Memorandum

To: Laura Vaugeois, Karl Wegmann
From: Patrick Pringle
Subject: Toats River WAU
2/4/2005

Summary

I have completed a review of the mass wasting assessment for the Toats River watershed. This mass wasting assessment, comprising a report and map, was prepared by Lee Benda and Associates, Inc, and included in a more comprehensive report by R2 and Associates in April 2002. Benda and Associates delineated 5 Mass Wasting Map Units (MWMUs) having high-to-low hazard rating. They also noted 11 landslides based on reconnaissance of aerial photographs and field work. They delineated these as simple numbered locations. I found only two sites of possible past shallow rapid landslides that were not delineated by Benda. I recommend that this mass wasting assessment be sent out for external review after these two sites be added to Benda's MWMU#1.

Methods

I evaluated Benda and Associates's hazard map using stereoscopic examination of 1989 and 1992 aerial photographs for most of the watershed. I then compared the mapped hazard areas of Benda and Associates with a 1:100,000-scale geologic map of the area by (Stoffel, 1990), a map delineating certain potentially hazardous areas based on the landform model SLPSTAB (Vaugeois, 2000), and with my own field observations made on a reconnaissance of the area with DNR Forester Tim Vugteveen. I also looked for visible sites of possible past slope failures that might have no corresponding MWMU delineated by Benda and Associates in their hazard assessment.

During my field reconnaissance, I noted the presence and distribution of geologic materials such as debris flow deposits, till, and stratified glacial drift that did not appear on the geologic map. There is no detailed large-scale geologic mapping for most of the watershed. Because of this limitation, I also consulted digital soils maps of the DNR's "soilsall" coverage in order to evaluate where mapped geologic parent material coincides with areas having slopes greater than 78 percent (as per 2003 written commun. from Domini Glass).

Results

Using the aerial photographs, I identified one area where disturbed or distinctive vegetation in two adjacent tributaries to Chow Creek indicated possible "shallow rapid" landslides had occurred in the past —these were not mapped by Benda's group. They are located in the NW ¼ section 12 and NE ¼ section 11, T38N, R23E.

On the aerial photos, I identified unusual mounds in valley bottoms in sections 13 and 24 of T38N, R23E and section 1 of T38N, R24E. Field inspection of these features revealed that they are kame-like mounds consisting largely of grus. A series of nested terraces at the mouth of Toats Creek might have been deposited by glacial outwash (uppermost) and debris flows (lowermost).

Discussion

The Sinlahekin River valley, which runs along the east margin of the watershed, was a major meltwater channel for the Okanogan lobe of the later Fraser continental ice sheet (Freeman, 1933). The eastern margins of the Toats watershed were glaciated by the western portion of the Okanogan lobe, which left striations and drift as high as 7000 feet on Chopaka Peak (Hibbard, 1962). This glacial history is undoubtedly more complicated than previously thought, and likely resulted in the damming of river systems that previously flowed north as well as the capture of drainage basins as noted by Riedel and Haugerud (1994). The glacial advances, damming, and outwash was thus largely responsible for the cutting of the relatively steep slopes of the Toats River valley and some of its tributaries, and for deposition of kame-like deposits (mounds of grus) mentioned above. It is not clear how much the mounds have been modified (assuming they were kames deposited during glacial recession).

Contrary to the Sinlahekin basin to the south, where most of the deep-seated landslide hazards noted by Benda and Associates were associated with tuff breccia of Eocene age, the deep-seated landslides in the Toats watershed are all associated with granodiorite of Jurassic age. As in the Sinlahekin watershed, it is possible this rock has a relatively high density of discontinuities (fractures) and locally lower rock mass strength values because of the proximity of a shear zone. Hibbard (1962) described the Chopaka fault zone, a north-trending structure that passes along the east boundary of the watershed. He noted that “smaller faults and shears are common” near this fault, and this therefore suggests that there will be areas where rock quality may be poor and the rock may be densely cut by discontinuities (fractures). One such area was observed in field reconnaissance in the watershed.

Assessment of Hazard Map

1. *Are the majority of landslides in the basin adequately identified?*

Yes,

2. *Do the Mass Wasting Map Units reflect reasonable assumptions based upon your review of the geology and landslides in the basin?*

The landslides delineated by Benda and Associates adequately reflect the geology of the area and extent of documented landslides. However, geologic mapping of the area is limited, thus, the extent of fragmental geologic material and rock quality inhomogeneities is not known in great detail.

3. *Are the hazard ratings assigned to the Mass Wasting Map Units reinforced by the distribution of landslides as shown in the landslide Inventory for the WAU?*

Yes.

4. *Are there landforms that seem to have a large number of landslides, but no associated Mass Wasting Map Unit?*

No.

5. *Does the text describing the Mass Wasting Map Units do an adequate job in presenting the landform / geology information that a forester using this map would need to identify the features on the ground?*

Yes.

6. *Are there additions to the mass wasting assessment products?*

Yes. I delineated two areas in NW ¼ section 12 and NE ¼ section 11 of T38NR23E that I recommend be added to MWMU#1 (shallow rapid landslides).

7. *Is this mass wasting assessment: (1) acceptable as is, (2) acceptable with revisions, or (3) not acceptable?*

(2) As soon as the suggested MWMU unit additions are reviewed, accepted, and added, this assessment is ready for external review.

References

Freeman, Otis Willard, 1933, Stagnation of the Okanogan lobe of the Cordilleran icesheet and the resulting physiographic effects: Northwest Science, v. 7, no. 3, p. 61-66.

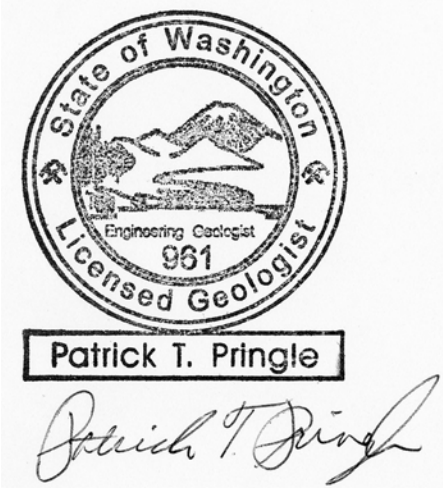
Glass, Domini, 2003, Memorandum discussing slope stability processes in northeastern Washington.

Hibbard, M. J., 1962, Geology and petrology of crystalline rocks of the Coulee Creek region, Okanogan County, Washington: University of Washington Doctor of Philosophy thesis, 96 p., 1 plate. Geologic map: Plate 1, scale 1:48,000.

Riedel, J. L.; Haugerud, R. A., 1994, Glacial rearrangement of drainage in the northern North Cascade Range, Washington [abstract]: Geological Society of America Abstracts with Programs, v. 26, no. 7, p. A-307.

Stoffel, K. L., compiler, 1990, Geologic map of the Oroville1:100,000 quadrangle,Washington: Washington Division of Geology and Earth Resources Open File Report 90-11, 58 p., 1 plate. Geologic map: Plate, scale 1:100,000.

Vaugeois, Laura, 2000, Creation of a slope stability-screening tool from landslide prediction models, Forest Practice Board Presentation: Washington Department of Natural Resources, Olympia, Washington.


State of Washington
Engineering Geologist
961
Licensed Geologist
Patrick T. Pringle

2/4/2005