Preventing Flood Disasters from Becoming Disastrous

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Photo: Varrella, 2013
Preventing Flood Disasters from Becoming Disastrous

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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*

Disasters Before the 2013 Flood

Colorado’s Front Range & Urban Corridor:

- 4 major fires 2010-2013
- 355 sq. miles affected
- 1,446 homes destroyed

Photo background: Google Earth
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
Disasters Before the 2013 Flood

Post-Fire Debris Flows:

Photo: Varrella, 2013

Me, for scale
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
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Sept. 2013 Colorado Disaster Overview

Sept. 9-16, 2013
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)*
Affected Communities:

- Fort Collins
- Estes Park
- Lyons
- Longmont
- Boulder
- Sterling
- Greeley
- Aurora

Map courtesy of FEMA and ESRI (2013)
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

Legend (in inches):
- Under 10: 35 to 40
- 10 to 15: 40 to 45
- 15 to 20: 45 to 50
- 20 to 25: 50 to 55
- 25 to 30: Above 55
- 30 to 35

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 0.4 km latitude/longitude and was resampled to 20 km using a Gaussian filter. Mapping was performed by Jenny Weihsburg. Funding was provided by USDA-NRCS National Water and Climate Center.
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??

Sept. 2013 Colorado Disaster Overview
EPIC DISASTER – Peak Flood Hydraulics:

Colorado Floods of 2013 - Flood Magnitude Analysis

- Buckhorn Creek (10-25 Year Flood)
- Cache La Poudre River (<50 Year Flood)
- Big Thompson River: Estes to Canyon Mouth (50-100 Year Flood)
- Big Thompson River: Canyon Mouth through Loveland (100 Year Flood)
- St. Vrain Creek (50-100 Year Flood)
- South Platte River (100-500 Year Flood)
- South Platte River (<50 Year Flood)
- Boulder Creek (<50 Year Flood)

Flood magnitude estimates based on incomplete gage data, FEMA flood maps, FIS studies, and high water mark analyses where available as of 10/26/2013.

Courtesy of the Colorado Dept. of Transportation (Ayres Assoc., 2013 draft)
The 2013 Flood Was…

A **Costly** Disaster

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

Photo: Varrella, 2013
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:

Exposed sanitary sewer on Fish Creek near Estes Park (Varrella 2013)
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-l0

• Loveland rural flooding (Big Thompson River)
  – http://youtu.be/tWGK4CiWxeM

• 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:

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

Former home foundation elevation

New temporary 2-ft sanitary sewer
Sept. 2013 Colorado Disaster Overview

HUMAN DISASTER – Homes:

- No-flush zone for 9 weeks in all upstream neighborhoods
- Still paying a mortgage; nothing left but the garage
- Destroyed structure on Fish Creek In Estes Park (Varrella 2013)
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
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
Sept. 2013 Colorado Disaster Overview

ENVIRO. DISASTER – Oil & Gas Releases:

Colo. Oil & Gas Conservation Comission. ([http://goo.gl/KvlJTO](http://goo.gl/KvlJTO))

- 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](http://goo.gl/7kBRqS))
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.
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
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 Lashbrook, The (Winston-Salem, N.C.) Journal-News

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 become 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.


“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.

Stay 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

Cedar Rapids Wants State, Feds to Bend Rules For Redevelopment


By Irlinda Young
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 tons of millions of federal disaster dollars have been or are being spent to buy out and demolish some buildings.
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Lessons Learned from Colorado Flooding

What We Cannot Afford to Forget

Photo: Varrella, 2013
Lessons From Colorado Flooding

Flooding happens in Colorado:

• And everywhere else!
• We were all warned
Lessons From Colorado Flooding

Flood Hazards Are Not Static (1 of 2):

Aerial photo courtesy of Ayres Associates (2013)
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
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:

- 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

Public “likes” on the FC Facebook Page
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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
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 crowdbmap 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
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.
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
Future Disaster Reduction Strategies

Break the Disaster-Damage Cycle:

- Water Quality
- Debris
- Erosion
- Flash Floods

Mitig $
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
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Questions?

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