Summary of April 30 Puget Sound Nutrient Forum Feedback

Background:

On April 30, over 70 people attended the Puget Sound Nutrient Forum meeting to discuss scenarios to be modeled by the Salish Sea Model in 2019-2020. These scenarios will help to inform the Puget Sound Nutrient Management Plan by increasing our understanding of how, where, and when excess nutrients impact dissolved oxygen levels in Puget Sound. Ecology presented a list of draft scenarios to the Forum. At the Forum meeting, we collected feedback through breakout discussion groups, consisting of a facilitator and 10-12 Forum attendees. We also collected feedback through a group discussion called a "Fishbowl" exercise. We have collected the feedback and organized a summary in this document as:

- Comments on draft scenarios
- A "Parking Lot" of new scenarios to be re-considered in the future
- Other comments and FAQs

Please review the April 30 Nutrient Forum meeting packet for more information on the draft scenarios and associated model runs with each Scenario.

We noticed from our discussion groups that Forum members still had some questions on previous modeling and water quality standards. We've compiled some resources that you may find useful for reviewing or answering questions in regards to these topics:

- Salish Sea Model web resources – this website has links to previous reports on the Salish Sea model.
- Bounding Scenarios Report
- Marine Dissolved Oxygen Water Quality Criteria

Comments on Scenarios from April 30 Forum Feedback

We compiled specific comments we recorded at the Forum and received in follow up emails for proposed changes to the draft scenarios to be modeled in 2019-2020. The Puget Sound Nutrient Source Reduction Project Steering Committee will consider these proposed changes as we revise and finalize our modeling scenarios and schedule. We will send out the finalized modeling scenarios by end of June or early July.

Scenario 1: Watershed Source Reductions by Puget Sound Basin

Objective: Understand the significance of watersheds grouped by Puget Sound basins relative to other basin watersheds.

Proposed changes to scenario

- Run the inverse of proposed scenario:
  - Set focus basin at reference conditions
  - Set other basins at existing conditions
- Geographic framework:
  - Separate Whidbey Basin so that Snohomish and Skagit river inputs are separated
  - Separate Sinclair Inlet from Main Basin
  - Reconsider combining discharges from Strait of Juan de Fuca with Admiralty Inlet Basin
- Watershed input:
  - Run watersheds with discharges that are meeting DO standards
- Include population growth and climate change boundaries in this scenario.

Scenario 2: Marine Point Source Reductions by Puget Sound Basin

Objective: Understand the effect of marine point sources on dissolved oxygen grouped by the Puget Sound basins they discharge to.

Proposed changes to scenario

- Run the inverse of proposed scenario:
  - Set focus basin for marine point source discharges to reference conditions
  - Set other basins at existing conditions
- Suggestion to model *both* this scenario and the inverse of this scenario to understand the full picture of the impacts of nutrient loading to Puget Sound AND the impact of reductions to Puget Sound.
- Geographic framework:
  - Separate Whidbey Basin into two sub-basins because it contains the region's largest watersheds.
  - Separate Sinclair Inlet from other Main Basin watersheds
- Run scenario at reduction levels by basin so that we continue to model impacts of advanced wastewater treatment.
- Input year:
  - Run this scenario using a year that shows us the "worst-case" scenario or a median of best and worst scenario years.

- Suggested other approach: turn all small treatment plants on at once and turn off big treatment plants.

Scenario 3: Annual vs. Seasonal Nutrient Load Reductions

Objective: Understand wastewater seasonal nutrient load reductions compared to reductions in annual loading and the resulting improvement to DO levels.

Proposed changes to scenario

- Consider putting watersheds at reference conditions vs. putting them at existing conditions
- Conduct cost-benefit analysis in place of running model scenario to better understand if seasonal or annual advanced treatment is more economically reasonable.
- For annual treatment input, run winter season at lower treatment level (Ex: 16 mg/L) and spring time at lesser concentration (8mg/L or less)
- Treatment input: choose treatment levels in lbs/year instead of concentrations since permits are issued with lbs/year limit.

Scenario 4: Future Population Growth & Climate Change

Objective: Understand the effect of a range of future conditions, impacts, and potential improvements.

Proposed changes to scenarios

- Future projection year:
    - Change the future projection input year to 2050 or 2060, depending on how good we feel about the data input. Should be mindful of the capital planning horizon.
- Marine point source inputs:
    - Change the marine point sources to existing conditions instead of reference conditions. This would should us what would happen if we do not intervene.
- Separate population growth and climate change inputs as individual scenarios:
    - The future population growth should be analyzed as a separate scenario as it would provide the most useful and comparable information to the other scenarios of understanding the effects of loads on future changes in location, magnitude, and duration of DO responses
    - Understanding the effects of climate change to DO response will be much more useful when refined scenarios are developed in Year 2 or beyond.
- Sequencing:
    - Move this scenario to Year 2 modeling schedule due to uncertainty of many model inputs.
- Population growth and climate change are boundary conditions, not scenarios. These should be inputs in each scenario.
- Climate change input:
    - Climate change inputs should use high projections, no reason to consider lower levels of climate change because these won't happen.

Scenario 5: Everybody, Everywhere

Objective: Understand the total nutrient reductions needed to meet DO criteria in Puget Sound through testing the improvement from estimated maximum nutrient reductions between marine point sources and watershed sources.

Proposed changes to scenarios

- No specific proposed changes, but instead questions on how we will decide inputs and how this scenario will be used, including:
  - What would the advanced treatment level input be: 3 mg/L, 5 mg/L
  - What are reasonable watershed reduction estimates and would it be different?
  - Will we use existing models or studies (like SPARROW) to establish reasonable number for watershed reductions

Parking Lot for New Scenarios:

This list includes ideas we recorded or later received for other scenarios or analyses that are different from the initial draft list of 5 scenarios. Ideas on this list may be added to our modeling schedule during the first or second modeling year depending on modeling resources.

- Create a new scenario to run sensitivity analyses around key parameters
  - Ecology should devote resources to conducting sensitivity analyses of key parameters, applicable to both reference conditions and existing conditions, to provide additional information that will be useful in the interpretation of the Year 1 modeling scenario results. Such information will be imperative in evaluating and comparing the location, magnitude, and duration of DO responses observed with the Year 1 modeling scenario results.
  - In addition, conducting a comparison of results from other Salish Sea models, such as LiveOcean by Parker MacCready's group and the NEMO model by Susan Allen's group, could greatly improve the understanding of confidence in model predictions. This approach is employed by the Chesapeake Bay program to better understand the probability of whether water quality criteria will be met with load reductions and places more confidence in model results.
- Run marine point sources by basin, but at advanced treatment levels (this is also included as proposed change to Scenario 2).
- Set advanced treatment levels on marine point sources and watersheds in Port Orchard System. Leave all other sources at existing and compare with Bounding Scenarios.
- It would be useful to have a Salish Sea Model-driven scenario that shows what reductions in nutrient inputs it might take to bring DO down to some acceptable level.
- Useful to think of scenarios in groups – here I use near and all to assign to some defined sets of watersheds. Eventually you might want to have a more streamlined set of scenarios like this (just an example).
    - Business as Usual - includes population growth
    - WWTP near - 3mg/L near DO problems)
    - WWTP all (5 mg/L everywhere)

        - Watershed near (50% reduction in watersheds that drive problem)
        - Watershed all (25% reduction everywhere)
        - WWTP and Watershed near (1+3)
        - WWTP and Watershed all (1+4)
- The modeling scenarios 1 & 2 should be run with all sources "on" at existing conditions, and only the basin watershed sources (Scenario 1) or point source (Scenario 2) in question should be turned "off". This approach of leaving all non-changed sources "on" at existing conditions will best facilitate being able to observe and provide the most useful information from these scenarios regarding the effect of each scenario to DO response (and changes observed will be most comparable between the scenarios).
- Regarding Scenario 5, there was discussion that it was unreasonable to assume 50-75% reduction of nonpoint sources based on a history of past poorly performing implementation, as well as based on an argument that future population in the area will increase rural area loadings. We disagree with the these premises for changing the approach to assume some "limited" level of nonpoint implementation, and rather believe it's more reasonable and appropriate to evaluate scenarios with an assumed "high" level of nonpoint nutrient reduction effort. The level of reduction should be based on available information from real nonpoint source reduction efforts that can define what a "highly effective" and "aggressive implementation" of nonpoint reduction effort assumption can achieve so that the scenario and approach is commensurate with the levels of effort that is being simulated for point source discharge reductions (e.g., all sources reduced, and near level-of-technology BNR treatment). To arbitrarily select and simulate a lesser level of nonpoint source reduction than is possible will not establish the most useful information on the "bookends" of what is possible for nitrogen reduction. Finally, assuming lesser levels of nonpoint source reduction in the watershed based on future growth also would be inconsistent with the approach applied to point sources for this future growth scenario.
- Regarding Scenario 5, we suggest simulating climate ***and*** projected future population growth should not be run in such a combined manner. The future population growth should be analyzed as a separate scenario as it would provide the most useful and comparable information to the other scenarios of understanding the effects of loads on future changes in location, magnitude, and duration of DO responses. Including climate change in the scenario will be a confounding factor in the analysis that might obscure the interpretation of the effects of loading changes. Furthermore, if resources for evaluating scenarios is limited, we would suggest the climate change scenario is not as important as all of the other scenarios being contemplated. Understanding the effects of climate change to DO response will be much more useful when refined scenarios are developed in year 2 or beyond.

FAQs and Comments:

We compiled a list of frequently asked questions (FAQs) and comments from discussions held at the April 30 Puget Sound Nutrient Forum. Questions and comments are grouped by category due to the overlap of comments across different scenario discussions. Some questions include Ecology responses in italicized text.

Nutrient Management Plan

- How do we know we aren't meeting water quality standards?
    - *The Salish Sea model tested existing conditions of nutrient loads to Puget Sound, which included marine point sources and watershed sources, and found dissolved oxygen standards were not met in any of the modeled years (2006, 2008, 2014). Under these conditions, approximately 20% of area in greater Puget Sound did not meet standards. These areas did not meet water quality criteria because they were either 1) below numeric criteria for minimum DO levels or 2) greater than 0.2 mg/L depletion below natural conditions. Our Salish Sea Model Results Web map visually represents these areas and the methods and results can be found in the Bounding Scenarios Report.*
- Why are we using DO water quality criteria instead of a biological indicator?
    - *The purpose of DO criteria are to protect aquatic life from exposures to low DO concentrations and also to indirectly limit excessive nutrients in waters that would otherwise lead to low DO concentrations. Biological indicators are used for regulatory tools like the biological index of biotic integrity (BIBI) but no such data is currently available for marine species in Puget Sound. Instead, numeric criteria for dissolved oxygen were set at levels intended to protect healthy, robust aquatic communities, including the most sensitive species. Explanation of the history and rationale for the state's Marine DO criteria is available in the August 2018 document: Washington State's Marine Dissolved Oxygen Criteria: Application to Nutrients.*

Comments:

- For future load reductions, should consider if and how watersheds may have different nutrient limits and target reductions.
- Forum curious about how ratepayers will pay for any future required wastewater treatment upgrades.
- The modeling used to inform a Puget Sound nutrient management plan should focus on where to get the "biggest bang for our buck."
- The Forum should explore and communicate how nutrient management plan will consider CSOs.
- Should explore the impacts of outfall depth. Would be good to explore if relocation of outfall depths could contribute to solutions.

Salish Sea Model

- How are watershed loads calculated?
    - *These inputs represent the loading of nutrients entering marine waters in the SSM domain at the mouth of each of these rivers. In this context, river inflows into SSM are integrated and do not distinguish between all upstream watershed sources*

- What are reference conditions?
    - *We created the reference condition scenario by setting watershed inputs and marine source inputs to an estimated natural load of nitrogen and carbon while keeping the model year climate, hydrology, and ocean boundary conditions the same as the existing conditions scenario. The reference condition is our best estimate of natural conditions and is specific to each model year.*
- Is it possible to use simplified model run for each individual facility?
    - *It is possible to perform a run that looks at the impact of an individual facility, but each model run is quite time intensive. This does not fit into our next year modeling schedule, but could be something to consider in the future.*
- Does the model account for wastewater treatment plants that discharge to rivers?
    - *Not directly. The watershed inputs in the model integrate all upstream human and natural sources, so the load at the mouth of a river does include all upstream sources, including wastewater treatment plants. However, we cannot isolate the effect of individual wastewater treatment plants that discharge to rivers using this model – we would need a watershed model along with more refined monitoring data to isolate upstream point sources from the river load*
- How long does it take to complete a model run?
    - *Each model run varies in completion time, but the time to prepare the inputs, run the model, and analyze the results take approximately 2-3 weeks.*

Comments:

- Should consider how water reuse could fit into Salish Sea modeling scenarios.
- When input years are decided, Forum would like to know how we choose model years and how we maintain sensitivity.
- Would like to continue modeling scenarios to understand whether reductions have linear improvement. Is the system linear vs. non-linear?
- Ecology needs to be incredibly transparent about the model and its limitations.
- Model should try to answer how much decrease in total DO occurs in each system and this should be quantified.

Watershed & Nonpoint sources

- What is the difference between a basin and a watershed?
    - *The model is driven with freshwater inflows from 161 watersheds. The watershed load is included as the load that discharges at the mouth of the river. There are six major basins in the Puget Sound. Scenarios that are looking at watersheds are testing the number of watersheds that discharge to the focus basin.*
- If we don't have watershed model, how can we start to explore impacts of watershed sources?
    - *We can still start to understand the impacts of cumulative watershed loads on dissolved oxygen levels across Puget Sound, particularly within a spatial context. This will be important for prioritizing watersheds in a nutrient management plan. Future watershed models may help in in more specific nutrient management plans for upstream nutrient sources and how to prioritize differing nutrient sources in watersheds.*
- How does stormwater play into watershed sources?

- *We don't have enough data to fully quantify the stormwater load to Puget Sound, but given what we do know we expect it to be relatively small particularly compared to the POTWs and other "watershed" sources to the major rivers including more POTWs and agriculture and forest practices and septic systems. Using a watershed model in the future will help us better understand this.*

Comments:

- Consensus around the importance of a watershed model in understanding the magnitude of upstream nutrient sources.
- Forum would like to know about differing options for watershed modeling in the future.
- Support for better understand spatial relationship between watersheds sources draining to a specific basin and how it impacts DO levels across Puget Sound.
- Need to consider and focus on impacts of OSS systems and how nutrient loading from OSS will only increase over time. This may require a more specific approach.
- Nonpoint nutrient sources are historically difficult to reduce relative to point sources and need to be realistic about this when creating nutrient management plan.
- Conversations concerning 50-75% nutrient reductions from watersheds seems unrealistic.
- When setting watershed reduction inputs, it's important to acknowledge which watersheds have more point sources than others; this will impact feasibility of reductions in each watershed.
- We need a better understanding of agricultural impacts to watersheds. It would be beneficial to explore whether there is more nitrogen loading from crop lands vs. animal feedlots.
- When addressing watershed nutrient sources, it's important to consider watersheds that may have more WWTPs than other watersheds. Point sources in watersheds could be contributing high loads to rivers.
- We should focus nutrient reduction work on mouths of rivers where we're seeing maximum DO depletions upstream.
- Modeling should focus on sensitive areas that have high load watersheds (e.g. Whidbey Basin and South Sound).
- Suggestion to hear more about agricultural best management practices (BMPs) in regards to nutrients.

WWTPs

- When modeling seasonal advanced wastewater treatment, what is the season used and how is this decided?
    - *Seasonal advanced wastewater treatment was set between April and October in the Bounding Scenarios Report.*
- Is it possible to model advanced wastewater treatment levels at lbs/year instead of concentrations?
    - *We will look into how to align our modeling limits and measurements with how limits and loadings are established in permits to establish more consistency.*

Comments:

- Curious about nutrient removal in the wintertime and whether this may have a negative impact on dissolved oxygen levels or Puget Sound biology.
- Modeling marine point sources by basin and in geographic frameworks could be important for future trading scenarios.
- Since NPDES permits set limits in lbs/year of nutrients, it would be good to match modeling limits instead of using nutrient concentrations.
- Some WWTPs may have different costs and benefits in updating technology to advanced treatment and between running seasonal and annual advanced treatment.
- Should think about the carbon footprint of upgrades to WWTPs.
- Modeling efforts should consider further separation of small and medium treatment plants when testing for impacts of WWTPs on DO.
- Would like to better understand how nutrient removal in wintertime will impact DO levels. It is possible nutrient removal in wintertime could have negative impact.
- Forum should look into how we can work to reduce flows.
- Questions about how advanced treatment works- is this an all or nothing deal for facilities?
- Using average nutrient reduction limit (ex: % reduction across the year) could give more flexibility with more time to meet limits.
- Facility planners would lie more certainty on what permitting may look like in the future.
- Better to require more stringent reductions to nutrient loads during summer when BNR actually works.
- Consider alternative ways to remove nutrients at WWTPs, such as groundwater recharge, reclaimed water, etc.
- Aging systems will be competing for funds for any advanced treatment; this will cause utility concerns for rate payers.