IMPACTS OF PROPOSED SNWA GROUNDWATER DEVELOPMEMNT IN CAVE, DRY LAKE, AND DELAMAR VALLEYS, WHITE PINE AND LINCOLN COUNTIES, NEVADA

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INTRODUCTION

Prior to the early 1960s the prevailing paradigm for groundwater flow within Nevada was that each basin with its surrounding mountains was a separate system with its own local recharge and discharge. Winograd and Thordarson (Winograd 1962; Winograd and Thordarson 1975), working at the Nevada Test Site in the early 1960s, hypothesized that the Paleozoic Carbonate Aquifer that underlies a large area of southern and eastern Nevada has the potential to integrate the groundwater hydrology of a number of valleys in the area.

The Winograd/Thordarson hypothesis (Winograd, 1962; and Winograd and Thordarson, 1975) was based upon the observation that the chemistry of groundwater from the Carbonate Aquifer in wells at the Nevada Test Site were similar to the chemistry of groundwater from the major springs that are associated with the Carbonate Aquifer to the south—Devils Hole, Ash Meadows, and the springs at Furnace Creek in Death Valley. Based upon this evidence they suggested that groundwater flows beneath the Nevada Test Site in the Paleozoic Carbonate Aquifer and ultimately discharges in the large spring complexes to the south. To reach Death Valley the groundwater must flow through the Funeral Mountains.

Other investigators quickly adopted the Winograd/Thordarson Paleozoic Carbonate Aquifer hypothesis. At the time, Tom Eakin was working in Cave Valley, Dry Lake and Delamar Valleys (Eakin, 1962; Eakin, 1963); he recognized that in all three of these valleys the recharge was not balanced by the local discharge. Groundwater was flowing out of the valleys as interbasin flow, probably through the Carbonate Aquifer. He published the idea of *a regional interbasin flow system in White River area* (Eakin, 1966). This immediately lent credence to the Winograd/Thordarson hypothesis.

Since the 1960s the conceptual idea of a large Carbonate Aquifer providing the potential to integrate groundwater flow between valleys in eastern and southern Nevada has become something more than a hypothesis; it is the prevailing doctrine.

The U.S. Geological Survey (USGS) did a Regional Aquifer System Analysis (RASA) of the Paleozoic Carbonate Aquifer province; this study included a groundwater model of the entire province (Prudic, et al., 1995). Figure 1 is a map of the Carbonate Aquifer province included in the USGS RASA study.

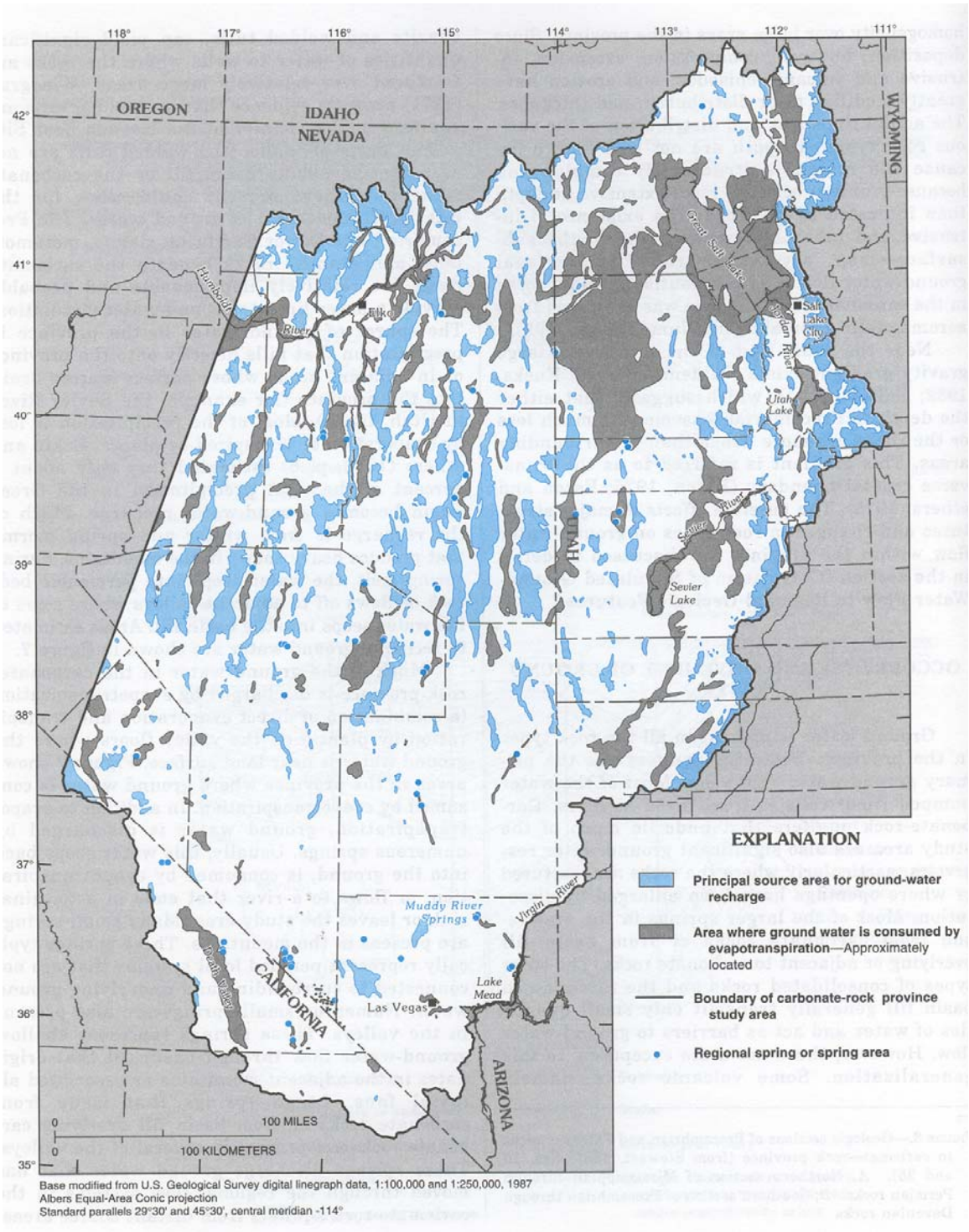

Figure 1. Carbonate aquifer province (Prudic, et al, 1995).

The carbonate province covers a large area of eastern and southern Nevada, and western Utah. The carbonate rocks are not present everywhere in this area; locally they are cutout by less permeable older and younger sediments, by igneous and volcanic rocks. However the Paleozoic carbonate rocks are present over most of the area. In the valleys, the carbonate rocks are often buried beneath alluvial sediments. The Carbonate Aquifer

provides a potential pathway by which many of the local valleys are integrated into larger groundwater flow systems.

The Carbonate Aquifer is not characterized by one master flow system. Rather the local topography of the region breaks up the groundwater flow within the aquifer into a number of regional, and sub-regional flow systems. For example, Cave, Dry Lake, and Delamar Valleys are in the White River Subregion, of the Colorado River Region flow system (Prudic, et al, 1995).

CAVE, DRY CREEK, AND DELAMAR VALLEYS

Tom Myers reviewed the estimates of recharge for the subject valleys. Tom Eakin's 1960s (Eakin, 1962; and Eakin, 1963) estimates seem as good as the more recent values; Harrill and Prudic (1998) used Eakin's estimates. The estimates are summarized in Table 1.

Table 1. Water budget estimates (acre-feet/year) for Cave, Dry Lake, and Delamar Valleys.

	Recharge	Discharge	Interbasin Outflow		
Cave Valley	14000	1200	12800		Outflow to the White River Valley
Dry Lake	5000	0	5000		Outflow to Pahranagat Valley
Delamar	1000	0	1000		Outflow to Pahranagat Valley

Based upon the hydrology of adjoining basins, and the topographic relationships between the basins, Eakin interpreted the interbasin flow from Cave Valley as inflow to the White River Valley, and the interbasin flow from Dry Lake and Delamar Valleys as inflow to Pahranagat Valley (Eakin, 1966). There are a number of springs in both the White River and Pahranagat valleys.

GROUNDWATER MODELS

SNWA argued in the 2006 Spring Valley hearing that because there was a lack of hydrologic data in Spring Valley any prediction of how the system would respond to development is inherently uncertain; furthermore, any prediction is sufficiently uncertain as to render it meaningless. They quoted my published work to bolster their argument. I countered by arguing that they took my work out of context; I believe model predictions can address relevant questions. Even with the inherent uncertainties, they provide insight into the implications of the proposed development—insights that we used to refer to as engineering judgment.

Even though there are not much data from Spring Valley, there are data from the Carbonate Province that are useful in constraining the local values to be used in any

model. Durbin (SNWA, 2006) in his SNWA model of Spring and adjoining valleys summarized much of the data from the province.

The models can provide the following relevant information:

1. How long will it take for a new equilibrium state to be reached? The answer will not be precise, but it is of interest—is it several decades or a millineum?
2. What is the magnitude of the expected drawdown?
3. How much water will be removed from transitional storage?
4. Is there a better pumping scheme that will minimize drawdown, or some other environmental impact of concern?

Admittedly, the model predictions will have uncertainty. Nevertheless, the results will provide much needed insight—as suggested above.

The USGS did a RASA model of the entire Paleozoic Carbonate province (Prudic et al, 1995). Because it covered such a large area the cell dimensions were large; the model consisted of two layers—1) the carbonate Aquifer and 2) the overlying material. The model was criticized as being too coarse in its cell dimensions, and with only two layers being overly simplistic. Even so, I find the results useful in providing insights into the groundwater hydrology of the province.

Schaeffer and Harrill (1995) used the RASA model to simulate the impact of a large-scale SNWA-like development. Schaeffer and Harrill analyzed a proposed pumping scheme of 180,000 ac-ft/yr. Their analysis provides an overview of the impact of a large-scale SNWA-like development on the entire province. The results suggest the order of magnitude of the drawdown produced by the proposed pumping. The model analysis also indicates the impacts on the major springs within the province. This analysis is the only estimate of the overall impacts of a SNWA-scale development.

Tom Myers used the USGS RASA model to analyze the impact of the proposed SNWA development on the local hydrology. Tom refined the grid in the vicinity of the valleys of interest—Cave, Dry Lake, and Delamar Valleys.

Tom's results indicate that pumping in Cave Valley will produce a relatively quick reduction in flow in the springs in the White River Valley. Similarly pumping in Dry Lake and Delamar Valleys produces a reduction in flow in the springs in the Pahranagat Valley. Schaeffer and Harrill (1995) found similar results.

SUMMARY

Pumping from the three valleys in question, Cave, Dry Lake, Delamar, will reduce the interbasin outflow from these valleys. That interbasin flow goes to support the water resources of White River Valley and Pahranagat Valley. Both the White River and the Pahranagat Valleys have major spring complexes whose flow will diminish as a consequence of development in the valleys in question.

It is my considered opinion that it is not in the State's interest to allow additional groundwater pumping in Cave, Dry Lake, or Delamar Valleys. Increased pumping will adversely impact existing water use in the White River Subregion of the Carbonate Aquifer province.

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SIGNATURE

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