Appendix I

Peak Flow Predictions

Contents

I. PEAK FLOW PREDICTIONS

MRC modeled potential changes in peak flows resulting from timber harvest (section 3.3.12). Appendix I provides the equation for peak flow predictions for those wanting this level of detail.

$$E(r) = \exp\{[1+B_2(t-1)]c[B_4+B_5\ln(y_c)+B_6\ln(w)]\}$$

Where:

r	ratio between the observed peak flow and the expected flow, without a logging effect in a watershed as the result of a storm
B_2	logging recovery coefficient (-0.0771)
t	number of summers since logging
c	proportion of the watershed logged (for partial harvest this is the portion of canopy removed)
B_4	constant (1.1030)
B_5	storm size coefficient (-0.0963)
y_c	expected mean peak discharge of control watersheds in Caspar Creek to a storm having the same return period as the storm being estimated ($m^3s^{-1}ha^{-1}$)
B_6	watershed wetness coefficient (-0.2343)
w	watershed wetness index

The above model predicts the increase in peak flow compared to a control watershed flow (y_c). For the purposes of analysis, we used the mean storm flow of the Hen and Ive stations in Caspar Creek as the control in the equation. This represents a 2-year event (0.0073 $m^3s^{-1}ha^{-1}$). A 2-year return interval peak flow event was selected because it is typically greater than the bankfull discharge, yet small enough to be sensitive to forest harvest effects. The equation was developed from analysis on clear-cut harvests in Caspar Creek and is likely a conservative estimate when applied toward selective harvest practices.

The peak flow equation was applied to the plan area at the CalWater planning watershed scale for current canopy conditions. The CalWater planning watershed scale, approximately 3000-5000 ac in size, was chosen because this is the scale at which cumulative effects are typically analyzed in timber harvest plans. The equation for peak flow prediction (Lewis et al. 2001) was developed for watersheds of approximately 1150 ac and smaller. We did not think it was appropriate to use the equation much beyond the CalWater planning watershed scale, as this is already 3 to 5 times larger than the North Fork Caspar Creek watershed. Observations of peak flows in much larger basins (>50 km^2) have not shown increases in peak flows proportional to smaller basins (Beschta et al. 2000).

The use of the equation is very sensitive to the wetness index (w). Values of wetness index observed at Caspar for a 2-year event range from approximately 50 for dry conditions to 600 for the wettest conditions in the middle of winter. The average watershed wetness index for a 2-year event was observed as 304 (Lisle et. al. 2000). For the purposes of this analysis, the average wetness index value of 304 was used. Some limited analysis, using the 50 and 600 wetness index values, was performed to provide a range of peak flow increases. For the proportion of watershed logged (c value in the peak-flow equation), we use 100% canopy minus the amount of canopy in the watershed. For the time since logging (t) we use 1. Canopy retention on land not owned by MRC is, of course, unknown. Therefore, any estimates of peak-flow increase are for effects in the plan area.