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APPLICATION OF PALEO-CLIMATE DATA TO WATER PLANNING AND MANAGEMENT

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ABSTRACT: S.S. Papadopulos & Associates has been working for the state of New Mexico on water resource questions for over two decades. Over the past two years, we have encountered several questions concerning how to handle and sample from data for use in modeling and planning studies, generally data from the past 25 to 50 years, such that the data will represent the type of climatic conditions we wish to reproduce. We review here three studies we have performed in this area:
· Determining what period of record should be used for water budget calculations and modeling for the Middle Rio Grande between Cochiti Dam and Elephant Butte Reservoir;
· Assessing the probability of multi-year drought in the Middle Rio Grande given that 2001 was a dry year;
· Constructing a 40-year synthetic climate sequence from measured 1975-1999 data to drive the Upper Rio Grande Water Operations Model (URGWOM) planning model, while both maintaining average conditions for the duration of the sequence and including representative drought, average and wet period conditions.

To answer these questions, we have relied on tree-ring reconstructions of both regional climate and climate forcing parameters such as El Nino/ENSO and the Pacific Decadal Oscillation (PDO). Using these reconstructions, we have assessed past climate and established likely climate forcing. Based on this information, we have been able to put the recent record, since 1900, in perspective.

We have found that the period from 1950-1999 is relatively representative of "average" long-term (past 1000+ years) conditions in the region, while including both a severe drought and one of the wettest periods on record. We also found that the recent record is strongly correlated with the PDO. Given that the PDO appears to have shifted phase in 1999, it is highly likely that the next two decades will be below average dry. For the URGWOM Planning Model, given that 1975-1999 was an unusually wet period, we "normalized" the flow record by establishing a relationship between flow and the Palmer Drought Severity Index which allowed us to divide measured flow into very dry, dry, average, wet and very wet conditions. Based on this division and information from the long-term record, we established probability distributions for conditions during drought, average and wet periods and used these to generate a 40-year climate sequence.

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