HYDROLOGIC CONDUCTIVITY ASSESSMENT IN THE UPPER BIG CREEK WATERSHED

Jovany Canchola

California State University, Fresno

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Position: Water Resource Institute Intern

Supervisor: Alan Gallegos, Southern Sierra Province Geologist:

Sierra, Sequoia, and Stanislaus National Forest

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Alan, Thank-you for being a great mentor and for providing Cody and myself with the skills and knowledge we need to complete our work efficiently.

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Executive Summary

This report includes information on a road inventory hydrologic conductivity assessment done in the Upper Big Creek Watershed. The Upper Big Creek Watershed is a part of a collaborative restoration project focused on improving water quality and enabling passage for aquatic organisms. In order to achieve these goals, inspections were conducted on the drainage systems in Upper Big Creek to determine what preventative measures have to be taken. Hydro-connectivity between road and stream systems are a big concern because it effects the performance of drain systems, damages road surfaces, and increases sediment discharge into Big Creek and Pine Flat Reservoir. An overload of sediment can degrade water quality and have a huge impact on the ecosystem.

Project Objectives

The overarching goal for this internship was to inspect all the drainage systems within the watershed boundary of Upper Big Creek. Upper Big Creek is a 22 acre watershed that can be split into smaller sub-watersheds. Two previous Water Resource Interns, Karen Jimenez and Victor Aldama, inspected drains systems in Summit Creek during the summer of 2015. In the summer of 2016, Cody Ellis-Herring and Jovany Canchola conducted hydrologic inspections for the sub-watersheds in Duff Creek and Providence Creek.

Most of these stream crossings were facilitated by culvert systems (see figure 2 & 3) that measured from 18 to 100 inches in diameter and range from 30 to 50 feet in length. Key inspection criteria were: fine sediment alongside the road, erosive activity such as rill or rut development, debris buildup in culverts, overside drains or inboard ditches, damage to

culverts, and whether a road was insloped, or outsloped. Based on these observations, my partner and I were able to review the data and make recommendations on how to mitigate hydrologic road connectivity and how to reduce non-point source pollution. The objective of the field assessments were to determine which forest service roads were hydrologically connected to the streams systems in Upper Big Creek Watershed.

The amount of practical skills adhered through this internship opportunity is immense. The interns learned the protocols for conducting road inventory hydrologic assessments, how to operate a Trimble GPS unit, and how to develop and incorporate many features into the GIS software, ArcMap (see figure 1). It's also great knowing that all of the work they've completed this summer is fully relevant to their career path, which is to become a hydrologist or geologist. Working for the USDA Forest Service: Sierra National Forest, has been a really great learning experience. They've built several close relationships with fellow interns and supervisors that will carry on after this internship is over.

Project Approach

The approach for this particular project was to work as efficiently as possible and to inspect all of the drainages in Upper Big Creek before the end of the internship. The water resource interns devised a method of having someone be a note taker, while the other be the observer. They also took turns driving to and from the field area to give each other breaks. Additionally, the water resource interns were working in an area that experienced a very high volume of tree mortality. The most important thing was to get in and out of our field area in the safest possible manner. It was determined that they would avoid driving into areas where

trees were highly susceptible to falling and blocking the exit. Other precautions were to drive to safe zones, areas without dead trees, to have lunch.

Project Outcomes

After inspecting a total of 828 culverts and drainage systems, it was determined that 238 systems were hydrologically connected and 590 systems were non-hydrologically connected. Some common issues of hydrologically connected road segments are damaged culvert inlets/outlets, buried culverts, fully plugged culverts, and failed water bars (See figure 4). Additionally, the high volume of tree mortality within Upper Big Creek may create future problems for channel crossings that are currently in non-hydrologically connected areas. For example, Road 10S018 is currently experiencing extensive removal of hazard trees. The slash and debris from the tree removal operations may potentially flow downhill and into stream channels after major wind or rain storms.

Conclusion

Conducting the hydrological assessment is only half of the work for this project. Developing a maintenance plan that will ensure that damaged and plugged culverts get fixed, as well as redesigning roads that are insloped, may substantially reduce hydro-connectivity and lessen sediment discharge into Big Creek and Pine Flat Reservoir. Although the internship is coming to a close, it's a great feeling knowing that partner and I took part in the restoration of the Upper Big Creek Watershed. Working as a geologic technician this summer has reinforced our goals to work towards becoming a hydrologist or geologist. The

experiential learning internship has provided us with exceptional amounts of practical knowledge and skills that we can apply to future jobs.

Appendices

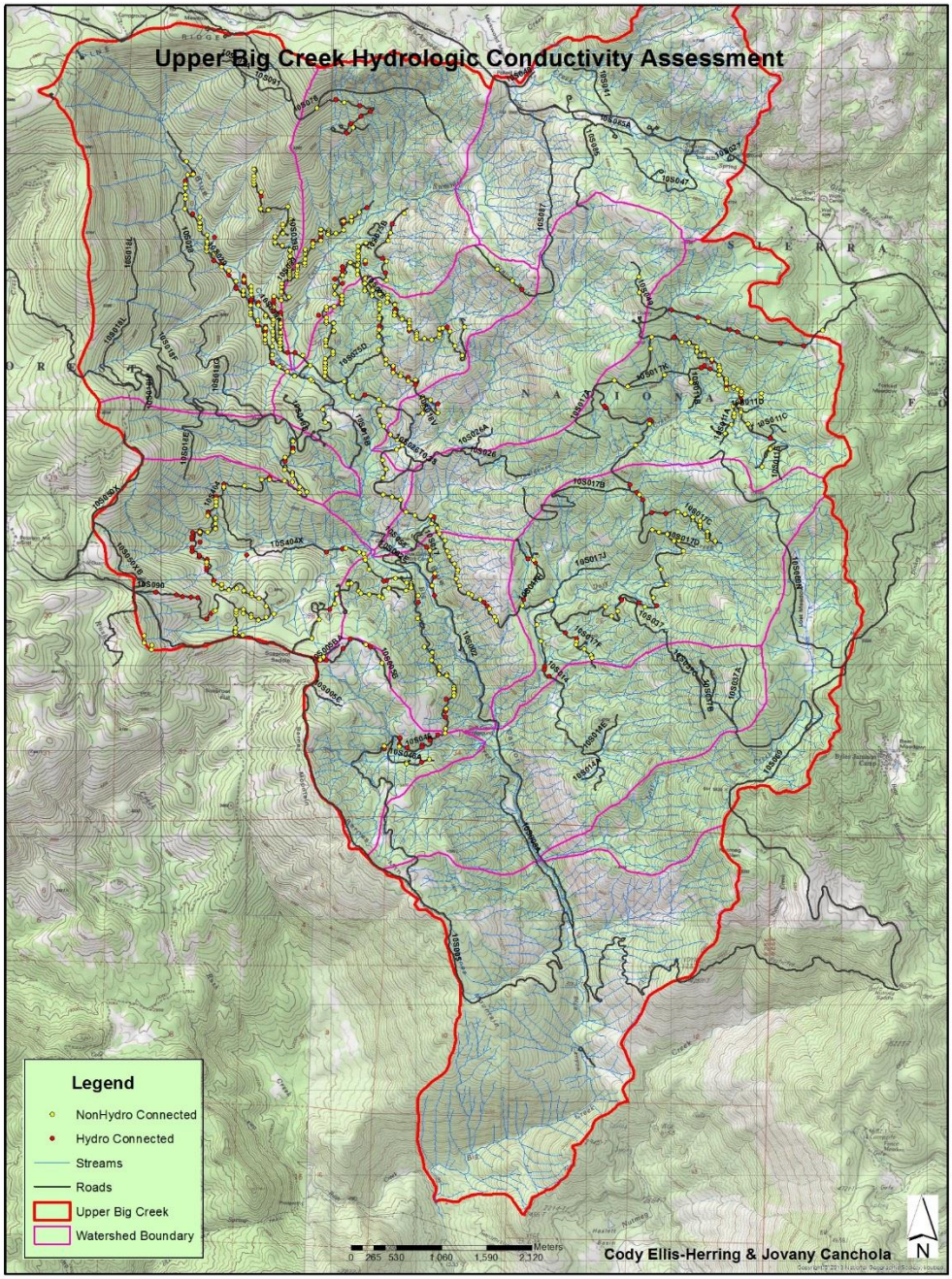

Figure 1: GIS map displaying the Upper Big Creek Watershed, sub-watersheds, and dots indicating locations that were inspected for hydrologic connectivity.

Figure 2: Culvert outlet, sometimes hidden or buried under fallen trees, debris or vegetation.

Figure 3: Culvert outlet with a shot gun. Protocol for culverts included measuring the culvert length, diameter, and outlet drop.

Figure 4: Road 10S090 is a good example of a hydrologically connected road segment with a failed waterbar and rills developing on the right side of the photograph.