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THE ROLE OF WEATHER MODIFICATION IN THE COLORADO RIVER BASIN STATES PROCESS

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1. BACKGROUND

In a May 2, 2005, letter to the Governors of the Seven Colorado River Basin States (Basin States, Parties) the Secretary of the Interior (Secretary) announced her intent to undertake a process to develop Lower Colorado River Basin (Arizona, California and Nevada) shortage guidelines and explore management options for the coordinated operation of lakes Powell and Mead. On June 19, 2005 the Bureau of Reclamation published a notice in the *Federal Register*, announcing its intent to implement the Secretary's direction.

On August 25, 2005 the Governors' Representatives for the Basin States wrote a letter to the Secretary expressing conceptual agreement in the development and implementation of three broad strategies for improved management and operation of the Colorado River: Coordinated Reservoir Management and Lower Basin Shortage Guidelines; System Efficiency and Management; and Augmentation of Supply. At the request of the Secretary, the Parties have continued their discussions relative to the areas of agreement.

The Parties have reached agreement to take additional actions for their mutual benefit, which are designed to augment the supply of water available for use in the Colorado River System and improve the management of water in the Colorado River Basin. Augmentation concepts have been identified such as vegetation management, desalination, and Weather Modification (WxMod). States in the Upper Colorado River Basin (Colorado, New Mexico, Utah, and Wyoming) have a variety of operational and experimental WxMod programs in the Colorado River Basin. These programs are funded, operated, and regulated at the state and local level. The Parties have agreed to implement actions toward optimizing cloud seeding activities.

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In an effort toward developing a long-term cooperative WxMod program in the Upper Basin, the Seven Colorado River Basin States are working together under the following guiding principles:

- Appropriately designed winter season orographic WxMod programs can increase winter snowpack in the Colorado River Basin. Increases in snowpack can increase the yield of the Colorado River or its tributaries by increasing runoff to streams, which augments the water supply in the Colorado River system.

- All Colorado River Basin States benefit from augmentation of the water supply in the Colorado River system. These benefits include: additional system storage to avoid or delay the onset of shortage conditions, increased power production, and increases in available water supply at local, regional, and basinwide scales.

- The science and operational data strongly suggest WxMod may be a cost-effective water supply augmentation strategy. However, further efforts to quantify the potential magnitude of increased snowpack and resulting increased runoff to the reservoir system from WxMod programs would be useful.

- Opportunities exist for the Basin States to augment Colorado River system runoff through a cooperative WxMod program. It is not the Parties' intent to claim a right to any increase in water supply resulting from WxMod programs. Any water resulting from these programs would become water of the Colorado River System as defined by the "Law of the River" and would not be claimed as attributable to any one Party or Parties.

2. WATER YEAR 2006 TRIAL EXTENSION

The Southwestern Water Conservation District (SWCD) in the vicinity of Durango, Colorado has been performing WxMod through cloud seeding in its district on and off since the late 1970s. This program has historically been funded by the SWCD, and more recently with supplemental funds from the Colorado Water Conservation Board (CWCB). On January 31, 2006, the normal Water Year (WY) 2006 WxMod budget was exhausted for this program. An opportunity for water augmentation through cloud seeding in late winter existed as indicated by the area's snowfall climatology. The SWCD and CWCB welcomed additional funding to extend the program on a trial basis for one year. As part of Colorado River drought management activities, it was proposed that the Lower Basin States provide funding to extend operations in WY 2006. Although there are several WxMod projects in Colorado which were good candidates for a trial extension, the San Juan mountains were chosen because snowfall in the range was far below normal that year.

Colorado River contractors in the Lower Basin, comprised of the Six Agency Committee, the Southern Nevada Water Authority, and the Central Arizona Water Conservation District contributed $15,000 each to this Trial Extension. The Six Agency Committee is composed of Palo Verde Irrigation District, Imperial Irrigation District, Coachella Valley Water District, The Metropolitan Water District of Southern California, San Diego County Water Authority, and the City of Los Angeles Department of Water and Power. Of the total, $35,000 was spent for seeding and $10,000 was spent for an evaluation component to document the runoff potentially made available by the late season trial extension. The SWCD contributed an additional $7,000 for seeding. An agreement among those Lower Basin contractors and SWCD was executed in early March, 2006. The extension added 1,745 hours of seeding by 24 generators.

The five river basins in which seeding was extended included: the Dolores, La Plata, Animas, Florida, and Pine. The area identified by number 1 on Figure 1 shows the San Juan mountains project area. All parties were satisfied with the results of the seeding. Descriptions of the success of this Trial Extension were presented at the June, 2006 Weather Modification Workshop held in Boulder, Colorado.

3. WATER YEAR 2007 ACTIVITIES

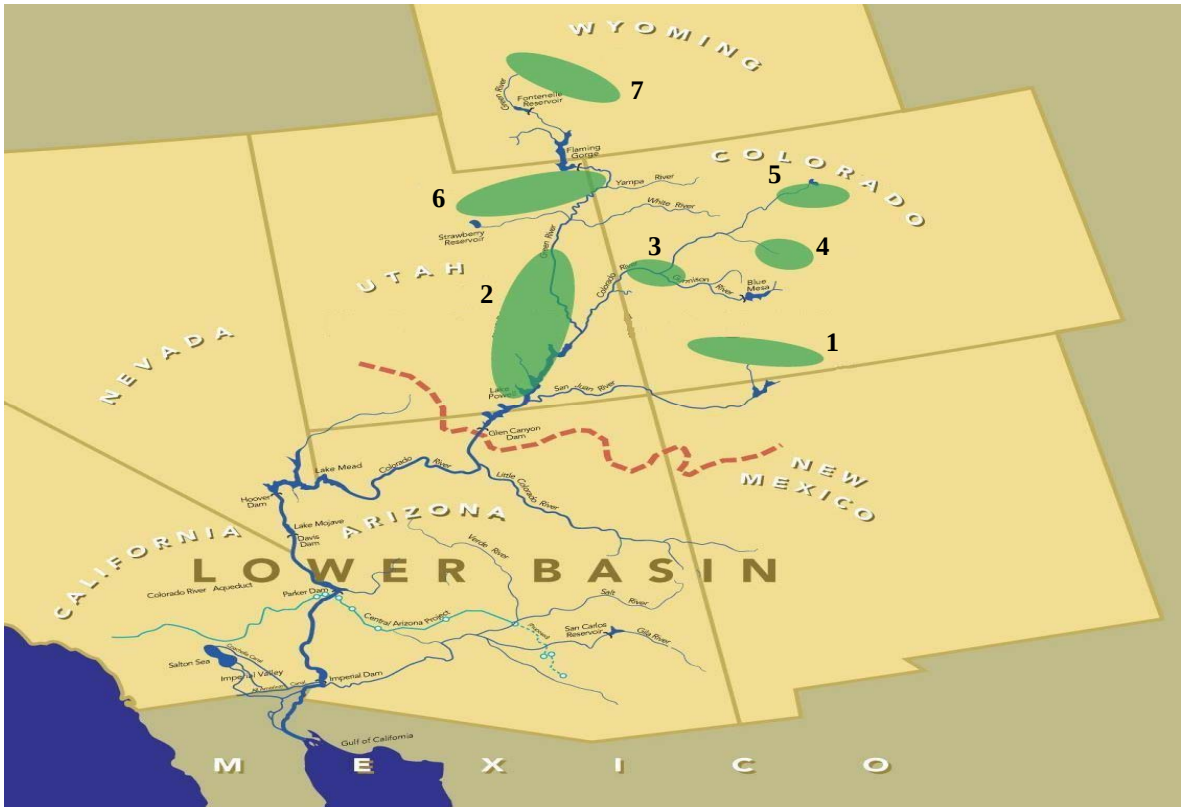
Building on the success, goodwill and momentum gained in the 2006 Trial Extension, in July 2007 the Basin States reached agreement regarding proposed activities to be implemented in WY 2007. The vehicle for implementation was an agreement among the Lower Basin contractors and each of the states of Colorado, Utah, and Wyoming. The form of the agreement is a base agreement with an Annual Supplement which would be developed for each WY that activities are proposed.

As part of the cooperative nature of this arrangement, all of the Basin States contribute to the programs, through either: direct funding, administrative and regulatory assistance, data collection, management and sharing, land and right-of-way access, technical and logistical assistance, or public education and outreach.

Activities for WY 2007 represented modest extensions of existing programs without acquiring additional equipment. Activities increased runoff to the Colorado River System reservoirs as well as built cooperation and local support for future programs. The Lower Basin contractors contributed approximately $42,000 each for the activities.

In Colorado, operations were extended in the Blue River, Roaring Fork, San Juan and Grand Mesa areas, and studies were initiated. In Utah, extensions were carried out for the High Uinta and Southern Utah Projects, and in Wyoming, funds were provided for the lease of equipment for data collection in the Wind River Range target area and Green River Basin (Figure 1).

Figure 1. Upper Basin WxMod Project Areas



1. San Juan; 2. Central and Southern Utah; 3. Grand Mesa; 4. Roaring Fork; 5. Blue River; 6. High Uinta; 7. Wind River and Green River

4. WATER YEAR 2008 ACTIVITIES

The second Annual Supplement was executed for WY 2008 activities. Activities for WY 2008 consist of enhancements of existing programs (extensions and expansions) that may increase runoff to the Colorado River or its tributaries, research in an effort toward long-term optimization of existing programs, purchase and lease of equipment, and building cooperation and local support for future programs. Some of the purchased equipment includes icing rate sensors and dataloggers to improve seed/no seed decision-making. Figure 1 shows the project areas in which activities were funded. The Lower Basin contractors contributed approximately $98,800 each for the activities. Approximately 71 percent of the funds are being spent on operations, and 29 percent on studies or equipment for long-term improvement of current operations.

5. LONG-TERM ACTION PLAN FOR WEATHER MODIFICATION ACTIVITIES IN THE COLORADO RIVER BASIN

The Basin States are preparing a Long-Term Action Plan (Plan). The Plan is a document that provides general guidance and is intended to be flexible. The Plan is to be the guiding document that identifies the studies and activities that need to be undertaken to ensure the implementation of a functioning WxMod program as envisioned by the Basin States. The Basin States would identify long-term goals, gather data, conduct preliminary planning for long-term projects, gain experience by using different methods, leverage funding of activities, balance current operations with research to prepare for long-term operations, implement what is being learned from other ongoing studies, and coordinate activities. Specific activities include project extensions and expansions, optimization, the development of new projects, design studies, and research. The Plan integrates this information and prioritizes proposed activities.

It is to discuss the institutional constraints and provide a budget. The authors of the Plan are from the Colorado River Basin States with input provided by independent operators, scientists, and consultants. The Plan is to describe the annual procedures for approval and funding of activities and contain a process whereby decisions can be made indefinitely. It will provide direction beginning in WY 2009, and is expected to be periodically updated based on new information received.