ADDENDUM

To

8th SEMI-ANNUAL REPORT

SPARTA AQUIFER RECOVERY STUDY

February 2006 – August 2006

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UNION COUNTY
WATER CONSERVATION BOARD

ADDENDUM TO 8TH SEMI-ANNUAL REPORT TO EPA

For the Sparta Aquifer Recovery Study, the current USGS groundwater flow model was updated with more recent pumping data. The purpose of the updated model is to permit the Board to continue to project the impacts of its Ouachita River Alternative Water Supply Project as described in the 8th Semi-Annual Report.

Introduction

A complete description of the USGS groundwater flow model, including changes made from previous models, numerical methods, model assumptions, and model development can be found in McKee and Clark (2003). Most of the model details found in McKee and Clark (2003) will apply to the updated version developed for the Board. Differences between the two models are described in the 5th Semi-Annual Report to EPA dated April 25, 2005.

Additional Modeling Run

The modified and recalibrated USGS model (hereinafter referred to as the "original model") was updated and adapted for the Board by Burns & McDonnell for use in the Study, to help predict the effects of discontinued groundwater use from the Sparta aquifer by the three selected industries (Lion Oil, El Dorado Chemical, and Chemtura). For the current modeling effort, the primary change from the previous model was to update pumping rates to include reported Union County water usage for the year 2005. Therefore, the new model is identical to the original model except that the pumping rates for Union County are based on more recent data. Union County Pumping rates used in the model are presented in Attachment 1.

Groundwater Vistas®, a pre- and post-processing program developed by Environmental Simulations, Inc. for running MODFLOW-2000 and numerous other groundwater flow and transport models on personal computers, was used to input the new data, run the model, and export model output data.

Calibration

A full description of the model calibration performed by USGS can be found in McKee and Clark (2003). Because USGS performed a detailed calibration of the original model, additional calibration of the adapted model was not performed. However, a limited calibration check was performed in which heads predicted by the adapted model were compared to observed water levels at six locations

within the model domain. Hydrographs developed for these sites are presented in Figure 1. Also incorporated into the hydrographs are the results of the original (USGS) model Scenario 2, so that projections made by the original model can be compared to those of the adapted model. The hydrographs are identical through 1997, as expected since all model parameters were identical up to that point in time. Updated groundwater pumping data incorporated into the adapted model accounts for the differences between the original and the adapted model hydrographs after 1997.

Residuals at the six locations were also calculated for 2005, as shown in Table 1. The residuals indicate that the updated model closely predicted the head at the five locations nearest El Dorado, although not for the monitoring well at Pine Bluff. The absolute mean residual for the year 2005 was 26.6 feet. This compares to an absolute mean residual of 10.9 for the USGS model run.

Table 1

Summary of Calculated Residuals (ft)

Well	2002 Original Model	2004 Model Update	2005 Model Update
Airport	NA	+12.3	-34.1
El Dorado No. 8	+34.8	-8.8	-29.3
Junction City	-18.6	-0.3	-5.8
Smackover	-1.0	-11.2	-8.0
Strong	NA	-13.3	+24.3
Pine Bluff	-4.3	-30.9	+57.9

NOTES: Original model used average 1990-1997 pumping rates for 2002, while model updates used actual rates for 2002, 2004, and 2005. Positive numbers indicate modeled head is greater than observed, and negative numbers indicate modeled

Pumping Scenarios

Two pumping scenarios were simulated in this model update:

- Scenario 1 – constant withdrawal rates from 1998-2004 with averaged rates for this period extended through 2034 (no conservation efforts), as a baseline scenario to show the potential effects of taking no action (similar to USGS Scenario 1a).

- Scenario 2 – average 2005 pumping rates extended through 2034, except reduced in Union County and Jefferson County to show the effects of current Union County conservation efforts, and potential conservation efforts in Jefferson County beginning in 2011 (similar to USGS Scenario 2 except for the timing of reduced withdrawals).

Model Results

Post-1997 modeling results are somewhat different than those obtained by USGS, due to the difference in simulated pumping rates. Scenarios from the adapted model are discussed below.

Scenario 1

A model simulation using constant withdrawal rates from 1998-2004 was conducted for the period 2005-2034, as a baseline scenario and to show the potential effects of taking no action to reduce Sparta withdrawals (similar to USGS Scenario 1a). Figure 2 shows the modeled potentiometric surface for 2034. Similar to results obtained by USGS, the contours indicate substantial declines in the area around El Dorado, with modeled potentiometric levels 200 feet below mean sea level and more than 200 feet below the top of the Sparta Sand and an expansive cone of depression around the major pumping centers.

Scenario 2

A second model simulation using constant withdrawal rates from 1998-2004, average withdrawal rates for Union County in 2005, and reduced rates in Union County and Jefferson County was conducted for the period 2006-2034. Note that for Union County, with the exception of the three industries no longer using Sparta water, 2005 rates were used for the period 2006-2034. A table of reported usage in Union County is presented in Attachment 1.

Figure 3 shows the contoured potentiometric surface from Scenario 2 at the end of 2009, approximately five years after the implementation of Phase II of the Ouachita River Water Supply Project. As in the original model, the results of Scenario 2 show that reduction of certain industrial withdrawals in the Union County results in a shallower and less expansive cone of depression (Figure 3) relative to Scenario 1 (Figure 2). The cone of depression around El Dorado is projected to be substantially smaller by 2009, with a significantly reduced degree of coalescence with the cone of depression around Monroe, Louisiana. Also note the shift in the cone of depression from central El Dorado to the northeast due to the City's discontinuation of downtown well usage.

Figure 4 shows the contoured potentiometric surface from Scenario 2 at the end of 2034, and assumes implementation of conservation measures in Jefferson County starting in 2011 that would reduce Sparta consumption by 50 percent county-wide. Continued conservation in Union County combined with reduction of overall pumping in Jefferson County results in an even shallower and less expansive cone of depression.

Also as in the original model, the Sparta aquifer's potentiometric surface is shown to be well above the top of the Sparta Sand over most of Union County, although not in much of the El Dorado area. By 2009, substantial aquifer recovery has occurred (Figure 3) throughout Union County and elsewhere in the model domain; however the potentiometric surface in the El Dorado area is predicted to be about 100 feet or more below the top of the Sparta Sand. Also note that observed data in Union County all appear to be trending upward, although at a slower rate than that predicted by the model.

Summary

Based on model results from Scenario 2, the potentiometric surface of the Sparta aquifer is predicted to rise to, or slightly above the top of the Sparta Sand at Smackover by about 2010 and at the Airport site by about 2025, assuming full implementation of Phase II of the Ouachita River Water Supply Project. However, the potentiometric surface in and around El Dorado is projected to remain below the top of the Sparta Sand even by 2034. This is in contrast to projections made with the original model, which projected the Sparta's potentiometric surface rising above the top of the Sparta Sand under most of El Dorado as well as in more than 90 percent of the county by 2027. Figure 5 shows the top of the Sparta Sand plotted with the hydrographs at the selected model target wells.

* * * * *

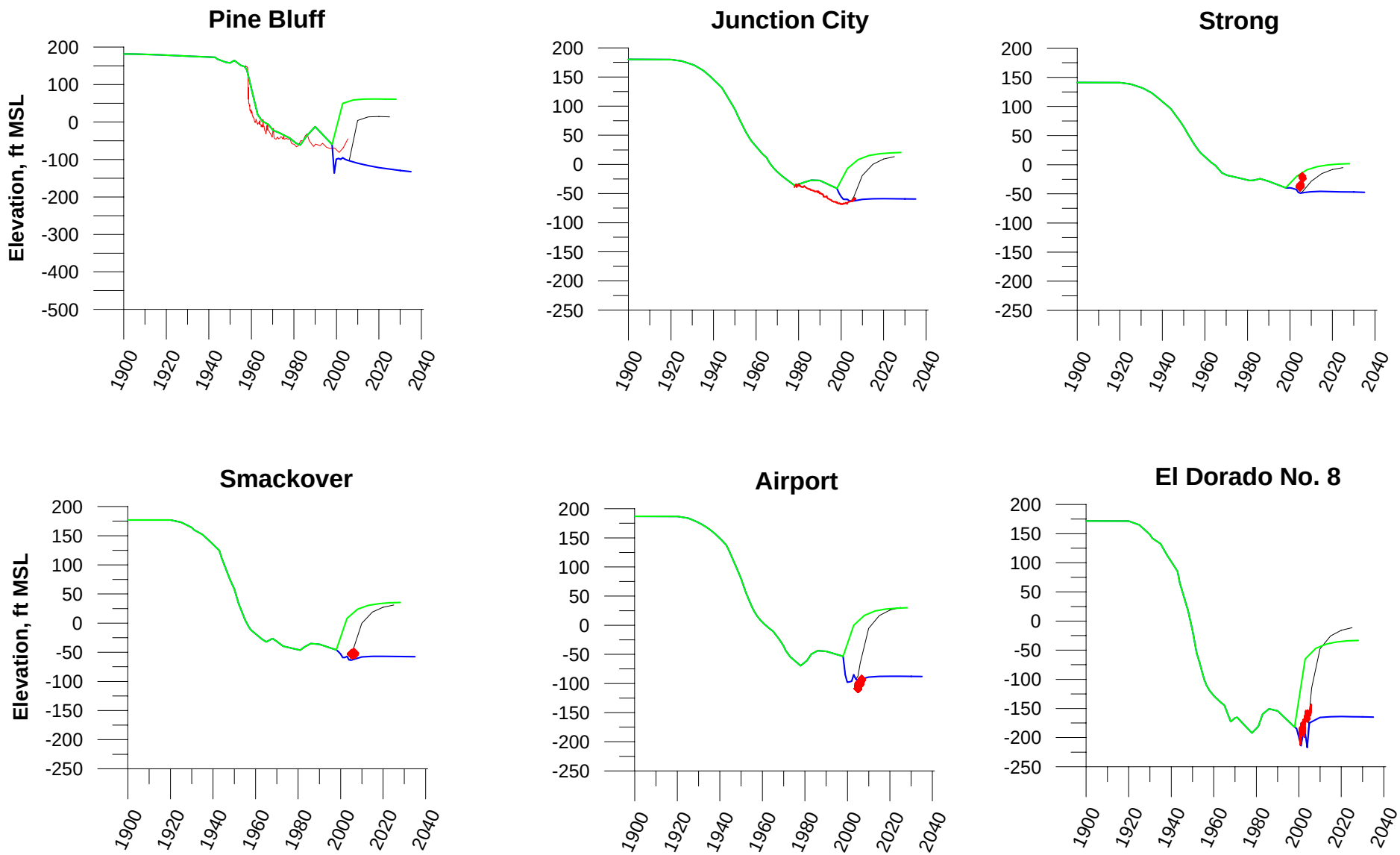

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Figure 1

MODELED VS. OBSERVED
HYDRAULIC HEADS
AT SELECTED AREA WELLS

plot120061006.grf 10/25/06

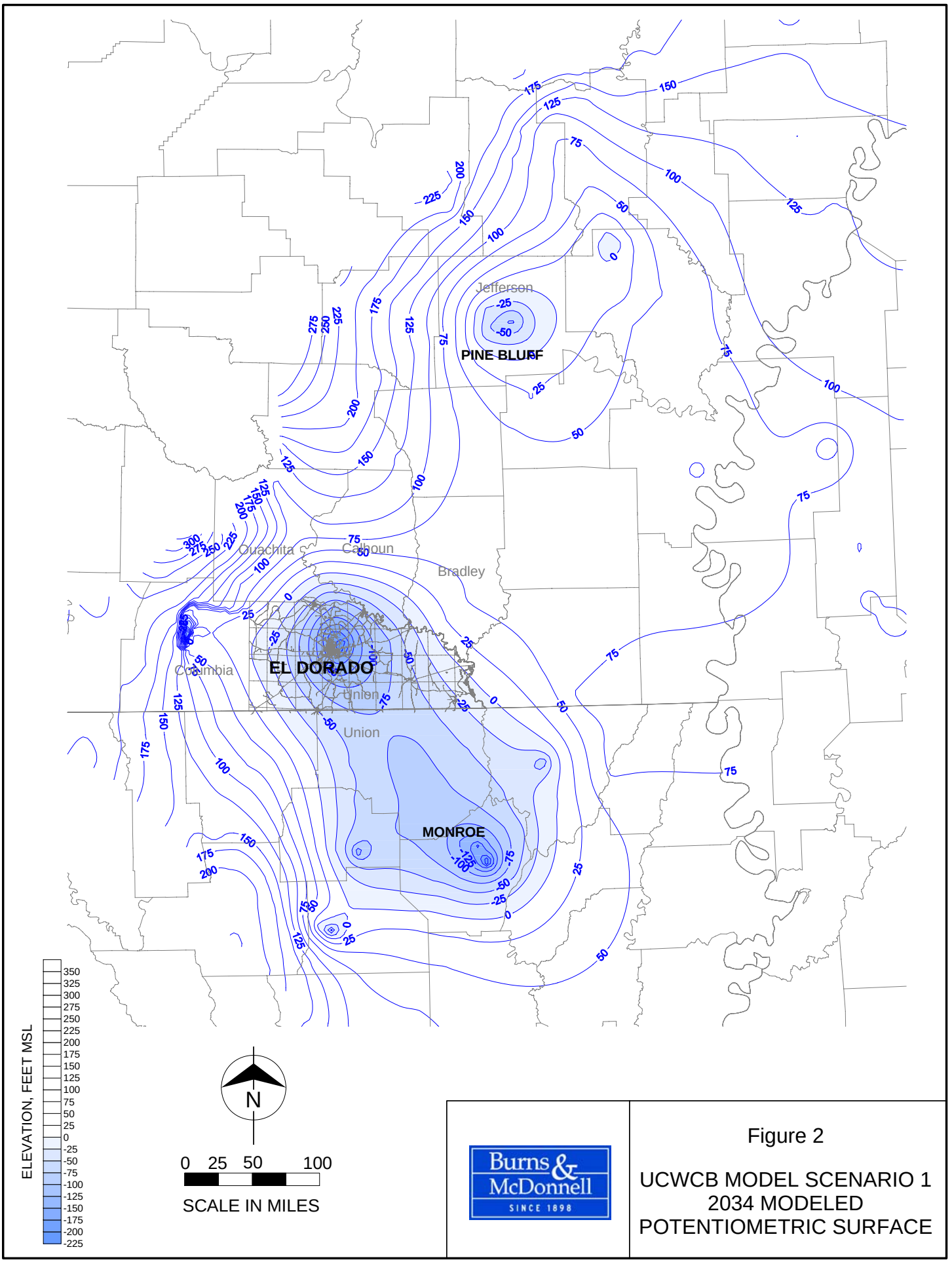

Figure 2

UCWCB MODEL SCENARIO 1
2034 MODELED
POTENTIOMETRIC SURFACE

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newsc2figure1.srf 10-09-06

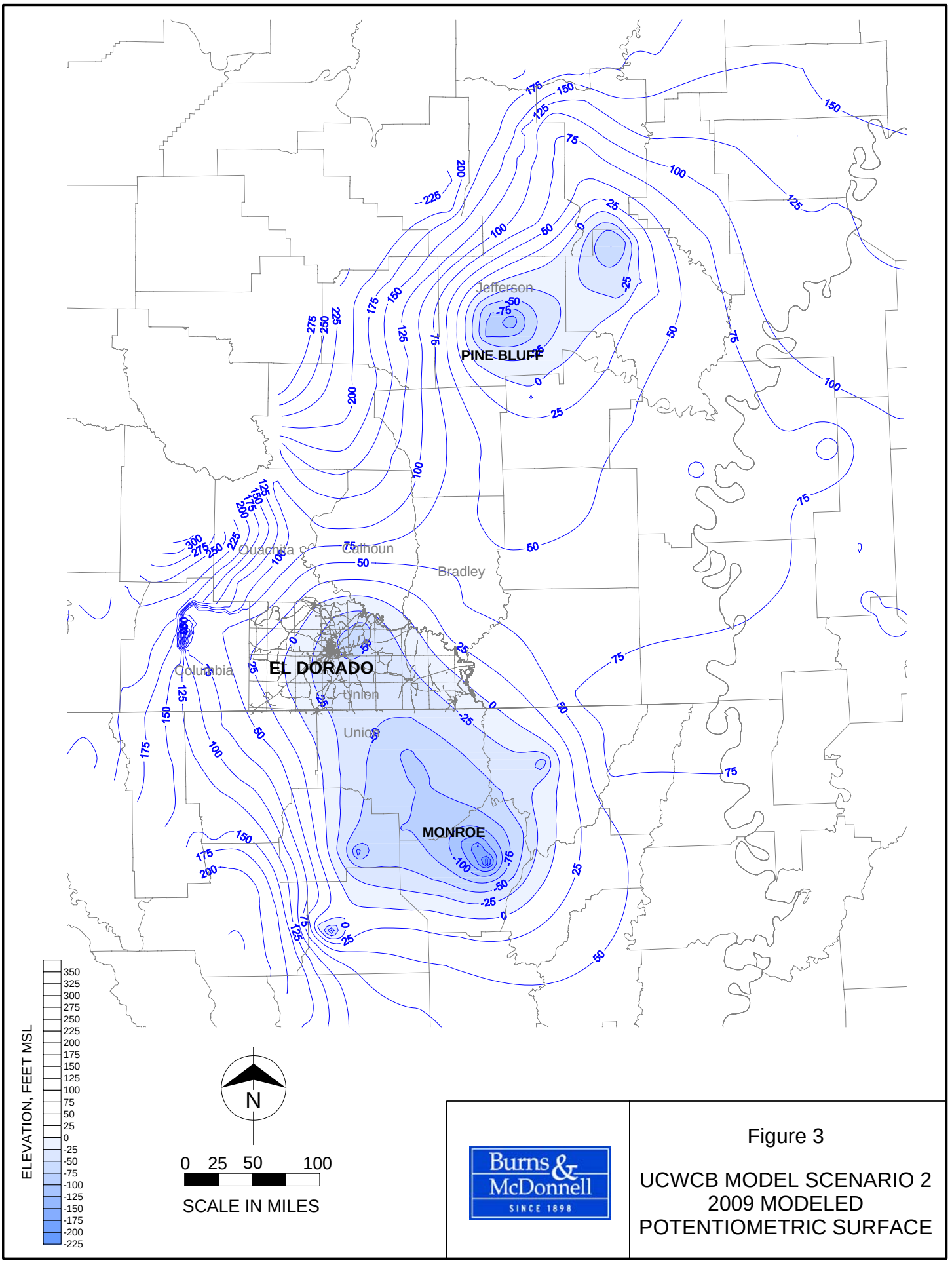

Figure 3

UCWCB MODEL SCENARIO 2
2009 MODELED
POTENTIOMETRIC SURFACE

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newsc2figure2.srf 10-16-06

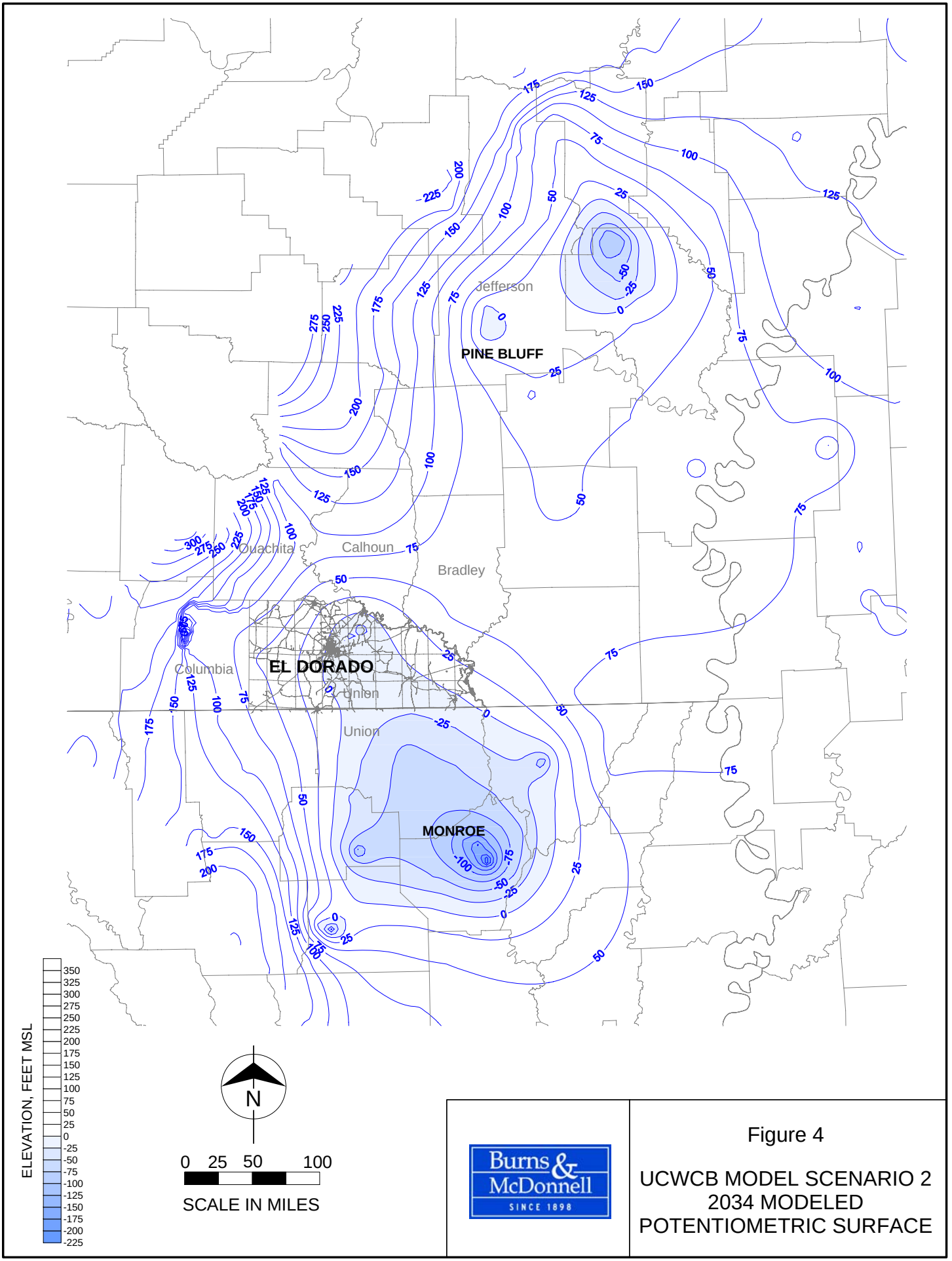

Figure 4

UCWCB MODEL SCENARIO 2
2034 MODELED
POTENTIOMETRIC SURFACE

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newsc2figure1.srf 10-16-06

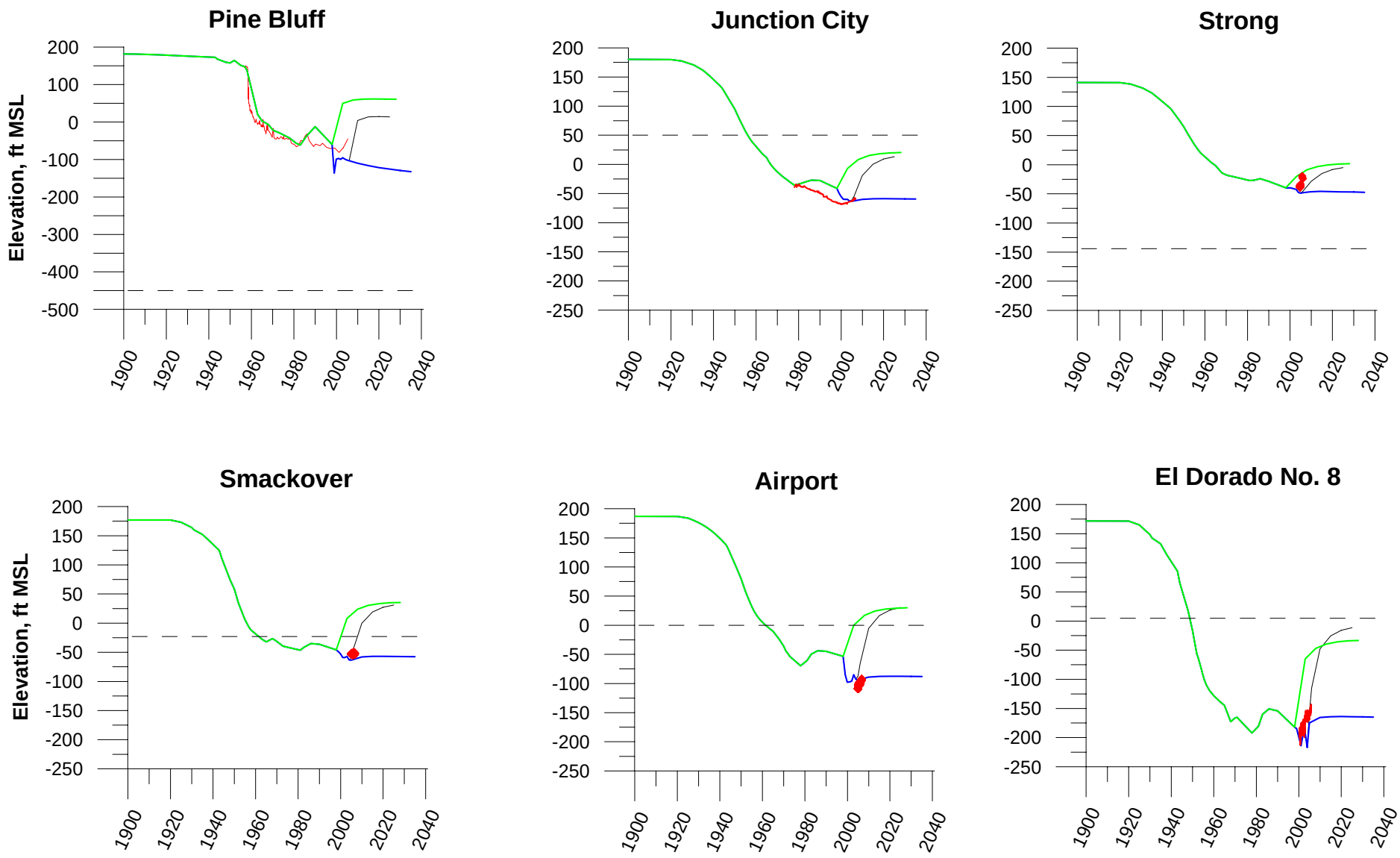

Figure 5

MODELED VS. OBSERVED HYDRAULIC HEADS AT SELECTED AREA WELLS

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Attachment 1
Union County Usage Data

Sparta Aquifer Usage Date
for Union County, Arkansas

Name	Well	2005 Totals Gallons	
Anthony	U1001	33,596,138	
Calion	U1002, U1003	23,083,000	
Eldorado Chemical	U1006 - U1010	359,353,000	
Eldo Water 21,22,23,24,25	U1011, U1017, U1018T	1,350,099,000	
Faircrest	U1023, U1024	52,564,000	
Felsenthal	U1025	7,255,000	
Batts Lapile	U1026	16,613,500	
New London	U1028	26,685,200	
Great Lakes South	U1030 - U1032	305,699,000	
Great Lakes Central	U1033 - U1035	996,225,000	
Great Lakes Newell	U1037 - U1039	0	
Great Lakes West	U1040, U1041	253,133,000	
Huttig	U 1043, U1044	37,986,000	
Johnson Township	U1045	25,116,300	
Junction City	U1046, U1047	26,496,500	
Lawson/Urbana	U1050	43,476,100	
Lisbon	U1058	14,021,500	
Mount Holly	U1059, U1060	20,765,900	
Marysville	U 1061, U1062	29,093,600	
New Hope	U1064	56,370,000	
Norphlet	U1065, U1066	60,801,000	
Old Union	U1067	42,350,100	
Smackover	U1072, U1074	122,237,000	
Strong	U1075 - U1080 and U1107	23,625,100	
Wesson/Newell	U1081	18,443,400	
Georgia Pacific	U1087	23,700,200	
Lion Oil	U1094	304,700,166	
Parkers Chapel	U1095	109,718,000	
Terris Industries (Ensco)	U1109	77,489,800	
Albemarle East	U1119	57,859,126	
		4,518,555,630	**TOTAL**

Data Source: UCWCB 2005 Union County usage data.