Whipple, John J., OSE

Fro Don Ostler [dostler@uc.usbr.gov] **Sent:** Wed 7/12/2006 12:39 PM

To: scott@balcombgreen.com; landerson@barnettwater.com; rbratton@bratton-mcclow.com; Dantonio, John, OSE; Mutz, Phil, OSE; ptyrre@seo.wyo.gov; Rod.Kuharich@state.co.us; Castillo, Candise, OSE; Don Ostler; dennisstrong@utah.gov

Cc: dmerritt@crwcd.org; ekuhn@crwcd.org; Lopez, Estevan, OSE; Whipple, John J., OSE; jshiel@seo.wyo.gov; Hal.Simpson@state.co.us; Randy.Seaholm@state.co.us; Brown, Jayne R., OSE; JERRYOLDS@utah.gov; robertking@utah.gov

Subject: Global Warming

Attachments: Global Warming Discussion.doc(37KB)

Hello all:
I don't know if you are getting a lot of questions about climate change and the possible effect on water supply as I am....I had a conversation with a snow scientist and modeler with NRCS to discuss some of the effects they can document. If you are interested, I have attached my notes and general conclusions...

We may want to invite this guy to make a presentation at our next Commission meeting...

Global Warming Discussion
With
Randy Julander
Snow researcher and modeler
Natural Resources Conservation Service
Salt Lake City, Utah

NOTES

Scientists generally agree that we are in a warming trend globally.....
Most agree there has been about a 1 degree C rise.....
Most scientists agree that greenhouse gases affect warming and may be responsible for about ½ the rise in temperature.....

We can quantify where we are and where we have been, but there is not agreement on where we are headed.....
Some scientists project a 2 to 4 degree C rise and some predict a catastrophic rise of 10-15%.....Some think the latter predictions rely upon an impossible set of assumptions.....assumptions based upon assumptions based upon assumptions.....
Most agree temperature is likely to continue a rising cycle to some degree.....

There is no agreement on the impact to winter snow pack in Utah or the Rocky Mountains.....
Utah and most Upper Colorado states have temperature to give before impacts on snow melt would come into play.....Can stand at least another 1 degree C without impact

Snow melts because of three factors...Short wave radiation, long wave radiation and temperature....Of the three, temperature has the least affect.....

He cannot statistically prove any effect of Global Warming on Utah snow pack looking at data going back to the 1930's.....We have had conditions like this in the past.

There is a lot of junk science about this topic.....
Some studies show less snow for an area but they do not look at all the causes. Aspen naturally give way to conifers.....Conifers do not hold the snow that aspen or meadows do because of sublimation and evaporation etc. The west has lost up to 40% of its aspen stands to conifers....Studies fail to look for all the sources of decreased snow pack.....

In Utah, ½ the sites show decreases in snow pack and ½ the sites show increases.....
Many studies pick a window of time beginning in the coldest and wettest period and end in the present hot dry period. This yields different results than studies starting in average

conditions and running to today. Most of the studies started in the 1950's when everyone was aware that North America had cooled by ½ degree C.....

Some studies say this is the hottest we have been in 2000 years. The data will not support such a conclusion. We may be the hottest in 150 years or maybe even 400. They used tree rings to get back to 2000 years. The tree ring correlation was only 0.05. This is no better correlation than could be obtained from a random number generator, but study proponents continue to use this in trying to convince everyone to their version of the effects of Global Warming.

Whipple, John J., OSE

From: Don Ostler [dostler@uc.usbr.gov] **Sent:** Mon 7/3/2006 11:28 AM

To scott@balcombgreen.com; landerson@barnettwater.com; rbratton@bratton-mcclow.com; Dantonio, John, OSE; Mutz, Phil, OSE; ptyrre@seo.wyo.gov; Rod.Kuharich@state.co.us; Castillo, Candise, OSE; Don Ostler; dennisstrong@utah.gov

Cc: SFARRIS@ago.state.nm.us; jlochhead@bhf-law.com; dmerritt@crwcd.org; ekuhn@crwcd.org; Lopez, Estevan, OSE; Whipple, John J., OSE; djensen@pblutah.com; jshiel@seo.wyo.gov; carol.angel@state.co.us; Hal.Simpson@state.co.us; Randy.Seaholm@state.co.us; Ted.Kowalski@state.co.us; Brown, Jayne R., OSE; Trujillo, Tanya, OSE; eolson@state.wy.us; hmcfad@state.wy.us; PMICHA@state.wy.us; Jane Bird; JERRYOLDS@utah.gov; normanjohnson@utah.gov; robertking@utah.gov

Subject: Fwd: Re: Lower Basin Presentation on Hydrologic Determination

Attachments:

Hello all:
This is an informational item only...The below e mail is a correspondence from Dave Trueman to me in response to my inquiry about the nature of his discussion with the lower basin about the hydrologic determination. The lower basin is meeting on July 13.....
Don Ostler
Upper Colorado River Commission

>>> Dave Trueman 06/29 11:14 AM >>>
Don, I plan on making the following points in my briefing with the LB States:

I would say that basically we find no authority for the Secretary to limit development in the Upper Basin, so having the Secretary declare or determine a yield "limit" seems inappropriate to us. What appears to be more appropriate is to have the Upper Basin States thru the Commission be heavily involved since they are responsible for meeting the terms of the Compact and bear the risk of under development or over commitment. When one looks at the law, the Secretary is charged with determining if water is reasonably available from Navajo Reservoir and NM's allotment before entering into a water supply contract. This is why you will see us being very deferential to the Commission in determining the yield which plays to NM's allotment. Our Navajo-Gallup Water Supply Project EIS basically shows the water is physically available from Navajo Reservoir.

In a perfect world with enough storage or flexible uses, using a mass balance on the historic data, the UB could in theory develop 15maf-LB Deliveries = between 6.75-7.5maf/yr depending upon how one interprets the Compact. The HD uses 5.76 maf/yr depletions + about 0.3maf/yr CRSP evaporation = about 6.1maf/yr.

I also plan on giving them a brief overview of how the spreadsheet works, summarize the findings of the HD, discuss critical period evaporation, how we handle salvage by use under CRSP reservoirs, and how we have improved the consistency of the natural flow record and depletion calculations.

I've discussed the agenda with Jerry Zimmerman and it looks like I'll have about an hour for the presentation and discussion.

Regards - Dave

>>> Don Ostler 6/29/2006 9:36:17 AM >>>
Commissioners and Engineers:
This is for your information....As you know, I sent the Lower Basin States a pdf file of the hydrologic determination, mass balance, spread

sheets provided by New Mexico. This meant that they could look at the results in each cell, but could not manipulate it or gain access to the forr behind each cell. As you see from Dave Trueman's e mail, they have asked for access to the spread sheets. Dave Trueman has talked to the folks in Washington and myself and all agree that we cannot/should not reject this request. Attached is the non-pdf spreadsheet Dave sent to them. As you can see from his e mail, the Lower Basin is having a meeting on July 13th (the day before our Basin States meeting) to discuss the hydrologic determination and other things. Dave Trueman will be there and has promised to let me know what comes out of the meeting on the 13th...The feedback I get from Washington folks is that Interior still feels this is primarily an issue affecting the Upper Basin states from a risk standpoint, so hopefully any objection from the lower basin will not have much traction.
Don Ostler

>>> Dave Trueman 06/28 2:26 PM >>>
Gentlemen,

I've noticed some requests for the original spreadsheet used by the Commission in their deliberations. As this will be a part of the briefing on July 13 for the Lower Basin States by Reclamation (me), I've received the ok from Washington to share the model with the Lower Basin States Representatives.

Please feel free for you or your staff to call me at my office below with questions.

Reg , - Dave

David Trueman
Division Manager
Resources Management Division
US Bureau of Reclamation
125 S. State Street, Rm 6432
Salt Lake City, UT 84138-1174
(801) 524-3759 work
801-633-5039 cell
(801) 524-5499 fax
dtrueman@uc.usbr.gov

Whipple, John J., OSE

From: Dave Trueman [DTRUEMAN@uc.usbr.gov] **Sent:** Thu 6/29/2006 2:34 PM
To: Whipple, John J., OSE; Don Ostler
Cc:
Subject: Hydor Determination Update on Progress
Attachments:

John and Don,

The HD transmittal package has been signed by the acting RD and overnighted to the Commissioner (today). I'd note that for the most part my editorial staff simply changed the section fonts, used left justification, and added a comma here and there, otherwise no significant changes. We expect the acting Commissioner to sign the transmittal forwarding the HD to the Secretary's Indian Water Rights Office (Pam Williams, Director) tomorrow (June 30). The Navajo-Gallup report also went to that same office on June 22.

Regards - Dave

Whipple, John J., OSE

From: Don Ostler [dostler@uc.usbr.gov] **Sent:** Thu 6/29/2006 9:36 AM

To: scott@balcombgreen.com; landerson@barnettwater.com; rbratton@bratton-mcclow.com; Dantonio, John, OSE; Mutz, Phil, OSE; ptyrre@seo.wyo.gov; rod.kuharich@state.co.us; Castillo, Candise, OSE; Don Ostler; dennisstrong@utah.gov

Cc: dmerritt@crwcd.org; ekuhn@crwcd.org; Lopez, Estevan, OSE; Whipple, John J., OSE; jshiel@seo.wyo.gov; hal.simpson@state.co.us; Randy.Seaholm@state.co.us; Brown, Jayne R., OSE; Dave Trueman; JERRYOLDS@utah.gov; robertking@utah.gov

Subject: Fwd: Re: Hydrologic determination

Attachments: HD Model.xls(1MB)

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Please feel free for you or your staff to call me at my office below with questions.

Regards - Dave

David Trueman
Division Manager
Resources Management Division
US Bureau of Reclamation
125 S. State Street, Rm 6432
Salt Lake City, UT 84138-1174
(801) 524-3759 work
801-633-5039 cell
(801) 524-5499 fax
dtrueman@uc.usbr.gov

6/5/06
UCRC mtg.

Scott Balcomb – need long-term planning tool for identifying full UB development & shortage considerations – UCRC take lead in determining our future, as opposed to SSI ad-hoc determinations – UCRC agreed.

SWCD (Barry Spears) – disappointed in not receiving assurances requested, but looking forward to working with NM on implementation of plan – reserve right to lobby legislators for language to protect CD's users

See Minutes of 6/5/06 UCRC mtg.

CO –

want NM support w/ fed. agencies for CO Sect. 7 consultations in amount of 29,500 (equal w/ NGP with equal sharing of depletions between NGP & CO projects w/in flow req's.)

	CO	NM
equitable – CO	1/2	1/2
RIP funds	1 : 3	
ALP	43/43	13/34
NGP	0/	21/- NN in NM

→ beginning depletions NGP

base for equitable ? – CO 1:1 sharing of future depletions

letter w/ process & conditions ?

how enforce or bind users/feds ?

support only w/ FWS, not all other aspects of project development (jointly support each others future depletions w/ FWS) recognizing can't bind them !

Scott – can't agree to indicate reduced UB delivery, use min PP, show any admin. shortages, any inc. in UB total dep's. above 6.0 maf ? States agreement – acctg. won't work

Whipple, John J., OSE

Fro. Scott Balcomb [scott@balcombgreen.com] **Sent:** Wed 5/24/2006 2:58 PM
To: Seaholm, Randy; DOSTLER@uc.usbr.gov; jshiel@state.wy.us; Whipple, John J., OSE; robertking@utah.gov; Lopez, Estevan, OSE
Cc: Kuharich, Rod; George, Russell; McAuliffe, Dan; Brown, Rick; McNulty, Frank; Shpall, Casey; Angel, Carol; Kowalski, Ted; ekuhn@crwcd.org; dmerritt@crwcd.gov; bspear@mbssllp.com; Simpson, Hal
Subject: RE:
Attachments:

All:

I suggest the following (page 4):

BE IT FURTHER RESOLVED, that while the Upper Colorado River Commission does not endorse the study assumptions used by the Bureau of Reclamation in its ___, 2006, draft hydrologic determination, **for the concept of accepting an "allowable overall shortage,"** and specifically . . ."

(including an assumption of a 6 percent allowable overall shortage)

Scott

-----Original Message-----
From: Seaholm, Randy [mailto:Randy.Seaholm@state.co.us]
Sent: Tuesday, May 23, 2006 11:27 PM
To: scott@balcombgreen.com; DOSTLER@uc.usbr.gov; jshiel@state.wy.us; jwhipple@ose.state.nm.us; robertking@utah.gov; elopez@ose.state.nm.us
Cc: Kuharich, Rod; George, Russell; McAuliffe, Dan; Brown, Rick; McNulty, Frank; Shpall, Casey; Angel, Carol; Kowalski, Ted; ekuhn@crwcd.org; dmerritt@crwcd.gov; bspear@mbssllp.com; Simpson, Hal
Subject:

Hi All,

Based on the CWCB resolution transmitted last Friday, attached are Colorado's proposed changes to the UCRC resolution and the proposed report. We will forward our thoughts on the District's letter shortly.

Randy Seaholm

Chief, Water Supply Protection

Colorado Water Conservation Board

1313 Sherman Street, Suite 721

Denver, Colorado 80203

303-866-3441

303-866-4474 FAX

randy.seaholm@state.co.us

Whipple, John J., OSE

Fro' Seaholm, Randy [Randy.Seaholm@state.co.us] **Sent:** Tue 5/23/2006 11:26 PM

To: scott@balcombgreen.com; DOSTLER@uc.usbr.gov; jshiel@state.wy.us; Whipple, John J., OSE; robertking@utah.gov; Lopez, Estevan, OSE

Cc: Kuharich, Rod; George, Russell; McAuliffe, Dan; Brown, Rick; McNulty, Frank; Shpall, Casey; Angel, Carol; Kowalski, Ted; ekuhn@crwcd.org; dmerritt@crwcd.gov; bspear@mbssllp.com; Simpson, Hal

Subject:

Attachments: CRhydrodeter brdoc3.doc(100KB) CRHydrodeter ucrcres3.doc(68KB)

Hi All,

Based on the CWCB resolution transmitted last Friday, attached are Colorado's proposed changes to the UCRC resolution and the proposed report. We will forward our thoughts on the District's letter shortly.

Randy Seaholm

Chief, Water Supply Protection

Colorado Water Conservation Board

1313 Sherman Street, Suite 721

Denver, Colorado 80203

303- -3441

303-866-4474 FAX

randy.seaholm@state.co.us

May 16, 2006, Draft

HYDROLOGIC DETERMINATION
2006

Water Availability from Navajo Reservoir and the Upper Colorado River Basin for Use in New Mexico

_____ Date

_____ Secretary of the Interior

Table of Contents, List of Tables and Figures

General Compact Disclaimers (Insert the standard disclaimer and make sure the following language is included: "The analyses in this investigation should not be construed to prejudice the positions of either the Upper Colorado River Commission or the States of the Lower Division as to the interpretation or administration of Article III of the Colorado River Compact."

Disclaimers Regarding the Proposed Contract

This determination is not to be construed as acceptance by the Department of the Interior of the terms of the Settlement Agreement, including the terms of the proposed contract. This determination also does not guarantee that the United States would be able to deliver water under the proposed contract without shortages in deliveries on account of drought or other causes outside the control of the Secretary. Nothing in this determination shall be construed to impose on the United States any obligation to maintain CRSP storage facilities, including Navajo Dam and Reservoir, or NIIP or Navajo-Gallup Water Supply Project facilities beyond their useful lives or to take extraordinary measures to keep these facilities operating.

I. Executive Summary

Determination as to the availability of water under long-term service contracts for uses from Navajo Reservoir involves a projection into the future of estimated water uses and water supplies. On the basis of this hydrologic investigation, water depletions by the Upper Basin states from the Upper Colorado River Basin can be reasonably allowed to rise to an annual average of 5.76 million acre-feet (maf) per year, exclusive of Colorado River Storage Project (CRSP) reservoir evaporation from Lake Powell, Flaming Gorge Reservoir and the Aspinall Unit. This depletion level can be achieved under the same shortage criteria upon which the allowable Upper Basin yield was determined in the 1988 Hydrologic Determination, without significant increase in the level of risk.

This determination certifies the availability through at least 2060 of water from New Mexico's Upper Basin allocation and Navajo Reservoir to service a proposed contract for the Navajo Nation's uses in New Mexico under the Navajo-Gallup Water Supply Project in the annual amount of 20,780 acre-feet (af) and the Navajo Indian Irrigation Project (NIIP) in the amount of 270,000 af per year on average over any period of ten consecutive years. It also is likely that sufficient water will be available ~~for depletion~~ from Navajo Reservoir to service the proposed contract after the 2060 planning horizon, depending upon future storage and hydrologic conditions and other factors. This determination does not guarantee that the United States will be able to deliver water under the proposed contract without shortages in deliveries, and does not obligate the United States to maintain storage facilities beyond their useful lives. The proposed contract is part of a Navajo Nation water rights settlement in the Upper Basin in New Mexico, and the settlement provides that uses made pursuant to the contract will be

subject to administration in accordance with the Upper Colorado River Basin Compact and New Mexico state law.

II. Introduction

The State of New Mexico has proposed the Navajo-Gallup Water Supply Project to provide a renewable water supply from the San Juan River for municipal and domestic uses for Indian and non-Indian communities located within New Mexico. Uses under the project by the Jicarilla Apache Nation and the City of Gallup would be supplied through the Jicarilla Apache Nation's Navajo Reservoir water supply contract approved by Congress in 1992. Uses in New Mexico under the project by the Navajo Nation would be supplied through a proposed new Navajo Reservoir water supply contract that is a component of the San Juan River Basin in New Mexico Navajo Nation Water Rights Settlement Agreement (hereinafter referred to as the Settlement Agreement) that the State of New Mexico and the Navajo Nation executed on April 19, 2005. The new contract also would supersede the existing Navajo Reservoir water supply contract for the Navajo Indian Irrigation Project (NIIP).

The Upper Colorado River Commission on June 19, 2003, resolved that the States of the Upper Division consent to the Navajo-Gallup Water Supply Project provided that water diverted by the project for use in New Mexico shall be a part of the consumptive use apportionment made to the State of New Mexico by Article III(a) of the Upper Colorado River Basin Compact. The maximum amount of consumptive use through the project by the Navajo Nation in New Mexico that would be permitted in any one year under the Settlement Agreement and the proposed contract is 20,780 acre-feet.

Public Law 87-483 at section 11(a) requires that no ~~new~~ long-term contract shall be entered into for the delivery of water stored in Navajo Reservoir, or any other waters of the San Juan River and its tributaries to which the United States is entitled, until the Secretary of the Interior has determined by hydrologic investigation that sufficient water to fulfill such contract is reasonably likely to be available for use in the State of New Mexico under the allocations made in Articles III and XIV of the Upper Colorado River Basin Compact, has submitted such determination to Congress, and Congress has approved the contract. The last such hydrologic determination was approved by the Secretary on February 2, 1989 (Hydrologic Determination, 1988, Water Availability from Navajo Reservoir and the Upper Colorado River Basin for Use in New Mexico, hereinafter referred to as the 1988 Hydrologic Determination). The 1988 Hydrologic Determination evaluated the availability of water from the Navajo Reservoir water supply for the Jicarilla Apache Nation's Navajo Reservoir water supply contract. The State of New Mexico by letter dated May 3, 2005, requested that the 1988 Hydrologic Determination be updated to evaluate the availability of water to service the proposed ~~contract for the~~ Navajo-Gallup Water Supply Project~~Nation under the NIIP contract~~.

This hydrologic investigation is made for the purpose of ~~contracting~~ for ~~of water~~ from the Navajo Reservoir water supply for the Navajo Nation's uses in New Mexico under the Navajo-Gallup Water Supply Project. The Bureau of Reclamation prepared the

hydrologic investigation in consultation with the Upper Colorado River Commission because of the critical nature of this determination of the Upper Basin water supply. The Upper Colorado River Basin Compact created and defines several areas of responsibility for the Commission that directly and indirectly relate to this investigation.

Previous Hydrologic Determinations

The 1988 Hydrologic Determination found that the yield from the Upper Basin was at least 6.0 million acre-feet and that New Mexico's share thereof was 669,500 acre feet. That 669,500 acre-foot apportionment included New Mexico's proportionate share of reservoir evaporation from Lake Powell, Flaming Gorge and the Aspinall Unit.

III. Upper Basin Yield

A. Basin Hydrology

The Upper Colorado River Basin currently yields approximately 15 million acre-feet of natural flow at Lee Ferry, Arizona. Of this amount, approximately ___ acre-feet originates in the San Juan River basin. Gage records for the San Juan River at Bluff, Utah indicate that the annual average long-term gage flow is approximately 1.8 million acre-feet. Current consumptive uses of water in New Mexico are ___ acre-feet on average. ~~We would note that while New Mexico is not presently using its full apportionment, it does have contracts in-place that would provide for such.~~ Consumptive uses in Colorado from the San Juan River basin are ___ on average.

~~A~~B. Approach

This hydrologic investigation considers and uses many of the same basic assumptions as the 1988 Hydrologic Determination. Both investigations assume use of the Colorado River Simulation System (CRSS) natural flows at Lee Ferry, ~~an minimum objective~~ minimum release of 8.23 maf from Lake Powell ~~with an evaluation of scenario's under which releases to the Lower Basin would be less than 8.23 maf from Lake Powell possibility of lower releases, a~~, an allowable overall shortage of no more than 6 percent ~~for a critical period~~, either maintenance or use of the minimum power pools at CRSP units, ~~reduced~~ storage capacity in Lake Powell due to ~~reduced for~~ sedimentation, and inclusion of bank storage. The CRSS natural flows at Lee Ferry for the period 1971-1980 ~~were increased to reflect recalculation of historic irrigation depletions in the Upper Basin~~ using the Soil Conservation Service (SCS) modified Blaney-Criddle method with SCS effective precipitation. ~~The~~. The revised CRSS natural flows for 1971-1980 are consistent with the CRSS natural flows at Lee Ferry determined for the remainder of the 1906-2000 period of record. Also, sedimentation in Lake Powell was adjusted to reflect a 2060 planning horizon, and a 4-percent bank storage factor was used in this investigation consistent with Reclamation's current CRSS model.

The Upper Colorado River Commission does not agree with the ~~minimum~~ objective minimum release of 8.23 maf and the ~~an~~ assumed delivery of 0.75 maf each year toward

the Mexican Treaty obligation included therein. At the request of the Commission, this hydrologic investigation considers for planning purposes considers both the minimum objective minimum release of 8.23 maf and a minimum release from Lake Powell of 7.48 maf annually. However, this hydrologic determination does not quantify the Colorado River Compact Article III(c) requirement or make or rely on a critical compact interpretation regarding Article III(c). The 1988 Hydrologic Determination also showed the Upper Basin yields under both minimum release scenarios.

Mass balance analyses were used to analyze potential water use by the Upper Basin under 2060 conditions. The mass balance considers Upper Basin reservoir storage, natural flows at Lee Ferry, deliveries to the Lower Basin, consumptive use demands in the Upper Basin, and CRSP evaporation as a function of storage volume. All existing Upper Basin storage capacity was included in the analysis because all storage supports water use in the Upper Basin and impacts stream flows. The CRSP and non-CRSP reservoirs as groups were assumed to be the same percent full each year, and CRSP storage was assumed to be distributed between units in accordance with the average historic storage distribution. The CRSP reservoir evaporation that is used in the mass balance analyses includes evaporation from Lake Powell, Flaming Gorge Reservoir and the Aspinall Unit that is shared among the Upper Division States, but and excludes evaporation from Navajo Reservoir which is charged to New Mexico. Shared CRSP reservoir evaporation is modeled using a regression equation relating historic shared CRSP reservoir evaporation from Lake Powell, Flaming Gorge Reservoir and the Aspinall Unit to the aggregate historic storage volume in these reservoir plus Navajo Reservoir. Evaporation equations were developed for both active and live storage. The 1988 Hydrologic Determination considered variations in shared CRSP reservoir evaporation with storage for conducting statistical trace analyses to evaluate possible frequencies and magnitudes of shortages on the one hand, but on the other hand deducted a long-term average shared CRSP reservoir evaporation of 0.52 maf per year from the critical-period Upper Basin yield of at least 6.0 maf/yr to determine the amount of water available for Upper Basin uses through the critical period.

B. Results

Mass balance analyses were performed for various combinations of storage, Lower Basin deliveries and overall shortages to evaluate the allocation of water to the Upper Basin (see mass balance analyses provided in Appendix A). The following is a summary of the results of the analyses:

Storage Assumption	Minimum Lower Basin Delivery (maf)	Yield without Shortages (maf)	Yield with 6% Overall Shortages (maf)
Maintain minimum power pools	8.25	5.55	5.79
	7.50	6.30	6.57

Use minimum power pools	8.25	5.72	5.98
	7.50	6.47	6.76

The yield is defined as the amount of water available at Lee Ferry for use, on average, by the Upper Basin, exclusive of shared CRSP reservoir evaporation. Shortages in the above table are defined as 6 percent or less overall computed shortage for any period of 25 consecutive years consistent with the 1988 Hydrologic Determination. Results are shown for minimum Lower Basin deliveries of 8.25 maf and 7.50 maf as was done in the 1988 Hydrologic Determination. ~~(Moved to the General Disclaimer) The analyses in this investigation should not be construed to prejudice the positions of either the Upper Colorado River Commission or the States of the Lower Division Basin as to the interpretation or administration of Article III of the Colorado River Compact.~~

For those analyses that use an allowable or tolerable overall shortage of 6 percent or less of the use ~~or less~~ over any period of 25 consecutive years, the results indicate that ~~under those scenarios~~ there would be 5 years of shortage out of 95 years of record used in this investigation. ~~As shown above, there are several assumptions that one can make to determine the amount of water available to the Upper Basin and the subsequent calculation of water available to New Mexico and for contracting out of Navajo Reservoir. There would likely be several factors contributing to shortage conditions at any given time. One of the major factors would like be the~~ However, including physical water supply shortages at the sites of use in the Upper Basin. ~~However,~~ Therefore, the annual amounts of computed shortages for those five years would not be expected to ~~fully~~ materialize because Upper Basin consumptive uses will be below average under critical-period hydrology ~~due to physical water supply shortages at the sites of use in the Upper Basin.~~ For example, the natural flow at Lee Ferry for 1977 was only 5.55 maf, and severe water supply shortages occurred throughout the Upper Basin in that year.

C. Comparison to 1988 Hydrologic Determination

The 1988 Hydrologic Determination concluded that the total Upper Basin yield, including CRSP reservoir evaporation, is at least 6.0 maf per year for the 1953-1977 critical period hydrology with a 6 percent allowable overall shortage for the period. ~~Shared CRSP evaporation u~~Under the conditions assumed in the current investigation, the shared CRSP evaporation varies with CRSP storage assumptions and storage levels. Assuming an average annual Upper Basin use of 5.79 maf, an annual Lower Basin delivery of 8.25 maf and maintenance of the power pools, the shared CRSP evaporation would range from an average of about 0.25 maf per year over the worst 25-year period of reservoir storage draw down (1953-1977) to an average of about 0.49 maf per year ~~(short-the-it was .505 maf in run 18)~~ over the period of record used in the analysis ~~(1906-2000). Thus, the~~ total Upper Basin depletion, including both Upper Basin uses and CRSP reservoir evaporation, would average about 6.04 maf per year or more over any period ~~of 25 consecutive years. The~~ total Upper Basin depletion amount for this scenario for the 1953-1977 period is comparable to the total Upper Basin depletion of 6.0 maf per year ~~for the period~~ determined to be available for the period by the 1988 Hydrologic

Determination. The difference is due to the revisions made to the CRSS natural flows for 1971-1980. If the minimum power pools are used, the shared CRSP reservoir evaporation ~~and the total Upper Basin depletion are~~is reduced due to increased reservoir storage draw downs.

IV. Water Use Projections

A. Upper Basin

The Upper Colorado River Commission last approved depletions schedules for the Upper Division States for planning purposes in 1999. The depletions schedules, dated January 2000, project that the total Upper Basin use exclusive of shared CRSP reservoir evaporation will average about 5.37 maf per year under 2060 development conditions. Unless additional Upper Basin water development occurs by 2060 as compared to the January 2000 depletions schedules, the Upper Basin use may average less than about 5.40 maf per year from now through 2060. The time required to develop the Upper Basin allocation reduces risk of shortage within the 2060 planning horizon.

B. State of New Mexico

The New Mexico Interstate Stream Commission provided to the Bureau of Reclamation a revised schedule of anticipated depletions through 2060 from the Upper Basin in New Mexico dated May 2006 (see Appendix B). The revised depletions schedule includes irrigation depletions calculated using the SCS modified Blaney-Criddle method with SCS effective precipitation so that demands and supply for this hydrologic investigation are evaluated using consistent methodologies. The irrigation depletions for the Navajo Nation's irrigation projects are water right depletion amounts provided by the Settlement Agreement. Both this hydrologic investigation and the 1988 Hydrologic Determination assume use of the full depletion amount for the NIIP. This is a conservative assumption because the total NIIP depletion right is not expected to be fully utilized under normal farm management practices. The revised depletions schedule does not include New Mexico's allocation of shared CRSP reservoir evaporation. The revised New Mexico depletions schedule shows a total anticipated depletion of 642,000 af per year, on average, for uses in New Mexico under 2060 development conditions. This represents an increase in New Mexico's total Upper Basin depletion, excluding shared CRSP reservoir evaporation, of about 0.02 maf per year as compared to the January 2000 depletions schedules.

V. Physical Availability of Water from Navajo Reservoir using a hydrologic model for the San Juan River Basin

The Bureau of Reclamation has evaluated the physical availability of water from Navajo Reservoir and the San Juan River for the Navajo-Gallup Water Supply Project, taking into account, among other things, the habitat needs of San Juan River populations of fish species listed as endangered under the Endangered Species Act. The physical water supply analysis contained in the Biological Assessment, Navajo-Gallup Water Supply Project, dated August 16, 2005, indicates that sufficient water is likely to be available

from the Navajo Reservoir water supply ~~through 2060~~ for the Navajo Nation's uses under the project. Although the depletions for ~~individual~~ uses in New Mexico that were used in the Biological Assessment differ slightly from those in New Mexico's May 2006 revised depletions schedule, the physical water supply analysis in the Biological Assessment assumes possible full use of the depletion rights for both the NIIP and the Navajo-Gallup Water Supply Project, and assumes up to about 640,500 af per year of depletion, on average, in New Mexico from the San Juan River. This amount of total average depletion in New Mexico is not significantly different than the amount of total average depletion in New Mexico shown in the May 2006 revised New Mexico depletions schedule under 2060 development conditions.

VI. Conclusions

It is concluded that the ~~required New Mexico water allocation and~~ Upper Basin yield and New Mexico water allocation needed ~~are reasonably likely to be available~~ to support New Mexico's revised Upper Basin depletions schedule are reasonably likely to be available. The mass balance analyses results are sufficient to conclude that: (1) the Upper Basin yield is at least 5.76 maf per year, on average, excluding shared CRSP reservoir evaporation; (2) New Mexico's Upper Basin allocation is at least 642,400 af per year, excluding shared CRSP reservoir evaporation; and (3) the total anticipated average annual consumptive use in New Mexico from the Upper Basin, including Navajo Reservoir evaporation, of 642,000 af per year as shown in the revised New Mexico depletions schedule is not likely to exceed New Mexico's Upper Basin allocation. This conclusion is reached assuming full use of the Navajo Nation's proposed depletion rights under the Settlement Agreement for both the Navajo-Gallup Water Supply Project and the NIIP.

Based on this hydrologic investigation for a ~~reasonable~~ planning horizon through 2060, the May 2006 revised New Mexico depletions schedule, and the Biological Assessment for the Navajo-Gallup Water Supply Project, sufficient water is reasonably likely to be available from the Navajo Reservoir water supply to fulfill the contract that is proposed by the Settlement Agreement to provide water for the Navajo Nation's uses in New Mexico under the Navajo-Gallup Water Supply Project and the NIIP ~~through 2060~~. Beyond 2060, ~~it also is reasonably likely that sufficient~~ water will be available for depletion from Navajo Reservoir to service ~~an extension of~~ the proposed contract, depending upon future storage and hydrologic conditions and other factors.

~~Current Water Supply Contracts and Requests for Water from Navajo Reservoir~~

NEED ADDITIONAL COMMENTS ON PROBABILITY ANALYSIS AND CURTAILMENTS\RIVER CALLS

DISCLAIMERS MOVED TO FRONT~~VII. Disclaimers Regarding the Proposed Contract~~

~~This determination is not to be construed as acceptance by the Department of the Interior of the terms of the Settlement Agreement, including the terms of the proposed contract. The Secretary intends to work with Congress, the State of New Mexico and the Navajo Nation to address contract and other issues not related to this determination of Upper Basin water supply. This determination also does not guarantee that the United States would~~will be able to deliver water under the proposed contract without ~~shortages in deliveries on account of drought or other causes outside the control of the Secretary. Nothing in this determination shall be construed to impose on the United States any obligation to maintain CRSP storage facilities, including Navajo Dam and Reservoir, or NIIP or Navajo Gallup Water Supply Project facilities beyond their useful lives or to take extraordinary measures to keep these facilities operating.~~

DISCUSSION DRAFT – April 4, 2006

RESOLUTION OF THE UPPER COLORADO RIVER COMMISSION

Regarding the Availability of Water to Provide for a Navajo Reservoir Supply Contract for Navajo Nation Uses within the State of New Mexico

WHEREAS, the State of New Mexico has proposed the Navajo-Gallup Water Supply Project to provide a needed renewable water supply from the San Juan River for municipal and domestic uses for Indian and non-Indian communities located within New Mexico in both the Upper Basin and the Lower Basin; and

WHEREAS, the State of New Mexico and the Navajo Nation on April 19, 2005, executed the San Juan River Basin in New Mexico Navajo Nation Water Rights Settlement Agreement (the "Settlement Agreement"), which is conditioned upon, among other things, the implementation of the Navajo Nation components of the Navajo-Gallup Water Supply Project within New Mexico; and

WHEREAS, the source of water supply for the proposed Navajo-Gallup Water Supply Project would be Navajo Reservoir and the San Juan River in New Mexico; and

WHEREAS, water from Navajo Reservoir and the San Juan River would be delivered to the proposed Navajo-Gallup Water Supply Project to meet the water demands of Navajo Nation communities in New Mexico through the proposed Settlement Contract between the United States, acting through the Secretary of the Interior, and the Navajo Nation (Appendix 4 to the Settlement Agreement); and

WHEREAS, Public Law 87-483 at section 11(a) requires that no new long-term contracts "... shall be entered into for the delivery of water stored in Navajo Reservoir or any other waters of the San Juan River and its tributaries, as aforesaid, until the Secretary has determined by hydrologic investigations that sufficient water to fulfill said contract is reasonably likely to be available for use in the State of New Mexico during the term thereof under the allocations made in articles III and XIV of the Upper Colorado River Basin compact, and has submitted such determination to the Congress of the United States and the Congress has approved such contracts"; and

WHEREAS, in furtherance of the Jicarilla Apache Tribe Water Rights Settlement Act of 1992, and the perpetual Navajo Reservoir water supply contract approved by said Act, the Secretary of the Interior pursuant to Public Law 87-483 on February 2, 1989, approved the report on "Hydrologic Determination, 1988, Water Availability from Navajo Reservoir and the Upper Colorado River Basin for Use in New Mexico" (the "1988 Hydrologic Determination"); and

WHEREAS, the 1988 Hydrologic Determination evaluated the availability of water from the Navajo Reservoir supply for uses in New Mexico through the 2040 planning horizon; and

WHEREAS, an update and extension to the 1988 Hydrologic Determination is needed to evaluate the availability of water from the Navajo Reservoir supply through a 2060 planning horizon under the allocation of water made to the State of New Mexico by the Upper Colorado River Basin Compact for the purpose of furthering Congressional legislative approval of the Settlement Agreement, the proposed Navajo-Gallup Water Supply Project, and the proposed Settlement Contract for the Navajo Nation's project uses in New Mexico; and

WHEREAS, the proposed Settlement Contract between the United States and the Navajo Nation would provide for water supply **contracts through 2060** for Navajo Nation uses in New Mexico under both the Navajo-Gallup Water Supply Project and the Navajo Indian Irrigation Project which was authorized by Public Law 87-483, and would supersede the existing Navajo Reservoir water supply contract for the Navajo Indian Irrigation Project; and

~~WHEREAS, the proposed Settlement Contract between the United States and the Navajo Nation would provide for the perpetual water supplies for Navajo Nation uses in New Mexico under both the Navajo-Gallup Water Supply Project and the Navajo Indian Irrigation Project which was authorized by Public Law 87-483, and would supersede the existing Navajo Reservoir water supply contract for the Navajo Indian Irrigation Project; and~~

WHEREAS, the US Bureau of Reclamation has presented to the Upper Colorado River Commission for its consideration a draft hydrologic determination, dated _____, 2006, that concludes: (1) at least _____ million acre-feet of water is available annually for use by the Upper Basin, exclusive of reservoir evaporation at Lake Powell, Flaming Gorge Reservoir and the Aspinall Unit reservoirs of the Colorado River Storage Project; and (2) sufficient water is reasonably likely to be available from the Navajo Reservoir supply to fulfill the proposed Settlement Contract for the Navajo Nation's uses in New Mexico under the Navajo-Gallup Water Supply Project and the Navajo Indian Irrigation Project, in addition to existing Navajo Reservoir water supply contracts for other uses, without causing New Mexico to exceed its Upper Colorado River Basin Compact allocation through 2060; and

WHEREAS, the Settlement Agreement provides at subparagraph 9.3.1: "The Navajo Nation and the United States agree that the State of New Mexico may administer in priority water rights in the San Juan River Basin in New Mexico, including rights of the Navajo Nation, as may be necessary for New Mexico to comply with its obligations under interstate compacts and other applicable law"; and

WHEREAS, the Settlement Agreement, at paragraph### contains contingencies that provide for reductions in Navajo Nation water uses, specifically by NIIP, to assure New Mexicio stays within its compact apportionments;

WHEREAS, the Upper Colorado River Commission supports water resource development in the Upper Colorado River Basin to enable the Upper Division States to fully develop their compact apportionments of Colorado River water while meeting compact obligations relating to the flow of the Colorado River at Lee Ferry; and

WHEREAS, it is the position of the Upper Colorado River Commission and the Upper Division States that, with the delivery at Lee Ferry of 75 million acre-feet of water in each period of ten consecutive years, the water supply available in the Colorado River System below Lee Ferry is sufficient to meet the apportionments to the Lower Basin provided for in Articles III(a) and III(b) of the Colorado River Compact and the entire Mexican Treaty delivery obligation; and

WHEREAS, the Upper Colorado River Commission anticipates that the Upper Division States will take all actions necessary to ensure that all Upper Basin States have access to their respective apportionments as specified in the Upper Colorado River Basin Compact; and

WHEREAS, depletions anticipated under this resolution will be diverted from the San Juan River basin and such depletions are considered by the USFWS in Section 7 Consultations and reported in sufficient progress findings under the San Juan River Basin Recovery implementation ("SJRIP") and are one compent considered in developing flow recommendations necessary to recover the endangered fishes; therefore, additional depletions allowed New Mexico under this Resolution will deplete additional (available) water under existing or modified SJRIP flow recommendations which have been used, but absolutely should not be used, to constrain the opportunity for water users in the Colorado portion of the San Juan River basin to deplete additional water under the Colorado River Compacts.

WHEREAS, the Upper Colorado River Commission on June 19, 2003, resolved that: (1) "the States of Colorado, New Mexico, Utah and Wyoming, support and to the extent necessary consent to the diversion of water from the Upper Basin for use in the Lower Basin solely within New Mexico via the proposed Navajo-Gallup Water Supply Project; provided, that any water so diverted by said project to the Lower Basin portion of New Mexico, being a depletion of water at Lee Ferry, shall be a part of the consumptive use apportionment made to the State of New Mexico by Article III (a) of the Upper Colorado River Compact;" and (2) "the Upper Colorado River Commission supports such Congressional action as may be necessary to authorize the Navajo-Gallup Water Supply Project."

NOW, THEREFORE, BE IT RESOLVED by the Upper Colorado River Commission, that the Commission supports Congressional action to approve the Settlement Agreement, authorize the proposed Navajo-Gallup Water Supply Project, and approve the proposed Settlement Contract for the Navajo Nation's uses in New Mexico from the Navajo Reservoir supply under the Navajo-Gallup Water Supply Project and the Navajo Indian Irrigation Project **through 2060.**

BE IT FURTHER RESOLVED, that while the Upper Colorado River Commission does not endorse the study assumptions used by the Bureau of Reclamation in its _____, 2006, draft hydrologic determination, and specifically disagrees with the assumption of a minimum Upper Basin delivery of 8.25 million acre-feet annually at Lee Ferry, the Commission would support a determination by the Secretary of the Interior that at least _____ million acre-feet of water is available annually for use by the Upper Basin, exclusive of reservoir evaporation at Lake Powell, Flaming Gorge Reservoir and the Aspinall Unit reservoirs of the Colorado River Storage Project **(and when considered in concert with the average annual evaporation from these reservoirs is estimated to be 6.2 MAF annually.)**

BE IT FURTHER RESOLVED, that the Upper Colorado River Commission would support a determination by the Secretary of the Interior that sufficient water is reasonably likely to be available to fulfill the proposed Settlement Contract for the Navajo Nation's uses in New Mexico from the Navajo Reservoir supply under the Navajo-Gallup Water Supply Project and the Navajo Indian Irrigation Project, in addition to existing Navajo Reservoir water supply contracts for other uses, without causing New Mexico to exceed its Upper Colorado River Basin Compact allocation **through 2060.**

BE IT FURTHER RESOLVED, that nothing in this Resolution, or resulting from the implementation of this Resolution, shall limit the right or ability of any Upper Basin State to develop the full apportionment made to it under the Colorado River Compact and the Upper Colorado River Basin Compact.

BE IT FURTHER RESOLVED, the Commission supports the Hydrologic Determination as set forth in the first resolution paragraph above as long as Colorado's ability under its Upper Colorado River Compact allocation to use and deplete water in the San Juan River basin, including development allowed under the SJRIP, is not (further) impaired either by New Mexico or otherwise.

BE IT FURTHER RESOLVED, that the water available pursuant to the contract with the New Mexico and the Navajo Nation that such contract water will not be marketed outside the State of New Mexico.

BE IT FURTHER RESOLVED, that the Commission supports provisions in any Federal legislation to protect Colorado water users in the San Juan River basin in accordance with the above.

BE IT FURTHER RESOLVED, that a copy of this resolution be transmitted to the Regional Director, Upper Colorado Region, Bureau of Reclamation, Salt Lake City, Utah.

CERTIFICATE

I, Don A. Ostler, Executive Director and Secretary of the Upper Colorado River Commission, do hereby certify that the Upper Colorado River Commission adopted the above Resolution at _____ Meeting held in _____, on _____, 2006.

WITNESS my hand this _____ day of _____ 2006.

_____
DON A. OSTLER
Executive Director and Secretary

Whipple, John J., OSE

Fro Whipple, John J., OSE **Sent:** Wed 5/3/2006 9:12 AM
To: randy.seaholm@state.co.us; robertking@utah.gov; jshiel@seo.wyo.gov; dostler@uc.usbr.gov; dtrueman@uc.usbr.gov
Cc: Lopez, Estevan, OSE
Subject: Hydro Determination update
Attachments: Navset.hydrodeter.yieldstudy3.xls(2MB)

All:

Attached is a revised yield study file - it is the same as the one sent to you last evening, except that I added Study No. 18 for our discussion. Study 18 assumes that the Lower Basin delivery does not exceed the Lee Ferry natural flow when the flow is less than 8.25 maf. That is, we neither deplete the natural flow nor release water from storage to supplement the natural flow at Lee Ferry in 1934 and 1977 (except that Upper Basin uses are made by exchange with CRSP stored water).

John Whipple

Upper Basin Yield Study - May 2, 2006, Draft
Summary of Results

Study	Natural Flow Data	Upper Basin Use	Storage Capacity	Lower Basin Delivery (maf)	Period	Average Annual Upper Basin Use (maf)	Average Annual Shared CRSP Evap (maf)	Total Annual Upper Basin Depletion, inc. CRSP Evap (maf)	Computed Annual Amounts of Shortage (maf) 1963	1964	1967	1968	1977	Total Computed Shortage Amount (maf)	Percent Shortage over Period
1	CRSS	Constant Average	CRSP Active	8.25	1953-1977	5.65	0.26	5.91	1.17	3.17	0.07	0.29	3.43	8.13	5.8
					1931-1977	5.65	0.37	6.02							3.1
					1906-2000	5.65	0.49	6.14							1.5
2	CRSS	Constant Average	CRSP Active + Other UB	8.25	1953-1977	5.75	0.26	6.01	0.00	3.16	0.37	0.39	4.33	8.25	5.7
					1931-1977	5.75	0.37	6.12							3.1
					1906-2000	5.75	0.49	6.24							1.5
3	CRSS	Constant Average	CRSP Active + Other UB (same % full)	8.25	1953-1977	5.75	0.25	6.00	0.17	3.27	0.34	0.39	4.12	8.29	5.8
					1931-1977	5.75	0.37	6.12							3.1
					1906-2000	5.75	0.50	6.25							1.5
4	Adjusted CRSS	Constant Average	CRSP Active + Other UB (same % full)	8.25	1953-1977	5.55	0.32	5.87	0.00	0.00	0.00	0.00	0.00	0.00	0.0
					1931-1977	5.55	0.42	5.97							0.0
					1906-2000	5.55	0.53	6.08							0.0
5	Adjusted CRSS	Constant Average	CRSP Active + Other UB (same % full)	8.25	1953-1977	5.79	0.25	6.04	1.15	3.31	0.45	0.43	3.14	8.48	5.9
					1931-1977	5.79	0.36	6.15							3.1
					1906-2000	5.79	0.49	6.28							1.5
6	Adjusted CRSS	Variable	CRSP Active + Other UB (same % full)	8.25	1953-1977	5.37	0.35	5.72	0.00	0.00	0.00	0.00	0.00	0.00	0.0
					1931-1977	5.47	0.45	5.92							0.0
					1906-2000	5.79	0.54	6.33							0.0
7	Adjusted CRSS	Shorted Supply (5.79 maf demand)	CRSP Active + Other UB (same % full)	8.25	1953-1977	5.57	0.29	5.86	0.00	0.00	0.00	0.00	1.36	1.36	1.0
					1931-1977	5.60	0.40	6.00							0.5
					1906-2000	5.66	0.52	6.18							0.3
8	Adjusted CRSS	Constant Average	CRSP Active + Other UB (same % full)	8.00	1953-1977	5.80	0.32	6.12	0.00	0.00	0.00	0.00	0.00	0.00	0.0
					1931-1977	5.80	0.42	6.22							0.0
					1906-2000	5.80	0.53	6.33							0.0
9	Adjusted CRSS	Constant Average	CRSP Active + Other UB (same % full)	8.00	1953-1977	6.05	0.25	6.30	1.40	3.32	0.48	0.44	3.22	8.86	5.9
					1931-1977	6.05	0.36	6.41							3.1
					1906-2000	6.05	0.49	6.54							1.5
10	Adjusted CRSS	Constant Average	CRSP Live + Other UB (same % full)	8.25	1953-1977	5.72	0.21	5.93	0.00	0.00	0.00	0.00	0.00	0.00	0.0
					1931-1977	5.72	0.34	6.06							0.0
					1906-2000	5.72	0.46	6.18							0.0
11	Adjusted CRSS	Constant Average	CRSP Live + Other UB (same % full)	8.25	1953-1977	5.98	0.13	6.11	0.70	3.37	0.64	0.50	3.67	8.88	5.9
					1931-1977	5.98	0.27	6.25							3.2
					1906-2000	5.98	0.42	6.40							1.6
12	Adjusted CRSS	Constant Average	CRSP Live + Other UB (same % full)	8.00	1953-1977	5.97	0.21	6.18	0.00	0.00	0.00	0.00	0.00	0.00	0.0
					1931-1977	5.97	0.34	6.31							0.0
					1906-2000	5.97	0.46	6.43							0.0
13	Adjusted CRSS	Constant Average	CRSP Live + Other UB (same % full)	8.00	1953-1977	6.24	0.13	6.37	0.95	3.38	0.67	0.51	3.75	9.26	5.9
					1931-1977	6.24	0.26	6.50							3.2
					1906-2000	6.24	0.42	6.66							1.6
14	Adjusted CRSS	Constant Average	CRSP Active + Other UB (same % full)	8.25	1953-1977	5.72	0.26	5.98	0.00	2.68	0.25	0.36	2.56	5.85	4.1
					1931-1977	5.72	0.38	6.10							2.2
					1906-2000	5.72	0.50	6.22							1.1
15	Adjusted CRSS	Constant Average	CRSP Active + Other UB (same % full)	8.25	1953-1977	5.76	0.26	6.02	0.42	3.28	0.37	0.40	2.89	7.36	5.1
					1931-1977	5.76	0.37	6.13							2.7
					1906-2000	5.76	0.50	6.26							1.3
16	Adjusted CRSS	Shorted Supply (5.76 maf demand)	CRSP Active + Other UB (same % full)	8.25	1953-1977	5.54	0.30	5.84	0.00	0.00	0.00	0.00	0.44	0.44	0.3
					1931-1977	5.57	0.41	5.98							0.2
					1906-2000	5.63	0.52	6.15							0.1
17	Adjusted CRSS	Constant Average	CRSP Live + Other UB (same % full)	8.25	1953-1977	5.76	0.19	5.95	0.00	0.00	0.00	0.00	0.98	0.98	0.7
					1931-1977	5.76	0.32	6.08							0.4
					1906-2000	5.76	0.45	6.21							0.2
18	Adjusted CRSS	Constant Average	CRSP Active + Other UB (same % full)	8.20 (lesser of 8.25/NF)	1953-1977	5.76	0.27	6.03	0.00	2.58	0.37	0.40	0.19	3.54	2.5
					1931-1977	5.76	0.39	6.15							1.3
					1906-2000	5.76	0.51	6.27							0.6

'es:

The New Mexico Interstate Stream Commission staff prepared this table using the annual water balance spreadsheet and CRSP evaporation equations developed for the current yield study. The ISC and USBR jointly developed the spreadsheet and evaporation equations. The spreadsheets for each study and the CRSP evaporation correlations are attached.

(2) The Upper Basin yields shown in Studies 1-7 and 10-11 assume a delivery of 8.25 maf per year to the Lower Basin at Lee Ferry. The yields can be increased by 0.1 maf for each 0.1 maf of decrease in the delivery at Lee Ferry as shown by Studies 8-9 and 12-13.

(3) If CRSP live storage is used instead of CRSP active storage, either the Upper Basin demands can be increased or computed shortages can be reduced. Using CRSP live storage plus all other Upper Basin live storage, and also adjusting CRSS natural flows for 1971-1980 to natural flows that would have been computed if the historic irrigation depletions had been calculated using the modified Blaney-Criddle method with SCS effective precipitation and SCS recommended growth season start temperatures for all crops consistent with 1981-2000 natural flows, a constant Upper Basin use of 5.72 maf/yr can be met without shortage (see Study 7). The evaporation amounts using CRSP live storage are less than the evaporation amounts using CRSP active storage due to storage draw downs below minimum power pools.

(4) The 1988 Hydrologic Determination concluded that the yield to the Upper Basin with tolerable shortages is at least 6.0 maf per year over a 25-year, 7-month critical period, including CRSP evaporation. In the current Upper Basin yield study, the draw down in reservoir storage from full storage conditions begins at the end of 1930, and full storage conditions are next attained in 1984 or 1985. In general, reservoir levels are drawn down from 1930 to 1940, recover to about 3/4-capacity by 1952, are drawn down again during the mid 1950s, are kept at very low levels from about 1956-1981, and then recover by 1984. Increasing the average annual Upper Basin demand above the firm yield demand first results in the occurrence of computed shortage in 1977, and further increases in demand cause shortages to also be computed in the 1960s. Although the critical period may differ from the 1988 Hydrologic Determination, the most significant difference between the current and 1988 studies is that the current studies recognize that CRSP reservoir evaporation changes with reservoir storage. CRSP reservoir storage is maintained at significantly lower levels, on average, during the 1953-1977 period as compared to the 1931-1964 period, primarily because CRSP active storage is maintained at under 10 maf for most of twenty years beginning the early 1960s. CRSP active storage rarely dips below 10 maf for the remainder of the period of record. The average annual evaporation amounts shown in this table for different periods illustrate the effects of storage on evaporation. To account for this, the current yield study segregates CRSP reservoir evaporation from the Upper Basin demand.

(5) Evaporation amounts include shared CRSP evaporation only. For the CRSP plus all other Upper Basin storage condition, inclusion of the existing Upper Basin storage capacity in the yield studies generally increases the yield by 0.1 maf. Thus, the evaporation amounts for the latter storage condition in Study 2 were assumed to be the same as the evaporation amounts for the CRSP only storage condition in Study 1. Study 3 assumes that CRSP unit and other reservoirs are the same percent full, and the CRSP reservoir evaporation is computed accordingly. The results essentially are the same, and the latter assumption is used for the remaining studies. The CRSP reservoirs generally will operate in about the same manner as they have historically, although other Upper Basin reservoirs are generally upstream from CRSP reservoirs and therefore may fill first. This upstream storage effect may cause the CRSP evaporation amounts to be slightly overstated for the CRSP plus all other Upper Basin storage condition.

(6) The 1988 Hydrologic Determination assumed that a total shortage of 6 percent overall for a 25-year, 7-month critical period was tolerable (with the shortage measured against the total Upper Basin depletion including shared CRSP reservoir evaporation). In this yield study, a 6 percent overall shortage limitation is applied for the worst 25-year period of reservoir draw down (with the shortage measured against the Upper Basin use exclusive of shared CRSP reservoir evaporation). CRSS natural flows for 1971-1980 are adjusted to reflect historic irrigation depletions recalculated using the modified Blaney-Criddle method with SCS effective precipitation and SCS recommended growth season start temperatures (consistent with 1981-2000 natural flows). Use of the water stored in CRSP minimum power pools to meet demands is not considered except in study 7. In 1977, the computed shortage of as much as about 3 maf under some scenarios would not actually materialize because Upper Basin uses in that year would be substantially lower than the average Upper Basin use demand as illustrated in studies 5 and 6. In below-average periods of runoff during which reservoir storage will be substantially drawn down, physical water supply shortages will cause Upper Basin uses to be less, on average, than the long-term average consumptive use by the Upper Basin states. Use of a constant Upper Basin consumptive use does not reflect, however, annual variations in consumptive uses caused by annual variations in water supply availability and physical water shortages in the Upper Basin. To this extent, the computed shortages are overstated as illustrated by studies 5 and 6. Also, if the yield studies were to include Upper Basin storage in excess of existing capacity as will be needed to fully develop the Upper Basin yield available for use by the states, either the computed yields could be increased or the computed shortages could be reduced (loss of existing storage capacity to sedimentation may be replaced).

(7) Study 5 incorporates annual variations in Upper Basin consumptive uses about the long-term average consumptive use that result from annual variations in water supply and physical shortages. The following is an excerpt from "Water Supplies of the Colorado River Available for Use by the States of the Upper Division and for Use from the Main Stem by the States of Arizona, California and Nevada in the Lower Basin," Part I - Text, Tipton and Kalmbach, Inc., July 1965, page 15: "A depletion factor was used to modify the assumed basic depletions by the States of the upper division of the Colorado River Basin. The philosophy of the depletion factor is based on the fact that during periods of low water supply in the Upper Basin all projects in operation will not receive a full water supply. Most of them will not have reservoirs, and some that have reservoirs will not have water in some years to fill those reservoirs. No rational means have been derived for varying the estimated uses by the States of the upper division because of varying water supply. The means used by the U.S. Bureau of Reclamation in its past studies, which it is assumed it is still using, are based on the assumption that the uses would vary from the normal use in a particular year by one-half of the percent that the virgin flow at Lee Ferry in that particular year varies from a long-time average of virgin flow." Using this assumption, the sensitivity of the amount of computed shortages to possible annual variations in physical water supplies and actual uses in the Upper Basin is illustrated. Under this scenario, actual Upper Basin uses by the states exclusive of shared CRSP evaporation would average about 5.37 maf during 1953-1977, 5.47 maf during 1931-1977, and 5.79 maf for the period of record, and except for physical water supply shortages in the Upper Basin, no other shortages are computed. Study 6 incorporates physical water supply shortages in the Upper Basin computed by the USBR's CRSS model under development of up to 5.48 maf in the Upper Basin, exclusive of shared CRSP evaporation. Under this assumption, no use in excess of an average long-term demand of 5.79 maf/yr is assumed, and the computed shortage in 1977 of about 1.5 maf is in addition to the CRSS physical shortages. The CRSS model understates actual use in above-average runoff years because it does not model variations in use above the average, and it also overstates actual use in below-average runoff years because it underestimates physical water supply shortages on tributaries to the mainstream rivers. Overall, the long-term average use under Studies 7 and 16 is understated.

(8) The following is a general summary of the results of this yield study:

	Minimum LB Delivery (maf)	Yield without Shortages (maf)	Yield with Shortages (maf)
Maintain minimum power pools	8.25	5.55	5.79
	8.00	5.80	6.05
Use minimum power pools	8.25	5.72	5.98
	8.00	5.97	6.24

Note: Yield defined as the amount of water available at Lee Ferry for use, on average, by the Upper Basin, exclusive of shared CRSP reservoir evaporation. Shortages defined as 6 percent or less overall shortage for any period of 25 consecutive years consistent with 1988 Hydrologic Determination.

(9) Assuming use of the minimum power pools and a minimum Lower Basin delivery of 8.25 maf, the firm annual yield is 5.72 maf. Study 14 indicates that if the minimum power pools are maintained and the Upper Basin use is 5.72 maf/yr, there would be an overall shortage of about 4 percent for the period 1953-1977 (with annual shortages of about 2.6 maf in 1964 and 1977). Thus, about 70 percent of the overall shortage amount, and about 80 percent of the annual shortage amounts for 1964 and 1977, at Lee Ferry computed under Study 5 (maintain power pools, Upper Basin use of 5.79 maf, and 6 percent overall shortage) are caused by protection of the power pools. An Upper Basin use of 5.76 maf/yr would result in a 5 percent overall shortage for 1953-1977 assuming maintenance of the power pools (Study 15), and would result in a shortage in 1977 only of about 10 percent of the use that year after CRSS-modeled physical water supply shortages are considered (Study 16). Using the power pools, an Upper Basin use of 5.76 maf/yr would result in a shortage in 1977 of about 1 maf (Study 17), which is less than the CRSS-modeled physical water supply shortage that year. The risk of shortages at Lee Ferry actually is less than computed in these studies because during years of below-average supply as occur during the critical period, the actual Upper Basin use will be less than the average.

(10) The Upper Colorado River Commission last approved depletion schedules for the Upper Division States for planning purposes in December 1999. The depletion schedules, dated January 2000, project that the total Upper Basin use exclusive of shared CRSP reservoir evaporation will average about 5.365 maf under 2060 development conditions. The January 2000 depletion schedule for New Mexico assumed its use would average about 619,000 af by 2060. New Mexico's current revisions to its depletion schedule indicate that its use would average about 642,000 af under full development, which compares to a New Mexico allocation of 642,400 af that is derived from an Upper Basin yield of 5.76 maf exclusive of shared CRSP reservoir evaporation. The increase in New Mexico's projected depletions is due to recalculation of irrigation depletions using the modified Blaney-Criddle method and minor adjustments for the NIIP, the Navajo-Gallup Project and other uses. Adjusting the total Upper Basin depletion for the revised New Mexico depletions indicates that the total Upper Basin use will develop to about 5.388 maf, exclusive of CRSP reservoir evaporation, unless the other Upper Division States schedule increased development by 2060. Thus, total Upper Basin use through much, if not all, the next 54 years extending to 2060 may be anticipated to be below the firm yield of 5.55 maf computed assuming a minimum Lower Basin delivery of 8.25 maf and maintenance of the minimum power pools. The time required to develop the Upper Basin allocation reduces risk of shortage within the planning horizon.

(11) Study 18 assumes that the minimum Lower Basin delivery is 8.25 maf if the natural flow at Lee Ferry exceeds this amount, or is equal to the natural flow at Lee Ferry if it does not exceed 8.25 maf (which situation occurs in 1934 and 1977). The Lower Basin delivery under this assumption averages 8.20 maf, excluding spills, over the period 1906-2000 and 8.15 maf for the critical period. The cumulative shortage amount computed in Study 18 of 3.54 maf is less than the amount of CRSP minimum power pool contents.

Upper Basin Yield Study - May 2, 2006, Draft

Study No. 18: Flows Adjusted, CRSP Active+Other UB Live Storage (same percent full), Constant 5.76 maf Upper Basin Use, LB Delivery lesser of 8.25 maf/Natural Flow

CY	CR Natural Flow at Lee Ferry (plus)	Total Carry-Over Storage (plus)	CRSP Carry-Over Storage	Lower Basin Delivery (minus)	10-Year Lower Basin Delivery	Upper Basin Use (minus)	Shared CRSP Evap (minus)	Net Available to Store (subtotal)	Spill to LC (minus)	Shortage (plus)	UC Basin Year-end Storage (equals)	CRSP Year-end Storage
1906	18,550,021	29,530,030	24,847,704	8,250,000		5,760,000	749,290	33,320,761	3,790,731	0	29,530,030	24,847,704
1907	21,201,694	29,530,030	24,847,704	8,250,000		5,760,000	749,290	35,972,434	6,442,404	0	29,530,030	24,847,704
1908	12,218,817	29,530,030	24,847,704	8,250,000		5,760,000	723,049	27,015,798	0	0	27,015,798	22,732,132
1909	22,356,301	27,015,798	22,732,132	8,250,000		5,760,000	723,049	34,639,050	5,109,020	0	29,530,030	24,847,704
1910	14,650,616	29,530,030	24,847,704	8,250,000		5,760,000	748,168	29,422,479	0	0	29,422,479	24,757,206
1911	15,499,729	29,422,479	24,757,206	8,250,000		5,760,000	748,168	30,164,040	634,010	0	29,530,030	24,847,704
1912	18,623,410	29,530,030	24,847,704	8,250,000		5,760,000	749,290	33,394,150	3,864,120	0	29,530,030	24,847,704
1913	14,536,373	29,530,030	24,847,704	8,250,000		5,760,000	746,988	29,309,416	0	0	29,309,416	24,662,070
1914	21,354,814	29,309,416	24,662,070	8,250,000		5,760,000	746,988	35,907,242	6,377,212	0	29,530,030	24,847,704
1915	13,623,277	29,530,030	24,847,704	8,250,000	82,500,000	5,760,000	737,556	28,405,751	0	0	28,405,751	23,901,692
1916	20,142,892	28,405,751	23,901,692	8,250,000	82,500,000	5,760,000	737,556	33,801,087	4,271,057	0	29,530,030	24,847,704
1917	22,942,804	29,530,030	24,847,704	8,250,000	82,500,000	5,760,000	749,290	37,713,544	8,183,514	0	29,530,030	24,847,704
1918	15,865,939	29,530,030	24,847,704	8,250,000	82,500,000	5,760,000	749,290	30,636,679	1,106,649	0	29,530,030	24,847,704
1919	12,651,369	29,530,030	24,847,704	8,250,000	82,500,000	5,760,000	727,517	27,443,882	0	0	27,443,882	23,092,339
1920	22,287,632	27,443,882	23,092,339	8,250,000	82,500,000	5,760,000	727,517	34,993,998	5,463,967	0	29,530,030	24,847,704
1921	22,526,781	29,530,030	24,847,704	8,250,000	82,500,000	5,760,000	749,290	37,297,521	7,767,491	0	29,530,030	24,847,704
1922	18,447,198	29,530,030	24,847,704	8,250,000	82,500,000	5,760,000	749,290	33,217,938	3,687,908	0	29,530,030	24,847,704
1923	19,024,046	29,530,030	24,847,704	8,250,000	82,500,000	5,760,000	749,290	33,794,786	4,264,756	0	29,530,030	24,847,704
1924	13,877,798	29,530,030	24,847,704	8,250,000	82,500,000	5,760,000	740,185	28,657,643	0	0	28,657,643	24,113,644
1925	14,430,701	28,657,643	24,113,644	8,250,000	82,500,000	5,760,000	727,874	28,350,470	0	0	28,350,470	23,855,177
1926	15,213,731	28,350,470	23,855,177	8,250,000	82,500,000	5,760,000	729,616	28,824,585	0	0	28,824,585	24,254,115
1927	19,539,212	28,824,585	24,254,115	8,250,000	82,500,000	5,760,000	741,927	33,611,870	4,081,839	0	29,530,030	24,847,704
1928	16,954,334	29,530,030	24,847,704	8,250,000	82,500,000	5,760,000	749,290	31,725,074	2,195,044	0	29,530,030	24,847,704
1929	21,829,585	29,530,030	24,847,704	8,250,000	82,500,000	5,760,000	749,290	36,600,325	7,070,295	0	29,530,030	24,847,704
1930	14,621,041	29,530,030	24,847,704	8,250,000	82,500,000	5,760,000	747,862	29,393,209	0	0	29,393,209	24,732,577
1931	8,474,134	29,393,209	24,732,577	8,250,000	82,500,000	5,760,000	681,543	23,175,801	0	0	23,175,801	19,501,011
1932	17,422,187	23,175,801	19,501,011	8,250,000	82,500,000	5,760,000	645,527	25,942,461	0	0	25,942,461	21,828,985
1933	12,183,500	25,942,461	21,828,985	8,250,000	82,500,000	5,760,000	648,570	23,467,390	0	0	23,467,390	19,746,365
1934	6,178,192	23,467,390	19,746,365	6,178,192	80,428,192	5,760,000	556,809	17,150,582	0	0	17,150,582	14,431,159
1935	12,630,349	17,150,582	14,431,159	8,250,000	80,428,192	5,760,000	471,559	15,299,372	0	0	15,299,372	12,873,480
1936	14,648,873	15,299,372	12,873,480	8,250,000	80,428,192	5,760,000	454,165	15,484,080	0	0	15,484,080	13,028,901
1937	14,306,056	15,484,080	13,028,901	8,250,000	80,428,192	5,760,000	454,440	15,325,696	0	0	15,325,696	12,895,630
1938	18,148,319	15,325,696	12,895,630	8,250,000	80,428,192	5,760,000	490,856	18,973,159	0	0	18,973,159	15,964,746
1939	11,164,059	18,973,159	15,964,746	8,250,000	80,428,192	5,760,000	494,065	15,633,154	0	0	15,633,154	13,154,337
1940	9,931,657	15,633,154	13,154,337	8,250,000	80,428,192	5,760,000	412,335	11,142,476	0	0	11,142,476	9,375,708
1941	20,116,678	11,142,476	9,375,708	8,250,000	80,428,192	5,760,000	424,768	16,824,385	0	0	16,824,385	14,156,685
1942	17,225,136	16,824,385	14,156,685	8,250,000	80,428,192	5,760,000	512,281	19,527,241	0	0	19,527,241	16,430,972
1943	13,731,401	19,527,241	16,430,972	8,250,000	80,428,192	5,760,000	532,030	18,716,612	0	0	18,716,612	15,748,878
1944	15,369,422	18,716,612	15,748,878	8,250,000	82,500,000	5,760,000	532,203	19,543,831	0	0	19,543,831	16,444,931
1945	14,140,528	19,543,831	16,444,931	8,250,000	82,500,000	5,760,000	536,599	19,137,760	0	0	19,137,760	16,103,248
1946	11,095,453	19,137,760	16,103,248	8,250,000	82,500,000	5,760,000	496,756	15,726,457	0	0	15,726,457	13,232,846
1947	16,439,486	15,726,457	13,232,846	8,250,000	82,500,000	5,760,000	481,484	17,674,459	0	0	17,674,459	14,871,970
1948	15,139,294	17,674,459	14,871,970	8,250,000	82,500,000	5,760,000	508,297	18,295,456	0	0	18,295,456	15,394,501
1949	16,933,584	18,295,456	15,394,501	8,250,000	82,500,000	5,760,000	539,659	20,679,381	0	0	20,679,381	17,400,427
1950	13,140,416	20,679,381	17,400,427	8,250,000	82,500,000	5,760,000	549,727	19,260,070	0	0	19,260,070	16,206,164
1951	12,505,894	19,260,070	16,206,164	8,250,000	82,500,000	5,760,000	513,852	17,242,112	0	0	17,242,112	14,508,177
1952	20,805,422	17,242,112	14,508,177	8,250,000	82,500,000	5,760,000	557,892	23,479,642	0	0	23,479,642	19,756,675
1953	11,165,419	23,479,642	19,756,675	8,250,000	82,500,000	5,760,000	587,176	20,047,885	0	0	20,047,885	16,869,062
1954	8,496,102	20,047,885	16,869,062	8,250,000	82,500,000	5,760,000	488,709	14,045,278	0	0	14,045,278	11,818,238
1955	9,413,908	14,045,278	11,818,238	8,250,000	82,500,000	5,760,000	374,184	9,075,002	0	0	9,075,002	7,636,056
1956	11,426,874	9,075,002	7,636,056	8,250,000	82,500,000	5,760,000	292,298	6,199,578	0	0	6,199,578	5,216,564
1957	21,500,963	6,199,578	5,216,564	8,250,000	82,500,000	5,760,000	336,954	13,353,588	0	0	13,353,588	11,236,222
1958	15,862,511	13,353,588	11,236,222	8,250,000	82,500,000	5,760,000	426,504	14,779,594	0	0	14,779,594	12,436,120
1959	9,598,169	14,779,594	12,436,120	8,250,000	82,500,000	5,760,000	391,257	9,976,506	0	0	9,976,506	8,394,616
1960	11,524,160	9,976,506	8,394,616	8,250,000	82,500,000	5,760,000	311,927	7,178,740	0	0	7,178,740	6,040,468
1961	10,010,259	7,178,740	6,040,468	8,250,000	82,500,000	5,760,000	238,491	2,940,507	0	0	2,940,507	2,474,256
1962	17,377,609	2,940,507	2,474,256	8,250,000	82,500,000	5,760,000	227,035	6,081,081	0	0	6,081,081	5,116,856
1963	8,840,900	6,081,081	5,116,856	8,250,000	82,500,000	5,760,000	203,737	708,245	0	0	708,245	595,944
1964	10,863,586	708,245	595,944	8,250,000	82,500,000	5,760,000	140,268	-2,578,437	0	2,578,437	0	0
1965	19,875,027	0	0	8,250,000	82,500,000	5,760,000	192,085	5,672,942	0	0	5,672,942	4,773,432
1966	10,679,844	5,672,942	4,773,432	8,250,000	82,500,000	5,760,000	214,300	2,128,486	0	0	2,128,486	1,790,990
1967	11,670,830	2,128,486	1,790,990	8,250,000	82,500,000	5,760,000	155,091	-365,775	0	365,775	0	0
1968	13,739,932	0	0	8,250,000	82,500,000	5,760,000	132,876	-402,944	0	402,944	0	0
1969	15,272,159	0	0	8,250,000	82,500,000	5,760,000	144,541	1,117,618	0	0	1,117,618	940,407
1970	15,344,136	1,117,618	940,407	8,250,000	82,500,000	5,760,000	168,372	2,283,382	0	0	2,283,382	1,921,325
1971	15,493,659	2,283,382	1,921,325	8,250,000	82,500,000	5,760,000	194,000	3,573,040	0	0	3,573,040	3,006,494
1972	13,186,637	3,573,040	3,006,494	8,250,000	82,500,000	5,760,000	196,813	2,552,864	0	0	2,552,864	2,148,078
1973	18,650,193	2,552,864	2,148,078	8,250,000	82,500,000	5,760,000	232,172	6,960,886	0	0	6,960,886	5,857,157
1974	13,285,426	6,960,886	5,857,157	8,250,000	82,500,000	5,760,000	267,821	5,968,491	0	0	5,968,491	5,022,118
1975	17,072,661	5,968,491	5,022,118	8,250,000	82,500,000	5,760,000	286,439	8,744,714	0	0	8,744,714	7,358,139
1976	11,313,561	8,744,714	7,358,139	8,250,000	82,500,000	5,760,000	284,304	5,763,971	0	0	5,763,971	4,850,027
1977	5,551,188	5,763,971	4,850,027	5,551,188	79,801,188	5,760,000	193,035	-189,064	0	189,064	0	0
1978	15,335,909	0	0	8,250,000	79,801,188	5,760,000	145,199	1,180,709	0	0	1,180,709	993,494
1979	17,825,429	1,180,709	993,494	8,250,000	79,801,188	5,760,000	195,306	4,800,832	0	0	4,800,832	4,039,605
1980	17,927,076	4,800,832	4,039,605	8,250,000	79,801,188	5,760,000	271,142	8,446,766	0	0	8,446,766	7,107,434
1981	9,015,200	8,446,766	7,107,434	8,250,000	79,801,188	5,760,000	254,409	3,197,558	0	0	3,197,558	2,690,548
1982	17,489,400	3,197,558	2,690,548	8,250,000	79,801,188	5,760,000	233,500	6,443,457	0	0	6,443,457	5,421,773
1983	24,361,989	6,443,457	5,421,773	8,250,000	79,801,188	5,760,000	371,544	16,423,902	0	0	16,423,902	13,819,703
1984	25,359,376	16,423,902	13,819,703	8,250,000	79,801,188	5,760,000	588,028	27,185,250	0	0	27,185,250	22,874,716
1985	21,246,109	27,185,250	22,874,716	8,250,000	79,801,188	5,760,000	724,818	33,696,541	4,166,511	0	29,530,030	24,847,704
1986	23,013,446	29,530,030	24,847,704	8,250,000	79,801,188	5,760,000	749,290	37,784,186	8,254,156	0	29,530,030	24,847,704
1987	15,640,478	29,530,030	24,847,704	8,250,000	82,500,000	5,760,000	749,290	30,411,219	881,188	0	29,530,030	24,847,704
1988	11,456,357	29,530,030	24,847,704	8,250,000	82,500,000	5,760,000	715,173	26,261,214	0	0	26,261,214	22,097,196
1989	9,921,847	26,261,214	22,097,196	8,250,000	82,500,000	5,760,000	631,794	21,541,266	0	0	21,541,266	18,125,650
1990	9,639,803	21,541,266	18,125,650	8,250,000	82,500,000	5,760,000	531,374	16,639,696	0	0	16,639,696	14,001,280
1991	12,170,021	16,639,696	14,001,280	8,250,000	82,500,000	5,760,000	456,250	14,343,467	0	0	14,343,467	12,069,145
1992	10,895,580	14,343,467	12,069,145	8,250,000	82,500,000	5,760,000	395,649	10,833,398	0	0	10,833,398	9,115,638
1993	18,160,118	10,833,398	9,115,638	8,250,000	82,500,000	5,760,000	398,173	14,585,343	0	0	14,585,343	12,272,669
1994	11,125,503	14,585,343	12,272,669	8,250,000	82,500,000	5,760,000	403,021	11,297,825	0	0	11,297,825	9,506,424
1995	20,047,166	11,297,825	9,506,424	8,250,000	82,500,000	5,760,000	427,259	16,907,731	0	0	16,907,731	14,226,816
1996	14,502,293	16,907,731	14,226,816	8,250,000	82,500,000	5,760,000	485,877	16,914,147	0	0	16,914,147	14,232,214
1997	21,622,438	16,914,147	14,232,214	8,250,000	82,500,000	5,760,000	559,556	23,967,029	0	0	23,967,029	20,166,781
1998	16,798,378	23,967,029	20,166,781	8,250,000	82,500,000	5,760,000	655,429	26,099,978	0	0	26,099,978	21,961,526
1999	15,934,210	26,099,978	21,961,526	8,250,000	82,500,000	5,760,000	690,566	27,333,622	0	0	27,333,622	22,999,561
2000	10,646,526	27,333,622	22,999,561	8,250,000	82,500,000	5,760,000	661,434	23,308,714	0	0	23,308,714	19,612,849
Total										3,536,221		
Averages:												
1953-1977	13,088,628			8,142,048		5,760,000	267,216		0	141,449	5,966,096	5,020,103
1931-1977	13,594,590			8,148,497		5,760,000	386,719		0	75,239	11,847,957	9,969,327
1906-2000	15,284,742			8,199,783		5,760,000	505,440		922,230	37,223	17,815,365	14,990,534

Variables	
Storage	30,167,576 af
Sedimentation Rate (Active)	24,292 af/yr
Bank Storage	4%
Adjusted Storage (2060)	29,530,030 af
UB Demand Level	5,760,000 af/yr
LB Delivery	8,250,000 af/yr

Results

Average CRSP Evap	505,440 af/yr
Total Yield w/ CRSP evap	6,265,440 af/yr

Shortage Years	Shortage
1963	0 af
1964	2,578,437 af
1967	365,775 af
1968	402,944 af
1977	189,064 af

NM allocation(w/o evap) 642,375 af/yr

Note: NM allocation is exclusive of its portion of CRSP evaporation. Navajo evaporation would be primarily charged against NM's allocation. Shared CRSP evaporation is already removed from UC demands.

Total Upper Basin depletion, inc. CRSP evap:

1953-1977	6,027,216 af/yr
1931-1977	6,146,719 af/yr
1906-2000	6,265,440 af/yr

Flow Adjustments:

1971	203,226 af
1972	226,985 af
1973	252,377 af
1974	196,384 af
1975	246,665 af
1976	173,250 af
1977	112,291 af
1978	152,187 af
1979	153,559 af
1980	161,893 af