2.0 INTRODUCTION

2.1 GENERAL SETTING

The Big Sandy groundwater basin covers an area of approximately 800 square miles in northwestern Arizona (Figure 1). The basin trends roughly north-south and is surrounded by the Peacock and Hualapai mountains on the northwest and southwest, and Cottonwood Cliffs and Aquarius Mountains on the northeast and southeast, respectively.

The mountains are primarily granitic and the central part of the basin contains as much as 2,000 ft of sedimentary rocks. Three hydrologic units occur in the valley: (1) the upper basin fill including streambed alluvium (upper aquifer), (2) the lower basin fill, confined where overlain by lakebed clay (middle aquifer), and (3) a largely confined volcanic unit (lower aquifer) present in the southwestern part of the basin.

The only inflow to the basin is infiltration from precipitation, primarily along the mountain fronts and stream channels. The primary outflows are to evapotranspiration via riparian vegetation along the river channel, evaporation and evapotranspiration at the marsh near the south end of the valley, a small amount of agriculture, and outflow at Granite Gorge at the southern end of the basin. Current consumptive groundwater uses include small-volume irrigation and public supply wells in the southern part of the basin and pumping in the north to supply the Phelps Dodge Bagdad mine. Current consumptive use of surface water is a small amount diverted for agriculture.

2.2 GROUNDWATER MODELING OBJECTIVES

The purpose of the groundwater model analysis was to create an understandable and technically sound groundwater flow model adequate for use in evaluating the long-term potential impact of the proposed Big Sandy Energy Project on the groundwater and surface water resources of the Big Sandy basin.

The overall objectives of the modeling analysis were as follows:

- Analyze existing groundwater conditions in terms of the following:
  - recharge/discharge flow patterns under steady conditions
  - simulation of the aquifer pumping test to evaluate model performance

- Analyze future groundwater conditions as follows:
  - recharge/discharge flow patterns under plant pumping conditions
  - impacts on water levels and flow rates resulting from plant pumping
  - sensitivity of model results to variations in key uncertain model inputs

- Provide input to a protective groundwater monitoring and water augmentation program.

The U.S. Geological Survey's (USGS) model MODFLOW, as embedded in Visual MODFLOW, was used for this analysis.

2.3 QUALITY ASSURANCE AND PEER REVIEW

The model analysis was prepared for, and conducted under the direction of, the Western Area Power Administration (Western) and the Bureau of Land Management (BLM), Kingman Field Office, for their use in preparing the environmental impact statement (EIS) for the Big Sandy Energy Project. Ongoing peer review of model input data, assumptions, calibration, and predictions was provided throughout the project by URS Denver modeling group staff, URS Phoenix project management staff, EIS preparation staff, and the following team of hydrologists and other resource specialists (hydrology team) drawn from cooperating agencies and their consultants, and project proponent staff and their consultants:

Andrew Hautzinger, U.S. Fish and Wildlife Service
Annette Morgan, Hualapai Tribe
Bob Orr, Western
Cisney Havatone, Hualapai Tribe
Cortney Brand, URS Corporation
Dale Mason, Arizona Department of Water Resources
Dave Carr, URS Corporation
David Schafer, David Schafer & Associates
Don Bay, Hualapai Tribe, Office of Natural Resources
Greg Beatty, U.S. Fish and Wildlife Service
Gwen Knadel, URS Corporation
Joanna Moreno, URS Corporation
Lin Fehlmann, BLM
Marc Sydnor, Greystone Consultants
Paul Manera, Manera Inc.
Paul Summers, BLM

The hydrology team conferred more than 10 times during the course of the modeling work. Modeling plans, framework, assumptions, input data, calibration results, predictive cases, sensitivity cases, and results were discussed and revised in response to these meetings. At several points in this report references are made to points of discussion from this group. This report was reviewed by several members of the hydrology team prior to submittal.

Groundwater modeling protocols have been attempted to be established in documents such as American Society for Testing and Materials (ASTM) standards D 5447-93, D 18.21.92.09, D5490-93, E 978-84, D 5610-94, D 5609-94, and U.S. Environmental Protection Agency (EPA 1992). These documents have not been widely accepted, or used as industry standard practice. They were used as checklists for this analysis.