Appendix A

Response to Comments by US EPA and Washington State Department of Ecology

This appendix documents the responses to questions and comments raised by the US EPA and Washington State Department of Ecology following their receipt of the Independent Peer Review of the Review of Available Science for Dissolved Oxygen. Responses to a set of specific questions were solicited through phone calls and email exchanges between the Puget Sound Institute and members of the Review Panel. The specific questions and responses are shown below.

Further, the DRAFT Response to Independent Review Report was sent to the Review Panel members with the opportunity to provide final feedback. These responses are also included below.

The comments and responses are summarized below:

COMMENT BY US EPA AND ECOLOGY

> The report does not answer question 4a. This question requests a recommendation on the method to estimate the DO deficit in Lynch Cove from the buoy data, particularly whether the DO of the full water column at Hoodsport should be used, or only values at depths less than the depth of Lynch Cove (see page 59 of the report for discussion).

Panel Member 1:

> I do not agree that question 4a as written was in particular about use of the full water column data from Hoodsport. I did note some questions about the analysis when I first read the report (is there structure to DO below 30 m and did anyone consider tracing isopycnals from Hoodsport to Lynch's Cove to identify a 'ventilation' depth) but I think this was a rather minor point compared to the other issues we identified and question in our review. I suspect that the DO deficit value will not be very sensitive to variations of the kind the question poses.

Panel Member 2:

> Clearly the model that is used here is a vast simplification of reality. So any estimate that results will have significant uncertainty. Perhaps computing the expected range is the best that can be expected. I would use the value of DO at the level in the profile with sigma_T equal to the value in the cove. I would take that as an estimate of the lower bound and then estimate the upper bound in the range by taking the DO as the value just below the pycnocline.

Summary of Conversation with Panel Member 3:

Regarding the note on question 4a – the Review Panel member reiterated the written comment that is important to consider the density structure when evaluating the transport of deep water from Hoodsport into Lynch Cove. Neither choosing the entire water column at Hoodsport nor simply choosing a depth at Hoodsport that corresponds to the depth at Lynch Cove are recommended approaches. One could follow the isopycnal surfaces from near the top and bottom of the deep water layer in Lynch Cove out toward Hoodsport and use that to define the appropriate water column. Recommended not using instantaneous values but appropriate seasonal averages.

COMMENT BY US EPA AND ECOLOGY

Assuming the vertical nitrogen flux methodology is corrected with a 2-layer Knudsen analysis as recommended earlier by the reviewers, the next question is this: At what depth in the water column should the vertical flux be estimated for use in the proportional DO impact equation (see Figure 18 and pages 46-47 for differing perspectives and assumptions)? Devol et al (2011) estimates the flux to the pycnocline depth (which is in the middle of the euphotic zone). This vertical flux is reduced by algae uptake below that depth. Brett (2011) estimates the total flux to the euphotic zone, which extends deeper than the pycnocline. We outline the reasons for this difference in approach on pages 46-47. The question for reviewers is: What choice is preferred for the purpose of estimating the DO impact with the proportional calculation?

Panel Member 1:

As we noted in response to question 3 the nitrogen flux estimates need to be revised, and in particular, attention must be paid to the position of the zero iostach (not pycnocline, though they may be at similar depths. but this hasn't been demonstrated). I don't recall a firm decision on which formulation was best, in part because both had identifiable problems. I tend to think the utilizing the full photic zone makes more sense as a control volume in which to assess the relative N contributions, mainly because the rationale for excluding the portion of the photic zone below the pyncocline (aka zero isotach) is unclear.

Panel Member 2:

Our central objection to the Devol approach was that it was inconsistent with the implied (prescibed) pattern of horizontal exchange and, consequently, the salt budget. I would suggest the Brett approach as a superior choice and assume that it would yield an upper bound. The lower bound could be estimated by estimating the fraction utilized in the layer between the 99% light level and the pycnocline. I understand that the second step might be difficult because of adaptation to low light

levels etc., but it is a complex problem. It requires bold assumptions and tolerance of large uncertainty.

Summary of Conversation with Panel Member 3:

Regarding depth for N-flux – again, the Review Panel member reiterated his written comments and reinforced the idea that there has to be consistency between the transport approaches (question 3) and the N loading exercise. So if a properly-implemented two-box model were utilized to evaluate marine transport, the same approach would be needed for N flux. Mixing a two box and three box approach seems inconsistent. I believe that they all felt that it was more logical/defensible to include the entire photic zone but also that it was crucial to first get the transport correct and also to consider the variance and uncertainty in these exercises.

Summary of General Responses to Comments by EPA and Ecology

- Regarding the response to summary point #2 - They reiterated the initial summary point that the overall estimates of likely underestimate N loads from the watershed, though are correct order of magnitude. However, the calculations would need to be done to verify.
- Others felt that there might be small areas to "quibble" about, but that these details would be unimportant compared to the magnitude of the major points they brought up in the review document (e.g., marine flux).
- It was also reiterated that the complexities in the system (biological response to N loading, spatial and temporal variations in species compositions, mixing, flux, etc.) make it difficult to provide simple and clear answers, as often there are not simple and clear answers.