



**Congressional
Research Service**

Informing the legislative debate since 1914

Management of the Colorado River: Water Allocations, Drought, and the Federal Role

Updated February 6, 2023

Congressional Research Service

<https://crsreports.congress.gov>

R45546



Management of the Colorado River: Water Allocations, Drought, and the Federal Role

The Colorado River Basin covers more than 246,000 square miles in seven U.S. states (Wyoming, Colorado, Utah, New Mexico, Arizona, Nevada, and California) and Mexico. Pursuant to federal law, the Bureau of Reclamation (part of the Department of the Interior) manages much of the basin's water supplies. Colorado River water is used primarily for agricultural irrigation and municipal and industrial (M&I) uses; it is also important for hydropower production, fish and wildlife, and recreational uses.

Apportioned Colorado River water is widely acknowledged to be in excess of the river's natural flows, and consumptive use plus other losses of these waters (i.e., evaporation) typically exceeds natural flows. This causes an imbalance in the basin's available water supply and demand. Stress on basin water supplies is exacerbated by a long-term drought dating to 2000.

River Management

The foundational document governing basin water management is the Colorado River Compact of 1922. Pursuant to the compact, the basin states established a framework to apportion water supplies between the river's Upper and Lower Basins, with the dividing line between the two basins located at Lee Ferry, AZ. Each basin was allocated 7.5 million acre-feet (MAF) annually under the compact, and an additional 1.5 MAF in annual flows was made available to Mexico under a 1944 treaty. Further agreements and court decisions addressed other issues, and subsequent federal legislation provided authority and funding for federal facilities that allowed users to develop their allocations. A 1963 Supreme Court ruling confirmed that Congress designated the Secretary of the Interior to manage the delivery of all water below Hoover Dam.

Reclamation and basin stakeholders closely track the status of two large reservoirs—Lake Powell in the Upper Basin and Lake Mead in the Lower Basin—as an indicator of basin storage conditions. Under criteria agreed upon by basin states, water releases from both lakes are tied to specific water storage levels. Since the onset of drought in the early 2000s, storage levels at these reservoirs have been falling. In 2021 and 2022, Reclamation declared the first-ever *Tier One* and *Tier Two* Shortages in the Lower Basin, respectively. These designations reduced water deliveries to contractors in Arizona and Nevada, as well as to Mexico. In the Upper Basin, Lake Powell's storage has continued to drop. This trend could soon jeopardize hydropower generation at Glen Canyon Dam, and has led to operational changes in the Upper Basin.

Efforts to Address Drought

The federal government has led multiple efforts to improve the basin's water supply outlook, resulting in collaborative agreements in 2003 and 2007 and the 2019 drought contingency plans (DCPs) for the Upper and Lower Colorado River Basins (authorized by Congress in the Colorado River Drought Contingency Plan Authorization Act, P.L. 116-14). The DCPs required new cutbacks to Lower Basin water deliveries based on specified storage levels in Lake Mead, committed Reclamation to supporting water conservation efforts, and put in place plans to coordinate Upper Basin operations to enhance Lake Powell storage levels and prevent the loss of hydropower generation.

The hydrologic outlook for the Colorado River Basin has deteriorated further since approval of the DCPs, and there remains widespread concern about the basin's long-term water supply. On June 14, 2022, Reclamation called on basin states to conserve an additional 2-4 MAF of water in 2023 and 2024. When these commitments failed to materialize, Reclamation initiated a process to revise its current operational guidelines for 2023 and 2024; this process could lead Reclamation to implement additional unilateral delivery curtailments without state input. In addition to these short-term water management decisions, decisionmakers face longer-term questions, such as whether to renew basin water management agreements (including the DCPs) expiring in 2026 and whether major changes to basin water management are warranted.

Congressional Role

Congress plays a multifaceted role in the federal management of the Colorado River Basin. Congress funds and oversees management of basin water and power facilities and has held oversight hearings on drought in the basin. Congress also has enacted legislation involving allocation of Colorado River waters (e.g., authorization of Indian water rights settlements; new water storage facilities) and authorities to mitigate water shortages (e.g., the DCPs and other related efforts). Further,

R45546

February 6, 2023

Charles V. Stern

Specialist in Natural Resources Policy

Pervaze A. Sheikh

Specialist in Natural Resources Policy

Congress may consider amending, extending, or repealing existing authorities or providing funding to mitigate the effects of the basin's water shortages. Most recently, in Section 50233 of P.L. 117-169 (popularly known as the Inflation Reduction Act), Congress provided \$4.0 billion for drought mitigation in the West, with priority given to Colorado River Basin activities.

Contents

| | |
|---|----|
| Introduction | 1 |
| The Law of the River: Foundational Documents and Programs | 3 |
| Colorado River Compact..... | 4 |
| Boulder Canyon Project Act..... | 4 |
| Arizona Ratification and <i>Arizona v. California</i> Decision | 5 |
| 1944 U.S.-Mexico Water Treaty..... | 6 |
| Upper Basin Compact and Colorado River Storage Project Authorizations | 6 |
| Water Storage and Operations | 9 |
| Annual Operations | 10 |
| Recent Conditions..... | 10 |
| Mitigating the Environmental Effects of Colorado River Basin Development..... | 11 |
| Salinity Control | 11 |
| Endangered Species Efforts and Habitat Improvements..... | 12 |
| Upper Colorado Endangered Fish Recovery Program..... | 12 |
| San Juan River Basin Recovery Implementation Program..... | 12 |
| Glen Canyon Dam Adaptive Management Program..... | 13 |
| Lower Colorado Multi-Species Conservation Program..... | 13 |
| Tribal Water Rights..... | 14 |
| Drought and the Supply/Demand Imbalance..... | 15 |
| Recent Developments and Agreements | 18 |
| 2003 Quantitative Settlement Agreement | 18 |
| 2004 Arizona Water Settlements Act..... | 18 |
| 2007 Interim Guidelines/Coordinated Operations for Lake Powell and Lake Mead..... | 19 |
| System Conservation Program..... | 20 |
| Minute 319 and Minute 323 Agreements with Mexico..... | 20 |
| 2019 Drought Contingency Plans | 21 |
| Upper Basin Drought Contingency Plan..... | 21 |
| Lower Basin Drought Contingency Plan | 22 |
| 500+ Plan | 25 |
| Potential for Additional Actions..... | 26 |
| Issues for Congress..... | 27 |
| Funding and Oversight of Existing Facilities and Programs..... | 27 |
| Tribal Water Rights Settlements and Leasing | 29 |
| New Facilities and Other Alterations | 29 |
| Post-2026 Operations/Agreements..... | 30 |
| Concluding Observations | 30 |

Figures

| | |
|---|----|
| Figure 1. Colorado River Basin and U.S. Areas That Import Colorado River Water..... | 2 |
| Figure 2. Colorado River Basin Allocations..... | 8 |
| Figure 3. Colorado River Natural Flow at Lees Ferry, Arizona, with 10-Year Moving Average, 1906-2022 | 16 |
| Figure 4. Combined Storage at Lakes Mead and Powell, 1960-2022 | 17 |

Figure 5. Lake Powell End of Month Elevation Projections 22
Figure 6. Lake Mead End of Month Elevation Projections 25

Tables

Table 1. Lower Basin Water Delivery Curtailment Volumes Under Existing Agreements 24

Contacts

Author Information..... 31

Introduction

From its headwaters in Colorado and Wyoming to its terminus in the Gulf of California, the Colorado River Basin covers more than 246,000 square miles. The river runs through seven U.S. states (Wyoming, Colorado, Utah, New Mexico, Arizona, Nevada, and California) and Mexico. Pursuant to federal law, the Bureau of Reclamation (Reclamation, a bureau in the Department of the Interior [DOI]) plays a prominent role in the management of the basin's waters. In the Lower Basin (i.e., Arizona, Nevada, and California), Reclamation also serves as *water master* on behalf of the Secretary of the Interior, a role that elevates the status of the federal government in basin water management.¹ The federal role in managing Colorado River water is magnified by the multiple federally owned and operated water storage and conveyance facilities in the basin, which provide low-cost water and hydropower supplies to water users.

Colorado River water is used primarily for agricultural irrigation and municipal and industrial (M&I) purposes. The river's flow and stored water also are important for power production, fish and wildlife, and recreation, among other uses. A majority of basin water supplies (70%) are used to irrigate 5.5 million acres of land; basin waters also provide M&I water supplies to nearly 40 million people.² Much of the area that depends on the river for its water supplies is outside of the drainage area for the Colorado River Basin. Storage and conveyance facilities on the Colorado River provide trans-basin diversions that serve areas such as Cheyenne, WY; multiple cities in Colorado's Front Range (e.g., Fort Collins, Denver, Boulder, and Colorado Springs, CO); Provo, UT; Albuquerque and Santa Fe, NM; and Los Angeles, San Diego, and the Imperial Valley in Southern California (**Figure 1**). Colorado River hydropower facilities can provide up to 4,200 megawatts of electrical power per year.³ The river also provides habitat for a wide range of species, including several federally endangered species. It flows through 7 national wildlife refuges and 11 National Park Service (NPS) units; these and other areas of the river support important recreational opportunities.⁴

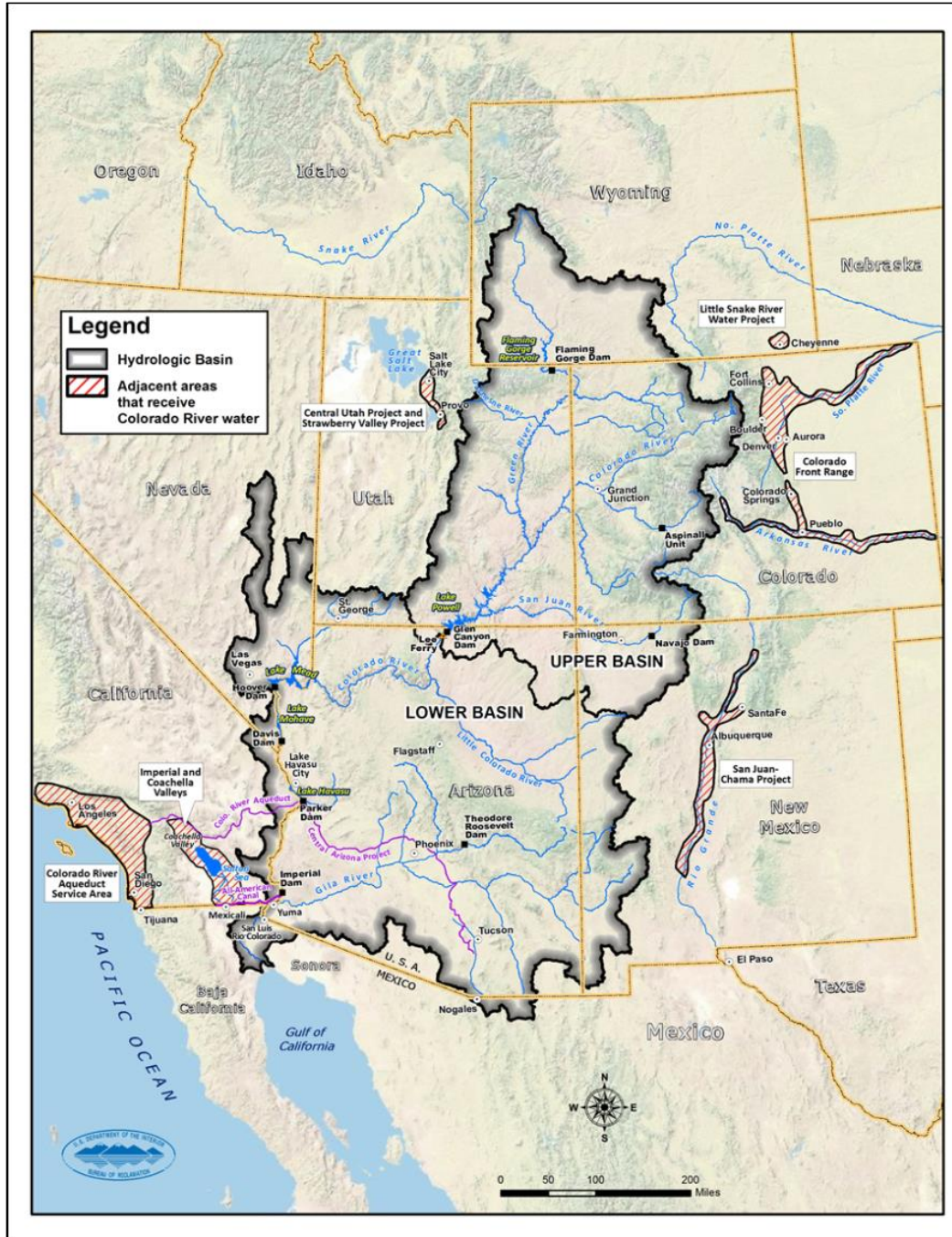
¹ As discussed later in the section, "The Law of the River: Foundational Documents and Programs," the Boulder Canyon Project Act of 1928 made the Secretary of the Interior responsible for the distribution (via contract) of all Colorado River water delivered below Hoover Dam (i.e., the Lower Basin), and authorized such regulations as necessary to enter into these contracts. Subsequent court decisions confirmed the Secretary's power to apportion surpluses and shortages among and within Lower Basin states; this forms the basis for the designation Lower Basin *water master*. No similar authorities and designation have been provided for the Upper Basin.

² U.S. Bureau of Reclamation (Reclamation), *Colorado River Basin Water Supply and Demand Study*, p. 4, December 2012, at <https://www.usbr.gov/lc/region/programs/crbstudy/finalreport/index.html>. Hereinafter, Reclamation, *2012 Supply/Demand Study*.

³ Reclamation, *2012 Supply/Demand Study*, p. 3.

⁴ Reclamation, *2012 Supply/Demand Study*, p. 3.

Figure I. Colorado River Basin and U.S. Areas That Import Colorado River Water



Source: Bureau of Reclamation, *Colorado River Basin Water Supply and Demand Study*, 2012.

Precipitation and runoff in the basin are highly variable. Water conditions on the river depend largely on snowmelt in the basin’s northern areas. Based on observed historical data (1906-2022), natural flows in the Colorado River Basin averaged about 14.6 million acre-feet (MAF) annually.⁵ Flows have dipped

⁵ Reclamation, “Colorado River Basin Natural Flow and Salt Data—Current Natural Flow Data 1906-2022,” April 2022 24 Month Study, at <https://www.usbr.gov/lc/region/g4000/NaturalFlow/provisional.html>. Hereinafter, Reclamation, “Reclamation Flow

significantly during the current drought, which dates to 2000; annual natural flows from 2000 to 2022 averaged approximately 12.1 MAF per year.⁶ Reclamation has noted that the 23-year period from 2000 to 2022 was the driest 23-year period in more than 100 years of record keeping, and among the driest periods in the past 1,200 years.⁷ Climate change impacts, including warmer temperatures and altered precipitation patterns, may further increase the likelihood of prolonged drought in the basin.⁸

Pursuant to the multiple compacts, federal laws, court decisions and decrees, contracts, and regulatory guidelines governing Colorado River operations (collectively known as the *Law of the River*), Congress and the federal government play a prominent role in the management of the Colorado River. Specifically, Congress funds and oversees Reclamation’s management of Colorado River Basin facilities, including facility operations and programs to protect and restore endangered and threatened species. Congress has also approved and continues to consider Indian water rights settlements involving Colorado River waters, and development of new and expanded water storage in the basin. In addition, Congress has approved supplemental funding to mitigate drought and stretch basin water supplies, and new authorities for Reclamation to combat drought and enter into agreements with states and Colorado River contractors. This report provides background on management of the Colorado River, with a focus on recent developments. It also discusses the congressional role in the management of basin waters.

The Law of the River: Foundational Documents and Programs

In the latter part of the 19th century, interested parties in the Colorado River Basin began to recognize that local interests alone could not solve the challenges associated with development of the Colorado River. Plans conceived by parties in California’s Imperial Valley to divert water from the mainstream of the Colorado River were thwarted because these proposals were subject to the sovereignty of both the United States and Mexico.⁹ The river also presented engineering challenges, such as deep canyons and erratic water flows, and economic hurdles that prevented local or state groups from building the necessary storage facilities and canals to provide an adequate water supply. In part because local or state groups could not resolve these “national problems,” Congress considered options to control the Colorado River and resolve potential conflicts between the states.¹⁰ In an effort to resolve these conflicts and avoid litigation, Congress gave its consent for the states and Reclamation to enter into an agreement to apportion Colorado River water supplies in 1921.¹¹

Data.”

⁶ Reclamation, “1906-2022 Natural Flows.”

⁷ Reclamation, Department of the Interior, “Request for Input on Development of Post-2026 Colorado River Reservoir Operational Strategies for Lake Powell and Lake Mead Under Historically Low Reservoir Conditions,” 87 *Federal Register* 37884, June 24, 2022. Hereinafter 87 FR 37884, 2022. For additional discussion on historic drought in the Colorado River, see Subhrendu Gangopadhyay, Connie A. Woodhouse, and Gregory J. McCabe, “Tree Rings Reveal Unmatched 2nd Century Drought in the Colorado River Basin,” *Geophysical Research Letters*, vol. 49, no. 11 (June 2022).

⁸ B. Udall and J. Overpeck, “The Twenty-First Century Colorado River Hot Drought and Implications for the Future,” *Water Resources Research*, vol. 53 (February 17, 2017), pp. 2404-2418.

⁹ *Arizona v. California*, 373 U.S. 546 (1963). Hereinafter, *Arizona v. California*.

¹⁰ S. Doc. No. 67-142 (1922). For example, the states in the Upper Basin (Colorado, Wyoming, Utah, and New Mexico), where the majority of the river’s runoff originates, feared that a storage facility making water available downstream might form a basis for claims to priority access to basin waters by Lower Basin states before Upper Basin states could develop means to access their share.

¹¹ Ch. 72, 42 Stat. 171 (1921). In lieu of litigation, interstate compacts have historically been a preferred means of allocating water among competing uses. Pursuant to the U.S. Constitution, Article I, Section 10, Clause 3, no such compacts can be entered

The below sections discuss the resulting agreement, the Colorado River Compact, and other documents and agreements that form the basis of the Law of the River, which governs Colorado River operations.¹²

Colorado River Compact

The Colorado River Compact of 1922, negotiated by the seven basin states and the federal government, was initially signed by all but one basin state (Arizona).¹³ Under the compact, the states established a framework to apportion the water supplies between the Upper Basin and the Lower Basin, with the dividing line between the two basins located at Lee Ferry, AZ,¹⁴ below the confluence of the Colorado and Paria Rivers near the Utah border.¹⁵ Each basin was apportioned 7.5 MAF annually for beneficial consumptive use, and the Lower Basin was given the right to increase its beneficial consumptive use by an additional 1 MAF annually. The agreement also required that Upper Basin states not deplete more than a total of 75 MAF over any 10-year period (i.e., 7.5 MAF per year), thus allowing for averaging over time to make up for low-flow years. The compact did not address inter- or intrastate allocations of water (which it left to future agreements and legislation), nor did it address water to be made available to Mexico, the river's natural terminus, which was addressed in subsequent international agreements. The compact was not to become binding until it had been approved by the legislatures of each of the signatory states and by Congress.

Boulder Canyon Project Act

Congress approved and modified the Colorado River Compact in the Boulder Canyon Project Act (BCPA) of 1928.¹⁶ The act ratified the 1922 compact, and authorized the construction of a federal facility to impound water in the Lower Basin (Boulder Dam, later renamed Hoover Dam) and of related facilities to deliver water in Southern California (e.g., the All-American Canal, which delivers Colorado River water to California's Imperial Valley). The act apportioned the Lower Basin's 7.5 MAF per year among the three Lower Basin states: 4.4 MAF per year to California, 2.8 MAF to Arizona, and 300,000 acre-feet (AF) to Nevada, with the states to divide any surplus waters among them. It also directed the Secretary of the Interior to serve as the sole contracting authority for Colorado River water use in the Lower Basin and authorized several storage projects for study in the Upper Basin.

Congress's approval of the compact in the BCPA was conditioned on a number of factors, including ratification by California and five other states (thereby allowing the compact to become effective without Arizona's concurrence), and California agreeing by act of its legislature to limit its water use to 4.4 MAF

into without the consent of Congress.

¹² The *Law of the River* is the commonly used shorthand for the multiple compacts, federal laws, court decisions and decrees, treaties, contracts, and regulatory guidelines collectively known under this heading.

¹³ Because the Colorado River Compact of 1922 did not specify the apportionments for individual states, Arizona initially refused to sign and ratify the agreement out of concern that rapidly growing California would lay claim to most of the Lower Basin's share of water. Arizona eventually signed and ratified the compact in 1944. See below section on "Arizona Ratification and Arizona v. California Decision."

¹⁴ *Lee Ferry* is the dividing line between basins designated in the compact. *Lees Ferry* (or *Lee's Ferry*), approximately 1 mile upstream from that point, is the location of the USGS streamgage that has measured flows dating to 1921. After the compact was signed, the Lees Ferry streamgage, along with a gage on the Paria River, became the measurements used to determine compliance with the compact.

¹⁵ Arizona receives water under both the Upper and the Lower Basin apportionments, because parts of the state are in both basins.

¹⁶ Boulder Canyon Project Act (BCPA), Ch. 42, 45 Stat. 1057 (1928), codified as amended at 43 U.S.C. §617.

per year and not more than half of any surplus waters. California met this requirement by passing the California Limitation Act of March 4, 1929, thus the compact became effective on that date.¹⁷

Arizona Ratification and *Arizona v. California* Decision

Arizona did not ratify the Colorado River Compact until 1944, at which time the state began to pursue a federal project to bring Colorado River water to its primary population centers in Phoenix and Tucson. California opposed the project, arguing that under the doctrine of prior appropriation,¹⁸ California's historical use of the river trumped Arizona's rights to the Arizona allotment.¹⁹ California also argued that Colorado River apportionments under the BCPA should include water developed on Colorado River tributaries, whereas Arizona claimed, among other things, that these apportionments included the river's mainstream waters only.

In 1952, Arizona filed suit against California in the U.S. Supreme Court to settle the issue.²⁰ Eleven years later, in the 1963 *Arizona v. California* decision,²¹ the Supreme Court ruled in favor of Arizona, finding that Congress had intended to apportion the mainstream of the Colorado River (i.e., with tributary flows reserved to the states) and that California and Arizona each would receive one-half of surplus flows. Multiple federal laws pertaining to Colorado River basin management refer to the decree the Supreme Court issued in this case the following year and instruct compliance therewith.

The same Supreme Court decision held that Section 5 of the BCPA, which gave the Secretary authority to issue contracts for Lower Basin waters, controlled the apportionment of mainstem water in Lower Basin states.²² The contracting clause gave the Secretary of the Interior authority to apportion Lower Basin shortages as he or she sees fit, in accordance with the BCPA and other priorities.²³ The ruling was notable in forgoing traditional Reclamation deference to state law under the Reclamation Act of 1902, and formed the basis for the Secretary of the Interior's unique role as *water master* for the Lower Basin.²⁴ The

¹⁷ The Department of the Interior also requested that California prioritize its Colorado River rights among users before the Colorado River Compact became effective; the state established priority among these users for water in both "normal" and "surplus" years in the California Seven-Party Agreement, signed in August 1931.

¹⁸ Historically, water in the western United States has been governed by some form of the *rule of prior appropriation*. Under this rule, the party that first appropriates water and puts it to *beneficial use* thereby acquires a vested right to continue to divert and use that quantity of water against claimants junior in time.

¹⁹ Under the BCPA, Arizona and California also were to divide any excess, or surplus, supplies (i.e., amounts exceeding the 7.5 MAF basic apportionment). What was meant by the term *surplus*—and how much water California could claim under this authority—was a major point of disagreement between the two states.

²⁰ Article III of the Constitution states that in all cases in which a state shall be a party, the Supreme Court has original jurisdiction. U.S. Constitution, article III, §2, cl. 2.

²¹ *Arizona v. California*, 373 U.S. 546, 573 (1963), hereinafter *Arizona v. California*. The 1963 Supreme Court decision in *Arizona v. California* is the first in a line of Supreme Court decisions and orders that address water allocation disputes within the Lower Basin. *Arizona v. California*, 373 U.S. 546, 601 (1963), 376 U.S. 340 (1964) (order issued), 383 U.S. 268 (1966) (amending judgment), 466 U.S. 144 (1984) (amending order), 530 U.S. 392 (2000) (subsequent determination), 531 U.S. 1 (2000) (supplemented), 547 U.S. 150 (2006) (consolidated decree); cf. *California v. United States*, 438 U.S. 645 (1978).

²² *Arizona v. California* at 593-594.

²³ *Id.* at 594. "None of this is to say that in case of shortage, the Secretary cannot adopt a method of proration or that he may not lay stress upon priority of use, local laws and customs, or any other factors that might be helpful in reaching an informed judgment in harmony with the Act, the best interests of the Basin States, and the welfare of the Nation. It will be time enough for the courts to intervene when and if the Secretary, in making apportionments or contracts, deviates from the standards Congress has set for him to follow, including his obligation to respect 'present perfected rights' as of the date the Act was passed."

²⁴ Pursuant to Section 8 of the Reclamation Act of 1902 (32 Stat. 388), Reclamation is not to interfere with state laws, "relating to the control, appropriation, use, or distribution of water used in irrigation" and that "the Secretary of the Interior, in carrying out provisions of the Act, shall proceed in conformance with such laws." However, in regard to the projects of the Colorado River Basin, the *Arizona v. California* noted, "Subjecting the Secretary to the varying, possibly inconsistent, commands of the different

decision also held that Native American reservations on the Colorado River were entitled to priority under the BCPA.²⁵ Later decrees by the Supreme Court in 1964 and 1979 supplemented the 1963 decision.²⁶

Following the *Arizona v. California* decision, Congress eventually authorized Arizona's conveyance project for Colorado River water, the Central Arizona Project (CAP), in the Colorado River Basin Project Act of 1968 (CRBPA).²⁷ As a condition for California's support of the project, Arizona agreed that, in the event of shortage conditions, California's 4.4 MAF has priority over CAP water supplies.²⁸

1944 U.S.-Mexico Water Treaty²⁹

In 1944, the United States signed a water treaty with Mexico (1944 U.S.-Mexico Water Treaty) to guide how the two countries share the waters of the Colorado River.³⁰ The treaty established water allocations for the two countries and created a governance framework (i.e., the International Boundary and Water Commission) to resolve disputes arising from the treaty's execution. The treaty requires the United States to provide Mexico with 1.5 MAF of Colorado River water annually, plus an additional 200,000 AF when a surplus is declared. During drought, the United States may reduce deliveries to Mexico in similar proportion to reductions of U.S. consumptive uses. The treaty has been supplemented by additional agreements between the United States and Mexico, known as *minutes*, regarding matters related to the treaty's execution and interpretation.³¹

Upper Basin Compact and Colorado River Storage Project Authorizations

Congress did not allow projects originally authorized for study in the Upper Basin under BCPA to move forward with federally funded construction until the Upper Basin states determined their individual water allocations, which occurred under the Upper Colorado River Basin Compact of 1948.³² Because there was some uncertainty as to the exact amount of water that would remain in the system after Lower Basin

state legislatures could frustrate efficient operation of the project and thwart full realization of the benefits Congress intended this national project to bestow. We are satisfied that the Secretary's power must be construed to permit him, within the boundaries set down in the Act, to allocate and distribute the waters of the mainstream of the Colorado River." *Id.* at 587, 589–90.

²⁵ Indian reserved water rights were first recognized by the Supreme Court in *Winters v. United States* in 1908. *Winters v. United States*, 207 U.S. 564, 575-77 (1908). Under the *Winters* doctrine, when Congress reserves land (i.e., for an Indian reservation), it implicitly reserves water sufficient to fulfill the purpose of the reservation. Because the establishment of Indian reservations (and, therefore, of Indian water rights) generally predated large-scale development of water resources for non-Indian users, the water rights of tribes often are senior to those of non-Indian water rights. For more information on the resulting settlements, see below section, "Tribal Water Rights" and CRS Report R44148, *Indian Water Rights Settlements*.

²⁶ *Arizona v. California*, 376 U.S. 340, 341 (1964). The 1964 decree determined, among other things, that all water in the mainstream of the Colorado River below Lee Ferry and within the United States would be "water controlled by the United States" and that the Secretary would release water under only three types of designations for a year: "normal, surplus, and shortage." The 1979 supplemental decree determined the present perfected rights of various parties in the Lower Basin.

²⁷ Colorado River Basin Project Act of 1968, P.L. 90-537. Codified at 43 U.S.C. §1501 note.

²⁸ 43 U.S.C. §1521.

²⁹ For more information on the 1944 U.S.-Mexico Water Treaty and Colorado River water sharing issues with Mexico, see CRS Report R45430, *Sharing the Colorado River and the Rio Grande: Cooperation and Conflict with Mexico*.

³⁰ The treaty also included water-sharing provisions relating to the Lower Rio Grande and Tijuana Rivers. See Treaty Between the United States of America and Mexico Respecting Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande, U.S.-Mex., February 3, 1944, 59 State. 1219, at https://www.ibwc.gov/Treaties_Minutes/treaties.html. Mexico ratified it on October 16, 1945 and the United States ratified the treaty on November 1, 1945. It became effective on November 8, 1945.

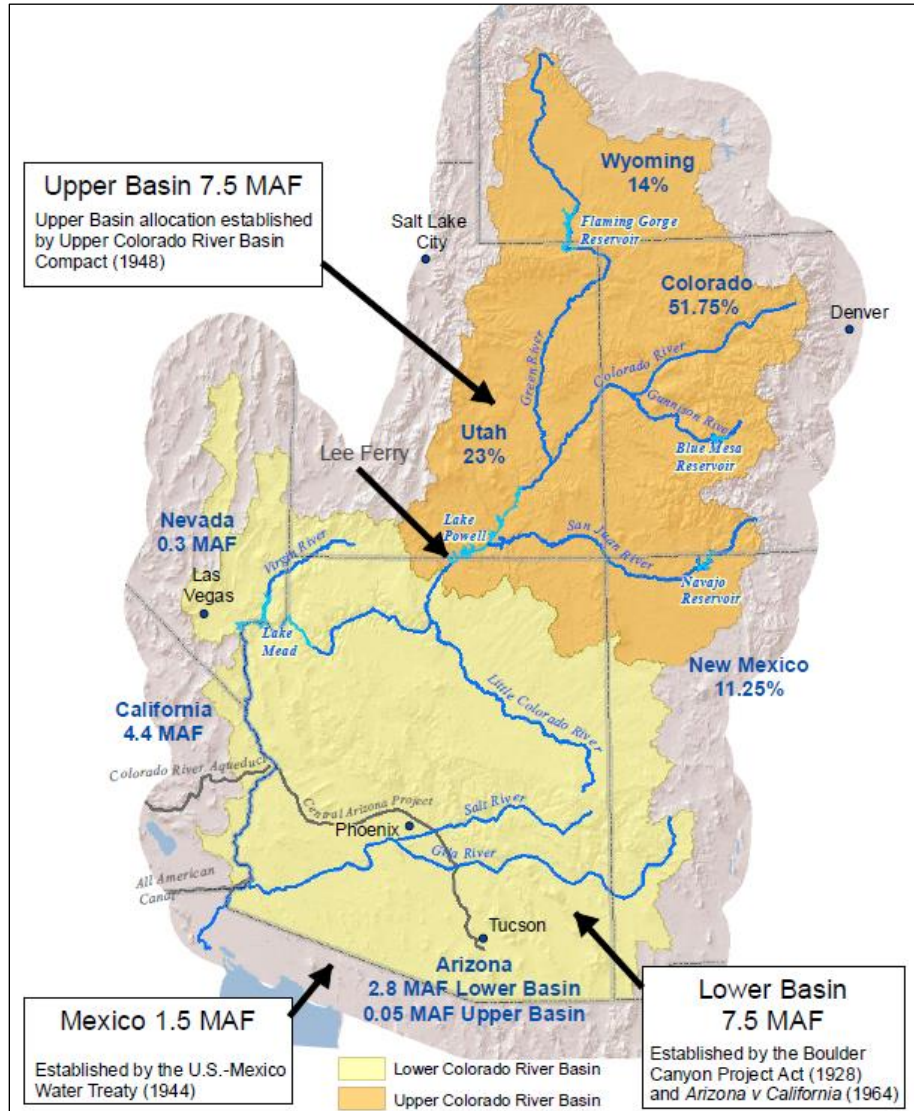
³¹ International Boundary & Water Commission, Minutes between the United States and Mexican Sections of the IBWC, https://www.ibwc.gov/Treaties_Minutes/Minutes.html. For more information on recent minutes, see section, "Minute 319 and Minute 323 Agreements with Mexico."

³² Upper Colorado River Basin Compact, 1948.

obligations were met, the Upper Basin Compact established state allocations in terms of percentage: Colorado (where the largest share of runoff to the river originates) is the largest entitlement holder in the Upper Basin, with rights to 51.75% of any Upper Basin flows after Colorado River Compact obligations to the Lower Basin have been met. Other states also received percentage-based allocations, including Wyoming (14%), New Mexico (11.25%), and Utah (23%). Arizona was allocated 50,000 AF in addition to its Lower Basin apportionment, in recognition of the portion of the state in the Upper Basin. **Figure 2** shows basin allocations by state following approval of the Upper Basin Compact (i.e., the allocations that generally guide current water deliveries). The Upper Basin Compact also established the Upper Colorado River Commission, an interstate administrative water agency charged with administering the provisions of the Upper Basin Compact.³³

³³ For more information, see Upper Colorado River Commission, “About the UCRC,” at <http://www.ucrccommission.com/about-us/>.

Figure 2. Colorado River Basin Allocations
(shown as percentage of allocation or million acre-feet [MAF])



Source: Figure by the Congressional Research Service (CRS), using data from USGS, ESRI Data & Maps, 2017, Central Arizona Project, and ESRI World Shaded Relief Map.

Notes: Although both the Upper and Lower Basins were each allocated 7.5 MAF, there was uncertainty about how much water would remain in the Upper Basin after Colorado River Compact obligations to Lower Basin states were fulfilled. Therefore, outside of 50,000 AF provided annually to Arizona, the Upper Basin Compact includes apportionments in terms of percentage of the overall Upper Basin allocation.

Subsequent federal legislation paved the way for development of Upper Basin waters. The Colorado River Storage Project (CRSP) Act of 1956 authorized CRSP *initial units* of Glen Canyon, Flaming Gorge, Navajo, and Aspinall in the Upper Basin. The act also established the Upper Colorado River Basin Fund, which receives revenues collected in connection with the projects, to be made available for defraying the project’s costs of operation, maintenance, and emergency expenditures.

The 1968 CRBPA amended CRSP to authorize several other Upper Basin projects (e.g., the Animas La Plata and Central Utah projects) as CRSP *participating projects*. It also directed that the Secretary of the Interior propose annual operational criteria for Colorado River Storage Project units (including the

releases of water from Lake Powell) that prioritize (1) treaty obligations to Mexico, (2) the Colorado River Compact requirement for the Upper Basin to not deplete more than 75 MAF to Lower Basin states over any 10-year period (i.e., 7.5 MAF per year), and (3) carryover storage to meet these needs. In the CRBPA, Congress also established the Upper Colorado River Basin Fund and the Lower Colorado River Basin Development Fund, authorized to utilize revenues from power generation from relevant Upper and Lower Basin facilities to fund certain expenses in the sub-basins.³⁴

Water Storage and Operations

Due to the Colorado River Basin's large water storage projects, as much as 60 MAF, or about four times the Colorado River's annual flows, can be stored to insulate water users from annual variability in flows. Thus, storage and operations in the basin receive considerable attention, particularly at the basin's two largest dams and their storage reservoirs: Glen Canyon Dam/Lake Powell in the Upper Basin (26.2 MAF of storage capacity) and Hoover Dam/Lake Mead in the Lower Basin (26.1 MAF of storage capacity). The status of these projects is monitored closely by Reclamation and interested stakeholders as an indicator of basin health.

Glen Canyon Dam, completed in 1963 at the southern end of the Upper Basin, serves as the linchpin for Upper Basin storage and regulates flows from the Upper Basin to the Lower Basin, pursuant to the Colorado River Compact. It also generates approximately 5 billion kilowatt-hours (KWh) of electricity per year, which the Western Area Power Administration (WAPA) supplies to 5.8 million customers in Upper Basin States.³⁵ Other significant storage in the Upper Basin includes the initial units of the CRSP: the Aspinall Unit in Colorado (including Blue Mesa, Crystal, and Morrow Point dams on the Gunnison River, with combined storage capacity of more than 1 MAF),³⁶ the Flaming Gorge Unit in Utah (including Flaming Gorge Dam on the Green River, with a capacity of 3.8 MAF), and the Navajo Unit in New Mexico (including Navajo Dam on the San Juan River, with a capacity of 1 MAF). The Upper Basin is also home to 16 participating projects, which are authorized to use water for irrigation, M&I uses, and other purposes.³⁷

In the Lower Basin, Hoover Dam, completed in 1936, provides the majority of the Lower Basin's storage and generates about 4 billion KWh of electricity per year for customers in California, Arizona, and Nevada.³⁸ Also important for Lower Basin Operations are Davis Dam/Lake Mohave, which regulates flows to Mexico under the 1944 Treaty, and Parker Dam/Lake Havasu, which impounds water for diversion into the Colorado River Aqueduct (thereby allowing for deliveries to urban areas in southern California) and CAP (allowing for diversion to users in Arizona). Further downstream on the Arizona/California border, Imperial Dam (a diversion dam) diverts Colorado River water to the All-

³⁴ Basin-wide operational commitments on the Colorado River were established in the 1970 Criteria for Coordinated Long-Range Operation of Colorado River Reservoirs, which coordinated the operation of reservoirs in the Upper and Lower Basins, including releases from Lake Powell and Lake Mead. These operating instructions have been modified by more recent operational agreements intended to mitigate the effects of long-term drought. For more information, see "The Criteria for Coordinated Long-Range Operation of the Colorado River reservoirs of 1970," at <https://www.usbr.gov/lc/region/pao/lawofrvr.html#lroc>.

³⁵ Reclamation, "Glen Canyon Unit," at <https://www.usbr.gov/uc/rm/crsp/gc/>.

³⁶ The Curecanti Unit was renamed the Aspinall Unit in 1980 in honor of U.S. Representative Wayne N. Aspinall of Colorado.

³⁷ In total, 16 of the 22 Upper Basin projects authorized as part of CRSP have been developed. (Of the six remaining projects, five were determined by Reclamation to be infeasible, and Congress deauthorized the the Pine River Extension Project.) For a complete list of projects, see Bureau of Reclamation, "Colorado River Storage Project," at <https://www.usbr.gov/uc/rm/crsp/index.html>.

³⁸ Reclamation, "Hoover Dam Frequently Asked Questions and Answers," at <https://www.usbr.gov/lc/hooverdam/faqs/powerfaq.html>, accessed August 3, 2022.

American Canal for use in some of the river's largest agricultural areas in California's Imperial and Coachella Valleys.

Annual Operations

Reclamation monitors Colorado River reservoir levels and projects them 24 months into the future in monthly studies (called *24-month studies*).³⁹ The studies take into account forecasted hydrology, reservoir operations, and diversion and consumptive use schedules to model a single scenario of reservoir conditions. The studies inform operating decisions by Reclamation looking one to two years into the future. They express water storage conditions at Lake Mead and Lake Powell in terms of elevation, as feet above mean sea level.

In addition to the 24-month studies, the CRBPA requires the Secretary to transmit to Congress and the governors of the basin states, by January 1 of each year, an *Annual Operating Plan* (AOP). In the AOP, Reclamation describes the actual operation for the preceding water year and the projected operation for the coming year. The AOP's projected January 1 water conditions for the upcoming calendar year establish a baseline for future annual operations.⁴⁰

Since the adoption of new operational guidelines by Reclamation and basin states in 2007 (see below section, "2007 Interim Guidelines"), Reclamation has tied operations of Hoover and Glen Canyon Dams to specific pool elevations at Lake Mead and Lake Powell. For Lake Mead, the first level of shortage (a *Tier One Shortage Condition*) in the 2007 guidelines, under which Arizona's and Nevada's allocations are decreased (along with releases to Mexico), is triggered if Lake Mead falls below 1,075 feet. For Lake Powell, releases under tiered operations are based on storage levels in both Lake Powell and Lake Mead. Drought contingency plans (DCPs) for the Upper and Lower Basins, enacted in 2019, overlaid additional operational changes tied to elevations in both reservoirs. For Lake Mead, this included additional curtailments beyond those established in 2007.⁴¹ For Lake Powell, the Upper Basin DCP incorporated a Drought Response Operations Agreement (DROA) that established a target lake elevation of 3,525 feet. It also provided for altered releases from Glen Canyon Dam and Upper Basin reservoirs below this level in order to protect Lake Powell from falling below an elevation that would no longer produce hydropower. These efforts are discussed more in the below section "Recent Developments and Agreements."

Recent Conditions

Falling water levels in Lake Mead have resulted in Reclamation announcing Lower Colorado River Basin delivery curtailments for Arizona and Nevada, in accordance with previous plans. In August 2021, Reclamation declared the first-ever Tier One Shortage Condition for the Lower Basin.⁴² In August 2022, Reclamation announced the first-ever Tier Two Shortage, which resulted in additional water supply

³⁹ Current 24-month studies, as well as two- and five-year probable projections of Lake Mead and Powell elevations, are available at Reclamation, "Colorado River System Projections Overview," at <https://www.usbr.gov/lc/region/g4000/riverops/coriver-projections.html>.

⁴⁰ Current and historical AOPs are available at Reclamation, "Annual Operating Plan for Colorado River Reservoirs," at <https://www.usbr.gov/uc/water/rsrvs/ops/aop/>.

⁴¹ For example, a new set of curtailments for Nevada and Arizona at lake elevations up to 1,090 feet (*Tier Zero*) was added pursuant to the 2019 DCP for the Lower Colorado River Basin. These agreements also added additional curtailment requirements to existing Tiers below Tier 1 (e.g., Tier 2, etc.). For more details, see **Table 1**.

⁴² Reclamation, "Reclamation Announces 2022 Operating Conditions for Lake Powell and Lake Mead," press release, August 16, 2021, at <https://www.usbr.gov/newsroom/#/news-release/3950>. Hereinafter, Reclamation, August 2021 press release.

delivery cutbacks.⁴³ In March 2022, Lake Powell fell below the target elevation of 3,525 feet for the first time since the late 1960s.⁴⁴

Mitigating the Environmental Effects of Colorado River Basin Development

Construction of most of the Colorado River’s water supply infrastructure predated major federal environmental protection statutes, such as the National Environmental Policy Act (NEPA; 42 U.S.C. §§4321 *et seq.*) and the Endangered Species Act (ESA; 87 Stat. 884, 16 U.S.C. §§1531-1544). Thus, many of the environmental impacts associated with the development of basin resources were not originally taken into account. Over time, multiple efforts have been initiated to mitigate these effects. Some of the highest-profile efforts have been associated with water quality (in particular, salinity control) and the effects of facility operations on endangered and threatened species.

Salinity Control

Salinity and water quality are long-standing issues in the Colorado River Basin. Parts of the Upper Basin are covered by salt-bearing shale (which increases salt content of water inflows), and salinity content increases as the river flows downstream due to both natural leaching and return flows from agricultural irrigation. The 1944 U.S.-Mexico Water Treaty did not set water quality or salinity standards in the Colorado River Basin. However, after years of dispute between the United States and Mexico regarding the salinity of the water reaching Mexico’s border, the two countries reached an agreement on August 30, 1973, with the signing of Minute 242 of the International Boundary and Water Commission.⁴⁵ The agreement guarantees Mexico that the average salinity of its treaty deliveries will be no more than 115 parts per million higher than the salt content of the water diverted to the All-American Canal at Imperial Dam in Southern California. To control the salinity of Colorado River water in accordance with this agreement, Congress passed the Colorado River Basin Salinity Control Act of 1974 (P.L. 93-320), which authorized desalting and salinity control facilities to improve Colorado River water quality. The most prominent of these facilities is the Yuma Desalting Plant, which was largely completed in 1992 but has never operated at capacity due to cost and other factors.⁴⁶ In 1974, the seven basin states also established water quality standards for salinity through the Colorado River Basin Salinity Control Forum.⁴⁷

⁴³ Reclamation, “Interior Department Announces Actions to Protect Colorado River System, Sets 2023 Operating Conditions for Lake Powell and Lake Mead,” press release, August 16, 2022, at <https://www.usbr.gov/newsroom/news-release/4294>.

⁴⁴ Reclamation, “Lake Powell to Temporarily Decline Below 3,525 Feet,” press release, March 4, 2022, at <https://www.usbr.gov/newsroom/#/news-release/4117>. 3,525 feet is established as a target because it is 35 feet above 3,490 feet, or the level at which power production would cease.

⁴⁵ See International Boundary and Water Commission, *Minute 242, Permanent and Definitive Solution to the International Problem of the Salinity of the Colorado River*, August 30, 1973, at https://www.ibwc.gov/Treaties_Minutes/Minutes.html.

⁴⁶ The Yuma Desalting Plant’s limited operations have been due in part to the cost of its operations (desalination can require considerable electricity to operate) and surplus flows in the Colorado River during some years compared to what was expected. In lieu of operating the plant, high-salinity irrigation water has been separated from the United States’ required deliveries to Mexico and disposed of through a canal that enters Mexico and discharges into wetlands called the Ciénega de Santa Clara, near the Gulf of California. Whether and how the plant should be operated and how the impacts on the Ciénega de Santa Clara from the untreated irrigation runoff should be managed remain topics of some debate in the basin and between Mexico and the United States.

⁴⁷ Additional information about the forum and related salinity control efforts is available at Colorado River Basin, “Salinity Control Forum,” at <https://www.coloradoriversalinity.org/>.

Endangered Species Efforts and Habitat Improvements

Congress enacted the ESA in 1973.⁴⁸ As the federal government listed some basin species under ESA in accordance with the act,⁴⁹ federal agencies and nonfederal stakeholders consulted with the U.S. Fish and Wildlife Service (FWS) to address the conservation of the listed species. As a result of these consultations, several major programs have been developed to protect and restore listed fish species on the Colorado River and its tributaries. Summaries of some of the key programs are below.

Upper Colorado Endangered Fish Recovery Program

The Upper Colorado Endangered Fish Recovery Program was established in 1988 to assist in the recovery of four species of endangered fish in the Upper Colorado River Basin.⁵⁰ Congress formally authorized this program in 2000.⁵¹ The program is implemented through several stakeholders under a cooperative agreement signed by the governors of Colorado, Utah, and Wyoming; the Secretary of DOI; and the Administrator of WAPA. The recovery goals of the program are to reduce threats to species and improve their status so they are eventually delisted from the ESA. Some of the actions taken in the past include providing adequate instream flows for fish and their habitat, restoring habitat, reducing nonnative fish, augmenting fish populations with stocked fish, and conducting research and monitoring. Reclamation is the lead federal agency for the program and provides the majority of federal funds for implementation. Other funding includes a portion of Upper Basin hydropower revenues from WAPA and funding from FWS; the states of Colorado, Wyoming, and Utah; and water users, among others.

San Juan River Basin Recovery Implementation Program

The San Juan River Basin Recovery Implementation Program was established in 1992 to assist in the recovery of ESA-listed fish species on the San Juan River, the Colorado's largest tributary.⁵² The program is a partnership implemented under a cooperative agreement between DOI and the states of Colorado and New Mexico, the Jicarilla Apache Nation, the Navajo Nation, the Southern Ute Indian Tribe, and the Ute Mountain Ute Indian Tribe.⁵³ It is concerned with the recovery of the Razorback sucker (*Xyrauchen texanus*) and Colorado pikeminnow (*Ptychocheilus Lucius*). Congress authorized this program in P.L. 106-392 with the aim to protect the genetic integrity and population of listed species, conserve and restore habitat (including water quality), reduce nonnative species, and monitor species. The program is coordinated by FWS, and Reclamation is responsible for operating the Animas-La Plata Project and Navajo Dam on the San Juan River in a way that reduces effects on the fish populations. The program is funded by a portion of revenues from hydropower revenues from WAPA in the Upper Basin, Reclamation, the Bureau of Indian Affairs, and participating states. Recovery efforts for listed fish are coordinated with the Upper Colorado Endangered Fish Recovery Program.

⁴⁸ For background information on the Endangered Species Act, see CRS Report R46677, *The Endangered Species Act: Overview and Implementation*.

⁴⁹ Several listed species are found throughout the Colorado River Basin. Some are specifically found in the Colorado River, such as the Razorback sucker (*Xyrauchen texanus*), Bonytail chub (*Gila elegans*), Colorado pikeminnow (*Ptychocheilus Lucius*), and Humpback chub (*Gila cypha*).

⁵⁰ The fish species are the humpback chub, bonytail, Colorado pikeminnow and razorback sucker. For more information, see Upper Colorado River Endangered Fish Recovery Program at <http://www.coloradoriverrecovery.org/uc>.

⁵¹ P.L. 106-392.

⁵² For more information, see U.S. Fish and Wildlife Service, "San Juan River Basin Recovery Implementation Program," at <https://www.fws.gov/southwest/sjrip/>.

⁵³ It also includes participation by water development interests in Colorado and New Mexico.

Glen Canyon Dam Adaptive Management Program

The Glen Canyon Dam Adaptive Management Program was established in 1997 in response to a directive from Congress under the Grand Canyon Protection Act of 1992 (P.L. 102-575) to operate Glen Canyon Dam “in such a manner as to protect, mitigate adverse impacts to, and improve the values for which Grand Canyon National Park and Glen Canyon National Recreation Area were established.”⁵⁴ This program uses experiments to determine how water flows affect natural resources south of the dam. Reclamation is in charge of modifying flows for experiments, and the U.S. Geological Survey conducts monitoring and other studies to evaluate the effects of the flows.⁵⁵ The results are expected to better inform managers how to provide water deliveries and conserve species. The majority of program funding comes from hydropower revenues generated at Glen Canyon Dam.

Lower Colorado Multi-Species Conservation Program

The Multi-Species Conservation Program (MSCP) is a multistakeholder initiative to conserve 27 species (8 listed under ESA) along the Lower Colorado River while maintaining water and power supplies for farmers, tribes, industries, and urban residents.⁵⁶ The MSCP began in 2005 and is planned to last for at least 50 years.⁵⁷ The MSCP was created through consultation under ESA. To achieve compliance under ESA, federal entities involved in managing water supplies in the Lower Colorado River Basin met with resource agencies from Arizona, California, and Nevada; Native American Tribes; environmental groups; and recreation interests to develop a program to conserve species along a portion of the Colorado River. A biological opinion (BiOp) issued by the FWS in 1997 covering operations and maintenance activities conducted by Reclamation along the Colorado River from Lake Mead to the Southerly International Boundary. Consultation was reinitiated in 2002 and a new BiOp was issued later that year.⁵⁸ Nonfederal stakeholders also applied and received an incidental take permit under Section 10(a) of the ESA for their activities.⁵⁹ This resulted in a habitat conservation plan for the MSCP that formed the basis for the program.⁶⁰ A Lower Colorado River Multi-Species Conservation Program Implementing Agreement integrated the federal and nonfederal activities in the MSCP and was signed by stakeholders in 2005.⁶¹

The objective of the MSCP is to create habitat for listed species, augment the populations of species listed under ESA, maintain current and future water diversions and power production, and abide by the

⁵⁴ For more information, see Reclamation, Glen Canyon Dam Adaptive Management Program, “Glen Canyon Dam High Flow Experimental Release,” at <https://www.usbr.gov/uc/progact/amp/ltemp.html>.

⁵⁵ Regardless of the status and results of flow experiments, the total annual volume of water released from Glen Canyon Dam remains dictated by the Law of the River, as described above.

⁵⁶ The stakeholders include 6 federal and state agencies, 6 tribes, and 36 cities and water and power authorities. Stakeholders serve more than 20 million residents in the region, and irrigate 2 million acres of farmland. For more information, see Lower Colorado River Multi-Species Conservation Program at <https://www.lcrmscp.gov/>.

⁵⁷ The program was formally authorized under Subtitle E of Title IX of P.L. 111-11.

⁵⁸ U.S. Fish and Wildlife Service, Reinitiation of Formal Section 7 Consultation on Lower Colorado River Operations and Maintenance - Lake Mead to Southerly International Boundary, Arizona, California and Nevada, April 30, 2002, <https://www.usbr.gov/lc/region/g2000/BO2002operations.pdf>.

⁵⁹ The incidental take permit is valid for 50 years from its date of issuance and covers the implementation of the Lower Colorado River Multi-Species Conservation Program, diversions of water from the river, demand for and receipt of hydropower, and flow and non-flow actions along the Colorado River with the geographic scope of the permit.

⁶⁰ Lower Colorado River Multi-Species Conservation Program, *Final Lower Colorado River Multi-Species Conservation Program Volume II: Habitat Conservation Plan*, December 17, 2004, at https://lcrmscp.gov/lcrm-prod/lcrm-prod/pdfs/hcp_volii_2004.pdf.

⁶¹ Lower Colorado River Multi-Species Conservation Program Implementing Agreement at https://lcrmscp.gov/lcrm-prod/lcrm-prod/pdfs/imp_agr_2005.pdf.

incidental take authorizations for listed species under the ESA. The estimated total cost of the program over its lifetime is approximately \$626 million in 2003 dollars (\$903 million in 2019 dollars) and is to be split evenly between Reclamation (50%) and the states of California, Nevada, and Arizona (who collectively fund the remaining 50%).⁶² The management and implementation of the MSCP is the responsibility of Reclamation, in consultation with a steering committee of stakeholders.

Hydropower Revenues Funding Colorado River Basin Activities

Hydropower revenues finance a number of activities throughout the Colorado River Basin. In the Lower Basin, the Colorado River Dam Fund uses power revenues generated by the Boulder Canyon Project (i.e., Hoover Dam) to fund operational and construction costs for related Reclamation facilities. A separate fund, the Lower Colorado River Basin Development Fund, collects revenues from the Central Arizona Project (CAP), as well as a surcharge on revenues from the Boulder Canyon and Parker-Davis Projects that was enacted under the Hoover Power Plant Act of 1984 (P.L. 98-381). These revenues are available without further appropriation toward defraying CAP operation and maintenance costs, salinity control efforts, and funding for Indian water rights settlements identified under the Arizona Water Settlements Act of 2004 (i.e., funding for water systems of the Gila River Indian Community and the Tohono O'odham Nation, among others). In the Upper Basin, the Upper Colorado River Basin Fund collects revenues from the initial units of the Colorado River Storage Project and funds operation and maintenance expenses, salinity control, the Glen Canyon Dam Adaptive Management Program, and endangered fish studies on the Colorado and San Juan rivers, among other things.

Source: Department of the Interior, *Department of the Interior Budget Appendix, Fiscal Year 2023 Budget Request*

Tribal Water Rights

Tribal water rights are often senior to other uses on the Colorado River,⁶³ and 18 of the 29 federally recognized tribes in the Colorado River Basin have recognized tribal water rights. Tribal water diversions based on these rights typically come out of individual state allocations.⁶⁴ According to Reclamation, as of December 2020 tribes held diversion rights to approximately 3.4 MAF per year of Colorado River water.⁶⁵ Previous studies noted that these tribes were using just over half of their quantified rights.⁶⁶ As of early 2023, the other 11 basin tribes had reserved water rights claims that have not been resolved; the total potential amount of these claims has not been estimated.⁶⁷

Because of the magnitude of tribal water rights and their relative senior status, future decisions by parties involved in the settlement and development of tribal water rights in the Colorado River Basin will significantly influence the availability of basin water resources for various uses. Increased consumptive

⁶² As of the end of 2021, more than \$381 million had been spent on program implementation. Lower Colorado River Multi-Species Conservation Program, "Implementation and Funding," at https://www.lcrmscp.gov/about_us/implementation_and_funding, accessed August 3, 2022.

⁶³ Tribal water rights claims typically arise out of the right of many tribes to water resources dating to the establishment of their reservations. These water rights are often senior to those of non-Indian water rights holders because they date to the creation of the reservation (i.e., prior to the awarding of most state water rights). For more information on Indian water rights settlements, see CRS Report R44148, *Indian Water Rights Settlements*.

⁶⁴ This figure includes tribes with recognized claims, and those partially recognized and partially unresolved claims. For a full list of federally recognized tribes in the basin, see Colorado River Ten Tribes Partnership, *Colorado River Basin Ten Tribes Partnership Tribal Water Study*, December 2018, Appendix 1b. Hereinafter, Reclamation, *Ten Tribes Study*, 2018.

⁶⁵ Reclamation, *Review of the Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead*, December 2020, p. 14.

⁶⁶ Colorado River Research Group, *Tribes and Water in the Colorado River Basin*, June 2016. According to this study, tribal consumptive use in 2015 (including leasing of tribal water to non-tribal entities) totaled 1.7 MAF of the 2.9 MAF in recognized diversion rights at that time.

⁶⁷ The largest remaining claims were previously noted as being associated with the Ute Tribe in Utah and the Navajo Nation in the Upper Basin in Arizona. See *Ten Tribes Study*, Chapter 5.

water use by tribes with existing water rights, and/or future settlement of claims and additional consumptive use of basin waters by other tribes that do not currently possess these rights, would exacerbate competition for basin water resources. At the same time, some tribes have entered into arrangements to lease or conserve their waters to other users; new agreements along these lines have the potential to secure water supplies for some non-tribal users without other viable alternative sources of water.

Drought and the Supply/Demand Imbalance

The Colorado River Compact was based on the assumption (formed by the available record at the time) that average annual flows on the river were 16.4 MAF per year.⁶⁸ As previously noted, from 1906 to 2022, observed historical natural flows on the river at Lee Ferry, AZ—the common point of measurement for observed basin flows—averaged 14.6 MAF annually (**Figure 3**).⁶⁹ Natural flows from 2000 to 2022 (i.e., during the ongoing drought) averaged less than 12.1 MAF annually,⁷⁰ with this period noted to be the driest 23-year period on record.⁷¹ At the same time, consumptive use and losses (e.g., evaporation) in the basin have regularly exceeded natural flows (in particular during the current drought).⁷² Consumptive use in the basin generally increased from 1971 to 2002 but declined after the 2003 approval of the Quantitative Settlement Agreement (QSA), which in part led to a decrease of consumptive use in the Lower Basin (see below section, “Recent Developments and Agreements”).⁷³ Despite this development, overall basin consumptive use and other losses continue to exceed natural flows in most years; the resulting “structural deficit” has caused a drawdown of basin storage (**Figure 4**).

The lack of a formal mechanism accounting for evaporative losses in the Lower Basin exacerbates the supply/demand disparity. A key difference between Upper and Lower Basin reporting involves how each basin accounts for consumptive use. In accordance with Articles I and V of the *Arizona v. California* decree,⁷⁴ a Lower Basin Water Accounting Report (published annually) reports only on *diversions from the system for consumptive use*. Conversely, the comparable Upper Basin accounting—the Upper Basin Consumptive Use and Losses Report (published every five years)—is prepared in response to congressional direction in the CRBPA, which directed “a detailed breakdown of the beneficial consumptive use of water on a State-by-State basis.”⁷⁵ Reclamation defines “beneficial consumptive use” to include *any removal from the system for beneficial consumptive use*, which Reclamation defines to include both diversions and losses from mainstem reservoir evaporation that occur prior to diversions⁷⁶

⁶⁸ National Research Council, Committee on the Scientific Bases of Colorado River Basin Water Management, Water Science and Technology Board, *Colorado River Basin Water Management: Evaluating and Adjusting to Hydroclimatic Variability*, 2007, at <https://www.nap.edu/read/11857/chapter/1>.

⁶⁹ Reclamation Flow Data.

⁷⁰ Reclamation Flow Data.

⁷¹ 87 FR 37884, 2022.

⁷² *Consumptive uses and losses* include reservoir evaporation and other consumptive use losses, which average an estimated 2 MAF per year. For more information on consumptive use, see Reclamation Consumptive Uses and Losses Reports at <https://www.usbr.gov/uc/DocLibrary/reports.html> and Reclamation Colorado River Water Accounting and Use Reports at <https://www.usbr.gov/lc/region/g4000/wtracct.html>.

⁷³ Consumptive use in the Lower Basin (excluding tributaries and evaporative losses) was in excess of 8.4 MAF in 2002 but had decreased to 6.8 MAF as of 2020.

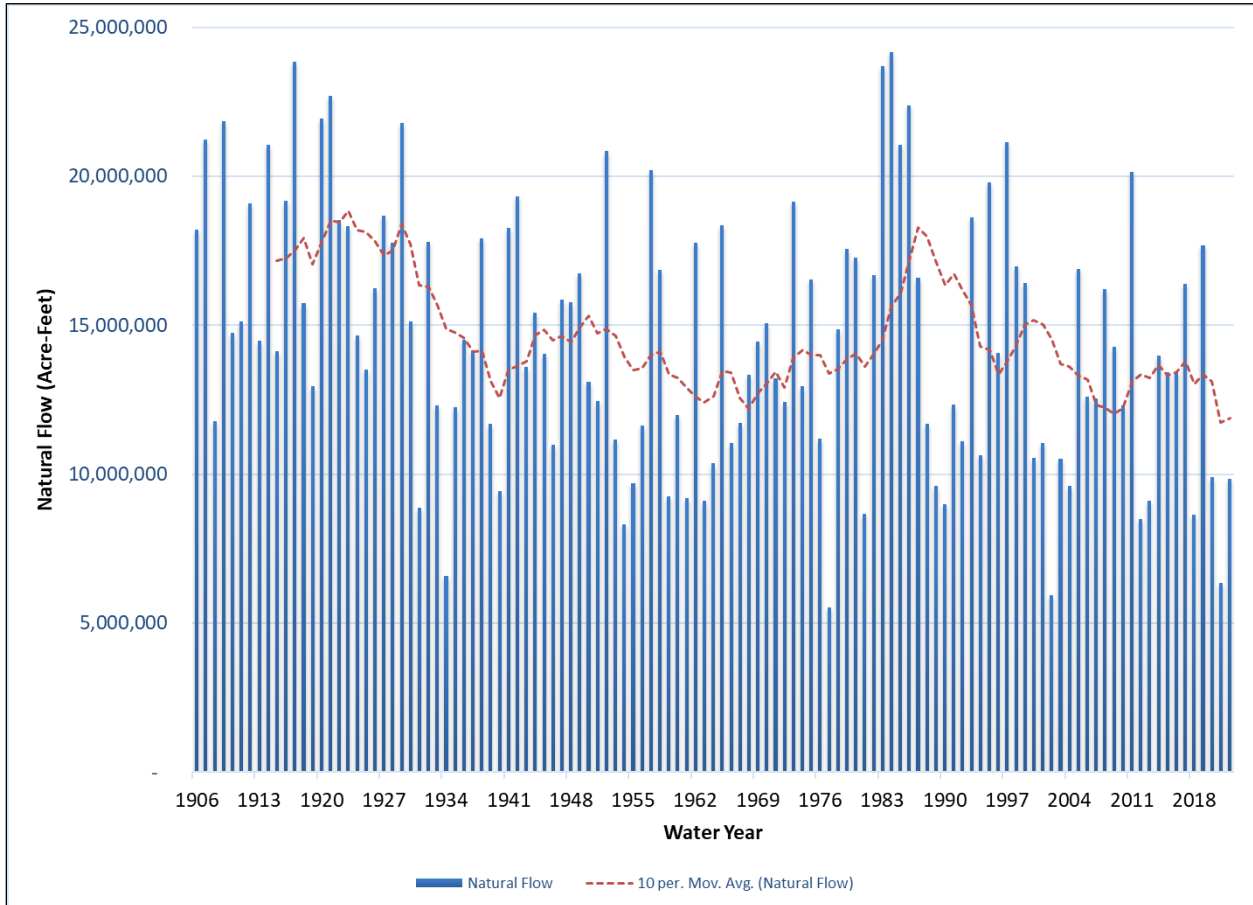
⁷⁴ See footnote 21.

⁷⁵ 43 U.S.C. §1551.

⁷⁶ See Bureau of Reclamation, Upper Colorado River Basin Consumptive Uses and Losses Report, 2016-2020, February 2022, p. 6.

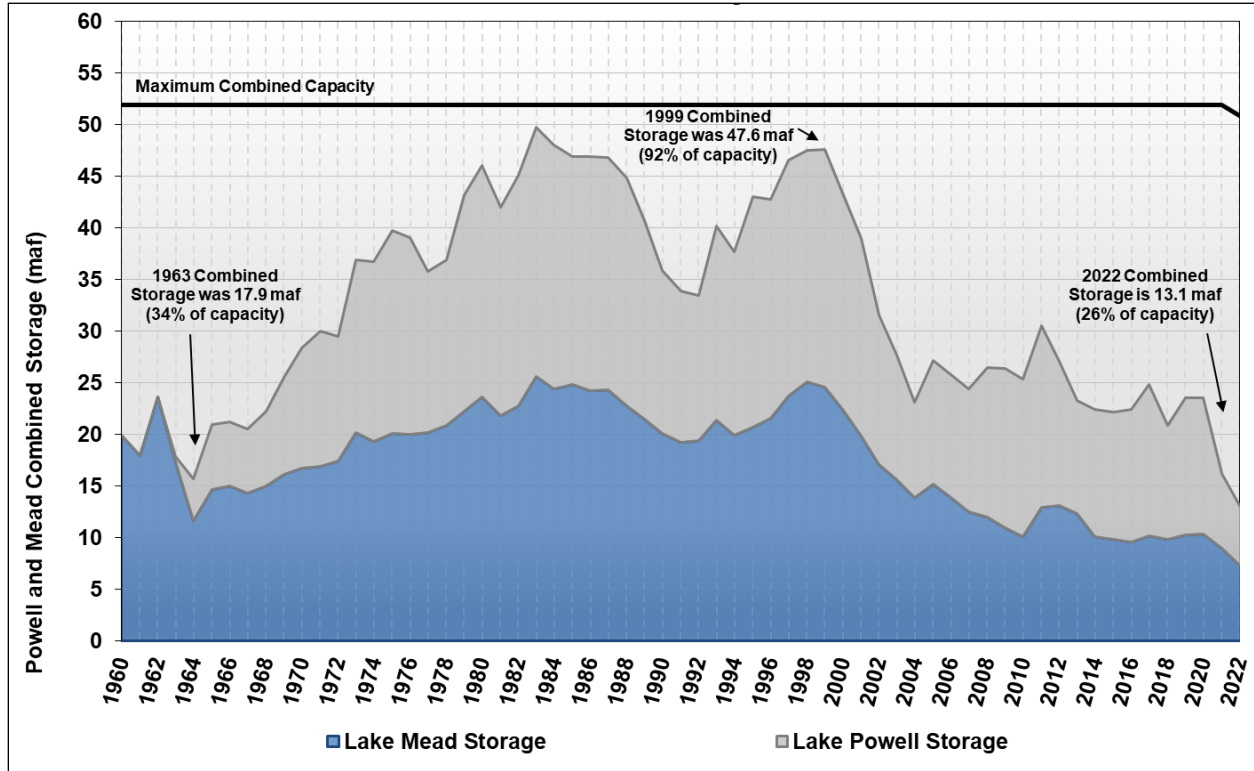
Thus, even though Lower Basin consumptive use is typically below the Compact threshold of 7.5 MAF, after accounting for evaporative losses, the total amount of water regularly exceeds this thresholds.

Figure 3. Colorado River Natural Flow at Lees Ferry, Arizona, with 10-Year Moving Average, 1906-2022



Source: Bureau of Reclamation data, *General Modeling Information*, at <https://www.usbr.gov/lc/region/g4000/riverops/model-info.html>.

Figure 4. Combined Storage at Lakes Mead and Powell, 1960-2022



Source: Bureau of Reclamation, *Notice of Intent to Prepare a Supplemental Environmental Impact Statement*, Public Webinar, November 9, 2022.

Note: Total storage = 52.3 million acre-feet.

Recent studies have concluded that Colorado River flows are unlikely to return to 20th century averages and that future water supply risk is high.⁷⁷ Overall, natural flows have declined by approximately 20% over the last century, and one study attributed more than half of this decline to increasing temperatures resulting from climate change.⁷⁸ Although there is potential for some precipitation increases in the region due to climate change, such potential increases are not expected to counteract projected drying resulting from rising temperatures.⁷⁹ As a result, most research has projected continuing reduction in runoff through the mid-21st century.⁸⁰

⁷⁷ B. Udall and J. Overpeck, “The Twenty-First Century Colorado River Hot Drought and Implications for the Future,” *Water Resources Research*, vol. 53 (February 17, 2017), pp. 2404-2418.

⁷⁸ Milley, P.S.D. and K.A. Dunne, “Colorado River flow dwindles as warming-driven loss,” *Science*, vol. 367, no. 6483 (March 13, 2020), pp. 1252-1255. Hereinafter, Milley, 2020. Also see M. Xiao, B. Udall, and D. P. Lettenmaier, “On the Causes of Declining Colorado River Streamflows,” *Water Resources Research* 54 (2018), pp. 6739–6756.

⁷⁹ Milley, 2020.

⁸⁰ Lukas, Jeff, and Elizabeth Payton, eds. *Colorado River Basin Climate and Hydrology: State of the Science*. Western Water Assessment, University of Colorado Boulder, 2020.

Recent Developments and Agreements

Drought conditions throughout the basin have raised concerns about potential negative impacts on water supplies. Concerns center on what sort of changes to the current water management regime might result if the Secretary of the Interior were to determine that a shortage condition exists in the Lower Basin. Some in Upper Basin States are also concerned about the potential for a *compact call* of Lower Basin states on Upper Basin states. This is the commonly used term for the Lower Basin states' hypothetical attempt to force deliveries of Colorado River water under the compact.⁸¹

Drought and other uncertainties related to water rights priorities (e.g., potential tribal water rights claims) spurred the development of several efforts that generally attempted to relieve pressure on basin water supplies, stabilize storage levels, and provide assurances of available water supplies. Some of the most prominent developments since the year 2000 (i.e., the beginning of the current drought) are discussed below.

2003 Quantitative Settlement Agreement

Prior to the 2003 finalization of the QSA, California had been using approximately 5.2 MAF of Colorado River on average each year (with most of its excess water use attributed to urban areas). Under the QSA, which is an agreement between several California water districts and DOI, California agreed to reduce its use to the required 4.4 MAF under the Law of the River.⁸² It sought to accomplish this aim by quantifying Colorado River entitlement levels of several water contractors; authorizing efforts to conserve additional water supplies (e.g., the lining of the All-American Canal); and providing for several large-scale, long-term agriculture-to-urban water transfers. The QSA also committed the state to a path toward restoration and mitigation related to the Salton Sea in southern California.⁸³

A related agreement between Reclamation and the Lower Basin states, the Inadvertent Overrun and Payback Policy (IOPP), went into effect concurrently with the QSA in 2004.⁸⁴ IOPP is an administrative mechanism that provides an accounting of inadvertent overruns in consumptive use compared to the annual entitlements of water users in the Lower Basin. These overruns must be “paid back” in the calendar year following the overruns, and the paybacks must be made only from “extraordinary conservation measures” above and beyond normal consumptive use.⁸⁵

2004 Arizona Water Settlements Act

The 2004 Arizona Water Settlements Act (AWSA, P.L. 108-451) altered the allocation of CAP water in Arizona. It ratified three water rights settlements (one in each title) between the federal government and the State of Arizona, the Gila River Indian Community (GRIC), and the Tohono O’odham Nation,

⁸¹ For more background, see Anne Castle and John Fleck, “The Risk of Curtailment under the Colorado River Compact,” November 20, 2019, at <https://ssrn.com/abstract=3483654>.

⁸² California Quantification Settlement Agreement by and Among Imperial Irrigation District, the Metropolitan Water District of Southern California, and Coachella Valley Water District, October 10, 2003.

⁸³ The Salton Sea is an inland water body in Southern California that was historically sustained by Colorado River irrigation runoff from the Imperial and Coachella Valleys, but is shrinking. Toxic dust from exposed seabed is a major concern for surrounding areas. For more information on the Salton Sea, see CRS Report R46625, *Salton Sea Restoration*.

⁸⁴ Reclamation, *Record of Decision for the Colorado River Water Delivery Agreement*, October 10, 2003, pp 16-19. Hereinafter, Reclamation, *Colorado River Water Delivery Agreement*.

⁸⁵ Reclamation, *Colorado River Water Delivery Agreement*.

respectively.⁸⁶ For the state and its CAP water users, the settlement resolved a final repayment cost for CAP by reducing the water users' reimbursable repayment obligation from about \$2.3 billion to \$1.7 billion. Additionally, Arizona agreed to new tribal and non-tribal allocations of CAP water so that approximately half of CAP's annual allotment would be available to Native American tribes in Arizona, at a higher priority than most other uses. The tribal communities were authorized to lease the water, so long as the water remains within the state via the state's water banking authority. The act authorized funds to cover the cost of infrastructure required to deliver the water to the Indian communities, much of it derived from power receipts accruing to the Lower Colorado River Basin Development Fund. It also authorized funding for the study of a potential New Mexico Unit of CAP.

2007 Interim Guidelines/Coordinated Operations for Lake Powell and Lake Mead

Another development in the basin was the 2007 adoption of the Colorado River Interim Guidelines for Lower Basin Shortages and the Coordinated Operations for Lake Powell and Lake Mead (2007 Interim Guidelines). Development of the agreement began in 2005, when, in response to drought in the Southwest and the decline in basin water storage, the Secretary of the Interior instructed Reclamation to develop coordinated strategies for Colorado River reservoir operations during drought or shortages.⁸⁷ The resulting guidelines included criteria for releases from Lakes Mead and Powell determined by "trigger levels" in both reservoirs, as well as a schedule of Lower Basin curtailments at different operational tiers (**Table 1**). Under the guidelines, Arizona and Nevada, which have junior rights to California, would face reduced allocations if Lake Mead elevations dropped below 1,075 feet. At the time, it was thought that the 2007 Guidelines would significantly reduce the risk of Lake Mead falling to 1,025 feet.

The 2007 agreement also included for the first time a mechanism by which parties in the Lower Basin were able to store conserved water in Lake Mead, known as Intentionally Created Surplus (ICS). Reclamation accounts for this water annually, and the users storing the water may access the surplus in future years, in accordance with the Law of the River. As of 2020, the portion of Lake Mead water in storage that was classified as ICS was 2.99 MAF.⁸⁸ That is, as of the end of the 2021 water year, approximately one-third of the water stored in Lake Mead was previously conserved ICS volume.

The 2007 guidelines are considered "interim" because they are scheduled to expire in 20 years (i.e., at the end of 2026). Thus, Reclamation began coordinating a review on the effectiveness of the 2007 guidelines in 2020, and in 2022 formally initiated the review process for post-2026 operations.⁸⁹ The review is expected to encompass negotiations related to renewal of the Upper and Lower Basin DCPs, which are an overlay on the 2007 guidelines (see below section, "2019 Drought Contingency Plans").

⁸⁶ Congress passed the Colorado River Basin Project Act of 1968 and authorized construction of CAP despite significant uncertainty related to tribal water rights related to the Colorado River. The Gila River, Arizona's largest tributary of the Colorado River, runs directly through the Gila River Indian Community, which encompasses approximately 372,000 acres south of and adjacent to Phoenix. Additionally, the Tohono O'odham Nation possessed reserved water rights near Tucson with the potential to disrupt that city's water supplies.

⁸⁷ Prior to this time, the Secretary of the Interior had the authority to declare a shortage, but no shortage criteria had been publicly announced or published. (Criteria for surplus operations were put in place in 2001.)

⁸⁸ Bureau of Reclamation, *Colorado River Accounting and Water Use Report, Calendar Year 2021*, at <https://www.usbr.gov/lc/region/g4000/wtracct.html>.

⁸⁹ Department of the Interior, Reclamation, "Request for Input on Development of Post-2026 Colorado River Reservoir Operational Strategies for Lake Powell and Lake Mead Under Historically Low Reservoir Conditions," 87 *Federal Register* 37884-37888, June 24, 2022.

System Conservation Program

In 2014, Reclamation and several major basin water supply agencies (Central Arizona Water Conservation District, Southern Nevada Water Authority, Metropolitan Water District of Southern California, and Denver Water) executed a memorandum of understanding to provide funding for voluntary conservation projects and reductions of water use. The activities outlined in the memorandum had the goal of developing new *system water*,⁹⁰ to be applied toward storage in Lake Mead, by the end of 2019.⁹¹ Congress formally authorized federal participation in these efforts, known as the Pilot System Conservation Program, in the Energy and Water Development and Related Agencies Appropriations Act, 2015 (P.L. 113-235, Division D).⁹² The Energy and Water Development and Related Agencies Appropriations Act, 2019 (P.L. 115-244, Division A) extended the authority through the end of FY2022, with the stipulation that Upper Basin agreements could not proceed without the participation of the Upper Basin states through the Upper Colorado River Commission. The authority was most recently extended through FY2024 in Division CC of the Consolidated Appropriations Act, FY2023 (P.L. 117-328).⁹³ Reclamation estimated that as of the end of 2019, the Lower Basin program had conserved more than 175,000 AF of water in Lake Mead, at an average cost of \$170 per AF.⁹⁴ Additional projects also were carried out in the Upper Basin by the Upper Colorado River Basin Commission; these efforts ended in 2018.⁹⁵

Minute 319 and Minute 323 Agreements with Mexico⁹⁶

In 2017, the United States and Mexico signed Minute 323, which extended and replaced elements of a previous agreement related to implementation of the 1944 U.S.-Mexico Water Treaty, Minute 319, signed in 2012.⁹⁷ Minute 323 includes, among other things, options for Mexico to hold water in reserve in U.S. reservoirs for emergencies and water conservation efforts, as well as U.S. commitments for flows to support the ecological health of the Colorado River Delta. It also extended the initial Mexican cutback commitments made under Minute 319 (which were similar in structure to the 2007 cutbacks negotiated for Lower Basin states) and established a Binational Water Scarcity Contingency Plan that included additional cutbacks that would be triggered if DCPs are approved by U.S. basin states (see the following section, “2019 Drought Contingency Plans”).

⁹⁰ *System water* refers to water that is provided to increase water supplies as a whole, without being directed toward additional consumptive use for specific contractors or water users.

⁹¹ Agreement Among the United States of America, Through the Department of the Interior, Bureau of Reclamation, the Central Arizona Water Conservation District, the Metropolitan Water District of Southern California, Denver Water, and the Southern Nevada Water Authority, for a Pilot Program for Funding the Creation of Colorado River System Water Through Voluntary Water Conservation and Reductions in Use, Agreement No. 14-XX-30-W0574, July 30, 2014, at <https://www.usbr.gov/lc/region/programs/PilotSysConsProg/PilotSCPFundingAgreement7-30-2014.pdf>.

⁹² P.L. 113-235, §206.

⁹³ P.L. 115-244, §205.

⁹⁴ Lower Colorado Region, “Pilot System Conservation Program,” at <https://www.usbr.gov/lc/region/programs/PilotSysConsProg/pilotsystem.html>. Accessed January 17, 2023.

⁹⁵ For more information, see Upper Colorado River Commission, “System Conservation Pilot Program,” at <http://www.ucrcommission.com/system-conservation-pilot-program/>.

⁹⁶ For more information on the 1994 U.S.-Mexico Water Treaty and Colorado River water sharing issues with Mexico, see CRS Report R45430, *Sharing the Colorado River and the Rio Grande: Cooperation and Conflict with Mexico*, by Nicole T. Carter, Stephen P. Mulligan, and Charles V. Stern.

⁹⁷ International Boundary & Water Commission, “Minutes between the United States and Mexican Sections of the IBWC,” at https://www.ibwc.gov/Treaties_Minutes/Minutes.html.

2019 Drought Contingency Plans

Ongoing drought conditions and the potential for water supply shortages prompted discussions and negotiations focused on how to conserve additional basin water supplies. After several years of negotiations, on March 19, 2019, Reclamation and the Colorado River Basin states finalized DCPs for both the Upper Basin and the Lower Basin. These plans, which are an overlay of the 2007 Interim Guidelines discussed above, required final authorization by Congress to be implemented. Congress approved the plans on April 16, 2019, in the Colorado River Drought Contingency Plan Authorization Act (P.L. 116-14); like the 2007 guidelines, these plans are scheduled to be in place through 2026. At the time of their enactment, the combined efforts represented by the DCPs were expected to cut the risk of Colorado River reservoirs reaching critically low elevations by approximately 50%.⁹⁸ Each of the basin-level DCPs is discussed below in more detail.

Upper Basin Drought Contingency Plan

The Upper Basin DCP aims to protect against Lake Powell reaching critically low elevations through coordinated Upper Basin reservoir operations; it also authorizes storage of conserved water in the Upper Basin that would serve as the foundation for a water use reduction effort (i.e., a *Demand Management Program*) that may be developed in the future.⁹⁹

Under the Upper Basin DCP's Drought Response Operations Agreement (DROA), the Upper Basin states agree to operate system units to keep the surface of Lake Powell above 3,525 feet, which is 35 feet above "minimum power pool" (i.e., 3,490 feet, the minimum elevation needed to run the dam's hydroelectric plant). Under DROA, the two main mechanisms to do this are altering the timing of releases from Glen Canyon Dam and operating "initial unit" reservoirs on the mainstem of the Colorado River (e.g., Navajo Reservoir, Blue Mesa Reservoir, and Flaming Gorge Reservoir) to protect Lake Powell elevations, potentially through storage drawdown. Operational changes may occur either through DROA's emergency provisions, which allow the Secretary of the Interior to make supplemental water deliveries at his or her discretion (after consultation with basin states), or through a planning process establishing formal triggers for Upper Basin water deliveries to Lake Powell, based on agreed-upon hydrological targets.

The other primary component of the Upper Basin DCP, the Upper Basin DCP Demand Management Program, has yet to be formally established. It would entail willing seller/buyer agreements allowing for temporary paid reductions in water use that would provide for more storage volume in Lake Powell. As noted, the Upper Colorado River Commission operated an Upper Basin System Conservation Pilot Program from 2015 to 2018; that program compensated water users for temporary, voluntary efforts that resulted in additional water conserved in Lake Powell. A future Upper Basin DCP Demand Management Program may expand on some of those efforts.

Due to falling lake levels, Reclamation implemented drought response operations under DROA that led to reduced storage in other Upper Basin mainstem reservoirs in 2021 and 2022.¹⁰⁰ Separately, Reclamation also began planning efforts under DROA, known as the *Drought Response Operations Plan*, and released

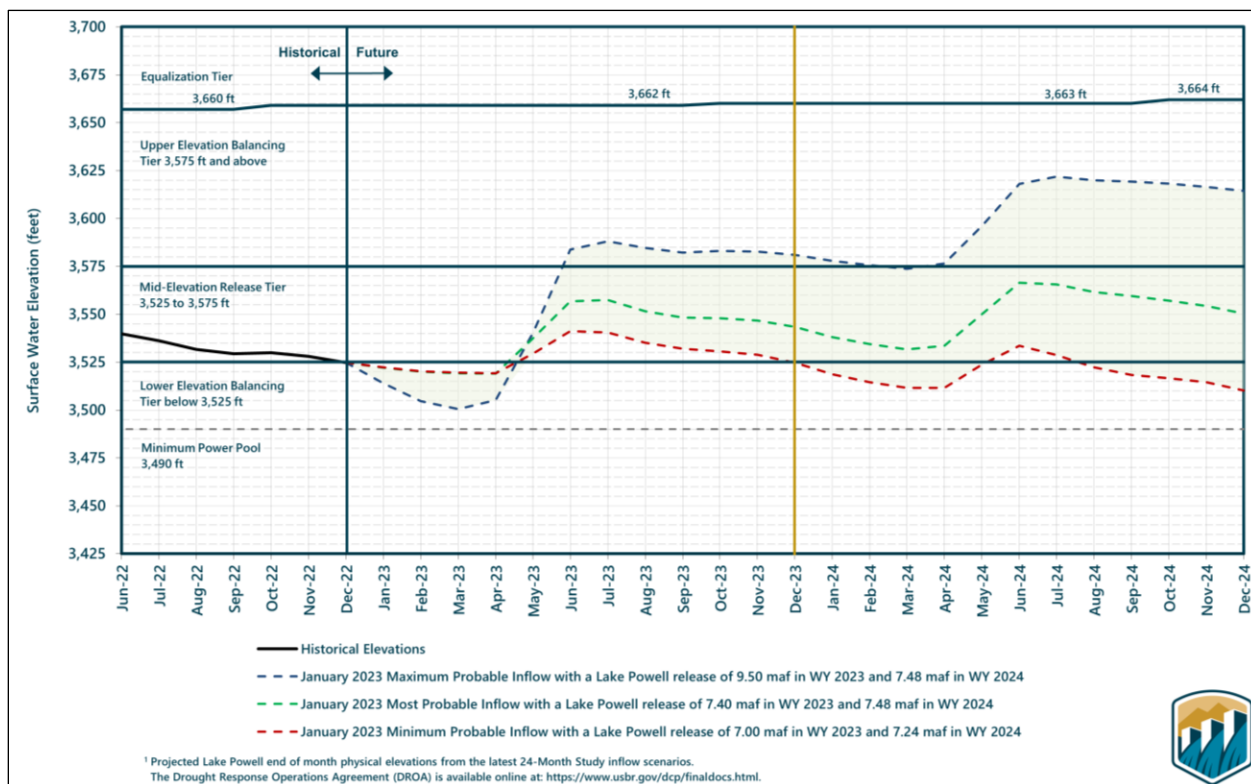
⁹⁸ U.S. Congress, House Committee on Natural Resources, Subcommittee on Water, Oceans, and Wildlife, *Oversight Hearing on the Colorado River Drought Contingency Plan*, 116th Cong., 1st sess., March 28, 2019, H.Hrg. 116-10 (Washington: GPO, 2019). Hereinafter, "2019 House Natural Resources DCP Hearing."

⁹⁹ While such a mechanism exists for the Lower Basin, a comparable program has not been developed in the Upper Basin.

¹⁰⁰ For example, in 2021, 180,000 AF was transferred to Lake Powell from Flaming Gorge Reservoir (125,000 AF), Blue Mesa Reservoir (36,000 AF), and Navajo Reservoir (20,000 AF).

a draft plan in early 2022.¹⁰¹ These efforts are expected to supplement Lake Powell storage, although the exact magnitude is uncertain and there remains a possibility of the lake level dropping to minimum power pool by 2024 (Figure 5).

Figure 5. Lake Powell End of Month Elevation Projections
(January 2023 24-month study inflow scenarios)



Source: U.S. Bureau of Reclamation, “24-Month Study Projections,” January 2023, at <https://www.usbr.gov/lc/region/g4000/riverops/24ms-projections.html>.

Notes: WY=Water Year. DROA= Drought Response Operations Agreement.

Lower Basin Drought Contingency Plan

The Lower Basin DCP is designed to require Arizona, California, and Nevada to curtail deliveries and thereby contribute additional water to Lake Mead storage at predetermined “trigger” elevations. It is also designed to create additional flexibility to incentivize voluntary conservation of water to be stored in Lake Mead, thereby increasing lake levels. Under the DCP, Nevada and Arizona (which were already set to have their supplies curtailed beginning at 1,075 feet under the 2007 Interim Guidelines) have committed to contributing additional supplies to maintain higher lake levels (i.e., beyond previous commitments). These reductions begin at 1,090 feet and would reach their maximums when reservoir levels drop below 1,045 feet. At the same time, the Lower Basin DCP includes—for the first time—delivery cutbacks for California. These curtailments begin with a 200,000 AF delivery reduction at Lake Mead elevations between 1,040 and 1,045 feet and would increase by 50,000 AF for each additional 5 foot drop in Lake Mead elevation below 1,040 feet, to as much as 350,000 AF at elevations of 1,025 feet or lower.

¹⁰¹ For more information, see Reclamation, Colorado River Basin Drought Contingency Plans, at “Drought Response Operations Agreement,” at <https://www.usbr.gov/dcp/droa.html>.

The curtailments in the Lower Basin DCP are in addition to those agreed to under the 2007 Interim Guidelines and under Minute 323 with Mexico. Specific and cumulative reductions are shown in **Table 1**. In addition to the state-level reductions, under the Lower Basin DCP Reclamation also agreed to pursue efforts to add 100,000 AF or more of system water within the basin. Some of the largest and most controversial reductions under the Lower Basin DCP were committed to by Arizona, where pursuant to previous changes under the 2004 AWSA, a large group of agricultural users were already facing major cutbacks to their CAP water supplies prior to the enactment of DCP.

Table 1. Lower Basin Water Delivery Curtailment Volumes Under Existing Agreements

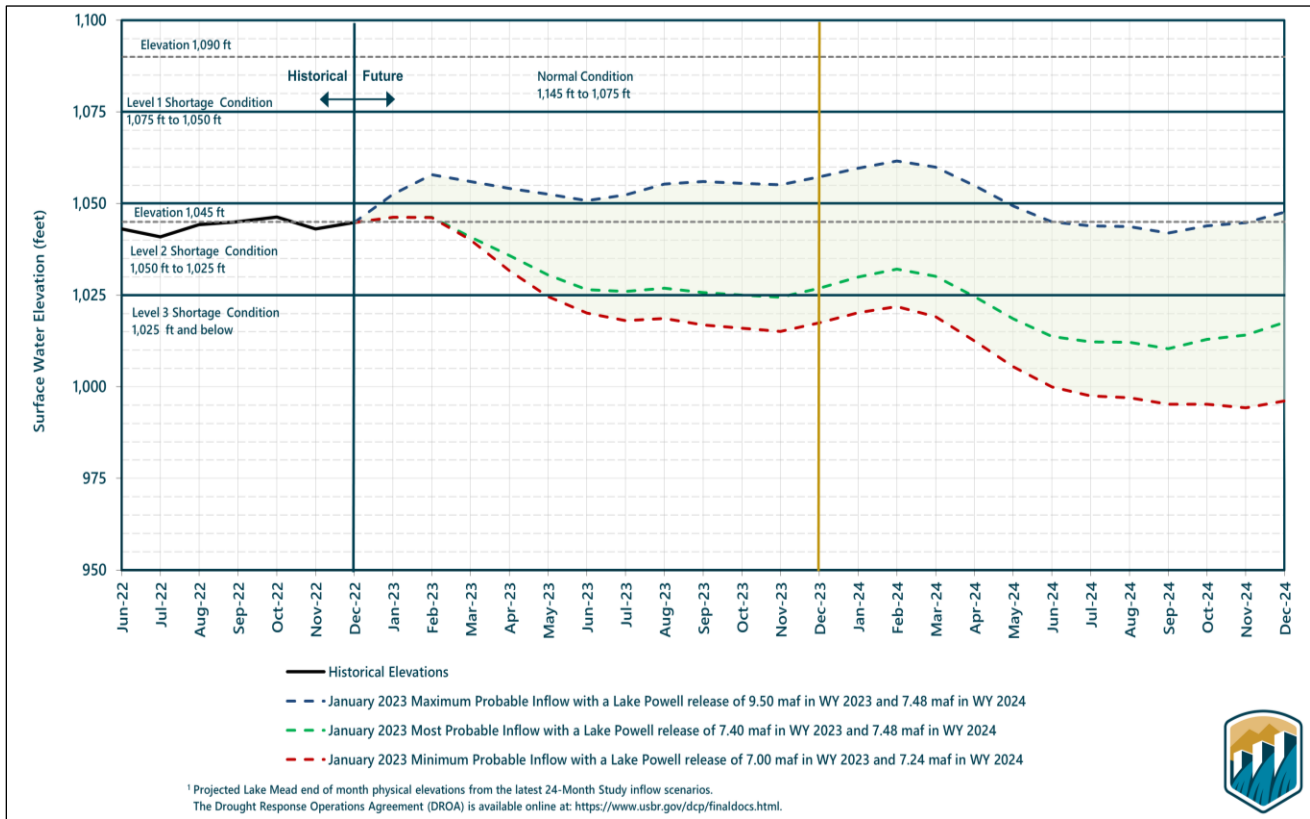
(values in thousands of acre-feet)

| Lake Mead Elevation (ft) | 2007 Interim Shortage Guidelines | | Minute 323 Delivery Reductions | DCP Curtailment | | | Binational Water Scarcity Conting. Plan | Total Volume of Curtailment (% of Lower Colorado River Apportionment) | | | | |
|--------------------------|----------------------------------|----|--------------------------------|-----------------|----|-----|---|---|------------|------------|-------|-----|
| | AZ | NV | | Mexico | AZ | NV | | CA | Mexico | AZ | NV | CA |
| 1,090 - >1,075 | 0 | 0 | 0 | 192 | 8 | 0 | 41 | 192 (6.8%) | 8 (2.6%) | 0 (0%) | 200 | 41 |
| 1,075 - >1,050 | 320 | 13 | 50 | 192 | 8 | 0 | 30 | 512 (18.2%) | 21 (7%) | 0 (0%) | 533 | 80 |
| 1,050 - >1,045 | 400 | 17 | 70 | 192 | 8 | 0 | 34 | 592 (21.1%) | 25 (8.3%) | 0 (0%) | 617 | 104 |
| 1,045 - >1,040 | 400 | 17 | 70 | 240 | 10 | 200 | 76 | 640 (22.8%) | 27 (9.0%) | 200 (4.5%) | 867 | 146 |
| 1,040 - >1,035 | 400 | 17 | 70 | 240 | 10 | 250 | 84 | 640 (22.8%) | 27 (9.0%) | 250 (5.6%) | 917 | 154 |
| 1,035 - >1,030 | 400 | 17 | 70 | 240 | 10 | 300 | 92 | 640 (22.8%) | 27 (9.0%) | 300 (6.8%) | 967 | 162 |
| 1,030 - 1,025 | 400 | 17 | 70 | 240 | 10 | 350 | 101 | 640 (22.8%) | 27 (9.0%) | 350 (7.9%) | 1,017 | 171 |
| <1,025 | 480 | 20 | 125 | 240 | 10 | 350 | 150 | 720 (22.8%) | 30 (10.0%) | 350 (7.9%) | 1,100 | 275 |

Sources: Table by CRS, using data in the 2007 Interim Shortage Guidelines, Minute 323 between Mexico and the United States, *Lower Basin Drought Contingency Plan*, and the Binational Water Scarcity Contingency Plan in Minute 323 between Mexico and the United States.

At the time of the act’s passage, Reclamation noted that the Lower Basin DCP significantly reduced the risk of Lake Mead elevations falling below critical elevation of 1,020 feet.¹⁰² Combined with the commitments from Mexico, total planned cutbacks under shortage scenarios (i.e., all commitments to date, combined) were expected to decrease Lower Basin consumptive use by 241,000 AF to 1.375 MAF per year, depending on the curtailments triggered by Lake Mead’s elevation.¹⁰³ Despite these efforts, Lake Mead has continued to decline since the Lower Basin DCP was finalized and is projected to continue to decline (Figure 6). These developments have triggered additional Lower Basin conservation efforts.

Figure 6. Lake Mead End of Month Elevation Projections
(January 2023 24-month study inflow scenarios)



Source: U.S. Bureau of Reclamation, “24-Month Study Projections,” January 2023, at <https://www.usbr.gov/lc/region/g4000/riverops/24ms-projections.html>.

500+ Plan

The Lower Basin DCP included a provision that if Reclamation’s modeling (which includes all of the aforementioned conservation efforts) indicates a possibility of Lake Mead reaching an elevation at or below 1,030 feet, the Secretary of the Interior and the Lower Basin states would consult on additional measures to avoid and protect Lake Mead from declining below 1,020

¹⁰² 2019 House Natural Resources DCP Hearing.

¹⁰³ For a summary of the curtailments that add up to this amount, see “1,090 - >1,075” row of **Table 1**.

feet.¹⁰⁴ This provision was triggered in Reclamation’s August 2021 24-month study, which projected the possibility for such a scenario by 2023 under its “Probable Minimum Inflow” scenario.¹⁰⁵ In response, in December 2021, Lower Basin parties and the DOI agreed to a new set of actions in a memorandum of understanding known as the *500+ Plan*. This plan calls for contributions of up to \$100 million by Lower Basin entities (\$40 million from the Arizona Department of Water Resources and \$20 million each from the Central Arizona Water Conservation District, the Metropolitan Water District of Southern California, and the Southern Nevada Water Authority), plus another \$100 million from the federal government, which collectively would fund actions intended to result in the conservation of an additional 500,000 AF in Lake Mead in 2022 and 2023 (i.e., 1 MAF).¹⁰⁶ Federal funding for these conservation efforts was made available through a combination of discretionary appropriations to Reclamation, as well as supplemental funding in the Infrastructure Improvement and Jobs Act (P.L. 117-58). However, actual conservation under this effort has not been reported on.

Potential for Additional Actions

At a June 14, 2022, Senate hearing, the Commissioner of Reclamation announced that basin states would need to conserve between 2 MAF and 4 MAF in 2023 to protect Lake Mead and Lake Powell storage volumes over the near-term period (2023-2026).¹⁰⁷ These amounts would be *in addition* to the previous commitments discussed above. The estimate was the result of a 2022 Protection Volume Analysis by Reclamation.¹⁰⁸ The Commissioner noted that if these targets were not met with voluntary actions by August 2022, DOI was prepared to act unilaterally.¹⁰⁹

No major commitments were announced in response to Reclamation’s June request, and Reclamation did not implement delivery curtailments beyond those previously agreed to.¹¹⁰ In late October 2022, Reclamation announced its intent to revise the 2007 Interim Guidelines in 2023 and 2024 (i.e., prior to post-2026 operational changes to the guidelines, which are proceeding separately) so as to address continued low runoff conditions in the basin. Reclamation published this Notice in the Federal Register in November.¹¹¹ The revisions are expected to

¹⁰⁴ Reclamation, *Agreement Concerning Colorado River Drought Contingency Management and Operations*, May 19, 2020, at <https://www.usbr.gov/dcp/docs/final/Companion-Agreement-Final.pdf>.

¹⁰⁵ Reclamation, *Operation Plan for Colorado River System Reservoirs, August 2021 24-Month Study, Minimum Probable Inflow*, at https://www.usbr.gov/lc/region/g4000/24mo/2021/AUG21_MIN.pdf. 24-Month Study Reports are available at Reclamation, *Operation Plan for Colorado River System Reservoirs (24-Month Study)*, at <https://www.usbr.gov/lc/region/g4000/24mo/index.html>.

¹⁰⁶ Similar to the aforementioned efforts under the System Conservation Program, funding for increased efficiency and decreased deliveries (e.g., through fallowing programs) are expected to be among the efforts funded through the 500+ Plan.

¹⁰⁷ U.S. Congress, Senate Committee on Energy and Natural Resources, *Short And Long Term Solutions To Extreme Drought In The Western U.S.*, Statement of the Honorable Camille Touton, 117th Cong., 2nd sess., June 14, 2022. Hereinafter “2022 Drought Hearing.”

¹⁰⁸ See Reclamation, *Colorado River System Mid Term Projections*, June 16, 2022, at <https://www.usbr.gov/ColoradoRiverBasin/documents/20220616-ColoradoRiverSystemMid-termProjections-Presentation.pdf>.

¹⁰⁹ 2022 Drought Hearing.

¹¹⁰ In a July 18, 2022, letter to Reclamation, the Upper Colorado River Commission declined to contribute a specific volume of cutbacks to these efforts, instead laying out a five-point plan as the basis for its water conservation efforts. Letter from Charles Cullom, Director, Upper Colorado River Commission, to Camille Touton, Commissioner, U.S. Bureau of Reclamation, July 18, 2022, at <http://www.ucrcommission.com/wp-content/uploads/2022/07/2022-July-18-Letter-to-Reclamation.pdf>.

¹¹¹ Notice of Intent to Prepare Supplemental Environmental Impact Statement for December 2007 Record of Decision Entitled Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell

consider a “consensus-based” set of actions developed by the states, as well as implementation of additional curtailments that Reclamation would develop unilaterally, potentially to “complement” consensus-based commitments.¹¹² The latter could involve reduced releases from both Glen Canyon and Hoover dams, thereby affecting downstream reservoir elevations and deliveries to basin contractors, among other things.

On January 31, 2023, all of the basin states but California submitted a combined proposal for a “Consensus Based Modeling Alternative” (CBMA) pursuant to the November Notice;¹¹³ California submitted its own response separately.¹¹⁴ The CBMA proposal would assess 1.543-1.943 million acre-feet (MAF) per year in new delivery reductions on Lower Colorado River Basin contractors (i.e., reductions in addition to previous commitments).¹¹⁵ Reductions would be phased in through two mechanisms: 1) the assessment of 1.543 MAF of evaporative losses on Lower Basin state contractors (referred to in the CBMA as “Infrastructure Protection Volume,” or IPV), which would be assessed based on recent consumptive use levels;¹¹⁶ and 2) additional operational tier changes and delivery reductions tied to Lake Mead elevations of 1,050 feet and lower.¹¹⁷ The CBMA’s cumulative reductions compared to current levels appear to be relatively greater for California than for Arizona and Nevada.¹¹⁸ For its part, California’s proposal would include 1.0-1.95 MAF per year in new delivery reductions for Lower Basin contractors, depending on Lake Mead elevations. These reductions would be phased in on a schedule starting with 1.0 MAF in reductions at a Lake Mead elevation of 1,045 feet, with additional reductions beyond that amount at 1,025 ft. For the first 1.0 MAF, California proposal’s reductions would be proportionally greater for Arizona and Nevada than on itself.¹¹⁹ Both proposals would also institute changes on Lake Powell’s operational tiers, so as to allow for more water to be left in that reservoir, although they would do so in different ways.

Issues for Congress

Funding and Oversight of Existing Facilities and Programs

The principal role of Congress as it relates to storage facilities on the Colorado River is funding and oversight of facility operations, construction, and programs to protect and restore listed species (e.g., Glen Canyon Dam Adaptive Management Program and the Upper Colorado River

and Lake Mead (Nov 17, 2022), at <https://www.federalregister.gov/documents/2022/11/17/2022-25004/notice-of-intent-to-prepare-a-supplemental-environmental-impact-statement-for-december-2007-record>. Hereinafter “November 2022 Notice.”

¹¹² November 2022 Notice.

¹¹³ Letter from Colorado River Basin State Representatives of Arizona, Colorado, Nevada, New Mexico, Utah, and Wyoming to Tanya Trujillo, Assistant Secretary, Water & Science, U.S. Department of the Interior, January 31, 2023. Hereinafter “CBMA Proposal.”

¹¹⁴ Letter from Colorado River Board of California to Deputy Interior Secretary Tommy Beaudreau et al., U.S. Department of the Interior, January 31, 2023. Hereinafter “California Proposal.”

¹¹⁵ CBMA Proposal.

¹¹⁶ CBMA Proposal This amount also assumes the assessment of evaporative losses on Mexico.

¹¹⁷ These reductions would move the current Tier 3 reduction schedule (which begins at 1,025 feet) up to a Lake Mead elevation of 1,050 feet, and would institute additional delivery reductions at Lake Mead elevations of 1,030 feet or lower.

¹¹⁸ CRS analysis of CBMA Proposal.

¹¹⁹ The proposal does not specify the allocation of reductions in excess of 1.0 MAF.

Endangered Fish Program). In the Upper Basin, Colorado River facilities include the 17 active participating units in the Colorado River Storage Projects, as well as the Navajo-Gallup Water Supply Project. In the Lower Basin, major facilities include the Salt River Project and Theodore Roosevelt Dam, Hoover Dam and All-American Canal, Yuma and Gila Projects, Parker-Davis Project, Central Arizona Project, and Robert B. Griffith Project (now Southern Nevada Water System).

Congressional appropriations in support of Colorado River projects and programs typically account for a portion of overall project budgets. For example, in FY2020, approximately 40% of Lower Colorado River Region's overall budget was funded with discretionary appropriations, with the remainder of funding coming from power revenues (which are made available without further appropriation) and nonfederal partners.¹²⁰ In recent years, Congress has also authorized and appropriated funding that has targeted the Colorado River Basin in general (e.g., the Pilot System Conservation Plan). Congress may choose to extend or amend authorities specific to the basin or alter basin funding levels.

While discretionary appropriations for the Colorado River are of ongoing interest to Congress, Congress has also addressed Colorado River funding outside of the regular appropriations process. In the 117th Congress, in Section 50233 of P.L. 117-169 (popularly known as the Inflation Reduction Act, IRA), Congress provided \$4.0 billion for projects that mitigate drought in the 17 arid and semiarid *reclamation states* in the West,¹²¹ with priority given to Colorado River Basin activities. This funding is available through FY2026 and is expected to be used for a variety of activities, including some of the previously authorized activities discussed above, as well as compensation for new efforts. Reclamation announced initial plans for this funding on October 12, 2022, in the form of a new program, the *Lower Colorado River Basin System Conservation and Efficiency Program*.¹²² The program has three components:

- Under the first component (1a), Colorado River water delivery contractors or entitlement holders submitted proposals resulting in water remaining in Lake Mead at a set price of \$330 per acre-foot for a one-year agreement, \$365 per acre-foot for a two-year agreement, and \$400 per acre-foot for a three-year agreement. These proposals were due in November 2022.
- For the second component (1b), Reclamation accepted proposals for additional water conservation and efficiency projects that could involve a variety of pricing options as proposed by Colorado River water delivery contractors or entitlement holders. These proposals were due in November 2022.
- The third component (2) would allow for proposals to be submitted in early 2023 for long-term system efficiency improvements that will result in multi-year system conservation. These proposals were expected to be solicited in early 2023.

The magnitude of water savings that might result from these voluntary agreements is unclear. If the agreements are successful, future federal funding similar to that provided in the IRA may continue to be requested to mitigate the effect of long-term drought in the basin and the shift away from current water consumption levels.

¹²⁰ Reclamation, *Lower Colorado Region Annual Report, Fiscal Years 2019 & 2020*.

¹²¹ "Reclamation states" refers to the 17 states designated by Congress to be in the Reclamation service area, pursuant to the Reclamation Act of 1902, as amended. 34 Stat. 259.

¹²² Reclamation, "Biden-Harris Administration Announces New Steps for Drought Mitigation Funding from Inflation Reduction Act," Press Release, October 12, 2022, at <https://www.usbr.gov/newsroom/news-release/4353>.

In addition to the aforementioned new program being implemented with IRA funding, the Administration also announced that \$250 million of the act's funding would go toward Salton Sea restoration activities over the 2022-2026 timeframe.¹²³ Restoration of the Sea is a high priority of the Imperial Irrigation District, one of the largest water rights holders on the Colorado River.¹²⁴

Tribal Water Rights Settlements and Leasing

Many tribal water rights are senior to other water rights in the basin, and thus are likely to play an important role in the future of the Colorado River. The extent to which tribes develop their water rights, or are willing and able to market their water to other users, has ramifications for water availability in the basin. The 117th Congress authorized a new Indian water rights settlement related to one tribe's rights to Colorado River water (the Hualapai Settlement, P.L. 117-349) and enacted a new authority for the Colorado River Indian Tribes, one of the largest water rights holders on the river, to enter into agreements to lease a portion of the tribes' Colorado River water (the Colorado River Indian Tribes Water Resiliency Act of 2022, P.L. 117-343).¹²⁵ As previously noted, Congress has approved Indian water rights settlements associated with more than 2.5 MAF of tribal diversion rights on the Colorado River; a portion of this water has been developed to date. Congress may be asked to consider new settlements that would add to this total.

New Facilities and Other Alterations

Some states may pursue further development of their unused Colorado River water (i.e., rather than cutting their use). For example, one project that would develop Upper Basin waters, the proposed Lake Powell Pipeline (LPP), would direct approximately 86,000 AF of Utah's Upper Basin Colorado River Basin annual apportionment from Lake Powell to Washington County, UT (i.e., the St. George, UT, area, which is technically located within the Lower Basin drainage area).¹²⁶ The pipeline would begin near Glen Canyon Dam in Arizona and would run through Arizona and Utah to Sand Hollow Reservoir near St. George, UT. Reclamation is the lead agency for the project under NEPA and is coordinating an Environmental Impact Statement (EIS) for the most recently proposed version of the project.¹²⁷

The debate over the Lake Powell Pipeline is illustrative of the issues future water development proposals may face in the basin. Supporters argue that the pipeline is needed to provide a secondary water source for the St. George area (in addition to its primary water source from the Virgin River). However, environmental groups have argued that the proposed development and diversion of additional Upper Basin waters is ill-advised in light of climate change and the basin's over-allocation.¹²⁸ The six other Colorado River Basin states have raised concerns related

¹²³ Reclamation, "Inflation Reduction Act Funds Landmark Agreements to Accelerate Salton Sea Restoration," Press Release, November 28, 2022, at <https://www.usbr.gov/newsroom/news-release/4380>.

¹²⁴ See footnote 83.

¹²⁵ Prior to the legislation's enactment, these tribes, who were awarded their water rights under the *Arizona v. California* decree, were not able to lease their water. This is not the case for most other tribes with Colorado River water rights.

¹²⁶ While St. George, UT, is technically within the Lower Colorado River Basin's drainage, Utah's state allocation comes out of waters available to the Upper Basin. Thus, the LPP would utilize Upper Basin waters.

¹²⁷ For project NEPA documents and studies, see <https://www.usbr.gov/uc/DocLibrary/EnvironmentalImpactStatements/LakePowellPipeline/index.html#intro>.

¹²⁸ Letter from Utah Rivers Council et al. to Rick Baxter, Program Manager, Bureau of Reclamation Provo Area Office, September 8, 2020.

to the proposed LPP’s “legal and operational issues,” and have criticized the use of the LPP NEPA process as a de facto forum for resolving a conflict among basin states. The six states previously requested that Reclamation refrain from issuing a final EIS until these issues can be resolved on a consensus basis.¹²⁹

Some groups that oppose new infrastructure development on the Colorado River also have proposed demolition of *existing* infrastructure, in particular Glen Canyon Dam. They argue that removing the dam would be beneficial to listed species and the Grand Canyon’s ecosystem and would be a cheaper and less politically problematic option than drying up Upper Basin farms to save Lake Powell.¹³⁰ For their part, water and power users and most governmental entities oppose these efforts for their potential economic damage. Reclamation reports that it is accelerating maintenance actions at Glen Canyon Dam to determine the reliability of using river bypass tubes at the dam to enable Lower Basin releases at storage levels below minimum power pool.¹³¹ Reclamation is also studying the efficacy of physical modifications to Glen Canyon Dam to allow for releases below critical elevations.¹³² Removing or significantly altering Glen Canyon Dam may require authorization by Congress.

Post-2026 Operations/Agreements

Congress is likely to remain interested in the status of long-term drought in the basin and in the implementation of the DCPs and other related agreements, including their ability to stem further delivery curtailments and add water to the basin’s storage reservoirs.¹³³ Congress also may be interested in broader basin planning. Federally led efforts to extend the 2007 Interim Guidelines (including the DCPs), which expire at the end of 2026, will frame future management of the Colorado River. At the same time, new agreements that would protect water supplies in the short-term, such as the 500+ Plan, an Upper Basin DPC Demand Management Program, and DROA Drought Plans, could themselves result in additional congressional involvement in funding, oversight, and/or enactment of new authorities.

Concluding Observations

There is wide acknowledgement that existing directives for managing Colorado River Basin waters are inadequate and do not account for the basin’s current and projected hydrology. The original basis for the Colorado River Compact assumed more water than turned out to be available for consumptive uses, and a drought dating to 2000 has exacerbated this issue. Although recent agreements have marginally reduced usage, basinwide consumptive use (including evaporation) has continued to exceed natural flows in most years of the past several decades. The resulting drawdown of basin storage has left Lakes Mead and Powell at historically low levels

¹²⁹ Letter from Colorado River Basin States Representatives of Arizona, California, Colorado, Nevada, New Mexico, and Wyoming to Secretary of the Interior David Bernhardt, September 8, 2020.

¹³⁰ Save the Colorado, “Save the Colorado’s Policies for Renegotiation of the 2007 Interim Guidelines for Management of the Colorado River,” Press Release, November 29, 2022.

¹³¹ Reclamation, “Interior Department Announces Actions to Protect Colorado River System, Sets 2023 Operating Conditions for Lake Powell and Lake Mead,” August 16, 2022. Hereinafter, “Reclamation August 2022 Press Release.”

¹³² Reclamation, August 2022 Press Release.

¹³³ For instance, 2021 and 2022 hearings on drought in the western United States included extensive discussion of drought conditions in the Colorado River Basin. See U.S. Congress, House Committee on Natural Resources, Subcommittee on Water, Oceans, and Wildlife, *The Status of Drought Conditions Throughout the Western United States*, 117th Cong., 1st sess., May 25, 2021 and U.S. Congress, Senate Committee on Energy and Natural Resources, *Short and Long-Term Solutions to Extreme Drought in the Western United States*, 117th Cong., 2nd sess., June 14, 2022.

that threaten both hydropower production and water deliveries throughout the basin. Water flow projections based on climate change estimate that flows will continue to decrease, whereas new demands and diversions (e.g., development of tribal water rights) suggest that competition for this water will continue to increase.

Despite agreement that some level of water delivery cutbacks will be necessary to protect power generation and reservoir storage, there remain considerable differences of opinion as to what form these actions should take, and whether they should be formulated at the federal or nonfederal (consensus-based) level. The question of which entities will face water delivery cutbacks and of what magnitude, as well as what sort of mitigation might accompany these efforts, take on an added level of urgency due to the river's economic importance to many areas. The relative importance of established water rights priorities in the basin, compared to priority for health, safety, and other uses, is a central issue currently facing decisionmakers. Other questions, including what changes to infrastructure (e.g., alterations to dam and water delivery infrastructure), accounting (e.g., whether and how to account for evaporation in the Lower Basin), and/or the basis for basin water management (e.g., water allocations based on inflows rather than set amounts) are also likely to figure into future discussions and negotiations.

Author Information

Charles V. Stern
Specialist in Natural Resources Policy

Pervaze A. Sheikh
Specialist in Natural Resources Policy

Disclaimer

This document was prepared by the Congressional Research Service (CRS). CRS serves as nonpartisan shared staff to congressional committees and Members of Congress. It operates solely at the behest of and under the direction of Congress. Information in a CRS Report should not be relied upon for purposes other than public understanding of information that has been provided by CRS to Members of Congress in connection with CRS's institutional role. CRS Reports, as a work of the United States Government, are not subject to copyright protection in the United States. Any CRS Report may be reproduced and distributed in its entirety without permission from CRS. However, as a CRS Report may include copyrighted images or material from a third party, you may need to obtain the permission of the copyright holder if you wish to copy or otherwise use copyrighted material.