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COLORADO DIVISION OF WATER RESOURCES
DEPARTMENT OF NATURAL RESOURCES

# StreamLines

Quarterly Newsletter of the Office of the State Engineer

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COLORADO DEPARTMENT OF NATURAL RESOURCES

## Construction Activities on Bear Creek at Morrison Gage

**Rodger Burcher, Hydrographer, Division 1**

The Bear Creek at Morrison gage was established on April 1, 1888, and has been on both sides of the stream at four different locations within 500 feet of the present location. The maximum discharge of record was 8,600 cfs in 1896. The maximum discharge during the past two decades was 894 cfs on June 18, 1995. The control at each location has been the cobble and boulder bed of the natural channel.

The sustained high flows of 1995 eroded the channel to a point where the stilling well inlets were well above the point of zero flow. In 1996, the 48-inch corrugated shelter and well were excavated and a new 48-inch well was set on a concrete base, and a recycled 60-inch corrugated shelter was set on the well.

Even though recent maximum discharges have been less than 250 cfs, the channel has continued to erode. During the drought experienced this summer, the stilling well inlets were again above the point of zero flow and the discharge was measured as low as 1.18 cfs.

The Bear Creek at Morrison gage is critical for administering downstream irrigation rights, as well as upstream and downstream municipal rights. During the worst of this summer's drought period, it became obvious that the gage required immediate attention.

Mr. Robert Cooper, Chief Hydrographer in Division 1, drafted a letter to the State Engineer and the Colorado Water Conservation Board explaining the seriousness of the situation and, within thirty days, funds were allocated to install a new control.

The bid from the contracting firm of Kemp and Hoffman was accepted and construction began in early September. Within two weeks, construction was completed and the gage now has a stable control. The control is a six-foot Cipoletti Weir contained within a broad crest weir. The weir is a five-foot high, steel reinforced concrete wall keyed three feet into the streambed and extending approximately 40 feet across the channel. After being rated, it is expected that the control will accurately measure flows from one to one thousand cubic feet per second.

# The Woes of Low Flows

**Bill Tyner, Assistant Division Engineer, Division 2**

Drought conditions in the Arkansas River Basin created historically low stream flows in numerous locations, including many instances of dry stream beds where even the basin's old-timers had never seen a dry river bed before. The low flow conditions did not, however, make either hydrographic work or water administration efforts particularly simple during 2002.

For example, the reach along the Arkansas River from Pueblo Reservoir at the west edge of the City of Pueblo to the confluence with Fountain Creek on the east edge of Pueblo became an area of focus involving a relatively small amount of water that required an inordinate amount of administrative and measurement activity.


Flood events like the one shown above on the Purgatoire River near Highland diversion dam were rare occurrences in 2002 in the Arkansas River Basin

Municipal water supply for Pueblo, Pueblo West, and the St. Charles Mesa east of Pueblo primarily is obtained from the Arkansas River in Pueblo Reservoir. The Pueblo Board of Water Works is the entity that manages the supply to Pueblo and manages a contract to deliver water downstream to the Comanche Power Plant, a large coal-fired power plant east of the city that supplies Pueblo's electrical power. A second, smaller private power plant owned by Aquila Corporation also receives water for cooling purposes from the Arkansas River in this reach. Additionally, a fish hatchery just below Pueblo Reservoir requires some water flow in order to maintain fish rearing operations.


Reservoir Outlet Gates at Pueblo Reservoir

One or more gates usually are releasing water as shown on the left. In 2002, Arkansas River flows were so low that all of the main gates were shut and a small gate through the fish hatchery was used to supply most of the flow below the dam.

Under normal conditions, the delivery of water downstream from Pueblo Reservoir to the two power plants is almost an incidental function of normal river operations because the requirement of the two plants (approximately 50 cfs combined) is usually small compared to the average summer flow of 500 cfs to 1,500 cfs that usually occurs through this reach. This summer, however, the river flows were so low that the Arkansas River call often was set at the Pueblo Board of Water Works April 1, 1874 water right. This meant that the Pueblo Board of Water Works was effectively "drying-up" the Arkansas River at Pueblo Reservoir in order to divert as much municipal supply as possible and little flows were being delivered from the reservoir to agricultural users below. Under these conditions it was still necessary to meet the needs of the two power plants to avoid creating another municipal problem through lack of electrical power generation.

Division of Water Resources staff, including Charlie DiDomenico, Monique Morey, Tony Gutierrez, and Tom Ley, worked carefully with all of the entities involved to try to maximize the limited water supply by identifying the daily minimum needs of each of the power plants and the fish hatchery, reviewing changes to inflow conditions and reservoir release requirements,

Diversion dam for one of the two power plants. Normal flows in this reach would remove the need for additional stream flow measurements. To ensure each power plant had enough water, CDWR staff measured flows just upstream and downstream of this dam at numerous times during the summer.

## The Woes of Low Flows (cont.)

making stream measurements more frequently — at locations not normally gaged — and calling for the reservoir outlet gates to be set appropriately. Through this extra effort, the City of Pueblo's critical needs were met, while causing no major disruptions to either of the power plants, and maintaining a reasonable flow through the fish hatchery to support operations.

Small amounts of water required careful measurement and administration to ensure

Alan Ward from the Pueblo Board of Water Works, Mark Even with Aquila Corporation, Jim McKissick and Dave Harris with the Pueblo Hatchery, and Steve Williams and Roy Vaughn with the U.S. Bureau of Reclamation operations staff at Pueblo Reservoir were also instrumental in communicating effectively to facilitate the coordination necessary to conserve the limited water supply.

Releases from Pueblo Reservoir were often small enough to be routed entirely through the fish hatchery. Hatchery staff worked with DWR to offset any depletions through the facility and communicated daily to ensure variable flows would not upset the fish rearing operations.

## Drought Results in Curtailment on Yampa Mainstem

**Robert Plaska, Division Engineer, Division 6**

For the first time in history, diversions to ditches on the mainstem of the Yampa River below Stagecoach Reservoir were curtailed to allow delivery of reservoir releases to power plants in Craig and Hayden. With river flows at historically low levels, reservoir releases were made from Elkhead, Stagecoach, and Steamboat Lake reservoirs for the benefit of the power stations located in the basin. In order to deliver these releases, ditches on the mainstem of the Yampa River and on the Elk River were curtailed to their decreed amounts based upon their relative priorities and the available natural flow. In order to effect the curtailment, many ditches were required to install or reset measuring devices. Thanks to the cooperation of the users, no formal orders had to be issued by the Division 6 office for the affected structures.

The curtailment of rights on this section of the Yampa River posed several problems that had never been faced before. The reach of the river that was subject to the curtailment was over 70 miles in length and spanned three water districts. A combined priority list was compiled to allow the water commissioners to determine which ditches were in priority for the available flow. The determination of the amount of native flow that could be diverted was also a problem. With only three river gages over the 70 miles, it was extremely difficult to estimate the amount of native flow and reservoir releases that were available at any location on the river. Adding to this difficulty was the fact that there have never been any gain/loss studies for this reach of the river and transportation losses were higher than expected.

In retrospect, the Division office learned some valuable lessons from the curtailment of the rights on the Yampa. First, it took a great amount of time for the water commissioners to explain what was happening to all the water users that wanted a first-hand explanation. Second, given the number of gaging stations located on the river, it was extremely hard to determine the amounts of available flow. Finally, there is a serious need to obtain additional information on the magnitude of transit losses in the system during low flow periods. The Division hopes to address these issues to be better prepared in the event a similar situation occurs in the future.

Mark your calendars for the **2003 Arkansas River Basin Water Forum**, which will be held March 27-28, 2003 at the University of Southern Colorado in Pueblo. The theme for the forum is ***"Watering Your Future."*** For more information, call Robert Appel at (719) 336-9421 or e-mail rappel@co.usda.gov.

# Ground Water Level Monitoring Program

George Van Slyke, Project Manager, Geotechnical Services Branch

Prior to 1988, the Division of Water Resources monitored fewer than 100 wells. These were mostly located in the alluvial aquifers in the Lost Creek, Kiowa-Bijou, and Upper Black Squirrel Designated Ground Water Basins. The U.S. Geological Survey performed almost all additional monitoring. During the 1980s, the USGS began discontinue monitoring of wells due to budgetary restraints. In 1987, the legislature passed Senate Bill 200 that created a ground water management cash fund allowing the Division to retain a portion of well permit fees to be used for ground water investigations and management. Part of the fund was designated for development of a statewide monitoring network.

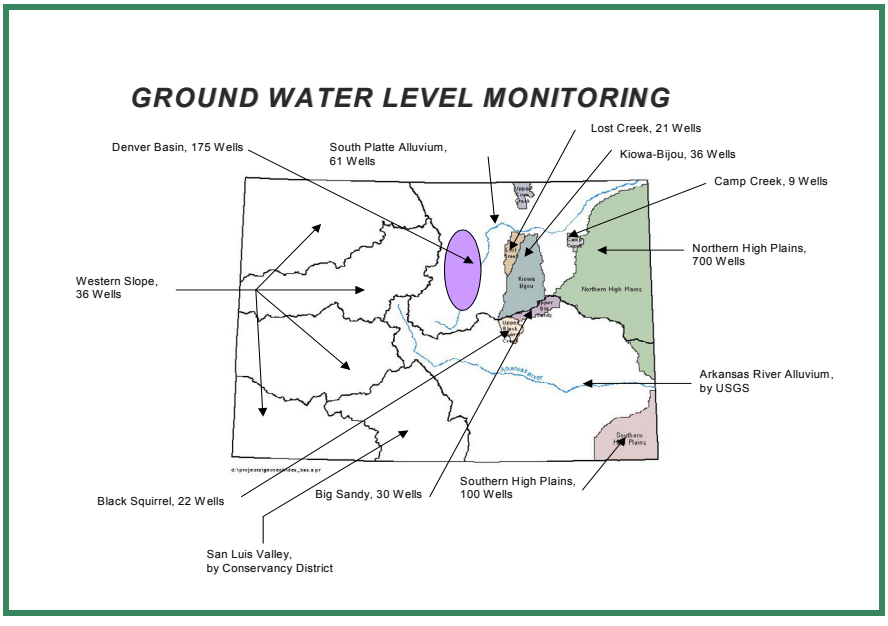
In 1988, a monitoring network was established for the Ogallala Aquifer on the eastern plains. The network utilized the existing USGS network. In addition, officials met with management districts to determine what they would like in a new network. The two items that consistently came up were: 1) well locations should be presented in a form that the well owners could identify; and 2) reports should be timely. In general, the USGS reports were completed between one and two years after the measurements were taken. The locations were given in a code or by latitude and longitude, and both methods were unfamiliar to local farmers. One of the main objectives was to develop a good working relationship with both the management districts and the farmers. To this end, staff began contracting with the districts to do the actual measurements with the Division analyzing and publishing the data. This proved to be a great working relationship. The first report was published within a month of the measurements.

Between 1988 and 1992, a network was established for most of the state and presently includes about 1200 wells in both bedrock and alluvial aquifers. The diagram below shows the distribution of wells measured. For each area, wells are measured, data analyzed and reports written each year. The reports are generally within a month of the measurements and reports are provided to the cooperators free of charge. For all other interested parties, there is a nominal fee to cover the cost of printing. The cost to maintain the network is about $50,000 per year. This is used for contracting with districts, making measurements with Division personnel, printing, and equipment.

The benefits of the program include:

- measurement of about 1200 wells annually;
- water level reports produced in a timely manner;
- analyses of water level trends and depletion by trained hydrgeologists of the Division;
- data given to well owners and cooperators free of charge;
- public contact during measurements and timely reports contribute to a positive image for the Division;
- having reliable and accurate data aids in the effective administration of ground water resources; and
- the technical and consulting community rely on our data and interpretations both for individual projects and in court proceedings.

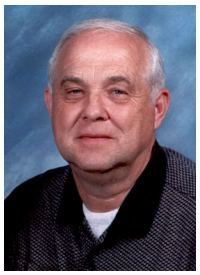
The diagram below shows the areas that are monitored and the number of wells in each area. Annual reports are prepared for each basin monitored.



# Human Resources

**New Employee — Sean Barr** began working for the Records Section in the Denver office on September 8, 2002. Although Sean has held a variety of working positions ranging from carpentry, to scanning, to serving customers, this is his first actual full-time job. Sean graduated from home-school in March 2002, and worked for the Division as a temporary hire for six months for the imaging project. His duties will include front desk customer service, prepping, scanning, filing, and special imaging-related projects.

## Retirements



**Dick Stenzel** retired at the end of November from the Division of Water Resources after working for 25 years with our agency. He was the Division Engineer in Water Division 1 from 1995 to 2002. Prior to that, he served as Assistant State Engineer for the North Region of the state from 1992 to 1995. He has held other management positions including Assistant Division 1 Engineer and Chief of the Water Management Branch. He also served on the Republican River Compact Engineering Committee and the South Platte Cooperative Agreement Water Management Committee. Upon Dick's retirement, it is his intent to complete a book on the history Colorado Water Development and the Appropriation Doctrine that he has drafted and put on shelf during the last 10 years.

**Will Burt,** Deputy State Engineer, retired from the Division on November 25. He was hired in 1972 to coordinate efforts between DWR and CSU to develop the Water Data Bank. This project used an early hierarchical data base system. DWR had already computerized its well data on an IBM mainframe, but that system was hard-coded and inflexible. DWR quickly saw the advantages of using a data base as the core of the data storage system. In 1978, many of our younger engineers were becoming computer literate, and wrote a variety of programs for their own use, including finite difference models and Blaney-Criddle Analysis. Word processing, spreadsheets, and PCs were still a figment of imaginations somewhere. When PCs were introduced in 1980, the Department soon proclaimed Wang as the department standard. Several were on hand when Will Burt returned to the Division after a five-year stint working for AMAX Mining, where computers of a variety of sizes, including IBM PCs, had been employed productively. Soon after Will's return, the Wang standard was quickly discarded in favor of IBM-compatibles, but the problem of standardization continues to this day. No longer was the Division dependent on the CSU mainframe. Simultaneously, PC data base software was employed to store the years of accumulated water data. Another major innovation occurred in 1985, when the Satellite Monitoring equipment and software was installed. This system remained in use until the year 2000, when the millennium change forced a conversion to a PC-based system. Over those many years, the Division enjoyed unprecedented efficiency benefits. No longer were employees required to visit stream gages daily to retrieve current data. That data was available first by computer in Division offices, later by dial-in from water commissioners' homes, and eventually by calling up a voice synthesizer on a touch-tone phone. In addition, our water users had access to the data as well. Above all of the Division's technology advances, Will credits this one as having done the most to improve productivity, and thus enabling doubling the numbers in administered water rights, headgate visits, and several other measures, with virtually no increase in staff over the period 1990-2000! Now the Division has entered into the central data base, GIS, and Internet age. These influences seem to be combining to again swing the computer development pendulum back to a more centralized, standardized, approach. These technologies provide huge benefits, but Will stated that he was happy to be here during the hot-rod years when individual development was encouraged, and at times, anarchy reigned!

**Bill McIntyre** retired the end of November. He started in 1984 as one of five dam inspectors hired due to the Lawn Lake Dam failure and performed 700 dam safety inspections over six years. Bill transferred to water supply and interstate compacts branch for three years, where he assisted in the Arkansas River litigation, Rio Grande Compact and Republican River Compact issues. In 1992, with the advent of teams in the Denver office, he was assigned as a Team Leader for Division 1 in support of surface and ground water responsibilities (outside of the Denver and Designated Basins).

**LaVera Davis** is retiring from the Division on December 31, 2002. LaVera started as a temp in February 1990 and was hired as permanent in August 1990. Her duties included data entry, permit issuance, and processing changes of ownership, permit extensions, monitoring hole notices, and statements of beneficial use. Her knowledge of the system will be greatly missed.

**Diana Melaragno** is retiring on December 31, 2002 after working for the state for 31 years, 23 of which have been for the Division of Water Resources. Due to Diana's perseverance and dedication to excellence, she advanced from a Data Entry Clerk, to Desktop Support, to Network Administrator covering 14 remote offices. She was instrumental in rolling out the first PC's in the mid-1980's and has probably repaired everyone's computer at some point over the years. Her easy-going manner and conscientious style has made Diana a favorite of the computer users. She now has more important things to "support" — her two beautiful grandchildren!

## CALENDAR OF EVENTS

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| **January 22-23** | Colorado Water Conservation Board Meeting, Northglenn, Colorado; for more information, contact Catherine Gonzales at 303-866-3441 |
| **February 4** | Colorado Board of Examiners of Water Well Construction and Pump Installation Contractors Meeting, Denver, Colorado; for more information, contact Gina Antonio at 303-866-3581 |
| **February 21** | Colorado Ground Water Commission Meeting, 1313 Sherman Street, Room 318, Denver, Colorado; for more information, contact Marta Ahrens at 303-866-3581 |


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**http://www.water.state.co.us**

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