The NHWC Transmission

September 2017

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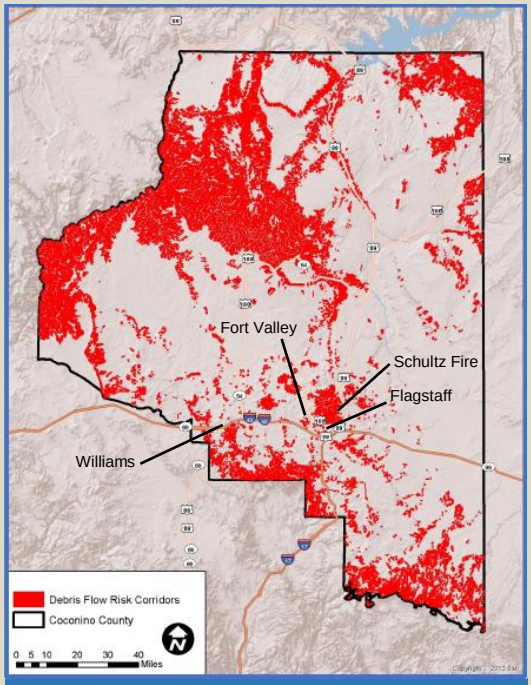
NHWC 2017-19 Officers and Directors

Post-Wildfire Debris-Flow and Flooding Assessment: Coconino County, Arizona

Joe Loverich[1], Ann Youberg[2], Mike Kellogg[1], and Jon Fuller[1]
[1]JE Fuller, [2]Arizona Geological Survey

Trends of increasing wildfire size and severity across the western U.S.[1] and concurrent encroachment and development into the wildland-urban interface[2] place more people and infrastructure at greater risks from wildfires and the aftermaths of fires. Wildfires dramatically alter watershed hydrologic conditions, substantially increasing the potential for post-fire floods and debris flows[3]. To further complicate matters in the Southwestern U.S., the wildfire season often ends at the onset of monsoonal rainfall, which may ultimately extinguish wildfires while producing large floods and debris flows in the immediate aftermath of a fire. These scenarios allow for very little time to assess post-wildfire damages and hydrologic changes, and to implement mitigation measures.

This phenomenon was highlighted in 2010 by the human-caused Schultz Fire on the Coconino National Forest northeast of Flagstaff, Arizona. The aftermath illustrates the challenges many developed areas have dealing with post-wildfire flooding and debris flows. The Schultz Fire was driven by high winds quickly across the steep eastern slopes of the San Francisco Peaks: approximately 60% of the total 15,075 acres (23.5 sq mi) burned on the first day[4]. Over a thousand residents from nearby housing developments were evacuated, although ultimately no structures were directly impacted by the fire itself. Following the fire, heavy rains from the 4th wettest monsoon on record in Flagstaff resulted in numerous debris flows, significant erosion, and substantial flooding of downstream residential areas[5].



Coconino County, Arizona Debris Flow Risk Corridors (JE Fuller)

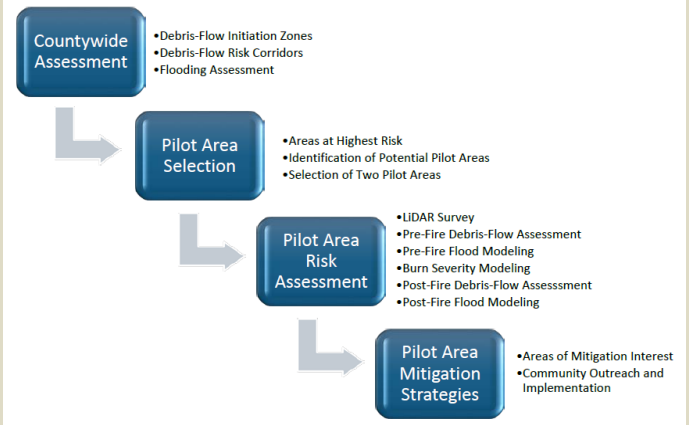
[1] Dennison et al., 2014; Westerling et al., 2006; Williams et al., 2010
[2] Moritz et al., 2014; Stein et al., 2013
[3] Moody and Ebel, 2012; Neary et al., 2005; Riley et al., 2013
[4] USDA Forest Service, 2010
[5] Youberg et al., 2010

Although the initial debris flows were confined to Forest Service lands, multiple sediment and ash-laden floods downstream of debris flow areas caused extensive damage to residential neighborhoods, homes, property and infrastructure up to four miles from the burn area[5]. The risk that wildfires pose on local communities can take many forms, many which happen after the fire has been extinguished.

Debris washed from the Schultz Burn Area (Youberg)

Working cooperatively with FEMA, the Arizona Geological Survey (AZGS) and JE Fuller, Coconino County (Arizona) has recently completed a study to determine areas within the county which may be at risk for flooding and debris flows in the aftermath of a reasonable-scenario wildfire. The study also includes detailed modeling and analyses to determine the extent and severity of that risk in two pilot study areas (Williams and Fort Valley).

This project includes a multi-stepped approach to understanding where there are post-fire flood and debris flow risks within Coconino County and the potential severity.



Multi-Step Project Approach

Two pilot study areas were selected for more detailed analyses. Two burn scenarios for the City of Williams area were developed by the US Forest Service (USFS). For the Fort Valley area, forest burn severity was modeled by JE Fuller for three different cases in utilizing FlamMap Version 5[6]. The results of the fire severity models were used to model changes in flood and debris flows risk. FlamMap utilizes a series of user-specified input parameters to approximate fire behavior over a landscape. The input parameters can be calibrated using data from recent nearby fires, and varied to produce reasonable fire behavior results.

Many of the parameters utilized for the Fort Valley area were provided to JE Fuller by the Coconino National Forest. These parameter files were used to represent conditions in which the fire is burning and, in the case of Fort Valley, parameters were used to closely represent conditions found at the time of the 2010 Schultz Fire. We chose to use parameters similar to the Schultz Fire to compare modeling results with previous post-fire responses. All model runs were completed using the Scott/Reinhardt crown fire calculation method.[7] The selected output included Crown Fire Activity and Heat/Unit Area.

FLO-2D PRO was chosen as the combined hydrologic and hydraulic model for both the pre- and post-fire conditions analysis. FLO-2D is a two-dimensional, flood routing model that simulates unconfined overland flow over complex topography. This modeling platform was chosen because of the distributary and unconfined sheet flooding conditions in the Fort Valley area. The model includes components such as rainfall, infiltration, and hydraulic structures (e.g., bridges, levees, culverts, etc.). An emphasis of this study is to understand and quantify the impact of increased forest health due to forest treatments (thinning, control burns, etc.) on downstream flood risk.

Debris flow inundation zones were determined in several steps. First, geomorphic data collected after the Schultz Fire were used to evaluate the current U.S. Geological Survey (USGS) post-fire debris flow volume model[8] with mapped post-Schultz Fire deposits[9]. The purpose of this step was to assess how well modeled debris flow

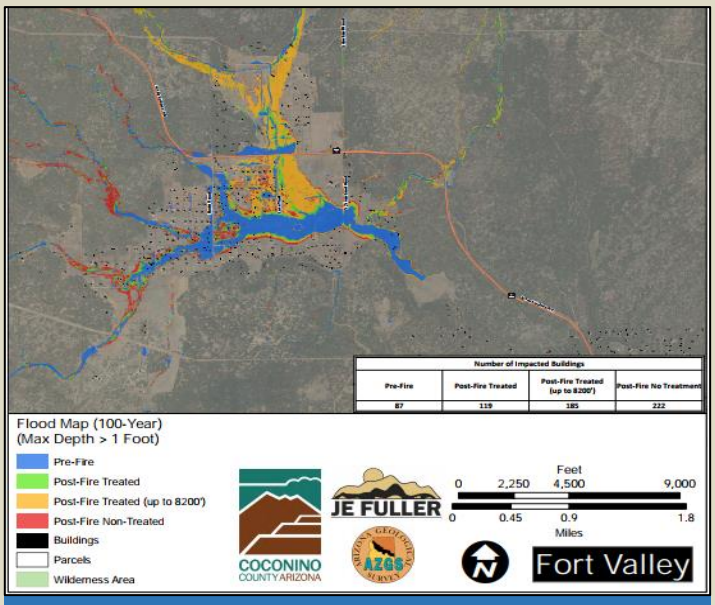
[6] Joint Fire Sciences Program, 2015
[7] Stratton, 2009
[8] Gartner et al., 2014; Staley et al., 2017
[9] Youberg, 2015

volumes compare to volume estimates derived from field mapping. These data were then used to select volumes for modeling potential inundation zones with LAHARZ[10]. LAHARZ is an empirical model first developed to identify potential hazard zones from lahars, a type of volcanic flow.

LAHARZ was later modified to include rock avalanches and debris flows, and subsequently adapted to model Arizona debris flows. LAHARZ is an ArcMap toolbox add-in. It provides a first-order approximation of the area that could be inundated by a debris flow for a given flow volume. Modeled LAHARZ inundation zones were compared with mapped post-Schultz Fire deposits to inform the interpretation of model results in the pilot study areas. The pilot study areas were assessed using the current USGS postfire debris flow probability and volume models[6], and potential inundation zones were identified using LAHARZ[8].

The study includes development of risk zone maps and mitigation strategy and implementation guidance for specific initiatives aimed at decreasing risks in the two pilot study areas. initiatives include revised planning and development guidance, forest treatment and restoration, community outreach/education, pre-fire resiliency infrastructure planning, post-fire emergency action plans and improvements to existing local flood warning systems.

[10] Schilling, 1998; Schilling, 2014



Flood Map for 100-Year Maximum Depths

Through predictive modeling and analyses, Coconino County now has the unique opportunity to plan for and take steps to mitigate potential risks posed by post-wildfire flooding and debris flows prior to the onset of the next wildland fire.

To view the full study with appendices, visit the Arizona Geological Survey's Document Repository at http://repository.azgs.az.gov/uri_gin/azgs/dlio/1727.

Hydrographer III Position Opening

Santa Clara Valley Water District

Santa Clara Valley Water District

The Hydrographer III position supports $1.6 million Hydrologic Data Measurement and Management Project within the Hydrology, Hydraulics, and Geomorphology Unit, which provides basic modeling calibration/data for the District's Flood Control and Groundwater Recharge Programs, and many other internal/external customers. This advanced journey Hydrographer III is required to properly support continuing expansion of the current 149 Surface Water Gauge Network, the training and teaching of apprentice staff, and new responsibilities focusing on recent State Water Resources Control Board legislation, Emergency Regulation for Measuring and reporting Diversion of Water (SB88).

Salary: $7,340.67- $9,396.40 Monthly*

Our comprehensive benefits package includes: vacation, 12 holidays, on call pay, personal leave and sick leave as well as medical, dental, vision, EAP, life and disability insurance. In addition, the District participates in the California Public Employees' Retirement System (CalPERS). Plus, optional benefits such as annual vacation cash out, wellness program that includes cash incentive, unlimited sick leave accrual with option to balance transfer for additional CalPERS service upon retirement, deferred compensation plan (457b) with up to $1000 annual District matching contributions, and much more.

Closing Date for Applications: October 4, 2017 by 11:59pm Pacific Time

For detailed information regarding requirements and qualifications for this opening and to apply online, please see the job posting by clicking on the following link: http://agency.governmentjobs.com/scvwd

For additional information contact Laurel Hanchett at recruit@valleywater.org

***Starting salary is based on years of experience and background.**

Registration is Open

for the

National Hydrologic Warning Council

9th Annual Texas Workshop

November 8-9, 2017

This 2-day interactive workshop will focus on hydrologic warning programs and systems in Texas, including flood warning system performance, flood forecasts and warnings, flood impacts, public communication, reservoir operations, and post flood activities. Other topics will include radio frequency encroachment, NOAA Atlas 14, and ALERT2 implementation.

The venue for this years' workshop will be the historic Menger Hotel located at 204 Alamo Plaza in San Antonio, Texas.

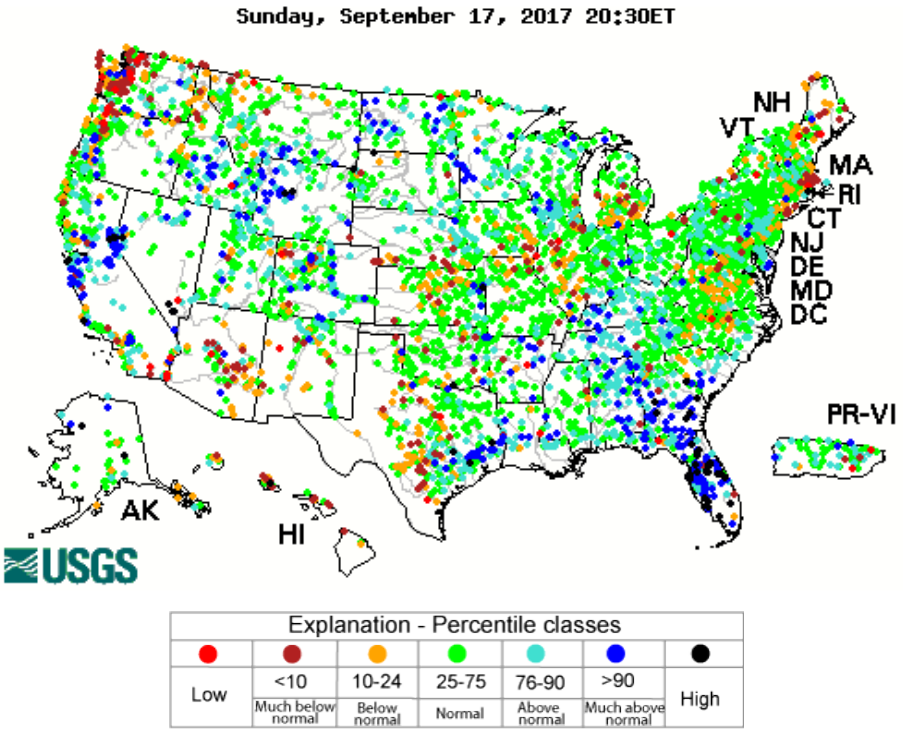
THE HISTORIC MENGER HOTEL

Visit the **NHWC** website to register.

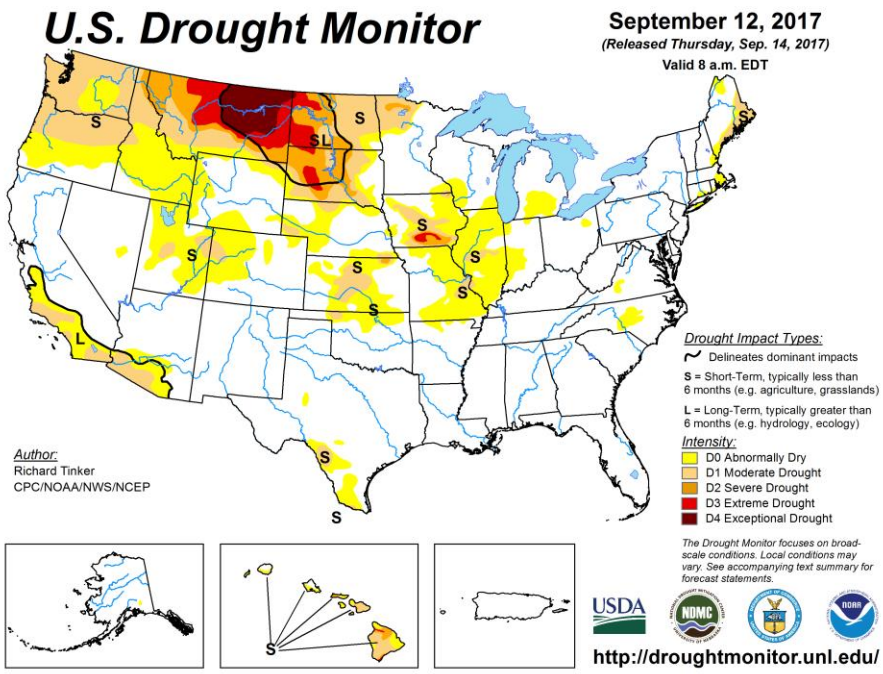
NATIONAL HYDROLOGIC WARNING COUNCIL

HARRIS COUNTY FLOOD CONTROL DISTRICT

Hydrologic Conditions in the United States
Through September 12, 2017



Latest stream flow conditions in the United States. (courtesy USGS)



Latest drought conditions in the United States. (courtesy National Drought Mitigation Center)

October Newsletter Articles Focus:

Data Collection

The NHWC is requesting articles that focus on practices, technologies and tools used to gather and disseminate real-time hydro-meteorological data.

Please consider writing an article that highlights how your organization collects and disseminates real-time data.

Submit your article to:

editor@hydrologicwarning.org

October 6th is the deadline for inclusion in the October issue.

Future Newsletter Articles Focus

To give you more time to prepare articles, below is the article focus schedule for the next four months:

Oct - Data Collection
Nov - Hydrology
Dec - Hazard Communication & Public Awareness
Jan - Modeling/Analysis

NHWC Calendar

November 8-9, 2017 - 9th Annual Texas Workshop, San Antonio, TX

General Interest Calendar

October 19, 2017 – The ALERT Users Group Fall Meeting & Workshop, Sacramento, California

November 5-9, 2017 – AWRA Annual Conference, Portland Oregon

April 17-20, 2018 – The ALERT User's Group Training Conference and Exposition, Ventura, California

Jun 4-7, 2018 – 2018 ASCE Environment and Water Resources Institute International Congress, Minneapolis, Minnesota

(See the event calendar on the NHWC website for more information.)

Parting Shot

Arizona Game and Fish Department Ash Creek ALERT Station

JE Fuller finished installing this new combination ALERT precipitation/stream and PTZ camera station on September 14th, 2017. This station was installed to provide advance indication of flooding from the Ash Creek Watershed which was recently burned by the Frye Fire that consumed over 48,000 acres in the Pinaleño Mountains of Arizona. Real-time data and camera imagery collected by this station can be accessed at https://water.azgfd.gov.

Photo by **Brian Iserman**, JE Fuller/Hydrology & Geomorphology, Inc.