

Boulder Creek Watersheds Pre-Fire Sediment Study



Goal

Pre-identify areas that are natural sediment deposition areas. Physically, these areas act as energy and sediment "sponges" during floods and after rain on burn scars. Then we can:

- 1) Target the areas for protection and/or stream and meadow restoration to further enhance their sponge characteristics.
- 2) Provide incentives to direct investment, development, and infrastructure into safer areas to increase community resiliency and reduce damage from future disturbances.
- 3) Identify watersheds that have limited amounts of these natural sponges between the potential burn areas and sensitive infrastructure and preferentially target those for forest health/wildfire mitigation practices.



Photo Credit: Katie Jagt, Hayden Pass fire



Pre-fire Planning Study

Identify watershed sediment sources.



Identify natural depositional areas.



Assess which depositional areas are between sediment sources and critical infrastructure/development.



Assess the existing functionality of the depositional areas to slow and spread flows and trigger sediment storage.



Assess which areas with major sediment sources do not have depositional areas between them and critical infrastructure.

Pre-fire Management Actions



If good, target areas for preservation or conservation.
If lacking, target area for rehabilitation or restoration.



Target area for forest health practices or thinning to reduce burn severity.



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Blue-Green Infrastructure: Natural Depositional Area



Photo Credit: Katie Jagt, Garfield County

Conceptual Understanding of Sediment in a Watershed



Source



Transport



Deposition



Wildfires impact both the sediment source characteristics of the watershed and the sediment transport characteristics of the channel. Sediment that enters into a stream corridor is either stored in the channel or on the floodplain or transported downstream where it may cause problems as it encounters homes, bridges, roadways, and water storage and supply systems.

Photo Credit: Katie Jagt, Calwood Fire

Conceptual Understanding of Sediment Supply in a Watershed

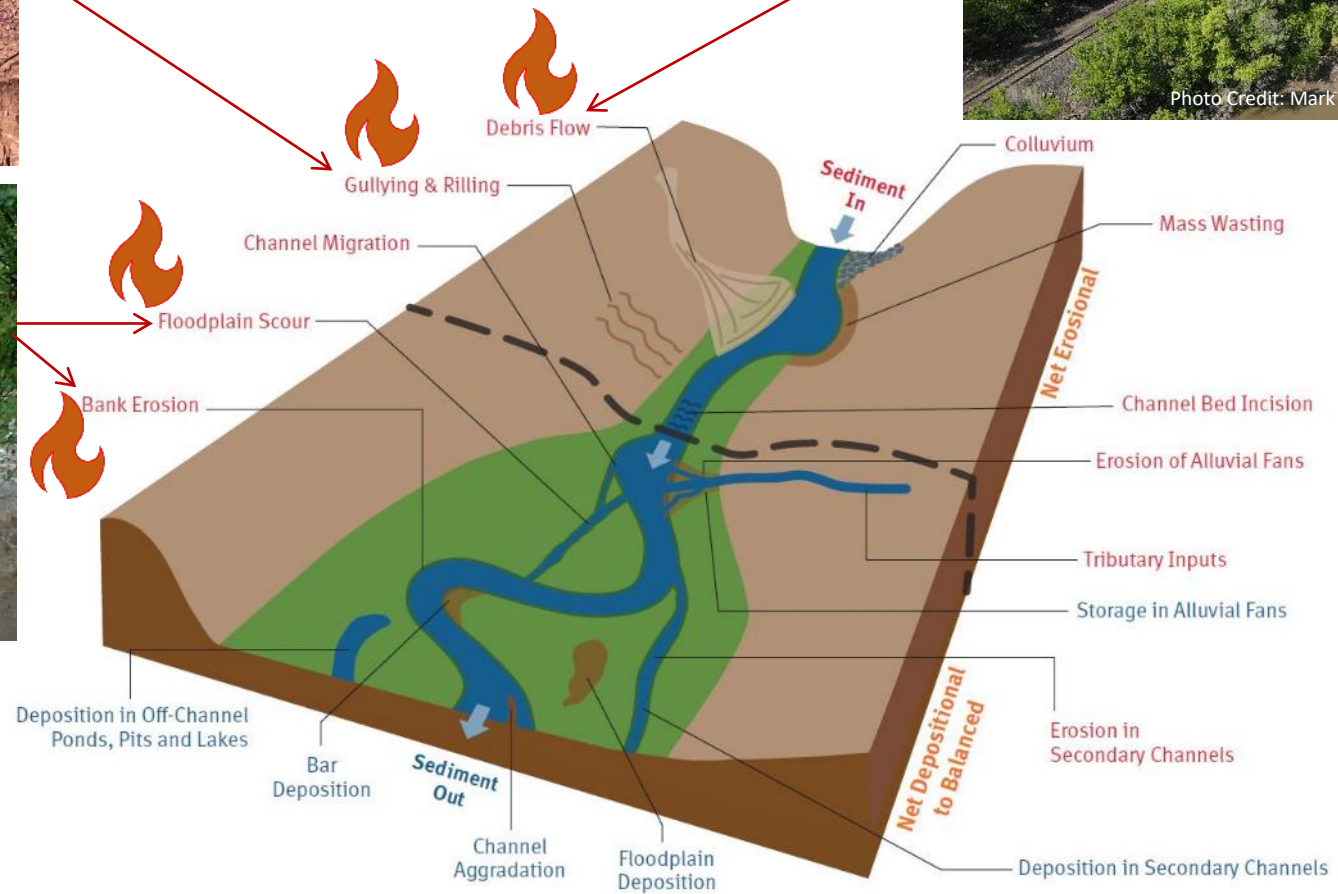
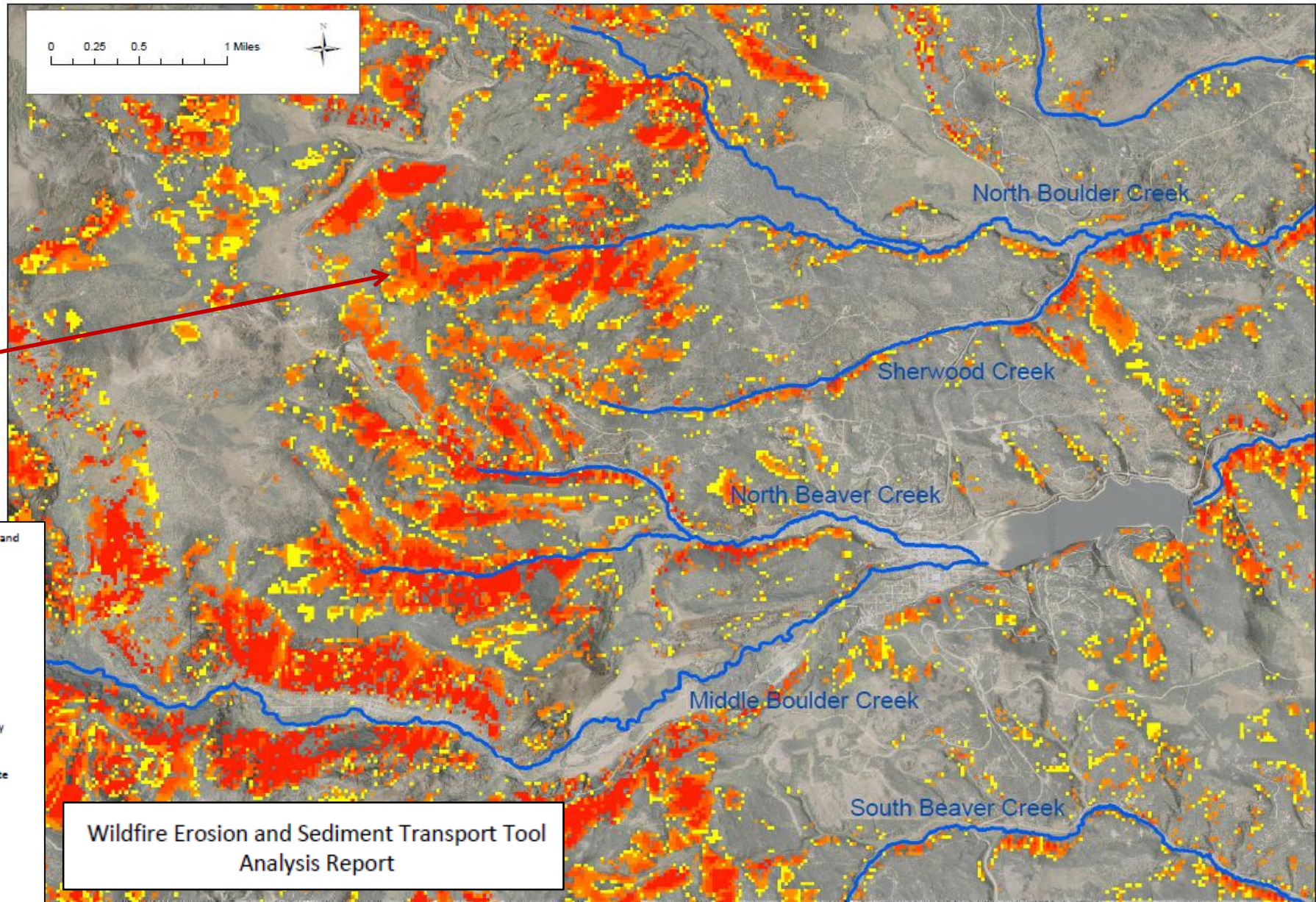


Figure from the 2020 CWCB Fluvial Hazard Zone Delineation Protocol v1.0

Surface Processes



Photo Credit: USGS, Buffalo Creek Fire



This document provides background information on the City of Boulder Wildfire Erosion and Sediment Transport Tool (WESTT) and analyses to inform wildfire preparedness efforts.

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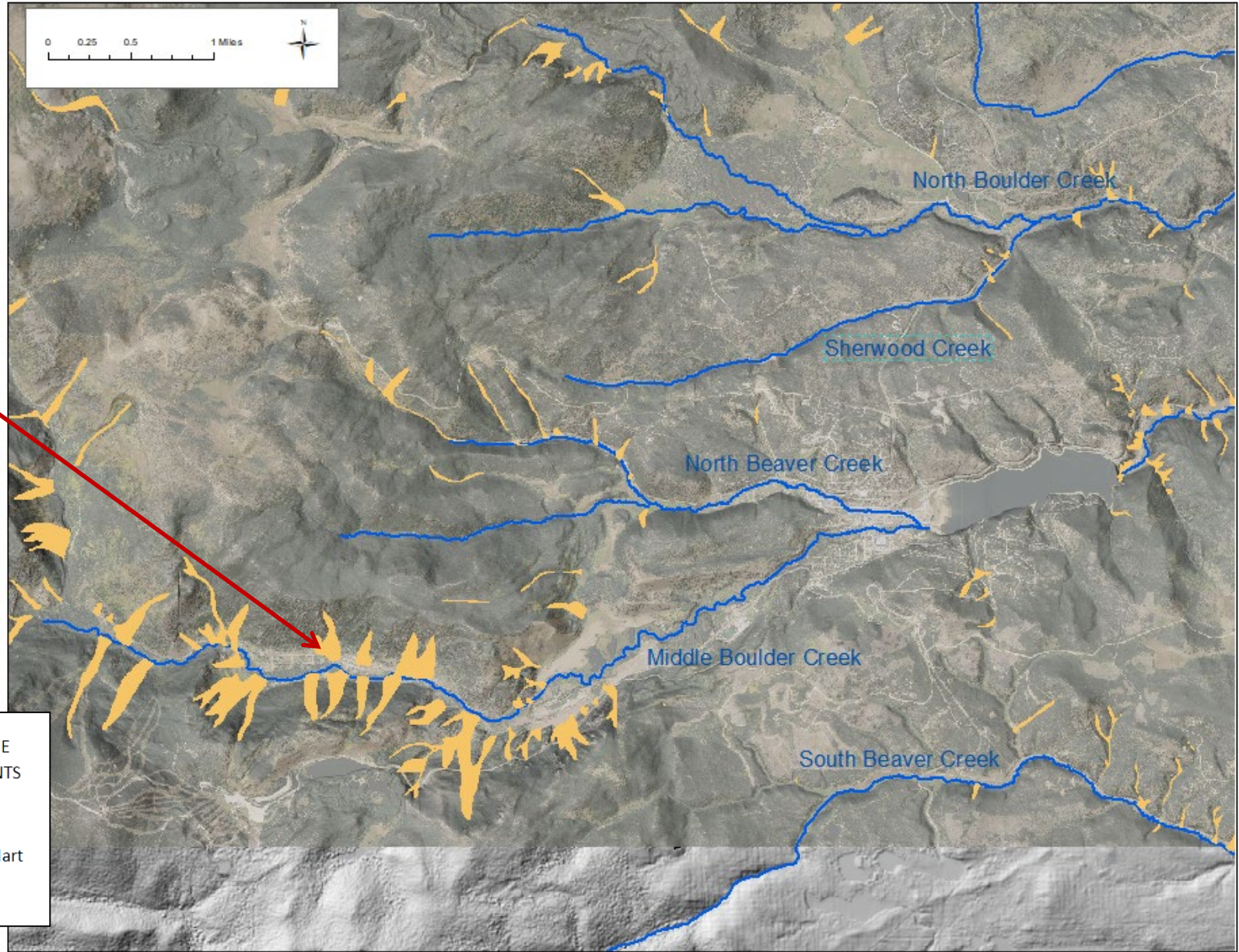


Wildfire Erosion and Sediment Transport Tool
Analysis Report

Debris Flow Processes



Photo Credit: Mark Weinhold, USFS, Grizzly Peak Fire



FOOTHILL AND MOUNTAINOUS REGIONS IN BOULDER COUNTY, COLORADO THAT MAY BE SUSCEPTIBLE TO EARTH AND DEBRIS/MUD FLOWS DURING EXTREME PRECIPITATION EVENTS

by

Matthew L. Morgan, Jonathan L. White, F. Scot Fitzgerald, Karen A. Berry, and Stephen S. Hart

CGS Open-file Report 14-02

Channel and Floodplain Scour



Transport and Deposition



Figure and text from the 2020 CWCB
Fluvial Hazard Zone Delineation
Protocol v1.0

SEDIMENT CONTINUITY AND STREAM POWER – A CONCEPTUAL MODEL

The capacity of a flow to transport sediment in a stream corridor can be quantified in relative, and highly simplified, terms by stream power (Ω) evaluated along an alluvial, or self-adjusting, reach:

$$\Omega = \gamma QS$$

where γ is the specific weight of water, Q is the discharge rate (e.g., peak discharge), and where S is the water surface slope, which, during floods, can be approximated by the valley slope. (Lammers and Bledsoe, 2018).

Landscape Analysis Results

Active Stream Corridor (high hazard zone)

Natural depositional areas

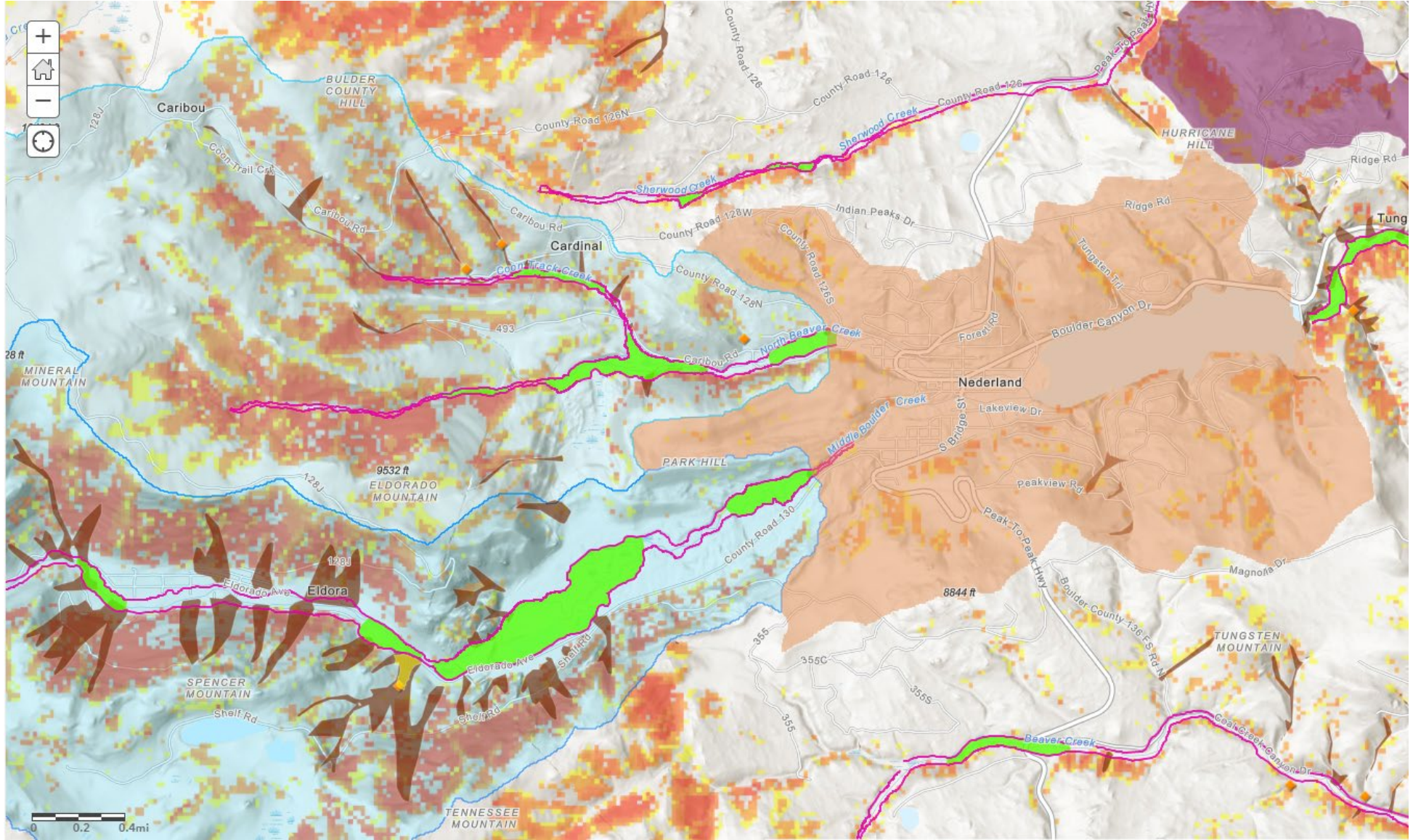
Areas with high hillslope erosion

Debris flow paths

Previous Wildfire Burn

Areas that drain to at least one "sponge"

Areas that drain directly to infrastructure (no sponges present)



Rapid Depositional Zone Functionality

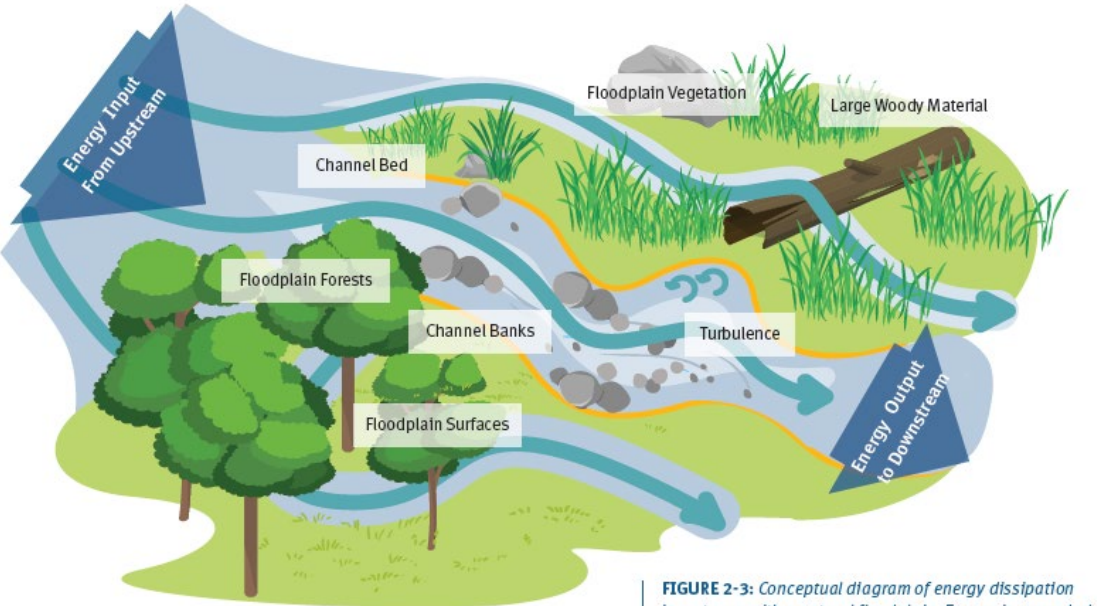


FIGURE 2-3: Conceptual diagram of energy dissipation in a stream with a natural floodplain. Energy is expended on the features shown in the white boxes.

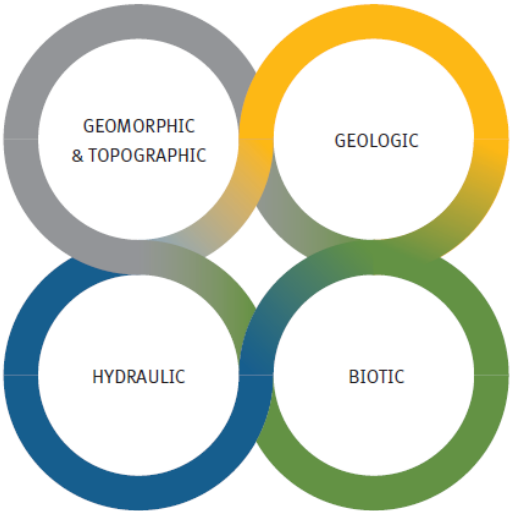
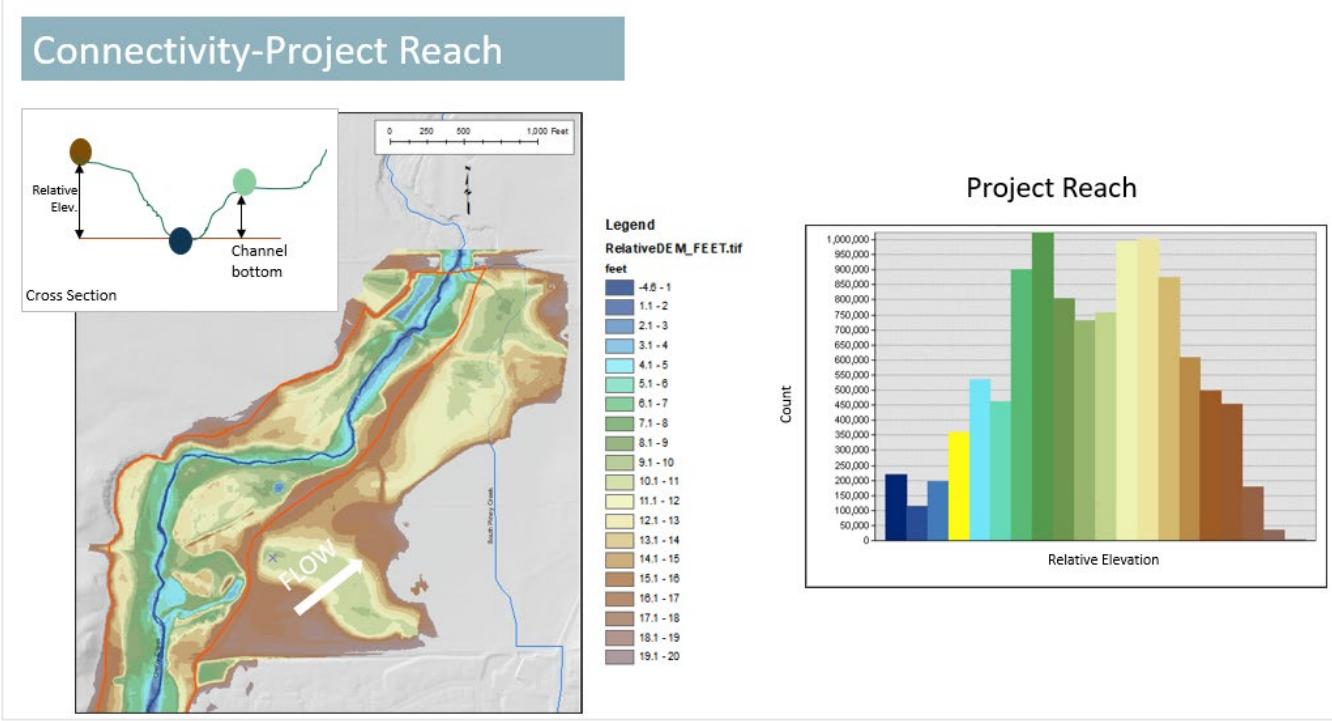


FIGURE 4-3: Geomorphic floodplains are delineated using data that is interwoven, not hierarchical.



Figures from the 2020 CWCB Fluvial Hazard Zone Delineation Protocol v1.0



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Pre-fire Management Actions



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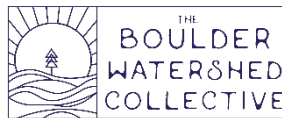
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Target area for forest health practices or thinning to reduce burn severity.



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Results and Example Potential Management Actions

-  Active Stream Corridor (high hazard zone)
-  Natural depositional areas
-  Areas with high hillslope erosion
-  Debris flow paths
-  Previous Wildfire Burn
-  Areas that drain to at least one "sponge"
-  Area that drains directly to reservoir (no sponges present)

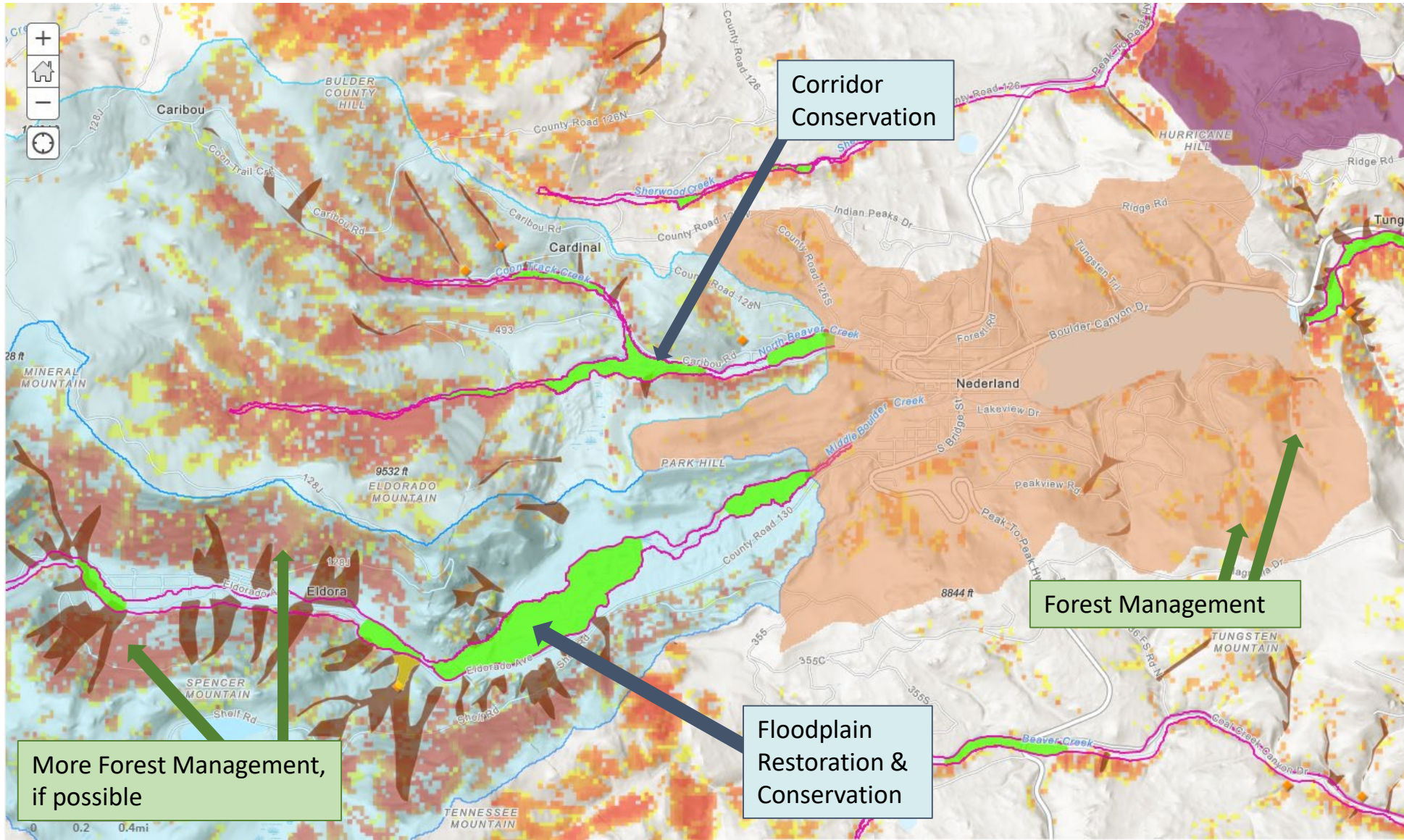




Photo Credit: USFS/USGS, Cameron Peak Fire

Photo Credit: Chris Sturm, Cameron Peak Fire



Photo Credit: Katie Jagt, Calwood Fire

Boulder Creek Watersheds Pre-Fire Sediment Study



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Photo Credit, Malachi Brooks, Calwood fire



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