
Appendix B

Hydrologic Modeling of Submitted Proposals

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Appendix B. Hydrologic Modeling of Submitted Proposals

B.1 Introduction

During the scoping period and during preparation of the draft Supplemental Environmental Impact Statement (SEIS), Reclamation received many suggestions for operations or operational concepts. The submissions that were eliminated from detailed analysis are described in **Chapter 2**, Section 7 of this draft SEIS. The focus of this appendix is on proposals that were within the scope and which had sufficient detail or relevance for additional discussion and analysis. The proposals addressed in this appendix are:

- The **6-States Proposal**: reflects the “Consensus-Based Modeling Alternative” submitted by the States of Arizona, Colorado, Nevada, New Mexico, Utah, and Wyoming
- The **CA Proposal**: reflects the “California SEIS Modeling Framework Alternative” submitted by the Colorado River Board of California
- The **Utton Center Proposal**: reflects the suggested actions submitted by the University of New Mexico School of Law’s Utton Center
- The **4-Lower Basin (LB) Tribes Proposal**: reflects the principles and modeling assumptions submitted by the Chemehuevi Indian Tribe, the Colorado River Indian Tribes, the Quechan Tribe, and the Cocopah Tribe

Formal submission letters from these entities are included as **Attachment B-2** to this appendix.

This appendix compares the proposals to the three SEIS alternatives described in **Chapter 2** of this study report: the No Action Alternative, Action Alternative 1, and Action Alternative 2. This analysis does not cover the breadth of resources or geographic locations included in **Chapter 3** of this report but focuses on higher level comparisons with respect to hydrologic resources and water deliveries, which are the primary categories from which relative effects on other resources can be inferred. For the sake of this analysis, some refinements were made to technical assumptions. These refinements are described in **Section B.3** of this appendix.

B.2 Review of Proposals Included in this Appendix

The proposals selected for this comparative analysis contained sufficient detail regarding modeling assumptions needed to perform additional modeling and analysis. This section provides a comparative review of the modeling assumptions provided in each of those proposals. For ease of comparison and analysis, the modeling assumptions reflected in the four proposals are described

according to four components: Upper Basin Demand Management, Colorado River Storage Project Act of 1956 (CRSPA) Initial Unit Contribution/Drought Response Operations Agreement (DROA; that is potential DROA contributions), Glen Canyon Dam Operations, and Lower Division States Shortages. In the table below, these components are described and compared across the four proposals. Following the table is additional discussion of concepts included in the proposals but not represented in the table.

As reflected in **Table B-1**, there are both similarities and differences across the modeling assumptions included in the submitted proposals. With respect to protection elevations in Lake Powell and Lake Mead, the importance of such a concept is noted in all (with a focus on Lake Mead in the 4-LB Tribes Proposal) with elevations suggested that range between 3,500 feet – 3,515 feet in Lake Powell and 975 feet – 1,000 feet at Lake Mead in the 6-States, CA, and Utton Center Proposals.

In terms of Glen Canyon Dam operations, the 6-States, CA, and Utton Center Proposals provide modeling assumptions to achieve the protection of Lake Powell elevations that consist of adjusting existing operating tiers (size of tier and specified releases) and minimum releases as necessary to protect the Lake Powell protection elevation. A key difference is that both the 6-States and CA Proposals move away from balancing releases while the Utton Center Proposal suggests solely balancing releases. While enough specific details are not provided to develop modeling assumptions, the 4-LB Tribes Proposal suggests that Glen Canyon Dam releases consider a minimum flow needed to ensure a “living river” below Lake Powell.

In the Lower Basin, the 6-States, CA, and Utton Center Proposals provide modeling assumptions for additional shortages to the Lower Division States but differ in their total volumes (see **Figure B-1**) and distribution across Lower Division States water users. While the 6-States and Utton Center Proposals include modeling assumptions that deviate from the strict application of the priority system in their distributions of Lower Division States Shortages, the CA and 4-Tribes Proposals reflect the priority system unless voluntary and compensated arrangements are otherwise made.

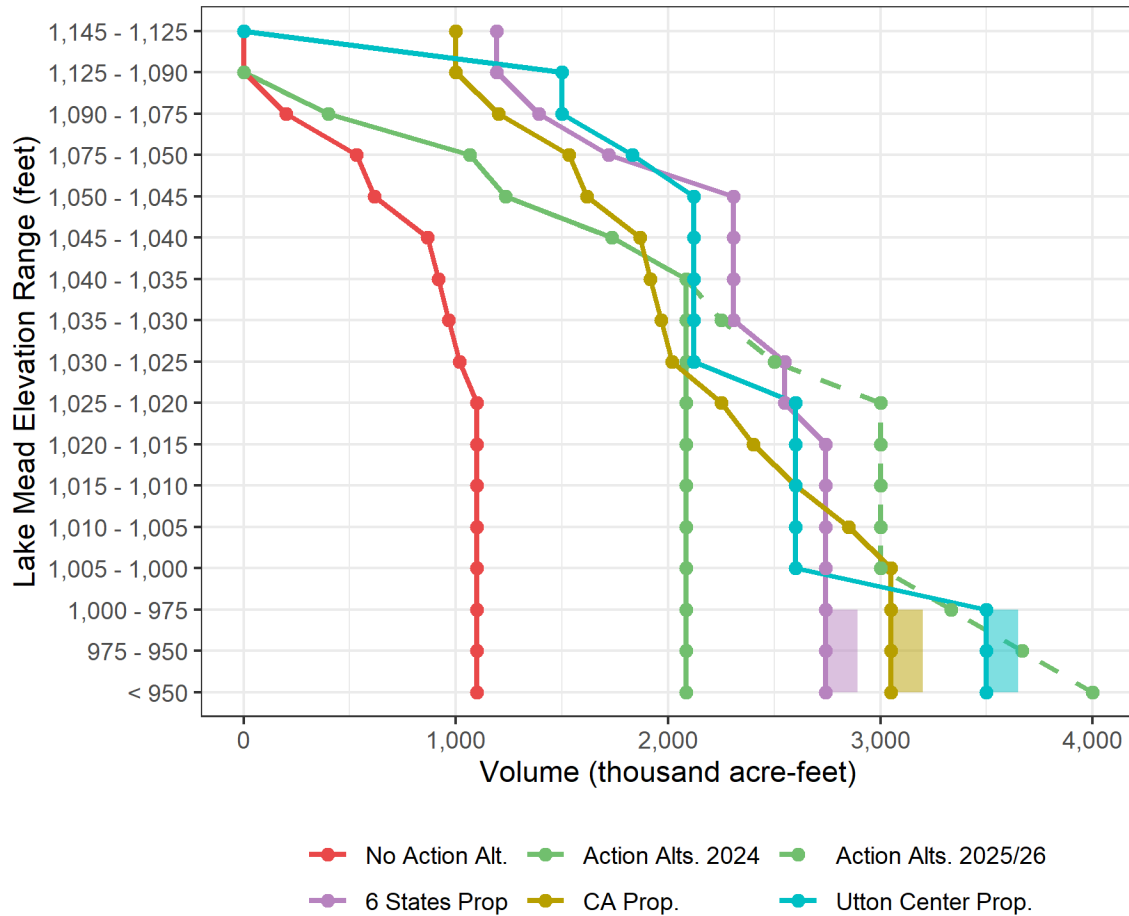
Figure B-1 compares Lower Division States’ Shortages across the proposals and with the SEIS action alternatives. The 4-LB Tribes Proposal is not reflected in this figure as it did not contain enough detailed information on volumes of Lower Division States’ Shortages.

The 6-States, CA, and Utton Center Proposals all propose additional shortages of over 1 million acre feet (maf) when Lake Mead is above 1,090 feet. For 2024, the Utton Center proposes the highest maximum specified shortages of 3.5 maf, but in 2025 and 2026 the SEIS action alternatives include modeled shortages of 4.0 maf. All three of the proposals include the “absolute protection” of Lake Mead elevations, meaning additional reductions would need to be implemented during the calendar year as necessary to protect Lake Mead elevations.

Table B-1
Summary of Modeling Assumptions Provided in Submitted Proposals

Component	6-States Proposal	CA Proposal	CA Proposal	4-LB Tribes Proposal
Upper Basin Demand Management	None provided	Up to 500,000 af annually when Lake Powell is below 3,575 ft	Between 100,000 af – 500,000 af annually	None provided
Initial Unit Contribution/DROA Modeling Assumption	DROA releases up to 500,000 af annually to help protect Lake Powell elevation 3,500 feet	DROA releases up to 500,000 af annually to help protect Lake Powell elevation 3,500 feet	None provided	Determine if DROA releases could provide Lake Powell protection volumes or minimum flows below Lake Powell to ensure a living river
Glen Canyon Dam Operations	<ul style="list-style-type: none"> Reduce releases as necessary to protect 3,500 feet Below 3,575 feet set release to 7.48 maf or 7.0 maf; eliminate balancing releases 	<ul style="list-style-type: none"> Reduce releases as necessary to protect 3,500 feet Below 3,575 feet releases range from 7.0 maf to 8.23 maf 	<ul style="list-style-type: none"> Reduce releases as necessary to protect 3,515 feet Below 3,575 feet balancing releases while protecting 3,515 feet and 975 feet 	None provided
Lower Division States' Shortages	<ul style="list-style-type: none"> Start additional reductions at Lake Mead elevation 1,145 feet with a maximum specified reduction of 2.734 maf when Lake Mead reaches 1,020 feet Implement additional reductions necessary to protect 1,000 feet (unspecified reductions) Three types of specified reductions proposed: <ul style="list-style-type: none"> - Additional reductions and DCP contributions between 1,050-1,000 feet to maintain current IG and DCP distribution - "Infrastructure Protection Volume" reductions distributed to all Lower Basin water users proportional to historical use and dependent on distance downstream from Lake Mead - Additional reductions proportional to state apportionment < 1,030 feet 	<ul style="list-style-type: none"> Start additional reductions at Lake Mead elevation 1,145 feet with a maximum specified reduction of 3.050 maf when Lake Mead reaches 1,005 feet Implement additional reductions necessary to protect 1,000 feet with releases available to protect human health and safety as determined by each Lower Basin state from stored ICS (unspecified reductions) Two types of specified reductions proposed: <ul style="list-style-type: none"> - Additional voluntary or mandatory reductions with proposed distribution of 56 percent to AZ, 40 percent to CA and 4 percent to NV - Additional reductions according to the priority system or voluntary arrangements < 1,025 feet 	<ul style="list-style-type: none"> Start additional reductions at Lake Mead elevation 1,125 feet with a maximum specified reduction of 3.5 maf when Lake Mead reaches 1,000 feet Implement additional reductions necessary to protect 975 feet (unspecified reductions) Specified reductions proportional to state apportionment 	<ul style="list-style-type: none"> Reductions to Tribal water allocations must be voluntary and compensated Convert system conservation to Reclamation-managed ICS account and maintain in Lake Mead as protection volume to protect critical infrastructure and/or volume to provide minimum flows to ensure a living river Maintain sufficient flow in Colorado River below Lee Ferry and Hoover Dam to ensure a living river through all reaches Analyze impacts to 5 mainstream Lower Basin Tribes as a unitary amount without regard to state line

Figure B-1
Modeled Lower Division States' Shortage Volume by Lake Mead Elevation –
Comparison of Action Alternatives and Submitted Proposals*



*Shaded regions indicate the 6-States, CA, and Utton Center Proposals include the concept of additional reductions during the calendar year as necessary to protect Lake Mead elevations.

The following sections provide a quantitative comparison of the proposals in terms of system performance. The LB 4-Tribes Proposal is not carried forward to this quantitative comparison as there is insufficient quantitative information to model the proposal. However, the LB 4-Tribes Proposal offers differing approaches and views for the main components reflected in the other three proposals and was, therefore, included to this point.

As described in detail in **Section B.3**, modifications were made to some of the specific modeling assumptions provided in the three modeled proposals. This was done to facilitate a more direct comparison of the system performance under each of the proposals.

Other proposals were received that included modeling assumptions but were determined to be not sufficiently different from the three proposals modeled in this appendix. The City of Peoria, Colorado School of Mines, Irrigation & Electrical Districts' Association of Arizona, John Rickenbach, Blue Ribbon Coalition, Colorado River Authority of Utah, and Pacific Institute all

provided scoping comments that included additional modeling assumption details. Reclamation reviewed and considered these assumptions as the submitted proposals were refined for comparison with the SEIS alternatives. The modeling assumptions included in these comments, which were within the scope of the SEIS, were found to be represented through the three explicitly modified proposals included in this appendix or the action alternatives. For example, the identified comments included additional shortages levels for the Lower Basin that are of similar volumes to those included in the proposals presented in this appendix, and their impact on the system performance can be inferred from those proposal comparisons.

B.3 Modeling Approach

This section summarizes the assumptions that were used in the hydrologic modeling and metrics used to analyze the submitted proposals. Future Colorado River system conditions during the analysis period for all alternatives and submitted proposals were simulated using the September 2022 Colorado River Mid-term Modeling System (CRMMS). For the purpose of this assessment, certain assumptions were modified from the submitted proposals. This was done to make certain assumptions consistent for all proposals analyzed, offering a more direct comparison of key components of each policy. Modeling assumptions included in the submissions are contained in **Table B-1**; details on the modeling assumptions used for the comparative analysis are found in **Sections B.3.1** and **B.3.2**. **Section B.3.3** summarizes the metrics used to compare the submitted proposals to the No Action Alternative and action alternatives.

B.3.1 Modeling Assumptions

The following section summarizes the assumptions for the submitted proposals analyzed in this appendix. The No Action and action alternatives are described in **Chapter 2** with detailed modeling assumptions in **Section 3.3.4** and **Appendix C**.

Initial conditions, hydrology inputs, and other modeling assumptions not described in the following sections are consistent with assumptions included in the No Action Alternative and action alternatives (see **Appendix C**).

Assumptions Common to All Submitted Proposals

The following modeling assumptions are used to model the 6-States, CA, and Utton Center Proposals:

- All simulations were performed with a start date of September 2022 and an end date of December 2026.
- Only operational changes for Lake Powell and Lake Mead as per Section 2.D, Section 6.C, and Section 6.D of the 2007 Interim Guidelines were considered; otherwise, operations for Lake Powell and Lake Mead are consistent with the No Action Alternative.

- Physical elevations are used for tier determinations and balancing releases for Water Years (WY) 2024 through 2026 with no assumptions for the repayment of the 480,000 acre feet (af) reduced delivery from Lake Powell in WY 2022¹.
- The DROA releases from Flaming Gorge—projected as 500,000 af for May 2022 through April 2023²—are included in tier determination and balancing releases as are the 2021 DROA releases (which totaled 161,000 af from Flaming Gorge and Aspinall), consistent with the official September 2022 CRMMS simulation.
- If the pool elevation at Lake Powell drops below 3,490 feet, it is assumed that only three of the four river outlet works would be available for use at any given time because of the need for periodic inspections and any associated maintenance activities. Reclamation believes this is a conservative and prudent estimation given the historical and future operations and maintenance requirements for the river outlet works.
- Releases from Lake Powell will be reduced as needed to maintain elevation 3,500 feet starting in WY 2024³.
- Hourly, daily, and monthly releases from Lake Powell will be consistent with the LTEMP so long as sufficient water is available for annual releases. Minimum flows analyzed in the LTEMP were 5,000 cubic feet per second (cfs) at night and 8,000 cfs during the day. If these minimum flows are not possible due to the projected monthly release volume, the model could simulate flows lower than the minimum flows analyzed in the LTEMP.
- Several submitted proposals included some suggestions for Upper Basin demand management. No Upper Basin demand management is modeled in CRMMS as a program has not been established pursuant to the Demand Management Storage Agreement and is outside the scope of the SEIS.
- Intentionally Created Surplus (ICS) and Drought Contingency Plan (DCP) contribution assumptions are consistent with the official September 2022 CRMMS simulation.
- For Lower Division States and Mexico use in the first year of the model run, water depletion schedules use water orders that reflect 2007 Interim Guidelines shortage conditions, DCP contributions, reductions under low elevation reservoir conditions and Binational Water Scarcity Contingency Plan (BWSCP) contributions per Minute 323, and executed system conservation agreements. For the remaining years in the model run, water depletion schedules reflect “normal” schedules and represent near-term historical trends in water use. All additional reductions (2007 Interim Guidelines shortages, DCP contributions, reductions under low elevation reservoir conditions and BWSCP contributions per Minute 323, and/or additional shortages in the action alternatives) reduce these “baseline/normal” consumptive use schedules.

¹ The reduction of releases from Lake Powell from 7.48 maf to 7.00 maf in WY 2022 resulted in a reduced release volume of 0.48 maf that normally would have been released from Glen Canyon Dam to Lake Mead as part of the 7.48 maf annual release volume, consistent with routine operations under the 2007 Interim Guidelines. The reduction of releases from Glen Canyon Dam in WY 2022 (resulting in increased storage in Lake Powell) did not affect the operating determinations for 2023, and it was accounted for “as if” this volume of water had been delivered to Lake Mead.

² The projected 500 kaf DROA release was reduced in March 2023 but is not reflected in the modeling assumptions. It may be updated for the final SEIS.

³ The Utton Center Proposal included an assumption to protect elevation 3,515 feet at Lake Powell; this was modified to 3,500 feet when modeling the proposal to facilitate a more direct comparison with the other submitted proposals.

- For modeling purposes, all additional shortages in the submitted proposals are treated as mandatory, regardless of proposed concepts for generating the reduction in use.
- For the purpose of this SEIS, shortages implemented through operational decisions are referred to as “shortages,” whereas shortages incurred as a result of unplanned or unforeseen hydrologic events and when water delivery requirements cannot be met are referred to as system shortages at dead pool, or “system shortages”⁴. Combined, shortages and system shortages may be referred to as “total shortages.”
- Releases from Lake Mead will be reduced as needed to maintain elevation 1,000 feet starting in Calendar Year 2024⁵. These shortages are not attributed to any one state or entity and are referred to as “unassigned shortage”⁶.
- The analysis for each submitted proposal includes modeled water delivery reductions to Mexico under low elevation reservoir conditions and Mexico’s BWSCP savings in accordance with Minute 323. No additional reductions for Mexico are modeled even if specified in the submitted proposals.

Modeling Assumptions for the 6-States Proposal

- The minimum elevation of the Mid-Elevation Release Tier and maximum elevation of the Lower Elevation Balancing Tier in Lake Powell are changed to elevation 3,550 feet. If the elevation was greater than or equal to 3,550 feet, Lake Powell operates in the Mid-Elevation Release tier; if the elevation was less than 3,550 feet, Lake Powell operates in the Lower Elevation Balancing Tier.
- Balancing releases are eliminated in the Lower Elevation Balancing Tier. The Mid-Elevation Release and Lower Elevation Balancing Tiers have set annual releases of 7.48 maf and 7.00 maf, respectively.
- The 6 State Proposal includes a modeling assumption regarding contributions from the Upper Initial Units of up to 500,000 af per DROA year (May 1 – April 30), which will conform to the DROA and its implementing documents and will be made only to help protect Lake Powell elevation 3,500 feet. The analysis refers to these as “potential DROA contributions.” These potential DROA contributions of zero to 500,000 af are modeled to occur if the projected Lake Powell end-of-water year (EOWY) pool elevation is less than 3,525 feet for 2024 through 2026 and are modeled consistent with the assumptions included in Action Alternative 2 (see **Appendix C**).
- An additional modeling run includes potential DROA contributions from zero to 100,000 af per DROA year to assess the sensitivity of results to the magnitude of the potential DROA contributions (see **Attachment B-1**).

⁴ System shortages are reported as a total for the entire Lower Basin because there are no explicit assumptions made in the CRMMS associated with how these shortages would be distributed in the Lower Basin. This results in users being shorted “hydrologically,” that is, upstream users access water before downstream users, but it does not reflect potential implementation of such system shortages.

⁵ The Utton Center Proposal included an assumption to protect elevation 975 feet at Lake Mead; this was modified to 1,000 feet when modeling the proposal to facilitate a more direct comparison with the other submitted proposals.

⁶ In the CRMMS, unassigned shortages are modeled the same as system shortages; that is, there are no explicit assumptions in the CRMMS associated with how these shortages would be distributed in the Lower Basin.

- Shortages from the 2007 ROD and 2019 DCP contributions that occur below elevation 1,025 feet at Lake Mead will occur if Lake Mead is below elevation 1,050 feet. (See **Section B.3.2.**)
- Shortage reductions in excess of the 2007 ROD and 2019 DCP are distributed to each Lower Division State using the specified state volumes in the proposal. For CRMMS modeling, the additional state shortages are distributed within each state using the same percentage across all modeled water users within each state based on a water user's historical calendar year 2021 consumptive use. Additional details on Lower Division State total shortages and DCP contributions, including the distribution among the Lower Division States, are provided in **Section B.3.2.**

Modeling Assumptions for the CA Proposal

- The minimum elevation of the Mid-Elevation Release Tier and maximum elevation of the Lower Elevation Balancing Tier are changed to elevation 3,550 feet. If the elevation was greater than or equal to 3,550 feet, Lake Powell operates in the Mid-Elevation Release tier (otherwise consistent with the Mid-Elevation Release tier constraints in the No Action Alternative); if the elevation was less than 3,550 feet, Lake Powell operates in the Lower Elevation Balancing Tier.
- Balancing releases in the Lower Elevation Balancing Tier are constrained to balance between 7.00 maf and 7.48 maf.
- The CA Proposal includes a modeling assumption regarding potential DROA contributions of up to 500,000 af per DROA year (May 1 – April 30), which will conform to the DROA and its implementing documents and will be made only to help protect Lake Powell elevation 3,500 feet. These potential DROA contributions of zero to 500,000 af are modeled to occur if the projected Lake Powell EOWY pool elevation is less than 3,525 feet for 2024 through 2026, and are modeled consistent with the assumptions included in Action Alternative 2 (see **Appendix C**).
- For modeling purposes, all shortage reductions in excess of the 2007 ROD and 2019 DCP are assumed to be distributed to Lower Division States using the following percentages – 56% to Arizona, 4% to Nevada, and 40% to California. For CRMMS modeling, the state-specific shortages are distributed at the same percentage across all modeled water users within each state based on a water user's historical calendar year 2021 consumptive use. Additional details on Lower Division State total shortages and DCP contributions, including the distribution among the Lower Division States, are provided in **Section B.3.2.**
- Metropolitan Water District (MWD) is assumed to be ICS neutral with no ICS creation or delivery for calendar years 2024 through 2026. ICS assumptions for other entities are consistent with the official September 2022 CRMMS simulation.

Modeling Assumptions for the Utton Center Proposal

- The Mid-Elevation Release Tier and Lower Elevation Balancing Tier are replaced with a new tier that balances storage above elevation 3,500 feet at Lake Powell with storage above elevation 1,000 feet at Lake Mead. There is no specified minimum release from Lake Powell.

- The Utton Center Proposal did not suggest any potential DROA contributions; however, it did include a range of Upper Basin demand management with a similar magnitude as the modeled potential DROA contributions in the other proposals. To make the comparison among submitted proposals easier, potential DROA contributions from zero to 500,000 af per DROA year (May 1 – April 30), which will conform to the DROA and its implementing documents and will be made only to help protect Lake Powell elevation 3,500 feet, were modeled. These potential DROA contributions of zero to 500,000 af are modeled to occur if the projected Lake Powell EOWY pool elevation is less than 3,525 feet for 2024 through 2026 and are modeled consistent with the assumptions included in Action Alternative 2 (see **Appendix C**).
- Shortage reductions in excess of the 2007 ROD and 2019 DCP are distributed to each Lower Division State using the specified state volumes in the proposal. For CRMMS modeling, the state-specific shortages are distributed at the same percentage across all modeled water users within each state based on a water user’s historical calendar year 2021 consumptive use. Additional details on Lower Division State total shortages and DCP contributions, including the distribution among the Lower Division States, are provided in **Section B.3.2**.

B.3.2 Shortage Sharing and Water Delivery Reduction Assumptions

A summary of modeling assumptions for the No Action Alternative, Action Alternatives 1, and Action Alternative 2, with respect to the reduction of deliveries to the Lower Division States, including the distribution of shortages by state for 2024–2026, is provided in **Tables 2-4, 2-7, 3-1, and 3-2**. The distribution of shortages to individual users based on CRMMS modeling assumptions can be found in **Appendix C**.

All three proposals provided shortage volumes in excess of the 2007 ROD and 2019 DCP. **Table B-2** summarizes the total Lower Division States’ shortage volumes for the No Action Alternative, Action Alternatives 1 and 2, and the submitted proposals. **Table B-3** shows the shortage and DCP contributions for all Lower Division States for each Lake Mead elevation level for the No Action Alternative and the submitted proposals. This table does not include the state breakout for the action alternatives, which can be found in **Tables 2-4, 2-7, 3-1, and 3-2**. **Table B-2** and **Table B-3** represent the total shortage and DCP contributions, inclusive of the 2007 ROD and 2019 DCP and proposed additional shortages. For modeling purposes, state-level shortages in **Table B-3** were further disaggregated within each state as described in **Section B.3.1**.

Table B-2
Modeled Lower Division States' Shortages and DCP Contributions, Action Alternatives
and Modeled Proposals*
(All volumes in 1,000 af)

Lake Mead Elevation (ft)	No Action Alternative	SEIS Action Alternatives 2024	SEIS Action Alternatives 2025-2026	6-States Proposal**	CA Proposal	Utton Center Proposal
>1,145	0	0	0	0	0	0
1,145-1,125	0	0	0	1,191	1,000	0
1,125-1,090	0	0	0	1,191	1,000	1,500
1,090-1,075	200	400	400	1,391	1,200	1,500
1,075-1,050	533	1,066	1,066	1,720	1,533	1,830
1,050-1,045	617	1,234	1,234	2,309	1,617	2,120
1,045-1,040	867	1,934	1,934	2,309	1,867	2,120
1040-1035	917	2,083	2,083	2,309	1,917	2,120
1035-1030	967	2,083	2,098	2,309	1,967	2,120
1030-1025	1,017	2,083	2,197	2,551	2,017	2,600
1025-1020	1,100	2,083	3,000	2,551	2,250	2,600
1020-1015	1,100	2,083	3,000	2,743	2,400	2,600
1015-1010	1,100	2,083	3,000	2,743	2,600	2,600
1010-1005	1,100	2,083	3,000	2,743	2,850	2,600
1005-1000	1,100	2,083	3,000	2,743	3,050	2,600
1000-975	1,100	2,083	3,333	2,743	3,050	3,500
975-950	1,100	2,083	3,667	2,743	3,050	3,500
<950	1,100	2,083	4,000	2,743	3,050	3,500

* This table only shows combined Lower Division State shortage volumes and DCP contributions. In addition to the volumes shown in this table, the analysis for each alternative and submitted proposal includes water delivery reductions to Mexico under low-elevation reservoir conditions and Mexico's savings that contribute to the Binational Water Scarcity Contingency Plan, in accordance with Minute 323 to the 1944 Water Treaty.

**Includes the Infrastructure Protection Volume (IPV) and additional reductions specified for the Lower Division States in the submitted proposal.

Table B-3
Modeled Shortages and Contributions by State, Modeled Proposals*
 (All volumes in 1,000 af)

Lake Mead Elevation	2007 ROD + 2019 DCP			6-States Proposal**			CA Proposal***			Utton Center Proposal		
	AZ	NV	CA	AZ	NV	CA	AZ	NV	CA	AZ	NV	CA
>1,145	0	0	0	0	0	0	0	0	0	0	0	0
1,145-1,125	0	0	0	408	17	766	560	40	400	0	0	0
1,125-1,090	0	0	0	408	17	766	560	40	400	560	60	880
1,090-1,075	192	8	0	600	25	766	752	48	400	560	60	880
1,075-1,050	512	21	0	899	39	782	1,072	61	400	880	70	880
1,050-1,045	592	25	200	1,094	49	1,166	1,152	65	400	960	80	1,080
1,045-1,040	640	27	250	1,094	49	1,166	1,200	67	600	960	80	1,080
1,040-1,035	640	27	300	1,094	49	1,166	1,200	67	650	960	80	1,080
1,035-1,030	640	27	350	1,094	49	1,166	1,200	67	700	960	80	1,080
1,030-1,025	640	27	350	1,182	59	1,309	1,200	67	750	960	80	1,080
1,025-1,020	720	30	350	1,182	59	1,309	1,364	76	810	1,280	90	1,230
1,020-1,015	720	30	350	1,252	67	1,424	1,448	82	870	1,280	90	1,230
1,015-1,010	720	30	350	1,252	67	1,424	1,560	90	950	1,280	90	1,230
1,010-1,005	720	30	350	1,252	67	1,424	1,700	100	1,050	1,280	90	1,230
1,005-1,000	720	30	350	1,252	67	1,424	1,812	108	1,130	1,280	90	1,230
<1,000	720	30	350	1,252	67	1,424	1,812	108	1,130	1,310	140	2,050

* This table only shows Lower Division State shortage volumes and DCP contributions. In addition to the volumes shown in this table, the analysis for each submitted proposal includes water delivery reductions to Mexico under low-elevation reservoir conditions and Mexico's savings that contribute to the Binational Water Scarcity Contingency Plan, in accordance with Minute 323 to the 1944 Water Treaty.

**Includes the Infrastructure Protection Volume (IPV) and additional reductions specified for the Lower Division States in the submitted proposal.

***For modeling purposes, all shortage reductions in excess of the 2007 ROD and 2019 DCP are assumed to be distributed to Lower Division States using the following percentages – 56% to Arizona, 4% to Nevada, and 40% to California.

B.3.3 Comparison Metrics

The modeled submitted proposals are compared with the No Action and Action Alternatives 1 and 2 in **Section B.4** using the following metrics:

Lake Powell

- Monthly pool elevation
- Percentages of traces that fall below elevation 3,490 feet in any month in a water year
- EOWY pool elevation
- Annual water year release
- Ten-year Lees Ferry gage flows

Lake Mead

- Monthly pool elevation
- Percentages of traces that fall below elevation 1,020 feet in any month in a calendar year
- End-of-calendar year pool elevation
- Annual calendar year release

Shortage Sharing and Water Delivery

- Depletions by Lower Division States
- Annual shortages and DCP contributions to Lower Division States
- System and unassigned shortages
- Total shortages

B.4 Modeling Results

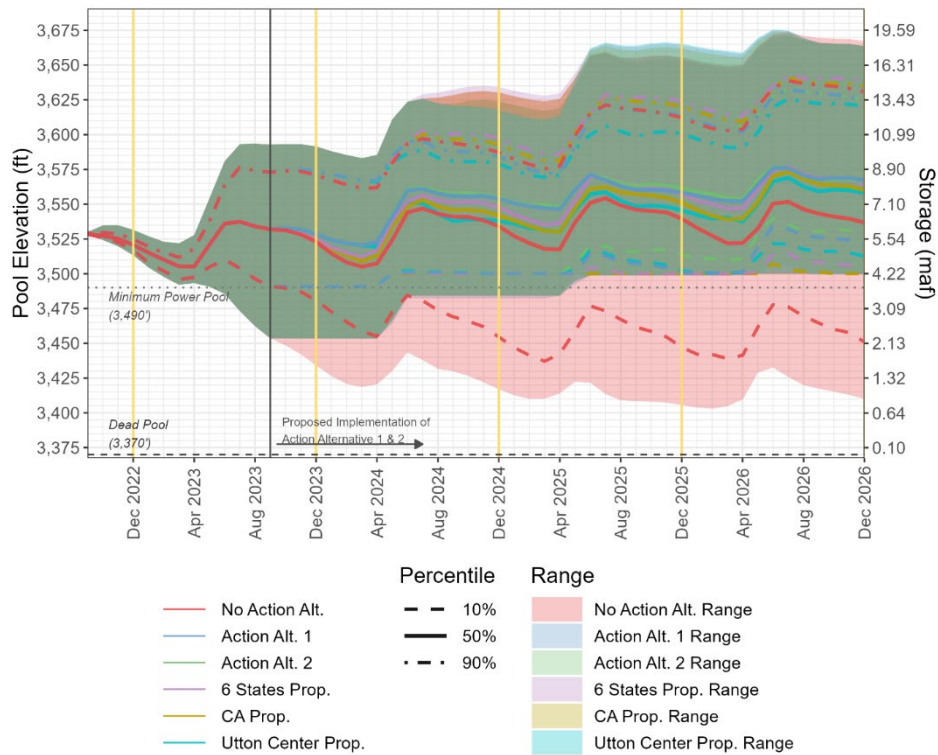
This section presents comparison across the SEIS No Action Alternative, Action Alternative 1, Action Alternative 2, 6-States Proposal, CA Proposal, and Utton Center Proposal. All statistics calculated are reflective of the hydrology scenarios and other assumptions used in modeling and are not intended to suggest actual probabilities of any events occurring. However, it is meaningful to compare statistics across alternatives to differentiate performance. See **Appendix C** for more information about hydrology scenarios used and modeling assumptions.

B.4.1 Lake Powell**Monthly Pool Elevations**

Figure B-2 presents a comparison of the 10th, 50th, and 90th percentiles of modeled Lake Powell elevations for all alternatives as dashed, solid, and dash-dotted lines, respectively. It also shows “clouds” representing the full ranges of modeled elevations for the three SEIS alternatives and the three proposals through 2026.

The cloud extents, or full ranges of modeled Lake Powell elevations in **Figure B-2**, are very similar for all alternatives and proposals at the high end and nearly identical for the two SEIS action alternatives and the three proposals at the lower bound. The lower bound of the No Action Alternative cloud drops to 3,417 feet in 2024 and decreases to a minimum of 3,403 feet in 2026. The lower bounds of the clouds for the other five alternatives/proposals fall to 3,462 feet in August 2023, before the revised operations take effect, but because they all include a provision to protect Lake Powell elevation 3,500 feet, the bottoms of the ranges increases until they reach 3,500 feet in June 2025.

Figure B-2
Lake Powell End-of-Month Pool Elevations



In **Figure B-2** the 10th percentile of the No Action Alternative falls below Lake Powell elevation 3,490 feet (below which the ability of Glen Canyon Dam to operate as intended is not guaranteed) in September 2024 and does not recover during the period of analysis. The 10th percentiles of modeled elevations for all the action alternatives/proposals are nearly identical until April 2025, when they increasingly diverge through 2026. The two SEIS action alternatives are highest at this percentile, and the CA Proposal is lowest. With respect to the medians of modeled elevations, the action alternatives/proposals are consistently higher than the No Action Alternative, and the two SEIS action alternatives are always highest of the five. There is some spread among the five action alternatives/proposals, but they converge to approximately 3,565 feet by December 2026. At the 90th percentile, all alternatives/proposals result in similar Lake Powell elevations except from June 2025 to June 2026 when the Utton Center Proposal is lower.

Percentages of Traces Below Critical Elevations

Figure B-3 shows the percent of modeled traces that fell below Lake Powell elevation 3,490 feet at any time during a year for the period of analysis. Remaining above 3,490 feet is critical to ensuring that Glen Canyon Dam can continue to operate as designed.

Figure B-3
Lake Powell Minimum Water Year Elevation, Percent of Traces Less than Elevation 3,490 feet msl

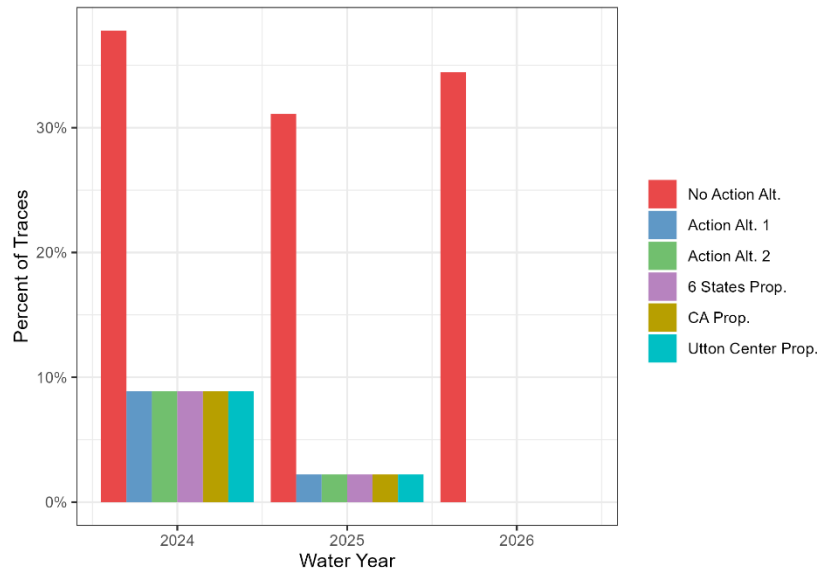


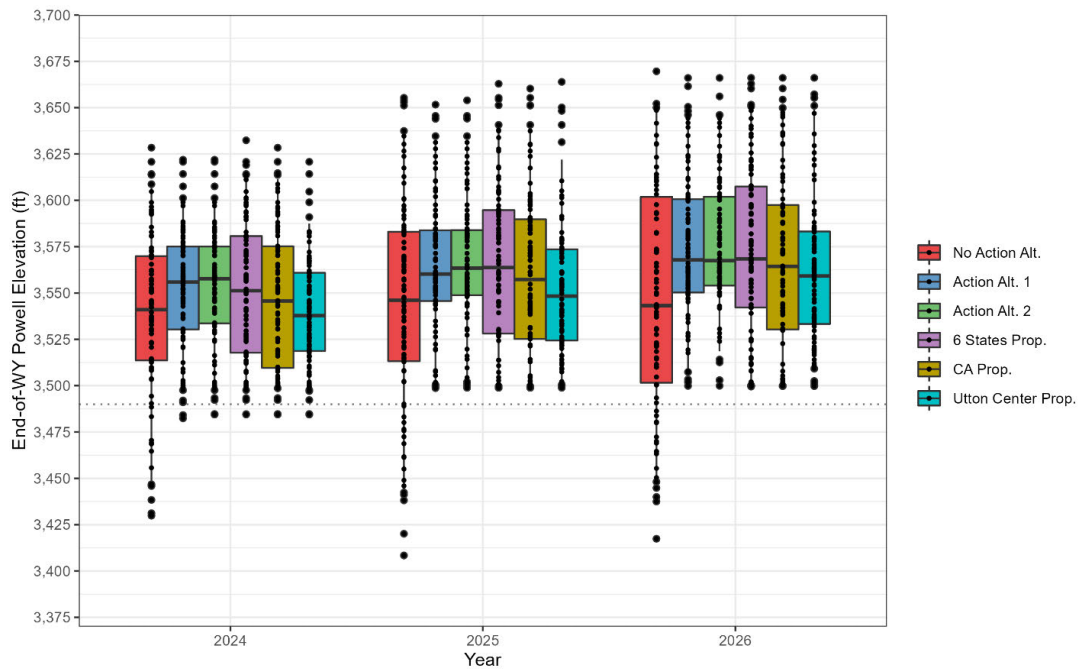
Figure B-3 shows that under the No Action Alternative more than 30 percent of modeled traces result in Lake Powell pool elevation dropping below 3,490 feet. Under the five action alternatives/proposals, identical numbers of traces fall below 3,490 feet in each year: 9 percent in 2024, 2 percent in 2025, and 0 in 2026 because each action alternative/proposal includes modeling to protect elevation 3,500 feet at Powell.

Annual Pool Elevations

Figure B-4 shows the distributions of modeled Lake Powell elevations on September 30 in 2024, 2025, and 2026. Each dot is the EOWY elevation produced by a single hydrologic trace. Dots may be plotted on top of one another. The top and bottom of each box captures the 25th to 75th percentile of the modeled elevations, the whiskers extend to the 5th and 95th percentiles, and the outliers are represented as dots beyond these lines.

Figure B-4 comparisons are consistent with those described above for **Figure B-2**. The No Action Alternative shows a wider range of modeled EOWY Lake Powell pool elevations than the five action alternatives/proposals throughout the period of analysis, especially at the lower ends of the ranges. The median pool elevations for the two SEIS action alternatives and the 6-States Proposal are the most similar to each other and are consistently 10 to 25 feet above the medians under the No Action Alternative. The CA Proposal and the Utton Center Proposal are approximately 3 and 20 feet below the two action alternatives, respectively, in all years.

Figure B-4
Powell EOWY Pool Elevations

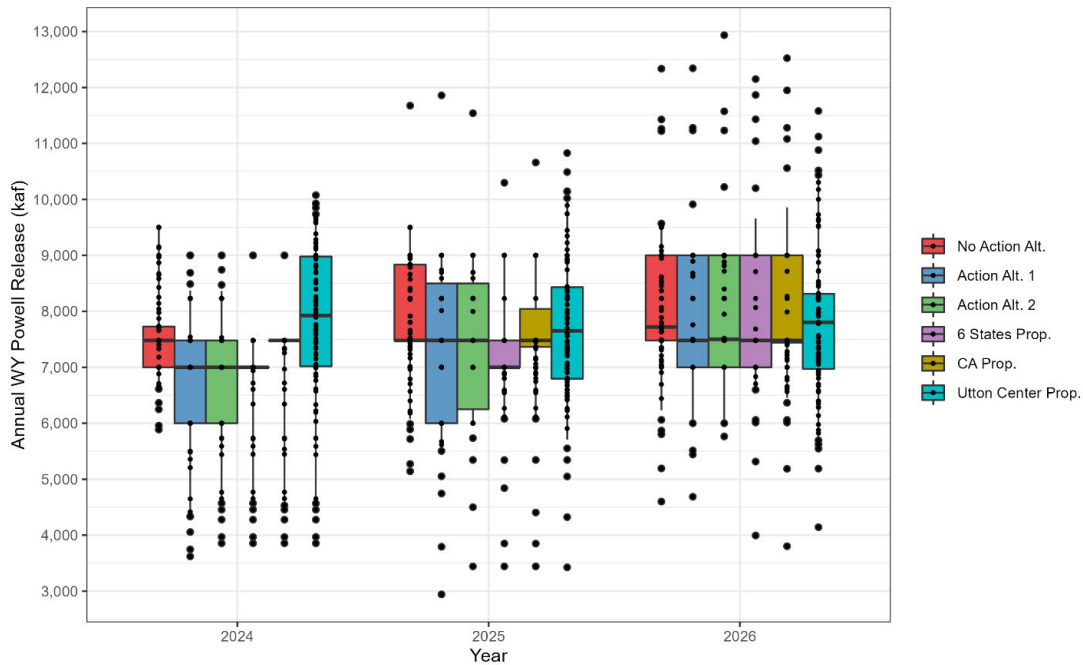


Annual Releases

Figure B-5 shows the distributions of modeled Glen Canyon Dam water year releases in 2024, 2025, and 2026. Each dot is annual release resulting from a single hydrologic trace. Dots may be plotted on top of one another. The top and bottom of each box captures the 25th to 75th percentile of the modeled elevations, the whiskers extend to the 5th and 95th percentiles, and the outliers are represented as dots beyond these lines.

The modeled Glen Canyon Dam water year releases shown in **Figure B-5** reflect the different approaches to Lake Powell operations assumed in the five action alternatives/proposals. All five limit releases to protect Lake Powell elevation 3,500 feet, so they have similar ranges and distributions at the low ends. When Lake Powell is between elevations 3,500 and 3,575 feet, the two SEIS action alternatives and the 6-States Proposal only have set release volumes (not balancing). The set releases under the two SEIS action alternatives range between 6 and 8.23 maf, which can be seen in the width of the boxes, while the 6-States Proposal only specifies 7.48 or 7.0 maf releases, which is apparent in the lack of or small boxes in 2024 and 2025. The CA Proposal assumes balancing in the release range of 7.0 to 7.48 maf, when Lake Powell is below 3,550 feet, and releases up to 8.23 maf when between 3,550 and 3,575 feet, which is apparent in the higher median modeled water year releases and higher ranges of boxes. The Utton Center Proposal is distinct from the other four action alternatives/proposals in the generally higher range and larger variety of modeled releases because it assumes unlimited (that is, there is no range specified for the volume that can be released) balancing of the volumes above 3,500 feet at Lake Powell and above 1,000 feet at Lake Mead.

Figure B-5
Glen Canyon Dam Water Year Release



In **Figure B-5** the medians of annual releases under the No Action Alternative are generally stable at or slightly above 7.48 maf in all years, and the distributions overall tend to be higher than in the five action alternatives/proposals. This occurs because releases under the No Action Alternative will only fall below 7 maf when modeling assumptions about Glen Canyon Dam infrastructure limit release capacity. The exception is the Utton Center Proposal, which has higher or similar modeled median annual releases because it is balancing storage between Lake Powell and Lake Mead more aggressively than the other alternatives/proposals.

Ten-Year Lees Ferry Gage Flows

Figure B-6 shows the distribution of modeled 10-year running sums of Lees Ferry gage flows in 2024, 2025, and 2026. The modeled 2024 flow is calculated using the observed deliveries from 2015 through 2022 and a modeled delivery volume in 2023. There is some variability in the 2023 volume, but it is common to all alternatives so it does not impact relative performance among alternatives. The modeled 2025 volume drops the 2015 observed volume, and the modeled 2026 volume drops 2015 and 2016.

Each dot is the 10-year volume resulting from a single hydrologic trace. Dots may be plotted on top of one another. The top and bottom of each box captures the 25th to 75th percentile of the modeled elevations, the whiskers extend to the 5th and 95th percentiles, and the outliers are represented as dots beyond these lines.

Figure B-6
Lees Ferry Gage 10-Year Running Total

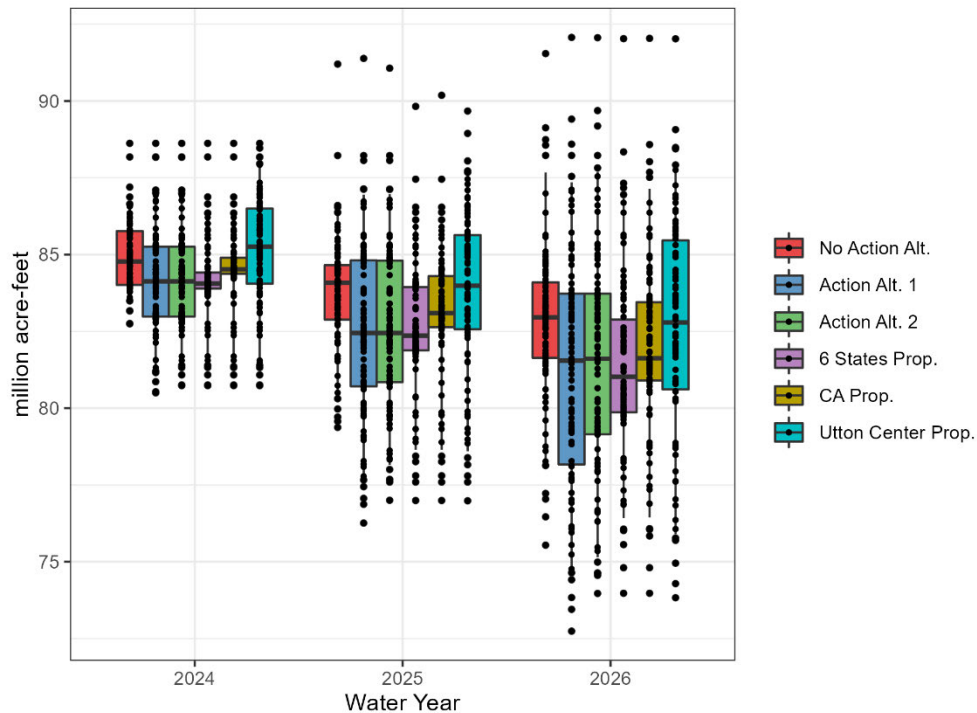


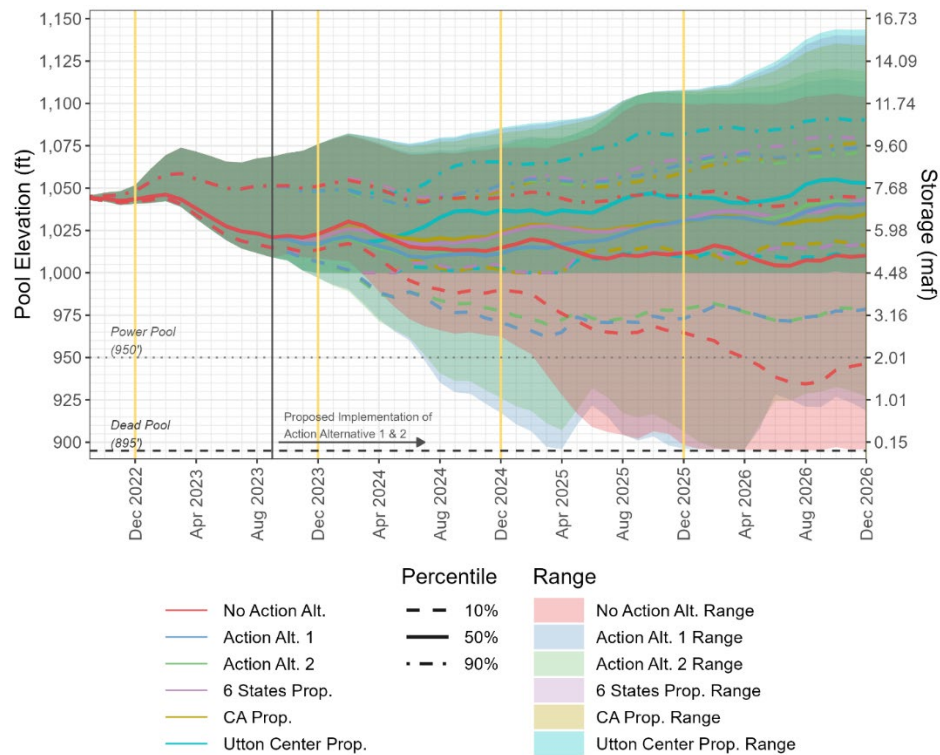
Figure B-6 shows that under all six alternatives/proposals, the median modeled 10-year total flows decline over time. Under the No Action Alternative, this is partially because relatively high Glen Canyon Dam releases from seven or more years ago dropping out of the running total and partially due to declining storage in Lake Powell. All five action alternatives/proposals have lower 10-year flows in the driest modeled traces than the No Action Alternative because they model limited releases to protect Lake Powell’s elevation 3,500 feet, and this occurs immediately in 2024. The median releases under the two SEIS action alternatives, the 6-States Proposal and the CA Proposal all have similar median 10-year flows because they constrain or eliminate balancing releases between Lake Powell and Lake Mead below Lake Powell elevation 3,575 feet. The Utton Center Proposal allows balancing in this range, resulting in higher median flows. By 2025, all alternatives/proposals result in 10-year totals below 82.3 maf in some modeled traces (ranging from approximately 20 percent under the No Action Alternative to almost 50 percent under the SEIS action alternatives). In 2026, approximately three to five percent of modeled traces fall below 75 maf in 10 years under the five action alternatives/proposals and zero percent do so under the No Action Alternative.

B.4.2 Lake Mead

Monthly Pool Elevations

Figure B-7 presents a comparison of the 10th, 50th, and 90th percentiles of modeled Lake Mead elevations for all alternatives as dashed, solid, and dash-dotted lines, respectively. It also shows clouds representing the full ranges of modeled elevations for the three SEIS alternatives and the three proposals through 2026.

Figure B-7
Lake Mead End-of-Month Pool Elevations



The upper bounds of the clouds in **Figure B-7** vary slightly between all alternatives/proposals in 2024 and 2025, and vary more in 2026. In 2026, the No Action Alternative has the lowest upper bound of modeled Lake Mead elevations and the Utton Center Proposal has the highest range of elevations. The six alternatives/proposals vary more significantly at the lower bounds of the clouds. In 2024, modeled Lake Mead elevations under the two SEIS action alternatives decline below elevation 926 feet by December, and each fluctuates between 895 feet (dead pool, or the elevation at which Lake Mead can no longer regularly release water) and 933 feet through the rest of the period of analysis. The lower bound of the No Action Alternative cloud declines more slowly, reaching dead pool in January 2026, and does not recover. The three proposals all have a provision to protect elevation 1,000 feet at Lake Mead, and therefore the lower bounds of their modeled elevations are all consistently at 1,000 feet.

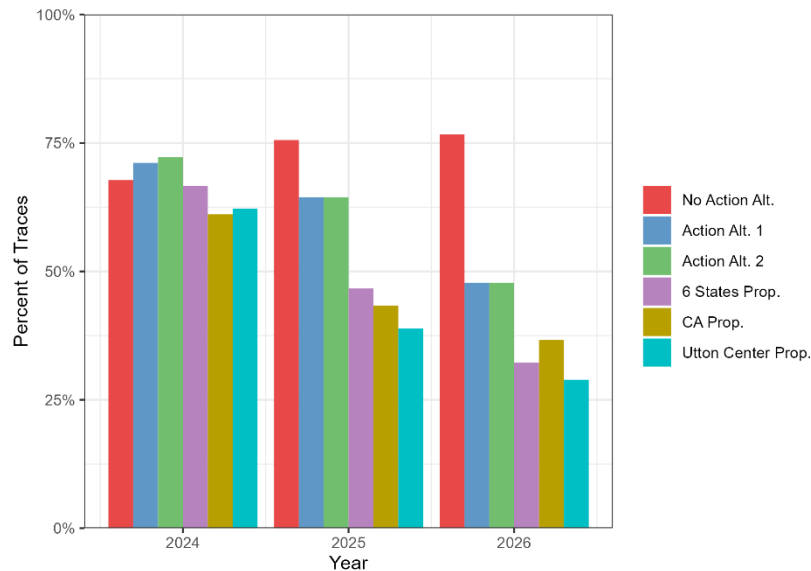
In **Figure B-7** the 10th percentiles of modeled Lake Mead elevations under the six alternatives/proposals exhibit the same relative dynamics as those described for the lower bounds of the clouds. At the median, the No Action Alternative declines slowly through the period of analysis and the other alternatives/proposals diverge at different times: in March 2024, the Utton Center Proposal median elevation climbs 17 to 25 feet higher than the other medians due to increased balancing releases from Lake Powell, reaching approximately 1,035 feet in September 2024 and continuing to increase over time; the CA Proposal climbs more slowly and does not reach approximately 1,035 feet until late in 2026; the two SEIS action alternatives do not diverge from the No Action Alternative until April 2025 and then reach an approximate Lake Mead elevation of 1,040

feet by the end of the period of analysis. At the 90th percentiles of modeled elevations, the No Action Alternative is significantly lower than all action alternatives/proposals, the two action alternatives and the 6-States Proposal and the CA Proposal follow similar trajectories, and the Utton Center Proposal is the highest at the 90th percentile.

Percentages of Traces Below Critical Elevations

Figure B-8 shows the percent of modeled traces that fell below Lake Mead elevation 1,020 feet at any time during a year for the period of analysis. Elevation 1,020 feet was identified as a critical elevation in the 2019 DCP.

Figure B-8
Lake Mead Minimum Calendar Year Elevation, Percent of Traces Less than Elevation 1,020 feet msl

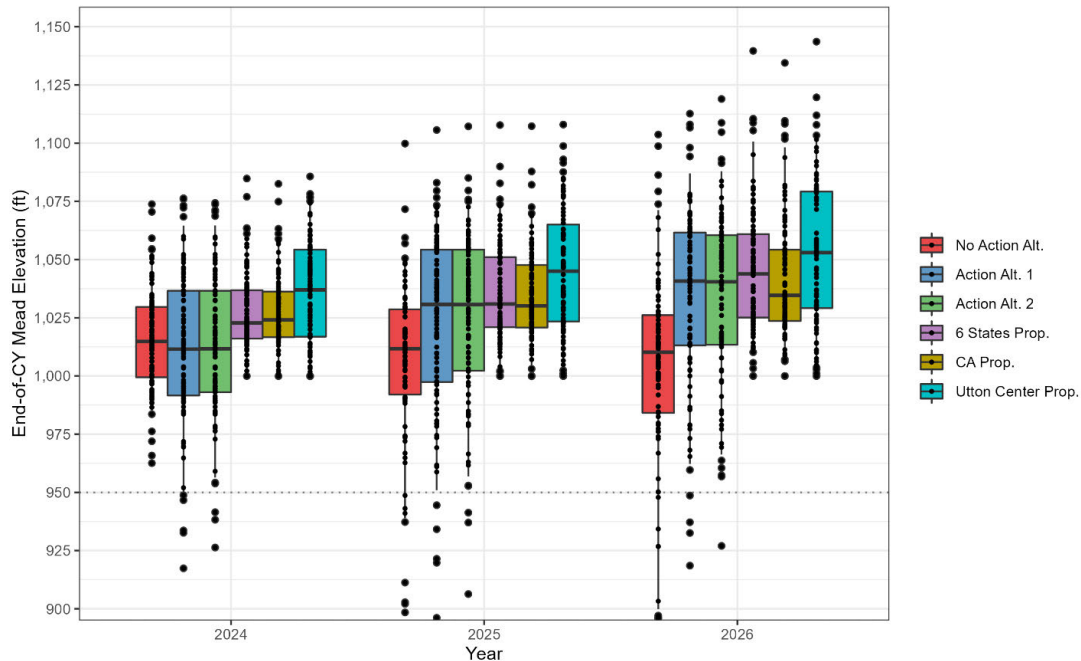


In **Figure B-8**, all six alternatives/proposals have similar percentages of modeled traces falling below Lake Mead elevation 1,020 feet in 2024; the No Action Alternative has approximately 68 percent, Action Alternative 2 has the highest percentage at 72 percent, and the CA Proposal has the fewest traces falling below at approximately 61 percent. Over the period of analysis, the percentages of traces falling below elevation 1,020 feet declines under all action alternatives/proposals, and in 2026 the Utton Center Proposal results in the fewest traces at 29 percent and the two action alternatives result in the most traces at 48 percent. The No Action Alternative exhibits increasing percentages of traces falling below Lake Mead elevation 1,020 feet; in 2026, 77 percent of the traces under this alternative fall below the critical threshold.

Annual Pool Elevations

Figure B-9 shows the distributions of modeled Lake Mead elevations on December 31 in 2024, 2025, and 2026. Each dot is the EOY elevation produced by a single hydrologic trace. Dots may be plotted on top of one another. The top and bottom of each box captures the 25th to 75th percentile of the modeled elevations, the whiskers extend to the 5th and 95th percentiles, and the outliers are represented as dots beyond these lines.

Figure B-9
Mead EOY Pool Elevations



The distributions of modeled EOY Lake Mead elevations for the six alternatives/proposals shown in **Figure B-9** exhibit the same dynamics as those described under **Figure B-7**. The medians of the No Action Alternatives decline from 2024 to 2026 and the variability increases, specifically as the lower ends of the distributions extend. Approximately 10 percent of modeled traces end the year below minimum power pool (950 feet) in 2025 and 2026 under the No Action Alternative. The two SEIS action alternatives display wide ranges in all years, but the medians and ranges consistently shift upward over the period of analysis. The three submitted proposals all include a provision to protect Lake Mead elevation 1,000 feet, so the bottoms of their ranges are truncated. The Utton Center Proposal has the highest median and range of elevations in all years due to the assumption of more balancing releases at lower elevations from Lake Powell.

Annual Releases

Figure B-10 shows the distributions of modeled annual releases from Hoover Dam in 2024, 2025, and 2026. Each dot is the volume release during that year under a single hydrologic trace. Dots may be plotted on top of one another. The top and bottom of each box captures the 25th to 75th percentile of the modeled elevations, the whiskers extend to the 5th and 95th percentiles, and the outliers are represented as dots beyond these lines.

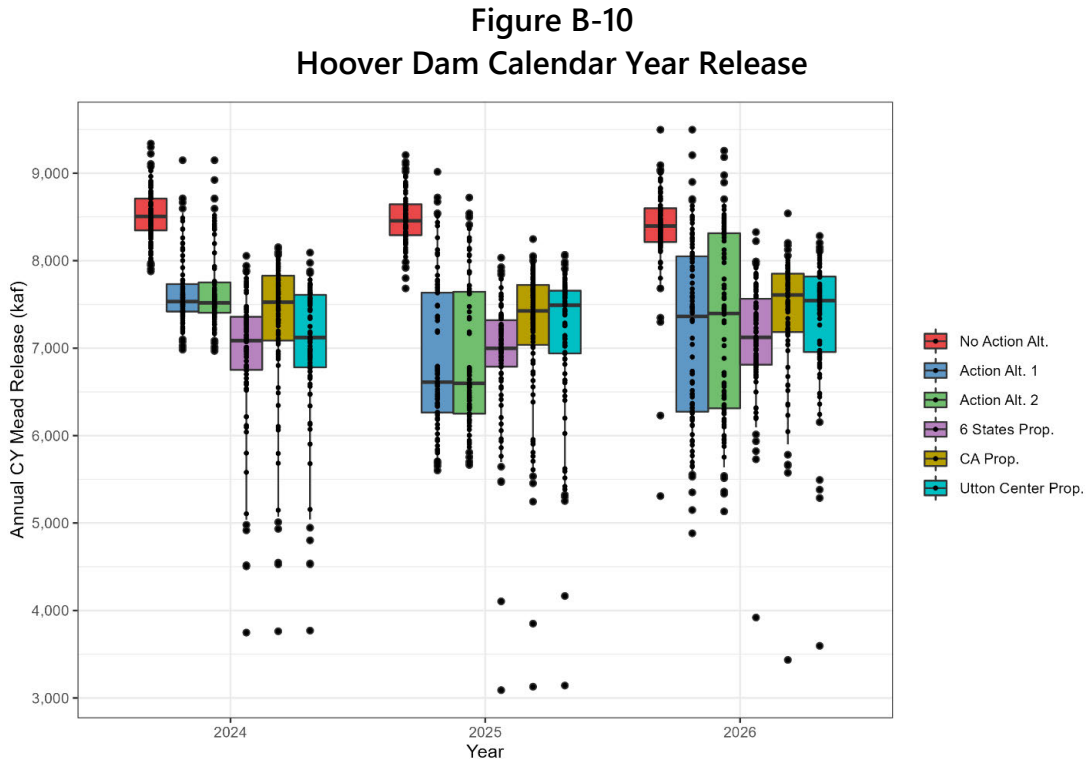


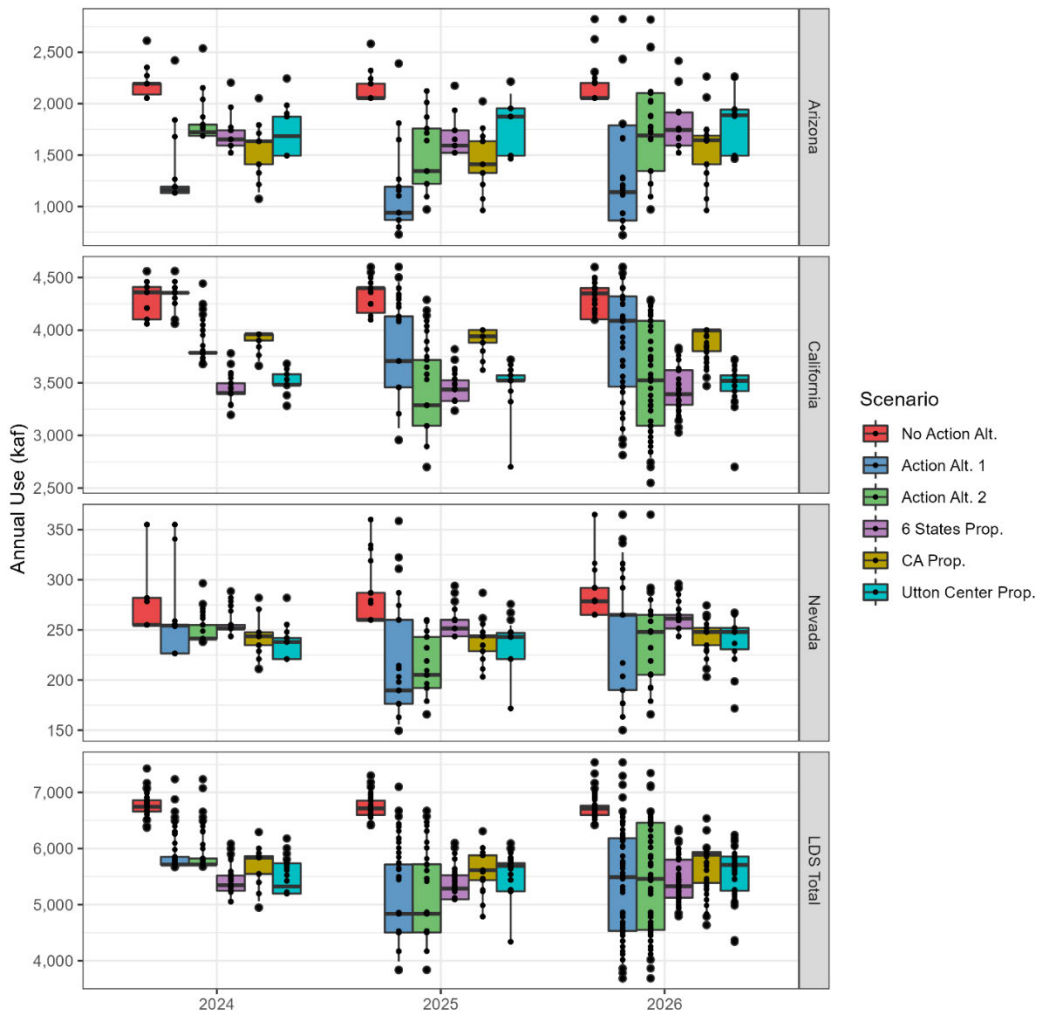
Figure B-10 shows that under the No Action Alternative, the modeled releases from Hoover Dam in 2024 and 2025 have ranges of approximately 1.5 maf, with medians that decline slightly from approximately 8.51 to 8.46 maf. In 2026 the median release again declines slightly, but the bottom of the range extends down to approximately 5.3 maf because releases are limited by the amount of water physically available when Lake Mead is at dead pool. In 2024, the two SEIS action alternatives have a higher overall range of releases with less variability than the submitted proposals, but this relationship changes in 2025 when the two action alternatives' additional shortage volumes take effect below Lake Mead elevation 1,040 feet. Because the three submitted proposals have a provision that protects Lake Mead elevation 1,000 feet, the distributions for all three have multiple traces where less than 5.0 maf is released in 2024 and 2025. In 2026, the medians of releases under the five action alternatives/proposals are all between approximately 7.1 and 7.6 maf and the median modeled release from Hoover Dam under the No Action Alternative is approximately 8.4 maf.

B.4.3 Shortage Sharing and Water Delivery

Lower Division Depletions by State

Figure B-11 shows the distributions of modeled Lower Division States’ depletions⁷ in 2024, 2025, and 2026. Each dot is the volume of water requested during that year under a single hydrologic trace. Dots may be plotted on top of one another. The top and bottom of each box captures the 25th to 75th percentile of the modeled elevations, the whiskers extend to the 5th and 95th percentiles, and the outliers are represented as dots beyond these lines. From top to bottom, the four panels display depletions for Arizona, California, Nevada, and Lower Division States total, respectively. The figure is oriented to facilitate the comparison of a single state’s modeled depletions across each alternative/proposal over the period of analysis. Figure B-11 reports the depletions that would occur after adjustments to demands based on ICS delivery or creation, shortages, and DCP contributions but before any system or unassigned shortages occur.

Figure B-11
Lower Division States’ Modeled Depletions



⁷ Modeled depletions, that is, modeled consumptive use

In the top panel of **Figure B-11**, Arizona’s modeled annual depletions are highest under the No Action Alternative and lowest under Action Alternative 1. Part of the reason for the seemingly high depletions under the No Action Alternative is that the reductions that result from Lake Mead being at dead pool, where deliveries are limited to inflow minus evaporation, are not recorded under this metric. In Action Alternative 1, shortages are applied based exclusively on the concept of priority, so Arizona’s junior users are significantly impacted. When the additional shortage volumes in the action alternatives take effect starting in 2025, the distributions of modeled Arizona depletions shift further down. Action Alternative 2 and the three submitted proposals have median depletion volumes that are generally more like each other while the other two alternatives (No Action Alternative and Action Alternative 1) bound the extremes.

In the second panel of **Figure B-11**, modeled annual depletions for California are highest in the No Action Alternative throughout the period of analysis (see discussion about Arizona depletions for additional context). In 2024, Action Alternative 1 shows the same median and range of depletions, but the medians and ranges for this alternative decrease when additional shortage volumes take effect starting in 2025. The medians and ranges of California depletions under Action Alternative 2 are lower than the other two SEIS alternatives due to the assumption that shortages would be distributed in the same percentage across all Lower Basin water users. Because the shortage volumes in the submitted proposals are consistent throughout the period of analysis, the distributions relative to one another are consistent, with the CA Proposal resulting in higher depletions than the other two proposals because it assumes that shortages will be distributed in a way that is more aligned with priority than proportionality.

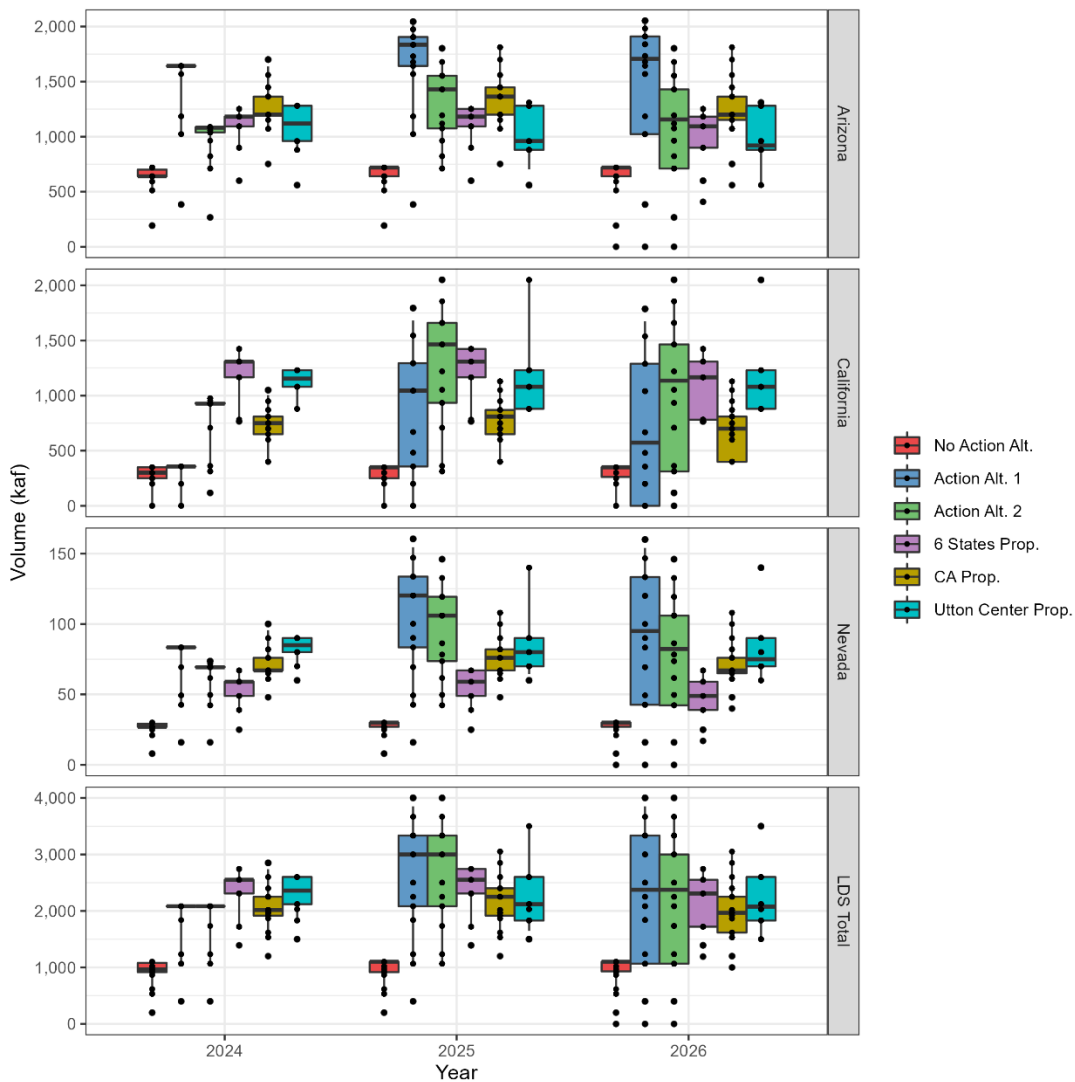
The modeled annual depletions for Nevada are shown in the third panel of **Figure B-11**. As in the other two states, the No Action Alternative has higher medians and ranges than the five action alternatives/proposals but the differences are smaller because, for most traces under the No Action Alternative, the model assumes that Nevada does not request the maximum amount of water available to it. The medians and distributions under the two SEIS action alternatives decline from 2024 to 2025 due to the additional shortage volumes, but the medians rebound in 2026 and are similar to the medians of the three submitted proposals. The absolute and relative medians and ranges for the three submitted proposals are steady over time.

The bottom panel of **Figure B-11** shows a comparison of how total modeled Lower Division States’ depletions were impacted by different alternatives/proposals. In 2024, the two SEIS action alternatives show approximately the same median depletions as the three submitted proposals. In 2025, when the additional shortages take effect, the medians and distributions of the two SEIS action alternatives decline and, while the medians rebound in 2026, the variability increases and approximately 50 percent of modeled traces result in depletions lower than 5.5 maf. The medians and ranges for the three submitted proposals are relatively consistent throughout the period of analysis but do not reflect the unassigned shortages necessary to protect elevation 1,000 feet at Lake Mead.

Annual Shortage and DCP Contribution Volumes by State

Figure B-12 shows the distributions of modeled shortages plus DCP contributions to Lower Division States in 2024, 2025, and 2026. Each dot is the volume of water required to meet DCP contributions, 2007 ROD shortages, and additional proposed shortages during that year under a single hydrologic trace. Dots may be plotted on top of one another. The top and bottom of each box captures the 25th to 75th percentile of the modeled elevations, the whiskers extend to the 5th and 95th percentiles, and the outliers are represented as dots beyond these lines. From top to bottom, the four panels display shortage and DCP contributions for Arizona, California, Nevada, and Lower Division States total, respectively. The figure is oriented to facilitate the comparison of a single state’s shortage and DCP contributions across each alternative/proposal over the period of analysis.

Figure B-12
Distribution of Lower Division Shortages and DCP Contributions



The distributions of modeled Arizona shortages and DCP contributions shown in the top panel of **Figure B-12** reflect dynamics over time and between alternatives/proposals that have been observed in previous figures and discussion. The No Action Alternative consistently applies magnitudes that are approximately half or less of the magnitudes that are applied in the five action alternatives/proposals. The magnitudes of reductions applied under the two SEIS action alternatives generally increase in 2025 and 2026 when additional volumes below Lake Mead elevation 1,040 feet take effect. Delivery reductions under Action Alternative 1 and the CA Proposal are higher than under the other three alternatives/proposals because they distribute shortage volumes based on the concept of priority, as opposed to using the same percentage across all Lower Basin water users to distribute shortages.

The second panel in **Figure B-12** shows the same dynamics in modeled distributions of California's shortages and DCP contributions that were described for Arizona, except that the relative higher and lower magnitudes between the five action alternatives/proposals are reversed: distributing shortages based fully or largely on proportionality results in higher reductions for California under Action Alternative 2, the 6-States Proposal, and the Utton Center Proposal, and using the priority system as a basis as Action Alternative 1 and the CA Proposal result in lower delivery reduction volumes for California.

With respect to modeled shortages and DCP contributions assigned to Nevada, panel three of **Figure B-12** shows that distributing shortages based on the concept of priority vs. using the same percentages across all Lower Basin water users is not as strong of a determinant of magnitudes as it is for Arizona and California. While Action Alternative 1 shows greater reductions for Nevada than Action Alternative 2 (priority and percentage, respectively), and the CA Proposal imposes more reductions than the 6-States Proposal (priority vs. proportionality, respectively), the Utton Center Proposal, which is more closely aligned with proportionality with respect to Arizona and California, assigns more shortage to Nevada than the other proportionally based alternatives/proposals. Relatively small magnitudes of differences between alternatives/proposals have an outsized effect on Nevada shortages and DCP contributions because the basic apportionment is much smaller than for the other states.

Panel four of **Figure B-12** shows that in 2024 and 2026, overall shortages and DCP contributions across all states have similar medians among all action alternatives/proposals. In 2025, the two SEIS action alternatives have median reductions that are 450,000 to 880,000 af higher than those of the other action alternatives/proposals when the additional shortage volumes below Lake Mead elevation 1,040 feet take effect. These higher shortage volumes rapidly boost Lake Mead's elevation in the modeled traces such that in 2026, lower shortages resulting from higher tiers cause the median delivery reductions under the two SEIS action alternatives to fall closer to those of the other three action alternatives/proposals. Additionally, the additional unassigned shortages necessary to protect Lake Mead elevation 1,000 feet in the submitted proposals are not reflected in **Figure B-12**, while the larger additional specified shortages at lower Lake Mead levels included in the action alternatives are reflected in **Figure B-12**.

System Shortages and Unassigned Shortages

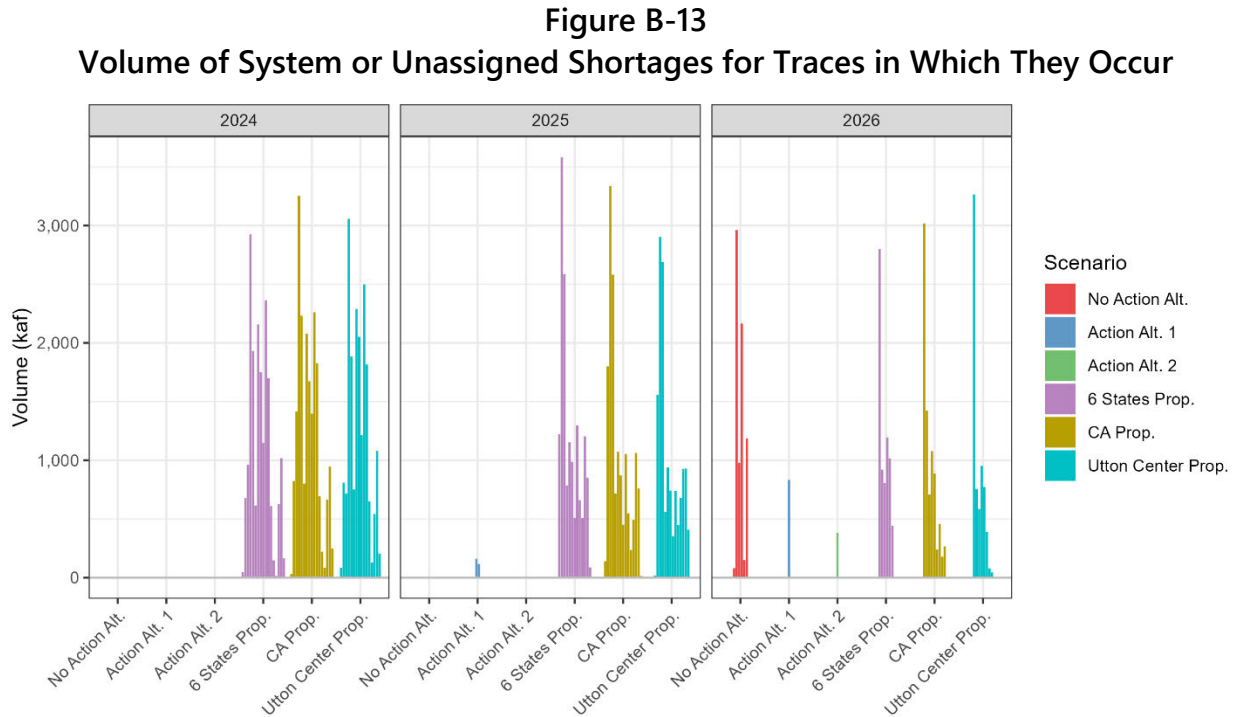
The previous figures in this section only showed the impacts of the different alternatives/proposals based on specified shortage volumes and DCP contributions that were assumed to be taken by a specific water user within a distinct elevation band in Lake Mead. There are two ways that shortages other than those specified can occur. Under the three SEIS alternatives, if Lake Mead reaches dead pool and user depletion requests cannot be fully met because there is not enough water in the reservoir, “system shortage” at dead pool occurs. The three submitted proposals all have a provision that protects Lake Mead elevation 1,000 feet, but they do not specify what users take the shortages necessary to achieve the protection. These are called “unassigned shortages.” **Table B-4** shows the percentages of modeled traces under each alternative/proposal that result in either system shortage or unassigned shortage in each year of the analysis period.

Table B-4
Percent of Traces with System or Unassigned Shortages

Alternative/Proposal	2024	2025	2026
No Action Alternative	0%	0%	7%
Action Alternative 1	0%	2%	1%
Action Alternative 2	0%	0%	1%
6-States Proposal	19%	14%	7%
CA Proposal	19%	17%	10%
Utton Center Proposal	18%	16%	9%

Table B-4 shows that all three submitted proposals result in significant incidence of unassigned shortages in 2024 and 2025, with some decline in prevalence in 2026. This is because approximately 50 percent of modeled traces in 2024 start below elevation 1,025 feet (see **Figure B-7**) and, therefore, are already close to requiring more than the specified shortage volumes within the year. The No Action Alternative does not result in system shortages until 2026, but the 7 percent of traces that reach dead pool require significant additional reductions, as shown in **Figure B-13**.

For each alternative/proposal, **Figure B-13** shows the modeled volume of system or unassigned shortage that resulted from each trace in which it occurred in 2024, 2025, and 2026. In every year, the three submitted proposals show nearly identical patterns and volumes of unassigned shortage. The maximum volumes of unassigned shortages under the proposals range from 2.8 to 3.6 maf with a median of approximately 1.0 maf. While the frequency of traces resulting in unassigned shortages declines over time, the ranges of all three submitted proposals are consistent with the values exhibited in 2024. In 2026, the No Action Alternative results in a max system shortage of approximately 3.0 maf and a median of approximately 1.0 maf. Action Alternative 1 results in two



traces where an average of approximately 140 kilo acre feet (kaf) of system shortage occurs in 2025. In 2026, Action Alternative 1 and Action Alternative 2 each result in a single trace with 832 and 380 kaf of system shortage, respectively.

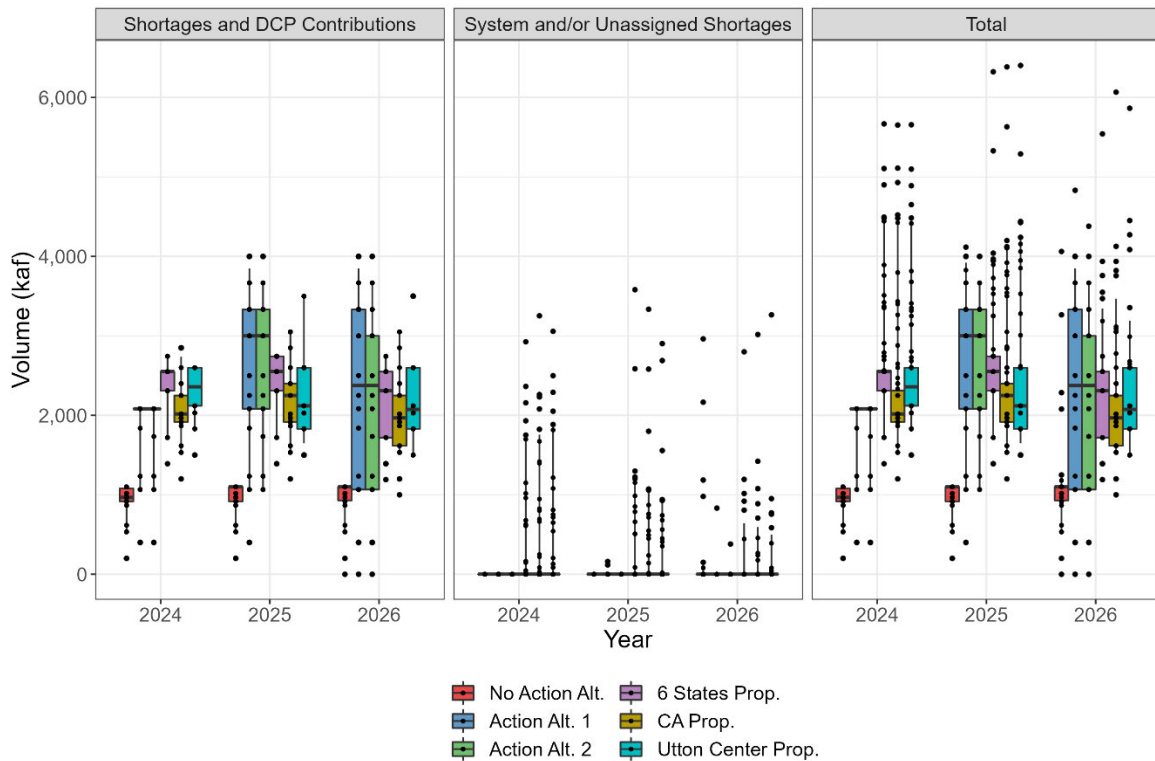
Total Shortages

Figure B-14 shows the distributions of modeled shortages and DCP contributions in 2024, 2025, and 2026. Each dot is the volume of water reduced during that year under a single hydrologic trace. Dots may be plotted on top of one another. The top and bottom of each box captures the 25th to 75th percentile of the modeled elevations, the whiskers extend to the 5th and 95th percentiles, and the outliers are represented as dots beyond these lines.

From left to right, panels one, two, and three of **Figure B-14** show modeled shortages and DCP contributions that are specified in the alternatives/proposals, system and/or unassigned shortages, and the sum of these two categories (total shortages and DCP contributions), respectively.

The left panel of **Figure B-14** shows the same distributions of modeled shortages and DCP contributions that were presented in the bottom panel of **Figure B-12**. See that description for discussion. The center panel shows, in boxplot form, the modeled traces that resulted in system or unassigned shortages that were described in **Figure B-13**. See that description for discussion. These two panels are included in **Figure B-14** to provide context for the right panel.

Figure B-14
Lower Division States' Total Shortages



The right panel of **Figure B-14** shows how the ranges of overall shortages and DCP contributions shift when system or unassigned shortages are added to the shortages and DCP contributions specified in each alternative/proposal. In the left panel, the No Action Alternative appears to only result in a maximum of approximately 1.1 maf in any modeled trace. However, when system shortage is included, in 2026, reductions up to 4.0 maf occur because Lake Mead is at dead pool. The distributions of total reductions for the two SEIS action alternatives are nearly identical in the left and right panels because annual deliveries are almost never affected by Lake Mead reaching dead pool (even though both alternatives do rarely fall to dead pool in 2025 and or 2026; see **Table B-4** and **Figure B-7**).

The ranges of modeled shortages and DCP contributions for the three submitted proposals expand significantly in the right panel of **Figure B-14** when compared with the distributions in the left panel. Without accounting for unassigned shortages, the maximum reductions in 2025 and 2026 for the 6-States Proposal, the CA Proposal, and the Utton Center Proposal are 2.7, 3.0, and 3.5 maf, respectively. **Figure B-13** and the middle panel of **Figure B-14** show that the magnitudes of unassigned shortages can be as high as the specified shortages and DCP contributions. The distributions of total shortages and DCP contributions in the right panel show that the maximum volumes for all three proposals are near or above 6.3 maf throughout the period of analysis.

B.5 Summary

At Lake Powell, modeling under the five action alternatives/proposals shows similar monthly and EOWY elevation ranges and identical frequencies of reaching the critical elevation of 3,490 feet. Compared with the No Action Alternative, all five action alternatives/submitted proposals have much higher lower bounds of elevations and minimal incidence of reaching 3,490 feet because they explicitly protect elevation 3,500 feet. The five action alternatives/proposals show variation over time and are compared with one another in their distributions of Glen Canyon Dam releases based on whether they include balancing releases below Lake Powell elevation 3,575 feet and the volumes of specified releases below 3,575 feet, where Lake Powell sits for the majority of analyzed traces throughout the period of analysis. The two SEIS action alternatives, the 6-States Proposal, and the CA Proposal have no or minimal balancing below 3,575 feet and their modeled median releases under are stable over time at 7.0 or 7.48 maf with ranges that tend to increase over time; the Utton Center Proposal median modeled Glen Canyon Dam releases are on average 7.8 maf throughout, but the variability is wider because Lake Powell always balances volumes above certain elevations. The medians of the No Action Alternative are similar to the medians of the other five alternatives/proposals, but the ranges in each year are generally smaller. Because of the assumption of protecting Lake Powell elevation 3,500 feet, the driest modeled traces result in 10-year Lees Ferry gage flows less than 82.3 maf in 2024 under the five action alternatives/proposals, with the share of these traces growing through 2026. In 2026, 3 to 5 percent of traces fall below 75 maf over 10 years under the action alternatives/proposals. The different assumptions about balancing below Lake Powell elevation 3,575 feet cause more varied behavior at the medians of 10-year flows under the action alternatives/proposals.

At Lake Mead, the submitted proposals differ from the SEIS alternatives because they explicitly protect elevation 1,000 feet. Thus, while 10 percent or more of the traces modeled under the three SEIS alternatives fall below 1,000 feet and some fall to dead pool, no traces do so under the submitted proposals. Median elevations at Lake Mead are higher for the submitted proposals than for the two SEIS action alternatives because they assume higher shortage volumes in 2024 (and in the case of the Utton Center Proposal, it is higher than all action alternative/proposals because it releases more water from Lake Powell due to balancing releases). When additional shortage volumes below elevation 1,040 feet take effect in 2025, median modeled Lake Mead elevations under the two SEIS action alternatives catch up to the submitted proposals. In 2026, median monthly and end-of-calendar year elevations under the No Action Alternative are approximately 10 and 40 feet lower, respectively, than the medians under the other alternatives/proposals. Under the No Action Alternative, 77 percent of modeled traces fall below Lake Mead elevation 1,020 in 2026 compared with approximately 30 to 50 percent of traces under the other alternatives/proposals. Releases from Hoover Dam are significantly lower under the five action alternatives/proposals than the releases modeled under the No Action Alternative because they apply additional shortages. The release medians and ranges for the three submitted proposals are generally consistent over the period of analysis, while the releases under the two SEIS action alternatives decrease and vary more widely after additional shortage volumes take effect in 2025.

In terms of shortage sharing and water deliveries to the Lower Division States, there are three major factors that drive the differences among the five action alternatives/proposals: (1) when shortages

take effect, (2) how shortages are distributed among users, and (3) whether Lake Mead elevation 1,000 feet is protected. Overall, the submitted proposals result in higher modeled shortages (and lower modeled depletions) in 2024 than the two SEIS action alternatives because the volumes they specify are greater than those of the two SEIS action alternatives for the same elevation bands in Lake Mead. In 2025 these positions reverse, and the delivery reductions under the two SEIS action alternatives are significantly higher because additional shortage volumes below Lake Mead elevation 1,040 feet are modeled. The result of these larger volumes is that Lake Mead elevations increase rapidly in 2026, leading to declines in delivery reduction volumes under the two SEIS action alternatives. The 2026 volumes under the two SEIS action alternatives are similar to the volumes modeled under the three submitted proposals.

The additional shortages applied to individual states vary among the five action alternatives/proposals depending on how the additional shortage volumes are distributed. Action Alternative 1 and the CA Proposal use the concept of priority as the full or partial basis for distributing shortages. The result of this is that modeled shortages and DCP contributions are relatively higher in Arizona and lower in California compared with the other three action alternatives/proposals. In contrast, Action Alternative 2, the 6-States Proposal, and the Utton Center Proposal base shortage distributions fully or primarily on the proportions of water apportioned to different states or users, and this results in relatively higher magnitudes of reductions in California and lower reductions in Arizona. The effects on Nevada of the two approaches to distributing shortages follow similar patterns to the effects on Arizona, though the Utton Center Proposal deviates from this.

The two SEIS action alternatives approach shortages at Lake Mead elevations below 1,000 feet differently from the three submitted proposals: the action alternatives define specific shortage volumes down to dead pool in Lake Mead and distribute them to users; the submitted proposals protect Lake Mead elevation 1,000 feet by reducing deliveries as much as necessary to protect that elevation. When reductions to protect 1,000 feet are required, the submitted proposals do not specify which users take these shortages, resulting in large volumes of unassigned shortage in nearly 20 percent of modeled traces in 2024. The percentages decline slightly in 2025 and again in 2026, though they are still required 7 to 10 percent of the time depending on the proposal. When these shortages are required they can exceed 3.0 maf, meaning that the unassigned shortages can be as large as the specified shortages. When shortages and unassigned shortages are combined, the submitted proposals' maximum modeled shortages are near or above 6.0 maf in all years during the period of analysis. The two SEIS action alternatives also exhibit additional shortages when Lake Mead does not physically have enough water to meet deliveries because it is at dead pool (system shortages). These system shortages are not attributed to any specific user, so they are similar to unassigned shortages in that they do not necessarily show up in analyses of shortages and DCP contributions. In the few modeled traces that system shortages occur, the magnitudes are between 117 kaf and 832 kaf. The No Action Alternative also includes system shortages that are more frequent and larger magnitude than the action alternatives.

Attachment B-1

Sensitivity Analysis of Potential DROA Contributions
from 6-States Proposal

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Attachment B-1. Sensitivity Analysis of Potential DROA Contributions from 6-States Proposal

This attachment analyzes annual releases from Glen Canyon Dam and Hoover Dam to compare two different assumptions about potential DROA contributions that were used in the 6-States Proposal. The analysis is limited to releases from Glen Canyon Dam and Hoover Dam because these are the variables that best show the differences due to the potential DROA contributions and because these variables aggregate the effects of potential DROA contributions on other variables, for example, Hoover Dam releases encompass changes to shortage tiers and volumes for all Lower Division States.

The “6-States Proposal: 500 kaf” scenario is identical (renamed for clarity of comparisons) to the “6-States Proposal” described previously in Appendix B and uses all the same assumptions described in **Section B.3.2** for the 6-States Proposal, including potential DROA contributions up to 500 kaf per DROA year. The “6-States Proposal: 100 kaf” scenario uses all of the same assumptions as the “6-States Proposal: 500 kaf” scenario, except it assumes potential DROA contributions up to 100 kaf per DROA year.

B-1.1 Annual Releases

Figure Attachment B-1-1 shows the distributions of modeled Glen Canyon Dam water year releases in 2024, 2025, and 2026. Each dot is annual release resulting from a single hydrologic trace. Dots may be plotted on top of one another. The top and bottom of each box captures the 25th to 75th percentile of the modeled elevations, the whiskers extend to the 5th and 95th percentiles, and the outliers are represented as dots beyond these lines.

Figure Attachment B-1-1 shows minimal differences in modeled water year releases from Glen Canyon Dam resulting from the 100-kaf assumption about potential DROA releases vs. the 500-kaf assumption. In the driest traces 5 percent of traces, releases are approximately 400 kaf higher in the 500 kaf assumption throughout the period of analysis, and this effect also shifts the median in 2026.

Figure Attachment B-1-2 shows that the different releases from Glen Canyon Dam that result from the 100-kaf vs. the 500-kaf assumptions have minimal impacts on releases from Hoover Dam. The differences in Glen Canyon Dam releases in the driest traces can propagate to larger magnitude differences in more traces if the additional volumes impact tiers of delivery reductions.

Figure Attachment B-1-1 Glen Canyon Dam Water Year Releases

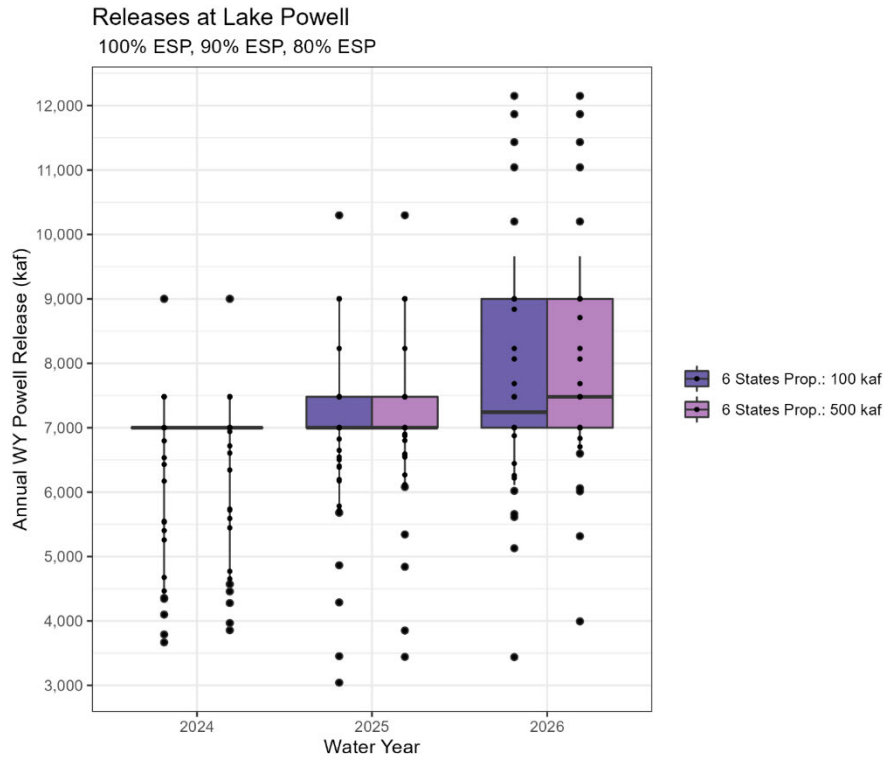
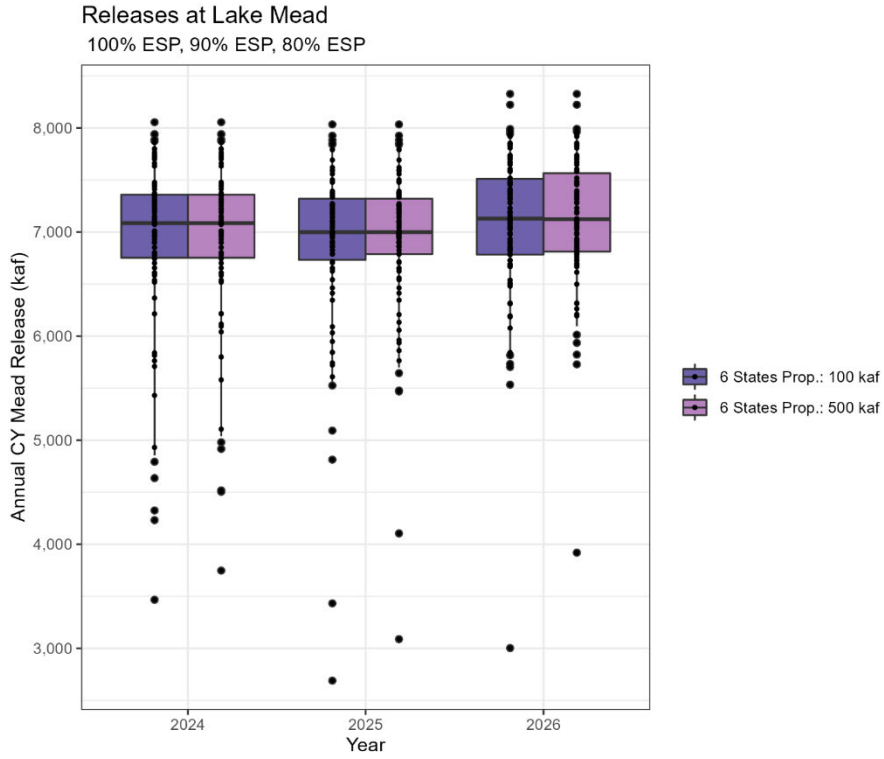


Figure Attachment B-1-2 Hoover Dam Calendar Year Releases



B-1.2 Summary

The different assumptions regarding potential DROA contributions have minimal impacts on Glen Canyon Dam releases except under the driest modeled traces. In the driest traces, the 500 kaf assumption results in the possibility for higher releases from Glen Canyon Dam than the 100 kaf assumption. When releases from Glen Canyon Dam are increased as a result of assuming 500 kaf potential DROA contributions instead of 100 kaf potential DROA contributions, releases from Hoover Dam also increase in some instances, with more pronounced effects if they result in a change in shortage tier.

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Attachment B-2

Submitted Proposals

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

January 31, 2023

The Honorable Tanya Trujillo
Assistant Secretary, Water & Science
U. S. Department of the Interior
Washington, DC 20240

The Honorable Camille Calimlim Touton
Commissioner
Bureau of Reclamation
Washington, DC 20240

Re: Notice of Intent to Prepare a Supplemental Environmental Impact Statement

Dear Assistant Secretary Trujillo and Commissioner Touton:

Consistent with the Department of the Interior (Interior), Bureau of Reclamation's (Reclamation) November 17, 2022, *Notice of Intent To Prepare a Supplemental Environmental Impact Statement for December 2007 Record of Decision Entitled Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations For Lake Powell and Lake Mead* (Notice), 87 FR 69043 (November 17, 2022), the undersigned Governors' Representatives submit this set of modeling assumptions for an alternative to be evaluated as a potential consensus-based set of actions consistent with the purpose and need set forth in the Notice (Consensus-Based Modeling Alternative or CBMA).

We ask that Reclamation model and evaluate CBMA impacts in the Draft Supplemental Environmental Impact Statement (SEIS) to be issued pursuant to the National Environmental Policy Act of 1969 (NEPA) before identifying a preferred alternative. The CBMA will promote NEPA's goal of fostering more informed decision-making. Therefore, we request that Reclamation advance the CBMA for further evaluation in the NEPA process for comparative purposes. We recognize that impediments may ultimately preclude the CBMA from being incorporated into a consensus-based set of actions to guide the operation of Glen Canyon and Hoover Dams.

Negotiations to implement actions contemplated by this CBMA, both by and between the undersigned and by and between other necessary parties, have not yet been completed, and in many cases have not yet begun. Accordingly, the States and water users expressly reserve their rights under applicable law, including, but not limited to, the Law of the River as broadly defined, and this submittal is not intended to be and shall not be construed in any way as a waiver of any such rights.

EXECUTIVE SUMMARY

The Notice anticipates that alternatives would make specific modifications to Lake Powell and Lake Mead operations governed by the Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead ('07 Guidelines) to prevent Lake Powell and Lake Mead from falling to critically low elevations impacting water delivery or power production from either reservoir in 2023 and 2024. In particular, Reclamation anticipates that alternatives will propose revisions to reduce annual Lake Powell release volumes governed by Sections 6.C. (Mid-Elevation Release Tier) and

6.D. (Lower Elevation Balancing Tier) of the '07 Guidelines to protect Glen Canyon Dam to ensure the deliverability of water downstream and power production. The Notice further anticipates that alternatives would provide for increased Lower Division State (Arizona, California, and Nevada) delivery reductions when Lake Mead is below elevation 1050 ('07 Guidelines Section 2.D.1.b.) or 1025 ('07 Guidelines Section 2.D.1.c.).¹

As more fully set forth below, the CBMA includes the elements anticipated by Reclamation's Notice. In addition to revising the specific '07 Guidelines provisions referenced in the Notice, the CBMA assesses 1.543 million acre-feet (maf) per year of reductions among all Lower Basin Contractors when Lake Mead is below elevation 1145 for the protection of critical infrastructure (Infrastructure Protection Volumes, hereinafter referred to as IPV). The undersigned believe implementation of the CBMA would protect Glen Canyon Dam infrastructure, water deliveries, and power production, and adequately mitigate the risk that either Lake Powell or Lake Mead reaches dead pool.

LAKE POWELL OPERATIONS

Reduced releases at Glen Canyon Dam would be accomplished by modeling operations under Sections 6.C. and 6.D. of the '07 Guidelines as follows:

1. Raise the lower elevation of the Mid-Elevation Release Tier (MERT) from elevation 3525 to elevation 3550 and fix the annual release volume in the MERT at 7.48 maf.
2. Raise the upper elevation of the Lower Elevation Balancing Tier (LEBT) from elevation 3525 to elevation 3550 and fix the annual release at 7.0 maf without balancing releases.
3. Reduce releases as necessary to protect elevation 3500.

LAKE MEAD OPERATIONS

Reduced deliveries from Lake Powell must be coupled with reduced deliveries from Lake Mead or Lake Mead's existing storage will be quickly depleted. The CBMA incorporates the following modeling adjustments to the '07 Guidelines and to elevation-dependent Drought Contingency Plan (DCP) contributions required under the Lower Basin Drought Contingency Plan Agreement Dated May 20, 2019, and the incorporated LBOps, to reduce Lake Mead outflows:

1. When Lake Mead is below 1145, Infrastructure Protection Volumes (IPV) consisting of evaporation and system losses in the amount of 1.543 maf are apportioned among all Contractors (as such term is defined in Section XI.F.9. of the '07 Guidelines) in accordance with the methodology outlined in Attachment 1, hereto.
2. Section 2.D.1.a. – no changes.
3. Section 2.D.1.b. – no longer applicable (see 4. below).

¹References to reservoir elevations throughout this correspondence are to January 1 most probable elevations as predicted by the preceding August 24-month study.

4. Section 2.D.1.c. – This provision, involving “Tier 3” shortages below elevation 1025, is moved up to elevation 1050 (i.e., elevation 1025 is replaced with elevation 1050), such that Arizona is apportioned 2.32 maf at elevation 1050 and below, and Nevada is apportioned 280,000 at elevation 1050 and below.
5. Arizona, California, Nevada, and Mexico would make DCP contributions in the amounts set forth in Table 1 of the LBOs as if Lake Mead is at or below elevation 1025 when the actual elevation of Lake Mead is at or below 1050. This would require for years when Lake Mead’s elevation is below 1050 feet DCP Contributions from Arizona in the amount of 240,000 acre-feet, from California in the amount of 350,000 acre-feet, and from Nevada in the amount of 10,000 acre-feet. To maintain parity and alignment of operations during those same years, Mexico would contribute 150,000 acre-feet towards Mexican Water Reserve (under the Binational Water Scarcity Plan of Minute 323).
6. In addition to the above, reductions at elevation 1030 and below and elevation 1020 and below are also part of this CBMA as follows:
 - a. At elevation 1030, a 250,000 acre-feet apportionment reduction in addition to all reductions at higher elevations that shall be apportioned 93,000 acre-feet to Arizona, 10,000 acre-feet to Nevada, and 147,000 acre-feet to California.
 - b. At elevation 1020, a 200,000 acre-feet apportionment reduction in addition to all reductions at higher elevations that shall be apportioned 75,000 acre-feet to Arizona, 8,000 acre-feet to Nevada, and 117,000 to California.
 - c. Additional reductions as necessary to protect elevation 1000.

Lake Powell and Lake Mead cannot be further diminished without unacceptable risk to the Colorado River System. Accordingly, to satisfy the Notice’s purpose and need, any preferred alternative must be sufficiently certain that system storage is maintained without reliance upon remote or speculative actions by third parties.

PARALLEL ACTIVITIES

The undersigned recognize that modifying the ’07 Guidelines is an important piece of the puzzle that might be formulated to protect and maintain the Colorado River’s ability to support 40,000,000 people in the Basin. However, other methods that help secure the water supply of the Basin have been proposed by Reclamation and others. These additional actions should be pursued with alacrity and in parallel with the operational changes contemplated by the SEIS.

One such action is beneficial use definitions and determinations under 43 C.F.R. Part 417 (Procedural Methods for Implementing Colorado River Water Conservation Measures with Lower Basin Contractors and Others). Each industrial, municipal, and agricultural user should be held to the highest industry standards in handling, using, and disposing of water; there is precious little water left to waste.

The Lower Colorado River Multi-Species Conservation Program provides Endangered Species Act compliance for operations of the Lower Colorado River, including water deliveries and hydropower. The actions contemplated in the preferred alternative will likely necessitate expanded compliance for lower Lake Mead elevations and reduced deliveries to all water users, including reductions to only those delivery volumes necessary to protect elevation 1,000 in Lake Mead. It is imperative this compliance moves swiftly and in parallel with this SEIS.

In addition to limiting releases from Glen Canyon Dam when Lake Powell drops below elevation 3550, measures to increase flows into Lake Powell may be needed to help protect water delivery infrastructure and hydropower operations. Accordingly, at appropriate elevations in the modified LEBT, there are parallel complementary actions that are not within the scope of this federal action. However, a reasonable range of their impacts, as further described below, should inform the modeling effort. Those actions include operations pursuant to the Drought Response Operations Agreement (DROA) and additional Upper Division State (UDS) considerations.

DROA planning and operations, including recovery, are conducted consistently with the DROA and existing authorities.² The CBMA includes assumptions regarding DROA releases from zero to 500,000 acre-feet per DROA Year (May 1 – April 30), which will conform to the DROA and its implementing documents and will be made only to help protect Lake Powell elevation 3500 feet.

Additional UDS considerations:

1. Hydrologic shortages are involuntary reductions in consumptive water use due to the lack of physical and legal availability of water. Hydrologic shortages occur to varying degrees annually and on a regular basis. Though hydrologic shortage quantification is complex and unique to each sub-basin each year, it should be estimated to inform this SEIS process using the best available science.
2. Voluntary contributions are voluntary reductions of consumptive use approved by the UDS to help protect elevations in Lake Powell for the duration of this SEIS. Voluntary contributions are generated from programs that result in reductions in consumptive use, such as the System Conservation Pilot Program, an Upper Basin Demand Management Program (if established), or similar actions. Voluntary contribution volumes will likely vary widely based on hydrologic conditions.

Finally, the SEIS should include modeling for the reconciliation of the 480,000 acre-feet withheld by the Secretary in Lake Powell in 2022, without making a final determination.

INCLUSION OF MEXICO

Mexico has been a progressive and dependable partner to the United States and Colorado River water users within the United States even as the worsening supply/demand imbalance has depleted storage within the system. In 2017's Minute 323 to the "United States-Mexico Treaty on Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande" signed February 3, 1944 ("1944 Water Treaty") for example, the United States and Mexico agreed on the "importance of aligning operations for

² 2019 Colorado River Drought Contingency Plan Authorization Act (Pub. L. 116-14).

both countries” and the need for their respective “governments and stakeholders to seek mechanisms to avoid reaching critically low reservoir elevations.” Glen Canyon dam’s infrastructure is currently threatened by significantly reduced inflows over the past two decades, in turn threatening to make deliveries to users in the Lower Basin difficult or impossible. We recognize that the Record of Decision will not determine actions regarding Mexico, and any participation shall be coordinated through the U.S. Section of the International Boundary and Water Commission. However, it is critical to consider the potential impacts of a range of actions including Mexico’s participation.

Accordingly, this CBMA and Attachment 1 hereto contemplate continued alignment of operations for users in both countries. Specifically, for modeling purposes, Mexico is allocated approximately 356,000 acre-feet of IPV reductions when Lake Mead’s elevation is below 1145, Mexico’s shortage volume and Mexico’s Water Reserve savings under Minute 323 is moved to Tier 3 along with the U.S. Contractors any time Lake Mead’s elevation is below 1050.

TERM

The Notice anticipates operational changes in 2024 but indicates that a selected alternative may “inform potential operations in the 2025 and 2026 operating years.” To protect the system through the expiration of the ’07 Guidelines, the undersigned suggest that any preferred alternative be sufficiently robust, even under very dry hydrology, to maintain Lake Powell at elevation 3500 and Lake Mead at elevation 1000 through at least 2026 or the establishment of new guidelines. The NEPA evaluation should similarly be robust enough to avoid a further supplementation process for years 2025 and 2026.

RESERVATION OF RIGHTS

By providing this CBMA, we do not waive any rights, including any claims or defenses, we may have or that may accrue under any existing federal or state law or administrative rule, regulation, or guidelines, including without limitation the Colorado River Compact of 1922, the Boulder Canyon Project Act, the Mexican Water Treaty of 1944, the Upper Colorado River Basin Compact of 1948, the Consolidated Decree of the U.S. Supreme Court in *Arizona v. California*, the Colorado River Storage Project Act of 1956, the Colorado River Basin Project Act of 1968, and any other applicable provision of federal law, rule, regulation, or guideline, including the Administrative Procedure Act. Any failure by the undersigned to address specific aspects of the SEIS, shall not be construed as an endorsement or an admission with respect to any factual or legal issue for the purposes of any future legal, administrative, or other proceeding. Moreover, we reserve the right to provide further comments and engage with Reclamation as it proceeds with subsequent phases of the SEIS process.

CONCLUSION

We appreciate the opportunity to provide this Consensus Based Modeling Alternative for Reclamation’s review within its SEIS process. While Reclamation is preparing the draft SEIS, we commit to continue to work with Reclamation on the CBMA and any additional development and refinement.

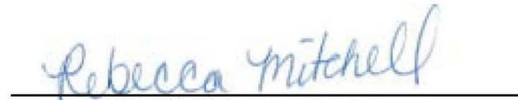
We recognize that over the past twenty-plus years there is simply far less water flowing into the Colorado River system than the amount that leaves it, and that we have effectively run out of storage to deplete. Accordingly, we will continue to work together and with the federal government, water users,

Basin Tribes, non-governmental organizations, and other Colorado River stakeholders to reach consensus on how best to share the burden of protecting the system from which we all derive so many benefits.

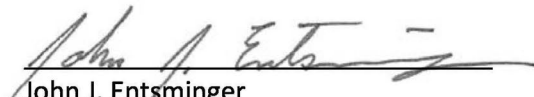
Sincerely,



Thomas Buschatzke
Governor's Representative
State of Arizona



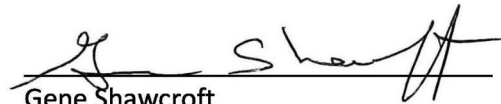
Rebecca Mitchell
Governor's Representative
State of Colorado



John J. Entsminger
Governor's Representative
State of Nevada



Estevan Lopez
Governor's Representative
State of New Mexico



Gene Shawcroft
Governor's Representative
State of Utah



Brandon Gebhart
Governor's Representative
State of Wyoming

cc: David M. Palumbo, Deputy Commissioner – Operations, Bureau of Reclamation
Reclamation 2007 Interim Guidelines SEIS Project Manager, Upper Colorado River Basin Region
Via email: CRinterimops@usbr.gov

Attachments

Attachment 1 - Distribution of Infrastructure Protection Volumes

The modelling assumptions for the Consensus Based Modelling Alternative (CBMA) should allocate Infrastructure Protection Volumes (IPV) and additional reductions among Contractors in the Lower Basin and Mexico using the following method. Please consult with Arizona and Nevada's technical representatives for details or questions.

1. A Contractor's recent Historical Baseline Consumptive Use (Historical Baseline), representative of non-shortage conditions, will be determined in the following manner:
 - a) Compute baseline consumptive use for each Contractor as its 3-year average consumptive use for the 2019-2021 period.
 - b) Any approved (intrastate forbearance) conservation activities, including ICS creation, and system conservation should be added to consumptive uses for each year.
2. Once Lake Mead operating conditions and associated reductions are determined in accordance with the 2007 Interim Guidelines and DCP, Historical Baseline shall be modified to reflect shortage and DCP conditions on the Central Arizona Project, Southern Nevada Water Authority and the Metropolitan Water District of Southern California (CAP/SNWA/MWD) consumptive use. Using the shortage schedules, compute the total shortage assigned to each State as the sum of the 2007 Interim Guidelines and DCP. Compute the adjusted CAP/SNWA/MWD entitlement by subtracting the total state shortage from their respective entitlement. DCP contributions being satisfied with stored ICS shall not be included in this calculation.
3. Historical Baseline shall be modified based upon the water available for consumptive use in the upcoming year (Modified Historical Baseline). *For example, if Nevada is taking 20,000 acre-feet (af) of shortage reductions and 10,000 af of DCP contributions, the historical baseline shall be adjusted such that Nevada is not being assessed an IPV charge for more water than is available to Nevada in the coming year (270,000 af).* If the Historical Baseline is less than the Modified Historical Baseline, carry the Historical Baseline forward.
4. Below elevation 1145' System losses will be assessed as follows:
 - Reach 1 Lee's Ferry to Hoover Dam (580,000 af)
 - Reach 2 Hoover Dam to Davis Dam (193,000 af)
 - Reach 3 Davis Dam to Parker Dam (329,000 af)
 - Reach 4 Parker Dam to Imperial Dam (365,000 af), and
 - Reach 5 Imperial Dam to the NIB (76,000 af)
5. For each reach, the Contractors that rely on the reach to store and/or transmit water deliveries would share proportionally in the system loss for the reach based on their fraction of the total water deliveries within the reach as modified for the upcoming year.
6. The system loss reduction shall be applied to the anticipated consumptive use for the year in which reductions will be applied. Anticipated consumptive use shall be based on the Modified Historical Baseline.

7. Between elevations 1030' and 1020' additional reductions will be assessed pro rata to Contractors' remaining allocations in each State as follows:
Arizona (93,000 af), Nevada (10,000 af), and California (147,000 af)
8. Below elevation 1020' additional reductions will be assessed pro rata to Contractors' remaining allocations in each State as follows:
Arizona (168,000 af), Nevada (18,000 af), and California (264,000 af)

A table of the anticipated Lower Basin and state level reductions is included below. Because past consumptive use, ICS, shortage, and DCP obligations all impact the IPV, these are estimates that should be updated and refined with the help of Reclamation staff.

Lower Basin Totals (all reductions in 1000 acre-feet)						
Tier	Elevation	IG	DCP	IPV	Add'l Reductions	Total
Tier 0	1090-1075	0	241	1,543	0	1,784
Tier 1	1075-1050	383	230	1,543	0	2,156
Tier 2a	1050-1045	625	750	1,543	0	2,918
Tier 2b	1045-1040	625	750	1,543	0	2,918
Tier 2c	1040-1035	625	750	1,543	0	2,918
Tier 2d	1035-1030	625	750	1,543	0	2,918
Tier 2e	1030-1025	625	750	1,543	250	3,168
Tier 3a	1025-1020	625	750	1,543	250	3,168
Tier 3b	1020-1015	625	750	1,543	450	3,368
Tier 3c	1015-1000	625	750	1,543	450	3,368

Tier	Elevation	Arizona					Nevada					California					Mexico				
		IG	DCP	IPV	Add'l Reductions	Total	IG	DCP	IPV	Add'l Reductions	Total	IG	DCP	IPV	Add'l Reductions	Total	IG	DCP	IPV	Add'l Reductions	Total
Tier 0	1090-1075	0	192	408	0	600	0	8	17	0	25	0	0	766	0	766	0	41	351	0	392
Tier 1	1075-1050	320	192	387	0	899	13	8	18	0	39	0	0	782	0	782	50	30	356	0	436
Tier 2a	1050-1045	480	240	374	0	1,094	20	10	19	0	49	0	350	816	0	1,166	125	150	335	0	610
Tier 2b	1045-1040	480	240	374	0	1,094	20	10	19	0	49	0	350	816	0	1,166	125	150	335	0	610
Tier 2c	1040-1035	480	240	374	0	1,094	20	10	19	0	49	0	350	816	0	1,166	125	150	335	0	610
Tier 2d	1035-1030	480	240	374	0	1,094	20	10	19	0	49	0	350	816	0	1,166	125	150	335	0	610
Tier 2e	1030-1025	480	240	369	93	1,182	20	10	19	10	59	0	350	813	147	1,309	125	150	343	0	618
Tier 3a	1025-1020	480	240	369	93	1,182	20	10	19	10	59	0	350	813	147	1,309	125	150	343	0	618
Tier 3b	1020-1015	480	240	364	168	1,252	20	10	19	18	67	0	350	810	264	1,424	125	150	350	0	625
Tier 3c	1015-1000	480	240	364	168	1,252	20	10	19	18	67	0	350	810	264	1,424	125	150	350	0	625

* All values are in 1000 acre-ft

January 31, 2023

Deputy Interior Secretary Tommy Beaudreau
Assistant Secretary for Water and Science Tanya Trujillo
Bureau of Reclamation Commissioner Camille Calimlim Touton

Dear Deputy Secretary Beaudreau, Assistant Secretary Trujillo, and Commissioner Touton:

The Colorado River Board of California (CRB)¹ appreciates the opportunity to submit an alternative for the Bureau of Reclamation (Reclamation) to analyze as part of Reclamation's preparation of a Supplemental Environmental Impact Statement (SEIS) for the December 2007 Record of Decision entitled "Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead."

As described in the Notice of Intent (NOI) to prepare this SEIS, if low runoff conditions into Lake Powell and Lake Mead continue, Reclamation's ability to protect dam infrastructure, make full water deliveries, and generate hydropower could be significantly impacted and result in the need to operate Glen Canyon and/or Hoover Dam in a manner beyond the scope of the 2007 Guidelines Record of Decision (2007 Guidelines ROD). 87 FR 69043 (November 17, 2022). Any modifications made to the operations of Lake Powell and Lake Mead as part of this process — particularly in the absence of a true consensus approach — need to be consistent with applicable federal laws, interstate compacts, and decrees and provide certainty to water contractors, protection of stored Intentionally Created Surplus and public health, safety, and welfare (as determined by each state) through the interim period.

Since Reclamation published the NOI in November, California has worked with the other Colorado River Basin States in an attempt to develop a joint Framework Agreement Alternative. Unfortunately, despite numerous meetings and intensive good-faith efforts, a seven-state consensus was not reached. Therefore, California respectfully submits the attached alternative for Reclamation's consideration, modeling, and analysis. The development of alternatives is the first step of the SEIS process. California looks forward to continuing collaborative work with the Basin States,

¹ Established in 1937, the Board protects the interests and rights of the agencies and citizens of the State of California to the water and power resources of the Colorado River System. The ten-person Colorado River Board is comprised of representatives from the Coachella Valley Water District, Imperial Irrigation District, Los Angeles Department of Water and Power, The Metropolitan Water District of Southern California, Palo Verde Irrigation District, San Diego County Water Authority, California Department of Water Resources, California Department of Fish and Wildlife, and members of the public.

Reclamation, and the Interior Department to develop consensus-based approaches. California appreciates Reclamation's recognition of the need to initiate this process. Our state's proposed alternative makes a constructive effort to uphold the Law of the River while making substantial efforts to protect the Colorado River system with voluntary reductions far beyond California's legal obligations. The 40 million people, nearly 6,000,000 acres of agriculture, and 30 Indian tribes that rely on the Colorado River require us to be successful in this effort. As this process moves forward, the State of California and California's Colorado River Contractors remain committed to continuing to work with you and others across the basin to protect the system. Now is the time to step up and demonstrate leadership through action and the development of other collaborative, innovative opportunities for basin-wide solutions.

Development and Evaluation of Alternatives

California proposes the attached alternative for Reclamation to analyze as part of the SEIS. California's alternative includes actions that build on the existing Colorado River reservoir management and operations framework. The NOI identifies that Reclamation may propose modifications to Sections 2, 6, and 7 of the 2007 Guidelines ROD for 2023, 2024, and possibly through the expiration of the 2007 Guidelines in 2026. The NOI anticipates that Reclamation will analyze alternatives, including a No Action Alternative and a Reservoir Operations Modification Alternative to be developed by Reclamation as a set of actions and measures adopted under Secretarial authority pursuant to applicable federal law. Given the brief period of time before the 2007 Guidelines ROD expires, California's alternative emphasizes additional voluntary reductions in water use.

California intends through its alternative proposed modifications to the 2007 Guidelines ROD to protect Lake Mead elevation of 1,000 feet and Lake Powell elevation of 3,500 feet by discontinuing the use of operational neutrality described in the May 3, 2022 letter regarding actions to protect Lake Powell, making changes to Lake Powell operational tiers and releases, modifying shortage conditions, and other changes described in the attachment. This alternative provides a realistic and implementable framework to address reduced inflows and declining reservoir elevations by building on voluntary agreements and past collaborative efforts in order to minimize the risk of legal challenge or implementation delay. California's alternative uses adaptive management to protect critical reservoir elevations through the interim period.

California's Actions Benefitting Lake Mead

California's Colorado River Contractors committed to conserving up to an additional 1,600,000 acre-feet of Colorado River water starting in 2023 and continuing until 2026, as described in CRB's October 5, 2022 letter. California was the first state to commit to conserving specific volumes of additional water after Commissioner Touton's call for further basin-wide conservation in June 2022. The State of California and California's Colorado River Contractors appreciate the Interior Department's collaboration and partnership at the Salton Sea, which will help facilitate this additional conservation of

Colorado River water in California. In 2019, California also agreed to participate in the Drought Contingency Plan (DCP), committing to make up to 350,000 acre-feet of DCP contributions annually. Between these two commitments, California could voluntarily reduce its use of Colorado River water by up to 750,000 acre-feet annually — even though California is not required to take shortages under the 2007 Guidelines ROD. Since the 2007 Guidelines ROD was adopted, California’s investments and conservation in various efforts including Intentionally Created Surplus, the 500+ Plan, and other forms of voluntary conservation raised the elevation of Lake Mead by more than 20 feet preventing Lower Basin shortage conditions for years before the first shortage was declared in 2022.

California’s Quantification Settlement Agreement

Prior to 2003, California historically relied on and put to beneficial use surplus Colorado River water. As Arizona and Nevada fully developed their allocations, this surplus water was no longer available. Federal action to ensure that California reduced its use of Colorado River water to the state’s legal entitlement triggered a difficult and expensive intra-state process that necessitated transfers and exchanges of Colorado River water from agricultural to urban uses through a complex set of agreements. California’s 2003 Quantification Settlement Agreement (QSA), the Colorado River Water Delivery Agreement (Federal QSA), and associated agreements permanently reduced California’s Colorado River water use by 800,000 acre-feet per year — even after decades of dependence on that supply by millions of urban users — through various water management programs that form the nation’s largest agricultural-to-urban water conservation and transfer agreement. These agreements also include shortage sharing provisions and obligations between California water providers that could be affected by the SEIS and related modifications to the 2007 Guidelines ROD in ways that cause disproportionate and unintended consequences on these California water providers. These shortage sharing provisions in California’s intrastate agreements are not well understood outside of California.

Just as the State of California was able to find ways to develop and implement intra-state agreements to drastically reduce water use and live within the state’s limited Colorado River water supply, so too may the State of Arizona be required to make similar arrangements to live within its available Colorado River water supplies. While California was able to complete the QSA only after a highly contentious legal, political, and policy process between various parties driven by the threat of unilateral federal action. Twenty years later the QSA serves as an example of temporary conflict caused by scarcity leading to long-term cooperation for sustainability — a model that other basin states and Reclamation should strongly consider.

The Absence of Consensus Agreement Between States Defaults to the Law of the River

In the absence of a seven-state consensus proposal, the SEIS process and the preferred alternative should maintain existing protections to California’s senior entitlements, protect stored ICS, and protect public health, safety, and welfare as

determined by each state (and particularly for disadvantaged communities with no alternative water supplies) through the interim period. The SEIS documents should address the manner in which the water demands within the states affected by a shortage declaration will be managed pursuant to the 1968 Colorado River Basin Project Act and the *Arizona v. California* consolidated decree. This approach would be comparable to the one used to develop Exhibit B contained in the 2003 Colorado River Water Delivery Agreement executed by the Department of the Interior pursuant to the Interim Surplus Guidelines.

The CRB appreciates the opportunity to provide California's alternatives for analysis in the SEIS and looks forward to working with Reclamation, the Interior Department, the Basin States, and Basin State Tribes throughout this process.

In partnership,

A handwritten signature in black ink that reads "JB Hamby". The signature is written in a cursive, flowing style.

JB Hamby
Chairman, Colorado River Board of California
Colorado River Commissioner, State of California

ATTACHMENT 1

CALIFORNIA SEIS MODELING FRAMEWORK ALTERNATIVE

PROPOSED LAKE POWELL & GLEN CANYON DAM OPERATIONS

1. Remove Operational Neutrality (i.e., use Powell actual water surface elevation to determine release tier).
2. EQUALIZATION TIER – Operations in this Tier conducted pursuant to the 2007 Interim Shortage Guidelines (ISG) Record of Decision (ROD).
3. UPPER ELEVATION BALANCING TIER – Below Equalization Tier to 3,575'. Balancing releases range between 9.0-7.0 MAF. Potential for recovery of prior Drought Operations Agreement (DROA) releases and the WY-2022 reduced Lake Powell release volume of 480 KAF.
4. MIDDLE ELEVATION RELEASE TIER – Spans Lake Powell elevations 3,575' to 3,550'. Annual releases from Glen Canyon Dam range between 8.23-7.48 MAF. Implement up to 100 KAFY of Upper Basin Demand Management activities to create additional protection volume for Lake Powell.
5. LOWER ELEVATION BALANCING TIER – Spans Lake Powell elevations 3,550' to 3,500'. Lake Powell annual release ranges between 7.48 - 7.0 MAF, unless lower releases are necessary to keep Lake Powell above elevation 3,500'. Implement up to 500 KAF DROA releases and up to 500 KAF of Upper Basin Demand Management activities to create additional protection volume for Lake Powell to absolutely protect elevation 3,500'.
6. $\leq 3,500'$ – Lake Powell releases restricted to maintain absolute Lake Powell protection of elevation 3,500'.

PROPOSED LAKE MEAD & HOOVER DAM OPERATIONS

1. Remove Operational Neutrality (i.e., use Mead actual water surface elevation to determine operating condition). This will increase the frequency and volume of shortage and Lower Basin Drought Contingency Plan (DCP) contributions without the need to modify agreements.
2. At all elevations below 1,145', provide 1.0 MAFY of additional interim period protection volumes. These volumes could be achieved through voluntary or mandatory means. California has proposed to conserve 400 KAFY of this volume through voluntary actions and its water districts are developing programs to initiate this plan in 2023. Proposed allocation of the remaining volume is based

on previous negotiations among the states: 560 KAFY to Arizona and 40 KAFY to Nevada.

3. Implement reductions described in the ISG, DCP, and Minute No. 323 using the existing schedules and volumes specified in those agreements, except that stored ICS may be delivered below 1,025' to meet human health and safety requirements .
4. If Lake Mead elevations decline further, Reclamation should reduce releases from Lake Mead in addition to the above volumes as follows:
 - a. $\leq 1,025'$: 150 KAFY
 - b. $\leq 1,020'$: 300 KAFY
 - c. $\leq 1,015'$: 500 KAFY
 - d. $\leq 1,010'$: 750 KAFY
 - e. $\leq 1,005'$: 950 KAFY

These reductions should be applied using existing authorities or implemented through additional voluntary compensated conservation agreements.

5. If these actions are insufficient, Lake Mead releases should be further restricted in order to preserve elevation 1,000'. Utilize the existing framework of the "Law of the Colorado River" and Priority System to deliver available supply to Present Perfected Rights, Federal Reserved Rights, and other senior water rights until available annual supply exhausted. If additional water is required to meet human health and safety requirements, stored ICS water may be released below 1,000'. Facilitate development of intrastate partnerships and/or temporary transfers to meet outstanding HHS needs if contractor's alternative water supplies are insufficient.
6. If necessary to keep Lake Mead above elevation 1,000', consider utilization of a periodic release (e.g., 250-500 KAF) from Lake Mohave to assist in meeting the annual U.S./Mexico Water Treaty delivery obligation.

Table 1: Proposed Lower Basin Reductions

Lake Mead Elevation	Baseline Reductions (ISG, DCP, Minute 323) (KAF)	Additional 1.0 MAF below 1,145' (KAF)	Additional Protection Volumes (KAF)	Cumulative Protection Volumes (KAF)
1,145	-	1,000	-	1,000
1,090	241	1,000	-	1,241
1,075	613	1,000	-	1,613
1,050	721	1,000	-	1,721
1,045	1,013	1,000	-	2,013
1,040	1,071	1,000	-	2,071
1,035	1,129	1,000	-	2,129
1,030	1,188	1,000	-	2,188
1,025	1,375	1,000	150	2,525
1,020	1,375	1,000	300	2,675
1,015	1,375	1,000	500	2,875
1,010	1,375	1,000	750	3,125
1,005	1,375	1,000	950	3,325
1,000*	1,375	1,000	950	3,325

*Additional reductions would be implemented to prevent Lake Mead from declining below elevation 1,000'.

John Fleck
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University of New Mexico School of Law
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fleckj@unm.edu

Dec. 20, 2022

Comments on preparation of a Supplemental Environmental Impact Statement for 2007 Record of Decision Entitled Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations For Lake Powell and Lake Mead

Sent via email to CRinterimops@usbr.gov

Reclamation 2007 Interim Guidelines SEIS Project Manager
Upper Colorado Basin Region, 125 South State Street, Suite 8100
Salt Lake City
Utah 84138

Dear SEIS Project Manager -

I thank you for this opportunity to contribute my suggestions to your efforts to save the Colorado River Basin and the economy and culture of the Western United States from the risk of catastrophe. What is at stake here is no less than that – the fate of this beloved region.

We as a community have made mistakes in managing the Colorado River, and we are now at the mercy of those mistakes. We cannot undo them, but we must learn from them.

The heart of our mistakes is this: we have obeyed a Law of the River that, year after year, permitted us to remove more water from the Colorado River than nature provided.

We now understand, to our great regret and peril, that the law is an ass.

As reservoirs reach critical elevations, we must be willing, if needed, to manage the Colorado River as an inflow-outflow system: the amount we take out for our communities' uses cannot continue to exceed the amount nature puts in.

My proposal, which I hope might be considered in your analysis, is four-fold

- sharply curtail water use in the Lower Colorado River Basin through a restructuring of section 2D of the 2007 Interim Guidelines, immediately;
- structure the Lower Basin cuts in a way that even deeper reductions *shall* be made if the hydrology demands it;
- adjust the framework for calculating releases from Glen Canyon Dam in order to protect critical elevations at the dam and, more importantly, begin refilling the reservoir;

- create a framework that leaves the door open for additional contributions from water users in the Upper Basin and Mexico toward the shared goal of saving the system and the West.

The problem

At least a dozen years ago, the Bureau of Reclamation began decorating its presentations with a slide that would be repeated in various forms in ensuing years. It showed what came to be known as “the structural deficit”¹ – the 1.2 million acre foot imbalance between the Upper Colorado River Basin’s deliveries from Lake Powell and the Lower Colorado River Basin’s use of water from Lake Mead. By failing to consider evaporation and system losses, the Supreme Court pointed the river’s management bus toward a ditch. In the years since, we were unable to grab the wheel and turn it. We are now in that ditch.

Modeling done in the years that followed suggested that the 2007 Interim Guidelines – the rules at issue again today in this Supplemental Environmental Impact Statement – were insufficient to protect the Colorado River system from crashing.²

An agreement calling for additional reductions, the “Drought Contingency Plan”, negotiated in the ensuing years but not signed until 2019, was similarly insufficient. Scenarios from Reclamation’s modelers presented during the agency’s Nov. 29 and Dec. 2, 2022, Supplemental Environmental Impact Statement briefings show that, under a credible low flow scenario (responsive to the changes in the climate that we have seen in the last two decades), elevations at Lake Powell could drop by summer 2023 below elevation 3,490. Absent steps to reduce Lake Powell releases to prevent that, Reclamation would be forced to use Glen Canyon Dam’s “river outlets”, which were not designed for sustained operations.³

Avoiding those risks by decreasing releases from Glen Canyon Dam would then, under this modeling scenario, send Lake Mead into free fall – to “dead pool”, the point at which the only water that leaves the reservoir is the amount flowing in - within two years. At that point hydrologic reality will dictate

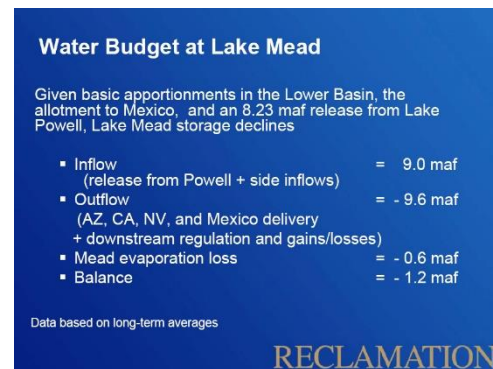


Figure 1 Fleck, May 2010; *River Beat: Why is Lake Mead Dropping?*; <https://www.inkstain.net/2010/05/river-beat-why-is-lake-mead-dropping/>

¹ Kuhn, Eric, and John Fleck. *Science be Dammed: how ignoring inconvenient science drained the Colorado River*. University of Arizona Press, 2019; p. 7

² *ibid.*, p. 205-07

³ Comments by Assistant Secretary of Interior Tanya Trujillo, Wallace Stegner Center Symposium, March 17, 2022

releases to water users in the Lower Basin – municipalities, tribes, farm communities, and Mexico – far less than contemplated in Section 2D of the 2007 Interim guidelines.

I detail my specific suggested revisions in detail below, but in narrative form, I ask that you analyze the following possible changes to the Colorado River’s operation:

Suggested Actions

Lake Powell Releases

The current “Mid-Elevation Release Tier” and “Lower Elevation Release Tier” should be replaced with a single “balancing tier” beginning at elevation 3,575 in Lake Powell. Below that point, Reclamation should “balance” the active storage in Lake Mead and Lake Powell, where “active storage” is redefined as the total available storage above elevation 3,515 in Lake Powell and 975 in Lake Mead – in each case, preserving 25 feet of risk mitigation water above minimum power pool in each reservoir.

Mead and Powell would then rise and fall together based on hydrology and use.

Importantly, there will be no minimum Powell release set in the new guideline – the risk of bad hydrology would be shared equally between the two basins.

Other numbers could be chosen for the elevations in Mead and Powell to protect, reflecting tradeoffs. Higher elevations would require cutting uses more now to protect against future risk. Lower elevations would trade allow more use now, at the expense of creating greater risk later.

Lake Mead Releases

Accepting the reality of the old “structural deficit” slide requires the immediate reduction of 1.2 million acre feet in use by the Lower Basin states, *now*. But the slide’s analysis falls short, presuming the river can continue to deliver 9 million acre feet per year in Lee Ferry flows and side inflows between Glen Canyon Dam and Lake Mead. We can no longer rely on that.

I recommend a release table that reduces the allocation available to the Lower Basin States by 1.5 million acre feet, to be shared proportionally by the three basin states relative to their full Arizona v. California allocation.

- California: 3.52 million acre feet
- Arizona: 2.24 million acre feet
- Nevada: 240,000 acre feet

As Lake Mead drops, the allocations would be reduced by the amount already negotiated by the states in the Interim Guidelines and Drought Contingency Plan. Should Lake Mead rise above elevation 1,125, the allocations would revert to their normal levels. Below that point, the Secretary would make a finding

under the 2006 Supreme Court Decree in the case of Arizona v. California that insufficient mainstream water is available to satisfy annual consumptive use of 7,500,000 in the Lower Basin states.

elevation	total	CA	AZ	NV
>1125	7.5	4.4	2.8	0.3
1125-1075	6.00	3.52	2.24	0.24
1075-1050	5.67	3.52	1.92	0.23
1050-1025	5.38	3.32	1.84	0.22
1025-1000	4.90	3.17	1.52	0.21
<1000	4.00	2.35	1.49	0.16

To be clear, this proposal if implemented will help guard against Lake Mead ever dropping into those lowest tiers. But we must not repeat a crucial mistake of the past. We need to know, today, what our plan is if, despite our best efforts, the hydrology takes us there.

Upper Basin Contribution

By permitting annual Lee Ferry releases to drop as far as it does, this plan creates a real risk for the states of the Upper Colorado River Basin that flows at Lee Ferry could drop below 82.5 million acre feet over a 10 year period, or even 75 million acre feet over a ten year period. That creates real risk of Colorado River Compact litigation that, depending on its outcome, might force curtailment of post-Compact rights in the Upper Basin.

In its NEPA analysis, Reclamation must model this risk.

In focusing on Sections 2D, 6C, 6D, and 7C of the Interim Guidelines, the Department of Interior leaves little space for imposing mandatory reductions in the Upper Basin. But the scenario outlined above or something very much like it - inevitable given hydrologic reality - suggests space for the sort of “grand bargain” that has been talked about in the basin for years: an Upper Basin contribution of water use reductions of some sort in return for a Lower Basin agreement not to pursue litigation as Lee Ferry deliveries fall.⁴

Both Upper and Lower Basin have strong incentives for a “consensus plan”, as encouraged by the Department of Interior, that would include concessions on both sides and would serve the basin well.

⁴ Kuhn, 2012, Risk Management Strategies for the Upper Colorado River Basin

Given the clear advantages of such a solution, I ask that you model the effect of a variety of hypothetical Upper Basin contributions ranging from 100,000 to 500,000 acre feet per year in foregone consumptive use to the resulting storage balances in Lake Powell and Lake Mead under a variety of hydrologies.

Impact on the Tribes

The analysis to be done in support of this decision must include analyses of the impact of the alternatives on the 30 Native American Sovereigns in the Colorado River Basin, including but not limited to those tribes with quantified and fully used water rights, those with water rights that have been quantified but not yet put to use, and those whose rights have not yet been quantified.

The Specifics

Rewrite Section 2.A of the interim Guidelines as follows:

1. Lake Mead above elevation 1,125 and below elevation 1,145

In Years when Lake Mead elevation is projected to be above 1,125 and below elevation 1,145 on January 1, the Secretary shall determine either a Normal Condition, or, under Section 2.B.5, an ICS Surplus Condition.

Rewrite Section 2.D.1 of the Interim Guidelines as follows:

- a. In years when Lake Mead content is projected to be at or below elevation 1,125 feet and at or above 1,075 feet on January 1, a quantity of 6 maf shall be apportioned for consumptive use in the Lower Division States of which 2.24 maf shall be apportioned for use in Arizona and 240,000 af shall be apportioned for use in Nevada in accordance with the Arizona-Nevada Shortage Sharing Agreement dated February 9, 2007, and 3.52 maf shall be apportioned for use in California.
- b. In years when Lake Mead content is projected to be at or below elevation 1,075 feet and at or above 1,050 feet on January 1, a quantity of 5.67 maf shall be apportioned for consumptive use in the Lower Division States of which 1.92 maf shall be apportioned for use in Arizona and 230,000 af shall be apportioned for use in Nevada in accordance with the Arizona-Nevada Shortage Sharing Agreement dated February 9, 2007, and 3.52 maf shall be apportioned for use in California.
- c. In years when Lake Mead content is projected to be at or below elevation 1,050 feet and at or above 1,025 feet on January 1, a quantity of 5.38 maf shall be apportioned for consumptive use in the Lower Division States of which 1.84 maf shall be apportioned for use in Arizona and 220,000 af shall be apportioned for use in Nevada in accordance with the Arizona-Nevada Shortage Sharing Agreement dated February 9, 2007, and 3.17 maf shall be apportioned for use in California.

- d. In years when Lake Mead content is projected to be at or below elevation 1,025 feet and at or above 1,000 feet on January 1, a quantity of 4.90 maf shall be apportioned for consumptive use in the Lower Division States of which 1.52 maf shall be apportioned for use in Arizona and 210,000 af shall be apportioned for use in Nevada in accordance with the Arizona-Nevada Shortage Sharing Agreement dated February 9, 2007, and 3.17 maf shall be apportioned for use in California.
- e. In years when Lake Mead content is projected to be at or below elevation 1,000 feet, a quantity of 4 maf shall be apportioned for consumptive use in the Lower Division States of which 1.52 maf shall be apportioned for use in Arizona and 210,000 af shall be apportioned for use in Nevada in accordance with the Arizona-Nevada Shortage Sharing Agreement dated February 9, 2007, and 2.35 maf shall be apportioned for use in California.

Rewrite Section 6.C of the Interim Guidelines as follows:

1. In Water Years when the projected Jan. 1 Lake Powell elevation is below 3,575 feet, the Secretary shall balance the contents of Lake Mead and Lake Powell, where the balancing volume is determined by the total storage in Lake Mead above elevation 975 feet and the balancing volume in Lake Powell is the total storage above elevation 3,515 feet.

Eliminate Section 6.D of the Interim Guidelines

Rewrite the final sentence of Section 7.C. of the Interim Guidelines as follows (additional language underline)

For Lake Mead, the Secretary in any mid-year review for the current Year to allow for additional or reduced deliveries from Lake Mead pursuant to Section 2 of these guidelines to prevent Lake Mead from dropping below elevation 975 in the remainder of the year.

Conclusion

I have long argued that it does not matter what I, a writer and quasi-academic, thinks should be done to solve the problems of the Colorado River Basin. What matters, I have argued, is what can emerge from the consensus of the basin water users.

But that consensus has failed us, left us with wrecked speedboats emerging from the depths of Lake Mead as the reservoir drops away from its old shorelines.

That consensus process has left us with reasonable near-term projections from Reclamation's scientists of reservoirs reaching dead pool if we see a repeat of dry years we all have already lived through.

I still believe a consensus plan from the States is a preferred alternative. But a credible alternative plan will be needed – to encourage the States to come up with their own, better plan. And to save the Colorado River if they do not.

Title I of the National Environmental Policy Act nicely frames the task ahead. It calls on us to “fulfill the responsibilities of each generation as trustee of the environment for succeeding generations”. That is our charge at this critical moment.

Sincerely,

A handwritten signature in black ink that reads "John Fleck". The signature is written in a cursive, slightly slanted style.

John Fleck

The Chemehuevi Indian Tribe, the Colorado River Indian Tribes, the Quechan Tribe and the Cocopah Tribe

The above named four tribes with mainstream allocations to the Colorado River as decreed in Arizona v. California submit the following principles and modeling assumptions with the request that Reclamation develop an alternative for the Supplemental EIS that includes each of these.

February 15, 2023

Submitted to: Genevieve Johnson at: gjohnson@usbr.gov; CRinterimops@usbr.gov

Principles:

1. Reductions to tribal water allocations and use must be voluntary and compensated. *See also December 20, 2022, comments Yuma County Agriculture Water Coalition; See December 20, 2022, comments from Pacific Institute and NRDC.*
2. Existing mechanisms should be used and expanded to help stabilize the Lower Basin including compensated forbearance (e.g. Quechan-MWD Agreement) and compensated rotational fallowing programs (CRIT System Conservation and the PVID-MWD agreements) *See January 31, 2023, proposal from the Colorado River Board of California.*
3. Lower basin system losses must be assessed according to existing contract provisions and possible new rules or regulations that may be adopted after public review.
 - a. The Six-States proposal does not include or reference the data or analysis that resulted in 1.543maf of system losses from evaporation and evapotranspiration. As of February 10, this information is not being provided by Arizona or Nevada.
 - b. There are many alternate ways to assess system losses from evaporation including reservoir evaporation assessed against the users, evaporation losses tied to atmospheric conditions and lake elevations, and a calculation of total evaporation loss or net evaporation loss from a reservoir as opposed to a pre-dam River.
 - c. System losses for evapotranspiration do not appear to distinguish from habitat for endangered species that may or may not be assessed against a water user and other vegetation and may encourage an ultimate result of eliminating the vegetation along the river to eliminate these losses.
4. The Six-States proposal inequitably affects tribal first-priority present perfected water rights and disproportionately impacts tribal governments who rely on the direct and indirect use of their water rights to fund critical governmental functions.

Requested assumptions to be included in Lower Basin Modeling

1. Convert the compensated system conservation that Reclamation is funding and creating to Intentionally Created Surplus in a Reclamation account for purposes of modeling. The goal is to determine if the water that Reclamation funds as system conservation can be carried over in Lake Mead from year-to-year to create a volume of water to maintain a minimum pool at Lake Mead and thereby protect critical infrastructure. This could be a true protection volume (PV)
 - a. The PV would be assessed evaporation losses annually as provided in the 2007 Interim Guidelines, not the one-time assessment as provided in the DCP.
 - b. Reclamation would continue the compensated program to increase the base amount of water in Lake Mead to replenish evaporation losses and to target critical elevations
 - c. It is hoped that the modeling will indicate the avoidance of having to make very large cuts each year and continuously having to fund system conservation to stabilize Lake Mead.

2. Maintain sufficient flow in the Colorado River below Lee Ferry and below Hoover Dam for the Colorado to be a living River through all reaches. This will require coordination with the Adaptive Management Work Group and minimum flows for compliance with the Grand Canyon Protection Act. *See December 20, 2022, City of Phoenix Comments, December 20, 2022, NGO Comments*
 - a. Preserve habitat and species and the cultural connections between and among tribes, other communities, and the River.
 - b. Provide additional funding for habitat protection and restoration and ensure that the water used for this purpose is not accounted for as losses from evapotranspiration or transmission.
 - c. Determine if DROA releases or compensated system conservation as described in number 1 above would provide protection volumes or water for minimum flows from Lake Powell

Assess the impacts to the five mainstream tribes in the Lower Basin as a unitary amount without regard to state lines. The tribal water rights are to serve each Reservation and are accounted for against the state apportionments. Reclamation should model each Reservation as one unit and provide the information about the impacts from extremely low conditions on the River to each tribe from the Ft. Mohave reservation near Hoover Dam to the Cocopah reservation south of the Northly International Border.