

Chapter 1 | Introduction

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In 2012, the Bureau of Reclamation (Reclamation), in partnership with the seven Colorado River Basin States¹ (Basin States) and in collaboration with a wide spectrum of Colorado River Basin (Basin) stakeholders, published the most comprehensive study of future Basin supply and demand ever undertaken. The Colorado River Basin Water Supply and Demand Study (Basin Study) defined current and future imbalances in water supply and demand in the Basin over the next 50 years and developed and analyzed options and strategies to resolve those imbalances. The Basin Study confirmed that, in the absence of timely action, there are likely to be significant shortfalls between projected water supplies and demands in the Basin in coming decades that are likely to affect each sector (for example, agricultural, municipal, energy, and environmental) dependent on the Colorado River and its tributaries. The Basin Study also confirmed that a wide range of solutions are needed to mitigate and adapt to such shortfalls (Reclamation, 2012a).

In response to the findings of the Basin Study, in May 2013, Reclamation and the Basin States, in collaboration with the Ten Tribes Partnership² and conservation organizations, initiated the *Moving Forward* effort to build on future consideration and next steps identified in the Basin Study³. Other areas identified in the Basin Study, beyond the three considered in the *Moving Forward* effort, are being advanced through separate activities led by Reclamation, the Basin States, and others (for example, the Ten Tribes Partnership).

The *Moving Forward* effort continues to facilitate and build upon the broad, inclusive stakeholder process demonstrated in the Basin Study. As such, this effort is

organized using three multi-stakeholder workgroups and a multi-stakeholder Coordination Team to guide and review the efforts of the workgroups. The three workgroups are as follows:

- Municipal and Industrial (M&I) Water Conservation and Reuse Workgroup
- Agricultural Water Conservation, Productivity, and Transfers Workgroup
- Environmental and Recreational Flows Workgroup

This report focuses on the outcomes of the three workgroups during Phase 1 of the *Moving Forward* effort, conducted between June 2013 and November 2014, and consists of the following chapters:

- Chapter 1 – Introduction
- Chapter 2 – The *Moving Forward* Effort
- Chapter 3 – Municipal and Industrial Water Conservation and Reuse
- Chapter 4 – Agricultural Water Conservation, Productivity and Transfers
- Chapter 5 – Environmental and Recreational Flows
- Chapter 6 – Summary and Next Steps

Commenting on the information provided in this Phase 1 Report is encouraged. Written comments should be submitted within 90 days following the release of this report. Comments will be summarized and posted to the *Moving Forward* website and will be considered in future *Moving Forward* phases.

Comments may be submitted in the following ways:

- Via the *Moving Forward* website at <http://www.usbr.gov/lc/region/programs/crbstudy/MovingForward/index.html>
- Email to ColoradoRiverBasinStudy@usbr.gov
- United States (U.S.) mail to Bureau of Reclamation, Attention: Ms. Pam Adams, LC-4017, P.O. Box 61470, Boulder City, NV 89006-1470
- Facsimile transmission to (702) 293-8340

¹ Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming

² 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 of the Uintah and Ouray Reservation, Ute Mountain Ute Indian Tribe

³ The Basin Study recommended future work in the following areas: water use efficiency and reuse, water banks, water transfers, water supply augmentation, watershed management, tribal water, environmental flows, data and tool development, climate science research, and partnerships.

1.1 Overview of the Colorado River Basin

Today, between 35 and 40 million people⁴ in the seven Basin States rely on Colorado River and its tributaries for some, if not all, of their municipal water needs. These same water sources irrigate nearly 4.5 million acres of land⁵ in the Basin and the adjacent areas that receive Colorado River water, generating many billions of dollars a year in agricultural and economic benefits. There are 22 federally recognized tribes in the Basin for whom the Colorado River and its tributaries are essential as a physical, economic, and cultural resource. In addition, the Colorado River is vital to the United Mexican States (Mexico). The river supports a thriving agricultural industry in the Mexicali Valley and provides municipal water supplies for communities in Mexico as far away as Tijuana. The Colorado River Basin is depicted in Figure 1.

The Colorado River and its tributaries provide habitat for a wide range of species, including several federally endangered species, and flows through seven national wildlife refuges and 11 National Park Service (NPS) units⁶. Throughout the Basin, the Colorado River and its tributaries provide a range of recreational opportunities such as boating, fishing, and hiking, all of which significantly benefit regional economies. Hydropower facilities in the Basin can supply more than 4,200 megawatts of vitally important electrical capacity to assist in meeting the power needs of western states, reducing the use of fossil fuels.

Total consumptive use⁷ and losses in the Basin has averaged approximately 15.0 million acre-feet⁸ (MAF) over the past decade. Agriculture is the dominant use of Colorado River water, with approximately 70 percent of total Colorado River water used to support agriculture. Of the total consumptive use, 40 percent is exported outside the Basin's hydrologic boundaries for use in adjacent areas. Colorado River water used in these areas is not returned to the Colorado River. As shown on Figure 1, several major metropolitan areas that receive Colorado River water, including Albuquerque, Denver, Los Angeles, Salt Lake City, and San Diego, are located outside the Basin's hydrologic boundaries.

The Colorado River system is operated in accordance with the Law of the River⁹. Apportioned water in the Basin exceeds the average long-term (1906-2012) historical natural flow¹⁰ of approximately 16.2 MAF. Up to this point, the imbalance has been managed, and demands largely met as a result of the considerable amount of reservoir storage capacity in the system (approximately 60 MAF or nearly four years of average natural flow of the river), the fact that the Upper Basin States of Colorado, New Mexico, Utah, and Wyoming are still developing into their apportionments, and the continuing efforts that Basin States are making to reduce their demand for Colorado River water.

⁴ The Basin Study estimated about 40 million people by 2015 in the portion of the Basin and the adjacent areas that receive Colorado River water in the U.S. See Basin Study, *Technical Report C* for additional detail (Reclamation 2012b). Estimate of 35 million people is based on the 2010 U.S. Census Bureau population data from cities within planning areas (as defined in the Basin Study) that receive Colorado River water.

⁵ The Basin Study estimated about 5.5 million irrigated acres by 2015 in the portion of the Basin and adjacent areas that receive Colorado River water in the U.S. See Basin Study, *Technical Report C* for additional detail (Reclamation, 2012b). This number was updated to 4.5 million irrigated acres by the Agricultural Workgroup to better reflect acreage in adjacent areas potentially receiving Colorado River water.

⁶ While there are more NPS units within the Basin, 11 are included in the NPS' Colorado River Program.

⁷ Consumptive use is defined as water used, diminishing the available supply.

⁸ Basin-wide consumptive use and losses estimated over the period 2003 to 2012, including the 1944 Treaty delivery to Mexico, reservoir evaporation, and other losses due to native vegetation and operational inefficiencies.

⁹ The treaties, compacts, decrees, statutes, regulations, contracts, and other legal documents and agreements applicable to the allocation, appropriation, development, exportation, and management of the waters of the Colorado River Basin are often collectively referred to as the Law of the River. There is no single, universally agreed upon definition of Law of the River, but it is useful as a shorthand reference to describe this longstanding and complex body of legal agreements governing the Colorado River.

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

FIGURE 1-1
Colorado River Basin



Note:
Similar to the Basin Study, the scope of the *Moving Forward* effort is limited to the portion of the Basin and adjacent areas that receive Colorado River water within the U.S.

1.2 Future Conditions and the Need for Future Action

The challenges and complexities of ensuring a sustainable water supply and meeting future resource¹¹ needs in an over-allocated and highly variable system such as the Colorado River have long been recognized and documented by Reclamation, the Basin States, and many stakeholders. Consequently, significant investments have been made in constructing infrastructure, developing other water resources, and implementing innovative conservation programs and policies to sustain current and future supplies. Many of these efforts have resulted in solutions to past water management challenges and will continue to provide benefits in meeting the challenges that lie ahead.

Future challenges arise from the likelihood of continued population growth coupled with significant uncertainty regarding an adequate future water supply. Nevada, Arizona, and Utah rank first, second and third, respectively, for the highest population growth rates in the U.S. from 2000 to 2010. During that same decade, California experienced the second highest numeric population increase in the U.S. (U.S. Census Bureau, 2011). The communities and economies of major cities such as Albuquerque, Denver, Las Vegas, Los Angeles, Phoenix, Salt Lake City, and San Diego are in part dependent, or in the case of Las Vegas, almost entirely dependent on the Colorado River for water supply. As water demand for municipal and agricultural purposes increases to serve the needs of growing populations, ensuring the availability of water for non-consumptive uses such as the environment, recreation, and hydropower becomes increasingly challenging. Both consumptive and non-consumptive uses face increasing levels of risk. Water supply uncertainty is further compounded by the potential impacts from climate change. Evidence indicates increased future climate variability in the Southwest, which may include longer, more extreme dry (and wet) periods than previously observed (Garfin et al., 2014).

It is impossible to know the precise trajectory of future water supply and demand or how those trajectories may impact the reliability of the Colorado River to meet the

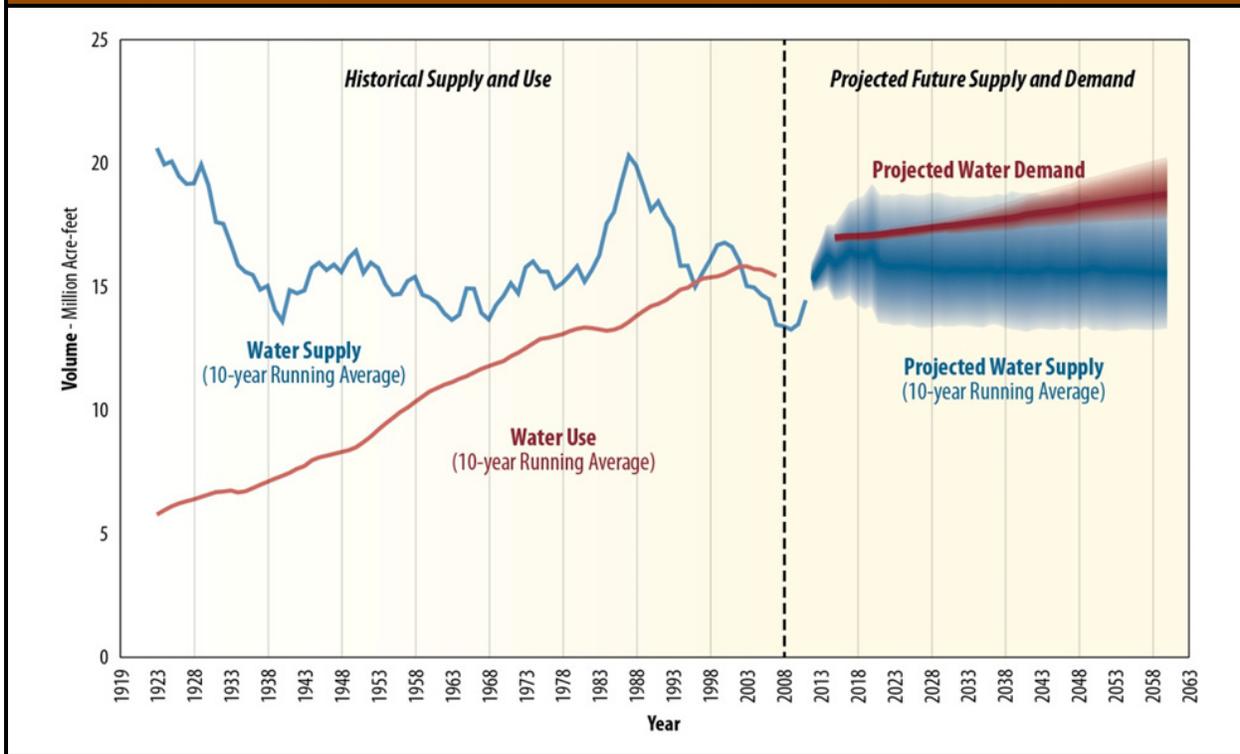
needs of Basin resources. To address this uncertainty, the Basin Study adopted a scenario planning process to capture a broad range of plausible water demand and supply futures and then assessed the impacts to Basin resources if such futures were to unfold. This approach confirmed that, absent future action, the Basin faces a wide range of plausible future long-term imbalances between supply and demand. This imbalance, computed as a 10-year running average, ranges from no imbalance to 6.8 MAF with a median of 3.2 MAF in 2060¹², as shown in Figure 1-2. The assessment of impacts to Basin resources found that any long-term imbalance will impair the ability of the Colorado River system to meet the needs of Basin resources resulting in negative impacts (for example, reduced reliability of water deliveries for municipal and agricultural purposes, decreased hydropower generation, reduced recreational opportunities).

In addition to the long-term challenges identified in the Basin Study, current extended drought conditions in the Basin and in neighboring river basins have further heightened a sense of urgency for ensuring Colorado River sustainability. The period from 2000 to 2014 was the lowest 15-year period for natural flow in the last century. Paleo records indicate that this period was also one of the lowest 15-year periods for natural flow in the past 1,200 years (Meko et al., 2007). Fortunately, the Colorado River system reservoirs were nearly full at the start of this drought. As a result, all requested deliveries were made in the Lower Basin during this period.

Existing drought conditions in areas adjacent to the Basin that depend on the Colorado River for part of their water supply can result in greater strains on the Colorado River. California is facing one of its most severe droughts on record. In January 2014, Governor Brown declared a drought State of Emergency and directed state officials to take all necessary actions to prepare for water shortages. Recent flows of the Rio Grande have been some of the lowest in more than 130 years of record-keeping, prompting drought declarations for municipalities, much reduced agricultural allocations, shrinking reservoir storages, and stressing water available to protect endangered species.

¹¹ Resources include water allocations and deliveries for municipal, industrial, and agricultural use; hydroelectric power generation; recreation; fish, wildlife, and their habitats (including candidate, threatened, and endangered species); water quality including salinity; flow- and water-dependent ecological systems; and flood control.

¹² Comparing the 90th percentile supply to the 10th percentile demand results in no imbalance. Comparing the 10th percentile supply to the 90th percentile demand results in a 6.8 MAF imbalance. Comparing the 50th percentile of both supply and demand results in a 3.2 MAF imbalance.

FIGURE 1-2Historical Supply and Use¹ and Projected Future Colorado River Basin Water Supply and Demand¹ (Reclamation, 2012a)

¹Water use and demand include Mexico's allotment and losses such as those due to reservoir evaporation, native vegetation, and operational inefficiencies.

Had the Colorado River system reservoirs not been nearly full in 2000, the Basin could be experiencing similar drastic conditions. Nevertheless, every resource in the Basin is feeling the impact of this current drought, proving that no one sector solely bears the burden of these challenging conditions. Looking ahead, no one sector can provide the solution for ensuring long-term sustainability. To respond to these future challenges, diligent planning will be required to find adaptable solutions that build resiliency and apply a wide variety of ideas at local, state, regional, and Basin-wide levels. With this in mind, the Basin Study recommended several future actions to move closer

toward implementing such solutions. These actions include, as a first step, resolving uncertainties related to water use efficiency, reuse, and environmental and recreational flows by shifting the focus from the Basin-wide approach taken in the Basin Study, to one that explores such areas in more detail. This Report provides information on the variety of water saving and management approaches currently being applied in various locations and regions throughout the Basin. This information is an important building block for exploring future innovative and cost-effective options that provide a wide-range of benefits to water users and enhance the health of the Basin's watersheds.

1.3 References

- Bureau of Reclamation (Reclamation), 2012a. *Colorado River Basin Water Supply and Demand Study, Study Report*. December.
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