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Regarding: Puget Sound Nutrient General Permit

The Scientific Basis for Regulation is Flawed

The Washington State Department of Ecology (hereafter Ecology), intends to implement the Nutrient General Permit on the basis that the state's water quality standard for dissolved oxygen is not being met, due in part to nitrogen discharge from wastewater treatment plants (WWTP). Ecology has used its implementation of the Salish Sea Model (SSM) to determine: a) the dissolved oxygen water quality standard is not being met, and b) WWTP are contributing to this non-compliance. These two factors are the basis for the Nutrient General Permit and, as such, questions about the SSM and the compliance determination process are relevant to the Nutrient General Permit under consideration. As detailed in my letter regarding the Draft Nutrient Permit dated 15 March 2021, I and other independent scientists with relevant expertise have repeatedly and publicly challenged Ecology's assertion that the SSM is sufficiently precise and accurate to determine compliance with the standard. In short, we believe that model uncertainty when predicting current conditions is too large to say that the standard is likely not being met. The response to my letter, provided by Ecology in the General Nutrient Permit Fact Sheet, fails to adequately address the issue of model uncertainty in determining compliance to the standard. *This use of the SSM to determine compliance to the water quality standard needs independent review by qualified scientists without conflicts of interest.*

Public Messaging from Ecology on Puget Sound Water Quality is Misleading and Not Based on Facts

Ecology's recent public messaging campaign that describes "dead zones" in Puget Sound (either current or future) as a meaningful problem for the ecosystem necessitating actionⁱ is not based on any published study or report. Ecology representatives have been on the record stating that salmon are suffocating because of nutrients from WWTPⁱⁱ, yet there is no scientific evidence pointing to low oxygen from nutrients as a cause of salmon mortality in Puget Sound. *Simply put, this public messaging campaign is a dishonest misrepresentation of the impacts WWTP are having on Puget Sound and should be immediately retracted.*

Here are the facts: Between 0.25% and 1% of the volume of Puget Sound is hypoxicⁱⁱⁱ during part of the summer, of which 80% to 85% of this hypoxia is due to natural processes outside of

human control (Ahmed et al. 2019, MacCready 2019). That means between 0.03% and 0.2% of the Puget Sound is becoming hypoxic due to humans, for part of the year, and actions to reduce nutrients from WWTP will not have a meaningful impact on hypoxia (MacCready 2019).

Effectiveness and Tradeoffs Must be Considered

The Puget Sound Ecosystem faces numerous challenges from myriad of stressors. This reality dictates that proposed solutions must be evaluated both on their likelihood of effecting change and the opportunity costs of actions that will not occur because the proposed policy. Ecology has never considered these critical factors in their decision-making around this issue! Given the high natural variability in dissolved oxygen in Puget Sound, it is a near certainty that there will be no observable change in dissolved oxygen as a result of this policy. Furthermore, because the SSM is a deterministic model, it is an absolute certainty it will indicate a water quality improvement, even if there is not an observable change, because it is written into the model. Will the public accept that the money they have spent on this action does not result in an observable change in dissolved oxygen even if the model says it should be there? *At a minimum, Ecology should detail how the effectiveness of this policy will be evaluated.*

Finally, the list of issues and potential actions to improve the health of Puget Sound is long – far longer than is possible, given available resources. Consideration of tradeoffs and optimization of actions is therefore a must. Recent research by King County suggests that actions to reduce stormwater runoff and improve habitat result in a far greater “bang for the buck” than nutrient reduction.^{iv} Ecology must take seriously the reality that resources are limiting and restoration actions must be prioritized. Otherwise, there is the substantial risk that money will be spent on this issue in vain and, even worse, the public will pull their support for future environmental initiatives. *As environmental scientists, engineers and policy-makers, have a responsibility spend the public’s money wisely.*

Recommendations

1. Delay implementation of the Nutrient General Permit until it is clear that: a) there is an ecologically meaningful problem as the result of nutrients from WWTP, b) the proposed action will provide ecological benefits to the Puget Sound, and c) critical funds are not better spent on alternative actions with higher likelihoods of success.
2. Revise Ahmed et al. (2019) to include the model uncertainties in a transparent and scientifically-defensible way that specifically includes the range of likely values (i.e., confidence intervals), not just a single number, for each model-generated result. When determining compliance to the dissolved oxygen standard, present the areas deemed to be out of compliance with an associated type I error probability.
3. Conduct a multi-model comparison of Puget Sound water quality, as is the current best practice. There are at least three existing models of water quality for Puget Sound that can easily be compared to one another as a means to assess model uncertainty.
4. Solicit an independent review of the science related to compliance standards and incorporate all relevant suggestions into a new presentation of results. The Washington State Academy of Sciences frequently conducts this type of scientific review for issues of high policy

importance such as this. It is therefore recommended that Ecology requests a full scientific review from the Academy.

5. Publicly retract all statements that suggest “dead zones” are a meaningful problem in Puget Sound that can be corrected by regulating nutrients from WWTP. Furthermore, Ecology should publicly retract all statements that suggest salmon are being impacted by “dead zones” in the Puget Sound (i.e., suffocating). Neither of these statements can be supported by data or modeling.

Sincerely,



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References Cited

- Ahmed, A., Figueroa-Kaminsky, C. Gala, J., Mohamedali, T., Pelletier, G., and McCarthy, S. 2019. Puget Sound Nutrient Source Reduction Project. Volume 1: Model Updates and Bounding Scenarios. Washington State Department of Ecology, Publication 19-03-001.
- MacCready, P. 2019. External Review of the Bounding Scenarios Report by Ahmed et al. Obtained by public records request.
- Diaz, RJ and R Rosenberg. 2008. Spreading Dead Zones and Consequences for Marine Ecosystems. *Science* 321(5891): 926-929. DOI: 10.1126/science.1156401

ⁱ <https://ecology.wa.gov/Blog/Posts/June-2021/To-prevent-dead-zones-in-Puget-Sound,-communities>

ⁱⁱ Puget Sound Partnership Leadership Council Meeting (open to the public) 18 February 2021.

ⁱⁱⁱ The term “dead zone” is poorly defined, but at a minimum it implies lethal consequences for marine life due to low oxygen. “Hypoxia”—typically defined as dissolved oxygen less than or equal to 2 mg/L—is a term used to indicate low oxygen that can negatively impact marine life, while mass mortality events are expected to occur at dissolved oxygen values of 0.5 mg/L or less (Diaz and Rosenberg 2008).

^{iv} Presentation by Dow Constantine, Abigail Hook, and colleagues at the Puget Sound Partnership Leadership Council Meeting (open to the public) 18 February 2021.