

Flood Control Project Tested by Design Storm

by

Kevin Stewart, PE, Project Engineer, Floodplain Management Program

In 1988, the District and the City of Broomfield completed \$370,000 in flood control improvements along Basin 3207 Drainageway (also known as Nissen Reservoir Channel) between E. 10th Ave. and Ash St. in Broomfield. This project involved the construction of two detention facilities (Ponds 6 and 7), which effectively reduced the 100-year discharge downstream by more than half (from 1090 to 480 cfs). This peak flow reduction resulted in a regulatory floodplain confined to the street and front yards along E. 7th Ave as shown in the figure, thus removing more than 60 residential properties from the 100-year floodplain.

One decade later on Saturday, July 25, 1998, these improvements returned dividends when a thunderstorm produced in excess of three inches of

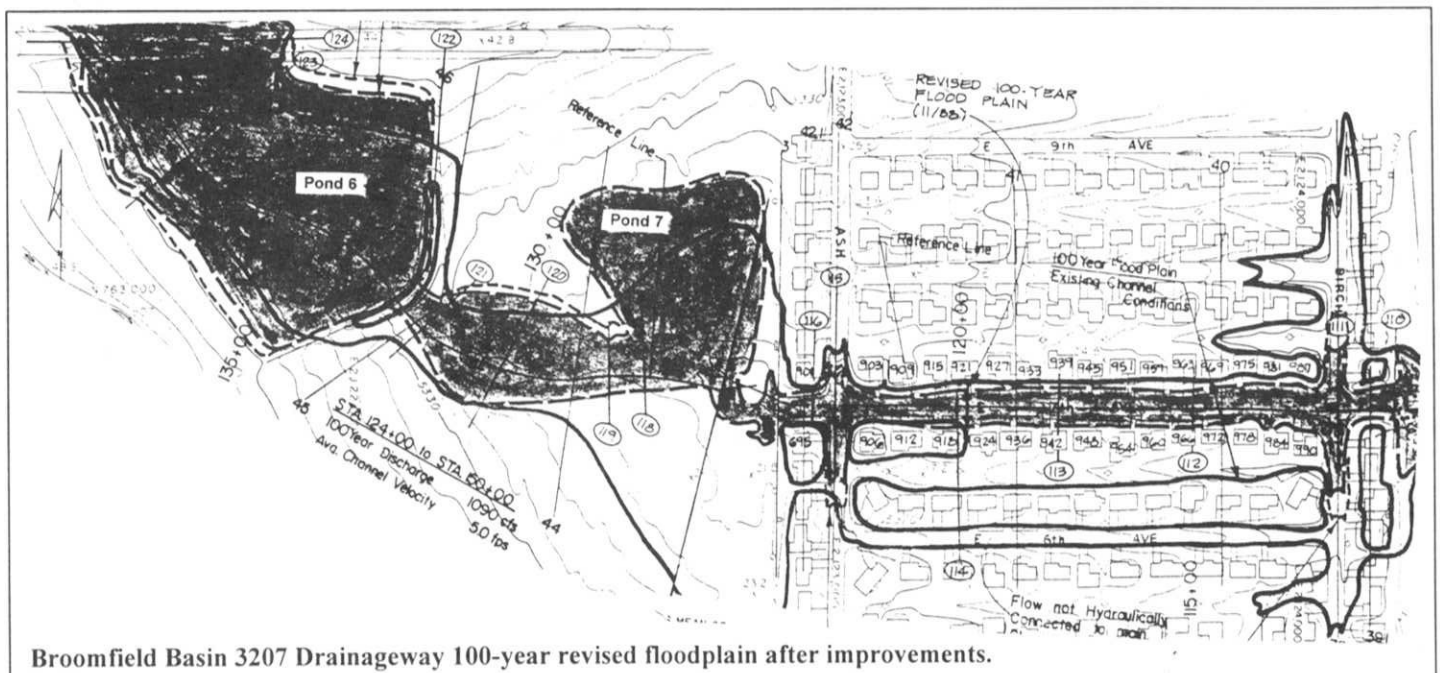
rain over significant portions of Basin 3207.

At Pond 6 the July 25 storm produced 2.76" of rain and resulted in a peak stage of 38.6 feet, equaling the 100-year design flood according to the consulting engineers' design report prepared by Sellards & Grigg, Inc. The data plot shows the stage hydrograph and 30-minute rainfall amounts between 7/25 noon and 7/26 midnight. A resident at the intersection of E. 7th Ave. and Birch St. measured 3.45" of rain. The storm hit the Basin 3207 area shortly after 5 p.m. with the first inch of rain falling within the first 20 minutes, causing major street flooding. Runoff quickly filled both detention ponds to capacity. The Pond 6 peak occurred at 6:54 p.m. cresting at a depth of 19" over the spillway and releasing 470 cfs.

Measurements at Pond 6 were made by an automated gauge that was installed as part of the flood control improvements (see photo). Prior to the July 25 storm, the largest recorded event occurred on May 17, 1995, with the water surface reaching a maximum stage of 35.7 feet. It is suspected that this stage may have been exceeded on July 19, 1997, but no data was available for this event thanks to the work of vandals on the preceding day. The Basin 3207/Pond 6 gaging station is one of 143 ALERT stations operated by the District.

During and following the July 25 storm, local officials received reports concerning flood problems at a number of locations throughout the City, but the

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Broomfield Basin 3207 Drainageway 100-year revised floodplain after improvements.

1998 Professional Activities of District Staff

Scott Tucker, Executive Director

- *Chaired program on Stormwater Management at National Association of Flood and Stormwater Management Agencies (NAFSMA) annual conference, in Denver in September.
- *Member of Board of Directors and Chairman of the Stormwater Management Committee of NAFSMA.
- *Member of the Stormwater Phase II Advisory Subcommittee, formed pursuant to the Federal Advisory Committee Act to assist in developing the EPA Phase II stormwater program.
- *Presenter of Large Municipal Case Study at Conference on Urban Stormwater Management in the Southwest: Cost-Effective Structural Solutions in Long Beach, CA in September.
- *Presenter of Regional Issues at American Society of Civil Engineers continuing education course on Applications in Stormwater Management in Denver in February.
- Presenter of Phase II impacts on local governments at Stormwater Workshop at National League of Cities annual Congressional Cities Conference in Washington, DC in March.

Dave Lloyd, Chief, Design and Construction Program

- *Co-authored, with Bill DeGroot, and presented "Acquisition and Relocation as a Floodplain Management Tool" at ASCE's conference in Chicago in June.
- *Co-presented, with Chuck McKnight from Sellards & Grigg, Inc., "A Case Study of the Goldsmith Gulch Flood Control Project" at the NAFSMA annual conference in Denver in September.
- *Co-authored and co-presented, with Mary Kay Provaznik from HDR Engineering, "Sustainable Watersheds – The Little Dry Creek Experience" at the CASFM annual conference in Steamboat Springs in September.
- *Speaker on District activities at Arapahoe County Mayors and Managers meeting in August.

Bill DeGroot, Chief, Floodplain Management Program

- *Chair of the Floodplain Management Committee of the National Association of Flood and Stormwater Management Agencies (NAFSMA), and chaired two sessions on Floodplain Management Issues at NAFSMA's annual meeting in Denver in Sept.
- *NAFSMA's technical advisor to the Technical Mapping Advisory Council.
- *Member of ASCE's Technical Mapping Advisory Task Committee.
- *Co-authored, with Dave Lloyd, and presented "Acquisition and Relocation as a Floodplain Management Tool" at the Association of State Floodplain Managers annual conference in Milwaukee in May and at the Colorado Association of Stormwater and Floodplain Managers annual conference in Steamboat Springs in October.
- Presented "Flood Insurance Rate Maps, A Local Perspective" at the Annual Flood Conference in Atlanta in June.

Kevin Stewart, Project Engineer, Floodplain Management Program

- *National Hydrologic Warning Council (NHWC) Representative for Southwestern Association of ALERT Systems (SAAS).
- *Attended NOAA Strategic 5-Year Planning Workshop in Washington, DC in February.
- *Developed presentation on accessing the District's ALERT System for the ASFPM Milwaukee, WI conference in May.
- *Speaker at ALERT Users Group conference in Palm Springs, CA in May.
- *Participated in study group for the National Research Council on "The Role of an Information Network in Reducing Losses from Natural Disasters" in Washington, DC in June.
- *Speaker at Public Private Partnership 2000 forum on "Real-Time Monitoring and Warning of Natural Hazards" at the American Geophysical Union in Washington, DC in June.
- *Participated in FEMA *Project Impact*, Community Partnership Workshop for developing a disaster resistant community for Fort Collins in July.
- *Participated in NWS Modernized Product Development Workshop in Boulder in September.
- *Participated in FEMA/NWS Joint Training Program Focus Group Meeting at FEMA's Emergency Management Institute in Emmitsburg, MD in September.
- *Speaker at ALERT~FLOWS East Coast Users Group conference in Nashville, TN in October.
- *Speaker at SAAS conference in Austin, TX in October.
- *Guest speaker at NWS sub-regional meeting in Cheyenne, WY in December.
- *Asked to serve on Colorado Water Conservation Board's Flood Mitigation Assistance Program Grant Review Committee for 1999.

Ben Urbonas, Chief, Master Planning & South Platte River Programs

- *Served on the French NOVATECH 98 conference's scientific group responsible for the evaluation of abstracts and the selection of conference papers, and attended the conference in early May.
- *Continuing as a Principal co-investigator (Eric Strecker & Jonathan Jones principal co-investigators) for an EPA funded ASCE effort to develop Nationwide BMP Evaluation Data Management software and to accumulate and evaluate BMP data for performance and its relationships to design parameters.
- *Organized and chaired a session on the topic of *South Platte River* at the Water Resources Planning and Management Division of ASCE Specialty Conference in Chicago in May, 1998. Presented a paper on *BMP Data Base Development* at this conference.
- *Continues to Chair the *Urban Gauging Networks Committee* of the Urban Water Resources Research Council of ASCE.

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Tucker-Talk

by L. Scott Tucker

Timely Comment from the District's Executive Director



We have believed in multiple use concepts at UDFCD since the early 1970's. Stream or channel corridors can and have been used for more than just flood control. They can also serve as open space corridors, hiker/biker trail corridors and habitat corridors. That thinking has paid off as the Denver metro area has many miles of drainageways that are available for other uses besides drainage and flood control.

In the early days we thought a grass-lined channel with 4:1 side slopes, a concrete low flow channel, and a trail provided for multiple uses. And it did and still does. The trend today, however, is for preservation of natural stream areas and, where possible, restoration of deteriorated urban streams to more "natural" conditions; or where right-of-way is limited, construction of grass-lined channels without any hard bottom. Preservation of a stream corridor has to take place as the land is developed. Many developers wish to develop as much of their available land as possible, so they are looking for ways to minimize the space taken for drainageways. Pressure is increasing, however, for developers to leave the corridors in as natural a state as possible and some developers are moving in this direction. The reality is that the public or the consumer likes riparian corridors and they can enhance a development and be an asset and not a liability.

There are still many situations where homes and businesses are situated in floodplains and some sort of remedial action needs to be taken. Removal of structures from the floodplain and restoration of the channel are options that are looked at very seriously. It is not always possible, however, and in many cases the most appropriate

solution is to construct some sort of "soft" channel with water trickling through the middle of it. Our approach now is to make the channel look as natural as possible within the constraints of the available right-of-way. In some cases, the stream can be made to look quite natural, but in other situations, a more formal grass-lined channel is constructed. However, in most of these cases a hard bottom low flow channel is avoided in lieu of a low flow area that will allow surface waters to interchange with ground waters. So the changing face of flood control is away from formalized drainage channels to more natural channels.

However, it is a simple fact that as undeveloped rural areas are converted into urban uses the hydrology and hydraulics of the streams change dramatically. In spite of detention systems that are almost universally required, low flows tend to increase dramatically both in terms of frequency and magnitude. Even if a stream corridor is left open and natural, erosion will eventually become a problem and erosion control measures will eventually be needed. We have addressed this problem through our maintenance program and much of the work that maintenance does is erosion control. Projects can take the form of bank protection or grade control structures. In some cases, like through formal parks, low flow channels have been lined with large boulders. In other situations, such as natural stream corridors, spot bank protection may be necessary at isolated locations or drop structures may need to be constructed to arrest channel degradation. Our drop structure of choice has been one constructed of large boulders that are grouted in place that allow water to fall over them in a waterfall type fashion.

These structures can be located at intervals while leaving the rest of a natural stream alone.

Also, stormwater quality is now a factor that must be considered. In the early 1970s stormwater quality was not an issue. Stormwater quality places an emphasis on the more frequent runoff events; whereas, flood control places the emphasis on the infrequent large flooding events. We are finally recognizing the obvious by paying more attention to what happens to the streams because of the more frequent events. Where we had at one time detention ponds to store water to reduce the downstream quantity of water, we are now incorporating into these detention ponds water quality features as well an attempt to improve the quality of stormwater.

The basic trend now is to preserve stream corridors and improve the water quality as much as possible. We are not always able to accomplish stream preservation, but it is always given consideration. In addition we are trying to restore streams where possible; and, where it is not possible, to provide as much opportunity for interaction between the water and people as possible. It still has to be recognized that urban conditions warrant urban solutions, which require careful engineering as well as development of natural flora and fauna. What we are doing now will become a more and more valuable asset as urban areas expand and open space becomes more and more limited. It will be interesting, say in 25 years, to look back and see how good the decisions are that we are making today. In looking back over the last 25 years we have been doing a pretty good job.'

South Platte River Program Notes

by

Ben Urbonas, P.E., Chief, South Platte River Program

Local Initiatives Along the Platte

City and County of Denver

We reported in 1997 that the City and County of Denver launched a major South Platte River initiative. This effort continues and the District is working with Denver to implement the river restoration and improvement features of this initiative.

Adams County

We also reported in 1997 that Adams County began a comprehensive look at the South Platte River corridor as an open space and recreational resource. The District is now continuing with this initiative, using the information, and documents developed by Adams County and other project sponsors, to prepare a master plan for the river through Adams County.

Maintenance Activities

Routine Maintenance

In 1998 the South Platte River routine maintenance included:

- 9 miles of tree trimming and pruning along the river trail,
- 6 acres of string trimming at access ramps and rest areas,
- 75 miles of trail edge mowing, and
- 179 miles of trash and debris pickup and removal along the river.

Approximately 103 truckloads of trash and debris were removed and taken to a landfill. Local government personnel and volunteer groups picked up and removed additional trash from the river corridor. Trash is also removed from trash receptacles maintained by park personnel along all recreational trails.

Although this type of routine maintenance often is not noticed or recognized by the public, without it the South Platte River corridor would have an entirely different "look" and "feel." This type of maintenance, we believe, is essential for the preservation of wildlife habitat. It also provides a more pleasant experience for the public when visiting the many trails and pocket parks along the 41 miles of the South Platte River

between Chatfield Dam and the Weld-Adams County line.

Tamarisk Infestation.

The South Platte River downstream of 88th Avenue in Adams County is experiencing rapidly spreading Tamarisk infestation. Tamarisk is a juniper-type plant. It has virtually crowded out the riparian growth along the banks of the Colorado River in Utah, to a point that fishermen cannot get to the water through the dense brush.

In October we started an eradication effort in hopes to check its spread (see related article by Ken MacKenzie). We are not sure how effective we will be at eliminating this noxious plant. We are limited in access to publicly owned property and much of the infestation is along the banks of old gravel pit lakes adjacent to the river. In addition, the seed can be viable for several years and Tamarisk in cleared areas is expected to reappear. We will have to keep removing new growth for several years before this infestation is under control.

Restoration Maintenance

The 1998 restoration maintenance program continued to stabilize, rehabilitate, and revegetate riverbanks experiencing severe erosion. In addition, the program repaired erosion damages along the recreation trail, repaired and constructed river grade control structures and assisted with replacement of old wood pedestrian bridges.

Due to the high flow event on July 25th, estimated to be 13,800 cfs at 19th Street in Denver, the restoration maintenance activities increased significantly. At least 12 sites along the river in Denver and Adams County experienced severe erosion needing immediate attention, namely over 5000 feet of eroded banks which have to be stabilized and revegetated due to this high flow. In addition, the concrete trail along the river was undermined at several locations and required immediate attention.

One large restorative maintenance project completed this year consisted of four grouted-boulder grade control structures below 19th Street in Denver. These structures reduce and stabilize the grade of the river and provide for enhanced boater safety between the new City of Cuernavaca Park and soon to be constructed Commons Park.

The District is continuing to assist Denver Parks and Recreation Department to replace the rapidly deteriorating timber pedestrian bridges along the South Platte River. Two of these bridges were replaced this year, one at Grant-Frontier Park upstream of Evans Avenue and the other at Frog Hollow Park upstream of 8th Avenue. The new steel bridges have a wider concrete deck, making it easier to traverse; need less maintenance; and are more resistant to vandalism. They also meet ADA access requirements. Over the next two to three years we hope to continue to work with Denver to replace up to four more deteriorating timber bridges along the South Platte River. In 1999 we hope to replace the bridge at Huron Street, located downstream of Alameda Avenue.

Last year we reported constructing a bank stabilization project using the bendway weir (i.e. rock jetty) concept. This method utilizes low height rock jetties to redirect erosive currents on the outside of a river bend away from the eroding bank. So far, this concept has performed well (See the "Alternative Bank Stabilization Update" article in this issue).

Cooperative Projects With Private Property Owners

In 1998 two cooperative projects were completed. The first involved the bank cleanup, stabilization, and revegetation along 1,400 feet of properties owned by Albert Frei and Sons, Inc. and the McIntosh Farm Company, downstream of the Brantner Ditch diversion in Adams County. This reach of the river has been experiencing bottom degradation and related bank erosion for

many years. Historically, river bank stabilization in this area has been attempted by the property owners by pushing large concrete pipe, cars, bed springs, etc. into and along the river – The Bigger the Better! Right? Wrong!

The combination of laying the bank back, armoring with a well graded buried rock riprap with extended toe, and native vegetation achieves much better results. It not only stabilizes the banks, but also cleans them up, improves their appearance and produces new and improved riparian habitat. The project was constructed by Frei on the flowage and maintenance easements dedicated to the District by both property owners. Work was jointly funded by the District and the property owners.

The second bank stabilization project took place adjacent to a gravel pit owned by Suburban Sand and Gravel Company in Adams County. The sand and gravel pit operator, Aggregate Inc., had reported several breaches of the berm separating the pit from the river during high flows the past few years. This project stabilized 1000 feet of bank using buried rubble and rock riprap and revegetation of the site. Work on this project was also jointly funded by the District and the property owners. In addition, the owners dedicated to the District a flowage and maintenance easement.

Revegetation of the bank included seeding with native grasses, mulching, live willow and cottonwood staking and the planting of native shrubs. In addition, since several large cottonwood trees had previously fallen into the river in this area, they were placed on the upper bank to enhance wildlife habitat. The before-and-after photos of this site illustrate the marked improvement of this badly abused riverbank. Comparisons that are more dramatic will be evident in the future when many of the recent plantings mature.

Two new cooperative projects are in the works for next year. One will involve working with a property owner to stabilize 1500 feet of an actively eroding bank, one that moved laterally more than 500 feet in the last 7 years,

near 144th Avenue, extended, in Adams County. The other project will involve working with Ready Mixed Concrete to clean up and stabilize a bank adjacent to a new pit operation near 154th Avenue, extended. This project will also help preserve a nicely vegetated natural area adjacent to the river.

Capital Improvement Projects

Upper Central Platte Valley Project

As reported in 1997, we have been working with Denver and the Public Service Company of Colorado (PSCo) to develop and design the Upper Central Platte Valley Project. A detailed preliminary design is now complete and a separate article by Leo Eisel and Bryan Kolstad describes this plan. The real challenge now facing us is to find \$17,000,000 need to implement this terrific river restoration project.

Globeville Area Project

The other ongoing capital improvement project along the river is located in the Globeville neighborhood in north Denver. Phases 1 and 2, for approximately 6,000 feet of the river, have now been completed. The final design of Phase 3 is nearing completion. We expect Phase 3 construction to begin in 1999. When done, a major hazard to kayakers, rafters and trail users will have been eliminated. In so doing, about 300 acres of developed lands in Denver and Adams County will have been removed from the 100-year floodplain.

Other News and Projects

Low Flow Channel Improvements

Early in 1997 Denver requested the District to take the lead in the design of low flow channel improvements starting at 15th Street and extending through Rockmont Park. The design has now been completed and some of the improvements have already been constructed by Denver and the District.



Before and after views of Suburban Sand and Gravel Co-op project. Note the gravel pit on the right side of the berm.

The remaining low flow channel improvements will be completed by Denver in 1999 as a part of their Commons Park project. A series of boatable grade control structures and low flow training jetties will provide pools and riffles and a better defined low flow channel through this downtown reach of the river.

Master Plan in Adams County

The District has entered into agreements with Adams County, the cities of Brighton, Thornton and Commerce City, the South Adams County Water and Sanitation District and the Denver Water Department to update the South Platte River Major Drainageway Plan through Adams County. The firm of Camp Dresser and McKee has been selected by the project sponsors to develop this new plan, which is now under way. The planning project is examining water quality, aquatic and terrestrial habitat, open space, recreation, water resources development, gravel mining needs, and many other issues affecting this river reach. We hope to have this multi-jurisdictional, multi-objective plan completed in 1999.

Flood Warning Program Activities

by
Kevin G. Stewart, P.E., Project Engineer, Floodplain Management Program

20 Years of Flood Prediction & Notification

The District's Flash Flood Prediction Program (F2P2) just completed its 20th year of providing local governments with early forecasts of flood potential, internal alerts and warnings.

Congratulations to John Henz who has served as the District's private meteorologist since 1979. John has been involved with three businesses in providing the contract services to the District:

1979-82, The GRD Weather Center

1983-89, Henz Kelly and Associates (HKA)

1990-98, Henz Meteorological Services (HMS)

In 1998, messages were issued on 33 days including 3 days in May, 3 in June, 14 in July, 12 in August and 1 in September. Flash flood warnings (Message 3) were issued on four days (July 25, 30, & 31, and August 21). With the arrival of the Denver monsoon beginning July 22, the next two-week period was marked by messages being issued every day except 7/27 and 8/2. What began as a very dry drought-like summer ending wetter than normal with the South Platte River basin receiving the highest rainfall amounts in the State (205% of July average) according to the Natural Resources Conservation Service.

ALERT System Use & Expansion

The District ALERT base station logged over 4900 modem connections during 1998 representing over 3500 hours of connect time. This represents a 113-percent increase in remote use time compared to last year's record-breaker of 1640 hours. It appears that Colorado's 1997 flood disasters may have contributed to this dramatic increased interest in real-time flood data. These numbers do not represent

total system usage since seven other base stations are also operating in the service area. Many new users are rapidly becoming aware of the availability of ALERT data on the Internet. The ALERT Web Server may be accessed from the District's home page (<http://www.udfcd.org/>).

The District provides its local government partners and certain other cooperators with free dial-up access to the base station. In addition to ALERT data displays, a full suite of weather products is also available including watches, warnings and advisories from the National Weather Service; and heavy precipitation outlooks, quantitative precipitation forecasts and internal message status reports from HMS.

The Douglas County flood detection network (FDN) project is nearing completion with 5 of 6 sites fully operational. This FDN consists of 3 weather stations and 3 rain/stream gages. Final site selection for the East Plum Creek gage is one remaining task. It is anticipated that this station will be in the vicinity of Castle Rock. The other two stream gages are located on West Plum Creek at Pine Cliff Road and on Cherry Creek at Castle Oaks Road. The weather stations are located at Highlands Ranch, Parker and Castle

Rock. A local flood warning plan will be developed with Douglas County in 1999.

ALERT data is currently available from 143 gaging stations comprising 124 rain gages; 69 water level sensors and 13 weather stations.

A new FDN project is expected to start next year for the Upper Sand Creek basin in Aurora. A preliminary design has been completed with five new ALERT stations proposed. The total expected cost for this expansion is \$60,000 with the District and Aurora cost sharing equally in the project. Once completed, the Sand Creek basin will be monitored by a total of 28 rain gages and 19 stream gages combining existing FDNs for Toll Gate Creek and Westerly Creek along with two other main stem gages on Sand Creek downstream of I-225.

1998 Floods

No federal flood disasters were declared in Colorado in 1998, but heavy rains and significant flooding continued to plague the Colorado front range much like the summer of 1997, which will be long remembered for the deadly July 28 flash flood in Fort Collins. Twelve other Colorado counties also received flood disaster declarations in 1997.



ALERT Web Base Station Early Flood Detection System

[ALERT Data Disclaimer](#) [District Flood Warning Program](#)

Current Weather & Flood Conditions in the Denver, Colorado Area

- Real time [Weather Conditions](#)
- Real time [Rainfall Totals](#)
- Real time [Stream and Reservoir Water Levels](#)

This is what you will see when accessing the District's ALERT Web Server.

With last year's events fresh in everyone's mind, flooding concerns in the Denver metropolitan area remained high and the 1998 storm season proved itself worthy of this attention.

Wednesday, July 22:

The monsoon season kicked-off with the heaviest rainfall being reported for Aurora in the vicinity of Mississippi and Chambers (2.59"). The ALERT system measured rainfall amounts exceeding one-inch at a number of locations. The cover story describes what happened on this day in Broomfield along City Park Drainageway. The gage at Broomfield measured 0.83" while other areas received more than twice this amount. The *Rocky Mountain News* characterized this day as "welcome relief from the recent heat wave."

Friday, July 24:

Heavy rains that occurred during the evening caused problems in Denver with flooded basements, stranded drivers and downed power lines. A forecaster for the NWS measured 3" in 30 minutes at his home near W. 38th Ave. and Federal Blvd. The railroad viaduct near 38th and Fox trapped motorists in water 4 to 5 feet deep. This notorious flood area has been less of a problem in recent years due to drainage improvements completed by Denver and the District, but this storm clearly exceeded the design rainfall amounts.

Saturday, July 25:

The cover story is devoted to this day and describes the benefits of completed drainage and flood control improvements in the City of Broomfield. Impacts to other areas are also described. The annual peak discharges listed in the accompanying table, "1998 Peak Flows" further illustrate the significance of this day District-wide.

Thursday, July 30:

In 20-years of measuring heavy rainfall with ALERT gages, this day marks the maximum measurement of rainfall

ALERT Record Rainfall July 30, 1998 Salisbury Park Weather Station in Parker					
1-min	5-min	10-min	30-min	60-min	Total
0.24"	0.83"	1.54"	3.07"	3.19"	3.43"

intensity and storm total by the ALERT system. It is also interesting to note that this measurement was made at a new site installed just this year in Parker. The accompanying table shows the duration and corresponding maximum rain amounts measured at the Salisbury Park weather station on July 30. At one point in the storm, rainfall intensities were approaching 20"/hour. According to the ALERT equipment vendor, Panama is the only other location known to have measured rain intensities of this magnitude with an ALERT tipping bucket. The NOAA precipitation frequency atlas estimates the 5-minute, 100-year intensity at 9"/hour.

A flash flood warning for the Parker area was issued based on both the precipitation forecast and the real-time rain observations from the Parker gage. HMS and District staff initiated the conversation with the NWS that led to the warning. This represents another landmark event illustrating how local programs in partnership with the NWS benefit the public by enhancing the early warning process. Richard Brandt, Acting Public Works Director for Parker, felt that the July 30 early warning was a very good decision.

Local streets and small drainageways in Parker were hit hardest by the flooding, while no major damages to private properties occurred. The worst stream flooding was reported along Sulphur Gulch and Tallman Gulch, but damages there were also low since development has been kept outside the floodway and above 100-year levels. Cherry Creek experienced an estimated 5-year event based on a field survey conducted by Leonard Rice Consulting Water Engineers for the District. The USGS stream gage on Cherry Creek at Main Street was damaged by floodwaters.

The effluent discharge pipe from the Parker wastewater treatment plant was buried under 4 feet of sand in Sulphur Gulch.

1998 Peak Flows. This table lists some of the more notable peak flows measured by the ALERT system in 1998.

Date/Time	Location	Peak (cfs)
May 6 23:07	Bear Creek above Cold Spring Gulch	560
July 25 18:54	Broomfield Basin 3207/Pond 6	* 470
July 25 18:56	Harvard Gulch Park	470
July 25 19:09	Goldsmith Gulch at DTC/Temple Pond	510
July 25 19:12	S. Platte River at Dartmouth Ave.	5,390
July 25 20:04	S. Platte River at 19 th Street	13,800
July 25 20:34	Holly Dam	126
July 25 20:46	Toll Gate Creek at E. 6 th Avenue	810
July 26 00:20	Englewood Dam	160
July 30 17:46	Lena Gulch below Youngfield Street	125
Aug 19 21:15	Westerly Creek at Montview Blvd.	720
Aug 22 04:52	Sand Creek Park near I-225	400
Oct 16 13:48	Ralston Creek at Carr Street	1,170

* Indicates new record

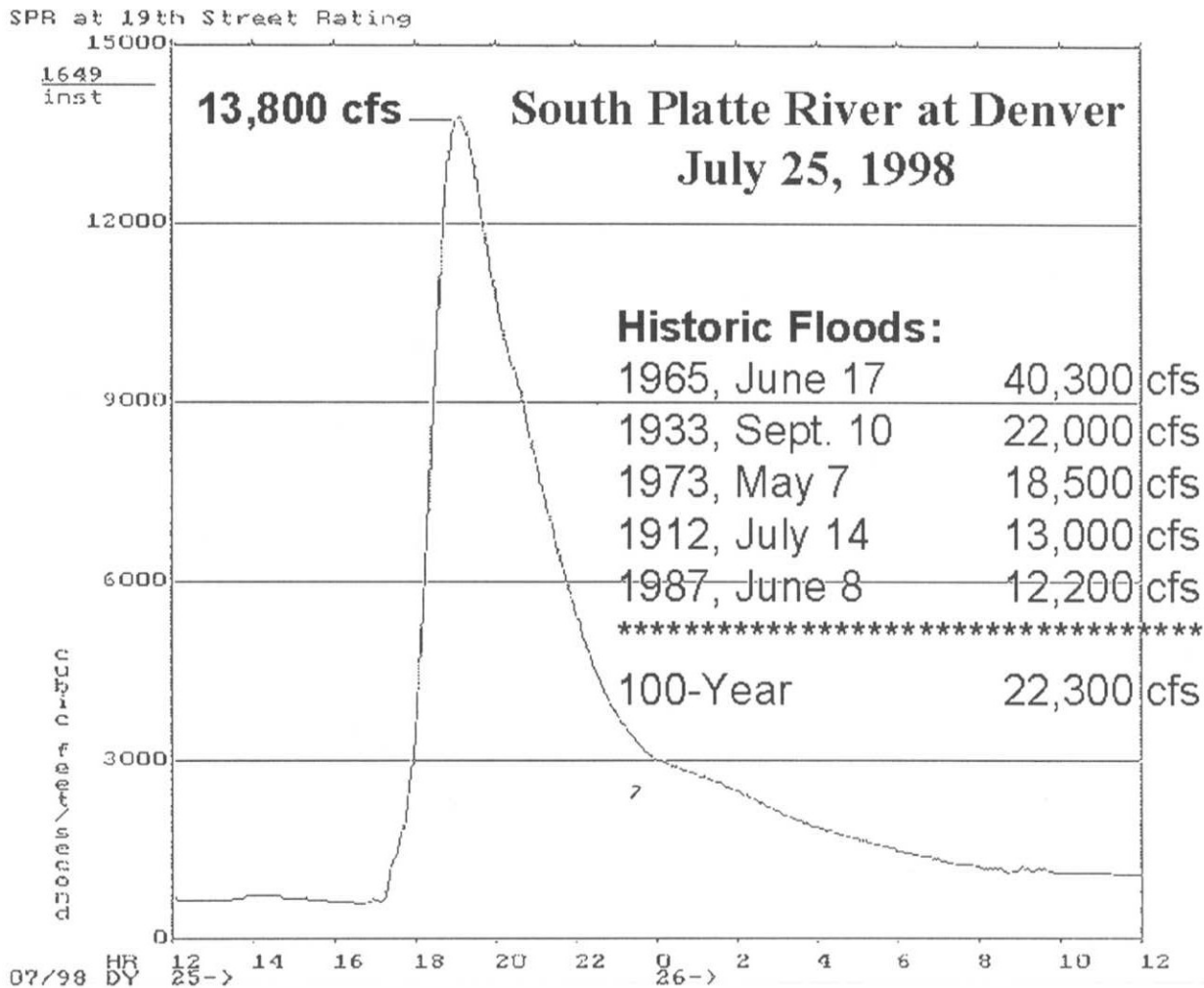
Coordination with the news media by District staff resulted in excellent coverage and documentation of the flooding at Parker. Video taken from the KCNC-News 4 and KMGH-News 7 helicopters was especially useful.

Parker was not the only area hit on July 30; with Denver street flooding, zodiac boat rescues at "Lake Logan" (Logan Street underpass of I-25) and a kayaker rescue from the S. Platte River at Santa Fe being the lead stories for the evening news.

Friday, July 31:

A flash flood watch was issued by the NWS shortly after 2 p.m. for the entire front range from Colorado Springs to Fort Collins. At approximately 6 p.m., a flash flood warning was issued for western Douglas County. Local authorities considered evacuating homes in the Sedalia area but no action was needed. In Denver, street flooding

An ALERT data plot of the South Platte River flood of July 25, 1998.



damaged private property in the vicinity of Evans Ave. and Lipan Street. Buffalo Creek flooding was the top news story. This Jefferson County mountain community has sustained numerous floods since a forest fire ravaged the area in May of 1996. Three inches of rain in one hour was reported to have fallen at Buffalo Creek causing extensive road damage, large debris accumulations, and disrupting electric, phone and water service for the night. Mudslides were a problem for a number of other mountain towns that evening.

Monday, August 10:

While no flash flood warning was issued for the August 10 storm, extensive urban flooding did occur in Lakewood and Denver. Between 4:45 and 5:45 p.m., 3.26 inches of rain was measured in Lakewood near the

intersection of W. 1st Ave. and Balsam Street. Rush-hour traffic was at a crawl while many homes had their basements flooded. Vehicles were floating in the Wal-Mart parking lot where the floodwater was 3 to 4 feet deep. This parking lot is located in the floodplain of South Lakewood Gulch near W. 2nd Ave. and Wadsworth Blvd. East of Kipling Street, McIntyre Gulch was out of its banks at a number of locations. Lakewood Gulch in Denver overtopped Wolff St. by at least 3 feet. This event contributed directly to a Lakewood City Council action exactly 2 weeks later endorsing a plan to form a storm water utility and establish a fee of 88 cents a month for each 1000 square feet of impervious area, costing the average home owner \$1.98 per month.

Friday, August 21

At 4:19 p.m., the NWS issued a flash flood warning for NW Elbert, south central Arapahoe and extreme NE Douglas Counties. The storm was centered over Coal Creek just outside the District in Elbert County, east of Parker and north of Elizabeth. Newspapers reported that up to six inches of rain fell in Elbert County with two county roads under water much of the evening. Roads in Arapahoe County were also closed. Coal Creek and Murphy Creek join to form Sand Creek near Buckley ANG Base in Aurora. The 1998 peak discharge at the Sand Creek Park ALERT gage below I-225 occurred nearly 12 hours later (see table).

Floodplain Management Program Notes

By

Bill DeGroot, P.E., Chief, Floodplain Management Program

25 Years . . .

January 31, 1999, will mark my 25th anniversary with the District. While I don't intend to wax nostalgic in this column, I do want to briefly highlight a couple of items of interest. In that 25 years we have seen the District's population grow by about 850,000 people, along with all of the structures needed to support that population, while the number of structures located in identified 100-year floodplains is approximately 4000 fewer than 25 years ago. This is the result of the District's long standing policy of correcting past mistakes through the planning, design, construction and maintenance of flood mitigation projects; while preventing new development in floodplains through the Floodplain Management Program. Of course none of this could have happened without the participation of our local government partners.

In the early years I spent a lot of time working with local government staffs, appointed boards and elected officials trying to convince them of the wisdom of adopting floodplain regulations, and a little later, of joining the National Flood Insurance Program (NFIP). Now all 31 of the communities within the District with identified floodplains have adopted floodplain regulations and are participating in the NFIP.

I remember explaining the NFIP to the Cherry Hills Village (a wealthy Denver suburb) city council. When I got to the part about flood insurance being required on loans for structures located in the floodplain, a member of the audience asked what the requirements were if you paid cash for your house.

In the early years most developers resisted attempts to manage the flood hazards. Today there are many developers, although not all of them for sure, who recognize that not only are floodplains hazardous locations for structures, but also that they can be terrific amenities to their developments by providing open space, recreation, etc. which sell to potential customers.

In fact, the Colorado Association of Stormwater and Floodplain Managers presented its 1998 Grand Award to a development, Rock Creek Ranch in Superior, for its floodplain preservation and stormwater management efforts. All previous awards had gone to government sponsored projects, with most of those projects completed to fix problems created by developers.

Work products I am proud of include:

- We send annual flood hazard information brochures to 23,000 addresses located in or near identified 100-year floodplains.
- We have an outstanding flood detection and notification, and flood documentation program.
- Almost no new structures located in identified floodplains over the last 25 years.
- Our maintenance eligibility program has raised the quality of the facilities designed and constructed by others, primarily developers, thus assuring lower long term maintenance costs.

The list goes on but I will stop here.

I do want to express appreciation to Scott Tucker for giving me enough rope to hang myself on occasion, without ever actually tying it to a tree.

. . . and Counting

Gazing into the old crystal ball can be fun as long as you don't start believing what you think you see. Therefore, I am not going to make any predictions about the future. I am going to mention a few events which, if they happen, will have a definite impact on our future.

A little over a year ago the Federal Emergency Management Agency (FEMA) staff developed a proposed Map Modernization Plan. There are 37 objectives associated with the plan and I'm not going to begin to discuss them here. However, it is important to note that, while FEMA can implement some of the objectives within its existing budget, full implementation is going to require significant funding from

Congress. The thing to look for in 1999 is whether the first round of needed funding is in the President's budget, and, if it is, how Congress responds.

One of FEMA's 37 objectives is to turn some of the responsibility for Flood Insurance Rate Map production and maintenance over to qualified local governments through Cooperating Technical Communities (CTC) agreements. We are in discussions with FEMA to become one of those CTCs. Will our discussions be successful in 1999?

One local one. I have been trying for five years to negotiate intergovernmental agreements between Denver, the Rocky Mountain Arsenal, Commerce City, Adams County and the District for the implementation of the Irondale Gulch master plan. About a year ago high-ranking officials from the Arsenal, Denver and Commerce City formed the Win-Win Coalition to identify and resolve issues surrounding the gradual change of the Arsenal from a nerve gas and pesticide production facility to a wildlife refuge. Resolution of drainage problems is one of those issues the coalition is concentrating on, and 1999 is the year it should get done.

Staff Notes

David Mallory's addition to the Floodplain Management Program has been very helpful to our efforts. Not only has he assumed responsibility for the maintenance eligibility program, but he has helped out with other, unanticipated (see crystal ball, above), problems during his first year on the job.

Kevin Stewart continues to assure that we have the best possible flood detection system, and he continues to be in demand as a national expert in this field (see his list of professional activities on page 2). If you check out our web site at www.udfcd.org you will also see Kevin's handiwork.

Stormwater Permit Activities

by
John T. Doerfer, Project Hydrologist, Master Planning Program

The District continued to assist the cities of Denver, Aurora, and Lakewood in 1998 to implement their municipal stormwater permits. In accordance with the Clean Water Act, the cities must fully implement all permit requirements within three years of permit issuance. The three cities have met all interim permit deadlines and are on schedule to be in full compliance by June 10, 1999.

During 1998, the following programs were developed:

New Development Program. Denver and Aurora adopted additional ordinances to require new development and redevelopment to include permanent structural best management practices (BMPs). Lakewood will complete its program in 1999 after formation of the stormwater utility approved in August. Although each city's requirements and administrative process are different, they are generally similar in nature. All three cities adopted Volume 3 of the District's Urban Storm Drainage Criteria Manual defining appropriate BMPs and design criteria. Review of drainage plans and inspection of constructed BMPs are included in this program.

Construction Sites Program. Each city developed a program requiring erosion and sediment control at construction sites. Site plans will be reviewed and approved, and sites inspected by city staff. Enforcement actions are also defined. Volume 3 provides the technical basis for BMPs. In addition, a training course for contractors at Red Rocks Community College was developed earlier by the District and CDOT as part of this program.

Public Education Program. Three brochures were developed for distribution in the spring of 1999: (1) Managing Your Household Wastes, (2) Caring for Your Lawn and Garden, and (3) Managing Your Construction Site. These are directed at the general public and offer ways to reduce stormwater pollution. We are also coordinating this effort with a statewide public education campaign by the League of Women Voters.

Monitoring Program. Water quality sampling during storm events at five sites on the South Platte River and tributaries was initiated in 1997. Under a cooperative agreement with the U.S. Geological Survey, equipment was installed and 4 to 8 rainfall events were monitored in 1998 at each site. One

snowmelt event will be monitored each year for the next four years.

Data Management. A software program was updated this year to manage storm drainage system data collected by the cities, such as outfall locations, dry-weather outfall sampling results and industries within the city. This database helps prepare the annual report submittal to the State.

In the future the three cities must assess the feasibility of retrofitting their existing flood-control facilities. In addition, they must identify the BMPs they will use for non-stormwater discharges such as street washing and municipal swimming pools. With the completion of those efforts, the three cities will have fully developed and implemented their stormwater management programs.

The District also assisted Arapahoe County to prepare its permit application submitted in July 1998. The District will continue to assist local governments to prepare for the Phase II stormwater rule expected to be finalized in March 1999. These permit applications will be due in June 2002.

Grouted Sloping Boulder Drop Structures

The District revised the Hydraulic Structures chapter of the *Urban Storm Drainage Criteria Manual* in 1990 to provide better guidance for the design of drop structures and check structures. One of the new drop structure designs, the Grouted Sloping Boulder (GSB) drop, has become far and away the most popular design.

Unfortunately, we have continued to see design drawings that provide inadequate details for construction. We therefore retained McLaughlin Water Engineers, Ltd. to prepare the *Example Construction Details – Grouted Sloping Boulder Drop* which are reproduced in

reduced form on the following two pages. We are encouraging design engineers within the District to refer to these details when preparing construction drawings. Copies of the details, either hard copy or electronic, can be obtained by contacting David Mallory at the District.



A Grouted Sloping Boulder Drop Structure on Cherry Creek in Denver constructed by the Maintenance Program.

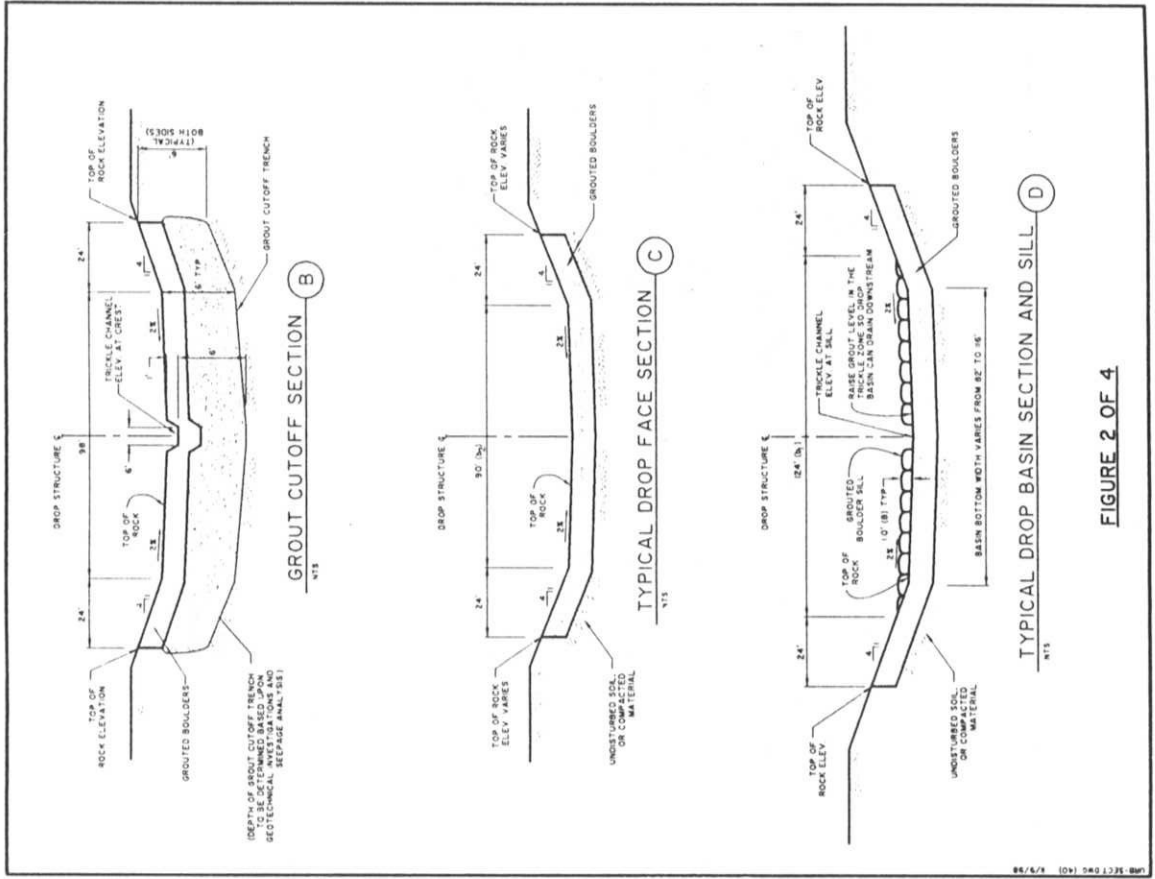


FIGURE 2 OF 4

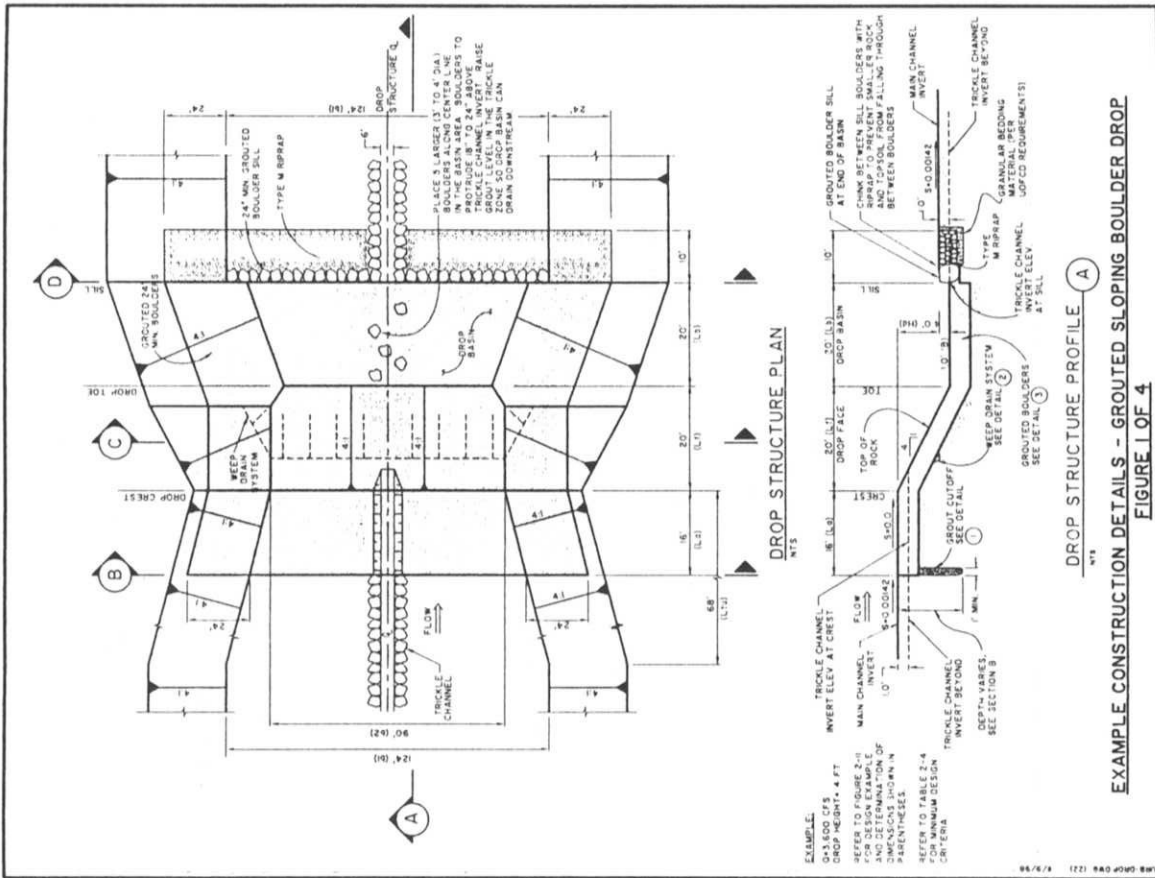
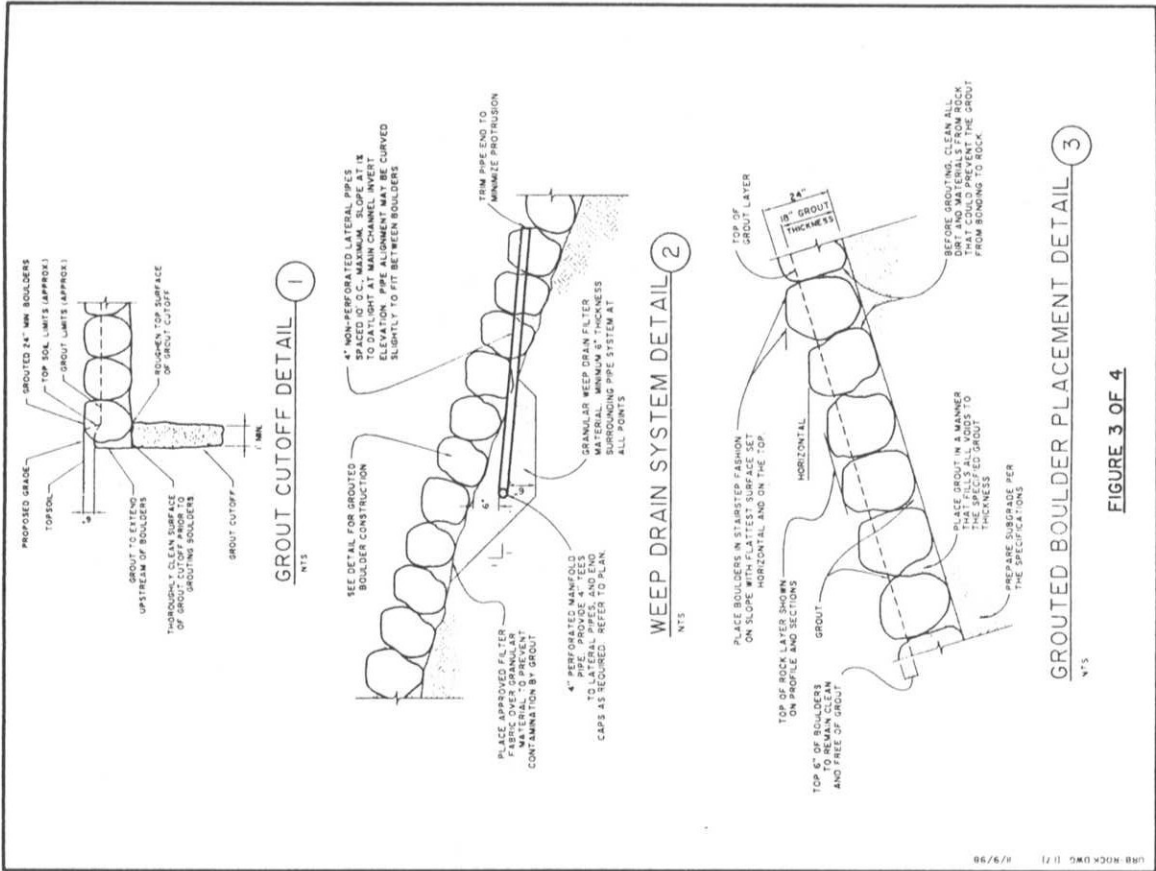


FIGURE 1 OF 4



GROUT NOTES

Material Specifications

1. All grout will have a minimum 28-day compressive strength equal to 3000 psi.
2. One cubic yard of grout shall have a minimum of six (6) sacks of cementitious material.
3. Type II cement shall be used. A maximum of 25% fly ash may be substituted for the cementitious material.
4. The aggregate shall be comprised of 70% natural sand (fines) and 30% 3/8 -inch rock (coarse).
5. The slump shall be 5-inches to 7-inches.
6. Air entrainment shall be 7 1/2 percent to 11/2 percent.
7. To control shrinkage and cracking, 1.5 pounds of Fibermesh, or equivalent, shall be used per cubic yard of grout.

Placement Specifications

1. All grout shall be delivered by means of a low pressure (less than 10 psi) grout pump using a 2" diameter nozzle.
2. Full depth penetration of the grout into the boulders shall be required. To achieve this, a pencil vibrator is to be used.
3. After placement, exposed boulder faces shall be cleaned with a wet broom.
4. All grout between boulders shall be finished with a broom finish.
5. All grout shall be sprayed with a clear liquid membrane curing compound as specified in ASTM C-309.
6. Special procedures will be required for grout placement when the air temperatures are less than 40°F or greater than 90°F. Contractor shall obtain prior approval from the design engineer of the procedures to be used for protecting the grout.

FIGURE 4 OF 4

Floods (Continued from page 1)

actually damages were relatively low considering the magnitude of the event. Five homes in the 900 block of Birch St. and three in the Eagle Trace Subdivision had water backup in their basements from sanitary sewers. The City later determined that this problem was caused by some unsealed manholes and property owners were compensated for their losses. No sewer backups were reported along E. 7th Ave. At least one resident along E. 7th Ave. did report two-inch deep water in her basement, presumably from seepage or poor site drainage. She also said that her property had been flooded five times in the past 26 years and this was the first high water since the flood control improvements were completed.

An Engineering Department official noted that storm drainage facilities at the new Broomfield Town Center along 120th Ave. (US 287) were flowing full and performed well on July 25. If the storm had been worse, businesses in this area may have sustained significant damages. Recent drainage improvements along City Park Drainageway were credited with preventing damages on July 25. The City official also noted that a smaller event had just occurred a few days earlier that nearly flooded the U.S. West Communications building located in the floodplain at 120th and Sheridan. The

July 22 flooding was aggravated by a construction project that partially obstructed the City Park Drainageway channel. The problem was immediately remedied, which proved fortunate just three days later.

The National Weather Service and Henz Meteorological Services (private forecast/notification service used by District) had the storm potential pegged early in the day. HMS first notified the District of the developing weather situation at 9:52 a.m., concerned about the potential for storms capable of producing rainfalls of 4.25"/hour and 3"/30-minutes. All District local governments were notified of this threat by 11:20 a.m. The NWS issued a special weather statement at 11:40 stating that "torrential rainfall rates are again possible." This public statement also indicated that 3 to 4"/hour rains were possible and that the NWS would likely issue a flash flood watch later in the afternoon. The watch was issued at approximately 4 p.m. and HMS updated local governments on the situation. The weather forecasting and coordination efforts that occurred on July 25 between HMS and NWS are indicative of the partnership that has evolved over the years. The District's Flash Flood Prediction Program (F2P2) just completed its 20th year of service.

Other parts of the Denver metropolitan area were impacted much worse than Broomfield on July 25. Consequently, the flooding in Broomfield went relatively unnoticed by the news media. In Denver, an unofficial rainfall report of 5.6" in the vicinity of Federal Blvd. and Evans Ave. drew the attention of the media where street and basement



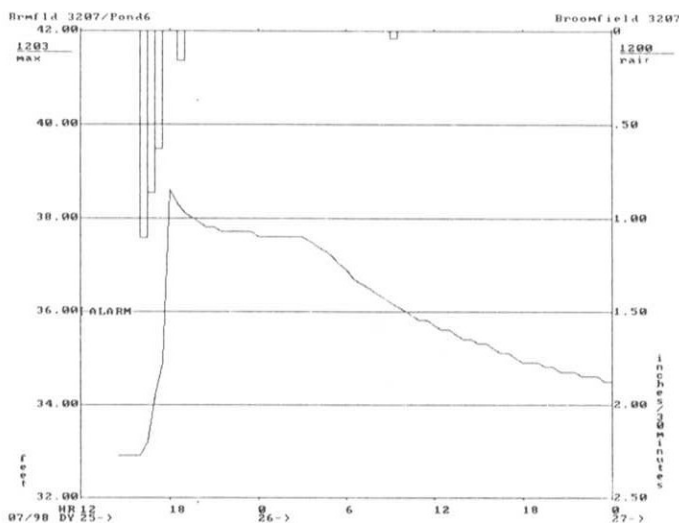
ALERT gauge at Pond 6



July 25, 1998 high water debris line at 918 E. 7th Ave.

flooding was occurring throughout much of southeast Denver and Englewood. Runoff filled the Logan Street underpass of I-25 to a depth of 15 feet. The South Platte River at Denver experienced its highest peak (13,800 cfs) since the flood of 1973. The ALERT system measured rainfall amounts exceeding one inch in less than one hour at 22 locations. The storm that hit Denver occurred about one hour after the Broomfield storm, while the earliest reports of heavy rainfall were from the foothills of Boulder County shortly after 4:30 p.m. In summary, July 25, 1998, was a very wet day for the District and a very successful day for flood control in Broomfield. Congratulations to all the agencies, businesses and individuals who contributed to make July 25 a non-newsworthy event for Broomfield.

An article elsewhere in this *Flood Hazard News* contains information about other significant 1998 flood events. Flood documentation is a routine function of the District's Floodplain Management Program. More detailed information may be obtained by contacting the District.



Pond 6 - ALERT rainfall and water levels, 7/25-26/98

Design and Construction Program Notes

By

David W. Lloyd, P.E., Chief, Design and Construction Program

1998 was a busy year for the District's Design and Construction Program and saw us committing over \$7.6 million to design and construction projects by year-end. Most of this funding has gone toward construction as well as initiation of several new design projects. Design and Construction currently has approximately 80 active projects in varying stages from design through construction.

The Drainageway A project in the City of Louisville came to a close at the end of 1998 with the completion of the detention pond improvements at Middle School Park and Lake Park. The added detention plus the outfall improvements installed in 1997 will eliminate a large area of downtown Louisville from the 100-year flood plain.

1998 marked the completion of the sixth and final phase of construction of the Upper Slaughterhouse Gulch Improvement Project. This project was initiated in 1985 with the City of Littleton and Arapahoe County and since that time the District has cooperated with Littleton and Arapahoe County in the construction of \$7.6 million in drainageway improvements. Congratulations to Littleton and Arapahoe County for their perseverance in the completion of this much-needed improvement project.

Rehabilitation of two regional detention ponds was completed in 1998. The first, Tom Frost Reservoir in the City of Broomfield was completed this past year. In addition to the detention benefits, a pool area was created and the City was successful in obtaining a Fishing Is Fun grant from the Division of Wildlife to provide a fishing resource within the reservoir area. A second regional detention pond was rehabilitated in cooperation with the City of Thornton. Eastlake Reservoir No. 3 improvements were constructed which involved the installation of a new outlet works and spillway.

STATUS OF DISTRICT DESIGN PROJECTS

Project	Participating Jurisdiction(s)	Status
Marston Lake N./Bear Cr. Park	Denver	Complete
Ralston/Leyden Feasibility	Arvada, Corps of Engineers	On hold
Van Bibber Final Design	Arvada, Corps of Engineers	Complete
Little Dry Creek Phase C	Westminster	Complete
Little Dry Creek RR Crossings	Adams County	Complete
Massey Draw at Carr St.	Jefferson County	Complete
Jewell Wetland Detention	Aurora	Complete
Grange Hall Creek	Northglenn	80% Complete
Lakewood Gulch - Perry St.	Denver	10% Complete
Niver Creek Tributary L	Thornton	30% Complete
Drainageway E	Columbine Valley	95% Complete
Irondale 80 th Ave. Outfall	Adams County, Commerce City	95% Complete
Little Creek	Arapahoe County	25% Complete
Goose Creek Phase 3	Boulder	25% Complete
McKay Outfall	Adams County	50% Complete
Pleasant View Trib. to Lena	Jefferson County	95% Complete
Rangeview Gulch	Littleton	90% Complete
Cottonwood Creek	Arapahoe County	40% Complete
Westerly Cr. @ Expo Park	Aurora	40% Complete
Lena Trib. H	Jefferson County	25% Complete

STATUS OF DISTRICT CONSTRUCTION PROJECTS

Project	Jurisdiction(s)	Cost	Status
Cherry Cr. Drop at Iliff	Arapahoe County	\$475,000	Complete
Lone Tree Cr. Pond L-3	Arapahoe County	700,000	Complete
Dry Gulch at 14 th and Lamar	Lakewood	350,000	Complete
Bear Canyon Creek	Boulder	1,000,000	Complete
Drainageway A	Louisville	1,250,000	Complete
West Evans Ph. 2	Denver	500,000	Complete
Monaco/Eastman Outfall	Denver	800,000	Complete
Tom Frost Reservoir	Broomfield	570,000	Complete
Eastlake No. 3	Thornton	450,000	Complete
Kalcevic Gulch Ph. 1	Adams County	870,000	Complete
Greenwood Gulch	Greenwood Village	1,800,000	Complete
Slaughterhouse Gulch Ph. VI	Arapahoe County	1,100,000	Complete
Longs Way Tributary	Parker, Douglas Co.	350,000	5% Complete
I-25/46th & Pecos Ph. IV and V	Denver	600,000	10% Complete
Niver Creek Trib. M	Federal Heights	200,000	50% Complete
Brighton North Outfall	Brighton	1,000,000	95% Complete
Parker/Mexico Outfall	Arapahoe County	800,000	25% Complete
West Evans Ph. III	Denver	500,000	10% Complete
Lakewood Gulch - 10 th Ave.	Denver	700,000	10% Complete
20 th & Meade Outfall	Denver	800,000	10% Complete
Willow Creek	Arapahoe County	550,000	40% Complete

The first phase of construction of the Little Creek improvement project was completed this past year which consisted of new crossings along Little Creek at Delaware and Arapahoe Streets plus drainageway improvements. A second phase of construction is planned for 1999.

A number of storm sewer improvement projects were completed in 1998 in cooperation with the City and County of Denver, Cities of Brighton, Commerce City and Adams County.

Several new design projects were initiated in 1998. Some of the more interesting ones include Grange Hall Creek in the City of Northglenn, Niver Creek Tributary L in Thornton, Westerly Creek at Exposition Park in Aurora and Marston Lake North in the City and County of Denver.

Construction photographs are shown on the top of page 15.

Construction Photographs



Top Left: Bear Canyon Creek in Boulder

Top Right: Middle School detention pond on Drainageway A in Louisville



Bottom Left: Tom Frost Reservoir in Broomfield

Bottom Right: Littles Creek in Littleton

ALTERNATIVE BANK STABILIZATION UPDATE

by
 Bryan W. Kohlenberg, P.E.
 Project Engineer
 South Platte River Program

In the spring of 1997 the District designed and constructed a bank stabilization project employing the concept of bendway weirs (i.e. rock jetties). Since the traditional bank regrading method would have required removal of mature cottonwood trees along the eroding bank, the weir concept was tried for bank stabilization (see 1997 *Flood Hazard News* for design

details). The final construction cost of the five weirs, spaced at approximately 100 foot intervals over 600 feet, totaled \$43,000 or \$72 per foot of bank.

Photos of the project area at about 152nd Avenue in Adams County are shown before, during, and 1-year after construction. Since construction we have observed:

- No noticeable damage to weirs during two high-flow seasons (maximum 9000 cfs in July 1998).
- Development of stable scour holes at ends of weirs.
- No further movement of the vertical bank.
- Some natural sloughing of vertical bank between weirs.

- Continued sediment, woody debris, and trash deposition between weirs adjacent to the bank.
- No noticeable damage to existing cottonwoods
- Strong growth of live-staked and volunteer willows and other wetland vegetation along lower bank, weirs, and newly-formed sandbars.

So far this alternative bank stabilization method at this location appears successful. In 1999 we hope to extend the project downstream by constructing an additional four weirs. We will continue to monitor the project over the next several years and report back.



Before (left), During (middle-note constructed weir), and 1-year after (right-looking upstream) photos of weir/jetty construction project

Maintenance Program Activities

by

Mark R. Hunter, P.E., Chief, Maintenance Program

Routine Maintenance

Through the routine maintenance program \$659,500 was spent in 1998 for mowing and debris pickups on approximately 218 different sections of drainageways within the District boundaries. This equates to a total of about 100 miles of drainageways in the Denver area where we performed routine mowing and debris pickup maintenance.

For 1998 we continued with the increased level of mowing and debris pickups on many urban drainageways. Most of the more urban drainageways now receive four to five mowings and debris pickups per year. Three to four mowings per year was inadequate for effective weed control and for overall appearance.

Other drainageways we maintain are more rural in character. On portions of some of these drainageways we have taken the opportunity to reduce or eliminate our mowing activities. This has been done to encourage habitat and leave a more natural character in the drainageway corridor.

The overall goal of our routine maintenance work continues to be the on-going upkeep of urban drainageways to insure that they function properly as flood carrying facilities.

Restoration Maintenance

In 1998 the restoration program completed \$1,428,000 of work. Restoration projects typically address isolated drainage problems where the solution involves small scale construction. One hundred individual activities were completed during the year. A major advantage of the restoration program is the opportunity to use it to react quickly to local drainage needs.

An example of reacting to a drainageway maintenance need occurred in Brighton, Colorado during the summer of 1998. City staff informed us that **Line B**, also known as South Urban

Channel, needed repairs. Line B was originally improved by the City of Brighton and the District Design and Construction Program about 20 years ago. Changes in the upstream reaches of the creek coupled with natural processes caused sediment deposition to occur in the improved section. What was originally intended to be an urban passive-recreation corridor was becoming a marshy and mosquito-ridden area. The channel was wide and flat-bottomed with a riprap-lined trickle channel. The deposition was occurring in and around the trickle channel due to the frequency of the smaller storm events and the roughness of the riprap. Our work included removing the sediment as well as reshaping and resetting the riprap for much of the length of the trickle channel. Not all the problems were solved, however. This section of Line B is still awaiting an improved outlet to the South Platte River.

A similar opportunity to react arose in mid-1998 on what is called the **Pinehurst Tributary** to Bear Creek in southwest Denver. At a rear-yard location overland flow was captured by an inlet and pipe system. Because of its setting the pipe inlet frequently became plugged with debris. The result was that runoff could not enter the pipe and would back up enough that the water, in its obligation to seek the lowest point, would sweep around and through several homes. The final solution to this problem was not in a maintenance project but in capital improvements that would ultimately remove the homes from the floodplain. Such improvements had yet to be planned, designed and built. Recognizing that it could be years before such improvements would be made project planners hoped to make short term changes to help the neighborhood. It was recommended that the inlet to the pipe be improved to increase the amount of water it let into the pipe. This fell within the work the Maintenance Program could perform. The inlet design and construction were completed

within a couple months. While the development of the master plan for flood control improvements is still underway the improved inlet will now provide better water carrying capacity for the neighborhood than they had before.

Rehabilitation Maintenance

Twenty-eight projects were at various stages of design or construction during 1998. Those projects are listed in the accompanying table titled "STATUS OF MAINTENANCE REHABILITATION PROJECTS". Rehabilitation projects usually take the form of consultant-designed repairs that are intended to address severe problems that have occurred on a previously improved urban drainageway. By the end of 1998 the District will have spent about \$3,030,000 on rehabilitative design and construction for the year. A few of the unique projects are discussed below.

Over the past two year we have reported on our project on **Niver Creek** in Adams County near the South Platte River. It has been a slow process but the result is a coordinated design for a new bridge, a rehabilitated open channel with drop structures, and an expanded trailhead park. The design has been completed and the work was recently publicly bid. With funding in place from several different sources construction of this project will soon begin. Deteriorated pipe, a concrete lined channel and an eroded channel will be replaced with a new bridge over Niver Creek, a restored open channel for Niver Creek and a trail-head park facility.

In Arapahoe county, just south of Dry Creek Road, **Willow Creek** had cut a 25-foot high eroded bank. About 2,000 feet downstream the creek entered the flood detention pool behind Englewood Dam. The flood pool had been experiencing aggradation for several years. The District's Design and Construction Program had a design underway to solve the severe erosion

problem. Coupled with that design the Maintenance Program had the same consultant design a sediment trap upstream of the flood pool. This trap will reduce the amount of large sediments being deposited in the detention pond and will improve the quality of the water in the stream. The sediment trap should also help reduce the on-going muck removal that has been necessary to keep open the pedestrian trail under Dry Creek Road. Construction on this project began in November, 1998 and should be finished in the spring of 1999. This is a new area of work for the Maintenance Program. We will provide updates on this project as it is completed and comes into service.

A similar sediment trap is proposed upstream of the flood detention pool behind Holly Dam on **Little Dry Creek**. This project is on the north side of Arapahoe Road about one mile north of the sediment trap on Willow Creek mentioned above. Design for this project will get underway in 1999.

In last year's *Flood Hazard News* we reported that two large projects were underway on **Goldsmith Gulch** in the City of Denver. Both projects are situated on park land and both have benefited from a design partnership with participants from nearby neighborhoods, the Denver parks department, the consultant and the District maintenance program.

Within Bible Park Goldsmith Gulch flowed through a broad natural area. The exception to this meadow-like setting was that the creek had eroded a vertical-sided channel ranging from three to ten feet deep and

STATUS OF MAINTENANCE REHABILITATION PROJECTS

Project	Jurisdiction		Cost	Status
ADAMS COUNTY				
Clear Creek – I-25 to Broadway	Adams County	Design	by others	100%
Repair three drop structures, partic.		Const.	\$60,000	100%
Grange Hall Creek – east of Irma	Northglenn	Design	23,064	100%
Detention Pond/outlet repairs, partic.		Const.	230,000	100%
Sand Creek -confluence with S. Platte R.	Commerce City	Design	14,600	25%
Repair bank erosion, participation		Const.	next year	0%
Niver Creek – S.Platte to Steele St.	Adams County	Design	by others	100%
Replace pipes,repair channel, partic.		Const.	242,500	0%
ARAPAHOE COUNTY				
Greenwood Gulch – east of Holly	Greenwood Village	Design	\$130,000	100%
Erosion repair/drop structures, partic.		Const.	550,000	100%
Little Dry Ck.d – west of Colorado	Arapahoe County	Design	69,037	100%
Drops and channel repair		Const.	187,197	100%
Little Dry Ck – north of Belleview Ave.	Cherry Hills Village	Design	24,000	80%
Repair several erosion sites, partic.		Const.	100,000	0%
Piney Creek Tribs-north of Orchard Rd.	Arapahoe County	Design	by others	95%
Repair 2 regional detention ponds		Const.	40,000	0%
W. Toll Gate Ck. – Delaney Farm	Aurora	Design	81,689	100%
N.E. of Alameda and Chambers		Const.	401,206	100%
Willow Creek – s. of Dry Creek Road	Arapahoe County	Design	29,600	100%
Sediment trap		Const.	211,496	25%
BOULDER COUNTY				
Bear Canyon Creek – in Martin Park	Boulder	Design	\$28,371	100%
Repair drops and channel, partic.		Const.	276,000	100%
Coal Creek – Drainageway #7	Lafayette	Design	24,914	75%
Louisville and Lafayette		Const.	260,000	cancelled
Fourmile Canyon Creek	Boulder	Design	46,192	100%
West of Broadway at Lee Hill		Const.	234,652	95%
Fourmile Canyon Creek	Boulder	Design	28,900	30%
East of Broadway		Const.	next year	0%
South Boulder Creek	Boulder	Design	19,085	100%
N.E. of Arapahoe Ave. and 55 th		Const.	68,059	100%
DENVER COUNTY				
Bear Creek – Raleigh to Sheridan	Denver	Design	\$111,588	100%
Repair bank and rebuild drop		Const.	520,000	5%
Bear Creek – n. of Hampden at Lamar	Denver	Design	by others	100%
Improve pedestrian bridge		Const.	75,000	0%
Cherry Creek – S.Platte R. to Delgany	Denver	Design	35,960	100%
Low flow channel protection, partic.		Const.	323,640	50%
Cherry Ck, Babi Yar T.-Yale & Havana	Denver	Design	34,865	70%
Drops, bank repair		Const.	next year	0
Goldsmith Gulch – Bible Park	Denver	Design	150,819	100%
Low flow channel and drops, partic.		Const.	318,000	100%
Goldsmith Gulch – Cook Park	Denver	Design	78,436	100%
Low flow channel repairs		Const.	453,510	0%
Lakewood Gulch – Federal to Knox	Denver	Design	78,432	80%
Channel erosion repair		Const.	next year	0%-phase 3
South Platte River – Westside Trib.	Denver	Design	43,868	95%
N.E. of 6 th and I-25. Install pipe.		Const.	next year	0%
Weir Gulch – 6 th Ave. & Federal	Denver	Design	by others	100%
Barnum Park detention		Const.	139,822	100%
DOUGLAS COUNTY				
Sulphur Gulch – u/s of Cherry Creek	Parker	Design	by others	100%
Trail construction, participation		Const.	\$155,000	100%
Willow Creek – south of Chatfield Res.	Douglas County	Design	by others	100%
Replace culverts under irr. canal, partic		Const.	50,000	100%
JEFFERSON COUNTY				
Dutch Ck – n.e. of Pierce & Coal Mine	Jefferson County	Design	\$30,768	95%
Repair eroding channel		Const.	next year	0%
Ralston Creek – west of Brooks Drive	Arvada	Design	48,237	100%
Repair narrow eroding channel		Const.	240,039	70%

afforded by the park to recreate a relatively natural riparian corridor for the stream. The recently-completed project created a meandering stream with shallow overbanks which made the stream more accessible and aesthetically pleasing to the park users. Thousands of wetland plantings were installed under this project. Late-season storms damaged some of the plant sites. The spring of 1999 will reveal how well these sites recover. Eventually we expect this project to be a remarkable restoration to an urban stream. The critical element was that there was enough land area to allow the design team to consider this type of project.

Within Cook Park, about one and one-half miles north of Bible Park, the erosion in the low flow channel of Goldsmith Gulch had created a steep-sided channel that is three to six feet deep. Although this was not as severe as the erosion in Bible Park the setting in Cook Park is an improved blue-grass multi-use area. This dictated that the channel configuration for Goldsmith Gulch be rehabilitated to be less of a threat to existing facilities such as pedestrian bridges and play areas. This project was bid in December, 1998. Construction should be complete by late spring, 1999.

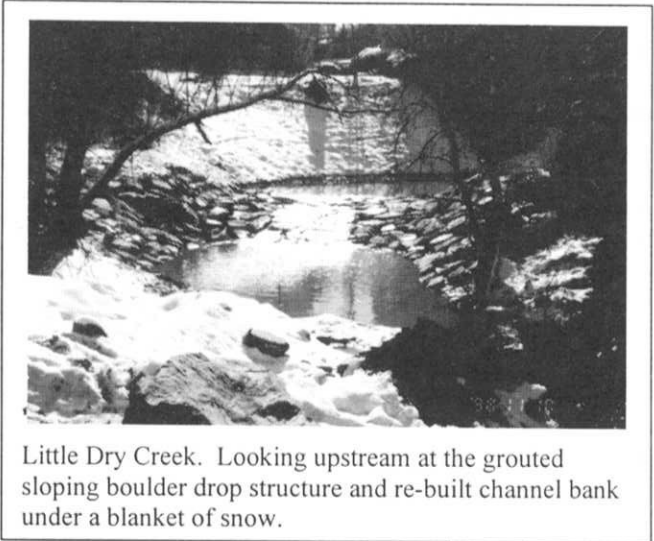
Ralston Creek is an example of a drainage way that had been severely modified by the development process. It is now confined to an inflexible corridor where natural changes in the stream cross-section often result in unacceptable impacts to the adjacent landowners. Construction is now underway incorporating bank protection and drop structures to repair the damage and to keep the creek within its limited corridor.

West of Colorado Boulevard in Arapahoe County was a setting where **Little Dry Creek** passed through an open space area dotted with large trees. The creek had eroded a near-vertical bank that threatened a parking lot and a pipe and manhole for a large sanitary sewer line. The solution called for moving the toe of the steep bank back toward the creek enough so the slope could be rebuilt to a safer two -to-one gradient. A grouted boulder drop

structure was installed downstream of the steep bank to reduce the erosive power of the creek and to protect the sewer line.

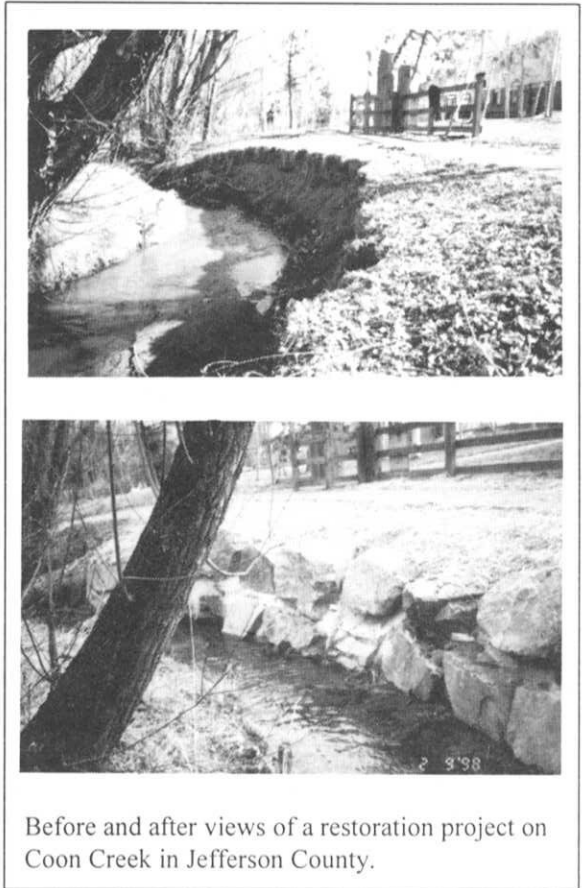
Barnum Lake on Weir Gulch at Federal Boulevard and 6th Avenue had filled in with so much sediment over the years that it had an average water depth of nine inches. The lake serves primarily as a natural habitat area and a stormwater detention pond. By its location it inevitably serves as a sediment trap as well. The Denver Parks Department designed a project to remove the accumulated sediment and restore the lake to an attractive wildlife habitat. Plans also included nature trails and fishing stations on the banks of the lake. The Maintenance Program participated in this project at two levels. Any sediment that was within the stormwater detention volume of the lake qualified for maintenance of a flood control facility. The Maintenance Program fully funded the removal of sediment that occupied the designed detention volume of the pond. Any sediment that was trapped within the permanent pool of the lake did not impact detention volume but did serve to improve the quality of the water in Weir Gulch. The Maintenance Program funded a part of the cost of removal of this sediment recognizing that improved water quality is a long-term benefit to the overall function of a drainage way.

New Staff Member
 Jeff Fisher has joined the District as an Engineering Inspector in the Maintenance Program. Jeff holds a Bachelor's of Science Degree in Natural Resources from Ohio State University. His



Little Dry Creek. Looking upstream at the grouted sloping boulder drop structure and re-built channel bank under a blanket of snow.

most recent work experience was with Drexel Barrell Inc. in Boulder Colorado where he was a Senior Inspector on construction projects. Prior to that he performed materials testing for a large pipeline project in Colorado and managed all phases of work for structural foundation improvements in Ohio. Jeff's favorite hobby is collecting old Keen Kutter tools.



Before and after views of a restoration project on Coon Creek in Jefferson County.

Master Planning Program Notes

by

Ben Urbonas, P.E., Chief, Master Planning Program

Planning Projects

The projects that were under way or completed in 1998 and the ones we hope to begin in 1999 are listed in "Status of Planning Projects." The planning workload is intense and some of the projects we hoped to get under way by mid-1998 will begin next year. The workload is expected to be as intense in 1999 with six new projects scheduled to be funded that year.

Technology Transfer & Education *Erosion Control Training*

Red Rocks Community College is continuing to offer training in runoff quality management during construction. Red Rocks also can certify for the Colorado Department of Transportation that an individual has successfully completed the *Erosion Control Supervisor Training* program. A certified supervisor is now required on CDOT construction projects. Scott Olson at Red Rocks (telephone 303-988-6160, X-282) can provide you with more information.

Software

I reported last year that the District and *Computer Software Library, Inc.* upgraded *CUHPFPC* and *UDSWM386*. *CUHPFPC* now provides an option to account for the effects of hydraulically unconnected impervious areas and *UDSWM386* has corrected some of the reported problems and can now handle up to 1900 gutter/pipe elements. Since then, both have been recompiled using Version 4.0 of the Microsoft FORTRAN Power Station™ 32 bit compiler and have been labeled *CUHPF95* and *UDSWM95* and will shell out directly from *Windows 95™* and NT operating systems without having to reboot in *DOS*. Both programs, and other District supported software, can be obtained through *Computer Software Library, Inc.* P.O. Box 27517, Denver, CO, 80227, Tel. 303-947-3413, FAX 303-985-8882, the District's software distribution agent.

STATUS OF PLANNING PROJECTS

Project	Sponsor(s)	Consultant	Status
Basin 4100, DFA 0054 & 0056 Update	Thornton & Adams Co.	Kiowa	10% Complete
Willow/Little Willow Cr.	Douglas Co.	ICON Engr., Inc.	Completed
Brighton Basin	Brighton & Adams Co.	WRC Engineering	Completed
Cherry Creek – Reservoir to County Line	Arapahoe Co., Aurora & Cherry Cr. Basin W.Q.A.	WRC Engineering	Completed
Academy Trib. to Bear Creek	Denver, Lakewood & Jefferson Co.	Kiowa	95% Complete
City of Englewood OSP	Englewood	TCB	95% Complete
Pleasantview Area OSP	Jefferson Co. & Lakewood	Turner Collie & Braden, Inc.	95% Complete
Lower Box Elder OSP	Adams Co. & Denver	n/a	Select Consultant
Areas SE of 54th & Pecos Trib to SPR	Denver & Adams Co.	Kiowa	50% Complete
Big Dry Cr. Tribs (ARAPCO)	Arapahoe Co.	WRC	10% Complete
Broomfield & Vicinity MP Update	Broomfield & Westminster	Kiowa	30% Complete
Quincy Reservoir Watershed Outfall Plan	Aurora	TCB	90% Complete
Sulphur & Tallman Gulches Outfall Plan	Douglas Co. & Parker	n/a	Select Consultant
Holly Hills Trib. To Harvard Gulch	Arapahoe Co. & Denver	WRC	10% Complete
Plum Creek OSP	Douglas Co.	n/a	Started Mapping
Cottonwood Area Catchment OSP	Parker & Douglas Co.	n/a	Mapping Completed
Pinehurst Trib. to Bear Creek	Denver, Lakewood & Jefferson Co.	Kiowa	35% Complete
Applewood OSP	Jefferson Co., Golden	n/a	Start in 1999
Upper Piney Cr. & Tribs	Aurora	n/a	Start in 1999
Lower Fist Cr. OSP Update	Adams County & Commerce City	n/a	Start in 1999
Four Mile Canyon Cr.	Boulder & Boulder Co.	n/a	Start in 1999
Town of Erie OSP	Town of Erie	n/a	Start in 1999
No-Name Tributary to W. Toll Gate Creek	Arapahoe Co., ECCV & Aurora	n/a	Start in 1999

Volume 3 of the Criteria Manual

In 1998 we started a three-year effort to update the *Urban Storm Drainage Criteria Manual*. With the help of CH2M-Hill we are completing and updating *Volume 3 – Best Management Practices*. To help with this effort, we established a Stormwater Criteria Advisory Committee (SMAC) comprised of representatives from large and small municipalities in and outside the Denver area, CDOT, industry, and the Home Builders Association.

We hope to have the first draft of the manual available early in 1999. If you are willing to volunteer your time to review and comment on this draft, please let me know. We want and need broad review to insure technical

accuracy and consistency and the latest thinking from end users before it is published.

The final version of Volume 3 will be published in printed form and in an interactive CD form. The latter will contain some AutoCAD™ and Excel™ spreadsheet files as well. These will be provided for the use of the manual holder to help size, design and draft BMPs used in land development. If you have any AutoCAD™ details that you are willing to share with us, please contact Jim Wulliman of CH2M-Hill at 303-713-5583.

Volumes 1 & 2 of the Criteria Manual

The work to update Volumes 1 & 2 of the *Urban Storm Drainage Criteria*

Manual will begin in 1999. These two vintage volumes have served us well since they were originally released in 1969. Several sections have been updated since then, but most of the manual has not been touched. Our goal is to reformat these two volumes to be consistent with the same format as the new Volume 3. In addition, outdated sections will be updated, the whole document modernized, known defects corrected and many of the computational procedures computerized to the extent our budget permits. Volumes 1 & 2 will also be published on a CD ROM as well as in traditional printed format.

Volume 3 Seminar

On January 22, 1999 the District will again sponsor a one-day seminar, this time to present the draft of the updated *Volume 3* of the *Urban Storm Drainage Criteria Manual*. The program will include a presentation on the selection and design processes for structural BMPs contained in the updated manual. We hope to have active audience participation on how the draft *Volume 3* may further be clarified and improved.

Fighting Tamarisk Infestations on the South Platte River

by

Ken A. MacKenzie, Engineering Inspector
South Platte River Program

Tamarisk, also known as saltcedar for the salty oil exuded by its leaves, was first introduced into the western United States in the late 1800's as an ornamental tree and windbreak. A prolific seed producer (a single plant may produce hundreds of thousands of viable seeds annually) it quickly escaped cultivation and now thrives in riparian corridors throughout the west.

Recognized as a noxious weed by many states, including Colorado, this highly invasive Eurasian evergreen has reddish brown bark, a light green feathery leaf appearance, and tiny pink flowers. This plant has virtually no wildlife habitat value and develops impenetrable coppices, blocking river access to

Registration fee for this seminar will be \$35.00, which includes lunch, handouts and coffee breaks. Space, unfortunately, has to be limited to 200. For more information contact Sandy Gonzales at 303-455-6277 (FAX 303-455-7880).

Stormwater NPDES Activities

New EPA Initiatives

EPA published proposed Phase II regulations for stormwater permits affecting municipalities with less than 100,000 in population (see related article by John Doerfer). We worked with local cities and counties on formulating comments which we and a number of municipalities in Colorado submitted to EPA. Final proposed regulations have to be issued in 1998 under a court ordered deadline. EPA received a large number of comments and the release of the final document is likely to not meet the deadline.

What municipalities need to get concerned about is the recently released advance notice proposed regulations. If EPA follows through on all of the topics it hopes to address by regulation over

wildlife while choking out willows, cottonwoods, and other desirable native vegetation.

Several infestations of tamarisk were targeted for eradication along the South Platte River in Adams County this fall. They were found in the area north of 88th Avenue and east of Riverdale road. This area of gravel pit lakes had provided the tamarisk an ideal growth environment and it had spread from the lakes to the lower banks on both sides of the river.

The District's routine maintenance contractor, RBI Maintenance, Inc. was given the task of removing approximately 9,500 plants from district easements on both sides of the river. With a crew of 4 laborers and a licensed herbicide applicator, RBI spent 150 man-hours cutting down and hauling away the tamarisk. Using a backpack spray applicator, each stump was treated with a solution of 1 part Garlon[®] 4 to 3 parts water, with a fluorescent blue dye added to ensure thorough application.

the coming years, land use decisions at the local government level will be controlled to a much greater degree than now by the requirements of the Clean Water Act. I urge city and county governments to become familiar with them and their potential long-term impact on local activities, decisions and budgets.

Continued Offer of Assistance

Should your city or county within the District's service area decide to work toward preparing information that may be eventually used to support a permit application, or is taking an initiative to develop its own stormwater quality management program, or simply wants to develop a stormwater system inventory, call us. We can provide you with advice and a fully developed set of consistent protocols and data management tools that can help make your job easier and consistent with others in this region, thereby qualifying your community for further support and assistance as you enter the world of stormwater permitting.

Close monitoring and follow-up maintenance of these sites will be necessary for years to come. We anticipate a 10% regrowth from the cut stumps, and an additional 10% occurrence of seedling plants in 1999 alone. As long as tamarisk is prevalent on adjacent properties, the South Platte River will be subject to new infestations of this insidious and detrimental weed.

We thank the following individuals for their guidance and advice on this project:

- Dr. K. George Beck, Associate Professor of Weed Science, Extension Specialist, Colorado State University
- Carl Zimmerman, Bent's Old Fort Park Ranger & Living History Interpreter, National Park Service
- Mary L. Powell, Natural Resource Specialist, ERO Resources Corp.

UPPER CENTRAL PLATTE VALLEY RIVER RESTORATION PROJECT

By

Leo Eisel, P.E. and Brian Kolstad, P.E.; McLaughlin Water Engineers, Ltd.

The Upper Central Platte Valley reach of Denver's South Platte River extends for approximately one mile, immediately west of downtown, from 8th Avenue to I-25 and runs through residential, commercial, and industrial areas. Historically, this reach of the South Platte has been subject to flood damage, channelization, and destruction of fish and wildlife habitat. Residential, commercial and industrial areas are still threatened by the 100-year flood. Flood waters escape from the channel in this reach, flow north and east along the channel and surround Elich Gardens and the area now being developed for the Pepsi Center.

The Public Service Company's Zuni Power Plant dominates this reach of the river visually, physically, and functionally. Its cooling water diversion dam is the sole remaining obstacle to boating the entire 10.5 mile reach of the South Platte through Denver. Water backup from the dam has replaced the river with a reservoir for nearly 1 mile upstream. The river banks in this reach are steep, making access difficult and impairing wildlife habitat. Much of the vegetation in this reach is non-native and in a degraded condition.

In 1995, Mayor Wellington Webb established the South Platte River Commission (Commission) to improve the river. Major goals established by the Commission include: reducing flood hazard, restoring fish and wildlife habitat, providing increased access to the river and providing more opportunities for recreation

on the river and in the river corridor. Creation of the Commission has resulted in renewed focus on the Upper Central Platte Valley reach. A Task Force, led by the Urban Drainage and Flood Control District has been formed and has developed a detailed plan for restoration of the South Platte River in the Upper Central Platte Valley reach. The Task Force has representatives from recreation, fishery, wildlife, water and neighborhood interests and also includes the Public Service Company, Denver Housing Authority, U.S. Army Corps of Engineers, and the Colorado Division of Wildlife. The major goals of the plan developed by the Task Force include:

Flood Damage Reduction.

Flood damage will be reduced for residents and businesses in the one-mile Central Platte River Valley by widening and lowering the river channel. Overbank flows will be reduced downstream in the areas adjacent to Elich Gardens and the Pepsi Center.

Elimination of Dam. By removing the Zuni Power Plant dam and providing a closed loop cooling system to the power plant, fish habitat, adjacent wetland habitat and boating opportunities will be restored and improved.

Fish Habitat Improvement. Creation of a low flow channel with deeper pools in the meanders will restore and improve fish habitat.

Recreation Improvements. The one-mile long recreation

corridor along the west bank will be improved.

Wildlife Habitat and Wetlands Improvements. A One-Mile Long wildlife corridor will be created along the east bank of the South Platte River.

Improved Access. The park at the confluence of Weir Gulch and the South Platte River, immediately adjacent to the Sun Valley Community Center and the Sun Valley neighborhood, will be improved to provide greater access to the river and create better interface between that neighborhood and the river.

Removal of the Zuni Power Plant dam is possible because Public Service Company has agreed to a closed loop cooling system, which reduces cooling water demand from approximately 100 cfs to 10 cfs. The reduced demand can be provided through an infiltration gallery, located beneath the channel of the South Platte River, thereby eliminating the need for a dam.

The cost estimate for this project is approximately \$17 million, which includes features for flood damage reduction, improved river access, restoration and improvement of fish and wildlife habitat, removal of the Zuni Power Plant diversion dam and replacement with a closed loop cooling system and improvements to make this reach boatable.

This project could be constructed in several phases, if necessary, to accommodate available funding. These phases could be further separated into

several component projects. The phases would need to be constructed in order beginning with the furthest downstream reach (Colfax Reach) so that the downstream channel would be capable of accepting upstream flood flows.

Colfax Reach (Lakewood Gulch to I-25). Implementation of the project in this reach will result in a substantial reduction in flood hazard and improvements in fish and wildlife habitat. The Colfax reach work can be broken down into several components:

- Repair west bank below existing bike trail.
- Excavate east bank, provide toe lining, and create wildlife corridor.
- Shape the low flow channel and create meanders in channel.
- Replace existing pedestrian/bicycle trail with new 10-foot-wide concrete trail.

Zuni Reach (11th Avenue to Lakewood Gulch). Implementation of the project in this reach will provide the greatest flood hazard reduction benefits. Estimated costs include providing temporary diversion facilities for Zuni Power Plant and constructing the closed loop cooling system. This project could be further separated into several components including:

- Build components of closed loop cooling system in Public Service Company Zuni Power Plant outside of river.
- Remove dam and construct infiltration gallery while providing temporary source of water supply for cooling purposes to Public Service Company.
- Excavate west bank, take out existing elevated trail.
- Shape low flow channel and create meanders.

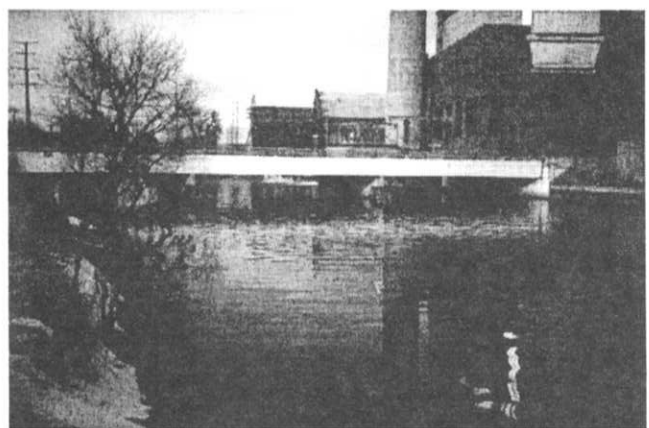
- Create wildlife corridor on east bank.
- Replace existing pedestrian/bicycle trail with new 10-foot concrete trail.

Sun Valley Reach (8th Avenue to 11th Avenue). Implementation of the project in this reach will provide improved access to the river for the Sun Valley Community Center and neighborhood. Components in this reach include:

- Lower a 54-inch water line.
- Widen the channel on the west side.
- Develop improvements at Weir Gulch Park.
- Create wildlife corridor on east bank.
- Shape low flow channel and create meanders.
- Replace existing pedestrian/bicycle with 10-foot wide trail.



Colfax Reach



Zuni Reach



Sun Valley Reach

Implementation of this project will represent completion of a key component in Denver's 10.5 miles of South Platte River.

Professional Activities (Continued from page 2)

- *Had a refereed paper titled "Design of a Sand Filter for Stormwater Quality Enhancement" accepted for publication in the *Water Environment Research* journal, which will appear in publication in 1998.
- *Invited as a keynote speaker at the 4th Brazilian Urban Drainage Symposium to be held in June, 1999.
- *Spoke about the stormwater NPDES program at the First Annual Urban Land Use Institute conference held at the Denver University Law School in October, 1998.

John Doerfer, Project Hydrologist, Master Planning Program

- *Chairman of the Stormwater Quality Committee, Colorado Association of Stormwater and Floodplain Managers (CASFM).
- *Chairman of Awards Committee, 1998 CASFM Annual Conference.
- *Speaker at 1998 NAFSMA/APWA workshop on Phase II Stormwater Issues in Denver in September.
- *Speaker on Volume 3 Update and Panelist on Structural BMPs at CASFM Conference in Steamboat Springs in September.

Mark Hunter, Chief, Maintenance Program

- *Member of International Erosion Control Association (IECA) standards committee on riprap and standards committee on articulating blocks.
- *Secretary of the Board of Directors for the IECA-Mountain States Chapter.

Paul Hindman, Project Engineer, Design and Construction Program

- *Volunteer chairman for 1999 APWA Congress and Equipment Exposition to be held in Denver.
- *Treasurer of the Colorado Chapter of APWA.
- *Presented "Update to Storm Sewer Pipe Material, Technical Memorandum" at APWA spring conference in Grand Junction and Inspectors conference in Northglenn.

Bryan Kohlenberg, Project Engineer, South Platte River Program

- *Co-authored, with Ben Urbonas, and presented "Maintaining an Urban River" at ASCE's 25th Annual Water Resources Planning and Management Division and Environmental Engineering Division Joint Conference in Chicago in June.
- *Continued as NSPE's scoring coordinator for the Jefferson Chapter and Colorado State MATHCOUNTS competitions for 7th and 8th graders.

Novatech 98 Stresses Innovation

Ben Urbonas, P.E.

I had the honor of serving on the scientific committee charged with selecting the papers for Novatech 98, held May, 1998 in Lyon, France. It was my pleasure to participate in this major international meeting of engineers and other professional working the urban stormwater management field. As the name implies, its purpose was to exchange information on new and emerging technologies.

Over 130 papers were supplemented by poster displays and a technical exposition by French and other European firms. The conference ended with a superb technical tour of stormwater quantity and quality management facilities in the Lyon metropolitan area, some of which were excellent examples of multiple uses and innovation.

The program stressed techniques for "sustainable development." Much of this is driven by Europe's dense population, where any new land development now has a significant impact on land, energy, air and water resources. Many Europeans now believe that sustainability is not just a buzzword, but that it is needed for the preservation of lifestyle quality. We in United States can learn from international exchanges of information and technology that conferences like Novatech 98 provide.

The stormwater management profession in United States is pretty much self-contained. This is because we live in a big and populous country and have done much technical development on our own. In fact, much of our past innovation has been recognized by Europe, Australia, and other countries and our earliest ideas have been embraced by their professionals. For example, copies of the District's Urban Storm Drainage Criteria Manual can be found in many countries around the world. However, we can no longer claim a monopoly on leadership in this

field. While we have been busy developing our own technology and exchanging ideas amongst ourselves in United States, and some of them are quite innovative, stormwater professionals in other countries are making great advances. Because of my attendance at Novatech 98, I was able to bring back some ideas that we may be able to incorporate into the revised Volume 3 of the USDCM.

District Wins Accounting Award

For the tenth year in a row the District has received a "Certificate of Achievement for Excellence in Financial Reporting" from the Government Finance Officers Association of the United States and Canada. The certificate is presented to government units whose comprehensive annual financial reports achieve the highest standards in government accounting and financial reporting. Congratulations to Frank Dobbins, Chief of Finance and Accounting, for continuing this string of awards.

EPA Offers Grants

The District, along with Wright Water Engineers and URS Woodward Clyde, is a participant in an American Society of Civil Engineers (ASCE) project funded by a U.S. Environmental Protection Agency (EPA) grant. The project is developing Best Management Practice (BMP) data base software and is attempting to assemble BMP evaluation data collected throughout the United States. EPA is offering, through ASCE grants to local jurisdictions, states, and other non-profits; to transfer BMP field evaluation data into a national database. These grants are expected to range from \$3,000 to \$15,000, with a duration of 3-12 months. Funds will be awarded to reimburse organizations to enter these data and the associated BMP design information into a national database. The long-term goal is to improve the technical design of BMPs and to better match their selection and design to local stormwater problems.

If you have BMP field evaluation data and are willing to help with the development of better design tools we encourage you to apply for a grant. Request an application packet from Ms. Megan Prosser at ASCE by phone at (703) 295-6157, by fax at (703) 259-6138, by e-mail at mprosser@asce.org, or by mail at ASCE, 1801 Alexander Bell Drive, Reston, VA 20191-4400.

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