Comments on the Totten Inlet Mussel Farm Drogue Study by Evans-Hamilton (May 2008), and the Brooks response (October 2008) to the ITRC Summary of Comments (March 2008)

Mitsuhiro Kawase, School of Oceanography, University of Washington

November 17, 2008

First, I would like to commend Evans-Hamilton for the quality and the quick turnaround of their drogue study in spite of field conditions that limited the scope of the study. It is a pity that a major flood couldn't be sampled; nevertheless the resultant data adds greatly to the physical characterization of the site. It also provides context to their earlier ADCP measurement at the proposed raft location. I believe a sufficient site characterization with regards to flushing is now possible through synthesis of the two kinds of data.

In Appendices A and B, it would be helpful if portions of data with suspect quality (such as lost panel on Drogue 4) could be visually distinguishable from the rest (e.g. plotted with dotted lines rather than solid or broken lines). Also, the maximum speed of Drogue 6 (60 cm/s) appears to be a spike as seen in the plot, and should be carefully examined before included as such.

With regards to the characterization of the ADCP data in the baseline document: First, ADCPs typically have difficulty making accurate measurements of currents immediately adjacent to the sea surface and the bottom. The exact range of data degradation depends on the frequency of the acoustic signal used by the instrument; but for the present data set, from the very small number of ensemble members in the top 1m bin (two orders of magnitude less than the numbers for the bulk of the water column), it is clear the top bin suffers from this degradation. Even if the remaining data in the bin is good, the very small size of the ensemble would make its statistics unrepresentative. The top bin should be marked as such and omitted from consideration. Even the 2m and the 3m bins are suffering from large data loss due to degradation (or possibly due to rise and fall of the sea surface, if the bins are defined relative to a fixed bottom). Their statistics should also be suitably qualified, since the remaining data may not cover all tidal phases equally.

From 4m downwards, the data tells a consistent story. The mean current speed, which I take to be the mean of the magnitude of the current, is 16 ~ 17 cm/s; typically this is approximately 64% ($2/\pi$) of the average maximum tidal current, which would then be about 25 ~ 26 cm/s. This is more in line with Figure 39 of the Totten Inlet Circulation Study Report by Evans-Hamilton, and also consistent with the current magnitudes calculated from the drogue data. Currents in excess of this may occur during particularly strong phases of the tide, or under the influence of weather. The site characterization and assessment of flushing should be done with current speeds under typical conditions rather than maximal conditions that may occur only in isolated instances.

By the way, given these numbers and especially given the new drogue trajectories I would provisionally concur with the characterization of the proposed raft site as well flushed. It appears that water passing through the site can, within a few tidal cycles at most, be transported to the mouth of the Inlet or otherwise over a substantial portion of the length of the Inlet. This case can be strengthened if a *vector average* of the ADCP current (after careful QC, and omitting near-surface and near-bottom bins) can be formed and shown to be towards northeast. If so the average displacement of the water would be towards the mouth, decreasing the possibility of whatever effect the raft would have getting trapped in the Inlet. It appears to be the case from the drogue data, although in this case the current may have been strongly influenced by the southerly wind. Such a mean outgoing current would require a compensating inflow elsewhere, perhaps along the northwestern shore of the Inlet, resulting an overall counterclockwise recirculation in the Inlet. Such horizontal recirculation has been found in Carr Inlet from a float / modeling study (Edwards, et al., 2007).

Reference

Edwards, K.A., M. Kawase and C.P. Sarason (2007) Circulation in Carr Inlet, Puget Sound during spring 2003. *Estuaries and Coasts*, 30, 945–958.