

28 February 2008

Review of Taylor Resources proposed Totten Inlet mussel farm water column related studies

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Due to my own time constraints, I have not conducted an extensive review all of the studies presented. I did find in the Supplemental Study of Dissolved Nutrients.... Report, and agree with Dr. Rensel that, many mis-interpretations were made regarding basic biological oceanographic concepts such as nutrient limitation, N:P ratios, C:chlorophyll ratios, and other issues that he points out in his review. These do not instill high confidence in this ITR that a good grasp of the processes involved is understood. However, the concerns I will put forth here regard that I have not found what I think are some important analyses to consider in an evaluation of the EIS for the proposed mussel rafts. As cited in our earlier ITR recommendations, these were to understand flushing, and the localized effect of mussel rafts on nutrients, phytoplankton, and dissolved oxygen.

Specifically, I do not see an appropriate evaluation of whether there will be any localized effect on the dissolved oxygen of the inlet.

1. Added nitrogen effect on phytoplankton and subsequent deep oxygen during summer: The NewFields Northwest analysis treats an annual situation. Added nitrogen, which is likely from mussel excretion of ammonium and urea, could have a significant stimulation of phytoplankton during summer. Could there be an effect on underlying dissolved oxygen from the additional phytoplankton? The cells would eventually settle out or would be consumed by grazers and their fecal pellets would sink. So it could be that the additional production would result in additional respiration load during summer. This is when the dissolved oxygen content of deep Puget Sound water is typically at its lowest so any reduction can have impact on biota. Washington's implementation of the Clean Water Act, WAC 173-201 A, regulates actions to a depression of the oxygen concentration to no more than 0.2 mg/L. Has this study assessed if any depression of oxygen would occur during summer/fall from nitrogen fertilization of nutrient-limited phytoplankton? I do not see this addressed, although the authors could. There should be seasonal budgets considered but especially this summer-fall scenario.

2. Added organic material from mussel rafts effect on deep oxygen: The mussel rafts will yield a certain amount of organic material concentrated under the rafts due to sedimentation of fecal material and pseudo-feces from the mussels. Could this additional organic load have an effect on the sub-surface dissolved oxygen concentration? It is possible that the respiration of the additional organic load could draw down the oxygen concentration, but what is needed is some calculation of the organic

sedimentation, conversion to an oxygen debt and then an understanding of the tidal flushing of the area. I do not see this type of analysis addressed.

3. Totten Inlet flushing rate:

A correct assessment of both the issues that I make above (#1 and 2) requires knowledge of the flushing of the inlet. I see that the Taylor Resources consultant reports did not include some of the work requested by the ITRs initially, to study this rate in Totten Inlet. There is also no justification nor explanation of why this was not addressed. In light of this omission, a possibility now is to make the above calculations with a variety of flushing rates around the previous estimates, thus doing a sensitivity analysis. Obviously there should be a wide range of rates used to cover various tidal phases. But attention should be made to address what the impact on oxygen would be under the worst case scenario (least flushing) to be sure that periodic low oxygen does not occur due to these activities. The vertical stratification of Puget Sound, the seasonal input of low oxygen waters from the Pacific Ocean during the upwelling season, and the turbulence over sills that brings deep low oxygen waters to the surface make Totten Inlet and Puget Sound a unique area in which to assess if these activities will result in oxygen depression.

In conclusion, it is my opinion that the reports have not fully addressed local potential for hypoxia though I do think these calculations are possible with the data in hand, as long as several scenarios are considered to cover uncertainties.