



COLORADO

Department of
Transportation



Colorado Framework for Hazard Mitigation

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Welcome to Colorful *COLORADO*!



Welcome to Colorful *COLORADO*!



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

Welcome to Colorful *COLORADO!*



Source: Colorado
Department of
Transportation, 2013

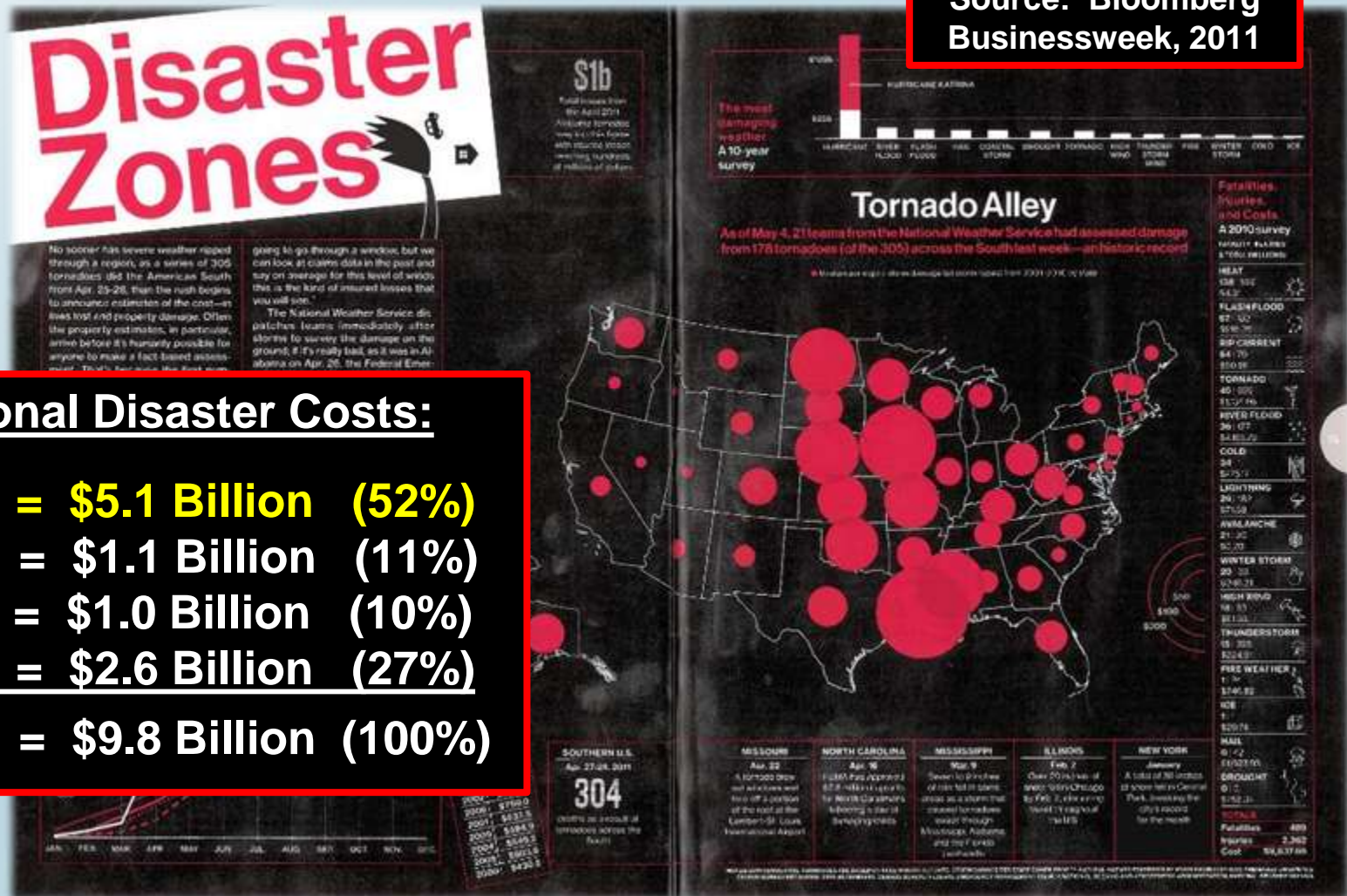


Why Hazard Mitigation?

Source: Bloomberg Businessweek, 2011

2010 National Disaster Costs:

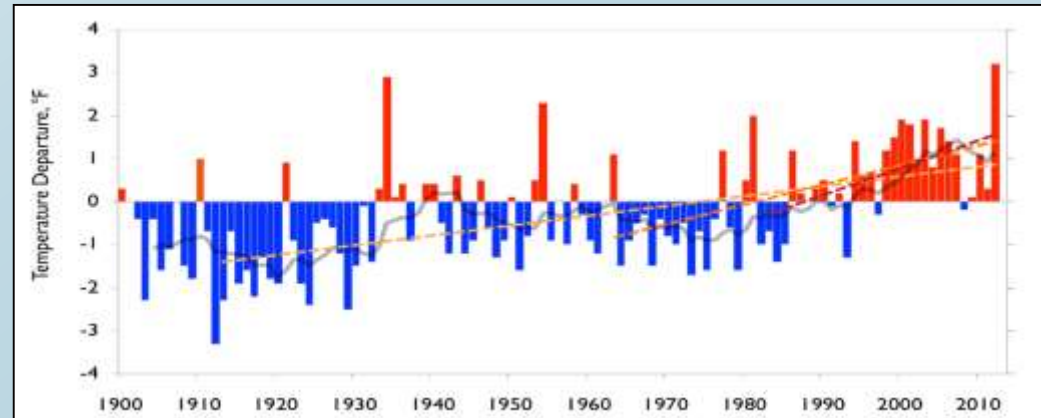
Flooding	= \$5.1 Billion	(52%)
Tornados	= \$1.1 Billion	(11%)
Hail Storm	= \$1.0 Billion	(10%)
<u>All Others</u>	<u>= \$2.6 Billion</u>	<u>(27%)</u>
TOTALS	= \$9.8 Billion	(100%)



Why Mitigation?

Population Current and Projected – Statewide and Select Counties				
Jurisdiction	2010 Census	Estimated 2013	Estimated 2020	Estimated 2040
State of Colorado	5,029,196	5,264,890	5,924,692	7,752,887
City and County of Denver	604,879	648,978	734,079	867,545
Boulder County	294,567	309,874	335,076	396,163
Larimer County	299,630	315,728	356,900	471,612
El Paso County	622,263	655,812	728,610	955,871
Eagle County	52,057	52,360	57,226	94,085
San Miguel County	7,356	8,063	9,408	15,523

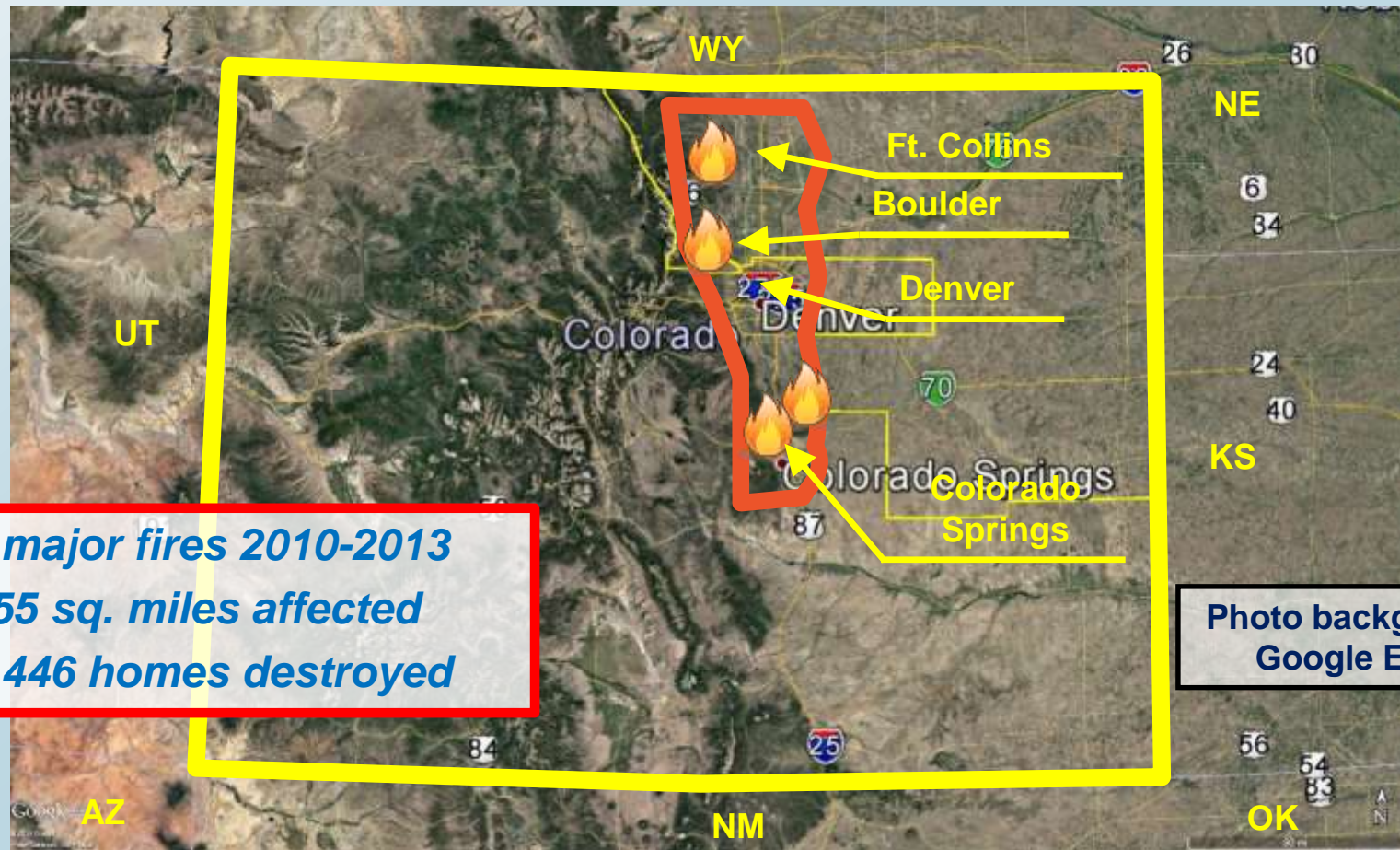
*Source: Colorado Department of Local Affairs Demography Office



Colorado Disaster History

Disaster	Communities Impacted	Disaster Impacts
1965 Floods	Colorado Front Range (South Platte and Arkansas basins)	21 lives lost; \$540M damages (1965 dollars); resulted in construction of Chatfield and Bear Creek reservoirs
Big Thompson Flood (1976)	Primarily Larimer County between Estes Park and Loveland	8 inches of rain in a one hour period; 145 lives lost; 418 houses destroyed.
2002 Drought and Wildfires	Statewide. Major fires included Hayman, Coal Seam, Missionary Ridge and others	Hayman fire burned 137k acres; Missionary Ridge 70k acres
2012-2013 Wildfires	Statewide; large fires in Larimer, El Paso, Fremont counties and the San Luis Valley	More than 1100 homes destroyed, \$1.2B in insurance claims
2013 Floods	24 counties impacted	10 lives lost; 1800 homes destroyed, \$3.9B in damages

Cascading Hazards



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

Photo background:
Google Earth

Cascading Hazards



Photo: Lucas Mouttet, 2013

Cascading Hazards



Source: Terry Martin,
ICON Engineering, 2013

Cascading Hazards

Source: Colorado
Department of
Transportation, 2013



Tumultuous Recent Disaster History

2012-2015 Colorado Disasters by the Numbers

\$5 billion...Housing, infrastructure, economic and watershed impact from floods and wildfires

\$1.7 billion...federal, state, local, private resources to support flood recovery

\$1.2 billion...wildfire insurance claims paid in 2012 and 2013

\$66.7 million...flood insurance claims paid after the 2013 floods

3,000...homes destroyed by floods and wildfires

100+...property acquisitions for flood and landslide mitigation since 2013

Introspection, Then Action

Non-Structural Mitigation:

*If you could do it all over again,
would you do it the same way?*

Source:
Varrella, 2016

-- Chris Sturm, CWCB (2013)





Colorado Resiliency Framework



Interdisciplinary Integration



Community Planning Assistance



- Project through Colorado Department of Local Affairs and Colorado Resiliency Working Group's *Community Sector*
- Guidance on hazard identification and risk assessment
- Flexible set of land use tools to enhance mitigation
- Adaptable to different Colorado community contexts
- www.planningforhazards.com

Revisiting Priorities

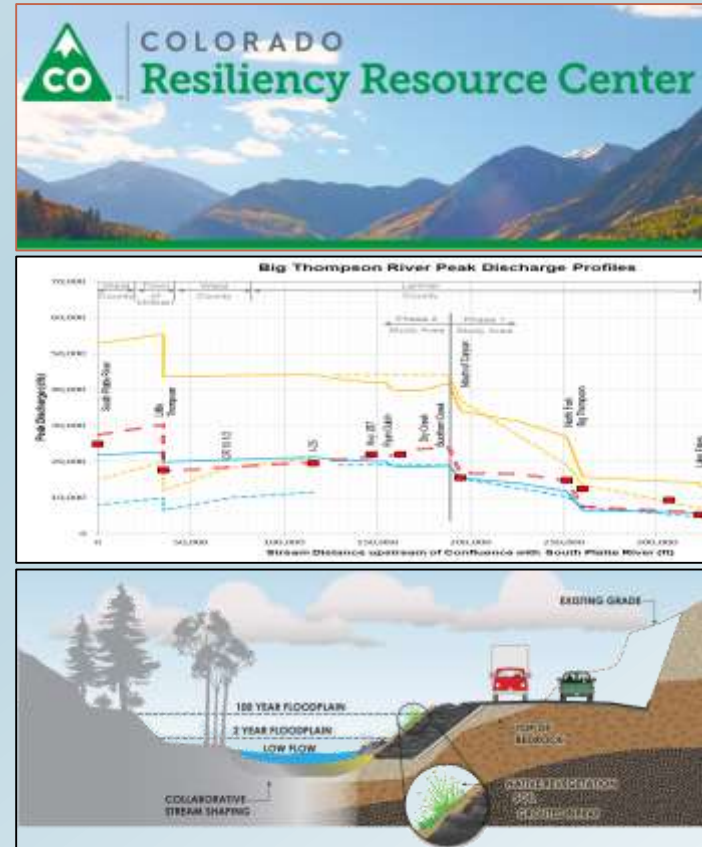
CDOT Resilience Index (RI):

- Reflects critical nature of highway assets
- Reflects typical annual construction investments
- Includes FHWA & CDOT investment

Criticality Score	Criticality Level	RI
4 to 10	Low	1.0
11 to 15	Moderate	2.0
16 to 20	High	3.0

Priorities To Action

- Build capacity and empower a culture of resilience
- Leverage data to manage risk
- Integrate resilience into capital investments



Funding and Support



Rivers flow downhill...and side to side

Senate Bill 15-245

- Three-year program
- Floodplains re-mapping
- Digitization of 28 counties
- Debris flow mapping in high risk, high consequence areas
- Erosion zones methodology and pilot mapping

Action On The Ground = *Partnering!*



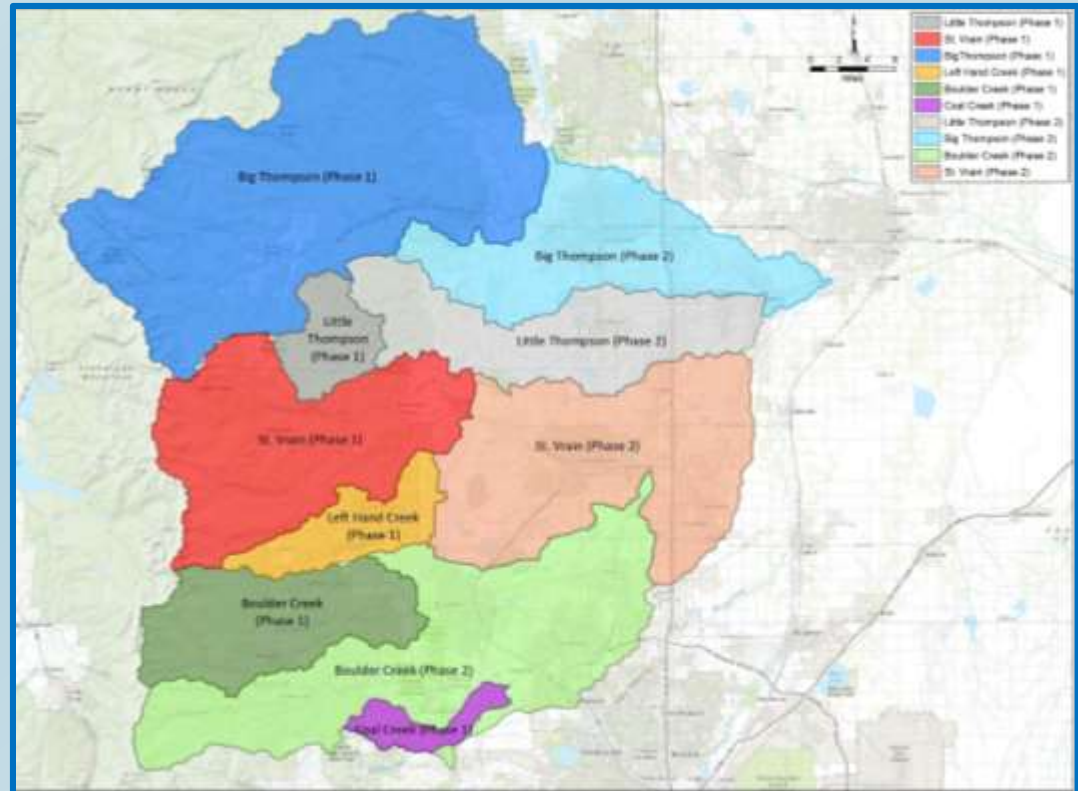
Updating Science for Design Criteria

- Partnership between **Colorado Water Conservation Board** and **Colorado Department of Transportation**

- Risk education
- Floodplain re-mapping
- Best available data - design and engineering
- Regulation

- Data sources**

- Rainfall intensity
- Stream gauges
- Post-flood high water marks



Local Engagement and Application

•**Framework:** Focus groups, interviews, peer review, Resiliency Heroes nominations

•**Hydrology:** meetings with individual communities to review draft results, gather input, refine results

•**Floodplain Mapping:** Quarterly stakeholder updates, Flood Risk Review meetings, public meetings, newsletter and website

•**Planning for Hazards:** State, local, non-government advisory committee, interactive website

Engagement Stakeholder Groups:



LOCAL
GOVERNMENT



LOCAL BUSINESSES
& AGRICULTURE



EXPERTS



LOCAL BUILDERS

- Developers
- Planners
- Utilities



LOCAL LEADERS

- Non-profits
- Faith-based organizations
- Volunteers

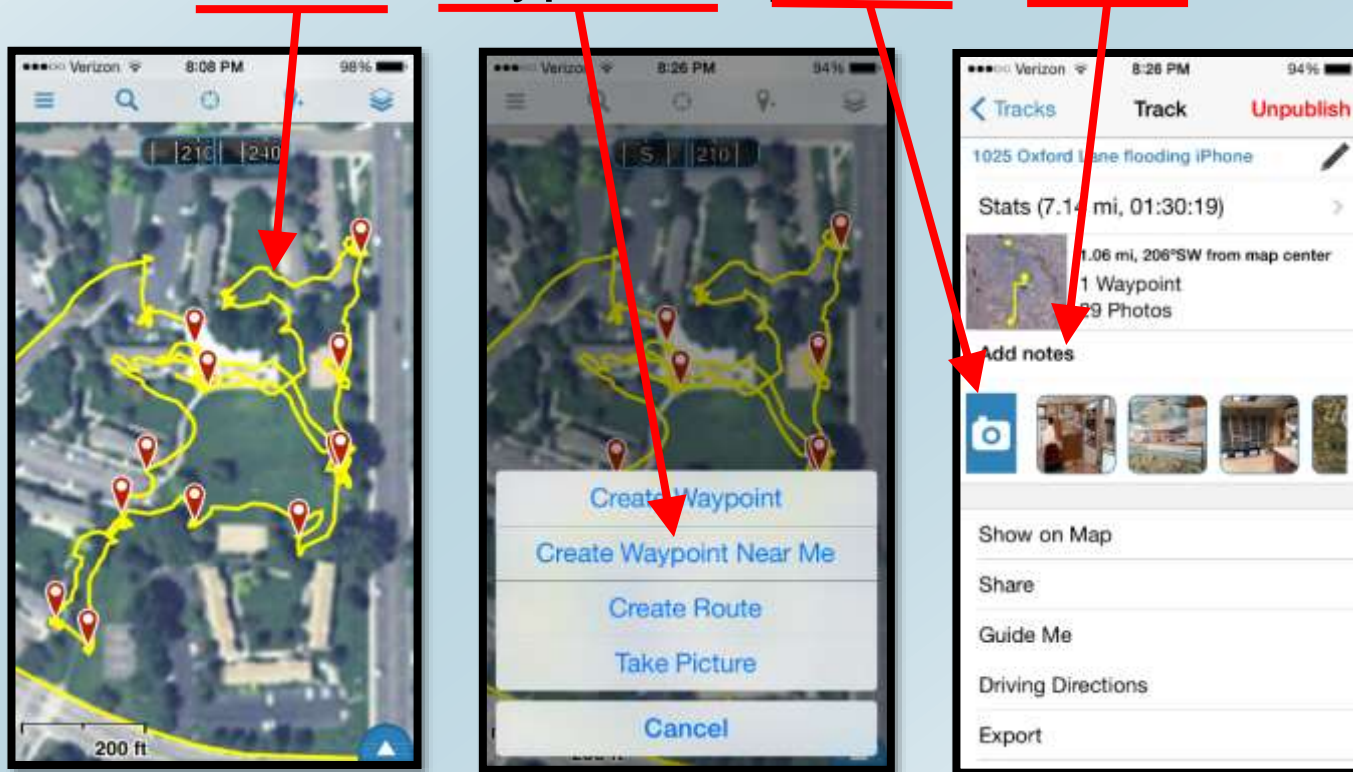


GENERAL PUBLIC

Leveraging Technology

Mobile Tech for Rapid Field Data Collection

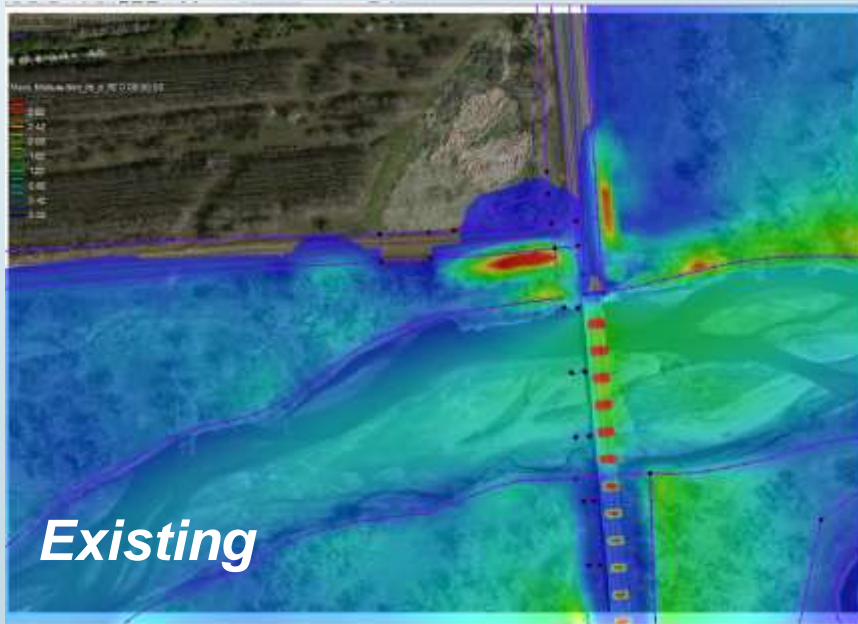
- Share information directly from the field
- Collect tracks, waypoints, photos & notes



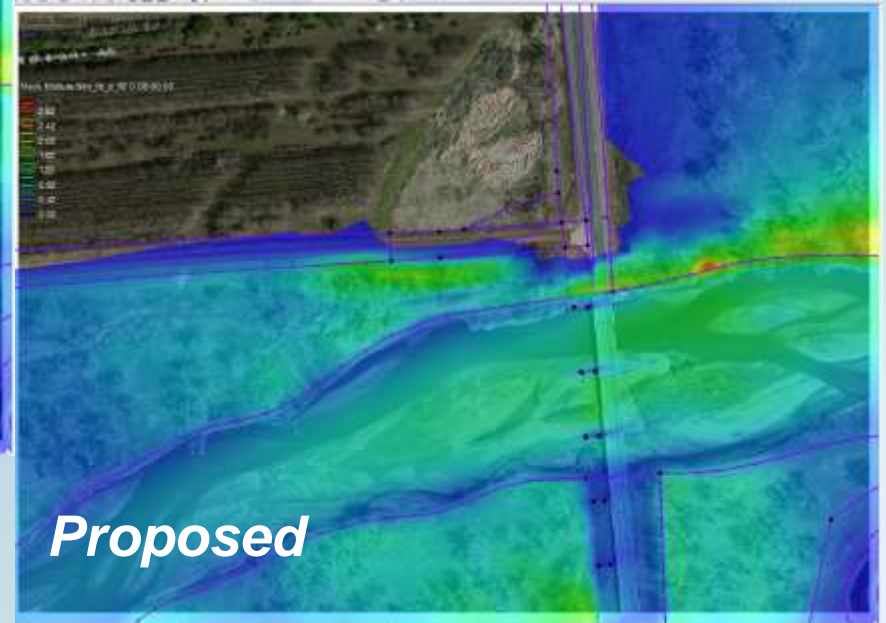
Leveraging Technology

2-D Hydraulic Modeling

Shear Stress:



Existing

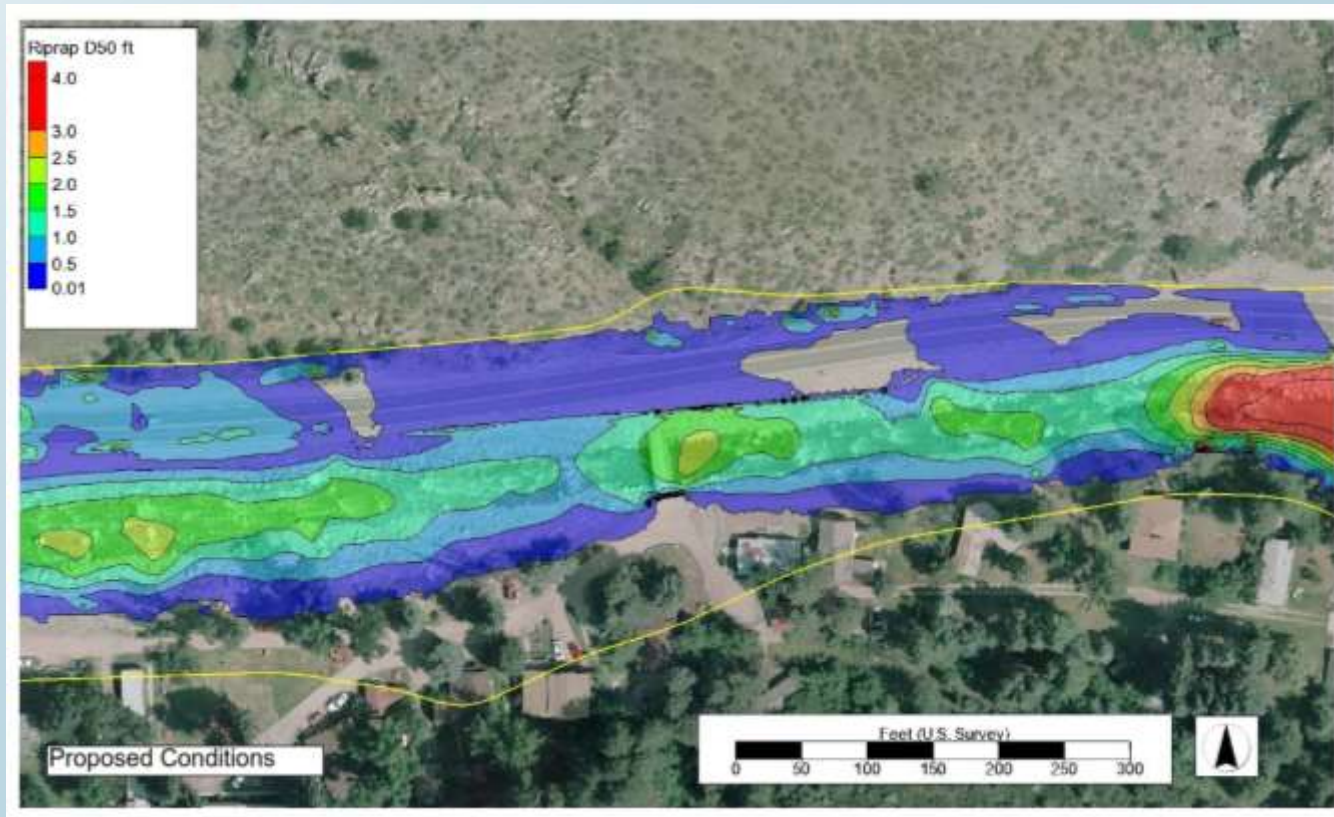


Proposed

CDOT Region 4 and
TSH Engineering,
SH 60 over the
South Platte River

Leveraging Technology

2-D Hydraulic Modeling



Credits: Ayres
Associates (2016)

Proposed Riprap Size (D_{50})

Continuous Improvement

Never one-and-done...



From Start to Finish...



Colorado Framework for Hazard Mitigation



In Memory Of

Suzie-Q

2003-2017

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Thank You!

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