ASSESSMENT OF POTENTIAL DEBRIS-FLOW PEAK DISCHARGES FROM BASINS BURNED BY THE 2002 MISSIONARY RIDGE FIRE, COLORADO


to: Susan H. Cannon, U.S. Geological Survey

BY THE 2002 MISSIONARY RIDGE FIRE, COLORADO


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infiltration into the soil and subsequent significantly increased overland flow and runoff in channels. Removal of obstructions by wildfire can enhance the erosive power of overland flow, resulting in accelerated erosion of material from channels, the net result being the transport and deposition of large volumes of sediment-laden flows, or damming and subsequent failure could contribute material to underground water systems, and provide for at least a relative measure of the debris-flow response of burned basin.

Methods from field surveys and DEMs were applied to determine estimates of peak discharge. Our modeling indicates that in response to the 5-year storm, Coon Creek (on analysis of data from post-wildfire debris flows, rather than estimates of flood discharge: (1) the range of peak discharge, and (2) the potential magnitude, in terms of peak discharge, of the debris-flow response. This relationship between the 10-year, 1-hour storm of 1.8 inches (46 mm) and the range of potential debris-flow peak discharges is shown in the following equation:

\[ \text{Discharge} = 6.7 \times 10^5 \times \left( \text{Rainfall} \right)^{0.9} \times \left( \text{Basin Area} \right)^{-0.4} \times \left( \text{Flow Duration} \right)^{-0.1} \]

Measurement of peak discharge, we then grouped the estimated discharges into categories of (low, medium, high) for each basin. We then plotted the range of potential debris-flow peak discharges for each basin against the 10-year, 1-hour storm rainfall estimate for the basin.

The standard uncertainty of the estimated peak discharge for each basin was calculated using a Monte Carlo simulation approach. This approach allows for variability in the input parameters, such as rainfall intensity, basin area, and flow duration, and provides a more realistic estimate of the range of potential debris-flow peak discharges. The uncertainty in each basin was calculated by running the simulation 1,000 times and calculating the standard deviation of the results. The uncertainty in the range of potential debris-flow peak discharges for each basin was calculated by running the simulation 10,000 times and calculating the standard deviation of the results.

The uncertainty in each basin was then plotted against the estimated peak discharge for each basin. The uncertainty in the range of potential debris-flow peak discharge for each basin was then plotted against the uncertainty in the estimated peak discharge for each basin. The result is a scatter plot that shows the relationship between the estimated peak discharge for each basin and the uncertainty in the range of potential debris-flow peak discharges for each basin.

The maps are intended for use in the context of engineering design. Although the range of potential debris-flow peak discharges for each basin may be generated from the basins burned by the Missionary Ridge fire, these failures generally contribute a relatively small portion of the total debris-flow response. The maps are intended for use in the context of engineering design.

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