

**HYDROLOGIC DETERMINATION  
2007**

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

**April 2007**

**MAY 23 2007**

**Date**



**Secretary of the Interior**

## **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.

This document determines 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 consumptive 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 from Navajo Reservoir to service the proposed contract after the 2060 planning horizon, depending upon future storage, 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. Implementation of the Navajo-Gallup Water Supply Project and the NIIP is subject to compliance with federal environmental laws including the National Environmental Policy Act and the Endangered Species Act.

## **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 NIIP.

On June 19, 2003, the Upper Colorado River Commission 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 long-term contract, except contracts for the NIIP and the San Juan-Chama Project, 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 Navajo-Gallup Water Supply Project.

This hydrologic investigation is made for the purpose of contracting for 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 this 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 defined several areas of responsibility for the Commission that directly and indirectly relate to this investigation.

### **III. Upper Basin Yield**

#### **A. General Upper Basin Hydrology**

Based on the Bureau of Reclamation's Colorado River Simulation System (CRSS), natural flows for the period 1906-2000, the natural runoff from the Upper Colorado River Basin averages about 15.3 maf per year at Lee Ferry. Of this amount, approximately 2 maf per year originates in the San Juan River Basin above Bluff, Utah. New Mexico can only develop its Upper Basin allocation from the San Juan River and its tributaries. The Bureau of Reclamation's Colorado River System Consumptive Uses and Losses Report for 1996-2000 indicates that current consumptive uses from the San Juan River Basin

average about 382,400 af per year in New Mexico and about 192,500 af per year in Colorado. Only minor amounts of depletions are made in the San Juan River Basin in Utah and Arizona.

## **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 CRSS natural flows at Lee Ferry, minimum releases from Lake Powell of between 7.48 maf and 8.23 maf annually, 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 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 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.

Neither the Lower Division states nor the Upper Colorado River Commission agree with the modeling assumption for the objective minimum release used in this report. At the request of the Commission, this hydrologic investigation considers for planning purposes both the 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 these 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 excludes evaporation from Navajo Reservoir which is chargeable to the states based on use. 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 reservoirs plus Navajo Reservoir. Evaporation equations were developed for both active and live storage, and were applied

to estimate annual shared CRSP evaporation based upon yearly reservoir storage volume (surface area). 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; however, it 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.

### C. 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:

<u>Storage Assumption</u>	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 for this analysis 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. 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.

For those analyses that use an allowable or tolerable overall shortage of 6 percent or less of the use over any period of 25 consecutive years, the results indicate that there would be 5 years of shortage to meet all demands on the Upper Basin out of 95 years of record used in this investigation. However, the annual amounts of computed shortages for those five years would not 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. The computations of shortage in this analysis give conservatively large estimates of annual shortages at Lee Ferry and do not fully reflect all factors,

including physical shortages in the Upper Basin that might contribute or relate to a shortage condition at any given time. The computed shortages in this investigation do not equate to administrative calls to curtail Upper Basin uses.

#### **D. 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. 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 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 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 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**

For use in this investigation, the New Mexico Interstate Stream Commission provided the Bureau of Reclamation with a preliminary 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 23,000 af per year, or about 0.02 maf per year, as compared to the January 2000 depletions schedules.

## **V. Probabilities of Calls to Curtail Upper Basin Uses**

The 1988 Hydrologic Determination included a probabilistic risk analysis of administrative calls to curtail Upper Basin uses that indicated that: (1) such calls would occur rarely at an Upper Basin demand level of 6.1 maf per year, though their effects could have significant impact to the Upper Basin; and (2) the frequency and magnitude of such calls would diminish rapidly below this demand level. The risk analysis was made using the CRSS model. It is not necessary for this investigation to duplicate such a risk analysis.

The computations of shortage in this current investigation give conservatively large estimates of annual shortages at Lee Ferry and do not fully reflect all factors, including physical shortages in the Upper Basin that might contribute or relate to a shortage condition at any given time. While this investigation uses a 2060 reservoir storage sedimentation condition for Lake Powell, a risk analysis should vary the storage development and sedimentation conditions over time. In addition, it will take decades to develop the Upper Basin allocation. Therefore, risk of shortage is reduced within a 2060 planning horizon. Even using the CRSS model, computed shortages would not necessarily equate to administrative calls to curtail Upper Basin uses.

## **VI. Physical Availability of Water from Navajo Reservoir**

The Bureau of Reclamation, using a detailed hydrologic model for the San Juan River Basin, 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 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 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.

## **VII. Conclusions**

It is concluded that based on the analysis performed by Reclamation in consultation with the Upper Colorado River Commission, the Upper Basin yield and New Mexico water allocation needed 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 upon this hydrologic investigation for a 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 through at least 2060 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. If the term of the contract extends beyond 2060, or is perpetual as proposed by the Settlement Agreement, the risk of shortages in deliveries under the contract may increase after 2060 depending upon future storage, hydrologic conditions, and other factors. Section 11(a) of Public Law 87-483 allows for contracting of water from Navajo Reservoir up to a total amount that, in the event of shortage, still results in a reasonable amount of water being available for the diversion requirements of the NIIP and the San Juan-Chama Project.

## **VIII. Disclaimers**

### **A. Interstate Compacts and Federal Laws**

Nothing in this report is intended to interpret the provisions of the Colorado River Compact (45 Stat. 1057), the Upper Colorado River Basin Compact (63 Stat. 31), the Water Treaty of 1944 between the United States of America and the United Mexican States (59 Stat. 1219), the decree entered by the Supreme Court of the United States in *Arizona v. California, et al.* (376 U.S. 340), the Boulder Canyon Project Act (45 Stat.



1057), the Boulder Canyon Project Adjustment Act (54 Stat. 774), the Colorado River Storage Project Act (70 Stat. 105), or the Colorado River Basin Project Act (82 Stat. 885). Implementation of the Navajo-Gallup Water Supply Project and the NIIP is subject to compliance with federal environmental laws including the National Environmental Policy Act and the Endangered Species Act.

**B. Proposed Navajo Reservoir Water 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.

## **List of Appendices**

APPENDIX A - Mass Balance Analysis

APPENDIX B - Reservoir Storage

APPENDIX C - CRSP Evaporation Analysis

APPENDIX D - New Mexico Depletion Schedule

APPENDIX E - Upper Colorado River Commission Resolution

## **APPENDIX A - Mass Balance Analysis**



















## **APPENDIX B - Reservoir Storage**

### Upper Colorado River Basin Reservoir Storage

Upper Colorado River Basin Reservoirs	Complete	Live Capacity	CRSP Live	CRSP Active	CRSP Active +Other	State	Major Basin	Hydromet	Source
1 Big Sandy	X	38,300			38,300	WY	GR	BGRW	Hydromet
2 Blue Mesa	X	829,500	829,500	748,500	748,500	CO	CR	BMDC	Hydromet
3 Boulder Lake	X	22,290			22,290	WY	GR		Jade Henderson Superintendent for Region IV
4 Bottle Hollow	X	11,779			11,779	UT	GR	BHRU	
5 Crawford	X	13,970			13,970	CO	CR	CFRC	Erik Knight from GJ office
6 Crystal	X	17,536	17,536	13,000	13,000	CO	CR	CRRC	Hydromet
7 Currant Creek	X	15,460			15,460	UT	GR	CURU	Hydromet
8 Dillon	X	252,678			252,678	CO	CR		NRCS Website <a href="http://www.wcc.nrcs.usda.gov/wsf/reservoir/rev_rpt.html">http://www.wcc.nrcs.usda.gov/wsf/reservoir/rev_rpt.html</a> NRCS Website
9 Eden	X	13,164			13,164	WY	GR		
10 Electric Lake - Utah Power ar	X	31,500			31,500	UT	GR	EDRU	Connelly Baldwin at Pacific Corp. <a href="mailto:Connelly.Baldwin@pacificcorp.com">Connelly.Baldwin@pacificcorp.com</a> or 801-220-4636
11 Elkhead	X	10,400			10,400	CO	GR		Bill Earley with the City of Craig Public Works Dept. 970-826-2014
12 Flaming Gorge	X	3,749,000	3,749,000	3,515,700	3,515,700	UT	GR	FGRU	Hydromet
13 Fontenelle	X	344,800			344,800	WY	GR	FTRW	Hydromet
14 Fremont Lake	X	30,899			30,899	WY	GR		Jade Henderson Superintendent for Region IV
15 Gould	X	10,390			10,390	CO	CR		George Wear with Colorado Division of Water Resources <a href="mailto:george.wear@dwr.state.co.us">george.wear@dwr.state.co.us</a>
16 Fruitgrowers	X	4,460			4,460	CO	CR	FGRC	Hydromet
17 Granby	X	540,033			540,033	CO	CR		NRCS Website <a href="http://www.wcc.nrcs.usda.gov/wsf/reservoir/rev_rpt.html">http://www.wcc.nrcs.usda.gov/wsf/reservoir/rev_rpt.html</a>
18 Green Mountain	X	153,678			153,678	CO	CR	GMRC	NRCS Website <a href="http://www.wcc.nrcs.usda.gov/wsf/reservoir/rev_rpt.html">http://www.wcc.nrcs.usda.gov/wsf/reservoir/rev_rpt.html</a>
19 Groundhog	X	27,500			27,500	CO	CR		NRCS Website <a href="http://www.wcc.nrcs.usda.gov/wsf/reservoir/rev_rpt.html">http://www.wcc.nrcs.usda.gov/wsf/reservoir/rev_rpt.html</a>
20 Gutley	X	12,035			12,035	CO	CR		George Wear with Colorado Division of Water Resources <a href="mailto:george.wear@dwr.state.co.us">george.wear@dwr.state.co.us</a>
21 Homestake	X	42,882			42,882	CO	CR		NRCS Website <a href="http://www.wcc.nrcs.usda.gov/wsf/reservoir/rev_rpt.html">http://www.wcc.nrcs.usda.gov/wsf/reservoir/rev_rpt.html</a>
22 Jackson Gulch	X	9,951			9,951	CO	CR	JGRC	Hydromet
23 Joe's Valley	X	61,590			61,590	UT	GR	JVRU	Hydromet
24 Johnson	X	15,300			15,300	CO	CR		
25 Kenny Reservoir (Taylor Dra	X	9,400			9,400	CO	CR		<a href="mailto:Erin.Light@state.co.us">Erin.Light@state.co.us</a> Division 6 Water Resources for State of Colorado
26 Lake Powell	X	24,322,000	24,322,000	20,309,919	20,309,919	AZ	CR	GLDA	Hydromet
27 Lake Viva Naughton	X	69,645			69,645	WY	GR		Connelly Baldwin at Pacific Corp. <a href="mailto:Connelly.Baldwin@pacificcorp.com">Connelly.Baldwin@pacificcorp.com</a> or 801-220-4636
28 Lemon	X	39,792			39,792	CO	SJR	LMRC	Hydromet
29 Long Park	X	14,600			14,600	UT	GR		
30 McPhee	X	247,400			247,400	CO	CR	MCRC	Hydromet
31 Meeks Cabin	X	29,870			29,870	WY	GR	MERW	Hydromet
32 Millsite	X	20,000			20,000	UT	GR		
33 Miramonte	X	11,620			11,620	CO	CR		George Wear with Colorado Division of Water Resources <a href="mailto:george.wear@dwr.state.co.us">george.wear@dwr.state.co.us</a>
34 Moon Lake	X	49,500			49,500	UT	GR	MNLU	Hydromet
35 Morgan Lake Dam	X	42,800			42,800	NM	SJR		
36 Morrow Point	X	117,025	117,025	42,120	42,120	CO	CR	MPRC	Hydromet
37 Narraguinnep	X	22,700			22,700	CO	SJR		NRCS Website <a href="http://www.wcc.nrcs.usda.gov/wsf/reservoir/rev_rpt.html">http://www.wcc.nrcs.usda.gov/wsf/reservoir/rev_rpt.html</a>
38 Navajo	X	1,696,000	1,696,000	1,036,100	1,036,100	NM	SJR	NVRN	Hydromet
39 New Fork Lake	X	20,340			20,340	WY	GR		Jade Henderson Superintendent for Region IV
40 Paonia	X	16,703			16,703	CO	CR	PARC	Hydromet
41 Pelican Lake	X	15,850			15,850	UT	GR		
42 Pleasant Valley (Lake Catam	X	7,275			7,275	CO	CR		<a href="mailto:Erin.Light@state.co.us">Erin.Light@state.co.us</a> Division 6 Water Resources for State of Colorado
43 Recapture Creek	X	16,000			16,000	UT	GR		
44 Redfleet	X	25,700			25,700	UT	GR	RFRU	Hydromet
45 Ridgway	X	82,980			82,980	CO	CR	RWRC	Hydromet
46 Rifle Gap	X	12,708			12,708	CO	CR	RGRC	Hydromet
47 Rusdi	X	102,330			102,330	CO	CR	RURC	Great Planes Region Website
48 Scofield	X	65,800			65,800	UT	GR	SFRU	Hydromet
49 Shadow Mountain	X	18,368			18,368	CO	CR	SMRC	Great Planes Region Website
50 Silver Jack	X	13,000			13,000	CO	CR	SJRC	Hydromet
51 Soldier Creek	X	1,105,910			1,105,910	UT	GR	SCRU	Hydromet
52 Stagecoach	X	33,275			33,275	CO	GR		<a href="mailto:Erin.Light@state.co.us">Erin.Light@state.co.us</a> Division 6 Water Resources for State of Colorado
53 Starvation	X	165,320			165,320	UT	GR	SVRU	Hydromet
54 Steteline	X	13,880			13,880	WY	GR	SLRW	Hydromet
55 Steamboat Lake	X	25,400			25,400	CO	GR		<a href="mailto:Erin.Light@state.co.us">Erin.Light@state.co.us</a> Division 6 Water Resources for State of Colorado
56 Steinaker	X	34,455			34,455	UT	GR	STRU	Hydromet
57 Taylor Park	X	106,210			106,210	CO	CR	TPRC	Hydromet
58 Upper Stillwater	X	31,362			31,362	UT	GR	USRU	Hydromet
59 Vallecito	X	125,400			125,400	CO	SJR	VCRC	Hydromet
60 Vega	X	33,311			33,311	CO	CR	VGRU	Erik Knight from GJ office
61 Williams Creek	X	10,084			10,084	CO	CR		George Wear with Colorado Division of Water Resources <a href="mailto:george.wear@dwr.state.co.us">george.wear@dwr.state.co.us</a>
62 Williams Fork	X	96,824			96,824	CO	CR	WFRC	Great Planes Region Website
63 Willow Lake	X	18,816			18,816	WY	GR		Jade Henderson Superintendent for Region IV
64 Willow Creek	X	10,550			10,550	CO	CR	WCRC	Great Planes Region Website
65 Wolford Mountain	X	66,000			66,000	CO	CR		George Wear with Colorado Division of Water Resources <a href="mailto:george.wear@dwr.state.co.us">george.wear@dwr.state.co.us</a>
66 Yamcolo	X	8,000			8,000	CO	GR		<a href="mailto:Erin.Light@state.co.us">Erin.Light@state.co.us</a> Division 6 Water Resources for State of Colorado
<b>Total Capacity</b>		<b>35,233,298</b>	<b>30,731,061</b>	<b>25,665,339</b>	<b>30,167,576</b>				

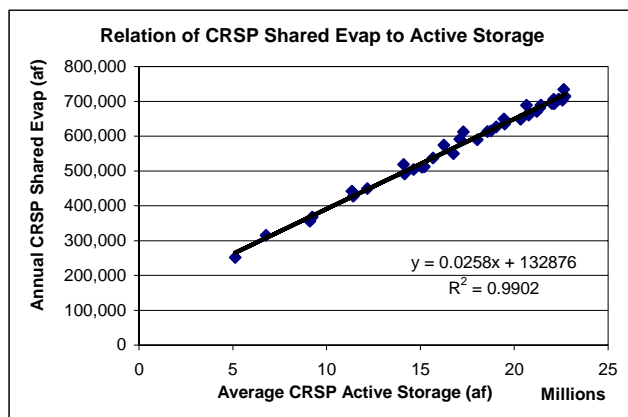
## **APPENDIX C - CRSP Evaporation Analysis**

### Relationships of CRSP Shared Reservoir Evaporation to Total CRSP Storage

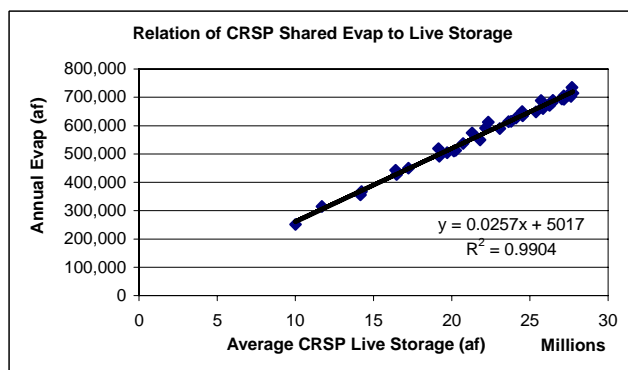
Year	Average CRSP Live Storage (af)	Average CRSP Active Storage (af)	CRSP Shared Evap (af)
1968	10,006,534	5,123,250	251,646
1969	11,701,142	6,764,000	315,083
1970	14,222,401	9,231,741	367,164
1971	16,417,858	11,354,088	442,260
1972	17,229,715	12,165,945	449,544
1973	19,703,066	14,639,296	504,409
1974	22,158,563	17,094,793	590,940
1975	23,634,096	18,570,326	613,612
1976	24,105,743	19,041,973	626,694
1977	20,730,592	15,672,536	537,406
1978	19,158,480	14,106,380	519,065
1979	22,336,514	17,284,414	612,639
1980	25,709,770	20,657,670	688,502
1981	25,392,305	20,340,205	648,525
1982	25,835,729	20,783,629	666,691
1983	27,692,454	22,640,354	734,416
1984	27,759,568	22,707,468	714,727
1985	27,619,938	22,567,838	702,973
1986	27,414,909	22,362,809	706,131
1987	27,153,464	22,101,364	705,172
1988	26,465,639	21,413,539	689,455
1989	24,540,351	19,488,251	634,821
1990	21,806,134	16,754,034	549,702
1991	20,141,572	15,089,472	510,689
1992	19,208,740	14,156,640	491,352
1993	21,297,564	16,245,464	573,884
1994	23,080,796	18,028,696	589,440
1995	24,500,724	19,448,624	649,206
1996	26,252,053	21,199,953	671,123
1997	26,416,641	21,364,541	681,115
1998	27,174,302	22,122,202	693,294
1999	27,050,819	21,998,719	694,007
2000	25,830,330	20,778,230	660,675
2001	23,802,258	18,750,158	614,593
2002	20,256,954	15,204,854	512,030
2003	16,472,537	11,420,437	427,526
2004	14,160,551	9,108,451	355,545

#### Regression Analyses

Active Storage:



Live Storage:



**Notes:**

- (1) Historic calendar year data from Bureau of Reclamation. Average storage values are based on the average of the end-of-year storage amounts for the year indicated and for the previous year. Storage amounts include storage in all CRSP units, including Lake Powell, Flaming Gorge Reservoir, Navajo Reservoir and the Aspinall Unit (Blue Mesa, Morrow Point and Crystal reservoirs).
- (2) CRSP shared evaporation includes lake evaporation for Lake Powell, Flaming Gorge Reservoir and the Aspinall Unit reservoirs, and is shared between the Upper Division States in proportions to their Upper Colorado River Basin Compact Article III(a) apportionments. CRSP shared evaporation is approximately 10,000 af at zero live CRSP storage (5,000 af based on the regression analyses) and approximately 130,000 af if storage in all CRSP reservoirs were at the top of the inactive pools (133,000 af based on the regression analysis). Lake evaporation for Navajo Reservoir is not included in CRSP shared evaporation.
- (3) Data for the period 1968-2004 were used in the regression analyses. Data prior to 1968 do not reflect a normal distribution of storage between CRSP unit reservoirs under future operational conditions (for example, Navajo Reservoir storage remained below the top of the inactive pool required for operation of the Navajo Indian Irrigation Project diversion from 1962 when it began storing water until 1968, and Morrow Point Reservoir began operation in 1968). For the period 1968-1977, the historic average end-of-year CRSP storage and annual CRSP evaporation amount were increased to reflect the average storage of 15,670 af and average evaporation amount of 340 af occurring at Crystal Reservoir after its initial filling in 1978.





**APPENDIX D - New Mexico Depletion Schedule**

**STATE OF NEW MEXICO SCHEDULE OF ANTICIPATED UPPER BASIN DEPLETIONS**  
(Units: 1000 acre-feet per year)

	<u>2000</u>	<u>2010</u>	<u>2020</u>	<u>2030</u>	<u>2040</u>	<u>2050</u>	<u>2060</u>
<b>IRRIGATION USES (1)</b>							
Navajo Nation Irrigation:							
Navajo Indian Irrigation Project	150.0	215.0	250.0	270.0	270.0	270.0	270.0
Fruitland-Cambridge Irrigation Project	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Hogback-Cudei Irrigation Project	15.5	15.5	21.3	21.3	21.3	21.3	21.3
Chaco River drainage irrigation	3.1	3.1	3.1	3.1	3.1	3.1	3.1
Crystal area irrigation	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Navajo Nation Irrigation Subtotal	176.9	241.9	282.7	302.7	302.7	302.7	302.7
Non-Navajo Irrigation:							
Above Navajo Dam (including Jicarilla)	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Upper San Juan (excluding Hammond)	10.3	10.3	10.3	10.3	10.3	10.3	10.3
Hammond Irrigation Project	12.1	12.1	12.1	12.1	12.1	12.1	12.1
Animas River ditches	40.7	40.7	40.7	40.7	40.7	40.7	40.7
La Plata River ditches	5.9	5.9	5.9	5.9	5.9	5.9	5.9
Farmers Mutual Ditch	11.2	11.2	11.2	11.2	11.2	11.2	11.2
Jewett Valley Ditch	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Chaco River drainage irrigation	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Non-Navajo Irrigation Subtotal	86.5	86.5	86.5	86.5	86.5	86.5	86.5
Irrigation Total	263.4	328.4	369.2	389.2	389.2	389.2	389.2
<b>STOCKPOND EVAPORATION AND STOCK USE</b>							
	4.0	4.0	4.0	4.0	4.0	4.0	4.0
<b>MUNICIPAL AND DOMESTIC USES (1)</b>							
Current Municipal and Industrial Uses	9.7	9.7	9.7	9.7	9.7	9.7	9.7
Animas-La Plata Project:							
San Juan Water Commission	1.0	5.0	10.4	10.4	10.4	10.4	10.4
Navajo Nation	0.0	1.0	2.0	2.3	2.3	2.3	2.3
La Plata Conservancy District	0.0	0.0	0.8	0.8	0.8	0.8	0.8
Ridges Basin Reservoir Evaporation - NM share	0.0	0.0	0.1	0.1	0.1	0.1	0.1
Animas-La Plata Project Subtotal	1.0	6.0	13.3	13.6	13.6	13.6	13.6
Navajo-Gallup Water Supply Project: (2)							
Navajo Nation	0.0	0.0	7.9	10.2	12.5	12.5	12.5
Jicarilla Apache Nation	0.0	0.0	0.8	1.0	1.2	1.2	1.2
Navajo-Gallup Project Subtotal (within Basin)	0.0	0.0	8.7	11.2	13.7	13.7	13.7
Navajo Nation Municipal Use, Future (exc. NGWSP)	0.0	0.0	1.0	1.0	2.0	2.0	2.0
Jicarilla Apache Nation Municipal Use (exc. NGWSP)	0.0	0.0	0.0	0.4	0.6	0.6	0.6
Scattered Rural Domestic (including Jicarilla)	1.0	1.0	1.0	1.1	1.1	1.2	1.2
Municipal and Domestic Total	11.7	16.7	33.7	37.0	40.7	40.8	40.8
<b>POWER AND INDUSTRIAL USES</b>							
PNM - Navajo Reservoir contract (3)	16.2	16.2	16.2	16.2	16.2	16.2	16.2
BHP Billiton	37.0	37.0	38.0	39.0	39.0	39.0	39.0
Bloomfield Industrial	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Navajo Nation - Shiprock	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Navajo-Gallup Water Supply Project - NAPI (2)	0.0	0.0	0.7	0.7	0.7	0.7	0.7
Small Navajo Reservoir Contracts	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Power and Industrial Total	56.1	56.1	57.8	58.8	58.8	58.8	58.8
<b>EXPORTS</b>							
San Juan-Chama Project	105.2	105.2	105.2	105.2	105.2	105.2	105.2
Navajo-Gallup Water Supply Project: (2)							
Navajo Nation in New Mexico	0.0	0.0	4.0	5.8	7.6	7.6	7.6
City of Gallup	0.0	0.0	4.7	6.1	7.5	7.5	7.5
Navajo-Gallup Project Subtotal (Export)	0.0	0.0	8.7	11.9	15.1	15.1	15.1
Export Total	105.2	105.2	113.9	117.1	120.3	120.3	120.3
<b>RESERVOIR EVAPORATION</b>							
Navajo Reservoir Evaporation	28.3	28.0	27.7	27.7	27.7	27.7	27.7
Small Reservoir Evaporation	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Reservoir Evaporation Total	29.5	29.2	28.9	28.9	28.9	28.9	28.9
<b>TOTAL DEPLETIONS (4)</b>							
	469.9	539.6	607.5	635.0	641.9	642.0	642.0
State Share of Upper Basin Yield (5)	642.4	642.4	642.4	642.4	642.4	642.4	642.4
Remaining Available (5,6)	172.5	102.8	34.9	7.4	0.5	0.4	0.4
Percent of State Share Remaining	26.9%	16.0%	5.4%	1.2%	0.1%	0.1%	0.1%

**NOTES:**

(1) Does not reflect post-1965 transfers from irrigation to municipal and industrial uses.

(2) Proposed Navajo-Gallup Water Supply Project depletions in New Mexico total 29,500 acre-feet per year. Exports to Gallup are anticipated to be supplied through a subcontract with the Jicarilla Apache Nation. Exports for Navajo Nation uses in Arizona are

(3) Supplied through a subcontract with the Jicarilla Apache Nation.

(4) This is a schedule of anticipated depletions for planning purposes only. It is not a tabulation or determination of water rights or actual uses. Total depletions exclude New Mexico's share of reservoir evaporation from the major reservoirs constructed

(5) This depletion schedule does not attempt to interpret the Colorado River Compact, the Upper Colorado River Basin Compact, or any other element of the "Law of the River." This schedule should not be construed as an acceptance of any assumption that lim

(6) Reserved.

**APPENDIX E - Upper Colorado River Commission Resolution**

RESOLUTION OF THE  
UPPER COLORADO RIVER COMMISSION

Regarding the Availability of Water from Navajo Reservoir 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 a 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, pursuant to Public Law 87-483, and in furtherance of the Jicarilla Apache Tribe Water Rights Settlement Act of 1992 and the Navajo Reservoir water supply contract approved by said Act, the Secretary of the Interior 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 authorization of the proposed Navajo-Gallup Water Supply Project, and the legislative approval of 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 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 May 2006, that evaluates the availability of water from the Navajo Reservoir supply through 2060 and shows: (1) at least 5.76 million acre-feet of water is reasonably 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, under the allocations made to New Mexico in Articles III and XIV of the Upper Colorado River Basin Compact; and

WHEREAS, the Settlement Agreement would provide 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 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

WHEREAS, it is the position of the Upper Colorado River Commission and the Upper Division States that the obligation of the Upper Basin under Article III(c) of the Colorado River Compact to deliver water toward the Mexican Treaty obligation does not require the delivery at Lee Ferry of 0.75 million acre-feet of water annually; 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, 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: (1) approve the Settlement Agreement; (2) authorize the proposed Navajo-Gallup Water Supply Project; and (3) 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.

BE IT FURTHER RESOLVED, that while the Upper Colorado River Commission does not endorse all of the study assumptions used by the Bureau of Reclamation in its May 2006 draft hydrologic determination, including an assumption of a 6 percent allowable overall shortage, and specifically disagrees with the modeling assumption of a minimum Upper Basin delivery of 8.25 million acre-feet annually at Lee Ferry, the Commission supports a determination by the Secretary of the Interior that at least 5.76 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.

BE IT FURTHER RESOLVED, that the Upper Colorado River Commission supports 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, under the allocations made to New Mexico in Articles III and XIV of the Upper Colorado River Basin Compact.

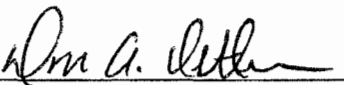
BE IT FURTHER RESOLVED, that nothing in this Resolution, or resulting from the adoption of this Resolution, shall limit the right or ability of any Upper Basin State to develop the full apportionment made to it under the Colorado River Compact and the Upper Colorado River Basin Compact.

BE IT FURTHER RESOLVED, 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 its regular meeting held in Jackson Hole, Wyoming, on June 5, 2006.

WITNESS my hand this 9th day of June 2006.

  
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DON A. OSTLER  
Executive Director and Secretary