



State of Colorado Fluvial Hazard Zone (FHZ) Mapping Pilot Program

Stephanie DiBettito, CFM
Colorado Water Conservation Board

Katie Jagt, PE, CFM
Watershed Science and Design, PLLC



COLORADO
Colorado Water
Conservation Board
Department of Natural Resources

June 22, 2018 2:30pm
ASFPM Phoenix, AZ
Session H7: Guidance & Standards Highlights



#ASFPM2018 #COFHZ

FLUVIAL HAZARD ZONE DEFINITION

“The Fluvial Hazard Zone (FHZ) is the area a stream has occupied in recent history, could occupy, or could physically influence as it stores and transports sediment and debris during flood events. The objective of a mapped FHZ is to identify lands most vulnerable to fluvial hazards in the near term.”




INTRODUCTION AND DEMONSTRATED NEED



Pre-Flood Channel
Location, Regulatory
Floodway and 100-year
Floodplain

Post-Flood Channel
Location

Home completely
missed by regulatory
floodplain mapping



Planning for erosion hazards is an essential component of effective river corridor management and the prevention of future flood damages.

Nationally, nearly 25% of flood insurance claims come from areas outside of the 100-year floodplain.

In Colorado, the figure is approximate 51% from the 2013 event alone, and 57% cumulatively, since 1978.*

*Only NFIP claims; meaning they came from people with flood insurance.

State of Colorado's Perspective

The Colorado Water Conservation Board (CWCB) is the state coordinating agency for the National Flood Insurance Program (NFIP). Floodplains are a matter of statewide importance and the CWCB has been given the authority to prevent flood damages, regulate and designate floodplains, and ensure proper regulation of floodplains. The CWCB has Rules and Regulations for regulatory floodplains that set higher standards for floodplain management for communities in the state.

The Fluvial Hazard Mapping Program will develop and implement a program for mapping fluvial hazard areas, which will help strengthen the CWCB's role in preventing flood damages, regulate and designate floodplains, and ensure proper regulation of floodplains. The CWCB will provide technical standards, conduct studies for communities requesting mapping, and provide regulatory guidance for communities interested in voluntarily adopting map products.

PHASE 1: PROOF OF CONCEPT

Timeline: 2014-2015

Developed Priorities and Preliminary Protocols for the FHZ Program

- Scientifically supported and reviewed
- Ability to scale in size, implement cost-effectively on a large scale
- Applicable to any stream, perennial or ephemeral, in the state of Colorado
- Ability to refine in detailed study based on presence of debris flow potential, burn scars, hazardous/critical infrastructure, and/or delineation disputes.
- Build off the programs in the US



Big Thompson River, Larimer County, Colorado
Photo Credit: Katie Jagt

PHASE 1: CONCLUSIONS

Timeline: 2014-2015

- Level 1 and Level 2 delineation for rapid planning and refined analysis
- Adopt highly revised version of all three types of methods used in the United States → could be considered a new method
- Introduce a geomorphic classification to determine which method is appropriate for each reach of river.
- No relative (or absolute) probabilities of hazard
- Automation of the delineation process is unlikely
- Understanding debris flows is critically important

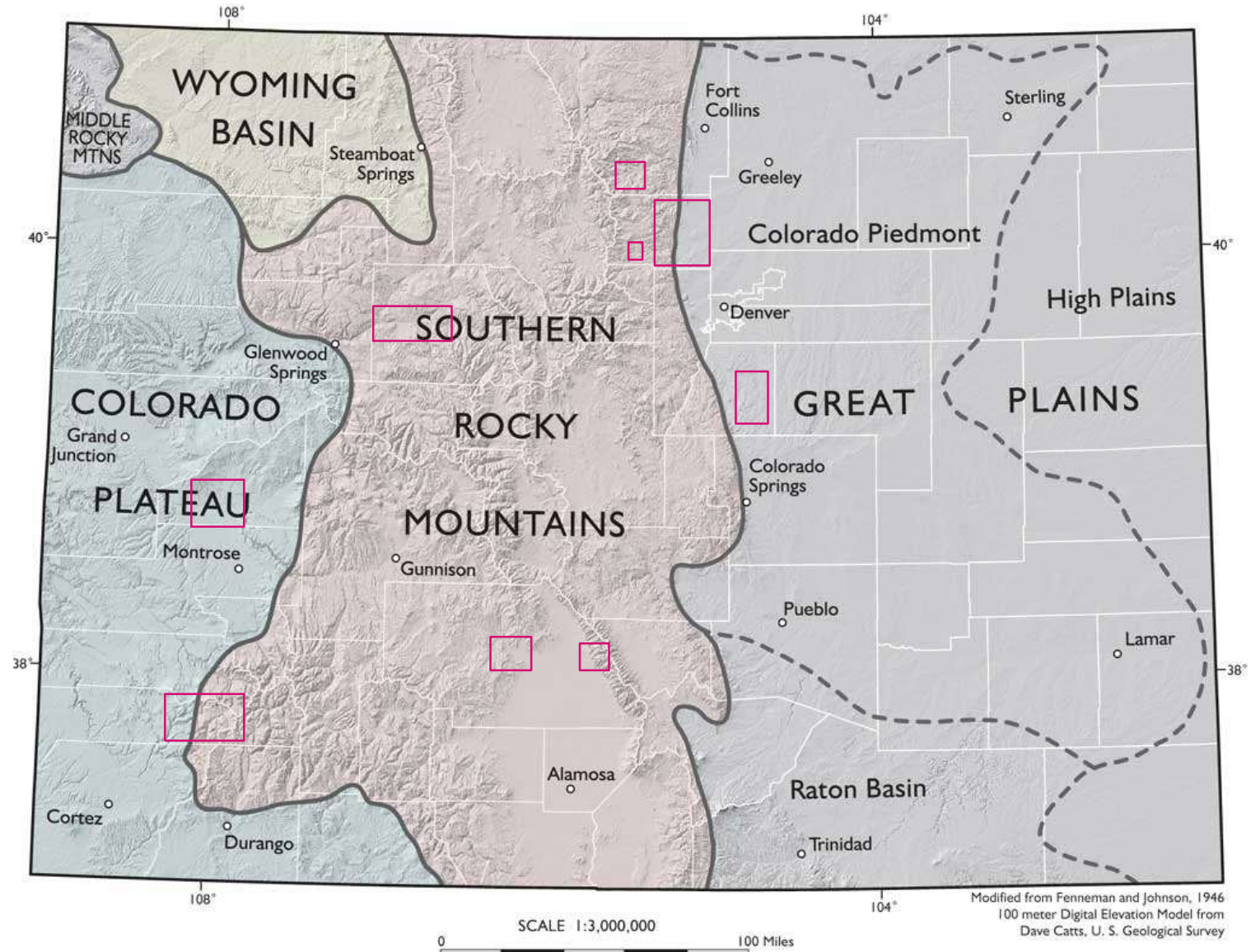


Estes Park, Larimer County, Colorado
Photo Credit: Town of Estes Park

FHZ PILOT PROGRAM

Provide funding to map fluvial hazard zones in eight diverse physio-regions of Colorado:

- San Miguel County
- Saguache County
- Eagle County
- Town of Estes Park
- City of Delta
- City of Castle Rock
- Town of Nederland
- Boulder County



PILOT PROGRAM PARTNERS



COLORADO

Colorado Water
Conservation Board

Department of Natural Resources



COLORADO

Department of Local Affairs



PILOT PROGRAM GOALS AND OBJECTIVES

Goal 1. Develop a scientifically defensible set of standards for Colorado.

Objectives: Determine through a piloted, field verified, and *peer-reviewed* approach an easily interpretable and *repeatable* methodology for identifying fluvial hazard zones across Colorado. It will be sensitive to the *variety* of geographies and hydro-climatologies within the state. When and where appropriate, we will leverage existing tools to support this objective. Where uncertainty exists within the methodology or within map products, we will define it and be transparent about it.



Big Thompson River, Larimer County, Colorado
Photo Credit: Katie Jagt

PILOT PROGRAM GOALS AND OBJECTIVES

Goal 2. Implement fluvial hazard mapping throughout Colorado.

Objectives: Select study areas to pilot the protocol in watersheds that are susceptible to fluvial erosion hazards, are undergoing or show signs of future growth, and are in communities that have shown an interest and commitment to implement more comprehensive hazard planning.



PILOT PROGRAM GOALS AND OBJECTIVES

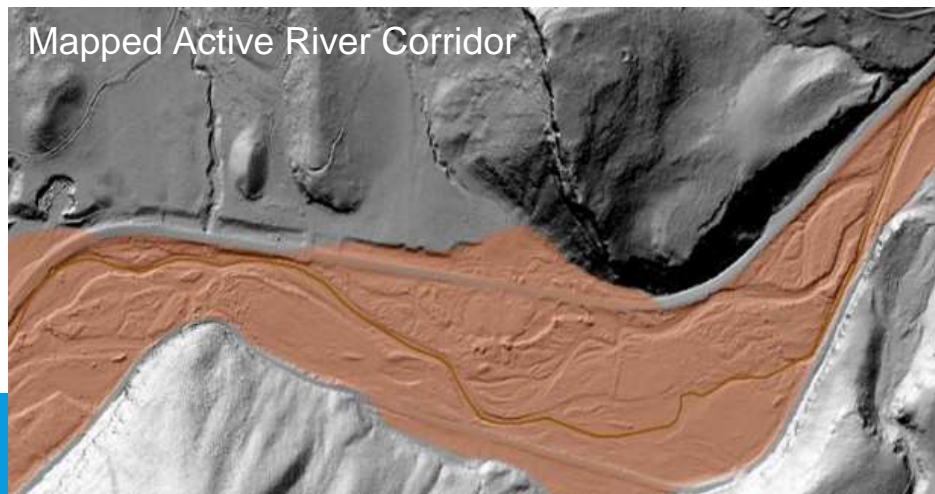
Goal 3. Reduce damage from future flood events by increasing awareness of fluvial (river-related) hazards thereby leading to better land use decisions.

Objectives: Develop a FHZ program that centers around a vetted and scientifically sound protocol and is supported by readily adoptable and easy to interpret communications. Promote natural processes as part of the FHZ mapping to assist communities in understanding that fluvial erosion and deposition processes are natural and fluvial hazards should be included in the discussions of 'flood hazards'. Produce additional information including but not limited to: scenarios for mitigation, resources for how and when to implement, an outline of roles and responsibilities of how communities can incorporate mapping into local planning and regulations, and model land use code(s) for voluntary local adoption.



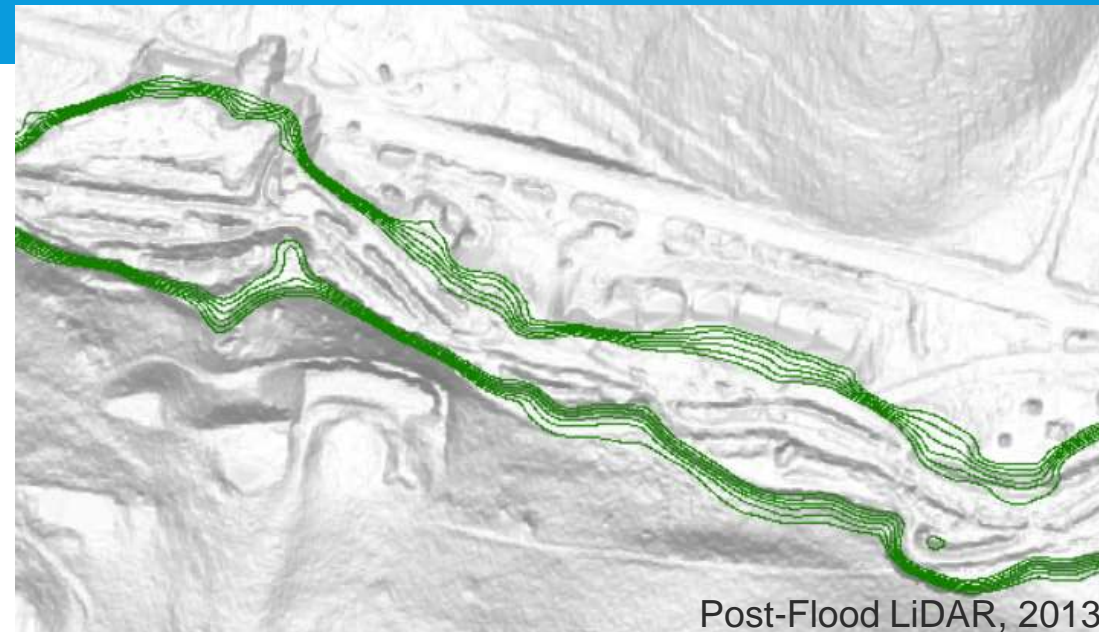
FHZ Components

The *active river corridor*, where the river has occupied in the past and is likely to occupy again in the future.





ARC DELINEATIONS USING AN REM



ARC DELINEATIONS USING AN REM



ARC DELINEATIONS IN OTHER SITUATIONS

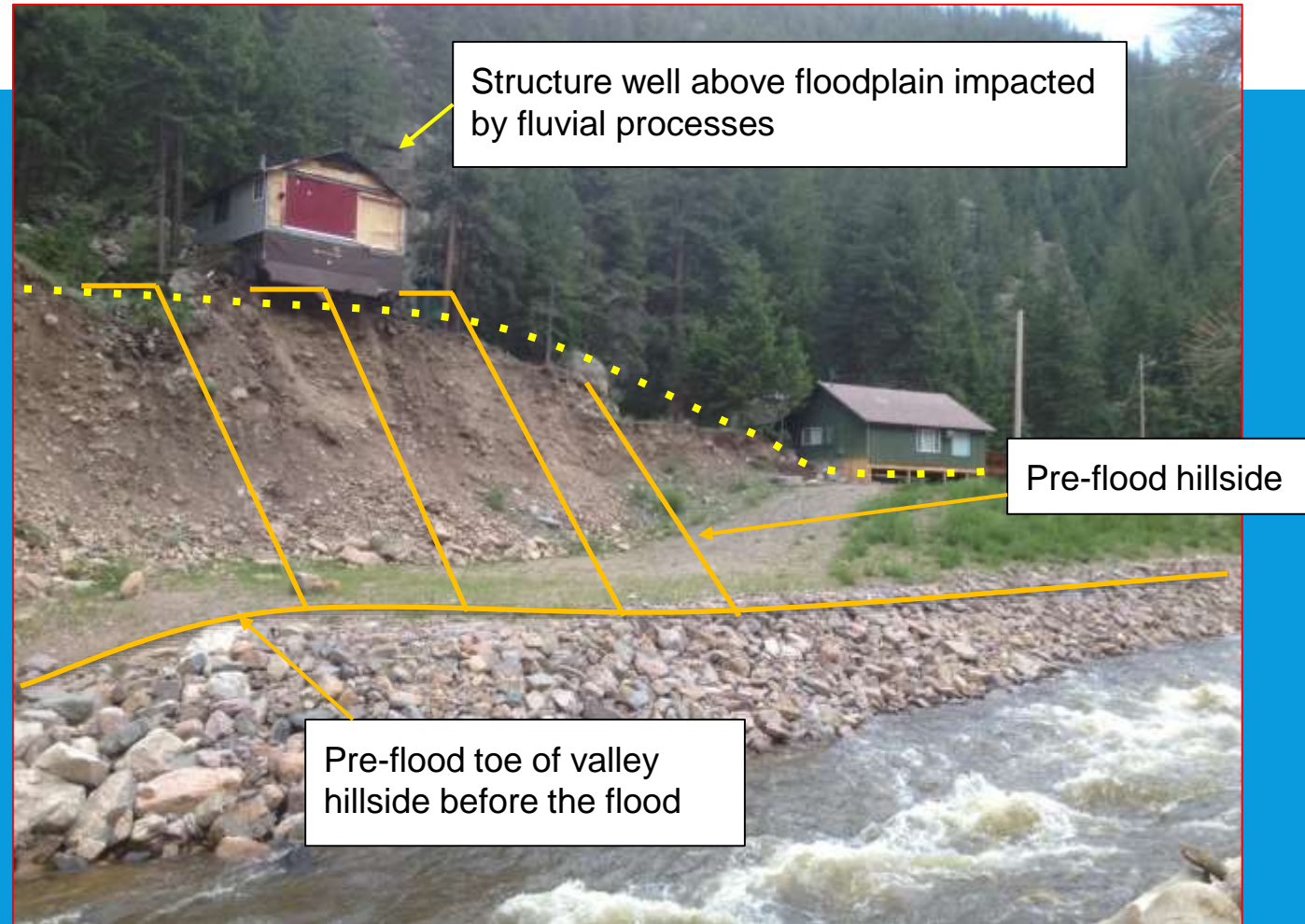
- Meander Beltwidth
- Headwaters
- Urban Areas
- Disconnected ARCs

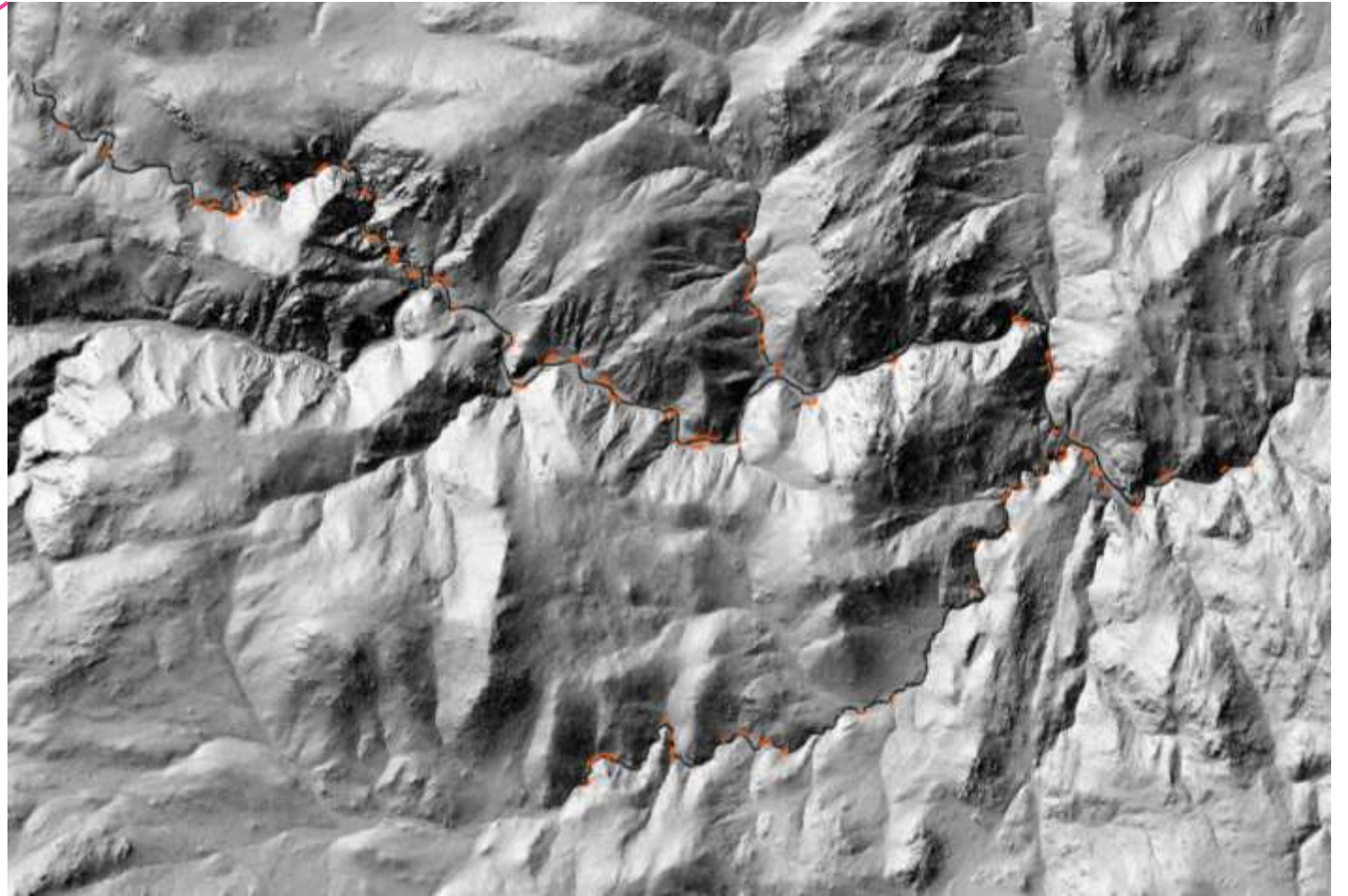
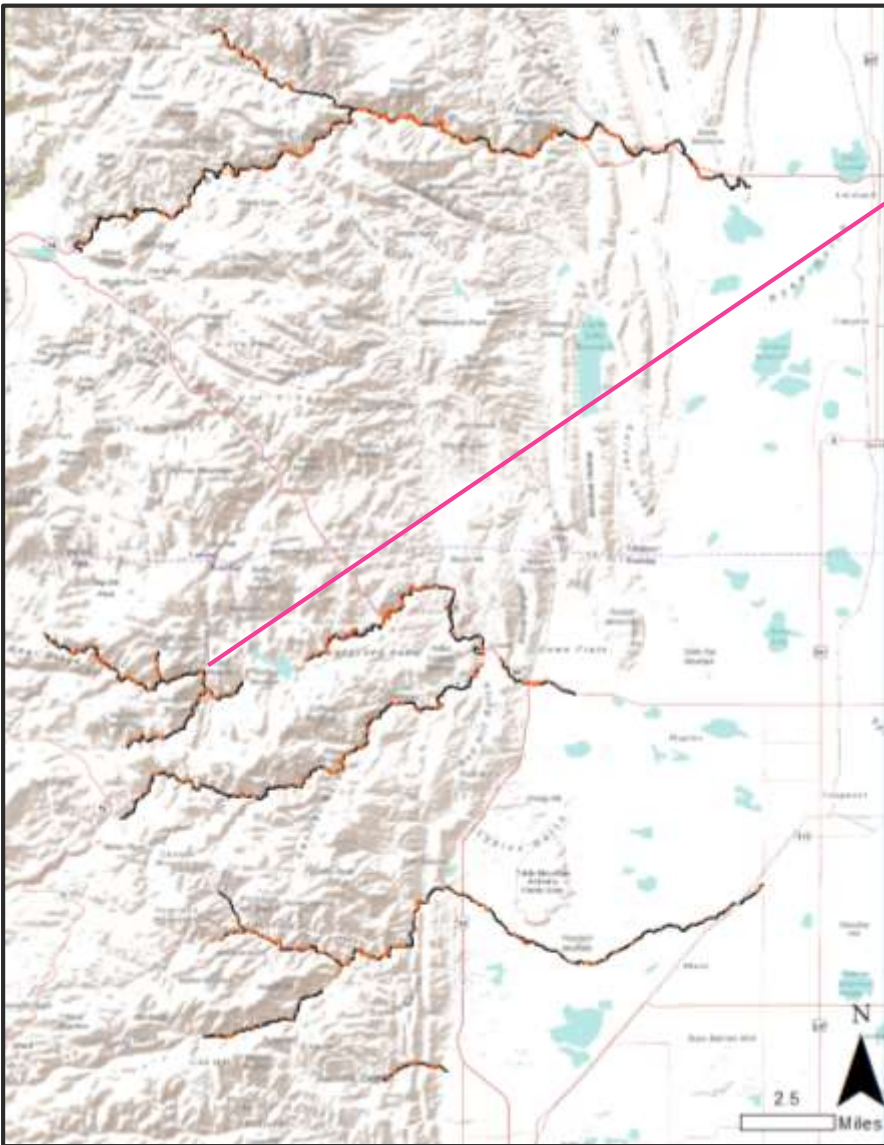


FHZ Components

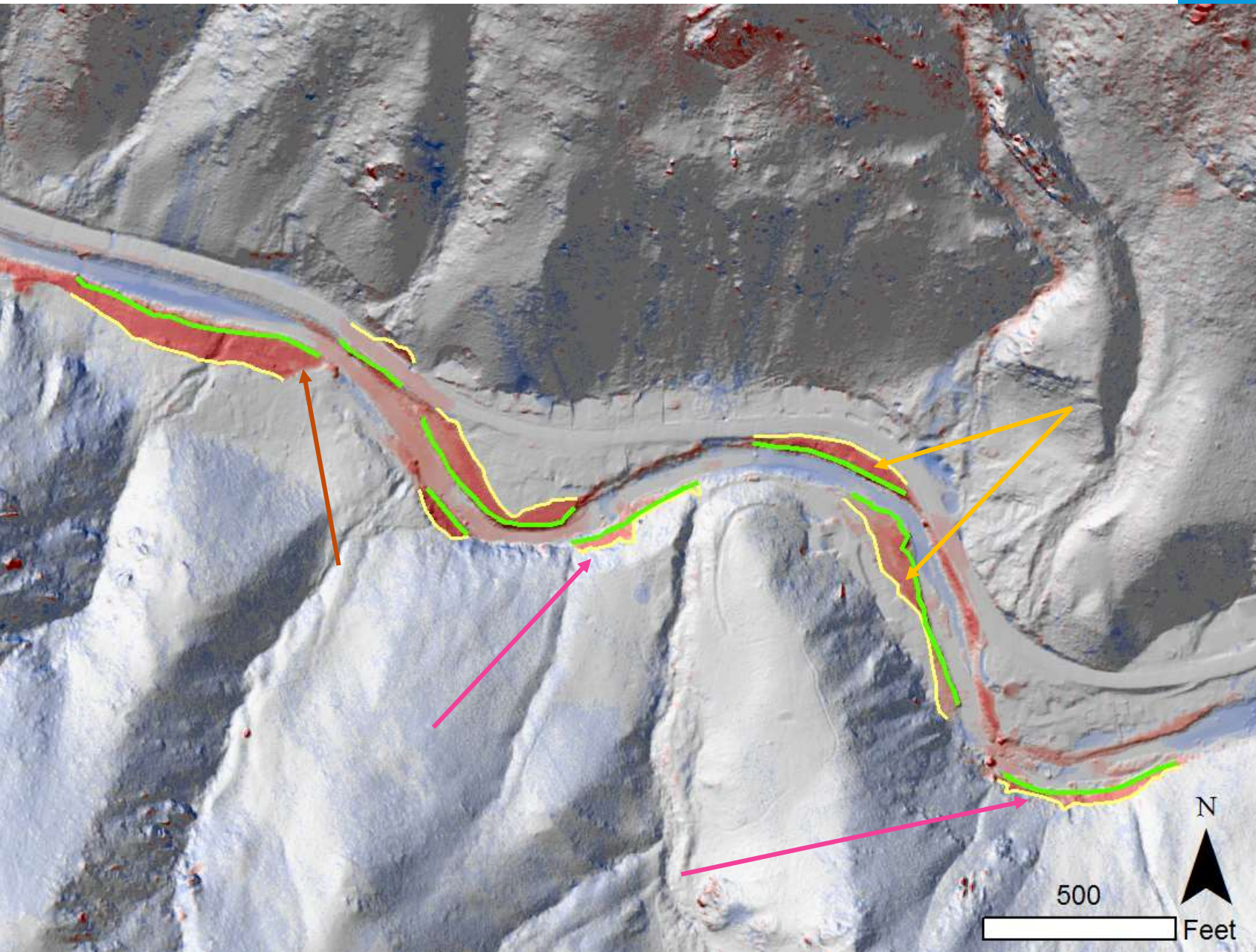
The erosion hazard buffer that generalizes the slope areas prone to erosion as a result of river lateral migration or toe erosion.

Erosion Hazard Zone extends back from active river corridor to account for the zone of influence imposed on valley side slopes due to undercutting by the river channel

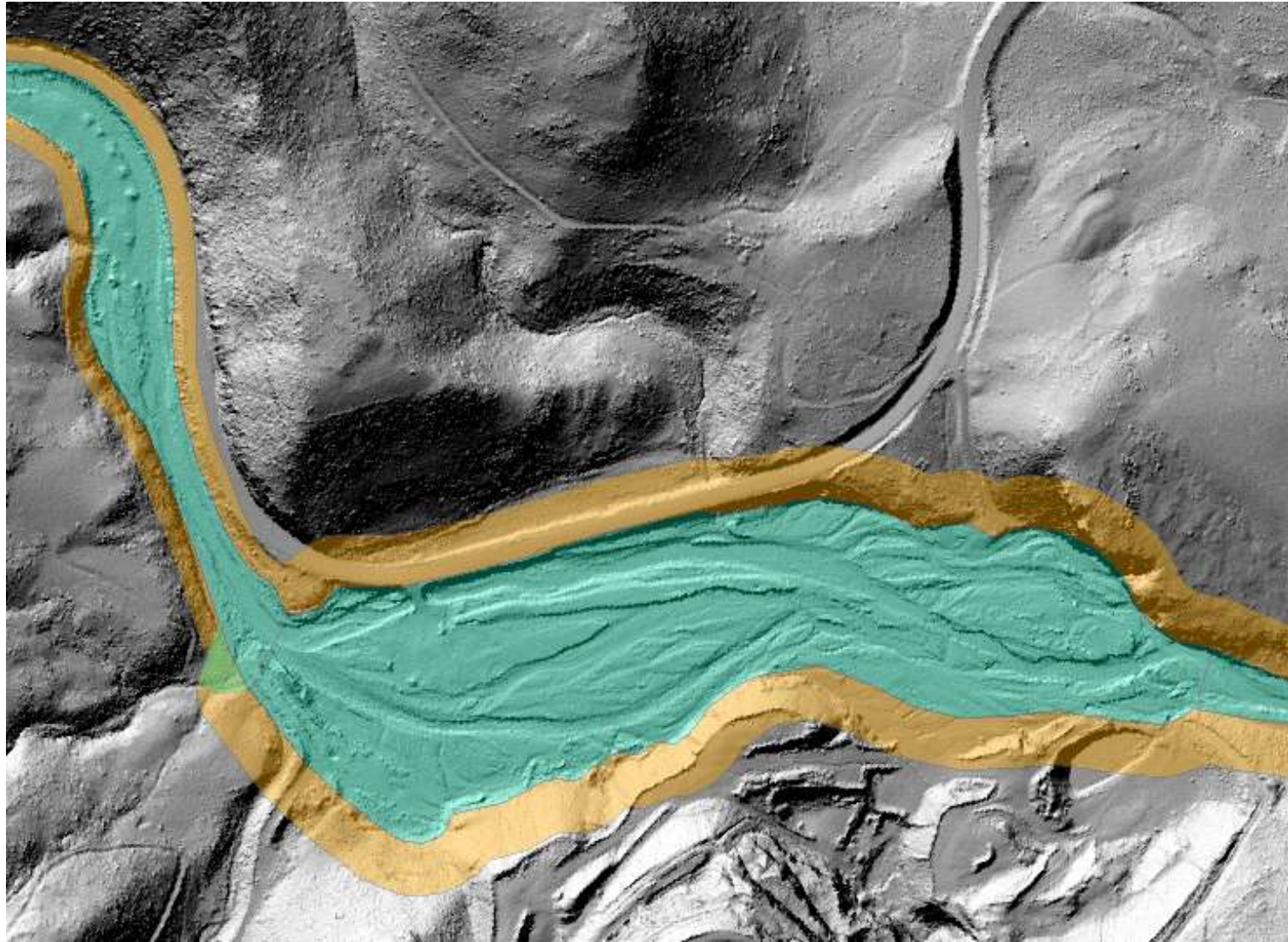




HILLSLOPE EROSION – 2013 FRONT RANGE FLOOD



MEASURING HILLSLOPE FAILURE



EROSION HAZARD BUFFER ADDED TO THE ARC

FHZ Components

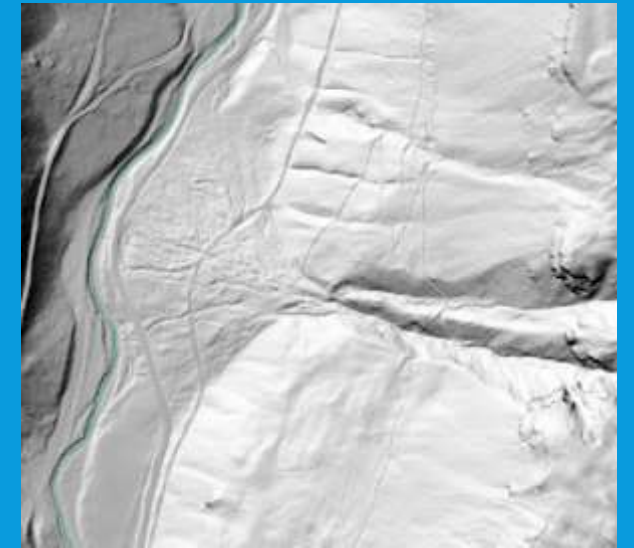
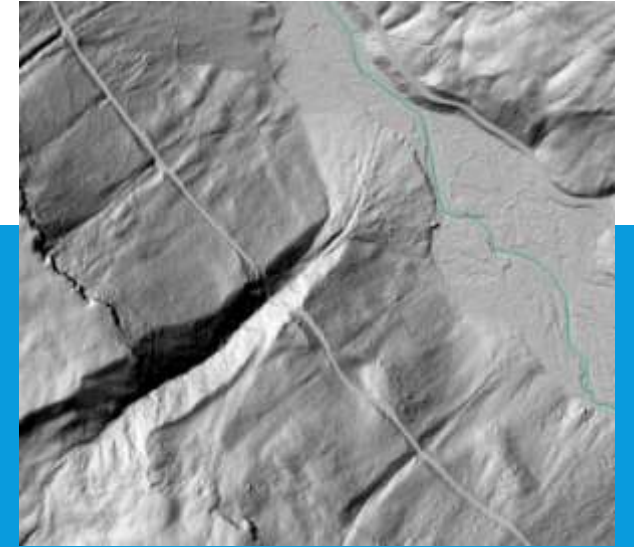
Channel avulsion zones are areas where the channel can dramatically change its position on the valley floor



FHZ Components

Debris Fans are depositional features that generally form at the transition from confined to unconfined reaches. An alluvial fan is highly susceptible to avulsion and bank erosion during all moderate to high flow events.

Fans can have primary and secondary effects on a river corridor.





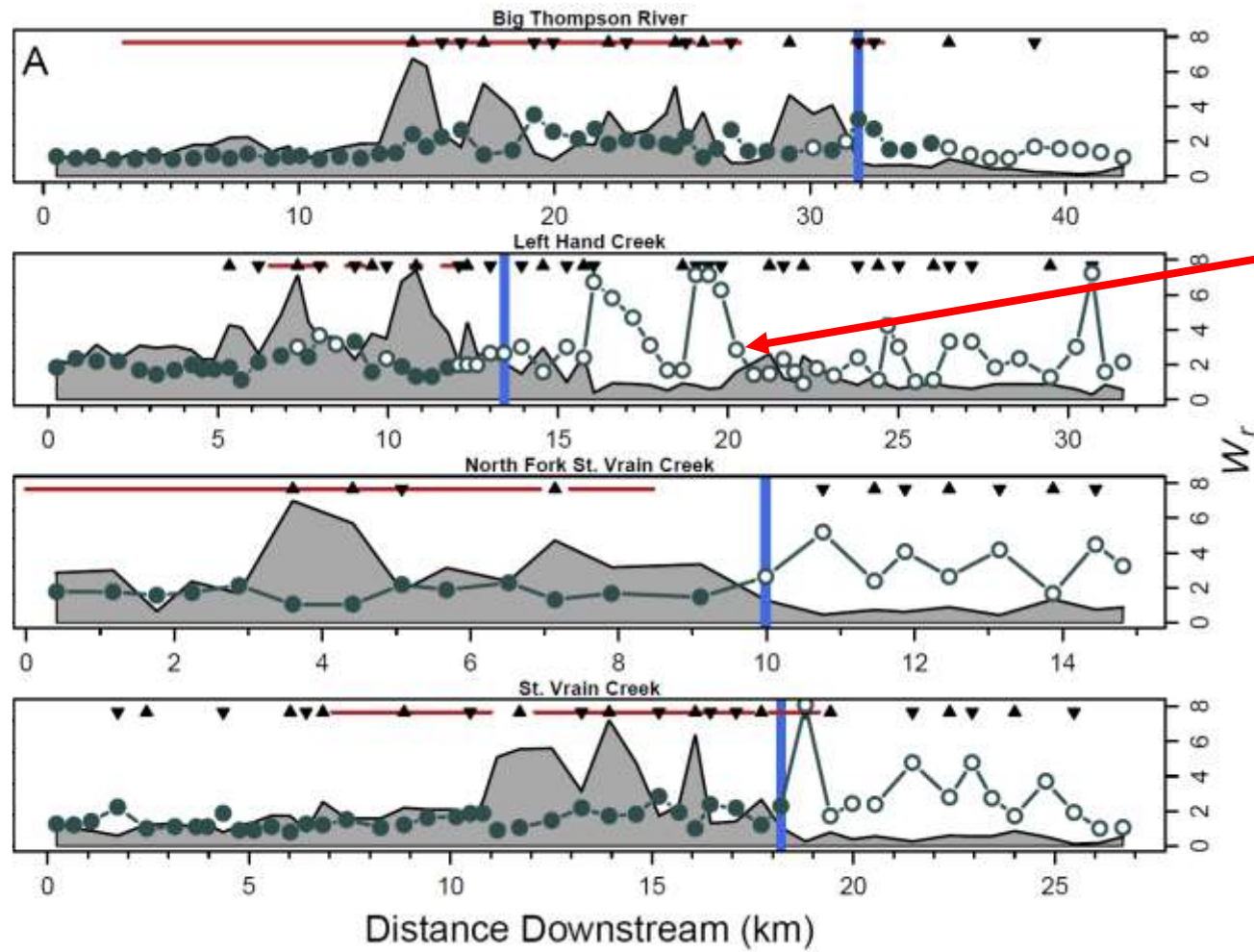
GO IN THE FIELD!



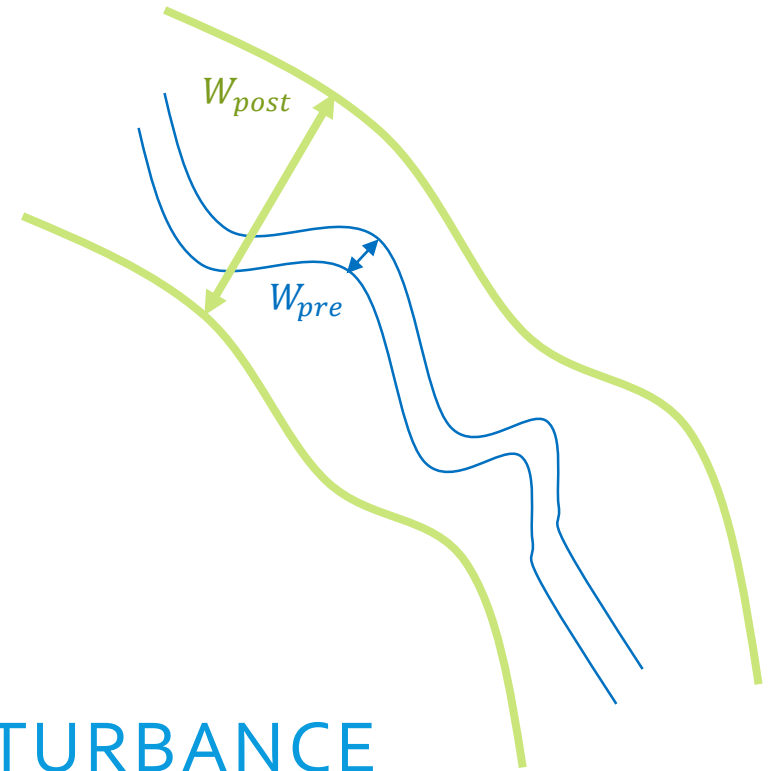
FIELD VERIFY—WHY?



USING DATA COLLECTED
AFTER THE FLOOD TO
VERIFY THE METHODS



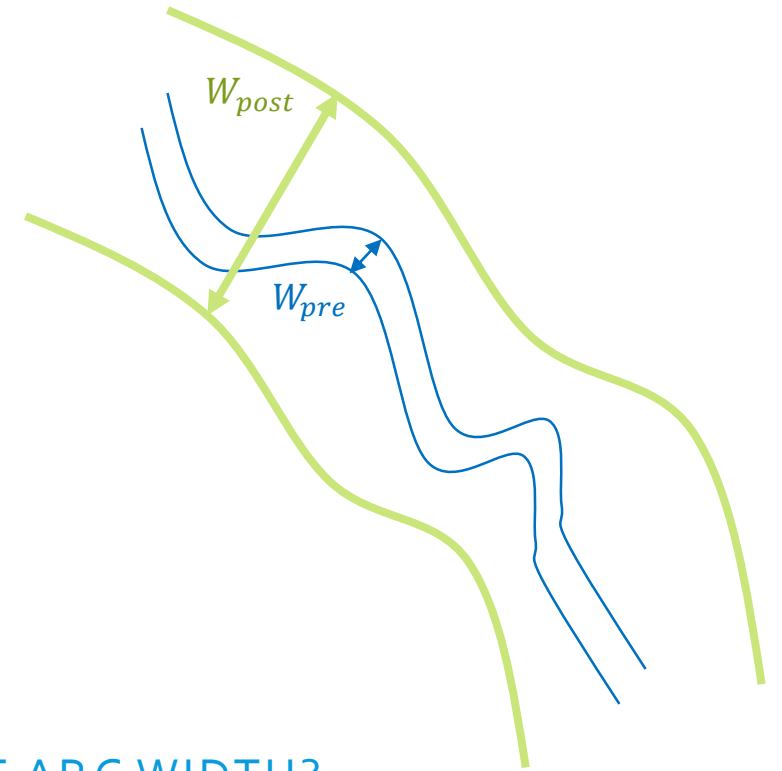
$$W_r = \frac{W_{post}}{W_{pre}}$$



MEASURED WIDTH OF FLUVIAL DISTURBANCE



$$W_r = \frac{W_{post}}{W_{pre}}$$



MEASURED WIDTH OF FLUVIAL DISTURBANCE → APPROXIMATE ARC WIDTH?

How Maps Might be Used

- Prevent community from investing services (e.g., schools, fire/rescue stations, water sanitation, etc.) In critical vulnerable areas.
- Provide information to landowners about existing risk
- Assist in transportation decisions where roads/rivers interact
- Inform land conservation planning
- Overlay in landuse or zoning





LIMITATIONS

Though this process constitutes a significant improvement to understanding fluvial hazards, it is understood the program does not and will not provide absolute safety or encompass all flood, geomorphic, and river-related hazards.

Complicating factors include the crossings and roadways, hillslope failures, future development and changing climatic conditions. Many opportunities to improve resiliency in

Colorado's river corridors are addressed by this project, and many still remain.

Secondary Benefits of Fluvial Hazard Mapping

Protection of river corridors for open space, recreation, critical wildlife habitat, flood control, water quality protection, *and the restoration of Colorado's wetlands - most of which had historically been located in riparian areas as a result of fluvial processes that scour depressions and abandon channels.*





COLORADO

Colorado Water
Conservation Board

Department of Natural Resources

Stephanie DiBetitto

Watershed & Flood Protection Section, CWCB
Community Assistance Program Coordinator

stephanie.dibetitto@state.co.us

303-866-3441 ext. 3221

Katie Jagt, PE, CFM

Senior Engineer/Geomorphologist

katiejagt@watershedscienceanddesign.com

720-526-2022

