

WILDFIRE READY WATERSHEDS

STATEWIDE POST-FIRE SUCEPTIBILITY

Program Update July, 2022



COLORADO

Colorado Water
Conservation Board

Department of Natural Resources



Wildfire Ready Watersheds

MISSION

The CWCB will assess the susceptibility of Colorado's water resources, communities and critical infrastructure to post-wildfire impacts and advance a framework for communities to plan and implement mitigation strategies to minimize these impacts – before wildfires occur.

Legislative directive from SB21-240



Wildfire Ready Watersheds

COMPONENTS

**STATEWIDE
SUSCEPTIBILITY**

**FRAMEWORK
FOR
COMMUNITIES**



Wildfire Ready Watersheds

POST-FIRE IMPACTS



**IMMEDIATE
IMPACTS**

**POST-FIRE
IMPACTS**

Threats to Life and Infrastructure



Threats to Water Resources



Threats to Water Quality





CONCEPTUAL APPROACH

Values at Risk

- Water Infrastructure
- Public Infrastructure
- Property
- Life Safety



Post-Fire Hazards

- Floods After Fire
- Fluvial Hazards: Channel migration, erosion, and deposition
- Mud & Debris flows
- Water Quality Impairments
- Hillslope erosion



Susceptibility

- Statewide Level
 - *Relative Risk by Watershed*
- Framework
 - *Direct Intersects*



Wildfire Ready Watersheds

VALUES AT RISK

Reservoirs and Dams

Municipal Water Intakes

Ag Water Infrastructure

Transportation Network

Life and Property

HAZARDS

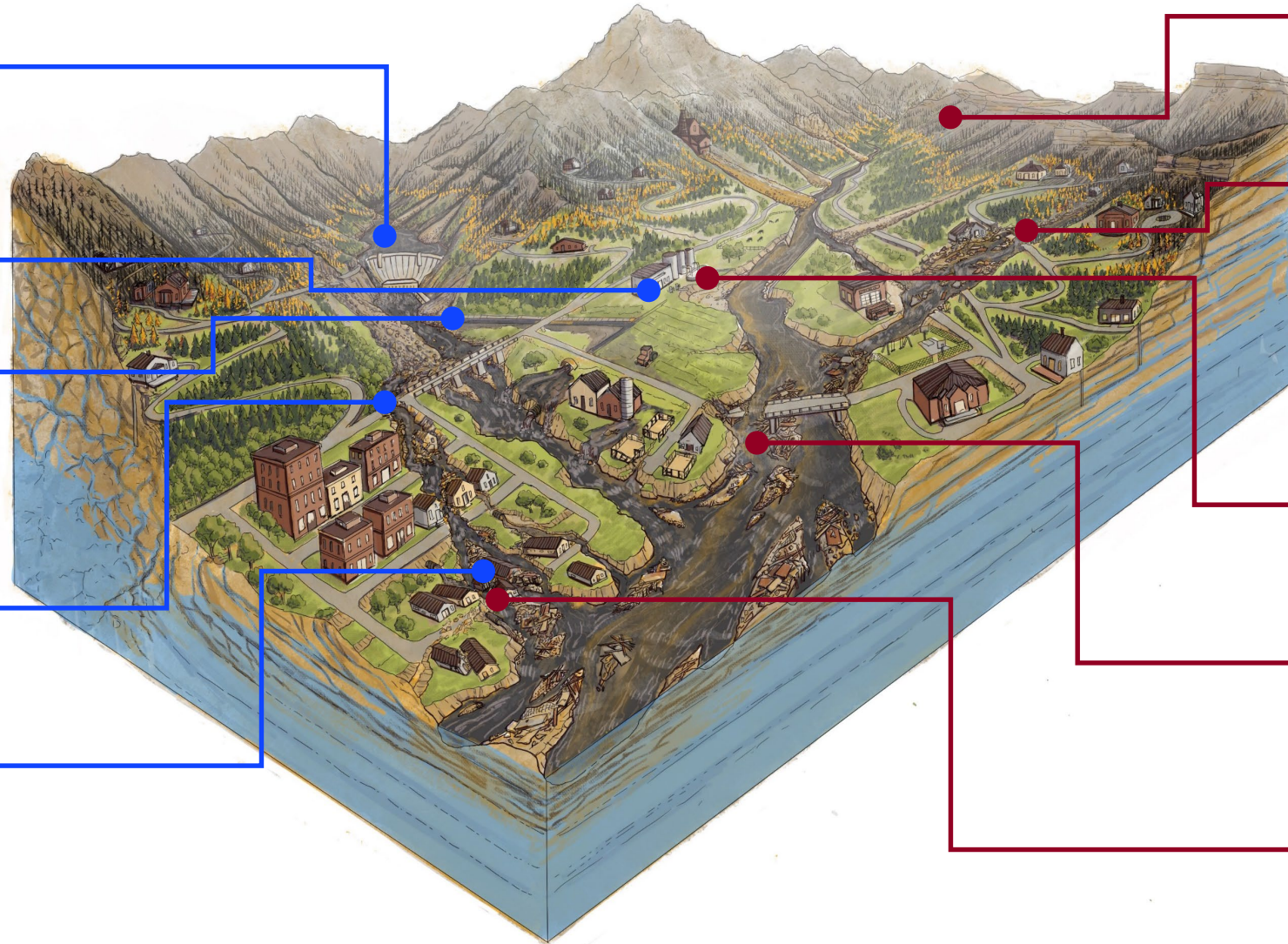
Hillslope Erosion

Debris and Mud Flows

Water Quality Degradation

Riverine Erosion & Sedimentation

Flooding





Wildfire Ready Watersheds

SUSCEPTIBILITY

PART 1: IDENTIFICATION OF VALUES AND ASSETS

WATER INFRASTRUCTURE

LIFE & PROPERTY

**BUILT WATER
INFRASTRUCTURE**

BUILDINGS

SOURCEWATER

CRITICAL FACILITIES

**HABITAT AND
CONSERVATION AREAS**

**TRANSPORTATION
INFRASTRUCTURE**





Wildfire Ready Watersheds

VALUES AT RISK

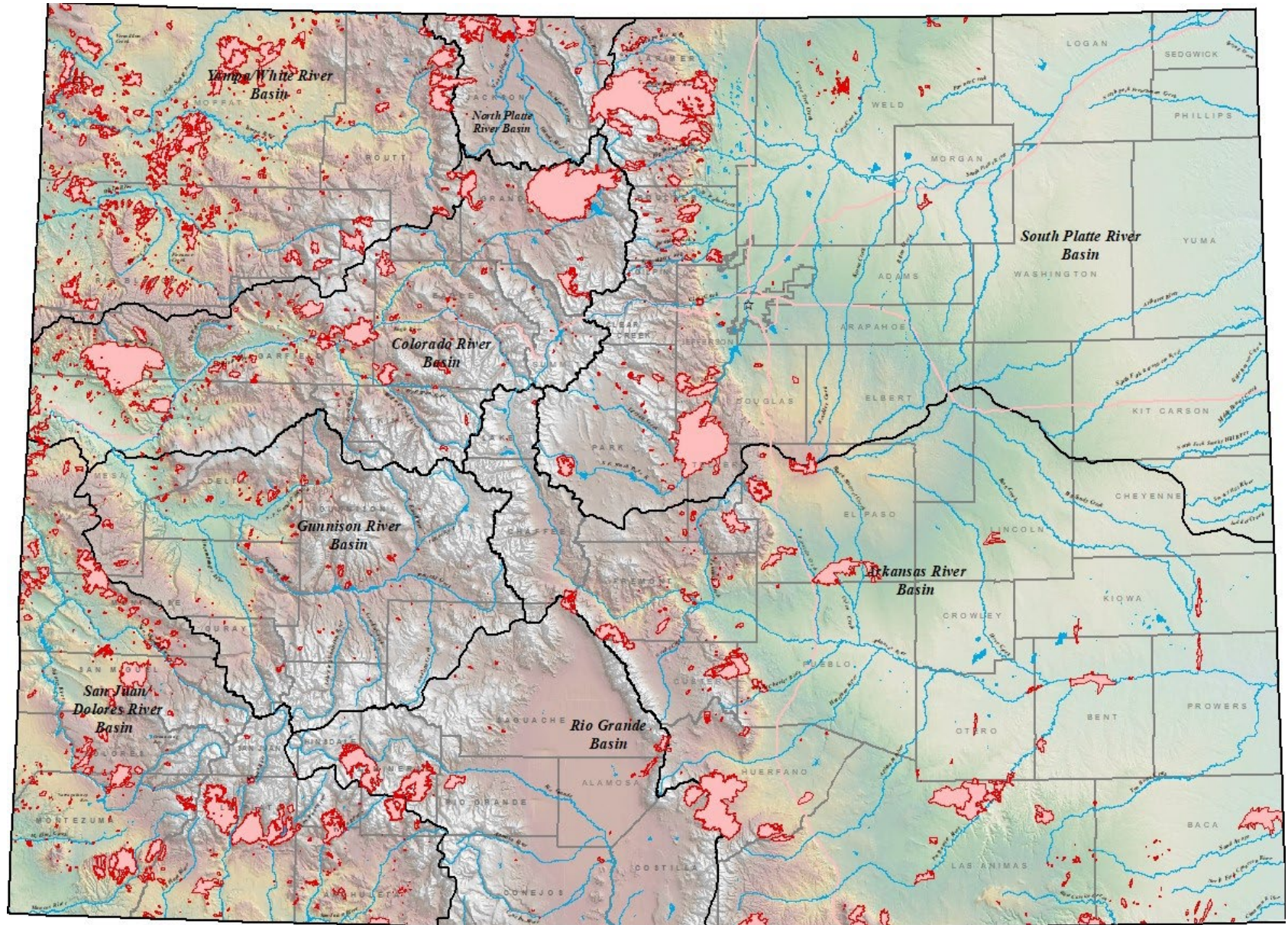
Values at Risk Data Sets

- These data sets represent the presence and number of assets within any given watershed (HUC12).
- Many of the watersheds (HUC12) shown are not at risk for wildfires that would generate high burn severity resulting in significant post-fire hazards.
- The asset layers form the foundation for the intersection with post-fire hazards.



Wildfire Ready Watersheds

Colorado Fires 1890-2020

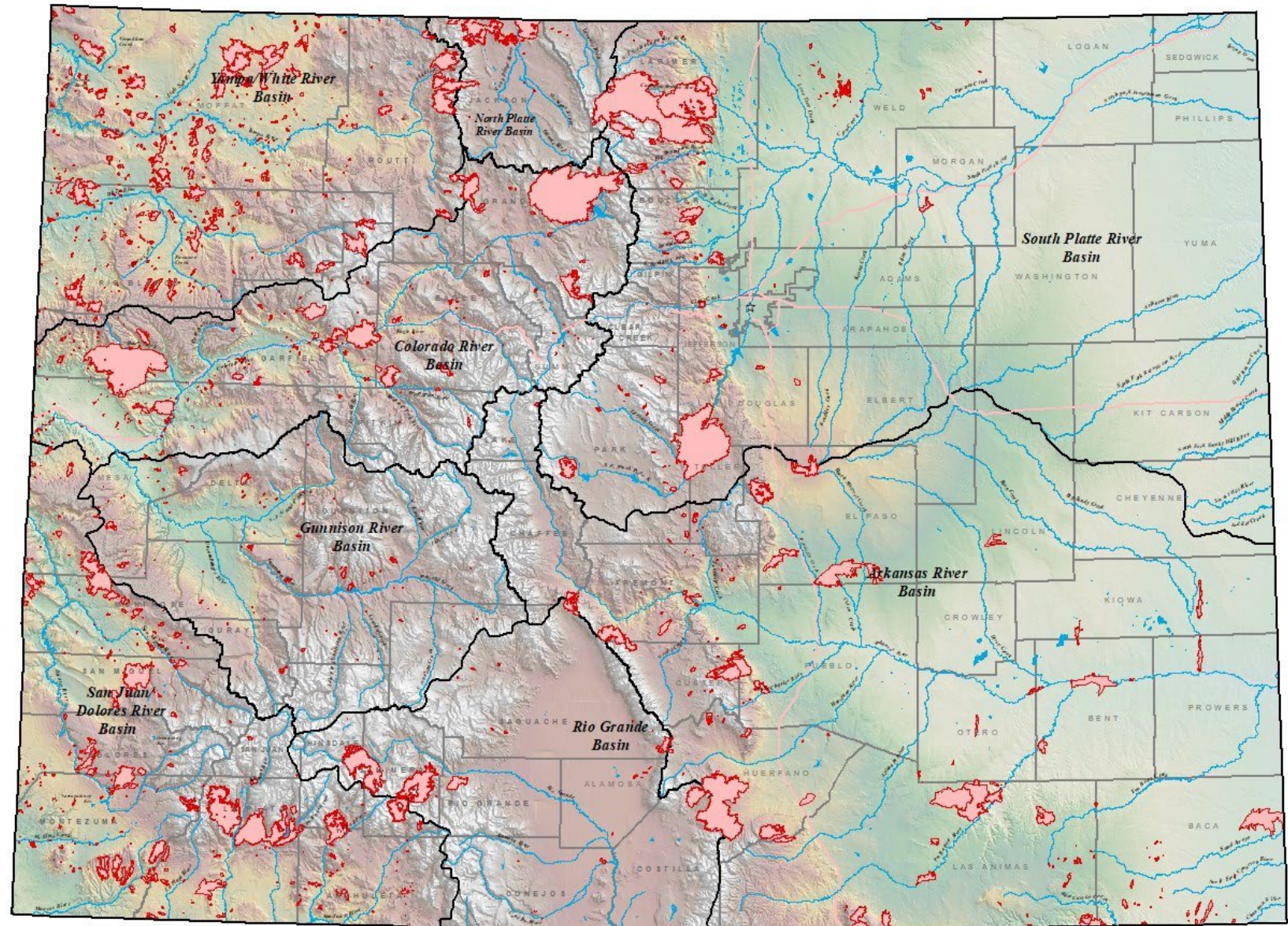


National Interagency Fire Center.
Data downloaded from
<https://data-nifc.opendata.arcgis.com/>



Wildfire Ready Watersheds

Colorado Fires 2002-2020

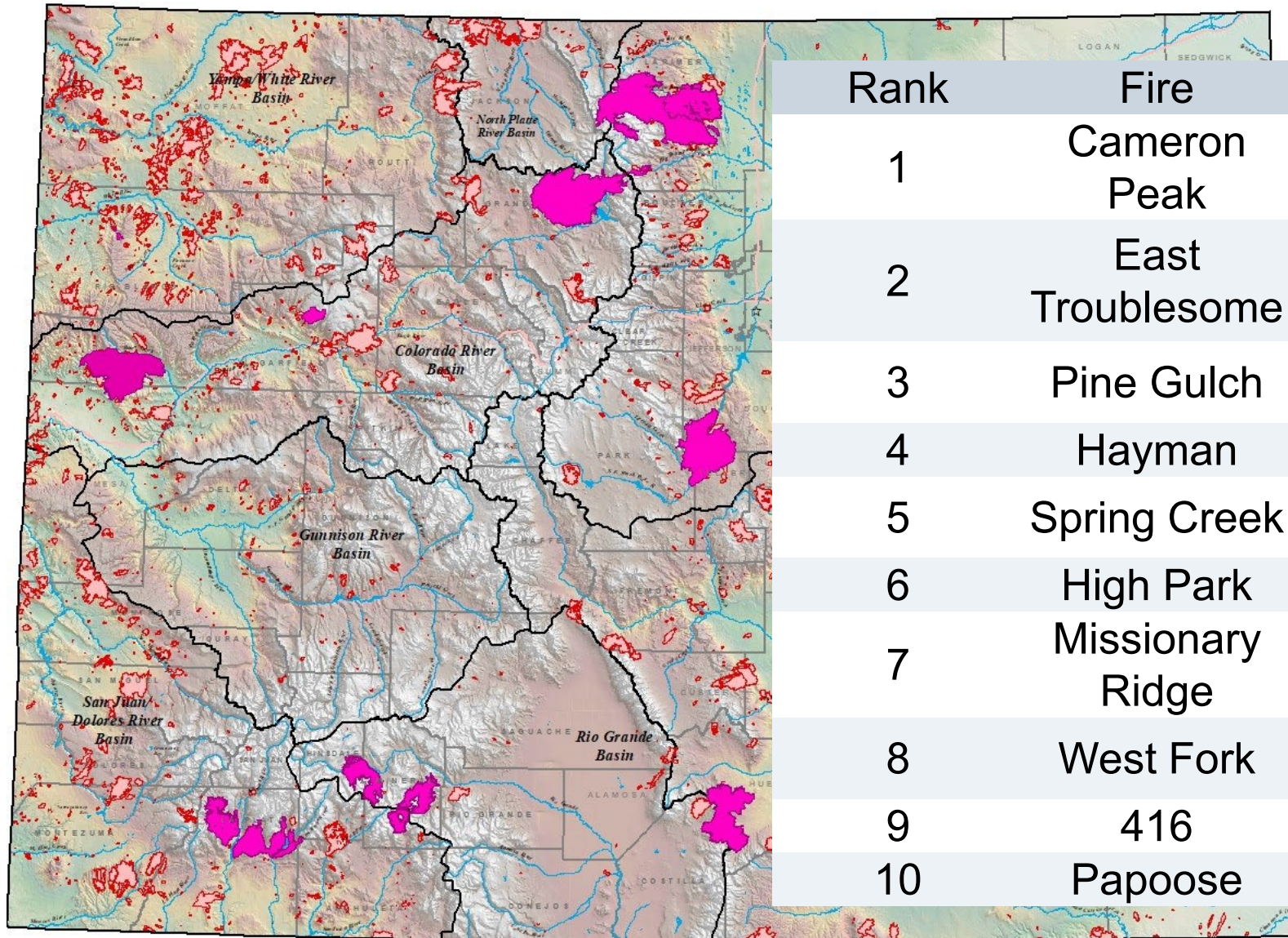


National Interagency Fire Center.
Data downloaded from
<https://data-nifc.opendata.arcgis.com/>



Wildfire Ready Watersheds

Colorado Fires - Ten Largest



Rank	Fire	Acres	Year
1	Cameron Peak	208,913	2020
2	East Troublesome	193,812	2020
3	Pine Gulch	139,007	2020
4	Hayman	137,760	2002
5	Spring Creek	108,045	2018
6	High Park	87,284	2012
7	Missionary Ridge	70,285	2002
8	West Fork	58,570	2013
9	416	54,129	2018
10	Papoose	49,628	2013

National Interagency Fire Center. Data downloaded from <https://data-nifc.opendata.arcgis.com/>



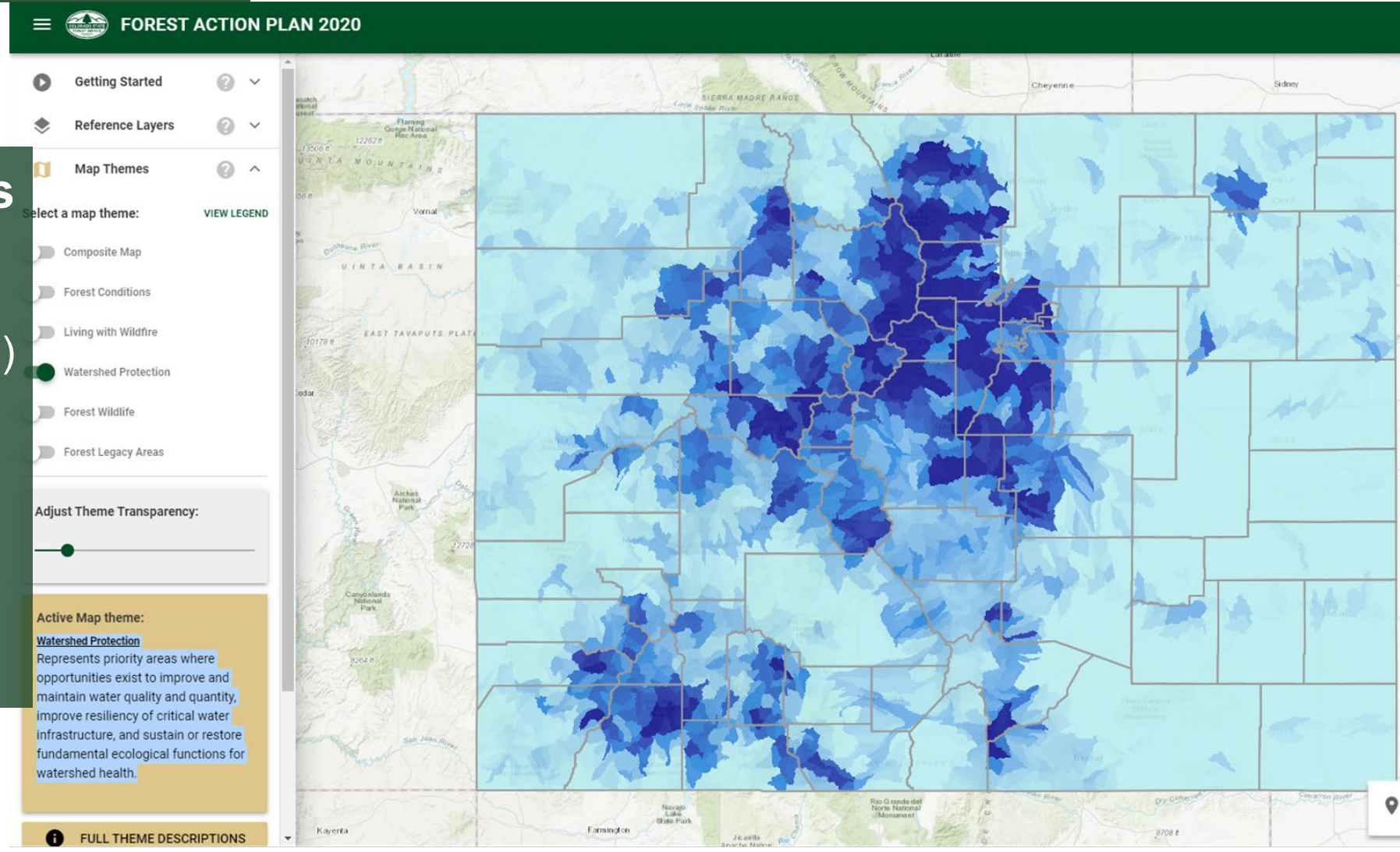
Wildfire Ready Watersheds

SUSCEPTIBILITY

Building on Past Efforts

Colorado Forest Action Plan (Colorado State Forest Service)

This CWCB effort seeks to learn from and build off previous efforts from the CSFS, enhancing asset layers as well as incorporating post-fire hazards into the susceptibility evaluation.



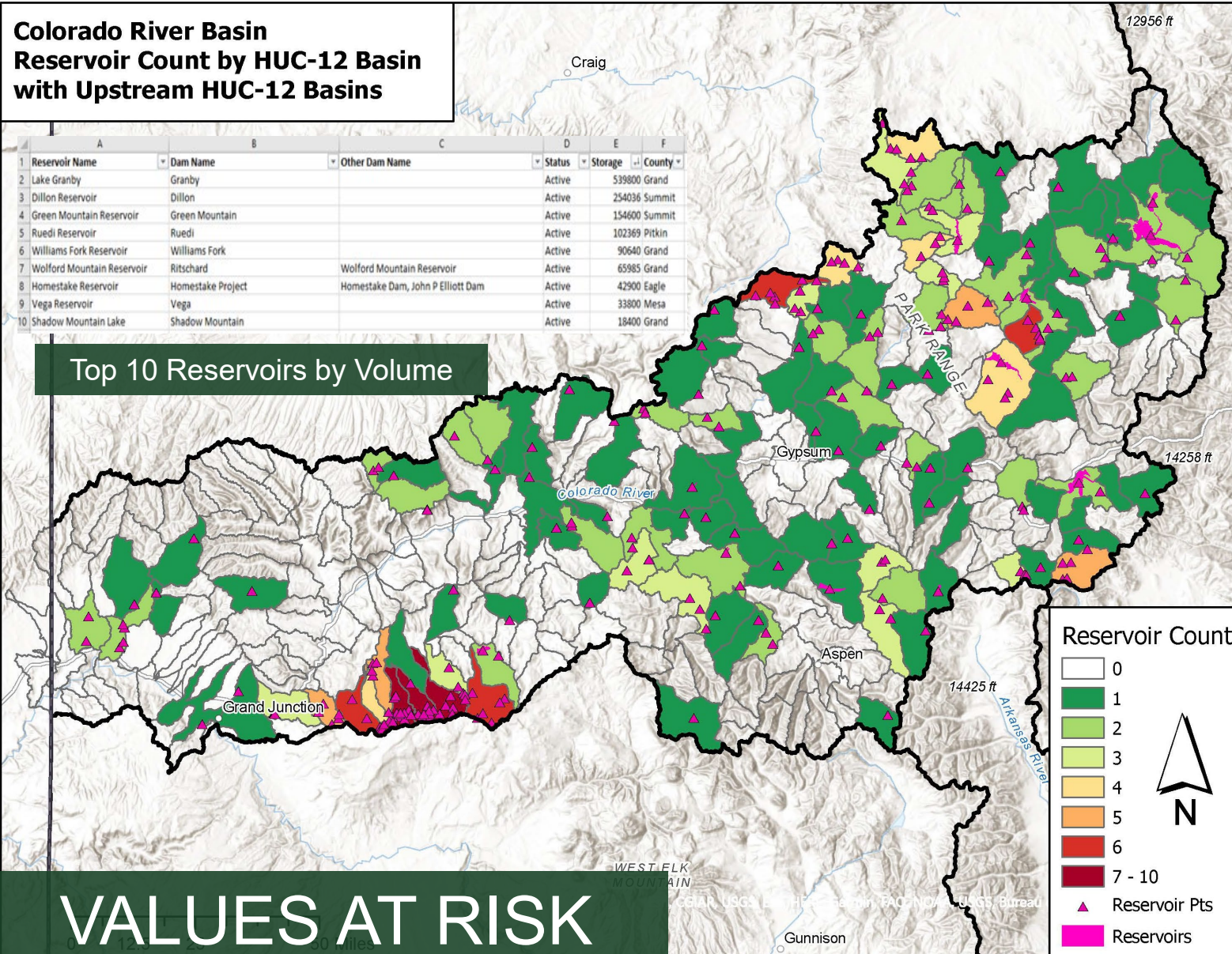


Wildfire Ready Watersheds

Storage Reservoirs

Identifying reservoirs and watersheds that directly discharge into reservoirs.

- Impacts due to:
- Sedimentation
 - Debris flows
 - Water quality degradation
 - Increased runoff





Wildfire Ready Watersheds

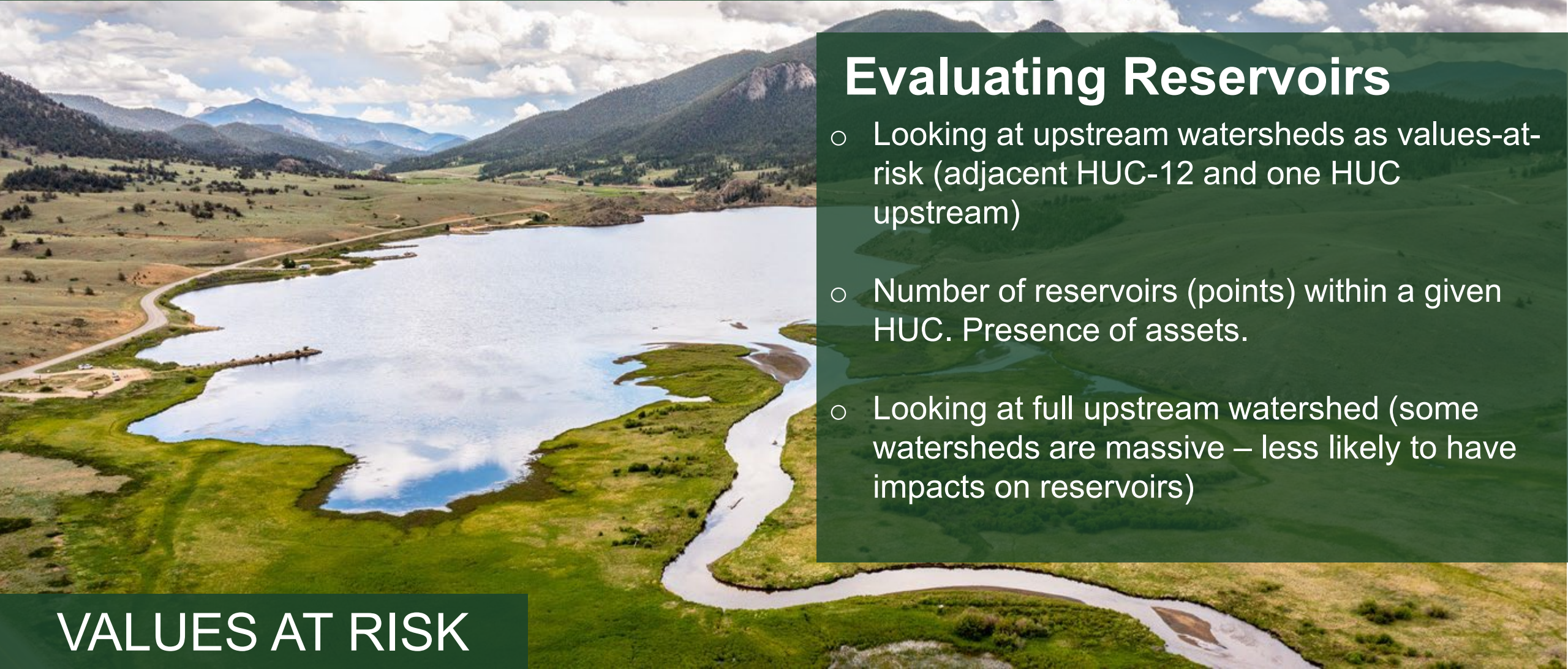
RISK



Evaluating Reservoirs

- Looking at upstream watersheds as values-at-risk (adjacent HUC-12 and one HUC upstream)
- Number of reservoirs (points) within a given HUC. Presence of assets.
- Looking at full upstream watershed (some watersheds are massive – less likely to have impacts on reservoirs)

VALUES AT RISK





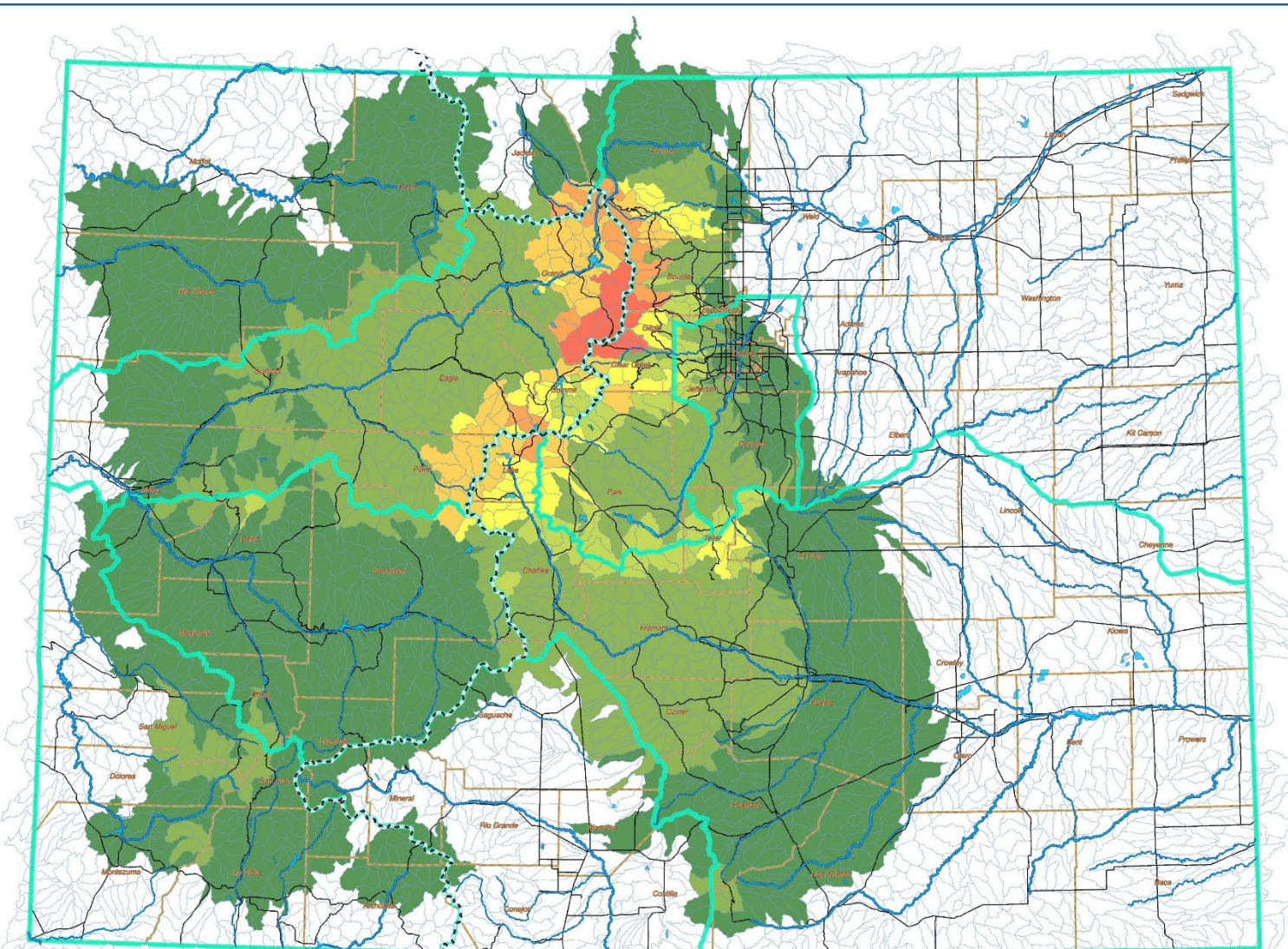
Wildfire Ready Watersheds

MUNICIPAL INTAKES

Sourcewater

Watersheds upstream of each intake.

Evaluates the number of intakes that rely on any given watershed (HUC).



Wildfire Ready Watersheds

Statewide Post-Fire Susceptibility Assessment

HUC12 Ranking Choropleth Municipal Water Intakes

Legend

- HUC12 Subwatersheds
- Continental Divide
- Major Colorado Waterbodies
- Major Colorado Rivers
- Basin Roundtable Delineations
- Highways
- Colorado Counties

Asset Ranking by HUC12

- Number of Municipal Intakes Affected
- 1 - 8
 - 9 - 19
 - 20 - 32
 - 33 - 45
 - 46 - 57
 - 58 - 70
 - 71 - 88

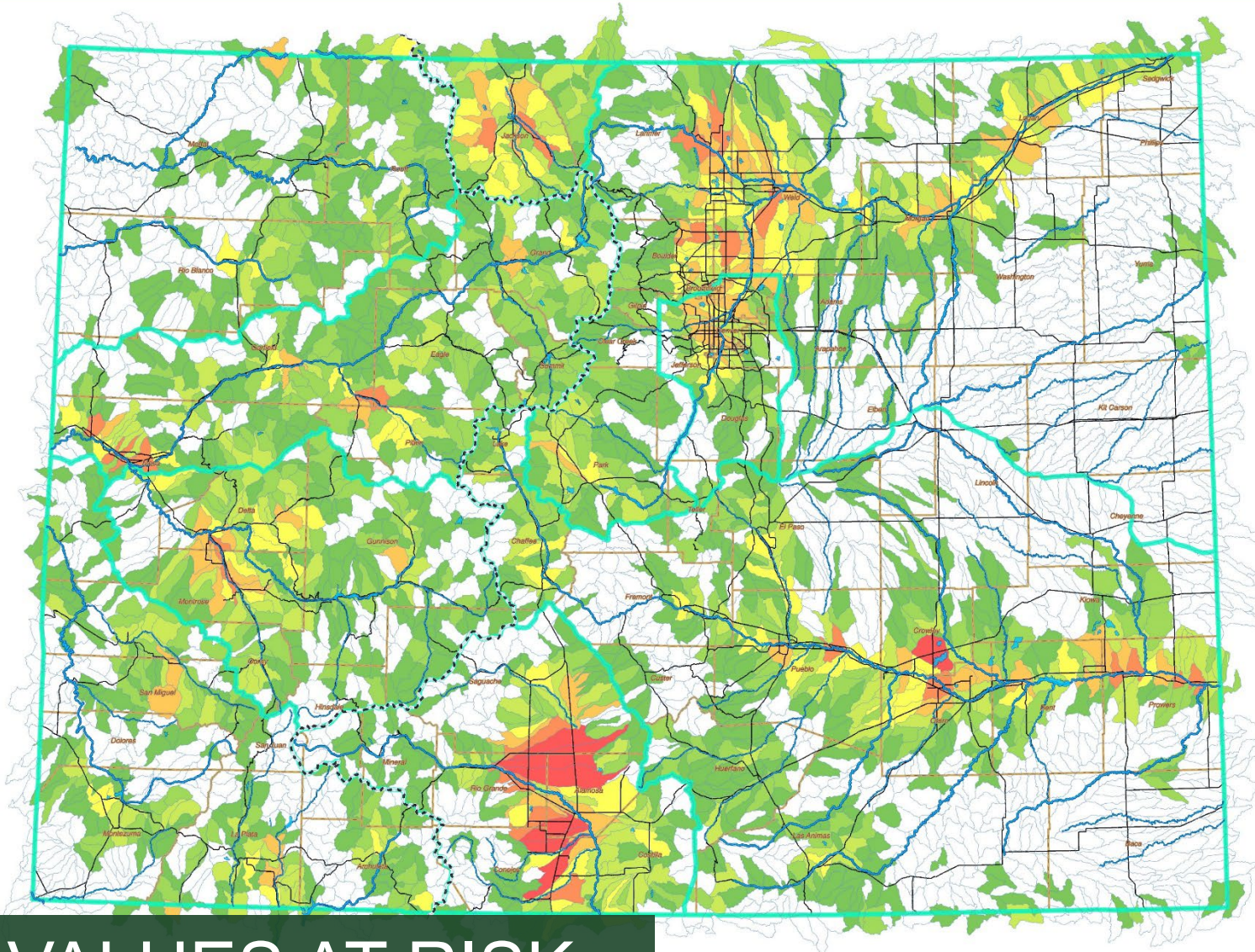
DRAFT

VALUES AT RISK





Wildfire Ready Watersheds



Wildfire Ready Watersheds

Statewide Post-Fire Susceptibility Assessment

HUC12 Ranking Choropleth
NHD Built Flowlines

Legend

- HUC12 Subwatersheds
- Continental Divide
- Major Colorado Waterbodies
- Major Colorado Rivers
- Basin Roundtable Delineations
- Highways
- Colorado Counties

Asset Ranking by HUC12

NHD Built Flowlines by Total Length

- 1 - Low Asset Presence
- 2
- 3
- 4
- 5
- 6
- 7 - High Asset Presence

DRAFT



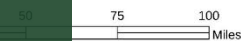
Built Flowlines

Built diversion infrastructure within a watershed.

Evaluates the length of Conveyance ditches by HUC.

Indicates where burned basins could affect downstream water users.

VALUES AT RISK



2022-06-30

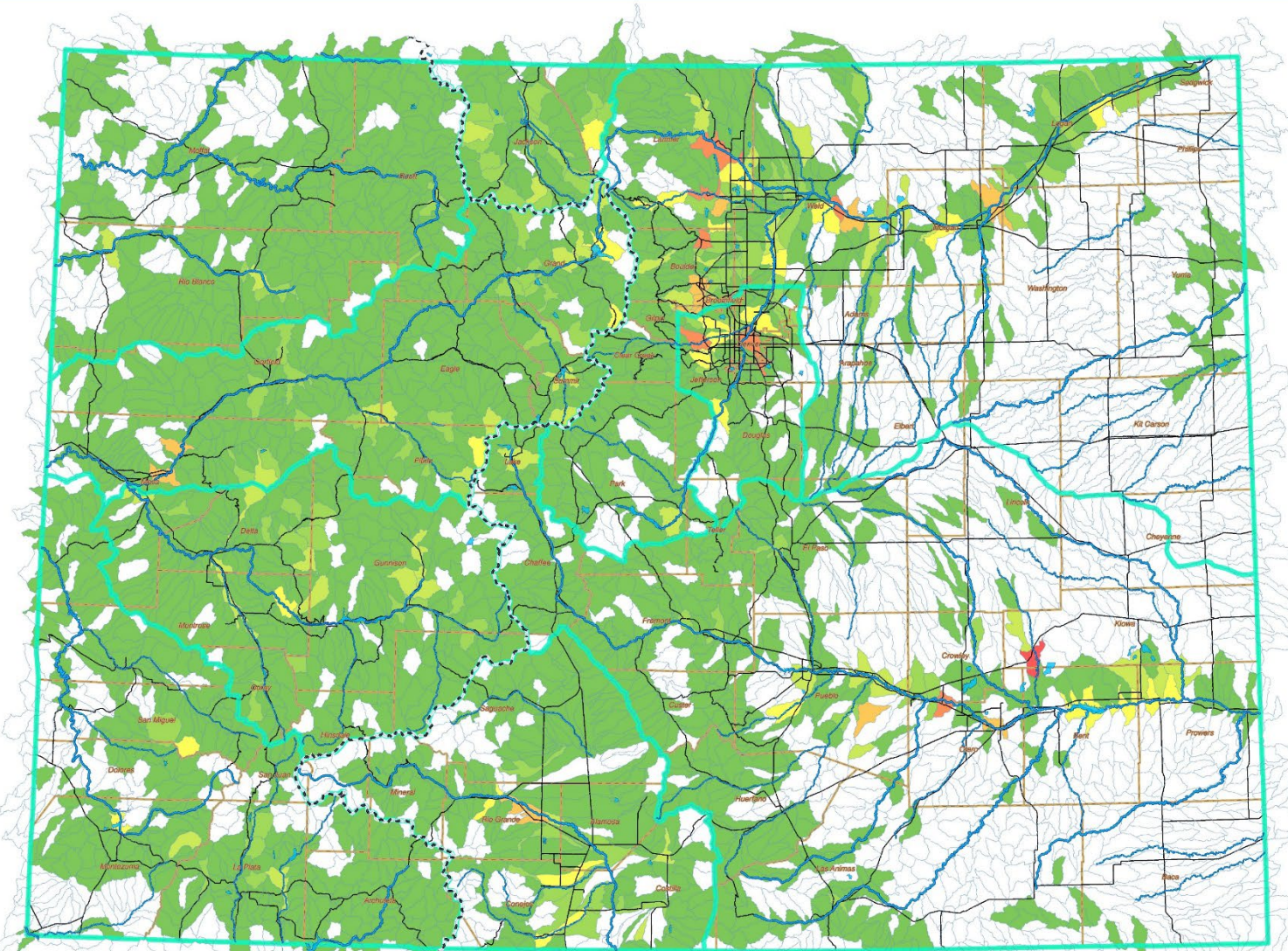


Wildfire Ready Watersheds

Decreed Water Rights

Considers water rights/diversion points by decreed volume.

Indicates where burned basins could affect downstream water users.



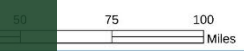
Wildfire Ready Watersheds
Statewide Post-Fire Susceptibility Assessment

HUC12 Ranking Choropleth
CDSS Decreed Features

- Legend**
- HUC12 Subwatersheds
 - Continental Divide
 - Major Colorado Waterbodies
 - Major Colorado Rivers
 - Basin Roundtable Delineations
 - Highways
 - Colorado Counties
- Asset Ranking by HUC12**
CDSS Select Decreed Features by Volume
- 1 - Low Asset Presence
 - 2
 - 3
 - 4
 - 5
 - 6
 - 7 - High Asset Presence

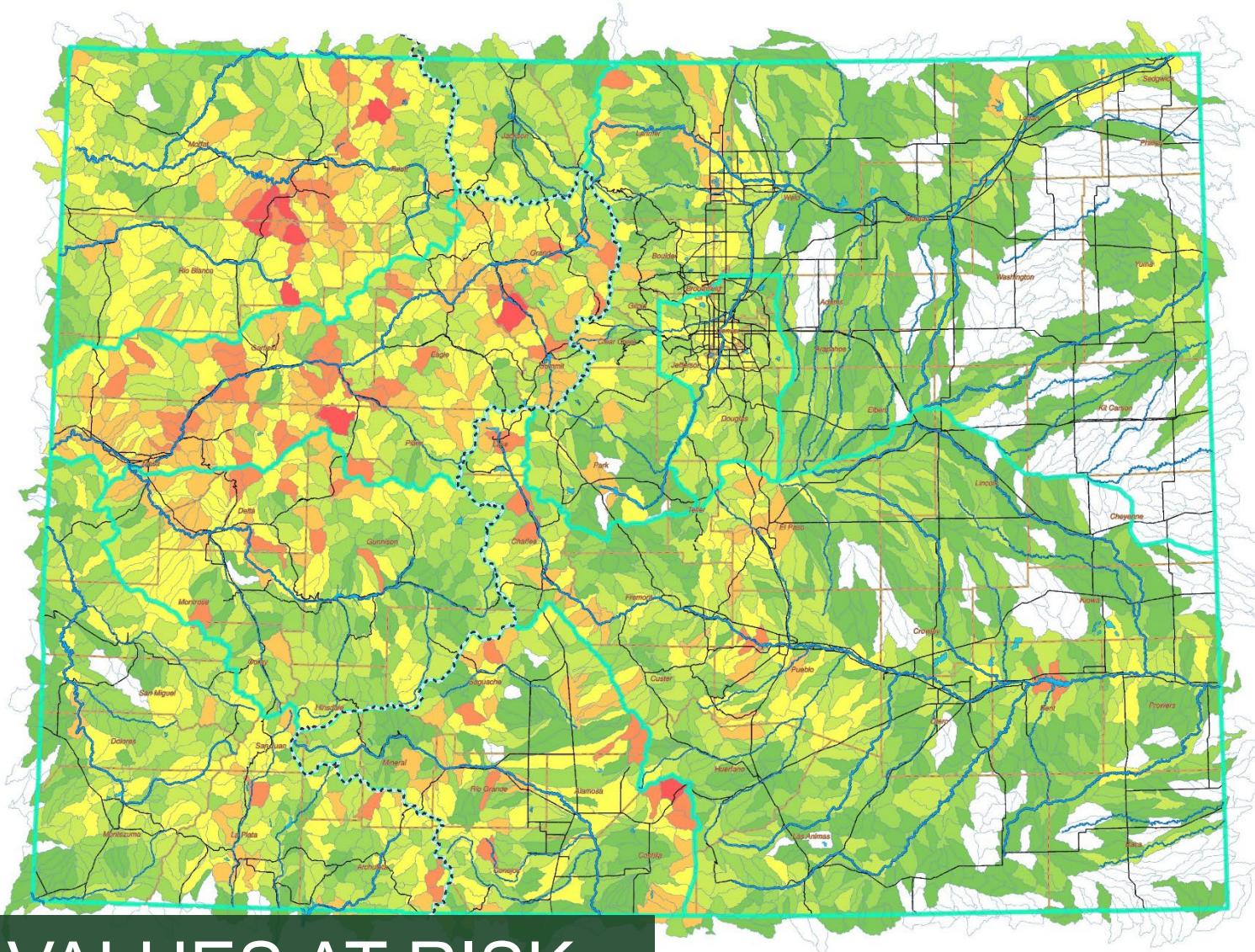
DRAFT

VALUES AT RISK





Wildfire Ready Watersheds



Wildfire Ready Watersheds
Statewide Post-Fire Susceptibility Assessment

HUC12 Ranking Choropleth
CPW Aquatic Resources

- Legend**
- HUC12 Subwatersheds
 - Continental Divide
 - Major Colorado Waterbodies
 - Major Colorado Rivers
 - Basin Roundtable Delineations
 - Highways
 - Colorado Counties
- CPW Aquatic Resources**
Combined CPW Aquatic Resources
- 1 - 3
 - 4 - 5
 - 6 - 7
 - 8 - 10
 - 11 - 13
 - 14 - 17
 - 18 - 21

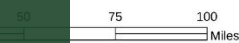
DRAFT

Aquatic Species Habitat

Evaluates high value habitat areas located within watersheds.

Indicates where burned basins could impact habitat conditions and water quality.

VALUES AT RISK





Wildfire Ready Watersheds

HAZARDS



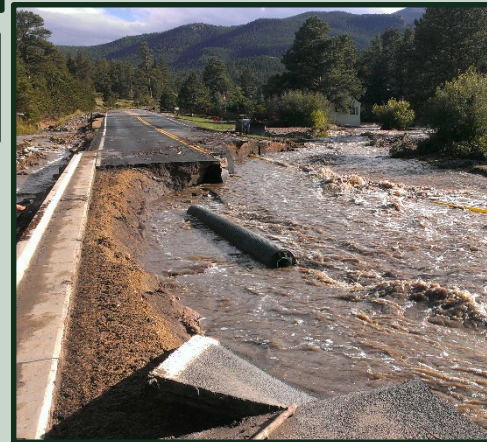
INCREASED RUNOFF



HILLSLOPE EROSION



MUD/DEBRIS FLOW



FLOODING



FLUVIAL HAZARD ZONE



Wildfire Ready Watersheds

RISK

$$\text{RISK} = \text{Probability Hazard} \times \text{Consequence Values-at-Risk}$$

Risk & Susceptibility

- Where values-at-risk are located
- Where hazards exist
- Understanding where hazards pose threats to values provides an overall understanding of susceptibility.



Wildfire Ready Watersheds

Hydrologic Change

Evaluates magnitude of change in runoff following a fire.

Indicates watersheds where flood after fire will be a significant concern.

Wildfire Ready Watersheds

Statewide Post-Fire Susceptibility Assessment

HUC12 Ranking Choropleth Hydrologic Risk

Legend

- HUC12 Subwatersheds
- Continental Divide
- Major Colorado Waterbodies
- Major Colorado Rivers
- Basin Roundtable Delineations
- Highways
- Colorado Counties

Hydrologic Risk

Hydrologic Risk DQ_FL

- 0.00 - 2.70
- 2.71 - 4.48
- 4.49 - 6.13
- 6.14 - 7.96
- 7.97 - 10.30
- 10.31 - 13.61
- 13.62 - 25.06

DRAFT



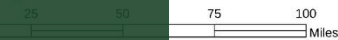
COLORADO
Colorado Water Conservation Board
Department of Natural Resources

2022-07-08



INCREASED RUNOFF

HAZARDS





Wildfire Ready Watersheds

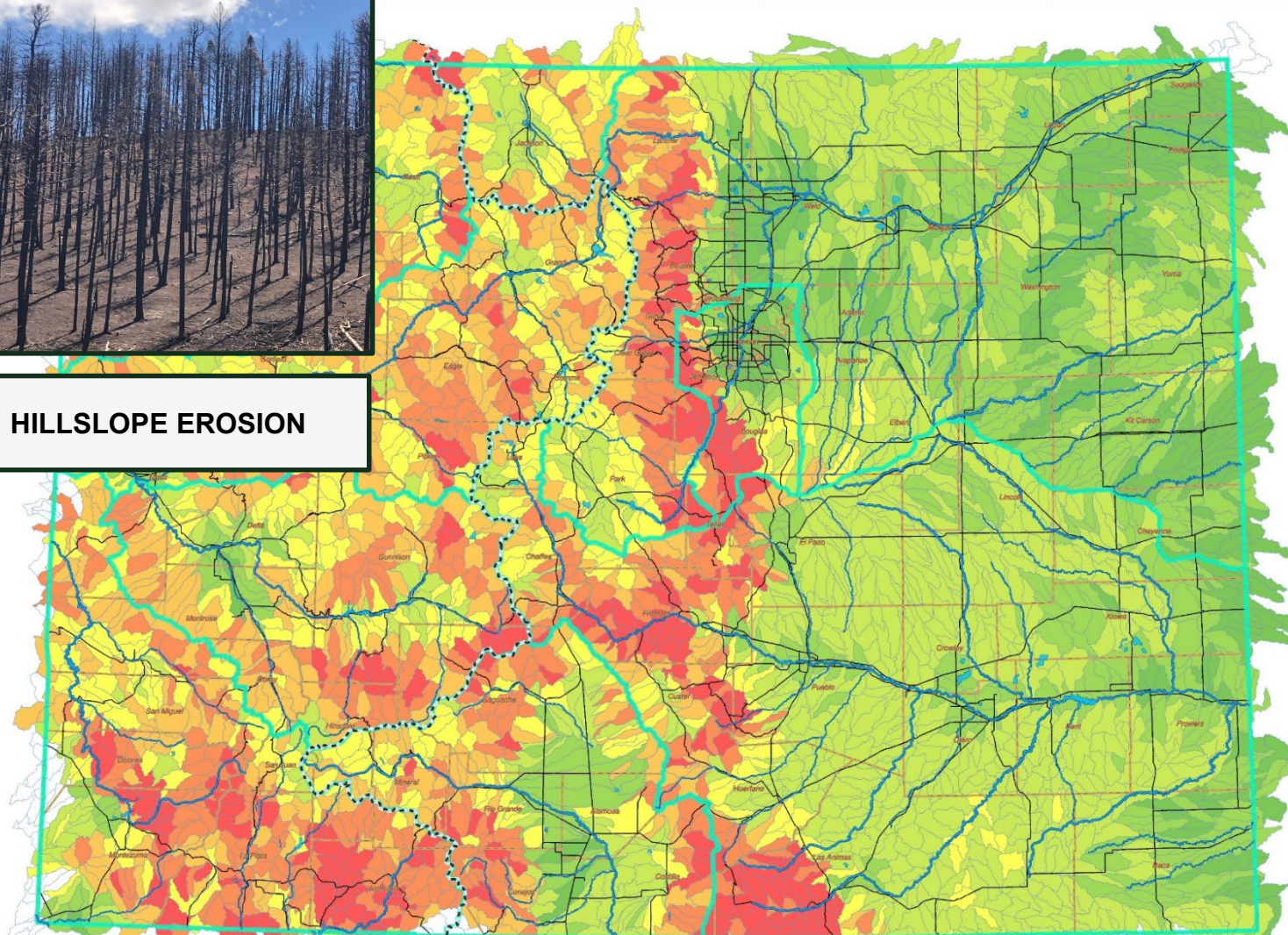
Hillslope Erosion

Evaluates magnitude of change in sediment yield pre and post fire.

Indicates watersheds where sedimentation and deposition will be a significant concern.



HILLSLOPE EROSION



Wildfire Ready Watersheds
Statewide Post-Fire Susceptibility Assessment

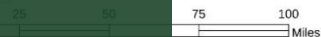
HUC12 Ranking Choropleth Erosion and Sedimentation

- Legend**
- HUC12 Subwatersheds
 - Continental Divide
 - Major Colorado Waterbodies
 - Major Colorado Rivers
 - Basin Roundtable Delineations
 - Highways
 - Colorado Counties

- Erosion and Sedimentation Risk**
- Sedimentation Risk**
- 0.00 - 1.91
 - 1.92 - 3.02
 - 3.03 - 4.06
 - 4.07 - 5.08
 - 5.09 - 6.14
 - 6.15 - 7.32
 - 7.33 - 10.47

DRAFT

HAZARDS

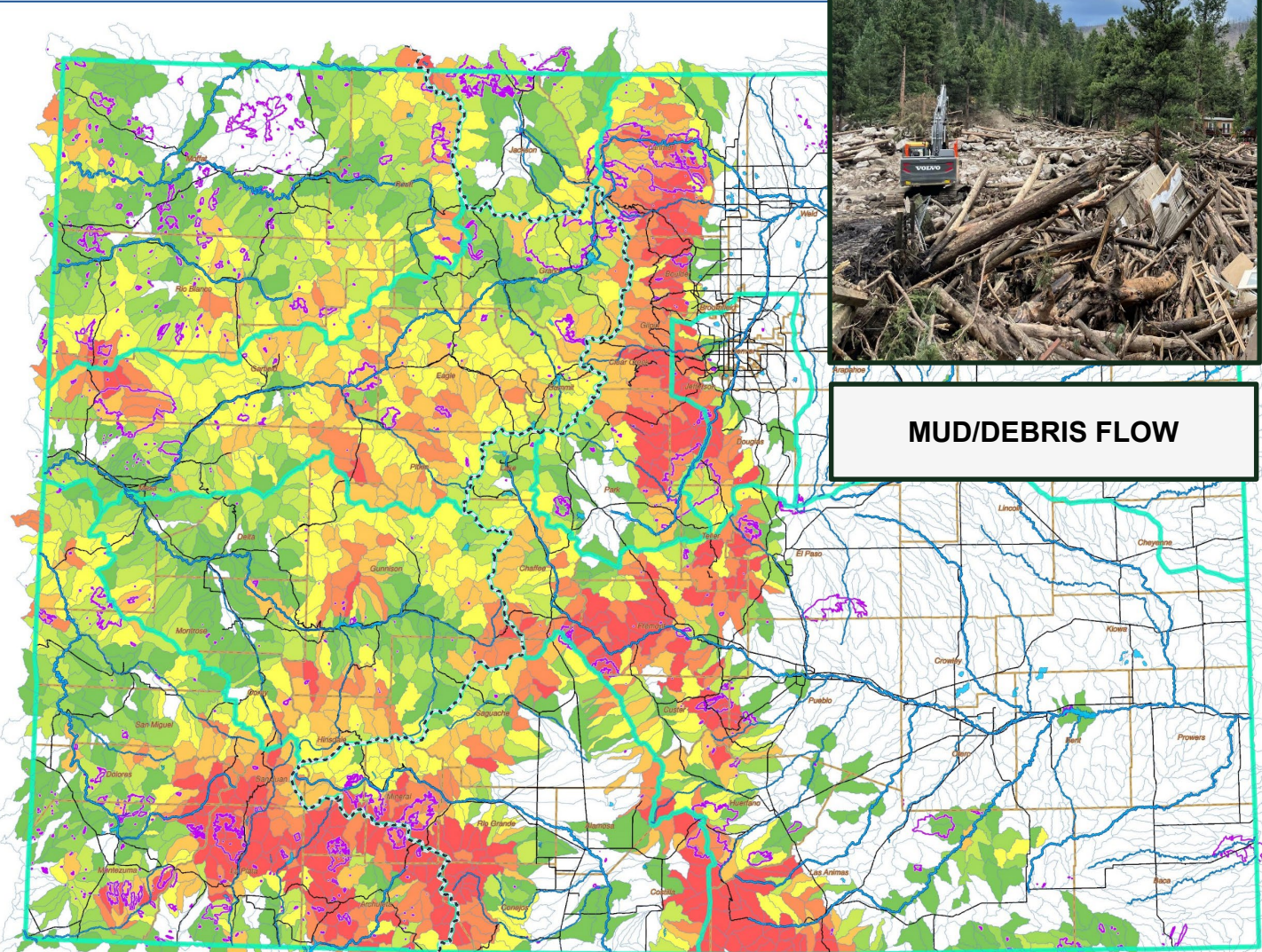




Wildfire Ready Watersheds



MUD/DEBRIS FLOW



Wildfire Ready Watersheds
Statewide Post-Fire Susceptibility Assessment

HUC12 Ranking Choropleth Debris Flow Risk

- Legend**
- HUC12 Subwatersheds
 - - Continental Divide
 - Major Colorado Waterbodies
 - ~ Major Colorado Rivers
 - Basin Roundtable Delineations
 - ~ Highways
 - Colorado Counties
 - Fire Perimeter History 2012 on
- Debris Flow Risk (2 year filtered)**
Debris Flow Risk (2 year filtered) REVISED
- 0.000001110 - 0.1094
 - 0.1095 - 0.2339
 - 0.2340 - 0.3656
 - 0.3657 - 0.4996
 - 0.4997 - 0.6409
 - 0.6410 - 0.8096
 - 0.8097 - 0.9963

DRAFT

Debris Flow

Identifies watersheds with high probability of debris flows.

Indicates watersheds where debris flow should be evaluated further to understand specific risk to life, infrastructure, and property.

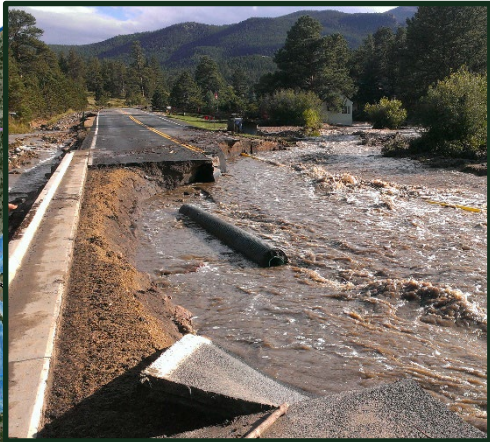
HAZARDS



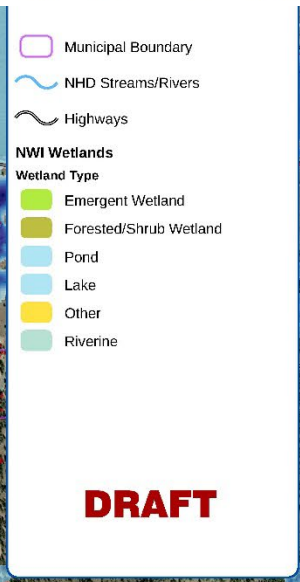
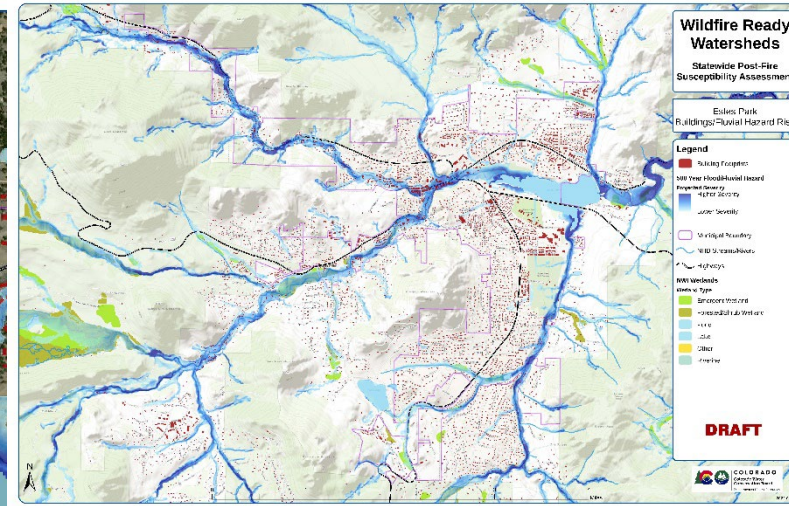
2-Year, Slope >10°



Wildfire Ready Watersheds



FLOODING



HAZARDS

Flooding

Evaluation of where post-fire floods are a threat to property and critical facilities.

Provides an understanding of high consequence watersheds based on the number of structures at risk.



Wildfire Ready Watersheds

FRAMEWORK

What is a framework?

A comprehensive guide for local watershed advocacy groups and agencies that can be followed to produce local-level post-fire susceptibility evaluations on a watershed scale to direct pre-fire and post-fire mitigation actions.

#wildfireactionplan101





Wildfire Ready Watersheds

FRAMEWORK

Wildfire Ready Watersheds
Template Scope of Work

PROJECT INFORMATION

PROJECT NAME:	Project Title
PROJECT SPONSOR:	Sponsor Name
PRIMARY CONTACT:	Contact Name
ADDRESS:	Contact Address
PHONE:	Grant/tee Address
PROJECT LOCATION:	Contact Phone Number
PROJECT AMOUNT:	Location Description
BUDGET FUNDING:	\$000,000
GRANT FUNDING:	\$000,000
GROUND FUNDING:	\$000,000

... is a strategy and program developed by the Colorado Water...
... approach to identify and address post wildfire impacts...
... hazards to community values such as water supplies, life...
... on post fire hazards include increased runoff, debris...
... flooding, and associated sediment erosion and...
... assess the susceptibility of Colorado's water...
... fire impacts and advance a framework for...
... minimize these impacts - before wildfires...
... communities after wildfires occur, but the focus of...
... before such an event. The **Project Sponsor** is...
Template Scope of Work
Page 1

WILDFIRE READY WATERSHEDS

seeking to perform a WRW Framework study for the Study Watershed. This study will follow the guidance...
... the WRW Framework regarding how to refine the statewide susceptibility evaluations for local...
... communities to utilize at watershed scales. The WRW Framework Study will serve as a guide for best...
... planning practices in advance of a wildfire and will also support post-fire mitigation strategies. This effort...
... includes data collection and GIS engineering/modeling, and pre and post fire management development...
... hazard analysis and evaluations, engineering/modeling, and pre and post fire management development.

Many projects implemented after a fire are for immediate protection of life, property, and water supplies...
... and have limited success as they are treating point of impact type problems with little regard to watershed...
... health or stream function. Projects constructed before fire provide the same or better protections while...
... also addressing multiple objectives in watershed health and water supply protection. These project types...
... are designed to protect and enhance ecosystem structure and function within the watershed drainage...
... network. Most implementation strategies will involve a mosaic of different project types employed across...
... the watershed.

Glossary of Terms

WRW
Wildfire Ready Watersheds

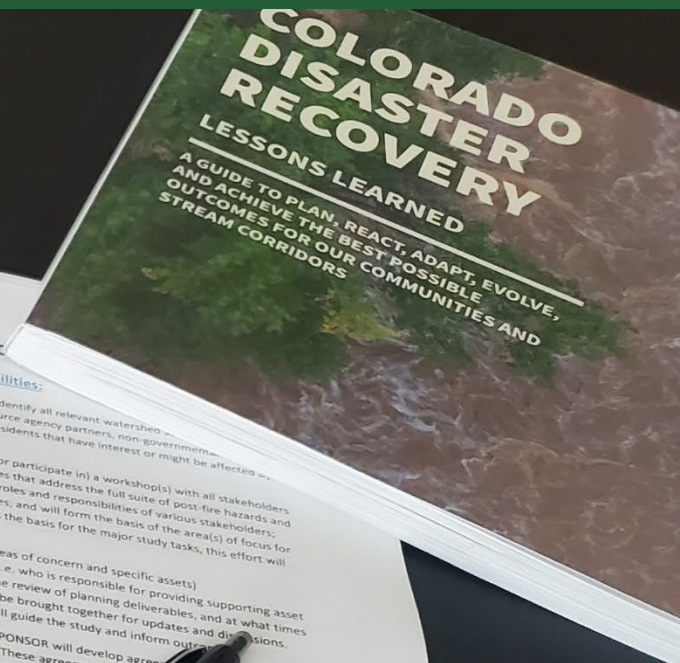
WRW Framework Study
A watershed study to identify post-fire hazards, susceptibility, and mitigation following the Colorado WRW Framework guidance

WRW Sponsor
Local study sponsor (typically the grantee)

WRW Team
Sponsor lead team including sponsor staff, partners, and technical professionals supporting the hazard analysis, risk assessment, and development of the mitigation framework. Typically this would be a procured consultant team, but could also include resources and staff from partner agencies and organizations.

Colorado Water Conservation Board
Colorado Water Conservation Board

Natural Resources Conservation Service
Natural Resources Conservation Service



Develop a framework for local communities and stakeholders that they can implement to further refine their susceptibility evaluations and determine both pre and post wildfire mitigation strategies to reduce risk to life, property and infrastructure.

SCOPE OF WORK



Wildfire Ready Watersheds

FRAMEWORK

Task 1: Capacity Building, Vision, and Establishment of Goals and Objectives

- Identify partners and stakeholders
- Develop overall vision for the WRW Framework Study
- Establish study goals and objectives
- Develop and execute agreements with partners





Wildfire Ready Watersheds

FRAMEWORK

Task 2: Stakeholder Collaboration, Community Outreach, and Public Meetings

- Regular communication with stakeholders
- Community outreach activities
- Workshops including project prioritization and mitigation funding
- Website creation and maintenance



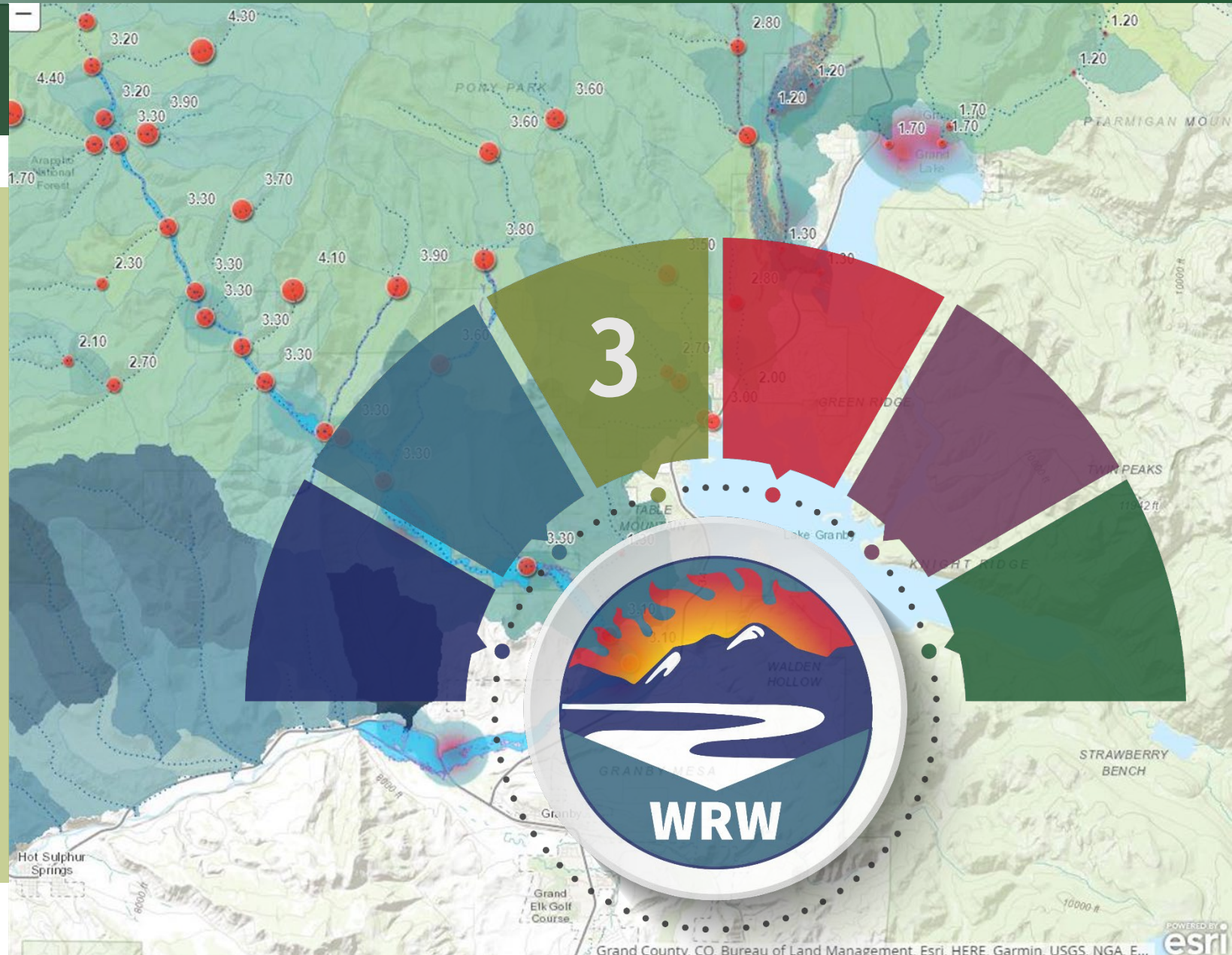


Wildfire Ready Watersheds

FRAMEWORK

Task 3: Data Collection, Research, Review, and Gap Analysis

- GIS data collection for values at risk, hazards, and supporting information
- Previous study and research review
- Infrastructure operations
- Data gap analysis (what's missing for the best possible outcome?)





Wildfire Ready Watersheds

FRAMEWORK

Task 4: Post Fire Hazard Analysis

- Analyses and evaluations to identify hazards for:
 - Hydrologic response
 - Floods after fire
 - Fluvial hazard zones
 - Debris flows
 - Hillslope and gully erosion
 - Water quality





Wildfire Ready Watersheds

FRAMEWORK

Task 5: Susceptibility Analysis

- Identification of Values-at-Risk using hazard overlay
- Determining consequences of post-fire hazards
- Developing a prioritization based on severity of consequences of post-fire impacts and





Wildfire Ready Watersheds

FRAMEWORK

Task 6: Pre-Disaster Mitigation Activities

- Development of both a:
 - Pre-Disaster Preparedness Plan (Mitigation projects before a fire)
 - Post-Disaster Preparedness Plan (action plan following a fire)
- Prioritize actions
- Establish roles and responsibilities for mitigation activities
- Determine financial needs
- Permitting requirements





Wildfire Ready Watersheds

VALUES AT RISK

Reservoirs and Dams

Municipal Water Intakes

Ag Water Infrastructure

Transportation Network

Life and Property

HAZARDS

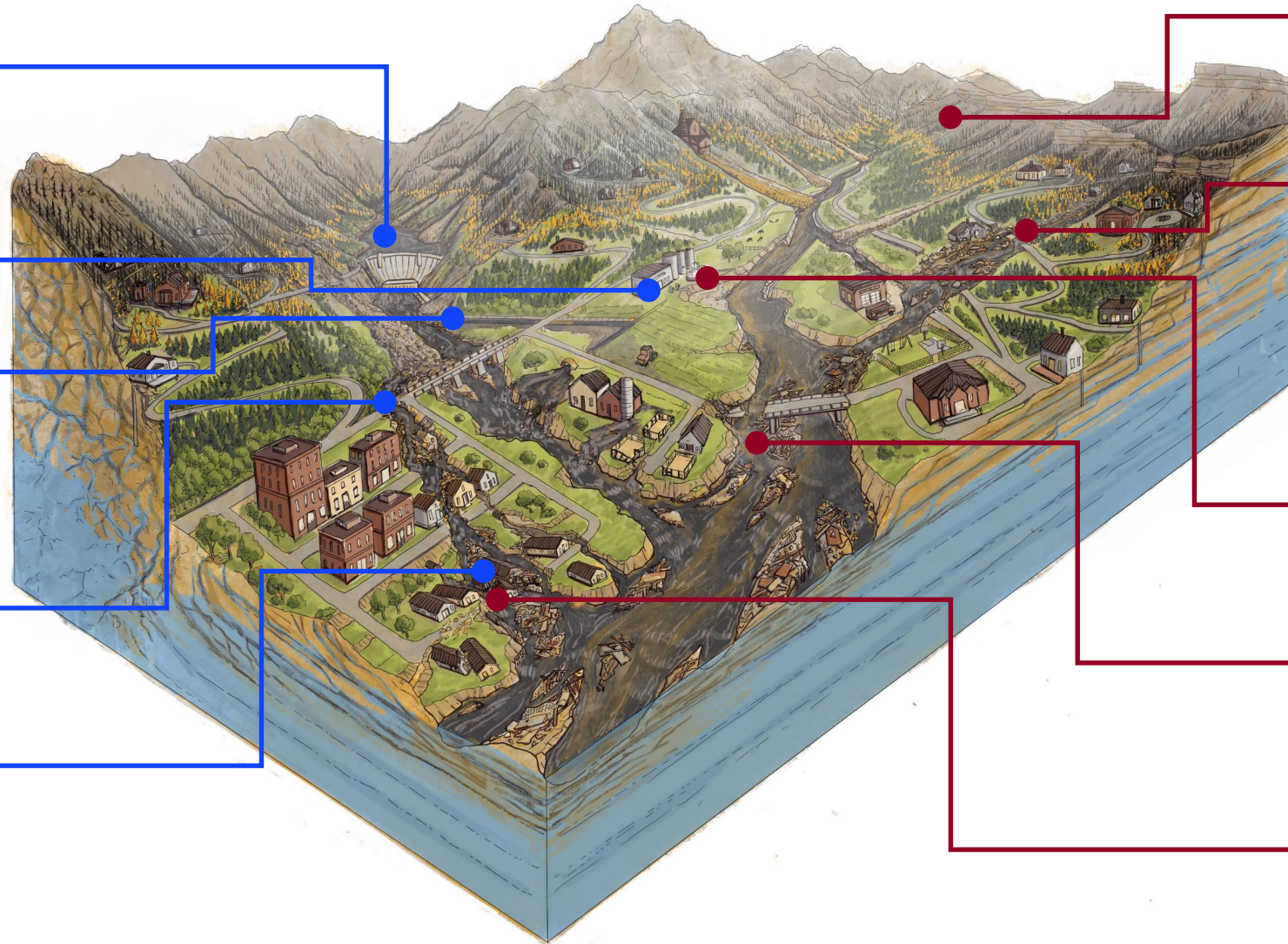
Hillslope Erosion

Debris and Mud Flows

Water Quality Degradation

Riverine Erosion & Sedimentation

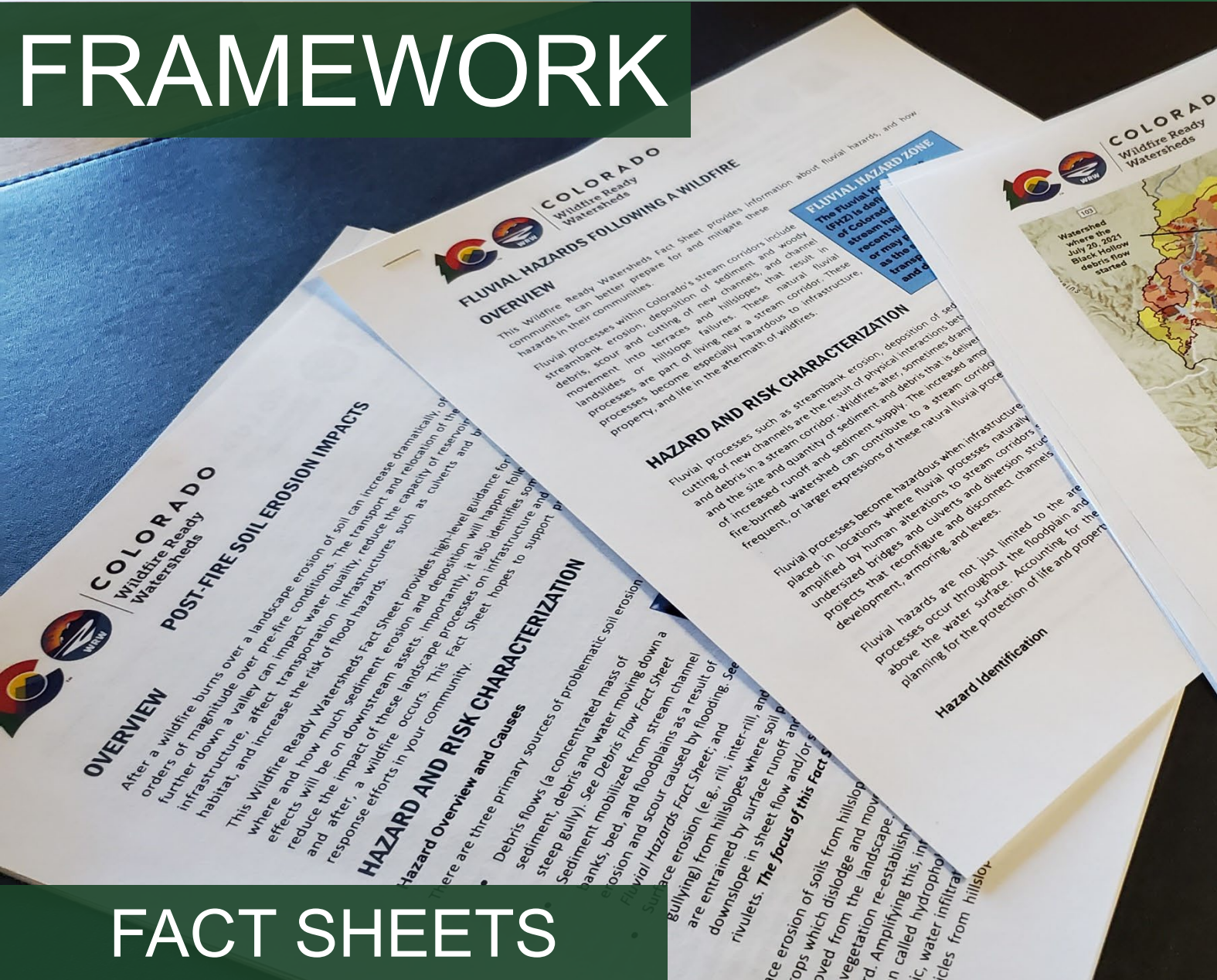
Flooding





Wildfire Ready Watersheds

FRAMEWORK



Fact Sheets:

- Hydrology/Hydraulics/Flood After Fire
- Debris/Mud Flow
- Fluvial Hazard Zone
- GIS Preparedness
- Stakeholder Outreach and Communication
- Hillslope Erosion
- Water Quality
- Municipal Water Supply

FACT SHEETS



Wildfire Ready Watersheds

Website

www.wildfirereadywatersheds.com



[About](#) [Statewide Study](#) [Local Framework](#) [Education/Resources](#) [FAQs](#) [Contact Us](#)

WILDFIRE READY WATERSHEDS

Working to understand the susceptibility of Colorado's watersheds to post-wildfire impacts and to plan and prepare for them – *before fires occur.*

Wildfire impacts don't stop when the flames do.

Impacts to water supplies, infrastructure, and human life can linger for many years after the firefighting crews head home. After a wildfire burns over a landscape, erosion of soil and runoff of rainfall can increase dramatically, oftentimes by several orders of magnitude over pre-fire conditions resulting in hazards within and downstream of burned areas as a result of transport and relocation of ash and debris further down valley (sometimes many miles from where a wildfire burnscar exists) can cause extreme impacts to water resources. Reduced capacity of reservoirs affect water delivery infrastructure, affect transportation infrastructures such as culverts and bridges, and increase the risk of flood hazards that threaten life and property.



COLORADO
Colorado Water Conservation Board

Department of Natural Resources

The Wildfire Ready Watersheds seeks to provide high-level guidance for helping communities predict what and where post-fire impacts will effect downstream assets. Importantly, the Program also seeks to help identify some actions that may be taken to reduce the impact of these low stream





THANK YOU

Questions?

Chris Sturm, CWCB

chris.sturm@state.co.us

Jeff Sickles, Enginuity

jsickles@enginuity-es.com

Katie Jagt, Watershed Science & Design

katiejagt@watershedscienceanddesign.com

Michael Blazewicz, Round River Design

michael@roundriverdesign.com



COLORADO
Colorado Water
Conservation Board

Department of Natural Resources