

## Introduction

The Bureau of Reclamation (Reclamation), acting on behalf of the Secretary of the Department of the Interior (Secretary), published a Notice of Availability (NOA) of a Draft Environmental Impact Statement (EIS) for Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead, and a schedule of public hearings, in the *Federal Register* on February 28, 2007 (72 Fed. Reg. 9026). The NOA commenced a public review period that ended on April 30, 2007.

Over 500 copies of the Draft EIS were distributed to interested federal, Tribal, state, and local entities and members of the general public for review; and the document was also available for public viewing at several local libraries and on Reclamation's Upper Colorado Region and Lower Colorado Region websites.

Three public hearings were held to receive oral comments on the Draft EIS during the month of April 2007. These three public hearings took place on April 3, 4, and 5, 2007 in Henderson, Nevada; Phoenix, Arizona; and Salt Lake City, Utah, respectively.

Two individuals provided oral comments during the public hearings. In addition to these oral comments, Reclamation received 78 letters with comments on the Draft EIS. The comment letters were submitted by a wide-range of interested parties that included businesses; federal, state and local agencies; Indian tribes; special interest groups; and individuals. Reclamation has reviewed all of the comments received during the Draft EIS public comment period.

As a result of Reclamation's review of comments received on the Draft EIS, and pursuant to the requirements of NEPA, Reclamation has prepared this Final EIS. Volume IV contains in Part I, reproductions of the letters and oral comments received, and Reclamation's responses to these comments; and in Part II copies of transcripts of the three public hearings.

Reclamation received a significant number of comments regarding climate change and hydrologic variability during the Draft EIS review period. In particular, questions were asked regarding the uncertainty of future inflow conditions and how this uncertainty was considered in the modeling of the alternatives. Reclamation believes that, it is appropriate to provide the following general response to the climate change and hydrologic variability questions.

### **General Response Pertaining to Climate Change and Hydrologic Variability**

The potential impacts of climate change and hydrologic variability on the Colorado River have been subjects for discussion for many years. The continuing drought in the Colorado River Basin which began in 2000, coupled with recent advances in scientific knowledge regarding the potential impacts of climate change, has heightened this interest. The Fourth Assessment Report (Summary for Policymakers) of the Intergovernmental Panel on Climate Change (IPCC), published in April 2007, presented a selection of key findings regarding projected changes in precipitation and other climate variables as a result of a range of climate change scenarios projected by IPCC over the next century. Although annual average river runoff and water

availability are projected to decrease by ten to 30 percent over some dry regions at mid-latitudes, information with regard to potential impacts on specific river basins is not included. Recently published projections of potential reductions in natural flow on the Colorado River Basin by the mid 21<sup>st</sup> century range from approximately 45 percent by Hoerling and Eischeid (2006), to approximately 6 percent by Christensen and Lettenmaier (2006). A recent analysis of future precipitation minus evaporation (a surrogate for runoff) in the basin suggests an “imminent transition to a more arid climate in southwestern North America” (Seager et al. 2006).

While these projections are of great interest, additional research is both needed and warranted to quantify the uncertainty of these estimates in terms of the actual uncertainty in the climate response as well as the uncertainty due to differences in methodological approaches and model biases in order to better understand the risks of current and future water resource management decisions.

Reclamation has been involved in a multi-faceted research and development program over the past three years to improve its risk assessment capabilities regarding projected climate change in the Colorado River Basin. Key components of this program include:

- ◆ Sponsorship of National Research Council’s (NRC) Committee on the Scientific Bases of Colorado River Basin Water Management in collaboration with the California Department of Water Resources, the Metropolitan Water District of Southern California, the Southern Nevada Water Authority, and the NRC’s Water Science and Technology Board.

The above noted NRC study culminated in a report published in early 2007, titled *Colorado River Basin Water Management: Evaluating and Adjusting to Hydroclimatic Variability*. Among several conclusions and recommendations, this report concluded that the trend of increasing mean temperatures across the Colorado River Basin over the 20<sup>th</sup> century and into the 21<sup>st</sup> century is likely to continue, and although there is less consensus regarding future trends in precipitation and runoff, the preponderance of the scientific evidence suggests warmer future temperatures will reduce future streamflow and water supplies and contribute to increase the severity, frequency, and duration of future droughts. The executive summary of this report is included as Appendix T;

- ◆ Collaboration with several climate researchers to assess the state of knowledge regarding the potential impacts of climate change on the Colorado River Basin, to assess methodologies that would be appropriate to quantify future conditions, and to prioritize future research and development needs.

This work culminated in a report titled *Review of Science and Methods for Incorporating Climate Change Information into Reclamation’s Colorado River Basin Planning Studies*. Among several conclusions and recommendations, this report concluded that for shorter look-ahead horizons (e.g., less than 20 years), interannual and decadal variability is likely to be a more significant source of uncertainty than the uncertainty due to near-term climate change. Although paleoclimatic information may not necessarily represent future climate scenarios, this information may be useful in framing assumed variability in future

hydrologic sequences, particularly with respect to drought potential. For longer look-ahead horizons (20+ years), further research and development is needed to translate climate projections from General Circulation Models (GCM) to the spatial scales necessary for use in Colorado River planning studies. This report is included in its entirety in Appendix U;

- ◆ Collaboration with several research partners including the United States Geological Survey (USGS), National Oceanic and Atmospheric Administration (NOAA), and various universities to improve the accuracy and spatial resolution of the output data from climate change models to enable use in Reclamation's planning model (CRSS); and
- ◆ Improvements to the decision-modeling framework (including the CRSS model and associated data handling and analysis tools).

Based on the current inability to precisely project future impacts of climate change to runoff throughout the Colorado River Basin at the spatial scale needed for CRSS, the primary hydrologic analysis for this Final EIS was based on the resampled historical record. However, in order to understand the potential effects of future inflow sequences outside the range of the historical flows (i.e., future sequences with increased variability including the severity, frequency, and duration of droughts), particularly during the 19-year period of the application of the proposed federal action, Reclamation analyzed the sensitivity of the hydrologic resources (including reservoir storage, reservoir releases, and river flows) to hydrologic scenarios derived from alternative methodologies. These methodologies, including stochastic hydrology methods and paleo-reconstruction methods and the analyses results were included in Appendix N of the Draft EIS. An additional analysis has been added to Appendix N in this Final EIS that incorporates newly published tree-ring reconstruction data (Meko et al. 2007) that extends the estimate of annual flow at Lees Ferry back to the year 762, a record length of 1,244 years.

Acknowledging the potential for impacts due to climate change and increased hydrologic variability, the Secretary proposes that these guidelines be interim in duration and extend through 2026, providing the opportunity to gain valuable operating experience for the management of Lake Powell and Lake Mead, particularly for low reservoir conditions, and improve the basis for making additional future operational decisions, whether during the interim period or thereafter. In addition, the Preferred Alternative has been crafted to include operational elements that would respond if potential impacts of climate change and increased hydrologic variability are realized. In particular, the Preferred Alternative includes a coordinated operation element that allows for the adjustment of Lake Powell's release to respond to low reservoir storage conditions in Lake Powell or Lake Mead as described in Section 2.7 and Section 2.3. In addition, the Preferred Alternative will enhance conservation opportunities in the Lower Basin and the retention of water in Lake Mead through adoption of the ICS mechanism. Finally, the Preferred Alternative includes a shortage strategy at Lake Mead that would result in additional shortages being considered, after appropriate consultation, if Lake Mead elevations drop below 1,025 feet msl.

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## Part 1 Comments and Responses

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This section contains copies of comment letters received by Reclamation in response to the public review of the Draft EIS. This section also includes two oral comments that were received during the public hearings. Finally, Reclamation's responses to each of the specific issues raised in the letters and comments are provided in this section. The contents of this section are organized as follows:

- ◆ Comment letters and the oral comments from the public meetings have been grouped according to their entity type (i.e., business; federal agency; special interest or non-governmental organization; individual; Indian tribe; local agency, city or water district; state agency; and oral comment). Comments were assigned a code and source identification according to the following method:
  - the grouped comments were assigned a letter code (i.e., business [B]; federal agency [F]; special interest or non-governmental organization [G]; individual [I]; Indian tribe [IT]; local agency, city or water district [L]; state agency [S]; and oral comment [PC]);
  - a number code was then assigned to identify the multiple comment letters within each grouping (e.g., the first letter in the local agency category is assigned code L-1 and the second letter is assigned code L-2); and
  - each comment letter has been further subdivided into issues which are marked with vertical lines and numbered sequentially within the right margin of the comment letter. The issue number is displayed after the comment letter group and number (e.g., L-1-1, L-1-2).
- ◆ Reclamation's response to each comment letter and oral comment immediately follows the respective letter and oral comment. The responses are numbered in the same method as the comment letter or oral comment and its respective issues.

