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HIGH DESERT POWER PROJECT
UPDATE OF GROUNDWATER MODEL MESH

Revised March 2003

Prepared for
High Desert Power Project, LLC

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1.0 INTRODUCTION

In permitting the High Desert Power Project (HDPP), the California Energy Commission (CEC) set conditions for the protection of soil and water within the Mojave River basin. This report is intended to satisfy condition of certification (COC) Soil & Water 9 (S&W 9), which requires that the project owners modify the groundwater-model mesh that was produced as part of the application for certification (AFC). (Bookman-Edmonston Engineering, Inc., 1999). In particular, the condition requires that the modifications accommodate the representation of gradational changes in hydraulic conductivity within the regional groundwater system, in conformance with the groundwater model produced by the U. S. Geological Survey (2001).

High Desert Power Project, LLC previously submitted to the CEC a groundwater-model mesh that incorporated the most recently available hydrogeologic information for the region underlying and adjacent to the HDPP. Based on that information, the original groundwater-model mesh produced for the AFC was updated to include hydrogeologic units that had not been included in the original mesh. That updated mesh is described in a report by Timothy J. Durbin, Inc. (2002) that was submitted to the CEC. However, because the CEC staff indicated that a lengthy period would be required to review the report, High Desert Power Project, LLC elected to resubmit a groundwater-model mesh that has the same hydrogeologic layering as within the original groundwater-model mesh produced for the AFC. That mesh is described in this report.

The HDPP is located along the Mojave River near Victorville, California. The City of Victorville will provide the primary water supply for the power plant with water imported from the State Water Project (SWP). In the event that imports are disrupted, SWP water previously banked in the local aquifer will be used as a backup water supply. The Victor Valley Water District (VVWD) will operate the aquifer banking system (ABS) on behalf of the HDPP by injecting treated SWP water into a dedicated well field located south of the power plant. The well field will include four aquifer storage and recovery (ASR) wells, which are referred to as wells F, G, H, and K. These wells will be used both for injection and storage recovery.

In accordance with COC S&W 5, the CEC will maintain an ongoing accounting of the stored groundwater available for recovery. That accounting will be based in part on a groundwater model that will utilize the modified groundwater-model mesh described in this report. Based on the three-dimensional groundwater-model mesh constructed previously by Bookman-Edmonston, Inc.(1999), a updated mesh was created for utilization with the computer program *FEMFLOW3D* (U. S. Geological Survey, 1998). The updated mesh was constructed to accommodate aquifer-parameter distributions used in the U. S. Geological Survey (2001) model of the Mojave River basin. Additionally, the mesh was constructed to accommodate the relocation of ASR wells. Finally, the mesh was constructed to expand the geographical extent of the model as requested by CEC staff (Linda Bond, written and oral communications, March 2003).

Computer files representing the groundwater-model mesh are included on a CD that is attached inside the back cover of this report. The node coordinates are contained in the ASCII file Grid.xyz. The element incidences are contained in the ASCII file Grid.ele. The CD contains the additional file Grid.3dm, which is formatted for input to the model-visualization program *GMS*.

2.0 CONSTRUCTION OF UPDATED MESH

Bookman-Edmonston Engineering, Inc. (1999) constructed a groundwater model of the ABS well field, which utilized the groundwater-modeling program *FEMFLOW3D* (U. S. Geological Survey, 1998). The plan view of the three-dimensional finite-element mesh for that model is shown on Figure 1. The mesh contains 1,725 nodes and 2,118 elements, and the hydrogeology of the well-field region is represented by two element layers within the mesh. The lower element layer represents older alluvium, and the upper layer represents younger alluvium or river deposits (Bookman-Edmonston Engineering, Inc.,1999, Figure 3). Additionally, the Turner Springs Fault is represented as a westward trending row of elements (Bookman-Edmonston Engineering, Inc., 1999, Figure 3). Within the file Grid.3dm, each element within the mesh is assigned to a hydrogeologic feature based on the codes listed in Table 1.

To satisfy the requirements of S&W 9, and additional requests from CEC staff (Linda Bond, written and oral communications, March 2003), the finite-element mesh was updated as follows:

1. The original mesh was modified to represent the relocation of wells within the ABS well field. The mesh constructed by Bookman-Edmonston Engineering, Inc. was based on the originally planned well locations. However, wells have been relocated, and the mesh was updated to accommodate the new locations.

2. The original mesh was modified to accommodate the geographic distribution of aquifer parameters used in the U. S. Geological Survey (2001) groundwater model.

3. The geographic extent of the original mesh was extended to represent the entire Alto subarea of the Mojave River basin. Simulations made with the original model produced significant groundwater-level changes along the southern boundary of the modeled area (Bookman-Edmonston Engineering, Inc., 1999, Figures 5 and 10). Given that the southern boundary is not a hydrologic boundary, the mesh was extended as agreed with CEC staff (Linda Bond, written and oral communications, March 2003).

4. The position of the Turner Springs Fault was changed from that in the original model (Bookman-Edmonston Engineering, Inc., 1999, Figure 3) to the position represented in the U. S. Geological Survey (2001, Figure 11) model. However, within the U. S. Geological Survey model, Turner Springs Fault is equivalent to the Shadow Mountains and Adelanto faults.

The plan view of the updated finite-element mesh is shown on Figure 2. The northern boundary of the modeled area coincides within the northern boundary of the original Bookman-Edmonston groundwater model. The other boundaries correspond with features represented within the U. S. Geological Survey (2001, Figure 11) model. The northeastern boundary coincides with the contact between alluvial deposits and granitic rocks along the base of Quartzite Mountain. The southeastern boundary follows the Apple Valley Fault. The southern boundary coincides with the contact between the alluvial deposits and granitic rocks along the base of the San Bernardino and San Gabriel mountains. The southwestern boundary follows the boundary between the Alto and Oeste subareas. The northwestern boundary coincides with the contact between the alluvial deposits and granitic rocks at the base of the Shadow Mountains.

The mesh has two element layers that correspond to the two layers used in the original Bookman-Edmonston groundwater model. The lower layer represents the older alluvium. Near the Mojave River, the upper layer represents the recent Mojave River deposits (Figure 2). In other areas, the upper layer represents the younger alluvium.

Corresponding to the two element layers are three node layers. The upper node layer defines the top surface of the upper element layer. The middle node layer defines the bottom the upper element layer and the top of the lower element layer. The bottom node layer defines the bottom of the lower element layer. Figures 3 through 5 show contours on the surfaces defined by the node layers. Those surfaces were determined as follows:

1. The elevation of the top nodes in the updated mesh corresponds to the measured groundwater elevations for 1998 as contoured by the U. S. Geological Survey (2001, Figure 37).

2. The elevations of the middle nodes in the updated mesh correspond to the thicknesses of the upper element layer as represented in the original Bookman-Edmonston mesh. Where the updated mesh and the original Bookman-Edmonston

mesh coincide geographically, the node elevations in the updated mesh are based on the layer thicknesses used in the original mesh. Where the updated mesh extends beyond the geographic extent of the original mesh, the node elevations are based on the extrapolation of the layer thicknesses used in the original mesh.

3. The elevation of the bottom nodes corresponds to the elevation of the bottom nodes in the original Bookman-Edmonston model. Where the updated mesh and the original Bookman-Edmonston mesh coincide geographically, the node elevations in the updated mesh are based on the node used in the original mesh. Where the updated mesh extends beyond the geographic extent of the original mesh, the node elevations are based on the extrapolation of the layer elevations used in the original mesh. The extrapolations are based largely on the elevations for the base of the groundwater system as represented by the California Department of Water Resources (1967, Plate 4). However, at the boundary between the original mesh and the extended geographic area of the updated mesh, the contours derived from the Bookman-Edmonston mesh do not match the contours represented by the California Department of Water Resources, and adjustments were made to the node elevations to create a smooth transition between the two contour sets. Nevertheless, other adjustments had to be made. In some locations the measured groundwater-level contours (U. S. Geological Survey, 2001, Figure 37) that define the top surface of the mesh are lower than the hydrogeologic contours (California Department of Water Resources, 1967) that define the bottom surface of the mesh. To address that incongruity, a thickness of 50 feet was assigned to the lower element layer wherever the contours sets would produce a thickness less than 50 feet.

3.0 REFERENCES CITED

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U. S. Geological Survey, 2001, Simulation of ground-water flow in the Mojave River Basin, California: Water-Resources Investigations Report 01-4002, Version 3.

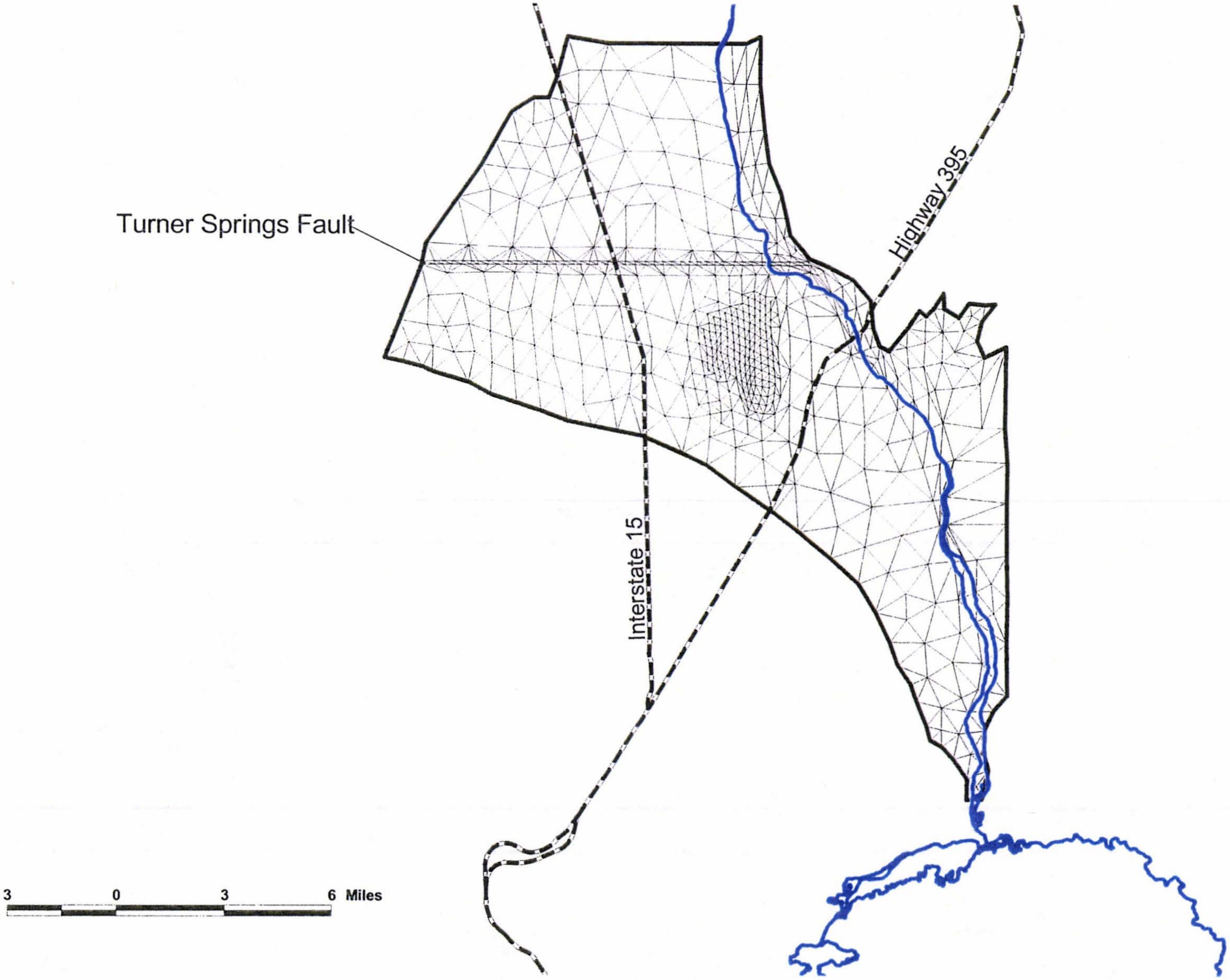

Figure 1 Bookman-Edmonston Groundwater-Model Mesh

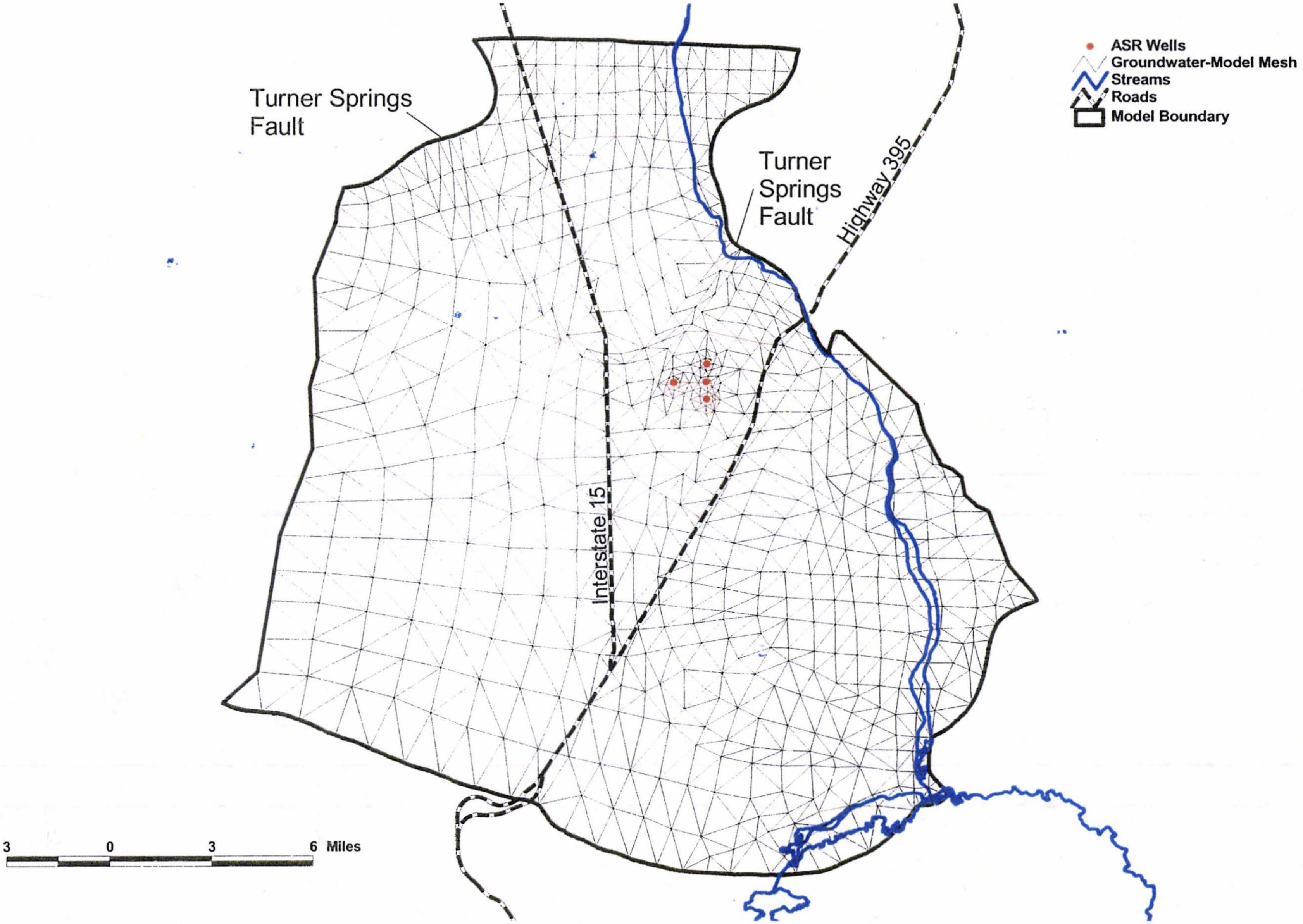

Figure 2 Revised Groundwater-Model Mesh

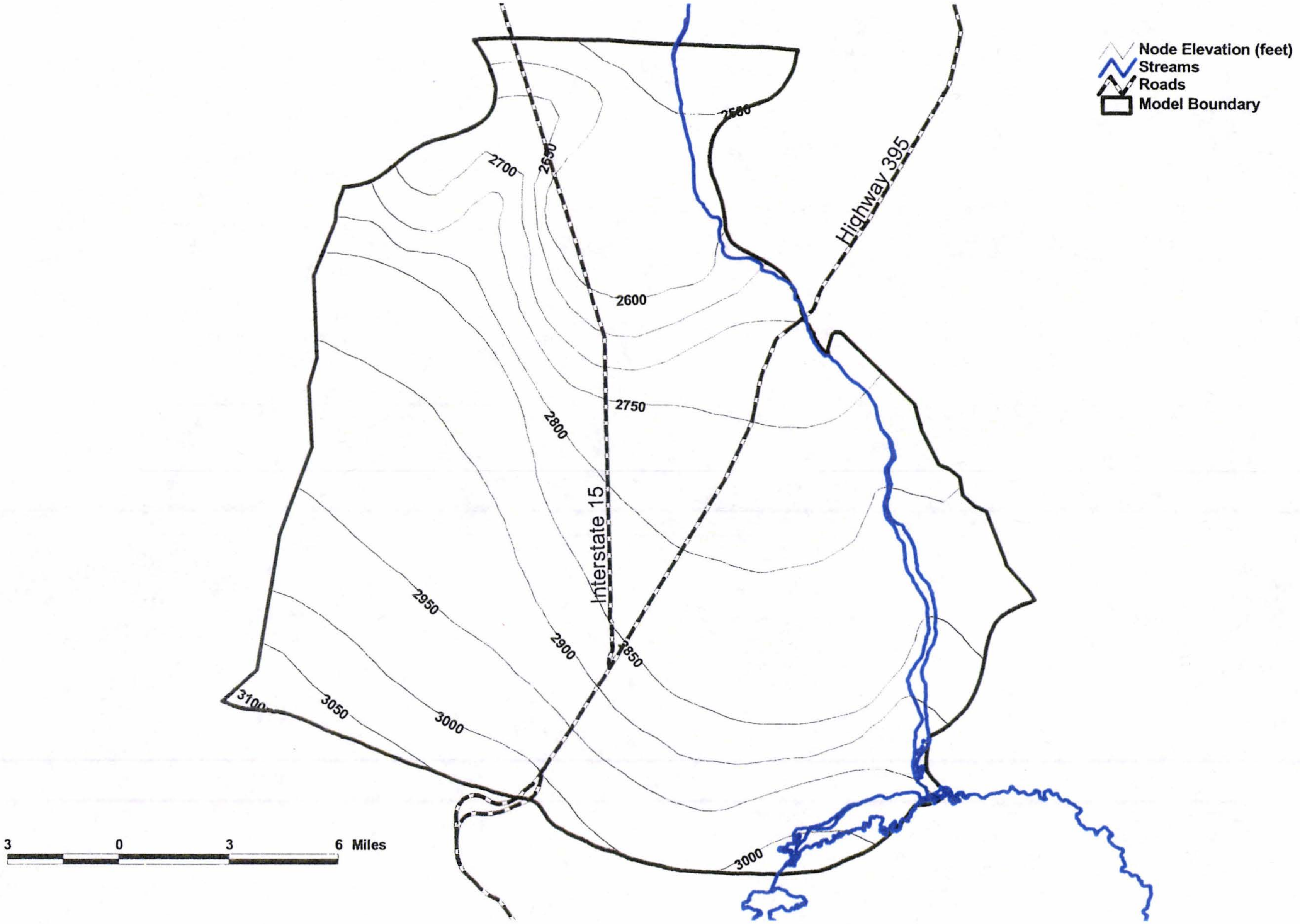

Figure 3 Elevation of the Top Nodes within the Revised Mesh

Figure 4 Elevation of the Middle Nodes within the Revised Mesh

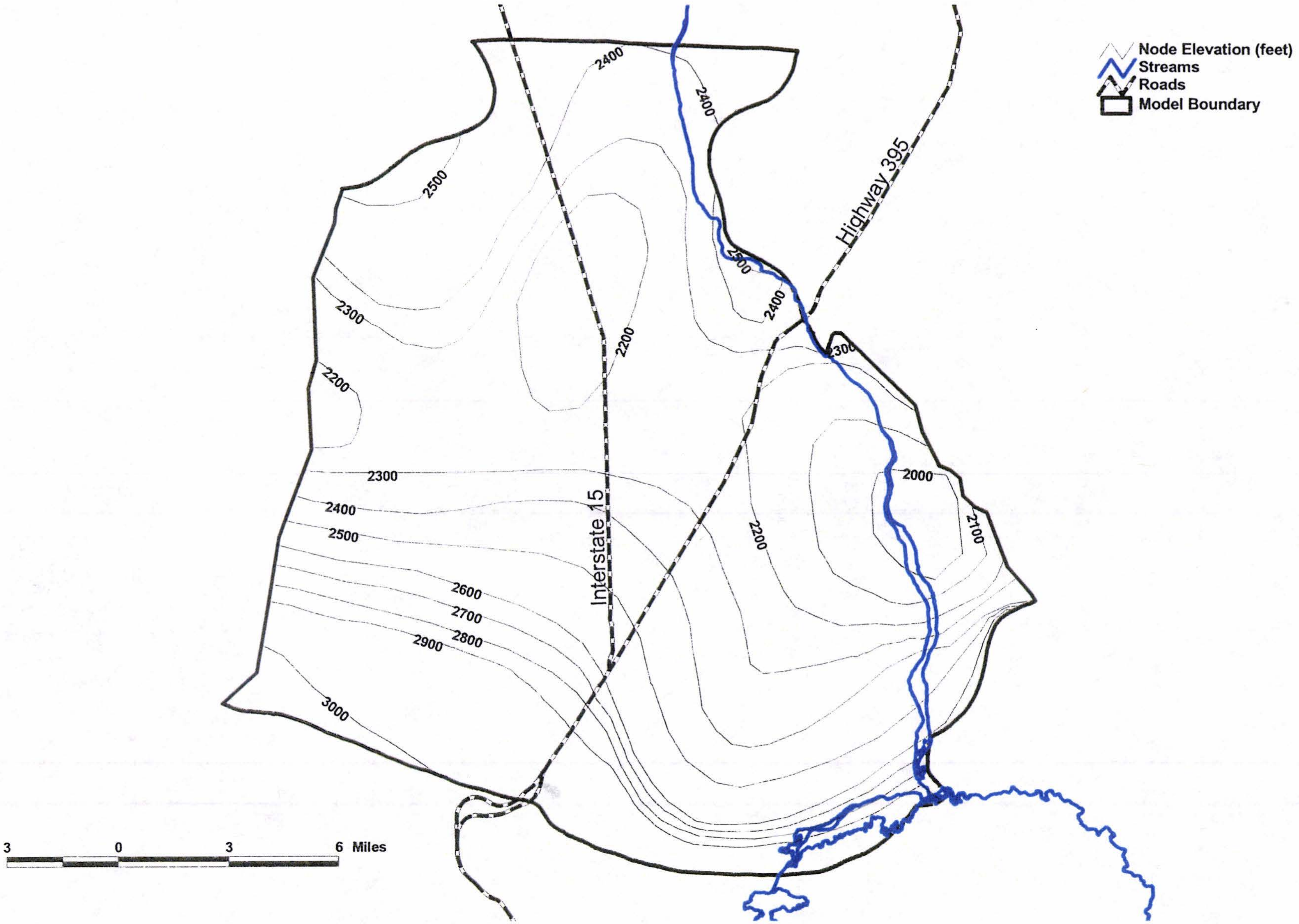

Figure 5 Elevation of the Bottom Nodes within the Revised Mesh

Table 1
Assignment of Material Codes to Geologic Features

Geologic Unit	Material Code
River Deposits	4
Younger Alluvium	1
Older Alluvium	2
Turner Springs Fault	3