

MAY 2007 - SKAGIT COUNTY STAFF SUMMARY:
**AN INDEPENDENT TECHNICAL REVIEW OF SKAGIT RIVER HISTORICAL HYDROLOGY AND
HYDRAULIC ANALYSES BY NORTHWEST HYDRAULIC CONSULTANTS**

Former County consultant, PIE and others have challenged the inclusion of four historic peak flow estimates within the Skagit River flood frequency analysis published by the US Army Corps of Engineers due to the inconsistency of these estimates with actual recorded flood peaks used in the analysis. The issue is important because the inclusion of the historic estimates for water years 1898, 1910, 1918, and 1922 affects the estimated 100-year base flood elevation used by FEMA for establishing flood insurance policies in the Skagit floodplain.

Skagit County contracted with Northwest Hydraulic Consultants (nhc) for an independent technical review of this matter in 2006. The County sought nhc's opinion on whether these historic estimates should be excluded, or not, and on actions that could be taken to reduce uncertainty over the Skagit River historical hydrology. nhc completed their review in 2007 with two conclusions and five recommendations.

nhc Conclusions

- 1) Estimates of the peak discharges for the four historic flood events should continue to be incorporated in hydrologic analyses of the Skagit River

Several issues raised about these historic floods, including questions about the 'Smith house' in Hamilton are addressed in the report. It is nhc's opinion that significantly reduced hydraulic conveyance at and downstream from Hamilton, could account for areas to be subject to flooding today, such as the 'Smith house', that were not subject to larger, historic flooding. The primary factors cited that could account for this reduced conveyance, especially when considered collectively are a reduction in channel width, reduction in channel depth, and construction of the training levee on Cockreham Island.

- 2) Uncertainty in the magnitude of the historic floods should be better accounted for in future hydrologic analyses.

It is NHC's opinion that an emerging alternative methodology, EMA (Expected Moments Algorithm), is more comprehensive and flexible at incorporating uncertainty of historic peak flow estimates than is available in the standard approach using the procedures of USWRC Bulletin 17B. (Bulletin 17B is the current methodology utilized by USACE to establish 100-year base flood elevations.) EMA is not yet accepted for broad application by the federal agencies, but it is being used and tested in some areas.

Key factors in using EMA are 1) the time frame of the historic record and 2) the 'range of uncertainty' that must be established for each historic peak flow estimate. nhc made these range estimates and conducted exploratory analyses with EMA on the Skagit River hydrology, extending the time frame for the historic period back to settlement of the Skagit Valley in 1870. The result indicated utilizing EMA had potential for a reduction in the unregulated 100-year peak discharge for the Skagit River near Concrete from the current estimate of 284,000 cfs to approximately 240,000 to 250,000 cfs.

NHC Recommendations

- 1) County should negotiate agreements with Seattle City Light and with Puget Sound Energy to ensure availability of 120,000 acre-ft of flood control storage at Ross Dam and 74,000 acre-ft of flood control storage at Upper Baker Dam earlier in the flood control season and no later than November 1.
- 2) The County should clarify with USGS regarding the potential for additional paleoflood studies to further reduce uncertainty in Skagit flood frequency analyses. (USGS proposed such a study in late 2006 that targets the pre-settlements floods of around 1856 and 1815: estimated to take 2 years and to require \$180,000 in non-USGS funding.) In considering the incorporation of pre-settlement floods into flood frequency analyses, estimates of both peak discharge and a time period within which each flood was the largest event, need to be established.
- 3) The County should determine whether the potential for some reduction in the 100-year peak unregulated discharge, based on more rigorous flood frequency analysis, warrants additional County investment in hydrologic and hydraulic studies.
- 4) Future flood frequency analysis using the EMA methodology holds the potential for further reducing uncertainty over the Skagit historic hydrology and producing more defensible estimates of 100-year base flood elevations. Should the County decide the answer to recommendation #3 above is 'Yes', discussions should be initiated with the USGS, the USACE and FEMA to explore the technical and institutional feasibility of using EMA to refine the current 100-year base flood estimates for the Skagit River near Concrete. Initial discussions should focus on:
 - the merits of using EMA as opposed to Bulletin 17B,
 - the acceptability of EMA to the three agencies,
 - institutional issues resulting from possible revisions to the current flood peak estimates, including scheduling and budgetary considerations,
 - the process for review and acceptance of revised flood peak estimates, and
 - establishing the range of uncertainty and time periods for historic peak flow values.
- 5) A staff gage should be installed at the original site of the Concrete gage, about 200 feet upstream from the current gage and arrangements made to read gage heights at both the current and original locations during future flood events. This will yield data that can be used to better correlate present flood peaks at Concrete to the peaks recorded at the original site.

While the above recommendations are under consideration and until they are implemented to further reduce uncertainty over the Skagit historic hydrology, nhc advises the County to continue development of flood hazard management projects on the basis of the Corps' current hydrologic analyses.