Manual and Automated Measurements of an Acequia System: Undergraduate research

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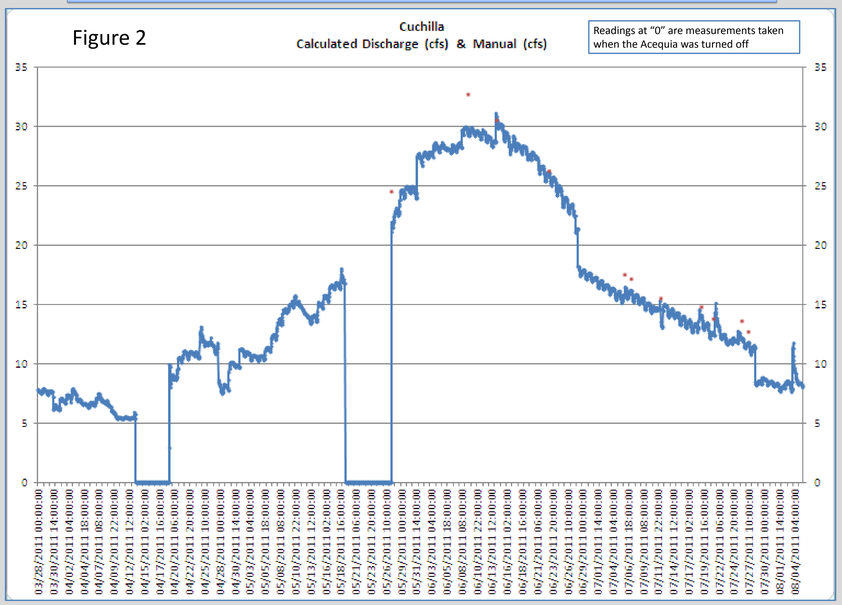
Why Measure Acequias?

River valleys are a common situation in which measurement of an Acequia system becomes important. Acequia flow measurements in a single valley can give us practical information about the usage of water, both by immediate agriculture or domestic consumption, and natural processes such as evaporation or infiltration. Several important processes, including Acequia to aquifer interactions for such a valley, are shown in figure 3. Proper and accurate measurement of an Acequia system ensures that usage is correctly distributed and accessible for the community. Measurement also ensures that a community's usage of the water system is sustainable and promotes overall health and safety for them and the environment. Figure 1 shows measurements being taken at the downstream location on the Rio Hondo, a critical measurement for determining the valleys total flow for that day.

Figure 1

Acequia Cuchilla

Figure 2



Manual and Automated Measurements

Manual: From May to August 2011 flow measurements were taken primarily in the El Rito and Rio Hondo areas. Average measurement time for each site was approximately 30 minutes, if no problems occurred. Travel time also averaged nearly 30 minutes when accounting for travel to and from lodging. 2-3 measurements were achieved per week at each monitoring site. Two manual methods were used; A Swoffer Model 2100 Current Velocity Meter and a Sontek Flow Tracker-Handheld-Acoustic Doppler velocimeter, both attached to self calibrating wading rods. Acequia measurements were taken at three inch intervals using a tape measure stretched over the Acequia and at a height above the bottom at 60% of the depth, calculated by the wading rod. Each depth and measurement was manually recorded as well as electronically for the acoustic meter.

Automated: The automated measurements consisted of three electronic measuring devices; Onset HOBO data logger, Sutron stage discharge recorder, and a Campbell scientific Pressure transducer. These three instruments took individual measurements at sixty minute intervals. The HOBO is a standalone unit that measures barometric pressure. One HOBO was placed in the flume and one in the station box. The SDR measures the depth of the water in the stilling well with a weight balance system. The pressure transducer is also located in the stilling well and measures the pressure based on the water level. All three automated devices record data that is usually collected and processed on a monthly basis to ensure proper functionality and accuracy.

Measurement Discussion

With use of the manual method we were able to ensure the accuracy of our automated systems. The manual method was far more time consuming and produced a significantly smaller amount of data. For the months of May thru August we collected roughly thirty measurements per individual monitoring location with the manual systems. For the same time period the automated systems were able to collect approximately twenty four hundred measurements each. The automated systems were very reliable and took accurate measurements but were very vulnerable to obstruction form debris and tampering. Manual measurements were also a very reliable source of data and were less likely to be obstructed because we were physically present.

Cost can be a source of limitation. The automated systems with account for labor, maintenance, and travel are noticeably higher than that of the manual method. Although cost is a major factor, in a time constraint situation, the automated system was able to produce a significant amount of reliable data, where the manual data may not have been sufficient on its own. By taking measurements, both manually and with automated systems, we were able to ensure that the data collected from both methods was precise and accurate.

Acequia Conceptual Model

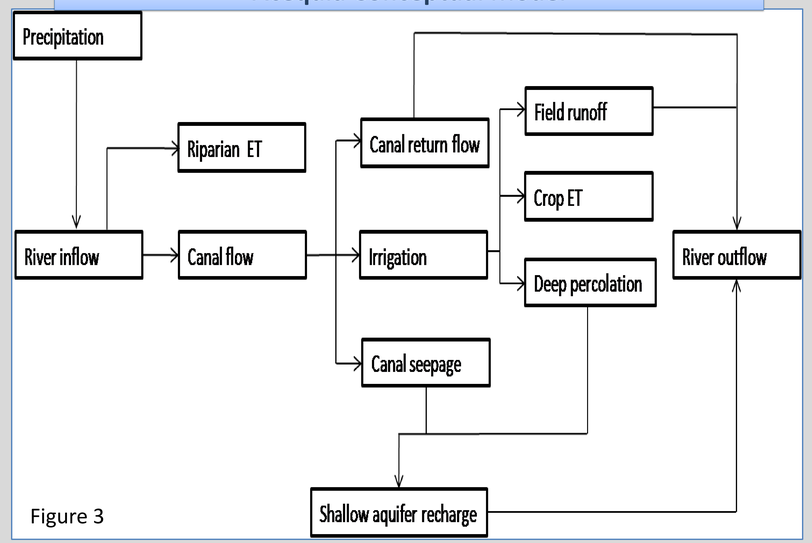


Figure 3