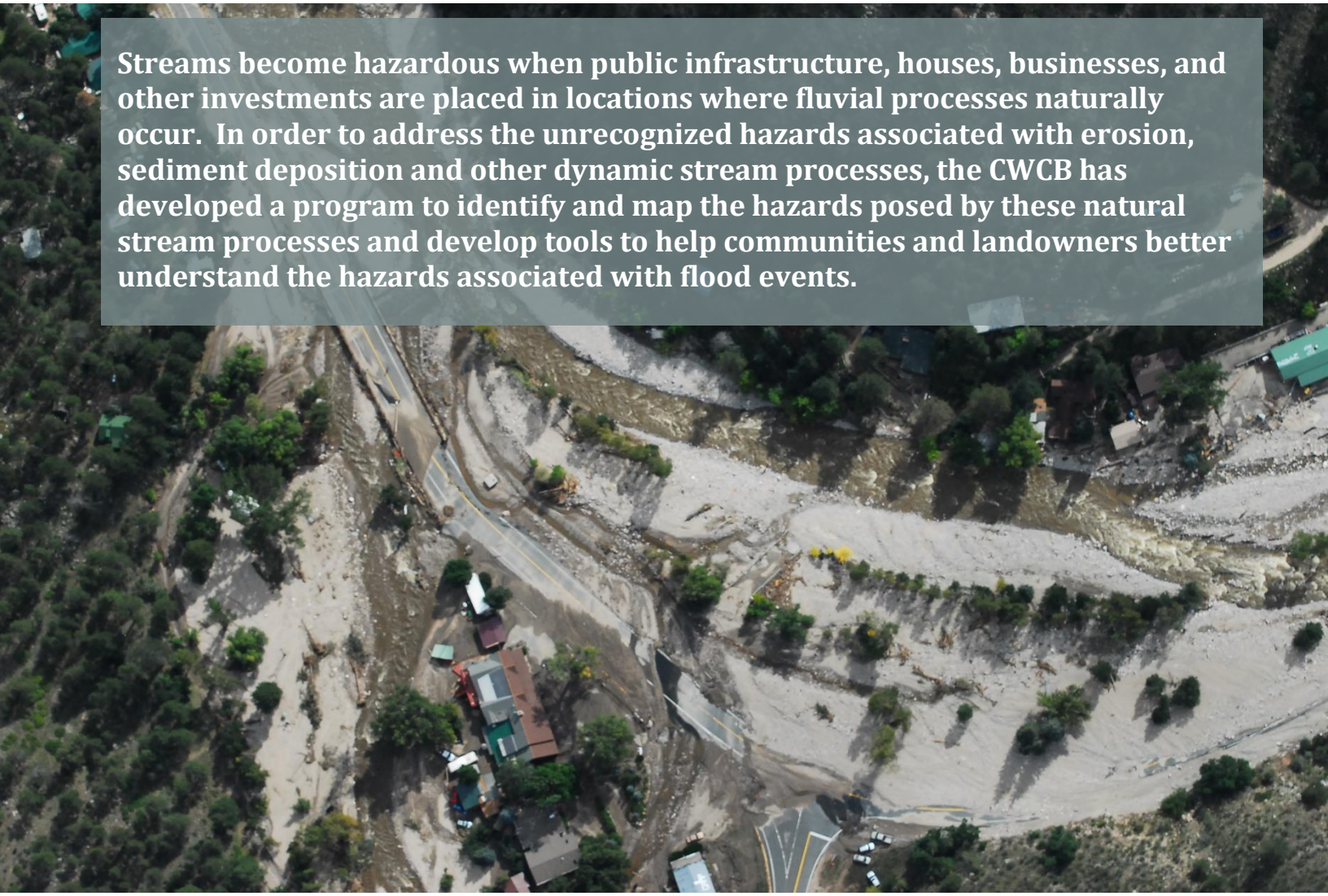
FLUVIAL HAZARD ZONE MAPPING



Streams become hazardous when public infrastructure, houses, businesses, and other investments are placed in locations where fluvial processes naturally occur. In order to address the unrecognized hazards associated with erosion, sediment deposition and other dynamic stream processes, the CWCB has developed a program to identify and map the hazards posed by these natural stream processes and develop tools to help communities and landowners better understand the hazards associated with flood events.

Fluvial hazard mapping is a component of the Colorado Hazard Mapping Program (CHAMP) effort underway by the Colorado Water Conservation Board in partnership with the Colorado Geological Survey, the Colorado Department of Local Affairs, and local governments. The CHAMP program is working toward effective long-term flood hazard reduction in Colorado through the development of Fluvial Hazard Zone mapping protocols and debris flow hazard assessments in combination with traditional floodplain mapping.

More information and FAQs about fluvial hazard zone mapping please visit:

www.ColoradoFHZ.com

FLUVIAL HAZARD ZONE

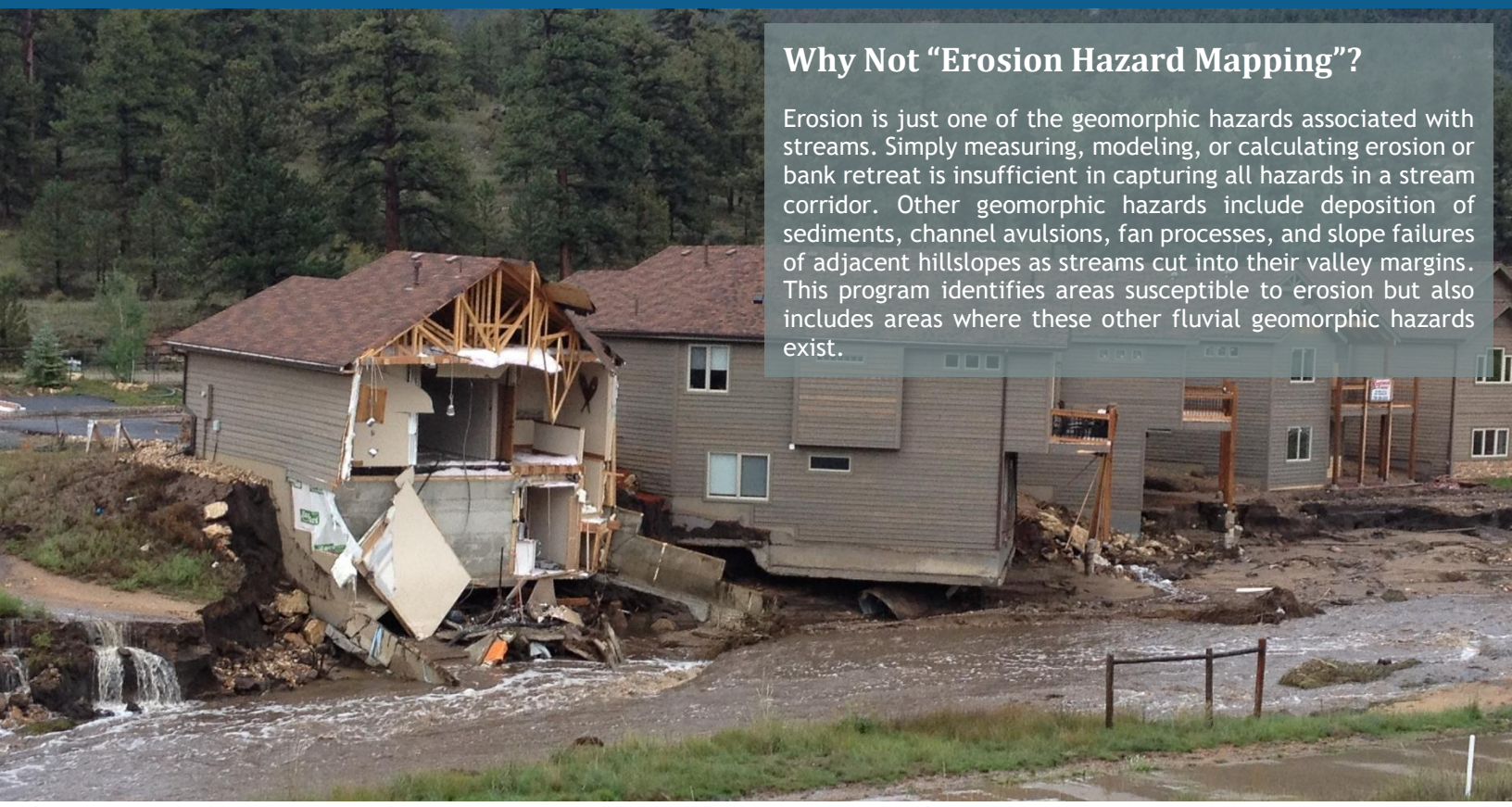
The Fluvial Hazard Zone (FHZ) is defined in the State of Colorado as the area a stream has occupied in recent history, may occupy, or may physically influence as the stream stores and transports water, sediment, and debris.

COLORADO FLUVIAL HAZARD ZONE

COLORADO Colorado Water Conservation Board Department of Natural Resources

Fluvial Hazard Zone mapping represents a significant and necessary step forward in identifying and addressing hazards posed by flood events. Flood hazard reduction, in the long-term, will be measured primarily by our ability to solve problems at the watershed and stream corridor scale, and secondarily by how we resolve conflicts at individual sites. From a physical standpoint, this means recognizing that streams transport and deposit water, sediment, and debris, and that streams are naturally dynamic systems prone to move.

Because streams and waterways do not follow political boundaries, preparation for flood-related fluvial hazards requires individual, local, regional, state and federal partnerships that can work across jurisdictional boundaries in watersheds to identify these areas and develop management policies that reduce long-term threats to life and property.



Why Not "Erosion Hazard Mapping"?

Erosion is just one of the geomorphic hazards associated with streams. Simply measuring, modeling, or calculating erosion or bank retreat is insufficient in capturing all hazards in a stream corridor. Other geomorphic hazards include deposition of sediments, channel avulsions, fan processes, and slope failures of adjacent hillslopes as streams cut into their valley margins. This program identifies areas susceptible to erosion but also includes areas where these other fluvial geomorphic hazards exist.

COLORADO FHZ PROGRAM GOALS AND OBJECTIVES

GOAL 1: DEVELOP A SCIENTIFICALLY DEFENSIBLE SET OF STANDARDS FOR COLORADO

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-climates within the state. When and where appropriate, we will leverage existing tools to support this objective. The program will identify uncertainty where it exists within the methodology or within map products.

GOAL 2: IMPLEMENT FLUVIAL HAZARD MAPPING THROUGHOUT COLORADO

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.

GOAL 3: REDUCE DAMAGE FROM FUTURE FLOOD EVENTS BY INCREASING AWARENESS OF FLUVIAL HAZARDS THEREBY LEADING TO BETTER LAND USE DECISIONS

Develop a program that centers around a vetted and scientifically sound protocol and is easy to interpret, is widely supported, and readily adoptable by communities. 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'.

ACCOUNTING FOR FLUVIAL PROCESSES

Flooding represents the most common natural disaster in the United States and results in significant property and infrastructure damage. Floods have resulted in 11 federal disaster declarations for Colorado with one or more major floods occurring every decade. Average ***annual*** flood losses in Colorado are estimated to be $83,000,000 in property damage based on data from 1911 to 2013 (inflation-adjusted 2013 dollars).

Historically, local governments have regulated stream corridors by relying on Federal Emergency Management Agency (FEMA) Guidance and Standards to create Flood Insurance Rate Maps (FIRMs) which are used to establish insurance premiums through the National Flood Insurance Program (NFIP). These maps are elevation-based, delineating ***only inundation*** hazards. These maps do not consider stream movement, the erosion of stream banks or hillslopes, or the impacts of sediment and debris deposition. As a result, properties located well above mapped floodplain elevations or outside FIRM floodplain boundaries may be affected by flood processes not accounted for in standard floodplain mapping.

Since 1978, approximately 49% of all NFIP claims in Colorado have come from policies written outside the high-risk area depicted on the FEMA FIRMs. The 2013 Colorado Front Range flood resulted in 52% of flood insurance claims originating outside of regulatory floodplains (personal communication Diana Herrera, FEMA Region 8) demonstrating that reliance on flood inundation maps alone does not provide a complete picture of flood hazards.

All streams are dynamic, and when floods occur or after wildfires burn their watersheds, they are prone to dramatically alter their size, shape and location. If not properly planned for, these natural processes of erosion and deposition can cause considerable damage to infrastructure, agriculture, and residential property as well as endanger lives.

In order to better understand, plan for, and communicate fluvial hazards, some Colorado communities are choosing to map the Fluvial Hazard Zone (FHZ) - the area a stream has occupied in recent history, may occupy, or may physically influence as it stores and transports water, sediment, and debris. FHZs are mapped primarily by fluvial geomorphologists through the interpretation of topographic, geologic, and geomorphic information (i.e., data that describes the physical location, form, and active sediment and debris transport processes of a riverine system).

Flood damage in Jamestown in 1969 demonstrate fluvial hazards inherent to James Creek and many of Colorado's communities. Jamestown also experienced devastating flooding in 1913 and 2013. Image courtesy of the Carnegie Branch Library/Boulder Historical Society.

Until recently, stream and flood management has largely focused solely on water: where it is expected to move during a flood and how to avoid or mitigate flooding through engineering means. However, streams transport more than just water. Streams gather, store, and move water, sediment and debris. Most of the time these processes are hardly noticeable but sometimes, especially during a flood event, erosion and deposition can happen rapidly, resulting in movement of the stream channel into new locations, bank retreat, and hill slope failures. This dynamism is innate to a stream. The resulting landscapes created by moving streams, scientists have found, have positive impact on the ecology and function of a stream corridor through the creation of new channels, wetlands, and riparian habitats.

FLUVIAL HAZARDS vs. FLOOD INUNDATION

FLUVIAL HAZARD ZONE MAPS (FHZ)

- Maps identify where a stream or river may move or may cause damage during a flood (e.g., erode a high bank and undermine a structure or deposit sediment and debris).
- Maps shows susceptibility rather than probability.
- Are separate and different than FIRMs but may use information from FIRMs to inform their extent.
- Use a variety of data and methods including high resolution topographic data (i.e., LiDAR), geologic and soils maps, and field verification.
- Assumes that stream dimensions change during a flood event and that flows are transporting sediment and debris.
- Rely on fluvial geomorphic (stream form and process) expertise to interpret landforms within the floodplain and along a stream.
- Do not affect flood insurance rates, though those with structures within the FHZ are encouraged to purchase flood insurance.
- Regulation, if any, is determined by local communities.
- Non-Federally regulated product.

FLOOD INSURANCE RATE MAPS (FIRMs)

- Map areas of flood water inundation.
- Correspond to only one estimated peak flow.
- Use a variety of data and methods to map flood surface elevations and extent. This may include historic flood data, rainfall data, topographic data (i.e., LiDAR and field surveys), along with computer models that calculate results for hydraulic equations.
- Rules for map development are set by the federal government via FEMA.
- Assumes a static stream system with no changes to a stream's shape through the duration of a flood.
- Developed with methods that typically do not account for the transport of sediment or debris.
- Are typically made by engineers with experience in hydrologic (rainfall and watershed) and hydraulic (stream channel and floodplain) computer modeling.
- Maps are part of the National Flood Insurance Program (NFIP) and used to determine where flood insurance is required and what rates apply.
- Federally and state-regulated product (for community participation in the NFIP).