



CSI—DAM SAFETY FORENSIC ANALYSIS AT GILLETT RESERVOIR DAM

Bill McCormick, Dam Safety Engineer, Division 2

On September 1, 2006 the Pueblo office of the Division of Water Resources received a call from a Colorado Department of Transportation (CDOT) representative who described an apparent dam failure. The CDOT representative described that on the afternoon of Friday, August 18, 2006, under clear skies, water was reported overtopping the State Highway 67 embankment at the Oil Creek crossing, approximately four miles north of Cripple Creek. No vehicles were caught in the relatively short flooding event, but significant culvert and roadway embankment damage resulted. CDOT asked the Dam Safety Branch for assistance in determining the cause of the flooding and in preventing future occurrences. A field investigation was planned and scheduled for September 7, 2006.



View of the breached dam observed on the September 7, 2006 site visit, from the access road below the dam.

A review of the Division of Water Resources HYDROBASE water rights data base was performed. Information dated 1919 indicated this reservoir was last used by a mining company located in Cripple Creek. Although the documents show State Engineer information concerning the Gillett Reservoir dam, records of the Dam Safety Branch contain no information of the structure and consultation with previous dam safety engineers in the area indicated the presence of a structure on Oil Creek was not previously known.

On September 7, 2006, a field visit was conducted to observe conditions in the Oil Creek drainage at the apparent dam site and gather information regarding the reported dam, reservoir, and extent of the flooding observed by CDOT. Dam Safety Engineer Bill McCormick was accompanied on the site visit by Charlie Judge, Water Commissioner for Water District 12. Bill and Charlie were both surprised upon seeing the view, shown in the photo on the left, of a structure neither were aware existed. The photo shows the view of the valley below the dam and the remains of the original Gillett Reservoir Dam. An obvious breach was observed on the left abutment. The observations indicate the main breach is a relatively old feature. Anecdotal evidence obtained from local sources suggests the original dam was breached by blasting

in the 1930s during a dispute over water. It is also possible that the dam was breached in the 1965 flood that also resulted in the breaching of Cripple Creek No. 1, No. 2, and No. 3 dams located just to the south.

The original breach was filled with a soil plug (embankment) to allow a reservoir. The field survey performed determined that the new embankment had a height of about 18.5 feet and a freeboard of about 5.5 feet. The measurements indicate the maximum water depth was 13 feet at the embankment. A field survey also included measurement of the width of the high water line at several locations from the upstream face of the dam to the upstream end of the reservoir. Elevation measurements were made at about 50-foot spacings from the upstream face of the embankment to the upstream end of the reservoir. These measurements were used to estimate the volume of water stored before the breach occurred. Measurements were also made of the geometry of the breach, including the bottom and top widths, and the angles the sides made relative to horizontal. Other field measurements made during the site visit included surveying a cross-section of the Oil Creek

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FORENSIC ANALYSIS AT GILLETT RESERVOIR DAM (cont.)



Looking east through the breached section from downstream to upstream. Note Water Commissioner for scale.

Channel between the dam and SH 67. A relatively narrow section was chosen about 2,500 feet downstream of the dam. Horizontal and vertical measurements were made of the channel configuration from the channel bottom to the high water line of the flood wave. At the intersection of SH 67 and Oil Creek, surveys were made of the inlet side of the 60-inch culvert that passes the Oil Creek flows beneath the highway. Measurements were made to determine the culvert size, the vertical distance between the invert of the culvert and the top of the asphalt road surface, and the horizontal length of the culvert and an estimate of the culvert slope.

The data collected in the field were reduced in the office for analysis. The survey data collected within the reservoir was used to develop elevation-area information at each foot of water depth within the reservoir. That information was used in a simple area-capacity spreadsheet to estimate the volume of water stored at the time of the breach. The results of the analyses indicated the reservoir was storing approximately 11 acre-feet of water at the time of the failure.

The Oil Creek channel cross-section was surveyed approximately 2,500 feet below the dam. The cross-section information was input into the Flow Master software program to allow a quick estimate of the maximum flow rate (cfs) that could have been conveyed through the section. The Flow-Master analysis suggested this section of the stream channel was carrying about 1,300 cfs when the peak discharge from the dam failure passed. This estimate of flow is consistent with the degree of attenuation of the piping breach discharge that might be expected given the relatively short distance from the dam and the steep slope of this mountain stream.

The survey data collected were

utilized in the Culvert Master software package to estimate the maximum capacity of the 60-inch culvert. The analysis indicated the culvert only had a capacity of about 300 cfs.

Since the State Highway culvert capacity is considerably less than the peak discharge estimated in the analyses described above, it was concluded that the flooding observed on August 18, 2006, was the result of the piping failure of the illegally constructed dam. These conclusions were transmitted to CDOT. State statutes regarding liability for damage resulting from dam failures will enable CDOT to pursue compensation for the costs of clean up and repair of damage resulting from this failure, if they so choose. To prevent a similar situation from developing at this site in the future, the owner of Gillett Reservoir Dam was notified of the results of the investigation and the dam was added to the DAMS Database maintained by the Dam Safety Branch. Adding the dam to the database allowed a zero-storage restriction order to be issued by the State Engineer. The zero-storage restriction order requires the owner to submit engineering plans and specification prepared by a professional engineer for review and approval prior to construction of any water-retaining structures at this site.

ELKHEAD CREEK DAM ENLARGEMENT DEDICATION

Marta Ahrens, Public Information Officer

On July 11, about 200 people, from state and federal officials, ranchers, to local residents, attended the completion celebration and dedication of the enlarged Elkhead Creek Dam and Reservoir at Elkhead Creek Reservoir State Park in northwest Colorado. The event was sponsored by the Colorado River Water Conservation District in cooperation with the Upper Colorado River Endangered Fish Recovery Program. Acknowledgements regarding the completion of the \$31 million project were made by Harris Sherman, Executive Director of the Department of Natural Resources, and representatives from the Colorado River District, the Nature Conservancy, and the Bureau of Reclamation. Sherman stated



Harris Sherman, Executive Director, DNR

that the project was an extraordinary collaboration between state, federal and local officials.

Elkhead Creek Reservoir recently reopened for public use following a 2 ½-year closure during which time the dam was enlarged to roughly double the reservoir's storage capacity to 25,000 acre-feet. The enlarged reservoir will provide 5,000 acre-feet of water permanently, and up to another 2,000 acre-feet of leased water annually to augment flows for federally endangered fish in the Yampa River during middle and late summer, a time when low flows can reduce their habitat and make them vulnerable to non-native predators. The additional water will be used to meet the needs of people in the Yampa River basin.

HUMAN RESOURCES

New Employees

Nicholle (Nikki) Rainey started on May 7 as Administrative Assistant and is the front desk receptionist in the Denver office. Prior to this appointment, she worked as a temp in the Records Section. Before starting with the Division, Nikki was fortunate to be a stay-at-home mom with her young son. She also worked for two other state agencies prior to coming to the Division.

Luis Heredia joined Division 3 as the Lead Water Commissioner in District 21 on May 7. Luis is a native of the San Luis Valley and had been the ditch superintendent of the Terrace Irrigation Company for the last 10 years. He and his wife and three sons live near Alamosa.

Ivan Hunter began work for Division 3 on May 19 as the Deputy Water Commissioner in District 21. Ivan has a wealth of experience in farming both in Colorado and New Mexico, and has been the ditch rider for the Miller Ditch Company for the last four years. Ivan and his wife live near La Jara.

Michael (Mike) Wild was hired on May 25 as a full-time Hydrographer and Deputy Water Commissioner for District 23 (South Park). Mike will spend most of his time on hydrographic work but will also work as the Deputy Water Commissioner in South Park. Mike has considerable experience, including spending the last five years working for the City of Aurora on their raw water system in South Park. Mike's work experience in municipal water treatment and supply should provide a strong base for working with the various municipal water suppliers with water rights in South Park.

Laura Kalafus was appointed on June 4 as the Program Assistant in the Division 4 office in Montrose. Laura has considerable state service experience from working for Fort Lewis College in Durango for three years, and also for a short time the Pikes Peak Community College in Colorado Springs. The Division 4 staff looks forward to working with Laura.

Craig Bruner began work on June 13 as an EIT1 in Division 5. Craig obtained a B.S. in Civil Engineering from the University of Nevada, Reno in 1992, with an emphasis in water resources. His previous experience was with the private sector working primarily for industrial contractors. Craig worked on numerous projects including, wastewater treatment facility expansions, water treatment plant expansions, bridge construction and copper and coal mining project.

Thomas Rozman started on June 25 as the Deputy Water Commissioner in Division 4, Water District 59, and is following in the long-standing tradition of the father-son water commissioner. Tom grew up in the area and is very familiar with the terrain and the people. "I look forward to going to work everyday," he said.

Matthew Gavin started work on July 23 as a Dam Safety Engineer in Durango. Matthew has a BS from CU and brings a variety of dam safety related experience to the branch ranging from hydrology and hydraulics and floodplain analysis to the design and construction of civil works facilities. He served as the project manager on the feasibility study for the enlargement of the Red Mesa Ward Dam in Division 7.

Gregory Powers was hired on July 24 as the District 41 Water Commissioner in Division 4. His previous experience includes serving over 11 years as an Accident Report Specialist with the City of Boulder Police Department. Greg and his family recently relocated to the Western Slope and he is enjoying his new job.

Scott Lorenz started on August 1 as a Reservoir Operations Specialist in Division 2. Scott's most recent work experience was from Southwest Sod Farms of Pueblo where he was the farm manager and performed day-to-day operation of the Excelsior Ditch, including operations of the augmentation station and recharge facilities, along with keeping the related accounting for AGUA. Previous to this, Scott assisted with the operations of the Sanchez Ditch and Reservoir Company in Division 3.

Jeremy Franz started work on August 1 as a Dam Safety Engineer in Greeley. Jeremy has a BS and MS from CSU and brings a strong hydrology and hydraulics background to the branch. He has a strong working background in the use of GIS applications. He has worked on several dam projects in the Fort Collins area ranging from dam break modeling to the performance of unsteady HEC-RAS hydraulic modeling.

Retired Employees

Hank LeValley retired in May 2007 after serving 24 years as Water Commissioner in Crawford. As is normal with Water Commissioners in these types of areas, he knew the country very well and everyone in it. He was always a tremendous resource for this office, and his expertise and experience will be sorely missed. The water users appreciated Hank's calm, confident nature that never seemed to get rattled. As rancher, he will have plenty of things to do in his retirement.

Les Dalby retired on May 31, 2005 after working for Division 1 for 28 years. Les started as a Well Commissioner in the Greeley office in 1979. In the 1980's, he shifted duties into the area of diversion records and water right tabulation to eventually become the "guru" of those areas for Division 1. Les was an outstanding staff member as evidenced by a number of internal awards including being named the Technical Staff of the Year in both 1996 and 2005.

Val Valentine is retiring on August 31 after 22 years with the Division. He began his career as a Deputy Water Commissioner in 1985 working three seasons on St. Vrain Creek. During that time, he attended Fleming Law School, University of Colorado, Boulder, auditing several water law classes. In 1988, he became the Lead Water Commissioner, Water District 29, Upper San Juan River working in what he often called, "the prettiest river district in the western hemisphere."



CALENDAR OF EVENTS

- August 7** Colorado Board of Examiners of Water Well Construction and Pump Installation Contractors Meeting, Denver, Colorado; for more information, contact Gina DeArcos at 303-866-3581
- August 17** Colorado Ground Water Commission Meeting, Sheraton Hotel, Colorado Springs,, Colorado; for more information, contact Marta Ahrens at 303-866-3581
- September 18-19** Colorado Water Conservation Board Meeting, Grand Junction, Colorado; for more information, contact Lisa Barr at 303-866-2599

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