

What we knew and didn't do about Gregory Creek drainage structures

Scott Hoffenberg

A Trip Down Gregory Creek

Flagstaff Rd.

6' Round Corrugated Metal Pipe
28.3 ft²



5' Round 1.5" Steel
19.6 ft²



Old Baseline Rd. (Private)

2 @ 23" Round Corrugated Metal Pipe

5.8 ft²



711 Willowbrook Rd. (Private)

2010 Request for LOMR
4'4" Round Reinforced Concrete Pipe
14.7 ft²

Downstream View



783 Willowbrook Rd. (Private)

5'3" x 10'
52.5 ft²



Willowbrook Rd.

5' x 9' Reinforced Concrete Box Culvert

45 ft²

Installed 1996



550 Aurora Ave. (Private)

7' x 16'
112 ft²



Aurora Ave.

2 @ 5' x 10'

3' Round Reinforced Concrete Pipe

107 ft²

Installed 1995



Euclid Ave.

4' Round Reinforced Concrete Pipe
12.6 ft²



4' Round Reinforced Concrete Pipe
12.6 ft²



College Ave.

6' x 5' Arch

26.1 ft²



617 College (Private)

Approx. 20 x 4
80 ft²



Pennsylvania Ave.

4' 7" x 3' Ellipse
10.8 ft²



7th St.

Trash Rack
4 ft. Round Reinforced Concrete Pipe
12.6 ft²



Pleasant St.

4' x 8' Reinforced Concrete Box Culvert
32 ft²
Installed 1995



University Ave.

6' x5' Arch
26.1 ft²



8th St.

3'2" x 5'5" Partial Ellipse
Approx. 14 ft²



810 Marine St. (City Owned)

3' x 4' Reinforced Concrete Box Culvert
12 ft²



Marine St.

4' x'8' concrete
32 ft²



Alley Between Marine & Arapahoe

3'5" x 5'5" Ellipse
14.3 ft²



Arapahoe Ave.

3' x 10'
30 ft²



Highland School (Private)

3'6" Round Reinforced Concrete Pipe
9.6 ft²



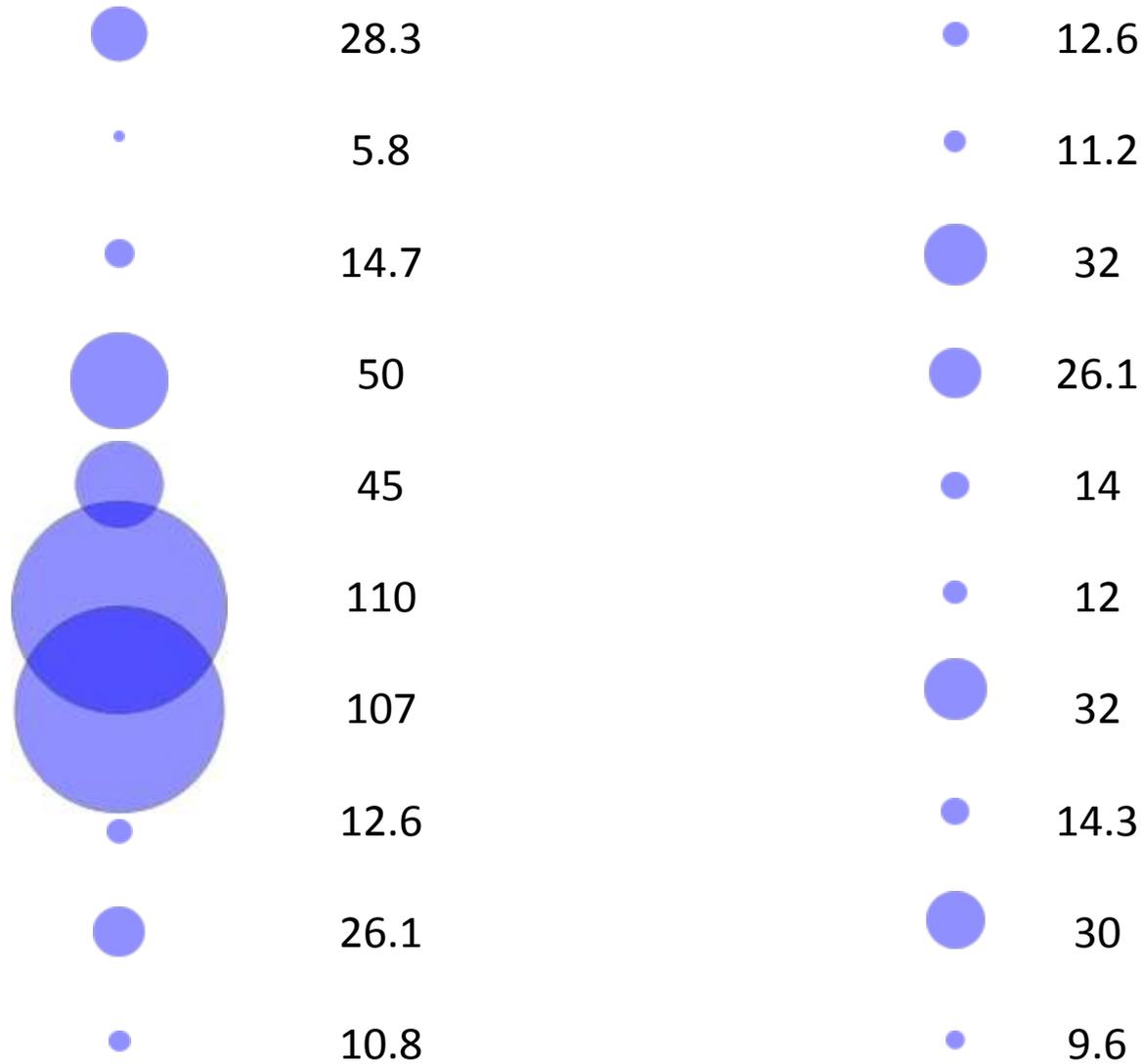
What Happened Before the Flood

Justin Hoffenberg

In Review

Culvert Sizes from Top to Bottom of
Gregory Creek

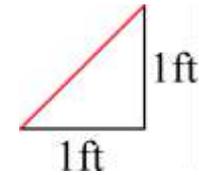
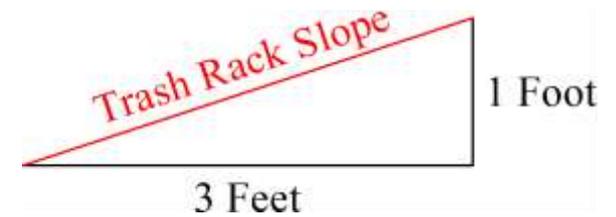
Area of Culverts (Ft²): Flagstaff Road to Boulder Creek*



*Taken from 2010 Request for Letter of Map Revision

Trash Racks

*“The longitudinal slope of the trash rack shall be no steeper than 3:1, horizontal to vertical.”**



Willowbrook and Cascade – 5’h x 9’w Culvert

Trash Racks

*“The entire trash rack shall have a clear opening at least three times the culvert opening area”**

Willowbrook Culvert = 45ft² (9'x5')
Required trash rack clear opening = 135ft²

18 openings at 4" per opening = 72"
Every 2" of rack length = 1ft² Open Area
(135ft² Required Opening) x (2" vertical rack length) = 270" rack length

Rack Approximately 22 Feet in length





Pre-flood



9/20/2013



11/18/2013

Pre-flood



7th Street Culvert At Flatirons Elementary School



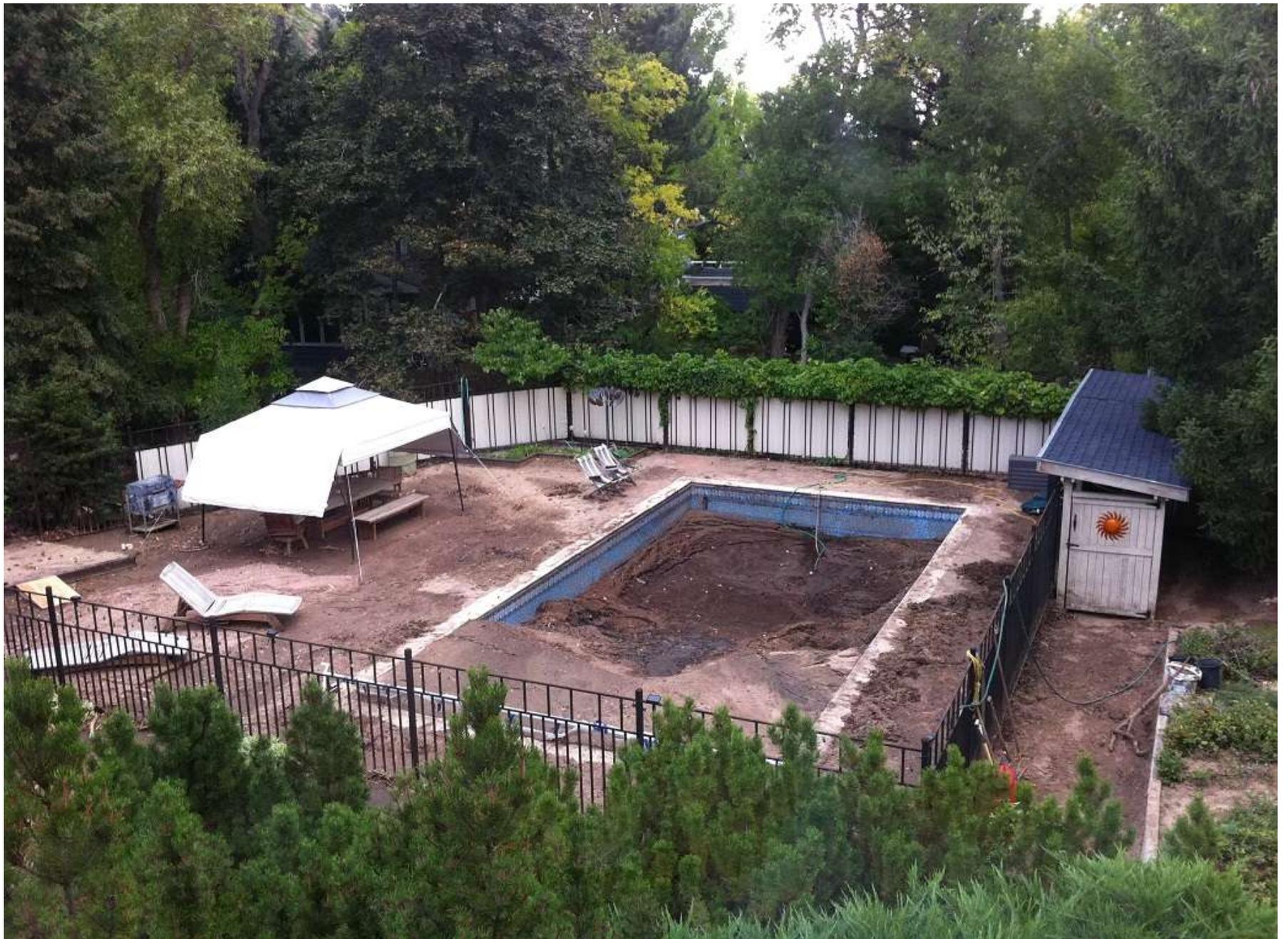
9/13/2013

2010 Request for Letter of Map Revision

MT-2 Form 2, Section A

Question 4 - Were the effects of sediment transport on hydrology considered?

“No. Gregory Canyon Creek is a steep-gradient stream with considerable velocities which average 9.2 ft/s over the study reach. Sediment deposition is not anticipated to be an issue on Gregory Canyon Creek.”













City of Boulder is under-investing in
flood mitigation, despite what is
studied and published

Roger Koenig

Requests of Boulder Water Resource Advisory Board

FLOOD HAZARD MITIGATION PLAN FOR COLORADO

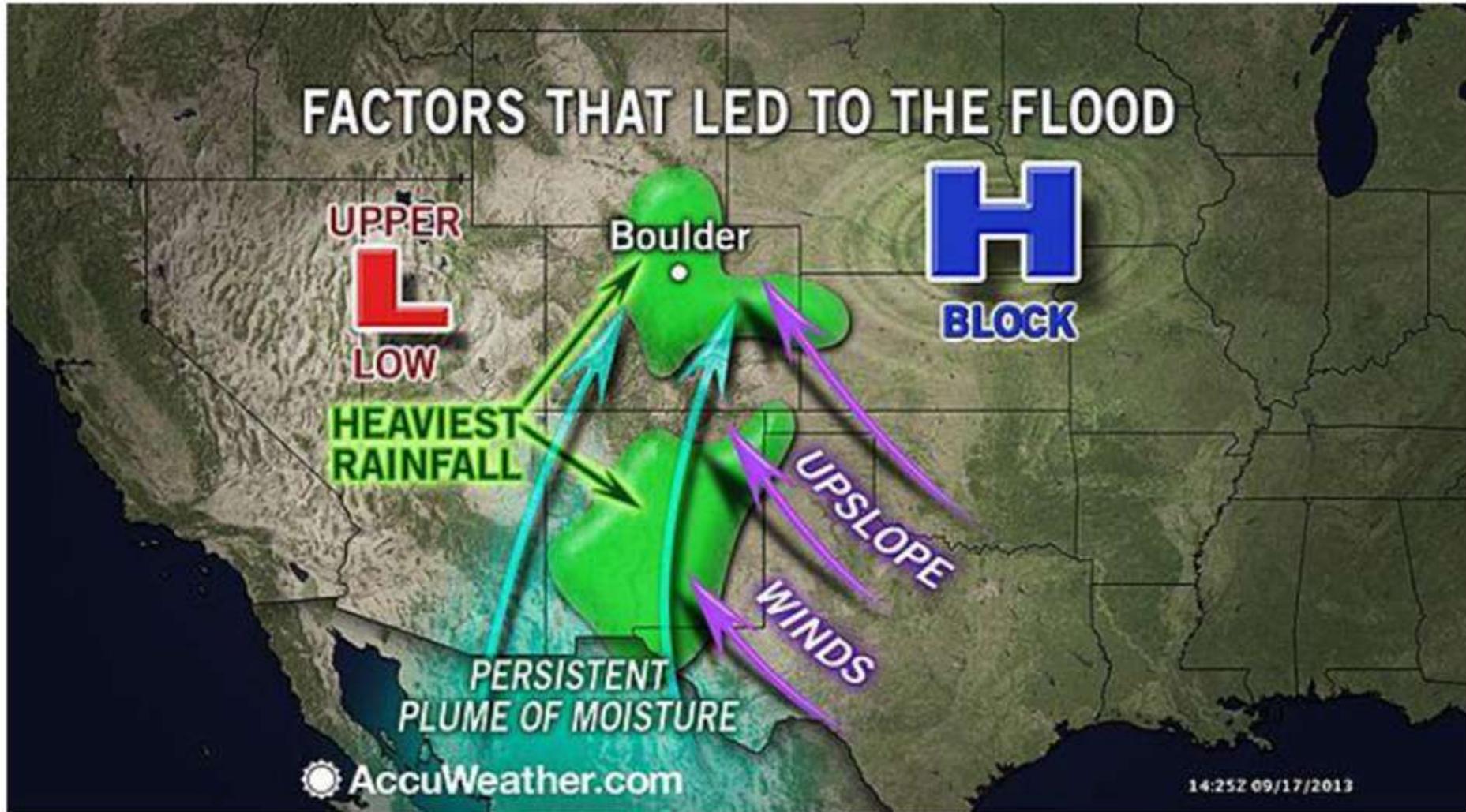


November 2013

Prepared Pursuant to
Disaster Mitigation Act 2000 & Section 409, PL 93-288

Figure 7

Weather Conditions that Led to September 2013 Flooding



Source: <http://www.accuweather.com/en/weather-news/colorado-flooding-why-so-bad/17861732>

Figure 8 1976 Big Thompson River Flood Explanation

What caused the Big Thompson flood

The causes of the July 31, 1976, Big Thompson Canyon flood — about 50 miles northwest of Denver — were similar to those of other flash floods, especially a flood that hit the South Dakota Black Hills June 10, 1972, killing 237 people.

5 Hardly any of the rain soaked into the steep-sided canyon.

4 Humid high-altitude air combining with weak winds meant the storm pulled in little dry air to weaken its rainfall.

3 Winds were less than 20 mph above 10,000 feet, too weak to move the storm away.

2 The unstable air continued rising as its water vapor condensed.

1 Winds from the east pushed very humid air up the mountains.

6 The river quickly went over its banks, filled with debris that acted like battering rams against downstream buildings, cars.

7 Water backed up in the canyon's narrow mouth. In floods, water often backs up as debris piles against bridges.

8 Flood water speeds up as it squeezes through narrow places, or is freed when a dam formed by debris bursts loose.

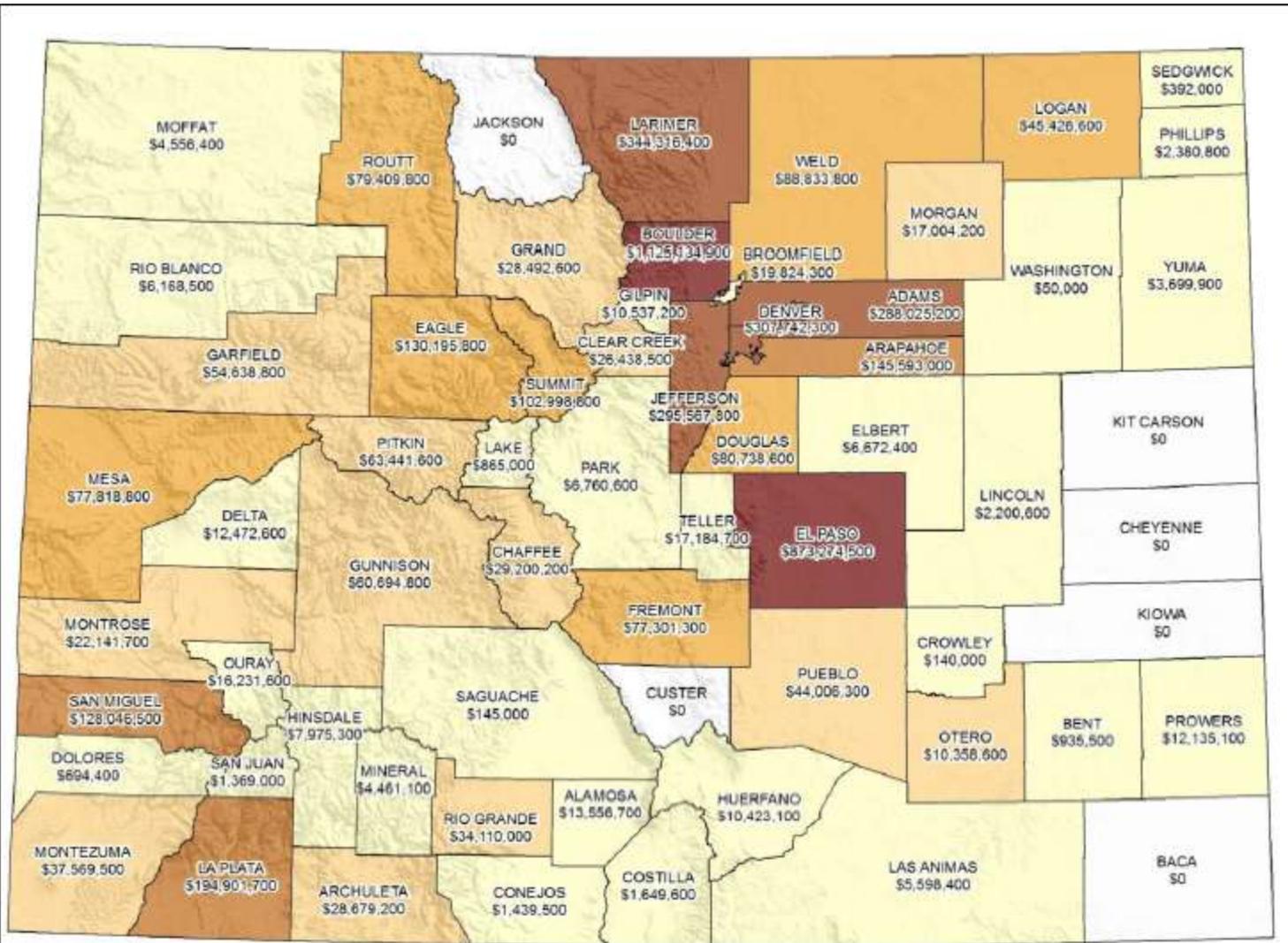
Normal river size

http://www.assessment.ucar.edu/flood/flood_summaries/07_31_1976.html

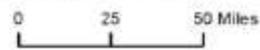
Line of thunderstorms from Little Rock, Arkansas to Wyoming (these events usually result from large-scale meteorological forces)

Boulder has not experienced deadly **flash floods**

<i>Year</i>	<i>Date(s)</i>	<i>Brief Description</i>
1894	May 29 - June 2	RECORD FLOOD on Boulder Creek, 4.5" to 6" totals west of Boulder, many bridges lost, extensive property and agricultural damage, one death , slow onset , South Boulder, Left Hand, Four Mile Canyon and St. Vrain also impacted.
1896	August 19	Fourmile Creek flash flood , storm center near Magnolia, rain amount unknown, road and property damage at Salina.
1914	June 1-2	Snowpack 50% above normal ; heavy rain in mountains; worst Boulder Creek flood since 1894; damage to bridges, farms and Boulder's water system.
1921	June 2-7	Record flow since 1916 at Orodell stream gage on Boulder Creek (June 6); 5-days of general rainfall over 520 sq. mi. of SPR basin, Longmont recorded 4.3" in 6 hours .
1929	July 31	Storm center near Bummers Gulch, heavy rain also in Boulder, flooding on Boulder, S. Boulder, Four Mile Canyon and Gregory Creeks; 4.8" rain, damage to streets, lawns, bridges, RR and at 9th & Arapahoe
1938	September 2	Record flood on South Boulder Creek; extensive damage at Eldorado Springs; 6" rains reported west of town.
1969	May 7	Long duration storm (May 4-8); 7.6" to 9.3" rain totals; most notable flooding along South Boulder Creek and Thunderbird Lane (Foothills Parkway area)—also downstream.



Map compiled 10/2013; intended for planning purposes only
 Data Source: FEMA Region VIII



Policies Since 1978	
0	301 - 500
1 - 100	501 - 800
101 - 300	801 - 1,800
	1,801 - 4,757

Table 8 Vulnerabilities Identified in Local Multi-Hazard Mitigation Plans

County	Level of Risk Identified in Local Plan	Population Affected by Flood	# of Structures Affected by Flood	# of Critical Facilities Affected by Flood	Potential Flood Loss (total \$ value)	Total Number of Structures	Total Number of Critical Facilities	Total Exposure (\$)
City of Boulder	High	7,851 (1% chance flood zone) 15,144 (0.2% chance flood zone)	2,021 (1% chance flood) 4,588 (0.2% chance flood)	78	\$489,967,000 (1% chance flood) \$1,210,428,000 (0.2% chance flood)	35,785	447	\$12,984,069,000

State of Colorado
Flood Hazard Mitigation Plan
November 2013

Colorado Governmental Immunity Act Increased Caps!

APRIL 30, 2013 BY [JIMMY VICIL](#)

[LEAVE A COMMENT](#)

On Friday, April 19, 2013, Governor Hickenlooper signed SB 13-023 which will amend the Colorado Governmental Immunity Act to allow the outdated damage caps to increase.

Essentially, the SB 13-023 changes the single claim cap against government entities from \$150,000 to \$350,000 and for multiple claims, from \$600,000 to \$990,000, with no single person being able to recover more than \$350,000 instead of the previous \$150,000.

According to the Bill, this change takes effect July 1, 2013, and applies to injuries occurring on or after said date.

For more information about the bill go to:

http://www.leg.state.co.us/CLICS/CLICS2013A/csl.nsf/fsbillcont3/5CF99C5C65A90D0B87257AEE0057AE90?Open&file=023_01.pdf

Is Boulder Flood Mitigation a **Great** Investment in comparison to \$1.2B of hard property loss?

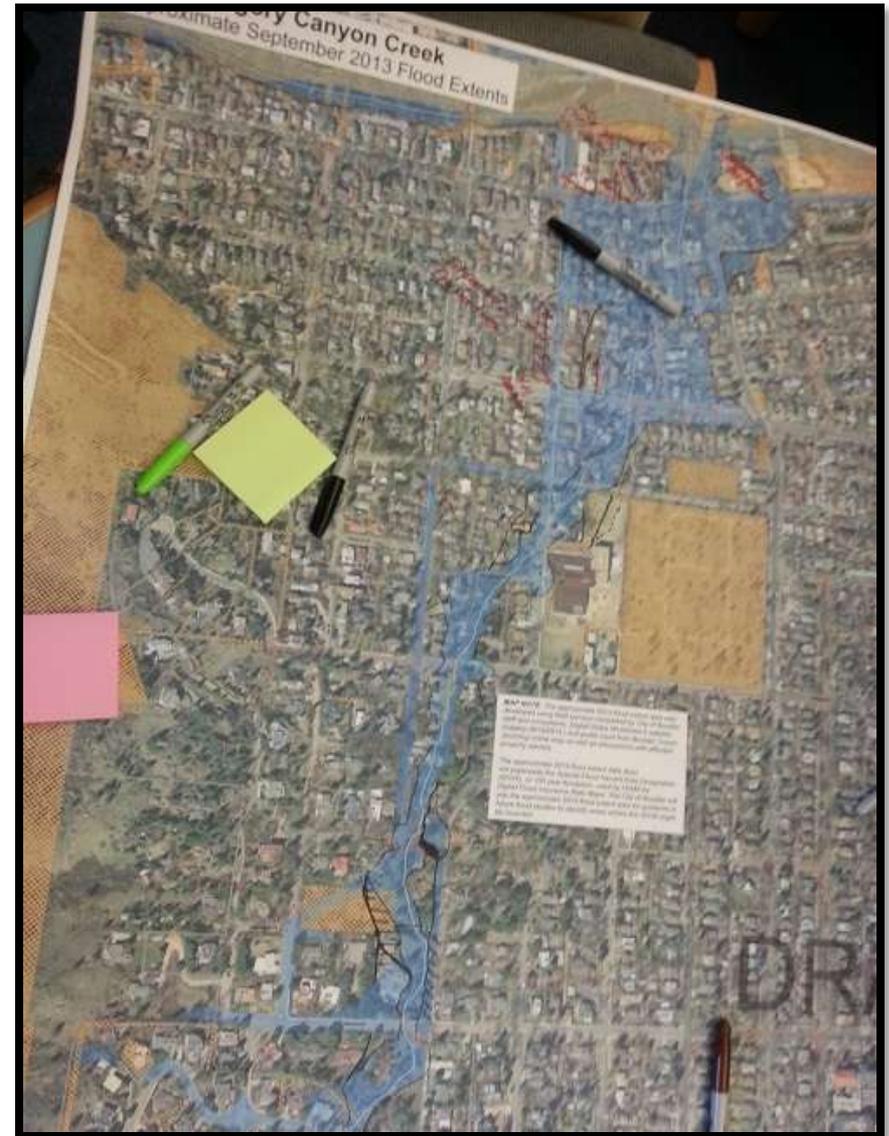
Advise a Plan for Gregory Flood Mitigation

1. **Maintain and Repair**

Schedule maintenance and repair or replacement of existing water conveyance structures that have failed or are known to fail. This should be done before this Spring's runoff, to avoid a secondary flood along Gregory. Engage property owners.

2. **Engineer bottom-up Flood Improvement**

Allocate engineering resources to establish a plan of improvement for Gregory Creek. Develop a scope of work and options. Identify internal and external funding sources. Begin the public process of participation.



Funding Options. What Should We Do and How Can it Be Paid For?

Ed von Bleichert

Potential Sources of Federal Funding

**National Flood
Mitigation Fund**



**Public Assistance
Mitigation Fund**



**General Investigations
and Continuing
Authorities Programs**



Potential Sources of State Funding

Tabor Reserves

**Severance Tax
Multi-Objective
Watershed Protection
Program**



**Colorado
Flood and Draught
Response Fund**



**Colorado Watershed
Restoration Program**

City of Boulder Utilities Funding Sources

- Service Charge Fees
- Plant Investment Fees
- Intergovernmental Reimbursements (Primarily UDFCD)
- Interest on Investments
- WASH

Does property acquisition come from any of these five sources?

Potential for short term one time increases to existing sources?

-Accelerate property and/or easement acquisition

Next Steps

Schedule informational meetings between city staff and community representatives.

Work with community to demonstrate to Planning Board and City Council the need to prioritize planning and funding of Gregory Creek improvements.

Time frame for next Comprehensive Flood and Stormwater Master Plan Update?

Commence needed planning immediately to determine scope, scale, and resources.

What is the soonest that significant funds will be available as part of the CIP and/or other flood mitigation planning?

Revise flood maps to show actual flooding.