

COLORADO RIVER BOARD OF CALIFORNIA

770 FAIRMONT AVENUE, SUITE 100
GLENDALE, CA 91203-1068
(818) 500-1625
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June 1, 2012

**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, the Acting Executive Director of the Colorado River Board of California, that a regular meeting of the Board Members is to be held as follows:

Date: June 13, 2012, Wednesday
Time: 10:00 a.m.
Place: Vineyard Room
Holiday Inn Ontario Airport
2155 East Convention Center Way
Ontario, CA 91764-4452
TEL: (909) 212-8000, FAX: (909) 418-6703

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: Christopher S. Harris, Acting 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.


Christopher S. Harris
Acting Executive Director

attachment: Agenda

Regular Meeting
COLORADO RIVER BOARD OF CALIFORNIA
June 13, 2012, Wednesday
10:00 a.m.

Vineyard Room
Holiday Inn Ontario Airport
2155 East Convention Center Way
Ontario, CA 91764-4452

A G E N D A

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. Opportunity for the Public to Address the Board (Limited to 5 minutes)
As required by Government Code, Section 54954.3(a)
3. Administration
 - a. Minutes of the Meeting Held April 11, 2012, Consideration and Approval (**Action**)... TAB 1
 - b. Approval of Fiscal Year 2012-2013 Colorado River Board Budget (**Action**) TAB 2
4. Agency Managers Meetings
5. Protection of Existing Rights
 - a. Colorado River Water Report TAB 3
Report on current reservoir storage, reservoir releases, projected water use,
forecasted river flows, scheduled deliveries to Mexico, and salinity
 - b. State and Local Water Reports TAB 4
Reports on current water supply and use conditions
 - c. Colorado River Operations TAB 5
 - First Consultation for 2013 Annual Operating Plan
 - Status of the Colorado River Basin Water Supply and Demand Study Report
 - Research Paper Entitled “Management of Water Shortage in the Colorado River Basin: Evaluating Current Policy and the Viability of Interstate Water Trading” and Published in the Journal of the American Water Resources Association, 2012
 - d. Basin States Discussions
 - Basin States Meeting, May 4, 2012
 - Status of U.S./Mexico Binational Discussions
 - e. Colorado River Environmental Issues and Water Quality TAB 6
 - Seven Basin States’ Comment Letter on FONSI for the Environmental Assessment for Development and Implementation of a Protocol for High-Flow Experimental Releases from Glen Canyon Dam and for Non-native Fish Control Downstream from Glen Canyon Dam

Agenda (continued)

- Status of Glen Canyon Dam Long-Term Experimental and Management Plan (LTEMP) EIS Process (Basin States' Letter, Basin States' Alternative Status, LTEMP EIS Development Schedule)
- Colorado River Basin Salinity Control Forum Meeting, Midway, Utah, May 15-18, 2012
- Salinity Management Study Update Workshop, June 1, 2012, Los Angeles, California

6. Executive Session

An Executive Session may be held by the Board pursuant to 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 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.

7. Other Business

- a. Next Board Meeting: Regular Meeting
July 11, 2012, Wednesday, starting 10:00 a.m.
Holiday Inn Ontario Airport
2155 East Convention Center Way
Ontario, CA 91764-4452
TEL: (909) 212-8000, FAX: (909) 418-6703

3.a. - Approval April 11, 2012. Board Meeting Minutes

Minutes of Regular Meeting
COLORADO RIVER BOARD OF CALIFORNIA
Wednesday, April 11, 2012

A Regular 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, Wednesday, April 11, 2012.

Board Members and Alternate Present

Dana Bart Fisher, Jr., Chairman

John V. Foley

W.D. Bill Knutson

Henry Merle Kuiper

John Pierre Menvielle

David R. Pettijohn

John Palmer Powell, Jr.

Jeanine Jones, Designee

Department of Water Resources

Christopher G. Hayes, Designee

Department of Fish and Game

Board Members Absent

Terese Maria Ghio

James B. McDaniel

Others Present

Steven B. Abbott

Autumn Ashurst

James H. Bond

John Penn Carter

J.C. Jay Chen

Andrew Fisher

David Fogerson

Leslie Gallagher

Christopher S. Harris

William J. Hasencamp

Eric M. Katz

Thomas E. Levy

Lindia Y. Liu

Jan P. Matusak

Carrie Oliphant

Glen D. Peterson

Collin Powell

Halla Razak

Steven B. Robbins

Phil Rosenbrater

Jack Seiler

Tina L. A. Shields

Jesse P. Silva

Catherine M. Stites

Mark Van Vlack

Fred A. Worthly

Bill D. Wright

Gerald R. 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 the meeting to the next agenda item.

ADMINISTRATION

Approval of Minutes

Chairman Fisher asked if there was a motion to approve the March 14th minutes. Mr. Wright requested a correction on page three, paragraph three, last line. With the correction to page three made, Mr. Menvielle moved the minutes be approved. Seconded by Ms. Jones and unanimously carried, the March 14th minutes were approved.

PROTECTION OF EXISTING RIGHTS

Colorado River Water Report

Mr. Harris reported that, October 1st to April 2nd precipitation in the Upper Basin was 79 percent of normal, compared with last month where it was 89 percent of normal. The snowpack was about 54 percent of normal, and last month it was 81 percent of normal. The projected April through July runoff, as of March 19th, was 4.8 maf, or 67 percent of normal. The anticipated 2012 water year runoff was 8.25 maf, or about 76 percent of normal.

Mr. Harris reported that as of April 2nd the storage in Lake Powell was 15.46 million acre-feet (maf), or 64 percent of capacity. The water surface elevation was 3,635.4 feet. The storage in Lake Mead was 14.54 maf, or 56 percent of capacity, and water surface elevation was 1,129.4 feet. Total System storage was about 37.56 maf, or 62 percent of capacity. Last year at this time, there was 31.49 maf in storage, or 53 percent of capacity.

Mr. Harris reported that Reclamation's projected consumptive use (CU) for the State of Nevada was under its entitlement of 300,000 acre-feet (i.e. 274,000 acre-feet); and for Arizona, the CU is projected to be slightly over its basic entitlement of 2.8 maf (i.e. 2.852 maf); and for California the CU is projected to be 4.249 maf. The total projected CU for the Lower Basin is estimated to be 7.375 maf.

State and Local Water Reports

Mr. Harris reported on the climate conditions within California. In the Los Angeles Basin precipitation is well below normal for this time of year, as is most of the southland. The snowpack in the northern part of the state is up to about 80 percent of normal. In the central part of the state the snowpack is about 51 percent of normal and in the southern part of the state the snowpack was about 39 percent of normal. The runoff is about 50 percent of normal. However, State Water Project (SWP) reservoir storage is at or above normal for this time of year. North of the Delta SWP storage was about 3.1 maf, or about 84 percent of

capacity. South of the Delta SWP storage was about 1.6 maf or 89 percent of capacity. The projected SWP deliveries of Table A entitlements was reduced from 60 percent to 50 percent. Ms. Jones added that the month of March was actually above average, but not enough to make up for the previous dry months. The northern Sierra came up the most and the southern Sierra is still dry. The Sacramento River is still dry and the San Joaquin River is still critically dry. The last statewide forecast for the year, the Bulletin 120 forecast, will be out May 8th. Currently statewide, precipitation is a little below the 50 percent of average, a dry year.

Mr. Foley, of The Metropolitan Water District of Southern California (MWD), reported that storage in Lake Skinner, Lake Mathews and Diamond Valley Lake, as of April 1, was 905,200 acre-feet, or 87 percent of capacity. Diamond Valley Lake was about 741,300 acre-feet, or 92 percent of capacity. Lake Mathews was about 127,200 acre-feet, or 70 percent of capacity, down a little as its source of water, the Colorado River Aqueduct, was shut down for maintenance. Lake Skinner was about 36,700 acre-feet, or 83 percent of capacity. There was a slight decrease in the storage curve from last month. Overall, MWD plans to divert approximately 708,000 acre-feet this year.

Mr. Pettijohn, of the Los Angeles Department of Water and Power (LADWP), reported that as of April 3rd, the current precipitation conditions in the Eastern Sierra are only about half of what normally occurs. There's been a slight increase over last month but conditions are still very dry.

Colorado River Operations

Status of the Colorado River Basin Water Supply and Demand Study Report

Mr. Harris reported that Reclamation and the Project Team sought and solicited public input and suggestions associated with potential options and strategies to help resolve future basinwide water supply and demand imbalances. Of a total of 139 options/strategies received, 21 options were submitted by members of the Project Team and 118 options were submitted by the public. Currently the Project Team is working on developing the "Project Types" and "Categories" that each of the submitted options and strategies will then be included for further analysis and evaluations. The Project is still on schedule to have the final Basin Study Report published in July 2012.

Reclamation's Verification of MWD 2010 Creation of Extraordinary Conservation Intentionally Created Surplus

Mr. Harris reported that, in a letter dated March 29th, Reclamation acknowledged MWD's creation of 100,864 acre-feet of Extraordinary Conservation Intentionally Created Surplus (EC ICS). On September 8, 2011, MWD submitted its 2010 Certification Report for EC ICS. The 100,864 acre-feet of EC ICS was created through the MWD funded PVID Forbearance and Fallowing Program. This amount does not reflect the one-time five percent "cut" for the System pursuant to Section 3.B.2 of the 2007 Guidelines.

Reclamation's Approval of MWD's 2012 Plan for Creation of Extraordinary Conservation ICS

Mr. Harris reported that on July 25, 2011 MWD submitted its 2012 Plan for the Creation of Extraordinary Intentionally Created Surplus (ICS Plan). Reclamation approved MWD's proposal in a letter dated March 29, 2012. MWD's ICS Plan intends to create up to 200,000 acre-feet of EC ICS water during calendar year 2012 with a mix of: Palo Verde Irrigation District Forbearance and Fallowing Program up to 116,000 acre-feet; Imperial Irrigation District Water Conservation Program, up to 105,000 acre-feet; and MWD funded Water Supply from Desalination of up to 56,300 acre-feet.

Basin States Discussions

Status of the Binational Discussions – U.S. and Mexico

Mr. Zimmerman reported that Mexico recently responded to the February 2012 draft U.S. Minute 319. Mexico responded with three documents that will need to be translated: 1) a downsized version of Draft Minute 319; 2) a joint engineers report; and 3) a background or rationale document. The documents were presented to the International Boundary and Water Commission (IBWC) on April 10th and are currently being translated. Mr. Zimmerman reported that it appears that the U.S. salinity proposal has been accepted by Mexico. More discussion and negotiation is needed for other proposals, such as the ICMA, surplus and shortage sharing.

With respect to domestic documents, Mr. Zimmerman reported that the Basin states' Technical Team is working on forbearance and operational agreements. The Technical Team is also looking at Exhibit A to the forbearance agreement covering the proposed ICS Pilot Project and working on the Domestic Protocol for Minute 319, which will be signed by IBWC, Reclamation, Interior, and the seven Basin states.

Chairman Fisher reported that the timetable for negotiations with Mexico is looking at a September completion. Mr. Bond asked whether Mexican ICS agreement is similar to that of the Basin states. Mr. Zimmerman responded that the forbearance agreement will be patterned after the 2007 forbearance agreement, except for some nuances and language. In terms of domestic agreements, it will be an addition to the 2007 Basin States Forbearance Agreement.

Colorado River Environmental Activities

Status of the Long-Term Experimental and Management Plan Environmental Impact Statement for Glen Canyon Dam

Mr. Harris reported that the Basin states are at work developing an alternative for analysis and evaluation in the Long-Term Experimental and Management Plan Environmental Impact Statement for Glen Canyon Dam (LTEMP EIS). The Basin states, Western Area Power Administration (WAPA), and several contract scientists have prepared a preliminary outline and schedule associated with development of a Basin states' LTEMP EIS Alternative. Currently, the states are proposing to have the alternative readied for submittal

by June 2012. The preliminary schedule for development of the Basin states' alternative was included in the Board folder. The Basin states, on March 22nd, formally requested an extension of time to prepare the Basin states' LTEMP EIS Alternative. On April 3rd, Reclamation and the National Park Service, as EIS co-leads, responded and informed the Basin states, via email, that alternatives will be accepted after the original April 11th deadline, since several other stakeholders have indicated an interest to submit alternatives as well. The Basin states and WAPA are holding a conference call on April 12th to continue working on developing a proposed Basin states' LTEMP EIS Alternative.

WATER QUALITY

Colorado River Basin Salinity Control Program Status

Mr. Harris reported that the Board has provided written testimony to various House and Senate committees and subcommittees in support of Fiscal Year 2013 funding for the activities associated with Colorado River Basin Salinity Control Program. The Board's letters in support for the federal agencies' budget requests including \$14.5 million for Reclamation's Basin-wide Salinity Control Program, \$18 million for USDA's EQIP Program, and \$5.2 million for BLM's salinity control effort in the Basin. Mr. Harris reported that MWD, the State of Wyoming, CAP, and the Colorado River Basin Salinity Control Forum on behalf of the seven Basin States also submitted written testimony. Mr. Harris reported that the federal agency budget requests supported by the testimony are consistent with the 2011 Triennial Review and the recommended three-year Plan of Implementation. The main point of the letters of support is that the federal budget requests are the minimum to keep the Program moving forward.

Status of the Moab Uranium Mill Tailings Remedial Action Project

Mr. Harris reported that the Department of Energy (DOE) has moved approximately five million tons of the 16 million tons of mill tailings near the Colorado River at Moab, Utah. With the use of "stimulus funds" the DOE was able to move the project ahead of schedule. The DOE ships one train load four days a week. Each train has 36 cars, with lidded containers, at about 5,000 tones per shipment, or 20,000 tones per week. With current funding levels shipments are expected to continue through 2025.

EXECUTIVE SESSION

Chairman Fisher requested the Board recessed to hold an Executive Session at 10:42 a.m.

Chairman Fisher reconvened the Board meeting at 11:32 a.m. Chairman Fisher reported that during the Executive Session Mr. Zimmerman briefed the Board on the status of negotiation with Mexico on the issues of Minute 319.

OTHER BUSINESS

Status of Governor's Proposal to Eliminate the Colorado River Board

Mr. Tom Levy reported that Assembly Budget Subcommittee had voted to reject the Governor's proposal to eliminate the Colorado River Board (CRB) and approved the Fiscal Year 2012-2013 Budget. April 11th, the State Senate will hold a subcommittee meeting to discuss and vote on the CRB issue. The Senate is expected to release the results of their Budget Subcommittee vote by April 12th.

Next Board Meeting

Chairman Fisher announced that the next meeting of the Colorado River Board will be held on June 13, 2012, 10:00 a.m., Holiday Inn Ontario Airport, 2155 E. Convention Center Way, Ontario, California.

There being no further items to be brought before the Board, Chairman Fisher asked for a motion to adjourn the meeting. Upon the motion of Mr. Knutson, seconded by Mr. Menvielle, and unanimously carried, the meeting was adjourned 11:36 a.m. on April 11, 2012.

Christopher Harris
Acting Executive Director

3.b. - Approval of Fiscal Year 2012-2013 Colorado River Board Budget

**COLORADO RIVER BOARD OF CALIFORNIA
FY 2012-13 BUDGET**

(Budget Approved June 13, 2012; Assessments Approved June 13, 2012)

	Current Year			Anticipated	Budget	
	Authorized FY 2011-12	Funded FY 2011-12		Expenditures FY 2011-12	FY 2012-13	
1. Colorado River Board Direct Support	\$ 1,546,800	\$ 1,546,800		\$ 1,518,800	\$ 1,545,800	
State Share(General Fund)	\$ -	\$ -	0.0%	\$ -	\$ -	0.0%
Six Agency Share	\$ 1,546,800	\$ 1,546,800	100.0%	\$ 1,518,800	\$ 1,545,800	100.0%
2. Colorado River Basin Salinity Control Forum Support	\$ 40,200	\$ 40,200		\$ 40,200	\$ 40,200	
State Share(CELPF)	\$ -	\$ -	0.0%	\$ -	\$ -	0.0%
Six Agency Share	\$ 40,200	\$ 40,200	100.0%	\$ 40,200	\$ 40,200	100.0%
3. Administrative Fee/Pro Rata	\$ -	\$ -		\$ -	\$ -	
State Share (CELPF)	\$ -	\$ -		\$ -	\$ -	NA
Six Agency Share	\$ -	\$ -		\$ -	\$ -	NA
4. Total Budget Estimate						
Colorado River Board	\$ 1,587,000	\$ 1,587,000		\$ 1,559,000	\$ 1,586,000	
State Share	\$ -	\$ -	0.0%	\$ -	\$ -	0.0%
Six Agency Share	\$ 1,587,000	\$ 1,587,000	100.0%	\$ 1,559,000	\$ 1,586,000	100.0%

STATE OF CALIFORNIA
STANDARD AGREEMENT
 STD 213 (Rev 06/03)

AGREEMENT NUMBER 45
REGISTRATION NUMBER

1. This Agreement is entered into between the State Agency and the Contractor named below:

STATE AGENCY'S NAME

Colorado River Board of California

CONTRACTOR'S NAME

Six Agency Committee

2. The term of this Agreement is: **July 1, 2012** through **June 30, 2013**

3. The maximum amount of this Agreement is: **\$ 1,586,000.00**

4. The parties agree to comply with the terms and conditions of the following exhibits which are by this reference made a part of the Agreement.

Exhibit A – Scope of Work 1 page(s)

Exhibit B – Budget Detail and Payment Provisions 1 page(s)

Exhibit C* – General Terms and Conditions

Check mark one item below as Exhibit D:

Exhibit - D Special Terms and Conditions (Attached hereto as part of this agreement) NA page(s)

Exhibit - D* Special Terms and Conditions

Exhibit E – Additional Provisions NA page(s)

NA

Items shown with an Asterisk (), are hereby incorporated by reference and made part of this agreement as if attached hereto. These documents can be viewed at www.ols.dgs.ca.gov/Standard+Language*

IN WITNESS WHEREOF, this Agreement has been executed by the parties hereto.

CONTRACTOR		California Department of General Services Use Only
CONTRACTOR'S NAME (if other than an individual, state whether a corporation, partnership, etc.) Six Agency Committee		
BY (Authorized Signature) 	DATE SIGNED (Do not type)	
PRINTED NAME AND TITLE OF PERSON SIGNING Dana B. Fisher, Jr., Chairman		
ADDRESS c/o 770 Fairmont Ave., Suite 100, Glendale, CA 91203-1068		
STATE OF CALIFORNIA		
AGENCY NAME Colorado River Board of California		<input type="checkbox"/> Exempt per:
BY (Authorized Signature) 	DATE SIGNED (Do not type)	
PRINTED NAME AND TITLE OF PERSON SIGNING Christopher S. Harris, Acting Executive Director		
ADDRESS 770 Fairmont Ave., Suite 100, Glendale, CA 91203-1068		

EXHIBIT A

WHEREAS, pursuant to Part 5 of Division 6 of the California Water Code, the Colorado River Board of California has the duty and responsibility 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, the 2012-13 State Budget sets forth an expenditure program for the Colorado River Board of California in the amount of \$1,586,000.00; and

WHEREAS, the 2012-13 State Budget provides for neither General Fund nor California Environmental License Plate Fund support to the Board; and

WHEREAS, the State and Contractor consider that it is in the best interest of the people of the State of California to maintain the program set forth in the 2012-13 State Budget, and to carry out this objective, State and Contractor agree that the Contractor shall fund and the State shall accept the cost of said budget in the amount of \$1,586,000.00, as modified by subsequent adjustments pursuant to the Budget Act of 2012 and Executive Orders of the Governor and in accordance with Exhibit B;

NOW, THEREFORE, State and Contractor hereby agree to the terms and conditions set forth in Exhibit B.

EXHIBIT B

The State shall provide the program set forth in the 2012-13 State Budget within the total expenditure of \$1,586,000.00 as modified by subsequent adjustments pursuant to the Budget Act of 2012 and Executive Orders of the Governor;

The Contractor shall pay the sum of \$1,586,000.00 toward said 2012-13 State Budget, such payment to be made no later than August 30, 2012. Said funds will be used to pay 100 percent of California's share of the funding of the seven-state Colorado River Basin Salinity Control Forum, the payee being the "Salinity Control Forum," and related activities; plus the remaining balance will be used to support activities of the Colorado River Board.

In the event at the end of the 2012-13 FY there remains an unexpended balance of the sum set forth in the 2012-13 State Budget for the Colorado River Board plus any additional funds advanced to the Board for Personal Services or other purposes, State shall pay to Contractor a sum equal to the said unexpended balance.

5.a. - Colorado River Water Report

**SUMMARY WATER REPORT
COLORADO RIVER BASIN
June 4, 2012**

RESERVOIR STORAGE (as of June 3)	May 7, 2012					
	MAF	ELEV. IN FEET	% of Capacity	MAF	ELEV. IN FEET	% of Capacity
Lake Powell	15.640	3,636.9	64	15.524	3,635.9	64
Flaming Gorge	3.103	6,023.4	83	3.206	6,026.2	86
Navajo	1.299	6,056.1	77	1.353	6,060.4	80
Lake Mead	13.518	1,119.1	52	13.926	1,123.3	54
Lake Mohave	1.683	642.4	93	1.687	642.6	93
Lake Havasu	0.593	448.7	96	0.595	448.8	96
Total System Storage	36.724		62	37.117		62
System Storage Last Year	33.371		56	31.561		53

	May 7, 2012	
WY 2012 Precipitation (Basin Weighted Avg) 10/01/11 through 6/04/12	72 percent (18.1")	75 percent (17.3")
WY 2012 Snowpack Water Equivalent (Basin Weighted Avg) on day of 6/04/12 (Above two values based on average of data from 116 sites.)	6 percent (0.2")	20 percent (2.7")
	May 3, 2012	
May 16, 2012 Forecast of Unregulated Lake Powell Inflow	MAF % of Normal	MAF % of Avg.
2012 April through July unregulated inflow forecast	2.260 32 %	2.360 33%
2012 Water Year forecast	5.472 51 %	5.568 51%

USBR Forecasted Year-End 2012 and 2011 Consum. Use, June 4, 2012 a.		MAF		
		2012	2011	
	Diversion	- Return =	Net	
Nevada (Estimated Total)	0.481	0.207	0.274	0.221
Arizona (Total)	3.779	0.921	2.858	2.785
CAP Total			1.612	1.625
<i>Az. Water Banking Authority</i>			0.134	0.134
OTHERS			1.247	1.160
California (Total) b./	5.037	0.630	4.407	4.315
MWD			0.688	0.699
3.85 Agriculture				
IID c./	<u>Total</u> 3.212	<u>Conserved</u> -0.306	<u>Forecasted</u> 2.906	<u>Estimated</u> 2.916
CVWD d./	0.360	-0.028	0.332	0.309
PVID	0.392	0	0.392	0.320
YPRD	0.042	0	0.042	0.048
Island e./	0.007	0	0.007	0.007
Total Ag.	4.013	-0.334	3.679	3.600
Others			0.040	0.016
PVID-MWD following to storage (to be determined)			--	<u>0</u>
Arizona, California, and Nevada Total f./	9.297	1.758	7.539	7.321

a./ Incorporates Jan.-Apr. USGS monthly data and 75 daily reporting stations which may be revised after provision; data reports are distributed by USGS. Use to date estimated for users reporting monthly and annually.

b./ California 2012 basic use apportionment of 4.4 MAF has been adjusted to 4.175 MAF for creation of Intentionally Created Surplus Water by IID (-25,000 AF), and Creation of Extraordinary Conservation (ICS) by MWD (-200,000 AF).

c./ In 2012, 0.105 MAF being conserved by IID-MWD Agreement as amended in 2007: 112,500 AF being conserved for SDCWA under the IID-SDCWA Transfer Agreement as amended, 90,000 AF of which is being diverted by MWD; 21,000 AF being conserved for CVWD under the IID-CVWD Acquisition Agreement, 67,700 AF being conserved by the All American Canal Lining Project.

d./ In 2011, 28,265 acre-feet conserved by the Coachella Canal Lining Project.

e./ Includes estimated amount of 6,660 acre-feet of disputed uses by Yuma Island pumpers and 653 acre-feet by Yuma Project Ranch 5 being charged by USBR to Priority 2.

f./ Includes unmeasured returns based on estimated consumptive use/diversion ratios by user from studies provided by Arizona Dept. of Water Resources, Colorado River Board of California, and Reclamation.

**SUMMARY WATER REPORT
COLORADO RIVER BASIN
May 7, 2012**

RESERVOIR STORAGE (as of May 6)	April 2, 2012					
	MAF	ELEV. IN FEET	% of Capacity	MAF	ELEV. IN FEET	% of Capacity
Lake Powell	15.524	3,635.9	64	15.465	3,635.4	64
Flaming Gorge	3.206	6,026.2	86	3.230	6,026.9	86
Navajo	1.353	6,060.4	80	1.310	6,057.0	77
Lake Mead	13.926	1,123.3	54	14.539	1,129.4	56
Lake Mohave	1.687	642.6	93	1.654	641.4	91
Lake Havasu	0.595	448.8	96	0.566	447.2	91
Total System Storage	37.117		62	37.559		62
System Storage Last Year	31.561		53	31.491		53

	April 2, 2012	
WY 2012 Precipitation (Basin Weighted Avg) 10/01/11 through 5/07/12	75 percent (17.3")	79 percent (15.2")
WY 2012 Snowpack Water Equivalent (Basin Weighted Avg) on day of 5/07/12 (Above two values based on average of data from 116 sites.)	20 percent (2.7")	54 percent (9.5")
	March 19, 2012	
May 3, 2012 Forecast of Unregulated Lake Powell Inflow	MAF % of Normal	MAF % of Avg.
2012 April through July unregulated inflow forecast	2.360 33 %	4.800 67%
2012 Water Year forecast	5.568 51 %	8.250 76%

USBR Forecasted Year-End 2012 and 2011 Consum. Use, May 9, 2012 a.		MAF	
		<u>2012</u>	<u>2011</u>
	Diversion	- Return =	Net
Nevada (Estimated Total)	0.482	0.209	0.273
Arizona (Total)	3.773	0.923	2.850
CAP Total			1.608
Az. Water Banking Authority			0.134
OTHERS			1.242
California (Total) b./	4.975	0.623	4.352
MWD			0.666
3.85 Agriculture			
IID c./	<u>Total</u>	<u>Conserved</u>	<u>Forecasted</u>
CVWD d./	3.184	-0.306	2.878
PVID	0.360	-0.028	0.332
YPRD	0.385	0	0.385
Island e./	0.045	0	0.045
Total Ag.	0.007	0	0.007
Others	3.981	-0.334	3.647
PVID-MWD following to storage (to be determined)			0.039
Arizona, California, and Nevada Total f./	9.230	1.755	7.475
			7.321

- a./ Incorporates Jan.-Mar. USGS monthly data and 75 daily reporting stations which may be revised after provision; data reports are distributed by USGS. Use to date estimated for users reporting monthly and annually.
- b./ California 2012 basic use apportionment of 4.4 MAF has been adjusted to 4.175 MAF for creation of Intentionally Created Surplus Water by IID (-25,000 AF), and Creation of Extraordinary Conservation (ICS) by MWD (-200,000 AF).
- c./ In 2012, 0.105 MAF being conserved by IID-MWD Agreement as amended in 2007: 112,500 AF being conserved for SDCWA under the IID-SDCWA Transfer Agreement as amended, 90,000 AF of which is being diverted by MWD; 21,000 AF being conserved for CVWD under the IID-CVWD Acquisition Agreement, 67,700 AF being conserved by the All American Canal Lining Project.
- d./ In 2011, 28,265 acre-feet conserved by the Coachella Canal Lining Project.
- e./ Includes estimated amount of 6,660 acre-feet of disputed uses by Yuma Island pumpers and 653 acre-feet by Yuma Project Ranch 5 being charged by USBR to Priority 2.
- f./ Includes unmeasured returns based on estimated consumptive use/diversion ratios by user from studies provided by Arizona Dept. of Water Resources, Colorado River Board of California, and Reclamation.

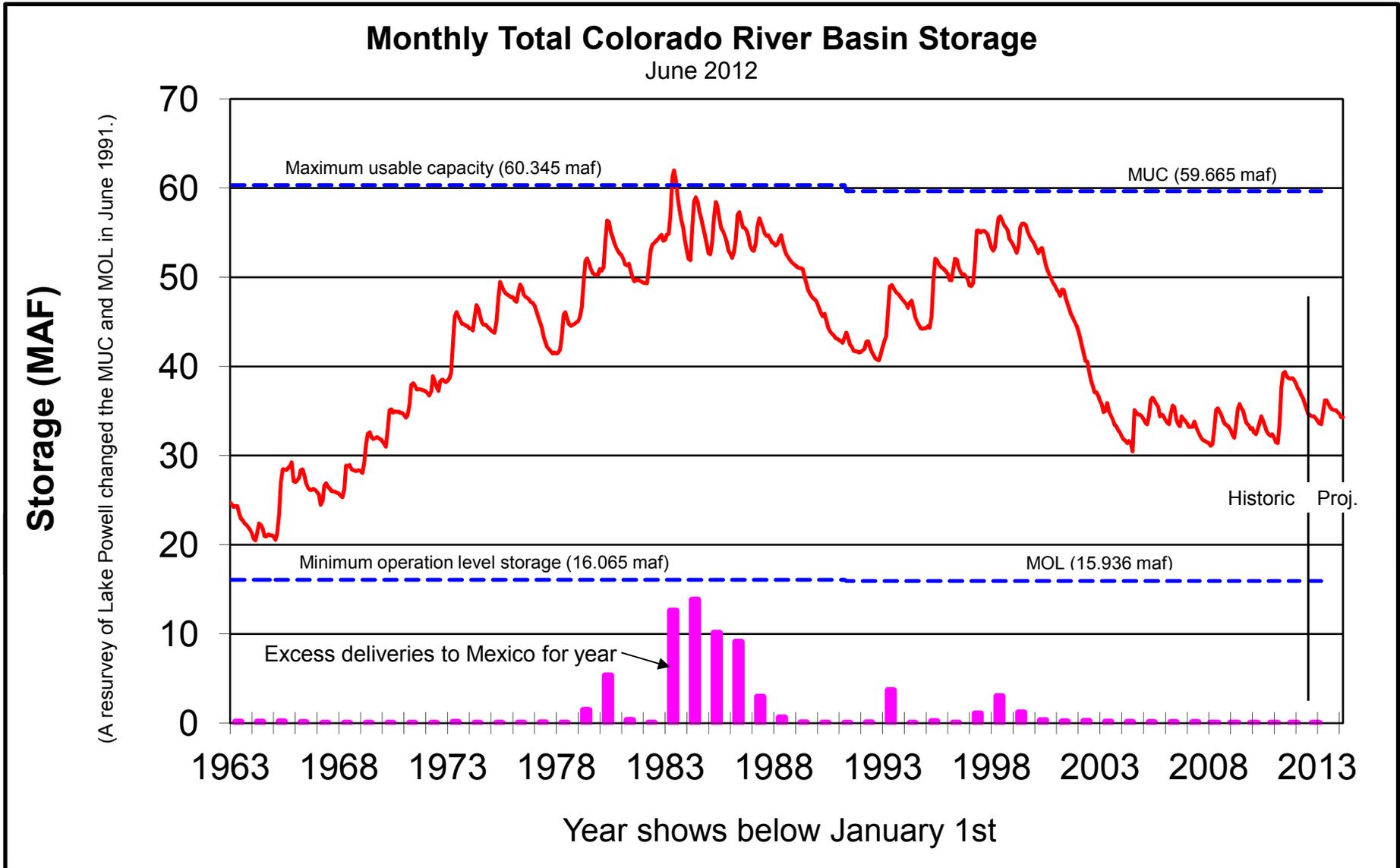


Figure 1. Total Colorado River Basin Storage as of June 2012

Figure 3. NOAA National Weather Service Monthly Precipitation Maps for April and May 2012

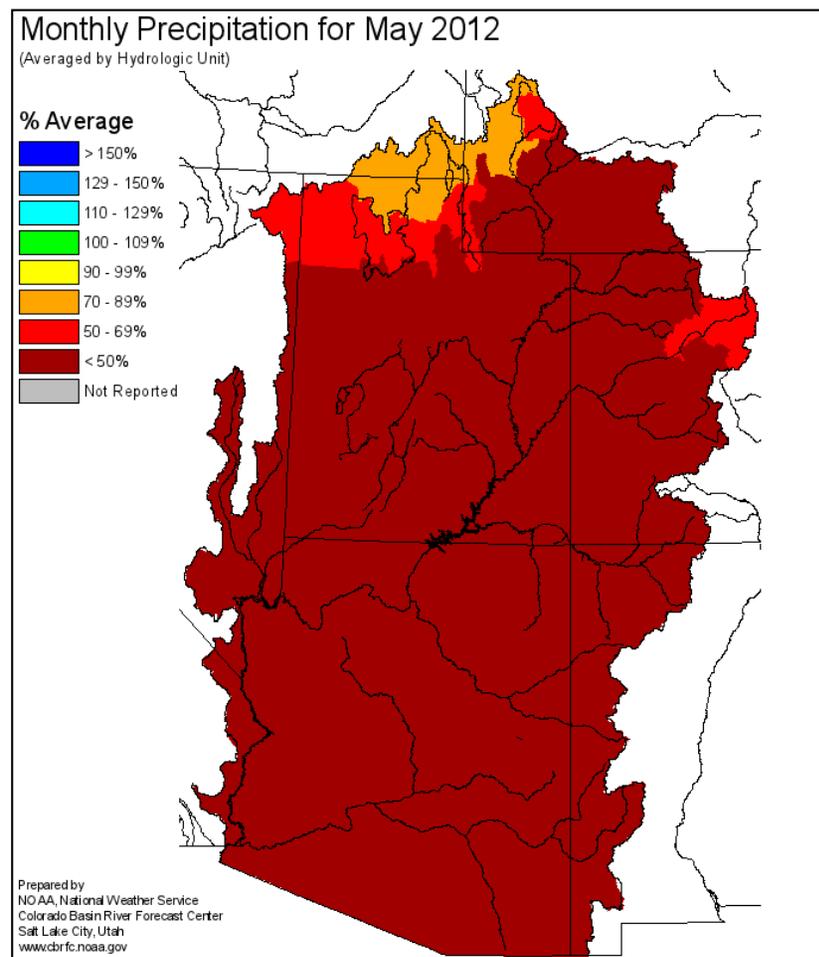
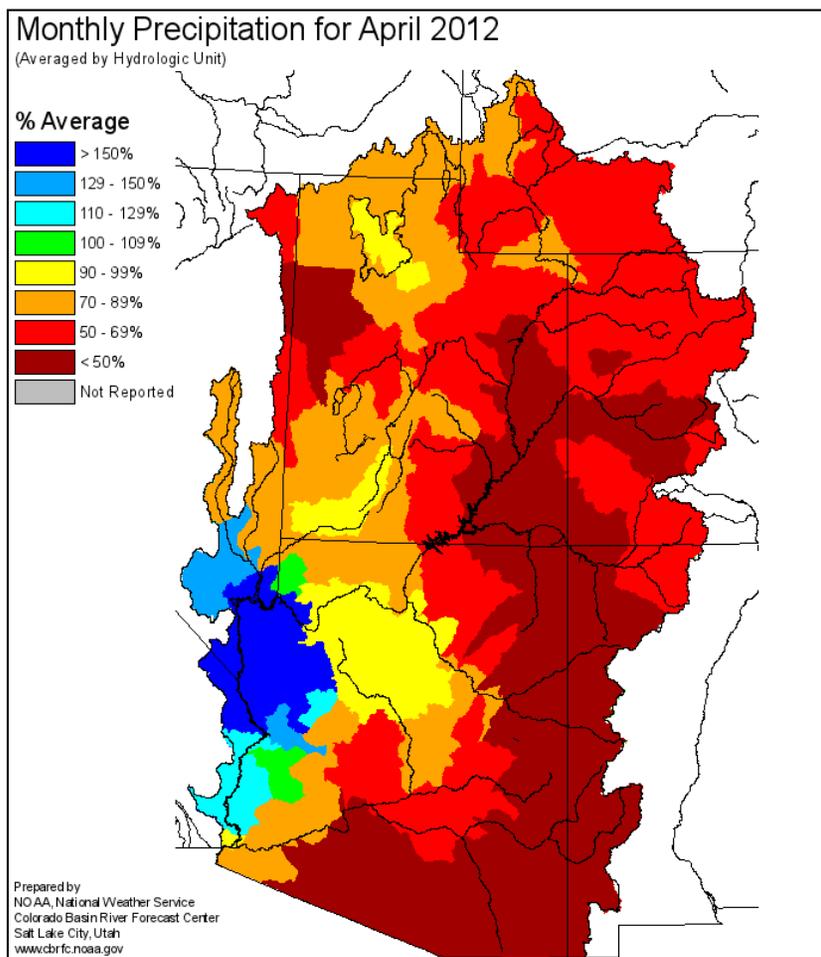
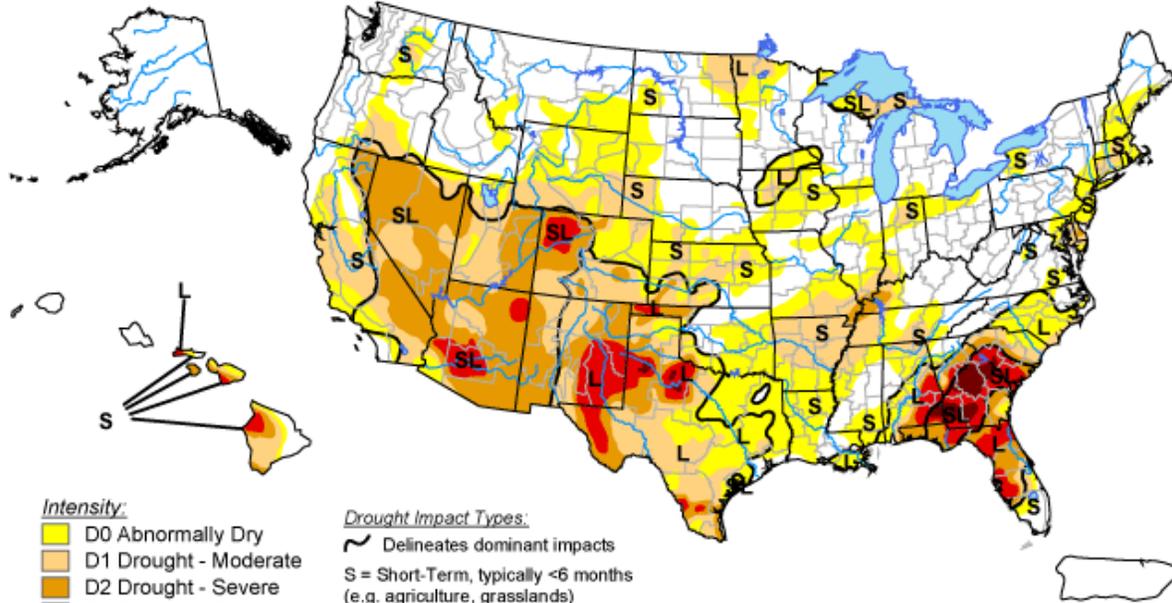


Figure 6. USDA United States Drought Monitor Map

U.S. Drought Monitor

May 29, 2012
Valid 7 a.m. EDT



Intensity:

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

Drought Impact Types:

- Delineates dominant impacts
- S = Short-Term, typically <6 months (e.g. agriculture, grasslands)
- L = Long-Term, typically >6 months (e.g. hydrology, ecology)

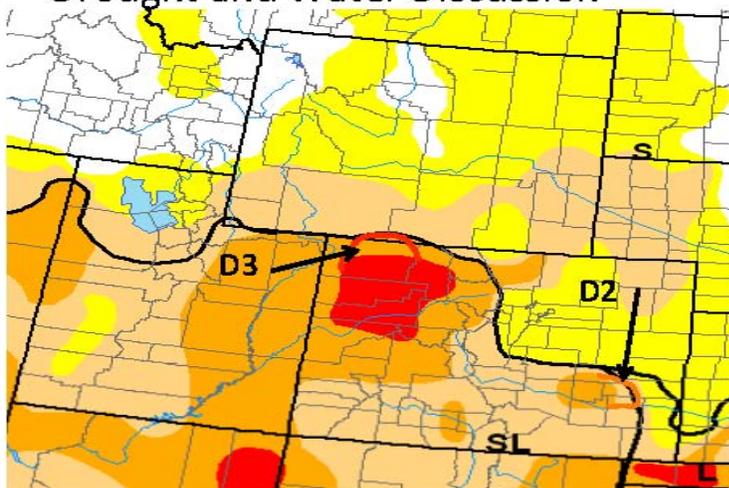
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

<http://droughtmonitor.unl.edu/>



Released Thursday, May 31, 2012
Author: Brad Rippey, U.S. Department of Agriculture

Drought and Water Discussion



Drought – Exceptional	0 to 2 (D4)
Drought – Extreme	2 to 5 (D3)
Drought – Severe	5 to 10 (D2)
Drought – Moderate	10 to 20 (D1)
Abnormally Dry	20 to 30 (D0)

Drought categories and their associated percentiles

VI. Scheduled Flows to Mexico — Arrivals and excess arrivals of Water for Calendar Year 2012
(Acre-feet)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	<u>Scheduled</u>	<u>Total</u>	<u>Excess</u>	<u>Other</u>	<u>Total</u>	<u>Cumulative</u>	<u>Flow</u>	<u>Flow By-Pass</u>
	<u>Flow</u>	<u>Arrivals</u>	<u>Arrivals</u>	<u>Excess</u>	<u>Excess</u>	<u>Excess</u>	<u>Through</u>	<u>Southerly</u>
			<u>in accord</u>	<u>Arrivals</u>	<u>Arrivals</u>	<u>Arrivals</u>	<u>NIB and</u>	<u>International</u>
			<u>with</u>				<u>Limitrophe</u>	<u>Boundary</u>
			<u>Minute 242</u>					
Jan.	130,284	141,101	10,501	316	10,817	10,817	120,438	10,498
Feb.	158,443	167,540	8,708	389	9,097	19,914	147,877	8,708
March	186,741	196,834	9,612	481	10,093	30,007	176,235	9,612
April	205,407							
May	112,314							
June	113,999							
July	115,191							
August	104,505							
Sept.	101,509							
Oct.	63,672							
Nov.	101,893							
Dec.	106,043							
	<u>1,500,001</u>	<u>505,475</u>	<u>28,821</u>	<u>1,186</u>			<u>444,550</u>	<u>28,818</u>

- Column (1). Flow schedule requested by Mexico. In surplus years as determined by the United States, Mexico can schedule up to 1.7 rather than 1.5 million acre-feet.
- (2). Total Colorado River waters reaching Mexico. It is the sum of: 1) Colorado River water measured at the Northerly International Boundary, 2) drainage waters measured at the Southerly International Boundary near San Luis, Arizona, and 3) Wellton-Mohawk drainage waters measured at the Southerly International Boundary. It is the sum of Columns (1) + (5).
- (3). Arizona's Wellton-Mohawk Irrigation and Drainage District drainage water. This water is discharged to the Santa Clara Slough in Mexico via a concrete-lined canal.
- (4). Excess arrivals other than Wellton-Mohawk drainage. It is the sum of: 1) a delivery of about 5,000 a. f. per year to ensure that Mexico receives what is scheduled, 2) releases from Parker Dam which are not used due to unexpected rainfall in the Palo Verde, Coachella, Imperial, and and Yuma areas, 3) controlled flood releases on the Gila and Colorado River, and 4) local runoff.
- (5). Sum of Columns (3) and (4).
- (6). Cumulation of Column (5).
- (7). Including Colorado River flow at the Northerly International Boundary plus flow from Cooper, 11-mile, and 21-mile spillways.
- (8). Including flow at the Southerly International Boundary, from the East and West Main canals, Yuma Valley Main, 242 Lateral plus diversions from Lake Havasu for Tijuana.

WEIGHTED MONTHLY SALINITY AT
SELECTED COLORADO RIVER STATIONS
AND RUNNING 12-MONTH NIB-IMPERIAL FLOW-WEIGHTED SALINITY DIFFERENTIAL
(in parts per million)

Month	Below Hoover Dam			Below Parker Dam ^{3/}			Palo Verde ^{3/} Canal Near Blythe			At Imperial Dam			At Northerly Inter- national Boundary			Running 12-Month Flow-Wtd. Differential ^{2/}	
	5-Year avg. ^{1/}			5-Year avg. ^{1/}			5-Year avg. ^{1/}			5-Year avg. ^{1/}			5-Year avg. ^{1/}				
	1974-78	2011	2012	1974-78	2011	2012 ^{4/}	1974-78	2011 ^{4/}	2012 ^{4/}	1974-78	2011	2012	1974-78	2011	2012	2011	2012
Jan.	690	606	544	709	620	620	751	640	640 ^{5/}	913	714	725	1,041	882	865	143.3	140
Feb.	675	612	574	706	620	620	732	620	630	835	686	683	998	779	810	137.9	127
March	684	589	568	699	620	610	727	610	620	805	660	662	925	802	801	147.1	139
April	680	613		700	620		714	630		801	674		892	735		153.6	
May	677	604		698	620		709	630		822	683		962	852		146.3	
June	678	602		695	620		712	640		812	667		956	819		140.1	
July	682	601		688	620		709	630		797	661		909	848		141.1	
August	690	577		686	620		706	610		800	680		907	915		142.4	
Sept.	672	565		686	620		737	630		815	693		952	913		145.1	
Oct.	680	559		689	600		739	620		854	694		1,070	913		151.4	
Nov.	682	544		692	610		746	640		897	739		1,010	879		153.1	
Dec.	681	589		702	620		731	660		877	769		999	868		155.9	

General Notes:

^{1/} 5-Year averages are arithmetical.

^{2/} 2011 values are 12-month flow-weighted differential between NIB and Imperial Dam through month shown in left column. 2012 values are IBWC monthly salinity differential

^{3/} Operational values only.

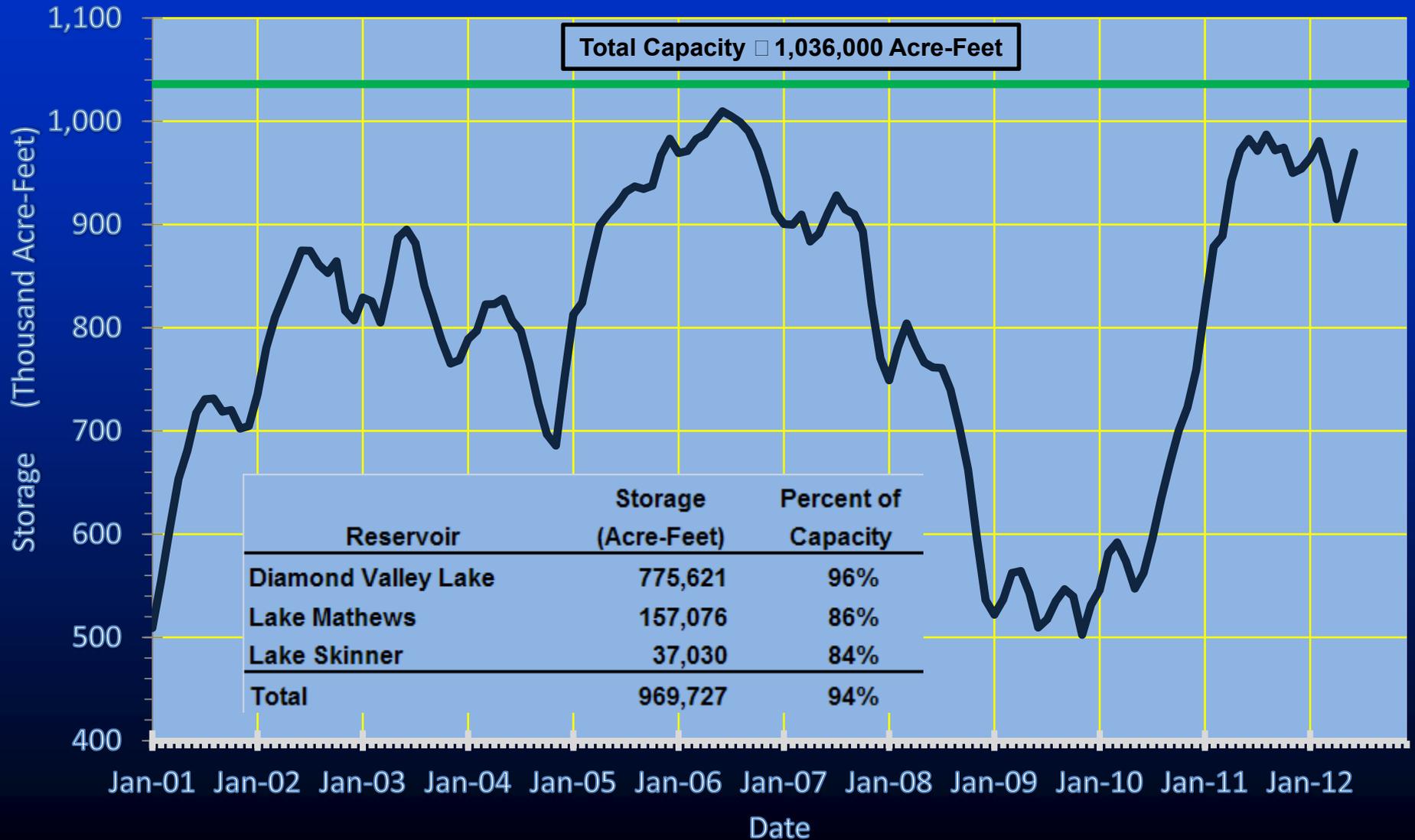
^{4/} Values are grab samples (one or two samples per month) and are rounded to represent general magnitude of salinity at Parker Dam and Palo Verde Canal..

^{5/} Estimate.

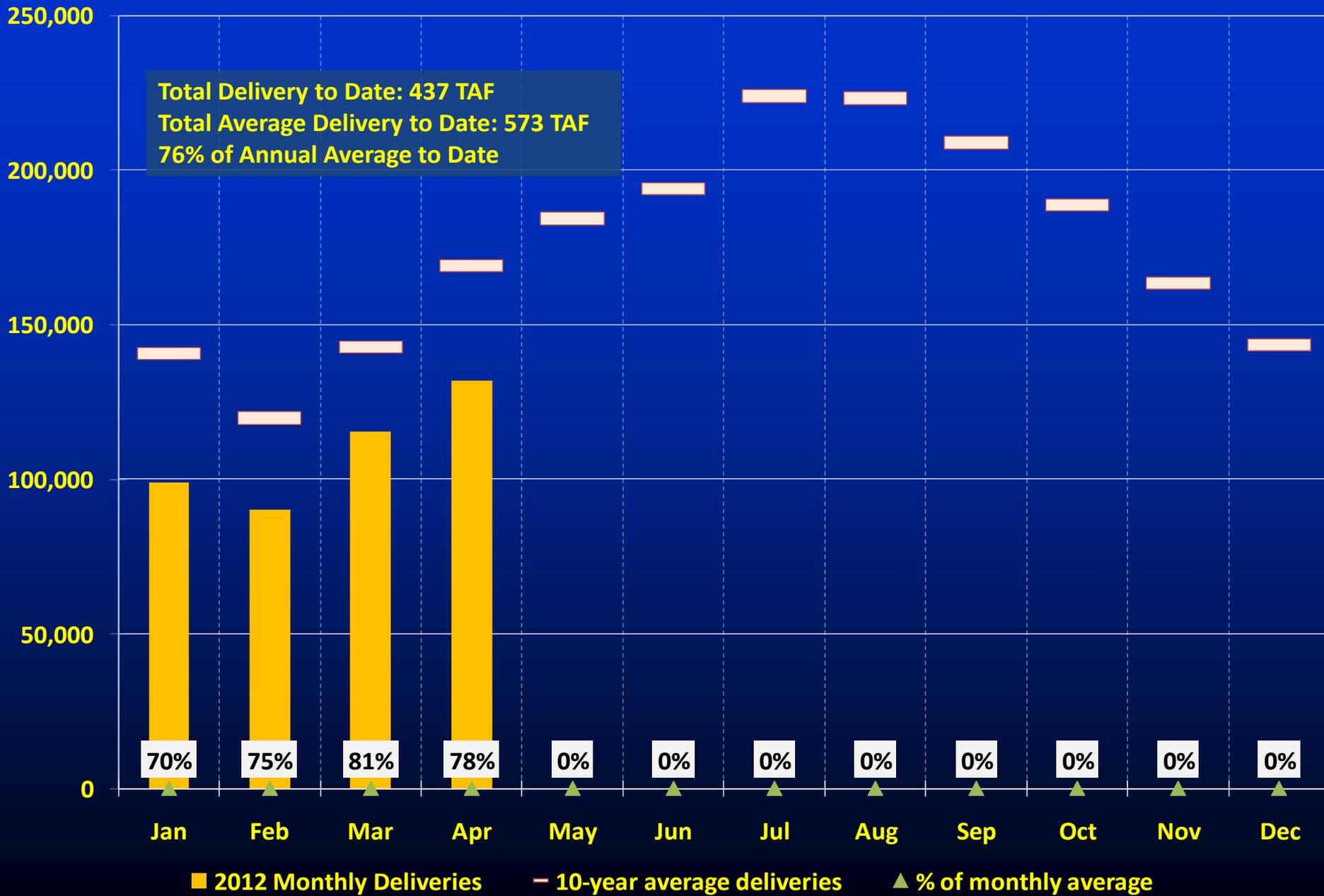
5.b. - State and Local Water Reports

MWD's Combined Reservoir Storage as of June 1, 2012

Lake Skinner, Lake Mathews, and Diamond Valley Lake

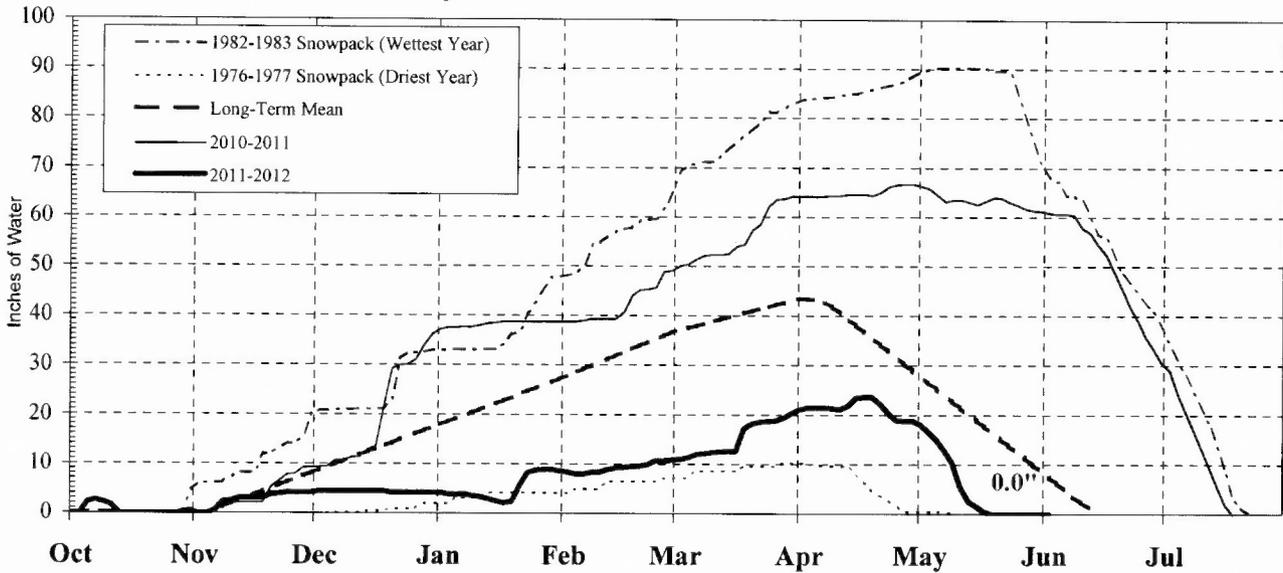


2012 Water Deliveries to Member Agencies (AF)

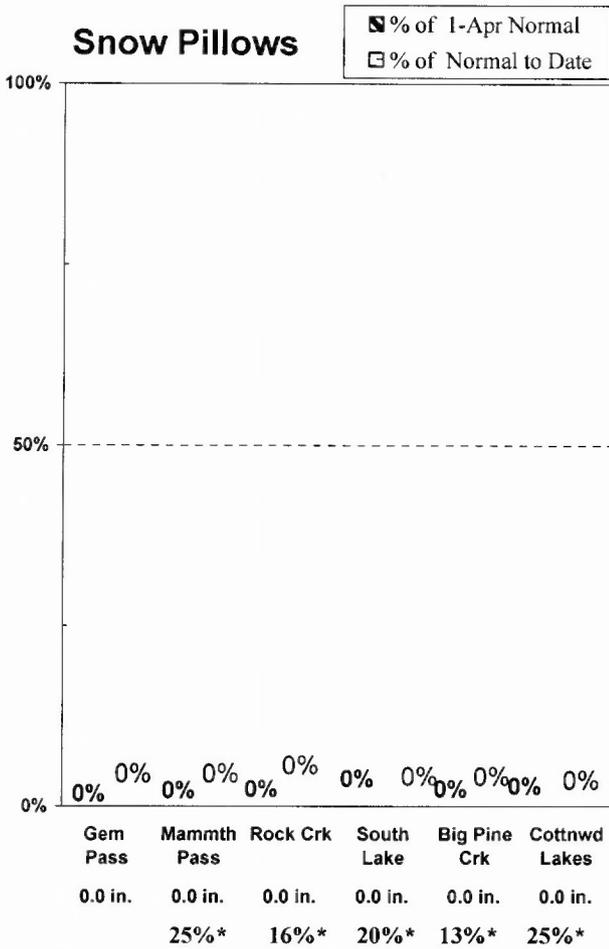


EASTERN SIERRA CURRENT PRECIPITATION CONDITIONS As of May 31, 2012

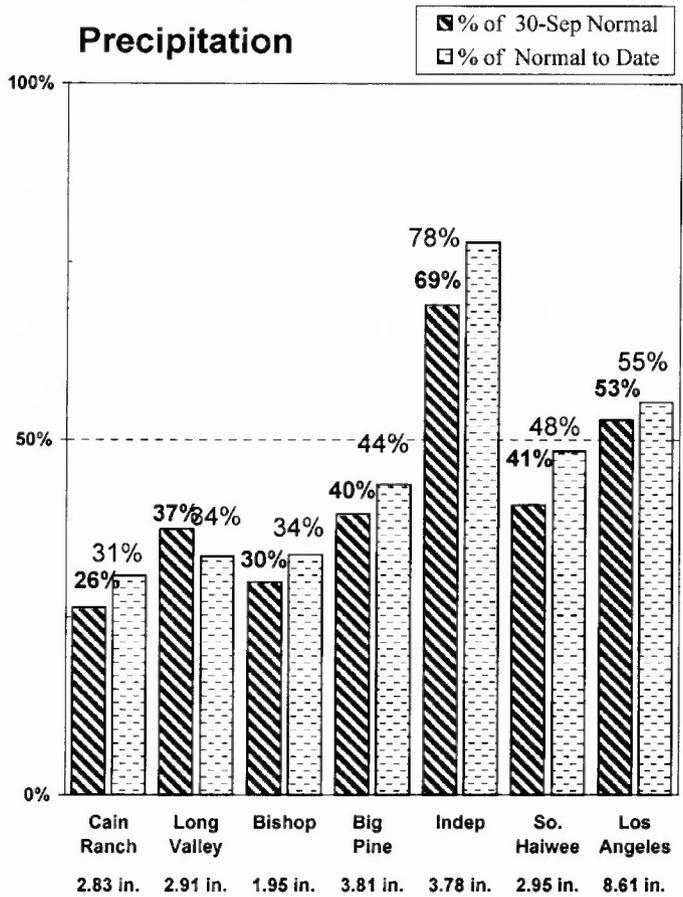
Mammoth Pass Snowpack



Snow Pillows



Precipitation



* Individual snow pillow represents an area that contributes this percent of the total Owens River Basin runoff.

Measurement as Inches Water Content; Precipitation totals are cumulative for water year beginning Oct 1

5.e. - Colorado River Operations



MANAGEMENT OF WATER SHORTAGE IN THE COLORADO RIVER BASIN: EVALUATING CURRENT POLICY AND THE VIABILITY OF INTERSTATE WATER TRADING¹

Richard A. Wildman, Jr. and Noelani A. Forde²

ABSTRACT: The water of the Colorado River of the southwestern United States (U.S.) is presently used beyond its reliable supply, and the flow of this river is forecast to decrease significantly due to climate change. A recent interim report of the *Colorado River Basin Water Supply and Demand Study* is the first acknowledgment of these facts by U.S. federal water managers. In light of this new stance, we evaluate the current policy of adaptation to water shortages in the Colorado River Basin. We find that initial shortages will be borne only by the cities of Arizona and Nevada and farms in Arizona whereas the other Basin states have no incentive to reduce consumptive use. Furthermore, the development of a long-term plan is deferred until greater water scarcity exists. As a potential response to long-term water scarcity, we evaluate the viability of an interstate water market in the Colorado River Basin. We inform our analysis with newly available data from the Murray-Darling Basin of Australia, which has used interstate water trading to create vital flexibility during extreme aridity during recent years. We find that, despite substantial obstacles, an interstate water market is a compelling reform that could be used not only to adapt to increased water scarcity but also to preserve core elements of Colorado River Basin law.

(KEY TERMS: water supply; water allocation; water law; water policy; water resource economics; water scarcity economics; climate variability/change; drought.)

Wildman, Richard A., Jr. and Noelani A. Forde, 2012. Management of Water Shortage in the Colorado River Basin: Evaluating Current Policy and the Viability of Interstate Water Trading. *Journal of the American Water Resources Association* (JAWRA) 1-12. DOI: 10.1111/j.1752-1688.2012.00665.x

INTRODUCTION

The Colorado River and its tributaries originate in the Rocky Mountains and provide much of the water that has allowed the economic, cultural, and political development of the arid southwestern United States (U.S.) (Powell, 2008). The water of these rivers is used by 30 million people and 4 million acres of farm-

land as the primary supply to several cities and \$3 billion in agricultural productivity across seven states (USBR, 2011). Spring runoff from winter snow is vital to maintaining a reserve of water stored primarily in two large mainstem reservoirs, Lake Mead and Lake Powell. However, runoff in the Colorado River Basin (CRB) has been markedly below its long-term average in several years since 2000; plentiful runoff occurred only in 2005, 2008, and 2011. During this

¹Paper No. JAWRA-11-0123-P of the *Journal of the American Water Resources Association* (JAWRA). Received October 2, 2011; accepted March 30, 2012. © 2012 American Water Resources Association. **Discussions are open until six months from print publication.**

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time, deliveries to water users continued undiminished, and so reservoirs reached record-low levels before rebounding somewhat (USBR, 2010). Continued low runoff coupled with steadily rising demand are forecast to exhaust reservoir storage in the coming decades (USBR, 2007; Barnett and Pierce, 2008; Rajagopalan *et al.*, 2009). Such a failure of the water supply system would lead to major economic and social disruption in the Southwest (Barnett and Pierce, 2008).

The U.S. Bureau of Reclamation (USBR) manages the dams of the Colorado River and its major tributaries and thus acts as the initial supplier of water to irrigation districts and municipal water supply agencies. In early 2011, it released the first interim report of its *Colorado River Basin Water Supply and Demand Study*. The purposes of this report are to quantify the reliability of the Colorado River to meet the needs of those who depend on it until 2060 and to formulate options for mitigating imbalances in the water supply system. The first interim report contains the concepts governing the study and quantitative forecasts for supply and demand in the CRB. The final report, which is scheduled for release in mid-2012, will include options for reform in the CRB (USBR, 2011).

The USBR adopts two important premises for the first time in this report. First, current demand in the CRB exceeds supply. The steadily growing annual demand first exceeded the 10-year running average of annual supply in 2003. Annual water deficits probably occurred earlier; for example, total water use across the Basin was 16.0 million acre-feet (maf; 1 maf = 1,233 ggaliters (GL); 16 maf = 19,700 GL) in 1999, whereas the long-term average flow in the mainstem of the Lower Colorado River (below the confluences of all major tributaries) is ~ 14.7 maf/yr (18,100 GL/yr) (USBR, 2011). Second, the USBR considers climate change explicitly for the first time in this report after having intentionally neglected its effects during previous planning documents that pertain to the CRB (e.g., USBR, 2007). The *Water Supply and Demand Study* states that climate change will lead to a “new mean state” of lower runoff in the CRB (USBR, 2011). Thus, the general management approach of the USBR now conforms much more closely to previous research implying a near-term transition to increased dryness in the Southwest (Seager *et al.*, 2007).

Australia has adapted to similar water scarcity by introducing an interstate water trading market in its Murray-Darling Basin (MDB), and thus its experiences may provide useful lessons to the CRB. Water markets allow water transfers at prices that respond to seasonal changes in demand and water availability (Howe *et al.*, 1986). Water rights are generally traded on either a temporary or a permanent basis, and, if

desired, prices can be reset yearly at initial values before trading begins anew (Chong and Sunding, 2006). An optimally efficient water market is one in which trading of water rights allows each user to get as much water as it is willing to buy and for each user to pay for the true value of the water it receives (Freebairn, 2003). However, over- or underregulation, which frequently occurs when diverse political concerns must be placated at the inception of a market (Colby, 2000), impedes efficiency (Colby, 1990). Water markets depend on a diversity of water users. When all users plant the same crop, they all tend to be either buyers or sellers at a given price, and no trades occur (Nieuwoudt and Armitage, 2004). Thus, markets that cover large geographic areas may be likely to thrive because of a diversity of water uses. Water markets incur costs that relate to both the regulation and execution of transactions and the mollification of potential impacts on parties external to a water sale (Chong and Sunding, 2006).

In light of the new attitudes put forth by the USBR in the *Water Supply and Demand Study*, this article analyzes the existing policy for low levels in the mainstem reservoirs of the CRB. This policy, articulated as the “preferred alternative” in the 2007 *Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations of Lake Powell and Lake Mead: Final Environmental Impact Statement* (henceforth, “the *Shortage Guidelines*”), represents the result of negotiation between the seven states of the CRB and subsequent minor modification by the USBR (NRC, 2007; USBR, 2007). It is the only enforceable document that targets management of the Colorado River during times of low water (USBR, 2007). We find that the *Shortage Guidelines* are a stopgap solution. They introduce supply shortages by decreasing the volume of water that can be diverted from Lake Mead. This slows the depletion of Lake Mead before 2026 and does little to protect water users during prolonged periods of scarce water. They do little to address demand, providing incentives for conservation only to some parties. Finding the *Shortage Guidelines* lacking, our second purpose in this article is to draw from recent experience in Australia to evaluate the viability of an interstate water market as a possible reform for the CRB.

RESPONSE TO DROUGHT IN THE COLORADO RIVER BASIN

The *Shortage Guidelines* exist in the context of the legal framework that governs water use in the CRB. Briefly, the seven states of the CRB are divided into



FIGURE 1. The Colorado River Basin. Blue lines are rivers, and black lines are aqueducts where water is pumped out of the Basin for irrigation and municipal use. Not shown is a major diversion from the northwestern portion of the Basin to Salt Lake City, Utah. Image courtesy International Mapping Associates, used with permission.

an “Upper Basin” (Colorado, New Mexico, Utah, Wyoming) and a “Lower Basin” (Arizona, California, Nevada) (Figure 1). The Lower Basin is guaranteed 7.5 maf/yr (9,250 GL/yr) from the Upper Basin, and, based on their understanding of CRB runoff, the framers of the original Colorado River Compact believed that this would leave the same amount for yearly use in the Upper Basin. Guaranteed a volume of water each year, the Lower Basin divided it among its states such that Arizona receives 2.8 maf/yr (3,500 GL/yr), California receives 4.4 maf/yr (5,400 GL/yr), and Nevada receives 0.3 maf/yr (370 GL/yr). A subsequent treaty and policy statement obligates each Basin to provide 0.75 maf/yr (930 GL/yr) to Mexico, but Lower Basin division of water has not changed to reflect this. In each CRB state, rights to the consumptive use of water are granted to entities and organizations such as irrigation districts, municipalities, corporations, landowners, and Native American tribes. These rights are honored in the order of their creation, with “junior” rights holders potentially losing their entire yearly share of water to ensure that rights of more “senior” users are fulfilled. This system of “prior appropriation” was preserved in the

federal Colorado River Compact: the USBR fulfills water rights of Lower Basin users in the order in which they were created. Further details of CRB law are described well in a review by MacDonnell (2009). Water appropriations are at or near their maximum in each Lower Basin state despite an estimated loss of 1.6-2.2 maf/yr (2,000-2,700 GL/yr) to evaporation from reservoirs, half of which can be attributed to each Basin (USBR, 2011). Thus, the Lower Basin suffers from a water imbalance that has been ameliorated by surpluses from the Upper Basin and storage in Lake Mead, the latter of which decreases when low runoff to Lake Powell induces minimum obligatory releases from Glen Canyon Dam.

The CRB has never experienced a shortage, and the three Lower Basin states have never received volumes below those promised for their consumptive use (see above). Federal law designates the USBR as the primary agency responsible for response to drought planning (NRC, 2007), and so the *Shortage Guidelines* were developed after years of below-average runoff in the CRB (USBR, 2007). The *Shortage Guidelines* provide revised management plans that decrease water deliveries from Lake Mead to when it is at low levels. As the water level in Lake Mead drops, the USBR will reduce withdrawals, augment supply, and encourage conservation. This is achieved through four specific approaches. First, water available for consumptive use in the Lower Basin will be reduced by 0.333, 0.417, and 0.5 maf/yr (411, 514, and 617 GL/yr, respectively) when the water level in Lake Mead falls to 1,075, 1,050, and 1,025 ft above sea level, respectively. At this lowest elevation, meetings between states will be convened with the purpose of writing additional guidelines. Second, water storage will be balanced between Lake Mead and Lake Powell during low reservoir levels. This provision has the practical effect of allowing increased deliveries from Lake Powell to Lake Mead. Third, a system of “intentionally created surplus” was created as a way of crediting water to Arizona, California, or Nevada when these states conserve water to leave it in Lake Mead. Fourth, previously negotiated guidelines that apply to times of surplus were suspended.

A variety of management options were considered in the *Shortage Guidelines*. Strategies ranged from declaring shortage earlier so that reservoir storage can be maximized to declaring no shortages until reservoirs are empty. The “preferred alternative” represents an effort to maintain water deliveries with minimal disruption while also protecting the drinking water supply of Las Vegas. In comparison with other management strategies, it is predicted to delay the probability of shortage declarations for Lower Basin states in the near term (before 2016) while having no significant impact on longer time scales (2030-2065)

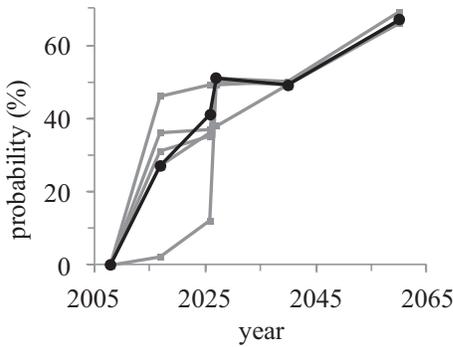


FIGURE 2. Probability of Shortage in the Lower Basin Under Various Management Scenarios. Black line: the “preferred alternative” in the USBR *Shortage Guidelines* that has become policy. Gray lines: other alternatives considered. From USBR (2007).

(Figure 2). If continued shortages are necessary in the medium term (2020-2026), the “preferred alternative” stipulates that they be more severe than other alternatives (with the exception of the strategy that maximizes reservoir storage) to extend the time that Lake Mead is >1,000 ft above sea level, the elevation at which submerged intake pipes withdraw water for Las Vegas (USBR, 2007). Furthermore, the *Shortage Guidelines* represent an agreement in effect until 2026, and the “preferred alternative” features an abrupt increase in the probability of a shortage declaration between 2026 and 2027. It is important to note that these forecasts are based on water availability in 2007. Although the specific dates of these time horizons would be different if the calculation were redone for current reservoir levels and water consumption patterns, the qualitative trends described here would not likely change significantly.

Shortages in this plan would not affect the three Lower Basin states equally. The Central Arizona Project (CAP), a large municipal and agricultural irrigation system that supplies water to both farms and major cities in Arizona, was built on the condition that Arizona’s water rights be subrogated to those of California. Consequently, after fulfillment of water

rights established before June 25, 1929 to users in the three Lower Basin states, all of California’s water rights must be met before any further water is delivered to Arizona (MacDonnell, 2009). Only 22.1% of the water rights in Arizona predate 1929, and these are mostly irrigators, small cities along the Colorado River, and Native American reservations (USBR, 2007). Thus, California will suffer reductions only during extreme shortages, whereas only a small subset of the population of Arizona is insulated from shortage. Nevada’s share of overall Lower Basin deliveries will remain constant, and thus it will suffer shortages at the first shortage declaration (Table 1).

This agreement, which was codified in the 1968 Colorado River Basin Project Act (CRBPA), represented a compromise that brought expensive water infrastructure to Arizona and greater water security to California. However, it may make the *Shortage Guidelines* impractical and unmanageable because, consistent with a steady growth in urban water use across the CRB in the last several decades (NRC, 2007), water rights created in Arizona and Nevada after 1968 have largely been granted to municipal and industrial users. Consequently, the large population centers in greater Phoenix, Tucson, and Las Vegas rely on some of the most junior water rights in their states (granted to the CAP and the Southern Nevada Water Authority [SNWA], respectively). Thus, they will be the first to be affected by water shortages. After Arizona cancels deliveries of 16,223 acre-feet per year (af/yr) (20 GL/yr) to some small municipalities and farms (by itself a not insignificant action), its most junior water user is the CAP, which has rights to 1.7 maf/yr (2,100 GL/yr). In 2008, municipalities used ~750,000 af (925 GL) of Arizona’s yearly Colorado River water (USBR, 2011). The CAP provides the vast majority of this, and thus municipalities are at risk during a shortage. The SNWA, the most junior user in Nevada, has rights to nearly the entire allotment of Nevada and distributes it to the ~2 million residents of the Las Vegas Valley (USBR, 2007).

TABLE 1. Effects of Water Shortages on Lower Basin States.

Shortage volumes and water deliveries (af/yr)				
Shortage	0	333,000	417,000	500,000
California	4,000,000	4,000,000	4,000,000	4,000,000
Arizona	2,800,000	2,480,320	2,399,680	2,320,000
Nevada	300,000	286,000	283,320	280,000
Volumetric reductions in water delivery (af/yr)				
Arizona	0	319,680	400,320	480,000
Nevada	0	13,320	16,680	20,000
Fractional reductions in water delivery (%)				
Arizona	0	11.4	14.3	17.1
Nevada	0	4.4	5.6	6.7

Note: All values from USBR (2007).

Both Arizona and Nevada have plans to replace water lost to curtailed deliveries from Lake Mead with other in-state sources. Arizona stores unused water in a groundwater bank. When that empties, it can protect its population by reducing CAP water deliveries to irrigators, essentially trading water security for economic security by supporting basic human needs at the expense of agricultural productivity. Nevada has been aggressively encouraging conservation by storing unused water in groundwater banks, which will yield 30,000 af/yr (37 GL) from separate banks in California and Arizona (SNWA, 2009) for as long as they last. Additionally, the SNWA has purchased 1.2 maf (1,480 GL) for \$350 million from Arizona in a unique water transfer (Tavares, 2009). It has also designed a >500-km long, \$3 billion pipeline to bring pumped groundwater from the center of the state. If approved and built, it is forecast to yield a maximum of 137,000 af/yr (169 GL/yr) (SNWA, 2009); the long-term sustainability of this yield is beyond the scope of this article. Thus, on a strictly volumetric basis, Nevada would seem able to withstand extended Colorado River shortages only on the condition that this politically contentious and expensive pipeline is built.

The potential shortages for which Arizona and Nevada must prepare contrast starkly with the uninterrupted water supplies to the other CRB states. The water supplies of the two Basins are separated legally, and, in 2008, no Upper Basin state consumed close to its maximum allotment (MacDonnell, 2009; USBR, 2011). Certainly, a sustained Basin-wide drought could require reductions in consumptive use in Upper Basin states for the Upper Basin to meet its required deliveries to the Lower Basin, but this scenario is not nearly as likely as the continued decline of Lake Mead due to overallocation of Lower Basin water, although this was interrupted by a significant rise in 2011 that resulted from extra releases from Lake Powell after bountiful inflows there. In California, senior water rights (2.7 maf/yr [3,300 GL/yr] were created before 1929) and the CRBPA ensure that it will not suffer shortages during conditions stipulated by the *Shortage Guidelines*. Consequently, whereas Arizona and Nevada have ample reason to conserve water, take advantage of the intentionally created surplus feature of the *Shortage Guidelines*, and maintain water levels in Lake Mead, the other five CRB states have no such motivation. If shortages continued for many years, Arizona and Nevada could face extremely difficult choices that may involve reductions in population or economic activity, whereas agricultural irrigation in the California desert and development of new water projects in the Upper Basin could continue unabated. This inequality, although consistent with existing laws, seems

sufficiently glaring to spark political outcry by the governors and federal representatives of Arizona and Nevada. If Lake Mead falls to 1,025 ft above sea level, the *Shortage Guidelines* offer no plan other than a meeting of the seven CRB states. Such a meeting is sure to feature insistence by Arizona and Nevada that the other CRB states share in the suffering created by low reservoir levels, despite their worsening bargaining position and existing legal protections for the other states. Because the *Shortage Guidelines* contain no long-term plan for Basin-wide adaptation to aridity, they present a threat to the legal framework of the Colorado River by potentially creating a scenario in which an increasingly desperate Arizona and Nevada may use every means at their disposal to force hasty changes to Colorado River law. Moreover, the *Shortage Guidelines* are designed to react to shortages forecast up to 2026, and this seems short-sighted given their assertion that shortages become significantly more probable immediately thereafter under the enacted “preferred alternative.”

A significant additional shortcoming of the *Shortage Guidelines* is their approach to reduced Colorado River flow as an ephemeral problem. The document was written as a response to drought (USBR, 2007), although its planning considers neither the possibility of a multidecade drought in the CRB, which is not without precedent (Meko and Woodhouse, 2005), nor evidence that severe multiyear droughts have occurred multiple times during the last 500 years (Woodhouse *et al.*, 2006). Moreover, as the *Water Supply and Demand Study* acknowledges, low river flows may be due to a long-term shift to increased aridity in the CRB, not temporary drought. Climate change is likely to lead to significant reductions in long-term average runoff in the CRB (NRC, 2007; Seager *et al.*, 2007; Barnett and Pierce, 2008; Cooley *et al.*, 2009), which is very sensitive to small increases in mean annual air temperature (McCabe and Wolock, 2007). After extensive consideration within the *Shortage Guidelines*, the USBR chose to neglect the effects of climate change in its runoff forecasts because global climate models at the time of publication could not provide sufficiently specific information about individual river basins. Although the USBR cited multiple studies that pointed to notable long-term changes in surface runoff in the western U.S. and thus knew that accepting the premise of no effect due to climate change would be flawed, the *Shortage Guidelines* were based only on the measured record of Colorado River flows (USBR, 2007). Thus, their forecasts probably overestimate future water supply and underestimate the need for long-term adaptation to decreased river flows. The *Shortage Guidelines* state that errors due to neglect of the

effect of climate change are acceptable because that document plans only to 2026 and thus requires an update relatively soon (USBR, 2007). The lack of a plan for Lake Mead elevations below 1,025 ft above sea level is a particularly glaring example of this optimistic, short-term approach. However, a pessimistic, long-term fate may await the Lower Basin: when flow reductions due to climate change were taken into account, a Monte-Carlo simulation indicated a 50% probability of total reservoir storage depletion as early as 2021, relative to 2007 conditions (Barnett and Pierce, 2008). This undercuts substantially the claim that there is sufficient time to plan by using projections that neglect climate change and then revise nearer to 2026. The reforms stipulated in the *Shortage Guidelines* are likely inadequate even if the premise of no effect due to climate change is correct. If the several forecasts of lower runoff due to climate change are correct, the *Shortage Guidelines* are even weaker. There appears to be a strong possibility that they will only delay an inevitable and painful confrontation between competing interests of the CRB.

AUSTRALIAN IMPLEMENTATION OF AN INTERSTATE WATER MARKET

Whereas the *Shortage Guidelines* have focused on progressive reductions in supply as a means of conserving water in Lake Mead, the MDB has instituted water reforms in the last decade that have moved existing water supplies to meet demands most efficiently. These reforms, which center on the creation of an interstate water market, have created the flexibility that has allowed both municipalities and a variety of irrigators to manage significant reductions in total supply that have prevented the failure of the MDB water supply. If prolonged aridity in the CRB leads to increasingly strict reductions in supply, important new information emerging from Australia's experience with water management reform in the last two decades may provide an effective example for future reform in the CRB.

The MDB covers 10.6 million km² and is drained by Australia's two longest rivers, the Darling (2,740 km long) and the Murray (2,530 km long), and their tributaries. Like the CRB, agricultural irrigation is the primary consumptive use of water; the MDB contains 65% of the irrigated land in Australia. Average runoff is 17.2 maf/yr (21,200 GL/yr), and several large reservoirs have a total storage capacity of just under 28.3 maf (34,900 GL) in preparation for recurring periods of aridity (MDBA, 2008; CSIRO,

2008). Climate change is likely to reduce long-term average runoff in the MDB. Such effects may have already started: flows in the Murray River reached historic lows during a long dry period from 1995 to 2009 (Pittock and Connell, 2010).

The two upstream riparian states of the Murray River, New South Wales and Victoria, share its yearly flow equally (i.e., the volume of water available to each state varies annually) after guaranteeing a fixed volume to South Australia, which lies downstream. During low river flow, the volume delivered to South Australia was reduced to bring it in line with its historical percentage of overall flows. After the yearly share to each state is announced, states declare the percentages of permanent water rights that will be delivered to each user. These "seasonal allocations," which are volumes of water delivered to users per month or year, are based on volumes stored in reservoirs. If necessary, they are small fractions of the volumes declared in permanent water rights, which are known as "entitlements." Thus, yearly consumptive use is tuned to the available water of that year (Cruse *et al.*, 2004; Turrall *et al.*, 2005).

Entitlements and seasonal allocations are traded in a regulated interstate water market that was created in 1989. Trading was insignificant until consumptive use of MDB water was capped in 1996 in response to drought conditions and increasing demand (Connell and Grafton, 2011). Then, yearly trading increased to <1% of entitlements and ~10% of allocations (Cruse *et al.*, 2004). Intense aridity from 2005 to 2009 sharply curtailed allocations and spurred interstate water trading, which represented 19.9% of all water trading in Australia in 2008-2009 (Australian National Water Commission, 2010). Patterns have since developed in the interstate market (Figure 3). In times of shortage, irrigators of opportunistic crops (e.g., rice, cotton) in New South Wales, particularly the Murrumbidgee River Basin, sold water to horticulturalists, viticulturalists, and dairy farmers in South Australia and Victoria, who require yearly supplies of water to prevent the death of plants and cows (Cruse *et al.*, 2004; Australian National Water Commission, 2009). The largest buyer of water was South Australia, which acted on behalf of Adelaide (Australian National Water Commission, 2009). When extremely wet conditions came in 2010-2011, all allocations across the MDB were ≥100% of entitlements. Irrigators had surplus water for their crops, and so large volumes of water were sold at low prices to regions that could store water for future years (Australian National Water Commission, 2011).

During recent dry years, these reforms appear to have provided essential flexibility to both sellers and buyers. The sales from New South Wales to irrigators in other states led to incomes in regions that did not

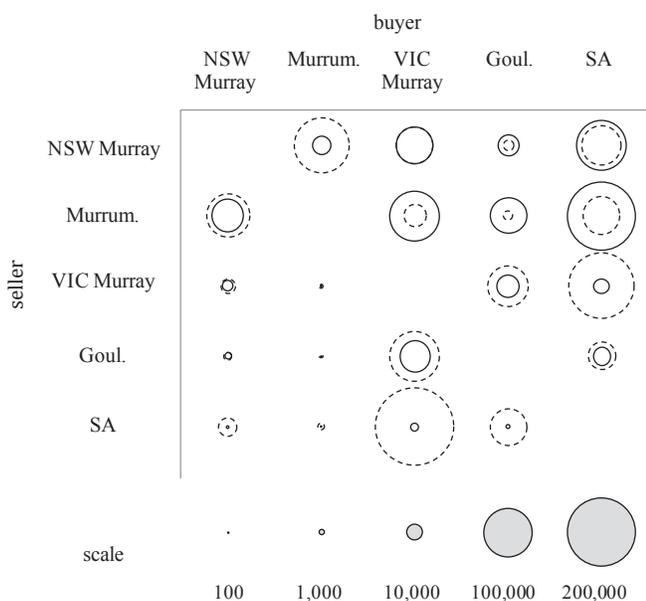


FIGURE 3. Water Transfers in the Murray-Darling Basin During the 2008-2009 (solid circles) and 2010-2011 (dashed circles) Growing Seasons. Buyers and sellers are abbreviated as follows: NSW Murray = the mainstem of the Murray River shared by New South Wales; Murr. = Murrumbidgee River subbasin, New South Wales; VIC Murray = the mainstem of the Murray River shared by Victoria; Goul. = Goulburn River subbasin, Victoria; SA = South Australia. Sizes of circles represent volumes transferred, in megaliters. Adapted from the Australian National Water Commission (2009, 2011).

have adequate water to raise their water-intensive crops, probably preventing recession (Pittock and Connell, 2010). In South Australia, the Murray River usually supplies ~40% of the municipal supplies for 1.525 million people (Adelaide, South Australia, is easily the largest city depending on the MDB system), with the remainder coming from small surface water sources, groundwater, and a desalination plant (SA Water, 2011). However, monthly allocations during the extremely dry 2008-2009 growing season ranged from 2 to 18% in South Australia, and so the state relied on the Murray River for 86% of its municipal water supply that year. Interstate water trading allowed the state to purchase 187,000 af (231 GL) for municipal uses (Australian National Water Commission, 2009); this accounted for nearly all of the municipal water delivered that year, which was 175,000 af (216 GL); (SA Water, 2009). Thus, interstate water trading was essential in preventing a municipal water supply emergency because the necessary volume of water did not exist within South Australia during 2008-2009. Conversely, the net volume of water purchased by South Australia in 2010-2011 was just 2% of that purchased in 2008-2009 and it was the largest gross seller in the MDB. In a wet year, interstate water trading allowed South

Australia and other saturated regions to gain an economic benefit from surplus water. In addition to responding to yearly variations in flow, Australia has used interstate water trading to accommodate two environmental protection measures: a cap on total water diversions from the MDB (Pittock and Connell, 2010) and a federal water purchasing program designed to leave additional water in the river (Connell and Grafton, 2011).

Water supply and water trading in the MDB are administered by multiple federal agencies such as the Murray Darling Basin Authority (MDBA), which is charged with the development of a Basin Plan to set long-term withdrawal limits for surface and groundwater, and the Australian Competition and Consumer Commission (ACCC), which monitors water trading and enforces market regulations (ACCC, 2011). Historically, Australian states operated with near-total independence with regard to their water resources, although they consulted with each other via the Council on Australian Governments (COAG) to form similar regional water management plans. However, Australian water reform has concentrated increasing power at the federal level, with the 2007 Water Act granting substantial interstate power to the newly formed MDBA and the ACCC in order to manage an increasingly limited resource amidst acrimony between states (Connell and Grafton, 2011). This was the outgrowth of successive basin-wide commissions formed by a coalition of states, yet its inception at the federal level has presented a challenge in that it brought long-standing tensions between states and the federal government into water management (Connell and Grafton, 2011). Concentration of power in a central, basin-wide authority is consistent with theoretical work that describes ideal water markets (Matthews, 2004).

It is important to acknowledge that the efficiency of water allocation in Australia has been impeded by noneconomic barriers to trading water between sectors of its economy. In addition to potential externalities that pertain to all water markets (Chong and Sunding, 2006), Australian culture includes a strong predisposition toward agricultural life, as a countryside of small farms was part of governmental plans to both settle the Australian interior during colonial times and to repatriate soldiers after the large wars of the 20th Century. This led to the development of Australia's water market only after drought persisted for several years and the inclusion of impediments to transfer of water away from agriculture in market rules (Cruse *et al.*, 2007). Additionally, state endorsement of water transfers from farms to cities counteracts a tradition of state sponsorship of irrigation infrastructure that is meant to offset precipitation variability, and so Australian state governments have

tended to respond to drought first with new infrastructure projects, not with policy reforms (Crase *et al.*, 2007).

AN INTERSTATE WATER MARKET IN THE COLORADO RIVER BASIN

Probable Features

Water trading is not unprecedented in the western U.S. Intrastate water markets are common, although they vary in their implementation. An early water market began in the Central Valley of California, which does not use Colorado River water, in 1992. Created in response to drought, it led to the sale of water from farmers to cities, with large profits made by the former (Loomis, 1994). In Arizona, only permanent yearly water rights established before 1919 can be traded, and transactions require a 420-day waiting period. In New Mexico, water rights must predate 1907 to be sold, and transactions can require up to 1.5 years. In the Northern Colorado Water Conservancy District, standardized water rights, small transaction fees, and short processing times have led to a vigorous water market in which sellers are nearly always irrigators who usually sell to municipalities (Brookshire *et al.*, 2004; Brewer *et al.*, 2007; Donohew, 2009). Across the western U.S., the number of transactions has been increasing over time due to increasing sales of permanent water rights (Brewer *et al.*, 2007), although sales of seasonal water deliveries have historically been much greater (Brown, 2006). Prices paid by agricultural users tend to be significantly lower than prices paid by urban users due to differing levels of utility for a unit volume of water. Both agricultural and urban prices have been steadily climbing over the last decade (Brown, 2006; Brewer *et al.*, 2007; Donohew, 2009).

The stable operation of water markets at the state level suggests that an interstate water market could be a viable option for the CRB. To date, isolated interstate agreements have been limited in scope and have transferred unused Arizona water to cities of southern Nevada or farms of southern California (U.S. Bureau of Reclamation *et al.*, 2002; MacDonnell, 2009). Given that both Arizona and Nevada have limited in-state water resources, intrastate water markets do not provide sufficient water security in these states. Furthermore, water is only used for municipal and industrial uses in Nevada, so an intrastate market would be useless due to a lack of diversity of users (Nieuwoudt and Armitage, 2004; USBR, 2011). Conversely, an interstate market would give

these arid states access to agricultural trading partners with different crops, planting patterns, and water needs. The CRB is large enough to contain a wide diversity of users, and the infrastructure exists to allow the physical transfer of water between most potential trading partners. The large sums of money offered by Nevada for additional sources of water indicate a clear willingness to pay, and California agriculture and unused Upper Basin water may be more practical sources than unused Arizona water or groundwater from central Nevada. In addition to a decrease in the long-term average runoff, interannual variability of runoff is likely to increase due to climate change (IPCC, 2007). Although the large reservoir capacity in the CRB mitigates interannual variability, water trading can also help alleviate it as it has in Australia. Thus, an interstate water market may not only be viable in the CRB, but the flexibility it provides may also become essential as scarcity and runoff variability increase.

An interstate water market will likely increase the economic efficiency when willing buyers in arid southwestern cities connect with potential agricultural sellers across the CRB. Generally, water allocation based on seniority without trading is extremely inefficient, with irrigators paying much less for their water than municipalities (Chong and Sunding, 2006). In the Colorado market from 1987 to 2005, the median prices of single-year agriculture-to-urban and agriculture-to-agriculture transfers were \$40/af (\$0.0324 per 1000 L) and \$10/af (\$0.0081 per 1000 L), respectively (Brewer *et al.*, 2007). By contrast, the purchase of unused Arizona water cost the SNWA \$291.67/af (\$0.2366 per 1000 L) (Tavares, 2009). This high price appears to be a function of a paucity of sellers willing to meet the demand of Las Vegas due to the lack of a functioning market for water.

The potential for any new water management practice to improve upon existing policy depends on understanding the costs of available alternatives. Implementing interstate water trading would bring new costs to the water supply of any participant, and so the magnitude of the benefit of a new interstate water market will vary by location and by water user. Thus, it will require a careful, site-specific study; although the costs of market regulation (see below) should be rather constant across the CRB, transaction costs could vary substantially between basin states. Such costs arise from any impediment to a water transfer. They tend to be higher in arid regions, and policy-induced costs are often desirable because they monetize externalities of trading (Colby, 1990). As a simple example, if water trading moved net consumptive use either upstream or downstream of Lake Powell and Grand Canyon during a given season, this could affect hydropower revenue at Glen

Canyon Dam, the health of (endangered) species in the sensitive Grand Canyon ecosystem, and recreational benefits in both locations. Although there is a clear need for research to quantify such costs and, consequently, the net economic benefit of the initiation of interstate water trading, the large difference between the prices of water in routine sales in the Colorado market relative to that of the SNWA-Arizona agreement indicates that interstate water trading offers strong potential for an increase in availability and a decrease in price for some willing buyers.

Water-scarce regions outside Arizona and Nevada stand to benefit from expanded interstate trading. For example, although California will not experience shortages under the *Shortage Guidelines* and enjoys the largest share of Colorado River water of any CRB state, the majority of this water is used on farms; the water supplies for metropolitan Los Angeles and San Diego are not plentiful. Although no intrastate market for Colorado River water exists in California, San Diego has purchased 0.2 maf/yr (247 GL/yr) from the Imperial Irrigation District starting at \$258/af (\$0.2092 per 1000 L) (San Diego County Water Authority, 2011). This demonstrates a strong willingness to pay for water in a state that receives a large volume from the Colorado River. Just as active trading in the Australian market occurs within states, junior rights holders across the CRB would likely be active participants in a freer water market, purchasing both in-state and out-of-state water.

The concept of prior appropriation and the seniority of certain water rights could be preserved in an interstate water market, as it has been in Australia. There, water rights are separated into two tiers known as “high security” or “low security” entitlements, which are more or less likely to receive their full seasonal allocation (e.g., Bjornlund, 2004). The trading of permanent or temporary water rights in the U.S. neither implies nor rejects the adoption of the Australian system of allocations. If desired, the CRB could maintain prior appropriation in a water market by classifying the seniority of a water right to reflect the date of its creation, not the date of its possession by its current owner. In this case, market participants could control the reliability of their water supplies as well as the size of their supplies. Presumably, senior water rights would sell (i.e., a permanent transfer) or lease (i.e., the purchase of a volume of water for a fixed time period, such as one year) for much higher prices than junior ones as they currently do in the Colorado intrastate market (Brookshire *et al.*, 2004; Brewer *et al.*, 2007). Preserving seniority of water rights should make interstate water trading attractive to senior rights holders across the CRB due to the strong potential for profit.

Coupled with the access to new sources of water for junior rights holders, it may make interstate water trading more universally appealing across the Basin. Thus, interstate water trading is not a threat to prior appropriation, one of the bedrock principles that has guided Western water law since its inception.

Barriers to Interstate Water Trading in the Colorado River Basin

Several barriers exist to the implementation of an Australian-style water market in the CRB. A merger of existing intrastate water markets would be problematic because regulations pertaining to water trading vary widely across the CRB (Colby, 1988; Loomis, 1994; Brookshire *et al.*, 2004). The water market in Colorado is the most efficient, whereas rules in Arizona and New Mexico seem intentionally restrictive to trading. The laws of Colorado thus provide the best model for standardization. The Australian innovation of “tagged trade,” in which the features of a water right are honored in the state of purchase, even if they are inconsistent with the rights created in that state (Australian National Water Commission, 2010), could allow for an interstate water trading system that does not necessitate the political and economic costs of full standardization. However, in the MDB, state laws were similar before the inception of interstate trading due to coordination through the COAG (Connell and Grafton, 2011), but, in the CRB, state laws vary to the extent that even the basic terminology of water rights depends on different definitions in different states (Colby, 1988).

The success of a water market depends on regulation by a central authority that can apply rules fairly to all participants, execute trades in a time frame that allows users to respond to changing water needs and availabilities, and protect third parties from potential negative effects of water transfers (Chong and Sunding, 2006). Consequently, Basin-wide standardization and subsequent market regulation would almost certainly require states ceding some authority to an entity with interstate jurisdiction. The states of the CRB hold strong authority over their water supplies, yielding only to legal agreements negotiated with other basin states or to federal laws that were not designed explicitly to control water, such as the U.S. Endangered Species Act (MacDonnell, 2009). The USBR provides a poor U.S. analogy to the Australian federal agencies; the former merely manages water infrastructure and does not set CRB-wide conservation or use policies. No other Basin-wide entity exists, and the creation of an authority that could operate above the CRB states would require delicate negotiation given the disquiet between states of the

two Basins as well as negativity related to perceptions of unnecessary new regulation by nonlocal government entities, which has been observed in Texas (Colby, 2000). The national economic and cultural significance of the Colorado River and the current involvement of the USBR suggest that a CRB Authority might lie within a federal agency. In addition to the MDBA, rough analogies for such an entity exist in those that regulate interstate electricity trading, and thus an Independent System Operator or a Regional Transmission Organization could serve as a model for some elements of a regulatory agency that oversees interstate water trading in the CRB.

Just as cultural factors have been an impediment to agricultural-urban water transfers in Australia (Cruse *et al.*, 2007), an additional, significant barrier to creation of an interstate water market in the CRB is strong resistance to change among Upper Basin states that is derived from fear that water transfers could remove water from economic use in the Upper Basin in favor of economic use in the Lower Basin. In 2008, then-Colorado senator (and the current U.S. Secretary of the Interior) Ken Salazar called any modification of the laws that divide CRB water between the Basin states “an anathema to the fundamental principles of Colorado’s water rights.” He believed that renegotiation of Colorado River law might lead to less water for Colorado and more for Lower Basin states, and Colorado “did not want California to gobble up all of the water supply on the Colorado River” (Ashby, 2008). Furthermore, survey data indicate that CRB water managers consider water law to be an important influence on local water supply yet have little understanding about how potential regulatory changes might affect them (USBR, 2011). Such distrust and uncertainty may delay meaningful CRB reform, including the implementation of interstate water trading, until the cities of the Southwest face certain crisis, at which point the flexibility provided by a water market would be largely diminished. Management of the psychological and emotional costs of the instability brought by institutional change has received attention in the field of sustainability theory (e.g., Senge, 1990; Senge *et al.*, 1999). A detailed discussion of the principles of change management with respect to water managers across the CRB is beyond the scope of this article, but the concerted application of these principles as well as effective public communication would be an essential part to any meaningful regulatory reform in the CRB. An interstate water market could be the reform that best suits the distrust in the CRB, because participation would be optional and Coloradoans (or others) could refuse to sell their water downstream. This may be preferable to entering into negotiations during a water crisis and receiving reduced access to the Colorado River with no option for amendment once an altered

Compact is finalized. Furthermore, interstate trading could be phased in gradually by first creating separate markets in the Upper and Lower Basins and then merging them after several years.

Although interstate water trading is not incompatible with prior appropriation, it could challenge other core principles of CRB water law. For example, the guarantee of a minimum flow from the Upper Basin to the Lower Basin could, in principle, be undermined if great volumes of water were voluntarily sold from users below Glen Canyon Dam to those above it, although this seems highly unlikely in the coming decades. Additionally, laws invalidate water rights if water is not put to beneficial use, and environmental flows are not considered as beneficial uses in all CRB states (Colby, 1988). Although advocates of ecological health might wish to purchase water to increase instream flows (as in Australia, see above), such an action runs counter to the values espoused in CRB water law. A complete review of the legal complexities induced by interstate water trading is beyond the scope of this article, but these examples indicate that responding to scarcity by creating an interstate water market may challenge some long-held beliefs that are embedded in the Basin’s laws. However, the existence of such conflicts does not negate the value of an interstate water market, which may be necessary to prevent desperate, poorly conceived, more significant challenges to CRB law from states suffering from shortages.

Should the CRB acquiesce to change and create an interstate water market, the attendant emotional fears should be easier for the new CRB-wide entity to address. Concerns such as entities being forced to sell and then experiencing financial ruin, farms losing all their water to wealthy cities, and farming towns depopulating have been debunked as existing water markets have been studied (Chong and Sunding, 2006). For example, based on data from California, Colorado, and Australia, it would seem unlikely that the sale of water at market prices from agricultural areas in Colorado and Utah to Lower Basin cities would have exceptionally deleterious effects to the economies or cultures of upstream regions. Other impediments to successful introduction of markets can arise if regulations are poorly written (cf., Colby, 2000), although ample legal precedent for the application of state water law exists (Colby, 1988). This should ease the adjustment to an interstate market somewhat.

CONCLUSIONS

The 2011 interim report of the *Water Supply and Demand Study* marks the first official acknowledge-

ment by the USBR of facts that nontechnical and peer-reviewed publications have reported for some time: supply in the Colorado River exceeds demand, and that supply is expected to decrease substantially due to climate change (USBR, 2011; e.g., Powell, 2008; Barnett and Pierce, 2008). Climate change cannot be ignored in reservoir management (Viers, 2011), and so this new stance by the USBR would seem to render obsolete an important premise that underlies the reactions to drought described by the *Shortage Guidelines* (USBR, 2007). Although the *Shortage Guidelines* are based on an outdated and flawed premise, their reaction to aridity persists as policy. They are consistent with the many laws governing the Colorado River, but they place the burden of low water availability on the cities of Arizona and Nevada and agriculture along the CAP. Were the reduced withdrawals from Lake Mead likely to prevent further shortage, then the *Shortage Guidelines* would offer some water security to Arizona and Nevada at high cost. However, the fall of Lake Mead to <1,025 ft above sea level remains a real possibility, and so current policy imposes high, targeted costs yet addresses the root problem inadequately, merely postponing contentious negotiations until less water is available.

It is unlikely that the impending water-shortage crisis of the Southwest can be managed by conservation alone, either at the regional level (i.e., as reduced deliveries from Lake Mead to Lower Basin states) or at the municipal level. During more than a century of water development in the CRB, demand has changed from the solely agricultural economy of the early 20th Century to a mixture of lucrative agriculture and large, economically and politically strong municipalities. However, the legal division of the Colorado River has not evolved. Allowing market forces to redistribute supply so that it matches demand will offer vital flexibility in the face of declining average yearly flows and steadily increasing the population while, if desired, also preserving the system of prior appropriation that is central to water rights in the American West. Recent data from active interstate water trading in Australia show that basin-wide water trading improved the well-being of both agricultural and municipal users during a time of prolonged aridity.

Currently, should forecasts for long-term aridity come true, Arizona and Nevada are extremely unlikely to have enough water to sustain their growth rates of recent decades. Under a market system, the price of water everywhere would rise when water becomes scarce and water will move to those most able to pay for it. This allows Arizona and Nevada to have water security, at a cost, and senior rights holders will have a new source of income during times of scarcity. Such a market would depend on effective regulation to

ensure fairness in transactions and limit negative third-party effects. Although the barriers to trading water across state lines in the CRB are not trivial, the potential benefits of an interstate water market there are too significant and numerous to ignore. The final report of the *Water Supply and Demand Study* is sure to spark conversations about updating water allocation policy in the CRB. Creation of an interstate water market there should be a meaningful part of that discussion.

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5.e. - Colorado River Environmental Issues & Water Quality



**Colorado River Basin State Representatives of Arizona, California, Colorado,
Nevada, New Mexico, Utah, and Wyoming**

May 11, 2012

Via E-mail and U.S. Mail

Mr. Larry Walkoviak, Regional Director
Attn: Dennis Kubly
Bureau of Reclamation
Upper Colorado River Office
125 South State Street, Room 7218
Salt Lake City, Utah 84138

Re: Comments on (1) Draft Finding of No Significant Impact for the Environmental Assessment for Development and Implementation of a Protocol for High-Flow Experimental Releases from Glen Canyon Dam, Arizona through 2020; and (2) Draft Finding of No Significant Impact for the Environmental Assessment for Non-native Fish Control Downstream from Glen Canyon Dam.

Dear Messrs. Walkoviak and Kubly,

On behalf of the seven Colorado River Basin states and Upper Colorado River Commission (collectively the "States"), we wish to thank the Bureau of Reclamation ("Reclamation") for issuing for public consideration and comment the Draft Finding of No Significant Impact for the Environmental Assessment for Development and Implementation of a Protocol for High-Flow Experimental Releases from Glen Canyon Dam, Arizona through 2020 ("Protocol FONSI") and the Draft Finding of No Significant Impact for the Environmental Assessment for Non-native Fish Control Downstream from Glen Canyon Dam ("Non-native Fish Control FONSI"). We submit these comments on both the Protocol and Non-native Fish Control FONSI, which were released on April 27, 2012 with the comment period ending on May 11, 2012. We ask that Reclamation please consider these comments in finalizing the NEPA process for these documents and compiling the administrative record.

Overall Comments:

The States wish to emphasize the importance of the HFE Protocol and Non-native Fish Control actions contemplated in a manner that complies with the Law of the River and promotes or avoids interfering with the survival of the endangered humpback chub. Toward these ends, the States applaud Reclamation for ensuring that both FONSI: (i) expressly recognize the actions contemplated will be implemented consistent with the 2007 Interior Record of Decision on the Colorado River Interim Guidelines for Lower

Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead; (ii) tier the actions to the 1996 Record of Decision for Glen Canyon Dam Operations that transcends the time period for the ongoing 5-Year Experimental Plan as well as the HFE Protocol and Non-native Fish Control actions; (iii) recognize the non-native fish control actions as necessary mitigation for implementing the HFE Protocol consistent with the 2011 Biological Opinion; (iv) set a path forward for operating Glen Canyon Dam while continuing to respect Tribal cultural values; (v) make clear the HFE Protocol is experimental as opposed to a management action as set forth in the 1996 Record of Decision or 1997 Operating Criteria; and (vi) expressly recognize implementing the proposed actions does not represent an interpretation of existing law nor predetermine future actions or operations at Glen Canyon Dam.

The States further provide the following comments to bolster the integrity of the FONSI and related actions consistent with our support.

Comments Applicable to Both FONSI:

A. Tribal Values and National Historic Preservation Act: The States support removal of non-native fish that both benefit native fish and respect the Tribes' cultural values. We believe the mitigation measures listed on page 11 of the Non-native Fish Control FONSI meet these twin goals.

However, in addition to introducing mitigation measures, both the Protocol FONSI and Non-native Fish Control FONSI conclude that taking of life associated with past non-native fish control results in adverse impacts under the National Historic Preservation Act (the "NHPA"). Non-native Fish Control FONSI, p. 11; Protocol FONSI, p. 14. This conclusion should not be regarded as implying the NHPA, in and of itself, provides an independent basis for protecting fish. See, 36 C.F.R. §§ 60.4 and 800.16(f)(1). Rather, the States understand, but may not agree, that the conclusion is intended to suggest non-native fish control actions may have an indirect effect on historical properties that implicate the NHPA.

To avoid unnecessary confusion and controversy, the States recommend Reclamation remove the conclusion that non-native fish control affects the NHPA from both the Protocol and Non-native Fish Control FONSI. In the alternative, the States reserve their rights to disagree with the assertion that non-native fish control actions may implicate the NHPA in any way based upon future evaluation and consideration.

B. Consistency between Documents: Both FONSI rely on and reiterate the requirements of the 2011 Biological Opinion. Non-native Fish Control FONSI, pp. 5-9; Protocol FONSI, pp. 7-11. When the two FONSI reference the 2011 Biological Opinion, they should remain consistent with each other. For example, in the Protocol FONSI, actions for the Kanab ambersnail are listed under Reasonable and Prudent Measures. However, page 7 of the Protocol FONSI states that the Reasonable and Prudent Measures ("RPMs") are for the humpback chub. Reclamation further lists measures for economics and cultural impacts that have nothing to do with RPMs for the

humpback chub. In comparison, the Non-native Fish Control FONSI lists the Kanab ambersnail actions as mitigation measures. Non-native Fish Control FONSI, p. 4. Given these references, the final FONSIs would benefit from changing the scope of the RPMs to include more than just humpback chub or moving the measures unrelated to humpback chub to the Mitigation Measures section. The States also recommend that both FONSIs use the same language to summarize the 2011 Biological Opinion and ensure that the defined terms throughout both FONSIs are consistent to avoid confusion.

In addition, the U.S. Fish and Wildlife Service will require Reclamation to conduct immediate non-native fish removal if certain triggers are met in the 2011 Biological Opinion. Non-native Fish Control FONSI, p. 4; Protocol FONSI, p. 5. It is the States' understanding that the Memorandum of Agreement regarding Non-Native Fish Control in the Colorado River below Glen Canyon Dam ("NNFC MOA") requires Reclamation to notify the Tribes at least 30 days prior to conducting live removal. NNFC MOA, p. 5. The Non-native Fish Control FONSI also emphasizes that consultation with the Tribes prior to non-native fish control, although it does not mention the 30-day requirement in the NNFC MOA. Non-native Fish Control FONSI, p. 11. It would be helpful if these requirements in the Non-native Fish Control FONSI and NNFC MOA were reconciled and tracked with the 2011 Biological Opinion requirement for immediate fish removal prior to finalizing the FONSIs.

Moreover, the Protocol FONSI states that Reclamation will "identify non-native fish species that may affect aggregations to determine the need for control actions" as part of the Conservation of Mainstem Aggregations. This measure is not listed in the Non-native Fish Control FONSI. Compare Non-native Fish Control FONSI, p. 7, with Protocol FONSI, p. 7. Non-native fish control is intended to serve as mitigation for the high-flow experimental releases proposed in the Protocol FONSI. The States would like to better understand the reason for this difference between the FONSIs or recommend that Reclamation make sure the Non-native Fish Control FONSI is complete and consistent with the Protocol FONSI.

Protocol FONSI Comments:

A. Proposed Action: The Protocol FONSI provides a general description of the proposed action as including experimental high-flow releases ranging in magnitude and duration based on input of tributary sediments, resource conditions and a three-prong decision-making process. Protocol FONSI at pp 3-4. It then notes that both the storage and release and rapid response approaches for timing high-flow releases "have been put forward." *Id.* at 4. Finally, the document refers in later sections to specific mitigation or conservation measures as also being part of the proposed action. See *e.g., id.* at pp. 7, 12. From these descriptions and references, what actually constitutes the elements of the proposed action remains unclear. To better understand the basis for the FONSI and the components of the proposed action, the final decision document should include a clear itemization of each element that constitutes part of the proposed action as it is

intended to be adopted and implemented pursuant to the Final Environmental Assessment and FONSI.

B. Consultation: In different sections the Protocol FONSI identifies different parties whom Reclamation will consult with prior to deciding to conduct an experimental high-flow release. In the Proposed Action Section, the FONSI notes the decision process will be carried out through the GCDAMP with input from the Adaptive Management Work Group, *id.* at 3, and that Reclamation will consult the Basin States prior to conducting an HFE, *id.* at 4. In the Reasonable and Prudent Measures Section, the FONSI explains how formal consultation with the U.S. Fish and Wildlife Service will be reinitiated, if necessary. *Id.* at 5-6. Likewise, in the Cultural Mitigation Section, the FONSI identifies a process for consulting parties to the Protocol MOA. *Id.* at 9. Because these references to input and consultation are general in nature and scattered throughout the document we cannot discern how these various consultation activities will be implemented and considered as part of the decision making process. The States recommend the Final FONSI clarify the consultation processes as contemplated, including who will be included and when they will be conducted.

Along these same lines, there is currently no mention of consultation in the Decision Matrix section of the Protocol FONSI. The section provides only that [r]ecommendations for HFEs developed by knowledgeable scientists and resource managers will be acted upon by Interior, as described above, with due consideration to the full breadth of resources that might be affected by the high-flow. *Id.* at 5. Because other areas of the FONSI reference consultation as being part of the decision making process, the Final FONSI would benefit from clarifying what is meant by "acted upon," as described above and further clarify how the consultation efforts are included in the decision matrix.

C. Flexibility: The Protocol FONSI suggests the Protocol may be modified as appropriate to provide the flexibility to respond to sediment inputs during windows of opportunity. *Id.* at 4. While such flexibility is beneficial, it is important to note it is not unlimited. It continues to be constrained by the purpose and parameters of the NEPA analysis.

D. Documentation: The Protocol FONSI refers to a number of reviews, evaluations and reports that will be provided and used as part of the decision to conduct a high-flow release. *See e.g., id. at 2, 5, 15.* The final FONSI should further clarify how the decision, based on the three-prong process of the decision matrix and various consultations, will be documented prior to conducting a high-flow release.

E. Impacts to Humpback Chub: The States appreciate Reclamation and the Department's willingness to re-evaluate the trigger for conducting a high-flow release and/or non-native fish controls based on the annual status of humpback chub population as identified according to the best available information.

As an additional noteworthy item, as currently set forth, the Protocol FONSI may be internally inconsistent regarding impacts to humpback chub. On page 12, under the heading "Impacts that may be both beneficial and adverse," the Protocol FONSI states that the proposed action is expected to have beneficial impacts to humpback chub. But page 17 "under the heading "Degree to which the action may adversely affect an endangered or threatened species" states that the Biological Assessment determined that the proposed action may affect and is likely to adversely affect humpback chub. Without further clarification, the conclusion on page 17 that "long-term consequences of the proposed action are expected to be beneficial" could be construed as being contradictory to determinations set forth in the Biological Assessment. See *id.* at 17. To avoid confusion and to demonstrate compliance with NEPA, the Protocol FONSI should clarify how it is consistent with the analysis and conclusions in the Biological Assessment.

F. Specific Observations:

1. Introduction "at page 1, 1st paragraph: The purpose of an HFE Protocol has been based on the need to explore opportunities associated with conducting and analyzing the effects of multiple experimental high-flow releases from Glen Canyon Dam. Because no such protocol has been implemented before, no one can determine whether such action will actually benefit resources downstream of Glen canyon Dam. To accurately reflect this situation, the words "whether and" should be inserted prior to "how multiple events can be used . . ."

Likewise, to better reflect the status of the current science, "can" should be changed to "may" where the Protocol FONSI states "The rebuilt and rejuvenated sand featured and associated backwater habitats **can** provide key wildlife habitat."

2. Proposed Action "at page 4, 3rd paragraph: This paragraph provides, "Sand deposited as sandbars was a primary component of the historic pre-dam Colorado River ecosystem." Because the pre-dam Colorado River was a sediment rich river that transported large quantities of sediment that scoured the canyon bottom and both eroded and deposited material along the river shores, the States request including a more complete description by stating, "Deposition and erosion of sand was a primary component of the historic pre-dam Colorado River ecosystem."
3. Decision Matrix "at page 5: According to this paragraph, "Reclamation will take a conservative approach and will re-evaluate, and suspend if necessary, the HFE Protocol, if it anticipates that significant impacts could occur that cannot be mitigated." The Protocol should be suspended well before permanent damage is done that cannot be mitigated. Accordingly, the States request Reclamation delete the language "that cannot be mitigated."

4. Conservation of Mainstem Aggregations at page 7: This paragraph provides that Reclamation will . . . work within its authority through the GCDAMP to ensure that a stable or upward trend of humpback chub mainstem aggregations can be achieved. It then outlines additional efforts that will be coordinated. The States support these efforts but disagree to the extent such efforts are considered an obligation under NEPA or the Endangered Species Act. The States recommend the language to ensure that a stable or upward trend . . . be changed to to promote a stable or upward trend . . .
5. Cultural Mitigation at page 9: Please provide a list of the parties to the Protocol MOA.
6. Impacts that may be both beneficial and adverse at page 12: The language in the first sentence should add including conservation and mitigation measures to clarify the basis for the statement. The new sentence would read: The proposed action, including the conservation and mitigation measures, is expected to have beneficial impacts to sediment resources, and to endangered species such as the humpback chub.

Given the uncertainty of the science regarding backwater habitats, the reference to benefits to associated backwater habitats should be qualified similar to that identified in Item Number 1, *supra*. Accordingly, the language backwater habitats that can provide key wildlife habitat . . . should be changed to backwater habitats that **may** provide key wildlife habitat . . .

7. Degree to which the effects on human environmental are controversial pages 13-14: Similar to explaining why the Tribal concerns associated with the Protocol are not highly controversial, the final document would benefit from including an explanation as to why the concern about having to find replacement power as a result of the Protocol is also not highly controversial.

Non-native Fish Control FONSI

A. Specific Comments

1. Distinction Between Mitigation Actions and RPMs pages 5-11: The FONSI sets forth at pages 5-6. conservation measures which have been agreed to as part of ESA section 7. The FONSI then identifies at page 7 the RPMs which are necessary and appropriate to minimize incidental take of humpback chub. In this section, Reclamation identifies additional non-native fish control options to reduce recruitment of non-native rainbow trout at Lees Ferry, including, for lack of a better term, the potential for stranding flows. Finally, at page 11, the FONSI states, Anglers have expressed concern about related actions that could directly affect the trout population but are not part of the proposed action, such as further testing of non-native fish suppression flows . . . Taking these statements together, it is unclear whether the discussion of stranding flows under the RPMs section is simply quoting the 2011 Biological Opinion or intended to be

May 11, 2012

Page 7 of 8

incorporated as a mitigation measure pursuant to the FONSI. For this reason, the States recommend that Reclamation clarify in the final documentation the role of "stranding flows" as part of the FONSI.

2. Conservation of Mainstem Aggregations at page 7: Same comment as Item Number 4 in the Specific Comments section for the Protocol FONSI.

Reservation of Rights

The States provide the above comments to the High-Flow Experimental Protocol and Non-native Fish Control FONSIs to bolster the integrity of the NEPA documentation consistent with our support. In the past, the States have agreed to not challenge an experimental high-flow release that bypasses the power plant facilities in the interest of comity and gaining useful information. We extend the same agreement to the high-flow experimental protocol, but reserve our positions and rights concerning future high-flow releases whether they are deemed experimental or management actions.

Furthermore, in the course of reviewing the material in the draft FONSIs, the States may have overlooked assertions that impact our respective interests. Failure to raise such concerns in these comments shall not be construed as an admission with respect to any factual or legal issue, or waiver of any rights for the purposes of any future legal administrative or other proceeding.

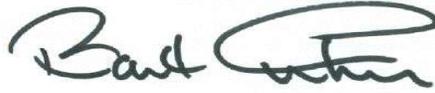
Thank you for your consideration of these comments.

Sincerely,

[Signatures on next page]



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Sandra A. Fabritz-Whitney
Director
Arizona Department of Water
Resources



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Dana B. Fisher, Jr.
Colorado River Commissioner
Colorado River Board of California



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Jennifer Gimbel
Director
Colorado Water Conservation Board



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Patricia Mulroy
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Jayne Harkins
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Estevan Lopez
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Wyoming State Engineer



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of the Interior**

www.doi.gov

News Release

Date: May 23, 2012

Contact: Adam Fetcher (DOI) 202-208-2416

Lisa Iams (Reclamation) 801-524-3673

Salazar Announces Improvements to Glen Canyon Dam Operations to Restore High Flows and Native Fish in Grand Canyon

Adaptive management strategy meets water and power supply needs

WASHINGTON □ Secretary of the Interior Ken Salazar announced today that, as part of the Interior's Glen Canyon Dam Adaptive Management Program, and in cooperation with five Interior agencies, the Bureau of Reclamation is approving two long-term research and experimental programs of high-flow releases and native fish protection to preserve and improve the Grand Canyon and its resources. Together, these decisions represent the most important experimental modification of operations of Arizona's Glen Canyon Dam in over sixteen years.

The two programs authorize changes in flow releases from the dam to meet water and power needs, but also to allow better conservation of sediment downstream, more targeted efforts to control non-native fish predation, and continued scientific experimentation, data collection, and monitoring to better address the important resources in the Colorado River below Glen Canyon Dam.

□ We've gained tremendous knowledge about the unique resources of the Grand Canyon in the Colorado River downstream of Glen Canyon Dam over the past sixteen years, □ said Secretary Salazar. □ Today's decisions constitute a milestone in the history of the Colorado River and will provide a scientific foundation to improve future operations to benefit resources in the Grand Canyon, as well as the millions of Americans who rely on the river for water and power. □

The first program establishes a long-term protocol for testing high-flow releases from Glen Canyon dam to determine whether multiple high flow events can be used to rebuild and conserve sandbars, beaches, and associated backwater habitats that have been destroyed or lost over the years of the dam's construction and operation. The experimental protocol will simulate natural flood conditions in order to provide key wildlife habitat, potentially reduce erosion of archaeological sites, enhance riparian vegetation, maintain or increase camping opportunities, and improve the wilderness experience along the Colorado River in Grand

Canyon National Park. The protocol is designed to take full advantage of sediment provided by tributaries of the Colorado River as a result of rainstorms and monsoons.

The protocol for high-flow experimental releases applies [scientific information gained](#) in previous high flow releases in 1996, 2004, and 2008 and provides the necessary, flexible framework to conduct further experimental releases through 2020 to determine the optimal timing, duration, frequency, and conditions that will maximize ecological and riparian benefits downstream in the Grand Canyon. For more information on the program, click [here](#).

The second program outlines a series of actions and research to control non-native fish and protect endangered native fish in the Colorado River below Glen Canyon Dam. Conservation of native fish, particularly the endangered humpback chub, will be enhanced by reducing the threat of predation and competition from non-native fish and improving critical habitat. The actions will also ensure continued compliance with the Endangered Species Act and a Final Biological Opinion issued by the U.S. Fish and Wildlife Service in 2011. Extensive government-to-government tribal consultations and analyses were conducted to ensure the required non-native fish control actions can be implemented in a way that respects tribal perspectives. For more information on the program, click [here](#).

□Implementation of these two programs marks a huge step forward in integrating the management of a dam that's critical to the delivery of water and power to millions of people in the Southwest with better conservation of the incredible values of the Grand Canyon, □said Assistant Secretary for Water and Science Anne Castle. □We are refining our operations to reflect what we've learned and address the concerns expressed by several Native American tribes about the management of fish at locations honored as sacred sites by many of the tribes and pueblos. □

The actions outlined in both detailed Environmental Assessments completed today include important scientific research and monitoring components that are fundamental to the adaptive management process. Reclamation has primary responsibility for operation of Glen Canyon Dam and the National Park Service has primary responsibility for Grand Canyon National Park and Glen Canyon National Recreation Area.

"The National Park Service is a strong supporter of high flow tests to help determine how best to rebuild and sustain the beaches and sand bars below Glen Canyon Dam. We appreciate the extensive collaboration required to develop these research programs which are critical to preserving the awesome resources and visitor experience along the Colorado River in Grand Canyon National Park," said Jonathan B. Jarvis, Director of the National Park Service.

Today's actions represent the most comprehensive experiment for protection of the Grand Canyon since Secretary of the Interior Bruce Babbitt signed a Record of Decision in 1996 and conducted the first high flow release. The experiments will help answer critical questions about the complex interactions between dam releases and resource responses, and also advance the goal of the Grand Canyon Protection Act to improve resource conditions.

###



**Basin States' Representatives on Colorado River Operations
States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming**

June 4, 2012

Via E-Mail and U.S. Mail

Ms. Beverly Heffernan
Bureau of Reclamation
Upper Colorado Regional Office
125 South State Street, Attn: UC-700
Salt Lake City, Utah 84138-1147

Mr. Rob Billerbeck
National Park Service
12795 W. Alameda Pkwy.
Lakewood, CO 80228

Re: Preliminary Alternative Concepts

Dear Ms. Heffernan and Mr. Billerbeck,

The seven Colorado River Basin States and the Upper Colorado River Commission (collectively "States") write this letter in response to the distribution and discussion of preliminary alternative concepts for the Long-Term Experimental and Management Plan EIS ("LTEMP EIS") and the May 10, 2012 correspondence from Glenn Knowles and Rob Billerbeck regarding the current schedule for drafting the LTEMP EIS. On March 30, 2012 the Bureau of Reclamation ("Reclamation") and the National Park Service ("NPS"), as co-lead agencies for the LTEMP EIS, distributed a newsletter summary of alternative concepts for consideration at a public meeting in Flagstaff, Arizona on April 4-5, 2012 ("Flagstaff Meeting"). According to the co-leads, the purpose of the Flagstaff Meeting was to present preliminary alternative concepts in an informal setting to increase public involvement and transparency. It was not intended to be a formal public comment meeting, but rather a workshop for discussion purposes only. In the May 10, 2012 correspondence, you indicated that "the lead agencies will create working draft alternatives for the project using the preliminary alternative concepts and the input...received at the public workshop on April 4-5, 2012 in Flagstaff, AZ." That correspondence also stated: "In June, the lead agencies will present draft alternatives to the Cooperating Agencies and solicit comments from them." This letter is submitted to clarify the States' understanding of the status of the alternatives development process for the LTEMP EIS.

As you are aware, the States are in the process of developing a meaningful alternative to include in the EIS analysis. We are presently researching the status of existing science on a variety of resources and considering mechanisms for addressing resource conditions downstream of Glen Canyon Dam consistent with the Grand Canyon Protection Act and "Law of the River," including the 2007

Interim Guidelines for Lower Basin Shortages and Coordinated Operation of Lake Powell and Lake Mead (“2007 Guidelines”). We appreciate your willingness to make Department of Interior (“Interior”) staff available to our efforts. The States intend to take you up on your offer to provide technical assistance to stakeholders developing alternatives. As we work through alternative development, we will keep you informed, and hope to include you in the later stages of development. Given the breadth and depth of such research, we appreciate the extension of time to complete the development of an alternative as noted in Glen W. Knowles April 24, 2012 3:54 PM e-mail and in your May 10 letter. The States are working diligently to develop this alternative for consideration by the July 2, 2012 extended deadline.¹

As part of the States’ effort to support Interior in the development of the LTEMP EIS, technical representatives for the States attended the Flagstaff Meeting to learn the details of the preliminary alternative concepts. In particular, the States were interested in understanding how the science has been and may continue to be synthesized to inform the alternative development process. Based on your comments and the public discussions at the Flagstaff Meeting and your subsequent correspondence, it appears the co-lead agencies were also anticipating the States and other stakeholders to provide meaningful feedback on the very preliminary alternative concepts. The States, however, were not yet in a position to take a stance on the elements of the alternative concepts for the reasons that follow:

- 1) **Scope:** The breadth of uncertainties acknowledged at the Flagstaff Meeting make it difficult to develop a well defined scope of work for the EIS, and has inhibited the States from knowing the most significant resource issues that should be considered in the EIS analysis. See *e.g.*, *CEQ Final Guidance*, 77 Fed. Reg. 14473, 14476 (March 12, 2012). That said, the States very much appreciate the co-lead agencies identifying certain “side boards” during the Meeting, which include the fact that the EIS: (a) will not consider dam removal; and (b) will not affect the annual amount of water that moves between Lake Powell and Lake Mead, as determined by the “Law of the River” and the 2007 Guidelines. It is helpful for the States to know that nothing in the LTEMP EIS process is intended to affect water allocation among the States or the Secretary of the Interior’s responsibilities related to water deliveries for allocation, appropriation, development and exportation.
- 2) **Litigation:** Ongoing litigation concerning operation of Glen Canyon Dam limits the States’ ability to openly discuss, brainstorm, or comment on the record about the alternative concepts at this time.

¹ Although the co-lead agencies have extended the time for submitting alternatives to July 2, 2012, the LTEMP EIS website continues to erroneously indicate that alternatives for the LTEMP will be decided and publically announced by the end of May 2012.

- 3) **States' Process:** As mentioned above, the States are in the midst of trying to develop a joint proposal for a balanced EIS alternative. Stating opinions and positions for the record regarding the elements of the preliminary alternative concepts could undermine our coordination process.
- 4) **Timing:** The States appreciate Interior's efforts to be transparent and take intermediate steps not normally part of the NEPA process. Public outreach on development of the LTEMP EIS is very important, and the States understand the difficulty in promulgating useful information in a timely manner. However, dissemination of a narrative outlining preliminary alternative concepts less than a week prior to the Flagstaff Meeting did not allow the States adequate time to formulate meaningful feedback.

"Alternatives are the heart of the EIS process." 40 C.F.R. § 1502.14 (2011). The States remain committed to contributing to Interior's LTEMP EIS process by developing and submitting, with technical assistance by Interior, a balanced alternative that results in the best possible combination of benefits to key resources based on the best available scientific information. We would welcome any information that the Department could share about the Department's proposed screening criteria for evaluating the different alternatives. Toward these ends, the States welcome the grant of an extension of time until July 2, 2012 to complete the alternatives development process and appreciate Interior's commitment to ensure adequate time is given to develop meaningful alternatives. Should you have any questions or concerns, please do not hesitate to contact any one of the State representatives at your earliest convenience. In the meantime, the States look forward to coordinating with the co-lead agencies in the very near future to continue furthering the LTEMP EIS process.

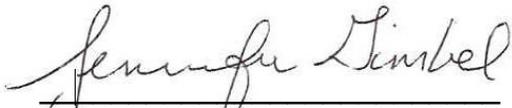
[Signatures on following page]



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Director
Arizona Department of Water
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Dana B. Fisher, Jr.
Colorado River Commissioner
Colorado River Board of California



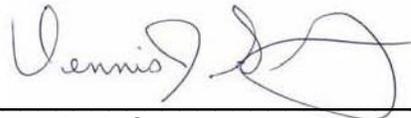
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Briefing Document...

Colorado River Basin Salinity Control Program

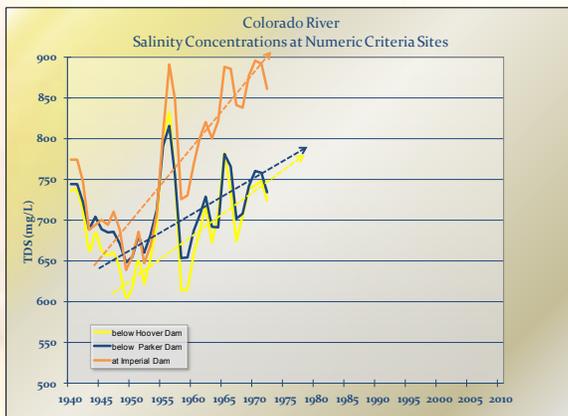
Background

The Colorado River flows more than 1400 miles from its headwaters in the Rocky Mountains through portions of seven states and the Republic of Mexico before it discharges into the Gulf of California. Through natural and man-induced causes, it picks up and dissolves salt along its path from about 50 mg/L at its source to nearly 850 mg/L (present concentrations) as it passes from the United States into Mexico.

Historically nearly 10 million tons of dissolved salts have passed down the river annually below Hoover Dam. The significant salt load creates environmental and economic damages to its users. The Colorado River is used by approximately 35 million people for domestic and industrial uses in the United States and is used to irrigate approximately 4 million acres of land.

Modeling by Reclamation shows that the quantifiable damages from high salinity water are several hundred million dollars per year to U.S. users with projections that damages would rise to more than five hundred million by 2030 if the Program were not to continue.

The early 1970s saw significant concern by US water users over the increasing Colorado River salinity concentrations, as well as issues between the United States and Mexico over the quality of water being delivered to Mexico pursuant to the treaty between the countries. These concerns, coupled with the passage of the Clean Water Act amendments in 1972 and concerns over EPA mandating state-line water quality standards, led the seven Colorado River Basin states to work with Interior agencies, the State Department and Congress in passage of the Colorado River Basin Salinity Control Act (Act, 1974). Now,



nearly four decades later, this unique partnership of federal and state agencies continues to work cooperatively with hundreds of local companies and thousands of individual water users to control the salinity levels of this major river while allowing development and usage of its waters pursuant to the Colorado River Compact. The salt load of the Colorado River has now been reduced by about 1.2 million tons annually, but continuance of the program is required to offset what otherwise would be increases in salinity levels.

Sources of Salinity

Much of the Upper Colorado River Basin is underlain by geologic formations composed of sediments which were deposited or precipitated in ancient inland seas and water ways which concentrated salts in these formations. The passing of water through these formations or their derived soils, either naturally or through human activity, dissolves and mobilizes these salts. EPA has identified that 62% of the salt load of the Colorado River above Hoover Dam comes from natural sources. With the significant federal ownership in the Basin, most of this comes from federally administered lands. Human activity, principally irrigation, adds to the salt load of the Colorado River. Further, natural and human activities concentrate the dissolved salts in the River. Such activities include out-of-basin exports, crop and other consumptive uses, phreatophytic evapotranspiration and evaporation from reservoir surfaces.



Colorado River Salinity Standard

In 1974 EPA adopted, and in 1975 the seven Colorado River Basin states adopted, a salinity standard for the Colorado River. That standard is composed of numeric criteria for total dissolved solids and a plan of implementation to meet the criteria. The numeric criteria were selected as the 1972 salinity levels at the three Lower Basin monitoring locations: below Hoover Dam, below Parker Dam and at Imperial Dam. The Plan of Implementation is designed to keep the average annual flow-weight salinity concentration at or below the 1972 levels while allowing continued use and development of waters upstream. In 2011 the seven Colorado River Basin States reviewed and adopted a revised standard with an updated Plan of Implementation. The Plan of Implementation calls for the creation of an additional 644,000 tons of annual salinity control practices by 2030.

Program Partners

Department of the Interior

Bureau of Reclamation*

Bureau of Land Management*

US Geological Survey

Fish and Wildlife Service

Department of Agriculture

Natural Resources Conservation Service*

US Environmental Protection Agency

State of Arizona

State of California

State of Colorado

State of Nevada

State of New Mexico

State of Utah

State of Wyoming

Literally hundreds of water districts, water user organizations and canal and ditch companies, as well as thousands of individual water users and producers.

* Implementing agency

Program Implementation

Implementation of the Program occurs principally through off-farm irrigation water delivery improvements implemented through Reclamation's Basinwide Program or on-farm irrigation improvement practices implemented through NRCS' Environmental Qualities Improvement Program (EQIP). Additional, salinity control is achieved through BLM practices and administration of NPDES permits by the states. Reclamation's Basinwide Program is a grant program under a funding opportunity announcement every two or three years. Potential participants make application to Reclamation and awards are granted based on cost-effectiveness and other factors. Most applications consist of canal and ditch lining or piping practices. Annual appropriation is about \$7 million. Under EQIP, NRCS assists producers with improvements to their on-farm irrigation practices – generally improving flood irrigation systems or providing sprinklers in the form of side rolls or center pivots. Reduced seepage from canals and laterals or reduced deep percolation from farm fields decreases the amount of dissolved salt which seeps to the Colorado River and its tributaries.



Cost Share

The Act requires that the states cost share up front 30% of the total cost of the practices implemented by Reclamation and NRCS. For example, if Reclamation were to implement \$10 million in practices under its Basinwide Program, then \$7 million would come from appropriated dollars and \$3 million would come from cost-share dollars. Alternatively said, the cost-share dollars are three-sevenths of the appropriated dollars (or 43%). That means that for every dollar appropriated to the Program, whether to Reclamation or NRCS, an additional 43 cents of cost share is added to the effort. It is important to remember that the required cost-share dollars are on a percentage of the appropriated dollars. Therefore, if the appropriated dollars are reduced, the cost share will automatically be reduced. In addition to the state cost-share dollars, under NRCS' EQIP, producers often contribute about 25% of the total cost of the improvements. Under Reclamation's Basinwide Program, applicants often expend meaningful dollars to buy down their projects to make their proposals more cost-competitive.

Program Needs

Reclamation's Basinwide Program

- Increases in funding levels to keep current with program needs and to integrate efficiently with NRCS' EQIP efforts

NRCS' EQIP

- Continuation of present funding levels and technical assistance to assist producers to implement and maintain practices

BLM

- Development of "a comprehensive program for minimizing salt contributions to the Colorado River from lands administered" by BLM and sufficient funding to implement such

Legislative History

1974 PL93-320

- Colorado River Basin Salinity Control Act (Act)
- Title I deals with waters below Imperial Dam and the US commitment to Mexico
- Title II created the Colorado River Basin Salinity Control Program and directed the Secretary of the Interior to implement salinity control projects

1984 PL 98-569

- Authorized the Secretary of Agriculture to establish a voluntary cooperative salinity control program
- Directed the Secretary of the Interior “to develop a comprehensive program for minimizing salt contributions to the Colorado River from lands administered by the Bureau of Land Management”

1995 PL 104-20

- Changed Reclamation’s program to the Basinwide Program to implement salinity control through competitive grants rather than large Reclamation projects

1996 PL 104-127

- Combined the USDA Colorado River Basin Salinity Control Program with three other programs under EQIP
- Authorized up-front cost sharing

2008 PL 110-234

- Created the Basin States Program through which the cost-share dollars are to be expended

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.

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Colorado River Basin
**SALINITY
CONTROL FORUM**