

# **FRONT RANGE WATERSHED PROTECTION DATA REFINEMENT WORK GROUP**

## **PROTECTING CRITICAL WATERSHEDS IN COLORADO FROM WILDFIRE: A TECHNICAL APPROACH TO WATERSHED ASSESSMENT AND PRIORITIZATION**

**EXECUTIVE SUMMARY  
FEBRUARY 2009**



# PROTECTING CRITICAL WATERSHEDS IN COLORADO FROM WILDFIRE: A TECHNICAL APPROACH TO WATERSHED ASSESSMENT AND PRIORITIZATION

## EXECUTIVE SUMMARY

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The seven major Front Range water providers – Aurora, Boulder, Colorado Springs, Denver Water, Fort Collins, Northern Colorado and Westminster – draw their water supplies from 10 watersheds in the mountains that collectively provide more than two-thirds of Colorado’s population with drinking water. Many cities, towns and villages in the mountains also depend on these watersheds for drinking water.

The Front Range of Colorado experienced major impacts on municipal water supplies as a result of flooding, erosion and sediment deposition after the 1996 Buffalo Creek Fire, 2000 Bobcat Fire, and 2002 Hayman and Schoonover fires. In July 2007, the Pinchot Institute for Conservation released an assessment report titled, “Protecting Front Range Forest Watersheds from High-Severity Wildfires,” which was funded by the Front Range Fuels Treatment Partnership. The study concluded that climate factors and forest conditions place Front Range source watersheds at high risk from severe wildfires that threaten water supplies and the integrity of reservoirs due to erosion and flood damage. General areas of wildfire hazards and water supplies at risk were identified.

In August 2007, the Colorado State Forest Service and U.S. Forest Service hosted a meeting with Front Range water providers to discuss the report’s findings and explore opportunities for joint action. In September 2007, the agencies and water providers met again and crafted the structural outlines of a partnership effort to protect Front Range watersheds from severe wildfires. As a result, the Front Range Watershed Wildfire Protection Working Group was formed to develop and implement a strategy to protect critical Front Range Watersheds from high-severity wildfires. The Working Group consulted with the Front Range Fuels Treatment Partnership Roundtable, which is composed of members from more than 40 participating organizations.

## FRONT RANGE WATERSHED PROTECTION ASSESSMENT PROCESS

The Front Range Watershed Protection Data Refinement Work Group (hereafter termed the Work Group) is one of three sub-work groups formed to implement the strategy of the Front Range Watershed Wildfire Protection Working Group. The purpose of this Work Group is to develop a methodology to identify and prioritize those watersheds that provide or convey water used by communities and municipalities. This identification of priority watersheds will, in turn, assist in prioritizing watersheds for hazard reduction treatments or other watershed protection measures. The Work Group adapted and refined the methods used by the Pinchot Institute for Conservation to assess individual watersheds within the 10-county area served by the Front Range Fuels Treatment Partnership and Roundtable. The Work Group also reviewed additional information and created a template for watershed assessments to identify critical watersheds that supply community or municipal water. The Work Group envisions that the template can be used in fifth-level watersheds in Colorado or the western United States.

*The purpose of the Data Refinement Work Group is to develop a methodology to identify and prioritize those watersheds that provide or convey water used by communities and municipalities. This identification of watersheds will, in turn, assist in prioritizing watersheds for hazard reduction treatments or other watershed protection measures.*

## GOALS

The primary goal of the Work Group was to develop and adopt a clear and common methodology to identify sixth-level watersheds (defined below) that are critical for public water supplies; to develop criteria and processes and recommend data that can be used to determine hazards/effects associated with fire and treatment potential for sixth-level watersheds; and to use the analysis results to help determine treatment priorities. A second goal was to apply the watershed assessment approach to a test case to help adapt and refine the approach.

## ANALYSIS UNITS

The Work Group used the existing national network of delineated watersheds in their approach. They chose to analyze and prioritize sixth-level (12-digit) watersheds, typically 16-63 square miles or 10,000-40,000 acres. A wide range of data generally is available at this scale, and this is an appropriate size for watershed analysis and planning for landscape-level fuels treatment. Sixth-level watersheds are the standard analysis unit recommended for the watershed assessments.

The Work Group chose the Upper South Platte Watershed, a fifth-level watershed that is approximately 649,694 acres in area and contains 22 sixth-level watersheds, as its test case because 1) it is well known and studied; 2) a previous prioritization exists to which results can be compared, and; 3) soils data for the area are challenging.

## WATERSHED ASSESSMENT COMPONENTS

The potential of a watershed to deliver sediments following wildfire depends on forest and soil conditions, the physical configuration of the watersheds, and the sequence and magnitude of rain falling on the burned area. High-severity fires can cause changes in watershed conditions that are capable of dramatically altering runoff and erosion processes in watersheds. Water and sediment yields may increase as more of the forest floor is affected by fire.

This Watershed Assessment considers four components that are integral in evaluating hazardous watershed conditions: **wildfire hazard, flooding or debris flow risk, soil erodibility, and water uses ranking.**

## Wildfire Hazard

In 2007, the Pinchot Institute for Conservation evaluated the wildfire hazard for the 10 Front Range counties based on data provided by the Colorado State Forest Service. The results of this analysis were used to assess wildfire hazards in the Upper South Platte Watershed test case. Wildfire hazard factors include the fuel hazard, disturbance regime, aspect, and slope. When combined, these factors produce an overall wildfire hazard ranking for sixth-level watersheds.

## Flooding or Debris Flow Risk

Watershed steepness or ruggedness is an indicator of the relative potential for debris flows following wildfires. The more rugged the watershed, the more likely it is to generate debris flows. A combination of slope, road density (miles of road per square mile of watershed area), and other data were used as inputs to the flooding or debris flow risk portion of the analysis.



*Erosion is evident in Spring Creek after the 1996 Buffalo Creek Fire.*

### Soil Erodibility

The soil analysis used a combination of two standard erodibility indicators, which are the inherent susceptibility of soil to erosion (K factor) and land slope derived from USGS 30m digital elevation models. The K factor data was combined with the slope grid using Natural Resources Conservation Service slope-soil relationships to create a classification of slight, moderate, severe, and very severe erosion hazard rating.

(**Note:** Soils scientists have observed that K factor in the Upper South Platte Watershed test case area does not adequately identify soil erodibility on granitic soils. Therefore, a geology layer was used to identify areas of granitic soils and the erodibility rating was increased for those soils. The soil erodibility analysis was extracted from the 1999 Upper South Platte Landscape Assessment.)

### Water Uses Ranking

Surface water intakes, diversions, conveyance structures, storage reservoirs, and streams are all susceptible to the effects of wildfires. These structures have been identified for the Colorado Source Water Assessment completed by the Colorado Department of Public Health and Environment. These data were used to define which sixth-level watersheds contain water nodes that are critical components of the public water supply infrastructure. For the purpose of this methodology, water nodes were defined as coordinate points corresponding to the surface water intakes, upstream diversion points, and classified drinking water reservoirs.



*Debris flowed into Strontia Springs Reservoir after the 1996 Buffalo Creek Fire.*

### OVERALL WATERSHED RANKING

Overall watershed ranking was determined by creating a Composite Hazard Ranking; creating a Final Watershed Prioritization map by adding the Water Uses Ranking (based on the selected approach) to the Composite Hazard Ranking map; and adding the Zones of Concern (described below) to the Final Watershed Prioritization map.

### COMPOSITE HAZARD RANKING

The Composite Hazard Ranking combines the first three components (Wildfire Hazard, Flooding/Debris Flow Risk, and Soil Erodibility) by averaging their rankings for each sixth-level watershed. A composite hazard map of the results is then created using the following scheme:

- Category 1 – Low
- Category 2 – Moderate
- Category 3 – Moderate-High
- Category 4 – High
- Category 5 – Very High

The Work Group believed it was valuable to create this Composite Hazard Ranking map to compare relative watershed hazards based solely on physical factors. (See *Upper South Platte Watershed Composite Hazard Map* on page 6.)

### FINAL WATERSHED PRIORITIZATION

The Final Watershed Prioritization involves combining the Composite Hazard Ranking map and the Water Uses Ranking. (See *Upper South Platte Final Watershed Prioritization Map* on page 7.) For example, if a water node is located in a sixth-level watershed, the Composite Hazard Ranking for that watershed is increased by one hazard category (e.g. High to Very High).

*Water intakes, diversions and storage reservoirs, and streams that are used as conveyances are more susceptible than pipelines to the effects of wildfires.*

## ZONES OF CONCERN

The Work Group identified an important risk factor for water uses related to transport of debris and sediment from upstream source water areas. The source water areas above important surface water intakes, upstream diversion points, and classified drinking water supply reservoirs that have a higher potential for contributing significant sediment or debris are called the Zones of Concern. These zones also could be used to further define project areas for stakeholders to focus watershed protection actions. The portions of sixth-level watersheds within that distance are considered to be within the Zone of Concern. The boundaries for the Zones of Concern are drawn and overlaid on the Final Watershed Prioritization map. (See page 8 for the *Upper South Platte Zones of Concern with Final Watershed Prioritization Map*.)

### **THE NEXT STEP — USING THE WATERSHED ASSESSMENT TO IDENTIFY AND DEVELOP CRITICAL COMMUNITY WATERSHED WILDFIRE PROTECTION PLANS**

Each surface water intake, upstream diversion point, classified drinking water supply reservoir, or other water infrastructure component has a set of stakeholders interested or involved in its operation and maintenance. In some cases, this

may be a single water provider or community. In other cases, multiple communities and water providers may have an interest.

In addition, existing Community Wildfire Protection Plans (CWPPs) may cover portions of the watershed(s) in which planning will occur. These existing plans should be inventoried and the stakeholders involved in those planning efforts should be invited to participate in the development of expanded watershed or source water protection plans. Specific treatment areas and priorities of existing plans also should be reviewed for their contribution to the watershed protection effort and incorporated into the expanded plan.

In a similar manner, other existing land and vegetation management plans, fuels treatment plans, source water protection plans, watershed restoration plans, or prescribed fire or fire use plans may exist that cover portions of the watersheds in which planning will occur. The stakeholders in these other efforts also should be invited to participate. After the stakeholder list is complete and existing treatment plans are inventoried, the planning effort may begin in earnest.

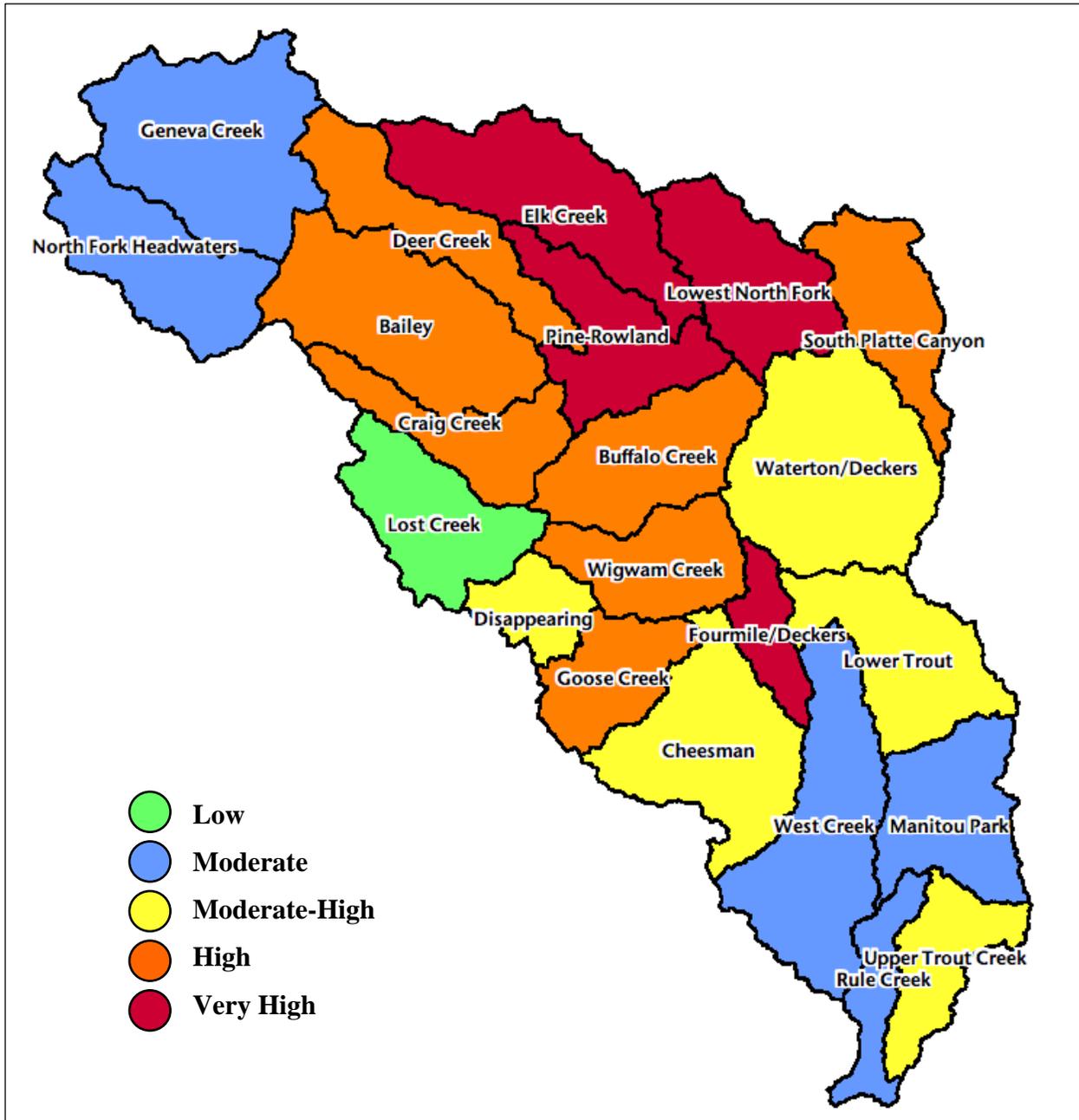
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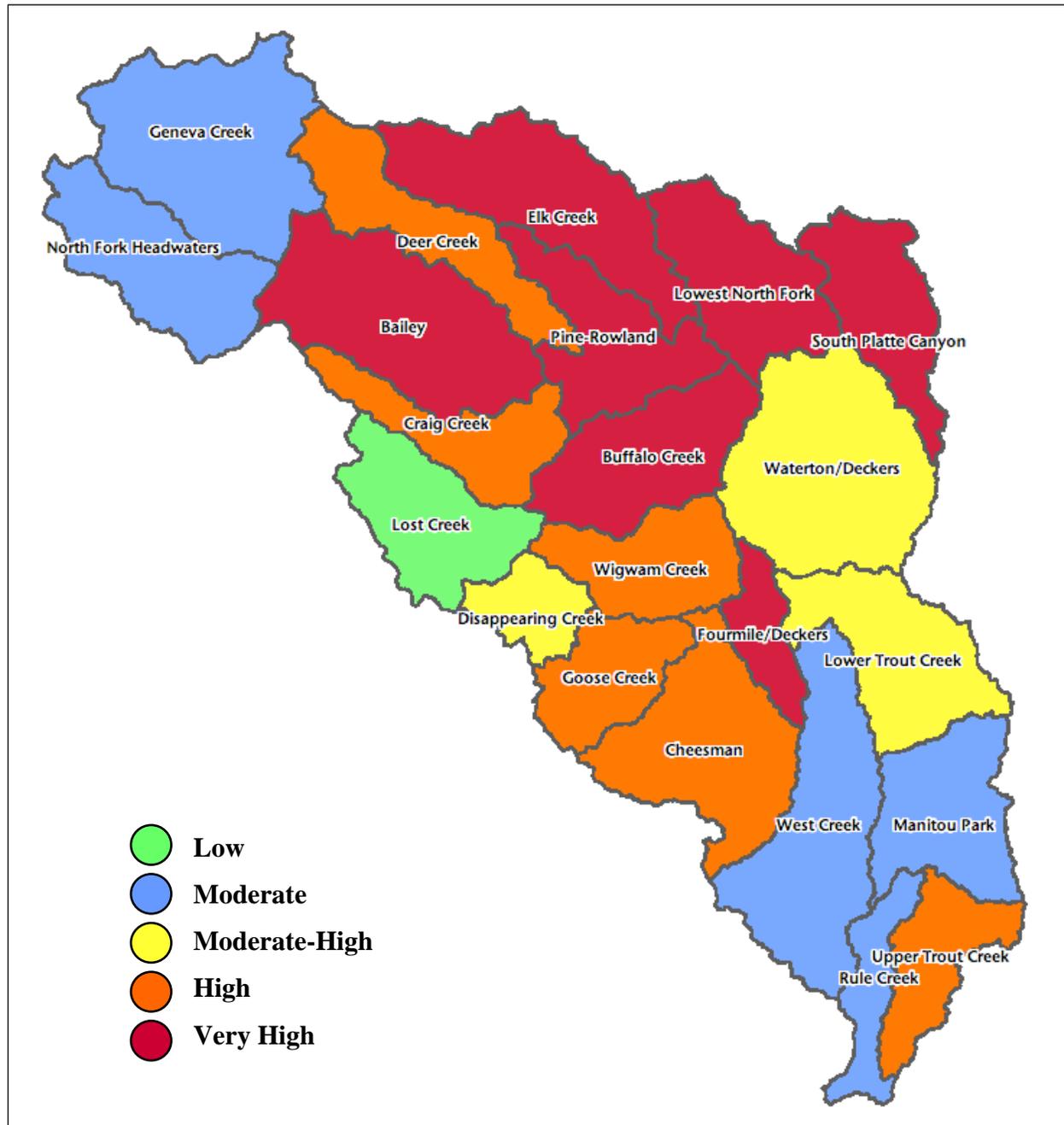
# UPPER SOUTH PLATTE WATERSHED COMPOSITE HAZARD MAP

The Composite Hazard Ranking combines the first three components (Wildfire Hazard, Flooding/Debris Flow Risk, and Soil Erodibility) by averaging their rankings for each sixth-level watershed.



# UPPER SOUTH PLATTE FINAL WATERSHED PRIORITIZATION MAP

The Final Watershed Prioritization combines the Composite Hazard Ranking and the Water Uses Ranking. Where a water use occurs within a sixth-level watershed, the Composite Hazard Ranking increases by one hazard category. The result is mapped as the Final Watershed Prioritization map.



## UPPER SOUTH PLATTE ZONES OF CONCERN WITH FINAL WATERSHED PRIORITIZATION MAP

The source water area upstream from important surface water intakes, upstream diversion points, and classified drinking water supply reservoirs that have a higher potential for contributing significant sediment or debris is referred to as the Zone of Concern.

