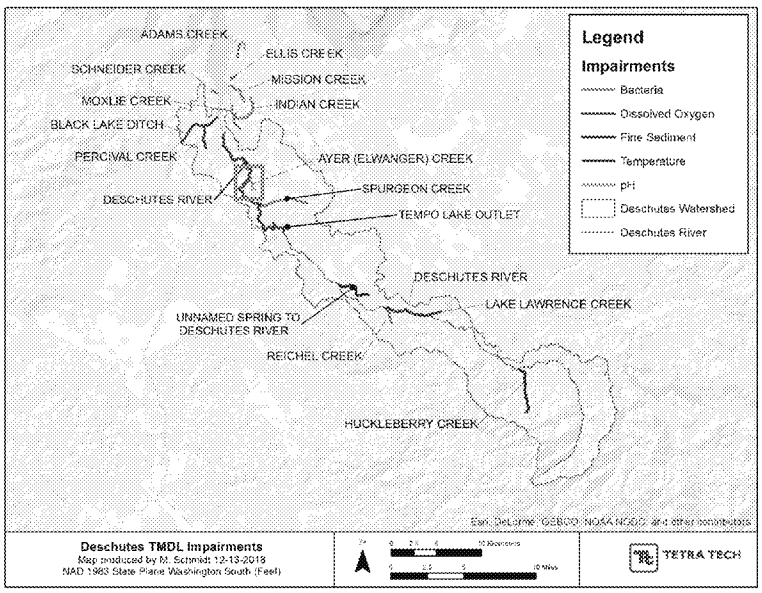
Ayer Creek Pilot Model

- Impaired for DO, pH, and water temperature

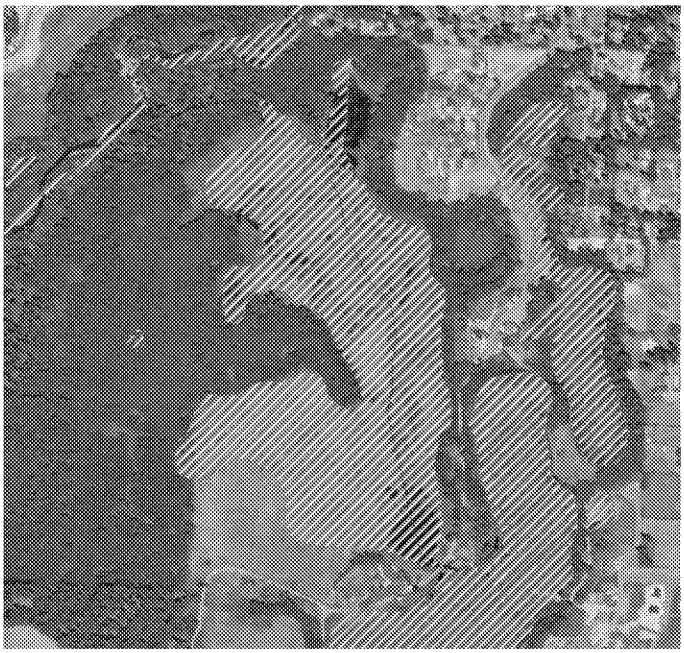


Ayer Creek Pilot Model

- Impaired for DO, pH, and water temperature

Ayer Creek Pilot Model

- Mapped wetland areas

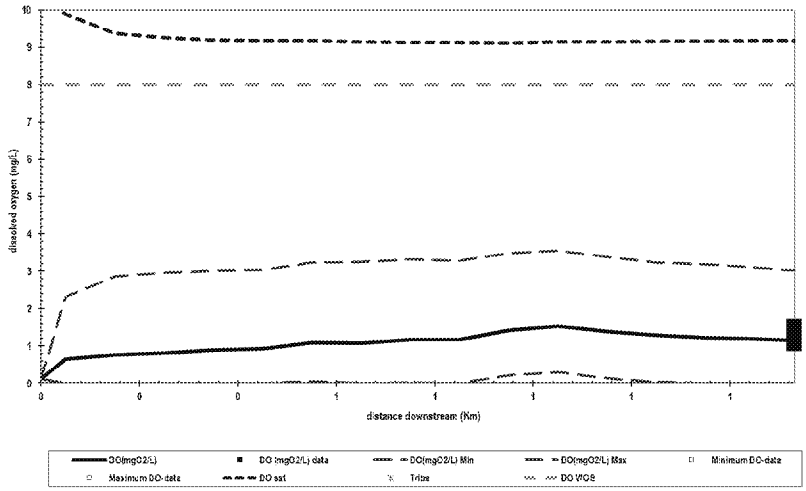


Calibration Model

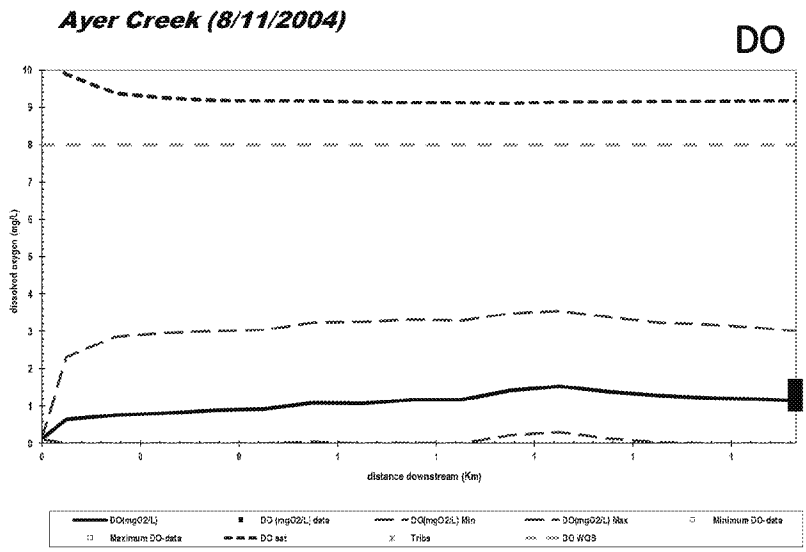
- Calibration model date – 8/11/2004 (same as the Deschutes River model and WQS not met for pH, DO, and temperature)
- Ttools derived inputs for the Shade model
- Shade model run for 8/11/2004 and outputs used for QUAL2Kw
- Parameterization informed by Deschutes model, references from the literature, QUAL2Kw guidance
- Established parameters fitting for Ayer Creek
  - Reaeration: Tsivoglou-Neal for low flow, sluggish reaches
  - Groundwater quality in the vicinity of Ayer Creek based on Sinclair and Bilhimer study (2007)
- Completed comprehensive calibration

Ayer Creek (8/11/2004)

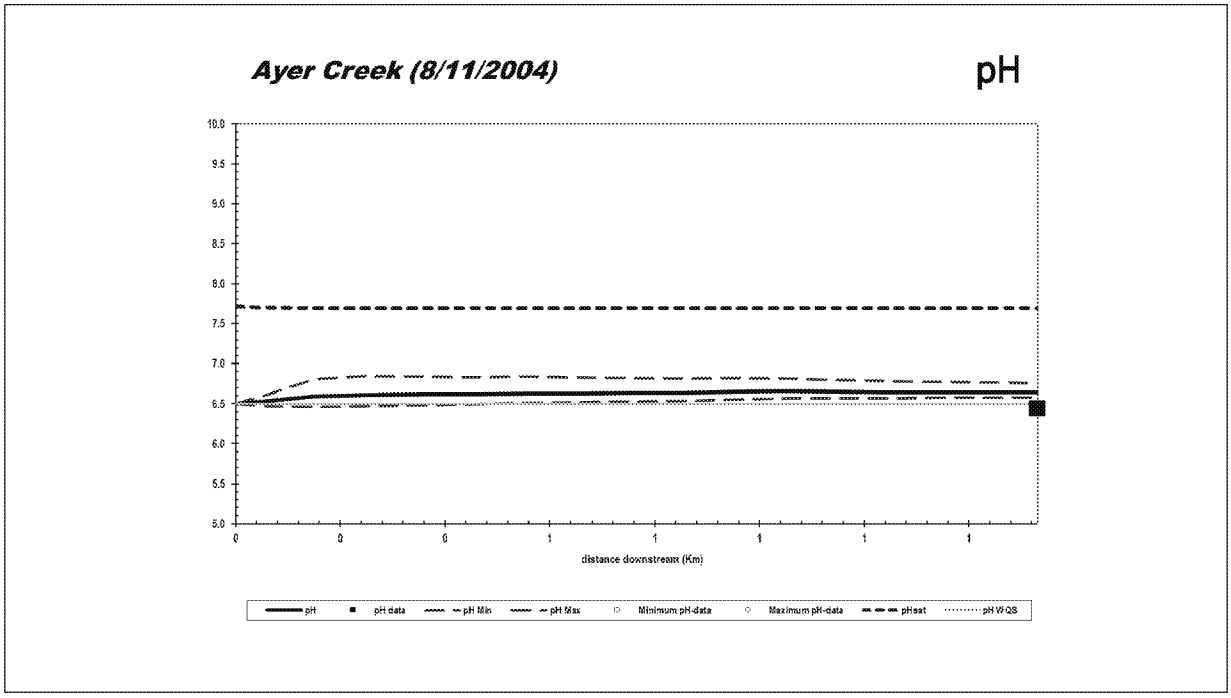
Temperature

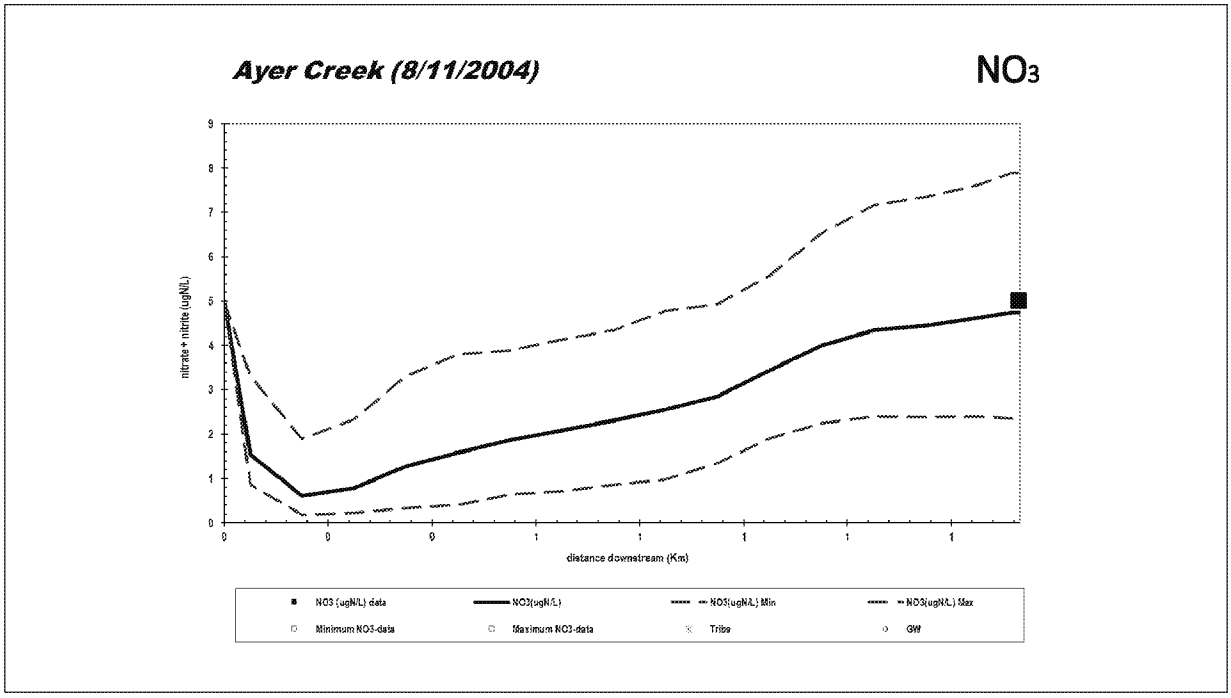


Data limited to downstream end



Groundwater DO = 0.12 mg/L


Ayer Creek (8/11/2004)
pH
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
0
0
0
1
1
1
1
1
distance downstream (Km)
pH
pH data
pH Min
pH Max
Minimum pH-data
Maximum pH-data
pHsat
pH WQS

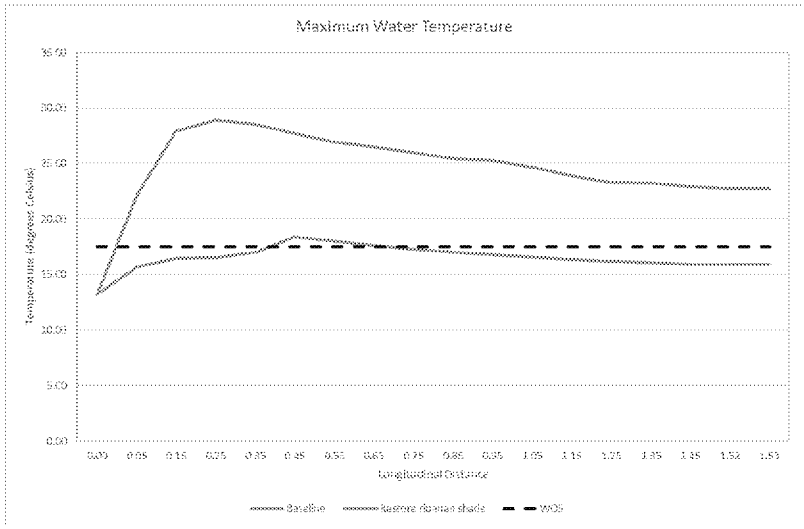

Ayer Creek (8/11/2004)
NO3
nitrate + nitrite (ugN/L)
distance downstream (Km)
NO3 (ugN/L) data
NO3(ugN/L)
NO3(ugN/L) Min
NO3(ugN/L) Max
Minimum NO3-data
Maximum NO3-data
Tribs
GW

Critical Conditions Model

- 7Q10 flow (slightly lower than calibration model flow)
- 90th percentile air and dew point temperatures
- Parameterization maintained from the calibration model

Completed example scenarios (e.g., nutrient reductions, restored shade)

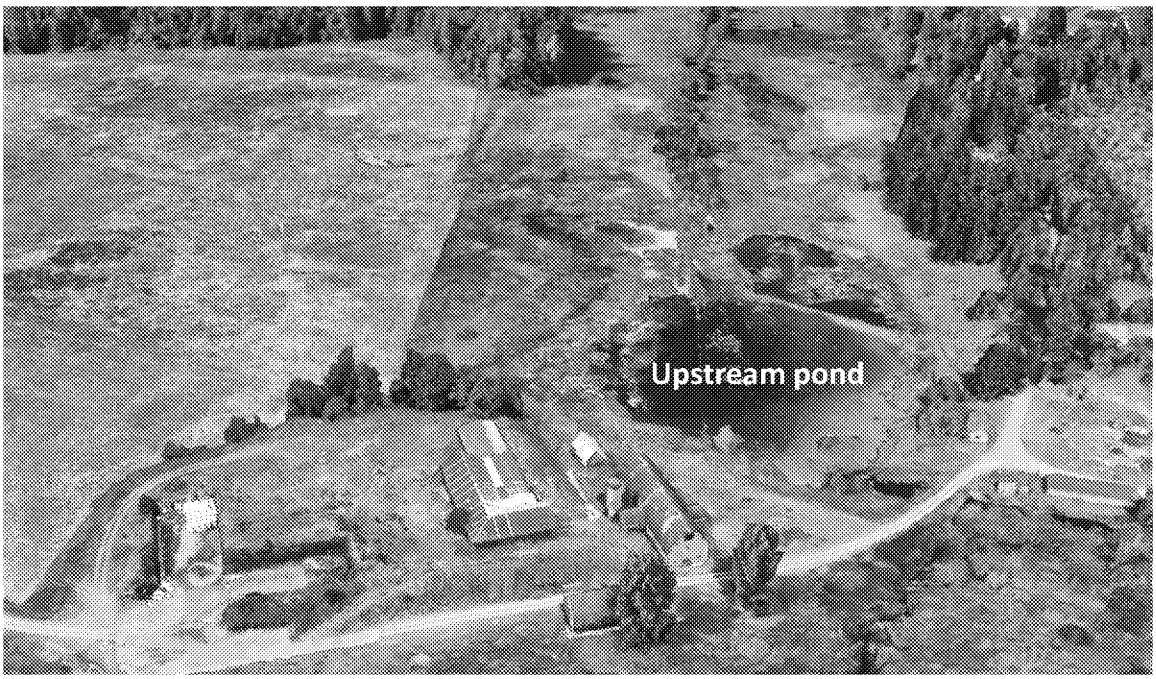
Water Temperature – Critical Conditions

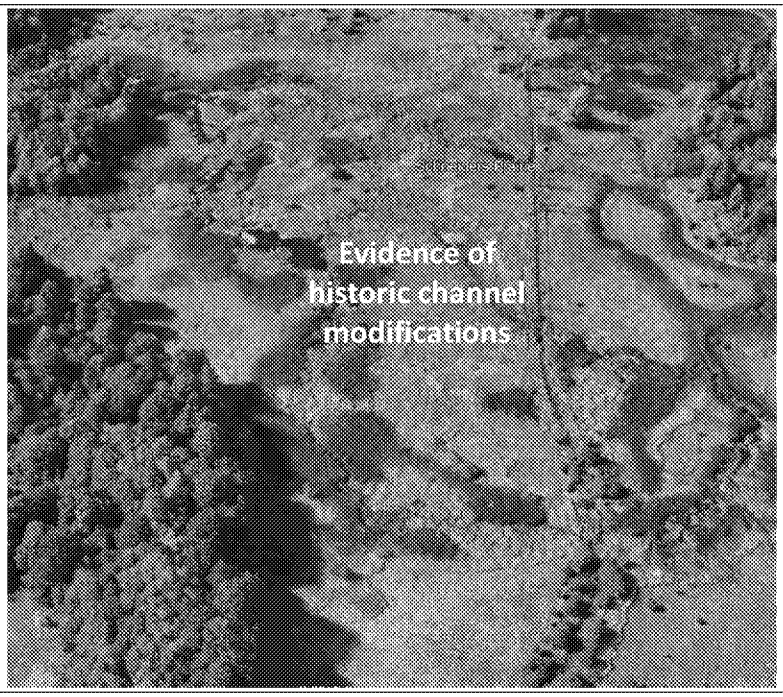


Longitudinal Average Maximum Daily Temperatures

Baseline: 24.6°C

Restore riparian shade: 16.5°C


Upstream pond


Evidence of
historic channel
modifications

pH

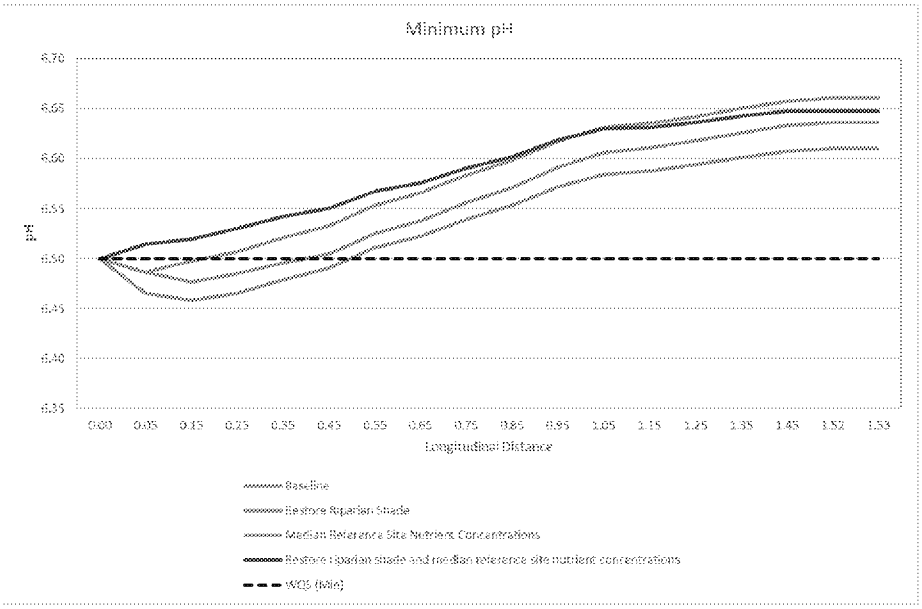
Baseline Nutrients:

0.18 mg-N/L
0.12 mg-P/L

Washington Reference Sites (N-STEPS)

Median for Puget Lowlands:
0.358 mg-N/L
0.015 mg-P/L

Lower N concentration in Ayer Creek potentially due to enhanced denitrification



Consideration of natural pH of wetlands

Ex. 5 Deliberative Process (DP)

DO

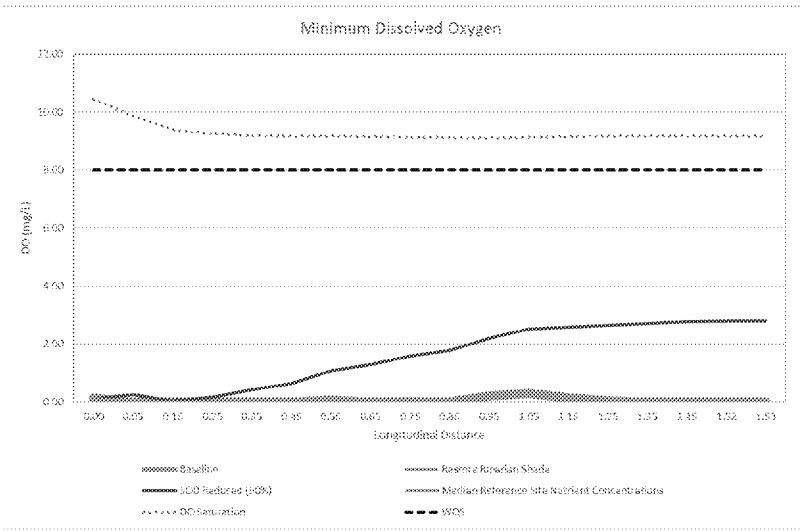
Summary of DO Monitoring for Ayer Creek

Observed:

DO Low
1.05 mg/L
(August)

DO High
8.6 mg/L
(early April)

Year-round
DO mean
3.6 mg/L



SOD – Sediment Oxygen Demand

Natural Conditions

- "Natural conditions" or "natural background levels" means surface water quality that was present before any human-caused pollution. When estimating natural conditions in the headwaters of a disturbed watershed it may be necessary to use the less disturbed conditions of a neighboring or similar watershed as a reference condition. (See also WAC 173-201A260(1).)

Natural Conditions for Ayer

- Headwater and diffuse flows – critical conditions
- Northern Thurston County Groundwater Report - Geohydrologic unit: Qvt
    - DO – 0.8 mg/L
    - pH – 6.8
- N-STEPS Analysis for Washington – Nutrient Concentrations from Reference Sites (median concentration for Puget Lowlands)
    - TN – 0.358 mg/L (higher than observations)
    - TP – 0.015 mg/L
- SOD and phytoplankton algae: negligible
- Restoration of riparian shade

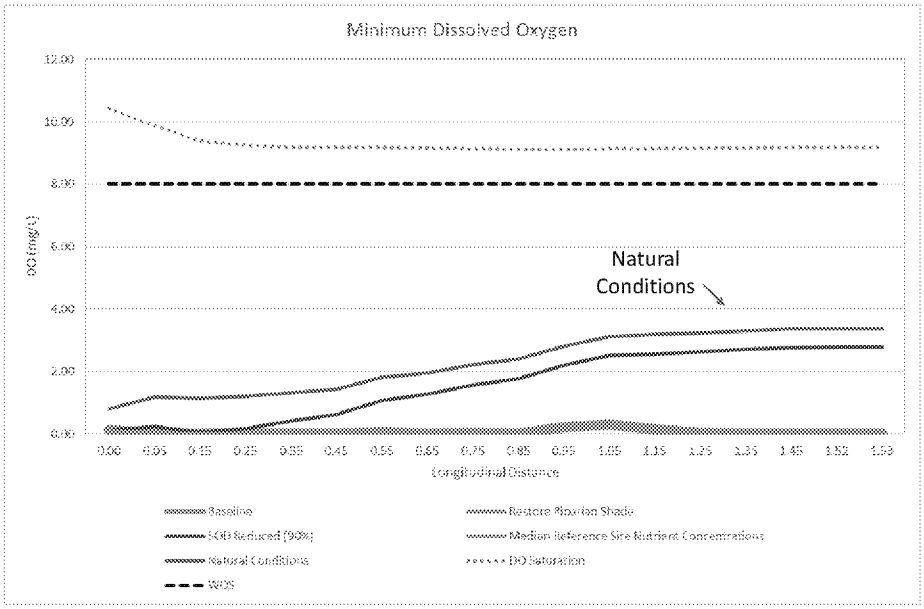
Longitudinal Averages:

Minimum DO: 2.3 mg/L

pH: 6.8

Maximum Temperature: 15.6ºC

DO WQS violated under natural conditions



Option for Defining Loading Capacity

- Human activity may not reduce DO concentrations by more than 0.2 mg/L if natural conditions result in DO concentrations lower than the criterion
- Ex. 5 Deliberative Process (DP)
-