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

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SUMMARY

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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 of these waters 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. In the future, observers expect ongoing strain on the basin's limited water supplies, which will be further stressed by climate change.

River Management

The *Law of the River* is the commonly used shorthand for the multiple laws, court decisions, and other documents governing Colorado River operations; its foundational document 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 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 (e.g., intrastate allocations of flows), 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 as the *water master* for the Lower Basin, a role in which the federal government manages 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, dam releases from these facilities are tied to specific water storage levels. On August 16, 2021, Reclamation declared the first-ever *Tier One* shortage condition in the Lower Basin beginning in 2022, which reduces deliveries to water contractors in Arizona and Nevada, as well as to Mexico. Reclamation also projected a high likelihood of Lake Powell's 2022 surface water elevation falling below target levels established to protect hydropower infrastructure at Glen Canyon Dam.

Operational Changes and Drought Contingency Plans

The federal government has led multiple efforts attempting to improve the basin's water supply outlook, resulting in previous collaborative agreements in 2003 and 2007. After several years of negotiations, in 2019 Reclamation and the basin states agreed on a new set of plans to alleviate the strain on basin water supplies. Congress authorized these drought contingency plans (DCPs) for the Upper and Lower Basins in 2019 in the Colorado River Drought Contingency Plan Authorization Act (P.L. 116-14). Among other things, the DCPs required reductions beyond previous curtailment plans based on Lake Mead storage levels, committed Reclamation to additional water conservation efforts, and put in place plans to coordinate Upper Basin operations to enhance Lake Powell storage levels and hydropower generation. Although the DCPs were widely lauded for their consensus-based development, many remain concerned about the basin's long-term water supply imbalance and the related potential for a compact call (a "call" on water rights between the Lower and Upper Basins). A central question facing decisionmakers is whether to renew interim agreements (including the DCPs) prior to their expiration in 2026, along with what (if any) additional changes might be necessary to prevent future shortages.

Congressional Role

Congress plays a multifaceted role in federal management of the Colorado River Basin. Congress funds and oversees management of basin facilities and has held oversight hearings on drought in the basin and elsewhere. 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 (i.e., the DCPs and other related efforts). In the future, Congress may be asked to amend or extend these authorities to combat long-term water shortages.

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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.[1] 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, part of 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.[2] The federal role in the management of 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 (70%) of basin water supplies are used to irrigate 5.5 million acres of land; basin waters also provide M&I water supplies to nearly 40 million people.[3] Much of the area that depends on the river for 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.[4] 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.[5]

Precipitation and runoff in the basin are highly variable. Water conditions on the river depend largely on snowmelt in the basin's northern areas. Observed historical data (1906-2018) show that overall, natural flows in the Colorado River Basin averaged about 14.8 million acre-feet (MAF) annually.[6] Flows have dipped significantly during the current drought, which dates to 2000; natural flows from 2000 to 2018 averaged approximately 12.4 MAF per year.[7] Reclamation has estimated that the 19-year period from

[1] J. C. Kammerer, "Largest Rivers in the United States," USGS Fact Sheet, May 1990, at https://pubs.usgs.gov/of/1987/ofr87-242/pdf/ofr87242.pdf.

[2] As discussed in the below 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.

[3] U.S. Bureau of 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.

[4] Reclamation 2012 Supply/Demand Study, p. 3.

[5] Reclamation 2012 Supply/Demand Study, p. 3.

[6] Department of the Interior, Open Water Data Initiative, *Drought in the Colorado River Basin*, accessed November 1, 2018, at https://www.doi.gov/water/owdi.cr.drought/en/#SupplyDemand.

[7] U.S. Bureau of Reclamation, Lower Colorado Region, "Colorado River Basin Natural Flow and Salt Data-Current Natural Flow Data 1906-2016," at http://www.usbr.gov/lc/region/g4000/NaturalFlow/current.html. Provisional natural flow measurements for 2017 and 2018 by U.S. Bureau of Reclamation, Lower Colorado River Operations, at https://www.usbr.gov/lc/region/g4000/riverops/model-info.html. Documentation for the natural flow calculation methods is available at http://www.usbr.gov/lc/region/g4000/NaturalFlow/NaturalFlowAndSaltComptMethodsNov05.pdf. Hereinafter, Bureau of Reclamation Flow Data, 1906-2018.

2000 to 2018 was the driest period in more than 100 years of record keeping.[8] The dry conditions are consistent with prior droughts in the basin that were identified through tree ring studies; some of these droughts lasted for decades.[9] Climate change impacts, including warmer temperatures and altered precipitation patterns, may further increase the likelihood of prolonged drought in the basin.

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 species. Congress has also approved and continues to actively 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 funding to mitigate drought and stretch basin water supplies and has considered 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.

[8] U.S. Bureau of Reclamation, *Annual Operating Plan for Colorado River Reservoirs, 2019*, September 10, 2018, p. 8.

[9] For additional discussion on historic drought in the Colorado River, see CRS Report R43407, *Drought in the United States: Causes and Current Understanding*, by Peter Folger.

Figure 1. Colorado River Basin and Areas That Import Colorado River Water

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

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.[10] 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. Because local or state groups could not resolve these "national problems," Congress considered ideas to control the Colorado River and resolve potential conflicts between the states.[11] Thus, in an effort to resolve these conflicts and prevent litigation, Congress gave its consent for the states and Reclamation to enter into an agreement to apportion Colorado River water supplies in 1921.[12]

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.[13]

Colorado River Compact

The Colorado River Compact of 1922, negotiated by the seven basin states and the federal government, was signed by all but one basin state (Arizona).[14] 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 at Lee Ferry, AZ,[15] below the confluence of the Colorado and Paria Rivers near the Utah border.[16] 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.[17] 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; this matter 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.

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[10] Arizona v. California, 373 U.S. 546 (1963). Hereinafter, *Arizona v. California*.

[11] 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 by Lower Basin states (California, Arizona, and Nevada) under prior appropriation doctrine before Upper Basin states could develop means to access their share.

[12] 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 into without the consent of Congress.

[13] 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.

[14] 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."

[15] *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.

[16] Arizona receives water under both the Upper and the Lower Basin apportionments, since parts of the state are in both basins.

[17] As a result, in some years in which Lake Powell inflows are less than 7.5 MAF, less than 7.5 MAF may be available to Lower Basin states.

Boulder Canyon Project Act

Congress approved and modified the Colorado River Compact in the Boulder Canyon Project Act (BCPA) of 1928.[18] The act ratified the 1922 compact, authorized the construction of a federal facility to impound water in the Lower Basin (Boulder Dam, later renamed Hoover Dam) and related facilities to deliver water in Southern California (e.g., the All-American Canal, which delivers Colorado River water to California's Imperial Valley), and apportioned the Lower Basin's 7.5 MAF per year among the three Lower Basin states. It provided 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 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.[19]

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,[20] California's historical use of the river trumped Arizona's rights to the Arizona allotment.[21] California also argued that Colorado River apportionments under the BCPA included 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 in the U.S. Supreme Court to settle the issue. Eleven years later, in the 1963 *Arizona v. California* decision,[22] the Supreme Court ruled in favor of Arizona, finding that Congress had intended to apportion the *mainstream* of the Colorado River and that California and Arizona each would receive one-half of surplus flows.[23] The same Supreme Court decision held that Section 5 of the BCPA controlled the apportionment of waters among Lower Basin States, and that the BCPA (and not the law of prior appropriation) controlled the apportionment of water among Lower Basin states.[24] The ruling was notable for its directive to forgo 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

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

[19] 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.

[20] 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.

[21] 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 significant to the arguments in the case.

[22] *Arizona v. California*, 373 U.S. 546 (1963).

[23] *Id*. at 546, 573.

[24] *Id*. at 585-586. This decision gave the Secretary the power to apportion surpluses and shortages among and within Lower Basin states.

Basin.[25] The decision also held that Native American reservations on the Colorado River were entitled to priority under the BCPA.[26] Later decrees by the Supreme Court in 1964 and 1979 supplemented the 1963 decision.[27]

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).[28] 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.

1944 U.S.-Mexico Water Treaty[29]

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 (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

Projects originally authorized for study in the Upper Basin under BCPA were not allowed to move forward until the Upper Basin states determined their individual water allocations, which they did under the Upper Colorado River Basin Compact of 1948. The Upper Basin Compact established Colorado (where the largest share of runoff to the river originates) as 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

[25] 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."

[26] 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 on "Tribal Water Rights" and CRS Report R44148, *Indian Water Rights Settlements*, by Charles V. Stern.

[27] *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.

[28] Colorado River Basin Project Act of 1968, P.L. 90-537.

[29] 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.

[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] The complete list of minutes is available at https://www.ibwc.gov/Treaties_Minutes/Minutes.html. For more information on recent minutes, see below section, "Minute 319 and Minute 323 Agreements with Mexico."

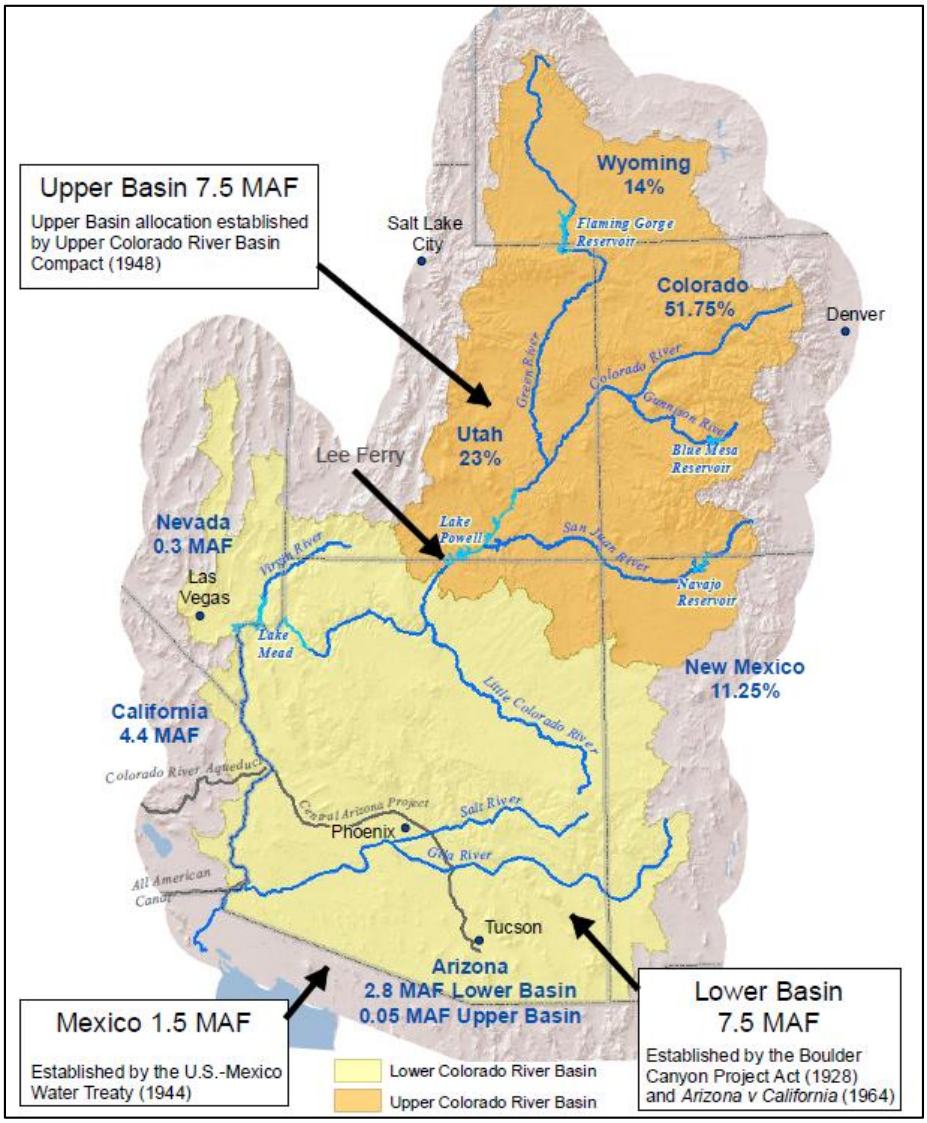
Lower Basin have been met. Other states also received percentage-based allocations, including Wyoming (14%), New Mexico (11.25%), and Utah (23%).[32] Arizona was allocated 50,000 AF in addition to its Lower Basin apportionment, in recognition of the small portion of the state in the Upper Basin. Basin allocations by state following approval of the Upper Basin Compact (i.e., the allocations that generally guide current water deliveries) are shown below in **Figure 2**. 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]

[32] 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.

[33] For more information, see http://www.ucrcommission.com/about-us/.

Figure 2. Colorado River Basin Allocations

(percentages of overall allocation and 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 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 allocations. The Colorado River Storage Project (CRSP) Act of 1956 authorized storage reservoirs and dams in the Upper Basin, including the Glen Canyon, Flaming Gorge, Navajo, and Curecanti Dams. 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.

In addition to the aforementioned authorization of CAP in Arizona, the 1968 CRBPA amended CRSP to authorize several additional 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 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. The CRBPA also established the Upper Colorado River Basin Fund and the Lower Colorado River Basin Development Fund, both of which were 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 basin's large water storage projects, basin water users are able to store as much as 60 MAF, or about four times the Colorado River's annual 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). The status of these projects is of interest to basin stakeholders and observers and is monitored closely by Reclamation.

Glen Canyon Dam, completed in 1963, 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 3.78 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, municipal and industrial 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 4.2 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-American Canal for use in California's Imperial and Coachella Valleys.

[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.

[35] Bureau of Reclamation, Upper Colorado Region, "Glen Canyon Unit," accessed February 21, 2019, 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 one project—the Pine River Extension Project—had its authorization deleted by Congress.) For a complete list of projects, see https://www.usbr.gov/uc/rm/crsp/index.html.

[38] Bureau of Reclamation, "Hoover Dam Frequently Asked Questions and Answers," accessed February 21, 2019, Bureau of Reclamation, Upper Colorado Region, *Glen Canyon Unit*, accessed February 21, 2019, https://www.usbr.gov/uc/rm/crsp/gc/.

Annual Operations

Reclamation monitors Colorado River reservoir levels and projects them 24 months into the future in monthly studies (called *24-month studies*). 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 (ft) 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, a report describing the actual operation for the preceding water year and the projected operation for the coming year. This report is commonly referred to as the *annual operating plan* (AOP). The AOP's projected January 1 water conditions for the upcoming calendar year establish a baseline for future annual operations.[39]

Since the adoption of new operational guidelines by Reclamation and basin states in 2007 (see below section, "2007 Interim Guidelines"), operations of the Hoover and Glen Canyon Dams have been tied to specific pool elevations at Lake Mead and Lake Powell (**Figure 3**). For Lake Mead, the first level of shortage (a *Level One* Shortage Condition) in the 2007 guidelines, under which Arizona and Nevada's allocations are decreased (along with releases to Mexico), is triggered if Lake Mead falls below 1,075 ft.[40] For Lake Powell, releases under tiered operations are based on storage levels in both Lake Powell and Lake Mead.[41] On August 16, 2021, Reclamation declared the first-ever Level One Shortage Condition for the Lower Basin in 2022, while also projecting substantive chances of Lake Mead declining to critical elevations of 1,025 feet and 1,000 feet by 2025.[42] Reclamation also predicted a high likelihood that Lake Powell would fall below the target elevation of 3,525 feet in 2022 and, in July 2021 implemented drought operations releasing additional water from Upper Basin units to protect Lake Powell.[43]

[39] Current and historical AOPs are available at https://www.usbr.gov/uc/water/rsvrs/ops/aop/.

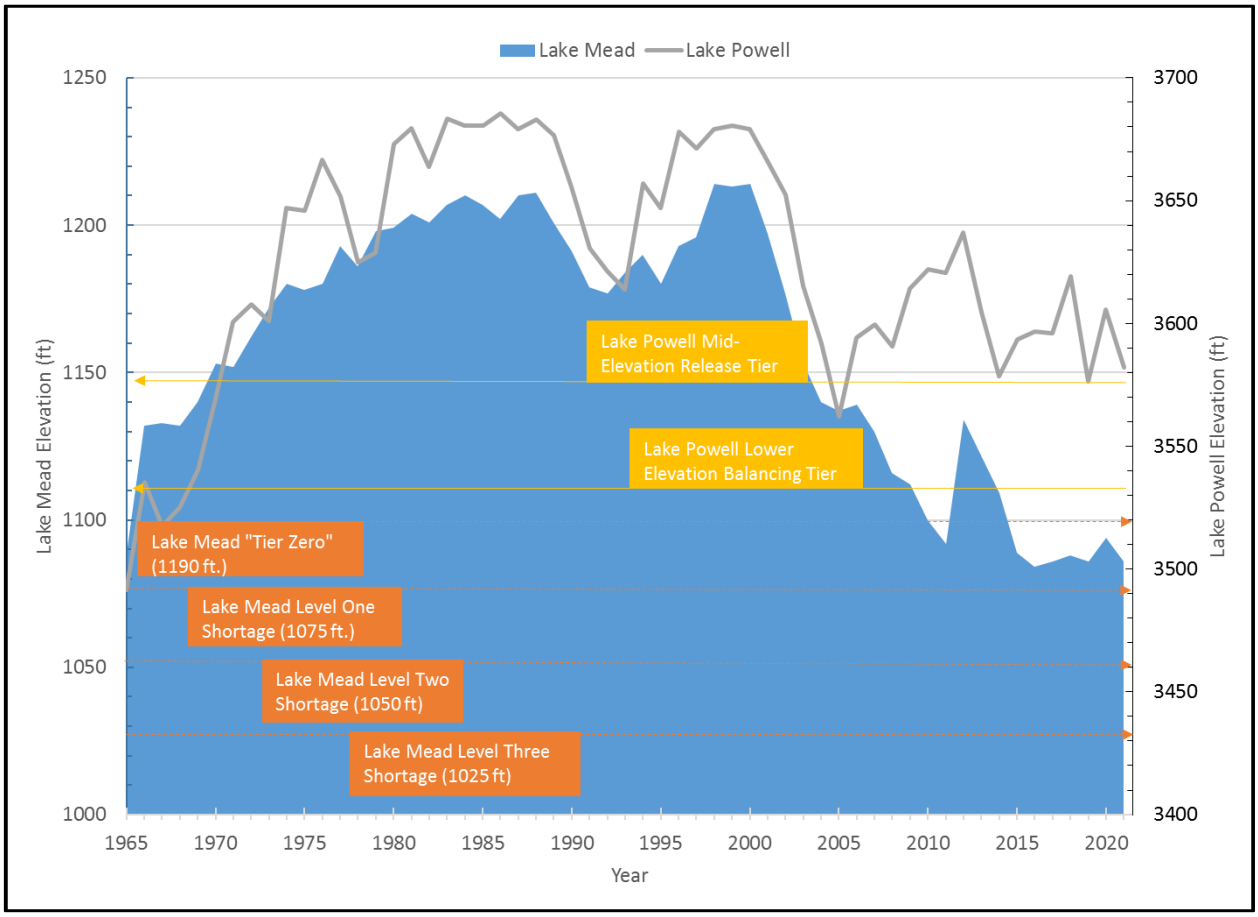
[40] Subsequently, a new set of curtailments for Nevada and Arizona at lake elevations up to 1,090 ft (*Tier Zero*) was added pursuant to the 2019 Drought Contingency Plan for the Lower Colorado River Basin.[40] See below section, "2019 Drought Contingency Plans."

[41] Unlike at Lake Mead, specific delivery curtailments to states based on lake levels have not been adopted for Lake Powell.

[42] Bureau of Reclamation, "Reclamation Announces 2022 Operating Conditions for Lake Powell and Lake Mead," press release, August 16, 2021. Hereinafter, Reclamation, August 2021 press release. Also see Bureau of Reclamation, "Percent of Traces with Event or System Condition. Results from August 2021," accessed August 16, 2021, at https://www.usbr.gov/lc/region/g4000/riverops/crss-5year-projections.html.

[43] Reclamation, August 2021 press release. This elevation has been targeted as a floor for Lake Powell operations because it provides a buffer designed to minimize the risk of dropping below the dam's minimum power pool elevation of 3,490 feet and thus balances protection of the dam's hydropower infrastructure with operational obligations to Lower Basin states.

Figure 3. Lake Powell and Lake Mead Elevations and Operational Tiers
(as of January 2021)



Source: Figure by CRS, based on Bureau of Reclamation data and information in the 2007 Interim Guidelines and the 2019 Drought Contingency Plan for the Lower Basin.

Notes: Depicts January 1 elevations for each year. For more information on delivery curtailments, see **Table 2**.

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 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 in 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.[44] 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.[45] In 1974, the seven basin states also established water quality standards for salinity through the Colorado River Basin Salinity Control Forum.[46]

Endangered Species Efforts and Habitat Improvements

Congress enacted the ESA in 1973.[47] As basin species became listed in accordance with the act,[48] 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 endangered 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.[49] Congress authorized this program in P.L. 106-392. The program is implemented through several stakeholders under a cooperative agreement signed by the governors of Colorado, Utah, and Wyoming; 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. It is also funded

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[44] 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.

[45] 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.

[46] Additional information about the forum and related salinity control efforts is available at Colorado River Basin, Salinity Control Forum, at https://www.coloradoriversalinity.org/.

[47] For more information on the ESA, see CRS Report RL31654, *The Endangered Species Act: A Primer*, by Pervaze A. Sheikh.

[48] Several endangered 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*).

[49] For more information, see Upper Colorado River Endangered Fish Recovery Program at http://www.coloradoriverrecovery.org/.

through a portion of Upper Basin hydropower revenues from WAPA; 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.[50] The program is a partnership implemented under a cooperative agreement between the Department of the Interior 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.[51] 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 Recovery Program is coordinated by FWS. 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 power generation, Reclamation, participating states, and the Bureau of Indian Affairs. Recovery efforts for listed fish are coordinated with the Upper Colorado River Program discussed above.

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."[52] 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.[53] 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.[54] The MSCP began in 2005 and is planned to last for at least 50 years.[55] 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

[50] For more information, see San Juan River Basin Recovery Implementation Program at https://www.fws.gov/southwest/sjrip/.

[51] It also includes participation by water development interests in Colorado and New Mexico.

[52] For more information, see Bureau of Reclamation, Glen Canyon Dam Adaptive Management Program, "Glen Canyon Dam High Flow Experimental Release," at https://www.usbr.gov/uc/rm/gcdHFE/.

[53] 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.

[54] The stakeholders include six federal and state agencies, six 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/.

[55] The program was formally authorized by Congress under Subtitle E of Title IX of P.L. 111-11.

biological opinion (BiOp) issued by the FWS in 1997 served as a basis for the program. Modifications to the 1997 BiOp were made in 2002, and in 2005, the BiOp was renewed for 50 years. Nonfederal entities received an incidental take permit under Section 10(a) of the ESA for their activities in 2005 and shortly thereafter implemented a habitat conservation plan.

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 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 ($882 million in 2018 dollars) and is to be split evenly between Reclamation (50%) and the states of California, Nevada, and Arizona (who collectively fund the remaining 50%).[56] 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.

Tribal Water Rights

Twenty-two federally recognized tribes in the Colorado River Basin have quantified water diversion rights that have been confirmed by court decree or final settlement. These tribes collectively possess rights to 2.9 MAF per year of Colorado River water.[57] As of 2015, these tribes typically were using just over half of their quantified rights.[58] Additionally, 13 other basin tribes have reserved water rights claims that have yet to be resolved, although the total potential amount of these claims has not been estimated.[59] Increased water use by tribes with existing water rights, and/or future settlement of claims and additional consumptive use of basin waters by other tribes, is likely to exacerbate the competition for basin water resources.

The potential for increased use of tribal water rights (which, once ratified, are counted toward state-specific allocations where the tribal reservation is located) has been studied in recent years. In 2014, Reclamation, working with a group of 10 tribes with significant reserved water rights claims on the

[56] As of the end of 2018, more than $295 million had been spent on program implementation. Lower Colorado River Multi-Species Conservation Program, "Funding," https://www.lcrmscp.gov/steer_committee/funding.html. Accessed February 22, 2019.

[57] Reclamation 2012 Supply/Demand Study, Technical Report C, Appendix C9, p. C9-4.

[58] Colorado River Research Group, *Tribes and Water in the Colorado River Basin*, June 2016, at https://www.coloradoriverresearchgroup.org/uploads/4/2/3/6/42362959/crrg_tribal_water_rights.pdf. 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 diversion rights.

[59] Colorado River Research Group, *Tribes and Water in the Colorado River Basin*, June 2016, at https://www.coloradoriverresearchgroup.org/uploads/4/2/3/6/42362959/crrg_tribal_water_rights.pdf.

Colorado River, initiated a study known as the *10 Tribes Study*.[60] The study, published in 2018, estimated that, cumulatively, the 10 tribes in the study could have reserved water rights (including unresolved claims) to divert nearly 2.8 MAF per year.[61] Of these water rights, approximately 2 MAF per year were confirmed by a court decree or final settlement and an additional 785,273 AF (mostly in the Upper Basin) remained unresolved.[62] The report estimated that, overall, the 10 tribes are diverting (i.e., making use of) almost 1.5 MAF of their 2.8 MAF in resolved and unresolved claims. **Table 1** shows these figures at the basin and sub-basin levels.[63] According to the study, the majority of unresolved claims among the 10 tribes are Upper Basin claims associated with the Ute Tribe in Utah (370,370 AF per year), the Navajo Nation in Utah (314,926 AF), and the Navajo Nation in the Upper Basin in Arizona (77,049 AF).

Table 1. Ten Tribes Study: Tribal Water Rights and Diversions

(values in terms of acre-feet per year)

	Current Use Diversions	Reserved/Settled Water Rights	Unresolved Water Rights	Total Estimated Tribal Water Rights
Upper Basin	672,964	1,060,781	762,345	1,823,125
Lower Basin	800,392	952,190	22,928	975,119
Total Basin	**1,473,356**	**2,012,971**	**785,273**	**2,798,244**

Source: U.S. Bureau of Reclamation, Colorado River Ten Tribes Partnership, *Colorado River Basin Ten Tribes Partnership Tribal Water Study,* Study Report, December 2018.

Note: Unresolved water rights include claims for potential water rights that have yet to be resolved.

Drought and the Supply/Demand Imbalance

When the Colorado River Compact was originally approved in 1922, it was assumed based on the historical record that average annual flows on the river were 16.4 MAF per year.[64] According to Reclamation data, from 1906 to 2020, observed historical natural flows on the river at Lee Ferry, AZ—the common point of measurement for observed basin flows—averaged 14.7 MAF annually.[65] Natural flows from 2000 to 2020 (i.e., during the ongoing drought) averaged considerably less than that—12.4 MAF annually.[66] At the same time, consumptive use and losses in the basin have grown since the compact was approved and have regularly exceeded natural flows (in particular during the current drought).[67] Consumptive use in the basin generally increased from 1971 to 2002 but declined after the 2003 approval

[60] The tribes are the Chemehuevi Indian Tribe, Cocopah Indian Tribe, Colorado River Indian Tribes, Fort Mojave Indian Tribe, Jicarilla Apache Nation, Navajo Nation, Quechan Indian Tribe, Southern Ute Indian Tribe, Ute Indian Tribe, and Ute Mountain Ute Tribe.

[61] U.S. Bureau of Reclamation, Colorado River Ten Tribes Partnership, *Colorado River Basin Ten Tribes Partnership Tribal Water Study,* Study Report, December 2018, p. 5.11-1, at https://www.usbr.gov/lc/region/programs/crbstudy/tws/finalreport.html. Hereinafter, Ten Tribes Study, 2018.

[62] Ten Tribes Study, 2018, pp. 5.11-1-5.11-2.

[63] Ten Tribes Study, 2018, p. 5.11-4.

[64] 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.

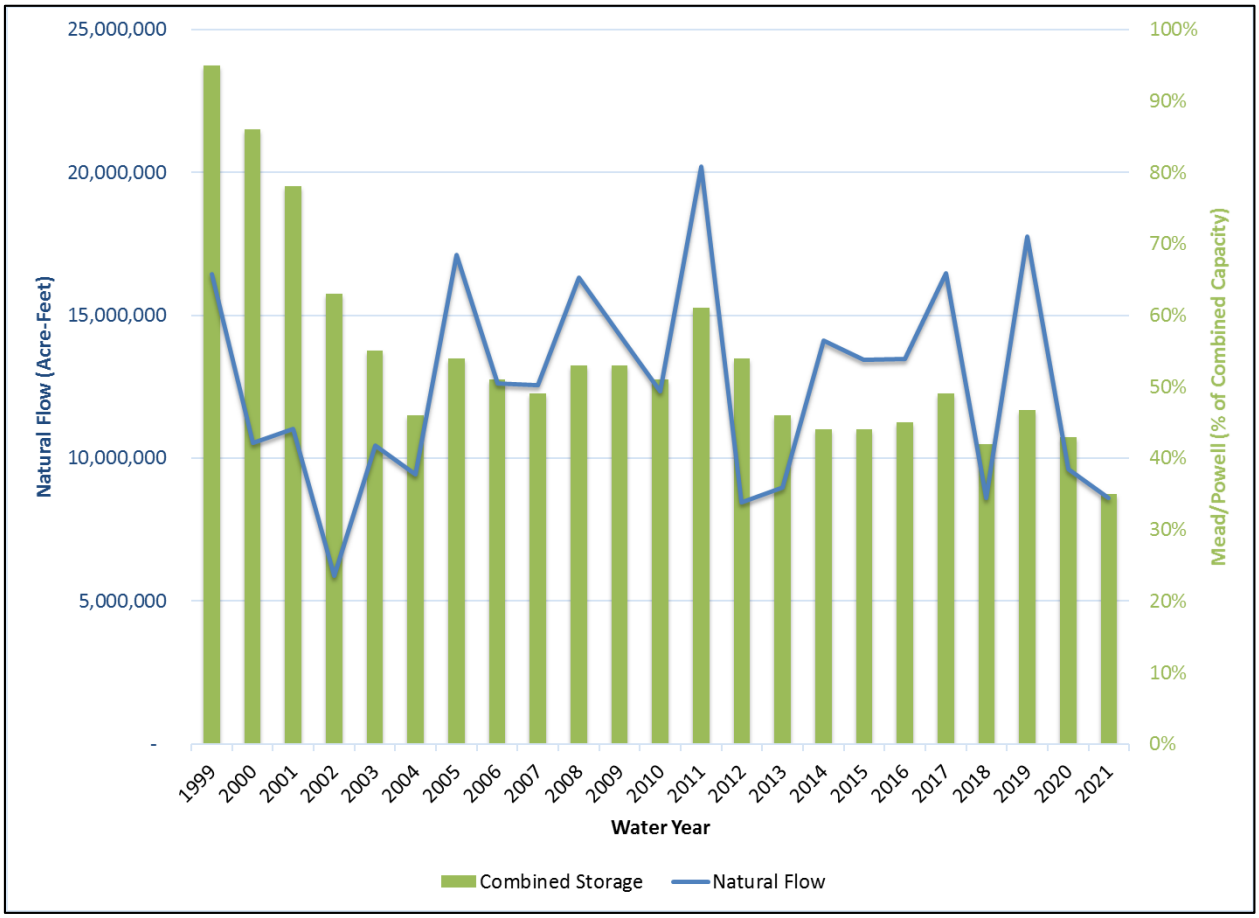
[65] Data available from Bureau of Reclamation, Lower Colorado River Operations, "General Modeling Information," at https://www.usbr.gov/lc/region/g4000/riverops/model-info.html. Hereinafter, Bureau of Reclamation Flow Data.

[66] Bureau of Reclamation Flow Data, 1906-2020.

[67] *Consumptive uses and losses* include reservoir evaporation and other consumptive use losses, which average in excess of 2 MAF per year.

of the Quantitative Settlement Agreement (QSA) led to a decrease of consumptive use in the Lower Basin (see below section, "Recent Developments and Agreements").[68] 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**).

Figure 4. Colorado River Flows, Combined Storage at Lakes Mead and Powell, 1999-2021



Source: Congressional Research Service, based on Bureau of Reclamation flow data for and Annual Operating Plans for Colorado River reservoirs.

Note: Total storage = 52.3 million acre-feet. 2021 flows and storage reflect provisional projections and current conditions as of late June 2021, respectively.

Observers have noted that Colorado River flows are unlikely to return to 20th century averages and that future water supply risk is high.[69] The period from 2000 to 2021 has been the driest 22-year period on record, and the current drought in the basin has resulted in 8 of the 20 driest years on record (1906-2020)

[68] Consumptive use in the Lower Basin (excluding tributaries) was in excess of 8.41 MAF in 2002 but had decreased to 6.79 MAF as of 2020. For more information on consumptive use, see Bureau of Reclamation Consumptive Uses and Losses Reports for 2006-2010, 2011-2015, and 2016-2020. Analysis of 2009-2020 Lower Basin consumptive use data by CRS, based on Bureau of Reclamation Colorado River Water Accounting and Use Reports for 2009-2020. Hereinafter, references to consumptive use data analysis based on these reports are referred to collectively as "CRS Analysis of Colorado River Consumptive Use Data."

[69] 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.

having occurred since 2000.[70] Overall, natural flows have declined by approximately 20% over the last century, and some studies attribute more than half of this decline to increasing temperatures resulting from climate change.[71] Further complicating the water-supply picture is that potential precipitation increases in the region due to climate change are not expected to counteract drying resulting from rising temperatures.[72] As a result, most models project an ongoing reduction in flows.

A 2012 study by Reclamation highlighted projected long-term imbalances in supply and demand in the Colorado River Basin.[73] In the study, Reclamation noted that the basin had thus far avoided serious impacts on water supplies due to the significant storage within the system, coupled with the fact that some Upper Basin states have yet to fully develop the use of their allocations.[74] However, Reclamation projected that in the coming half century, flows would continue to decrease, while drought would increase in frequency and duration.[75] At the same time, Reclamation projected that demand for basin water supplies would increase, with annual consumptive use projected to rise from 15 MAF in 2012 to 18.1-20.4 MAF by 2050, depending on population growth.[76] Most of the increase in demand was expected to come from municipal and industrial users.[77]

Reclamation's 2012 study posited several potential ways to alleviate future shortages in the basin, such as alternative water supplies, demand management, drought action plans, water banking, and water transfers/markets. Some of these options already are being pursued. In particular, some states have become increasingly active in banking unused Colorado River surface water supplies, including through groundwater banks or storage of unused surface waters in Lake Mead.

Recent Developments and Agreements

Drought conditions throughout the basin have raised concerns about potential negative impacts on water supplies. Concerns center on uncertainty that might result if the Secretary of the Interior were to determine that a shortage condition exists in the Lower Basin, and that related curtailments were warranted. Some in Upper Basin States are also concerned about the potential for a *compact call* of Lower Basin states on Upper Basin states.[78] 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.

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[70] CRS Analysis of Bureau of Reclamation Flow Data.

[71] 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, D. P. Lettenmaier, "On the Causes of Declining Colorado River Streamflows," *Water Resources Research* 54 (2018), pp. 6739–6756.

[72] Milley, 2020.

[73] Reclamation 2012 Supply/Demand Study.

[74] This is largely due to a lack of development in Wyoming (which uses approximately 500,000 acre-feet of its 1 MAF in Colorado River supplies) and Utah (which uses approximately 800,000 acre-feet of its 1.7 MAF in supplies).

[75] Reclamation 2012 Supply/Demand Study, p. 7.

[76] Reclamation 2012 Supply/Demand Study, p. 8. Population growth in central Arizona and on the Front Range of Colorado is expected to comprise the majority of basin population increases.

[77] Reclamation 2012 Supply/Demand Study, *Technical Report C*, p. C-22. The majority of this demand increase was assumed to come from Central Arizona and the Front Range in Colorado.

[78] A *compact call* is the commonly used term for the Lower Basin states' hypothetical attempt to force deliveries of Colorado River water under the compact. For more background, see Anne Castle and John Fleck, "The Risk of Curtailment under the Colorado River Compact," November 8, 2019, at https://ssrn.com/abstract=3483654.

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, 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.[79] 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 for restoration and mitigation related to the Salton Sea, a water body in Southern California that was historically sustained by Colorado River irrigation runoff from the Imperial and Coachella Valleys.[80]

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.[81] 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.[82]

2004 Arizona Water Settlements Act

The 2004 Arizona Water Settlements Act (P.L. 108-451, AWSA) significantly altered the allocation of CAP water in Arizona.[83] 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, respectively.[84] 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 $1.65 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 Indian 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.

[79] 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.

[80] For more information on the Salton Sea, see CRS In Focus IF11104, *Salton Sea Management and Restoration Efforts*, by Pervaze A. Sheikh and Charles V. Stern.

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

[82] Reclamation, *Colorado River Water Delivery Agreement*.

[83] P.L. 108-451.

[84] Congress passed the CRBPA 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.

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

Another significant 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 (and a record low point in Lake Powell of 33% active capacity), the Secretary of the Interior instructed Reclamation to develop coordinated strategies for Colorado River reservoir operations during drought or shortages.[85] 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 2**). Under the guidelines, Arizona and Nevada, which have junior rights to California, would face reduced allocations if Lake Mead elevations dropped below 1,075 ft. At the time, it was thought that the 2007 Guidelines would significantly reduce the risk of Lake Mead falling to 1,025 ft.

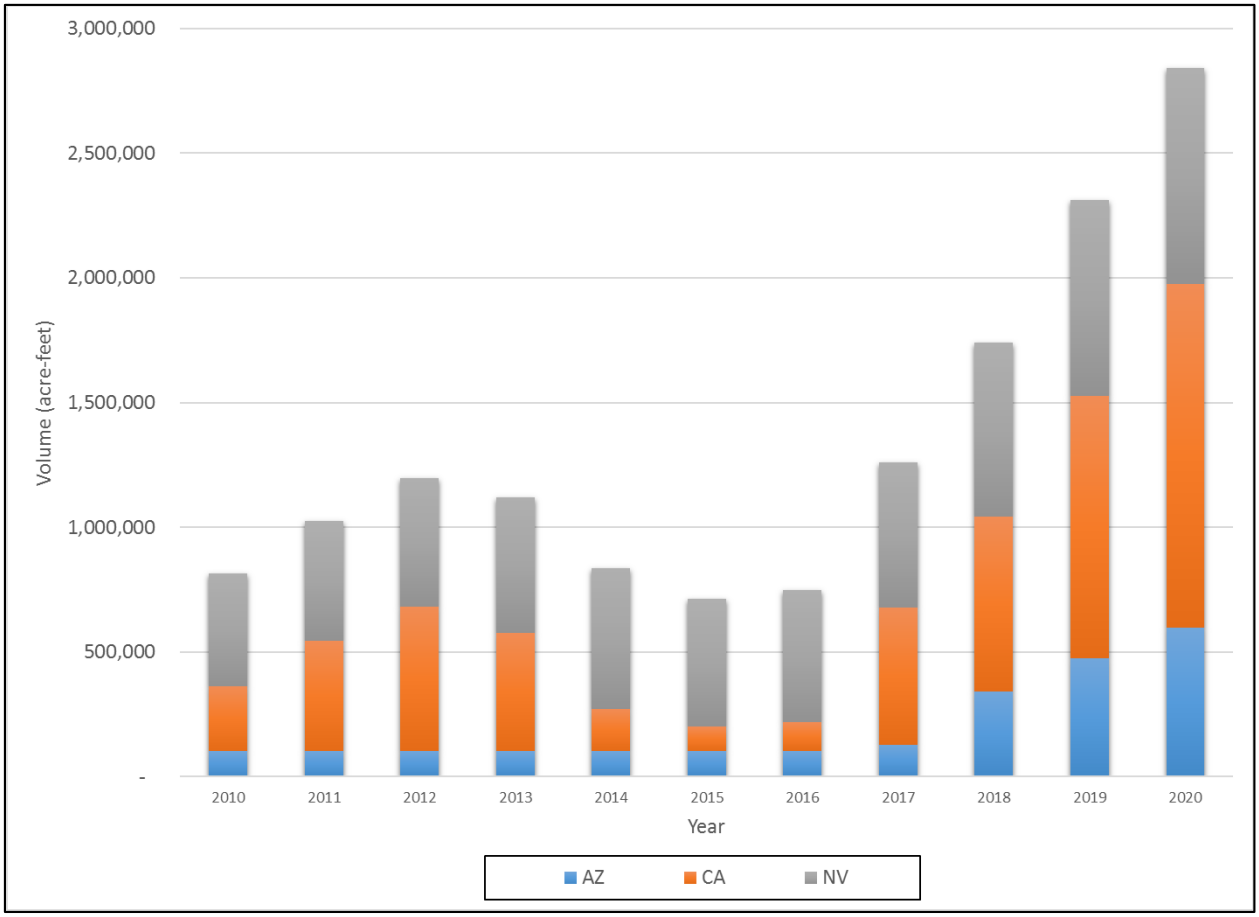
The 2007 agreement also included for the first time a mechanism by which parties in the Lower Basin were able to store conserved water in Lake Mead, known as Intentionally Created Surplus (ICS). Reclamation accounts for this water annually, and the users storing the water may access the surplus in future 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 reached a new high of 2.84 MAF (**Figure 5**).[86]

The 2007 guidelines are considered "interim" because they are scheduled to expire in 20 years (i.e., at the end of 2026). Thus, beginning in 2020, Reclamation coordinated a review on the effectiveness of the 2007 guidelines. Forthcoming reconsultation on the 2007 guidelines also will encompass negotiations related to renewal of the Upper and Lower Basin Drought Contingency Plans, which are an overlay on the 2007 guidelines (see below section, "2019 Drought Contingency Plans").

[85] 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.)

[86] Bureau of Reclamation, *Colorado River Accounting and Water Use Report, Calendar Year 2020*, at https://www.usbr.gov/lc/region/g4000/wtracct.html.

Figure 5. U.S. Lower Basin States: Intentionally Created Surplus Balance, 2010-2020



Source: Figure by CRS, based on data from Bureau of Reclamation, *Colorado River Accounting and Water Use Report, Calendar Years 2010-2020*, at https://www.usbr.gov/lc/region/g4000/wtracct.html.

Pilot 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. These activities had the goal of developing new *system water*,[87] to be applied toward storage in Lake Mead, by the end of 2019.[88] Congress formally authorized federal participation in these efforts in the Energy and Water Development and Related Agencies Appropriations Act, 2015 (P.L. 113-235, Division D), with an initial sunset date for the authority

[87] *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.

[88] 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.

at the end of FY2018.[89] 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.[90] As of September 2019, Reclamation estimated that the Lower Basin program had resulted in a total of 175,347 AF of system water conserved, at an average cost of $170.14 per AF.[91] Additional projects also were carried out in the Upper Basin by the Upper Colorado River Basin Commission, but these efforts ended in 2018.[92]

Minute 319 and Minute 323 Agreements with Mexico[93]

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.[94] 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 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 drought contingency plans (DCPs) are approved by U.S. basin states (see following section, "2019 Drought Contingency Plans").

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 required final authorization by Congress to be implemented. On April 16, 2019, Congress authorized the DCP agreements in the Colorado River Drought Contingency Plan Authorization Act (P.L. 116-14). The DCPs are an overlay of the 2007 Interim Guidelines discussed above, thus similar to the 2007 guidelines; they are scheduled to be in place through 2026. 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.[95] Under the Upper Basin DCP, the Upper Basin states agree to operate system units to keep the surface of Lake Powell above 3,525 ft, which is 35 ft above the

[89] P.L. 113-235, §206.

[90] P.L. 115-244, §205.

[91] Lower Colorado Region, "Pilot System Conservation Program," at https://www.usbr.gov/lc/region/programs/PilotSysConsProg/pilotsystem.html. Accessed September 24, 2020.

[92] For more information, see http://www.ucrcommission.com/system-conservation-pilot-program/.

[93] 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.

[94] The text of these minutes is available from the International Boundary and Water Commission at https://www.ibwc.gov/Treaties_Minutes/Minutes.html.

[95] While such a mechanism exists for the Lower Basin, a comparable program has yet to be developed in the Upper Basin.

minimum elevation needed to run the dam's hydroelectric plant. Other large Upper Basin reservoirs (e.g., Navajo Reservoir, Blue Mesa Reservoir, and Flaming Gorge Reservoir) would be operated to protect the targeted Lake Powell elevation, potentially through drawdown of their own storage. If established by the states, an Upper Basin DCP Demand Management Program would likely entail willing seller/buyer agreements allowing for temporary paid reductions in water use that would provide for more storage volume in Lake Powell.

Reclamation and other observers have stated their belief that these efforts will decrease the risk of Lake Powell's elevation falling below 3,490 ft, an elevation at which a significant reduction in hydropower generation would occur.[96]

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 ft 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 ft and would reach their maximums when reservoir levels drop below 1,045 ft. 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 of 1,040-1,045 ft and would increase by 50,000 AF for each additional 5 foot drop in Lake Mead elevation, to as much as 350,000 AF at elevations of 1,025 ft or lower.

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 2**. 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 face major cutbacks to their CAP water supplies. The Tier Zero Arizona curtailment of 192,000 AF at Tier Zero represents a 12% reduction in CAP water supplies.

Reclamation has noted that the Lower Basin DCP significantly decreases the chance of Lake Mead elevations falling below 1,020 ft, which would be a critically low level.[97] Some parties have pointed out that although the DCP is unlikely to prevent a shortage from being declared at 1,075 ft, it would slow the rate at which the lake recedes thereafter.[98] Combined with the commitments from Mexico, total planned cutbacks under shortage scenarios (i.e., all commitments to date, combined) would reduce Lower Basin consumptive use by 241,000 AF to 1.375 MAF per year, depending on the curtailments triggered by Lake Mead's elevation.[99]

[96] Bureau of Reclamation, "Presentation to Congressional Staff on Draft Drought Contingency Plans," October 16, 2018. Hereinafter, 2018 Reclamation DCP Presentation.

[97] 2018 Reclamation DCP Presentation. Currently, there are no agreed-upon curtailment levels governing operations below 1,020 ft, thus that level represents an unknown and likely more severe level of curtailment that would affect more users than those affected under the 2007 guidelines.

[98] Tom Buschatzke, Arizona Department of Water Resources Director, and Ted Cooke, Central Arizona Project General Manager, "The DCP Makes CO River Delivery Shortfalls Less Painful, but It Doesn't Make Them Go Away," Arizona Department of Water Resources, September 5, 2018, at https://new.azwater.gov/news/articles/2018-05-09.

[99] For a summary of the curtailments that add up to this amount, see "1,090->1,075" row of **Table 2**.

Table 2. 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 Colorado River Apportionment)				
	AZ	NV	Mexico	AZ	NV	CA	Mexico	AZ	NV	CA	Lower Basin	Mexico
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, the *Lower Basin Drought Contingency Plan*, and the Binational Water Scarcity Contingency Plan in Minute 323 between Mexico and the United States.

Opposition

Although the DCPs and the related negotiations were widely praised, some expressed concerns related to the implementation of the DCPs as they relate to federal and state environmental laws. Most Colorado River contractors supported the agreements, but one major basin contractor, Imperial Irrigation District (IID, a major holder of Colorado River water rights in Southern California), did not approve the DCPs. IID has argued that the DCPs will further degrade the Salton Sea, a shrinking and ecologically degraded water body in southern California that relies on drainage flows from lands irrigated using Colorado River water. IID made support for the agreements contingent on corresponding federal support for Salton Sea restoration efforts.[100] While other basin interests have generally agreed with the need to mitigate and restore parts of the Salton Sea, some have disagreed with IID's linking of the Salton Sea to the DCPs.[101] Following enactment of the DCPs, IID filed suit in state court alleging that state approval of the DCPs violated the California Environmental Quality Act.[102]

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 endangered species (e.g., Glen Canyon Dam Adaptive Management Program and the Upper Colorado River 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, for the most recent year available (FY2018), the Lower Colorado Region's operating budget was $559.5 million; $134.8 million of this total was provided by discretionary appropriations, and the remainder of funding came from power revenues (which are made available without further appropriation) and nonfederal partners.[103] In recent years, Congress has also authorized and appropriated funding that has

[100] IID, the largest water rights holder on the Colorado River, did not approve the Lower Basin DCP. While there were no formal requirements for IID delivery curtailments under the Lower Basin DCP (other contractors have committed to implementing California's curtailments), IID objected to the lack of commitments for Salton Sea restoration under the plans. For more information, see CRS In Focus IF11104, *Salton Sea Management and Restoration Efforts*, by Pervaze A. Sheikh and Charles V. Stern.

[101] See, for example, Tom Buschatzke, et al., "Colorado River Drought Contingency Plan Is Necessary Now," *The Desert Sun*, March 28, 2019, at https://www.desertsun.com/story/opinion/contributors/valley-voice/2019/03/26/colorado-river-drought-contingency-plan-necessary-dcp/3272667002/.

[102] IID, "Salton Sea Is Focus of IID's Legal Challenge to Drought Contingency Plan," press release, April 17, 2019, https://www.iid.com/Home/Components/News/News/685/30?backlist=%2f.

[103] Bureau of Reclamation, *Lower Colorado Region Annual Report, FY2018*, at https://www.usbr.gov/lc/docs/LCRegionReportFY18.pdf.

targeted the Colorado River Basin in general (e.g., the Pilot System Conservation Plan). Congress may choose to extend or amend these and other authorities specific to the basin.

While discretionary appropriations for the Colorado River are of regular interest to Congress, Congress may also be asked to weigh in on Colorado River funding that is not subject to regular appropriations. For instance, in the coming years, the Lower Colorado River Basin Development Fund is projected to face a decrease in revenues[104] and may thus have less funding available for congressionally established funding priorities for the Development Fund.

Indian Water Rights Settlements

Congress has previously approved Indian water rights settlements associated with more than 2 MAF of tribal diversion rights on the Colorado River. Only a portion of this water has been developed. Congress likely will face ongoing decisions regarding whether to fund development of previously authorized infrastructure associated with Indian water rights settlements in the Colorado River Basin. For example, the Navajo-Gallup Water Supply Project is being built to serve the Jicarilla Apache Nation, the Navajo Nation, and the City of Gallup, New Mexico.[105] Congress may also be asked to consider new settlements that may result in tribal rights to more Colorado River water.

Plans for New and Augmented Water Storage, Conveyance

Some states in the Upper Basin have indicated their intent to further develop their Colorado River water entitlements. For example, in the 115th Congress, Section 4310 of America's Water Infrastructure Act (P.L. 115-270) authorized the Secretary of the Interior to enter into an agreement with the State of Wyoming whereby the state would fund a project to add erosion control to Fontenelle Reservoir in the Upper Basin. The project would allow the state to potentially utilize an additional 80,000 acre-feet of water storage on the Green River, a tributary of the Colorado River.

Another project that would develop Upper Basin waters is the proposed Lake Powell Pipeline (LPP), which would direct approximately 86,000 acre-feet of Utah's Upper Basin Colorado River Basin 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).[106] 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 has been designated 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.[107] Supporters in Utah argue that the pipeline is needed to provide a second primary water source for the St. George area, in addition to the Virgin River. Some 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 issues with over-

[104] The projected decrease in revenues is due to, among other factors, the decommissioning of the Navajo Generating Station (whose receipts are one source of incoming revenue accruing to the fund).

[105] This project was authorized in the Omnibus Public Land Management Act of 2009 (P.L. 111-11), Title X, Part III.

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

[107] For project NEPA studies, see https://www.usbr.gov/uc/DocLibrary/EnvironmentalImpactStatements/LakePowellPipeline/index.html#intro.

allocation. These groups have argued for major changes to the scope of the EIS.[108] The six other Colorado River Basin states have raised concerns related to the proposed LPP's "legal and operational issues," and they have raised concerns with the LPP NEPA process as the de facto forum for resolving a conflict among basin states. The six states have requested that Reclamation refrain from issuing a final EIS until these issues can be resolved on a consensus basis.[109]

Drought Contingency Plan Implementation and Future Basin Agreements

Congress is likely to remain interested in the status of drought in the basin in general,[110] as well as in the implementation of the DCPs and other related agreements and their success or failure at stemming further delivery curtailments and adding water to the basin's storage reservoirs. Similarly, Congress may be interested in the overall hydrologic status of the Colorado River Basin, including new and existing efforts to plan for increased demand in the basin and stretch limited basin water supplies.

Federally led efforts to extend the 2007 Interim Guidelines (including the DCPs), which expire at the end of 2026, look to be the next major hurdle in the consensus-based management of the Colorado River. These reconsultation efforts, including any major alterations to the existing agreements, are key to managing the basin's future water resources. Insofar as these agreements involve new federal authorities, Congress may be asked to play a part in their approval.

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

[109] 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.

[110] For instance, a May 2021 hearing 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.

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