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Application of Salish Sea model: water quality improvement through anthropogenic nutrient reductions

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Application of Salish Sea Model

Linking Water Quality Improvement to Anthropogenic Nutrient reductions

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303(d) listings for DO
Dissolved Oxygen (DO) standards

(A) Numeric criteria

(B) If natural conditions are below the standard, anthropogenic sources cannot reduce natural DO by more than 0.2 mg/L
Application of Salish Sea Model: Dissolved Oxygen (DO) improvement through Anthropogenic Nutrient Reduction

• What is the current state of Dissolved Oxygen (DO) in Salish Sea?
  • Are DO standards currently being met?
  • Are DO standards met under reference conditions?
  • What is the net anthropogenic DO impact?
  • Is there inter-annual variability in anthropogenic DO impact?
• What would happen to DO if we did nothing?
• How much DO can be improved from anthropogenic nutrient reductions?
Anthropogenic depletion of dissolved oxygen, 2006

2006 - Exist1

2006 - Ref1

Difference

Minimum DO (mg/l)

Difference in Minimum DO (mg/l)
Anthropogenic depletion of dissolved oxygen, 2014
Consider inter annual variability in DO depletions

- Lower freshwater flows
  - Increase residence times (i.e. how long it takes to flush water out of a region)
  - Buildup of pollutant concentrations
  - Increased productivity and depletion of nutrients
  - Promotes oxidation of ammonia to nitrate
  - Promotes decomposition of organic carbon

Residence Time index for Central Basin
(Courtesy, Skip Albertson, 2015 PSEMP report)
Application of Salish Sea Model:

DO improvement through Anthropogenic Nutrient Reduction Strategies (multiple year analysis)

Bounding Scenarios

- What is the maximum improvement in DO with BNR at WWTPs?
- What is the maximum improvement in DO from nutrient reductions in watersheds?
- What would DO be under status quo?

Strategic Scenarios through collaborative process

- Impact of BNR at selected WWTPs?
- Impact of different nutrient reduction levels in watersheds?
- Combination of BNR and watershed reductions?
Application of Salish Sea Model:

Bounding scenario: WWTP at BNR?

BNR levels for ammonia and nitrate set by 2011 Puget Sound WWTP report*

- Use only dry weather treatment (May – Oct)
- DIN (ammonia + nitrate) = 8 mg/L (NH3 = 0.25 mg/L, NO3 = 7.75 mg/L)

LOTT has already achieved levels of DIN = 3 mg/L

Application of Salish Sea Model:

Bounding scenario: WWTP at BNR?

NH₃ \rightarrow_{\text{Nitrification}} NO₃ \rightarrow_{\text{Denitrification}} N₂
Application of Salish Sea Model:

- Strategic Scenarios through collaborative process

- Multiple scenarios of point and nonpoint source reductions will be evaluated
- Final solution set includes regulatory requirements and considers costs, feasibility, priority, and sequencing
Questions:

- Bounding Scenarios Draft Report: end of 2018
- Scenarios for Nutrient Management Strategy >= 2019

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