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# Flood Hazard News

An annual publication of the Urban Drainage and Flood Control District

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## District Construction Projects Win Awards

by

**Richard Borchardt, Bryan Kohlenberg and David Bennetts, all Urban Drainage and Flood Control District; and Vince Auriemma, City of Golden**

The District's Design, Construction, and Maintenance Program had several construction projects win awards in 2009. Below are brief descriptions and a few photographs of each project.

### Utah Park

The Utah Park project received an Honor Award from the Colorado Association of Stormwater and Floodplain Managers (CASFM) for 2009. This project also received the 2009 American Public Works Association – Colorado Chapter – Public Works Project Award for Drainage and Flood Control in a Large Community.

Utah Park artfully integrated flood control and drainage improvements with multiple recreation uses and park renovations. The project included a detention pond that provided 157 acre-feet of storage that removed 40 homes from the Westerly Creek floodplain. Westerly Creek and the Jewell Tributary were removed from culverts and returned to the surface through the construction of new channels within the park. The natural streams and lake provided with these improvements revitalized the park and enhanced the park user's experience with nature. Park improvements included the addition of a picnic pavilion overlooking the lake, a performance stage, renovation



Utah Park – Drainage and Park Improvements working in concert (lake area, trail crossing, and park pavilion are shown)



**Utah Park Master Plan**



**Westerly Creek (what was once in pipe is now returned to the surface).**



**Bio-swale treats parking lot runoff before entering lake.**

of playground, and bathroom facilities. Care was taken to include green components including water quality features (open channels and bio swales) and recycling of existing materials (processing of concrete pipe to be used as stabilization material). The total cost of the project was \$5.6M. Urban Drainage and Flood Control District thanks the City of Aurora Parks, Recreation, and Open Space for their effort and coordination which was pivotal to the success and completion of the project. The lead design consultant was Design Concepts with engineering support provided by CH2M Hill. The project was constructed by ECI.

**South Platte River**

The South Platte River – North Globeville Area Flood Control Project, highlighted in the 2007 and 2008 editions of *Flood Hazard News* has been honored with two prestigious awards in 2009: The American Public Works

Association – Colorado Chapter – Public Works Project Award for Drainage and Flood Control in a Large Community, and the Colorado Association of Stormwater and Floodplain Manager's Grand Award For Engineering Excellence.

The project, located between 38<sup>th</sup> Street and just downstream of Franklin Street, was jointly funded by the District and the City and County of Denver. The lead engineer was Love and Associates, Inc. dba Belt Collins, and the construction was completed in three phases by L & M Enterprises, Inc., New Design Construction, and Lawrence Construction.

The 13 year, \$25,000,000 project consisted of 1.5 miles of channel improvements necessary to remove over 300-acres of land in north Denver and Adams County from the 100-year floodplain (22,000 cfs) while incorporating aquatic and wildlife habitat enhancements, recreational improvements, landscape plantings and wetlands creation. Major channel improvements included removal and replacement of a railroad bridge, reconstruction of a 36-inch water line bridge, trail bridge construction, and the reconfiguration/relocation of the Burlington Ditch head gate. Major trail improvements consist of a new underpass at Franklin Street, eliminating a dangerous at-grade trail crossing, and a new pedestrian bridge spanning the river just downstream which connects Denver's South Platte River Greenway trail to Adams County's trail network.

To assure project stakeholders, most notably the Farmers Reservoir and Irrigation Company (FRICO) that the design would work, a physical model was built at the Colorado State University Hydraulics Laboratory in Fort Collins. One major modification and several minor modifications were made to



One of the most complex elements of the South Platte River project was the relocated intake structure for the Burlington Ditch (starting below the new traffic bridge on this photo and joining the existing ditch on the top right).

verify that delivery of water to the diversion ditch would not be adversely affected by the proposed channel improvements.

The project was officially dedicated in June of 2008 at which time the following statements were made:

“Today I see a renaissance of the South Platte River. We look around us and see this is truly a crown jewel for the Denver metropolitan area.” - Secretary Of The Interior Ken Salazar

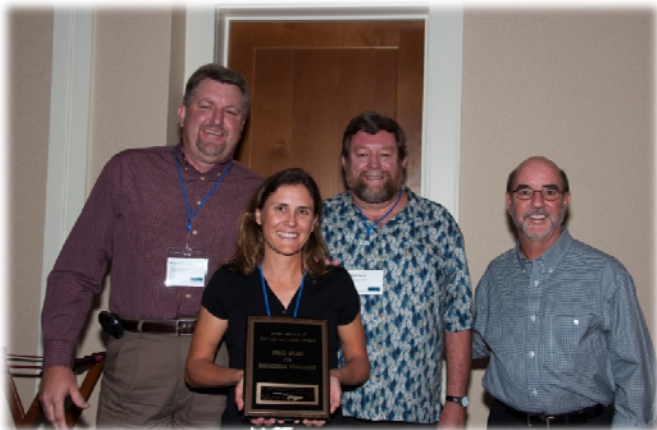
“This project is a wonderful success which creates a wildlife refuge, clearly improves public access to the river and most importantly provides flood protection to remove more than 300 acres of North Denver from the floodplain.” - Denver Mayor John Hickenlooper

Congratulations to the entire design and construction team for a job well done.

**Lena Gulch**

This project won the American Public Works Association – Colorado Chapter – Public Works Project Award for Drainage and Flood Control in a Small Community for 2009.

An undersized and failing metal culvert caused a sinkhole to open in Heritage Road on May 2, 2009. The City of Golden coordinated design and construction of a project with Jefferson County, Urban Drainage, Xcel Energy, Naranjo Civil Constructors, and a private property owner. A gas line was moved and the undersized metal culvert was replaced with a 100-year concrete box culvert large enough to accommodate a future trail underpass. The culvert was completed and the road was opened to traffic only nine weeks after the sinkhole was reported. This project cost was \$230,000 and serves as a good example of coordination between project partners to get the job done quickly and better serve the public.



From left, Bryan Kohlenberg, Urban Drainage; Kimberly Watanabee, Denver; and Dave Love, Belt Collins; accept the CASFM award from Awards Committee Chair John Pflaum.



The problem, right, and the finished product, above.

# Hind' sight

By Paul A. Hindman

*Timely Comment from the District's Executive Director*

One year under my belt and things are going great. Luckily the staff here at the District is superb which makes my job a lot easier. We have made a few changes here at the District that in the long run will make us run more efficiently but in the short term has caused some disruption. If you ask the staff, they might use a different term than "some disruption" but some things you just can't put in print. What I am referring to is our attempt to become more digital or electronic in our operations. One change was seen externally and the other internally.

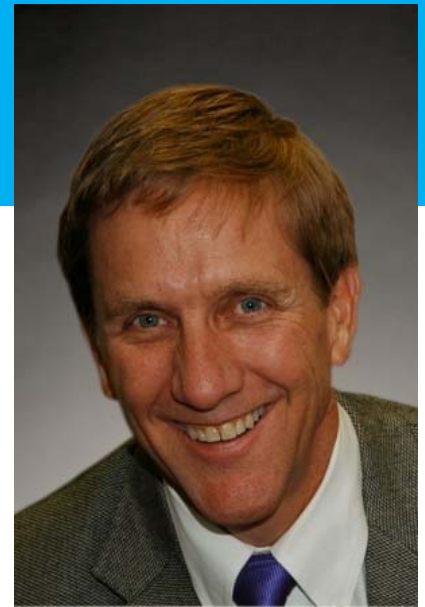
The first was to move the majority of the printed information in our library to our website. This included Master Plans, construction As-builts, Flood Hazard Area Delineation reports, Outfall Systems Planning reports, and other special reports. One of the steps to accomplish this feat was to have all the Program Managers go through every document in the library and determine if it was worth keeping, should be scanned and put on the web, or should be discarded. I knew the only way I could coax them into doing this was "food". I bought donuts and bagels one day and they all started going through the library book by book, report by report. Bill DeGroot was the first to cry "uncle". He was okay reviewing documents at eye level but that bottom shelf was a back killer.

Throughout the day, people were dropping like flies. At day's end, we had made a huge dent in the task and over the next week, everyone spent short stints in the library and eventually everyone went through every document. Next came the scanning. Sandy Gonzalez and her crew tackled this with enthusiasm not seen since I closed the office for a snow day. After the scanned documents were completed, Derrick Schauer quickly got busy uploading the reports to the District's web page. To view these documents, go to Publications under the Downloads pull down menu.

Now that the library had fewer documents and reports, the construction crew came in and built a new wall which in effect made the library a third its previous size. Sandy and the administrative staff, along with the help of student interns ("other duties as assigned"), put together a new library with the reports and publications that weren't scanned but we felt still needed to be kept. I guess our efforts had the desired effect because I don't think we have had one visitor from the outside world visit the new library. I'm not saying we don't like visitors; it's just that we wanted our documents to be easier to access and I'm assuming the outside world is doing just that on our web page.

An added benefit to shrinking the library is we were now able to build an office for Terri Fead and Joanna Czarnecka. Terri and Joanna are both part time employees who work for Dave Mallory in the Floodplain Management Program. Previously they both had a work space as part of our back hallway, stuck against a window and a wall. We still gave them a window but now it just looks into the hallway and Dave's office. I hope they think this was an improvement.

The other major change that affected us mostly internally is moving our paper filing system to an electronic one. Sandy Gonzalez, our Administrative Services Manager, took charge of this enormous task. With the help of Ikon Office Solutions, we zeroed in on the Fortis software program. After many in-house and outside meetings, we have now fully embraced the new system. It went live 12/1/09. In essence, instead of creating more waste for a future landfill, all new documents are scanned into the system for future retrieval. If anyone else has gone through this task, you know it is very hard to get rid of old habits and how scary it is to trust that your documents truly exist. Time will only tell. However, we are



**Ground Breaking of Terri and Joanna's new office (Joanna is center with the scissors; Terri is on the far right in red).**

going into the future with great optimism and will continue to find ways to retrieve information electronically, both internally and externally. Look for a new map interface in the future on our website that will be an interactive way to retrieve data and reports.

Another item we ventured into last year was to create Mission and Vision statements for the District. With the help of Pat Docherty, Mountain States Employers Council, all the staff got involved at various points throughout the process to craft the following statements.

**Mission Statement**

*The Urban Drainage and Flood Control District works with local governments to solve and prevent multi-jurisdictional drainage and flood control challenges in order to protect people, property, and the environment.*

**Vision Statement**


*Achieve a sustainable network of safe, efficient, and environmentally sensitive drainage and flood control facilities to best serve an urban community that is aware of its flood risks. Lead the region and the nation by implementing innovative thinking and technology and by promoting wise use of public and private lands, while providing unsurpassed service to the community.*

We have always lived by these guiding principles but it was great to get them down on paper.

The last item of note that happened at the District in 2009 was that the Town of Morrison, Lakewood, Town of Sheridan and Denver received one of the biggest floods of history which caused major damage to all four cities. You are probably wondering why you didn't see it on the news. That is because it only happened in the virtual world. In June the District staged a mock flood event that roared down Bear Creek Canyon into the Town of Morrison virtually flooding the entire downtown area. Then as it filled Bear Creek Reservoir it was large enough that it flowed over the spillway. In Lakewood it washed out a few bridges and culverts and then onto the Town of Sheridan and eventually Denver as it spilled into the South Platte River.

Our whole staff was mobilized, including being called to the Jefferson County Emergency Operations Center. Only Kevin Stewart, AMEC Consulting Group, and I knew the scenario before it occurred. Our staff cleared their schedules for the day and just took what came at them. This included a news crew coming through our front door to find out who was responsible for all the damage. I am very proud of the way they all performed and am confident when the real thing happens, and it will, we will be up to the task of helping our local governments anyway we can both during the flood, but most importantly after the event.

I look forward to 2010 and know it will be a successful one because I have the best staff anyone could ask for.



Mark Hunter, Manager of the Design, Construction, and Maintenance Program has decided to retire in early 2010 after 29 years with the District. Mark started with the District in 1981 as a Project Engineer with the original staff of the Maintenance Program. He later served as Chief of the Maintenance Program until 2006 when he was instrumental in reorganizing the Maintenance Program and the Design and Construction Program into a single program to serve the local governments. Since 2006 he has been the Manager of the Design, Construction, and Maintenance Program.



Six District staff members participated in the 2009 Bike to Work Day. Pictured above, from left to right, Chad Kudym, Paul Hindman, Kevin Stewart, Holly Piza and Ken MacKenzie. Also participating was David Mallory.

# Master Planning Program

Ken MacKenzie, PE, Program Manager

## Staff Changes

In February, Holly Piza joined UDFCD as a Master Planning program project engineer. Holly will focus on criteria development, NPDES permitting assistance, and stormwater quality issues, while Shea Thomas, who was promoted to Senior Project Engineer in 2008, will continue the fine work she has been doing in guiding the development of major drainageway and outfall systems planning studies.

## Master Planning Projects

We completed three planning projects in 2009 with seventeen additional projects under way; and we hope to begin six new planning projects in 2010.

We now have a total of 142 completed watershed-level major drainageway and outfall system plans in our inventory, including updates of master plans completed in the past.

## Urban Storm Drainage Criteria Manual

Work continues on a major update to the Urban Storm Drainage Criteria Manual Volume 3: *Best Management Practices*. This manual is considered by many as the standard by which other stormwater best management practice manuals are measured, and is one of the most respected stormwater management criteria manuals nationally and around the world.

We are still on track to release the updated Volume 3 in April 2010. All three volumes of the Urban Storm Drainage Criteria Manual (USDCM) are available in pdf format on our web page ([www.udfcd.org](http://www.udfcd.org)) for download. Each chapter is marked with the revision date and I encourage you to check the website frequently for the latest updates.

## UDFCD Computational Tools and USDCM Support Group

You too can be a member of the UDFCD cyber-community by subscribing to this internet discussion group at:

### STATUS OF PLANNING PROJECTS

Project	Sponsors	Consultant	Status
Baranmor Ditch OSP	Aurora	Olsson	75% Complete
Big Dry Creek MDP & FHAD	Adams, Thornton, Westminster	Wright Water	25% Complete
Cherry Creek Stabilization Plan	Joint MP-DC&M Programs	Matrix	5% Complete
Cottonwood Creek (Lower) OSP Update	SEMSWA, Douglas	Muller	75% Complete
Dutch Creek, Coon Creek, Lilley Gulch MDP & FHAD	Denver, Columbine Valley, Jefferson, SEMSWA	PBS&J	Completed in 2009
East Toll Gate Creek (Upper) MDP and FHAD	Aurora, SEMSWA	J3	50% Complete
First Creek (Upper) MDP & FHAD	Aurora, Denver	Moser	50% Complete
Four Mile Canyon Creek & Wonderland Creek MDP	Boulder	Love	Completed in 2009
Hidden Lake - Bates Lake MDP Update	Adams, Arvada, Westminster	Matrix	Completed in 2009
Irondale Gulch OSP	Commerce City	Moser	5% Complete
Lafayette / Louisville Boundary OSP	Lafayette, Louisville	McLaughlin	50% Complete
Little's Creek MDP and FHAD	SEMSWA	None Yet	2% Complete
Lone Tree, Windmill, & Dove Creek MDP & FHAD	Douglas, SEMSWA	Icon	90% Complete
North Dry Gulch OSP	Lakewood	None Yet	2% Complete
Park Hill (Lower) Drainage OSP	Denver, Denver Water	None Yet	2% Complete
Pine Gulch Dam Analysis & OSP Update	Parker, Douglas County	URS	15% Complete
Piney Creek OSP & FHAD	SEMSWA, Aurora, Douglas	None Yet	5% Complete
S. Boulder Creek Flood Mitigation Study	City of Boulder	CH2M Hill	5% Complete
Westerly Creek (Lower) MDP	Aurora, Denver	Kiowa	50% Complete
Willow Creek, Little Dry Cr & Greenwood Gulch OSP	Douglas, Greenwood Village, Lone Tree, SEMSWA, SSPRD	CH2M Hill	75% Complete

(MDP = Major Drainageway Plan, OSP = Outfall Systems Plan, FHAD = Flood Hazard Area Delineation)

<http://groups.google.com/group/UDFCD-support>. Ask a question about the Criteria Manual, software, or spreadsheets and hear what we and other users have to say. We post messages to this group whenever a new version of the spreadsheets, software or manual is posted so this is a great way to be alerted to new releases on our website.

## UDFCD Software

You may download the UDFCD software program *Colorado Urban Hydrograph Procedure (CUHP)* and other free software, including *UDSEWER* that includes a profile plotter, and many other free design aid workbooks from our website at [www.udfcd.org](http://www.udfcd.org). To download the CUHP companion EPA SWMM program, we have placed a hyperlink from our software site to the EPA website.

## UDFCD Annual Seminar

At our 2009 annual seminar we had over 260 registrants. The proceedings are available at: <http://udfcd.org/conferences/conferences.htm>

On April 29, 2010 we will have our next annual seminar. This one-day program will be at the Stapleton Doubletree Hotel and registration will be \$60. Mark your calendar and join us to find out what is going on regionally and nationally in drainage, stormwater, and floodplain management.

At our 2009 annual seminar we had over 250 registrants. The proceedings are available at: <http://udfcd.org/conferences/conferences.htm>.

#### Holly Piza joins District staff

As noted above, Holly Piza has joined the District as a Project Engineer in the Master Planning Program. Holly holds a B.S. degree in Environmental Engineering from the University of Florida and is a certified Floodplain Manager and licensed Professional Engineer in Colorado. Her previous

engineering experience includes work with the engineering firms of Calvin, Giordano & Associates, Sellards and Grigg, and Short Elliott Hendrickson. Please join me in welcoming Holly to the District.



## Bill Taggart Receives 2009 Friend of UDFCD Award

In 2007 the District initiated the Friend of UDFCD award with the intent to recognize individuals who have significantly and selflessly contributed to the field of stormwater and flood management and its technology in the Denver Region and within the State of Colorado

Bill Taggart, who passed away in 2008, was one of those people. He had an untiring energy investigating better ways to convey stormwater. His biggest contribution to the District was the 1986 Drop Structure Manual authored by Bill. The preparation of the manual culminated in a seminar at the then Executive Tower Inn, which was attended by all of the designers and planners in the area that had an interest in stormwater. Following the seminar, Bill's findings and recommendations were incorporated into the District's *Urban Storm Drainage Criteria Manual*. Bill's work is still being used today as the standard in the Denver Metro area. Hundreds of drop structures have been built based on his work.

Some other notable projects Bill worked on for the District include:

- Creek Front Project on Cherry Creek
- Confluence Park
- Denver City Park
- Little Dry Creek, Englewood, Colorado
- South Platte River Greenway

We were all saddened to hear of his passing last year and he will be sorely missed by his colleagues and the District. As a small token to remember him, the District presented the "Friend of UDFCD" award to his wife Naomi.

Pictured here are two of Bill's most interesting and memorable projects.



Confluence Park in Denver



Little Dry Creek in Englewood

# Floodplain Management Program

Bill DeGroot, PE, Program Manager

One of the privileges I have had in this job has been to represent the District and our local governments with the National Association of Flood and Stormwater Management Agencies (NAFSMA). It was 1995 when then Executive Director Scott Tucker, who had helped form NAFSMA and was then a Board member, asked me if I would be interested in chairing a new NAFSMA Floodplain Management Committee. I said yes, and then NAFSMA President John Byke appointed me. I have been chair or co-chair of the committee ever since, until September when I relinquished the co-chairmanship. President Gayle Fraser has appointed David Mallory to succeed me.

When Scott retired I was elected to fill his vacancy on the NAFSMA Board, and was later elected to the executive committee. I recently stepped down from the executive committee because I was in line to become president for a two year term in 2012, the year I turn 65 years old. I knew that, although I do not have a retirement date in mind, I do not plan to be here until I'm 67. Some people interpreted these moves as a sign of impending retirement, but I still serve on the board of directors and hope to continue in that role.

During my time with NAFSMA I have had the privilege to represent our members in several advisory capacities as I will briefly describe below.

Shortly after I became committee chair we caught wind of the establishment of the Technical Mapping Advisory Council (TMAC). This was a 12-member council established by federal law to advise the Federal Emergency Management Agency (FEMA) on flood insurance rate map (FIRM) modernization issues. None of the members represented local government, one of the biggest users of the maps. We requested an audience with TMAC, and President Byke, Executive Director Susan Gilson and I made a presentation on the necessity for local government representation on TMAC. Because their membership was established by law, the council invited NAFSMA to provide an advisor to the council, and President Byke appointed me to that role, which lasted from 1997 to 2000, when the council was sunset.

With the help of TMAC, FEMA developed a Map Modernization (MapMod) concept, which President Bush and the Congress committed to funding for five years. During the MapMod period there was no "son of TMAC" to advise FEMA or their contractor, Michael Baker Jr., Inc. During that time we at NAFSMA and representatives from the Association of



**Ed Thomas, left, was the facilitator for the Focus Group meeting at the District in July. Ed is a leading proponent of No Adverse Impact and later in the day made a presentation to a CASFM barstool continuing education session.**

State Floodplain Managers (ASFPM) met periodically and informally with Baker to identify problems and suggest solutions regarding MapMod.

We are now through the MapMod period, and into its successor, Risk MAP (Mapping, Analysis, Planning). We now have a new advisory group called Operating Partners Focus Group; consisting of NAFSMA, ASFPM, FEMA and the Risk MAP contractors; which meets quarterly to again advise FEMA and its contractors on issues relevant to our members.

The District hosted the July Focus Group meeting, which lasted a day and a half, and consisted mainly of FEMA presenting their options for various aspects of Risk MAP, and providing NAFSMA and ASFPM representatives the opportunity to provide their input. It was a very successful meeting, which demonstrated the progress that is possible when federal, state and local representatives gather in a true spirit of cooperation.

I have also had the privilege to represent NAFSMA on the Intergovernmental Flood Risk Management Committee (IFRMC), which includes NAFSMA, ASFPM, FEMA and the Corps of Engineers. The IFRMC meets quarterly in Washington, and frequently attracts the highest management levels from FEMA and the Corps, including FEMA Director Craig Fugate and Major General Bo Temple, Deputy Commanding General of Civil Works for the Corps. These meetings give us the opportunity to bring our issues and



recommendations directly to the decision makers for these agencies.

The IFRMC has also hosted two invitation only conferences intended to bring together representatives of as many stakeholders as possible to gather their perspectives on flood risk management. The most recent conference was in Maryland in July.

I'm planning on continued involvement in both the Focus Group and the IFRMC for the foreseeable future.

### **Floodplain delineation**

We completed our first digital flood hazard area delineation (DFHAD) study this year for Lone Tree, Windmill and Dove Creeks in Centennial and Douglas County. In the future, all of our Flood Hazard Area Delineation Studies will be published in digital form only. No more paper reports will be published. Our DFHAD Guidelines, prepared for us by Moser and Associates, will guide our consultants through the process of publishing DFHAD's in pdf format.

We have FHADs underway for First Creek in Denver and Aurora; Upper East Toll Gate Creek in Aurora; Big Dry Creek in Adams County, Thornton and Westminster; Piney Creek in Centennial, Arapahoe County, Aurora and Douglas County; Littles Creek in Littleton and Arapahoe County; Cottonwood Creek in Greenwood Village, Centennial, Arapahoe County, Douglas County and Lone Tree; and Willow Creek in Arapahoe County, Lone Tree and Douglas County.

All of these studies will be compatible with FEMA's DFIRM specifications, and will be provided to FEMA for incorporation into the appropriate DFIRMs.

### **DFIRM projects**

This year we received four grants from FEMA FY2009 Risk MAP funds to update existing DFIRM's for the City and County of Broomfield, City and County of Denver, Douglas County and Jefferson County. We also completed the 90-day appeal period for the Arapahoe County DFIRM, and are awaiting a Letter of Final Determination with an effective date, probably a late 2010 date.

The Boulder County DFIRM conversion project, which is being managed by the CWCB has also been delayed, but should go effective sometime in late 2010 or early 2011.

### **Maintenance Eligibility**

Our maintenance eligibility program continues to flourish under David Mallory's direction. See David's column elsewhere in this issue.

### **LOMC delegation**

We have been reviewing requests for Letters of Map Change (LOMC) for FEMA since July 1, 2001. We pretty much handle the entire process now, including technical review, drafting the letters and exhibits and uploading all of the backup material to the Mapping Information Platform (MIP). See David's column for more information.

We were projecting a slow year with the economy bringing development almost to a standstill. However, we had one of our busiest years ever. Essentially all of the requests for Conditional Letters of Map Revision were for government funded projects, and the only private sector requests for Letters of Map Revision were for projects completed before the economy really went south.

### **Westerly Creek Dam Regulations**

One of our more challenging projects in 2009 was the development of our "Westerly Creek Dam Development and Operations Regulations." A little history first. The District was the local sponsor for this Corps of Engineers constructed dam. The dam was built on Lowry Air Force Base, so we did not acquire the right-of-way as would normally be required of a local sponsor. Then the base closed and development of the property was turned over to the Lowry Redevelopment Authority. We were left with a flowage easement over the dam and flood pool and some adjacent land.

As development began to occur we were constantly put in the position of defending the embankment and flood pool from encroachment by developers, both public and private. The District and the Corps were constantly being asked to review and comment on various proposals that impacted the facility. The Corps finally asked us to develop a plan for the facility to use to judge future development requests.

We decided to develop regulations rather than simply a plan because they would have more weight. After much give and take with the property owners and other stakeholders, we held a public hearing in August and the Board of Directors adopted the regulations. We think we were able to strike a balance between the desires of the actual owners of the underlying land and our need to preserve the integrity of the facility. There is a link to the regulations on our web site.

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**Cindy Thrush**, Senior Project Engineer in the Design, Construction and Maintenance (DCM) Program left in late 2009 after having worked for the District for nearly 11 years. She was initially responsible for Maintenance Program work in Arapahoe County and Douglas County. With the combining of the Maintenance and Construction Programs she took over responsibility for all design and construction work in Arapahoe County, later carrying out similar duties for the DCM Program in Boulder County and the City and County of Broomfield.

We wish Cindy well in her new position with the Corps of Engineers in Portland, OR.



# Maintenance Eligibility Program

David Mallory, PE, Senior Project Engineer, Floodplain Management Program

Last year I reported work on several Floodplain Management Program initiatives:

- *Maintenance Eligibility on GIS*
- *Digital Flood Hazard Area Delineation (DFHAD) Guidelines*
- *Floodplain Preservation, Protecting Beneficial Functions, Reducing Flood Losses and Saving Lives*

All of these initiatives have been completed. Maintenance eligibility on GIS is currently an internal application which is a huge help in tracking development projects through the various stages of completion. The GIS application will eventually make it into the District's web-based electronic library. The DFHAD Guidelines and prototype are available on our website. The guidelines represent our latest attempt to remain current with floodplain mapping technology.

In 2008, we published the "marketing brochure" which makes the environmental, floodplain management and economic case for the floodplain preservation approach to development projects. We made presentations at the Floodplain Managers Association annual conference in San Jose, California, the ASFPM annual conference in Orlando, Florida and the NAFSMA annual meeting in Colorado Springs. NAFSMA even gave us an award for our efforts (see article elsewhere).

Ed Thomas has been instrumental in helping us promote the message, which compliments very nicely ASFPM's NAI initiative. We are scheduled to make presentations in 2010 in Georgia in March, ASFPM in May and the APWA Sustainability conference in Minneapolis in June. The floodplain preservation message is important as environmental stewardship becomes a more focused federal goal in coming years. A new initiative for 2010 will be a follow up with local governments in order to assess the impact and utilization of the "marketing brochure" within the development community. We anticipate a revised printing as a result.

## The Projects

Large-scale development projects were essentially non-existent in 2009. We did spend significant effort on several public sector projects:

### *RTD FasTracks West Corridor Project*

We have worked with RTD on this project since 2004. In early 2009, RTD completed the design package release to the Denver Transit Construction Group JV (DTCG) for the guaranteed maximum price quote. The notice to proceed with full construction was issued last spring. Unfortunately, none of the major drainage elements had been approved by

the District for maintenance eligibility. DTCG began work on all the major drainage elements, including several locations on Lakewood Gulch and Dry Gulch during a very wet spring. Initial water control efforts proved ineffectual. Joanna Czarnecka, EIT was in the field everyday coordinating the construction/design effort. Terri Fead, PE, CFM spent most of the first half of 2009 plowing through design documents, change orders and requests for information. After a very rocky start, we eventually got the project under control and



**Drop Structure No. 2 on Lakewood Gulch west of Knox Court in the "Oxbow Area"**

headed in the right direction. Muller Engineering Company, the drainage design sub-consultant was very helpful in staying one step ahead of the backhoes. We appreciate that RTD and DTCG recognized the District's very real concerns and worked hard on addressing those concerns.

### *Saint Anthony West, McIntyre Gulch*

A portion of the Denver Federal Center has been turned over to the City of Lakewood for redevelopment. The Saint Anthony West Hospital and attendant medical facilities site straddles McIntyre Gulch. McIntyre Gulch did not fare well in the past under federal ownership. The stream was relocated and straightened and subsequently incised. The Denver Federal Center also located a landfill along the right bank. The design was very challenging due to the degraded condition of the channel, site constraints and significant environmental concerns.

Walsh Environment, with the aid of Bill Ruzzo, worked very hard with Lakewood and the District to craft the best possible solution. The design included a sculpted concrete drop, integrated existing bedrock outcroppings and utilized a

number of traditional and bioengineered stabilization techniques. Terri provided the design review and Joanna represented the District through the construction phase. Territory Unlimited, assisted by Naranja Civil Constructors completed the stream restoration work. I was pleasantly surprised with how well the project looked and functioned in the end, truly a success story.



**McIntyre Gulch sculpted concrete drop structure at the confluence of the North and South Branches.**

#### *McKay Lake Drainageway*

McKay Lake, located west of Huron Street and just south of 144<sup>th</sup> Avenue in Westminster is a jurisdictional dam that provided water supply, recreation and flood control for the Cities of Westminster and Thornton and the City and County of Broomfield. The connecting drainageway between the embankment and the natural confluence with Big Dry Creek was obliterated over the years. A development project and road construction on Huron Street reestablished the stream corridor to a point just east of Huron Street. The absence of a culvert crossing at I-25 and resultant upstream ponding was limiting development in an area of interest to both Thornton and Westminster. WHPacific was commissioned to prepare channel plans that included drop structures, roadway crossings and a regional detention pond. The project will be constructed in three phases, the first of which is nearing completion. Terri provided the technical review and WHPacific and Joanna will see the project through the construction phase.

#### **FEMA Letters of Map Change (LOMC)**

We completed 8 years of the FEMA LOMC Delegation Pilot project in June of 2009. Throughout the life of the pilot project, ICON Engineering Consultants has provided us able assistance with the technical reviews of LOMRs and CLOMRs. FEMA funding levels have remained fixed for the last seven years. This year, in spite of development stagnation, we received a record number of cases. Cases were also very complex, the South Platte River at Globeville for example (see

cover story). We determined early on that our funding levels were insufficient to meet the case load. We considered a number of options, and decided to review most cases using District staff. Terri has spent most of the last half of the year working through the case load. ICON Engineering continued to assist with map production and Michael Baker Jr. was helpful with technical support. While this was an internal funding problem, we worked very hard to render minimal impact to LOMC applicants. No federally mandated deadlines were missed throughout the year. We are optimistic FEMA will correct our current funding deficiencies and provide adequate support in the coming year.

One of the frustrating aspects of the current LOMC program is the rather low quality submittals FEMA will accept. We believe the availability of quality DFIRM mapping now available in the Denver Metropolitan area, coupled with generally very good consulting expertise should result in better submittals and lower review costs. We have commissioned ICON Engineering to develop voluntary submittal guidelines. Complete, well organized and well documented submittals are very helpful to us, but they will also save applicants time and money through the technical review cycle. The goal is better quality floodplain maps, which start with better data.

It is evident from the foregoing that Joanna and Terri bring a very unique set of skills to the maintenance eligibility program. Joanna continues to provide very effective representation of our field operations. She has to maintain a balance with owners, contractors, engineers and local government representatives, none of whom are bound contractually with the District. She somehow gets her way tactfully and respectfully. Terri is at the top of her game with plan reviews and the very specialized field of LOMC reviews. This would have been a very different article without her help. I also need to acknowledge the leadership and mentoring of Bill DeGroot. He is a gifted floodplain manager and a lovely human being. He makes this job challenging and enjoyable.



**McKay Lake Drainageway, phase one channel construction nearing completion between I-25 in the foreground and Washington Street in the background.**

# Design, Construction & Maintenance Program

Mark Hunter, PE, Program Manager

Three years ago it was decided to combine the Design and Construction Program, the Maintenance Program, and the South Platte River Program into a single organizational structure called the Design, Construction, and Maintenance (DCM) Program. The DCM Program consists of a manager, an assistant manager, four senior project engineers and one project engineer, four senior construction managers and one construction manager, and seven student interns. The staff members were regrouped so they would deal with all construction-related activities within their assigned territories rather than dealing with just a single category of work spanning many local governments.

The advantage of this change is that it now provides a single point of contact at the District for our local governments with the goal of providing consolidated and streamlined design, construction, and maintenance for all construction work within their jurisdiction. One of the main advantages for the District is that it will simplify the hand-off from the construction of a project to the maintenance of that same project. We believe this allows us to be more comprehensive in our day-to-day operations and provide better relationships with our local government partners.

Even though all construction activity is now organized under the DCM Program the three original separate legislative authorizations require that the funding, budgeting, and project accounting for the three program funds must remain independent. In 2009, \$7.1 million in Construction Fund money will be committed to projects. The Maintenance Fund will encumber \$7.6 million for maintenance and construction work. The South Platte River Fund will spend \$1.8 million in its field activities.

## Routine Maintenance

For the year 2009 we awarded nine contracts for scheduled debris pickups and native-grass mowing under our routine maintenance agenda. Six of those contracts were competitively bid among private contractors while the other three contracts were awarded as renewals of the prior year contract. The value of each of the renewed contracts was limited to match the change in the regional Cost of Living

### 2009 Routine Maintenance Summary

Adams County	22.0 miles
Arapahoe County	44.2 miles
Boulder County	23.5 miles
Broomfield County	0.2 miles
Denver County	47.1 miles
Douglas County	14.4 miles
Jefferson County	33.7 miles
South Platte River	36.7 miles
TOTAL	221.8 miles

Adjustment over the prior year.

Within the routine maintenance category we do some noxious tree and weed control and some

revegetation efforts in addition to native-grass mowing and debris pick-up. During the year routine maintenance work was done on about 300 different sections of urban native-grass-lined drainageways within the District's boundaries. The contractual value of the work by the end of the year is expected to be \$850,000. The table summarizes the miles of drainageways within each territory of the District on which we performed regularly scheduled mowing and/or debris pickup maintenance.

## Construction Projects

### Adams County

The District and the City of Westminster constructed drainage improvements in the fall of 2008 along **Cozy Corner Tributary Number 5** (Cozy Corner Tributary) from Sheridan Boulevard to approximately 1,000 feet east of Wolff Street. The Cozy Corner Tributary emerges from existing culverts under Sheridan Boulevard into a straight, narrow ditch that did not have the capacity to pass the 100-year flood event. The tributary flows east to Wolff Street where the invert of the existing box culvert was four feet lower than the upstream and downstream channel inverts resulting in significant ponding.

From Sheridan Boulevard to Wolff Street, the project improvements consisted of increasing the Cozy Corner Tributary capacity by steepening the channel gradient and by enlarging the channel cross section. Improvements east of Wolff Street consisted of re-grading the existing Clover Creek Detention Pond so that during a 100-year flood event approximately 625 cfs would be routed through the pond for water quality enhancement and 375 cfs would safely overflow to the existing channel. The pond, enhanced with a water quality capture volume, entailed a unique design to diversify the riparian zone along the edge of the pond. A six foot deep permanent pool was established with a clay liner which allows for the submergence of a diverse species of wetlands plants within the littoral bench.

As the detention pond and channel system matured this past year, algae became a water quality and aesthetic issue that the District and the City have been trying to contain. As the detention pond matures, experts counseled that the level of algae would decrease as the nutrient level stabilizes. The District and the City have an interest in accelerating the stabilization of the nutrient levels in the detention pond. After research and consultation with industry experts, a floating wetland island was installed in the summer. Made from layers of recycled plastic "matrix" which was bonded together with adhesive foam, the floating island was planted with wetland sod and plugs. The vegetation will be allowed to grow naturally, and, as it develops, the plant roots will grow through the matrix and into the water below. Over



**Floating Island during installation**



**Floating Island after installation**

time, a natural eco-system will evolve on the island. The expectation with the floating islands is that the additional surface area of fibers (root system from the wetlands) will increase uptake of nutrients in the detention pond and assist in stabilizing the in-situ condition of the pond.

The City of Brighton and the District collaborated on a drainage improvement project along the **South Urban Channel** to improve conveyance and to eliminate the flooding potential of adjacent residential properties. The South Urban Channel serves as a primary storm drainage collection channel for the southern portion of Brighton. The channel conveys storm water from east to west through the City eventually discharging storm water to the South Platte River just north of Southern Street. Near the confluence with the South Platte River, the South Urban Channel crosses the McCann Irrigation Ditch with an 8' x 6' concrete box culvert (CBC). The CBC has capacity to convey only 640 cfs of the 1930 cfs during a 100-year storm event. As a result of the limited capacity of the CBC to convey the 100-year storm event, backwater from the CBC reduced the capacity of the channel and caused storm water to overtop the channel banks into the adjacent residential properties. To eliminate the flooding potential during the 100-year storm event, a side

channel was designed and constructed upstream of the CBC. The side channel will convey storm flows in excess of the CBC capacity to the South Platte River. Construction started in the summer of 2009 by Kemp and Hoffman and was completed by the end of the summer.

### **Arapahoe County**

The District and Southeast Metro Stormwater Authority (SEMSWA) are nearing completion of a capital project on **Little Dry Creek** just west of Arapahoe Road and Quebec Street. The project improves the capacity of the culverts under Arapahoe Road, which has had a history of flooding problems. Drop structures and bank protection have been added to the project to reduce erosion on Little Dry Creek. The project meets the District's multi-use goal by providing a pedestrian underpass under Arapahoe Road. This crossing reduces hazards associated with crossing a busy street and is an important link to the nearby elementary school and Holly Park. Careful design and precise construction were required to deal with the numerous utilities and change in channel direction across Arapahoe Road. The result is a curved alignment of box culverts and safety additions to the pedestrian underpass.



**Before – Little Dry Creek at Arapahoe Road looking upstream.**



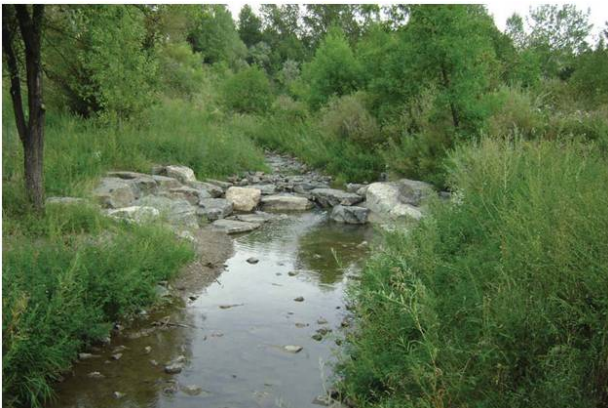
**Near Completion – Same view at Arapahoe Road.**



**Cottonwood Creek trail construction near Caley Ave and Lima St.**

The District and Greenwood Village have completed the construction on capital and maintenance projects for **Cottonwood Creek**, located north of the intersection of Caley Avenue and Lima Street. The project called for the installation of a drop structure, bank protection, and a pedestrian bridge. The drainage improvements protect sanitary sewer lines and adjacent homes. The drop structure creates a water fall that can be seen from the bridge. The pedestrian bridge provides a trail connection between a nearby park area and open space. Cottonwood Creek has a change in jurisdiction along the west bank of the project. This situation required special coordination with SEMSWA to get the trail and bridge properly aligned.

The District completed a maintenance project on **Lee Gulch** located in Ridgewood Park southwest of Ridge Road and Windermere Street. Erosion on Lee Gulch was threatening nearby homes, existing habitat, and a regional/maintenance trail crossing. Drop structures, bank protection, and habitat improvements were made to preserve the peaceful open space of the park. Close coordination with Littleton, adjacent property owners, the Army Corps of Engineers, and the contractor provided an opportunity to make a critical change during construction.



**Lee Gulch west of Windermere St. after construction of drop structure.**

This change enabled the project to save a large section of trees and native brush to preserve habitat and the environment of the open space.

**Boulder County**

The DCM Program staff for Boulder County had the opportunity to work on several different size projects in this past year. For the City of Boulder one project was completed and another is still underway on **Elmer’s 2 Mile Creek at Glenwood Drive**. The first project consisted of the removal of a 6’x 3’ reinforced box culvert which served as the “control structure” for a detention pond that was located in the park upstream. The removal of the box culvert was done to eliminate the backwater effect that the box culvert caused and to reduce the 100 year flows that would spill over to the adjacent properties along the drainageway. This work was an integral part of the second project which is a multi-million dollar construction effort on the downstream portion of Elmer’s 2 Mile Creek. This on-going project will remove



**Drainageway #2 pedestrian north of Baseline Road in Lafayette.**

properties from the floodplain and includes several hundred feet of 12’x 6’ concrete box culvert plus a boulder-lined wetland channel. Elmer’s 2-Mile Creek will have an improved trail system and be separated from an irrigation ditch before it discharges into Goose Creek south of Valmont Street.

In unincorporated Boulder County the reconstruction of a grade control structure on **Coal Creek at Kenosha Road** is currently underway and a stream restoration effort on **Rock Creek at Zaharias Open Space** will begin soon.

Along **Drainageway #2, downstream of 111<sup>th</sup> Street north of Baseline Road** in the City of Lafayette, we constructed a low wetlands crossing and installed a pedestrian bridge across Drainageway #2 at Finch Avenue. The wetlands crossing was built to prevent the wash out of the trail during minor storm events. The bridge was installed to replace a low flow crossing that was very dangerous during minor storm events. Included in the project was the restoration of the Wild Ridge Detention Pond adjacent to the drainageway,

which was undersized for the desired volume needed to handle the current upstream development.

Two projects were done this year For the Town of Superior. **Community Drainageway East, at the end of Mount Sopris Parkway**, had bank repairs and head cutting prevention done to a short section of the drainageway to prevent future erosion of the channel. The other work was at **Rock Creek, McCaslin Tributary at McCaslin Boulevard** which consisted of repairing a road side ditch that had eroded away and was blocking the Rock Creek culvert with sediment. The concrete pipe culvert was extended and a rundown constructed to reduce the erosion due to the excessive slope of the roadside ditch.

### **Broomfield County**

There will be plenty to do in the City and County of Broomfield in the upcoming year. The District will continue with the improvements along **City Park Drainageway**. We



**After – City Park Drainageway in Broomfield looking upstream.**

just completed City Park Drainageway Phase 1 at 120<sup>th</sup> and Lowell Blvd late this summer and will continue with the construction work with City Park Drainageway Phase 2 which will serve as the outfall connecting Phase I to Big Dry Creek.

A section of **Nissen Drainageway at Lowell Blvd** will have major bridge and drainageway improvements. Similar to the City Park Drainageway work mentioned above, this project will be a cooperative effort with the City of Westminster. The District is also investigating maintenance needs within the City and County of Broomfield to identify drainageways that would benefit from maintenance work.

### **Denver County**

The **Westerly Creek Dam** is a regional flood control facility located on Westerly Creek at the south end of the former Lowry Air force Base (Alameda Avenue and Havana Street). The dam was designed and constructed in the early 1990s by the United States Army Corps of Engineers to serve as a flood control facility for the City and County of Denver and the City

of Aurora. As a compacted earth fill dam, Westerly Creek Dam has a total storage volume of 9,300 acre-feet (volume to the top of the spillway) attenuating the 100-year storm flows from a 9.26 square mile drainage basin to 98 cfs. The dam is one of the few facilities for which the District serves as the designated local sponsor and likely future owner. As the local sponsor, the District has the responsibility of maintaining and operating the facility. Each year, the District performs several maintenance and operational activities to remain in compliance with the Federal Rehabilitation and Inspection Program.

In March 2009, a grass-fire scorched the inside face of the dam embankment and an area upstream of the embankment resulting in significant loss of vegetation. With the quick response of the Aurora, Denver, and South Metro District Fire Rescue teams, the fire did not result in loss of structures to the adjacent residences. The loss of vegetation, however, was significant and re-vegetation was a priority. With the expertise of Wildlands Consultant Inc. and the collaboration of Denver and Mother Nature, the re-vegetation of the burn area was a success. The growth of the upland grasses and wetlands has been excellent with the density near (if not better than) pre-fire conditions. Subsequent to the re-vegetation, a weed and tree management and debris removal program was implemented in the late summer to address other issues lingering from the fire and to perform routine maintenance.

In addition to the efforts on the ground, the District has been busy with several administrative projects including the Development and Operation Regulations (Regulation) and the Emergency Action Plan (EAP) for the Westerly Creek Dam. The Regulation was completed in the summer of 2009 and adopted by the District's Board of Directors. The document prescribes the development regulations that must be adhered to for any activities within or adjacent to the Westerly Creek Dam. An EAP was developed for the dam when it was conceived in the 1990s. A significant update to the EAP is in progress and will be completed in 2010 to provide very specific emergency response guidelines for the District and local responders.



**Westerly Creek Dam one month after fire**



**After – Cherry Creek upstream of Havana Street.**

The City and County of Denver and the District collaborated on a project, **Cherry Creek Drop Number 26 Bank Improvements**, to stabilize a reach of Cherry Creek just upstream of Havana Street located within the John F. Kennedy Golf Course. A sinuous and much incised low flow channel of Cherry Creek was slowly undermining the banks of the main channel and threatening structures and large cottonwood trees. A design was conceived to maintain the existing sinuosity of the low flow channel but decrease the sinuosity in the main channel to stabilize the reach. Bank revetment with soil riprap afforded stability to the outside regions of bends while soil lifts with an array of wetland plants were introduced in lower shear stress regions. A wetlands bench was also incorporated at the entry to the improved channel reach to diversify the wetland plant palette. Design was provided by CH2M Hill Inc. with Naranjo Civil Constructors providing the construction services. The improvements were completed in December, 2009.

#### **Douglas County**

In 2009, the District partnered with the Castle Pines North Metropolitan District to perform stream improvements on the upper portion of the **Oak Hills Tributary**. The project is generally located north of the intersection of Daniels Park Road and Castle Pines Parkway. Improvements were required to repair an 11-foot vertical head-cut that was threatening to impact adjacent properties.

Muller Engineering Company, Inc. was the design engineer and early on it was determined that the improvements should be localized to minimize impacts and keep construction costs from exceeding the available budget. An approach was developed that consisted of a 1-1/2 foot high check structure at the upper end of the project followed by roughly 70 linear feet of void-filled riprap channel lining placed over controlled fill. These two elements allowed the eroded channel to be raised up to pre-eroded conditions and support the adjacent stands of gambel oak. Immediately downstream of the gambel oaks the channel grade was

lowered by means of an 8-foot tall drop structure. Below the drop structure is another 30 linear feet of void-filled riprap channel lining which ties into the undisturbed downstream channel.

Access became an issue on the project and it was determined the least impact would be to obtain construction easements through the two adjacent private properties. Fortunately the residents were extremely supportive of the improvements and agreed to the access request. Both the check structure and drop structure were constructed using steel reinforced shotcrete, which was carved and stained to simulate natural sandstone outcroppings in the area. To create additional visual interest, in some locations the shotcrete was washed to create an exposed aggregate finish, and in other areas additional cobble was added to the shotcrete surface. Planting pockets were also strategically located within the structure. For a final touch, fallen and dead pieces of gambel oak were collected and placed on and around the drop structure to soften the transition from the existing banks.

The general contracting work was performed by Territory Unlimited, Inc. and the shotcrete work was performed by



**Before – Oak Hills Tributary in Castle Pines North**



**After – Oak Hills Tributary in Castle Pines North**



Silvercloud Construction Group. Re-vegetation will consist of native grasses, wildflowers, and shrubs. Portions of the re-vegetation were completed in the fall while the remainder will be completed in early 2010. Ark Ecological Services, LLC is performing the re-vegetation.

CH2MHill Inc. completed the design of a sculpted drop structure for **Sulphur Gulch**, approximately 800 linear feet upstream of Riva Ridge in the City of Parker, under the 2008 maintenance program. The eight foot tall structure provided needed grade control for this reach of Sulphur Gulch and construction for the project was funded in 2009 under the maintenance program.

In this reach a parallel secondary channel had developed and due to permitting requirements it was essential that the improvements kept this channel active in higher flows. CH2MHill designed the drop structure to split the flows out of the stilling basin. The low flows would still be directed down



**After – Sulphur Gulch near Riva Ridge in Parker.**

the main channel, but larger events would also direct water down the secondary channel.

Naranjo Civil Constructors did an outstanding job constructing the sculpted drop structure which has now developed into an attraction for the local neighborhood.

#### **Jefferson County**

In 2002, the District completed Phase I of the **Lena Gulch Drainageway “G” Project** at the Jefferson County Fairgrounds. In 2009, in a combined effort with Jefferson County, the District went into Phase II of this capital project. Designed by Moser Engineering and constructed by Concrete Express, the purpose of Phase II was to construct an additional detention pond to meet the Master Plan flow rates. The Jefferson County Fairgrounds is located on the south side of 6th Avenue just west of Indiana Street in Golden.

The proposed site of this off-line detention pond was in the open field just south of the frontage road at the entrance into the Fairgrounds. A diversion structure was constructed upstream and flows exceeding a 10-year event will spill into a 72-inch reinforced concrete pipe that conveys the water into the off-line detention pond.

The Fairgrounds is an extremely busy facility year round with numerous events and large volumes of traffic. Therefore, traffic control and construction phasing was a challenge throughout the project. The District was very grateful to the Jefferson County Fairground’s personal who worked closely with the contractor to make this project a success.

As a finishing touch, Left Hand Excavating placed feature boulders at the entrance to the grounds and Arrowhead Landscaping planted trees and shrub throughout the project site.

As Jeff Fisher always says, “no good deed goes unpunished,” and this project definitely falls into that category. In 2008, the District completed a sediment removal on **SJCD South** at the culvert under Carr Street (just south of Ken Caryl Blvd.) under the maintenance program. Once the sediment was removed it caused the upstream channel to become unstable. The channel degraded about two feet and a head cut developed. In addition to this, the channel further upstream was also causing concern for the property owners as a meander was cutting into the yard and a ten foot vertical bank developed. Therefore in 2009, at the request of Jefferson County, the District hired Olsson Associates to design channel improvements.

A total of three boulder drop structures were constructed. The District also partnered with Southwest Metro Water and Sanitation District to move the sanitary sewer main from the bottom of the channel to the north side. Construction in the backyards of residents was certainly challenging but was



**Lena Gulch – Example of the hail and wind storm damage in Wheat Ridge.**

completed successfully by Left Hand Excavating.

Mother Nature exhibited her awesome power in July of 2009. In what was recorded as the 2nd most costly hail storm in Colorado's history, Jefferson County took the brunt of the \$350 million in reported damage. **Lena Gulch and Clear Creek** within the City of Wheat Ridge suffered extensive blockage from fallen trees and massive amounts of debris. In a coordinated effort, the District worked closely with Margaret Paget, Wheat Ridge's Forestry and Open Space Supervisor, to begin the seemingly daunting process of clearing away the debris. Utilizing three separate contractors, the District contributed \$80,000 and removed an estimated 150,000 cubic feet of debris in the weeks following the storm.

### South Platte River

In 2009 the lone capital project along the South Platte River was the on-going **Upper Central Platte Valley – Zuni/Sun Valley** reach channel lowering/widening project between 8<sup>th</sup> Avenue and Lakewood Gulch in Denver. This major flood control project was combined with the Lower Lakewood Gulch channel improvement project to form one large construction project that was publicly bid and awarded to Lawrence Construction Company. This work will eliminate the 100-year overbank flooding through the Upper Central Platte Valley of Denver and provide flood control improvements necessary to allow for the RTD West Corridor



**Before and After– South Platte River looking upstream adjacent to gravel mine at 120<sup>th</sup> Ave**



Light Rail bridge crossings of the South Platte River and Lakewood Gulch. The construction is estimated to cost approximately \$18 million, shared by the District and Denver, and scheduled for completion in 2012.

In 2009 several restoration maintenance projects were completed along the **South Platte River**. One such project was a 1000-foot long bank restoration/stabilization adjacent to an old sand and gravel mine operation, now converted to a

Denver Water storage reservoir. This project is located upstream of the 120<sup>th</sup> Avenue crossing on land owned by Denver Water with an underlying flowage and maintenance access easement dedicated to the District by the original mine owner. Several breaches of the bank had historically occurred along this reach of the river, therefore Denver Water requested that the District stabilize the bank to help protect the river and the reservoir and to aesthetically improve the look of the bank. The large mining overburden pile along the bank and the exposed trash and re-bar laden concrete rubble were removed prior to installation of the 2.5/3:1 slope soil riprap revetment. Currently, these bank stabilizations typically cost approximately \$175 to \$200 per linear foot to construct.

Cooperative projects are constructed on **South Platte River** flowage and maintenance access easements dedicated to the District. The easements are granted to the District by private property owners adjacent to the river in exchange for river restoration work. The District can participate financially up to 75% of the total project cost. This year's co-op project consisted of over 1600 feet of soil riprap bank stabilization adjacent to South Adams County Water and Sanitation District's Williams/Monaco Wastewater Treatment Facility located on the east bank of the South Platte River just downstream of the McKay Road Bridge in Adams County. The Sanitation District was concerned that bank erosion, left

unchecked, would prevent perimeter access to their plant. The soil riprap bank is almost complete with revegetation efforts to begin this spring.

# Design, Construction, and Maintenance Program

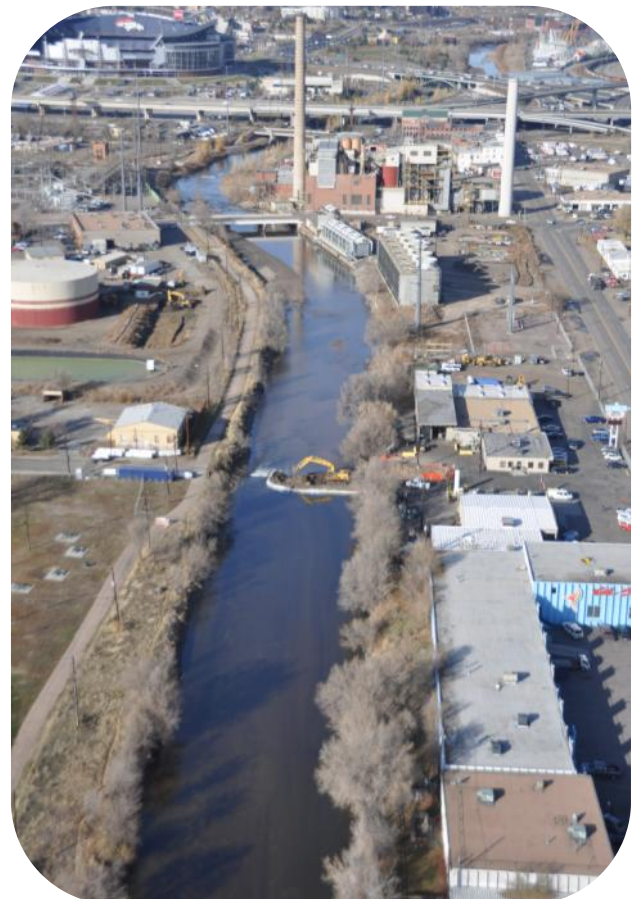
## Status of Projects In 2009

Project	Participating Jurisdiction	UDFCD Funds x \$1,000 / Fund Source	Design / Const Status %
<b>ADAMS COUNTY</b>			
Brantner Gulch at Holly	Thornton	250 / Capital	60 / 0
Brantner Gulch at Riverdale Road	Adams Co	0 / Capital	30 / 0
Big Dry Ck, Cozy Corner Trib	Westminster	300 / Maint	100 / 100
Bolling Drive Tributary	Aurora	200 / Capital	20 / 0
Globeville Utah Junction	Adams Co	680 / Capital	100 / 100
Grange Hall Creek	Thornton	450 / Capital	95 / 0
Grange Hall Creek at Washington	Northglenn	100 / Capital	40 / 0
Hoffman Drainageway	Adams Co	150 / Capital	0 / 0
Irondale G – Dahlia, Kenwood	Adams Co	0 / Capital	100 / 50
Little Dry Creek at 64 <sup>th</sup> Avenue	Adams Co	97 / Maint	100 / 100
Little Dry Creek – Federal to Lowell	Adams Co/Westy	100 / Capital	5 / 0
McKay Outfall	Adams Co.	0 / Capital	100 / 0
McKay Pond	Adams Co	50 / Maint	40 / 0
Niver Creek	Thornton	260 / Capital	100 / 100
North Outfall	Brighton	400 / Capital	90 / 0
Quail Creek	Westminster	800 / Capital	100 / 100
Shaw Heights	Adams Co/Westy	60 / Capital	95 / 0
South Outfall	Brighton	350 / Capital	100 / 100
Tanglewood Creek at 121 <sup>st</sup> Ave	Westminster	30 / Maint	10 / 100
Utah Junction – Clay St Outfall	Adams Co	0 / Capital	100 / 90
<b>ARAPAHOE COUNTY</b>			
Big Dry Creek – Cherrywood Outfall	SEMSWA	350 / Capital	100 / 0
Big Dry Creek – Easter and Univ	SEMSWA	182 / Maint	100 / 95
Big Dry Creek d/s of Santa Fe	Englewood	115 / Maint	100 / 100
Big Dry Creek u/s of Colorado	SEMSWA	100 / Maint	100 / 5
Cherry Creek at Eco Park	SEMSWA	50 / Capital	10 / 0
Cottonwood Creek – bridge u/s pond	Greenwood Village	122 / Cap / Maint	100 / 95
East Toll Gate Creek at Hampden	Aurora	200 / Capital	5 / 0
East Toll Gate Creek tribs at Miss.	Aurora	88 / Maint	100 / 70
First Creek – Detention Pond	Aurora	200 / Capital	0 / 0
Goldsmith Gulch – Dayton & P'view	SEMSWA	100 / Capital	50 / 0
Goldsmith G, W Trib – Davis Pk	Greenwood Village	210 / Capital	100 / 100
Goldsmith G, W Trib – Orchard	Greenwood Village	265 / Capital	100 / 0
Irving Street Outfall	Sheridan	56 / Capital	100 / 100
Lee Gulch at Highline Canal	Littleton	38 / Maint	0 / 0
Lee Gulch – Ridgewood Park	Littleton	225 / Maint	100 / 100
Little Dry Creek at Arapahoe Rd	SEMSWA	450 / Capital	100 / 80
Little Dry Creek u/s Platte River Dr	Englewood	30 / Maint	100 / 100
Little's Creek at Gallup	Littleton	105 / Maint	100 / 75
Little's Creek – Lake to Caley	Littleton	300 / Capital	100 / 0

Project	Participating Jurisdiction	UDFCD Funds x \$1,000 / Fund Source	Design / Const Status %
<b>ARAPAHOE COUNTY (continued)</b>			
No Name Creek u/s Copperleaf Pky	SEMSWA	76 / Maint	100 / 0
Normandy Gulch/SJCD North	Columbine Valley	492.5 / Capital	100 / 10
Piney Creek – W. of Parker Rd	Centennial	95 / Maint	100 / 100
Piney Creek – Tower to Liverpool	SEMSWA/Cent.	1,000 / Capital	100 / 0
Sable Detention, Granby Ditch	Aurora	1,925 / Capital	100 / 0
West Harvard Gulch Trail	Englewood	87 / Maint	95 / 0
West Toll Gate Creek – City Center	Aurora	550 / Capital	100 / 0
West Toll Gate Creek – Chambers	Aurora	225 / Maint	100 / 95
Westerly Creek – Utah Park	Aurora	450 / Capital	100 / 100
Willow Creek at Willow Way	SEMSWA	110 / Maint	100 / 0
<b>BOULDER COUNTY</b>			
Boulder Creek – 95 <sup>th</sup> St bridge	Boulder Co	600 / Capital	100 / 85
Coal Creek – Bldr. Crk. to Kenosha	Boulder Co	234 / Maint	100 / 15
Coal Creek – u/s of McCaslin	Superior	100 / Capital	5 / 0
Drainageway G	Louisville	875 / Capital	100 / 90
Drainageway G u/s of Hwy 287	Lafayette	100 / Capital	40 / 0
Drainageway No. 2	Lafayette	600 / Capital	85 / 50
Elmer's Two Mile d/s of Iris	Boulder	163 / Maint	100 / 100
Elmer's Two Mile	Boulder	1,800 / Capital	100 / 75
Fourmile Cnyn Crk – 28 <sup>th</sup> to 30 <sup>th</sup>	Boulder	44 / Maint	100 / 100
Reach BP-20	Erie	71 / Capital	90 / 0
Rock Creek	Superior	100 / Capital	100 / 100
Rock Creek u/s McCaslin-Zaharias	Boulder Co	147 / Maint	100 / 5
Rock Creek – Carolyn Holmberg	Boulder Co	50 / Capital	90 / 0
<b>BROOMFIELD COUNTY</b>			
City Park Basin at 120 <sup>th</sup> Ave	Broomfield/We sty	900 / Capital	50 / 50
<b>DENVER COUNTY</b>			
40 <sup>th</sup> Street Outfall	Denver	245 / Capital	5 / 0
Babi-Yar Creek	Denver	750 / Capital	50 / 0
Cherry Creek – Drop No 24	Denver	250 / Capital	100 / 100
Cherry Crk – U/s Havana, drop 26	Denver	350 / Maint	100 / 95
Cherry Crk – U/s Havana, drop 27	Denver	850 / Maint	100 / 100
Cherry Crk – U/s Holly, trail	Denver	125 / Maint	100 / 100
First Creek at Tower Road	Denver	151 / Maint	90 / 0
Globeville – Utah Junction Outfall	Denver	1,500 / Capital	50 / 0
Lakewood Gulch at Wolff Street	Denver	0 / Capital	100 / 0

Project	Participating Jurisdiction	UDFCD Funds x \$1,000 / Fund Source	Design / Const Status %
<b>DENVER COUNTY (continued)</b>			
Lakewood Gulch/SPR – FasTracks	Denver	See SPR summary	100 / 5
Sand Creek – 30 <sup>th</sup> & Magnolia	Denver	550 / Capital	100 / 100
Sanderson Gulch d/s of Zuni	Denver	40 / Maint	30 / 0
West Harvard Gulch – Zuni Street	Denver	250 / Capital	100 / 0
West Harvard Gulch – SPR to RR	Denver	1,087 / Cap/Maint	95 / 0
<b>DOUGLAS COUNTY</b>			
Bayou Gulch – Timbrs Ck, Fox Sprw	Douglas Co	480 / Maint	90 / 0
Big Dry Creek – Gleneagle	Douglas Co	120 / Maint	100 / 100
Big Dry Creek, Upper	Douglas Co / H.R	300 / Capital	100 / 100
Cherry Creek – Apache Plume	Parker	1,050 / Capital	100 / 100
Cherry Creek – Main Street	Parker	100 / Capital	90 / 0
Cherry Creek – Stroh Ranch	Parker	600 / Capital	100 / 100
East Dad Clark G – Venneford Rd	Douglas Co / H.R	150 / Cap / Maint	100 / 100
Happy Canyon Ck – Grandview Trib	Douglas Co	600 / Capital	100 / 20
Happy Canyon Ck – Surrey Ridge	Douglas Co	330 / Capital	75 / 0
Newlin Gulch at Stonegate	Douglas Co	450 / Capital	100 / 30
Newlin Gulch u/s of Jordan	Douglas Co	45 / Capital	50 / 0
Oak Hills Tributary	Castle Pines North	80 / Capital	100 / 100
Sulphur Gulch u/s of Riva Ridge Rd	Parker	250 / Maint	100 / 100
Sulphur Gul – 20 Mile to Dransfeldt	Parker	30 / Maint	95 / 0
Tallman Gulch – grade control, trail	Parker	250 / Maint	100 / 100
<b>JEFFERSON COUNTY</b>			
Airport Creek at Big Dry Ck	Westminster	350 / Capital	100 / 10
Arvada Channel	Wheat Ridge	325 / Capital	90 / 0
Clear Ck and Lena G storm cleanup	Wheat Ridge	100 / Maint	100 / 100
Coon Creek	Jefferson Co	200 / Capital	100 / 100
Coon Creek – North Branch	Jefferson Co	40 / Capital	25 / 0
Coyote Gulch	Lakewood / Jeff Co	220 / Capital	100 / 100
Dry Gulch – RTD, Fastracks	Lakewood	350 / Capital	100 / 0
Dutch Creek u/s of Kipling	Jefferson Co	50 / Maint	0 / 0
Dutch Creek at Weaver Park	Jefferson Co	40 / Maint	25 / 0
Jefferson County Fairgrounds	Jefferson Co	750 / Capital	100 / 100
Kenney’s Run –Johnson Road	Golden	695 / Maint	100 / 100
Lakewood Gulch – Dudley at 8 <sup>th</sup>	Lakewood	400 / Maint	100 / 50
Lakewood Gulch – Welchester Pk	Jefferson Co	315 / Capital	100 / 100
Lena Gulch at Heritage Road	JeffCo / Golden	115 / Capital	100 / 100
Lena Gulch at Isabell	Jefferson Co	220 / Capital	100 / 100
Lena Gulch at Simms, Acquisition	Wheat Ridge	200 / Capital	100 / 100
McIntyre – Swamp Angel	Jefferson Co	835 / Capital	100 / 0

Project	Participating Jurisdiction	UDFCD Funds x \$1,000 / Fund Source	Design / Const Status %
<b>JEFFERSON COUNTY (continued)</b>			
North Dry Gulch Lamar to Teller	Lakewood	75 / Capital	15 / 0
North Sanderson Gulch at Lamar	Lakewood	200 / Capital	100 / 95
Ralston Creek – Taft St. to Urban St	Arvada	120 / Maint	100 / 100
SJCD South – Kendall to Pierce	Jefferson Co	200 / Maint	100 / 0
South Lakewood Gulch – CCU	Lakewood	1,050 / Capital	100 / 95
SJCD South – Carr St & Ken Caryl	Jefferson Co	250 / Maint	100 / 100
Tributary B	Arvada	60 / Maint	75 / 0
<b>SOUTH PLATTE RIVER</b>			
CWCB/USACE – Channel Maint	Littleton/Engle w’d	150 / SPR Maint	100 / 90
Denver Trail Wall Repair	Denver	499 / SPR Maint	100 / 100
Pedestrian Trail Bridges	Adams Co	300 / SPR Capital	100 / 100
River South Master Plan	Denver	125 / SPR Capital	95 / 0
SPR/Lakew’d G – Zuni/SV&FasTrks	Denver	8,348 / SPR Cap	100 / 5



Looking downstream at the Central South Platte River reach soon to be under construction.

# Information Services and Flood Warning Program Notes

Kevin Stewart, PE, Program Manager

## 2009 Flood Season Unusually Active

What a contrast between the 2008 and 2009 flood seasons! Flash Flood Prediction Program (F2P2) meteorologists recorded twice the number of flood threat days in 2009 compared to the previous year (52 vs. 26). These past two years also represent the program's most and least active years since the F2P2 first began in 1979.



Although opportunities for flooding were many, annual streamflow peaks failed to capture 2009 news headlines. The July 20 late evening severe storm that caused nearly \$400 million in damages in

Arvada, Wheat Ridge and Lakewood from the high winds and hail was arguably the year's biggest weather news story in the District. The District (DCM Program's contract maintenance crews) was publically acknowledged for assisting Wheat Ridge with debris removal along Clear Creek after the storm.

While rainfall was plentiful, nearly all of the flooding this past year might best be categorized as nuisance events, unless you talk with residents from Denver that had their



apartments flooded on two separate occasions (June 25 and July 3) or the unfortunate owner of 4x4 pickup truck that somehow got parked in a bad spot in Parker on June 23.

The first five weeks of the F2P2 operational season (15 Apr – 15 Sep) passed without incident but then the last week in May began showing signs that a busy flood season might lie ahead. In June and July, flood threat messages were issued for more than half the days in both months. August and September were also highly active compare to prior years.

The District was impacted by National Weather Service (NWS) flash flood warnings on three days (see table for dates), but no flash flood watches were issued for the District during 2009. This may have been another first for the District and was due to the relatively low predicted storm rainfall amounts. For highlights of the more notable events, read the flood season recap later on in this section of *Flood Hazard News*.

Although storm rainfall totals were low (generally less than 2-inches), high rainfall intensities were quite common

and widespread during 2009 as illustrated by the large number of rainfall rate alarms generated by the ALERT System (see table). The discussion on extreme rainfall later in this section may help explain this observable fact and provide some clarity on why so-called "rare events" seem to happen so often. This may be a good opportunity to consider changing how we attempt to make clear our understanding of flood risk when talking with other professionals and communicating with the public.

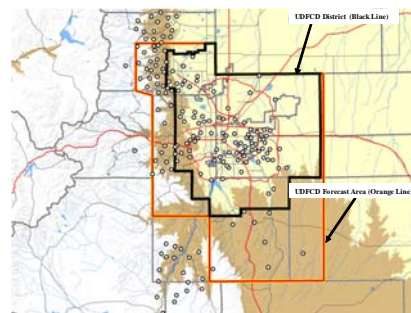
## 52 days with flood potential ties 31-year record

May	22, 23, 24, 25, 30, 31	6
June	1, 4, 7, 9, 10, 11, 12, 13, 14, 15, 17, 18, 23, 24, 25, 26	16
July	2, 3, 4, 5, 6, 10, 11, 12, 13, 20, 21, 22, 25, 26, 27, 28, 29	17
August	5, 6, 9, 10, 13, 17, 18, 25, 26	9
September	5, 8, 9, 13	4

Red dates denote days when rainfall measured by automated gages exceeded alarm thresholds. Yellow highlighted alarm dates indicate that the measured heavy rainfall only impacted the 2002 Hayman Burn Area. Red boxes designate NWS flash flood warnings that affected the District.

## Early Prediction, Notification and Threat Assessment

The meteorological support team of Genesis Weather Solutions and Skyview Weather provided local governments with heavy precipitation forecasts and flood threat notifications for the third consecutive year. Project manager and chief meteorologist Bryan Rappolt completed his 16<sup>th</sup> year of service. Bryan is the president and founder of GWS. Skyview Weather's CEO is Tim Tonge. Brad Simmons with Skyview served his third operational flood season as one of the team's lead forecasters. Met-tech Chris Anderson spent many hours during his second F2P2 season monitoring weather conditions from the District's Flood Prediction Center at Diamond Hill.



The F2P2 operates from April 15 through September 15. The forecast services focus primarily on heavy rain and flash flood threats over an approximate 3,000 square mile area (see orange boundary on map). During the snowmelt runoff season—late spring to early summer—rivers and mountain streams usually overflow their banks. Although the program's prediction services are less directed toward this type of flooding, corresponding

flood information is disseminated to affected local governments when the NWS issues its flood watches and warnings. The program meteorologists also relay information concerning reservoir releases made by the U.S. Army Corps of Engineers from Chatfield, Bear Creek Lake and Cherry Creek Lake. The F2P2 works in close partnership with the NWS Forecast Office located in Boulder.

For the past three years the District has employed the services of JP Consulting (Judy Peratt) to evaluate F2P2 performance and user perceptions. Judy is a former Jefferson County Director of Emergency Management and resides in Windsor. Judy meets individually with her former counterparts from each of the jurisdictions that receive direct communications from GWS/Skyview. She also interviewed 911 dispatch supervisors and public works officials to get their feedback on the program. This process has been tremendously helpful to the District in its relentless effort to improve services. The District would like to thank the many local government officials that participated in the survey process.

A web-based product generator developed by the District was used operationally for the first time in 2009. This greatly simplified the process for creating and disseminating flood outlooks and other forecast products. The Internet application coupled with a District-supported email subscription service allows users to control the type of information they receive, e.g. long content or short abbreviated text messages designed for smart phones and other handheld devices. The retention of forecast products including flood threat notifications (aka Messages), storm tracks, daily outlooks, etc. was also made easier with access to the archive now open to all users (see [f2p2.udfcd.org](http://f2p2.udfcd.org)).

Future program changes will focus on improving communications by using more plain language and less technical jargon. To help all parties understand each other better and provide another opportunity for feedback, a new training initiative tailored primarily for dispatchers will be conducted early in 2010 before the flood season begins. More emphasis will also be placed on delivery of electronic information, which may eventually lessen the requirements for voice contacts concerning alerts of so-called nuisance flood potentials.

Douglas County took some innovative steps in 2009 toward assessing potential flood threats and corresponding impacts in real-time. Working with the consulting firms of HDR Engineering and Water & Earth Technologies, County Engineering developed a GIS-driven Flood Hazard Inventory Tool (FHIT). This database is capable of supporting countywide access to flood information available from the Internet or County LAN connections, and then translate the flood info into potential impacts, e.g. roadway overtopping, trail inundation, buildings at risk, etc. The District is investigating possibilities for regional implementation of this idea using open source database technologies.

### CoCoRaHS Update

The Community Collaborative Rain, Hail and Snow network is operated by the Colorado Climate Center at



Colorado State University in Fort Collins. The network now covers all 50 states (see article by CoCoRaHS National Coordinator Henry Reges in this issue of *Flood Hazard News*). The District has been a sponsor of CoCoRaHS since 2001 and routinely makes use of this valuable data source including many innovative ways of displaying the data. CoCoRaHS is truly a community-based initiative that would not possible without the help of people just like you. So please consider becoming a CoCoRaHS volunteer or sponsor today, and visit [www.cocorahs.org](http://www.cocorahs.org) for the latest news.

### EMWIN-Denver Update

The Emergency Managers Weather Information Network continues to gain popularity under the leadership of the steering committee chaired by Rick Newman with the Adams County Office of Emergency Management. EMWIN-Denver was developed as a reliable source of weather alerts for local governments in the 10-county North Central All-Hazards Region, which includes Adams, Arapahoe, Boulder, Broomfield, Clear Creek, Denver, Douglas, Elbert, Gilpin and Jefferson Counties. Weather alerts for the region are automatically sent by email to affected jurisdictions. The District maintains the email list server where interested parties can subscribe.

In 2009 a good neighbor policy was implemented allowing emergency managers and response agencies from 22 Colorado counties to sign up for the weather alerts. This area corresponds to the region services by the NWS-Boulder Forecast Office. For more information about EMWIN-Denver visit [emwin.udfcd.org](http://emwin.udfcd.org).

### ALERT System News

The District's ALERT system currently collects hydrologic data in real-time from over 200 stations including 8 radio repeaters, 186 rain gages, 92 stream gages and 24 weather stations. Eleven new



ALERT stations and upgrades were installed in Douglas County in 2009. Locations include: Russelville Gulch on E. Tomichi Road SE of Franktown; East Cherry Creek Road on the SE corner of Douglas County; Spring Valley Road weather station upgrade in the upper Cherry Creek basin; Douglas County Public Works in Castle Rock; Indian Creek near Louviers; Rampart Range Road in the foothills south of

Roxborough State Park (pictured); Dakan Road in the upper West Plum Creek basin; Tomah Road weather station upgrade north of Larkspur; and West Creek weather station in the Pike National Forest southwest of Larkspur; Stroh Road rain/stream gage on Cherry Creek in Parker; and the Cottonwood Park rain/stream gage on Cherry Creek at the Apache Plume confluence near the northern Douglas County border.

Douglas County also installed a webcam and staff gage at the State Highway 105 crossing of East Plum Creek. These JPG images are updated every 10 minutes. Check out the following link for current conditions:

[www.wunderground.com/webcams/WETInc/1/show.html](http://www.wunderground.com/webcams/WETInc/1/show.html)

OneRain, Inc. (formerly DIAD) of Longmont completed their 18<sup>th</sup> consecutive year of field maintenance services. OneRain also provides the District with automated daily and weekly monitoring reports (Excel worksheets) that indicate the overall health of the ALERT system and target stations that may require an unscheduled service call.

Water and Earth Technologies (WET) of Fort Collins provided their second year of maintaining Douglas County gages and preparing monthly QA/QC reports. The area-wide system performance reports include maps showing total rainfall amounts for the month and data transmission statistics along with plots of average and peak hourly data rates. A supplemental monthly rainfall intensity analysis by WET has helped the District quantify rainfall magnitude and frequency.

OneRain completed installation of a parallel prototype data delivery system by deploying new equipment on repeaters and implementing a separate receiver platform at the District. The new method is expected to increase the efficiency of ALERT radio communications substantially and remedy data losses that have been experienced in recent years caused by the large size of the expanding gaging network. Early testing of the new data protocol, now commonly known as ALERT-2, appears promising as the radio traffic loading approached 300,000 reports per month during 2009. The City of Overland Park, Kansas is conducting similar tests.

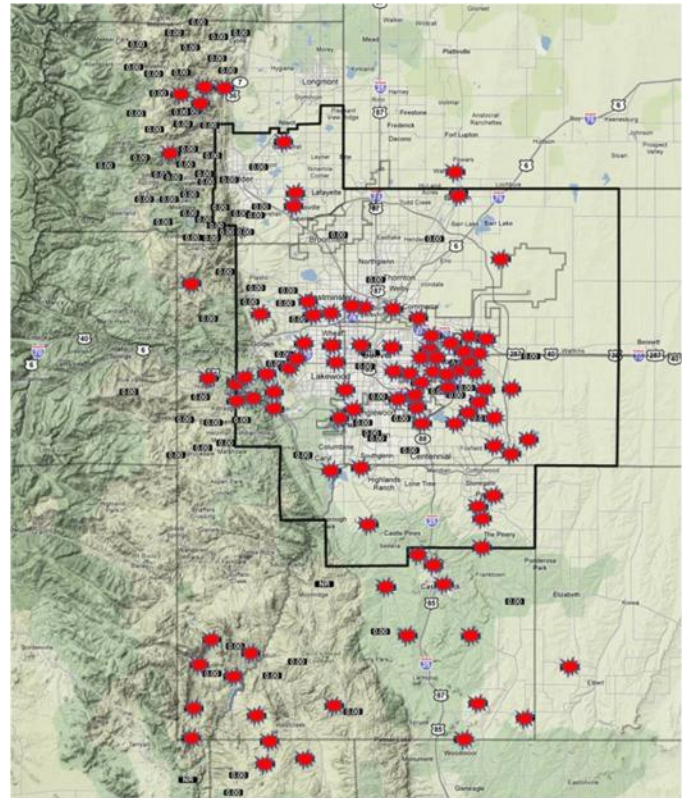
Leonard Rice Engineers (LRE) continued to support real-time hydrologic models for Boulder Creek in Boulder County; Lena Gulch in Jefferson County; and Harvard Gulch and Goldsmith Gulch in Denver, and the upper Cherry Creek basin in Douglas County. The models activate automatically whenever flood threat notifications are issued by the F2P2 meteorologist. Graphical enhancements supported by LRE include an AHPS-like interface patterned after the NWS Advanced Hydrologic Prediction Service and a "Hydrologic Data Service" that integrates data from various sources.

The District's base station software—Novastar4 by HydroLynx Systems of West Sacramento, CA—is nearing its end. This platform currently hosts all District-supported webserver located at the District's main office and the Flood Prediction Center; at The Consolidated Mutual Water

Company (Lena Gulch base station) in Lakewood; at Denver Public Works Wastewater Management Division; and at the Boulder Office of Emergency Management (see [alert.udfcd.org](http://alert.udfcd.org)). The current version was implemented in 2000...remember Y2K? Now it's time to change once again. The new version—Novastar5—is being tested and will be running parallel with NS4 during 2010. By 2011 the District expects to abandon the old software and move to the new, which runs on a Linux operating system with a PostgreSQL database. This widely used open source database should give the District more flexibility on how webpages are presented and provide others with the ability to build their own creative displays.

### 2009 Flood Season Recap

Heavy rainfall caused the ALERT system to set off alarms on 32 days in 2009 which is more than five times the prior year's count of 6 days and a record number for the gaging network, shattering the 20-day record set in 1999. The specific alarm dates are shown in the table on the first page of this section. The 2002 Hayman Burn Area in southwestern Douglas and southern Jefferson Counties is given special attention because the area is outside the District's primary area of interest. The map shows gage locations where rainfall alarm thresholds were exceeded in 2009. A number of automated gages experienced alarms on multiple days. The rainfall alarm log for the year tallied 43 occurrences of 1" in 1-hour and 112 incidents of 0.5" in 10-minutes.



The following briefly describes some of 2009's more notable events:

### Thursday-Saturday, April 16-18

The first big precipitation event arrived on day two of the 2009 flood season by way of a winter storm. Precipitation totals from a combination of melted snow and rain exceeded 4-inches in SE Boulder County. A number of ALERT stations elsewhere measured more than 3-inches while one gage in Jefferson County (West Metro Fire Station 12) recorded more than 5-inches. Many streams were flowing well above normal and four stormwater detention basins recorded annual peaks: Kelly Road Dam in Denver, Flying-J in Aurora, Gunbarrel in Boulder and Basin 3207/Pond 6 in Broomfield. The Denver Fire Department rescued at least one person that became trapped between the channel walls of Cherry Creek. The storm forced closure of many schools as well as the District's office. No flood watches or warnings were issued for this event.

### Friday-Monday (Memorial Day), May 22-25

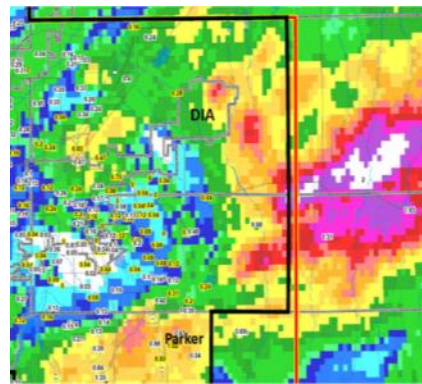
This holiday weekend kicked-off on Friday (May 22) with the year's first heavy rain threat, but that day passed with few incidents worth mentioning within the District. However, a large storm that just missed the District dumped more than 3-inches in rural Arapahoe County according to radar estimates. Saturday (May 23) produced the first ALERT rainfall rate alarms of the year in Wheat Ridge and Louisville accompanied by expected street flooding. Sunday (May 24) brought more heavy rain (1.88" in 30 minutes near 23<sup>rd</sup> and Youngfield) and some minor flooding to McIntyre Gulch in Lakewood and along Lakewood Gulch through Lakewood and Denver. Bob Jarrett with the USGS estimated a peak flow of approximately 600 cfs on Lakewood Gulch at 10<sup>th</sup> Avenue in Denver, exceeding the "flash flood" peak that claimed the life of a two-year-old on May 14, 2007. Commerce City and Adams County north of DIA also received heavy rainfall on Sunday. Memorial Day (May 25) brought an end to this first intense rain threat period of the season but not without dropping two-inch plus rains over central Jefferson County, Denver and Aurora. So much for a nice relaxing four-day holiday weekend!

### Monday, June 1

After another weekend of heavy rain...that's right—both Saturday and Sunday were active T-storm days with rainfall amounts exceeding two inches on both days...a slow moving thunderstorm moved across east-central Douglas County producing 2 to 3-inches in just 90 minutes. Resulting runoff caused high flows on Cherry Creek through and downstream of Castlewood Canyon State Park. The USGS stream gage at Franktown measured a very rapid 6-foot plus rise with a corresponding peak discharge of 4,370 cfs. According to the USGS, the observed flash flooding in Castlewood Canyon State Park was the third highest event on record since 1940.

### Thursday, June 11

The Parker area received approximately 1-inch of very intense rainfall (5.2"/hr in 5 minutes) between 1 and 2 p.m. resulting in street flooding. But the big storm of the day occurred in Adams and Arapahoe Counties where, according to radar estimates, rain totals exceeded 3 inches over a rather large area. This was one of the largest short duration



Rain totals for June 11, 2009. White pixels east of District boundary (black line) indicate radar estimates exceeding 3 inches.

rainfall events of the year, but it did not receive much attention because of its rural location. Had this storm happened over the urban area, we would be telling a much different story.

### Sunday, June 14

This day caught the media's attention as Rockies fans got to watch a funnel cloud west of Coors Field. It was also the sixth of seven consecutive days of nuisance flooding potential. During this 7-day period the heaviest rains once again made their appearance on Saturday (in Douglas and Elbert counties) and Sunday. *Another weekend!* Sunday's storm occurred along a line from north Lakewood through Wheat Ridge and continuing northwesterly through Adams County west of Brighton. Radar rainfall estimates exceeded 2" with the highest ALERT measurement of 1.5" occurring at Hidden Lake in Adams County. The most intense rainfall of 6.1 inches/hour was recorded during a 5-minute period at the Sloan Lake detention facility near Wheat Ridge City Hall.

### Tuesday, Wednesday & Thursday; June 23-25

Finally some midweek storms, two of which resulted in flash flood warnings for the District. The June 23 storm impacted the Parker area between 4 and 5 p.m. while another large storm was dumping on DIA. The severe thunderstorm in northeast Douglas County and Parker also produced 1.5" diameter hail with strong straight-line winds (see photo on first page of this section). The heavy rainfall exceeded 2-inches in just 30-60 minutes in the Parker area prompting the NWS to issue the flash flood warning.

The storm on Wednesday (June 24) was another windy street flooding rush-hour hailer that hit the northwest metro area. The heaviest measured rainfall (1.34") occurred at the Little Dry Creek at 64<sup>th</sup> Avenue gage in Adams County between 5:30 and 6:00 p.m.



On June 25 a line of moderate to strong thunderstorms developed over the higher terrain of Jefferson County. An outflow boundary from these storms produced additional strong east moving thunderstorms over

Denver and western Aurora that caused a downpour of 1.5 to 2.4 inches in 20-45 minutes and prompted the second NWS flash flood warning in this 3-day



period. Four east Denver apartments were flooded by 4 feet of water between 2 and 3 p.m. at 5300 East Cherry Creek Drive South. Rainfall totals exceeded 2 inches at some locations. No major stream flooding was reported.

#### *Friday, July 3*

July is when the summer monsoon arrives in Colorado, but somehow it seemed like the monsoon should be over after last month's 3 to 6-inch rain totals, which were well above Denver's average monthly rainfall of 1.8 inches. In preparation for another holiday weekend of rain, this day was the second in a 5-day series of stormy days. Flooding in Denver nearly mimicked what happened on June 25. Fortunately the rainfall amounts from this storm were less as were the impacts.

#### *Friday-Monday, July 10-13*

After a nice mid-week break in the weather, the storms returned on Friday for another weekend round. Friday (July 10) was the biggest rain day of the period but the storm rainfall totals throughout this period were much less than prior weekends. Friday's storms triggered many rainfall rate alarms between 8:30 and 10 p.m. in Denver and Aurora causing some minor street flooding.

#### *Monday, July 20*

Hard to believe—a weekend without any flooding! This Monday was also a nice day, right up to about 10 p.m. Then without warning, things quickly went from good to bad. A supercell thunderstorm developed across southeast Boulder County and moved quickly to the south producing very intense rainfall, large hail and powerful straight line winds in eastern Jefferson County affecting Westminster, Arvada, Wheat Ridge and Lakewood. Property damages from the wind and hail were high, but only minor nuisance flooding was reported. The photo on the first page of this section taken in Wheat Ridge illustrates the severity of this storm.

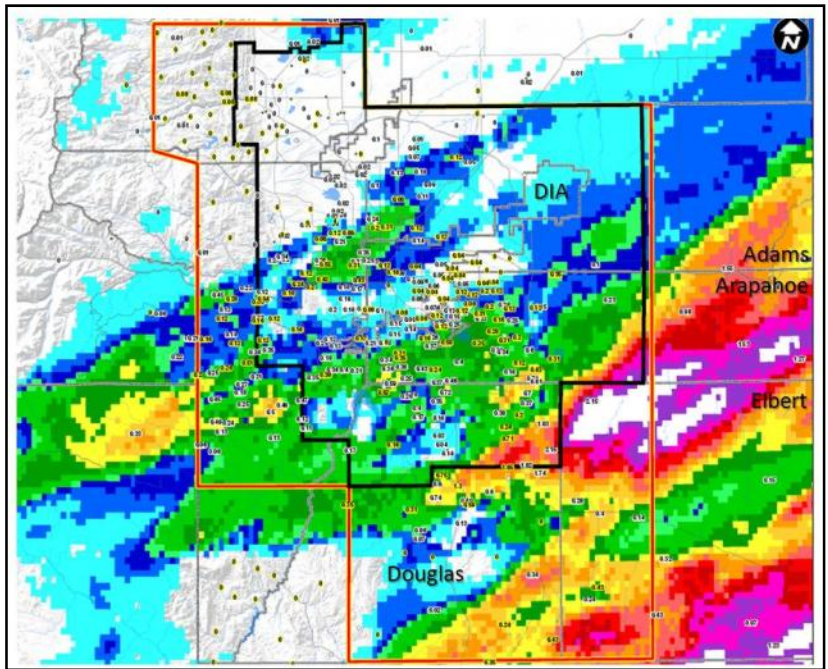
The storm duration at any one point was short but the rainfall intensities were very high. Some of the higher rainfall totals from this storm occurred in the Standley Lake area where one CoCoRaHS observer reported 1.33 inches. The biggest downpour of the evening, however, was not connected to the Jefferson County storm but occurred near Brighton in Adams County where 1.61" fell in under 30 minutes. The peak 5-minute rain rate from this storm was nearly 11 inches per hour making this the most intense rainfall measurement of 2009 from the ALERT system.

#### *Tuesday, July 21*

The Hayman Burn Area in Douglas County received heavy rainfall between 8:00 and 9:30 p.m. causing wash outs at points along State Highway 67. A number of private drive crossings including the YMCA Camp access road were also damaged. Events like this have been relatively common since the massive wildfire in 2002.

#### *Monday, August 17*

Reminiscent of June 11, this was another too-close-for-comfort late evening big rain event that did not receive much



news media attention. The 1.65 inches measured by an ALERT gage south of Parker in Douglas County does not do justice to what brushed the District's southeast corner. Like the June 11 map, the white pixels at the storm's core represent the area that received more than 3 inches—a quite large area to be sure. I wonder how much longer our good fortune will continue having noted a number of events like this one occurring in recent years with little if any consequence to the District.

#### *Saturday, September 5*

The year's flood season would not have been complete without one final weekend flash flood warning on the last month of the program. The storm this day was extremely isolated but it produced an admirable storm total and intensity. The target was located in Aurora where Liverpool Street crosses Piney Creek south of Smoky Hill Road. The rainstorm dropped 2.4" in 1-hour and sustained an impressive rainfall rate of 4 to 5 inches/hour over the first 30 minutes of the storm. Only minor street flooding occurred due to the isolated nature of this storm.

#### **Closing remarks on the 2009 flood season**

The District took a big preparedness step this year by conducting its first ever flood disaster tabletop exercise for the entire staff. The drill featured realistic mock TV News on-camera interviews and message injects from local governments. Jefferson County, Lakewood and Morrison participated and helped add realism to the exercise. AMEC Earth & Environmental lead the design and facilitation. Gonder Public Relations conducted the media interviews and professional video recording. The District will use the lessons learned from this experience to improve internal standard operating procedures for 2010.

A complete set of storm summary maps can be found at [f2p2.udfcd.org](http://f2p2.udfcd.org). For detailed reports on the ALERT system and F2P2 operations see [www.udfcd.org/FWP/ALERT\\_Reports/](http://www.udfcd.org/FWP/ALERT_Reports/) and [www.udfcd.org/FWP/F2P2\\_Reports/](http://www.udfcd.org/FWP/F2P2_Reports/).

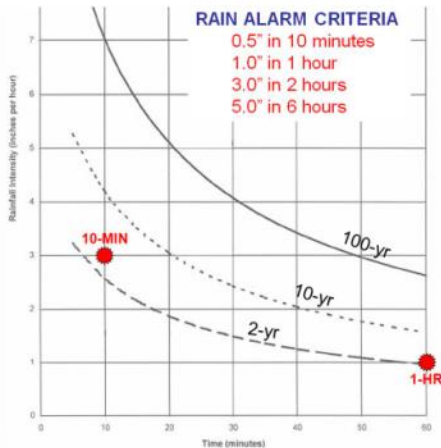
## Extremes Revisited

Have you ever heard someone say – “What if the worst happens and we have a 100-year flood?” I wonder how many people think this way. I suspect that that number is quite large but I know of no research that supports this opinion. A more disturbing question might be...how many professional engineers, floodplain managers and stormwater specialists would agree that the 100-year flood is the worst thing they can imagine? I hope that number is very small, but I have my concerns that the truth might be disappointing.

FEMA, ASFP, NAFSMA, ASCE, USACOE along with other federal agencies and organizations have recently been seeking answers to questions like this. Katrina’s impact has been a major motivating factor, but since that 2005 hurricane a number of other flood events have caused further concern. The National Flood Insurance Program (NFIP) fund is in the red and FEMA wants a better way to address the problem than just continuing along the same unsustainable path.

In the 2007 edition of *Flood Hazard News*, an article entitled “Understanding Extremes” pointed out that alleged rare events actually happen quite often, and data from the District’s ALERT System was used to illustrate this truth. Given the two unusual flood seasons that followed, it seemed like this might be a good time to refresh the 2007 table/chart and keep the dialog going about what really constitutes an extreme event and how we—the so-called flood experts—should communicate our understanding about flood risks when talking with others.

Year	Alarm Days	Gage Points
2009	32	151
2008	6	42
2007	17	53
2006	13	45
2005	10	38
2004	18	61
2003	13	70
2002	8	17
2001	14	57
2000	7	34
1999	20	62



The table shows how 2009 crushed earlier alarm records that date back to 1986. Only the last decade of statistics are provided because, over the years, the ALERT rain gage network coverage has increased substantially thus skewing the comparison. For example, the Hayman network did not come on line until 2003. Regardless, it is fair to conclude that while 2009 is not considered a big flood year; it definitely produced a high number of heavy rain events with intensities exceeding the 2-year frequency.

As floodplain managers and designers of major drainage and flood control facilities we tend to stay focused on engineering design thresholds and in doing so, we talk a lot about that single event. We attempt to communicate flood risk in terms of frequency or probability, e.g. 100-year or 1%

annual chance. Sometimes we try to describe the 100-year flood’s likelihood over a longer period of time like 30 years—the term of a typical home mortgage—as having a one-in-four chance of occurring. While we may well understand what we are saying, our non-technical audience may not fully appreciate how this affects them personally.

Consider this...Knowledge of local flood history can be extremely helpful when trying to make a connection with people and gain their trust. People like to hear and tell stories about past floods. Let others tell their stories whenever the opportunity presents itself. After a short journey through the past, it may be much easier to discuss flood risk in ways people can better comprehend.



Bear Creek flood levels in Morrison between Market Street and Mount Vernon Street downstream of the Mount Vernon Creek confluence. The “Historical Flood High Water Mark” depicts the level of the September 2, 1938 flood.

Sometimes flood history is lacking for a specific location. In this situation remember that extreme floods have certainly occurred somewhere nearby. One good example is the Morrison flood of 1938. That particular flood exceeded the 100-year design flood on Bear Creek through downtown Morrison, but the most noteworthy fact that sticks in my mind is that Bear Creek was not the main source of flooding; rather it was the Mount Vernon Creek tributary that peaked at twice its 100-year discharge. The cause of the 1938 flood is another useful fact to point out—it resulted from a very intense rainstorm that dropped nearly 8-inches of rain at its core, while the design rainfall used for calculating the 100-year flood is less than 3-inches. As engineers we should own up to the fact that even our best flood control projects and land use management practices will fail to protect when too much rain falls.

Catastrophic flooding from events like Hurricane Katrina and worse will occur in the future, but not in the District—right? That’s what we would like to believe but most of us know better. As engineers and “experts” on floods, we should continue to educate ourselves about extreme events and find better ways to more effectively inform others about the true risk of flooding and what individuals and families can do to protect themselves.

## IS/FWP Staff Change



Chad Kudym, GIS & Information Systems Administrator, left the District in December for greener pastures in Lincoln, Nebraska where he accepted a high-level position with GIS Workshop. Chad first came to the District in early 2005 and made significant contributions during his tenure. He guided GIS development activities for all District programs and was the principle architect for many Flood Warning Program web-based applications that are widely admired today. A look back at past issues of *Flood Hazard News* provides an excellent summary of his accomplishments. The District wishes Chad the best in his pursuit of a very promising career.

## Information Services Update

The District continues to make progress on creating more efficient ways to obtain information from the Internet. A project known as “Electronic Data Management” was initiated in 2008 with CH2M HILL’s development of a MS-Access database and GIS data layers for locating District studies, design drawings and other documents. In 2009 the District hired Julia Bailey and GIS Workshop to help transfer the data to an open source SQL database; develop a web interface for updating and adding records; and to make use of ESRI’s GIS Server and Adobe’s Flex Viewer with a map frontend to give users an easy way to find and view District documents. The District anticipates that this new browser-driven application will be ready for release by spring of 2010.

Since YouTube™ has become so popular, now might be a good time to introduce UD-Tube (*UD...Urban Drainage*). With our student intern Stephanie LaCrue at the helm, we started a project with Vantage Point Media to convert the District’s archive of flood videos for Internet viewing. Historical flood information that predates the invention of television will also be included. Watch for this new feature to appear soon on the flood safety page of our website.

Derrick Schauer has his hands full keeping the District’s mission-critical IT infrastructure well-oiled. LAN security, data backups, system monitoring, disaster recovery planning, daily requests for help (*and occasional demands*) from staff, website maintenance; equipment repairs/upgrades; new software installations and patches; OS upgrades and general troubleshooting are some of Derrick’s normal duties. No complaints yet about job boredom.

As we move into the second decade of the 21<sup>st</sup> century, the need for quality information services from the District is expected to grow. The District believes it is well-postured to meet this challenge through the close working relationships we have built with our local government partners; consultants; other federal, state and regional agencies; universities and research organizations; professional associations; local news media; and others. Your ideas on how we might better serve you and the public are always welcome.

Document Name	Document Type	Year	Drainage Way Year	Engineering Firm
Applewood OSP Ph A 2001.pdf	OSP			
Applewood OSP Ph B 2003.pdf	OSP			
Pleasant View OSP Ph A 1997.pdf	OSP			
Pleasant View OSP Ph B 1999.pdf	OSP			
Clear Creek Lower MDP Ph A 1980.p	MDP			
Clear Creek Lower MDP Ph B 1981.p	MDP			
Clear Creek MDP Ph A 2007.pdf	MDP			
Clear Creek MDP Ph B 2008.p	MDP			
Clear Creek Youngfield thro	MDP			
Lena Gulch Lower MDP Ph A	MDP			
Lena Gulch Lower MDP Ph B	MDP			
Lena Gulch Upper MDP Ph A 1	MDP			
Lena Gulch Upper MDP Ph B 1994.p	MDP			
Clear Creek FHAD ADCO 2005.pdf	FHAD			
Clear Creek FHAD ADCO and Jeffco	FHAD			
Clear Creek FHAD Denver and Jeffco	FHAD			
Lena Gulch Lower FHAD 2007.pdf	FHAD			
Lena Gulch Upper FHAD 1993.pdf	FHAD			
South Platte MDP Ph A 1984.pdf	MDP			

# Stormwater Quality & Permitting Support Activities

## Holly Piza and Ken MacKenzie, Master Planning Program

UDFCD continued to be active in the stormwater quality arena in 2009, with commitments to the following organizations and activities:

### Best Management Practices (BMP) Advancements:

UDFCD is currently rewriting Volume 3 of the Urban Storm Drainage Criteria Manual (USDCM). The goals of the rewrite include updating design criteria and maintenance recommendations, promoting volume reduction, and improving readability of the manual.

### UDFCD BMP Monitoring Program:

The UDFCD BMP monitoring program continued in 2009 with some sites collecting over 30 rain events. We monitored a side-by-side porous asphalt and permeable interlocking concrete paver test site at the Denver wastewater building, pervious concrete and a sand filter at the Lakewood Maintenance facility, and an Extended Detention Pond (EDB) in Grant Ranch. Both flow and pollutant data will be formatted for submittal to the International BMP Database.

### New Discoveries:

Our open-bed sand filter BMP at the Lakewood city shops continued to quickly clog even after we installed a pre-sedimentation chamber. Through field testing, we found that pre-rinse from the city's vehicle wash bay was creating an impermeable crust on the sand surface. The city is now using

a different chemical pre-rinse that we tested and found not to clog the filter. This is an important observation for filtering BMPs adjacent to car washes. Although this BMP had problems, the technology is sound and we learn valuable lessons from these experiences.

### Colorado MS4 Stormwater Group:

The District continued to host quarterly luncheon meetings to discuss stormwater issues in 2009. These meetings are open to all Colorado communities affected by the Clean Water Act, which requires permits for municipal separate storm sewer system (MS4) discharges. The meetings serve as a forum to exchange ideas and experiences and to meet face-to-face with the Colorado Department of Public Health and Environment regulators.

### Green Roof Design Guidelines Specific to the Arid West:

UDFCD has assisted with the development of a design and maintenance document for green roofs. The document, *Design Guidelines and BMP/Maintenance Manual for Green Roofs in the Arid West*, is specific to arid regions and is consistent with and more comprehensive than the stormwater focused green roof guidance that will be included in the Volume 3 update scheduled to be completed in April 2010. Development of the document is lead by The University of Colorado Denver and should be available in February 2010.

## Other District Award Winners

For the twentieth 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, Manager of Finance and Accounting, and assistant Darla Reeves for continuing this string of awards.

The District received the third place award for *Excellence in Communication, Public Awareness of Flooding and Flood Prevention* from the National Association of Flood and Stormwater Management Agencies (NAFSMA) for its brochure "Preserving the natural and beneficial values of floodplains adjacent to development projects (A guide for creating project value and selection of amenity

enhancements)." Bill DeGroot, David Mallory, Senior Project Engineer, Floodplain Management Program, and Michelle Leach, Matrix Design Group, authored the brochure.



**Bill DeGroot (right) accepts the NAFSMA award from President Gale Fraser. Note the copy of the brochure in Bill's pocket.**

# 2009 Professional Activities of District Staff

## **Paul Hindman, Executive Director**

- \*\*Co-Chair of Cherry Creek Stewardship Partners Annual Conference
- \*Co-Chair of Cherry Creek Stewardship Partners annual "Run for the Watershed"
- \*Chair of the 2011 Denver Site Committee for the American Public Works Association (APWA) International Public Works Congress and Exposition.
- \*Chapter Delegate, APWA Colorado Chapter
- \*Member, APWA National Water Resource Committee
- \*Organizer and Facilitator, APWA Stormwater Workshop, Columbus, Ohio
- \*Planned and facilitated "Pie Eating Contest", Western Snow and Ice Conference. Estes Park, Colorado
- \*Planned and facilitated "Poker Night", 2011 Congress fund raiser, APWA Colorado Chapter Spring Conference, Grand Junction, CO
- \*Planned and Facilitated "Poker Night", 2011 Congress fund raiser, APWA Western Snow and Ice Conference, Estes Park, Colorado

## **Bill DeGroot, Manager, Floodplain Management Program**

- \*Secretary of the Board of Directors and Co-Chair of the Floodplain Management Committee of the National Association of Flood and Stormwater Management Agencies (NAFSMA).
- \*Attended the ASFPM annual conference in Orlando, FL in June. Helped present a workshop on Protecting the Property Rights of All.
- \*Attended the CASFM Annual Conference in Crested Butte Colorado, in September.
- \*Attended NAFSMA's annual meeting in Colorado Springs in October. Chaired the Floodplain Management Committee meeting.
- \*Represented NAFSMA as a member of FEMA's Operating Partners Focus Group, which meets quarterly with representatives from FEMA, their Risk MAP contractors, NAFSMA and ASFPM to discuss Risk MAP and other mapping issues.
- \*Represented NAFSMA as a member of the Intergovernmental Flood Risk Management Committee (IFRMC), meeting quarterly with NAFSMA, ASFPM, FEMA and the Corps of Engineers,
- \*Attended the IFRMC Flood Risk Management Summit in Cambridge, MD in July.
- \*Member of Association of State Floodplain Managers (ASFPM), American Society of Civil Engineers (ASCE), and Colorado Association of Stormwater and Floodplain Managers (CASFM).

## **Kevin Stewart, Manager, Information Services and Flood Warning Program**

- \*President of the National Hydrologic Warning Council (NHWC).
- \*Nominated for appointment to U.S. Department of the Interior's Advisory Committee on Water Information and alternate member to their Subcommittee on Hydrology.
- \*Steering Committee member for the American Meteorological Society's (AMS) Commission on the Weather and Climate Enterprise.
- \*National coordinating committee member for WERA 1012: "Managing and Utilizing Precipitation Observations from Volunteer Networks" authorized by the Western Association of Agricultural Experiment Station Directors and member of their Sustainability/Funding subcommittee.
- \*Steering Committee member for EMWIN-Denver (Emergency Managers Weather Information Network).
- \*Member of ASCE, ASFPM, CASFM and the Colorado Emergency Management Association.
- \*Attended AMS annual meeting, conferences and exposition in Phoenix, AZ in January.
- \*Session moderator and speaker at NHWC National Conference and Exposition in Vail, CO in May.
- \*Participated in NAFSMA/ASFPM Flood Risk Summit in Cambridge, MD in July.
- \*Attended AMS Summer Meeting in Norman, OK in August.
- \*Speaker at CASFM 20<sup>th</sup> Annual Conference in Crested Butte, CO in September.
- \*Attended ALERT Users Group Fall Meeting in Riverside, CA in October.
- \*Speaker at NAFSMA Annual Meeting in Colorado Springs in October.
- \*Participated in NOAA-sponsored Integrated Hazard Information Services Workshop in Boulder, CO in October.
- \*Participated in ASFPM Foundation symposium on "Flood Risk Perception, Communication and Behavior" and subsequent FEMA-sponsored National Flood Insurance Program (NFIP) Stakeholder Listening Session in Washington, DC in November.
- \*Speaker at NHWC/Southwestern Association of ALERT Systems-sponsored "Texas Flood and Dam Safety Monitoring Best Practices Workshop" in Austin, TX in November.

**Ken MacKenzie, Manager, Master Planning Program**

- \*Presented “UDFCD – A Model For Flood Mitigation Efforts” at the International Workshop on Comprehensive River Basin Management in Taipei, Taiwan in December 2008.
- \*Presented “Porous, Pervious & Permeable Pavements: UDFCD Demonstration Projects” at the APWA Rocky Mountain Management Conference in May.
- \*Taught 2-day training course on “Stormwater Quality Best Management Practices” to the U.S. EPA’s District 8 headquarters staff, Chicago in July.
- \*Presented “Water Quality Trading and Using TMDLs to Measure NPDES Compliance” at the APWA Annual Congress in Columbus, OH in September.
- \*Presented “The Cure for Pervious Concrete Problems” at the CASFM annual conference in September.
- \*Authored “12 Steps to Save Our Urban Lakes and Streams” article in the Colorado Water Newsletter (September/October 2009).
- \*Co-authored “Design of Street Sump Inlets” technical paper in ASCE Journal of Hydraulic Engineering (November 2009).
- \*Served on the board of directors of the Urban Watershed Research Institute.
- \*Taught 2-day training courses on street hydraulics, inlet sizing, storm sewer design, detention pond design, reservoir routing, and stormwater quality best management practices throughout the 2009.
- \*Served on the NAFSMA Stormwater Committee.
- \*Served on the CASFM Outreach Committee.
- \*Served on the Denver Regional Council of Governments Water Quality Advisory Committee.
- \*Member of ASCE, ASFPM and CASFM.

**Mark Hunter, Manager, Design, Construction & Maintenance Program**

- \*Serves as Chairman of the Operations Committee on the Board of Directors of the Metro Wastewater Reclamation District in Denver, Colorado.
- \*Serves as Treasurer on the Board of Directors of the International Erosion Control Association (IECA).
- \*Co-Chairman of the IECA SOIL Fund Committee.
- \*Member of IECA Awards Committee and the Stream Restoration Technology Section.
- \*Member of the Mountain States Chapter of IECA.
- \*Member of IECA, APWA and CASFM.
- \*Co-presented “Highlights of the 2008 Design, Construction, and Maintenance Program” at UDFCD’s annual seminar in February in Denver.

**David Bennetts, Assistant Manager, Design, Construction & Maintenance Program**

- \*Program Chair for the 20<sup>th</sup> Annual CASFM Conference in September at Crested Butte
- \*Presented “40 years of Drop Structure Innovation” in a Technical Session at CASFM Conference in September at Crested Butte
- \*Co-Presented “Highlights of the 2008 Design, Construction, and Maintenance Program” at UDFCD’s Annual Seminar in February
- \*Attended Colorado Municipal League’s Annual Legislative Workshop in February in Denver
- \*Attended ASFPM’s Annual Conference in July in Orlando
- \*Attended NAFSMA’s Annual Conference in October in Colorado Springs
- \*Attended Mountain States Employers’ Council Workshop on “Performance Management Skills” in November in Denver
- \*Attended Cherry Creek Stewardship Partners Annual Conference in November in Lone Tree
- \*Acquired Association of State Floodplain Managers Certified Floodplain Manager Certification
- \*Member CML’s Statewide Municipal Water and Wastewater Issues Committee
- \*Council Member, CU Denver Engineering Leadership Council
- \*Serves as Vice Chair, CASFM Board of Directors
- \*Member of ASCE, APWA, ASFPM, and CASFM

**Bryan Kohlenberg, Senior Project Engineer, South Platte River – Design, Construction & Maintenance Program**

- \*Continued as National Society of Professional Engineers’ (NSPE) scoring coordinator for the Jefferson, North Metro and Colorado State MATHCOUNTS competitions for 6<sup>th</sup>, 7<sup>th</sup> and 8<sup>th</sup> graders.
- \*Member of American Society of Civil Engineers (ASCE), Colorado Association of Stormwater and Floodplain Managers (CASFM) and American Public Works Association (APWA).
- \*Presented "2008 South Platte River Highlights" at the UDFCD Annual Seminar in February.
- \*Attended CASFM Annual Conference in Crested Butte and Presented "South Platte River – Globeville Flood Control and Greenways Project" in consideration for 2009 Grand Award.

**David Mallory, Senior Project Engineer, Floodplain Management Program**

- \*Elected to the Colorado Association of Stormwater and Floodplain Managers (CASFM) Board of Directors as Chair.
- \*Co-chair of the Floodplain Management Committee of the National Association of Flood and Stormwater Management Agencies (NAFSMA).
- \*Participated in the panel discussion segment during "Total Water Resources Management" with the Baker team at the Association of State Floodplain Managers (ASFPM) annual conference in Orlando, Florida in June.
- \*Presented "Communicating Floodplain Preservation Values in Land Use Decisions" at the Floodplain Management Association annual conference in San Jose, California in September.
- \*Attended the CASFM annual conference in Crested Butte in September.
- \*Attended NAFSMA's annual meeting in Colorado Springs in October.
- \*Participated in the initial meeting of the National Coalition for Protecting and Restoring the Natural Functions and Resources of Floodplains in November.
- \*Member of Floodplain Rules Advisory Committee for Colorado Water Conservation Board.
- \*Member of CASFM and ASFPM.
- \*Received a Certified Floodplain Manager certificate through ASFPM.

**Rich Borchardt, Senior Project Engineer, Design, Construction & Maintenance Program**

- \*Presented at 2009 UDFCD Conference
- \*Presented at 2009 APWA Colorado Chapter Spring Road/Bridge Conference
- \*Certified as ASFPM Certified Floodplain Manager
- \*Attended 2009 APWA National Congress
- \*Attended 2009 CASFM Conference
- \*Served as Water Resource Committee Chair for APWA Colorado Chapter

**Shea Thomas, Senior Project Engineer, Master Planning Program**

- \*Presented "*UDFCD Stormwater Quality Program*" at the annual UDFCD seminar in Aurora in February.
- \*Presented "The Measure of Success – Quantifying Performance at Colorado Demonstration Sites" at the StormCon Conference in Anaheim, California in August.
- \*Presented "*Low impact Development*" at the APA Conference in Estes Park in October.
- \*Served as the Treasurer and Scholarship Committee Chair for CASFM.
- \*Member of CASFM and RMWQAA.

**Barbara Chongtoua, Senior Project Engineer, Design, Construction and Maintenance Program**

- \*Attended the ASCE International Association of Hydraulic Engineering and Research 2009 Congress, Water Engineering for a Sustainable Environment.
- \* Author of the "Exploring Hybrid Drop Structures in Urban Drainageways" paper that will be presented at the ASCE World Environmental and Water Resources Congress 2010.
- \*Member of ASCE, APWA, Chi Epsilon, and CASFM.

**Laura A. Kroeger, Project Engineer, Design, Construction & Maintenance Program**

- \*APWA Colorado Chapter At-Large Board Member and Education Chair
- \*Serve on the APWA National Generational Issues Sub Committee
- \*Serve on the ACEC Scholarship Committee
- \*APWA National Congress Work Shop Speaker/Panelist on Generational Issues

**Holly Piza, Project Engineer, Master Planning Program**

- \*Presented "*Adventures in Algae – Maintaining Constructed Wetlands in Residential Areas*" at the annual CASFM conference in Crested Butte in September 2009.
- \*Presented "*Low Impact Development*" at the APA Conference in Estes Park in October.
- \*Presented "*Rewriting Volume 3*" at the October ASCE Environment and Water Resources Technical Group Meeting and in November at the quarterly MS4 meeting hosted by UDFCD.
- \*Served as the CASFM Water Quality Co-Chair.
- \*Member of CASFM.

**Mike Sarmiento, Senior Construction Manager, Design, Construction & Maintenance Program**

- \* Co-presented at Annual UDFCD seminar – topic “Construction Management”.
- \* Co-presented at Annual CARMA/APWA Spring Conference in April – Topic “Bank and Channel Stabilization”
- \* Received OSHA HAZWOPER 8-hour Recertification
- \* Received FEMA certificate as a Debris Management Specialist in November.
- \* Named to the Student Membership Committee of American Institute of Hydrology

**Steve Materkowski, Senior Construction Manager, Design, Construction & Maintenance Program**

- \* Presenter, 2009 UDFCD Conference
- \* Completed FEMA ICS 700 and ICS 800
- \* Completed OSHA, 40 Hr HAZWOPER Course
- \* Completed UWRI, Stormwater BMP Selection and Design Course
- \* Completed FEMA, Debris Management Technician Course

**Joe Williams, Senior Construction Manager, Design, Construction & Maintenance Program**

- \* Attended presentation on “Construction Inspection: A Review” presented by the American Public Works Association.
- \* Attended a short course on “Structural Best Management Practices Selection and Design” presented by the Urban Watersheds Research Institute.

**Darren Bradshaw, Construction Manager, South Platte River – Design, Construction & Maintenance Program**

- \* Joined the Association of State Floodplain Managers (ASFPM)
- \* Joined the American Public Works Association (APWA)
- \* Obtained certification for the ASFPM Certified Floodplain Manager (CFM)
- \* Participated in the “UDFCD View of Construction Stormwater Quality BMPS” presentation at the UDFCD annual Conference in February
- \* Attended short course on “Structural Best Management Practices, Selection and Design” in September
- \* Attended APWA “Construction Inspection Conference” in February
- \* Attended APWA “Construction Inspection: A Review Workshop” in April

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## **CoCoRaHS now in all 50 states**

### **By Henry Reges, CoCoRaHS National Coordinator**

CoCoRaHS, the Community Collaborative Rain, Hail and Snow Network, continues to grow and expand across the country. December 2009 brought the addition of its 50th state, Minnesota. The network consists of 14,500 volunteers of all ages and backgrounds who measure rain, hail and snow in their backyards. The daily observations are immediately available to view on the CoCoRaHS website ([www.cocorahs.org](http://www.cocorahs.org)). CoCoRaHS started in the Denver Metro area in the early 2000's and has supplemented the District's rainfall network with several hundred additional measurement points. Storms are so incredibly variable in this area. Increasing the number of rain gauges is like increasing the number of pixels on a digital photo -- the more pixels the clearer the image.

The past year demonstrated once again why it is so important to have as many observations as possible. Rain fell approximately two out of every three days all summer across the metro area with several intense storms. This year, many of the heaviest rains fell in the same general areas. East central and southeast portions of the City and County of

Denver were especially hard hit with over 12" of rain from late May through early August.

CoCoRaHS volunteers can also submit "Significant Weather Reports" to report storms in progress. These reports are immediately received by the National Weather Service and the District. "Significant Weather Reports" of intense rainfall can supplement the District's flood warning system and provide eye witness reports of heavy rain and high water. Real time hail and snowfall reports also play an important role in giving critical information for early warnings of severe weather.

Interested in taking precipitation observations? The network is still striving for a density of at least one station per square mile across the region. Please consider becoming a CoCoRaHS observer today and invite others to join. It's easy to join on our website.