Colorado River Water Supplies: *Back to the Future*

***Eric Kuhn** – Colorado River Water Conservatiaon District*

Glen Canyon Dam and Lake Powell, December 2004. Photo by Howard Grahn.

When I first started working for the Colorado River Water Conservation District in 1981, Lake Powell had just finished its initial fill and there was ample water in the system. For the next 20 years, Colorado River Compact issues were for the most part on the back burner. My district's focus, and indeed the focus of the entire basin, was on the further development of Colorado River waters.

Today, after several years of below-average runoff, storage in Lake Powell has dropped to levels not seen since the late 1960s. The latest 24-month operations study by the Bureau of Reclamation (Reclamation) shows Lake Powell is expected to reach a low of around 8 million acre-feet (maf) of storage in April 2005, about 32 percent of active storage. Water managers and water policy boards throughout the Colorado River Basin are now asking legitimate questions concerning the supply and reliability of their Colorado River sources. In December 2004, U.S. Department of the Interior Secretary Gale Norton challenged the seven Colorado River Basin states to develop a plan to address shortage and drought conditions on the river.

15 maf or 13.5 maf?

Several studies from previous decades suggest we should not be surprised with current conditions on the river. In 1965, the Colorado engineering firm of Tipton and Kalmbach (Tipton) prepared a report for the Upper Colorado River Commission. The report examined the water supply available to Upper Basin (Colorado, New Mexico, Utah, and Wyoming) and Lower Basin (Arizona, California, and Nevada) states under a variety of assumptions. Tipton utilized a 1914 to 1964 period of record, but considered the 1930 to 1964 period to be the "firm yield" period. This 35-year period had a mean undepleted flow at Lee Ferry in the range of 13.5 maf per year.

A second significant study, published by Stockton and Jacoby in 1976, presented groundbreaking work estimating the long-term flow of the Colorado River system based on analysis of the tree ring record. They concluded that the long-term mean undepleted flow of the Colorado River at Lee Ferry is 13.5 ±5 maf/year, similar to Tipton's results.

In contrast to these estimates, Reclamation's current river modeling tools utilize the 1906 to 1995 period, with a mean undepleted flow at Lee Ferry of about 15 maf/year. A difference in the mean of 1.5 maf/year may seem small, but at today's level of development on the Colorado River, its implications for water use throughout the Colorado River Basin are enormous.

Is the Upper Basin Already at Capacity?

Tipton concluded that if 13.5 maf/year is a more realistic flow, then the Upper Basin may already be approaching full usage of its portion of the river. If the Upper Basin's annual delivery obligation at Lee Ferry was 8.25 maf/year (the current but disputed minimum objective release level based on the Law of the River), after deducting Colorado River Storage Project (CRSP) reservoir evaporation, the Upper Basin states could develop and use only about 4.8 maf/year. Based on the latest Colorado River Consumptive Uses and Losses Report published by the Secretary of the Interior and information from the states, the Upper Basin states are currently using about 4.3 maf/year (not counting CRSP evaporation). The unused capacity of existing projects and projects currently under construction could probably develop another 300,000 to 500,000 acre-feet per year; thus, the Upper Basin may already have the infrastructure in place to fully use 4.8 maf/year.

If we assume that the Upper Basin will continue to deliver 8.25 maf/year at Lee Ferry, one does not need a model to demonstrate the problems facing the basin:

Available supply at Lee Ferry	13.5 maf/year
Delivery to Lower Basin	-8.25 maf/year
CRSP reservoir evaporation	-500,000 to 700,000 af/year
Available for use in Upper Basin	**4.55 to 4.75 maf/year**

This amount is very close to the current level of development and is consistent with the Tipton report.

Lower Basin Impact

Consideration of conditions in the Lower Basin further illustrates the core problem of insufficient water in the system. If unlimited storage were available for the Upper Basin to store all excess water, and with a small amount of new development to utilize it, the Upper Basin would consistently deliver to the Lower Basin only the minimum required amount.

Without any excess deliveries, what would happen in the Lower Basin? System gains between Lake Powell and Lake Mead are estimated to be in the range of 600,000 to 750,000 af/year (Tipton), providing an inflow to Lake Mead of 8.85 to 8.95 maf/year, or approximately 9.0 maf/year. In an average year, the demands on Lake Mead are:

California, Nevada, and Arizona	7.5 maf/year
Mexico	1.5 maf/year
Evaporation and system losses	1.0 to 1.5 maf/year
Total demands	**10.0 to 10.5 maf/year**

Under this scenario, which also represents an average flow year under current storage capacity, demands on Lake Mead exceed the supply by 1.0 to 1.5 maf/year. If the Lower Basin no longer received any excess flows from the Upper Basin, the Lower Basin would ultimately always be short by this amount, and under the Law of the River, the Central Arizona Project, Nevada, and perhaps Mexico would bear the brunt of the shortage.

Although storage in the Upper Basin is large, it is not unlimited. Even with a mean flow of 13.5 maf/year, wet cycles would still increase the volume of Lake Powell, triggering equalization releases to Lake Mead, and dry cycles would trigger shortages of greater than 1.0 maf/year. However, excess releases will be far less frequent than under the 15 maf/year mean flow under which we currently operate the system.

Short- or Long-Term Planning?

As the basin states face the challenge from Secretary Norton to address river shortage conditions, officials face a fundamental choice: adopt a strategy to take us through the current drought using Reclamation's assumed 15 maf/year mean at Lee Ferry, or assume a lower mean flow as supported by Tipton and the tree ring record and plan for the long-term future. If we assume the 15 maf/year mean at today's level of depletions in the Upper Basin, Lake Mead and Lake Powell will ultimately recover. But how bad will the situation get before recovery occurs and when can we expect it to happen? If we assume a 13.5 maf/year mean, the Upper Basin states will have to recognize they are at or near full development. And Lower Basin states will have to prepare to permanently reduce consumptive uses by at least a million acre-feet per year.

Eric Kuhn, the general manager of the Colorado River Water Conservation District, can be reached at ekuhn@crwcd.org. The District is a political subdivision of the State of Colorado, covering the entire Colorado River Basin within Colorado outside the San Juan and Upper Dolores River Basin.

References

Stockton, C.W., and G.C. Jacoby, 1976. Long-term surface-waters supply and stream flow trends in the Upper Colorado River Basin, Lake Powell Research Project Bulletin No. 18, Inst. of Geophysics and Planetary Physics, University of California at Los Angeles.

Tipton and Kalmbach, Inc., 1965. Water Supplies of the Colorado River, July 1965. Prepared for the Upper Colorado River Commission.

United States Department of Interior, Colorado River System Consumptive Uses and Losses Report. The 1996-2000 final report has not yet been issued but table UC-1 through UC-8 is available on the USBR Upper Colorado River Region, website at www.usbr.gov/uc/library/envdocs/reports/crs/crsul.html.