BUREAU OF RECLAMATION

Draft Report

Review of the Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead

Upper and Lower Colorado Basin Regions

U.S. Department of the Interior

October 2020

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The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

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Review of the Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead

Upper and Lower Colorado Basin Regions

Cover Photo: Glen Canyon Dam, Hoover Dam. (Reclamation)

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Acronyms and Abbreviations

1944 Water Treaty	*United States-Mexico Treaty on Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande* signed February 3, 1944
7.D. Review	Review of the Effectiveness of the 2007 Colorado River Interim Guidelines
af	acre-foot (feet)
AOP	Annual Operating Plan for the Colorado River Reservoirs
Basin	Colorado River Basin
Basin States	Colorado River Basin States
Basin Study	Colorado River Basin Water Supply and Demand Study
BICS	Binational Intentionally Created Surplus
BWSCP	Binational Water Scarcity Contingency Plan
CAWCD	Central Arizona Water Conservation District
CBRFC	National Weather Service's Colorado Basin River Forecast Center
cfs	cubic foot (feet) per second
CRSS	Colorado River Simulation System
CY	calendar year
DCP(s)	Drought Contingency Plan(s)
Department	U.S. Department of the Interior
Drought MOU	*Memorandum of Understanding for Lower Basin Pilot Drought Response Actions*
EC	Extraordinary Conservation
EIS	environmental impact statement
EOWY	end of water year
ESP	Ensemble Streamflow Prediction
Final EIS	*Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead Final Environmental Impact Statement*
Forbearance Agreement	*Lower Colorado River Basin Intentionally Created Surplus Forbearance Agreement*
GCD AMWG	Glen Canyon Adaptive Management Work Group
Guidelines	Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead
HFE	High Flow Experiment
IBWC	International Boundary and Water Commission, U.S. and Mexico
ICS	Intentionally Created Surplus

IID	Imperial Irrigation District
kaf	thousand acre-feet
LROC	*Criteria for Coordinated Long-Range Operation of the Colorado River Reservoirs*
LTEMP	*Glen Canyon Dam Long-Term Experimental and Management Plan*
maf	million acre-feet
MAE	mean absolute error
Mexico	Country of Mexico
Moving Forward Effort	*Colorado River Basin Stakeholders Moving Forward to Address the Challenges Identified in the Basin Study*
MTOM	Mid-term Operations Probabilistic Model
MWD	Metropolitan Water District of Southern California
NEPA	National Environmental Policy Act
NGO	non-governmental organization
NPS	National Park Service
Partnership	Ten Tribes Partnership
Pilot Program	*Pilot Program For Funding the Creation of Colorado River System Water through Voluntary Water Conservation and Reductions in Use*
PSCP	Pilot System Conservation Program (Lower Basin)
Reclamation	Bureau of Reclamation
ROD	*Record of Decision for Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead*
SCPP	System Conservation Pilot Program (Upper Basin)
SE	System Efficiency
Secretary	Secretary of the Interior
SNWA	Southern Nevada Water Authority
SOPs	Standing Operating Procedures
TC	Tributary Conservation
Tribal Water Study	Colorado River Basin Ten Tribes Partnership Tribal Water Study
USIBWC	United States Section of the International Boundary and Water Commission
WY	water year
YDP	Yuma Desalting Plant
YMIDD	Yuma Mesa Irrigation and Drainage District

Note to reader: In addition to these acronyms and abbreviations, this Report utilizes the definition from Section XI.F. of the ROD.

1 Introduction

Spurred by an ongoing multi-year drought, decreasing system storage, and growing demands for Colorado River water, in December 2007, Secretary of the Interior (Secretary) Kempthorne approved the Record of Decision (ROD) for the *Colorado River Interim Guidelines for Lower Basin Shortages and the Coordinated Operations for Lake Powell and Lake Mead* (Guidelines) (U.S. Department of the Interior [Department], 2007). The Guidelines, which are anticipated to be in place for an interim period through 2026[1], provide operating criteria for Lake Powell and Lake Mead including provisions designed to provide a greater degree of certainty to water users about timing and volumes of potential water delivery reductions, and additional operating flexibility to conserve and store water in the system.

The interim nature of the Guidelines provided the opportunity to gain valuable experience for the management of Lake Powell and Lake Mead under modified operations and improve the basis for making future operational decisions, whether during the interim period or after. The requirement to document this experience is set forth in Section XI.G.7.D. of the ROD: "Beginning no later than December 31, 2020, the Secretary shall initiate a formal review for purposes of evaluating the effectiveness of these Guidelines. The Secretary shall consult with the Basin States in initiating this review" (7.D. Review). In December 2019, Secretary Bernhardt directed the Bureau of Reclamation (Reclamation) to begin a review of the Guidelines in early 2020. This Report is the culmination of that process.

This Report documents Reclamation's operational experience and provides a retrospective evaluation of whether operations and actions specified by the Guidelines have adhered to common themes and been effective with respect to the purpose stated in the ROD. The results of this evaluation are not intended to imply correctness of any particular operational provision or recommend future policies or actions. Reclamation anticipates that this Report will be a valuable source of information during upcoming activities in support of post-2026 operational guidelines -- but that this Report is only *one of many* sources of information that will be relied on to guide that process and inform upcoming decisions on operations. Reclamation recognizes there are other areas of interest beyond the scope of this Report that should be considered in future discussions. These topics include but are not limited to the impacts to environmental, recreational, and hydropower resources, how to meaningfully engage representation of perspectives from a diverse group of partners and stakeholders, and other recommendations from tribes, states and other stakeholders. Reclamation anticipates that additional studies and activities will be undertaken and used to inform discussions related to future operations of Lake Powell and Lake Mead.

Written comments on this draft Report are encouraged and are requested by November 13, 2020. For information about how to submit comments, visit the 7.D. Review website.

[1] Except for the special provisions described in Section XI.G.8. of the ROD, the Guidelines are anticipated to remain in effect through December 31, 2025 (through preparation of the 2026 Annual Operating Plan). With the exception of certain Intentionally Created Surplus (ICS) recovery and Upper Basin demand management provisions, operations under the Guidelines and the DCPs are in effect through 2026, and nothing in this report represents any determinations by Reclamation in any manner regarding post-2026 operations.

2 Background on the Development of the Guidelines

During the years 2000 through 2004, the Colorado River Basin (Basin) experienced the lowest five-year average annual hydrology in the observed record, reducing combined storage in Lake Powell and Lake Mead from 55.7 million acre-feet (maf) (approximately 94 percent of capacity) to 29.7 maf (approximately 52 percent of capacity). This was the first sustained drought experienced in the Basin at a time when all major reservoirs were in place and when use by the Lower Division states[2] met or exceeded the annual "normal" apportionment of 7.5 maf pursuant to Article II(B)(1) of the Consolidated Decree. The Department, the agency charged with management of the Colorado River, had not yet developed operational rules for the full range of operations at Lake Powell and Lake Mead because these types of low-reservoir conditions had not previously occurred.

In the absence of specific criteria for managing the reservoirs at low elevations, a determination by the Secretary pursuant to Article I(2) of the *Criteria for Coordinated Long-Range Operation of the Colorado River Reservoirs* (LROC) was the only mechanism for adjusting reservoir releases or reducing deliveries in response to drought conditions. Recognizing that a consensus approach to addressing the declining reservoirs was preferable to a unilateral determination, in December 2004 Secretary Norton urged the Colorado River Basin States (Basin States)[2] to develop a plan to manage the river during drought, including identifying criteria related to reservoir levels and releases from Lake Powell. Despite productive discussions, the Basin States could not agree on a proposal. In April 2005, at the request of the Upper Division states[2], the Secretary undertook a review of the operations set by the 2005 Annual Operating Plan for the Colorado River Reservoirs (AOP) to determine if a lower release from Lake Powell was warranted. After considering comments from partners and stakeholders throughout the Basin and reviewing projections of runoff into Lake Powell, Secretary Norton did not adjust the release.

The magnitude of the challenges facing the Basin indicated that year-to-year, discretionary Secretarial determinations of drought operations based on the LROC would not be sufficient to maintain regional stability and avoid litigation. Colorado River water users and managers needed detailed and objective shortage guidelines and coordinated reservoir management strategies to provide a greater degree of certainty. Failing to develop additional operational guidelines would make sustainable Colorado River management extremely difficult. In response to the Upper Division states' April 2005 comment letter, Secretary Norton stated that "it is preferable to develop strategies to address drought and other water management challenges in processes other than annual operating plan consultation meetings." She then directed Reclamation to build on discussions among the Basin States by convening a public meeting to identify appropriate processes and mechanisms to address the challenges. In September 2005, pursuant to the National Environmental Policy Act (NEPA), a notice of intent to prepare an environmental impact statement (EIS) to develop new operational guidelines was published in the Federal Register.

Public involvement during the NEPA process, which spanned June 2005 to November 2007, included scoping, consultation, and coordination with interested stakeholders and members of the general public.

[2] Upper Division states includes the states of Colorado, New Mexico, Utah, and Wyoming. Lower Division states includes Arizona, California, and Nevada. Basin States include both the Upper and Lower Division states.

Reclamation worked with cooperating federal agencies[3], the Basin States, and non-governmental organizations (NGOs) to develop five action alternatives considered in the EIS. Assisted by the Bureau of Indian Affairs, Reclamation conducted government-to-government activities with tribal entities having entitlements to or contracts for Colorado River water, and those that may have been affected by or had interests in the proposed federal action. The 29 federally recognized tribes in the Basin and 14 other tribes were notified of the action and coordinated with through letters, consultations, and discussions with tribal representatives at public meetings.

Reclamation also consulted with the Country of Mexico (Mexico) through the International Boundary and Water Commission, U.S. and Mexico (IBWC) to identify potential impacts to obligations under 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).

Details about public outreach activities can be found in Chapter 6 and Appendix I of the *Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead Final Environmental Impact Statement* (Final EIS) (Reclamation, 2007).

The technical analysis that supported the NEPA process relied heavily on Colorado River Simulation System (CRSS), Reclamation's long-term planning model. CRSS was used to project the potential future conditions of the Colorado River system at a monthly time-step for the period from 2008 through 2060. Due to uncertainty regarding future inflows into the system, multiple simulations were performed based on samples taken from the natural flow record over the 100-year period from 1906 through 2005 in order to quantify the uncertainties of future conditions. The Basin States submitted the water diversion and depletion schedules used in the technical analysis for water users in their respective boundaries (see Appendix C and Appendix D of the Final EIS for more information) (Reclamation, 2007).

CRSS modeling provided the basis for the analysis of potential future Colorado River system conditions (such as, reservoir elevations, reservoir releases, river flows), as well as the potential effects of each alternative on resources such as recreation, biology, and electrical power within the geographic scope[4] of the federal action. Comparisons between the action alternatives and the No Action alternative were typically expressed in terms of the differences in probabilities of specific conditions. Across all resources analyzed, given the supply and demand assumptions used and the spatial and temporal constraints of CRSS, modeling showed that the Preferred Alternative (that is, the alternative on which the Guidelines were based) had mostly positive or neutral impacts, with some minor negative impacts in select biological and electrical power resources. The Final EIS provided environmental compliance for the duration of the Guidelines, that is, through 2026. See Chapter 4 of the Final EIS for detailed information about methodologies and results for all resource analysis or Table ES-2 in the Final EIS Executive Summary for an overview of findings by resource (Reclamation, 2007).

Comments that were received on the scope and approach of this 7.D. Review indicated that a diverse group of partners and stakeholders are interested in reflecting on the stakeholder engagement process and the modeling assumptions used to develop the Guidelines and the resource analysis contained in the Final EIS. These interests are discussed in more detail in Section 5.

[3] Bureau of Indian Affairs, Fish and Wildlife Service, National Park Service, Western Area Power Administration, and United States Section of the International Boundary and Water Commission.

[4] The geographic region that could have potentially been affected by the proposed federal action begins with Lake Powell and extends downstream along the Colorado River floodplain to the Southerly International Boundary (SIB) with Mexico, along with the service areas of Lower Basin water agencies.

3 Purpose of the Guidelines and Common Themes

The purpose of the Guidelines, as stated in the ROD, consists of three components. This purpose was determined in the early stages of the NEPA process led by Reclamation to develop the Guidelines. The purpose is to:

- improve Reclamation's management of the Colorado River by considering trade-offs between the frequency and magnitude of reductions of water deliveries, and considering the effects on water storage in Lake Powell and Lake Mead, and on water supply, power production, recreation, and other environmental resources;
- provide mainstream United States users of Colorado River water, particularly those in the Lower Division states, a greater degree of predictability with respect to the amount of annual water deliveries in future years, particularly under drought and low reservoir conditions; and
- provide additional mechanisms for the storage and delivery of water supplies in Lake Mead to increase the flexibility of meeting water use needs from Lake Mead, particularly under drought and low reservoir conditions.

The Guidelines are comprised of four operational elements collectively intended to address the purpose. These elements are as follows:

- **Shortage Guidelines**: Determines those conditions which the Secretary would reduce the annual amount of water available for consumptive use for Lake Mead to the Lower Division states below 7.5 maf pursuant to the Consolidated Decree.
- **Coordinated Reservoir Operations**: Defines the coordinated operation of Lake Powell and Lake Mead to provide improved operation of these two reservoirs, particularly under low reservoir conditions. As described in Section XI.G.6. of the ROD, the objective of the operation of Lake Powell and Lake Mead is "to avoid curtailment of uses in the Upper Basin, minimize shortages in the Lower Basin and not adversely affect the yield for development available in the Upper Basin."
- **Storage and Delivery of Conserved Water**: Allows for the storage and delivery, pursuant to applicable federal law, of conserved Colorado River system and non-system water in Lake Mead to increase the flexibility of meeting water use needs from Lake Mead, particularly under drought and low reservoir conditions.
- **Surplus Guidelines**: Determines those conditions under which the Secretary may declare the availability of surplus water for use within the Lower Division states. Modifies the substance of the Interim Surplus Guidelines existing at the time the Guidelines were adopted by extending the term from 2016 to 2026 and terminating the most permissive provision.

During the public process to develop the Guidelines, consensus emerged around a number of common themes. As described in the ROD, the operational tools provided by the Guidelines should:

- encourage conservation,
- plan for shortages,
- implement closer coordination of operations of Lake Powell and Lake Mead,
- preserve flexibility to deal with further challenges such as climate change and deepening drought,
- implement operational rules for a long – *but not permanent* – period in order to gain valuable operating experience, and

- continue to have the federal government facilitate – *but not dictate* – informed decision-making in the Basin.
- Encourage parties to address future controversies on the Colorado River through consultation and negotiation … before resorting to litigation.

The purpose of the Guidelines and the common themes provide the basis of the evaluation of the effectiveness of the Guidelines, as described in Section 5.

4 Complementary Activities Since Adoption of the Guidelines

Adoption of the Guidelines for an interim period through 2026 provided an opportunity to gain valuable operating experience for the management of Lake Powell and Lake Mead under modified operations and created a stable foundation for making additional operational decisions and conducting exploratory studies during that period. Since 2008, motivated by the ongoing historic drought, complementary activities consisting of Basin-wide planning studies, operational agreements, and other drought response actions have enhanced system management and expanded knowledge in the Basin. These activities are described below.

4.1 Basin-Wide Studies

In January 2010, Reclamation and the Basin States, in collaboration with a wide range of partners throughout the Basin, began work on the Colorado River Basin Water Supply and Demand Study (Basin Study). The purpose of the Basin Study was to define current and future imbalances in water supply and demand in the Basin over the next 50 years (through 2060) and to develop and analyze adaptation and mitigation strategies to resolve those imbalances. The Basin Study incorporated many advancements beyond previous planning studies including: information derived from global climate models; a scenario planning process to develop a range of scenarios for future water supply and demand; an advanced, vulnerability-based approach to risk assessment; and automated modeling of adaptive portfolios to address future water supply and demand imbalances (Reclamation, 2012).

Completed in 2012, the Basin Study concluded that without a range of further proactive actions involving all sectors in the Basin, there may be a long-term potentially significant imbalance in future water supply and demand. Major factors in the Basin Study's success in advancing Basin planning and communicating risks and strategies include research relationships, extensive public outreach, and collaboration between Reclamation, partners, and stakeholders.

In response to the findings of the Basin Study, in May 2013, Reclamation and the Basin States, in collaboration with Basin stakeholders, initiated the Colorado River Basin Stakeholders *Moving Forward* to Address the Challenges Identified in the Basin Study (*Moving Forward* Effort) to build on future considerations and next steps identified in the Basin Study. The effort included over 100 partners and stakeholders spanning all water use sectors engaged in three workgroups focused on water use efficiency (urban and agricultural) and environmental and recreational flows. The final report identified twenty-five

opportunities related to funding and incentives, data and tools, outreach, and partnerships, coordination and integration, infrastructure improvements, and flexible water management (Reclamation, 2015).

In recognition of the importance of bringing the tribal perspective to bear in the Basin, Reclamation and the Colorado River Basin Ten Tribes Partnership[5] (Partnership Tribes) began the Colorado River Basin Ten Tribes Partnership Tribal Water Study (Tribal Water Study) in 2014. Completed in 2018, the study was the outcome of a commitment between Reclamation and the Partnership Tribes to prepare a joint study to build on the scientific foundation of the Basin Study. The Tribal Water Study documents how Partnership Tribes currently use their water, projects how future water development could occur, and describes the potential effects of future tribal water development on the system. The study also identifies challenges related to the use of tribal water and explores opportunities that could provide a wide range of benefits to both Partnership Tribes and other water users (Reclamation, 2018).

4.2 Operational Agreements

As the drought deepened, subsequent major operational agreements and their associated activities provided additional certainty and flexibility for river management. Many of these agreements, specifically the DCPs, were needed because the Guidelines were not adequately reducing the risk of reaching critically low reservoir elevations. The Guidelines were foundational to creating the framework and establishing the mechanisms on which these additional agreements were based.

The United States and Mexico, through the International Boundary and Water Commission (IBWC), have a history of successful cooperation on the Colorado River to address Basin issues through Minutes[6] to the 1944 Treaty. In April 2010, the United States and Mexican Sections of the IBWC adopted Minute 316 which identified elements of binational cooperation during a period of operational testing of the Yuma Desalting Plant (IBWC, 2010a). This effort represented the first operational cooperative program involving both nations and NGOs that focused on the environmental resources of the Colorado River Delta region, with a specific focus on the Ciénega de Santa Clara.

In June 2010, the United States and Mexican Sections of the IBWC adopted Minute 317, which identified framework for binational discussions on Colorado River cooperative actions (IBWC, 2010b). This effort was instrumental in ensuring that a wide range of interested stakeholders in both nations could participate as ideas and concepts were considered between the United States and Mexico.

While binational discussions on the contents of the foregoing Minutes were underway, in April 2010, an earthquake struck Mexicali Valley, Baja California, and damaged a water distribution network that impacted 148,000 acres of farmland in Mexico. In response, the United States and Mexico negotiated and concluded Minute 318, which allowed Mexico to temporarily defer delivery of a portion of its annual Colorado River water allotment for later recovery while repairs were made to the irrigation system in Mexico (IBWC, 2010c). This historic Minute demonstrated the two nations' capacity for good faith negotiations and responsive actions in times of crisis.

[5] Chemehuevi Indian Tribe, Cocopah Indian Tribe, Colorado River Indian Tribes, Fort Mojave Indian Tribe, Jicarilla Apache Nation, Navajo Nation, Quechan Indian Tribe, Southern Ute Indian Tribe, Ute Indian Tribe, Ute Mountain Ute Tribe

[6] Minutes are implementing agreements which clarify details regarding specific provisions of the Treaty. Once approved by both Governments, the Minutes are binding obligations of the United States and Mexican Governments.

In 2011, Reclamation and the National Park Service initiated a NEPA process involving stakeholders, federal agencies, tribes, scientists, and NGOs to develop a comprehensive framework for adaptively managing Glen Canyon Dam, which resulted in completion of the Glen Canyon Dam Long-Term Experimental and Management Plan (LTEMP) in 2016 (Reclamation, 2016). The need for the LTEMP stems from the need to use scientific information developed since the 1996 Glen Canyon Dam Operation ROD to better inform Department decisions on dam operations and other management and experimental actions so that the [Secretary] may continue to meet related statutory responsibilities (Department, 1996). These include protecting downstream resources for future generations pursuant to the Grand Canyon Protection Act, conserving species listed under the Endangered Species Act, avoiding or mitigating impacts on National Register of Historic Places-eligible properties, and protecting the interests of tribes, while meeting obligations for water delivery and the generation of hydroelectric power. Designed as a 20-year framework for adaptive management, the LTEMP provides for more even monthly release patterns from Glen Canyon Dam, within the annual release determined by the Guidelines, and specifies several experimental flow regimes. Under the LTEMP, the impacts of Glen Canyon Dam operations will continue to be monitored and studied by government scientists, stakeholders, and outside advisory scientists to learn about target resources.

In 2012, Minute 319 extended the delivery flexibility provided for in Minute 318 and established several groundbreaking cooperative operational mechanisms (IBWC, 2012). Under Minute 319, Mexico gained the opportunity to temporarily take deliveries above 1.5 maf when Lake Mead elevations were high, agreed to share in delivery reductions when Lake Mead elevations were low, and gained the ability to proactively conserve water in U.S. reservoirs for future delivery. Minute 319 developed an innovative mechanism whereby the U.S. government and water districts invested in water conservation projects in Mexico in exchange for a portion of the water conserved. Water conserved from these projects also provided part of the environmental flows under the Minute, with the remaining water conservation accruing to Mexico. Another groundbreaking component of Minute 319 was the provision of 158,088 acre-feet (af) of environmental flows for the Colorado River Limitrophe and Delta provided by means of the participation of Mexico, the United States, and NGOs in both countries. The significant participation of the Basin States and NGOs enabled parties to develop this provision. The successful implementation of an environmental pulse flow in 2014 was due to the collaboration among scientific, technical, policy, and legal experts from universities, NGOs, water districts, and government agencies in both countries. Minute 319 also addressed cooperative measures related to salinity management and a framework for cooperation for future water conservation and new water sources projects.

In summer 2013, as drought conditions worsened after the two of the driest back-to-back years on record, the Basin States and Reclamation began work to develop Drought Contingency Plans (DCPs) to provide additional mechanisms to protect storage in Lake Powell and Lake Mead (Department, 2019). Each basin developed an approach to help reduce the risk of the reservoirs reaching critically low elevations. The Upper Basin DCP was designed to help assure continued compliance with the 1922 (and 1948) Compacts by: a) protecting critical elevations at Lake Powell, and b) authorizing storage of conserved water in the Upper Basin that could help establish the foundation for a Demand Management Program that may be developed in the future. The Lower Basin DCP was designed to: a) require Arizona, California and Nevada to contribute additional water to Lake Mead storage at specified reservoir elevations, and b) create additional flexibility to incentivize additional voluntary conservation of water to be stored in Lake Mead. Additionally, Reclamation committed to continue efforts to create or conserve 100 thousand acre-feet (kaf) or more per year through water delivery efficiency improvements and other programs, subject to appropriations and within existing authorities. To explore what measures would be needed to mitigate future risk, a novel hydrologic scenario that represented the potential risks from the continuation of recent conditions was used

in quantitative analysis and model simulations. Referred to as the "Stress Test", this scenario is comprised only of the flows recorded since 1988.

After nearly six years of negotiations among states, municipal water agencies, and irrigation districts, collaboration among Arizona water users[7] including participation by tribes proved essential to ensure Arizona's participation and thus ensured the support of all seven Basin States in the March 2019 submittal of the DCPs to Congress. The legislation that was passed in April 2019, the Colorado River Drought Contingency Authorization Act (Public Law 116-14), was accomplished with essential engagement and support of tribes and NGOs. This legislation paved the way for securing DCP implementation beginning in May 2019.

Prior to finalization of the DCPs, in 2017, Minute 323 extended Mexico's delivery flexibility, included a water conservation investment and exchange mechanism, provided water for the environment and funding for habitat restoration, established cooperative actions for low and high reservoir conditions similar to Minute 319, and addressed other operational issues (IBCW, 2017). In addition, to avoid reaching critical reservoir elevations at Lake Mead, the Binational Water Scarcity Contingency Plan (BWSCP) was adopted, under which Mexico agreed to save specified volumes of water at certain low reservoir elevations for recovery at a later date when reservoir conditions improve provided that a U.S. Lower Basin DCP was put into effect. When federal legislation implementing the DCPs was passed by Congress in April 2019 and the final agreements were signed in May 2019, the conditions for formally triggering the BWSCP were met. After the completion of a Joint Report of the Principal Engineers of the IBWC with the implementing details of the BWSCP, the binational plan was put into effect in mid-2019.

4.3 Drought Response Actions

In recognition of the persistent drought conditions, the increasing risk of reaching critically low elevations at Lakes Powell and Mead, and findings of the Basin Study, Basin-wide conservation initiatives were undertaken. In July 2014, an agreement for system conservation was executed among Reclamation and the major municipal water providers in both the Upper and Lower Basin. The agreement for a *Pilot Program for Funding the Creation of Colorado River System Water through Voluntary Water Conservation and Reductions in Use* sets up a Pilot Program to fund the creation of Colorado River system water through voluntary, measurable reductions in consumptive use for the benefit of all users to help offset declining reservoir elevations

In the Lower Basin, the Pilot Program provided almost $30 million to fund 16 projects and conserved over 175 kaf. Between 2015 and 2018, in the Upper Basin, the program provided over $8.5 million to fund 64 projects and conserved over 47 kaf. The Pilot Program demonstrated that there is significant interest in voluntary conservation, provided valuable experience with administration of conservation projects, and demonstrated that collaboration between states, tribes, municipal water agencies, NGOs, stakeholders and the federal government was effective in reducing water use in the Basin.

In December 2014, a Memorandum of Understanding for Lower Basin Pilot Drought Response Actions (Drought MOU) recognized ongoing efforts within the Lower Division states and further solidified the commitments among states, water agencies, and Reclamation to continue to address the need for urgent and collaborative drought response. In the Drought MOU, the major municipal water providers in the Lower Basin and Reclamation agreed to make best efforts to generate protection volumes for Lake Mead through

[7] Among the Basin States, Arizona was the only state that required passage of state legislation for implementation of the DCP.

creation of ICS, system conservation, and other system efficiency improvements. These efforts were successful in meeting the protection volume goals of 740 kaf for the period from 2014 through 2017 and between 1.5 and 3.0 maf in total from 2014 through 2019.

In December 2014, as part of the 2015 Consolidated and Further Continuing Appropriations Act (Public Law 113-235) Congress provided certain funding authorities to the Secretary to implement these drought response actions. This Act also requires the Secretary to submit a report to Congress that evaluates the effectiveness of Pilot Program projects and recommends to Congress whether the activities undertaken by the Pilot Program projects should be continued. The report required by the 2014 Act is currently in preparation by Reclamation.

4.4 Summary and Observations

Without the operational stability provided by the Guidelines and the commitment to cooperation represented and preserved by them, along with the willingness of the Basin States, tribes, NGOs and Mexico to come together to find common ground and consensus solutions, the activities described above would not have been possible. The interim nature of the Guidelines encouraged additional operational decisions and planning studies that have all contributed to the effectiveness of the Guidelines and added to the experience and knowledge needed to inform post-2026 operations of Lake Powell and Lake Mead. Two threads that are particularly important to current and future Basin management, and which are strongly represented in the decisions and activities since 2008, are the incorporation of new scientific information and the increasing inclusivity of diverse stakeholders and partners.

Advancements in science have driven both the operational agreements and the Basin-wide studies since the adoption of Guidelines. As these complementary activities played out amidst a historic drought, the need for increasingly robust scientific analysis in addressing the effects of rising Basin temperatures and to plan for scenarios beyond those conventionally used became clear. The Basin Study and the Tribal Water Study used scenario planning to develop scenarios to explore wide ranges of both water supply and demand while Minute 323 and the DCPs were predicated on future scenarios that assumed drier futures more representative of the current drought conditions, essentially eliminating the likelihood of the early 20th century flows considered to be unrealistically high given current conditions. As the body of science continues to grow, using the best available science to inform decisions and other activities in the Basin will remain important to their success.

In each of the complementary activities described above, the expanded role of stakeholder involvement proved to be critical to its success. The binational cooperative process, where Reclamation works in partnership with the Basin States, United States Section of the IBWC (USIBWC), and Mexico and the expanded role of NGOs led to binational approaches to address water conservation, historic drought, and environmental enhancement in the Colorado River Limitrophe and Delta. Linking to the DCPs, Minute 323 provided an important catalyst by conditioning the BSWCP on the success of the Lower Basin DCP. Essential to the success of the Lower Basin DCP was the role of tribes in Arizona and the voices lent by tribal leaders and NGOs in support of the DCP legislative package. These are but a few salient examples of the partnerships and cooperation necessary for these complementary activities and the types of partnerships that will be needed again as the Basin confronts future challenges.

5 Approach to the Review of the Guidelines

Section XI.G.7.D of the ROD states that "…the Secretary shall initiate a formal review for purposes of evaluating the effectiveness of these Guidelines," and "these Guidelines" are defined as the operational provisions described in Section XI of the ROD. The goals of the 7.D. Review are to: 1) evaluate the effectiveness of the Guidelines, and 2) document the operational experience under the Guidelines from 2008 through 2019.

The evaluation of effectiveness is based on whether the provisions and subsequent management activities achieved the purpose of the Guidelines and adhered to the common themes described in Section 3. These effectiveness criteria represent the contemporaneous goals (the purpose) and understanding of how to achieve those goals (the common themes) at the time the Guidelines were negotiated. Some determinations of effectiveness are based on quantitative information and some are based on qualitative assessments.

The 7.D. Review also documents operations for each year from 2008 (the year the Guidelines were implemented) through 2019 (the most recent complete year of operations), as provided in Appendix A. The quantitative information provided throughout this Report is one of the factors relied on to support the effectiveness evaluation.

The stakeholder engagement processes and the analytical methods used during the development of the Guidelines were driven by the participation dynamics and prevailing knowledge in place at that time. Reclamation believes that the most appropriate evaluation of the Guidelines is with respect to the stated goals and policy considerations as set forth in the ROD. Those elements were highly influential in shaping the final provisions, but Reclamation does not view this 7.D. Review as an opportunity to attempt to determine in 2020 the appropriateness and/or adequacy of any individual element of the Guidelines. Such an analysis is not within the scope of the 7.D. Review. However, reflections on the evolution of many factors, including hydrology, science, and stakeholder engagement, are discussed in Section 6.

Since the adoption of the Guidelines, there have been complementary studies, processes, and decisions in response to evolving knowledge, conditions, and needs that demonstrate the commitment throughout the Basin to continually work toward cooperative and collaborative actions to ensure sustainable management. The most significant examples of complementary activities are described in Section 4. While these complementary activities influence Colorado River operations as well as the effectiveness of the Guidelines, a detailed analysis of the processes, methods, and impacts of the activities is beyond the scope of the 7.D. Review.

6 Significant Considerations Based on Scope and Approach Comments

Reclamation commenced the 7.D. Review process by hosting two public webinars on March 24, 2020, and April 1, 2020, and gathering input on the proposed scope and approach. Several suggestions expressed in multiple letters by a diverse group of partners and stakeholders were related to revisiting, revising, or reevaluating specific resources analyses contained in the NEPA documentation or evaluating the NEPA

process itself. Because this Report is focused on the effectiveness of the adopted elements of the Guidelines, Reclamation has communicated to commenters that these matters will not be quantitatively or systematically addressed. However, these issues are important to acknowledge and briefly discuss for the purpose of establishing a common understanding of how conditions, capabilities, and expectations have evolved since the Guidelines were adopted. These considerations are related to three aspects of the NEPA process used to develop of the Guidelines:

- the modeling approach used to evaluate operational alternatives;
- the resource analysis; and
- the stakeholder engagement process.

Given the advances in scientific information, as well as greater partner and stakeholder participation in Basin decision-making since the adoption of the Guidelines, Reclamation anticipates focusing more on these comments, issues, and concerns in the development of public processes that will be initiated to develop post-2026 operating rules. The received comment letters can be viewed on the 7.D. Review website.

6.1 Modeling Approach

Several letters expressed commenters' dissatisfaction with the modeling assumptions that were made during the development of the Guidelines, with most comments citing issues with hydrology and water demands. The assumptions represented plausible future conditions, not predictions, and thus cannot be assessed as accurate or inaccurate. It is, however, instructive to reflect on the projections in light of the observations, scientific findings, and a better understanding of potential future water development that have evolved since the Guidelines were developed.

With respect to hydrology, the 1906 to 2005 observed record that was used for the primary analyses in the Final EIS includes a wide range of annual flow volumes and multiple challenging drought sequences, but the frequency of below and far-below average flows that has been observed since 2000 has been greater than what had been observed at the time. Neither the megadroughts represented in the paleo record nor the aridification suggested by some climate modeling was part of the primary analysis, though the paleo record was used for sensitivity analyses in Appendix N of the Final EIS. It is important to note that both climate change and paleo scenarios include an overall wider range of volumes and sequences than the observed record, reflecting greater uncertainty and not just the potential for longer and deeper droughts. Appendix U of the Final EIS provided an assessment of the state of knowledge at that time with regard to climate change and modeling for the Basin and provided recommendations on future research and development needs, many of which have been pursued as part of Reclamation's research program and through subsequent studies.

Regarding demand assumptions, one scenario was used to project plausible Upper Basin, Lower Basin, and tribal demands. Tribes have expressed their view that the representation of their demands in that scenario did not adequately consider tribal water rights. When comparing projected Upper and Lower Basin demand to observations (to the extent possible[8]), projected demand was greater than observed use. With respect to potential future tribal water development, tribes have suggested that some considerations were not fully

[8] Because the Upper Basin regularly experiences hydrologic shortages, it is difficult to assess and compute historical water demand. Historical consumptive use can be compared to projected water demand (over a historical period) but this only provides an estimate of the differences.

captured in the assumptions. Understanding of the implications that different demand assumptions have on projected conditions throughout the Basin continues to improve and this knowledge will contribute to future studies.

Since the adoption of the Guidelines, Reclamation has expanded the bases of long-term modeling assumptions and worked to identify appropriate methods for analyzing uncertainty. Even though the true probability of any combination of conditions and thus system impacts cannot be assessed, a wider range of hydrology and demand assumptions and attention to those ranges that are more challenging to the system are useful for supporting a common understanding of system vulnerability. Hydrology, water demand, and analytical methods have evolved through the following efforts:

- the Basin Study, Minute 323, the Tribal Water Study, and DCPs analyses all used the paleo record, climate model-derived hydrology, and/or different subsets of the observed record designed to capture the trend of decreasing flows;
- the Basin Study and Tribal Water Study developed and used additional demand and development projections;
- through experiences in the Basin Study and Tribal Water Study, Reclamation gained a better understanding of how the tribes would like their water use and future development to be represented; and
- the Basin Study introduced vulnerability-based analysis.

Reclamation continues to pursue these advancements and anticipates that they will play an important role in future studies and decision-making processes.

6.2 Resource Analysis

Several comments requested discussion in this Report of the Final EIS resource analysis and modeling capabilities. Specifically, commenters highlighted their views that representation of tribal water rights and tribal perspectives related to cultural, environmental, biological, and other resources was inadequate, that further analysis of environmental, biological, recreational, and hydropower resources was needed, and that impacts to resources since the adoption of the Guidelines should be evaluated.

The resource analysis performed during the development of the Guidelines was based on the best information available and the modeling capabilities in place at that time. Reclamation anticipates that analyses in future decision-making processes will build on the approaches previously used. Reclamation also recognizes that it is important to understand how the Guidelines have impacted Basin resources. This will be critical knowledge to inform decisions regarding post-2026 operating rules. Reclamation anticipates that future efforts to analyze resource impacts will be built on improved modeling capabilities, data and information gained through resource monitoring, operational experience, and expanded stakeholder involvement. As an example, the Department continues to work with Basin partners and stakeholders in the Glen Canyon Dam Adaptive Management Program which conducts long-term monitoring and research on various resources in the Grand Canyon National Park and Glen Canyon National Recreation Area. Complementary programs are also implemented in the Lower Basin under the auspices of the Multi-Species Conservation Program. These efforts and other relevant advances in resource analysis will provide important information for future analyses.

With respect to modeling, CRSS was (and remains) the primary tool used to model hydrologic resources (for example reservoir elevations and release), and, like any model, cannot perfectly represent the dynamics of a complex river basin. However, CRSS undergoes constant evaluation and development. Involving diverse partners and stakeholders has led to many model advancements, such as improvements in representing and assessing environmental and recreational flows, additional capabilities to couple with other modeling tools, and more precise representation of water right priorities. Emphasis on improvements to model structure continues; for example, the Tribal Water Study found that development is needed to better represent tribal water use and the Basin's reliance on unused tribal water rights. Reclamation looks forward to working with partners and stakeholders on this needed development and identifying future opportunities to advance technical information and capacity in support of the process to develop post-2026 operating rules.

6.3 Stakeholder Engagement

Multiple commenters expressed an interest in including a review of the stakeholder engagement process used during the development of the Guidelines with particular attention to what they view as inadequate efforts to meaningfully engage a sufficiently diverse group of stakeholders. An area of their specific concern is whether there was an appropriate level of tribal participation. In addition to currently unquantified rights, Reclamation recognizes that tribes hold quantified rights to a significant amount of water from the Colorado River and its tributaries (approximately 3.4 maf of annual diversion rights) that often are senior in priority to those held by other users. The United States has a trust responsibility to protect federal Indian reserved water rights.

Since the adoption of the Guidelines, the ongoing drought has driven Basin partners to cultivate cooperative relationships for addressing Basin-wide challenges through consensus and collaboration. As described in Section 4, meaningfully engaging and encouraging the participation of tribes, Mexico, and NGOs was crucial to the success of the key operational decisions and studies to come about since the adoption of the Guidelines: the Basin Study, the Pilot Program, multiple Minutes to the 1944 Water Treaty, the Tribal Water Study, and the DCPs. This expanded inclusivity will continue to forge and strengthen partnerships that will be critical as we address the significant challenges ahead. As Secretary Bernhardt noted when he directed Reclamation to prepare this Report, "the coalition of support—Mexican, Tribal, and NGO support—that was necessary for DCP passage will likely be needed again in a few short years from now, when the Basin looks at post-2026 operations.

7 Implementation of the Guidelines

This section describes the implementation of the Guidelines during the period of 2008 through the end of Calendar Year (CY) 2019. The provisions of the Guidelines described in Section XI of the ROD are presented in the following manner:

- Determination of Lake Powell and Lake Mead Operations
- Coordinated Operation of Lake Powell and Lake Mead
- Lake Mead Operations
- Intentionally Created Surplus
- Process and Consultation

Generally, for each topic, the discussion includes an overview of the provisions, a discussion of the key observations, and a comparison of the operations projected at the time the Guidelines were being developed (as included in the Final EIS) to what actually occurred.

This section begins with an overview of the past and present conditions of Lake Powell and Lake Mead, including an operational summary and discussion of other key factors that have impacted those conditions.

7.1 Overview of Lake Powell and Lake Mead Conditions

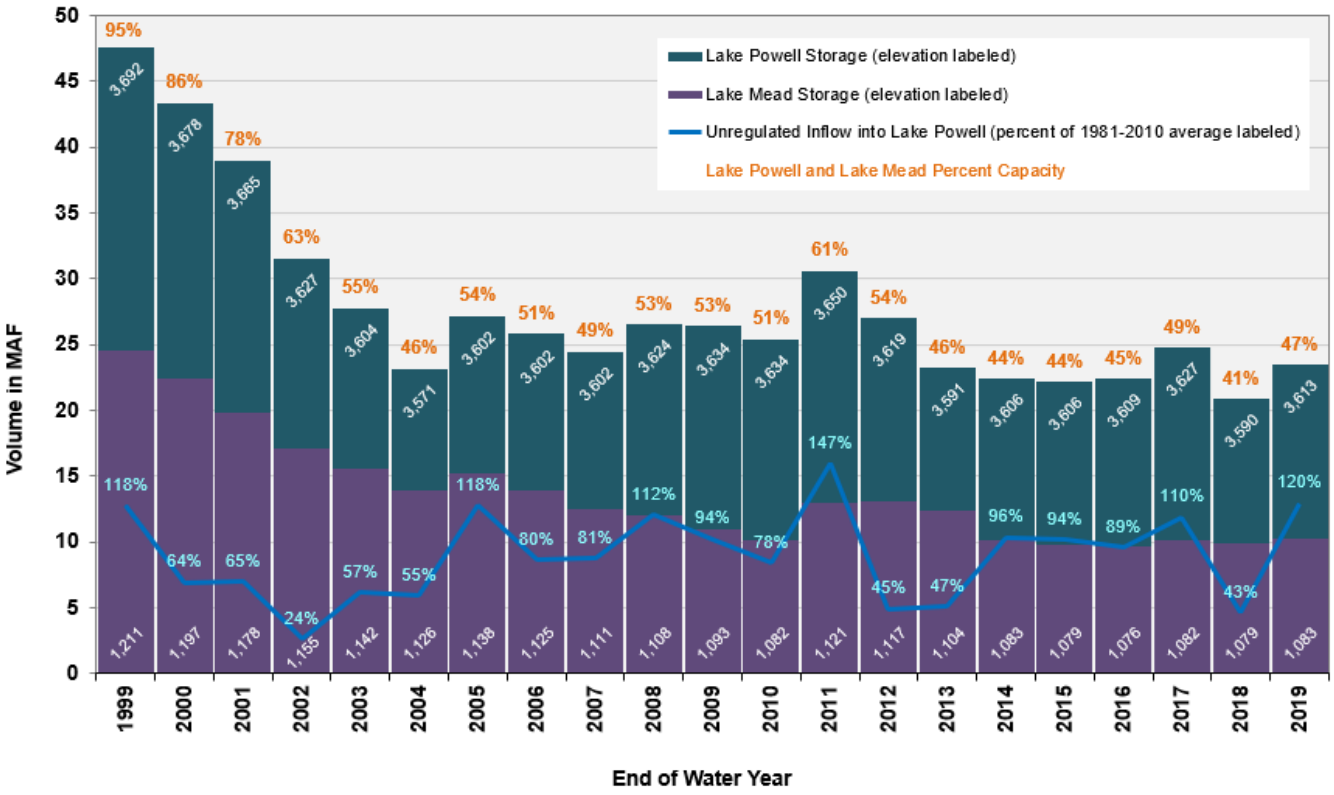
The primary factors influencing Lake Powell and Lake Mead conditions are: Upper Basin hydrology[9], Lake Powell and Lake Mead operations, and Lower Basin water use. This section provides a summary of how these factors have evolved since the adoption of the Guidelines and concludes with a comparison of Lakes Powell and Mead elevations projected in the Final EIS to actual elevations.

The period of 2000 through 2019 was the lowest 20-year period in the historical natural flow[10] record that dates back to 1906. The average Upper Basin natural flow of this period was over 14 percent less than the long-term average natural flow. When the Guidelines were adopted in December 2007, conditions at Lake Powell and Lake Mead had declined from nearly full at the start of the drought in 2000 down to a combined 49 percent of capacity at elevations 3,602 feet and 1,111 feet, respectively, as illustrated in Figure 1. As the drought continued, yielding only four years of above average unregulated flows in the Upper Basin over the next 12 years, storage in the two reservoirs remained near 50 percent capacity.

[9] Upper Basin hydrology accounts for about 92 percent of the total inflow in the Basin (Lukas and Payton, 2020). Upper Basin water use and the operation of reservoirs above Lake Powell impact the inflow that arrives at Lake Powell. These items are outside the geographic scope of the Guidelines.

[10] Natural flow represents the flow that would have occurred at the location had depletions and reservoir regulation not been present upstream of that location.

Figure 1. Unregulated Inflow[1] into Lake Powell and Lake Powell and Lake Mead Storage and Elevation.



[1] *Unregulated inflow adjusts for the effects of operations at upstream reservoirs. It is computed by adding the change in storage and the evaporation losses from upstream reservoirs to the observed inflow. Unregulated inflow is used because it provides an inflow time series that is not biased by upstream reservoir operations.*

Table 1 summarizes the annual Lake Powell and Lake Mead operations since 2008. The Upper Elevation Balancing Tier and the Normal/ICS Surplus Condition were the most common operation since 2008 due to: 1) the Lake Powell and Lake Mead elevations during this time and 2) the Lower Basin use of the ICS mechanism and other conservation activities. Sections 7.2 through 7.5 expand on the operational experience under each Lake Powell/Lake Mead operating tier/operation condition.

Lower Basin water use affects Lake Mead elevation and, because of the coordinated operations, Lake Powell elevation as well. As shown in Figure 2 (and discussed further in Section 7.2), Lower Basin water use has decreased since the adoption of the Guidelines. This decrease in water use is due to drought, conservation of Colorado River water through the ICS mechanism, and participation in other voluntary conservation programs. Conservation activities since the implementation of the Guidelines have resulted in approximately 3.1 maf of water savings and has led to the elevation of Lake Mead being approximately 35 feet higher than it may otherwise have been at the end of 2019. Lake Powell release is another key component impacting Lake Mead elevation and is also shown in Figure 2.

Table 1. Summary of Lake Powell and Lake Mead Coordinated Operations 2008-2019.

	Lake Powell Operations (WY)					Lake Mead Operations (CY)
Year	Operating Tier	April Adjustment	WY Unregulated Inflow (% average)	Release Volume (maf)	Equalization Volume (maf)	Operating Condition
2008	Upper Elevation Balancing	Equalization	112	8.98	0.75	Normal/ICS Surplus
2009	Upper Elevation Balancing	None	94	8.24[1]	-	Normal/ICS Surplus
2010	Upper Elevation Balancing	None	78	8.23	-	Normal/ICS Surplus
2011	Upper Elevation Balancing	Equalization	147	12.52	4.29[2]	Normal/ICS Surplus
2012	Equalization	NA	45	9.47	1.23[3]	Normal/ICS Surplus
2013	Upper Elevation Balancing	None	47	8.23	-	Normal/ICS Surplus
2014	Mid-Elevation Release	None	96	7.48	-	Normal/ICS Surplus
2015	Upper Elevation Balancing	Balancing	94	9.00	-	Normal/ICS Surplus
2016	Upper Elevation Balancing	Balancing	89	9.00	-	Normal/ICS Surplus
2017	Upper Elevation Balancing	Balancing	110	9.00	-	Normal/ICS Surplus
2018	Upper Elevation Balancing	Balancing	43	9.00	-	Normal/ICS Surplus
2019	Upper Elevation Balancing	Balancing	120	9.00	-	Normal/ICS Surplus

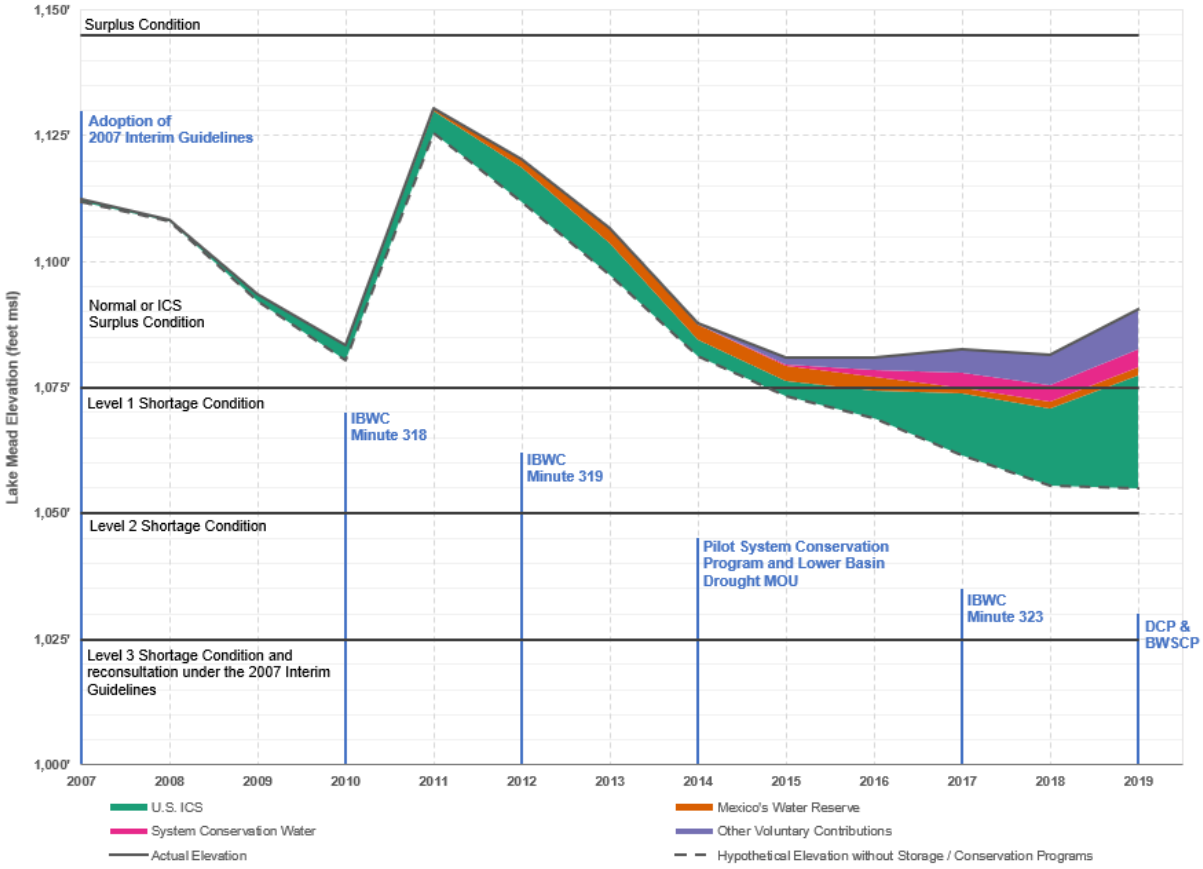
[1] *In 2009, while the scheduled release volume was 8.23 maf, the actual release was 8.24 maf due to rounding and a release of 5,702 acre-feet above 8.23 maf. Balancing did not occur in 2009.*

[2] *The total 2011 equalization volume was 5.52 maf, with 4.29 maf released in WY 2011. The remaining equalization volume was released as soon as practicable and fully by December 31, 2011.*

[3] *Although Lake Powell operated in the Equalization Tier in 2011, 8.23 maf was released in WY 2012 due to dry conditions, the additional release of 1.23 maf was WY 2011 equalization water released during WY 2012. The difference between 9.47 maf and 1.23 maf is not exactly 8.23 maf due to rounding.*

Figure 2. Lake Mead Storage and Conservation Savings.

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Lake Powell WY Release (MAF)	8.98	8.24	8.23	12.52	9.47	8.23	7.48	9.00	9.00	9.00	9.00	9.00
Lower Basin & Mexico CY Delivery (MAF)	9.02	8.94	8.88	8.77	8.81	8.85	9.20	8.95	8.73	8.28	8.64	8.03



[1] *The hypothetical elevation is computed by subtracting the storage gained through conservation activities from the actual elevation and does not take into consideration how Lake Mead or Lake Powell may have operated differently.*

Significant uncertainty exists when projecting future conditions in long-term planning efforts such as the development of the Guidelines. When the Guidelines were being developed, as presented in the Final EIS, the approach to addressing and estimating this uncertainty was to use CRSS not to *predict* future conditions, but rather to project a range of what might occur. These projections were used to provide a relative comparison between alternatives. While it was and remains impossible to predict how each of the factors described in this section (that is, Upper Basin hydrology, Lake Powell and Lake Mead operations, and Lower Basin water use) would play out over the next 12 years after adoption of the Guidelines, it is informative to reflect back on those *projections of what might occur* and compare them to *what actually occurred*. Figure 3 and Figure 4 are updates to figures from the Final EIS that showed the 90th, 50th, and 10th percentile projections[11] for the alternatives; here only the Preferred Alternative is shown, the 20th, 30th, and 40th percentile elevations from the Preferred Alternative projections are added for context, and the observed

[11] This statistical method was used to efficiently summarize the ranges of reservoir elevations modeled across all hydrologic sequences.

reservoir elevations are also plotted. Section 2 provides additional background on the modeling approach taken in the Final EIS.

These figures demonstrate that the observed elevations are clearly within the range of what was projected. However, due to the continuation of the drought, the observed elevations fell consistently below the 50th percentile, with the exception of 2011 (when Water Year [WY] unregulated inflow into Lake Powell was 147 percent of average). Lake Powell reached the lower percentiles, hovering between the 20th and 30th percentile in almost all years from 2012 through 2019. Lake Mead ranged between the 30th and 40th percentiles during this period.

Figure 3. Update to Final EIS Figure 4.6-1. Lake Powell End-of-March Water Elevations. Comparison of Preferred Alternative Percentile Values to Observed.

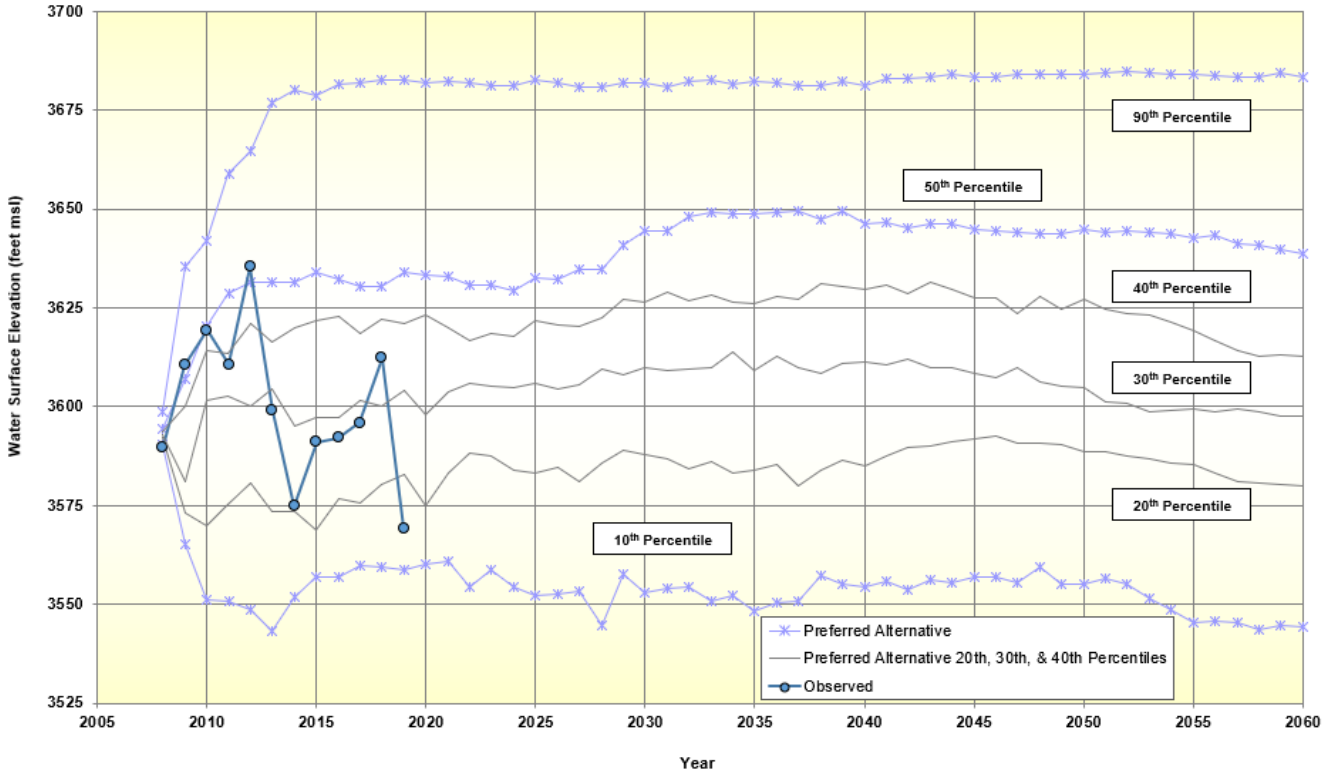
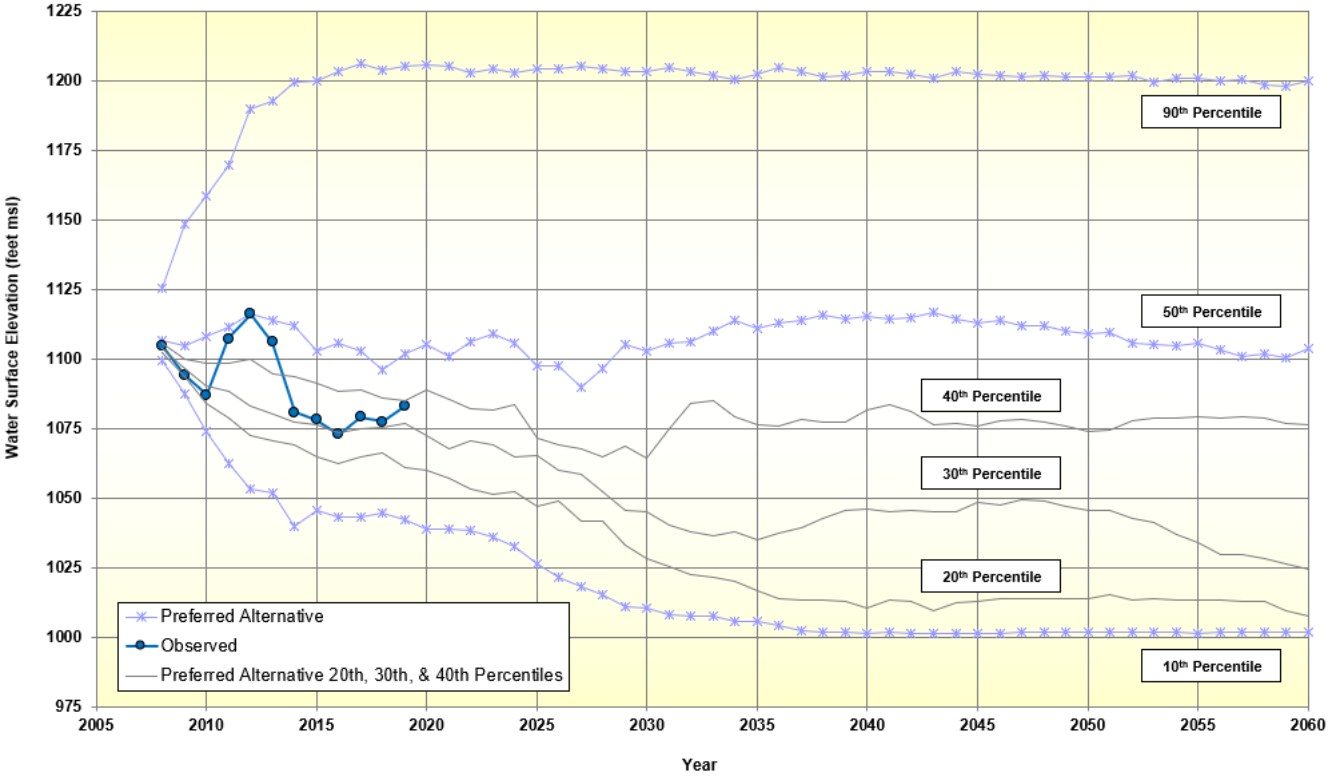


Figure 4. Update to Final EIS Figure 4.6-2. Lake Mead End-of-July Water Elevations. Comparison of Preferred Alternative Percentile Values to Observed.



While the Guidelines provide operational criteria for the full range of reservoir elevations encompassed by these percentiles, including those experienced, the probability of reaching certain elevations in the future (for example, critically low elevations) can vary considerably in any given year based on the conditions at that time. As Lake Mead and Lake Powell decline, they are increasingly susceptible to the highly variable hydrology in the Basin. This fact motivated the final push to complete the DCP when in 2018, the second-driest year since the beginning of the drought, the probability of reaching critically low elevations in Lake Mead by 2026 increased nearly four-fold over what was projected in the Final EIS (Reclamation, 2018a).

A comparison of projected elevation percentiles to actual elevations is presented above to provide a basis for discussion about the way the projections were used and how views about future risk influenced, and were influenced by, the development of the Guidelines. This type of comparison is also provided in subsequent sections with respect to ICS behavior, Lake Mead condition, and coordinated operations. The intent of these comparisons is to be a source of information for the design of the technical approach to future planning processes.

7.2 Determination of Lake Powell and Lake Mead Operations

In reviewing the experience of determining and implementing annual operations at Lake Powell and Lake Mead under the Guidelines, Reclamation identified several topics that lend themselves to syntheses above the level of specific provisions. These topics include the interaction between projections and elevation thresholds, and timing complexities related to monthly release schedules and the overlapping WY (Lake

Powell) and Calendar Year (CY) (Lake Mead) operations. Refer to Appendix A – Operational Documentation for a diagram of reservoir operations and more information about operations and conditions in specific years.

7.2.1 Implications of Projections When Reservoirs are Near Thresholds

As defined in the Guidelines, the August 24-Month Study projections of January 1 system storage and reservoir elevations are used to determine Lake Powell's operating tier and Lake Mead's operating condition for the upcoming year. Pursuant to Section 6 of the ROD, if the August 24-Month Study determines that Lake Powell will operate in the Upper Elevation Balancing Tier, then April 24-Month Study projections of September 30 system storage and reservoir elevations may be used to adjust Lake Powell's operations for the remainder of the WY (known as an April adjustment). Because the January and April projections (and, to a lesser extent, projections in other months) are at the core of how the Guidelines are implemented, it is important to acknowledge that projections are inherently uncertain and that the impacts of these uncertainties grow in significance when Lake Powell and Lake Mead are at or near operational thresholds.

Using the 24-Month Study to project future conditions requires the use of assumptions based on the best information available at the time. Under the Guidelines, there are three categories of assumptions that have the most significant implications for making projections of reservoir elevations on specific future dates: hydrology forecasts, water use assumptions, and monthly Lake Powell release patterns. When Lake Powell or Lake Mead is either near or projected to be near an elevation threshold that triggers different operations, it is possible for small differences between assumptions and actual operations in any of the categories to cause an operationally relevant discrepancy between projected and actual elevations.

Hydrologic forecasts are the greatest source of uncertainty, as precipitation (and resulting streamflow) is difficult to predict and because the magnitude is greater and can vary more widely than either monthly releases or water use. The combination of reservoirs hovering near thresholds and unforeseen hydrologic conditions (either drier or wetter than forecasted) has resulted in swings in expected operations several times in the past 12 years.

In 2012 and 2014, the two years when actual January 1 Lake Powell elevations did not match the tiers determined in the August 24-Month Study projections, August forecasts of fall conditions did not foresee extremely dry and extremely wet conditions, respectively.

In 2009, an April adjustment to Equalization operations that had been anticipated since late CY 2008 did not occur because of an unexpectedly dry March.

In 2019, consistent forecasts of below average hydrology from late CY 2018 to early CY 2019 led multiple 24-Month Studies to project that Lake Mead would operate in a Level 1 Shortage Condition in 2020, but significantly above-average hydrology in the spring (followed by passage of the DCPs and additional reductions in water use due to conservation) averted this outcome.

Neither assumptions about water use nor monthly release patterns have ever caused operationally relevant differences between projections and observations, but they do have the potential to have an impact in certain months if reservoirs are close enough to operational thresholds.

Operating experience when reservoirs are hovering near thresholds, which has been a common occurrence since adoption of the Guidelines, has focused greater attention on how assumptions for the 24-Month Study

projections are developed. This has brought about greater transparency and improvements in operational projections and a desire to ensure that they are as accurate as possible.

7.2.2 Timing Complexities

The Guidelines establish the annual regime for determination of releases from Lake Powell to Lake Mead. However, there are additional objectives and circumstances at smaller timescales that must be considered when implementing the annual requirements. For example, experimental releases from Lake Powell to assess potential resource benefits in the Grand Canyon have been carried out in multiple years since 2008. In 2014, the United States and Mexico implemented a "pulse flow" as part of Minute 319. This pulse flow experimental release required distributing releases from Lower Basin reservoirs across the months of March, April and May 2014. Dam maintenance schedules can also impact timing of monthly releases. Despite these relatively frequent complexities, Lake Mead and Lake Powell have been able to effectively meet annual requirements while accommodating objectives at smaller timescales.[12]

The August 24-Month Study projection of January 1 elevations determines Lake Mead's operating condition for the upcoming CY, and Lake Mead is operated on a CY basis, so the projection target date corresponds with the relevant operational cycle. However, given that this same August 24-Month projection determines Lake Powell's operating tier for the upcoming WY (October 1 through September 30), the projection target date is one quarter of the way through the year being determined, and limits the flexibility of operations during the October through December period.

7.3 Coordinated Operation of Lake Powell and Lake Mead

Section XI.G.6. of the ROD sets forth the strategy for coordinating the operations of Lake Powel and Lake Mead. The objectives of these coordinated operations are "to avoid curtailment of uses in the Upper Basin, minimize shortages in the Lower Basin and not adversely affect the yield for development available in the Upper Basin." The August 24-Month Study projections of the January 1 system storage and reservoir water surface elevations for the following WY are used to determine Lake Powell's operational tier (which determines releases to Lake Mead), with the goal of balancing storage between the two reservoirs as nearly as is practicable by the end of each Water Year (September 30) when equalizing or balancing. The Guidelines define four operational tiers for Lake Powell: Equalization Tier, Upper Elevation Balancing Tier, Mid-Elevation Release Tier, and Lower Elevation Balancing Tier. April adjustments to Lake Powell operations in the Upper Elevation Balancing Tier (as specified in Sections 6.B.3. and 6.B.4.) are based on the April 24-Month Study projections of the September 30 system storage (end of water year [EOWY]) and Lake Powell and Lake Mead water surface elevations for the current WY. Observations about operational experience related to coordinated operations are provided below. In some cases, references to specific years are made. Refer to Appendix A – Operational Documentation for more information about operations and conditions in specific years and for a diagram depicting operating tiers and conditions for Lake Powell and Lake Mead.

[12] Reclamation believes that it is very important that it retained the ability to implement these experimental releases from Glen Canyon Dam and Hoover Dam within the framework of the Guidelines. Had the Guidelines foreclosed such opportunities, Reclamation's ability to manage the River for multiple purposes and changing and evolving circumstances would have been hampered, diminishing the opportunity to gain valuable operating experience and scientific knowledge.

7.3.1 Observations Related to the Coordinated Operation of Lake Powell and Lake Mead

7.3.1.1 Equalization Tier

Lake Powell will operate in the Equalization Tier when the August 24-Month Study projects its January 1 elevation to be above the Equalization Line. Lake Powell operated in this tier in 2008, 2011, and 2012. In 2008 and 2011, operations were adjusted to Equalization as a result of April 24-Month Study projections.

It is instructive to expand briefly on the circumstances around the 2011 Equalization volume that was completed in 2012. The April 24-Month Study that shifted Lake Powell into Equalization resulted in a WY release of 12.52 maf. Due to physical limitations in the ability to release water through Glen Canyon Dam, it was not possible to release the full equalization volume by September 30, and the Guidelines do not provide explicit guidance on this circumstance. The LROC provision that states that the remainder of the water "will be released through the Glen Canyon Powerplant as soon as practicable to equalize the active storage in Lake Powell and Lake Mead", was relied upon for guidance. Carry-over releases were completed by late December.

7.3.1.2 Upper Elevation Balancing Tier

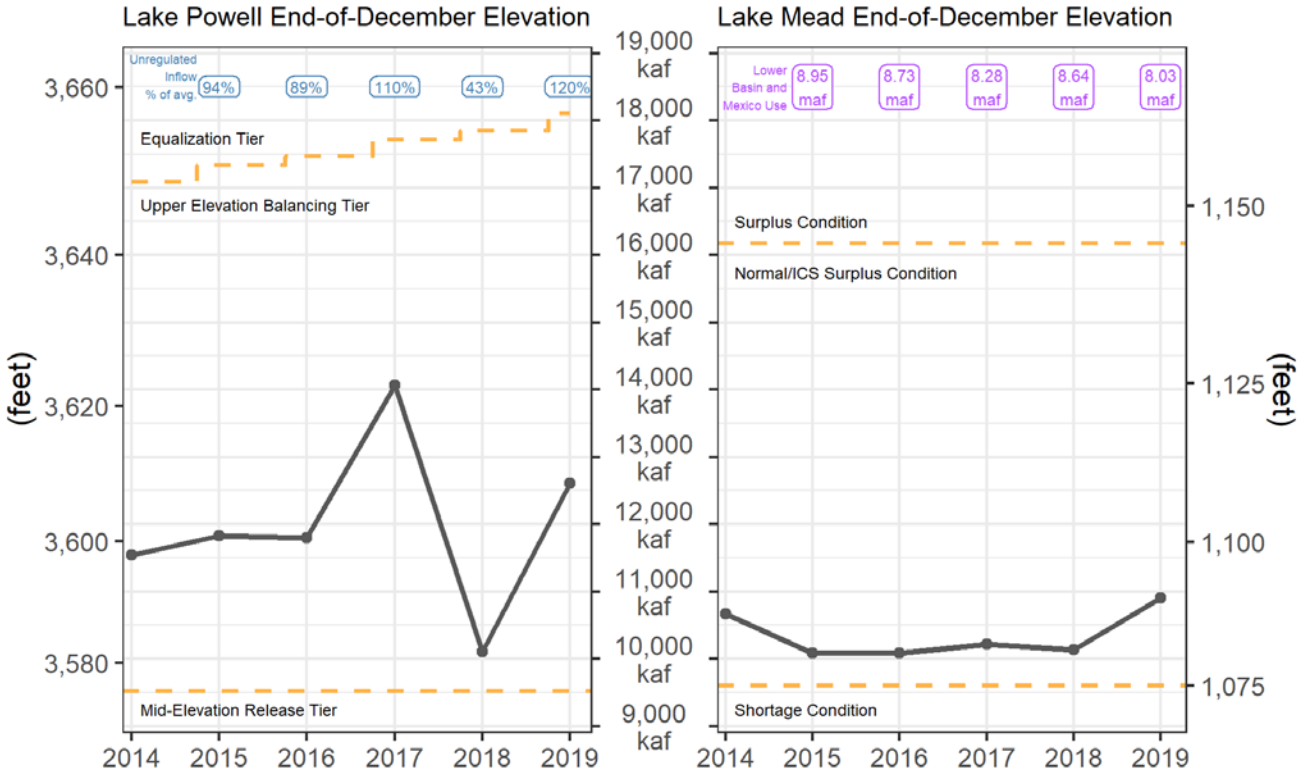
Lake Powell will operate in the Upper Elevation Balancing Tier when the August 24-Month Study projects its January 1 elevation to be below the Equalization Line and at or above 3,575 feet. From 2008 through 2019, 10 out of 12 years started in the Upper Elevation Balancing Tier. The prevalence of this tier is due to the fact that it is a relatively large tier and provisions related to the Upper Elevation Balancing and Equalization Tiers have the effect of putting Lake Powell in this elevation range by the end of each WY. As such, it is unlikely that any given August 24-Month Study will determine a different operating tier unless initial reservoir conditions are generally high or low and/or hydrology projections or observations are significantly above or below average.

The significant observations from operating in the Upper Elevation Balancing Tier are related to the April adjustment, which is discussed in Sections VII and XI.G.6. and specified in Sections XI.G.6.B.2-5 of the ROD. These provisions were designed to allow for operational flexibility if observed hydrologic conditions throughout the WY differ from those used in the August 24-Month Study. In practice, April adjustments have occurred (or not occurred) because of large differences between hydrologic forecasts and observations (for example 2011) or smaller differences at key times (for example 2009). In theory, when Lake Mead's projected elevation is a factor in determining whether an April adjustment will occur, Lower Basin projected water use can impact this determination. Impacts from changes in hydrology and/or water use projections are more likely to occur if Lake Powell and/or Lake Mead is projected to be near a threshold elevation at the end of the WY.

April adjustments occurred in 7 out of 10 years; 2 years shifted to Equalization (2008 and 2011) and in 5 years operations shifted to balancing (2015 through 2019). In each of these balancing years, 9.0 maf was released because Lake Powell was projected to end the WY above 3,575 feet while Lake Mead was projected to end the WY below 1,075 feet should Lake Powell only release 8.23 maf[13]. Figure 5 presents the main contributing factors that led to these operations: unregulated inflow into Lake Powell, Lower Basin water use, and Lake Powell and Lake Mead elevations.

[13] In determining if an April adjustment will occur, a Lake Powell WY release of 8.23 maf is assumed in the 24-Month Study. The resulting Lake Powell and Lake Mead end of WY elevations are then compared against the appropriate thresholds. Referred to as a "tier determination run", this is discussed in more detail in Appendix A.

Figure 5. Lakes Powell and Mead Elevations, Upper Basin Hydrology, and Lower Basin Water Use Years 2015 through 2019.



As shown in Figure 5, Lake Powell entered 2015 well within the Upper Elevation Balancing Tier. The near-average unregulated inflow for the next 5 years (averaging 91 percent 2015-2019) was neither high enough to shift Lake Powell into the Equalization Tier nor low enough for a shift into the Mid-Elevation Release Tier. There was little variation in Lake Mead elevation during these years with Lower Basin water use averaging 8.53 maf from 2015 to 2019. A Lake Powell release of 9.0 maf combined with this Lower Basin water use had the effect essentially stabilizing Lake Mead's elevation, varying only 5 feet until the end of 2019. The result was that, each April, Lake Mead was projected to drop below 1,075 feet by the EOWY assuming an 8.23 maf release from Lake Powell, thus triggering an April adjustment to a balancing release of 9.0 maf for the WY. Even though Lake Powell operated in the Upper Elevation Balancing Tier in WY 2020, an April adjustment to a balancing release did not occur in this year because Lake Mead was sufficiently above 1,075 feet, due to Lower Basin water use significantly below its Colorado River apportionment.

7.3.1.3 Mid-Elevation Release Tier

Lake Powell will operate in the Mid-Elevation Release Tier when the August 24-Month Study projects its January 1 elevation to be below 3,575 feet and at or above 3,525 feet. Lake Powell operated in the Mid-Elevation Release Tier in 2014. This year provided valuable operational experience related to differences between hydrology forecasts and observations interact with the provisions of the Guidelines and the current approach to implementing them through the 24-Month Study process.

7.3.1.4 Lower Elevation Balancing Tier

Lake Powell will operate in the Lower Elevation Balancing Tier when the August 24-Month Study projects its January 1 elevation to be below 3,525 feet. Lake Powell did not operate in the Lower Elevation Balancing

Tier between 2008 and 2019. However, it should be noted that the physical limitations of releases from Glen Canyon Dam at low reservoir elevations may constrain the release volume.

7.3.2 Projected vs. Actual Comparison

The Final EIS modeling projected a range of possible outcomes for Lake Powell's annual releases from Glen Canyon Dam and subsequent 10-year deliveries. Figure 6 presents the projected range of releases from Glen Canyon Dam along with the actual releases from 2008 to 2019, while Table 2 shows the projected distribution of releases from the Final EIS along with the actual distribution for the 2008-2019 period. The WY releases clearly fall within the range (10^{th} – 90^{th} percentiles) of projected releases, and for the period of 2015-2019 fell exactly on the median release (9.0 maf).

Table 2 shows that some release ranges were observed with greater or lower frequency than projected. The most common release range projected for 2008-2019 was the Minimum Objective Release; the most common observed range was the 8.51-9.00 maf range. However, releases above 8.23 maf were not significantly more common in observations than projections; Table 2 shows that the total frequency of all releases greater than 8.23 maf was similar: 55.75 percent of projected years had releases greater than 8.23 maf release, while 58.33 percent of observed years were above 8.23 maf.

Figure 7 presents flow-duration curves of the 10-year volumes projected in the Final EIS for the Preferred Alternative for 2008 through 2060, the projections for 2008 through 2019, and the observed 10-year volumes from 2008 through 2019. The curves show that the observed 10-year releases fall between the 30^{th} and 80^{th} percentile exceedances of the Final EIS projections, meaning that the observed volumes were significantly lower than the high end of projections. The adjacent boxplot of 2008 through 2019 projections demonstrates this more clearly, and the observations plotted on top as dots reflect that two observed years were lower than approximately 70% of the projected volumes. The lowest observed 10-year release volume of 83.1 maf occurred in 2010. A comparison of observations to the analysis performed in the Final EIS is informative, but in presenting such information the Department did not – either in the Final EIS or in this Report – attempt to independently determine or substitute its judgement for that of the Upper Division states' views regarding the assessment of the risk of future potential curtailments and/or yield for development.

Minimizing shortages in Lower Basin and avoiding risk of curtailment in Upper Basin are objectives of these coordinated operations. However, the duration and magnitude of the drought and low-runoff conditions since adoption of the Guidelines, and the associated increase in risk of Lake Powell and Mead declining to critically low elevations have increased the risk of failing to meet these objectives. Acknowledging this increased risk, the Basin States and the Department formally agreed in the DCPs that it was necessary and beneficial to pursue additional actions beyond those contemplated in the Guidelines to reduce the likelihood of reaching critical elevation levels in Lake Powell and Lake Mead through the interim period (Department, 2019).

Figure 6. Update to Final EIS Figure 4.3-12. Glen Canyon Dam Water Year Releases. Comparison of Preferred Alternative 90th, 50th, and 10th Percentile Values to Observed.

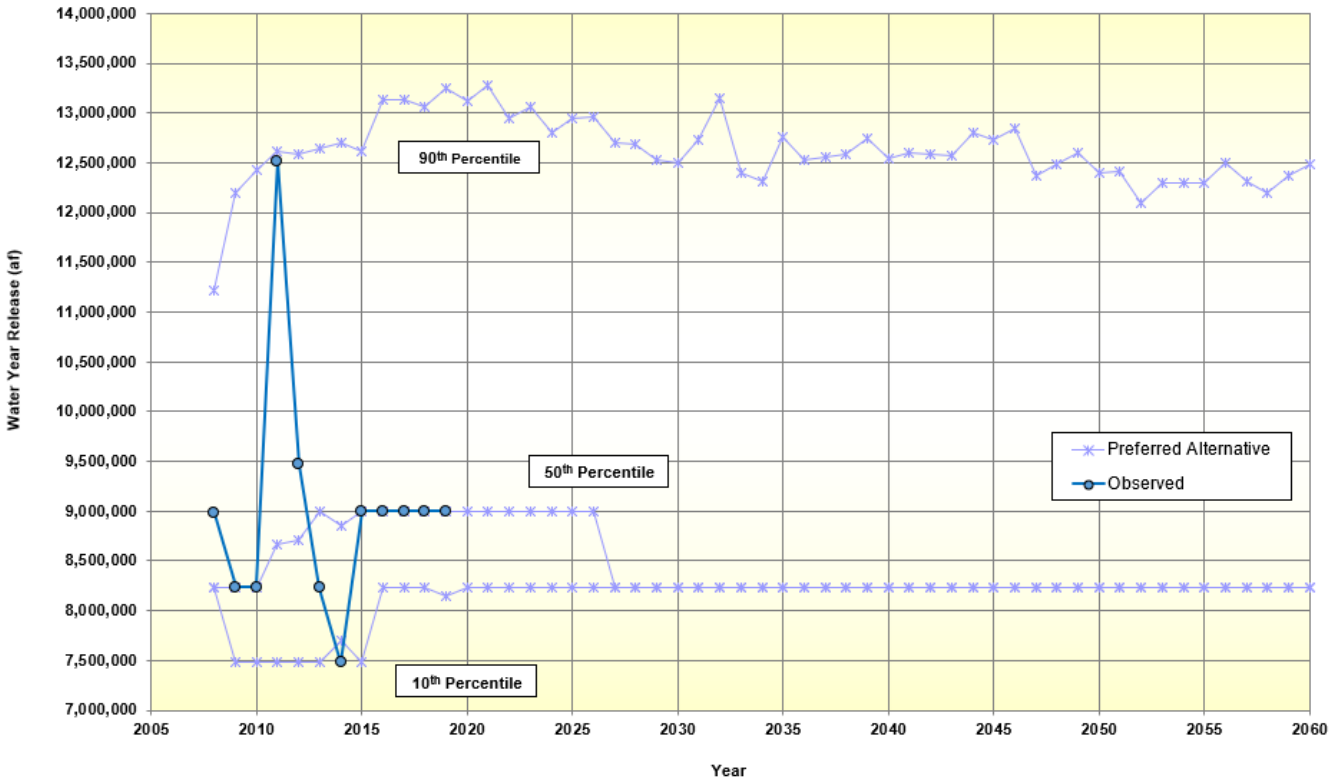


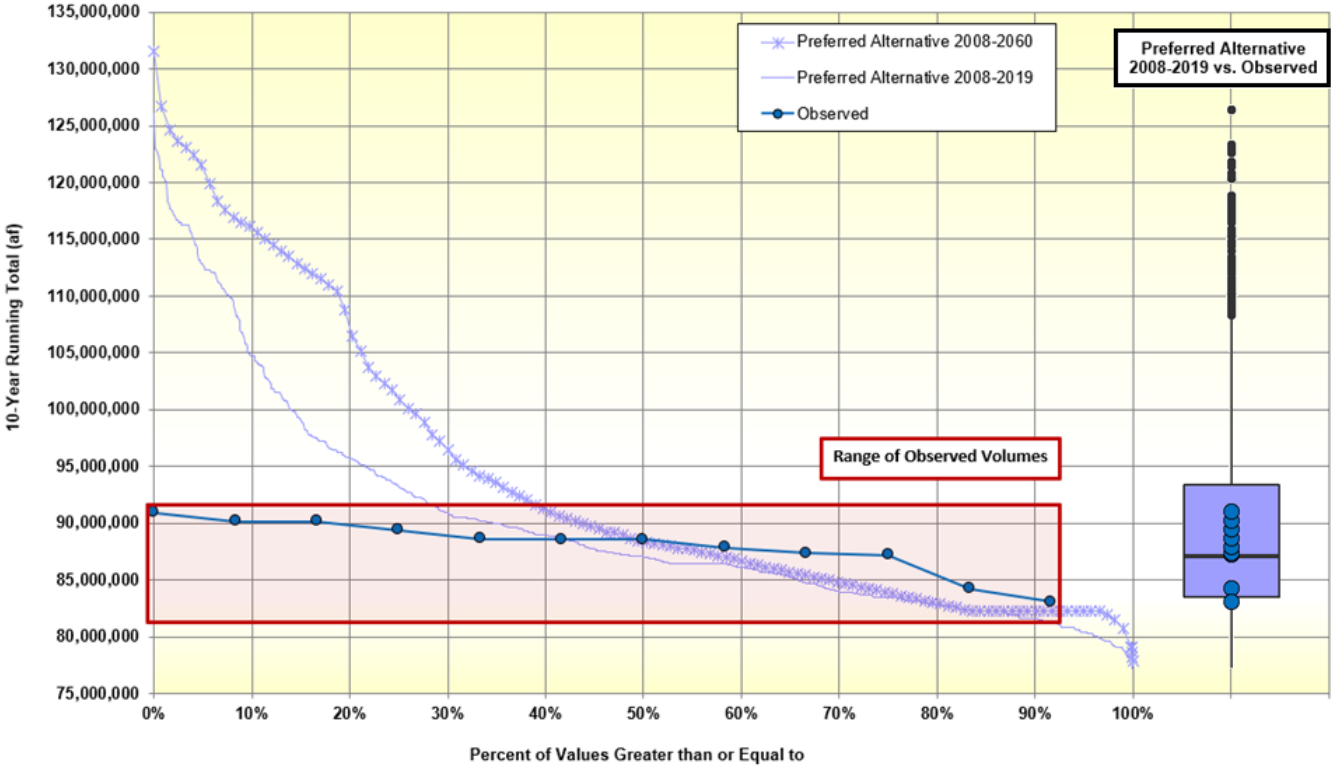
Table 2. Update to Final EIS Table 4.3-11. Glen Canyon Dam Annual Water Releases. Probability of Occurrence of Different Release Volumes (percent) Comparison of Preferred Alternative to Observed.

Glen Canyon Dam Release Volumes	Preferred Alternative 2008-2026	Preferred Alternative 2008-2019	Observed 2008-2019
Greater than 16.00 maf	3.53	2.75	0.00
Between 11.01 to 16.00 maf	16.42	17.50	8.33
Between 9.01 to 11.00 maf	14.37	15.50	0.00[1]
Between 8.51 to 9.00 maf	22.37	18.08	50.00
Between 8.24 to 8.50 maf	2.11	1.92	0.00[2]
Minimum Objective Release of 8.23 maf	31.16	32.58	33.33
Between 7.51 to 8.22 maf	0.68	0.92	0.00
Between 7.01 to 7.50 maf	8.11	9.17	8.33
Less than or equal to 7.00 maf	1.26	1.58	0.00
Total	*100.00*	*100.00*	*100.00*

[1] *The WY 2012 release was 9.47 maf. 8.23 maf was released in WY 2012 due to dry conditions. The additional 1.23 maf was WY 2011 equalization water carried over to WY 2012. Therefore, WY 2012 is included in the 8.23 maf release percentage.*

[2] *The WY 2009 release was 8.24 maf (8,235,702 acre-feet); however, it is counted in the 8.23 maf release category because it was intended to be an 8.23 maf release year.*

Figure 7. Update to Final EIS Figure 4.3-15. Glen Canyon Dam 10-Year Running Total of Water Year Releases Comparison of Preferred Alternative to the Observed.



7.4 Lake Mead Operations

Section XI.G.2. of the ROD states that "the Secretary shall use the August 24-Month Study projections for the following January 1 system storage and reservoir water surface elevations to determine the Lake Mead operation for the following Calendar Year…". The Guidelines define three operating conditions: Normal Condition, Surplus Conditions (four categories), and Shortage Conditions (three levels). Observations related to these conditions are described below. Refer to Appendix A – Operational Documentation for a diagram depicting Lake Mead operating conditions and for more information about operations and conditions in specific years.

7.4.1 Observations Related to the Determination of Lake Mead Operations

7.4.1.1 Normal Conditions

Lake Mead will operate in the Normal Condition when the August 24-Month Study projection of its January 1 elevation is above 1,075 feet and below elevation 1,145 feet. This elevation range also applies to the ICS Surplus Condition, which is designated when the Secretary determines that delivery of ICS may occur during the year. For each year 2008 through 2019, Lake Mead operated in a Normal Condition/ICS Surplus Condition.

7.4.1.2 Surplus Conditions

Lake Mead will operate in a Surplus Condition when the August 24-Month Study projection of its January 1 elevation is at or above 1,145 feet. There are three types of Surplus Conditions that can occur in this elevation range which could take effect at Lake Mead: Domestic, Quantified (70R Strategy), and Flood Control. Between 2008 and 2019, there were no Surplus Condition determinations in the Lower Basin (other than the ICS Surplus Condition noted above).

7.4.1.3 Shortage Conditions

Lake Mead will operate in a Shortage Condition when the August 24-Month Study projection of its January 1 elevation is at or below 1,075 feet. Shortage volumes for Arizona and Nevada total 333 kaf under a Level 1 Shortage Condition (at or below elevation 1,075 feet), 417 kaf under a Level 2 Shortage Condition (below elevation 1,050 feet), and 500 kaf under a Level 3 Shortage Condition (below elevation 1,025 feet). The specification by the Guidelines of these fixed elevations and volumes has impacted the Basin in multiple ways despite the fact that no years between 2008 and 2019 operated in a Shortage Condition.

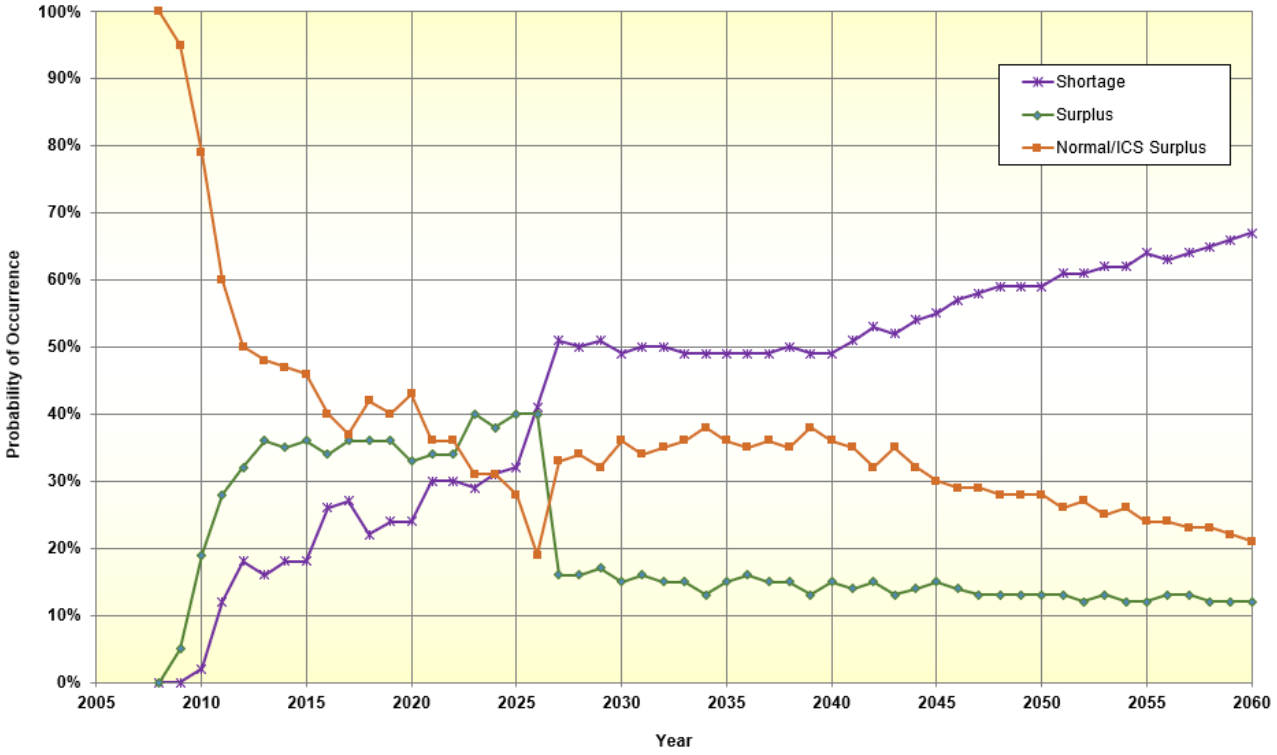
Fixed elevations and volumes have improved Reclamation's and stakeholders' ability to clearly identify and communicate to the public what operating conditions will be in the upcoming year and to track how risk of falling below critical elevations at Lake Mead has evolved. Furthermore, they were useful concepts for negotiations with Mexico during Minutes 319 and 323 to enable Mexico to share in delivery reductions and increases at identical elevations – a development that contributed to the ongoing productive and collaborative relationship between the two countries. However, it is important to recognize that reliance on projections of discrete elevations can result in challenges when reservoirs are near thresholds, as described in Section 7.2

The continuation of the drought since 2008 revealed that the shortage elevations and volumes specified in the Guidelines were not sufficient to keep the risk of Lake Mead falling to critical elevations at a comfortable level. This prompted the beginning of DCP negotiations in 2014 and subsequent BWSCP negotiations during Minute 323. The resulting Lower Basin DCP and BWSCP took effect in 2019 and provide for required water savings in addition to the shortage volumes and at higher Lake Mead elevations. Continued operational experience through 2026 with the Guidelines, DCPs, and BWSCP in place will shed further light on the efficacy of the fixed elevations and volumes currently specified.

7.4.2 Projected vs. Actual Comparison

Figure 8 presents a comparison of the distribution of Lower Basin conditions of the Preferred Alternative projected in the Final EIS. A Normal Condition was projected to be the most likely condition through 2022 after which Surplus became more likely. The chance of a Shortage Condition was projected to be mostly below 30 percent through 2026.

Figure 8. Update to Final EIS Figure 4.4-19. Surplus, Normal, and Shortage (Involuntary and Voluntary) Conditions. Percent of Occurrence of Any Amount.



Lake Mead operated in a Normal/ICS Surplus Condition every year from 2008 through 2019. The closest Lake Mead came to operating in a Surplus Condition above elevation 1,145 feet was in 2012, when the projected end of CY 2011 was approximately 11 feet below the threshold. Lake Mead nearly operated in a Shortage Condition in several years, but this did not occur.

7.5 Intentionally Created Surplus

The Guidelines included the adoption of the ICS mechanism to address the ongoing need to provide Colorado River Contractors additional flexibility in managing their water supplies. The ICS provisions set forth in the Guidelines established the framework necessary to provide the incentive for a Contractor to take actions to conserve and/or import water to the system and to provide Contactors that took such actions the assurance that no other Contractor would claim or divert the conservation achieved (either under Article II(B)(2), or II(B)(6) of the Consolidated Decree). As stated in the ROD, the primary purposes of ICS are to:

(a) encourage the efficient use and management of Colorado River water; and to increase the water supply in Colorado River System reservoirs, through the creation, delivery and use of ICS;
(b) help minimize or avoid shortages to water users in the Lower Basin;
(c) benefit storage of water in both Lake Powell and Lake Mead;
(d) increase the surface elevations of both Lake Powell and Lake Mead to higher levels than would have otherwise occurred; and

(e) assure any Contractor that invests in conservation or augmentation to create ICS that no other Contractor will claim the ICS created by the Contractor pursuant to an approved plan by the Secretary.

The implementation of an ICS program aligned with these purposes required that the Guidelines and concurrent agreements establish several concepts and procedures:

- forbearance (Section XI.A. of the ROD) – Contractors needed to agree to not exercise their rights to surplus water stored in Lake Mead as a result of another Contractor's ICS activity;
- creation procedures and limits (Section XI.G.3.B. of the ROD) – requirements were established for Contractors to submit plans for the creation of ICS (ICS Plan) describing the extraordinary measures that will be taken to conserve or import water, the term of the activity, an estimate of water conserved or imported, a proposed verification method, and documentation that all required permits or approvals have been obtained, and the limits to annual creation and total accumulation volumes were defined;
- system and evaporation assessments (Section XI.G.3.B. of the ROD) – provisions were established to ensure that benefits of the ICS program accrue to the Colorado River System as a whole, and to offset reductions due to evaporation;
- delivery conditions and limits (Section XI.G.3.C. of the ROD) – legal requirements and reservoir conditions were identified under which ICS could be delivered and limits to annual delivery volumes were established;
- accounting, verification, and reporting requirements (Section XI.G.3.C. of the ROD) – ICS creation, reporting and verification requirements were established to document each Contractor's ICS account information.

Four categories of ICS are defined in Section XI.G.3.A. along with their applicable conservation activities, limitations, and other considerations. These categories are summarized in Table 3, along with the volumes created, delivered or applied to payback obligations under the Inadvertent Overrun and Payback Policy (IOPP), and accrued as system benefits through 2019. Table 3 also includes Binational ICS (BICS), which was an additional category of ICS created through Minute 319. DCP ICS, another category created through the DCP, does not appear in Table 3 because 2020 was the first year in which DCP ICS could have been created.

Through 2019, more than 3.1 maf of ICS have been created. Most of this conservation was generated as Extraordinary Conservation (EC) ICS (approximately 2.1 maf) and System Efficiency (SE) ICS (approximately 630 kaf), with the remaining conservation generated as Tributary Conservation (TC), Imported, and BICS.

The ICS program has provided individual ICS creators additional operational flexibilities. Through 2019, Contractors have applied approximately 21 kaf of ICS to pay back an existing overrun, offset a potential overrun, or to backfill a shortfall within California's annual transfer obligations under the Quantification Settlement Agreement. Additionally, Contractors have requested and received delivery of ICS to meet demands when additional water supplies have been required. Through 2019, approximately 551 kaf of ICS have been delivered.

Key elements of the ICS program and complementary activities subsequent to adoption of the Guidelines that affect the ICS program as set forth in the Guidelines are further discussed below.

Table 3. Summary of ICS Created, Assessed System Benefit, and ICS Delivered or Applied Towards IOPP Paybacks, by Category, Through 2019. All values shown are rounded to the nearest kaf. (Due to rounding, grand totals may differ from the sum of the individual values.)

ICS Category	Creation Mechanism(s)	Amount Created[1]	Assessed System Benefit[2]	Amount Delivered or Applied Towards IOPP Paybacks[3]
Extraordinary Conservation (EC) ICS	May be created by implementing projects designed to conserve Colorado River water that would have otherwise been beneficially used. Examples of projects that may be used to create EC ICS include, but are not limited to: fallowing of agricultural land; canal lining programs; desalination programs; turf conversion programs; rebate programs that incentivize installation of indoor water conservation devices, and programs resulting in the development and use of a non-Colorado River System water supply used in lieu of mainstream water.	Arizona: 389 California: 1,526[4] Nevada: 165[5] **Total: 2,081**	Arizona: 43 California: 164 Nevada: 45 **Total: 252**	Arizona: -- California: 446 Nevada: 75 **Total: 521**
Tributary Conservation (TC) ICS	May be created by purchasing or leasing documented water rights on Colorado River System tributaries that have a demonstrated history of use and have been perfected prior to June 25, 1929. TC ICS not delivered in the year of creation is converted to EC ICS on January 1 of the following year and subject to all provisions applicable to EC ICS.	Arizona: -- California: -- Nevada: 339 **Total: 339**	Arizona: -- California: -- Nevada: 18 **Total: 18**	Arizona: -- California: -- Nevada: 15 **Total: 15**
System Efficiency (SE) ICS	May be created when a Contractor makes a capital contribution for use in funding projects designed to realize system efficiencies that save water that would otherwise be lost from the mainstream in the United States.	Arizona: 103 California: 124 Nevada: 403 **Total: 630**	0 (No system assessment for SE ICS)	Arizona: -- California: 35 Nevada: -- **Total: 35**
Imported ICS	May be created by introducing non-Colorado River System water into the mainstream of the Colorado River. Imported ICS not delivered in the year of creation is converted to EC ICS on January 1 of the following year and subject to all provisions applicable to EC ICS.	Arizona: -- California: -- Nevada: 10 **Total: 10**	Arizona: -- California: -- Nevada: 1 **Total: 1**	Arizona: -- California: -- Nevada: 1 **Total: 1**
Binational ICS (BICS)	May be created when a Contractor makes a contribution of capital to participate in a binational project in Mexico that will conserve or augment Colorado River water supplies.	Arizona: 24 California: 47 Nevada: 24 **Total: 95**	Arizona: -- California: -- Nevada: -- **Total: --**	Arizona: -- California: -- Nevada: -- **Total: --**
	Grand Total (all states)	**3,155**	**271**	**572**

[1] *The amount of ICS created, prior to any applicable system or evaporation assessments.*

[2] *Includes assessments applied in accordance with Sections XI.G.3.B.2 (system assessment) and XI.G.3.B.7 (evaporation) of the ROD and Section IV.1 of LBOps.*

[3] *Includes volumes of ICS delivered and used to offset a potential overrun, to pay back an existing overrun or to backfill a shortfall within California's annual transfer obligations under the Quantification Settlement Agreement.*

[4] *Values shown include EC ICS created by the IID and MWD 2006 and 2007 under an ICS Demonstration Program.*

[5] *The non-federal funders received 600 kaf and 30 kaf of SE ICS credits for construction of Brock Reservoir and the YDP Pilot Run, respectively. From 2013-2019, water savings generated by the operation of Brock Reservoir is provisionally estimated to be 389 kaf.*

[6] *Value shown does not include EC ICS created through the conversion of TC ICS or Imported ICS.*

7.5.1 Observations Related to Intentionally Created Surplus

7.5.1.1 Forbearance

As part of the legal framework that was developed to implement the Guidelines, the 2007 *Lower Colorado River Basin Intentionally Created Surplus Forbearance Agreement* (Forbearance Agreement) was developed to document the commitment from a Contractor to forego (or "forbear") delivery of any surplus water that has been stored as a result of another Contractor's ICS activity. The Forbearance Agreement contains descriptions of the limited conditions under which forbearance would be granted, that is, the specified ICS volumes created by specified approved projects. At the time it was executed, the Forbearance Agreement incorporated 15 exhibits which included ICS projects proposed by the Imperial Irrigation District (IID), the Metropolitan Water District (MWD), and the Southern Nevada Water Authority (SNWA); and the Drop 2 (Warren H. Brock) Reservoir SE ICS project, through which SE ICS credits were provided to the Central Arizona Water Conservancy District (CAWCD), IID, MWD, and SNWA. One additional exhibit was executed on October 28, 2009, for the YDP Pilot Run, which provided SE ICS credits to CAWCD, MWD, and SNWA.

As contemplated in Section XI.A. of the ROD, any Contractor desiring to participate in the ICS program would need to secure the necessary forbearance through approval of a new exhibit attached to the Forbearance Agreement. Article 3.2 of the Forbearance Agreement requires written approval of all Parties[14] for new exhibits to be added. This allowed any individual objecting Party to prevent new exhibits and limited participation in the ICS program. During the period 2010 through 2018, no new exhibits were approved, though conservation activities were undertaken that were ultimately credited as ICS.A total of four Contractors participated in the ICS program between 2008 and 2018. It was not until passage of the DCPs in 2019 that 14 new ICS exhibits were approved as part of Congressional legislation and four additional Contractors gained access to the ICS program as part of the DCPs. The need for legislation to make the ICS exhibits effective, for example in the case of the exhibit provided by the Colorado River Indian Tribes (CRIT), is burdensome, generally considered to be contrary to the intent of the process envisioned in the Guidelines, and casts uncertainty on future exhibits or modifications to existing exhibits. Other difficulties were experienced by participating tribes, which could limit their future participation in the ICS program. See Section 7.5.2 for further discussion.

7.5.1.2 Creation

A Contractor desiring to create ICS must submit to the Secretary, for review and approval, an ICS Plan. Reclamation consults with the Lower Division and Upper Division States on all ICS Plans and upon completion of the consultation process, Reclamation provides written notice to the Contractor approving the ICS Plan for implementation.

A Contractor may modify its approved ICS Plan, subject to approval by the Secretary; however, any such modification may only request to reduce the amount of ICS proposed to be created. A Contractor cannot increase the amount of ICS it had previously scheduled to create during a given year. Contractors have suggested the inability to schedule an increase has been viewed as too limiting. While the intent of this policy was to provide flexibility while preventing a Contractor from using serendipitous water to create ICS, the provision does not account for the possibility that a desired increase may be due to unanticipated or

[14] The Parties to the Forbearance Agreement include the State of Arizona, acting through the Arizona Department of Water Resources, the Palo Verde Irrigation District, IID, the City of Needles, the Coachella Valley Water District, MWD, SNWA, and the Colorado River Commission of Nevada.

unforeseen circumstances arising from actual operating experience. As a result, Contractors have generally sought approval for maximum ICS creation amounts in their ICS Plans.

Another consideration regarding the ability to adjust scheduled ICS creation is that the timing of the notification to change could have implications for Lake Powell release; April projections of Lake Mead's September 30 elevation are part of the criteria used to determine whether the annual release volume previously determined will be adjusted. Although it has not occurred, it is theoretically possible that adjustments in ICS behavior could result in a different April adjustment in Lake Powell operations than would have otherwise occurred.

The Guidelines allow for EC ICS created by one Contractor to be credited to the ICS account of another Contractor within the same state, with written agreement of the Contractor that funded the project. This flexibility was helpful to California Contractors. Due to limits on IID's ICS storage capacity, this provision was used to enable IID to conserve water and store it in MWD's ICS account. This type of flexibility was expanded as part of the DCP, as described in Section 7.5.2.

7.5.1.3 Annual Creation Limits and Accumulation Limits

The Guidelines limit the total amount of ECICS that can be created during any year to a maximum of 625 kaf (400 kaf for California Contractors, 125 kaf for Nevada Contractors, and 100 kaf for Arizona Contractors). The Guidelines also limit the maximum quantity of EC ICS that can be accumulated in all ICS accounts, at any time, to 2.1 maf (1.5 maf for California Contractors, 300 kaf for Nevada Contractors, and 300 kaf for Arizona Contractors). As the drought continued beyond its 15th year and as part of DCP negotiations, Reclamation and Contractors recognized that the role of ICS in preventing Lake Mead's decline to critical elevations was becoming increasingly important, and that the creation and accumulation limits set forth in the Guidelines disincentivized Contractors from creating additional voluntary conservation to improve reservoir conditions. In response, the DCP incorporated greater annual flexibility and a higher accumulation limit. See Section 7.5.2 for further discussion.

7.5.1.4 System and Evaporation Assessments

The Guidelines require that a one-time deduction of 5 percent be applied to EC, TC, and Imported ICS in the year of its creation. The purpose of this system assessment is to generate system water for storage in Lake Mead, thereby helping to protect critical elevations. Since the adoption of the Guidelines, 176 kaf of system assessment water has benefited Lake Mead.

The Guidelines also require that any EC ICS remaining in a Contractor's account at the end of the year be reduced by 3 percent to account for losses due to evaporation. This evaporation assessment is applied annually, beginning in the year after the ICS is created, and continues until the EC ICS balance is extinguished. Since the adoption of the Guidelines, 95 kaf of water has been stored to account for evaporation in Lake Mead. Because balances were reduced every year, Contractors viewed this as a disincentive for long-term storage of ICS. In response, the assessments (both evaporation and system) were adjusted as part of the DCPs. See Section 7.5.2 for further discussion.

7.5.1.5 Delivery

A Contractor can take delivery of ICS consistent with the terms of its ICS Delivery Agreement. Unlike modifications to planned ICS *creation* amounts, which may only be reduced from the original ICS Plan, a Contractor may request a mid-year modification to either increase or reduce the amount of ICS to be delivered during a year. This flexibility proved useful, but provisions related to timing of deliveries and the restriction of delivery to certain Lake Mead elevations were difficult to implement or problematic.

The "May provision" in Section XI.G.3.C.5. of the ROD says that if operational projections made in May indicate that a Shortage Condition would be determined in the upcoming year if the current year's requested ICS amounts were delivered, the amount of ICS requested to be delivered may be reduced by the Secretary. Although this provision was not triggered, Lake Mead's projected conditions were closely monitored in 2016 prior to August determination for Lake Mead's operation in CY 2017, as scenarios with below average inflows coupled with higher than projected Lower Basin water use had the potential to trigger a Shortage Condition. Given the hydrologic and operational uncertainty that exists during the months of May through July leading up to the August determination, this provision would be difficult to implement.

The Guidelines do not restrict the window during which Contractors may request changes to ICS delivery amounts. Similar to the concern described in Section 7.5.1.2, because Lake Powell releases may be adjusted in April based partly on projected elevations in Lake Mead, it is possible that these adjustments could be influenced by ICS activity.

Under the Guidelines, ICS may only be delivered in a year in which the Secretary determines an ICS Surplus Condition, which can only occur when the August 24-Month Study projects Lake Mead elevation to be above 1,075 feet on January 1. As Lake Mead elevations declined, it became clear that this limitation could have inhibited flexibility at a time when Contractors might need it most and encouraged the withdrawal of ICS as Lake Mead was approaching 1,075 feet, thus exacerbating Lake Mead's decline. As modified by the DCP, ICS may now be delivered when Lake Mead elevation is above 1,025 feet. See Section 7.5.2 for further discussion.

7.5.2 Observations Related to Activities Complementary to Intentionally Created Surplus

Building on the programs that were initiated by adoption of the Guidelines and the demonstrated success of the ICS mechanism, additional activities and programs were developed and implemented throughout the Lower Division States[15] and with Mexico to incentivize water conservation. These programs provide an operational framework to increase Lake Mead elevations and provide flexibilities for water users in both countries. These activities and their resulting conservation are summarized in Table 4.

The existence of the ICS mechanism was fundamental to the development of the Lower Basin DCP. It provided the framework for the concept of DCP contributions, which were created to reduce the risk of reaching critical elevations at Lake Mead. Because many aspects of the Lower Basin DCP were developed as a direct result of the operational experiences with ICS that were described above, they are covered here in more detail.

The experience with forbearance, and specifically with the unanimous consent limitation included in the Forbearance Agreement, prevented broader participation in the ICS program and likely reduced the volume of ICS that could otherwise have been created between 2008 and 2019. Fourteen new exhibits were added through Congressional approval of the DCPs, allowing four new entities to participate: CRIT, the Gila River Indian Community (GRIC), the Mohave Valley Irrigation and Drainage District (MVIDD), and the Wellton Mohawk Irrigation and Drainage District. It is significant that two participants are tribal partners as expanding their access to ICS is beneficial for tribes and the Basin as a whole.

In recognition that more conservation would likely be necessary to reduce risks to Lake Mead, the Lower Basin DCP increased accumulation limits and expanded accumulation and annual creation flexibility. Under

[15] The Pilot Program included Upper Basin participation and are important programs to incentivize conservation for the benefit of the system.

the Guidelines, accumulation was limited to 2.1 maf across all ICS accounts. The Lower Basin DCP expanded this to 2.7 maf and allows for the sharing of accumulation capacity among Contractors in different Lower Division States (not just within states, as restricted in the Guidelines). While annual creation limits across all Contractors remains at 625 kaf, the Lower Basin DCP added the flexibility for Contractors to make available their annual creation capacity to others. Despite this increased capacity and flexibility, projections suggest that Arizona and Nevada may reach their accumulation limits by the end of 2021, and that California may reach its limit by the end of 2022.

To address the issue that the 3/5 percent assessment for evaporation/system may have disincentivized long term storage of ICS, the Lower Basin DCP instead applies a one-time combined system and evaporation assessment of 10 percent. As an additional incentive to replenish ICS volumes stored in Lake Mead, the 10 percent assessment does not apply to the creation of EC ICS if it is replenishing the volume delivered to the same Contractor in the preceding year.

Finally, to ensure that Contractors can take delivery of their ICS during a wider range of conditions, specifically those that may accompany deeper stress to many water supply sources, the Lower Basin DCP allows for most types of ICS to be delivered down to Lake Mead elevation 1,025 feet with lessening flexibility as Lake Mead declines.

Table 4. Summary of Complementary Activities Implemented between 2008 and 2019 that have generated Conserved Colorado River Water. All values shown are rounded to the nearest kaf.

Conservation Program/Activity	Conservation Program/Activity Description	Year(s) Implemented	Amount Created through 2019	Additional Creation Amount Anticipated Beyond 2019
Deferred Delivery of Mexico's Colorado River Allotment (Creation of Mexico's Water Reserve)	Originally established under Minute 318; allows Mexico to temporarily defer delivery of a portion of its annual 1.5 maf Colorado River water allotment under the 1944 Treaty for subsequent delivery in future years.	2010-2026	410[1]	Unknown
System Water Provided to the U.S. Pursuant to Minutes 319 and 323	In accordance with Minutes 319 and 323, water that has been or will be provided to the U.S. by Mexico in exchange for funding conservation projects in Mexico. This water is considered Colorado River system water and remains in Lake Mead to benefit system storage.	2012-2026	29	50
Lower Basin Pilot System Conservation Program (PSCP)	Pilot program to assess whether voluntary, measurable reductions in consumptive use of Colorado River water are a feasible and cost-effective method to partially mitigate the impacts of long-term historic drought on the Colorado River System. All water conserved under the PSCP is considered Colorado River system water and remains in Lake Mead to benefit system storage.	2014-2035	165	10
2014 Memorandum of Understanding for Pilot Drought Response Actions	Voluntary agreement among Reclamation, CAWCD, MWD, SNWA and the Lower Division States to use best efforts to generate additional conserved water to protect Lake Mead elevations.	2014-2019	>740	--
Other Programs to Create System Conservation Water	System conservation water created pursuant to various agreements including: CAWCD/Yuma Mesa Irrigation and Drainage District Pilot Fallowing and Forbearance Program Agreement; Reclamation-funded System Conservation Agreements with GRIC, the Fort McDowell Yavapai Nation, and MVIDD (pending); and the CRIT System Conservation Agreement. Water conserved under these agreements remains in Lake Mead to benefit system storage.	2014-2026	115	201

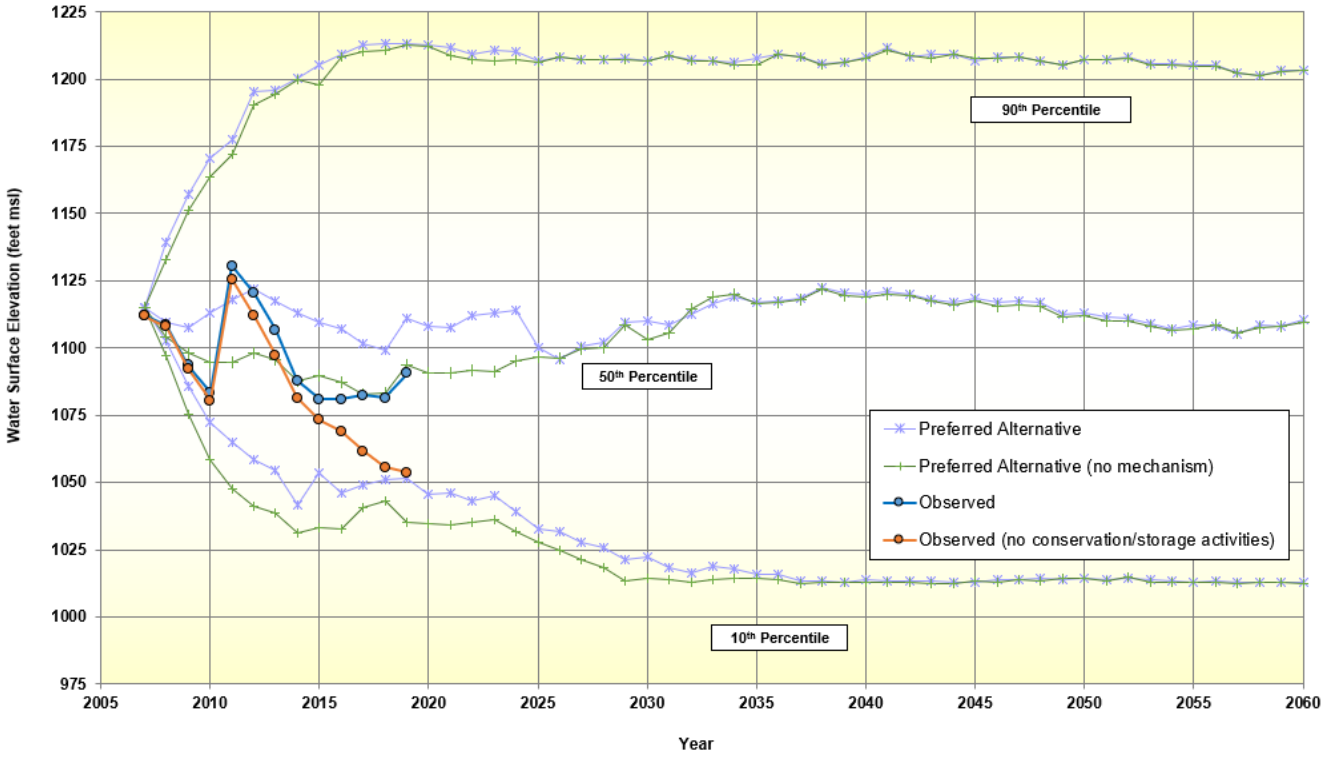
[1] *Amount shown is prior to any applicable system or evaporative assessments; and does not reflect reductions in Mexico's Water Reserve due to: (1) the volume of water delivered to Mexico in 2014 at the Northerly International Boundary in the form of a pulse flow to the Colorado River Delta in accordance with Minute 319 (105 kaf); and (2) the volume of water provided to the United States in 2017 in accordance with Minute 319 (124 kaf).*

7.5.3 Projected vs. Actual Comparison

In the development of the Guidelines, as presented in the Final EIS, modeling assumptions were made with respect to the entities that might participate in a storage and delivery mechanism, later to become the ICS mechanism, and their respective level of participation. Applying those assumptions, Figure 9 illustrates the projected impact of such a mechanism on Lake Mead elevations through the comparison of the Preferred Alternative with and without a mechanism. This comparison indicated that the benefit to Lake Mead elevation would be almost immediate, reaching an almost 25-foot increase in the 50th percentile by 2010.

The benefit to Lake Mead elevations that has been observed since 2008 can be estimated by comparing the Observed to the Observed (no storage/conservation activities). The magnitude of benefit that was projected in the Final EIS may have taken longer to occur in reality, but the observed benefit ultimately exceeded what was projected, reaching a nearly 35-foot increase in Lake Mead's elevation by 2019. This primary driver of this increased ICS benefit was the continuation of the drought, which brought enhanced focus to the ICS mechanism as a critical tool to improve Lake Mead conditions and inspired other conservation programs.

Figure 9. Update to Final EIS Figure 4.3-28. Lake Mead End-of-December Water Elevations. Comparison of Preferred Alternative With and Without a Storage and Delivery Mechanism. 90th, 50th, and 10th Percentile Values to Observed With and Without Storage and Conservation Activities.



[1] *The hypothetical elevation is computed by subtracting the storage gained through conservation activities from the actual elevation and does not take into consideration how Lake Mead or Lake Powell may have operated differently.*

The Preferred Alternative included a maximum accumulation limit of 4.2 maf although the ROD anticipated an accumulation limit of 2.1 maf. The inclusion of this larger amount provided the compliance to support the additional ICS activity that ultimately occurred.

7.6 Process and Consultation

In implementing the Guidelines, the ROD emphasizes the importance of communication, coordination, flexibility, responding to changing or unanticipated circumstances, and the benefit of gaining operational experience. These principles are reflected through the utilization of the Annual Operating Plan process, the broad circumstances under which consultation is required, the mid-year review and the requirement to evaluate the effectiveness of the Guidelines prior to determining their replacement.

In addition to these provisions in the ROD, the adoption of the Guidelines activated a legal agreement among the Basin States that contains another critically important provision: the Basin States have agreed to mandatory consultation provisions to address future controversies on the Colorado River through consultation and negotiation, as a requirement before resorting to litigation.

7.6.1 AOP Process

The Guidelines are implemented on an annual basis through, and documented in each year's Annual Operating Plan (AOP). The AOP serves as a single, integrated reference document required by section 602(b) of the 1968 Colorado River Basin Project Act regarding past and anticipated operations.

Acting on behalf of the Secretary, the AOP is prepared by Reclamation in consultation with a diverse group of interested partners, stakeholders, and the public through the Colorado River Management Work Group. This Work Group holds consultation meetings at least three times each year prior to the AOP being finalized and signed by the Secretary. The AOP is usually published by the end of December of the current CY.

The AOP process has proven to be an inclusive and effective method of coordinating and consulting with interested parties on development of annual operations.

7.6.2 Consultation

Section XI.G.7.B of the ROD, identifies eight circumstances in which the Secretary shall consult with the Basin States and, in some cases, also the Department of State and IBWC. The ROD states that consultation shall not be limited to these circumstances. Of these eight circumstances, two (5 and 7) related to ICS required consultation specifically for that purpose. One (6) was not required and the remainder became part of the external consultation processes that led to the development of the DCPs and Minutes 319 and 323. This is described in more detail below.

1. **Prior to substantive changes to the Guidelines**
   Consultation with the Basin States occurred through external processes to develop the DCPs. However, the DCPs were not viewed as a substantive change to the Guidelines, but rather supplement the Guidelines and work in conjunction with them.
2. **Attempt to resolve controversies by mutual agreement**
   There were no claims or controversies that required the Secretary to invoke this consultation. Discussions with the Basin States related to the DCPs and IBWC related to the development of the Minutes occurred through other collaborative processes.

3. **Prior to Shortage determination regarding reductions to water deliveries to Mexico under the 1944 Water Treaty**
   Through joint binational processes and consultations with USIBWC and Mexico, Minute 319 was implemented in 2012 providing guidance for determining reductions to Mexico deliveries during Shortage/Low Elevation Reservoir Conditions based on specified Lake Mead elevations. Prior to the expiration of Minute 319 in 2017, Minute 323 was executed which continues this guidance for reductions under Shortage/Low Elevation Reservoir Conditions through 2026. To date, there has not been a Shortage Condition determination in the Lower Basin.
4. **When Lake Mead is below 1,025 and approaching 1,000**
   Lake Mead has not declined to an elevation below 1,025 feet; therefore, this specific consultation has not occurred. The extended duration of the current drought led to the increasing risk of reaching critically low reservoir elevations to unacceptable levels. For this reason, consultations focused on actions to reduce this risk through 2026 occurred, resulting in the DCP and the BSWCP.
5. **Regarding the administration of ICS**
   Reclamation consults with the Basin States on all annual ICS Plans of Creation. Comments received from the Basin States are incorporated into revised ICS Plans of Creation before they are approved by Reclamation. Reclamation notes that except for the ICS exhibits approved at the adoption of the Guidelines and the YDP Pilot Run exhibit executed in October 2009, only the DCP process resulted in additional ICS exhibits.
6. **Regarding ICS created through other extraordinary conservation measures pursuant to Section 3.A.1.h.**
   Several of the exhibits added during the DCP process included other extraordinary conservation measures, and consultation occurred during this process.
7. **Regarding the creation of System Efficiency ICS**
   There have been two SE ICS projects during the interim period: the construction of Drop 2 (a.k.a. Brock) Reservoir, and the Yuma Desalting Plant (YDP) Pilot Run. Both resulted in the creation of SE ICS credits for the funding partners. Funding and construction of Brock Reservoir was made in accordance with an agreement approved at the time of the ROD among Reclamation and the funding partners. The YPD Pilot Run, which started in 2010, required additional consultation with multiple parties including IBWC and Mexico.
8. **To evaluate actions at critical elevations that may avoid Shortage determinations**
   The extended duration of the current drought led to the increasing risk of reaching critically low reservoir elevations to unacceptable levels. For this reason, consultations focused on actions to reduce this risk through 2026 occurred, resulting in the DCPs and the BSWCP, rather than actions focused on avoiding Shortage in that year.

7.6.3 Mid-Year Review

To date, there has not been a mid-year review at the request of any Basin State or the Upper Colorado River Commission.

7.6.4 Operations During Interim Period

7.6.4.1 Implementation of the LROC

The Guidelines state that "It is the Department's decision that the Guidelines implement the LROC on an annual basis through the Interim Period and that the operation of the relevant Colorado River reservoirs be

documented in each year's AOP…. The Guidelines implement the LROC and may be reviewed concurrently with the LROC five-year review." While there have been a number of complementary activities as described in Section 4, there has not been a formal 5-year review of the LROC during the interim period.

7.6.4.2 Extraordinary circumstances

The only invocation of the Guidelines' provisions regarding an extraordinary circumstance related to "other unanticipated or unforeseen activities arising from actual operating experience" occurred in mid-2017 when MWD requested that the Department approve an increase in their authorized creation of ICS during CY 2017. By letter dated July 31, 2017, MWD submitted a Modified ICS Plan requesting approval to create and retain approximately 200 kaf AF of additional water in Lake Mead as ICS. Subsequently, following consultation, in a joint letter to the Secretary dated September 18, 2017, the seven Basin States collectively provided their concurrence recommendation, subject to the limitations and conditions set forth therein, that the Secretary invoke Section XI.G.7.D. of the ROD and authorize Reclamation to consider and, subject to its technical review, approve MWD's Modified ICS Plan. After appropriate review, the Department approved MWD's request.

8 Effectiveness of the Guidelines

The development of the Guidelines was initiated in 2005 as a historic drought impacted the Basin resulting in rapidly declining reservoir levels. Interstate and inter-basin tensions escalated as objective operational rules to guide the operation of Lake Powell and Lake Mead at the approaching lower reservoir elevations did not exist. Federal action by Secretary Gale A. Norton resulted in a public process to develop objective operational guidelines, for a full range of reservoir levels.

During the 12 years of reservoir operations pursuant to the Guidelines, the drought has persisted. Through many of those years, storage in Lakes Powell and Mead has remained near 50 percent capacity. Although Lake Powell has never operated in its lowest tier and Lake Mead has never operated in a Shortage Condition - due to modestly improved hydrology and sustained actions taken to specifically avoid reaching those levels (actions that were only possible because of the Guidelines) - the Guidelines contained specific operational provisions in the event reservoir levels dropped further. Those provisions created the operational stability that became the platform for the collaborative decision-making that protected the Colorado River system from crisis.

Regarding whether these Guidelines were effective as measured against their *purpose*, as stated in the ROD, the following key conclusions are offered:

- *Improve Reclamation's management of the Colorado River by considering trade-offs between the frequency and magnitude of reductions of water deliveries, and considering the effects on water storage in Lake Powell and Lake Mead, and on water supply, power production, recreation, and other environmental resources.*
    - The Guidelines improve Reclamation's management of the Colorado River. Prior to the Guidelines, objective operational criteria for a full range of reservoir elevations had not been developed for Lakes Powell and Mead. The fact that the Guidelines provide the additional objective operational criteria for both reservoirs is an important improvement.
    - However, due to the persistence and magnitude of the drought, had Reclamation continued operations solely according to the Guidelines, the risk of reaching critically low elevations in

Lake Powell and Lake Mead by 2026 was projected to increase nearly four-fold over what was projected in the Final EIS and at the time of the adoption of the ROD. In light of this increased risk, additional voluntary adaptive management actions were conceptualized and adopted, including through the Upper and Lower Basin DCPs. These additional elements utilized the structure of the Guidelines and mitigated the increased risk.

  - The trade-offs between the frequency and magnitude of reductions of water-deliveries and the effects on Basin resources were evaluated in the development of the Guidelines through the NEPA process, providing environmental compliance for the duration of the Guidelines, that is, through 2026. Re-evaluation of these items and relevant resource conditions is an essential component of determining operations beyond 2026.

- *Provide mainstream United States users of Colorado River water, particularly those in the Lower Division states, a greater degree of predictability with respect to the amount of annual water deliveries in future years, particularly under drought and low reservoir conditions.*
  - The Guidelines provide water users in the Lower Division states a greater degree of predictability regarding water deliveries, particularly in low reservoir conditions. Structuring deliveries around specific Lake Mead elevations facilitated projections of risk concerning reaching those elevations and promoted the development of strategies to avoid risk. The structure of specific elevations tied to specific reductions in water deliveries enabled a common framework for appreciation of future risk and thus a common incentive to avoid such elevations.
  - The ability of the Guidelines to protect the system from the effects of persistent drought, however, became increasingly uncertain. The framework of the Guidelines provided the basis for subsequent required conservation and increased flexibilities for Lower Basin water users. Likewise, the Guidelines facilitated opportunities for conservation in the Upper Basin through the Pilot Program and in the Upper Basin DCP, through a potential demand management program, which is subject to ongoing consideration and decision-making by the individual Upper Division states.
- *Provide additional mechanisms for the storage and delivery of water supplies in Lake Mead to increase the flexibility of meeting water use needs from Lake Mead, particularly under drought and low reservoir conditions.*
  - The Guidelines provide additional mechanisms for the storage and delivery of water supplies in Lake Mead. A broad mechanism such as ICS did not exist prior to adoption of the Guidelines. The increased usage of ICS as a drought response tool played a critical role in the avoidance of reaching low Lake Mead levels. The existence of the ICS mechanism was fundamental to the development of the Lower Basin DCP; it provided the framework for the concept of DCP contributions.
  - Reclamation and Contractors gained important experience through the Forbearance Agreement regarding increasing their usage of the ICS mechanism. This experience also uncovered several aspects of the ICS mechanism that could be modified to increase ICS participation, particularly from Contractors who have not used it before. Even with these limitations, upon adoption of the DCPs, new ICS exhibits for Lower Basin water users, including two tribes, were implemented.

Regarding whether these Guidelines were effective as measured against the *common themes* that emerged during the public process to develop the Guidelines, the following is offered:

- *Encourage conservation*
  - The Guidelines encouraged robust conservation through the implementation of the ICS mechanism, and served as a foundation for development of a similar mechanism for Mexico as

implemented through IBWC Minutes 318, 319, and 323, as well as providing the framework for system conservation agreements and other contributions to protect Lake Mead.[16] Important experiences were also gained that highlighted questions about ICS creation limits, flexibilities and the ease of full participation by Lower Basin water users (particularly tribes).

- *Plan for shortages*
  - The Guidelines provide clear definition on the specific and objective Shortage Conditions that facilitated planning. As the probability of Shortage and the risk of reaching critically low elevations at Lake Mead increased, the need to plan for additional reductions in water deliveries became apparent and responsive actions were developed and implemented (see Figure 2).
- *Implement closer coordination of operations of Lake Powell and Lake Mead*
  - Combined, the balancing and equalization operations were the most prevalent Lake Powell operation resulting in close coordination of operations between the reservoirs. Through these experiences the implications of particular provisions were called into focus, highlighting that through close operational coordination of Lakes Powell and Mead, other activities in the Upper and Lower Basin become linked, for example, ICS activity in the Lower Basin can impact Lake Powell release. This led to the development of provisions in the DCPs that provide greater transparency with respect to operational projections and decision-making.
  - Minimizing shortages in Lower Basin and avoiding risk of curtailment in Upper Basin are objectives of coordinated operations. However, the duration and magnitude of the drought and low-runoff conditions since adoption of the Guidelines, and the associated increase in risk of Lake Powell and Mead declining to critically low elevations have increased the risk of failing to meet these objectives. Acknowledging this increased risk, the Basin States and the Department formally agreed in the DCPs that it was necessary and beneficial to pursue additional actions beyond those contemplated in the Guidelines to reduce the likelihood of reaching critical elevation levels in Lake Powell and Lake Mead through the interim period.
- *Preserve flexibility to deal with further challenges such as climate change and deepening drought*
  - As was experienced through the subsequent operational decisions put into place to address the deepening drought, the Guidelines provided not just the flexibility, but the legal, policy and operational stability to support those decisions. This foundation was essential to the development of complementary domestic and binational agreements designed to address drought and low reservoir conditions.
- *Implement operational rules for a long – but not permanent – period in order to gain valuable operating experience*
  - The Guidelines are anticipated to be in effect through 2026, providing 19 years of operational experience that will be critical to determining their replacement. This Review provides the opportunity to build a common understanding regarding 12 years of operational experience.
- *Continue to have the federal government facilitate – but not dictate – informed decision-making in the Basin and Encourage parties to address future controversies on the Colorado River through consultation and negotiation … before resorting to litigation.*

[16] The framework established by the Guidelines were also effective in facilitating federal and non-federal investments in a number of programs that assisted in water conservation and reliability in the Basin during a period of historic drought. These included conservation of system water in both the Upper and Lower Basins, development of significant ICS volumes, investment in water conservation infrastructure in Mexico, and other related actions. Absent the Basin States consensus represented in adoption of the Preferred Alternative, it is uncertain whether any of these programs could have been developed and implemented.

- The collaborative decision-making that has continued in in the Basin since the adoption of the Guidelines is strong evidence that the Guidelines have been effective in the continuation of the Department's role as a facilitator and the encouragement of negotiation before litigation.

9 Summary

This Report was prepared to meet Reclamation's obligations under Section XI.G.7.D. of the Guidelines and serves to document Reclamation's operational experience implementing Guidelines. This report provides Reclamation's retrospective evaluation of whether operations and actions specified by the Guidelines have adhered to common themes and been effective with respect to the purpose stated in the ROD.

Applying this approach to evaluate effectiveness, Reclamation concludes that the Guidelines were largely effective as measured against both their purpose and common themes. The increasing severity of the drought necessitated additional action to reduce the risk of reaching critically low elevations at Lake Powell and Lake Mead to the risk levels projected when the Guidelines were developed leading to the adoption of the DCPs and other voluntary adaptive actions.

The experience gained over the last 12 years provides important considerations for enhancing future effectiveness, particularly with respect to: 1) enhanced flexibilities and transparency for water users; 2) expanded participation in conservation and Basin-wide programs; 3) increased consideration of the linkage that occurs through coordinated reservoir operations, particularly with respect to the inherent uncertainties in model projections used to set operating conditions; and, 4) more robust measures to protect reservoir levels.

The results of this evaluation are not intended to imply correctness of any particular operational provision or recommend future policies or actions. Reclamation anticipates that this Report will be one of many valuable sources of information during upcoming activities in support of the development of post-2026 operational guidelines.

10 References

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