Mr. Kevin Merli
Department of Homeland Security
FEMA, Region 1
99 High Street, 6th Floor
Boston, MA 02110

Mr. Merli,

I am writing to you as a follow-up to a conference call held on October 4, 2006 regarding two new studies of the Suncook River in Epsom, New Hampshire. This letter is designed to provide the documentation that you requested so that the Federal Emergency Management Agency (FEMA) can make a determination if the studies can be supported under the Hazard Mitigation Grant Program (HMGP) which was authorized under Section 404 of the Robert T. Strafford Disaster Relief and Emergency Assistance Act.

In June of 2006, the USGS submitted a concept proposal to the Federal Emergency Management Agency (FEMA) and the State of New Hampshire to conduct a flood study along the Suncook River in Epsom, NH. This proposal was submitted at the request of the New Hampshire Department of Environmental Services (NHDES) and the New Hampshire Office of Emergency Management (NHOEM) in response to the May 13-16, 2006 flooding in New Hampshire that resulted in a breach (located south of Route 4 and east of Route 28) in the bank of the Suncook River that caused the river to follow a new path. This breach caused the river to form a new channel upstream of both Bear Island and two dams located at the north end of Bear Island, with the new channel rejoining the old channel to the east of Bear Island. After May 16th, there was no flow in the western reach and northeastern reach of the Suncook River around Bear Island. As a a result of the breach that occurred during the flood of May 13-16, 2006, the new channel through the gravel pit is approximately 1 mile in length whereas the abandoned channel is approximately 2.0 miles in length.

The decreased length of the Suncook River channel resulted in the average gradient of the river increasing 44% to 23 feet per mile from 16 feet per mile (Wittkop, 2006). This increase in gradient will cause an increase in the average velocity of the river which will likely increase the river's ability to erode laterally and vertically. In addition, the steeper slope, decreased streambed roughness below the avulsion (sand, rather than bedrock, cobble and gravel) and loss of 1 mile of stream length on the Suncook River could result in a flood wave moving through the watershed more rapidly creating a higher magnitude event with a shorter duration.

Erosion of the new channel to the east through the gravel pit and the adjacent wetlands has been estimated to have introduced 150,000 cubic yards of sediment (Wittkop, 2006) into the Suncook River. Much of the sediment was deposited downstream of the avulsion channel in silt and sand sheets up to 5 feet thick. It is expected that this large volume of sediment will result in dramatic changes in water surface elevation which would exacerbate flooding in the new channel; resulting in a higher frequency of flooding at lower flows along with an increase in over-bank flooding due to decreased channel depth. This could have a direct affect on local infrastructure and homes.

Impact of the May 2006 Flood

A) Agriculture
The new channel of the Suncook River along with the deposited silt and sand, has impacted 41 acres of cropland, 4 acres of forest and 22 acres of pasture (Town of Epsom, 2006). The Suncook River now flows through a former cornfield (figure 1, Orff, May 23, 2006). The sandy to silty glacial lake and stream sediments at the avulsion site and upstream will continue to erode and supply large amounts of sediment to the river and the former cornfield.

New flood mapping would determine areas of the current agricultural fields that would be inundated when future flooding occurs.

Figure 1. Suncook River's path through a cornfield due to the May 2006 flooding (Orff, 2006).

B) Water Supply

The Epsom water district lost 100 feet of a 400 foot earthen dike that was built to protect a municipal pump house and well. Due to water quality concerns after the May 2006 flooding, the well could not be used for several weeks, leaving the town to rely on a single well to supply water to 280 households (Town of Epsom, 2006 and personal commun., Gary Kitson, Epsom Village District, October 19, 2006). To date, the 400 foot earthen dike has not been rebuilt. This dike was originally built to protect the municipal well supply and was 15 feet high, 45 feet wide at the base and 10 feet wide at the top (personal commun., Gary Kitson, Epsom Village District, October 19, 2006).

C) Homes

In recent years, major structural and residential development has occurred in Epsom. Two new bridges and earthwork along Route 4 over the Suncook River along with the changes in channel slope due to the May 2006 flood have the potential to change flood elevations and flood boundaries which would effect many homes and businesses in the vicinity of the Epsom Traffic Circle as well as upstream and downstream of this area.

The decreased channel depths in the aggraded stream reaches will increase the potential for over-bank flooding and flooding at lower flows. The largest residential community in Epsom, NH that would be impacted by future flooding is the Kings Towne Mobile Home Park on Rte. 28 in Epsom. This community consists of 298 units and is located along the Suncook River and approximately 0.5 miles downstream of the Short Falls Road Bridge. The 1978 FIRMs currently show several streets within the Kings Towne Mobile Home Park within the 100-year floodplain. There are also many other areas south of Epsom along the Suncook River (including, but, not limited to, another Mobile Home Park downstream of the Kings Towne Mobile Home Park in Allenstown, NH) downstream to the confluence of the Suncook and Merrimack Rivers that will have flood elevation and boundary changes due to the increased volume of sediment that has been transported downstream.

D) Bridges

An inspection of bridges by the New Hampshire Department of Transportation (NHDOT) on May 23, 2006 found the following issues and concerns related to the floods and the new Suncook River channel (personal commun. K. Nyhan, NHDOT, October 12, 2006):

1. NH Route 28 bridge over the Suncook River and located in Allenstown, NH (Bridge ID Allenstown 107/098) has a lot of debris at pier 1 and a lot of erosion along the northeast corner through the parking lot. This bridge is located approximately 1.0 miles downstream of the Epsom/Allenstown corporate limit.
2. Short Falls Road bridge over the Suncook River and located in Epsom, NH (Bridge ID Epsom 063/093) appeared to be okay but, NHDOT was unable to check for scour at the piers due to high water. A visit by USGS personnel found that there has been erosion and deposition of sand and silt along the left bank downstream of the Short Falls Road bridge. Scour at the piers could not be determined during the USGS site visit.

3. U.S. Route 4 bridge over the Suncook River and located in Epsom, NH (Bridge ID 086/127) appeared to not have been impacted by the flood.

Flood Recovery Mapping

Infrastructure and homes in Epsom and Allenstown, NH will be impacted by future flood events as a result of the May 2006 avulsion, sediment transport, and subsequent increase in channel and over-bank elevations. Flood recovery mapping is needed as a management tool for protecting and maintaining the roads, bridges and water supply as well as to make determinations as to property and homes that may be damaged as a result of future flooding events.

In comparing the May 2006 flood discharge to USGS gage data on the Suncook River in North Chichester, NH (gage number 01089500, discontinued 1970), the flood of May 2006 was an approximately a 50-year event at the discontinued Suncook river gage with a peak flood of 7,600 cfs on May 15, 2006 (personal commun., S. Olson, USGS, 2006). For the period of 1918 to 1970, the peak of record was the 1936 flood event of 12,900 cfs (personal commun., S. Olson, USGS, 2006) at the USGS gage on the Suncook River in North Chichester, NH (gage number 01089500, discontinued 1970).

Sediment Transport Model

River pattern, profile and dimension affect flood water conveyance and are directly linked to flood water velocity, lag times, and flood extent. As a result of the May, 2006 avulsion, the Suncook River hydraulic energy has increased and the river will compensate by downcutting below the avulsion, in the vicinity of the gravel pit. An understanding of the specific hydraulic and sediment relations in the Suncook River will enable a quantitative prediction of stream stability and adjustments in channel plan, pattern and profile features. Aggradation and degradation have occurred in the Suncook River as a result of the change in the sediment load and size in the river, stream slope and discharge. The Suncook River's new channel has created a deep incision in the former gravel pit. After deepening, the over-steepened sand banks will likely eventually collapse and this will result in widening of the channel. The resulting shallower channel will have less energy and sediment will aggrade. An understanding of the sediment transport in the Suncook River would reveal the likelihood of bank collapse, successive river widening and sediment transport that could potentially have a great impact on the homes and infrastructure in Epsom and Allenstown, NH. Because of the potential for change in the degree of river incision over time, a sediment transport model would be of great benefit to the community.

References

Orff, E., May 23, 2006 picture accessed at http://www.friendsofsuncookriver.org/page11C.htm on October 11, 2006.

Town of Epsom, 2006, Geomorphic-based Restoration Plan for the Suncook River in Epsom, NH, 6 p.

Wittkop, C., June 30, 2006, NH Geological Survey letter to the New Hampshire Department of Environmental Services entitled: Suncook River Initial Assessment, 2 p.