



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 3755
SEATTLE, WASHINGTON 98124-3755

FEB 16 2007

Planning Branch

Mr. Chal Martin
Director, Public Works
City of Burlington
900 E. Fairhaven Avenue
Burlington, WA 98233

RECEIVED

FEB 26 2007

Dear Mr. Martin:

Thank you for your letter dated November 1, 2006 concerning the Skagit River Basin's hydrology and hydraulics data and models. I appreciated the invitation to the Dike and Drainage District 12 pre-flood meeting in Burlington this past October. It gave me an opportunity to meet some of the key people and to hear the concerns of the diking districts, cities, and agricultural community concerning flooding and regulatory issues in the Skagit River Basin. I agree with you that the U.S. Army Corps of Engineers (Corps) teams working on emergency flood-fighting for the Skagit are professional and highly committed. The General Investigation (GI) team includes some of the best technical and professional staff in our District, and I am equally proud of their work.

I also appreciate your concern that the data and modeling for the Skagit basin will have a large impact on the feasibility of flood-damage reduction. I recognize that you disagree with the Corps regarding the modeled hydrology and do not think that we have adequately considered the information provided by the county and cities. I have evaluated the technical reviews of the various hydrologic models, the information provided by the county and cities, and the reports provided by the United States Geological Survey (USGS) on historic Skagit River flood events. I am confident that all information has been rigorously and independently considered and have determined that the Corps model will be used as a basis for our GI study. The Corps Engineering Manual 1110-2-1417, Flood Runoff Analysis, stipulates that "frequency-based estimates of flood discharge are a fundamental requirement for flood-risk investigations and flood-damage analysis." The county's hydrologic model cannot be used to develop hypothetical flood events, and thus does not meet our frequency-based requirements. A brief history of the review of engineering data for the Skagit River hydrologic/hydraulic model is enclosed as a reference. The Corps, however, remains open to the consideration of new technical information that may be developed on this matter.

The Corps supports the evaluation of operational and structural changes at Upper and Lower Baker Dams as part of the GI process. However, the Baker River system provides less than 20% of the flow into the Skagit River, with the majority of the river's inflow coming from the uncontrolled Sauk River. This limits the ability of the Baker Dams to solve the majority of the

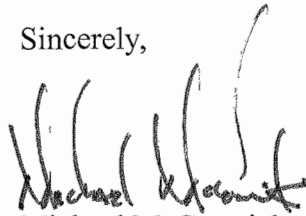
flooding problems in the lower basin, particularly in a large event. It is possible that in smaller flood events operational changes at Upper Baker Dam may provide some benefit, and we are evaluating this as part of the GI.

The Corps has the responsibility to consider risk to those in the floodplain as well as cost in the design and implementation of flood damage reduction projects. We acknowledge that the construction and maintenance costs of a regional flood-damage reduction system for the Skagit River Basin will likely be expensive. We are willing to partner with Federal, state, and regional agencies to develop a funding plan for the Skagit basin within the limitations of our authority. We are exploring with Washington State opportunities for support of flood-damage reduction projects that would protect vital infrastructure, such as the Interstate 5 corridor.

The success of the GI process and the ultimate Congressional authorization and funding of a flood-damage reduction project for the Skagit River will require the strong, united support of all stakeholders. I hope that we can also look to Skagit County and the cities, including Burlington, to provide the necessary leadership and support.

If you have further questions concerning the GI study, please contact Ms. Linda Smith, Project Manager, at (206) 764-6721 or linda.s.smith@usace.army.mil. A copy of this letter is being sent to the individuals on the enclosed listing.

Sincerely,



Michael McCormick
Colonel, Corps of Engineers
District Commander

Enclosures

Review History of Engineering Data for Hydrologic/Hydraulic Modeling Skagit River, WA

1. NWS H&H Models (2002-2004): Seattle District's hydrologic model was reviewed internally¹ and the hydraulics model was technically reviewed by WEST Consultants² in 2002. In 2004, the Hydrologic Engineering Center (HEC) at Davis, California conducted an independent technical review. HEC reviewed the models and met with NWS staff. After some modification, HEC accepted the NWS models and determined they could be used as a predictive model for synthetic events.³ Concurrent with HEC's review, Puget Sound Energy hired Tetra Tech to perform a complete review. Tetra Tech provided 26 pages of comments that were addressed.⁴ At the same time, the United States Geological Service (USGS) tasked William Kirby from their headquarters office to review the hydrology. After comments were addressed, USGS concurred with the NWS analysis.⁵

2. Skagit County H&H Models (2005): In 2005, HEC conducted an independent technical review of Skagit County's H&H model, developed by Pacific International Engineering (PIE). After HEC reviewed the models and met with PIE staff, HEC determined that the PIE hydrologic model was not recommended for the simulation of hypothetical events and that PIE's reservoir modeling had no sound basis for evaluation of hypothetical events.⁶ In addition, **PIE's hydraulic model was calibrated using hydrology from the hydrologic model, and HEC found the historic hydrologic effort to be "deficient" in its use of 5 parameters used in the model which can have a large impact on the results.** HEC concluded that "statements regarding the accuracy of the hydraulic model calibration are not credible because of this unresolved issue regarding appropriate historic hydrologic inputs".⁸ After reaching this conclusion, HEC terminated their technical review.

3. USGS Data Points (2005): In 2005, USGS performed a verification study to corroborate four particular data points or determine whether an improvement could be made to these estimates.⁹ The conclusion of this study was that the new 1921 peak discharge estimate was not significantly different than the previous calculation. In addition, at the request of Skagit County, USGS had the findings further reviewed by Dr. Robert Jarrett of their National Research Program. Dr. Jarrett was also provided comments from Skagit County's consultant, PIE, to review. Dr. Jarrett determined that the flow estimates determined by USGS are as good as could be obtained while recommending further study to include the 1815 and 1856 floods¹⁰ which would most likely increase the 100-year flood estimation. **Representative Rick Larsen requested that the USGS review and comment on Larry Kunzler's white paper outlining his analysis of USGS' work on Skagit's historic floods. Matthew Larsen, USGS's Chief Scientist for Hydrology, concluded in response that 1) there is little more that could be done at this point to verify data collected nearly a century ago, 2) it would be wrong to eliminate the data from the flood frequency analysis, 3) there is good evidence that these floods were large floods, and 4) the stage of the 1921 flood is precisely known and the computation of discharge is as good as can be done today.**¹¹

4. Flood Insurance Study (2007): The Corps is working for FEMA to provide a revised flood insurance study for the Skagit River basin. The H&H models used for the FEMA study are based upon the models developed for the GI study. The Corps has submitted the hydrology and hydraulics to FEMA's independent contractor, Michael Baker Corporation (Baker), for review. While in this process, the Skagit County Commissioners asked FEMA to review a report by PIE which made the case that a different hydrology be used. Baker reviewed this submittal and compared it with what was submitted by the Corps and concluded that the Corps analysis was more reasonable than the PIE analysis for 7 different reasons.¹² There will still be an open public comment period once the draft maps are released by FEMA and the Corps will make any corrections if errors are identified as a part of this process under the direction of FEMA.

¹ Ken Brettmann's 17 pages of comments resolved 9 January 2002.

² HEC-UNET hydraulic model review by Anand Raman resolved 11 September 2002, FLO-2D hydraulic model review by John Howard resolved 17 July 2002.

³ HEC H&H Review: Hydraulics – Michael Gee comments resolved 29 July 2004, Hydrology – Tom Evans comments resolved 5 August 2004. Skagit County was provided HEC comments and responses by email on 1 September 2004.

⁴ Tetra Tech review comments provided 18 June 2004, addressed 20 August 2004. Skagit County was provided these comments and responses by email on 1 September 2004.

⁵ Received USGS comments on 29 June 2004, addressed 20 August 2004. Skagit County was provided these comments and responses by email on 1 September 2004.

⁶ HEC Skagit Review Backcheck.pdf file, pages 1, 5. Provided to Skagit County by email 11 April 2005.

⁷ HEC Skagit Review Backcheck.pdf file, page 1. Provided to Skagit County by email 11 April 2005.

⁸ HEC Skagit Review Backcheck.pdf file, page 6. Provided to Skagit County by email 11 April 2005.

⁹ USGS study (by M.C. Mastin and D.L. Kresch): *Verification of 1921 Peak Discharge at Skagit River near Concrete, Washington, using 2003 Peak-Discharge Data*, August 2005.

¹⁰ USGS review and comments of Pacific International Engineering's *Draft Evaluation of Flood Peaks Estimated by USGS*, dated November 16, 2004. Reviewed by Robert D. Jarrett, Ph.D., USGS, National Research Program, Paleohydrology and Climate Change Project, Lakewood, Colorado, February 2005, page 8.

¹¹ USGS letter response to Dan O'Donnell from Matthew Larsen, dated 26 October 2006, pages 16-17 (Skagit County also cc:ed).

¹² Michael Baker Corporation, Alexandria, Virginia (Wilbert O. Thomas, Jr): *An Evaluation of Flood Frequency Analyses for the Skagit River, Skagit County, Washington*, on behalf of the Federal Emergency Management Agency, Region X, Bothell, Washington, dated 9 February 2006, pages 11,12. Emailed to Skagit County on 2/10/06 by Ryan Ike, FEMA Region X.

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