Water quality

Researchers look at big picture for Ark Valley

By CHRIS WOODKA
THE PUEBLO CHIEFTAIN

Water quality studies originally intended to improve agricultural practices could help predict the effects of large transfers of water to cities.


Tim Gates

Tim Gates, a professor of engineering at Colorado State University, has led a team studying water quality as it relates to irrigation practices in the Arkansas Valley since 1999.

"Theoretically, we can use our models to look at future conditions, to say what would happen if we reduce the supply," Gates said.

The study has been massive, with 288 sites on more than 200,000 acres of farmland from Manzanola to the Kansas state line. While that's about half of the irrigated land in the Arkansas Valley below Pueblo Dam, the study helps in predicting what could happen in the entire valley if Colorado Springs builds its Southern Delivery System and could have ramifications for the Arkansas River Compact.

"We're going to be using the model in the next few months to look at the SDS," Gates said. CSU has contracts with both the Bureau of Reclamation and the Southeastern Colorado Water Conservancy District to study the relationship between salinity and groundwater levels in the Arkansas Valley.

The SDS is a $900 million proposal by Colorado Springs to build a second 43-mile, 66-inch-diameter pipeline from Lake Pueblo to deliver 78 million

PLEASE SEE WATER, 2A

SALT STUDY

Some preliminary findings of research by Colorado State University researchers Tim Gates, Luis Garcia and John Labadie on water quality problems in the Arkansas Valley:

- Shallow water tables, those about 8 feet below the surface, contributed to about 52,600 acre-feet of nonbeneficial consumption in the wetter years of 1999-2001. The report states: "Considering additional water extractions by invasive tamarisks along the river banks, indications are that a substantial volume of water loss is occurring that might be recouped for the benefit of the basin."

- Shallow water tables, which create higher concentrations of salts through capillary action, dropped to about 30 percent from 40 percent of cultivated land above John Martin Dam studied during the drought years of 2002-2003. However, salinity remained about the same, 2,700 mg/L, because there was less water to flush solids from fields.

- Shallow water tables downstream of John Martin Dam were found under 30 percent of cultivated land during the drought years. Salinity increased to 4,500 mg/L from 4,200 mg/L in 2003 from 2002.

- Salinity of irrigation water above John Martin Dam varied from 618 to 1,090 mg/L, a moderate amount. Salinity of water in the Arkansas River below John Martin Dam is 2,000-4,000 mg/L, about the same as groundwater in the upper half of the study.

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gallons of water per day to the city. New reservoirs would be constructed to store water. Critics say the pipeline will degrade water quality and increase flows down Fountain Creek. The environmental impact of the project currently is under review by the Bureau of Reclamation.

The Arkansas River Compact is a federal agreement between Colorado and Kansas for delivery of water at the border. At last year's compact meeting, Kansas commissioners said water quality will be an issue in future years, much as quantity has been an issue in the past. Kansas sued Colorado in 1985 over the impacts of water development, and it took 19 years to resolve the issues.

Gates' role in those issues is to sort out the science behind the politics.

"As a university, we strive to be objective," Gates said. "If we do have a bias or motivation, it's toward developing research that will improve agricultural methods and maintain the rural lifestyle."

A sweeping project

The research model Gates is working on serves two purposes, to look at what has happened in the past and to predict what could happen in the future.

It's not an easy job. While other studies have looked at water quality in the Arkansas River basin over the years, Gates' research is the most detailed about how the use of water affects water quality. One problem is that there is no starting point, or baseline, from which to compare.

Gates' model — numbers fed into computers, updated with more numbers — can be used both to calibrate past water use and project the impact of future use. As more numbers are collected, the more accurate the tool becomes to look at both the past and future.

Gates becomes philosophical when talking about the late jump researchers have on studying the relationship between water development and quality.

"The ongoing problem of humanity is not to tackle a problem until we have a problem," Gates said. "When we start monkeying around with the system, because we never think about it, we never get the baseline data. I wish we'd started in 1980 or 1990."

During the mid-1980s, major water rights sales and exchanges began to move water out of the lower Arkansas Valley to diversion points upstream. Water quality may have suffered as a result, but there aren't the type of detailed numbers Gates is collecting to make a comparison.

The study area is divided into two major regions:

- Above John Martin Dam, in a 40-mile stretch from Manzanola to Adobe Creek near Las Animas, 170 sampling sites are on 125,000 acres of irrigated land.
- From Lamar to the Kansas border, a 30-mile stretch, 118 wells on 80,000 irrigated acres are being tested.

Samples are taken weekly during irrigation season and less frequently after the season ends to determine changes agriculture itself has on the water.

The area is split because water quality in the Arkansas River becomes worse as it flows east.

'Maintain balance'

Preliminary results of the testing show the right amount of water is more important than too much or too little for farmers in improving crop yield, Gates said.

"Those plants in the field are distilleries for salt," he said. "If you don't maintain a balance, you see salinization."

In 1999, when studies began, it was a very wet year. In 2002 and 2003, Colorado endured a severe drought. What had caused misfortune to farmers created an ideal laboratory for Gates.

Three major quality issues are being studied:

- Waterlogging, where capillary action leeches minerals from the ground to the top of the water table.
- Salinization, where solid particles become more concentrated in water.
- Selenium and iron concentration, which become harmful to wildlife above certain levels.

Gates found overwatering fields in wet years increased salinization and mineral buildup in water tables, while in dry years, there wasn't enough water to leach harmful components from the water. This reduced the yield as much as 89 percent in some fields, and overall by 11 to 19 percent.

"You have to have good conditions for drainage. Beyond the root zone, water has to be able to flow at a high enough rate to flush the system," Gates said. "You can never have good irrigation without adequate drainage. Crops don't like excess salt."

When the water table dropped, and some areas couldn't be irrigated, the overall level of salts in groundwater did not change. In some cases, salt levels dropped because waterlogging stopped, but in other cases, there wasn't enou water to leach out solids.

"In a more normal year, yo can try to achieve a better ba ance," Gates said. "How do w learn how to do that?"

Future projections

So how will taking mo water out of the river as citi grow, or flushing more minera down Fountain Creek, affe water quality if Colorad Springs develops SDS?

Gates said a larger sca model is being developed look at the entire Arkansas Va ley, extrapolating calibrati and projections from the stu area to the whole valley.

"The larger scale model w encompass every tributa along the river," Gates said. " takes into account all the wat rights within the valley and th Arkansas River Compact. . We can look at what would ha pen if rates and quality chan and look at the effect dow stream at every headgate."