Information Services and Flood Warning Program Notes

Kevin Stewart, PE, Program Manager

This past year brought some exciting changes and new challenges to the District's Information Services and Flood Warning Program. After the departure of our GIS administrator in late 2009, the District was well-staged to take advantage of technologies put in place over the previous four years. With the addition of Julia Bailey to our staff, we quickly wrapped-up the first public release of an Internet mapping application (a.k.a. EDM) that makes finding useful District documents easier than ever. The EDM's floodplain map and routine maintenance tabs are other nice features to explore. If you haven't visited the District website lately, I encourage you to do so. As you browse keep in mind that this new e-Library resource is just beginning to evolve.

Our IT guru Derrick Schauer continues to build the foundation that supports all of our information services. The District website www.udfcd.org is Derrick's creation and he is always opening new doors for innovation. Internally, Derrick has the pulse of the staff as he keeps LAN communications and equipment in top working order.

Stephanie LaCrue is our engineering student intern from the Colorado School of Mines who worked most closely with Julia over the past year. She has been instrumental in assembling the District's flood history archive of local newspaper articles and other information sources; storm/flood videos; and streamflow data summaries from the ALERT System. Much of her work will soon be Internet accessible. Stephanie received her B.S. degree in Civil Engineering from Colorado School of Mines in May and was soon thereafter accepted into their graduate program. Congratulations Stephanie!

The biggest local news story of the year that affected the District's Flood Warning Program was the Fourmile Canyon Fire that started on Labor Day (Sept. 6) near Emerson Gulch, burned 6,200 acres over a 5-day period and destroyed 169 homes in the Gold Hill area of Boulder County. This event was Colorado's most costly wildfire to date with property damages exceeding $200 million. Major efforts are now underway to address mitigation measures; recovery plans; public information and education needs; and flood preparedness. Quantifying the increased flood risk and developing strategies on how to best warn the public and respond to the threat is high on the priority list. Areas both in and downstream of the burn area, including the City of Boulder, are of great concern. Debris flows and floods will pose serious threats for years to come.

This past flood season had an average number of threat days that mostly resulted in minor flooding in the District. While numerous heavy rainstorms were observed, the largest of these events skirted the District boundary. Read on for a description of the more notable events of 2010.

36 days with flood potential in 2010

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

Red dates denote days when rainfall measured by automated gages exceeded alarm thresholds. Yellow highlighted dates indicate that heavy rainfall measurements only affected areas outside the District's main area of concern, i.e. Hayman Burn Area in Douglas and Jefferson Counties, and St. Vrain Creek in northern Boulder County. Blue boxes designate NWS flood watches that affected the District. No flash flood warnings were issued for the District in 2010.

New Addition to District Staff

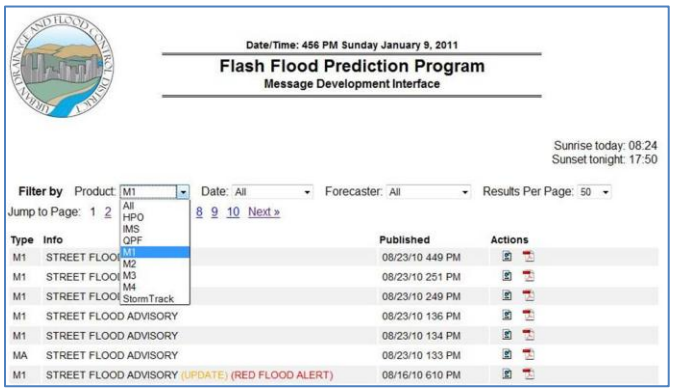
Julia Bailey joined the District as our first Information Services Engineer in February of 2010. Julia graduated from the Colorado School of Mines in 2009 with a B.S. degree in Metallurgy and Materials Engineering. Since 2005 she worked part-time for the District's Design, Construction and Maintenance Program as an engineering student intern. During those four years Julia gained considerable skill working with GIS projects and database applications. Her handiwork is clearly evident in the article describing the District's public release of the Electronic Data Management (EDM) internet application. She has certainly made herself a valuable and welcomed staff addition.

Early Flood Prediction and Notification Services

The hydro-meteorological support team of Genesis Weather Solutions and Skyview Weather provided local governments with heavy precipitation forecasts and flood threat notifications for the fourth consecutive year. Project manager and chief meteorologist Bryan Rappolt completed his 17th year of service to the F2P2. Bryan's support team was comprised of Skyview Weather's Tim Tonge and Brad Simmons as lead forecasters joined by Chris Anderson and Daryl Brynda providing valued technical support. This District program was established after the deadly 1976 Big Thompson Canyon flash flood and has served the Denver/Boulder metropolitan area for the past 32 years.

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 encompassing the District and drainage areas upstream. During the snowmelt runoff season, late spring to early summer, mountain streams typically overflow their banks. Although the program's prediction services are less oriented to this type of flooding, corresponding flood information is disseminated to affected local governments when warranted. Program meteorologists also relay information concerning reservoir releases made by the Tri-Lakes Office of the U.S. Army Corps of Engineers from Chatfield, Cherry Creek and Bear Creek dams. The F2P2 works in close partnership with the National Weather Service Forecast Office in Boulder.

An external evaluation of the F2P2 was conducted by Judy Peratt of JP Consulting for the fourth consecutive year. The purpose of this activity is to gain a better understanding about how well the program is working from a local government perspective and to obtain suggestions on how to improve future services. Judy also assisted GWS/Skyview with a new training initiative for dispatchers and other local officials involved with the F2P2. The feedback from this first attempt has been extremely positive and a repeat performance is currently being planned. This may become a regular pre-flood season activity.



Anyone interested in looking back at products and services rendered by the F2P2 should visit f2p2.udfcd.org. Daily heavy precipitation outlooks, quantitative precipitation forecasts, messages specific to local governments, message status reports, and storm tracks can be easily sorted and downloaded. Storm summary maps for the past four flood seasons are also available at this website.

CoCoRaHS Update

The Community Collaborative Rain, Hail and Snow network is operated by the Colorado Climate Center at Colorado State University in Fort Collins. This nationwide network has become a popular source of precipitation data for many users that represent the public, private and academic sectors of the weather and climate enterprise. The District has been a sponsor of CoCoRaHS since 2001 and routinely makes use of this valuable data source including innovative ways of displaying the data (www.udfcd.org/FWP/LDAD/gmap.html). CoCoRaHS is a community-based initiative that would not possible without help from people like you. Consider becoming a CoCoRaHS volunteer or sponsor today by visiting www.cocorahs.org.

EMWIN-Denver Update

The Emergency Managers Weather Information Network continues to provide timely weather warnings and advisories to 22 counties in NE Colorado. The EMWIN-Denver steering committee meets quarterly to review operations, address issues and recommend system enhancements. In 2010 the rebroadcast portion of the network was discontinued due to the difficultly of maintaining the VHF and UHF radio equipment. Also, the multi-path Internet delivery has proven to be highly reliable making the need for redundant radio broadcasts much less critical. Next steps include finalizing the cost sharing arrangements for long-term maintenance and implementing the EAS (Emergency Alert System) activation request procedure for local governments. For more information about EMWIN-Denver visit emwin.udfcd.org.

ALERT System News

The District's ALERT system currently collects data from 217 stations including 8 radio repeaters, 188 rain gages, 96 stream gages and 24 weather stations. Only a few changes to the automated gaging network occurred in 2010. A stream gage was added to the East Plum Creek at Colorado Highway 105 station in southern Douglas County and the nearby Dakan Road rain gage (pictured) near West Plum Creek was upgraded to a repeater site to relay data from the more remote Highway 105 station. In Boulder County new ALERT streamflow monitoring equipment was installed at Barker Dam to measure reservoir levels and downstream releases. In Aurora the Sable Ditch rain/stage gage was moved a short distance upstream from the concrete channel at E. 18th Ave. to a recently completed stormwater detention facility downstream of E. Colfax Ave.

OneRain of Longmont and Water & Earth Technologies (WET) of Fort Collins provided preventative maintenance and repair services for 2010. Automated daily/weekly monitoring reports by OneRain were used to determine which stations required special service calls and to monitor the overall health of the ALERT system. Detailed monthly reports by WET helped assess the overall system performance by focusing on decoded ALERT messages received by the District's base station. Lost reports, unknown decoded sensor ID's and data transmission rates were analyzed. WET's monthly rainfall intensity analysis is used by the District to assess how often "infrequent" rain events occur within the approximate 3,000 square mile area monitored by the network. The District base station decoded over 4-million ALERT messages in 2010 with the peak hourly rate of 1,638 reports occurring on July 30 between 7 and 8 pm. That's a lot of data!

The ALERT2™ 4800 baud protocol implementation continues to show much promise. Although the hydro events of 2010 failed to push the limits of the 300 baud legacy protocol, monthly reports by WET consistently revealed improved performance using the new protocol. The District is clearly one step closer to replacement of the 40-year-old technology.

Leonard Rice Engineers (LRE) continued their support of the real-time hydrologic models for Boulder Creek in Boulder County; Lena Gulch in Jefferson County; and Harvard Gulch and Goldsmith Gulch in Denver, and upper Cherry Creek in Douglas County. These models activate automatically when corresponding flood threat notifications are issued. With the FMC Fire having impacted the Fourmile Creek watershed so severely, the Boulder Creek model needs revision. Before the fire, 1 to 2-inch rainfalls caused very little runoff. Now many experts believe that dangerous flooding will occur from rainstorms producing less than one inch. LRE has been asked to quantify the increased threat by making appropriate adjustments to the model.

For more information about the District's F2P2 and ALERT System operations, read the detailed reports at: www.udfcd.org/FWP/ALERT_Reports/ and www.udfcd.org/FWP/F2P2_Reports/.

2010 Flood Season Recap

Heavy rainfall caused the ALERT system to set off alarms on only 17 days in 2010 compared to 32 days the previous year. The specific alarm dates are shown in the table on the first page of this newsletter article. On half of those days, rainfall amounts exceeded 1-inch in 1-hour or less (6/11; 7/4, 6, 8, 20, 30 &31; and 8/1&4). For all other intense rainfall dates the alarms resulted from one-half inch falling in a very short 10-minute time period. That small but intense rainfall amount equates to a 3-inch per hour intensity and is certain to at least cause some impressive street flooding.

The following briefly describes some of 2010's more notable events:

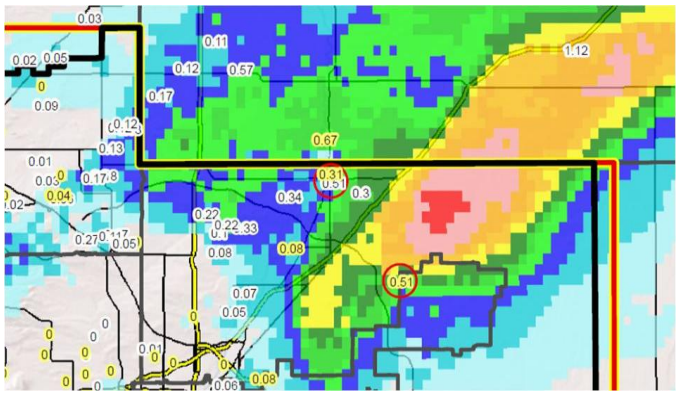
Wednesday-Friday, April 21-23

The 2010 flood season got off to an interesting start when a system of strong thunderstorms arrived Wednesday afternoon producing large hail and heavy rainfall. The stormy period lasted about 48 hours, changing over to a widespread rain/snow storm with precipitation totals exceeding two inches at many locations and prompting the NWS at 4:38 pm on Friday to issue a flood warning for the South Platte River from Henderson to Fort Lupton. Runoff from the storms caused annual flood peaks at 29 ALERT gages affecting Ralston Creek in Arvada, Lena Gulch in Lakewood, Little Dry Creek in Adams County, Kelly Road Dam on Westerly Creek in Denver, Toll Gate Creek in Aurora, Sand Creek, Cherry Creek through Denver, Bear Creek, the South Platte River, and a number of other District streams. While no serious damages occurred, it is safe to conclude that this was the largest widespread flooding event of the 2010 flood season.

South Platte River at Confluence Park in Denver--April 23, 2010

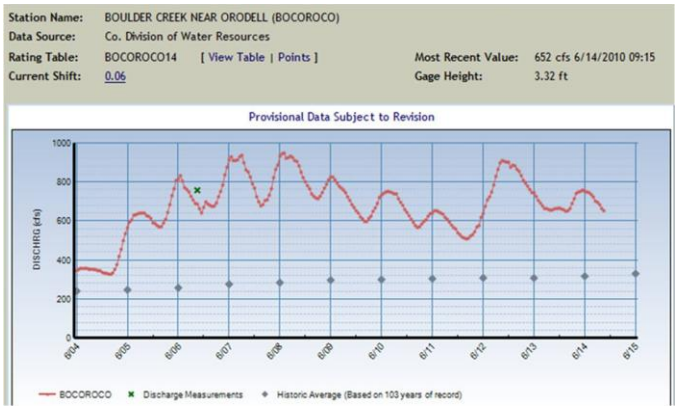
Wednesday, May 26

Multiple severe thunderstorms brought copious amounts of large hail, strong winds and tornados to Adams and Weld County north of DIA. Radar-estimates of precipitation totaled an impressive 4.65 inches but no rain gages were close enough to verify this amount (see ALERT and CoCoRaHS maximums of 0.51" circled in following figure). Hail tends to cause overestimates of rainfall from Radar data. It is interesting to note that a similar storm the previous week (May 18) targeted nearly the exact same area. Property damage estimates from the hail was approximately $70 million. No significant flood damage was reported.



Tuesday, June 8

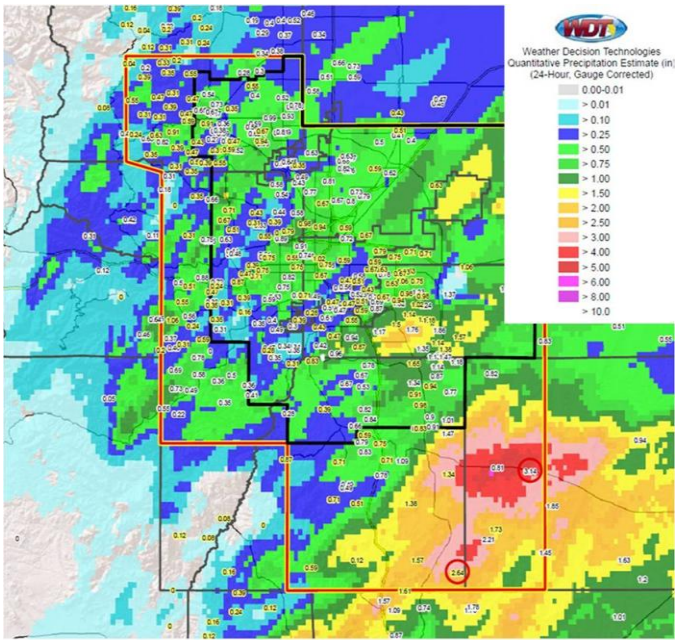
High snowmelt runoff rates are common in mountain streams at this time of year. What is not common is the issuance of a flash flood watch for snowmelt runoff without any threat of heavy rainfall, but that's precisely what happened on this particular day. The circumstance that led to this decision by the NWS was the partial failure of a private road crossing of Boulder Creek at the Red Lion Inn in the canyon west of Boulder. The main concern was for areas immediately downstream in the event that runoff waters would pile-up and release suddenly. Fortunately, nothing serious developed. Peak flows on Boulder Creek were approaching 1,000 cfs when the runoff waters did an end-around leaving the culverts in place with the road crossing impassable. For five consecutive days following for Red Lion incident (June 9-13), a heavy rain threat did exist for the region prompting the NWS to issue subsequent flash flood watches for the 12th and 13th. From June 11-13, the rainfall totals in the Boulder Creek watershed upstream of Boulder ranged from 2 to 3 inches but the intensities were quite low and the resulting runoff well-behaved.



Hydrograph plot for Boulder Creek near Orodell for 2010 peak snowmelt runoff period. June 12 peak caused by rainfall.
http://www.dwr.state.co.us/SurfaceWater/data/division.aspx?div=1

Sunday, July 4

Independence Day seems to be a recurring favorite for thunderstorms competing with fireworks. This year an upper level storm system brought unseasonably cool and very wet weather to the region. Multiple thunderstorms produced heavy rainfall across the entire District with the highest rainfall amounts observed in the Cities of Aurora, Centennial and Parker. Rainfall amounts produced by each storm ranged from ½ to 2½ inches. The Sulphur Gulch stream gage at Parker recorded its annual peak at 11:43 pm. Southeast of the District in Elbert County, radar rainfall estimates totaled 6.1" for the 24-hour period. Now that's wet!



Storm summary map showing 24-hour rainfall totals for July 4, 2010 from the ALERT System (yellow background), CoCoRaHS (white background) and gauge corrected Radar estimates ending at 7AM the following day.

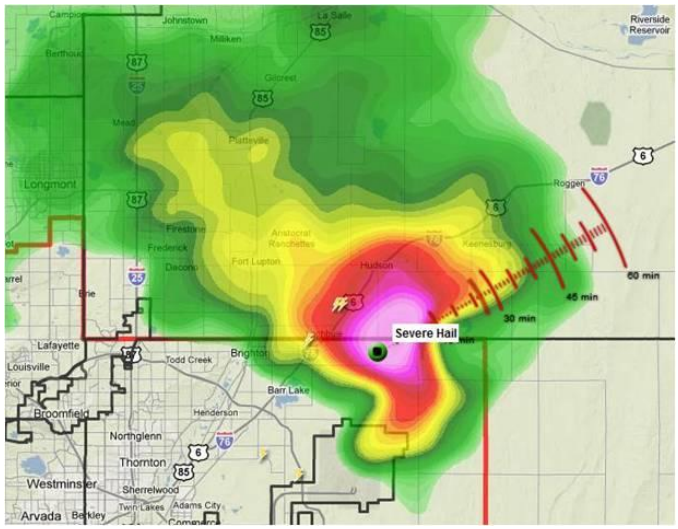
Tuesday, July 6

The storm activity in the District on this day was rather unremarkable, but nearby a couple of storms are worth honorable mention. In Boulder County north of the District, an ALERT rain gage south of Lyons in the Red Hill Gulch basin measured the year's most intense 10-minute rainfall of 5.4 in/hr during a 10 pm storm that lasted only 17 minutes. Earlier that same evening the NWS issued a flash flood warning at 7:27 pm for another intense storm that dropped 2 to 3 inches east and southeast of the District in northern Elbert and central Arapahoe and Adams Counties.

Wednesday, July 28

A very impressive severe thunderstorm in the Nederland area west of Boulder dropped over 8 inches of pea-to-marble-sized hail near the Eldora ski area with radar-estimated rainfall totaling 2-4 inches and prompting the NWS at 3:55 pm to issue its second flash flood warning of the year for Boulder County. Runoff from this storm caused streams to overflow their banks and wash over bridges and roadways, flooding streets in Nederland and causing car accidents. Roads were closed until they could be reopened by snowplows. Like the July 6 storm, the District was not impacted by this event.

Dan Barber with the Boulder Office of Emergency Management was highly complementary of District services provided prior to and during this storm, with the earliest notification of a potential threat being the 9:32 am heavy precipitation outlook that indicated a high potential for flooding later in the day. This early forecast also noted that should a strong thunderstorm become nearly stationary it could result in up to 2.5" in 60-75 minutes. As the situation developed later that afternoon, Mr. Barber was able to monitor a custom radar display developed for the District and later commented that: *"…I was able to anticipate and react to your radar and what I was seeing before NWS issued a flood warning."* The following image shows an example of the Google Map-based custom radar application used by Mr. Barber. Users may also select other information to display such as GIS layers (e.g. floodplains, burn areas, etc.) and real-time ALERT data.



Screen capture from June 11, 2010 showing WDT iMap™ Radar image with lightning strikes, storm attributes and projected storm track.

Friday, July 30

After two days of nearby flash flood warnings for Nederland (July 28) and the Hayman Fire Burn Area (July 29),

this Friday kicked off a 3-day weekend of NWS flash flood watches, typical for Colorado's monsoon season. While the storm activity this day did not culminate in any flash flood warnings or serious flooding in the District, a number of intense rainstorms produced amounts ranging from 1.8 to 2.4 inches over eastern and southern portions of the District's forecast area. The ALERT system measured 10-minute rainfall rates exceeded 3 in/hr at DIA and in Arapahoe and Douglas Counties. Eight rain gages also measured 1-hour totals exceeding one-inch followed by 8 stream gages recording annual peaks between 6:30 pm and midnight.

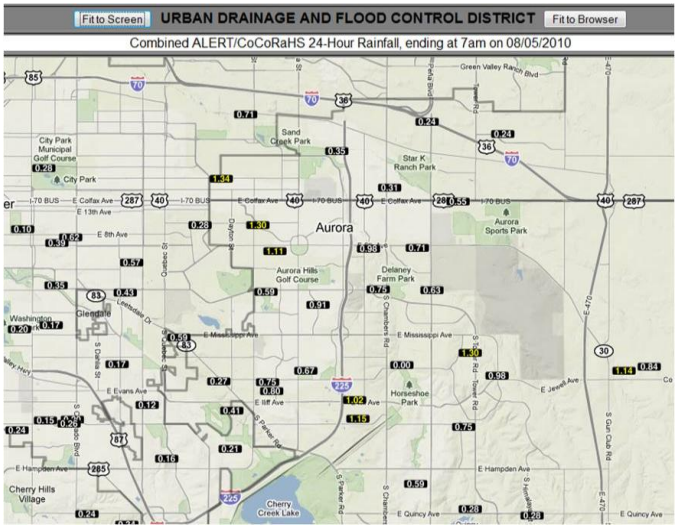
One storm near Castle Rock in Douglas County caused East Plum Creek at Haskins Gulch to rise 4.8 feet between 7 and 9:30 pm according to USGS records. The peak flow was estimated at just over 1,000 cfs. This is the largest event measured by this USGS gaging station since it was established in 1999. The largest known flood at this location occurred in June of 1965.

Sunday, August 1

This final District flash flood watch day of 2010 produced the ALERT System's largest 1-hour rainfall measurement for the year (1.93") in the Hayman Burn Area resulting in another flash flood warning for that area. North Boulder County rain gages in the St. Vrain Creek watershed also measured one-hour amounts exceeding an inch. Third Creek at DIA recorded its annual peak at 3:36 pm. While this day certainly produced the greatest 1-hour rain gage measurement of the year, a number of other days likely produced significantly larger events. As seen in the past, big storms have an interesting way of missing rain gages.

Wednesday, August 4

This day marked Hayman's third and final flash flood warning of 2010. Heavy rains elsewhere impacted Westerly Creek in Aurora and Denver, and Toll Gate Creek in Aurora. Annual flood peaks were recorded by 7 ALERT gages in these two drainage basins. Both streams are tributaries of Sand Creek. While rainfall totals only approached 1.4 inches in this area, four stations measured 10-minute rain intensities between 3 and 4 inches/hour. That's intense!



Monday, August 16

Although this was not the final flood threat day of 2010, it did mark the second most intense downpour measurement of the year—4.96" in 10 minutes at 5:47 pm, Station No. 4840 (South Boulder Creek at South Boulder Ditch) near CU-Boulder's South Campus site. Heavy rainfall was also observed in the upper Cherry Creek and Plum Creek basins in southern Douglas County.

Concerning heavy rainfall at Hayman and other burn areas

Past issues of *Flood Hazard News* documented many storms and flash flood warnings that affected the Hayman Burn Area in Douglas, Jefferson, Park and Teller Counties since the 2002 fire. Hayman was Colorado's largest ever wildfire having burned over 138,000 acres. Prior to 2002, Buffalo Creek in Jefferson County (12,000-acre burn area) was a notorious target for heavy rainfall resulting in very costly and deadly floods following the May 1996 fire. In 2011 and for some time period beyond the greatest concern for dangerous flooding on Colorado's Front Range will likely be the Fourmile Canyon (FMC) Burn Area west of Boulder. This burn area is half the size of Buffalo Creek but the watershed slopes are twice as steep. Debris and mudflows will soon become a recurring problem and the potential for dangerous and destructive floods is also very high. The current condition of the watershed resembles the conditions at the turn of the prior century when the area surrounding Gold Hill was heavily mined and cleared of timber.

The 1894 flood was Boulder's largest known flood. It washed away buildings, bridges and long sections of roads and railroads. The estimated peak discharge on Boulder Creek through Boulder was 12,000 cfs, equaling the 100-year (1% annual chance) flood. According to the USGS, the flood on Buffalo Creek that occurred just two months after the fire produced at peak discharge of 14,000 cfs of which 7,000 cfs came from a small tributary named Sand Draw that drains just over 1,000 acres. According to Bob Jarrett with the USGS, paleoflood studies show that Fourmile Creek was the primary source of the 1894 flood with little evidence of high flows from Boulder Creek upstream of the confluence.

Scientists and meteorologists who have studied wildfire impacts have observed that larger more intense rains appear to occur more frequently over burn areas compared to the adjacent healthy forest. This may just be a coincidence or just plain luck, but in the case of Hayman and Buffalo Creek this phenomenon is well document. One locally well-known meteorologist, John Henz, has called this a "chimney effect" and he believes it occurs because the exposed ground lacks shade formerly provided by the forest. The solar-heated soils cause a column of warm air to rise above the burn area, thus creating a rich environment for storm development and intensification. While the jury is still out on this issue, it is one plausible theory to consider and if true, the increased flood potential from the FMC-BA may be far worse than some engineers and hydrologists currently believe.

As empirical evidence in support of the chimney theory—in 2010 Hayman residents experienced three days reacting to NWS flash flood warnings (7/29, 8/1,4) and eight more days when heavy rainfall exceeded ALERT alarm thresholds (6/11,12,27 and 7/20,22,30,31 and 8/23). With experts telling us that as little as 1/4-inch of rain in one hour will cause large debris flows in the FMC-BA, we predict that flood warnings for this area will soon become commonplace.

Extreme Rainfall Not Required

How likely are flood-producing rainstorms really? Three years ago a small magnitude flood on Lakewood Gulch in Denver claimed the life of a child. It was this tragic event that prompted me to begin writing about what we have learned about rain frequency and flood frequency from more than 20 years of measuring rainfall and streamflow. In 2009 after the busiest year of flood threats in 30 years, the question of extreme rainfall and floods was revisited and suggestions were made concerning how subject matter experts might better communicate truths about floods. This year the FMC Fire in Boulder County created yet another opportunity to take a much closer look at flood risk with respect to alleged "infrequent" rainstorms.

Rather than ramble on trying to prove my case beyond reasonable doubt, I have simply chosen to present the following opinions and supporting evidence to challenge you, the reader, to refute these conclusions:

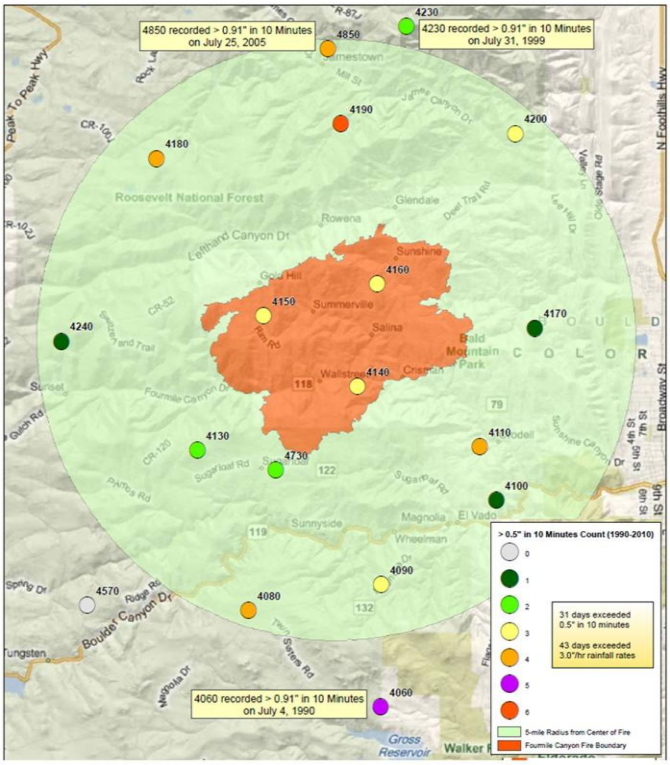
1. Big floods happen (support: many historic flood accounts for the region dating back to the 1860's)
2. Big rains happen often (read 2007 & 2009 issues of *Flood Hazard News* and preceding text)
3. Big rains do not always cause big floods (see past 20+ issues of *Flood Hazard News*)
4. Rainfall of a given magnitude, normally expressed as annual probability of occurrence or return period, never causes a like-magnitude flood on the receiving stream (support: have neither witnessed nor read an account of a flood with these characteristics).
5. Small floods can be deadly (e.g. Lakewood Gulch 2007)
6. Big floods occur in dry years (e.g. Big Thompson 1976 and Cherry Creek at Denver 2008)
7. Small rains can cause big floods (e.g. Hayman, Buffalo Cr)

Point No. 7 concerns everyone involved with the FMC-BA projects as well as the people who live in or travel through the high risk areas. One urgent question currently being asked is: How much rain will it take to seriously threaten lives and properties? For areas in and immediately downstream of the BA the answer seems fairly simple…it will not take much, possibly at little as ¼-inch in one hour, and such events are highly likely. For the City of Boulder the answer is more difficult and steps are currently being taken to make some reasonable educated guesses. Until then we should trust what we have learned from Hayman and Buffalo Creek.

The following table and figure provide a revealing historical look at rainfall measured within a 5-mile radius of the center of the FMA-BA over the past 21-years. Hopefully this data will help interested parties comprehend the likelihood of experiencing relatively small rainfalls. I wonder what flow rate the half-inch storm will produce? Time will certainly answer this question. Remember that a foot of rain fell nearby in 1976 (Big Thompson) and again in 1997 (Ft. Collins).

Number of 30-Minute Duration Storms Exceeding:

	0.25"	0.5"	0.75"	1.0"	1.25"	1.5"
1990	18	14	3	2	1	0
1991	25	9	3	2	1	0
1992	18	2	0	0	0	0
1993	20	4	0	0	0	0
1994	27	8	1	0	0	0
1995	22	4	0	0	0	0
1996	23	8	2	0	0	0
1997	27	9	1	0	0	0
1998	22	9	3	1	0	0
1999	35	16	5	3	0	0
2000	12	2	0	0	0	0
2001	27	7	2	0	0	0
2002	13	3	1	0	0	0
2003	16	6	3	1	1	1
2004	13	8	0	0	0	0
2005	9	3	1	1	1	0
2006	2	1	1	1	0	0
2007	9	4	2	2	0	0
2008	1	0	0	0	0	0
2009	5	0	0	0	0	0
2010	5	2	0	0	0	0
TOTALS:	**349**	**119**	**28**	**13**	**4**	**1**



Let's prepare for the worst and hope that it does not happen.

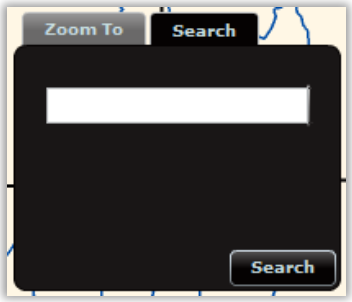
Public Release of the Electronic Data Management Application

Julia Bailey, Information Services Engineer, Information Services and Flood Warning Program

The District's Electronic Data Management (EDM) web map application developed by GIS Workshop Inc. (GISW) was launched for public use in April of 2010. Since then, the District has received typically positive feedback from users on the functionality and increased availability of District reports and data. The map application consists of three tabs (Document Search, Floodplain, and Routine Maintenance). Each tab can display three views (Map, Aerial, and Terrain) and multiple scales similar to a Google map. Users can use the Zoom-To tool to navigate the map by entering an address, intersection, stream, confluence, stream crossing, or section/township/range.

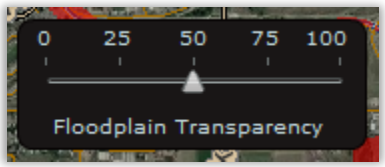
Buttons that control the map view.

The Document Search tab features an additional text search option in the upper right. This option allows users to search District report documents and index information such as name, author, sponsor, drainageway, year, and document type. When hovering over a particular map feature, the feature will become highlighted and a popup displays the feature name. Users may also search for documents by clicking on a highlighted basin or stream. The search results are displayed in a list with sort and filter capabilities. Reports can be opened in a browser window by double clicking on a report title. It is also possible to open reports directly from the map by clicking on a highlighted point feature.



Text search window is available by clicking the Search tab.

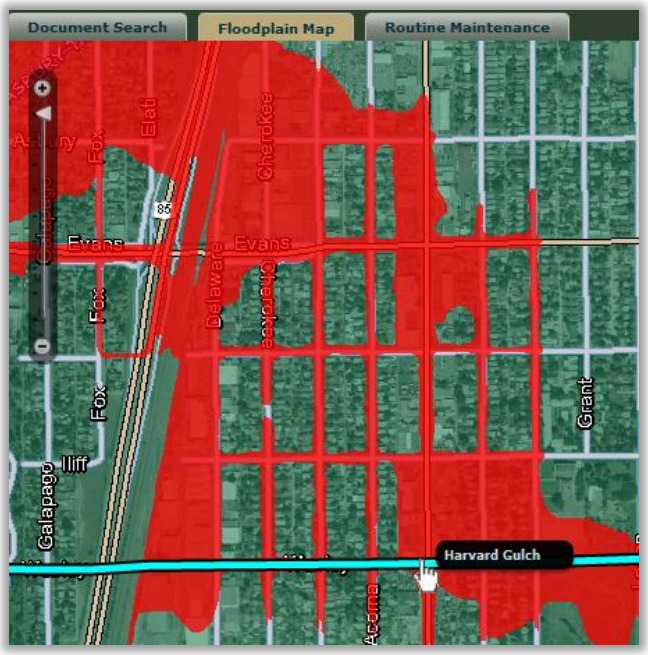
The Floodplain tab shows the District's consolidated floodplain layer. The floodplain boundaries are approximate and should not be used for official floodplain determinations. A slider bar at the top right allows the user to control the layer transparency.



The Routine Maintenance tab is a simple viewer for work item limits of debris removal, weed control, and natural areas. Similar to the Routine Maintenance tab, a Maintenance Eligibility tab viewer has been developed and will be available for public use in the coming months.

In parallel with EDM development, GISW built a web based data entry form. The webpage grants direct access to the MySQL database driving the application. District staff utilizes the web access of the database to upload reports and manage attributes. The District administers unique value tables in the database through phpMyAdmin.

The next phase of development includes a professional graphic redesign of the web map application, additional organization features of the MySQL entry form and expansion of interface functionality. By March of 2011, the District anticipates that the EDM will replace the existing SVG floodplain map referenced in the annually distributed flood hazard information brochures.



The District's consolidated floodplain layer at Harvard Gulch.

The FEMA National Flood Hazard Layer (NFHL) web map service is a new enhancement feature being added to the Floodplain tab. Where NFHL data does not exist, users will still be able to see the District's consolidated floodplain layer. Transparency of the floodplain layers will be controlled through the slider bar. A legend will also be added for easy determination of the floodplain information source.

One significant improvement to get excited about is that GISW will replace the ESRI geocode service in the address tool with the Google geocode API. This change will mean that the EDM Zoom-To address and intersection feature will locate the same result as Google maps.

The District encourages user comments and feedback on the EDM application.