

City of

**Mount  
Vernon**

Mayor

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Mr. Syed Qayum,  
National LOMR Technical Manager  
FEMA National Service Provider  
3601 Eisenhower Avenue  
Alexandria, VA 22304-6426

RE: Submission to FEMA of the City of Mount Vernon's Request for a Conditional Letter of Map Revision (CLOMR)- Mount Vernon Downtown Project.

Dear Mr. Qayum:

The purpose of this letter is to provide an overview of the City of Mount Vernon (the Applicant) submission of its application and supporting documentation for a Conditional Letter of Map Revision for the City of Mount Vernon Downtown Flood Protection Project (the Project) which are enclosed in notebook style format. The Applicant includes two requests: 1) submittal of a project design and engineering analysis to substantiate a request to change the Flood Insurance Rate Maps (FIRM's) in the historic downtown Mount Vernon area and, 2) submittal of a Skagit River Basin hydrology analysis for review as an alternative to the hydrology that FEMA is currently using for the ongoing restudy.

### **Project Purpose**

There is a substantial and well-documented risk of flooding within Skagit County from the Skagit River, with a 100-year flood damage event estimated to exceed \$1 billion by the U.S. Army Corps of Engineers. Flooding has the potential to cripple key transportation, water, other critical infrastructure, residential areas, and farmland. Since 1991, four floods have caused \$71 million in flood damage in Skagit County, with a flood of record occurring in October 2003. This threat places at risk the historic downtown Mount Vernon area which is adjacent to the Skagit River and within the FEMA 100-year floodplain. The historic downtown area contains essential infrastructure critical to carry on a functioning local, state and federal government including but not limited to the County jail, the County Superior and District courthouses, County law enforcement and prosecutors offices, City government facilities including City Hall, the regional U.S. Post Office, Interstate Five (a part of the federal interstate highway system), State Route 536, the Burlington Northern Santa Fe international rail line running from Canada to the south Washington border, Skagit Station (a multi-modal transportation facility that serves as the hub for the County Connector which provides bus service between Skagit, Whatcom, and Snohomish counties), and the City's wastewater treatment plant. The historic downtown area also contains historic structures, landmarks and residential housing (including affordable and senior housing) to many Mount Vernon citizens. The purpose of the Project is to provide permanent 100 year flood protection to the historic downtown area thus protecting key infrastructure, historic structures and landmarks and residents in the historic downtown area.

### **Computer Model Used**

The Project has been designed using the current FEMA hydrology developed by the U.S. Army Corps of Engineers (USACE), FEMA's study contractor in the Skagit River Basin. The effective FIRM is no longer accurate and a re-study has been underway for several years by FEMA Region X. On June 20, 2008 representatives of the City of Mount Vernon met with FEMA representatives and confirmed that application of the FLO-2D model developed by the FEMA study contractor was the appropriate model to use for the Lower Skagit River flood plain analysis. Consequently, the City of Mount Vernon has used the FEMA provided FLO-2D model to determine the proposed revisions to the BFE's and flood boundaries in the area affected by the Project.

### **Project Design**

The City of Mount Vernon is currently protected from flood waters by a system of levees, a temporary flood wall and a volunteer based flood fight program using sand bags. The Flood Protection Project includes replacement and rehabilitation of the existing system with a new system of permanent flood walls including openings, closure structure with stop logs, and reconstructed levees. The Project as designed will provide a level of protection for the base flood flow estimated by the FEMA study contractor. Revision of the hydrology to the base flood flow presented in the hydrology report will reduce the top elevation of the flood structures by approximately 1.5-ft.

### **Hydrological Analysis**

It is important to recognize that the Project is designed to provide a level of protection using the base flood flow estimated by the USACE as the FEMA study contractor. However, the Applicant has enclosed an alternative hydrological analysis that supplements USACE analysis with superior data and methodology. Basin hydrology and flood frequency analysis was performed by the USACE (FEMA study contractor). Eighty-three years of the data were used to determine the base flood flows including 79 years of systematic records from a USGS gauging station and four historic data of unrecorded floods estimated using high water marks (HWMs) and the slope-area methodology. In addition, for the last several years the Applicant and other Skagit Valley Communities have engaged engineering and forensic consultants to perform an independent and rigorous analysis of the historical data associated with developing the basin hydrology. The results of this work demonstrated the following: 1) that poor quality data had been used in calculating the base flood flows, and 2) application of superior methodology to the derivation of historical flood flows would change the base flood elevations significantly.

**Poor Quality Data.** Current FEMA hydrologic analysis incorporates estimates for four historical floods that occurred before installation of the USGS gage at Concrete. The USGS performed the hydrologic analysis using an application of the slope-area methodology to estimate the magnitude of the December 1921 event. The magnitude on the other three unrecorded floods was derived using a comparative relationship to the December 1921 event. The USGS used high water marks (HWMs) identified by USGS engineer James Stewart downstream of the Concrete gage. These HWMs were not tied to a benchmark or datum.

Stewart had previously surveyed HWMs upstream of the Concrete gage and tied them into the USGS benchmark, mean sea level or MSL datum, in Concrete. The USGS was either unaware that Stewart had surveyed these HWMs or was unable to use them in their analysis. The Applicant's hydrologic report uses the upstream HWMs surveyed by Stewart and tied to the USGS benchmark. Section 3.2 of the Skagit Basin Hydrology Report (included herein) discusses this finding in detail. Stewart also identified and surveyed many other HWMs downstream of Concrete in the vicinity of Hamilton. These HWMs were tied into the USGS benchmark or the Great Northern Railroad Company (GNRR) rail grade which was tied to the mean sea level (MSL) datum.

The Applicant's use of all the HWM data surveyed by James Stewart in both the vicinity of Concrete and Hamilton tied to the MSL datum to perform the hydrologic analysis demonstrates a higher quality and greater quantity of data input whereas the current FEMA analysis uses only data that is not tied into a benchmark or datum. As such, Applicant's alternative hydrology shows a greater degree of 'technical correctness' as that standard has been defined in FEMA regulation 44 CFR § 59.1.

**Superior Methodology.** The USGS performed the hydrologic analysis to estimate the flows for the four historic floods at Concrete that are currently used by FEMA to determine the base flood flows on the Skagit River. USGS applied the indirect slope-area methodology using 3 cross sections over a one-mile reach downstream of the Concrete gage to estimate these flows. Limitations on the slope-area methodology include an assumption that the flow velocity remains relatively constant from section to section. The short reach where USGS performed the analysis has high velocity with surging characteristics during flood flows. The methodology used by the Applicant has factored in a sensitivity to changes in velocity and is thus more accurate. The USGS recently performed a study to check its earlier estimates. The recent study included using HWMs collected from the 2003 flood of record event within original USGS study reach. The newly observed HWMs varied over a wide range prompting USGS to state that uncertainty of the Stewart's estimate was high in the 20% to 25% range. In 2007 the USGS published a report which revised its estimate of the 1921 flood flow down by 5% to 228,000 cfs from 240,000 cfs. FEMA has since accepted the revised flow estimates made by USGS and has incorporated them into the ongoing FIS study.

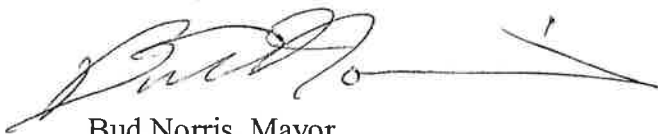
The Applicant has employed a current methodology involving the application of the USACE, HEC-RAS model applied over a much longer reach of the Skagit River just upstream of the USGS study reach. The Applicant's model incorporates 27 cross sections in a reach extending 2.5 miles. The model was calibrated using 12 observed and surveyed high water elevations from the 2003 flood of record. The accuracy of the calibration over the reach is within +/- 0.4-ft. The model was then used to predict the flows of the four historic floods by incrementally inputting higher flow into the model until a flow was reached that modeled a water surface matching the Stewart HWMs (both Concrete and Hamilton) for the 1921 flood. This analysis predicts that the 1921 flood flow is 169,700 cfs. This flow is 58,300 cfs, or 34.4 percent, lower than the USGS revised estimate and that being used by the FEMA study contractor

An additional verification of the Applicant's prediction was performed by comparing flood elevations of the 1921 flood to historic flood photos and water marks on currently existing buildings that were built before 1921. A forensic analysis was done on water stains on the interior of several walls to identify the maximum flood elevation experienced by two of these structures. Using the calibrated HEC-RAS model, the predicted flood flow by the Applicant for the 1921 flood results in an elevation that does not exceed the maximum recorded elevation identified in the historic photos and by forensic analysis. The USGS predicted flood flow for the 1921 event, however, exceeds the maximum recorded elevation by up to 9 feet.

The difference between the current FEMA base flood flows and the Applicant's base flood flows result in a 4-ft differential in the base flood elevation in areas of existing major commercial and residential development in the cities of Mount Vernon and Burlington, as well as transportation infrastructure in the I-5 corridor. The enclosed hydrologic alternative analysis represents best available science and demonstrates that USACE study is technically and/or scientifically incorrect as those standards are defined in FEMA regulations. *See* 44 CFR § 59.1. However, as stated previously, the Project is designed to provide a level of protection that uses the higher base flood flow estimates by the USACE as the FEMA study contractor

The Skagit River Valley communities have experienced several devastating floods during the past century and continue to be at significant risk each year. The communities have worked diligently for many decades to reach an understanding of the basin hydrology and identify technically viable, cost effective methods to provide protection to the citizens and critical infrastructure that is at risk. Construction of the Mount Vernon Flood Protection Project will provide flood protection to a major community and provide for the return of economic growth and vitality to a historic city in the State of Washington. We look forward to working with FEMA in this request for a Conditional Letter of Map Revision.

Sincerely,

A handwritten signature in black ink, appearing to read 'Bud Norris', with a long horizontal line extending to the right.

Bud Norris, Mayor  
City of Mount Vernon