Rebuttal Report

Stable Isotope Evaluation of Water Budgets for the White River and Meadow Valley Wash Regional Groundwater Flow Systems in East-Central and Southeastern Nevada

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Cave, Dry Lake, and Delamar Valley Rebuttal Letter Report

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The following comments were provided based on my review of the reports submitted by Tom Meyers and Tim Mayer.

- The Kirk and Campana (1990) report was cited as evidence for the accuracy of the Eakin recharge values by both Mayer and Meyers.

Response: Although Kirk and Campana (1990) used Eakin recharge values as initial values in their models of the White River Flow System (WRFS), these values needed to be modified and water needed to be removed from and added to the Eakin (1966) WRFS delineation of this system (which used the Maxey-Eakin recharge values) to obtain model solutions. For all three discrete-state compartment (DSC) models developed by Kirk and Campana (1990), the following modifications to the Eakin recharge estimates and groundwater flow routing were needed to obtain calibrated models:

1. Kirk and Campana (1990) state "recharge from the Sheep Range to Coyote Spring Valley is at least 90% greater then previously believed". The Eakin recharge value of 2,600 acre-feet per year (afy) (0.102 m^3/s) was increased to 5,000 to 6,000 afy (0.196 to 0.235 m^3/s) to obtain DSC model solutions.

2. Kirk and Campana (1990) state "Lower Meadow Valley is part of the WRFS and contributes underflow to Upper Moapa Valley". In order to obtain calibrated DSC models, groundwater flow from Lower Meadow Valley to Upper Moapa Valley (the Muddy River Springs area) ranged from 4,500 afy (0.176 m^3/s) to 8,000 afy (0.313 m^3/s).

3. Kirk and Campana (1990) state "underflow with an average value of 4,200 afy (0.163 m^3/s) flows westward out of the system along the Pahranagat Shear Zone". In order to obtain calibrated DSC models, groundwater was removed from the Pahranagat Valley area of the original Eakin (1966) WRFS model.

Additionally, Kirk and Campana (1990; page 363) state that "This study has adopted the ET estimates of Eakin as the more rigorous approach of phreatophyte mapping was beyond the scope of this study." And on page 373 Kirk and Campana (1990) state "Eakin considered ET to be minor in all other valleys. This assumption may be in error, but is adopted for this regional analysis. In lieu of phreatophyte mapping in the study area, Eakin's (1966) estimates were used."

Thus, given the changes to the Eakin (1966) flow system listed above needed to obtain calibrated DSC models for the Kirk and Campana study and the lack of detailed ET data, citing the Kirk and Campana (1990) report as evidence for the accuracy of Eakin recharge estimates is suspect. Additionally, Kirk and Campana (1990) were limited to 74 analyses for the entire WRFS, whereas there are currently more than 500 isotopic analyses for the WRFS (Thomas and Mihevc, 2007).

- Direction of Groundwater Flows from Delamar Valley. Mayer (p. 7 and 10) and Myers (p. 17) assert that flows from Delamar go to Pahranagat Valley. Mayer then adds that a reduction in flow from Delamar will harm FWS water rights in Pahranagat Valley. Myers makes the same arguments on p. 58.

Response: Very little, if any, Delamar Valley groundwater outflow is discharging from Pahranagat Valley warm springs based on isotopic data. This conclusion is based on the much more positive isotopic values of groundwater in the carbonate aquifer and of local recharge in Delamar Valley as compared to the regional warm springs in Pahranagat Valley. The Pahranagat Valley warm springs have a discharge weighted average isotopic composition of -108.9 and -14.26 permil for deuterium and oxygen-18, respectively. A well completed in the carbonate aquifer in Delamar Valley has an isotopic composition of -100.3 and -13.33 permil for deuterium and oxygen-18, respectively, and local recharge to Delamar Valley has an isotopic composition of -92.8 and -12.39 permil for deuterium and oxygen-18, respectively. The Mayer report acknowledges that only the Eakin (1966) study has all of the Delamar Valley groundwater outflow going to Pahranagat Valley. Kirk and Campana (1990) only have about 10 % of Delamar Valley groundwater outflow (including the inflow from Dry Lake Valley to Delamar) going to Pahranagat Valley.

- According to Myers (p. 43), BARCAS had 7,000 afy of outflow from Cave Valley to White River Valley, using geochemistry information, but if geochemistry was ignored this number would be 9,300 afy. Therefore, the Myers report puts all outflow from Cave Valley into White River Valley with none going south into Pahroc Valley. The report then asserts that pumping in Cave Valley would affect the water right holders on springs and streams in White River Valley.

Response: Deuterium and oxygen-18 data indicate that little if any outflow from Cave Valley is discharging from the warm springs in southern White River Valley. The study by Kirk and Campana (1990), cited in the Myers report, has groundwater flow going from Cave Valley to Pahroc Valley for all three model scenarios with no outflow going to southern White River Valley. Thomas and Mihevc (2007) have 4,000 afy flowing to southern White River Valley from Cave Valley, but this flow enters the valley south of the warm springs. In summary, the isotopic composition of groundwater flowing out of Cave Valley (deuterium = -106.5 permil and oxygen-18 = - 14.28 permil) is too positive to contribute any significant flow to the regional spring discharge in southern White River Valley (deuterium = -119.2 permil and oxygen-18 = - 15.71 permil). Groundwater flowing from northern White River Valley (deuterium = -121.4 to -117.5 permil and oxygen-18 = -15.86 to - 15.52 permil) has a similar isotopic composition as the southern White River Valley warm springs and is the source of this spring water. Thus, pumping in Cave Valley should not affect regional springs in White River Valley.