Let's Talk Water – BARCASS Recharge Estimates

By Dr. Mike Strobel

Last Thursday, the project team working on BARCASS (Basin and Range Carbonate Aquifer System Study, otherwise referred to as the USGS-DRI ground-water study in White Pine County) had the opportunity to discuss the study design and approach with the public at a meeting in Ely. The presentation covered many of the topics I have and will be discussing in these newspaper articles and offered the opportunity for the public to ask questions. I have heard that not everyone feels satisfied with the scope of the study, but hopefully people now have a better understanding of the allowable scope based upon the authority provided in the language of the Lincoln County Lands Act, and the limitations because of the timeframe.

The USGS does not have a stance on water exportation. I have mentioned in every talk I have presented in eastern Nevada and in many of my articles in the Ely Times that the USGS is an unbiased, neutral organization. We are not advocates for any position on any issue and our involvement is strictly scientific. At the meeting last Thursday, a number of individuals posed questions that solicited the USGS presenters to make statements concerning water exportation and water management. We cannot and will not make such statements because the USGS has no bias concerning political or management decisions. Science is a tool for making those decisions, but USGS scientists are required to comment only on the science and not on how it is applied for decision-making activities. This is why USGS science has the reputation and regard it has been given by decision makers, including the State Engineer. We provide data and interpretations that offer the best science available without advocating any position in the water management arena

Another issue brought up at the meeting on Thursday was some disagreement concerning additional research on the ground-water system. Many people felt that there was more benefit in focusing the study specifically on the potential impacts from pumping. As pointed out in the meeting and in earlier articles, the BARCASS is limited in scope by the Lincoln County Lands Act. The Act specifies that we carry out a ground-water resource evaluation. As pointed out in the meeting, in order to evaluate the effects from pumpage, we would need two additional components to the study. One would be a long-term pumping test where we can actually measure effects in the carbonate and alluvial aquifers. The second would be a calibrated numerical ground-water flow model, which cannot be accomplished given the timeframe for the present study.

Some people felt that BARCASS, as presently designed, is not meeting the needs of the people in eastern Nevada and western Utah. They feel a ground-water study misses the point and that BARCASS should focus on the effects from pumpage for exportation. As I mentioned earlier, we are limited in the scope of the study by the law. In addition, I also believe there is a huge benefit in doing the present study because the scientific techniques now available allow us to better quantify the inputs and outputs for each basin. It is critical, in my scientific opinion, to have accurate baseline data before one can begin to assess the impacts from pumpage. You need to understand the system in order to identify

and quantify how stresses, such as pumping, affect it. BARCASS will provide the baseline information on which to compare pumping effects.

Now that I have addressed some of the issues raised in the meeting, I want to discuss the BARCASS work task on recharge. Recharge is the input part of the water budget. If you remember earlier discussions on water budgets, the simple relation is:

Input = Output + or - Change in Storage

Therefore, in a ground-water system, recharge equals discharge, plus or minus changes in ground-water levels in the aquifers. If the recharge is increased and the discharge kept constant, then ground-water levels rise. The inverse is true if recharge is decreased and discharge remains constant. Most ground-water systems in their natural state are in long-term equilibrium, which means that over the course of many years, recharge equals discharge and water levels remain constant. The reason I say “long-term” is because there will always be seasonal and climatic variations that alter the amount of recharge and discharge, but over enough years, these factors tend to equal out.

In order to understand the water budget for a particular basin, we want to measure the recharge and discharge. Recharge to a basin is dominated by precipitation in the form of rainfall and snowfall. Precipitation in Nevada mainly occurs in the higher elevations of the mountain ranges. The fate of this precipitation, whether it is lost to evapotranspiration and sublimation (snow lost as vapor to the atmosphere), runs off over the surface of the rocks, or infiltrates into openings in the rocks, depends on factors such as climate conditions, geology and vegetation cover. Water that runs off the surface or infiltrates into the subsurface can ultimately recharge the bedrock and/or alluvial aquifers.

In order to estimate mean annual recharge from precipitation, two approaches will be used. One method uses the distribution of precipitation and estimates of evapotranspiration, along with values for soil-water storage and bedrock permeability, to determine weekly or monthly recharge to the water budget. The second method involves using a rainfall-runoff model for selected basins. This model determines the daily water balance for a basin by looking at precipitation, snow accumulation, sublimation, snowmelt, infiltration into the root zone, evapotranspiration, drainage, water content in the root zone, runoff, streamflow, and infiltration from the root zone further into the subsurface. The model, although sounding quite complicated, is very useful because it incorporates all the major paths that precipitation can take once it falls on the earth’s surface.

Another form of recharge to a basin is ground-water inflow from adjacent basins. This is not something one can directly see, but measurements of ground-water gradients and geochemistry can help to quantify this component of recharge.

Once we have adequate estimates for recharge for a basin, we can compare these numbers to our estimates of discharge (which I will discuss next week) and see how closely these balance. If there are huge differences, then we can reexamine some of the

variables to see if we are overlooking something, better define those variables where we feel we have accurate measurements, and determine the degree of uncertainty we feel exists in the numbers for recharge and discharge for a specific basin. Ultimately, the goal is to quantify the amount of recharge to a basin and how certain we are of that number. This is the information the State Engineer and other water managers will look at in considering a quantity for perennial yield related to a specific basin.

Next week, I will discuss the discharge component of BARCASS. If you have any questions, please contact me via the Ely Times or at mstrobel@usgs.gov.