Let's Talk Water – Your Questions Answered

by Dr. Mike Strobel

Before I begin, I would like to solicit input on the level of interest for these articles. This is the 14th volume of Let's Talk Water and we have discussed a wide variety of water issues. I am curious about how people view the column and if folks feel there is a benefit in learning about these issues. My purpose in writing the articles is to help people understand water. In eastern Nevada, this is an extremely important resource and community members need to understand it so that informed decisions concerning resource management can be made. If you have any input concerning this column, please send comments to me or to the Ely Times.

In this edition of Let's Talk Water, I want to address a few of the many questions I have received over the past three months. I think these questions have a general interest to the readers, so I wanted to share them and my answers with you.

Question 1: I have a question about the area of ELY - it's water? Since the west is going through terrible drought, would that town be worse off?

Many places in the west are experiencing the effects of the drought. It's probably most felt on surface water, where lower amounts of precipitation have caused decreased streamflow (Lake Mead and Lake Powell are dropping in stage because less water is coming in). We tend to see drought effects quickly in surface water because its more reactive to climate conditions (same reason we get flash floods during heavy precipitation). The drought is affecting ground water and we do see a decrease in ground-water levels in many places, but the impact is less visible than in surface water because most aquifers are huge reservoirs of water and it takes time to show large changes. Most of rural Nevada uses ground water, so the drought, although important, has less immediate impact than it might on larger cities utilizing surface water. Natural events, like drought and wet periods, usually have limited extent (a few years to decades) which will allow ground-water levels to rise and fall dependent on the climatic conditions. I think you need to look at long term records (water levels over many decades) to get a good handle on what the water conditions will be over the long run. Typically, natural changes in ground-water levels related to climate are much less than human-induced changes due to pumping.

Question 2: It appears to me, eyeballing popular maps and driving the Sunnyside cutoff, that the White River flows to the south to the Pahranagat Lakes--and that those lakes when full empty into the Muddy/Virgin/Lake Mead water body. If so, that would make the White River Valley part of the Colorado River drainage, not part of the hydrologic Great Basin. Can you confirm whether that is the case? I would guess that in all the Colorado River litigation someone has made a determination about that, even if the White River does not materially contribute to the Las Vegas / Imperial Valley water supply. (If the Pahranagat Lakes don't drain, what keeps them fresh?)

The area we refer to as the Great Basin was originally defined by John C. Fremont in his 1845 report as: "the intermediate region between the Rocky mountains and the next range [the Sierra Nevada] containing lakes, with their own system of rivers and creeks, (of which the Great Salt Lake is the principal), and which have no connexion with the ocean, or the great rivers which flow into it."

In this classic definition, the Great Basin encompasses most of Nevada, western Utah, and parts of California, Oregon, Idaho, and Wyoming.

You are correct in that the White River flows to Pahranagat Lakes and that in the past, surface runoff continued south to the Muddy River and the Colorado River. Most delineations of the Great Basin (hydrographic, physiographic, and floristic), however, include the White River in the Great Basin. The hydrographic or classic definition of Fremont includes the White River because Pahranagat Lakes have not had surface discharge to the Muddy River in historic times. This definition is similar to the Great Salt Lake which once was connected to the Snake River during a past high stand. In contrast, Meadow Valley Wash (east of the Pahranagat Lakes), and Muddy River Springs and Las Vegas Valley (south of Pahranagat Lakes) are often excluded from the delineation of the Great Basin in the classic definition because surface runoff has historically reached the Colorado River. For a detailed history and delineation of the Great Basin I suggest you read "The Desert's Past, A Natural Prehistory of the Great Basin" by Donald K. Grayson. It was published in 1993 by the Smithsonian Institution.

Other delineations of the Great Basin region consider ground-water flow. The ground-water flow system in the White River drainage is similar to surface runoff in that it also flows to the south. However, unlike surface runoff, ground-water is presently flowing into the Colorado River drainage. The contributing area for the ground water that flows into the Colorado River drainage, as estimated from ground-water budgets, ground-water levels, and chemistry, is thought to extend as far north as Butte Valley, northwest of Ely, although ground water may take centuries to millennia to travel from the northern end to the Colorado River drainage. This ground-water flow system known as the White River flow system is a series of basins made up of carbonate rock that extend from within White Pine County down to the area around Muddy Springs. In the White River flow system, many springs (such as Muddy Springs, Ash Spring, and Crystal Spring) are fed by discharge from the carbonate aquifer (as shown from geochemical analysis). Some delineations of the Great Basin include Meadow Valley Wash, the Muddy Springs region, and Las Vegas Valley because ground-water flow connects these areas with areas within the Great Basin.

Other delineations exclude all basins that contribute either surface runoff or ground-water flow to the Colorado River drainage (including those that contribute ground-water flow to the White River flow system) even though surface drainage in several of the basins has no outlet to the ocean. If one accepts the classic definition of John C. Fremont, then the White River should be within the Great Basin, however, if one also considers ground-water flow as part of the delineation, then the White River flow system could be excluded from the delineation. The difficulty in excluding the White River flow system from

adjacent areas in the Great Basin is that the boundary of the White River flow system is not known exactly (the area does not need to follow topographic divides) and the boundary could change as a result of ground-water pumping either within the White River flow system or in adjacent areas.

In response to your last question as to why the Pahranagat Lakes contain fresh water, the most likely answer is that ground water moves water into and out of the lake in a manner similar to the Ruby Marshes (Lakes) in Ruby Valley. Flow from Ash and Crystal Springs supply water to the Pahranagat Lakes. However, these lakes probably also receive ground-water inflow from the surrounding mountains. I'm not an expert on the local hydrogeology of these valleys but I assume that Pahranagat Lakes are flow-through lakes, which means that the lakes both have input and output to the underlying aquifers, and as such serve as a window to the aquifers. During periods of high lakes levels (during the past glacial period), there can be spillover to surface runoff from Pahranagat Lakes to the south. (response assistance from Dave Prudic, USGS).

Question 3: In your article on precipitation and its enclosed map, by my estimate, it seemed that Elko had more water than Ely. Am I correct? Which towns/cities have the most precipitation?

The map that shows precipitation distribution indicates that most precipitation falls in very high elevations. In the Ely area, that would be around Great Basin National Park on some of the higher peaks. In the Elko area, that would be in the Ruby Mountains and other high peaks. If you look at the precipitation record for the city of Ely (period of record 1897 to 2003) it gives an average annual precipitation of 9.53 inches. The record for Elko (at the airport, period of record 1890 to 2003) is also an average of 9.53 inches per year. So, the two cities have virtually the same precipitation amounts over the long period of record (see the interactive webpage at www.wrcc.dri.edu/summary/mapnv.html and click on any area for which you want to see weather records).

Please keep in mind that once the precipitation falls in the mountains, where it ends up (as streamflow and ground water) greatly depends on numerous variables. It is hard to make any conclusions about which town has more water based on just a precipitation distribution map.

If you have questions concerning water, please email me at mstrobel@usgs.gov or in care of the Ely Times. Next week, we discuss water witching.