

Commemorating the 50th Anniversary of the 1965 Flood

by

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Fifty years ago the Denver area was beginning a long recovery process from its worst disaster in modern times, brought forth by the destructive flooding of June 16-17, 1965. No one alive at that time had ever seen anything like it. The damages then were comparable in magnitude (~\$4 billion in current dollars) to Colorado's more recent experience...the "September-to-Remember" floods of 2013. This article will attempt to draw some contrasts between those two major flood events, but the main goal is to remember the earlier event and highlight the good things that have happened over the past five decades largely in response to the infamous 1965 Flood.

Contrasts

Living with a new normal became a theme in the aftermath of the 2013 floods. This premise was equally true for Denver area residents in 1965. So much has been written about the '65 flood over the years that to recount too many specifics would be redundant. But some recap of the details from 1965 is needed to gain a clearer picture of the risks people face today, primarily as it relates to the South Platte River.

The '65 Denver Flood originated in the Plum Creek watershed of Douglas County south of Castle Rock from a storm that produced upwards of 14 inches of rain over a 3 to 4 hour period. Ten-inch plus rains also fell in the Cherry Creek basin causing an estimated peak flow rate of 39,900 cfs at the old Melvin gaging station located downstream of Piney Creek in the flood pool of Cherry Creek Reservoir. This event was larger than the major flood that occurred in August of 1933 when the Castlewood Canyon Dam failed.

Had Cherry Creek Dam and Reservoir not been there in 1965, the losses along Cherry Creek through Denver would have been devastating.

The large rain totals from the June 16, 1965 storm were similar to 2013 figures, but they occurred over a much shorter time period. In 2013, while 7-day totals approached 18 inches, maximum 24-hour measurements were closer to 12-inches and the peak 6-hour measurement from automated rain gauges was just slightly more than 6-inches. In other words, the '65 rainstorm was in a league by itself when compared to 2013.

Damages along Plum Creek and its two major tributaries, East and West Plum Creek, were extensive and the peak flows were much higher than the regulatory (100-year) discharges used today. The following table compares some of the estimated 1965 flood peaks with the 100-year (1% annual chance) and 500-year (0.2% annual chance) published flow rates for Plum Creek and the South Platte River:

Location	1965 Peak Flows (CFS)	Q100/Q500 (CFS)
East Plum Creek near Castle Rock	126,000 (6/16)	15,800 / 26,400
West Plum Creek at Sedalia	36,800 (6/16)	11,700 / 19,200
Plum Creek at Louviers	154,000 (6/16)	39,100 / 70,400
South Platte River at Littleton	110,000 (6/16)	12,700 / 22,000
South Platte River at 19 th Street	40,300 (6/17 @ 0145)	22,000 / 35,000

Fatalities

News reports occasionally leave false impressions about what really happened in June of 1965. More than one story last summer commemorating the flood made reference to 21 lives that were lost while showing shocking pictures of damages along Plum Creek and the South Platte River. Research for this article revealed that the South Platte River Basin claimed between the 8 and 13 lives. The other 10 or so Colorado fatalities occurred in the Arkansas River Basin. At least 2 deaths were directly related to flooding in the Plum Creek drainage basin of Douglas County. Although the numbers differ somewhat between sources, not a single source reported any direct floodwater-related deaths along the mainstem of the South Platte River—an interesting detail considering the massive devastation that this river valley suffered. Compared with 2013, both floods claimed lives in the South Platte and Arkansas River basins, but the statewide totals from 1965 were over twice the number of flood-related deaths that occurred in September of 2013.

Preventing Future Catastrophes

Every flood disaster of the magnitude of the 1965 flood sparks actions to prevent that disaster from happening again, and the response to this flood was no exception. Among the actions taken were the following:

- Development of the *Urban Storm Drainage Criteria Manual* by the Denver Regional Council of Governments (DRCOG), with a grant from the U.S. Department of Housing and Urban Development (HUD)
- Creation of the Urban Drainage and Flood Control District (UDFCD) by the State of Colorado
- Construction of Chatfield Dam and Bear Creek Dam by the federal government through the U.S. Army Corps of Engineers (USACE)
- Creation by Denver of the Platte River Development Committee (PRDC), later to become the Greenway Foundation. Later on, suburban “greenway” organizations were formed upstream and downstream of Denver.

An organization called the Five-County Engineer’s Council was instrumental in pursuing the idea of a regional flood control entity. The council membership included county engineers from Adams, Arapahoe, Boulder, Denver and Jefferson Counties. Also included were engineers from Public Service Company, Mountain Bell, Denver Water Board, Littleton, Englewood, Portland Cement Association and Wheat Ridge Water and Sanitation District. State Senator Joe Shoemaker became involved in 1967.

The council became the Metropolitan Urban Drainage Advisory Committee of DRCOG in 1967. DRCOG hired Wright-McLaughlin Engineers to prepare the *Urban Storm Drainage Criteria Manual (USDCM)*; and the Advisory Committee helped DRCOG with policy questions during preparation of the USDCM. The policy decisions and an article by Shoemaker entitled “An Engineering-Legal Solution to Urban Drainage Problems” which appeared in the *Denver Law Journal* became the framework for UDFCD’s formation.

The Advisory Committee decided to pursue legislation in 1969 that would create an Urban Drainage and Flood Control District. Senator Shoemaker introduced the legislation, which passed; and UDFCD’s first Board of Directors meeting was held in July of 1969. Starting with a staff of two and a small planning budget, the District has grown in a very careful and responsible way to its current size and scope. The USDCM was turned-over to UDFCD to maintain.

An early study showed that 26% of Denver area drainageways had developed to the point that some new flood control facilities would be needed to achieve 100-year protection, but that the other 74% “lend themselves to non-construction measures, which will preserve them as floodplains, preventing future loss of human life and property damage.” In 1973, UDFCD’s Board of Directors adopted a two-pronged approach of remedial projects in developed areas and preventive actions for undeveloped floodplains by establishing the Design and Construction, and the Floodplain Management Programs.

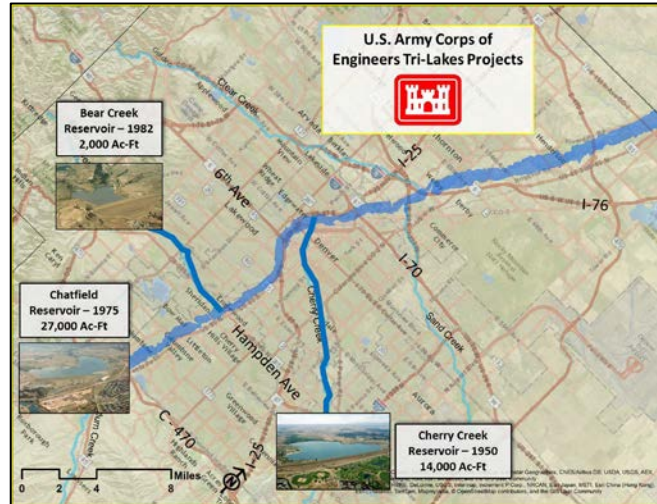


South Platte Park includes land acquired by the USACE and City of Littleton

Chatfield Dam was built at the confluence of the South Platte River and Plum Creek (the major source of floodwaters in 1965) south of Denver to reduce flood risks in the Denver area. Construction that began in 1967 was completed in 1975, storing runoff from a total drainage area of about 3,018 square miles. The flood pool area is now operated as a state park and has become the most popular park in Colorado.

In another development in 1974, Congress, for the first time ever, at the request of the City of Littleton, authorized the USACE to use federal funds earmarked for an outlet channel from Chatfield Dam for floodplain acquisition instead, which became part of South Platte Park. Littleton was also a major contributor of funds for the project.

Bear Creek Dam was the last of three dams built by the USACE, with Cherry Creek Dam, completed in 1950, being the first. The dam, located at the confluence of Bear Creek and Turkey Creek on the west edge of the City of Lakewood, holds back runoff from a drainage area of 236 square miles. It was authorized in 1968 but not completed until 1982. The flood pool area is managed as a park by Lakewood. Bear Creek Lake clearly prevented flood damages in both 2013 and 2015. Collectively Cherry Creek, Chatfield, and Bear Creek Dams are known as the Tri-Lakes Project.



The USACE Tri-Lakes Project provides flood protection for the urban core of the Denver area

In 1974 Denver Mayor Bill McNichols created the nine-member PRDC, with Senator Shoemaker serving as chair; with the charge to start revitalizing the South Platte River. Two years later, it became a non-profit organization called The Greenway Foundation, which made it easier to raise funds from private sources. As previously noted, its success encouraged the formation of other organizations to extend the greenway upstream and downstream, as well as on any number of tributaries. According to the [Greenway Foundation's 2015 Annual Report](#) "...over \$500 million has been invested into the river and its parks and trails..."

Over the last 46 years, UDFCD has gone from Master Planning to adding a Floodplain Management Program and a Design and Construction Program, then a Maintenance Program and finally the South Platte River. The Flood Warning and Information Services Program spun off from the Floodplain Management Program, and stormwater quality expertise was added to the Master Planning Program.

As UDFCD added programs and staff, it also established important policies that have endured to the present. Among those were to: 1) maintain a small staff; 2) maximize reliance on the private sector; 3) require matching funds for planning, design and construction projects; and 4) return revenues through projects to the counties they came from.

The population of the District has roughly tripled since it was formed in 1969. In spite of this large amount of urbanization, there are approximately 5,000 fewer units (e.g. single-family residence = 1 unit, duplex = 2 units) in mapped 100-year floodplains. This statistic is a testament to the wisdom of the two-pronged approach envisioned over 40 years ago.

Could it happen again?

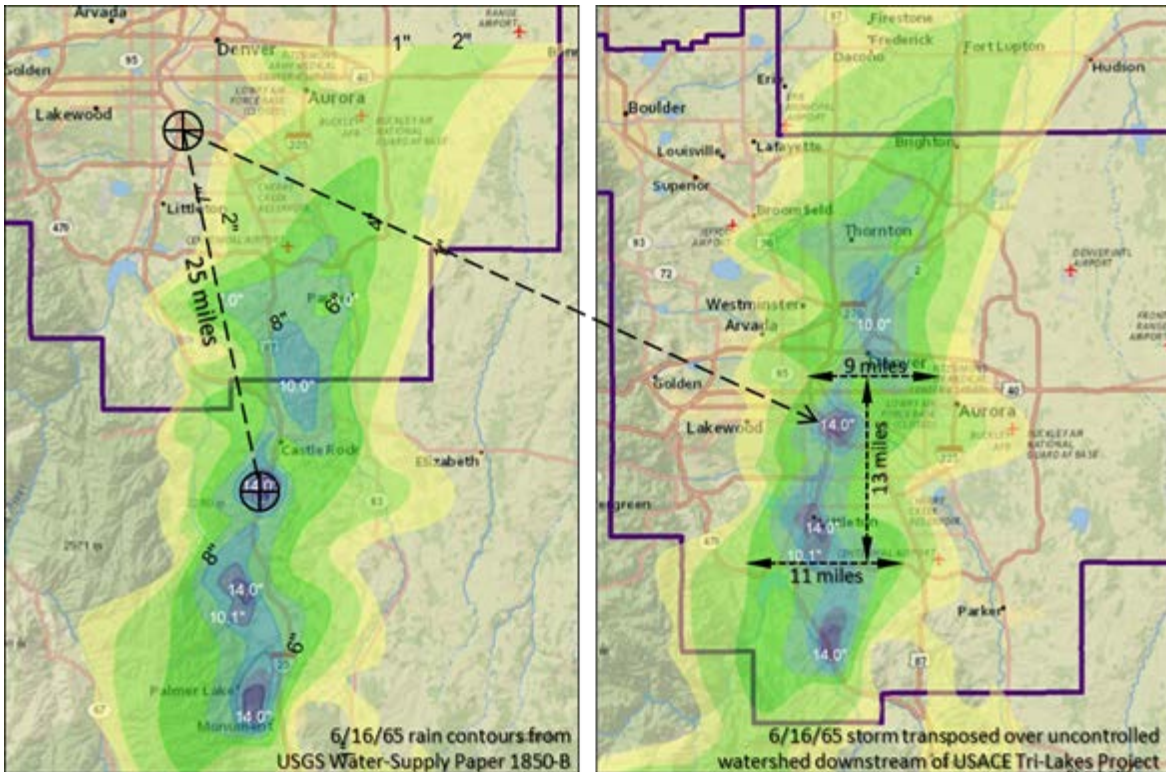
There is little doubt that if a repeat performance of the June 16, 1965 downpour occurred over the Plum Creek watershed today, many bridges, roadways and buildings in Douglas County would receive heavy damage but not the areas along the South Platte River through Denver. Chatfield Dam and Reservoir has effectively mitigated that risk.



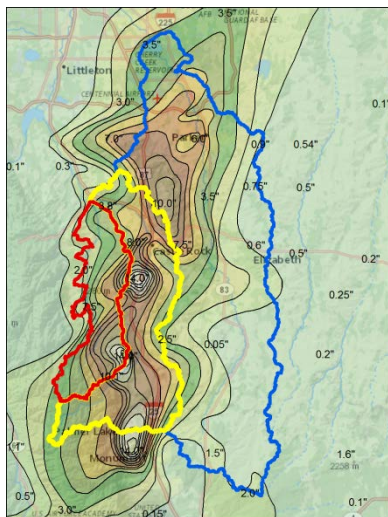
Uncontrolled drainage area below the Tri-Lakes

South Platte River watershed not protected by the Tri-Lakes Project. The total “uncontrolled” drainage area downstream of Tri-Lakes is about 220 square miles.

To put a slightly different spin on this question, let’s consider what might happen if a rainstorm of similar magnitude occurs about 25 miles further north. The two figures below show 1965 rain depths taken from a [USGS flood report](#). The figure on the right illustrates what that storm would look like with the 14-inch rain amount that occurred south of Castle Rock relocated to a point near the I-25/Santa Fe interchange in Denver. Note the coverage of the 4-inch plus rains (darker green). Where Cherry Creek joins the South Platte River at Confluence Park, the transposed storm has a width of over 9 miles with rainfall amounts exceeded 4-inches. On the south side along C-470 the width is about 11 miles with the length between being about 13 miles. This represents roughly 130 square miles of the



Rain contours from 1965 (left) transposed to an area downstream of the USACE Tri-Lakes dams



Plum Creek watershed with 1965 rain contours

GIS analysis of the 1965 rain contours over the Plum Creek watershed revealed that the basin average rainfall at the confluence of East and West Plum Creeks (where the yellow and red lines meet) was 6.2 inches over an approximate 200 square mile effective drainage area. Note that the watershed representation on the map does not include the entire drainage basin of West Plum Creek since little or no runoff occurred from the western portion of that watershed. The total drainage area of East and West Plum Creek is actually 274 square miles.

From the table on page 1 we find that the peak flood flow downstream of this confluence point (Plum Creek at Louviers) was estimated at 154,000 cfs. This equates to a unit discharge of 770 cfs/sq.mi. At another point in the watershed (East Plum Creek near Castle Rock), the USGS estimated a unit peak of 1,170 cfs/sq.mi. Both are huge numbers! Another way to understand how extreme this flood was is to compare these numbers with the published 500-year discharges. At the Louviers streamgauge that flood peak was

more than twice the 500-year value and at the Castle Rock location, the same comparison was almost a 5-fold difference.

Finally, let's revisit the "uncontrolled" drainage area downstream of Tri-Lakes in Denver where Cherry Creek joins the South Platte River. Just like Plum Creek, that watershed area is also of over 200 square miles but unlike Plum Creek, the area is highly urbanized. Thus, more runoff should occur from this area but for this illustration, let's assume it does not. If experts can agree that big rains like the 1965 storm can still occur over large areas of let's say **100 square miles** to keep the math simple, then the question remains—could a future flood peak on the South Platte River at Denver ever possibly reach the 40,000 cfs threshold experienced in June of 1965? To avoid overstating the situation, let's apply a unit peak discharge that is less than the 1965 estimates of say **500 cfs/mi²**. If these assumptions are reasonable, one must logically conclude that a future flood peak of **50,000 cfs** (500x100) for the South Platte River at Denver is conceivable, which would top the 1965 flood. Stating this a different way—does anyone really believe that a rainstorm similar to 1965 can never happen over the 220 square mile area downstream of the three large federal flood control dams that protect the Denver metropolitan area?



Confluence Park in Denver where Cherry Creek joins the South Platte River

Life is good along the South Platte River.

The 1965 Flood forever changed Denver and the surrounding metro area. The massive undertakings described in this article could not have happened without the involvement of many local governments, special districts, state and federal agencies, and non-profit organizations. The partnerships that evolved since 1965 have had a profound impact on the Denver region and the entire state. Working together, much has been achieved over the past 50 years to make the South Platte River through the city an incredible amenity. Today, people freely enjoy life on the South Platte; except when those floodwaters return to remind us all that risks still exist.