COLORADO CLIMATE CENTER
WALTER SCOTT, JR.
COLLEGE OF ENGINEERING
DEPARTMENT OF ATMOSPHERIC SCIENCE
1371 Campus Delivery
Fort Collins, Colorado 80523-1371
970.491.8682
www.atmos.colostate.edu

Craig Godbout
Colorado Water Conservation Board
Water Supply Planning Section
1313 Sherman Street, Suite 718
Denver CO 80203

March 6, 2020

Final Report project 5315001

This project was created to better quantify consumptive use of water on crops in the North Platte River Basin. To accomplish this the Colorado Climate Center (CCC) continued running the three CoAgMET weather stations in the North Platte River Basin that were installed in 2009 as part of an earlier consumptive use study. The weather stations are in Larand, Hebron, and Cowdrey. The purpose of the weather stations is to remotely collect the weather variables that go into calculating Reference Evapotranspiration (ET) over reference conditions. The weather variables air temperature, relative humidity, incoming solar radiation and wind speed go into calculating the reference ET. The stations also collect precipitation, wind direction and soil temperature at 2 and 6 inches below the surface.

To perform this study, a large part of this project was to install two high quality automated lysimeters adjacent to the Cowdrey CoAgMET station. The lysimeters are fully automated and allow for collection of actual ET. Two lysimeters were used as a redundancy in the event one failed. The lysimeter data is then compared to the CoAgMET computed crop evapotranspiration data. This comparison allows for calculation of more accurate crop coefficients to better quantify consumptive use in the North Platte River Basin.

This project was started by Wendy Ryan, then with the Colorado Climate Center. In May of 2015 Wendy left the CCC to work with Wilson Water Group. The CCC contracted with Wilson Water Group to allow Wendy to continue her work with the lysimeters. Wendy eventually began working with Colorado River Engineering and the CCC was able to transfer the contract over, so Wendy was able to continue running the lysimeters and the computation of the crop coefficients.

Since Wendy continued running the lysimeters, she has given updates to the Basin Roundtable of the status of the lysimeters and her results. This report will focus on the CoAgMET weather stations.

To ensure the weather stations collect high quality data they have a maintenance schedule of at least one visit per year. The annual visits are to replace bearings on anemometers (wind speed sensor) to ensure accurate wind measurements and an overall check of the system and all sensors. Every two years the temperature/relative humidity and solar radiation sensors are replaced and sent to Campbell Scientific for a factory calibration. This ensures the sensors stay within the limits and do not drift and collect inaccurate data. The stations are solar powered and have a battery for nighttime and cloudy days. The battery is also checked during all service visits. Annual maintenance visits are completed in the spring, before the growing season, to ensure accurate data from the start of the season. In addition to the annual visits, the data are quality controlled almost daily and errors are caught and fixed. If an issue with the stations comes up between visits, a special "emergency" trip is made to fix the issue.

Few issues occurred with the weather stations during this project. The stations communicate back to the CCC using radios and a repeater in the valley to the extension office. Normally the CoAgMET stations communicate using cell phone modems, however cell service in the basin is spotty, and radios do a great job. In 2016 the power cord on the repeater failed, so remote communication with the stations was delayed for a few weeks in July. This did not affect the project since the comparison is not done in real-time, however, every effort to get communication back was made. The power was restored to the radio and real-time communication was back. No data was lost during this brief downtime and data were backfilled.

Other than the radio issue, there were some minor battery issues where a weather station did not report at night due to the battery losing power and the station only running off solar power during the day. These were fixed quickly by CCC staff, CSU Extension in Walden and Wendy Ryan during lysimeter service trips.

The lysimeters were installed in September 2015, too late to gather data for the 2015 growing season. Due to issues getting the lysimeter running properly, which Wendy can explain in updates, the first two years of data, 2016 and 2017 were not satisfactory. Only two years of solid data were collected. In order to collect enough data for accurate results, at least three more years of data needs to be collected.

For various reasons this project came in under budget. In order to continue the study, it was decided to transfer the financial agent over to Colorado River Engineering for the remaining funds in the project. To keep the weather stations running and maintained so the study can be completed the Colorado Climate Center has applied for another Water Supply Reserve Account grant from the North Platte Basin Roundtable.