



State of Washington
DEPARTMENT OF FISH AND WILDLIFE

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June 21, 2011

TO: Laura Casey, King Co. Department of Development and Environmental Services

FROM: Bob Barnard, Environmental Engineer

SUBJECT: Washington Department of Fish and Wildlife Shoreline Exemption L10SX040, Tokul Hatchery Emergency Repairs and Mitigation

Laura, in your November 23, 2010 letter to Marty Peoples, you said that our proposed mitigations structures may increase the threat to landslides. Specifically:

This project is located on a reach of Tokul Creek that experiences landslides on the south side of the Creek. A couple of the tri-groin structures are proposed opposite recent landslides and in narrow portions of the stream. Please have your engineering geologist or fluvial hydrogeomorphologist respond with an evaluation of the risk of future landsliding due to installation of these tri-groin structures.

We have now changed the location of these structures from what was originally proposed and reduced the number from 3 to one. Please see the revised drawings in this package for their new location. By moving what has now become a small log jam, we have substantially reduced the threat of landslide for two reasons.

1. The channel at this location is much less confined. The entrenchment ratio in the upstream reach is probably less than 2 with typically deep flow and high velocity during storm events. Confined channels are prone to bed or bank erosion because of this and structures that further confine flow can exacerbate the effect. The entrenchment ratio at the new site is likely in excess of 3 with lower hydraulic stress. I do not believe that adding wood to this reach, in the way that we propose, will cause channel wide scour.
2. Rather than the steep high bank common in the upstream reach, there is a 15 foot high terrace behind a 45 ft wide floodplain. Please see Figure 1. Should there be any left bank erosion, it would move into the low bank flood plain area and not at the toe of a steep slope. In the unlikely event that substantial lateral erosion occurred and it did reach the toe of the terrace, there would not be the massive response that occurred at the DOT site.

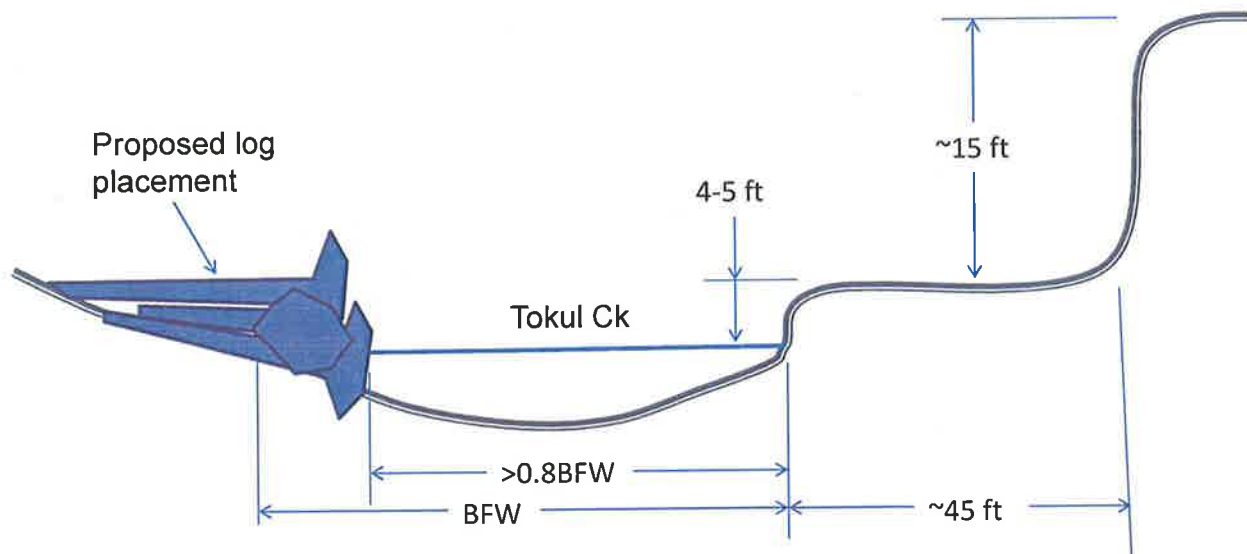


Figure 1: Cross section of Tokul Ck at the location of the proposed log jam. Not to scale.

I have suggested to our design staff that the log structure should not penetrate more than 20% into the bankfull channel. Various researchers (Young 1991; Gippel, O'Neill et al. 1996; Dudley, Fischenich et al. 1998) have found that when wood structures block less than about 15-20% of the bankfull with, there is minimal channel backwater and the channel wide effects that that causes.

- Dudley, S. J., J. C. Fischenich, et al. (1998). "Effect of woody debris entrapment on flow resistance." Journal of the American Water Resources Association **34**(5): 1189-1197.
- Gippel, C. J., I. C. O'Neill, et al. (1996). "Hydraulic guidelines for the re-introduction and management of large woody debris in lowland rivers." Regulated Rivers: Research and Management **12**: 223-236.
- Young, W. J. (1991). "Flume study of the hydraulic effects of large woody debris in lowland rivers." Regulated Rivers: Research **6**: 203-211.