

# Preventing Flood Disasters from Becoming Disastrous

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Photo: Varrella, 2013

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# Preventing Flood Disasters from Becoming Disastrous

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Stock Photo ☺



# Preventing Flood Disasters from Becoming Disastrous

## Today's Agenda

1. Disasters Before the 2013 Flood
2. Sept. 2013 Colorado Disaster Overview
3. The Role of Human Complacency
4. Lessons Learned from Colorado Flooding
5. Better Practices in Disaster Mitigation
6. Future Disaster Reduction Strategies

# NE Colorado Disaster Overview

Disasters **Before**  
The 2013 Flood

*Colorado Wildfires  
Modified Watersheds*



Photo: RJ Sangosti, published  
in the Denver Post, 2012.



# Disasters Before the 2013 Flood

## Post-Wildfire Fallout:

- Every wildfire is followed by...
  - Flash flooding
  - Burn debris slides
  - Soil erosion & deposition
  - Water quality degradation
- Resulting in...
  - Injuries & fatalities
  - Environmental damage
  - Transportation disruption
  - Drinking water supply degradation



Photo:  
Varrella 2013



Photo: Lucas  
Mouffet, 2013

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# Disasters Before the 2013 Flood

## Post-Fire Debris Flows:



Photo: Varrella, 2013



Photo: Varrella, 2013



# Disasters Before the 2013 Flood

## Post-Fire Debris Flows:

Photo: Mouttet, 2013



# Disasters Before the 2013 Flood

## Post-Fire Soil Erosion & Deposition:



Photos: Varrella, 2013

# Disasters Before the 2013 Flood

## Water Quality Degradation:



Photo: Lucas Mouttet, 2013



Video: Lucas Mouttet and Jill Oropeza, 2013

# Preventing Flood Disasters from Becoming Disastrous

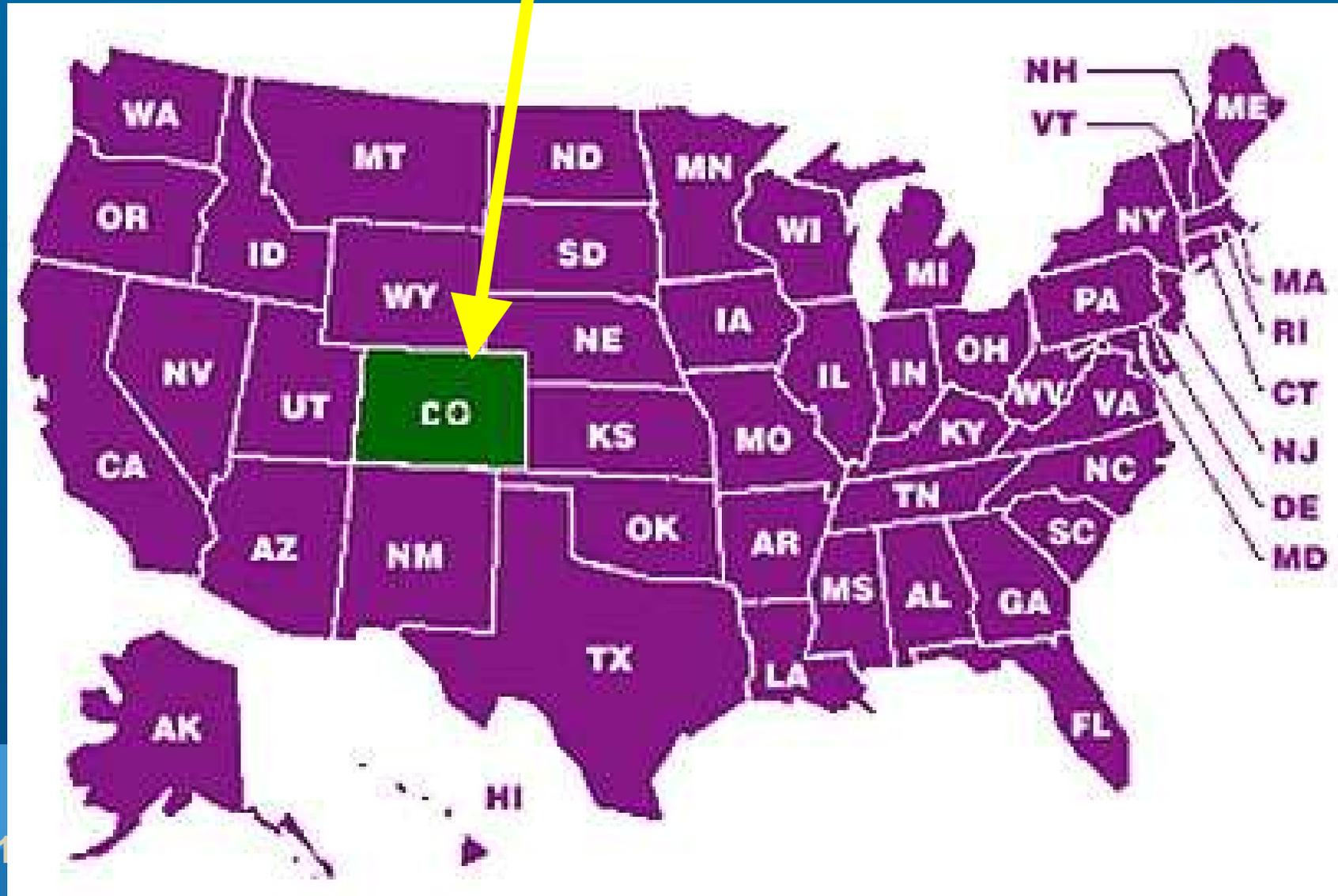
Photo: Doug Swartz, 2013

Sept. 2013 Colorado  
Disaster Overview

*Sept. 9-16, 2013*



# Sept. 2013 Colorado Disaster Overview

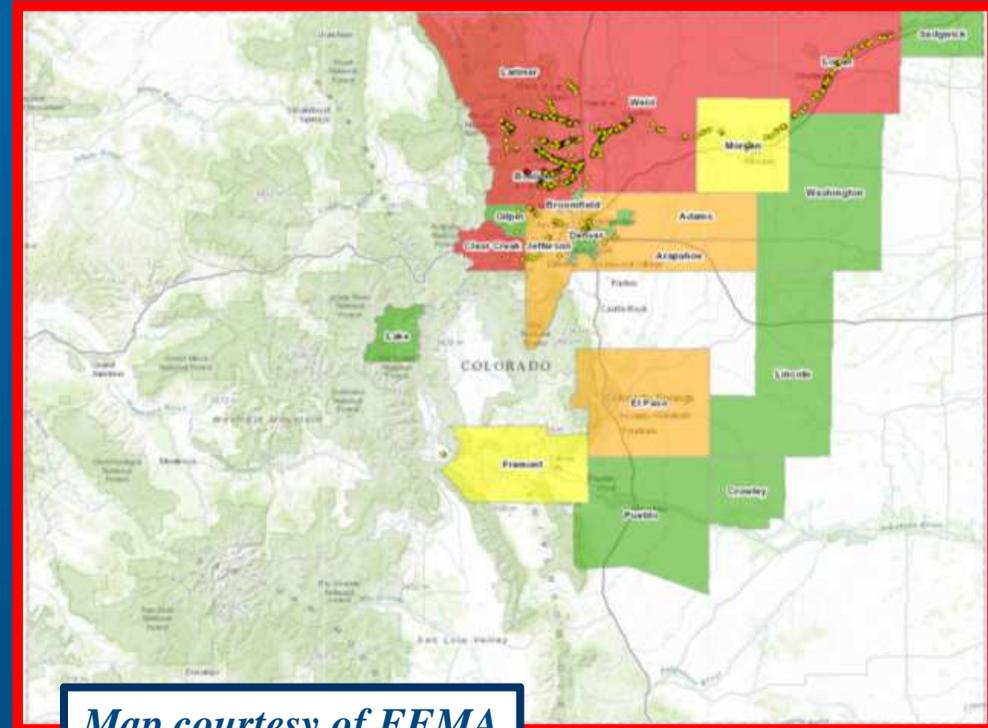


# Sept. 2013 Colorado Disaster Overview

## The 2013 Flood Was...

### A *Widespread* *Disaster*

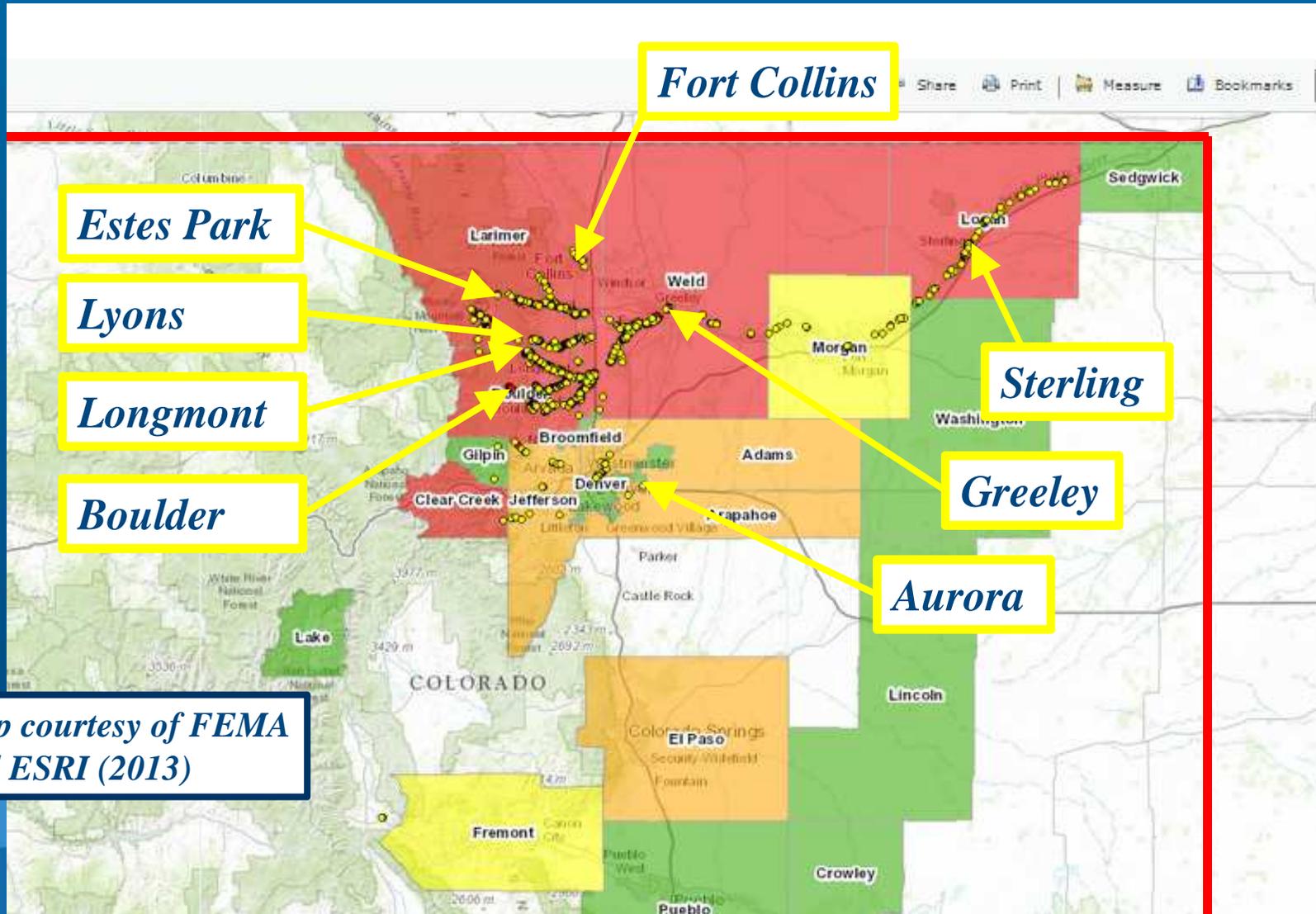
- 1,500 sq. miles affected
- 20+ Counties affected
  - COEM, Dec. 2013



Map courtesy of FEMA  
and ESRI (2013)

# Sept. 2013 Colorado Disaster Overview

## Affected Communities:



Map courtesy of FEMA and ESRI (2013)

# Sept. 2013 Colorado Disaster Overview

## The 2013 Flood Was...

### An *Epic* Disaster

- 5-7 days of rainfall
- Record-setting rainfall totals
- Headlines across the U.S.



Photo: Varrella, 2013



# Sept. 2013 Colorado Disaster Overview

## EPIC DISASTER – Typical Annual Precip.::

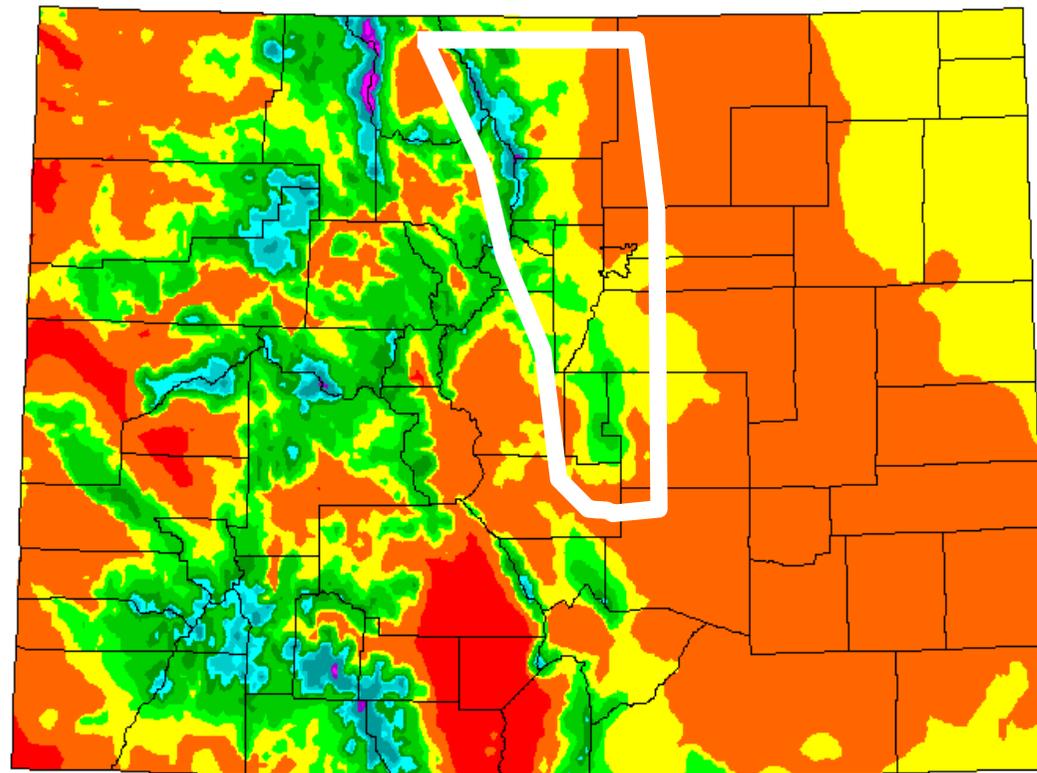
*Image courtesy of Boulder Area Sustainability Network (2013)*  
<http://bcn.boulder.co.us/basin/learning/colorado.html>

Average Annual Precipitation  
Colorado



Period: 1961-1990

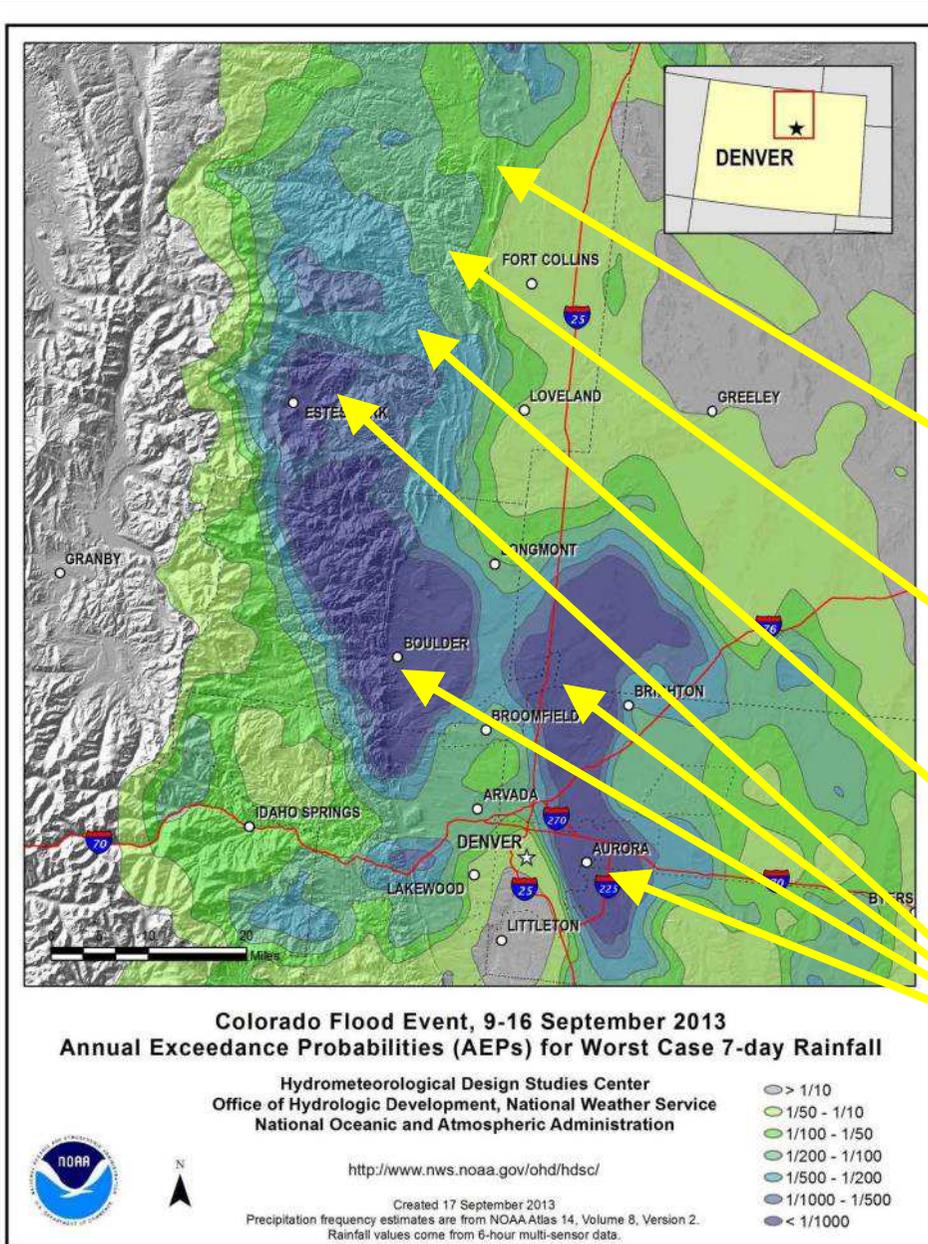
This map is a plot of 1961-1990 annual average precipitation contours from NOAA Cooperative stations and (where appropriate) USDA-NRCS SNOTEL stations. Christopher Daly used the PRISM model to generate the gridded estimates from which this map was derived; the modeled grid was approximately 4x4 km latitude/longitude, and was resampled to 2x2 km using a Gaussian filter. Mapping was performed by Jenny Weisburg. Funding was provided by USDA-NRCS National Water and Climate Center.



12/8/97

# Sept '13 Colorado Disaster Overview

## EPIC DISASTER – Flood Hydrology:



*2% to 1% Exceedance Probability Zone*

*1% to 0.5% Exceedance Probability Zone*

*0.5% to 0.2% Exceedance Probability Zone*

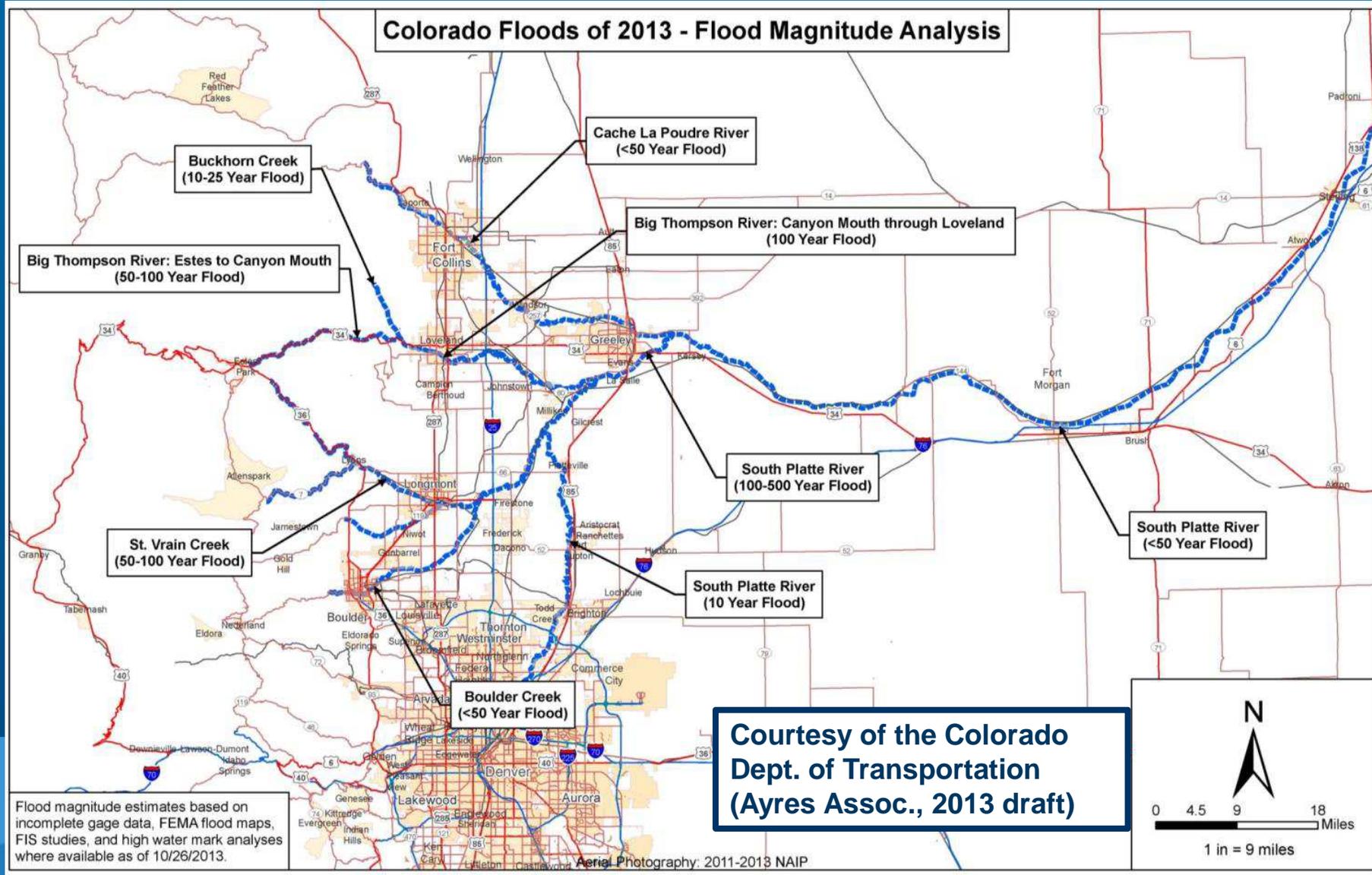
*What is this??*

*7-day Precip. Exceedance Probabilities, N. Colorado, Sept. 9-16, 2013, (NOAA 2013)*

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

# Sept. 2013 Colorado Disaster Overview

## EPIC DISASTER – Peak Flood Hydraulics:



# Sept. 2013 Colorado Disaster Overview

## The 2013 Flood Was...

Photo: Varrella, 2013

### A **Costly** Disaster

- **\$3.4 billion in total estimated damages**
- **18,000 homes damaged**
  - Caitlin Coleman, CFWE (2014)



# Sept. '13 Colorado Disaster Overview

## COSTLY DISASTER – Infrastructure:

2" gas line

Broken sanitary sewer

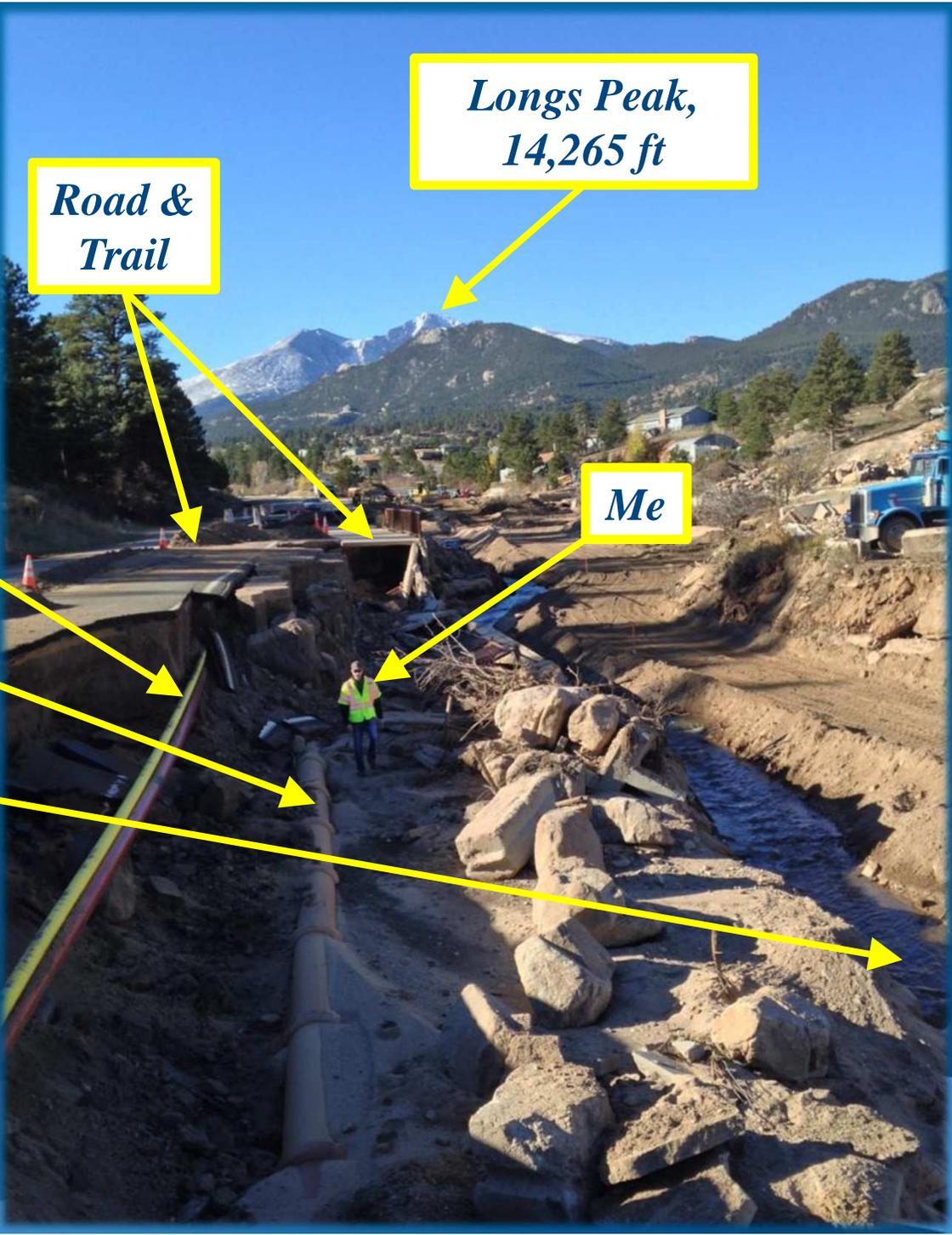
Fish Creek (open sewer)

Exposed utilities, open sewage, and roadway damage on Fish Creek in Estes Park (Varrella 2013)

Road & Trail

Longs Peak, 14,265 ft

Me



# Sept. 2013 Colorado Disaster Overview

## COSTLY DISASTER – Infrastructure:



*Flow fill on formerly-buried sanitary sewer*

Exposed sanitary sewer on Fish Creek near Estes Park (Varrella 2013)

# Sept. 2013 Colorado Disaster Overview

Photo: Varrella, 2014

The safety  
of the people  
shall be the  
highest law.

Cicero

## The 2013 Flood Was...

A **Human**  
*Disaster*

- ***10 confirmed fatalities***
- ***28,000 registrations for Individual Assistance***
- ***Biggest airlift since Hurricane Katrina***
  - COEM, Dec. 2013

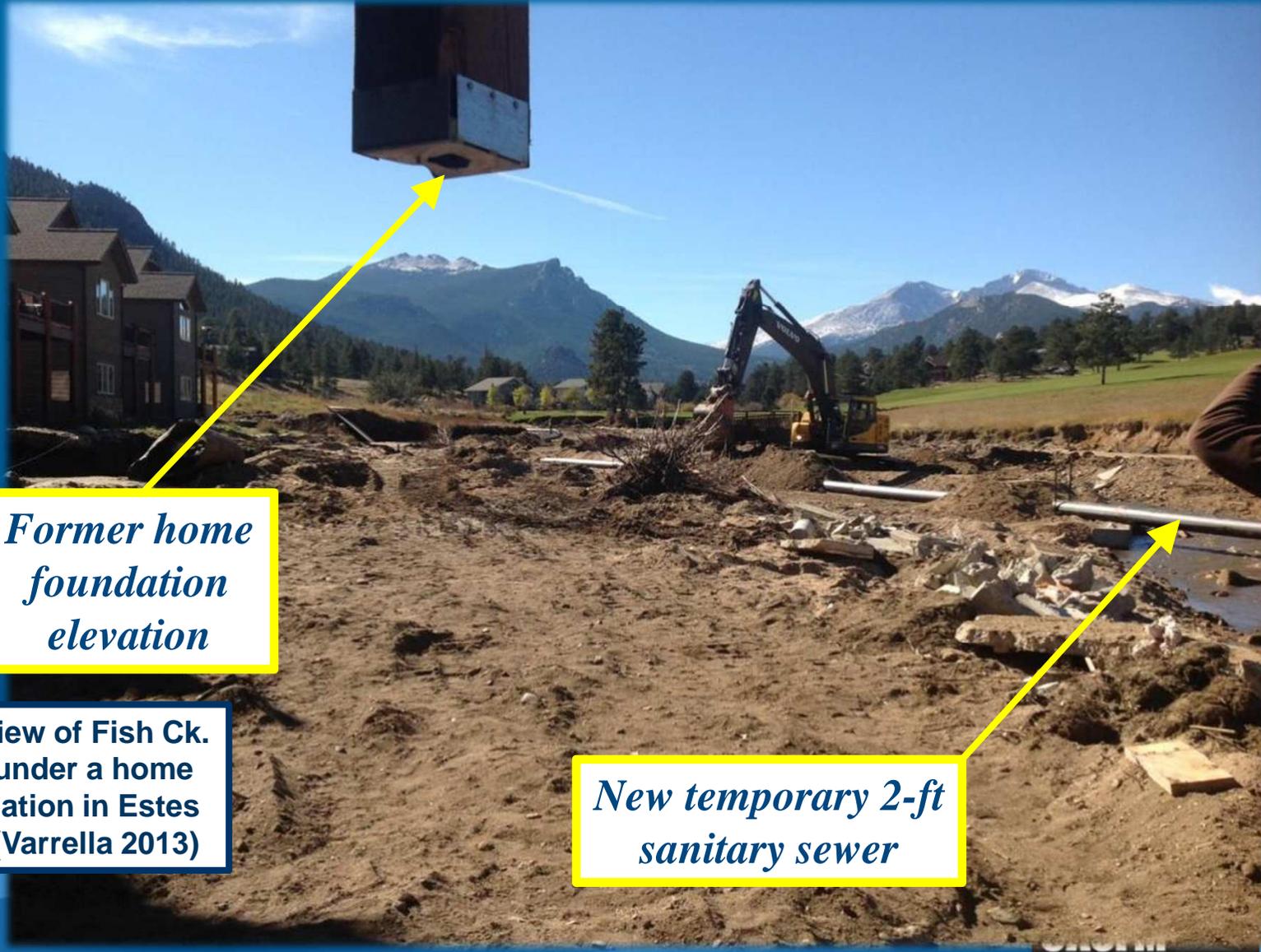
# Sept. 2013 Colorado Disaster Overview

## HUMAN DISASTER – Videos:

- Boulder urban flooding (Boulder Ck. Watershed)
  - Univ. of Colorado students playing in floodwater
  - <http://youtu.be/xiiLhNJ5-lo>
- Loveland rural flooding (Big Thompson River)
  - <http://youtu.be/tWKGK4CiWxeM>
- Glen Haven destruction (Big Thompson watershed)
  - Voice-over from V.P. Joe Biden's speech
  - <http://youtu.be/UYPYTQHxPz8>

# Sept. 2013 Colorado Disaster Overview

## HUMAN DISASTER – Homes:



*Former home  
foundation  
elevation*

The view of Fish Ck.  
from under a home  
foundation in Estes  
Park (Varrella 2013)

*New temporary 2-ft  
sanitary sewer*

# Sept. 2013 Colorado Disaster Overview

## HUMAN DISASTER – Homes :

Destroyed structure  
on Fish Creek In Estes  
Park (Varrella 2013)

*No-flush zone for 9 weeks in  
all upstream neighborhoods*

*Still paying a mortgage;  
nothing left but the garage*



# Sept. 2013 Colorado Disaster Overview

## HUMAN DISASTER – Infrastructure Impacts:

- Lyons; all infrastructure destroyed
- Loveland; 2 of 3 drinking water pipelines destroyed
- Longmont; 4 of 5 drinking water pipelines destroyed
  - *“Everywhere I’ve been, people have asked me, ‘When are they going to come fix it?’ They? There is no ‘they.’ No cavalry is coming to make the decisions. It’s us.”*
    - Longmont Public Works Dale Rademacher  
The Denver Post, Nov. 3, 2013  
<http://goo.gl/edHiGc>

# Sept. 2013 Colorado Disaster Overview

Photo: Varrella, 2014



The 2013 Flood Was...

An **Environmental**  
Disaster

- **59 WTPs & WWTPs requested assistance**
- **\$170 Million in water and wastewater infrastructure damages**
  - *Colo. Foundation for Water Education, 2014*

# Sept. 2013 Colorado Disaster Overview

## ENVIRO. DISASTER – Channel Regrading:

Photo: Varrella, 2014



# Sept. 2013 Colorado Disaster Overview

## ENVIRO. DISASTER – Channel Regrading:

Photo: Varrella, 2014



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# Sept. 2013 Colorado Disaster Overview

## ENVIRO. DISASTER – Oil & Gas Releases:

Colo. Oil & Gas Conservation Comissn. (<http://goo.gl/KvIJTO>)

- 2,658 wells shut-in before flooding
- 14 “notable” flood-caused spills
  - 50 total sites for remediation
  - 48,250 gallons of crude oil spilled
  - 43,479 gallons of product water spilled
- Cleanup 36% complete 10 months later



Photo by Andy Cross,  
The Denver Post, 2013  
(<http://goo.gl/7kBRqS>)



Photo by Andy Cross,  
The Denver Post, 2013  
(<http://goo.gl/npa3Zc>)

# Preventing Flood Disasters from Becoming Disastrous

The Role of  
Human Complacency

*Challenging Disbelief  
in Disasters*



Photo: Varrella, 2014

# The Role of Human Complacency

## Recent Flood History Was Misleading:

- 11-year running drought before 2013 in Colorado
- No Presidentially-declared flood disaster since 1999
- Public did not believe in regional floods
  - *“It only floods near wildfire burn areas”*
  - *“It never floods here”*
  - *“Flooding won’t impact me”*

*“It is better to change the manner in which a man perceives the world than it is to change the world he perceives.”*

-- Martin Booth, *A Very Private Gentleman*, 2004

# The Role of Human Complacency

## Perception – Troy and Romm, 2004:

- *“The West in general has highly seasonal precipitation patterns...that may appear misleadingly dry much of the year.”*
- Risk **perceptions** are regionally skewed



Photos: Varrella, 2012

# The Role of Human Complacency

## Perception – Chivers and Flores, 2002:

- *When do homebuyers in floodplains discover mapped flood risk?*
  - 8% = before offer
  - 6% = before closing
  - 60% = at closing  $\Sigma = 70\%$
  - 10% = after move-in or a flood
  - 16% = other
- **Q:** Which U.S. City has the highest risk of flash flooding?
  - **A:** **Boulder, CO**
- 2002 Dataset; **Boulder, CO**



Photo: Jay Barber, 2008

# The Role of Human Complacency

## Let's Face It, We Like Risk:

We have a skewed perception of risk & natural hazards

- We accept risk as natural
- Our brains like risk



Photo: Varrella, 2011



Photo: Jon Haukaas, 2011

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# The Role of Human Complacency

## The Results of Risk Complacency:

- People continue to build “stuff” in hazardous areas
- The **damage-stress-rebuild-damage** cycle continues
- Decision-makers lose their history
- Policy decisions get washed out over time
- Disasters continue...

### Tools available to help deal with stress after storm

By Linda Lombroso, The (Westchester, N.Y.) Journal News 6:37p.m. EST November 4, 2012

0 Comments Share



(Photo: Jason Towler, Home News Tribune)

WESTCHESTER, N.Y. — When Hurricane Katrina hit the Gulf Coast in 2005, it left behind record numbers of people afflicted with post-traumatic stress that has lingered, in some cases, for years.

While the after-effects of Superstorm Sandy are still wreaking havoc on the East Coast, it is important to face worries before they careen out of control, say mental-health experts. And there are plenty of tools that can restore emotional equilibrium even if you're still getting dressed in the dark.

First, count your blessings if you've managed to escape physical harm from the storm, said Bonnie Goldstein, a Los Angeles-based clinical psychologist and author of "I'll Know What to Do: A Kid's Guide to Surviving Natural Disasters," published by the American Psychological Association.

"Once you get past 'Am I safe?' it becomes a day of thanksgiving before Thanksgiving, and that gratitude is what helps people get through," she said.

Slay away from frightening visuals of disaster scenes — be thankful, said Goldstein, if your TV is not working — since often such images can escalate stress and lead to a sense of helplessness.

### KCRG-TV9 | Cedar Rapids, Iowa News, Sports, and Weather

[Print this article](#)

## Cedar Rapids Wants State, Feds to Bend Rules For Redevelopment

Originally printed at <http://www.kcrq.com/news/local/Cedar-Rapids-Wants-State-Feds-to-Bend-Rules-For-Redevelopment-160163603.html>

By Belinda Yeung  
June 24, 2012

CEDAR RAPIDS, Iowa — Not all rules are black and white, are they?

That's the question four years after the flood as Cedar Rapids seeks a little leeway for redevelopment inside the 100-year flood plain, where tens of millions of federal disaster dollars have been or are being spent to buy out and demolish some buildings.

# Preventing Flood Disasters from Becoming Disastrous

## *Lessons Learned from Colorado Flooding*

What We Cannot  
Afford to Forget

Photo: Varrella, 2013



# Lessons From Colorado Flooding

## Floods happen in Colorado:

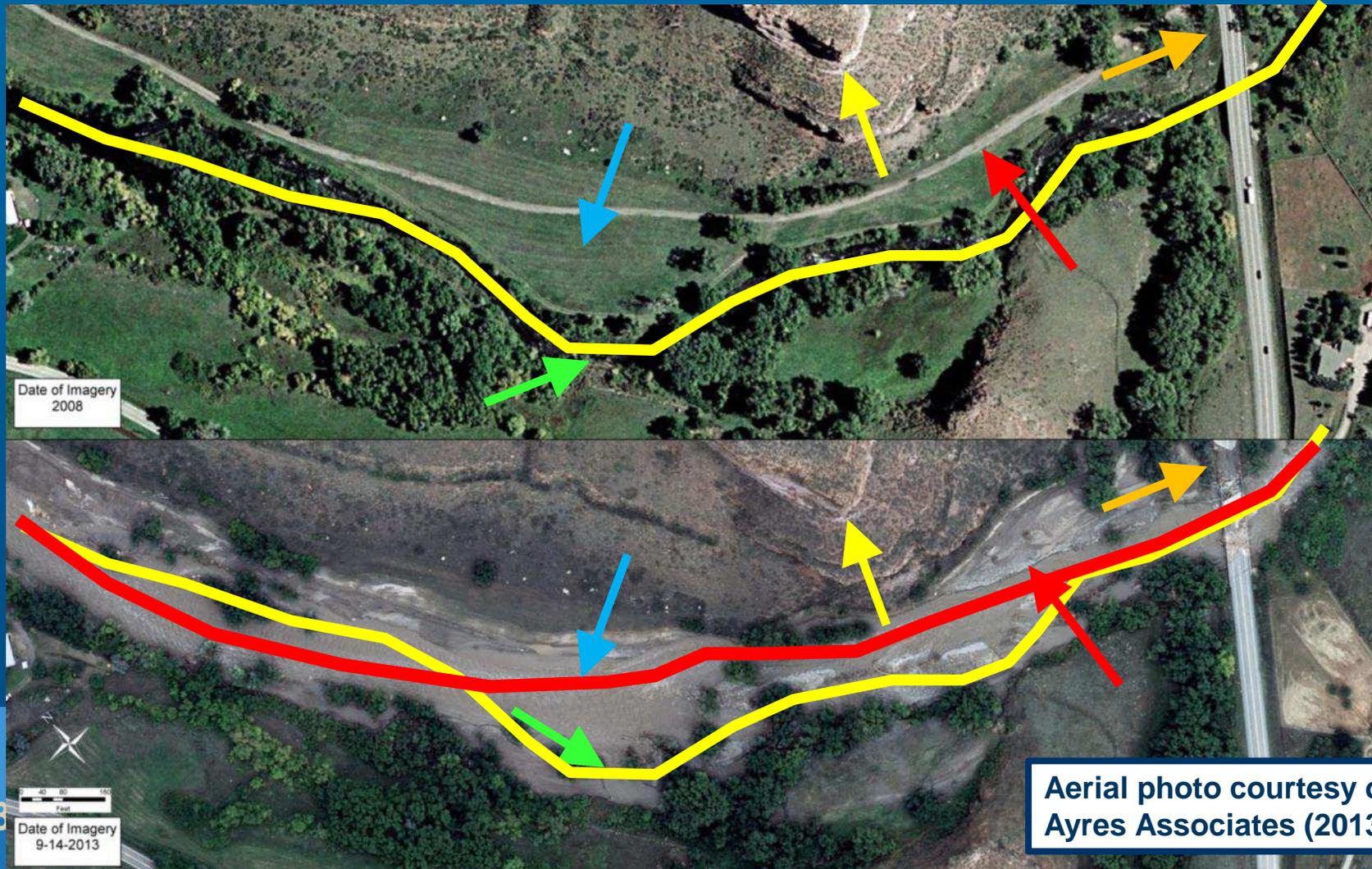
- And everywhere else!
- We were all warned



Photo: Varrella, 2009

# Lessons From Colorado Flooding

## Flood Hazards Are Not Static (1 of 2):



# Lessons From Colorado Flooding

## Flood Hazards Are Not Static (2 of 2):



Big T. and N. Fork Big T.  
from the Denver Post  
(Andy Cross 2013)  
<http://goo.gl/2iLyDI>

# Lessons From Colorado Flooding

## Local Officials – This Is YOUR Disaster:

- You MUST **take command** of your own disaster
  - Feds & State will support...
  - But, the work of recovering is yours
- Get a community inventory now
  - Recovery \$\$\$ is based on pre-disaster conditions
  - Take videos & photos as an archive now
  - LiDAR & aerials are affordable
- Guide FEMA – keep your records simple
  - Stick to your plans through FEMA staff changes

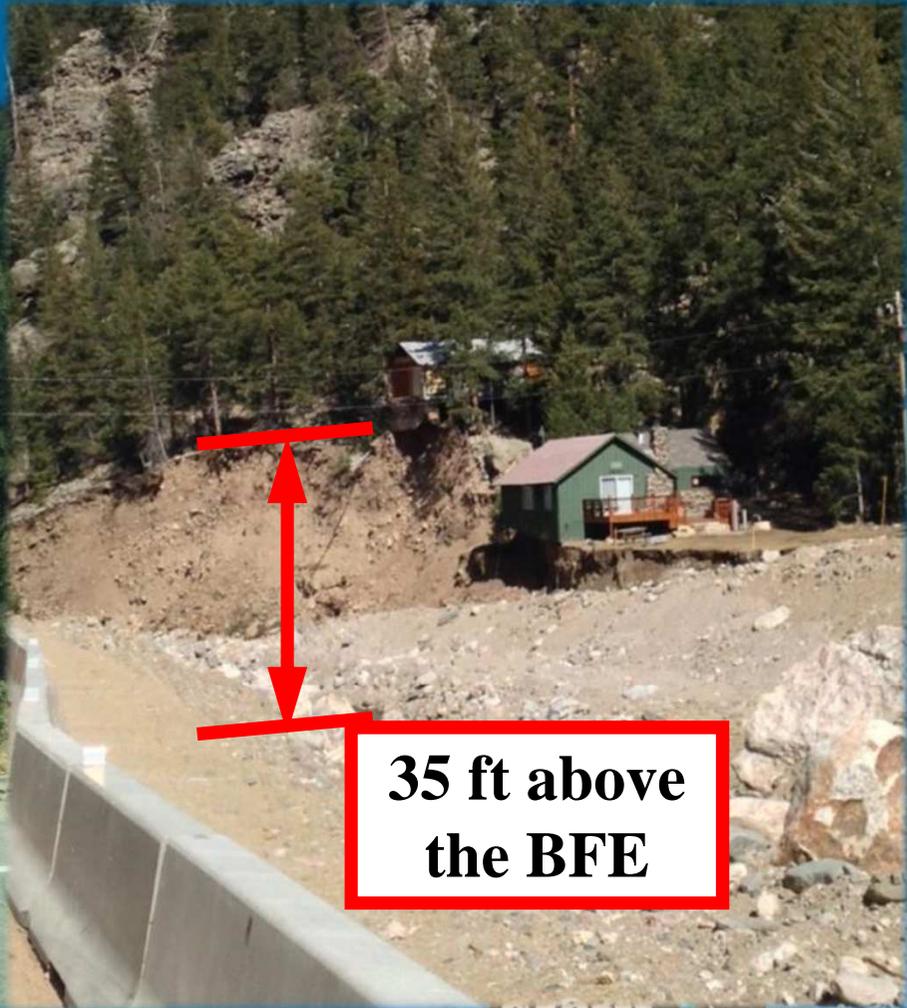
# Lessons From Colorado Flooding

## Elevation/Freeboard Doesn't Always Work (1 of 3):

Photos: Varrella 2014



**35 ft above  
the BFE**



**35 ft above  
the BFE**

# Lessons From Colorado Flooding

## Elevation/Freeboard Doesn't Always Work (2 of 3):



Photo: Marsha  
Hilmes-Robinson, 2013

# Lessons From Colorado Flooding

## Elevation/Freeboard Doesn't Always Work (3 of 3):

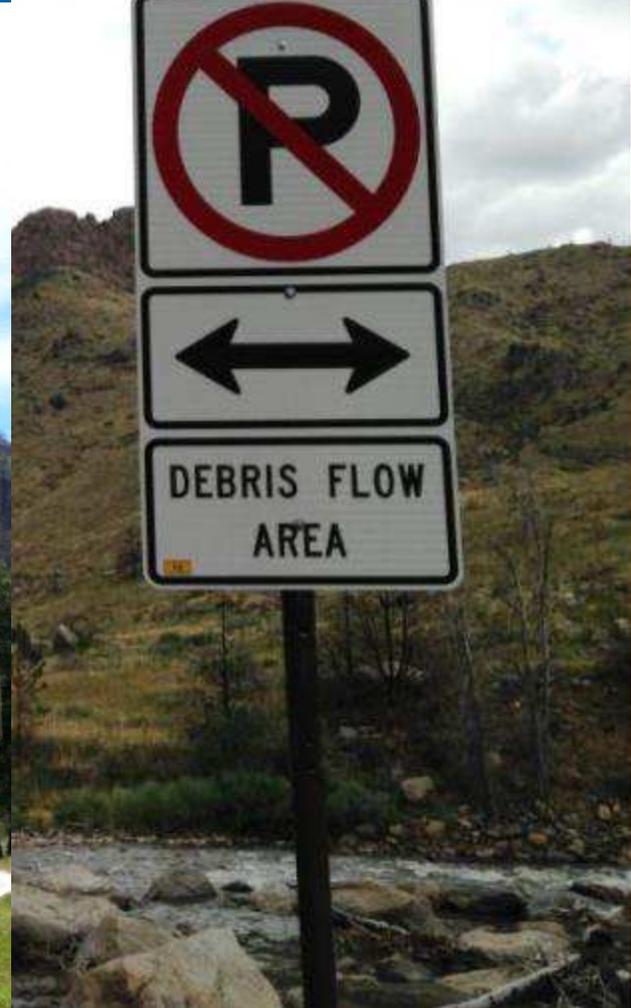
Photos: Marsha  
Hilmes-Robinson, 2013



# Lessons From Colorado Flooding

Clear Messaging Saves Lives:

Photos:  
Varrella, 2013



# Lessons From Colorado Flooding

## Flood Warning Systems Save Lives:



Photo: Chris Lochra, 2013

# Lessons From Colorado Flooding

## Neighbors Will Help During Disasters:

- Mutual aid agreements – get ‘em in place NOW
  - Fully reimbursable on time & expenses
- Use EMAC – Emergency Mgt. Assistance Compact
  - Through your State Office of Emergency Mgt.
  - Must talk peer-to-peer
- Volunteer time; check with State Attorney General
  - Colorado protects P.E. liability
  - Other states offer similar protections to non-profits

# Lessons From Colorado Flooding

## Social Media is Relevant:



*Public “likes” on the  
FC Facebook Page*

- People use social media to share flood info
- Ft. Collins Facebook (*3 days*)
  - Population 150,000
  - Direct views = 178,872 people
  - Shared views = 264,967 people
  - **Directly engaged 68,470 people**
- Ft. Collins Twitter (*3 days*)
  - 12-fold increase in traffic
  - 20% increase in followers

# Preventing Flood Disasters from Becoming Disastrous

## *Future Disaster Reduction Strategies*

Actions to Take Now  
to Prepare & Mitigate  
for Next Time



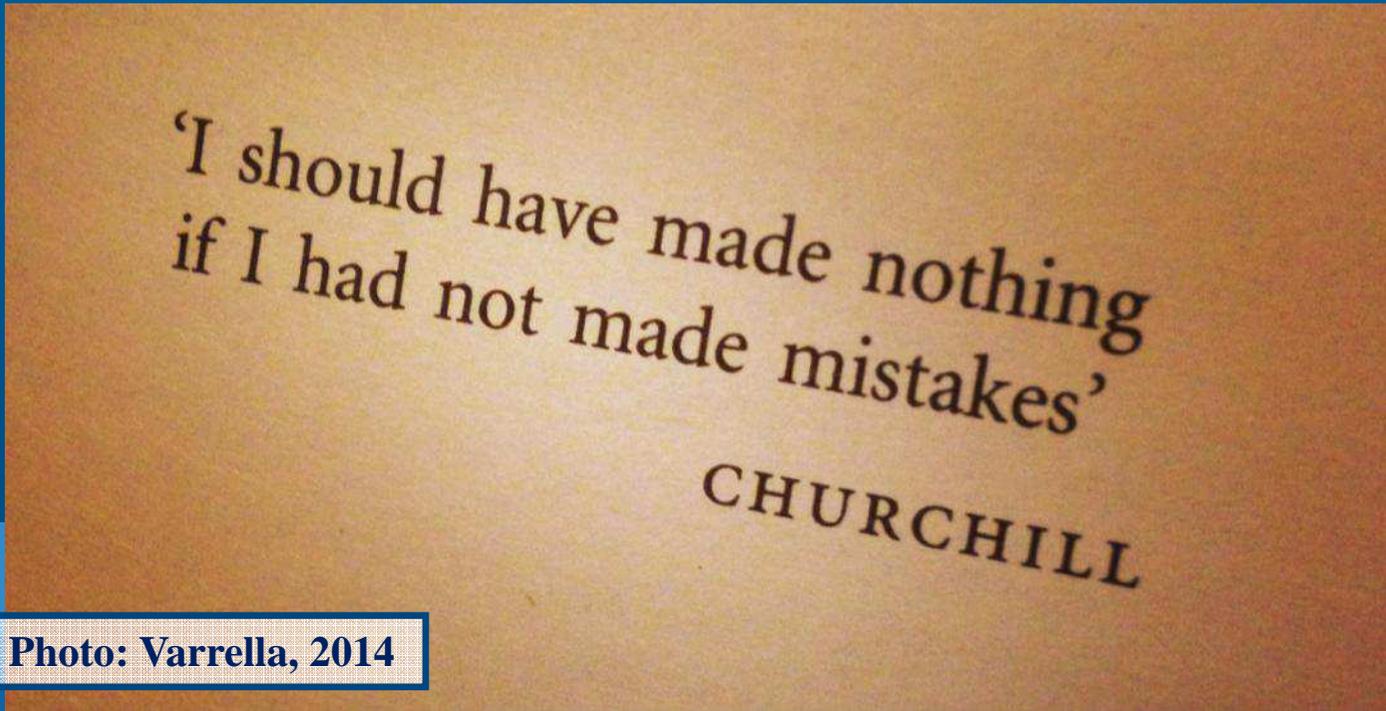
The Suz, 2012

# Better Practices in Mitigation

## REMEMBER: Evolution of Best Practices

History + new info = new best practices.

*“If you could rebuild it all over again, would you do it the same way?”* Chris Sturm, CWCB Stream Team Leader, 2013.



‘I should have made nothing  
if I had not made mistakes’

CHURCHILL

# Future Disaster Reduction Strategies

## Recommendation #1:

### Communicate frequently across multiple platforms

- People receive info from MANY sources
- Meet the public wherever they might be
  - Tell them what actions to take

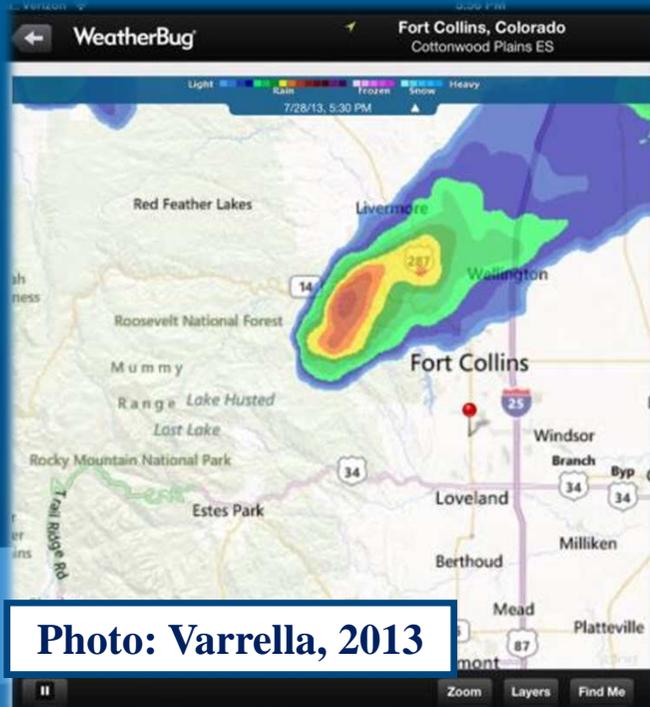


Photo: Varrella, 2013

**Justin Smith**  
July 13, 2013 · 🌐

Weather forecasters are advising us of significant chance for torrential showers in Larimer County, both today and tomorrow from noon to midnight.

The best way to remain alert is a NOAA Weather Radio, so you can receive immediate alerts at your home. Radios can typically be found at some local merchants and can easily be purchased online.

Like · Comment · Share

👍 26 people like this.

Like Page

Top Comments

Facebook Post from the Larimer Co. Sherriff, 2013

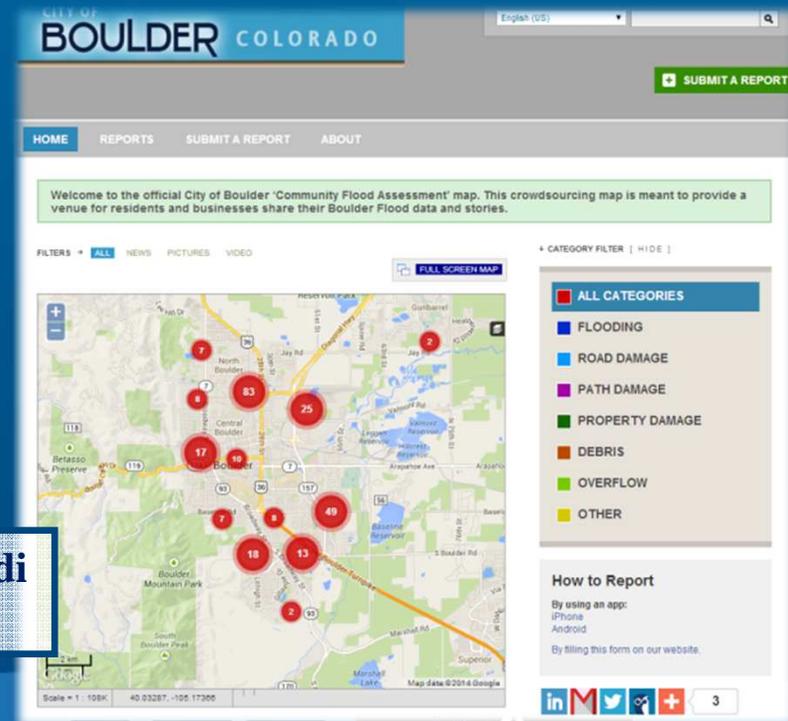
# Future Disaster Reduction Strategies

## Recommendation #1 Continued:

### Keep Web Resources Updated:

- Special **websites** can be set up for storm info
  - Convenient platform for communication
  - Update content regularly
    - Press releases
    - Help finding assistance
    - Other Agency contacts
    - **Interactive maps (GIS)**

Boulder, CO crowdmap platform using Ushahidi  
<https://boulderflood2013b.crowdmap.com/>

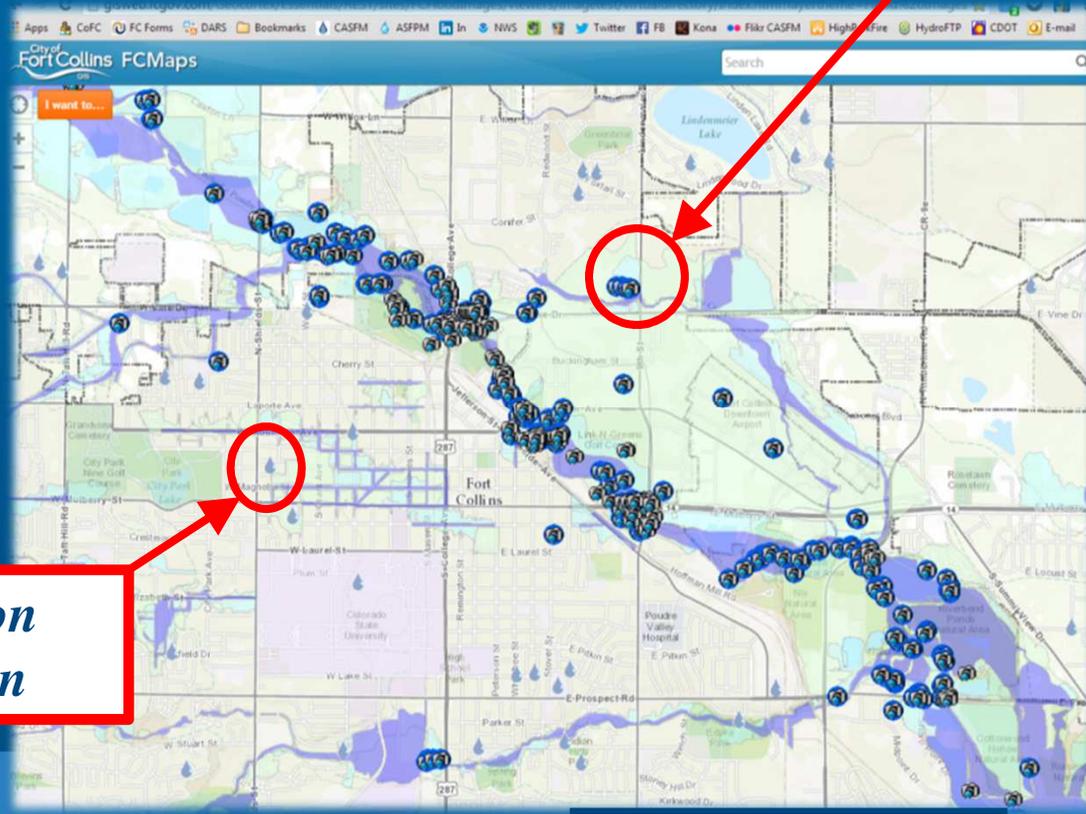


# Future Disaster Reduction Strategies

*Recommendation #1 Continued:*

**Compile Digital Info for the Public:**

*Flood-related ground photograph*



*Precipitation information*

Photo: Varrella, 2013



# Future Disaster Reduction Strategies

## Recommendation #2:

Defy human logic to change **perceptions**

- Look for human patterns instead
- Accommodate those patterns, and adjust messaging

Photo: Varrella, 2012



# Future Disaster Reduction Strategies

## Recommendation #3:

### Collaborate as a watershed (*Stream Teams*)

- One watershed, many resources, many solutions
- Private stakeholders + govt. agencies + non-govt. orgs.



Photo: Mouttet, 2013



Photo: Varrella, 2013

# Future Disaster Reduction Strategies

## Recommendation #4:

### Identify & regulate HAZARD BUFFERS

- **FIRMs** don't show all flood hazards
- **Erosion** ignores FIRM boundaries
- **Setbacks** save lives
- Channel migration functions are **assets**
- **NBF = A-OK**

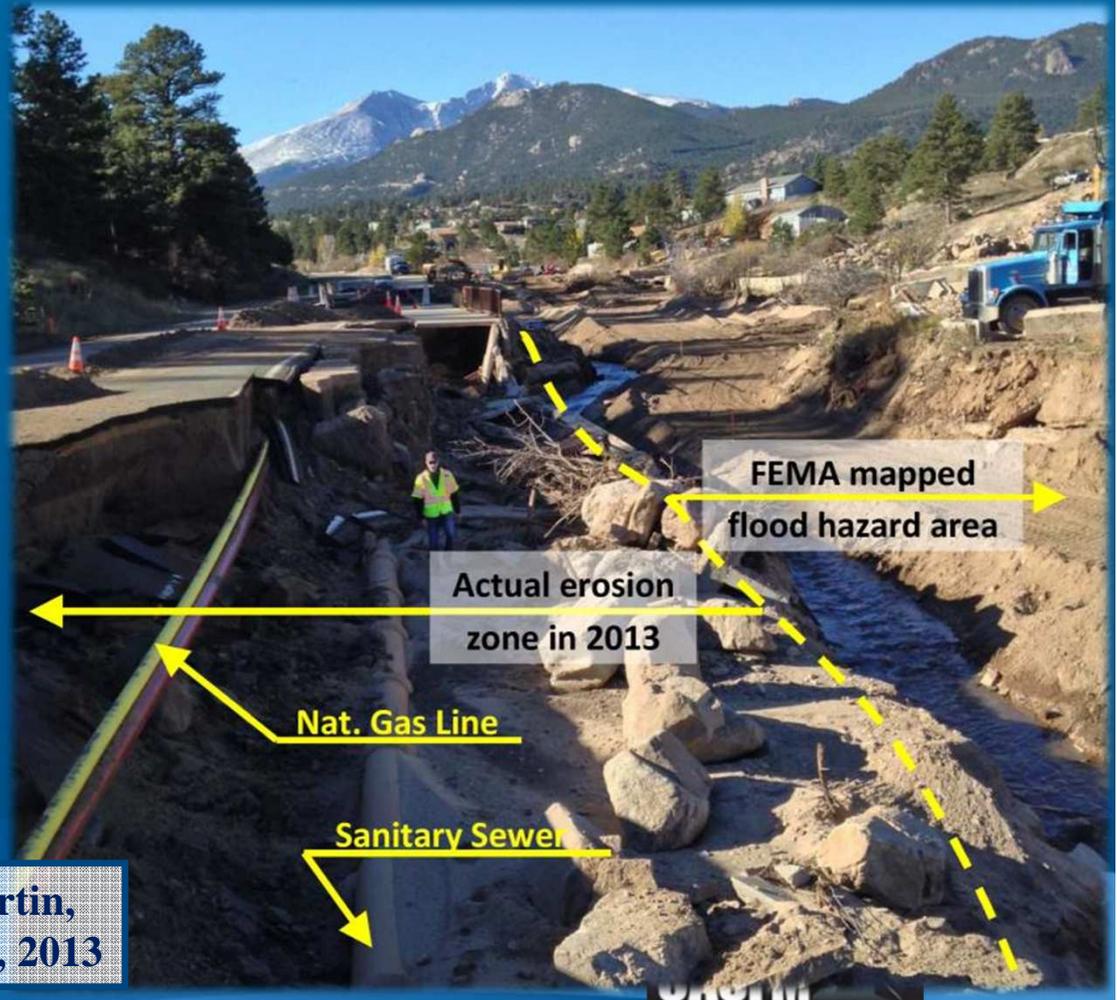


Photo: Terry Martin,  
ICON Engineering, 2013

# Future Disaster Reduction Strategies

## Recommendation #5:

### Break the fire-flood-erosion damage cycle

- Manage watershed resources as assets
- Pre-disaster flood mitigation should have ecological components



Photo: Mouttet, 2013



Photo: Varrella, 2013

# Future Disaster Reduction Strategies

Break the Disaster-Damage Cycle:



# Future Disaster Reduction Strategies

Recommendation #6:  
Give us more helicopters

Photo: Randy Gustafson,  
City of Greeley, 2013

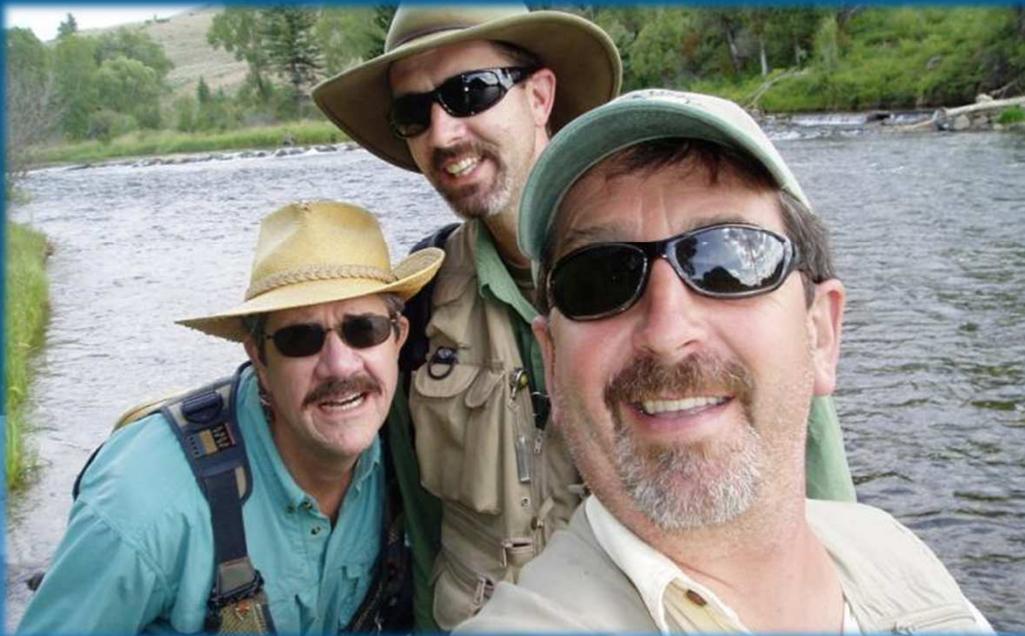


# Future Disaster Reduction Strategies

## Final Thoughts (editorial):

Allstate – “*good life*” ad campaign for risk

- “*All the bad things that can happen in life, they can’t stop us from making our lives ... good.*”
- <http://youtu.be/kl1bKm22Up0>



Photos: Varrella, 2011

# Preventing Flood Disasters from Becoming Disastrous



Thanks for  
Listening

Questions?

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