Water Availability Task Force
November 21, 2013
2013 Flood

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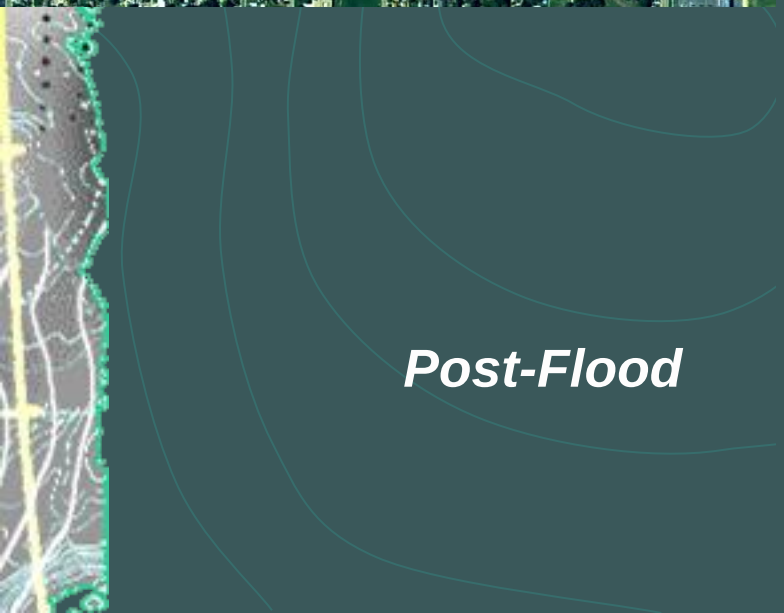
Chief, Watershed and Flood Protection Section
Colorado Water Conservation Board

Pre and Post Aerial Images

Big Thompson & Little Thompson at Milliken

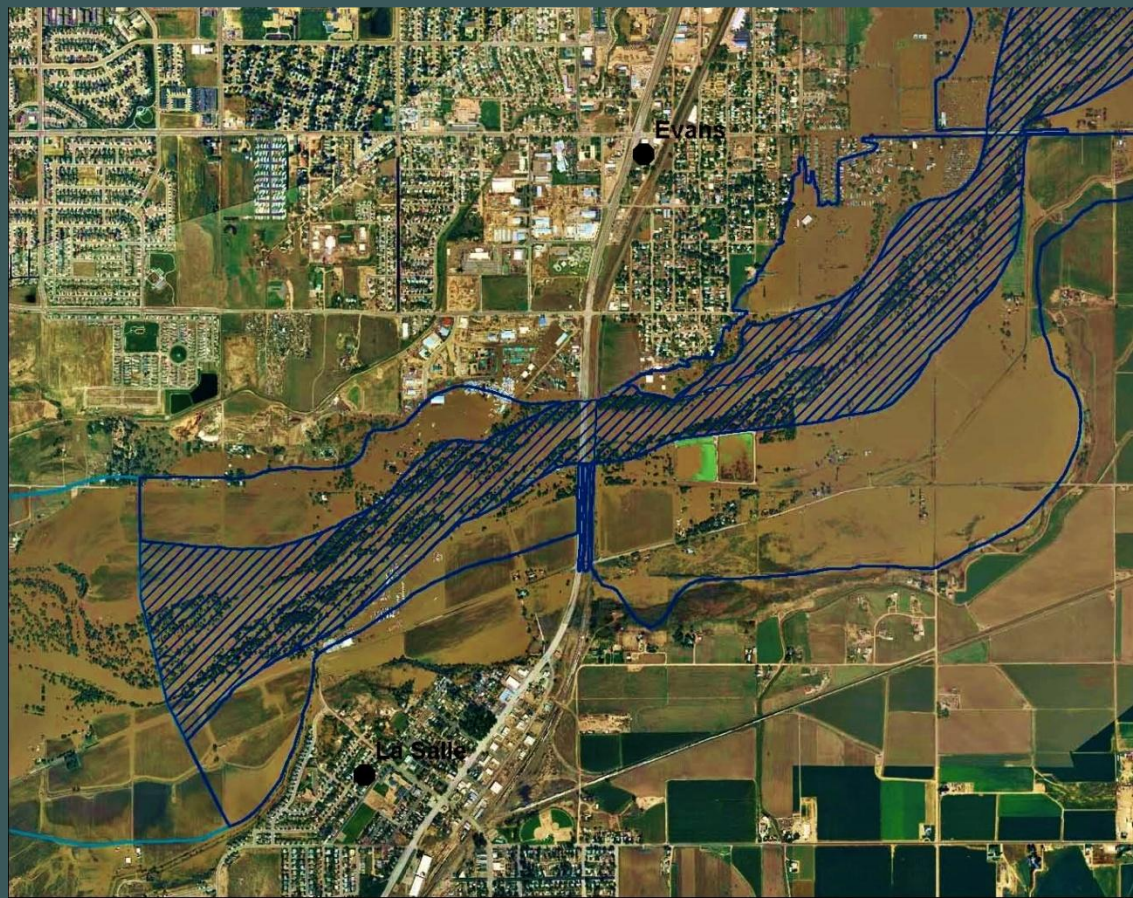
Pre-Flood



Post-Flood

South Platte near Evans and La Salle

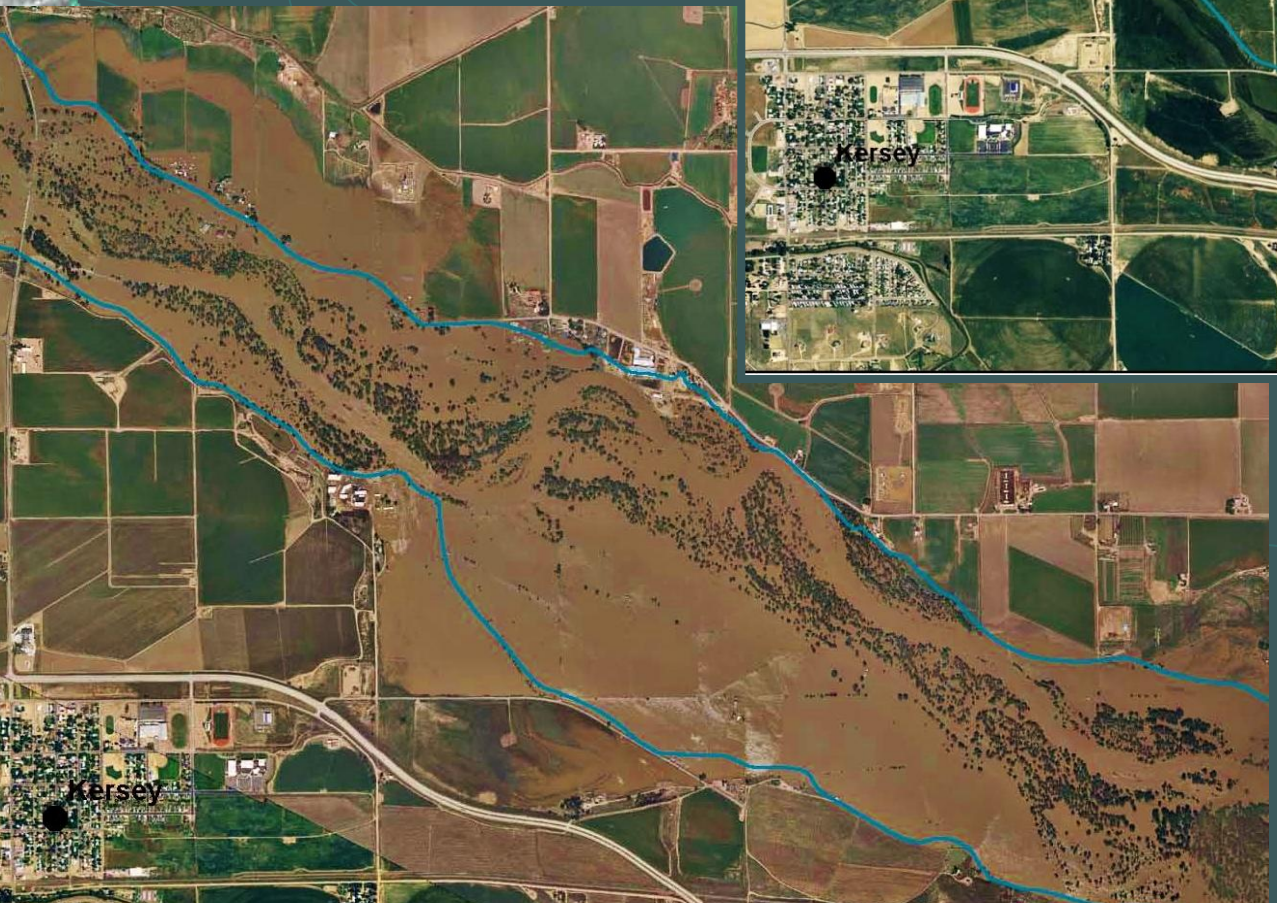
Pre-Flood



Post-Flood

South Platte River at Kersey

Pre-Flood



Post-Flood

South Platte River
Sterling

Pre-Flood

Post-Flood

Road and Bridge Damages

Highway 7 Washout Above Lyons

Damages to Critical Facilities

- Water and wastewater treatment plants
- Utility lines
- Oil and gas facilities
- Schools
- Government buildings

Damages to Critical Facilities

Crest View Elementary, Boulder

Damages to Critical Facilities

Damaged Oil Facility Near Milliken

NOAA Rainfall Atlas

- Has been the standard for design rainfall determination since 1973
- Updated in 2013 by National Oceanic and Atmospheric Administration with assistance by Colorado Water Conservation Board and Colorado Climate Center
- http://hdsc.nws.noaa.gov/hdsc/pfds/

Design Rainfall Totals - Denver

- 1-Day, 100-Year 4.78”
- 1-Day, 500-Year 6.25”
- 1-Day, 1000-Year 6.92”
- 7-day, 100-Year 6.36”
- 7-day, 500-Year 8.00”
- 7-day, 1000-Year 8.74”
- Note: Average Annual Precipitation 14.30”

Rainfall Totals – Sept 9-16

- Boulder 3.3 SE 18.13”
- Aurora 4.0 N 15.68”
- **Justice Center 15.32”**
- Pinewood Springs 13.83”
- Gold Hill 12.6”
- Bellvue 6.2 W 12.44”
- Denver International Airport 4.65”

Rainfall Frequencies – Justice Center

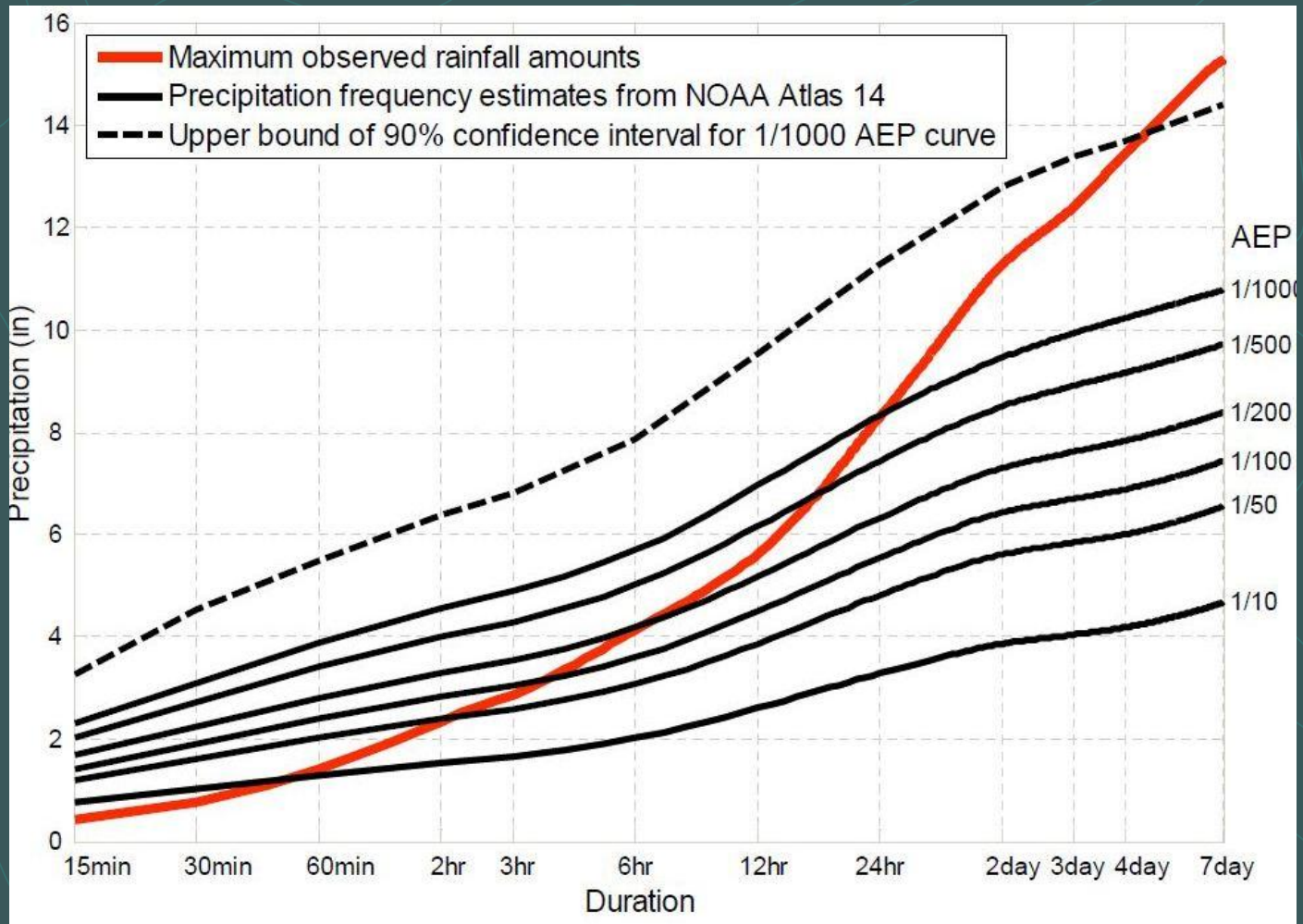


Figure 1. Maximum observed rainfall amounts in relationship to corresponding precipitation frequency estimates for the Justice Center gauge.

Rainfall Frequencies – 7 Day

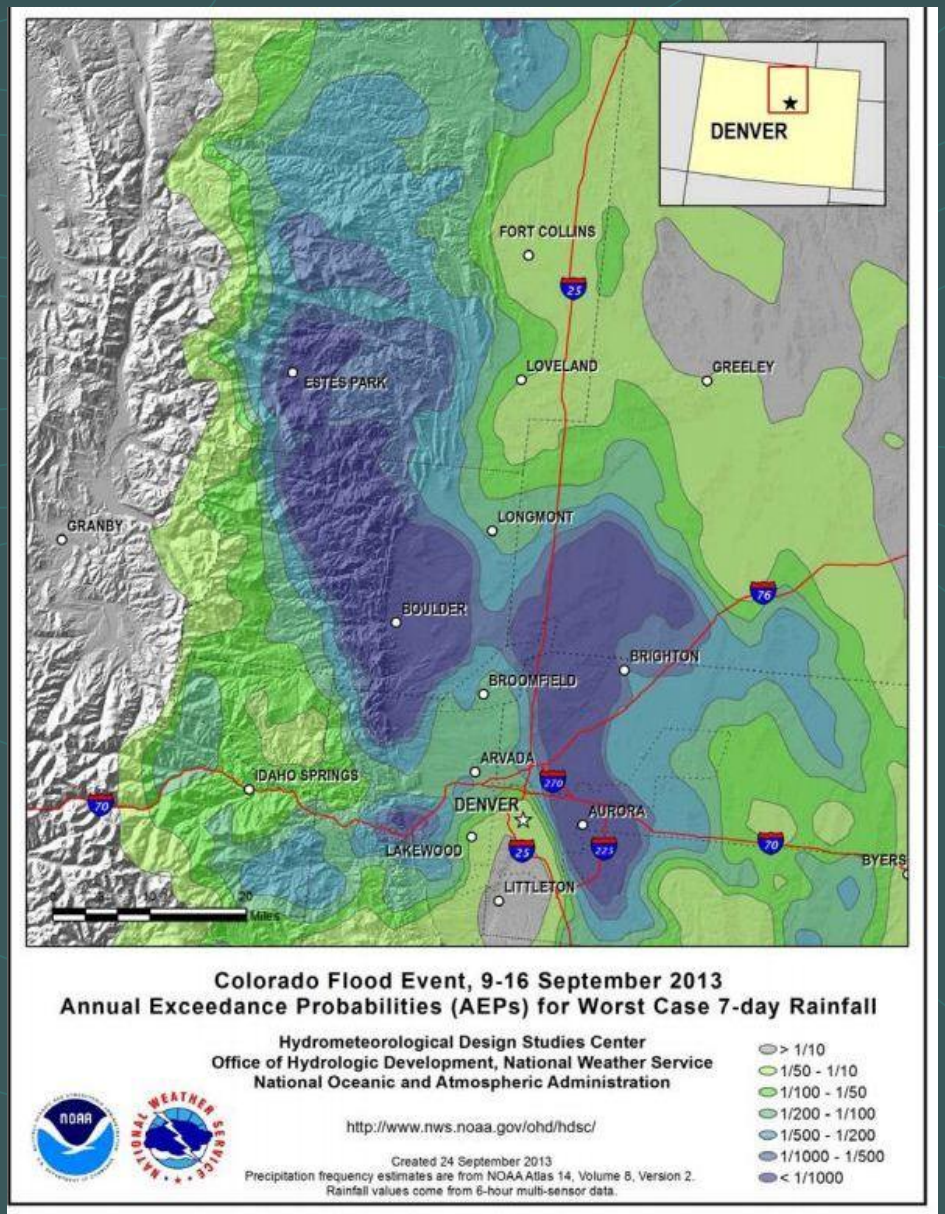


Figure 4. Annual exceedance probabilities for the worst case 7-day rainfall.

Conclusion

- Rainfall was well in excess of 1,000-Year frequency in some locations for various durations

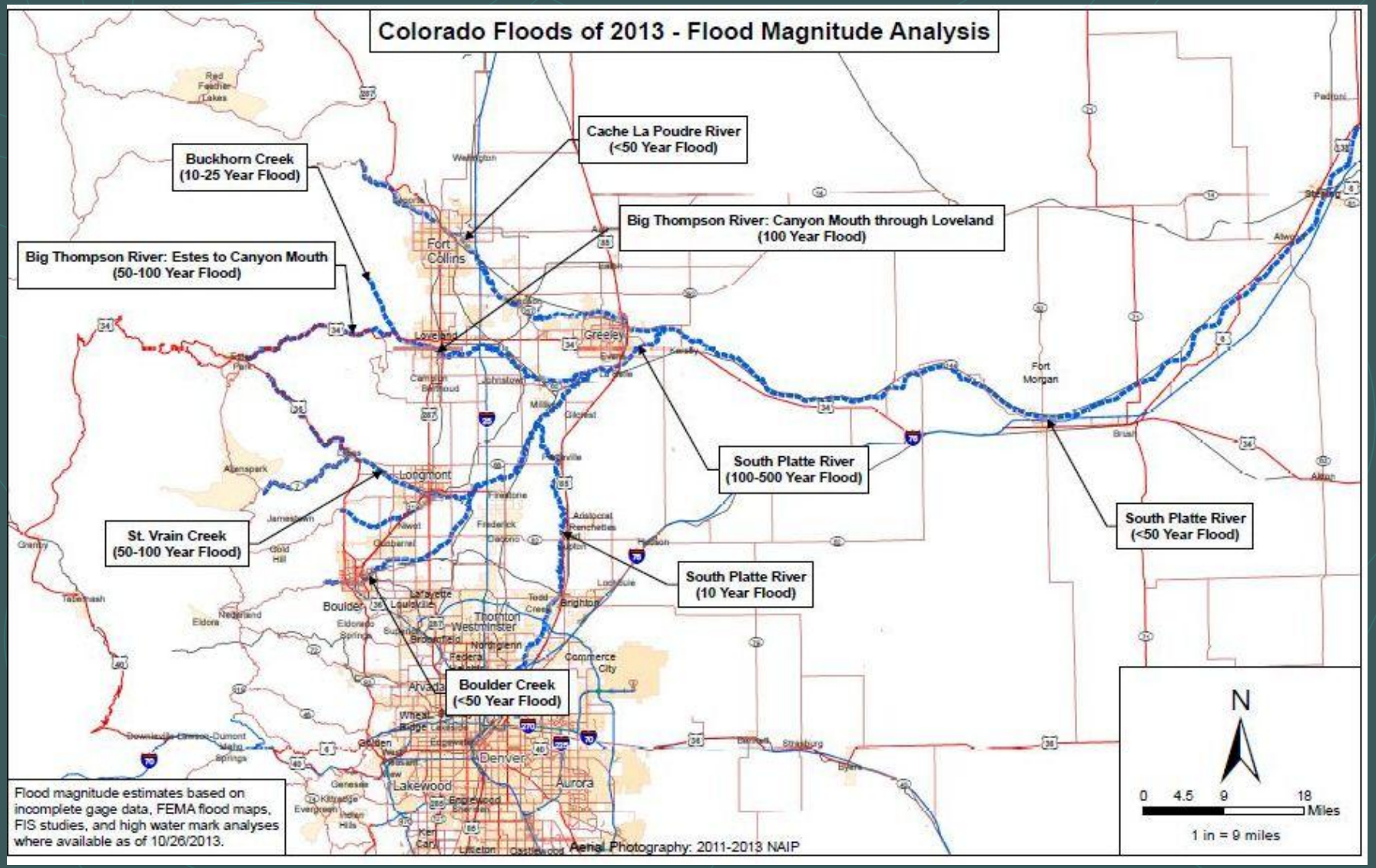
What About Streamflows?

- Estimating streamflow frequencies is much more complicated
  - Destroyed streamgauge measuring devices makes direct flow measurements difficult or impossible
  - Relocated river channels renders rating curves useless

Streamflow Estimates

- Boulder Creek in Boulder
  - 25-Year Event
- Cache La Poudre River in Fort Collins
  - 50-Year Event
- Big Thompson River in Loveland
  - 100-Year Event
- Locals are estimating St. Vrain at Lyons to be greater than 500-Year

CDOT Flow Estimates



Why the Difference?

- Rainfall was long and sustained, but not particularly intense for short periods
- Design rainfall assumes heavy rain over entire watershed
- Some flows may be detained by non-regulatory detention or storage

Home in Evans

Why So Much Damage?

- Infrastructure from before floodplain regulations
- Sustained high water resulted in significant channel erosion and relocation
- Significant development just outside the regulatory floodplain

Based on community audits, the affected communities had effective floodplain management programs.

"The erosion of Sand Creek adjacent to the Hite Facility is stunning"
-Barbara Biggs

Quick Summary of Damages

- 9 fatalities (most in CO flood since 1976)
- 20 counties impacted
- 16,000 damaged homes
- 1,800 destroyed homes
- 750 damaged businesses
- 200 destroyed businesses
- 200 miles of state highways damaged

Water Infrastructure Damage

- 207 dams impacted
- 9 low hazard dams lost
- $350K streamgauge replacement cost
- Over 160 diversion structures damaged/destroyed

*Courtesy of Division of Water Resources

Stream Geomorphology

- This was a historic storm, not just in relation to Colorado, but nationwide
- Realigned channels create both short-term and long-term conundrums
  - Technical
  - Regulatory
  - Financial


Stream was 100 yards to the
left prior to flood

Lingering Questions…

- What to do with the River?
- What elevations to build to?
- What to do with floodplain maps?

Answer: Short-term (maybe temporary) solutions combined with long-term master planning and recovery mapping.

Temporary Solutions

Temporary Solutions

Who is responsible for moving the stream back to it's old alignment (or not?)

Multi Agency Task Force

- Advisory in nature
- Can advise on the following:
  - Assembling local stream coalitions
  - Permitting
  - Technical Assistance
  - Funding
  - Project Design, Prioritization, Implementation

Multi Agency Task Force

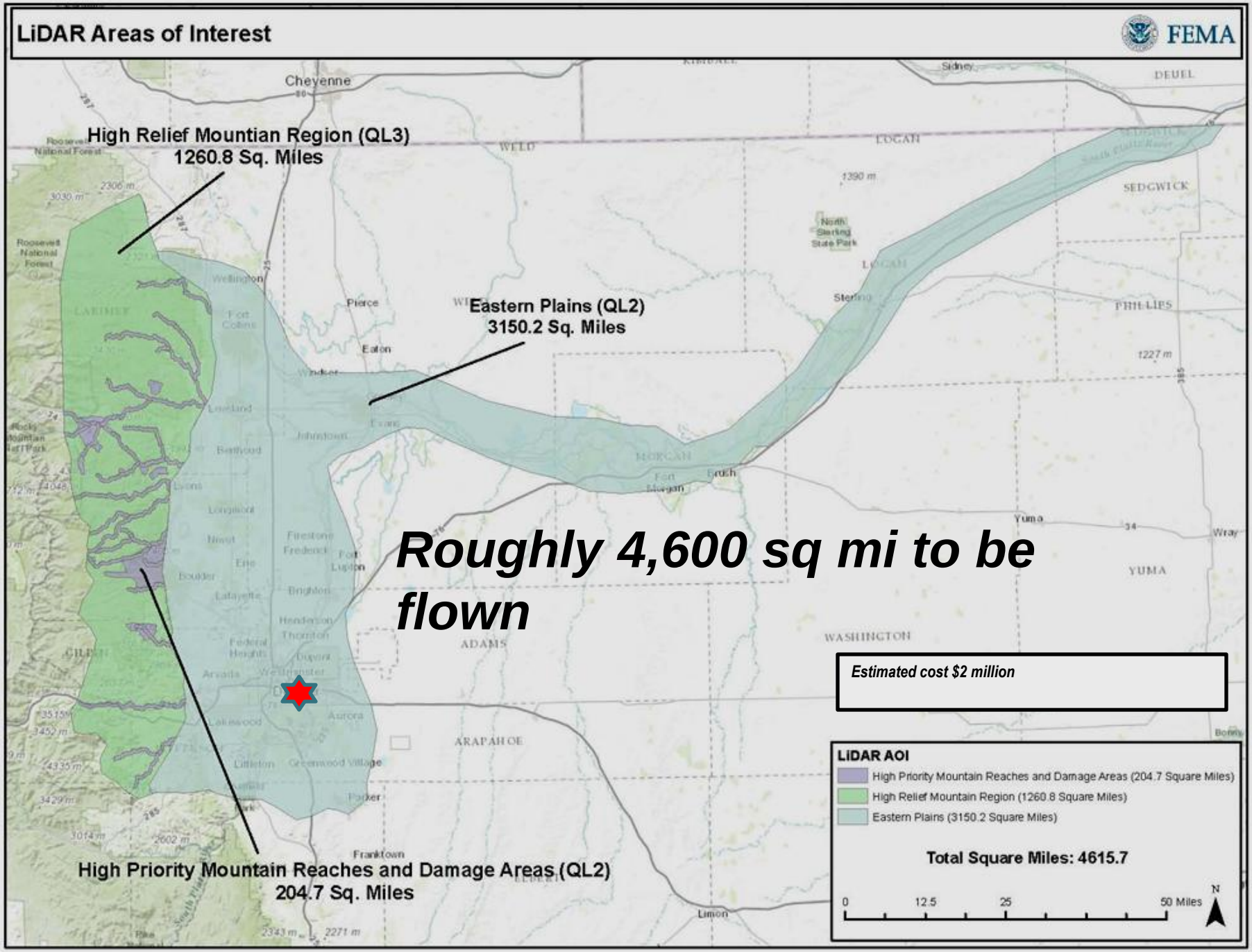
- Cannot do the following:
  - Reconfigure the stream channel
  - Pay to reconfigure the stream channel
  - Bypass federal, state, or local permitting requirements
  - Approve conversion of temporary fixes to permanent fixes

Stream Recovery Activities

- Decision should be made at the local level, or even better, at the watershed level
- Private property rights and responsibilities remain intact following the flood
- All federal, state, and local permits and permissions must still be obtained
- Temporary fixes may be appropriate…but they are just that – temporary

Master Planning Assistance

- CWCB to release funding through the Watershed Restoration Program
- Approved by the CWCB Board on 10/21
- First round of applications to be due 11/15
- Official announcement to be released next week
  - www.cwcb.state.co.us


LiDAR Areas of Interest
FEMA
High Relief Mountian Region (QL3)
1260.8 Sq. Miles
Eastern Plains (QL2)
3150.2 Sq. Miles
High Priority Mountain Reaches and Damage Areas (QL2)
204.7 Sq. Miles
Roughly 4,600 sq mi to be flown
Estimated cost $2 million
LIDAR AOI
High Priority Mountain Reaches and Damage Areas (204.7 Square Miles)
High Relief Mountain Region (1260.8 Square Miles)
Eastern Plains (3150.2 Square Miles)
Total Square Miles: 4615.7
0
12.5
25
50 Miles
N
Cheyenne
Sidney
DEUEL
LOGAN
WELD
SEDGWICK
PHILLIPS
Sterling
Fort Collins
Loveland
Greeley
Longmont
Boulder
Brighton
Aurora
Littleton
Parker
Franktown
Limon
Fort Morgan
Yuma
Wray
YUMA
ADAMS
ARAPAHOE
WASHINGTON
MORGAN

Examples of Colorado Flood Events

- 10's – Cherry Creek in Denver ($161 million, 2 deaths)
- 20's – Arkansas River at Pueblo ($1.02 billion, 78 deaths)
- 30's – Monument Creek ($69 million, 18 deaths)
- 50's – Purgatoire River at Trinidad ($48 million, 2 deaths)
- 60's – South Platte River in Denver ($2.95 billion, 8 deaths)
- 70's – Big Thompson Canyon ($114 million, 144 deaths)
- 80's – Heavy Snowmelt Runoff 1984 ($63 million, 2 deaths)
- 90's – Fort Collins, Sterling, Lower Arkansas River ($518 million, 6 deaths)
- **00's – No major disasters, but damages occurred**

All values are in 2010 dollars

Since 1900, the AVERAGE annual flood losses in Colorado is over $57 million. Nearly 400 lives have been lost.

A Visual Tour of Flood Damages

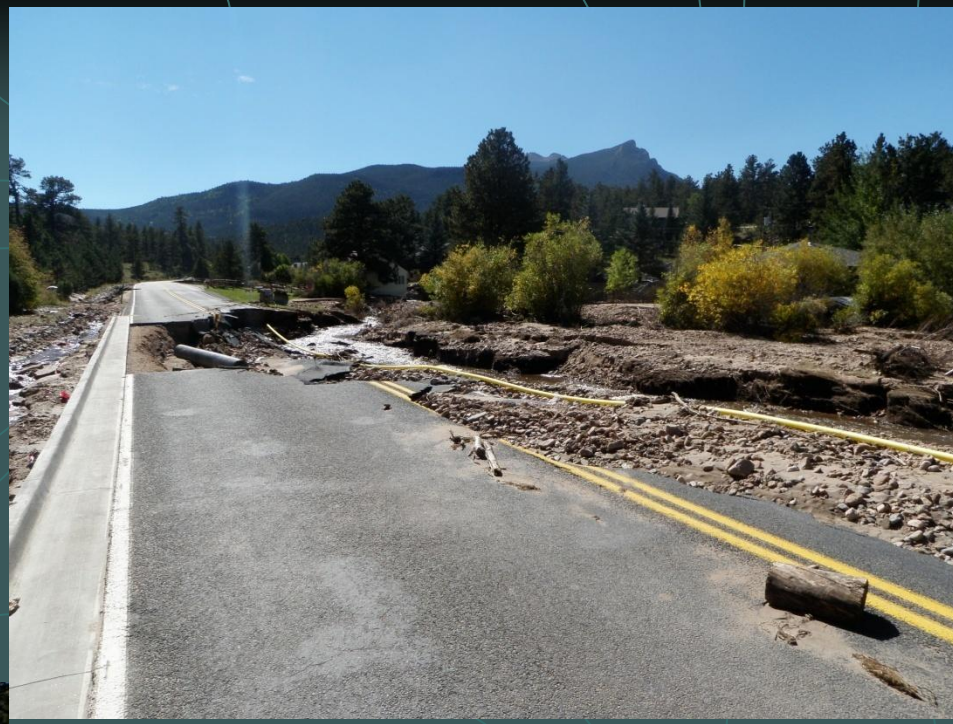
Glen Haven
Larimer County

Photos by
Kevin Houck

*Typical James Creek flows **just** prior*

During the rains and floods

Fish Creek
Estes Park



Photos by
Kevin Houck

Fall River
Estes Park

Photos by
Kevin Houck

Mouth of the Big Thompson Canyon

Photos by Kevin Houck

Loveland Parks

Photos by Kevin Houck

Little Thompson River

Photos by Kevin Houck

Fun City in Estes Park
Photo from Twitter by @TWCBreaking

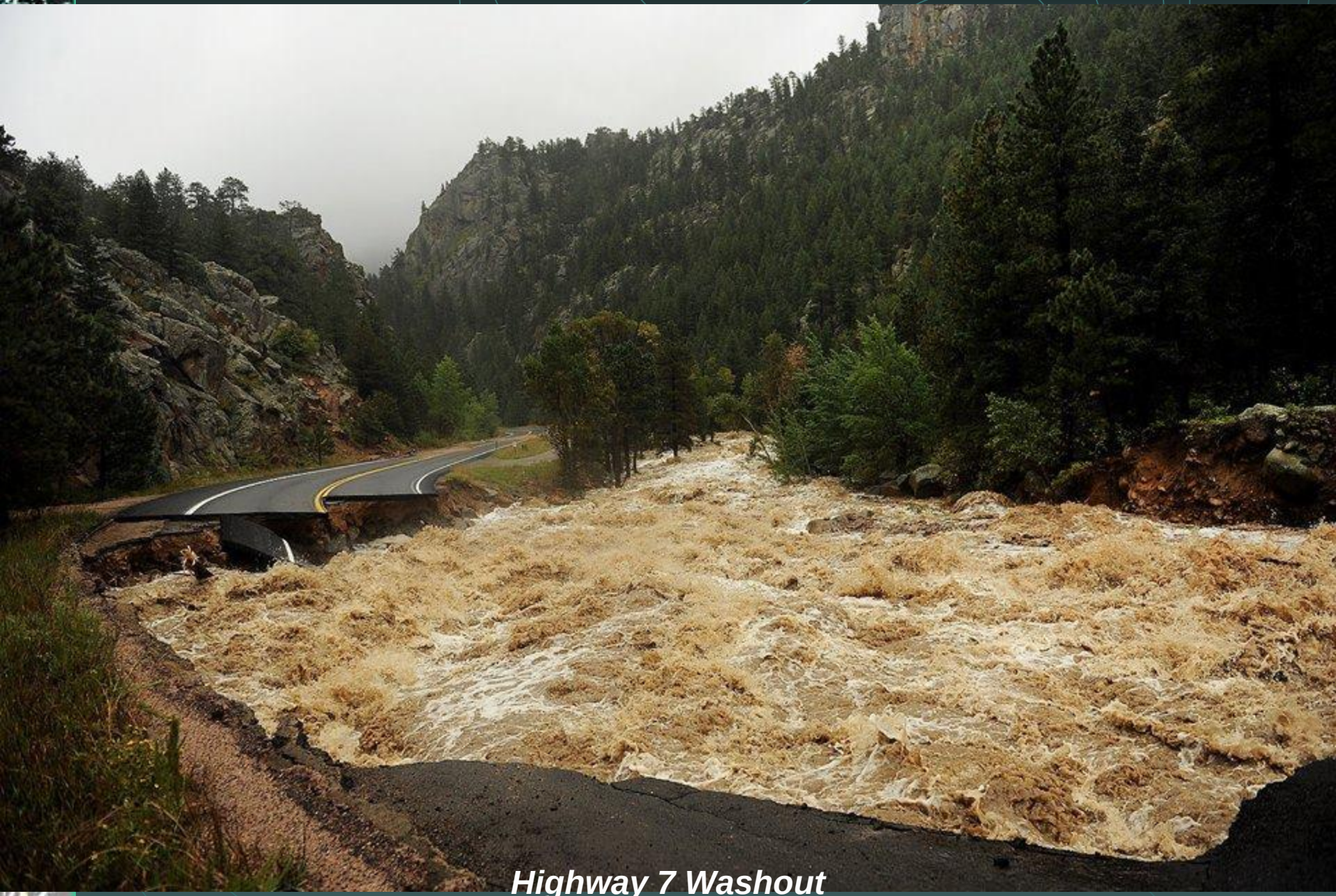
Highway 34, East of Greeley
Photo by Tom Browning

I-25 Big Thompson Flooding
Photo from Twitter by @joelhillan

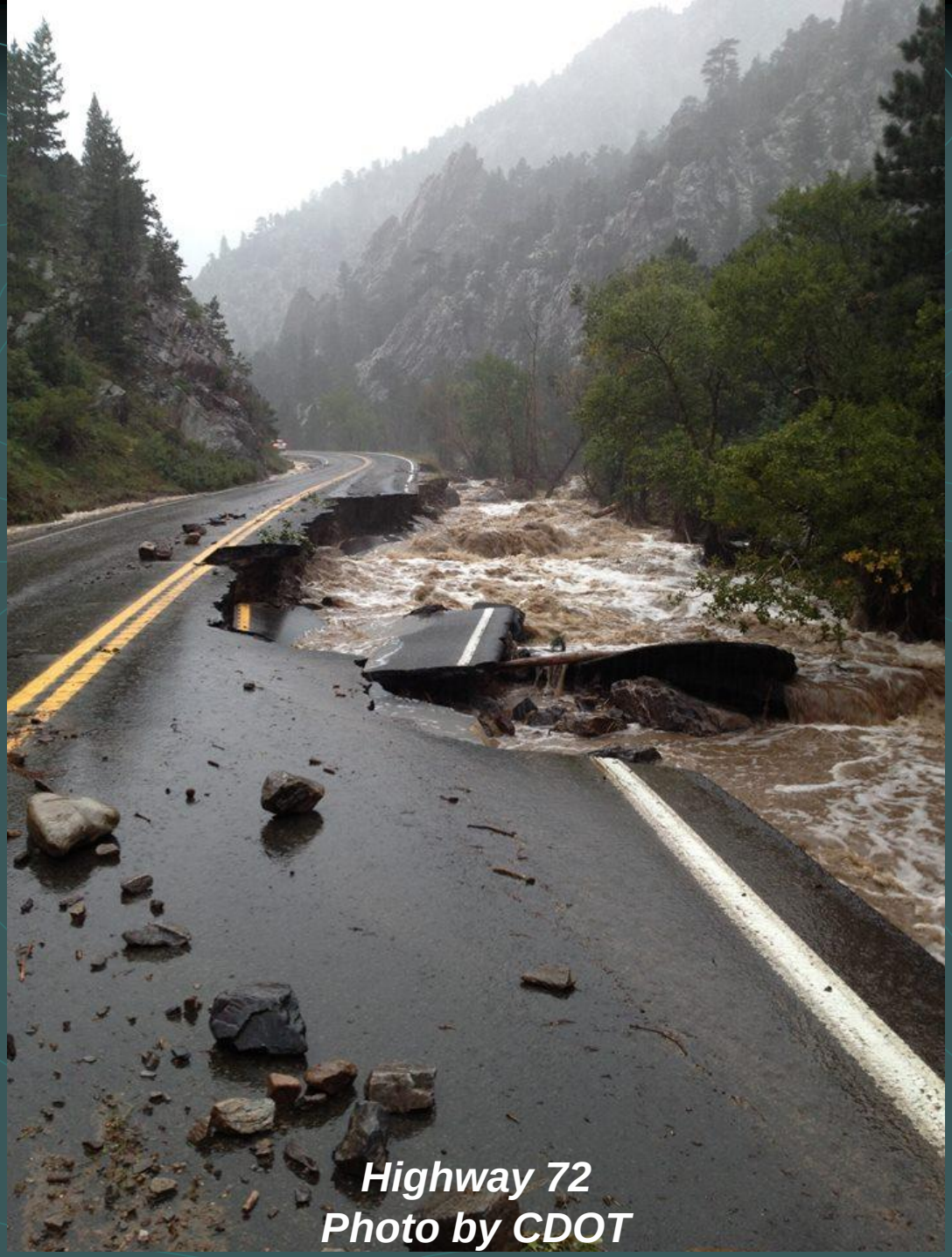
South Platte Hwy 37 in Weld County
Photo by Tom Browning

South Platte Hwy 37 Washout
Photo by, Tom Browning

Lyons
Photo from Twitter by @NewsBreaker



Highway 7 Washout
Photo by Estes Park News



Highway 72
Photo by CDOT

House in Lyons
Photo by Ed Hueser

287 and Dillon
Photo from Twitter by @KellyCBS4

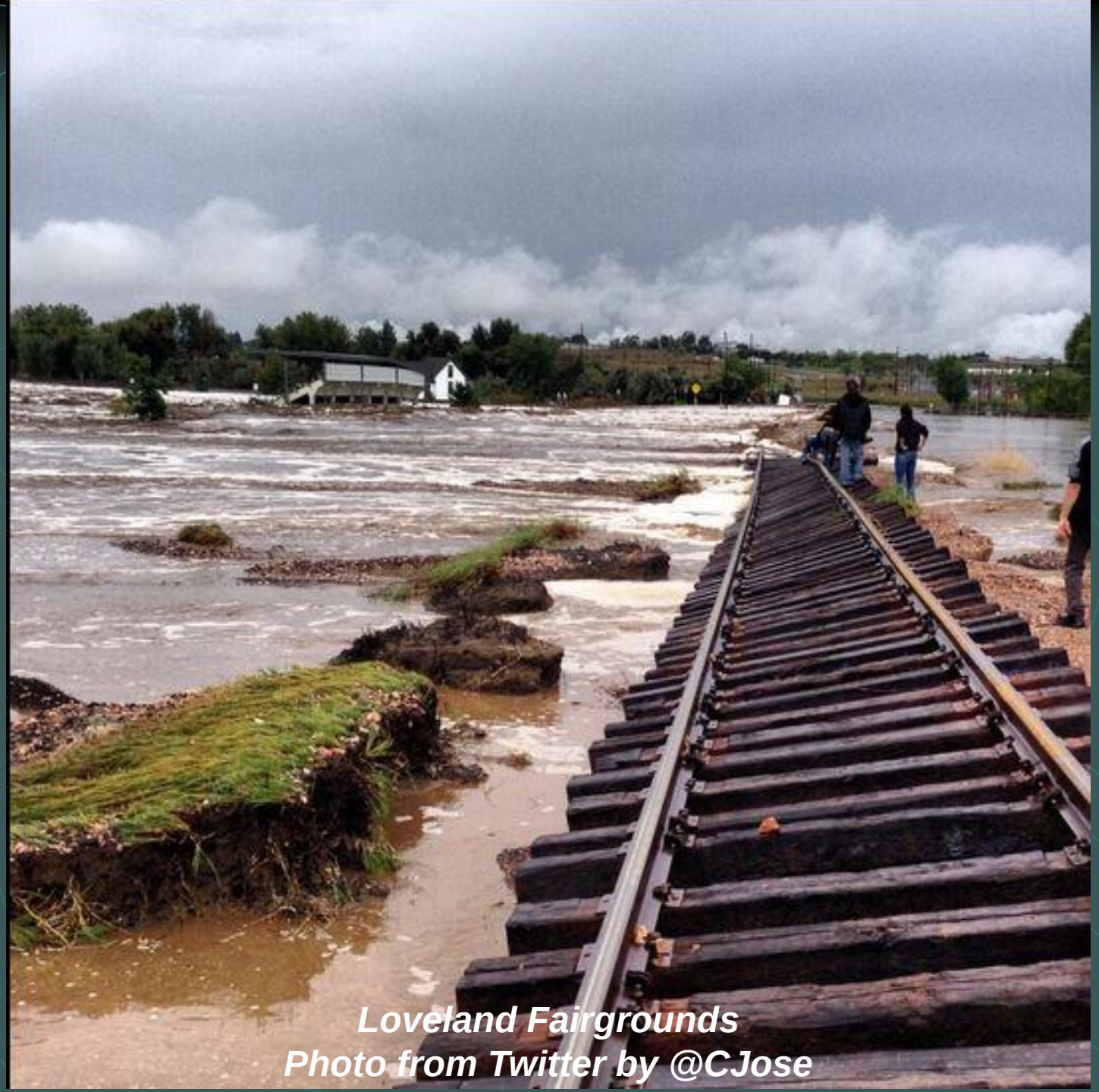
City of Boulder Waste Water Treatment Plant
Photo from Twitter by @pattycox

Flooded Fields Near Longmont
Photo from Twitter by @JeremyHubbard

1st Ave in Longmont
Photo from Twitter by @TWCBreaking

Middle Boulder Creek Near Downtown
Photo from Twitter by @Sean_Breslin

Highway Washouts in Estes Park
Photo from Twitter by @KDVR



Loveland Fairgrounds
Photo from Twitter by @CJose

Lyons Flooding
Photo by, Blanca Blanco

Former Gauge Location in Big Thompson Canyon

Residential Damage in Evans
Photo by Tom Browning

Hwy 85 Near Evans
Photo by Tom Browning


Destroyed House in Weld Co
Photo by Tom Browning

Lefthand Canyon, Photo by Tom Browning

Colorado Flooding
September, 2013

Lyons Photos
All By Tom Browning


St Vrain
Grocery
Market

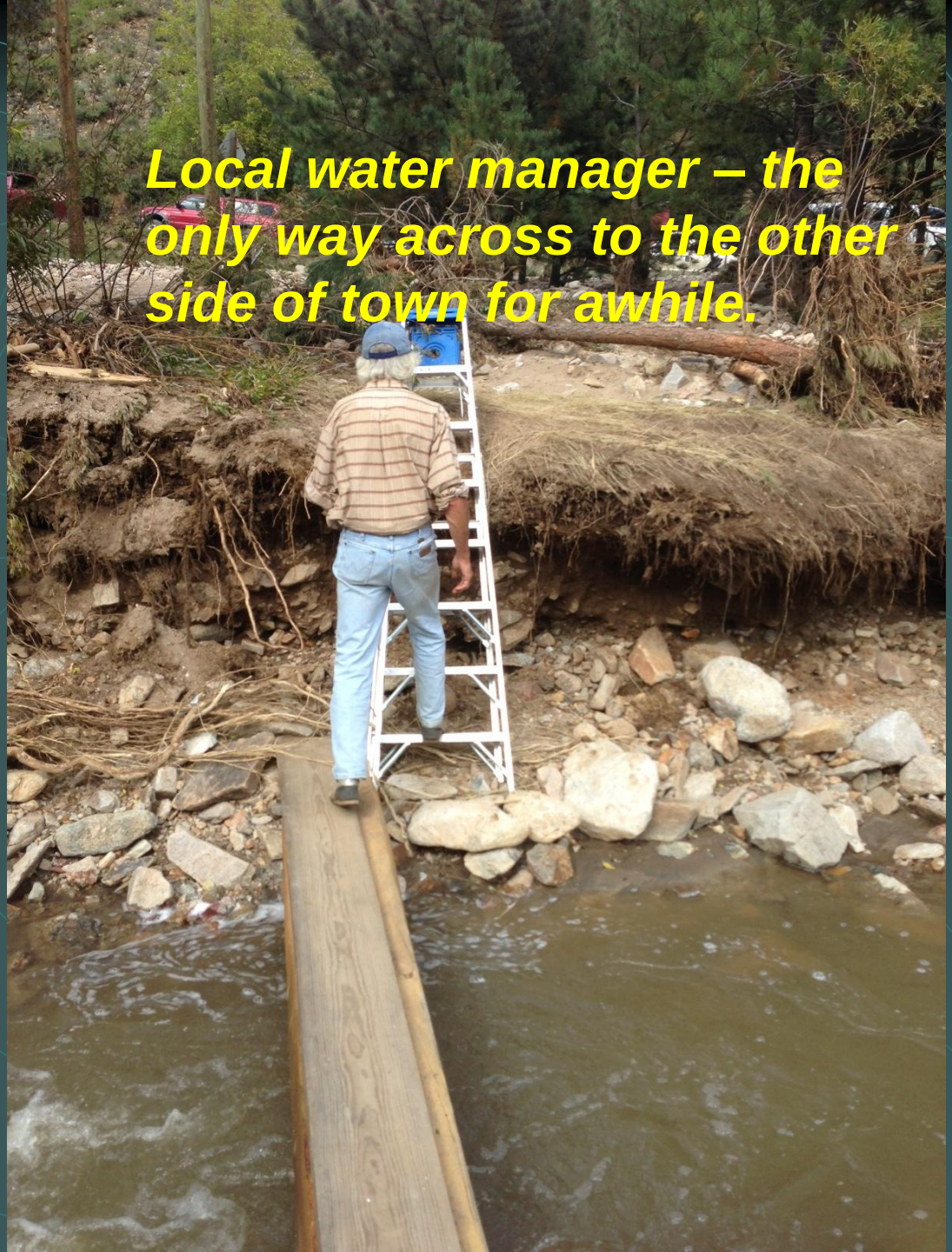
OUTBACK
COLORADO


325

Colorado Flooding
September, 2013

Jamestown Photos
All By Tom Browning


Just upstream of water intake and treatment plant


Local water manager – the only way across to the other side of town for awhile.


Former house in this location


29


Stream was 100 yards to the
left prior to flood


House pushed off foundation and moved significant distance downstream


FRAGILE
LEGACY
2.5GT
472·OJN
COLORADO


What's left of a home…


WE Love
You
Joey


Back side of house from previous photo.
Occupant was killed by wall of water, rock and mud

Their former home site – nothing left
- Courtesy of Dave Rosenberg

THANK YOU!

For more information, contact:

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