The Middle Rio Grande Conservancy District

Challenges for the 21st Century

David Gensler, July 15, 2009
The Middle Rio Grande – New Mexico
EL VADO DAM
On the Rio Chama - For water storage

COCHITI DAM

ANGOSTURA Diversion Weir

ISLETA Diversion Weir

SAN ACACIA Diversion Weir

Bosque del Apache Refuge
Irrigated agriculture in New Mexico is very old, perhaps older than anywhere else in the United States. Founded by Spanish colonists in the early 1600’s, but prior to that the region’s Pueblo Indians were practicing flood irrigation along the banks of the Rio Grande.
The MRGCD formed in 1925. It combined an existing system of 79 independent Acequia associations, many of which were over 300 years old. It is complex, but still remarkably effective at delivering water to over 70,000 acres of middle valley farm land.
• MRGCD constructed 6 diversion structures, 400 miles of main canals, and 800 miles of drains. It also constructed a levee system throughout its 150 mile length, and a mountain storage reservoir of 180,000 AF capacity. Completed 1935
El Vado Reservoir
Construction was completed in 1935 and provided MRGCD with the ability to store over 180,000 Acre Feet of water for irrigation purposes.
El Vado Spillway and Outlet Works
Spillway capacity of 20,000 CFS,
Outlet works capacity of 6,850 CFS
Cochiti Dam

Constructed by USACE, replacing original MRGCD diversion weir of the same name. Completed in 1975 to provide about 1,000,000 AF of flood protection for the middle valley.
Angostura Diversion Weir
6 miles north of Bernalillo, provides water to Albuquerque division of the MRGCD.
Isleta Diversion Weir
Located at Isleta Pueblo, south of Albuquerque. MRGCD’s largest diversion point, this structure provides water for MRGCD’s Belen division, and much of the supply for Socorro division.
San Acacia Diversion Weir
Final Diversion point for MRGCD, and the site of much of the Rio Grande Silvery Minnow Controversy.
Life was Good!

Then, we were struck with a pair of 3” hammers.

Rio Grande silvery minnow
*Hybognathus amarus*

Southwestern willow flycatcher
*Empidonax trailii extimus*
• MRGCD efficiency improvements began in 1997, as a response to ESA, drought, urbanization pressures, and increased awareness of water supply.

• MRGCD and irrigated agriculture were criticized by the environmental community for inefficient practices, and blamed for the demise of the RGSM. The state of New Mexico was also critical of the MRGCD for perceived over-diversion.

• In response, MRGCD began a program of measurement, automation, and the re-introduction of irrigation scheduling and rotational water delivery.
Telemetry

Measurement

SCADA

Automation
•This program initially involved expansion of, and improvements to, measurement.....After all, how can you manage a resource when you don’t know how much of it you have to manage?

MRGCD had 15 gauges, equipped with Stevens recorders, data picked up at the end of each season.
When you have a good measurement, how do you provide timely access to the information for management purposes? Telemetry!.

First attempt was GOES satellite. Effective, but had time limitations. A one way street!

Next try was telephone. Both landline and cellular. Worked, but the recurring costs quickly soared!
Third time was the charm for MRGCD. FM licensed radio proved to be the final solution. Very reliable. Moderate initial cost. Very low recurring cost.

Some initial setbacks, until the right equipment source was found, but now MRGCD has near 100% RF throughput rates to anywhere in its service area.

Cost per site is low, about $2500 per new installation.
In 1998, we began replacing old gauges with concrete long-throated metering flumes, and added new sites. We now have about 75 gauging structures, most designed with BOR “Winflume” software.
The same metering flume structure in operation
ALGODONES DRAIN GAGE AND FLUME

BEFORE (2001)

AFTER (2003)
CONSTRUCTION OF FLUMES ALLOWS FOR A STRONG CORRELATION BETWEEN STAGE AND DISCHARGE

Compare stage/discharge measurements before and after flume construction on the Algodones drain in 2002.
New flume and gauge on the Isleta Drain, measuring inter-division return flow.

• Gauging projects soon led to automation projects!

Once we figured out how much water was moving where, we realized how badly automatic control was needed.
First automated gate in MRGCD, at Central Avenue Wasteway
A “do-it-your-selfer” project, with great educational value.
Initial automation efforts tended to be at diversion structures including Langemann gates at Angostura dam. In the photo at left, one of the gates is being maneuvered into place with a crane.

Completed control gates at Angostura dam. These gates measure the flow being diverted, and automatically adjust for changing river levels.
• Initial automated major diversion structures, but quickly followed by construction of automated structures at the lateral level.

Typical automation of a Lateral heading using Langemann gate and concrete box structure.

Controller/RTU used in MRGCD automated structures. Incorporates I/O, logic, and communications in a single device.
Typical automated check structure in main canal using a LOPAC type gate
The “accidental” SCADA system

• MRGCD built gauges, automated gates, and incorporated telemetry. But, these components were developed nearly independent of each other. What was missing was a way to tie all these components together.

• While searching for appropriate software to control the telemetry devices and store data……….BANG!

• Suddenly, it was all tied together and we realized we had created a SCADA system!
MRGCD now has a comprehensive system of control screens at the Division Level, allowing the operator to drill down to Canal Level and Gate Level for remote monitoring and control of structures.
Images of control screens are pushed out to the web for public.
• A system of climate stations (20) has been installed through the valley to provide information for crop and riparian ET calculations.
ET Toolbox (a precursor to DSS) has been developed to assist both MRGCD and irrigators to determine water needs. Not only for crop use, but for “River” use as well.
Colorado State University has developed a “Decision Support System” (DSS) for MRGCD. This system attempts to predict “demand” in various portions of the MRGCD, and schedules canal operations to meet those needs.

The DSS depends on the following inputs:

- Real time and forecast meteorolgy
- Acreage and cropping patterns
- Soil type and moisture content
- Canal parameters (capacity, length, slope, etc.)
- Operator inputs

The result is both a predictive and real-time operational model for MRGCD water deliveries that will be implemented for the 2008 irrigation season.
Water 2025 funding has been used to perform a pilot canal lining project (Phase I now completed) on the Cochiti Main Canal. This project includes a metering flume visible in the background of the photo below.
8400’ of the Cochiti lining project is complete and 3 new check structures have been installed and automated.

View looking south along Cochiti Main Canal lining project.

New Check Structure (automated after photo taken) on Cochiti Main Canal lining project.
The amount of water used by crops stays essentially constant. Reduction comes from both loss and return flows.
Due to these various efficiency improvement projects, MRGCD diversions have averaged about 6.0 AF/acre over the last 8 years. Deliveries to irrigators have remained steady.

What are the implications of the diversion reduction?

• At times, more water left in river
  • Smaller releases from storage
  • More carryover storage
• More consistency for irrigators
• Assisting NM to meet its RG Compact obligations
More consistent water supply for the MRGCD means the risk of catastrophic drying down to Isleta Dam is minimal.

Also, MRGCD water provides carriage for Federal Water leased for species purposes, allowing that water to do what it is intended, instead of paying carriage losses.

However, at many locations, return flows have been reduced to near zero, and the Rio Grande is probably drier than a decade ago.

This is particularly interesting since a primary driving force for the changes was to provide water for environmental purposes. Many from the environmental community have difficulty understanding this “efficiency paradox”
A closing example!
MRGCD is fully committed to continuing efficiency improvements for the benefit of the Rio Grande, the RGSM, and all middle valley residents.

Thank You!