Engineers; however, this algorithm is not modular, thus it was embedded in the user interface and SCADA systems. So to better meet the needs of Reclamation, it was made into a modular, stand-alone algorithm.

The hope is to have these optimization systems at every powerplant in Reclamation. The first installation was in August 2013, at the Black Canyon Control Center, which serves five powerplants in Idaho: Black Canyon, Palisades, Minidoka, Boise River Diversion, and Anderson Ranch. In 2014, installation is planned for the

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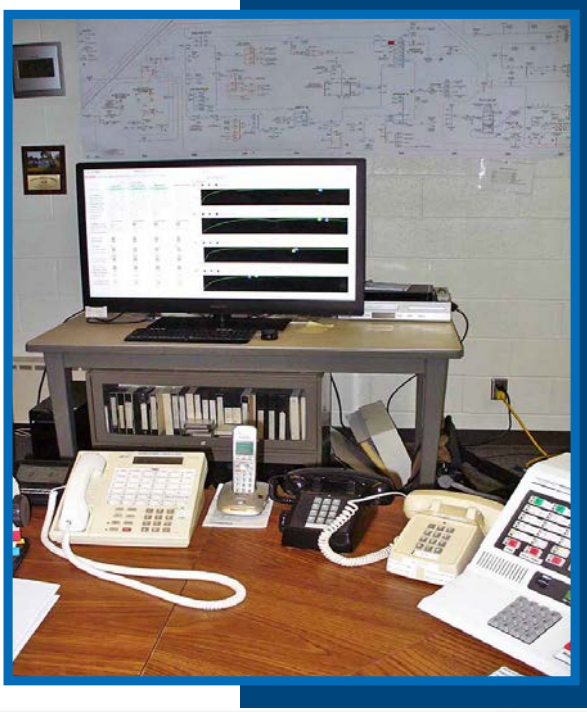
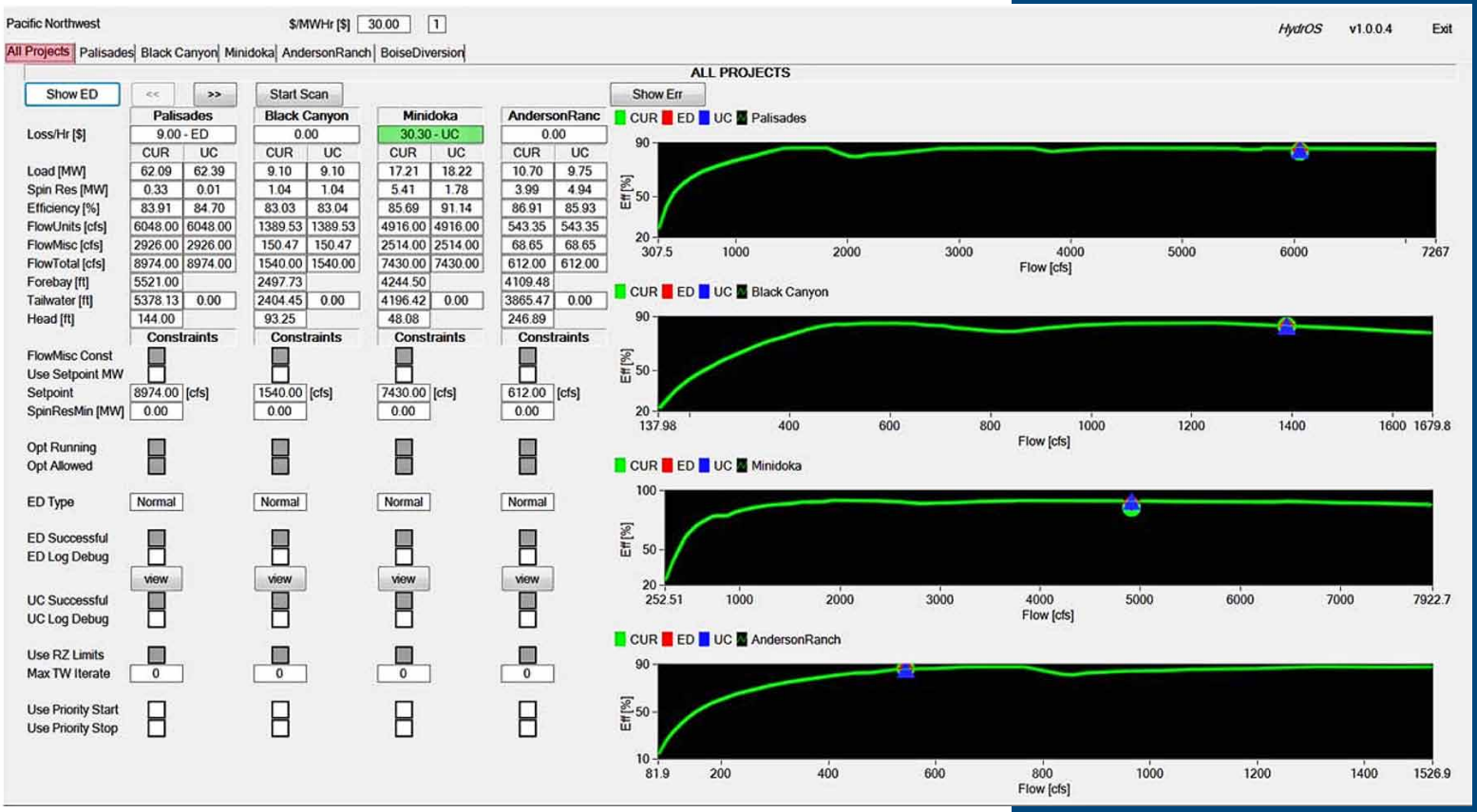
Glen Canyon Control Center and Elephant Butte Powerplant. As a control center can run up to 18 powerplants, Reclamation will be even closer to the goal of improving efficiency by at least 1 percent for all its powerplants.

Using this system, powerplant operators (and SCADA systems) can provide information about the amount of flows, power demands, maintenance, and other parameters. The interface then provides a guideline for which units to operate at what capacity to achieve the most effective operations. This is akin to a Global Positioning System (GPS) system for a car—the system provides a roadmap, which operators then consider as they grapple with other factors. Having this system will allow Reclamation's powerplants to function at their very best—saving money, providing more water for other uses, and garnering many benefits for Reclamation.



A view of the optimization system from the operator's desk.



Optimization screen demonstrating that it is possible to keep the same cubic feet per second (cfs) flow through Palisades, but generation can be increased from 62.09 to 62.39 megawatts (MW). At Minidoka, the cfs flow can be kept the same, but generation can be increased from 17.21 to 18.22 MW.

RECLAMATION Managing Water in the West

Summer 2014
Research and Development Office
Bulletin 2014-10

The Knowledge Stream

Research Update

Validating and Improving Models for Power Systems

Using online "disturbance" data to help improve the accuracy of Reclamation's power system models

Bottom Line

This research provided several new methods for testing and validating computer models of powerplant generator controllers to develop more accurate methods of simulating generator systems.

Better, Faster, Cheaper

Meeting WECC and NERC requirements for modeling generator systems is vital in keeping Reclamation powerplants operating reliably. The more accurate Reclamation's power system simulations are, the better they are able to help predict potential power system instability issues and avoid outages. Moreover, this research developed improved ways to use online data, saving staff time, travel expenses, and generation outages—and getting more accurate data over a longer timeframe.

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Problem

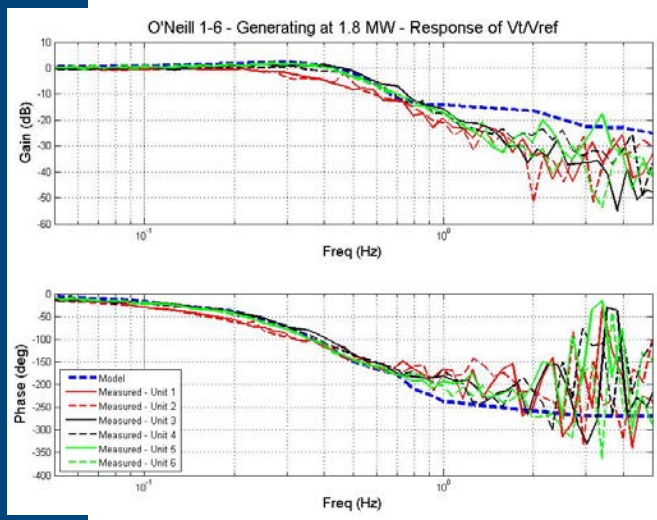
Power system operators and planners regularly perform dynamic simulations using computer models. After the power system blackouts of 1996, studies by the Western Electricity Coordinating Council (WECC) showed that many generation plant models were inaccurate and could not predict the type of system instability that led to the blackouts. To correct this inaccuracy, WECC began requiring generator owners to regularly validate the computer models representing their plants.

Validating models involves a series of staged tests and/or naturally occurring events with adequate recorded measurements of the response of the installed equipment, followed by computer simulations of the measured tests events, and then adjustments to the model until the simulation produces similar results. This has improved simulation accuracy of major dynamic events and, currently, North American Electric Reliability Corporation (NERC) standards are being drafted to require all plants in North America to regularly validate plant computer models.

However, there are no standard procedures for obtaining data, performing validations, or determining the quality of the resulting model. Consequently, model quality varies widely. Moreover, there is no listing of which tests or natural events are most important and which yield less value for the invested effort in test, measurement, and validation. To increase power system reliability, more research is needed to develop the standards that would result in best practices, economic solutions, or significantly improved models.

Solution and Results

To gain more insight into the best way to improve simulation accuracy, this Reclamation Science and Technology Program research project examined four test parameters:



Online frequency response model data versus measured data.

1. **Frequency Response Measurements.** Code was developed for the computer to simulate the online frequency response test. This provides a more complete picture of generator control systems interacting with the power system. (Previously, frequency response data in the simulation program were only available when the generator unit was offline.) This new code is used in a software package that simulates large power interconnections, so the frequency response tests of a single unit connected to the power system can be simulated under the same conditions as the actual staged tests.

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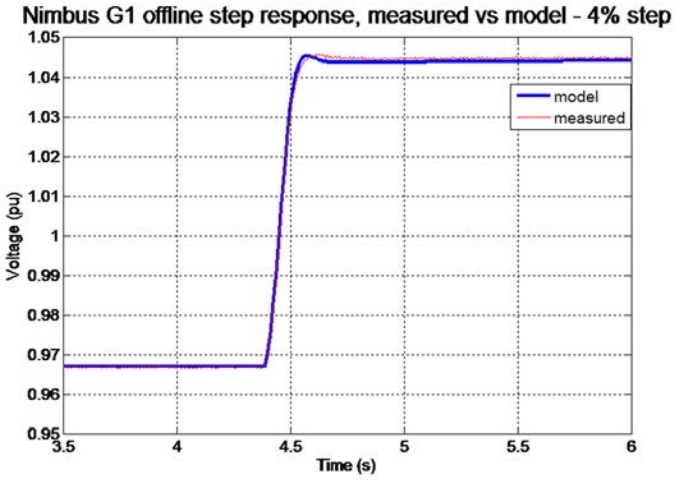
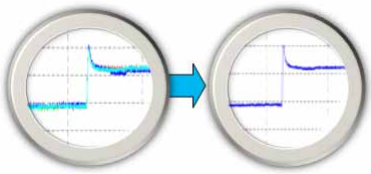
2. **Online Disturbance Data.** Typically, test engineers must go to the facility, run a series of tests on each piece of equipment, record the data, and bring it back to the office for processing. However, if the powerplant has online "disturbance" monitoring systems that record critical data (power, voltage, current, frequency, etc.), snapshots of power system events can be used to compare an event to the simulation of the same event to confirm (or improve) existing models. A new process was developed using disturbance data from online monitors at Yellowtail Powerplant, Montana, to confirm model simulations. Unfortunately, this newly developed process could not be fully tested as the recorded signals from the online monitors were inaccurate (incorrect scaling or offsets) and too slow (sampling rate was too low). The online monitoring system at the powerplant has been improved by replacing transducers and increasing the sampling rate. Once additional disturbance data are captured, this process can be fully tested.

3. **Exciter Step Response.** For WECC model validation, step response tests are typically performed by inserting a 1 percent (%) change in voltage into the exciter input and measuring the excitation system response. At Nimbus Powerplant, California, additional research tests of 2, 3, and 4% magnitudes were conducted to determine if simulated model step responses match measured data just as well for larger responses as they do for the standard 1% response. When larger step responses were performed, the exciter hit upper or lower limits and stimulated internal processing non-linearities. By performing additional larger step responses, these limit values and processing non-linearities can be proven in the test results and then used in the models.

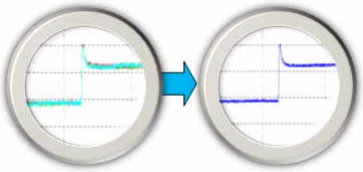


A terminal voltage response, 4% step response, measured test data versus calculated model data.

4. **Time Domain Averaging Technique.** The time domain averaging technique uses multiple step responses to create a single "clean" step response. The technique has successfully removed random noise and power system disturbance signals, while also providing users with the tools to determine step responses that contain outlying data properties (to be removed by the user) for a more accurate representation of the actual step response. One key feature of this algorithm is that it does not affect the phase response or overall shape of the response—it merely removes random and power system disturbance-based noise signals. This technique can be further refined by using standard deviations and/or other data point comparison techniques to remove outlying data points from the time domain averaging algorithms automatically.



Multiple step responses with system disturbance (all responses analyzed).



Multiple step responses with system disturbance (selected responses analyzed).

"This research is helping Reclamation become more efficient in obtaining higher quality data and validating models to save a significant amount of money and resources."

James Zeiger
Manager, Power System Analysis and Control Group, Reclamation's Technical Service Center

Future Plans

Reclamation has installed new transducers at the Yellowtail Powerplant to address the scaling and bandwidth issues and will plan to re-validate the disturbance data to the computer models once a significant power system disturbance is recorded. This re-validation will prove that Reclamation's power system models can be validated using this method, as long as a detailed model development was already performed by collecting data for each individual piece of equipment at the powerplant.

Test engineer performing model validation testing.

Results of this research will be presented at the WECC modeling workshops in 2014, and beyond, to make the industry aware of Reclamation's valuable findings.

More information

www.usbr.gov/research/projects/detail.cfm?id=1482

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RECLAMATION Managing Water in the West

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Bulletin 2014-11

The Knowledge Stream
Research Update

Signal to Noise: Analyzing Generator Performance and Reliability

Adapting signal processing techniques to analyze generator and controller structures, operating parameters, and performance.

Bottom Line

This research project developed new hardware and software tools based on common digital signal processing techniques. The hardware and software tools are being used to collect more accurate model validation data from generators and controllers (e.g., voltage regulators, power system stabilizers, and speed governors) used in Reclamation powerplants. With more accurate data, Reclamation can do a better job verifying powerplant performance, providing early warnings for potential power system stability problems, and preventing power system outages and blackouts.

Better, Faster, Cheaper

Meeting WECC and NERC requirements for modeling generator systems is vital in keeping Reclamation's powerplants operating reliably. The more accurate Reclamation's power system simulations are, the better they are able to help predict potential power system instability issues and avoid power system outages. Moreover, this research developed improved ways to collect and analyze field data, which results in models that better represent actual response and performance of equipment installed at Reclamation's powerplants.

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Problem

As hydropower system interactions become more complex with the growth of the power grid, more reliable information about a powerplant's performance and condition is needed. Getting information about the structure, operating parameters, and performance of generators and controllers (voltage regulators, power system stabilizers, speed governors) is becoming even more critical as hydrogenerator control systems must be ever more reliable.

Further, organizations such as the Western Electricity Coordinating Council (WECC) and North American Electric Reliability Corporation (NERC) require monitoring information as input to model the Nation's power grid. The model needs to accurately represent the actual installed equipment so that regional power system stability studies can be more meaningful. It is important to collect "clean" test data without the random signal "noise" and disturbances from the power grid. Otherwise, the model could be influenced by the negative effects of "noise" which could, in turn, result in skewed models that do not represent the equipment accurately.

Currently, to get this information, test engineers must travel to the generation site with specialized test equipment, insert test signals, record test data, and interpret results. This is high risk, time consuming, labor intensive, and costly. Most of the costs involved are a direct result of temporarily taking the generators out of service for an average of a couple of days per generator, which could easily result in lost generation costs totaling thousands of dollars.

Solution and Application

To increase the quality and accuracy of the field data collected for model validations, Reclamation researched the following hardware and software tools:

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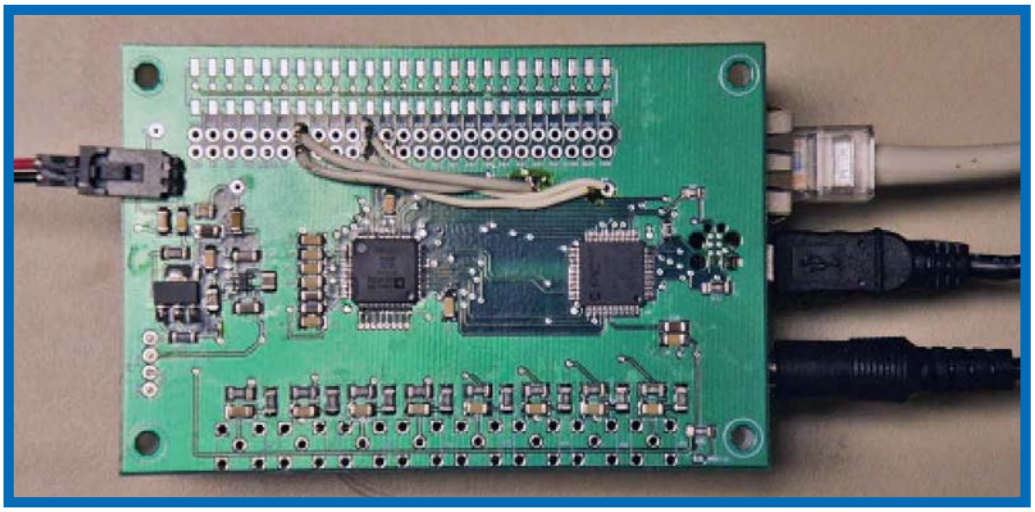

Modular hardware design with Ethernet interface.

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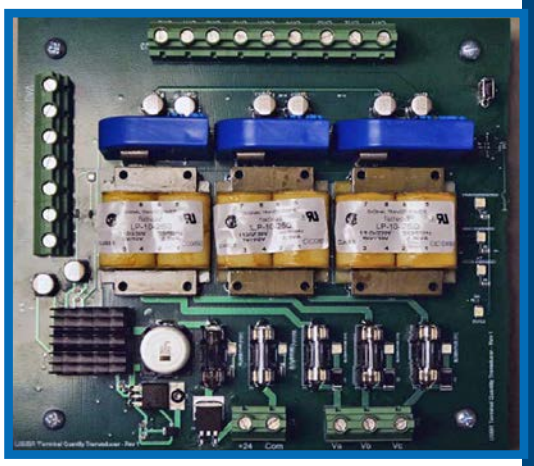
Hardware Tools. Two separate designs were developed for collecting model validation data. The first design was a modular hardware design, which featured separate input and output cards that can be stacked and wired to a main central processing unit (CPU) to gain a nearly limitless number of input and output channels. The main advantage to this modular design is that the CPU digitizes all of the analog input readings and sends the values across to a personal computer that can store the real-time data without the need for a separate data acquisition module.



All-in-one hardware design with calculated voltages.

The second design was a three-phase, all-in-one board, which featured input circuitry for handling large signals. However, this design lacks the capability to expand the number of input and output channels and has no Ethernet connection to a personal laptop. Instead of an Ethernet connection, each analog output channel provides a direct current (DC) voltage output in the range of ±10 volts that is proportional to the corresponding input signal. This board is designed for use with a commercial, off-the-shelf-type data acquisition system.

The developed hardware uses chips that have only been available for a few years and are capable of performing faster calculations, leaving room for more data to be processed. This encouraged the efforts to improve signal processing techniques and derive better algorithms to get precise data. The equipment can even be quickly modified to provide viewing and recording of dynamic signals for any application, not just generator testing alone.

Software Tools. While looking through step responses, Reclamation noticed that some were "noisy" at the same time that others were "clean." It was decided to experiment with a time domain averaging technique that uses multiple step responses to create a single "clean" step response. The technique has successfully removed random noise and power system disturbance signals, while also providing users with the tools to determine step responses that contain outlying data properties (to be removed by the user) to provide a more accurate representation of the actual response. One key feature of this algorithm is that it does not affect the phase response or overall shape of the response, it merely removes random and power system disturbance-based noise signals. This technique can be further refined by using standard deviations and/or other data point comparison techniques to remove outlying data points from the time domain averaging algorithms automatically.

Future Plans

The Power Systems Analysis and Control Group in Reclamation's Technical Service Center now uses these digital signal processing techniques to perform tests for Reclamation powerplants. The next step is to continue designing, testing, and fine tuning the hardware solutions developed for this research project to continue pushing the limits of collecting data that are more accurate and better represent the actual equipment from which the data are being measured. Case studies are being done to present to WECC for the industry to adapt, so that collection of better data can be used for performing model validation studies.

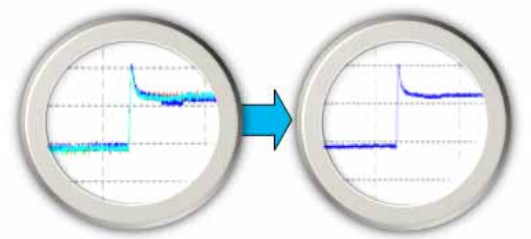
More information

www.usbr.gov/research/projects/detail.cfm?id=9962

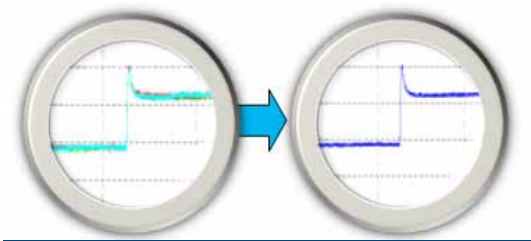
Clair, K. and J. Stenberg. 2012. *Signal Processing Techniques for Determining Powerplant Characteristics.*

"This research is helping to provide Reclamation with cutting edge tools used for generator control system testing and generator plant model generation/validation."

Kyle W. Clair
Electrical Engineer, Reclamation's Technical Service Center



Multiple step responses with system disturbance (all responses analyzed).



Multiple step responses with system disturbance (selected responses analyzed).

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RECLAMATION Managing Water in the West

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Bulletin 2014-12

The Knowledge Stream

Research Update

Keeping Track of the Generator's Condition

Industry's first open source hydrogenerator condition monitoring software package

Bottom Line

This research developed a machine condition monitoring package for hydropower plants with a broad range of applications that can be used to monitor a wide variety of plant equipment. It uses free, open-source software code and can be expanded to communicate with existing or future data acquisition hardware.

Better, Faster, Cheaper

Without machine condition monitoring, it is very difficult to determine when preventive maintenance is needed. This system is an online, real-time detection system that can ascertain when repairs are needed without bringing the generator offline. The system enhances plant operator's ability to prevent unplanned outages and detect impending problems that, if left unresolved could lead to a catastrophic failure resulting in millions of dollars in repairs and outage costs, lives lost, and/or power system blackouts.

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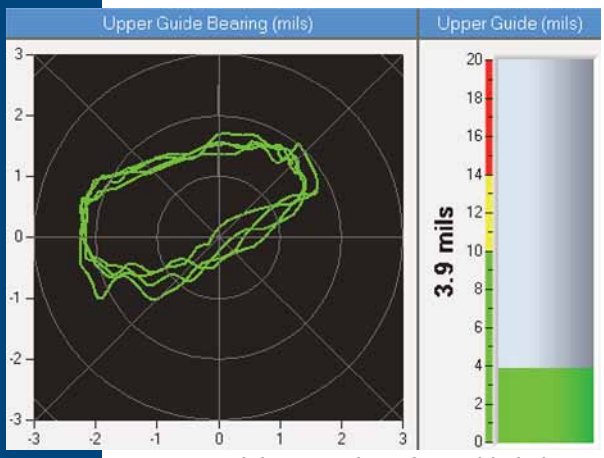
Problem

Operation and maintenance costs are a hydropower plant's largest expense. Maintenance is typically scheduled on a periodic basis that may result in some plant components being undermaintained (increased risk of failure), while other components being overmaintained (increased cost). For example, the generator rotating components must remain properly aligned and balanced, and the generator bearing clearance must be properly maintained. If there is an issue with any of these components, the generator will become unbalanced (imagine an imbalanced washing machine the size of a large room shaking). Without a monitoring system, experts must travel to the unit and set up a temporary monitoring system to check these components.

Improper operation of a generator can also lead to generator component failure and increase costs. For example, operating a generator in a rough zone for an extended period of time can decrease the life of generator components and, in some cases, could potentially lead to a catastrophic failure of the generator. A generator rough zone occurs only at specific operating points that change depending on the elevation of the lake. When a unit is in a rough zone, the water turbulence just below the generator turbine pushes the turbine sideways, which increases generator vibration, and the turbulence smacks into the draft tube wall, which shakes the plant and causes a loud booming sound. At remote automatic operating plants, no one is around to hear the problems or feel the shaking, and the situation could continue until the generator is damaged. In addition, the magnitude of the sound or vibration is subjective, thus without monitoring there is no definite way to determine the magnitude of the problem. The worst case scenario occurred at Sayano-Shushenskaya Power Station in 2009, when a unit was operated in a rough zone for an extended period of time, which contributed to a catastrophic generator failure resulting in the partial destruction of the plant and the deaths of 75 workers.

Following the Sayano-Shushenskaya Power Station event, all of Reclamation powerplants must now install a generator vibration monitoring system. *Power Equipment Bulletin No. 42* states that "all facilities shall install vibration monitoring on all units. The system must consist of proximity probes at each guide bearing elevation, with output data transmitted to a system that is capable of alarming on peak-to-peak vibration levels."



Partial screenshot of an orbital plot to determine a generator's vibration.

While industry has proprietary monitoring systems that can be installed to meet this requirement, these systems are often costly and require specialized upgrades. Moreover, industry may stop supporting certain hardware and/or software, requiring the expense of an entirely new system when repairs to the monitoring system are required.

Solution

Reclamation's Power Resources Office and key Reclamation facilities collaborated on this Reclamation Science and Technology Program

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research project to develop a system that can meet these monitoring needs. Reclamation's machine condition monitoring system can:

Jim DeHaan of Reclamation's TSC installing and configuring the machine condition monitoring system at Grand Coulee Powerplant, Washington.

- Record almost any signal (e.g., bearing runout, megawatts, megavars, terminal voltage and current, field voltage and current, frequency, pressures, gate limit and position, speed, forebay and tailbay elevation, flows, temperatures, breaker status)
- Measure and display generator vibration (orbit plots) and provide alarms to plant operators, if extensive vibration is detected
- Allow the user to detect rough zone operation and provide alarms to plant operators, if extended rough zone operation is detected
- Allow the user to diagnose and troubleshoot abnormal events
- Capture electrical and mechanical quantities and signals that can indicate potential problems that may otherwise go undetected
- Provide different alarm thresholds to reduce false alarms during startups, shutdowns, or any other defined operating condition
- Gather and store data over a long period of time for understanding a generator's condition more acurately, evaluate trends in operation, and provide meaningful data for improved operation of the hydroelectric facilities
- Alert remote operators to potential problems, allowing the most effective and safe operations
- Adapt to new and future needs, provide an open-source software code that allows the software to be modified to work with a large variety of data acquisition hardware, and can expand to meet the unique requirements of all hydropower plants

The system helps diagnose pre-failure conditions to prevent catastrophic failures. It allows the user to predict when to perform maintenance on various components on the generator. The software can alarm to let the operators know when the generator is in an abnormal condition, and prevent any unnecessary wear and tear on the machine. Thus, machine condition monitoring reduces operation and maintenance costs, increases plant availability, and preserves Reclamation's infrastructure by providing current and relevant information on the present condition of plant equipment.

Application and Results

This project has already shown that it can meet the needs at Reclamation's powerplant facilities. The near-term goal is to cover about half of Reclamation generators. The initial version of this system is presently installed on over a dozen generators at various Reclamation powerplants. Several more sites have either scheduled, or are considering, adding this system. Field personnel from the initial installations have provided valuable feedback to improve the system. Several improvements have also been identified that will make the system easier to use and improve computer security. These improvements are being implemented in a second version of the software, already in development.

Future Plans

A new version of this software should be available to install by the end of calendar year 2014. Reclamation's Technical Service Center (TSC) plans on supporting the machine condition monitoring package in the future. TSC is continually expanding this software to eventually supersede the functionality of machine condition monitoring packages currently available on the market.

"This open-source software code works with a wide variety of data acquisition equipment including off-the-shelf data acquisition systems, specialized monitoring systems, and other computer systems. Hydrogenerator condition monitoring saves time and money, while improving the reliability of hydropower."

Nathan Myers
Manager, Hydropower Diagnostics and SCADA Group, Reclamation's Technical Service Center

Collaborators

Reclamation:

- **Power Resources Office**
- **Elephant Butte, Fontenelle, Fremont Canyon, Grand Coulee, Judge Francis Carr, Mount Elbert, Palisades, Yellowtail, and Lower and Upper Molina Powerplants**

Army Corps of Engineers:

- **Truman Powerplant**

More information

www.usbr.gov/research/projects/detail.cfm?id=2879

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RECLAMATION Managing Water in the West

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Bulletin 2014-13

The Knowledge Stream
Research Update

Catching Problems Early: Predicting Shear Pin Failures With Acoustic Emission Sensing and Analysis

Monitoring turbine linkage shear pins and detecting shear pin failures at Reclamation's powerplants

Bottom Line

Under certain conditions, the failure of a turbine wicket gate shear pin can cause substantial damage to the turbine of a hydroelectric generator. This research explores using acoustic emission and other types of sensors attached to shear pins to detect the start and propagation of a crack before the shear pin breaks so that the unit can be shut down to prevent further damage.

Better, Faster, Cheaper

It is crucial that Reclamation keeps its powerplants running. By detecting shear pin failures in time, operation and maintenance costs can be reduced, powerplant availability can be increased, and Reclamation's infrastructure can be preserved. This also provides current and relevant information on the real-time condition of powerplant equipment, reducing the downtime needed for maintenance. This preventative maintenance can generate significantly more hydropower and avoid more costly failures of a turbine component.

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Problem

In the past, when hydroelectric units were manually controlled, it was common to staff plants with a plant operator(s) 24 hours a day, 7 days a week. A major element of the plant operator's job was to monitor the unit—to listen for abnormal sounds and to take action to shut the unit down if a shear pin failed. Today, it is more common to remotely control plants or units. Most Reclamation plants are not staffed on weekends and some smaller, remote located plants only see occasional maintenance staff visits during the workweek. This puts the power generation units at a high risk, as no one is around when a serious problem develops.

Finding problems early then becomes key to avoiding serious failures. Most hydroelectric turbines have around 20 wicket gates, each with a shear pin, that control the waterflow into the turbine. Shear pins are designed to shear or break if there is a mechanical overload on the wicket gate and are sacrificial parts that prevent more expensive parts from being damaged.

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Hydroelectric turbine at Flatiron Powerplant. Photograph courtesy of John Germann.

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Yet, without a way to detect when a shear pin fails, the turbine will continue to run and risk even more damage. A wicket gate with a broken shear pin disrupts the waterflow and can cause the unit to severely vibrate. On occasion, the gate will violently slam closed causing adjacent wicket gate shear pins to break, creating a cascading effect of failures. Hydraulic imbalance created by the uncontrolled gates can move the rotating runner into destructive contact with the guide bearings and stationary wear rings. A number of hydroelectric units within the industry have suffered severe damage from not detecting a shear pin break early enough to shut the unit down in time.

Solution and Application

Using acoustic emission sensors is a promising method for detecting shear pin failure early. Acoustic emission techniques have a proven history for detecting cracks. When external forces or internal pressures cause discontinuities within a material, it emits stress waves at the onset and during crack growth. In a shear pin, the pin is stressed by an applied load. Acoustic emission sensors can detect this early release of energy and provide warning signs prior to the sudden failure of a material, in this case, the shear pin.

There is increased evidence that fatigue may also contribute to frequent shear pin failure with older shear pins. This Reclamation Science and Technology Program research project examined ways to effectively detect fatigue crack propagation prior to failure. Reclamation looked at detecting shear pin failure by continuously monitoring acoustic emissions through the crack process—from the early start of microcracks in the stressed pin through ultimate failure. The ultimate goal of the research is to design a detector that is non-intrusive to the pin, easily adaptable to any kind of shear pin, robust, reusable, cost effective, and maintenance free.

Understanding the fundamentals of shear pin cracking and fatigue-related issues of metal shear pin failures will lead to better methods to protect hydroelectric turbines from catastrophic failure and reduce maintenance requirements. Laboratory results so far have led to a better understanding of how shear pins fail and of the material science used for shear pins. These results have shown that acoustic emissions may be a useful method to detect shear pin failure.

Future Plans

Reclamation plans on further laboratory work and then testing results in the field. If a successful shear pin protective device can be designed and constructed, it will be available and deployed to Reclamation powerplants as another tool in the overall machine condition monitoring package. Findings will be shared through technical papers with Reclamation and the hydropower community.

More information

www.usbr.gov/research/projects/detail.cfm?id=7567

"The ability to predict some shear pin failures would be advantageous. Replacing shear pins would no longer be a "hurry-up-and-react" situation resulting in forced outages. Instead, shear pins could be replaced during planned outages. While this process may not predict all failures, even finding one or two could save millions of dollars in damaged equipment."

Russell Anderson
Reliability Program Analyst, Reclamation's Power Resources Office

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Collaborators

Reclamation:

- **Northern California Area Office**
- **Eastern Colorado Area Office, Elephant Butte Powerplant**

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RECLAMATION Managing Water in the West

Summer 2014
Research and Development Office
Bulletin 2014-14

The Knowledge Stream
Research Update

Detecting Cavitation to Protect and Maintain Hydraulic Turbines

Detecting, monitoring, and preventing cavitation damage at Reclamation's powerplants

Bottom Line

This research develops effective cavitation detection and monitor techniques to accurately predict erosive cavitation and thus substantially reduce hydro turbine maintenance costs.

Better, Faster, Cheaper

Turbine cavitation damage is usually the most costly maintenance item on a hydroelectric turbine, and there is no effective method to detect ongoing erosive cavitation on an operating turbine. This research provides a better understanding of cavitation to identify ranges where damaging cavitation occurs so that the turbine can be operated to avoid those ranges.

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Collaborators

Reclamation's Northern California Area Office

Problem

It is crucial to our Nation's power system that Reclamation's powerplants keep running. Moreover, changing reservoir levels due to droughts or floods can require powerplants to operate at water conditions that they were not designed for, which can cause damage.

Vapor bubbles form when exposed to an area of subatmospheric conditions. When these tiny bubbles of vapor are subjected to pressure in a liquid, they can implode onto a surface (such as a turbine runner blade) causing damage called "cavitation." Cavitation commonly occurs in a wide variety of equipment (e.g., marine propellers, hydrofoils, nozzles, and injectors). When damaging cavitation occurs in the turbine, unexpected shutdowns and unplanned maintenance is required for repairs. The Judge Francis Carr Powerplant (J.F. Carr) in California has two units, both with recent cavitation issues that have cost an estimated $5 million in lost generation and repairs, not including long-term costs related to lost operational ranges, future repairs, and future lost generation. This unexpected repair work should be minimized to maximize hydroelectric production. Although hundreds of papers have been written on the subject, minimal research has focused on preventing cavitation damage occurring within an actual operating hydropower turbine.

Cavitation damage to a turbine runner blade of J.F. Carr Unit 2 in February 2013. Photograph courtesy of John Germann.

Various types of cavitation can occur, which require different detection, prevention, and mitigation measures. Cavitation commonly occurs in hydroelectric turbines around guide vanes, wicket gates, the turbine runner, and in the draft tube. Cavitation damages to the machinery components are compounded with other associated problems, including losses of efficiency and output, lengthy repair outages, and severe vibrations.

Cavitation in hydraulic turbines is primarily influenced by hydraulic design and operating conditions. Detecting cavitation in an operating hydroelectric turbine is difficult, as this is a complex phenomenon that is difficult to assess. Direct access to

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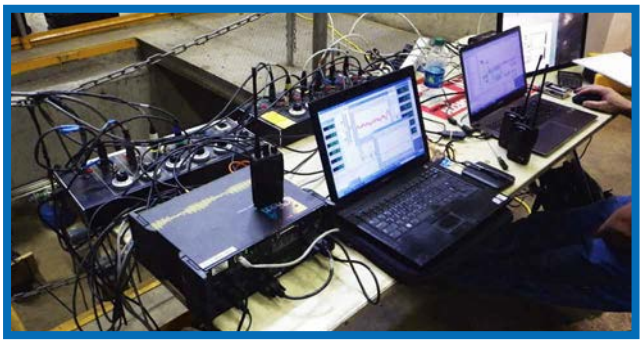
assess cavitation occurring within the water passage of the turbine when the unit is running is impossible, and thus it is hard to determine if the cavitation is damaging the unit—until it is too late. Reclamation initially began researching cavitation detection in hydro turbines in 2004, purchasing and testing several commercially available cavitation monitors. These monitors used a very simplistic approach and did not perform well, as they could not distinguish damaging (erosive) cavitation from non-erosive cavitation within the fluid stream. Thus, Reclamation and the hydropower industry need a machine condition monitoring tool to detect cavitation problems while the turbine is operating.

Solution and Application

This Reclamation Science and Technology Program research project is developing better techniques and instrumentation that will be used as a machine condition monitoring tool. One goal is to build an online cavitation monitor to identify, alarm, and record cavitation activity over long-term operations. This allows better prediction of cavitation behavior over varying unit operations and reservoir elevation. A prototype system was tested in 2011 at the Fremont Canyon Powerplant in Wyoming.

A shaft mounted cavitation detector was developed to better detect damaging cavitation. This new package uses a shaft-mounted accelerometer and acoustic emission sensor, and then a wireless transmitter to send high frequency signals from the turbine shaft. Online tests showed this wireless system operation to be reliable. As well as accelerometers, acoustic emission sensors are used to assess cavitation impact signals and track cavitation activity, as very high frequency noises unique to cavitation can often be identified.

Jim DeHaan of Reclamation's TSC installing a cavitation monitor at the J.F. Carr Powerplant.



Monitoring for cavitation.

Current cavitation research is focused on the existing runners at the J.F. Carr Powerplant in northern California. These units are an excellent research platform for these studies because they exhibit severe erosive cavitation. This powerplant has two hydro turbines with new turbine runners that are exhibiting extremely aggressive cavitation. In 2013, Reclamation's Technical Service Center (TSC) and Northern California Area Office (NCAO) partnered to conduct machine condition monitoring and cavitation detection research at J.F. Carr Powerplant. These tests were to determine if it is possible to detect and measure cavitation-induced vibration and acoustic signals created by cavitation that is causing severe erosion on the leading edges of the turbine blades.

The tests identified the operating ranges where peak cavitation is occurring on the turbine runners. Online cavitation monitors are being developed that will monitor and map conditions over long-term operations. Current cavitation damage is being repaired and the new monitors are being installed.

"Besides predicting and reducing the damaging effects of cavitation, this research could reduce the hazards employees are exposed to during cavitation repairs. Cavitation is very damaging and requires extensive corrective maintenance to repair. Any steps that can be taken to reduce cavitation would be beneficial."

Russell Anderson
Reliability Program Analyst, Reclamation's Power Resources Office

Future Plans

Reclamation's TSC and NCAO will work together over the long term to determine cavitation trends and further identify operational ranges to avoid cavitation, and hopes to continue to improve on cavitation detection and analysis and to refine past techniques. These new monitors could potentially be adapted to monitor and avoid cavitation in a wide variety of cavitation-prone hydro turbines. Findings will be shared through technical papers with Reclamation and the hydropower community.

More information

www.usbr.gov/research/projects/detail.cfm?id=2386

www.usbr.gov/research/projects/detail.cfm?id=9933

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Renewable Energy

The Phoenix Area Office in Arizona, in cooperation with staff from NREL, performed an analysis of the capabilities of using renewable energy to transmit water the long distance from the Colorado River to the central Arizona communities of Phoenix and Tucson. In this analysis, Reclamation worked closely with NREL staff using the "Solar Energy Suitability Analysis" Reclamation produced to locate and screen the potential renewable energy sites on Reclamation properties.

The two categories considered were utility-scale and facility-scale installations. NREL used the information provided from the Solar Energy Suitability Analysis and gave specific information on both of these categories of renewable generation. It was determined that it may be feasible to add solar generation at the Hassayampa, Arizona, commercial site to operate the existing pumping system. It was also determined that solar photovoltaic could be installed at the Phoenix Area office to augment grid connected power. NREL provided specific benefits for each installation and the potential challenges Reclamation should expect.

National Renewable Energy Laboratory Partnership

Reclamation has partnered with the National Renewable Energy Laboratory (NREL) to investigate the feasibility of primarily solar and wind (also called non-hydroelectric renewable energy) development at Reclamation's lands and facilities. Renewables can be used to meet a wide array of Reclamation needs and objectives, both on a facility scale—where renewable energy is used to supply some or all of the power demand for a Reclamation building or structure—and on a utility scale—where renewable generation is massed in a complex large enough to produce significant amounts of electricity for the power grid. Reclamation's hydropower fleet is its major source for renewable energy generation, so it is recognized that non-hydroelectric renewable energy is controversial and, therefore, its development must be directly related to Reclamation's mission and customer needs.

Developing and integrating wind, sun, and geothermal energy can help Reclamation meet Federal objectives. Possibilities include:

- Building onsite renewable energy generation to meet small or large Reclamation power loads, such as for office buildings, pumping plants, or water treatment plants, especially when old power contracts expire and costs increase
- Reducing power transmission and distribution losses and costs by making energy exchanges between Reclamation's power marketing agencies and other utilities
- Improving reliability by co-locating solar energy to provide backup power in the event of electric grid emergencies and widespread power outages
- Mitigating price shocks to customer groups
- Meeting goals associated with the *Guiding Principles for High Performing and Sustainable Buildings* where energy consumption from renewable energy is one of the guiding principle requirements and installing non-hydroelectric renewable energy will further a building's progress towards compliance

Development must consider a range of factors including administration goals, available budget, local renewable resources, permitted land uses and environmental constraints, existing loads and market prices, and viable business models for either Federal or private development. NREL has worked with Reclamation to:

- Use Geographic Information System (GIS) to identify Reclamation-owned land (by county), which are potentially suitable for utility-scale concentrating solar power, photovoltaic, and wind power development. The counties with the greatest potential for power development with Reclamation lands were identified and ranked from highest to lowest. Further analysis is necessary at each individual site to identify the specific capacity potential based on Reclamation's lands and facilities.
- Assess the facilities at the Phoenix Area Office in Arizona. The facility can host up to 200 kilowatts (kW) of photovoltaic power. Salt River Project incentives are available for systems up to 30 kW in size. The payback for a Federal Government-owned system (up to 30 kW) is estimated to be 27 years. A power purchase agreement with a private developer may have better cost benefits.

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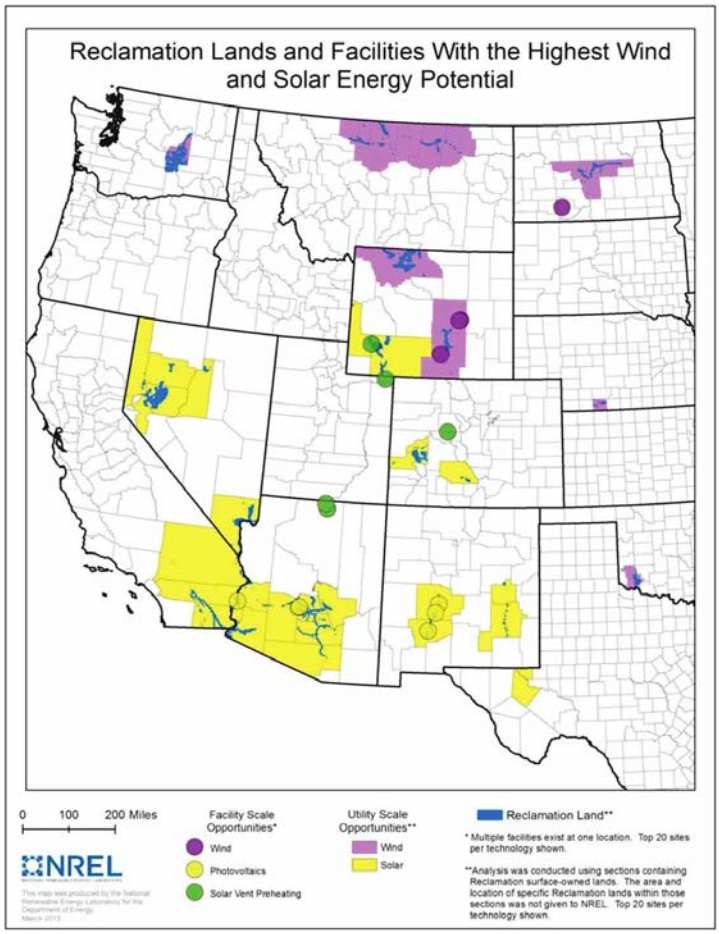
- Assess the economic feasibility analysis of installing photovoltaic (PV) at the Willows Office and Lake Berryessa Recreation Resources Branch facility (Lake Berryessa facility) in California. The Willows Office already has a small PV installation that generates approximately 12,000 kilowatt hours (kWh) per year. Reclamation identified other areas that could accommodate 265 kW (93 kW is sufficient to make the office net zero). Payback is estimated to be 15 years for a third party-owned system. The Lake Berryessa facility has three ground-mounted photovoltaic power opportunities totaling 133 kW. Estimated payback is 15 years for a third party-owned system and 22 years for a Federal Government-owned system. However, operational constraints may preclude actions now.

- Conduct site assessments of potential sites for utility-scale concentrating solar power and photovoltaic facilities along the Central Arizona Project and the Yuma Area Office in Arizona.

- Evaluate the suitability for wind energy development in the North Platte cluster in Montana and west of Casper, Wyoming, to identify parcels most suitable for wind energy development. In Montana, one parcel (Chouteau County cluster) can support over 300 megawatts (MW) of wind energy development; two parcels (Glacier County and Philips County clusters) can support approximately 100 MW each; and five additional parcels that can potentially support modest wind energy development (50 to 100 MW). In general, Reclamation-owned parcels do not appear to offer compelling advantages over nearby non-Reclamation-owned land. In most cases, Reclamation-owned parcels will need to be aggregated with adjacent non-Reclamation-owned land to support a large wind farm.

- Provide training to over 60 Reclamation employees on non-hydroelectric renewable energy at Reclamation. This 3-day training session included participation from the Bureau of Land Management, National Park Service, U.S. Fish and Wildlife Service, and Nevada State agencies. Topics ranged from technical information on solar and wind technologies to environmental concerns, NEPA compliance, and case studies for facility- and utility-scale development at Reclamation.



"The working relationship with NREL was terrific and I recommend using their services in the future for other renewable energy endeavors."

Mitch Haws
Water Resource Planner, Reclamation's Lower Colorado Region

More information

www.usbr.gov/research/docs/updates/2012-24-renewable-energy.pdf

Top 10 counties and top 20 facilities (by technology) for potential renewable energy deployment (see *Renewable Energy Assessment of Bureau of Reclamation Land and Facilities Using Geographic Information Systems* at: www.nrel.gov/docs/fy13osti/57124.pdf).

Utility-scale solar and wind data can be viewed as part of the BORGIS Tessel web mapping application (http://dogis/Tessel8).

Please note that Tessel is a Reclamation-specific web application and is not available to the public.

RECLAMATION Managing Water in the West

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Bulletin 2014-15

The Knowledge Stream
Research Update

How Much Does it Cost to Start/Stop a Hydrogenerator?

Determining start/stop costs for hydropower generators to support integrating renewable power into the grid

Bottom Line

Integrating renewable energy into the power system requires existing energy sources to provide additional services to ensure the reliability of the power system. These additional services, such as increased starts/stops, have both direct and indirect costs directly correlated to capital costs, maintenance, and operation. This project strives to determine realistic costs realized by hydro utilities when incorporating renewables into their energy portfolio.

Better, Faster, Cheaper

Being able to assign costs for each time a hydropower generator is started/stopped allows planners to determine the most cost efficient and effective way of operating powerplants and integrating wind and solar energy into the power grid. Understanding the associated costs allows the utilities to have an improved understanding of costing for the services they provide over the life of equipment to support renewables.

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Problem

Having power available anytime you want to plug in a device is a tough balancing act, juggling energy demands with power production—on a minute-to-minute basis. Traditional powerplants using coal need a long time to ramp up to produce energy and cannot change output quickly. Wind and solar energy production rely on natural cycles, so their availability may not match demands. Hydro generation has unique characteristics that make it attractive as a source of variable power. Hydro can be started, stopped, and load-changed more easily and economically than steam generation. In fact, many hydrogenerators are operated in just this way—as a variable supplement to base-loaded powerplants.

Thus, hydropower generators can be held in a reserve mode, ready to deploy to meet demands in a more flexible manner, but these operations also must consider many factors such as water operations, water availability, and generator maintenance.

Starting and stopping generators help to balance power availability and assist in integrating wind and solar energy into the power system. However, just like driving your car in stop-and-go traffic, which causes more wear and tear on your engine, more frequent starts/stops can increase the cost of operation and maintenance. When a generator is called upon to start from dead-stop (not spinning) to become available for service, there are impacts on staff, equipment, and water supply. These impacts have real effects on operation and maintenance practices and overall plant costs. As more starts/stops are required, these costs increase and should be accounted for. It may be appropriate for the increased costs to be incorporated into power rates charged to customers.

The question is: how much of an increase is there, and how are these costs determined? Powerplant operations are complex, spanning a wide range of factors. Because each plant is unique, no single start/stop cost factor can be applied to all plants. The fossil fuel generation industry has done extensive research into costing unit cycling, but very little reliable information exists in the hydroelectric industry about start/stop costs. The available studies approach the costing task in different ways and, currently, there is no industry standard for which cost factors should be included or how to derive the cost of each factor.

John W. Keys III Pump-Generating Plant, Grand Coulee Dam, Columbia Basin Project, Washington.

Thus, a start/stop cost model is needed that addresses all potential cost factors and that provides a reasonable framework for calculating start/stop costs at a powerplant—to use at Reclamation powerplants and, possibly, to be adapted industry-wide.

Solution

As part of this Reclamation Science and Technology Program research project, a model was developed that includes cost factors of increased maintenance, accelerated equipment degradation, lost generation opportunity, lost water, and reduced efficiency. This model was then used to calculate start/stop costs for a pilot plant, resulting in a cost of approximately $274 to $411 per start/stop, depending on assumptions used. These figures should be used with caution, representing only one generating unit at one plant. However, these numbers are consistent in magnitude with other industry studies that use different assumptions and methods.

The control room at Flatiron Powerplant, Colorado-Big Thompson Project, Colorado.

This research includes a sensitivity analysis that identifies which cost factors are most important to overall start/stop costs, thus providing direction for future emphasis in refining costs. The model and methods developed in this research can be applied at other Reclamation powerplants. Experience at other plants will improve the model and broaden the base of data analyzed, better ensuring a reasonable start/stop cost.

Application and Results

For the pilot plant test study, the Flaming Gorge Powerplant on the Green River in northeastern Utah, and part of the Colorado River Storage Project in the Upper Colorado Region, was selected. Start/stops have significantly increased at the powerplant in the last several years. This test study found that some cost factors are more significant than others and that the relative importance of factors may depend on the site.

Right Powerhouse, Grand Coulee Dam, Columbia Basin Project, Washington.

Future Plans

The results of the hydro model data project provide a good starting point in working with other hydropower producers, power marketing administrations, and renewable energy integration model builders in creating more accurate models. The results of this study can be used to direct future research and as a template for start/stop cost analysis at other Reclamation plants. Full-fledged data collection for improving integration models (planning and/or real-time dispatching) will require significant improvement in Reclamation's data collection and reporting systems. This improvement can be coordinated with another initiative to establish standard operations reporting data throughout the hydropower industry.

"Reclamation is being called upon more frequently to start and stop units to support grid reliability, but the tools and methods available to understand the costs of these start/stops have been lacking. The development of this cost model will provide great value to Reclamation by delivering more reliable start/stop costs through a more user-friendly process."

Mike Pulskamp
Renewable Energy Program Manager, Reclamation's Power Resources Office

Collaborators

- **Reclamation's Power Resources Office and Flaming Gorge Powerplant**
- **National Renewable Energy Laboratory**
- **Centre for Energy Advancement through Technological Innovation (CEATI)-Hydraulic Plant Life Interest Group**
- **Bonneville Power Administration**

More information

www.usbr.gov/research/projects/detail.cfm?id=6144

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RECLAMATION Managing Water in the West

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The Knowledge Stream
Research Update

Hydrokinetic Demonstration Results to Date and Path Forward

Can hydrokinetic projects work in canals while still maintaining efficient water and power deliveries?

Bottom Line

Develop and calibrate a model (HEC-RAS) to determine if a HK project could work in a particular canal while maintaining efficient water and power deliveries. This tool will use canal geometry and operating information to predict impacts on water delivery systems and associated powerplants from HK turbines.

Better, Faster, Cheaper

This model will be a useful tool for both private developers and water system owners to help determine if and where an HK device could be deployed without impacting existing water or power operations, before any installations are made.

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Problem

Unlike traditional hydropower or low-head hydropower, hydrokinetic (HK) devices do not require a reservoir or head drop to operate. HK devices use flowing water to turn the turbine rotor and produce energy. In general, Reclamation's canals were designed so that water flows slowly and efficiently to deliver water with the least amount of wasted energy possible. Thus, adding a new component such as an HK device could impact canal hydraulics. Moreover, powerplants or other existing hydraulic structures and facilities in the system could be affected, lowering their efficiency. Therefore, these HK devices should only be installed in systems and at strategic locations where they can operate without causing negative impacts to existing canal operations. Careful consideration should be given to determine if and where this could be possible.

Since 2011, Reclamation has received requests from private HK developers to install their technology in Reclamation canal systems for demonstration testing. This is a relatively new field and, while many new technologies are being developed, their impact on the performance of the overall system is still largely unexplored.

Solution and Application

As the impacts of this technology on existing systems are unknown, Reclamation partnered with a private developer to install an HK device and to determine the hydraulic effects of these devices on existing water delivery and hydropower operations.

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The HK device is attached to a spanning structure that is secured to both sides of the Roza Canal on concrete foundations. The spans prevent contact with the existing canal structure to preserve the physical integrity of the canal lining, as well as ongoing operations. Visitors to the site (left to right): Jane Shaw, Canadian Consulate Seattle; Shannon Halliday, IES; Sid Ottem, Reclamation; Brett Hawse, IES; Ken Miller, IES; Phil Georgariou, BAE Systems; Ali Grovue, IES; Jim Hawse, IES; Shane Grovue, IES; and Congressman Doc Hastings.

— continued

In August 2013, Instream Energy Systems Corporation (IES) deployed their newly designed 25 kilowatt (kW) BAE Systems rotor and generation system in the Roza Main Canal near Yakima, Washington, about 5 miles upstream from the existing Roza Powerplant.

This Reclamation Science and Technology Program research project will use the data from this installation to develop a computer modeling tool to predict the devices' impacts on canal systems. Water surface elevations and canal velocities were measured, which if changed, could alter the canal operations (e.g., raising the canal's water levels or impeding the waterflow). Physical data from this installation is currently being used to calibrate the numerical model under a range of canal and HK turbine operating conditions. By using this model, private developers and water system owners can evaluate if an HK device could be deployed without impacting existing water delivery operations.

To ascertain the effects of the HK device on existing hydropower operations, a performance test on the downstream Roza Powerplant was also conducted. As the device did not impact hydropower performance at the Roza Powerplant, it was determined that there was no need for further testing for existing hydropower impacts at the powerplant. However, as each hydropower plant has varying circumstances and factors that need site-specific consideration, further analysis will be needed for each potential site to determine the hydraulic impacts to any existing hydropower operations.

"A well-developed numerical model will be a useful tool for both private developers and water system owners to help determine if and where a hydrokinetic device could be deployed without impacting existing water delivery operation, before any installations are made."

Josh Mortensen
Hydraulic Engineer, Reclamation's Technical Service Center

Future Plans

It is anticipated that testing at the Roza Canal will continue through 2015, with various configurations of turbine scenarios. Field results will help calibrate the numerical model to better predict impacts within the range of conditions that have been tested. For example, Reclamation or an irrigation district could provide canal geometry and operational information and the model could then predict what impacts would occur, determine whether HK devices are appropriate and, if so, then identify potential places for effective HK use.

Tagline and Rio Grande Acoustic Doppler Current Profiler (ADCP) at a section upstream from the HK turbine. Canal velocities were measured at the same cross-sections as water surface elevations with and without the HK device operating for comparison.

Reclamation recognizes the valuable opportunity to provide field testing and help further understand the operational criteria and limitations of HK devices. As with other renewable energy technologies, the market and economics will help define the niche that these devices can play in the future of the electrical power grid.

More information

www.usbr.gov/research/projects/detail.cfm?id=7973

http://instreamenergy.com/projects/yakima-washington/

Collaborators

- **Reclamation's Power Resources Office**
- **Instream Energy Systems Corporation**
- **Sandia National Laboratories**

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Hydro Award Recipients

Hydro Research Foundation Announces New Research Awards Program Recipients

The Hydro Research Foundation (Foundation) was established in 1994 and became an independent 501(c)(3) non-profit corporation in 1996. The Foundation has two principal objectives: 1) to facilitate research and 2) to promote educational opportunities related to hydropower.

On May 30, 2014, the Foundation announced 12 new research students joining its Research Awards Program, a Fellowship program.

The Fellowship program was established to award research opportunities to graduate-level students researching topics of interest to the hydropower industry through a 2-year, $1 million grant from the U.S. Department of Energy's Wind and Water Power Program.

A selection committee that represents utilities, academia, industry, and researchers selected the 2014 class of research students. Forty-five applicants from 26 universities applied and 12 were selected to conduct research related to conventional or pumped storage hydropower. The research students selected began their work with the Foundation as early as June 2014.

More than 25 students working with the Foundation attended the HydroVision International Conference in Nashville, Tennessee, in July 2014. The new research students introduced their topics of study and 25 final findings were presented by previous classes of Fellows.

The Foundation will be working with the hydropower industry to secure internships, partnerships, mentors, and career opportunities for each of these research students.

Contact: Brenna Vaughn, Program Director | Hydro Research Foundation, 303- 324-1736, brenna@hydrofoundation.org

PennWell Hydro Group Announces Inaugural Class of Women With HydroVision Award Recipients

On July 1, 2014, the PennWell Hydro Group (HydroWorld) announced the inaugural class of recipients of the Women with Hydro*Vision* Award.

This award program is designed to honor the most influential women in the hydropower industry. As the industry itself is rather diverse, the market/award was divided into 10 separate categories. The 2014 winners are listed below by category:

- Communications; Public Relations; Industry Support—Deborah Linke, Executive Director and President
- Dam Safety—Peggy Harding, Chief Dam Safety Engineer
- Engineering Consulting and Plant Services/Maintenance—Lorraine Krout, Chief Executive Officer
- Environmental Protection and Mitigation—Celeste N. Fay, Senior Project Engineer
- Equipment Supply—Jeanne Hilsinger, President and Executive Chairman
- Marine and Hydrokinetic Energy—Susan Skemp, Executive Director
- New Development—Kristina Johnson, Chief Executive Officer
- Policies and Regulations—Linda Church Ciocci, Executive Director
- Power Plant Portfolio Management/Operations and Maintenance—Janet M. Audunson, P.E., Esq., Senior Counsel
- Research and Technology—Maryse Francois-Xausa, Senior Vice President

These 10 women were all nominated by their peers and were selected for this honor based on the tremendous influence and impact they have had on the larger hydropower industry.

The awards were given at the Women with Hydro*Vision* luncheon at the HydroVision International Conference in Nashville, Tennessee, in July 2014.

More Information

Information about the Hydro Research Foundation can be found at: www.hydrofoundation.org/index.html

More information about the Hydro Research Foundation's 2014 Research Awards Program recipients and their topics of study can be found at: www.hydrofoundation.org/awardNews.html

Information about the PenWell Corporation can be found at: www.pennwell.com/index.html

Information about the PenWell Hydro Group (HydroWorld) can be found at: www.hydroworld.com/index.html

More information about the 2014 winners can be found at: www.hydroworld.com/articles/2014/06/inaugural-class-of-women-with-hydro-vision-award-recipients-announced.html

Recent Hydropower/Renewable Energy Research Products

The following publications were either sponsored or produced by Reclamation's Research and Development and Power Resources Offices.

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Bureau of Reclamation. April 2012. *Technology Review: Stator Winding Insulation Life Expectancy and Start/Stop Related Aging.* CEATI Report No. T102700-0369. Hydraulic Plant Life Interest Group (HPLIG). Report for Centre for Energy Advancement through Technological Innovation (CEATI) International, Inc., Montreal, Quebec, Canada.

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Bureau of Reclamation, Power Resources Office. July 2013. *Pumped Storage Evaluation Special Study: Yellowtail, Seminoe, and Trinity Sites*. Final Phase 2 Report.

Bureau of Reclamation, Power Resources Office. August 2014 Expected Release. *Pumped Storage Screening Study II*.

Claire, Kyle and Jeff Stenberg. October 2012. *Signal Processing Techniques for Determining Powerplant Characteristics*. Bureau of Reclamation Science and Technology Program, Project ID 9962.

HDR Engineering, Inc. May 2014. *Assessment of the Potential for In-Stream Hydrokinetic Technologies in North America*. CEATI Report No. T122700-0539. Strategic Options for Sustainable Power Generation Interest Group (SOIG). Report for Centre for Energy Advancement through Technological Innovation (CEATI) International, Inc., Montreal, Quebec, Canada.

Sandia National Laboratories, Water Power Technologies. Quarterly Release. *Canal Based Hydrokinetic Testing: Summary of Activities*. Water Power Milestone Report. Prepared for the Wind and Water Power Technologies Program, Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy, Washington D.C.

Jim DeHaan installing specialized monitoring equipment inside a generator.

Hydroplant condition monitoring setup.

Hydrogenerator Condition Monitoring

Jim DeHaan is a senior electrical engineer for the Hydropower Diagnostics and SCADA Group in Reclamation's Technical Service Center. Jim is presently leading a research effort to develop and implement a hydrogenerator condition monitoring system. The system software was developed "in-house" and is designed to work with a wide variety of off the-shelf data acquisition hardware. The software measures, analyzes, and stores sensor data from the generator that are used to help predict the "health" of the unit. Having more information available to plant operators enhances their understanding of generator conditions and reduces operation and maintenance costs—the largest expense for a hydropower plant.

One of the system's main uses thus far is to monitor turbine generator vibration. High vibration can lead to generator damage and, potentially, to catastrophic failure. The monitoring system helps detect and diagnose high vibration conditions and can alert plant personnel to a potential problem.

The monitoring system is currently installed on over a dozen generators at various Reclamation powerplants, and several more sites are either scheduled for installation or under consideration. The short term goal is to equip nearly half of Reclamation generators with this hydrogenerator condition monitoring system.

Contact: James (Jim) DeHaan | Reclamation's Technical Service Center
303-445-2305, jdehaan@usbr.gov

Federal Highway Administration Adopts Reclamation Hydraulic Model

The Federal Highway Administration has officially adopted Reclamation's Sedimentation and River Hydraulics–Two-Dimensional Model (SRH-2D) hydraulic and sediment transport model to simulate the river hydraulics past bridge crossings. This model was developed by Dr. Yong Lai of the Sedimentation and River Hydraulics Group in Reclamation's Technical Service Center (TSC) and has been used extensively by TSC, several area offices, consultants, and others internationally.

The hydraulic model simulates water depth and velocity along and across the river channel and floodplains for a given streamflow hydrograph. The model is also capable of simulating the erosion and deposition of sediment over time. These results are important for protecting infrastructure and property and for restoring habitat to keep Reclamation projects functioning.

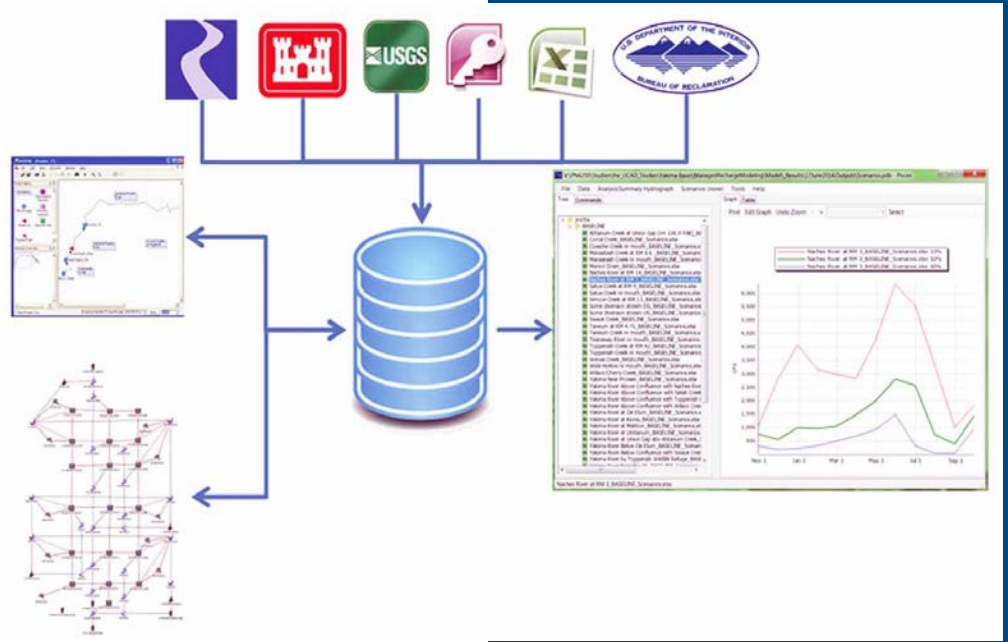
Contact: Yong Lai | Reclamation's Technical Service Center
303-445-2560, ylai@usbr.gov or

Timothy (Tim) Randle | Reclamation's Technical Service Center
303-445-2557, trandle@usbr.gov

Pisces

Large datasets often show data for long periods of time at fine temporal resolutions. These large datasets can be unwieldy and hard to manipulate to determine trends and identify patterns. The Pisces tool is a powerful data management and analysis toolset that can handle large time-series datasets typically associated with hydrologic and meteorological observations and model outputs. Pisces has several built-in functions that make summarizing and analyzing large datasets easier. Pisces' open source nature, its hierarchical library organization, and the ability to program plug-ins in the C# programming language ensure a good level of flexibility in enabling Pisces to interact with multiple data repositories and modeling platforms.

Pisces is able to interface with U.S. Geological Survey, U.S. Army Corps of Engineers, Oregon Water Resources Department, and Idaho Department of Water Resources data repositories and web services to download hydrologic data. It is also able to import RiverWare DMI, MODSIM, and Microsoft Excel and Access model outputs. Pisces can be easily customized via the use of plug-ins to import any kind of time-series data, to perform virtually unlimited calculations and analyses on time-series datasets, and to interface with various modeling platforms. The Pisces source code is available on GitHub at https://github.com/usbr/Pisces and an executable installer is available at www.usbr.gov/pn/hydromet/pisces/.



Pisces Time-Series Database connects to many time-series sources.

Example Custom Programs That Leverage Pisces Libraries

RiverWare DMI	This program provides a custom data interface between Pisces and RiverWare DMI.
Pisces to MODSIM	This program loads the MODSIM model with time-series data managed by Pisces.
Rogue Biological Option Minimum Flow Checker	This custom Pisces database and program analyzes the Rogue River Basin to determine if minimum flow requirements are met depending on time of year, river gage, ramping rates, and upstream and downstream diversions.
U.S. Geological Survey Oregon Water Resources Department Idaho National Labs Idaho Power Company Natural Resources Conservation Service's Snotel	Custom programs for each of these data types leverage the different Pisces libraries to import data into the Pacific Northwest Region's Hydromet System.

Contact: Karl Tarbet | Reclamation's Pacific Northwest Region
208-378-5272, ktarbet@usbr.gov

Multimedia Around Reclamation

"About a year ago, Great Plains' Public Affairs folks were brainstorming how to better 'tell our story.' That effort led to development of a [hydroelectric dam] model we can use for outreach events. We have already identified several events where we can use the model to spread the word about who we are and what we do.

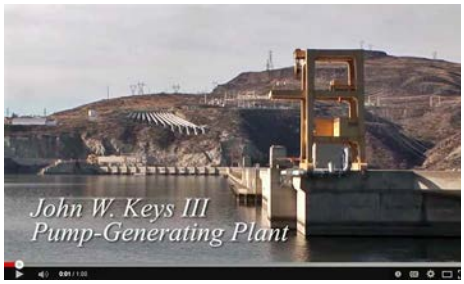
"Buck Feist is our primary person for this. From concept through design and development, he cajoled, coordinated, collaborated, and delivered the product. Perhaps our partners in the U.S. Corps of Engineers or one of the power marketing agencies may want one for their outreach?"

Michael (Mike) Ryan
Regional Director,
Reclamation's Great Plains Region

"Buck [Feist] and the crew did a nice job running through the various design and build stages of putting the model together. I think it will serve us nicely at a good number of public outreach events in the coming years."

Tyler Johnson
Supervisory Public Affairs Specialist, Reclamation's Great Plains Region

How It Works: John W. Keys III Pump-Generating Plant



The pump-generating plant at Grand Coulee Dam was completed in 1973. It contains 12 pumps that lift water from the Columbia River up the hillside to a canal that flows into Banks Lake, which provides irrigation water to over 670,000 acres in the Columbia Basin Project. Six of the pumps can be reversed to generate hydroelectricity when demand exists.

Published on August 7, 2014. See:
www.youtube.com/watch?v=kuLpIUeAqHs&feature=youtu.be

Hydroelectric Dam Model

Working Model of a Hydroelectric Dam—This is the scale working model of a Hydroelectric Dam built for Reclamation. It was built to illustrate four concepts of a hydro dam: 1) the spillway, 2) the bypass, 3) the riverflow, and 4) electric generation.

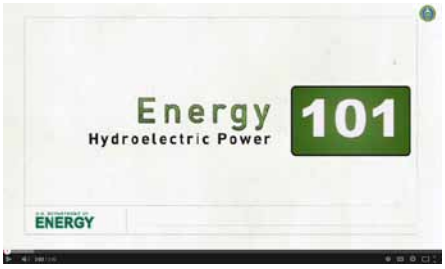
Published on June 3, 2014. See:
www.youtube.com/watch?v=ufB3U6GxnUQ&feature=youtu.be

Grand Coulee Dam: A Man-Made Marvel

The *Grand Coulee Dam: A Man-Made Marvel*, produced by Reclamation's Pacific Northwest Region Public Affairs Office, is now showing to enthusiastic audiences at the dam's Visitor Center. This film, newest in the lineup, is loaded with historic construction footage, photographs, and newsreels from Reclamation's legendary hydropower workhorse.

Published on May 13, 2014. See:
Trailer: www.youtube.com/watch?v=_Z3LAj4RxHg
Full Movie: www.youtube.com/watch?v=BU4qw9zYX9Y

Energy 101: Hydropower



Learn how hydropower captures the kinetic energy of flowing water and turns it into electricity for our homes and businesses.

Published on April 19, 2013. See:
www.youtube.com/watch?v=tpigNNTQix8

Q&A With Acting Commissioner Lowell Pimley – Climate Change and Drought

Acting Commissioner Lowell Pimley provides the second in a series of podcasts. In this question and answer session he discusses climate change and drought.

Published on July 8, 2014. See:
www.youtube.com/watch?v=t0u6BdsNoV4&list=PL97E2B161CFD30D5B&index=2

DesertLCC [Desert Landscape Conservation Cooperative]

Reclamation and the U.S. Fish and Wildlife Service have partnered to develop the *DesertLCC* webinar video series. The Desert LCC is a binational, self-directed, non-regulatory regional partnership formed and directed by resource management entities as well as interested public and private entities in the Mojave, Sonoran, and Chihuahuan Desert regions of the Southwestern United States and Northern Mexico. Through collaborative partnerships, the Desert LCC seeks to provide scientific and technical support, coordination, and communication to resource managers and the broader Desert LCC community to address climate change and other landscape-scale ecosystem stressors.

For further information about Desert LCC please visit www.usbr.gov/dlcc/.

Latest webinar series video published on June 19, 2014. See:
www.youtube.com/user/DesertLCC/feed

Reclamation Climate Change Research Series

This video series summarizes collaborative research addressing climate change and variability impacts, estimating flood and drought hazards, and improving streamflow prediction. This information was presented in January 2014 at the Second Annual Progress Meeting on Reclamation Climate and Hydrology Research. To learn more about climate change and variability research please visit www.usbr.gov/research/climate.

Latest series video published on May 29, 2014. See:
www.youtube.com/playlist?list=PLvHsnLEo5Rt4MZjJ1sYrmEXvQm7TVcMYv

Introducing the Downscaled Climate and Hydrology Projections

These two videos serve as an introduction to the *Downscaled Climate and Hydrology Projections* website. Several Federal and non-Federal agencies partnered and collaborated on this website, which provides access to downscaled climate and hydrology projections for the contiguous United States and parts of Canada and Mexico, derived from contemporary global climate models.

In the first video, Dr. Subhrendu Gangopadhyay, hydrologic engineer at Reclamation's Technical Service Center, introduces the website and provides an overview of the MetEd lesson, *Preparing Hydro-Climate Inputs for Climate Change in Water Resources Planning*. This lesson provides necessary background information needed to use the projections site effectively to retrieve climate and hydrology projections data for impacts analysis. In the second video, Dr. Gangopadhyay steps through the process of retrieving projections data using the website.

This resource, produced in cooperation between Reclamation and the COMET® Program, is hosted on COMET's YouTube Channel.

Published on January 29, 2014. See:
Videos: www.youtube.com/playlist?list=PLsyDl_aqUTdERdXxM0guc1ZHWj1Eqzknk
Website: http://gdo-dcp.ucllnl.org/downscaled_cmip_projections/
MetED Lesson: www.meted.ucar.edu/training_module.php?id=959

Recent Events

This list of events is intended for informational purposes only and does not necessarily constitute an endorsement by Reclamation. These events may be of interest to the science, research, and related communities and are not necessarily hosted by Reclamation.

Find our most recent list of events at: www.usbr.gov/research/events.

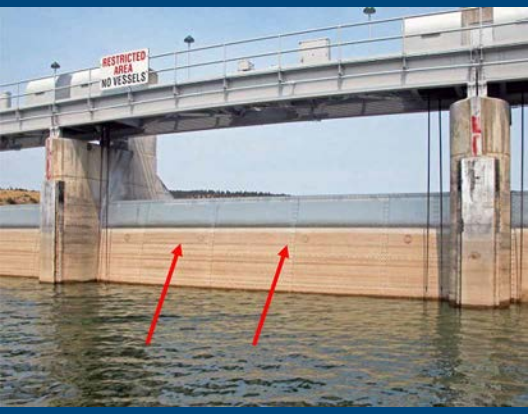
HydroVision International Conference and Exhibition

July 22 - 25, 2014 | Nashville, Tennessee

The HydroVision International Conference and Exhibition, the year's largest gathering of influential hydro decisionmakers, featured more than 70 sessions and over 450 speakers covering a wide range of topics important to the further development of hydropower.

The HydroVision International Conference and Exhibition is the leading annual hydro event with more than 3,000 attendees and over 300 exhibitors, which offered attendees countless opportunities to network, share best practices, meet with product and service providers, and more.

Radial gate on East Low Canal.



Radial gate with impressed current cathodic protection at Angostura Dam. Low profile disc anodes can be seen mounted to the skin plate.

The opening keynote was from Lieutenant General Thomas P. Bostick, the Commanding General of the U.S. Army Corps of Engineers (Corps), on plans and investments for modernizing the Corps' fleet of aging hydropower and civil infrastructure facilities. Attendees also heard from the World Bank as "sustainable hydropower is part of the solution for tackling the development challenges encompassed in its mission to end extreme poverty within a generation and boost shared prosperity."

Additional conference and exhibition information:

http://s36.a2zinc.net/clients/pennwell/hvi2014/Public/Content.aspx?ID=43509

Corrosion Mitigation of Gates—Webinar Training

July 24, 2014 | Denver, Colorado

Reclamation has hundreds of gates on structures such as dams, canals, and pumping plants. Due to the high cost and frequency of recoating, Reclamation is increasingly considering retrofitting gates to include cathodic protection as part of the corrosion mitigation system. Jessica Torrey in Reclamation's Technical Service Center presented information on design, installation, maintenance, and testing of corrosion mitigation for gates. Additionally, Jessica presented an introduction to the Mobile Information Collection Application (MICA). This is an app for tablets, which was developed by the U.S. Corps of Engineers and has been tailored for field data collection of cathodic protection systems. The field test and integration of this app into Reclamation is being funded through Reclamation's Science and Technology Program (www.usbr.gov/research/projects/detail.cfm?id=6816). This Reclamation-hosted webinar training consisted of a 40-minute presentation followed by 20 minutes of questions, answers, and comments.

Contact and additional webinar training information:
Jessica Torrey, 303-445-2376, jtorrey@usbr.gov
Daryl Little, 303-445-2384, dlittle@usbr.gov

https://www4.gotomeeting.com/register/886793375

Safety Evaluation of Existing Dams International Technical Seminar and Study Tour

June 10 - 19, 2014 | Denver, Colorado

Reclamation officials provided the training for this seminar. The first portion of this seminar took place in Denver, Colorado, and consisted primarily of classroom presentations and discussions. A tour of the Reclamation Research Laboratories was also featured. Lectures, case histories, and structured discussions covering all aspects of a dam safety examination program were led by Reclamation engineers and geologists with extensive experience and knowledge in the areas of design, construction, operation, maintenance, and dam safety. The training outlined the hydrologic, seismic, geotechnical, electrical, mechanical, and structural considerations of dam safety as well as operation, maintenance, surveillance, and emergency preparedness. Presentations, case histories, and a walk-through abbreviated examination was used to present the multidiscipline approach to an effective dam safety program. The second portion of this seminar consisted of site visits and took participants to the States of Nevada and Oregon. Participants also enjoyed a "free" day in Las Vegas, Nevada.

Contact and additional seminar and study tour information:
Leanna Principe, 303-445-2127, lprincipe@usbr.gov
Angela Medina, 303-445-2139, amedina@usbr.gov
www.usbr.gov/international/seed_2014seminar.html

Hoover Dam in Arizona/Nevada.

Data Stewardship - Best Practices—Information Technology Workshop

June 10, 2014 | Denver, Colorado

Reclamation hosted U.S. Geological Survey (USGS) representative, Vivian (Viv) Hutchison, who described what data stewardship is, why it is important, and how it should be undertaken. Viv also illustrated best practices and the USGS experience. Douglas Clark in Reclamation's Technical Service Center presented, and participation via webinar was also available.

Contact and additional workshop information:
Douglas R. Clark, 303-445-2271, drclark@usbr.gov

Curt Brown, 303-445-2098, cbrown@usbr.gov

https://www4.gotomeeting.com/register/540119503

Viv Hutchison

"If your data source is well documented, you know how and where to look for your information and the results you return will be what you expect. In addition, accurate data are legally and scientifically defensible. Such data may aid the agency by reducing litigations and appeals."

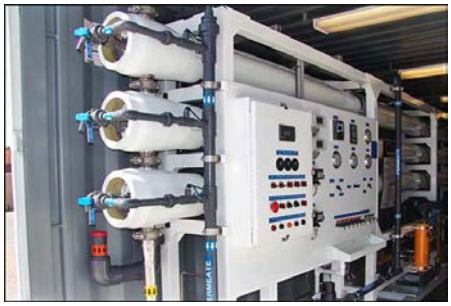
Recent Research Products

To get the information generated by research quickly into the hands of end users and the broader public, our researchers and partners publish their results in peer-reviewed journals, technical memoranda, research reports, and other venues.

Contact the authors/principal investigators for information about these documents or research projects. Use the Science and Technology Program research project ID number to access contact information or the documents themselves at:

www.usbr.gov/research/projects/search.cfm.

Rock Ramp Design Guidelines
By David Mooney, Chris Holmquist-Johnson, and Susan Broderick
Project ID 7621



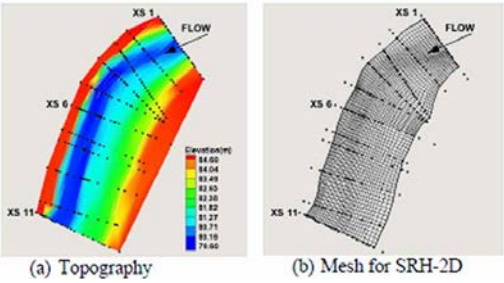
Optimizing Seawater Reverse Osmosis for Affordable Desalination
By John MacHarg
Project ID 9081

Water Resistant Concrete
By Kevin Kelly
Project ID 919

Equilbrium Scour Downstream of Three-Dimensional Grade-Control Structures
By Steven Abt, Michael Scurlock, and Christopher Thornton
Project ID 7621

On a Two-Dimensional Temperature Model: Development and Verification
By Yong Lai and David Mooney
Project ID 7872

Physical Hydraulic Modeling of Canal Breaches
By Tony Wahl
Project ID 8442



(a) Topography (b) Mesh for SRH-2D

Coupling a Two-Dimensional Model With a Deterministic Bank Stability Model
By Blair Greimann, Robert Thomas, Yong Lai, and Andrew Simon
Project ID 6606

Membrane Pretreatment With Ion Exchange for Natural Organic Matter (NOM) Removal
By Steve Dundorf
Project ID 536

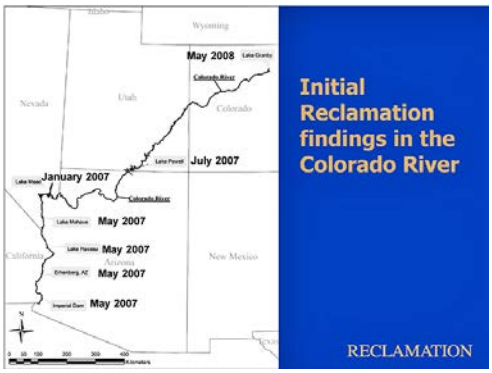
Brackish Water Treatment for Native American and Small Communities in the Pacific Northwest Region
By Steve Dundorf
Project ID 1282

Scour Analysis Upstream of the San Acacia Diversion Dam on the Rio Grande
By Yong Lai and Jon Aubuchon
Project ID 6606

Flow Calibration of Submerged Sluice Gates
By Tony Wahl
Project ID 2597

American Recovery and Reinvestment Act Toxin Data
By Chris Holdren
Project IDs 1221 and 2358

Factors Affecting the Spread of Dreissenid Mussels in Western Reservoirs
By Chris Holdren
Project ID 1221



An Analysis of Phosphorus Perchlorate Inputs to Lake Mead
By Chris Holdren
Project ID 1221

Factors Affecting the Spread of Dreissenid Mussels in Western Reservoirs
By Chris Holdren
Project ID 6003

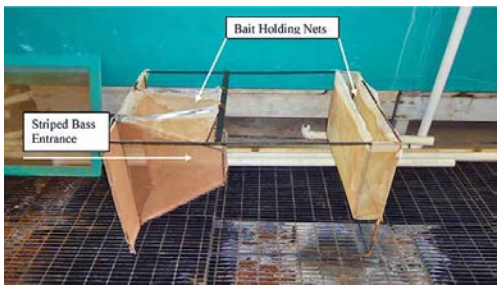
Description of Meandering Model
By Blair Greimann and Victor Huang
Project ID 92

Vegetation Modeling With SRH-1DV
By Blair Greimann
Project ID 1368

Drought Assessment Using Paleoclimate and BCSD-CMIP3 Climate Projections
By Subhrendu Gangopadhyay and Tom Pruitt
Project ID 99

Butterfly Assemblages Associated with Invasive Tamarisk (Tamarix spp.) Sites: Comparisons With Tamarisk Control and Native Vegetation Reference Sites
By Mark Nelson and Richard Wydoski
Project IDs 5524 and 9331

The Influence of Rebates on the Purchase of and Willingness to Pay for Water Conservation Devices
By Steven Piper
Project ID 1591



Fish Predator Reduction Using Fish Traps With Bait Attraction
By Josh Mortensen
Project ID 4290

Invasive Mussel Control in Pipelines Using Turbulence—Field Demonstration Testing
By Sherri Pucherelli
Project ID 7169
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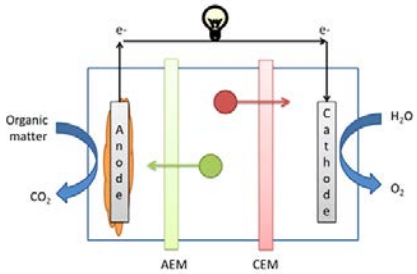
Lake Mead Revised Carbon Dioxide Study Plan
By Kevin Kelly
Project ID 1367

The Value of Water: Scoping a Research of Analysis
By Darlene Tuel
Project ID 7013

The Influence of Conservation Pricing and Other Non-Price Factors on Residential Water Demand
By Steven Piper
Project ID 414



Microbial Desalination Fuel Cells: Assessment of Technology Status and Potential Benefit for Reclamation
By Katherine Guerra
Project ID 8673

Final Report for Estimating Unmetered Ground Water Irrigation Demand With High-Resolution Remote Sensing Data
By Eve Halper
Project ID 1545

Pulsed-Power Electromagnetic Effects on Crystallization in Reverse Osmosis Systems
By Katherine Guerra
Project ID 3195

Produced Water Project Update
By Katherine Guerra
Project ID 8552

Use of Nanofiltrationon Recycled Water for Energy Production
By Katherine Guerra
Project ID 400

Projected Impacts of Climate Induced Water Quality Trends on Reclamation Operations
By Katharine Dahm
Project ID 4311

Rope Access Anchors: Research and Testing of Concrete Anchor Bolts
By Shaun Reed
Project ID 6390
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Monitoring Invasive Quagga Mussels, Dreissena rostriformis bugensis (Bivalvia:Dreissenidae), and Other Benthic Organisms in a Western U.S. Aqueduct
By Mark Nelson
Project ID 4442

Using Ultrasound as a Tool for Fish Research and Management
By Susan Broderick
Project ID 4067

Evaluation of Non-Nuclear Moisture Meters and Moisture-Density Gages for Reclamation Construction QC/QA
By Robert Rinehart
Project ID 8920

Evaluation of Intelligent Compaction Technology Based on Correlations to Relative Density
By Robert Rinehart
Project ID 3785

SmeltCam: Underwater Video Technology for Identifying and Measuring Abundance of Pelagic Fishes
By Donald Portz
Project ID 3618

Linking Extreme Precipitation and Floods: Implications for Climate Change Scenarios
By Jeanne Godaire
Project ID 879

PIT Tag Monitoring for Emigrating Juvenile Chinook Salmon at Three Flow Conditions
By Donald Portz
Project ID 4427

Recent Research Products

Research Roadmapping Method Development and Pilot Study
By Daryl Little and Bobbi Jo Merten
Project ID 4022

Implementation of Geophysical Techniques to Monitor Embankment Dam Filter Cracking
By Robert Rinehart
Project ID 5500

Investigation of Climate Change Impact on Reservoir Capacity and Water Supply Reliability
By Jianchun Victor Huang
Project ID 8990

Summary of Laboratory Experiments to Evaluate Consumption of Juvenile/Adult Quagga Mussel by Redear Sunfish and Bluegill
By Cathy Karp
Project ID 9508

Summary of Predation Issue Conversations at Reclamation Facilities and Operations
By Cathy Karp
Project ID 7432

Progress Report on Testing of Commonly Used Fish Screens for Their Resistance to Invasive Freshwater Mussel Fouling
By Josh Mortensen
Project ID 4923

Characterization of Cyanobacterial Biomass in a Reclamation Reservoir
By Chuck Korson
Project ID 3837

Evaluation of Channel Catfish Ictalurus Punctatus Age/Length Structure in the San Juan River From 2002 to 2011
By Mark McKinstry
Project ID 2408

Effects of Electrofishing Removal on the Channel Catfish, Ictalurus Punctatus, Population in the San Juan River, New Mexico
By Mark McKinstry
Project ID 2408

Evaluate the Impacts of Climate Change on the Effectiveness of Habitat Restoration Structures and Restoration Activities
By Toni Turner
Project ID 8765

Investigation of Coating Fillers and Coating Fillers #2
By Allen Skaja
Project IDs 1898 and 7408
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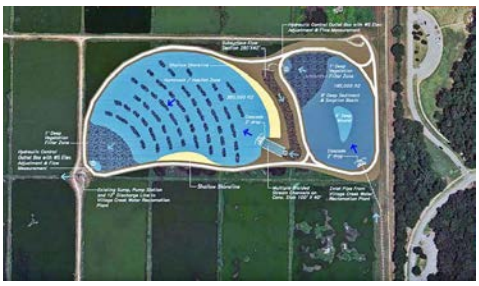
Adaptive Water Operations and Planning Decision Support Using Reliability-Based Global Optimization and Integrated-Hydrologic HydroGeoSphere Model
By George Matanga
Project ID 1010



Demonstration Project Alternatives Analysis
By Anna Hoag, Collins Balcombe, and Michelle Chapman
Project ID 104

Hydrological, Chemical, and Biological Monitoring Plan
By Joan Daniels, Katharine Dahm, Stephanie Keefe, Bryan Brooks, and Larry Barber
Project ID 104

Ecotoxicology Studies for Reclamation's Research and Development Office
By Zak Sutphin
Project ID 6407
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Development of Software Tools for Efficient Processing of Bathymetry and Discharge Data
By Daniel Dombroski
Project ID 3937

Integrated Information Management System, Development of Web Interface, a.k.a. Online Data Portal (ODP)
By Eric Peterson
Project ID 3625

Integrated Information Management System (IIMS)—An Information and Data Management System for Science-Based River Management
By Eric Peterson
Project ID 165

Resolving Disputes Over Science in Natural Resource Agency Decisionmaking
By Emily Ruell, Nina Burkardt, and Douglas Clark
Project ID 7515

An Exploration of Bureau of Reclamation Approaches for Managing Conflict Over Diverging Science
By Nina Burkardt, Emily Ruell, and Douglas Clark
Project ID 7515

Durable Foul Release Coatings
By Allen Skaja
Project ID 8305

OHRC Testing of Swim-Thru Fishway
By Ryan Couture
Project ID 7707

Change Detection Methodology for the Application of Light Detection and Ranging (LiDAR) Technology to Improve the Management and Protection of Heritage Assets in the American Falls Archaeological District, Idaho
By Dale Lindeman
Project ID 9541

GRI—Evaluation of a High Recovery NF-RO Integrated Treatment System
By Bruce Mansell
Project ID 7251

Implementation of the Endangered Species Act on the Platte River Basin: Summary of an Interview with Dr. Curtis Brown, Platte River Study Manager
By Douglas Clark and Dennis Kubly
Project ID 6641

Survey of the Reclamation Research Community Concerning Data Stewardship Practices
By Douglas Clark, Curtis Brown, Art Coykendall, and Jim Nagode
Project ID 3789

Observations on the Hyporheic Environment Along the San Joaquin River Below Friant Dam
By Gregory Reed
Project ID 5683

Science and Economic Aspects of Impact of and Adaptation to Climate Change Induced Water Scarcity in Western U.S. Agriculture
By Arisha Ashraf, Ariel Dinar, and Todd Gaston
Project ID 7430

Leaching Lithium Scoping Study
By John Robertson
Project ID 2488

Natural Biocides for Zebra and Quagga Mussel Control
By Allen Skaja
Project ID 2647

Pipeline Coatings
By Allen Skaja
Project ID 5733

Evaluation of Protective Coatings
By Allen Skaja
Project ID 1597

Electro-Osmotic Pulse Leak Repair Method: Evaluation in Trinity Dam Bonnet Chamber, Central Valley Project, Trinity River Division,California
By Daryl Little and Kurt Von Fay
Project ID 772

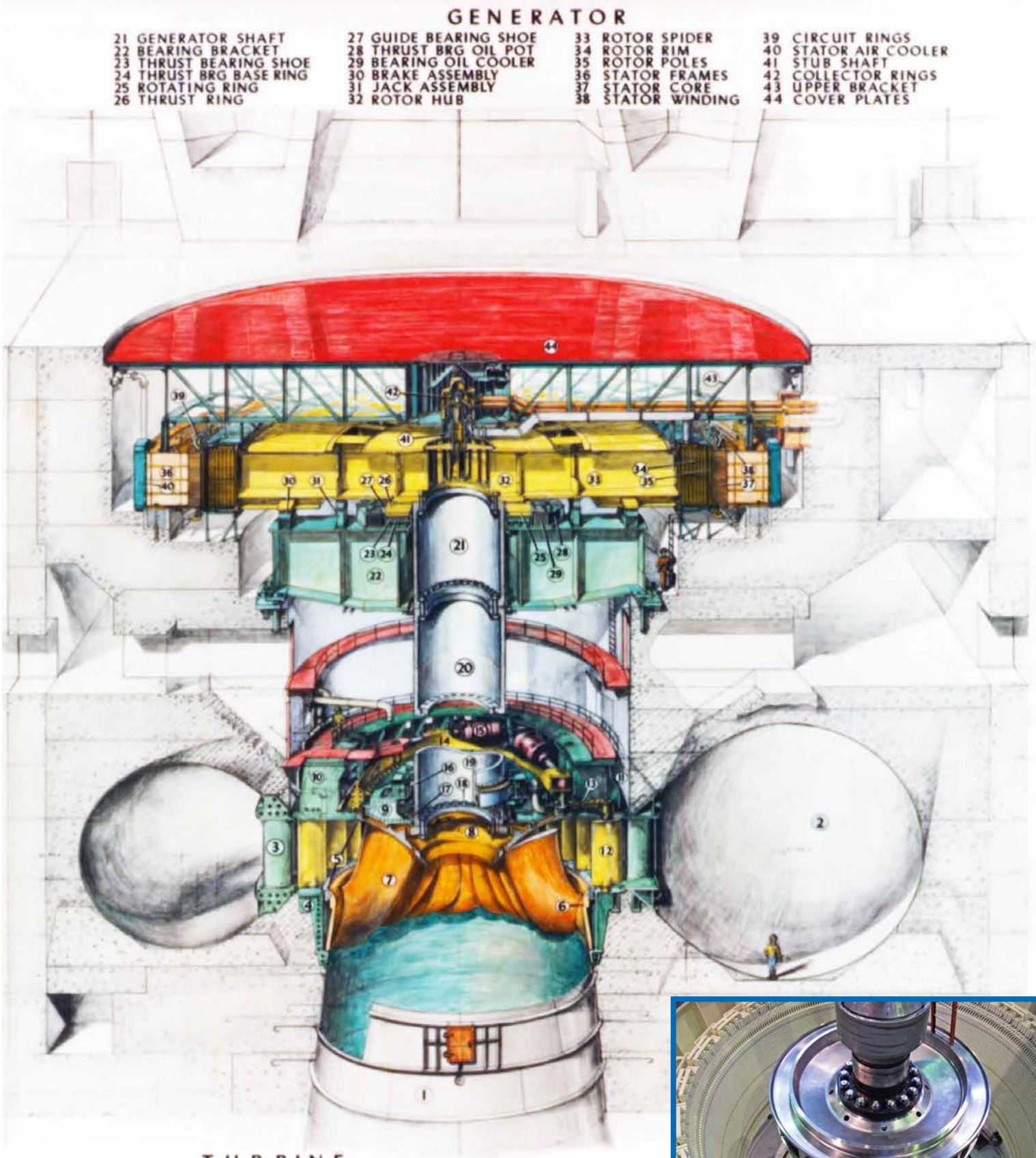
Investigation of Low Pressure Membrane Performance, Cleaning, and Economics Using a Techno-Economic Model
By John Pellegrino
Project ID 4141

Sharing Water, Building Relations: Managing and Transforming Water Conflict in the U.S. West (Instructor's Manual)
By Douglas Clark
Project ID 147

An Investigation of Incentives and Disincentives for Conflict Prevention and Mitigation in the Bureau of Reclamation's Water Management
By Kim Ogren and Aaron Wolf
Project ID 147

Sharing Water, Building Relations: Managing and Transforming Water Conflict in the U.S. West (Participant Workbook)
By Juliia Doermann and Aaron Wolf
Project ID 147

Understanding Incentives and Disincentives for Conflict Prevention and Mitigation: A Case Study Examination of the Bureau of Reclamation's Response to the Endangered Silvery Minnow in the Middle Rio Grande Basin
By Kim Ogren and Aaron Wolf
Project ID 147



Photograph and detailed drawing of Turbine–Generator. Note the size ratio of the worker in the lower right side of the drawing just above the photograph.