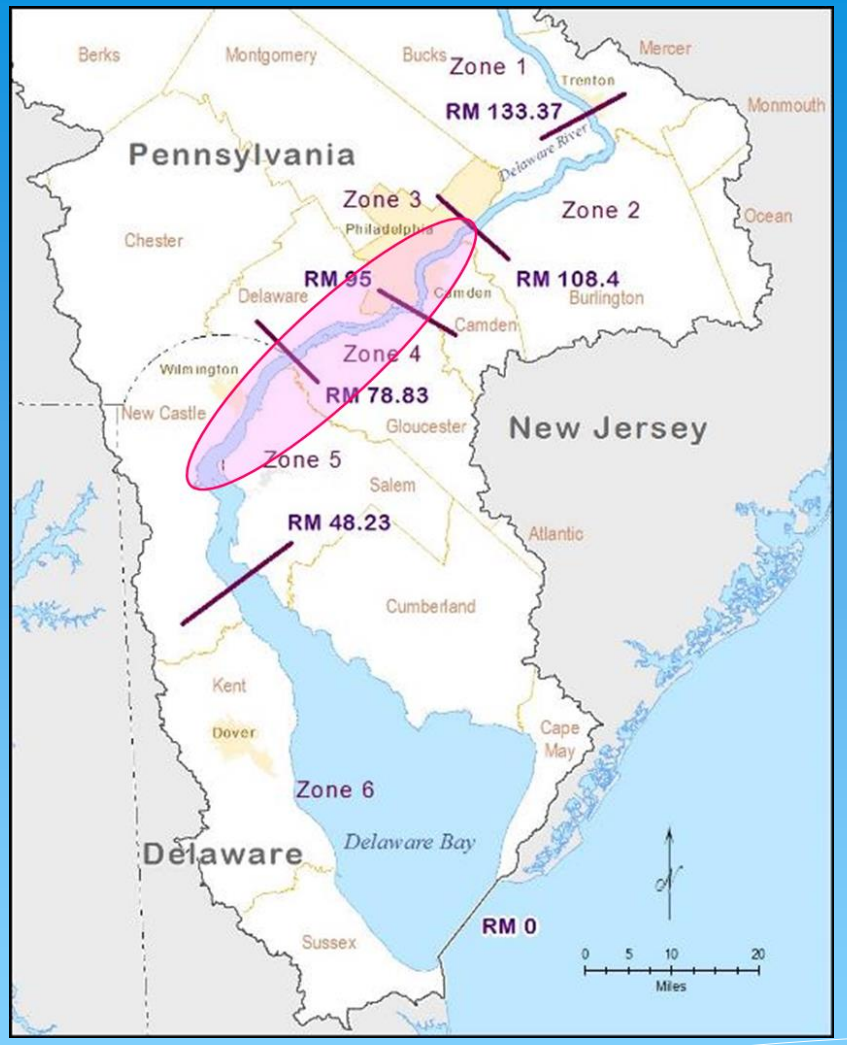
Analysis of Attainability Progress Update

Water Quality Advisory Committee

August 18, 2022



Presented to an advisory committee of the DRBC on August 18, 2022.

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What is this "Analysis of Attainability"?

Regulatory basis

- Aquatic life use defined as the degree of propagation associated with a given dissolved oxygen condition

Purpose

- **Highest Attainable Dissolved Oxygen (HADO) condition to be determined based on feasibility, costs, and benefits in the fish maintenance area**

Outcome

- Revised designated use will be the enhanced degree of propagation associated with the HADO condition

Analysis of Attainability

Rulemaking

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Discussion Items

Source Sensitivity Evaluations

- Results of tributary load sensitivity analyses
- What Matters and What Doesn't
- Ranking dischargers to ID potential Class A
  - Class A dischargers can impact DO in the estuary by reducing effluent ammonia
  - Class A discharges will be included in AA candidate scenarios
- Comparison of effluent reduction scenarios
- Identification of Class A' and A Dischargers
- Impact of Effluent DO

Preview of Analysis of Attainability

- "Candidate" scenarios
  - Varying degrees of nitrogen reduction from various point source dischargers
  - Implementation of CSO long-term control plans
  - Varying effluent DO = 6 mg/L
- Reserve capacity – likely 5-10% of wastewater
- Scenarios to be characterized
  - Maintain current water quality
  - 85% CSO reduction
    - ≤10 mg/L ammonia-N
    - ≤5 mg/L ammonia-N
    - ≤1.5 mg/L ammonia-N
    - ≤4 mg/L total nitrogen

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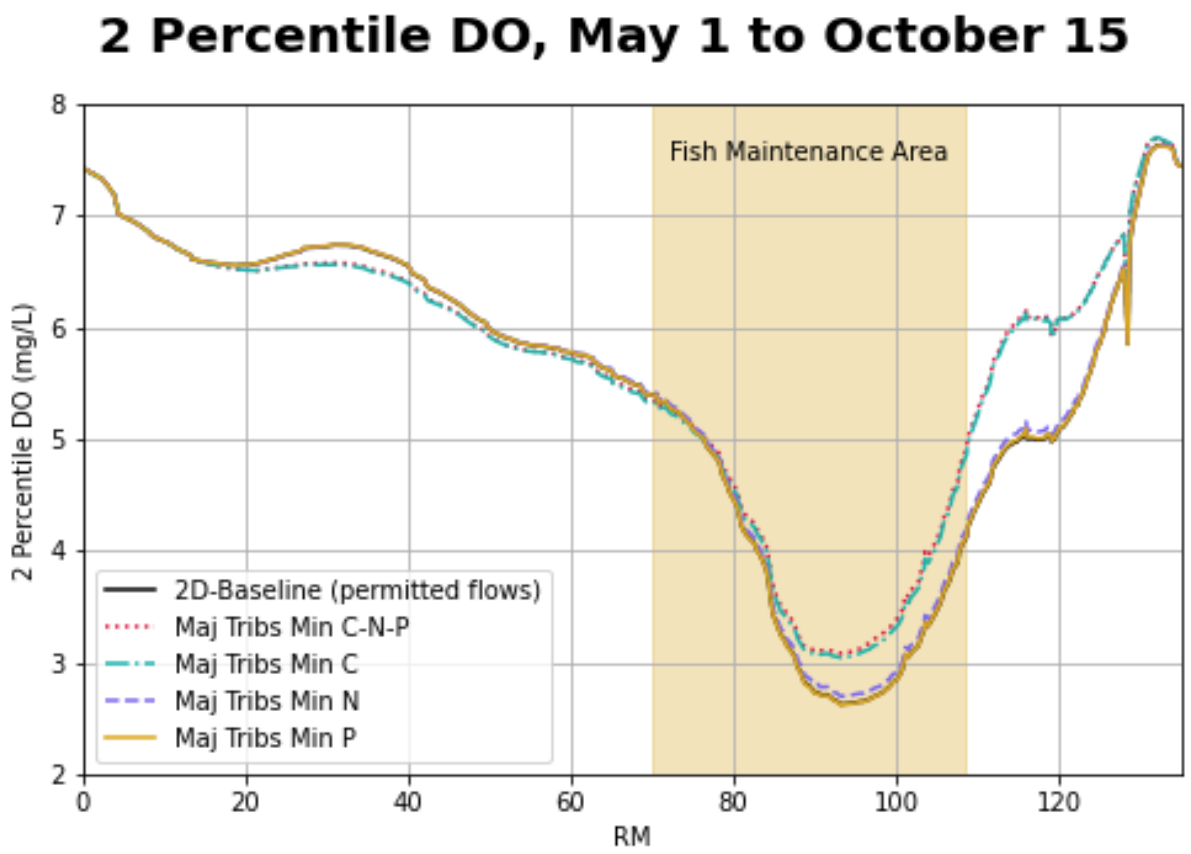
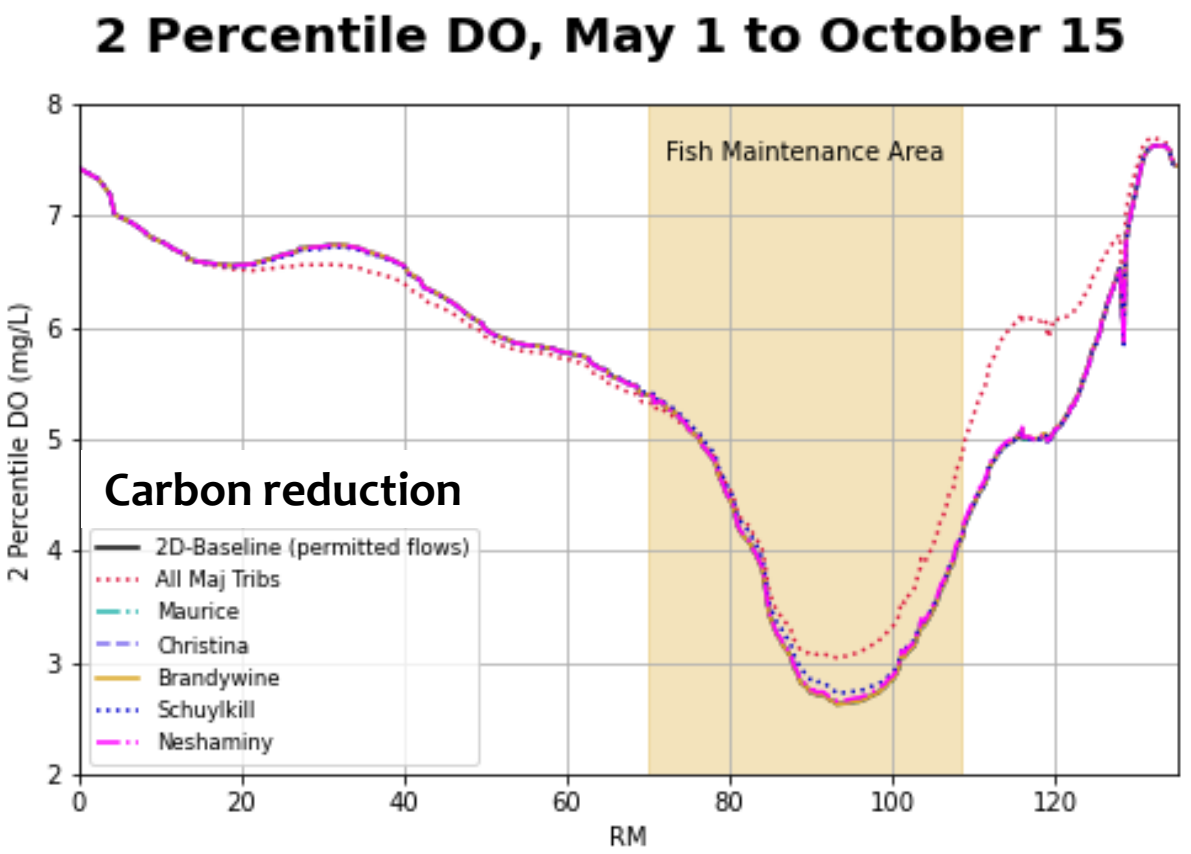
Tributary Sensitivity Tests

C, N, and P set to minimal concentrations in 6 major tribs:
(Maurice, Christina, Brandywine, Schuylkill, Neshaminy, Delaware @Trenton)





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Sources that Significantly Impact Dissolved Oxygen in the Delaware Estuary

What Matters

- **Summer ammonia from large point source dischargers within the estuary**
- CSOs exert a non-negligible impact on DO
- Tributary carbon loads
  - Delaware River at Trenton and, to a much lesser degree, Schuylkill River
  - Driven by flows (not elevated concentrations)
- Effluent dissolved oxygen levels from largest dischargers

What Doesn't Matter

- Carbon from point sources within estuary
- Nitrate from point sources within estuary
- Winter ammonia loads from point sources
- Tributary nutrient loads
  - Nitrogen and phosphorus – insignificant impact
  - Carbon – insignificant impact from almost all other tributaries
- Direct runoff and stormwater

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Identification of Potential "Class A" Dischargers

based on 2D simulated reductions of individual dischargers

PS_Tier	ZONE	State	PS Name	Summer NH4 Load (kg/day)	% contribution	cumulative load %
1	4	PA	PWD Southwest	14,354	37%	37%
1	3	NJ	Camden County MUA	5,241	13%	50%
1	5	DE	City of Wilmington	4,807	12%	62%
1	3	PA	PWD Southeast	3,626	9.2%	71%
1	3	PA	PWD Northeast	3,535	9.0%	80%
1	4	NJ	Gloucester County UA	2,438	6.2%	87%
1	2	NJ	Hamilton TWP WPCF	1,634	4.2%	91%
1	4	PA	Delcora	1,014	2.6%	93%
1	2	PA	Lower Bucks County JMA	748	1.9%	95%
2	6	NJ	City of Millville STA	495	1.3%	96%
1	2	NJ	Trenton SU	411	1.0%	98%
1	2	PA	Morrisville BMA	262	0.7%	98%
2	6	NJ	Cumberland County UA	125	0.3%	99%
2	2	NJ	Cinnaminson SA	121	0.3%	99%
1	2	NJ	Willingboro WPCP*	97	0.2%	99%
3	4	NJ	Logan Township MUA	67	0.2%	99%
2	2	NJ	Florence Township STP	56	0.1%	99%
3	5	NJ	Penns Grove SA	55	0.1%	100%
3	2	NJ	Beverly SA	55	0.1%	100%

PS_Tier	ZONE	State	PS Name	% Reduction DO Stress in FMA
1	4	PA	PWD Southwest	52%
1	3	NJ	Camden County MUA	37%
1	3	PA	PWD Southeast	25%
1	3	PA	PWD Northeast	20%
1	4	NJ	Gloucester County UA	11%
1	2	NJ	Hamilton TWP WPCF	2.6%
1	2	PA	Lower Bucks County JMA	1.8%
1	5	DE	City of Wilmington	1.3%
1	2	NJ	Trenton SU	1.0%
1	2	PA	Morrisville BMA	0.9%
1	4	PA	Delcora	0.8%
2	2	NJ	Cinnaminson SA	0.8%
2	2	NJ	Florence Township STP	0.3%
1	2	NJ	Willingboro WPCP*	0.3%
2	6	NJ	City of Millville STA	0.3%
3	5	NJ	Penns Grove SA	0.3%
3	2	NJ	Beverly SA	0.2%
2	6	NJ	Cumberland County UA	0.0%
3	4	NJ	Logan Township MUA	0.0%

PS_Tier	ZONE	State	PS Name	Weighted DeltaDO Volume (m^3 at Δ1 mg/L)	% decrease
1	4	PA	PWD Southwest	3.16E+08	
1	3	NJ	Camden County MUA	1.38E+08	56%
1	3	PA	PWD Southeast	7.92E+07	42%
1	3	PA	PWD Northeast	7.80E+07	1%
1	5	DE	City of Wilmington	6.98E+07	11%
1	2	NJ	Hamilton TWP WPCF	5.24E+07	25%
1	4	NJ	Gloucester County UA	4.45E+07	15%
1	2	PA	Lower Bucks County JMA	1.71E+07	61%
1	2	NJ	Trenton SU	1.10E+07	36%
1	2	PA	Morrisville BMA	8.68E+06	21%
2	2	NJ	Cinnaminson SA	2.69E+06	69%
2	6	NJ	City of Millville STA	1.95E+06	27%
1	4	PA	Delcora	4.73E+04	98%
2	2	NJ	Florence Township STP	3.87E+01	100%
1	2	NJ	Willingboro WPCP*	0.00E+00	100%
3	5	NJ	Penns Grove SA	0.00E+00	#DIV/0!
3	2	NJ	Beverly SA	0.00E+00	#DIV/0!
2	6	NJ	Cumberland County UA	0.00E+00	#DIV/0!
3	4	NJ	Logan Township MUA	0.00E+00	#DIV/0!

- Class A = 8 to 11 dischargers (likely 9)
  - Class A' = 4 to 7 dischargers (likely 6)

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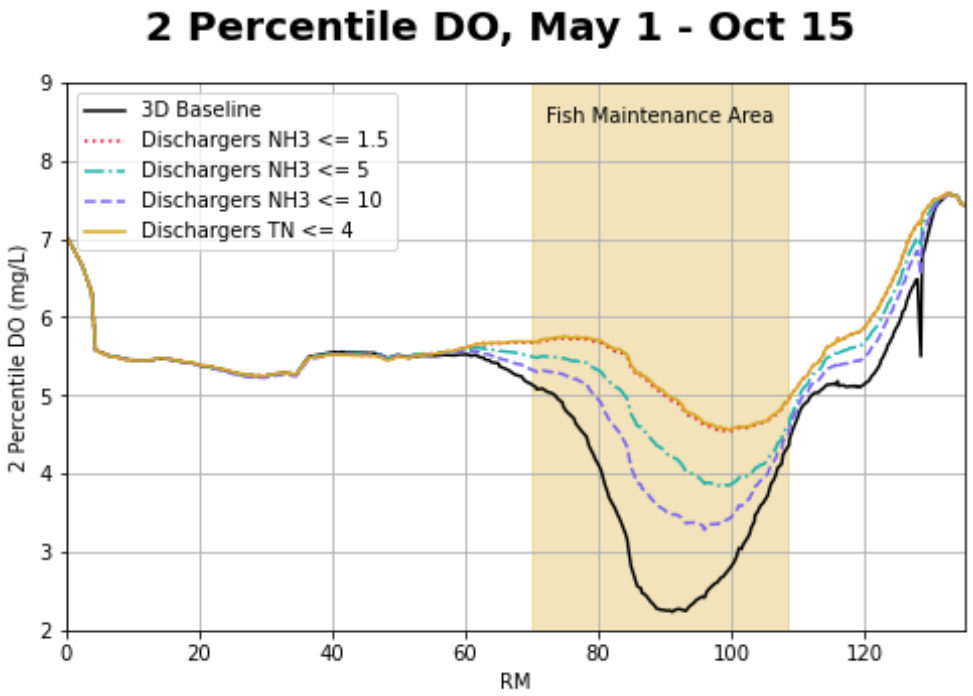
Comparison of effluent reduction scenarios

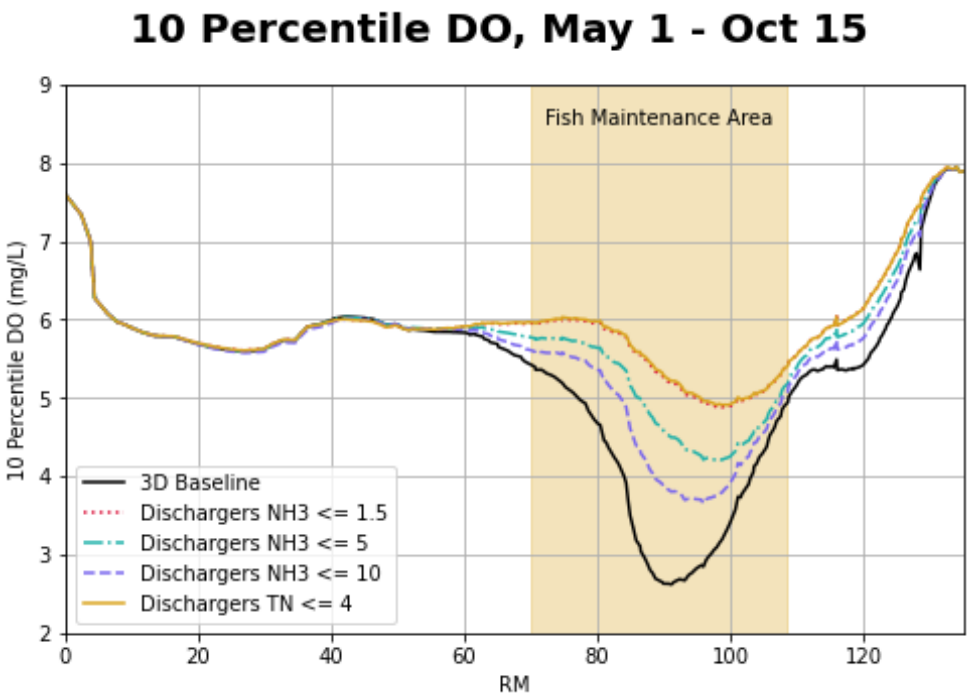
2, 10, 25, 50 Percentile DO* May 1 to Oct 15

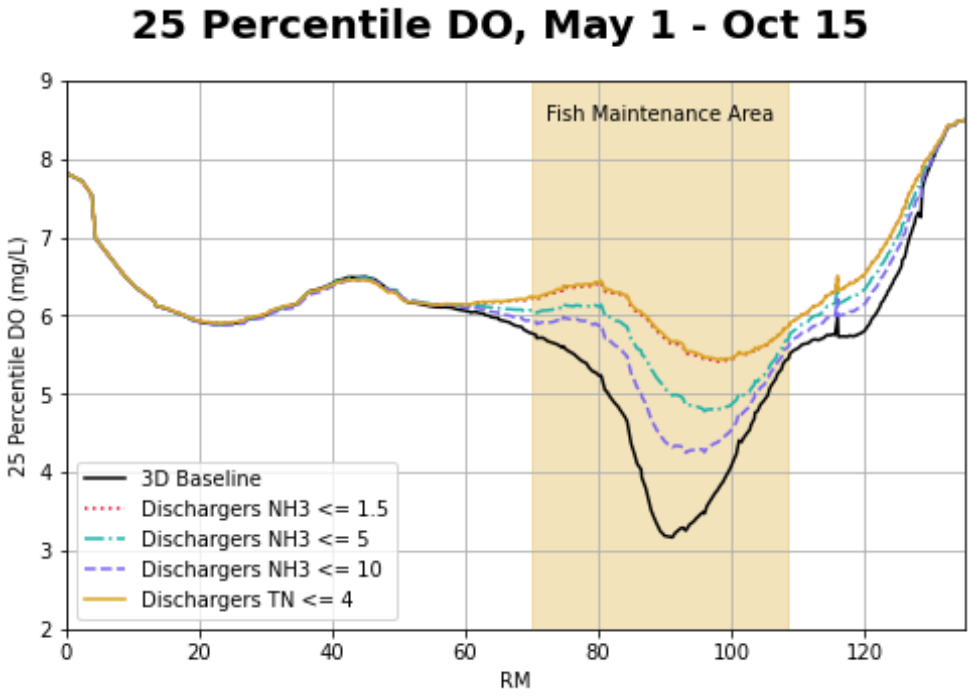
Lower NH3 loading improves low DO values

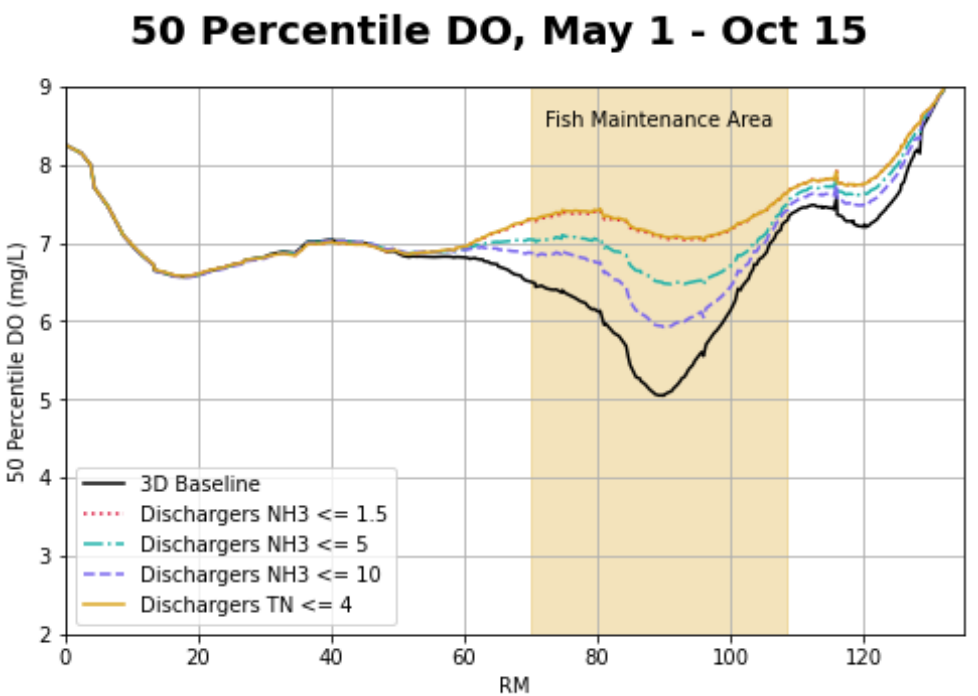
Adding TN cap on top of NH3 cap does not add benefit

*Nitrogen reduction scenarios simulated for 13 dischargers.







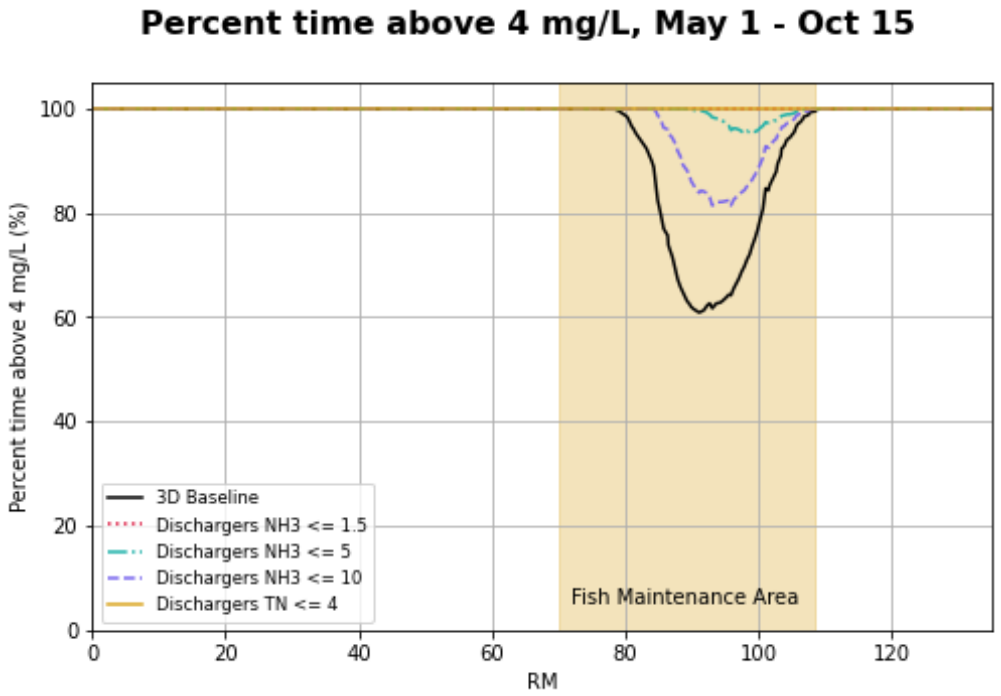


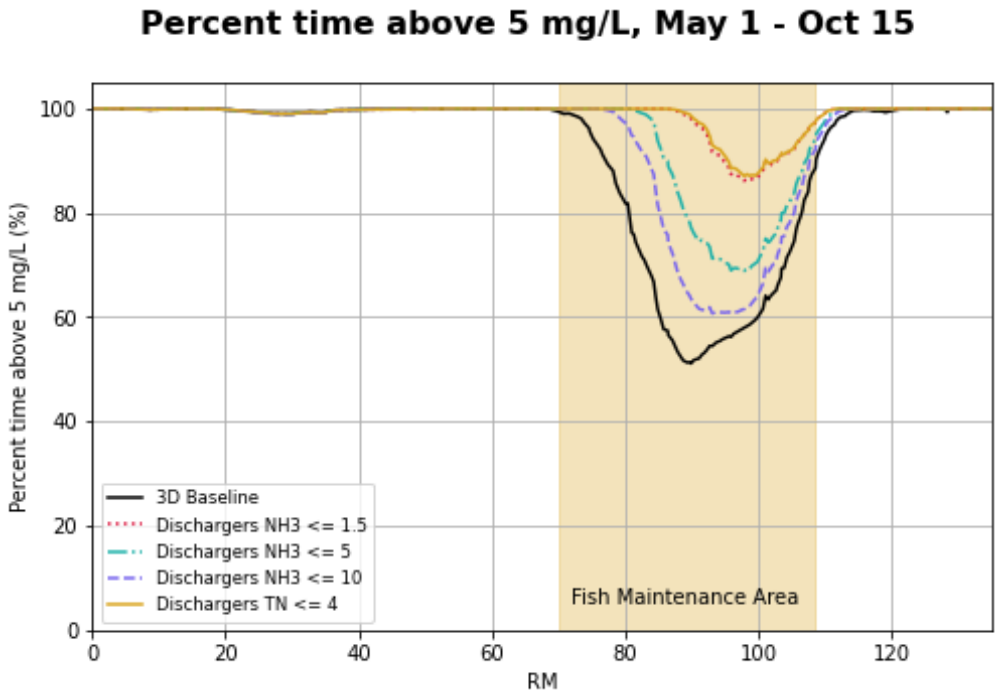
Percent time above 4, 5, 6, 7 mg/L DO*
May 1 to Oct 31

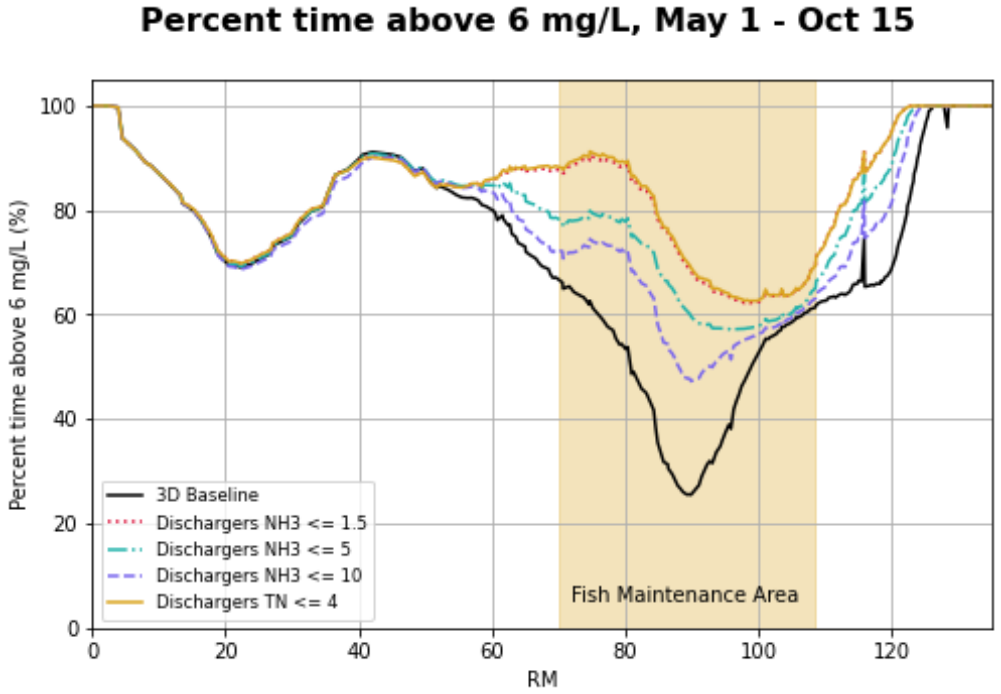
Lower NH3 loading increases time spent at higher DO values

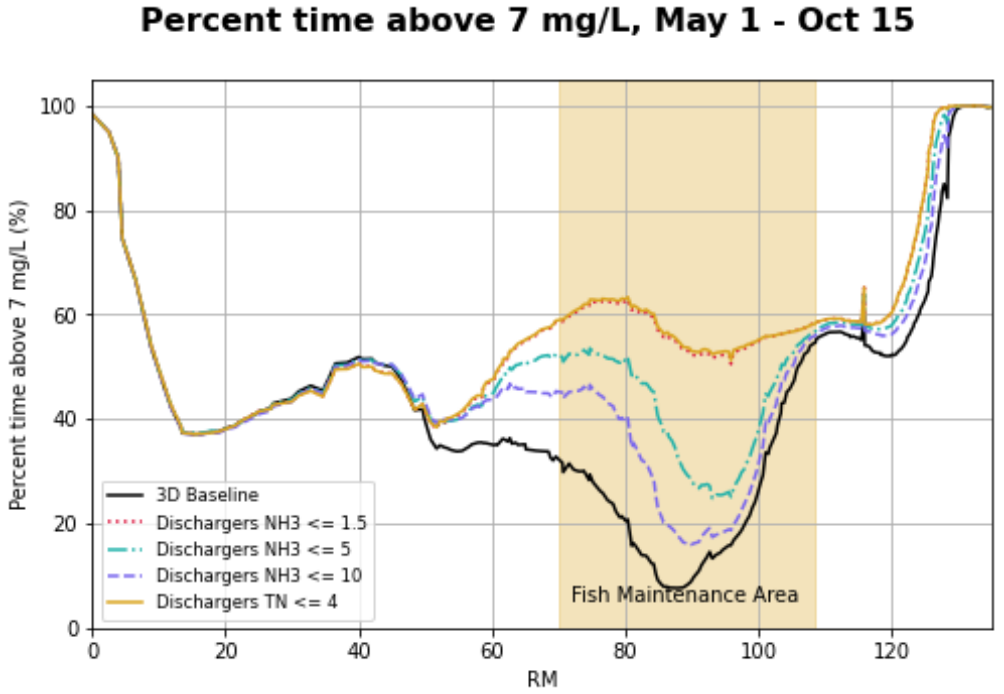
Adding TN cap on top of NH3 cap does not add benefit

*Nitrogen reduction scenarios simulated for 13 dischargers.









Identification of Class A' Dischargers

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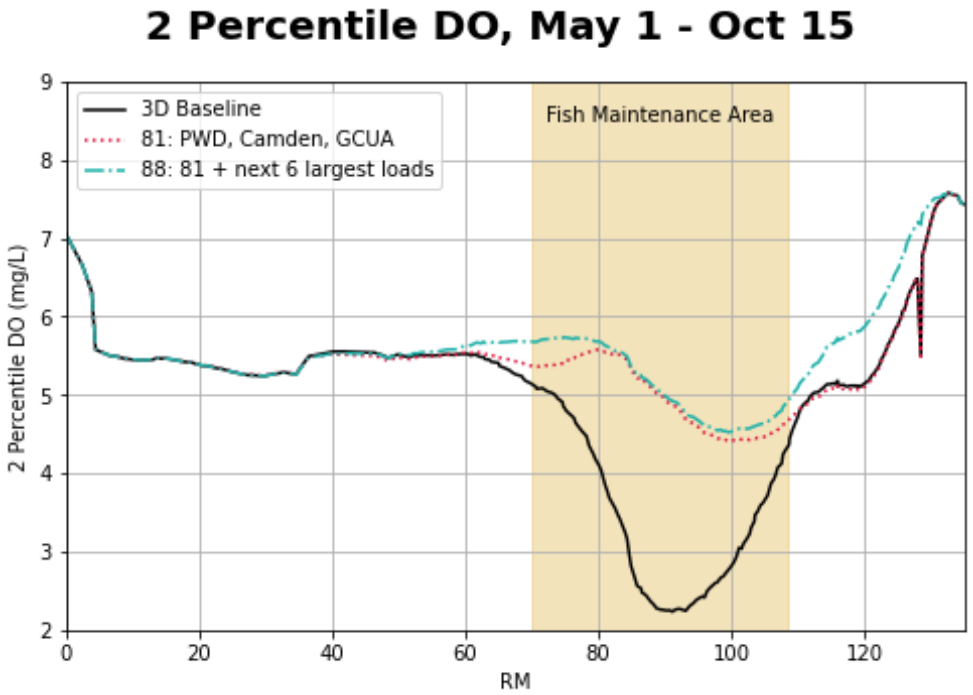
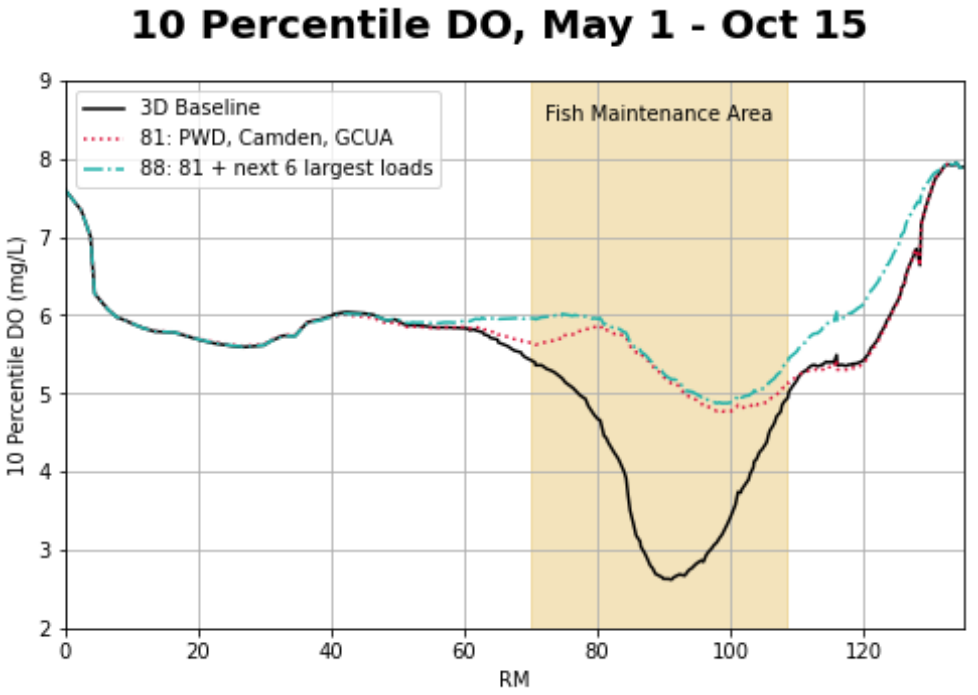
2, 10, 25, 50 Percentile DO
May 1 to Oct 15

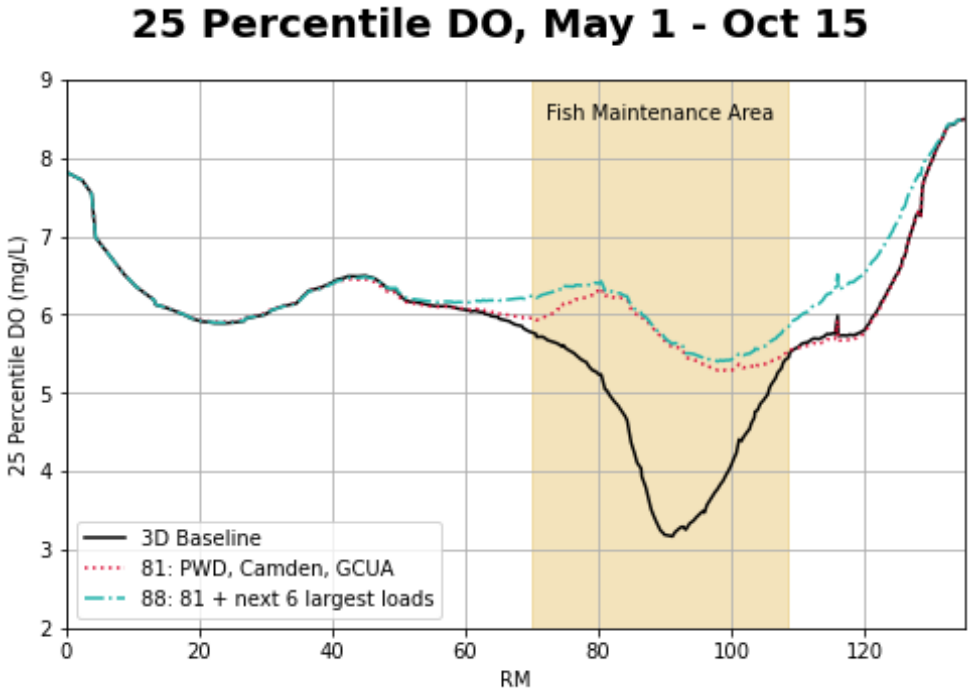
5 dischargers have potential to improve oxygen at the trough of the DO sag

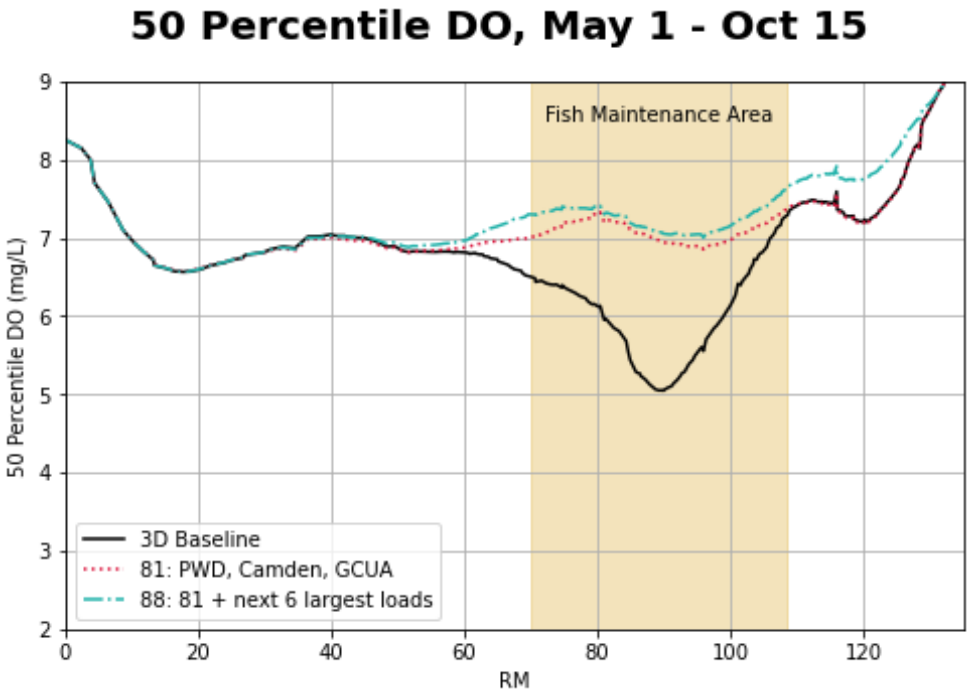
Other 6 dischargers* have potential to improve oxygen at the upstream and downstream portions of FMA

* Wilmington, Delcora, Hamilton, LowerBucks, Trenton, Morrisville









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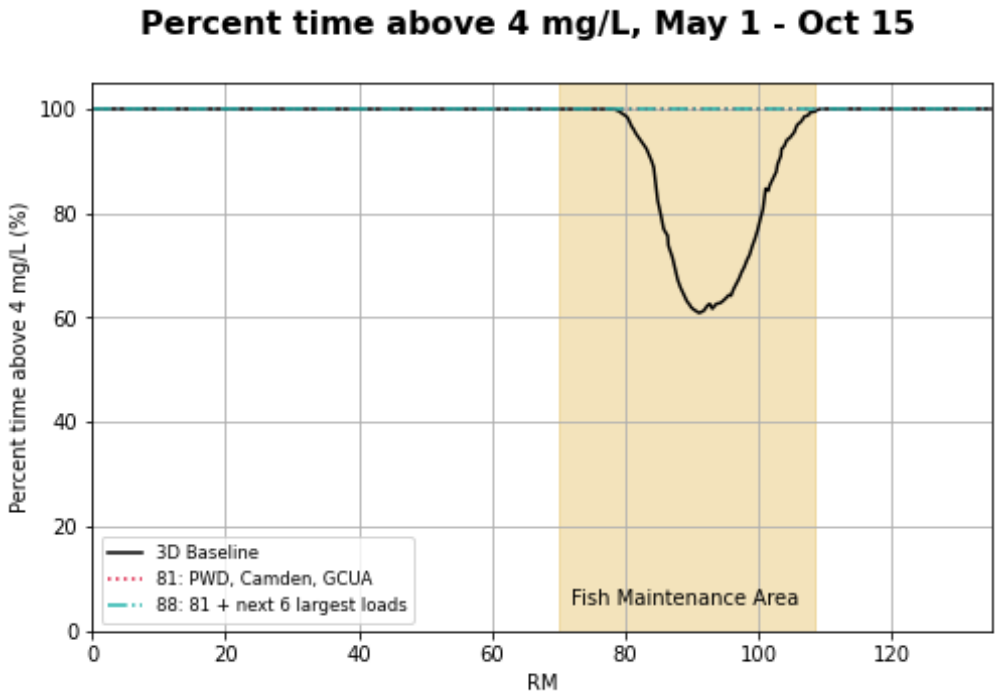
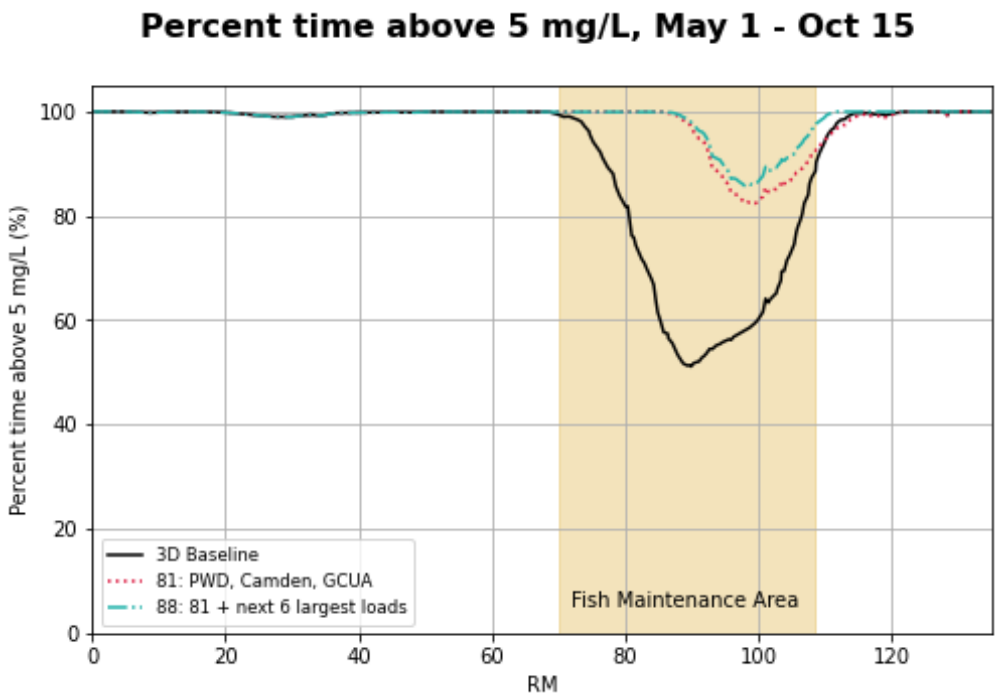
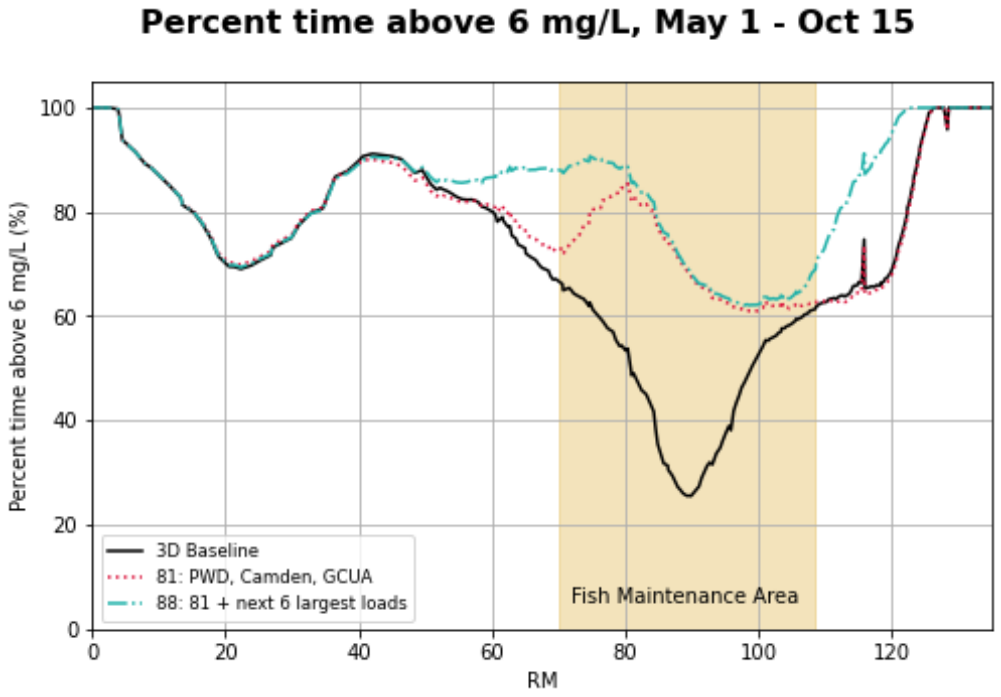
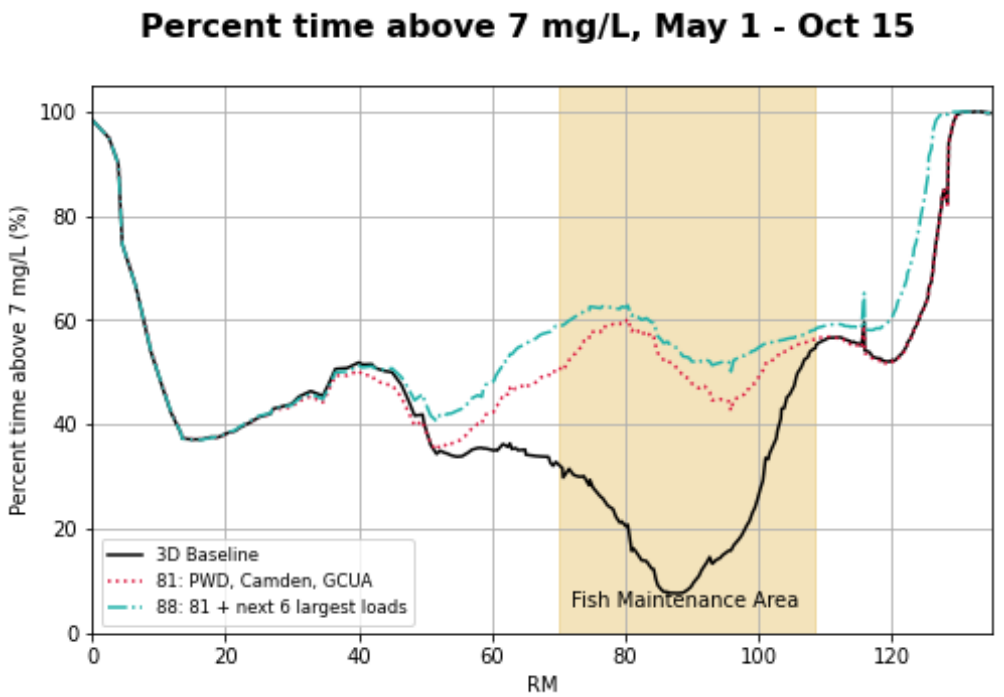
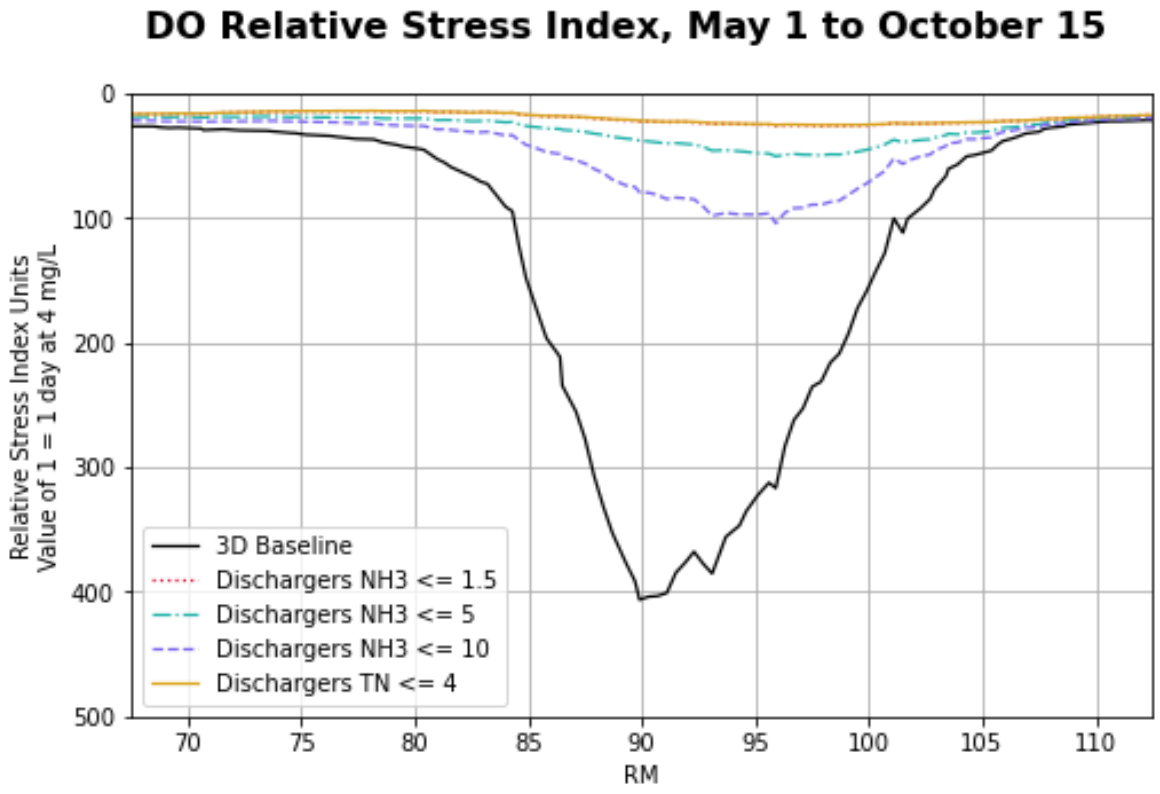


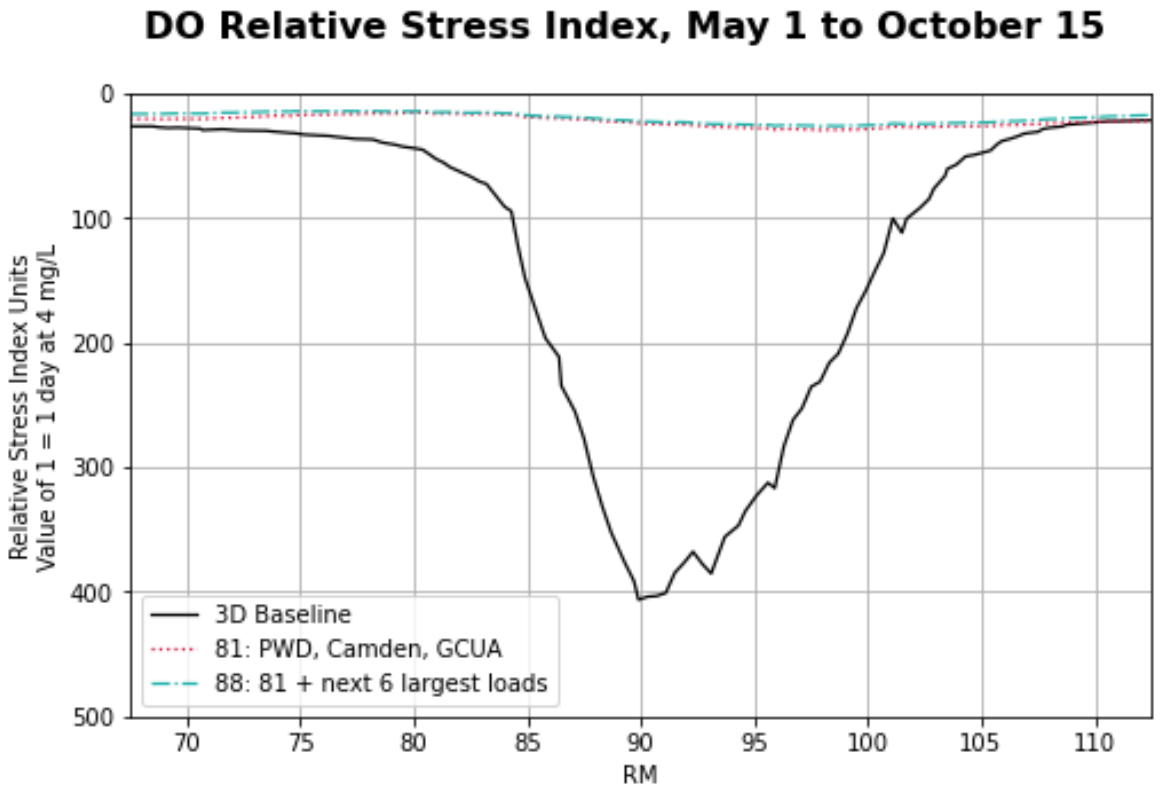






DO Relative Stress Index
May 1 to Oct 15





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Identification of Class A Dischargers

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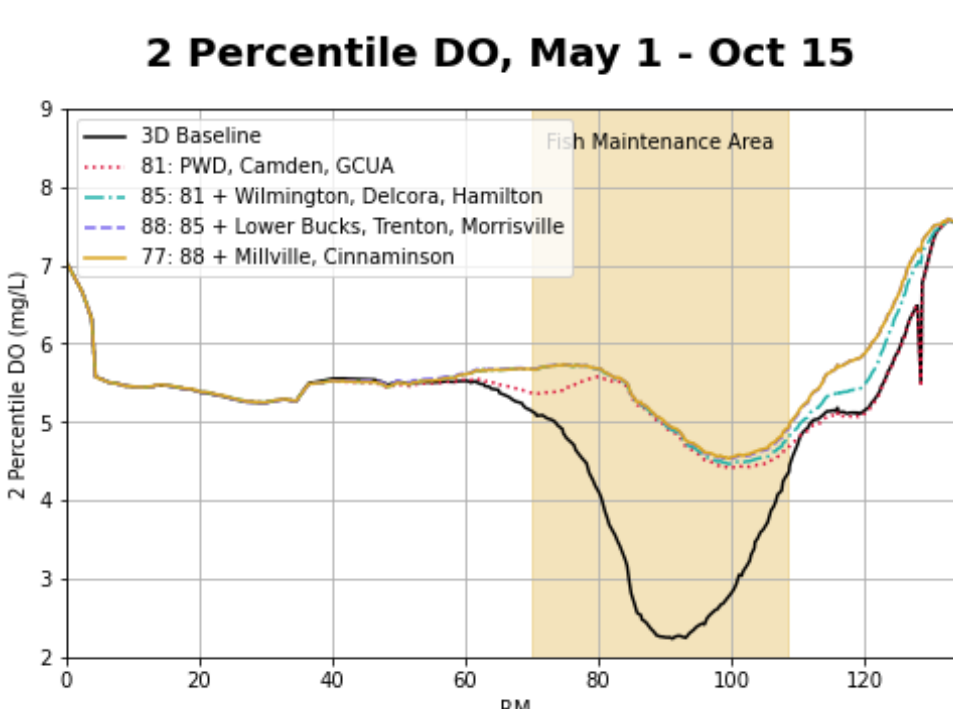
2, 10, 25, 50 Percentile DO

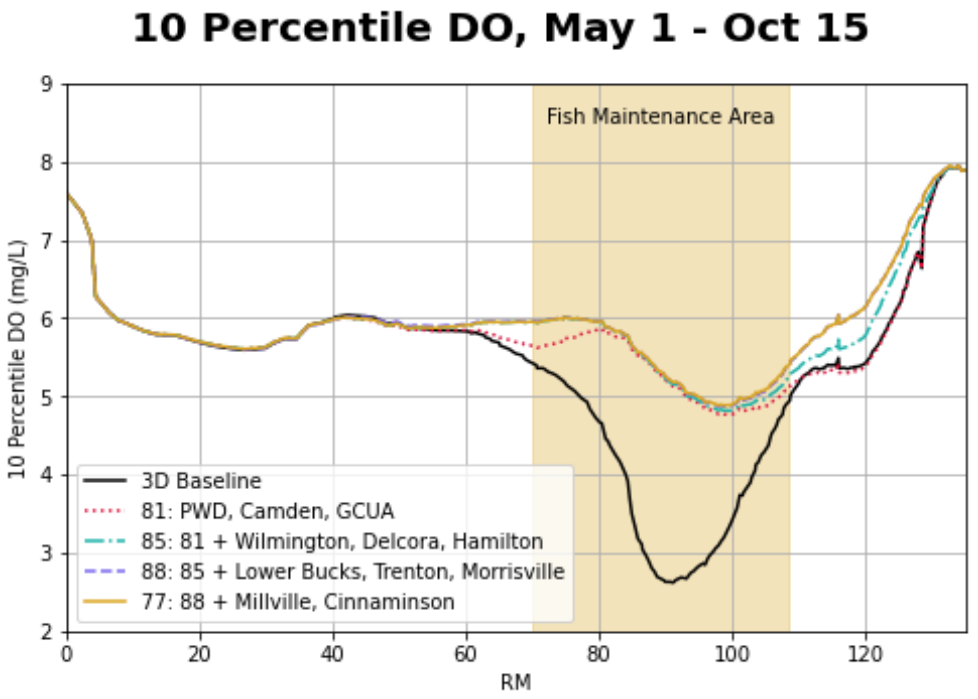
May 1 to Oct 15

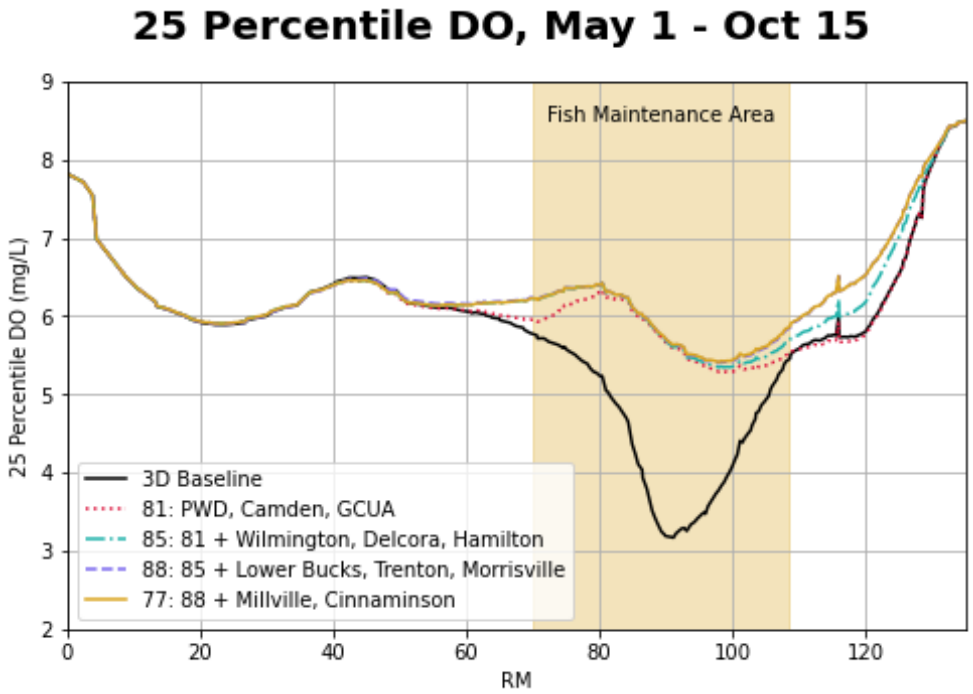
Adding Wilmington, Delcora, Hamilton has significant DO benefit at RM 60–80 and RM 100+

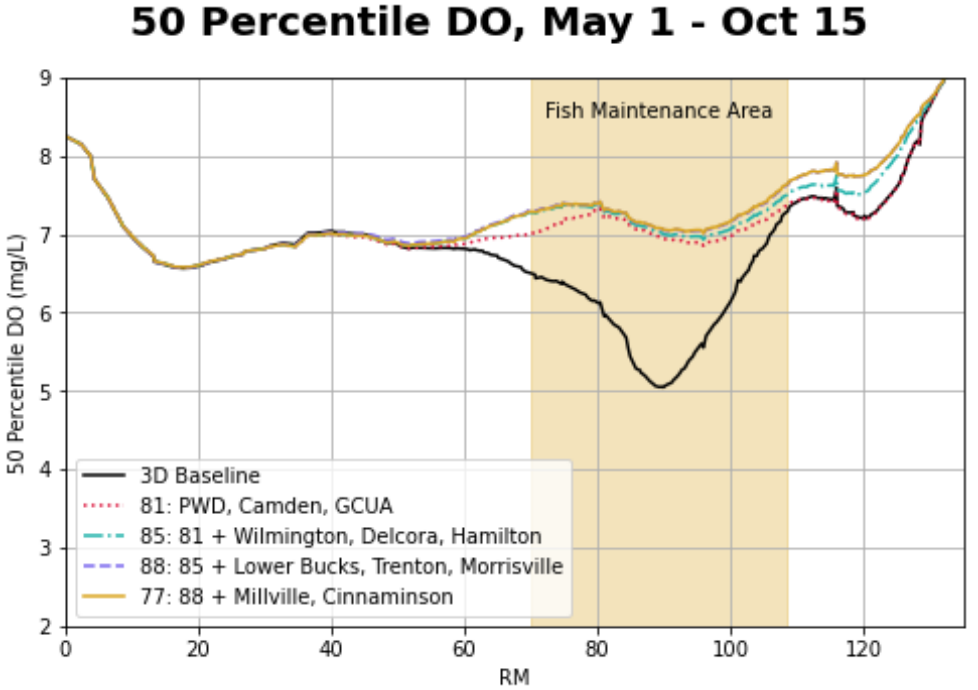
Smaller but visible impact from adding Lower Bucks, Trenton

Note that the order of cumulative simulations matters. Simulations ongoing to determine which dischargers have potential to impact FMA.









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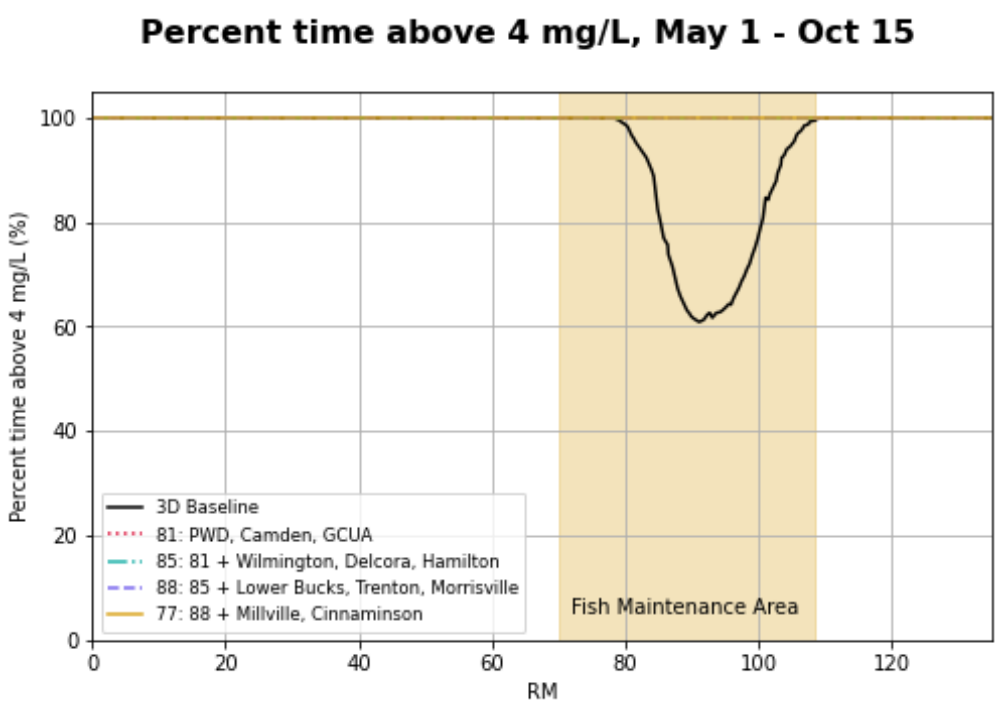

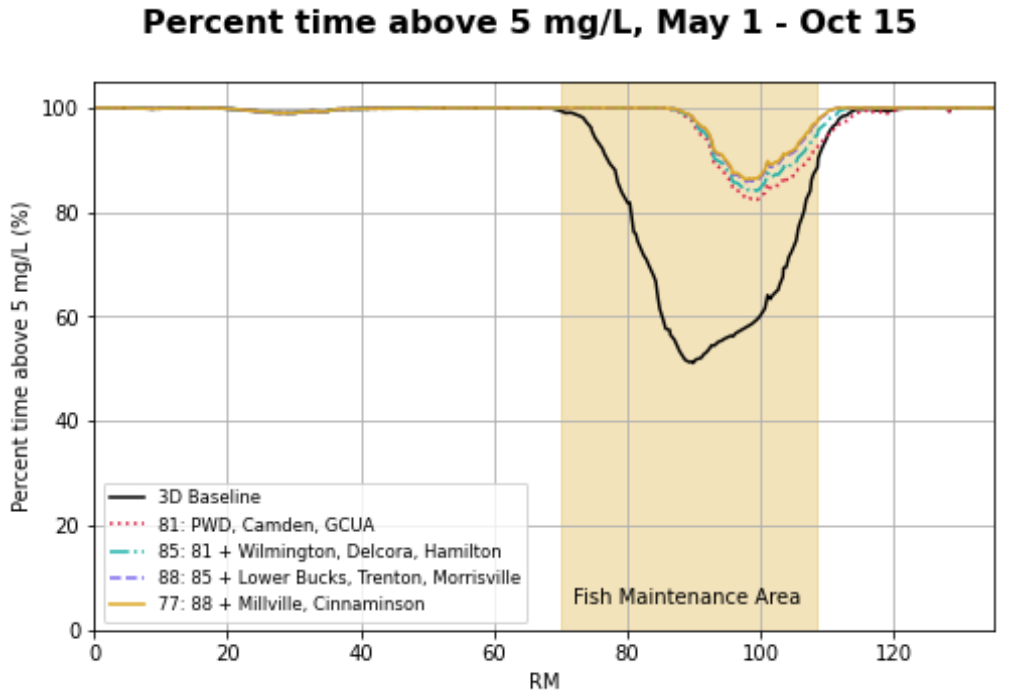

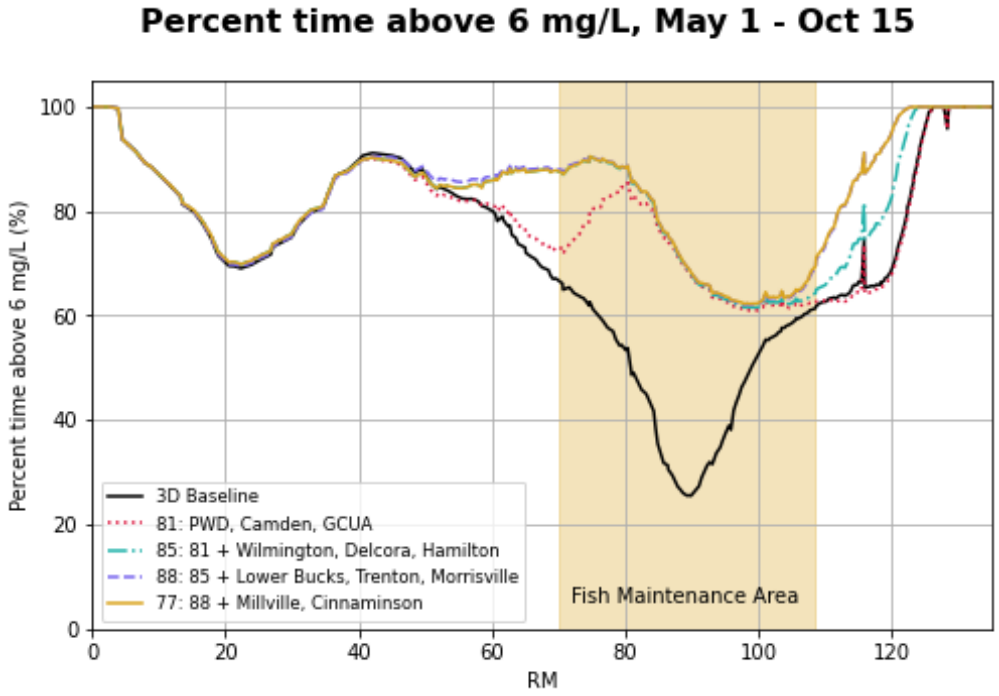

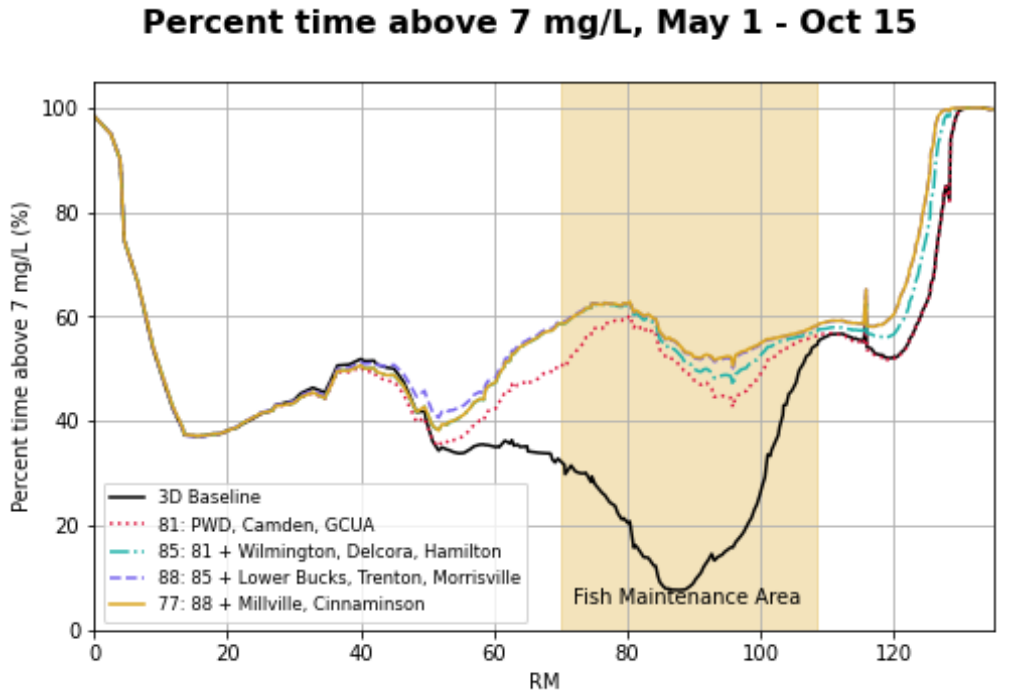

Impact of Effluent DO

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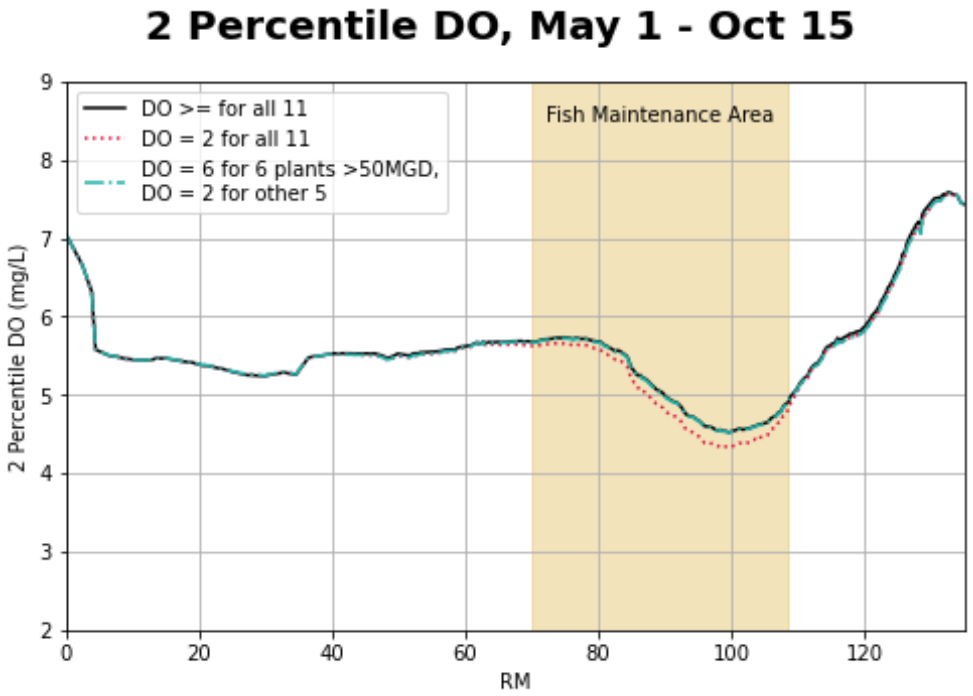
2, 10, 25, 50 Percentile DO

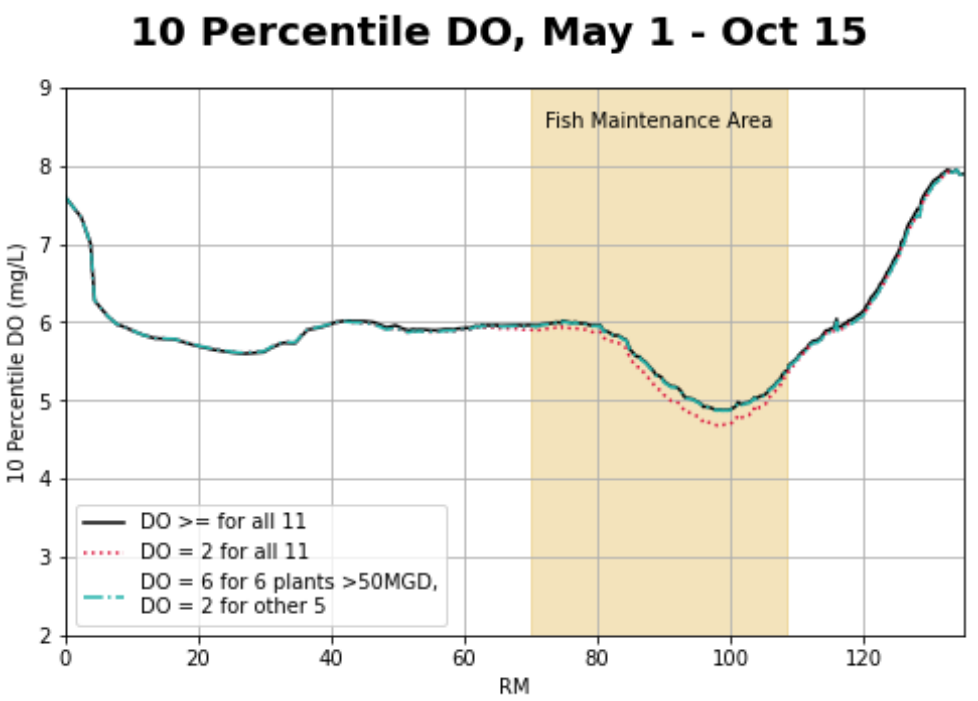
May 1 to Oct 15

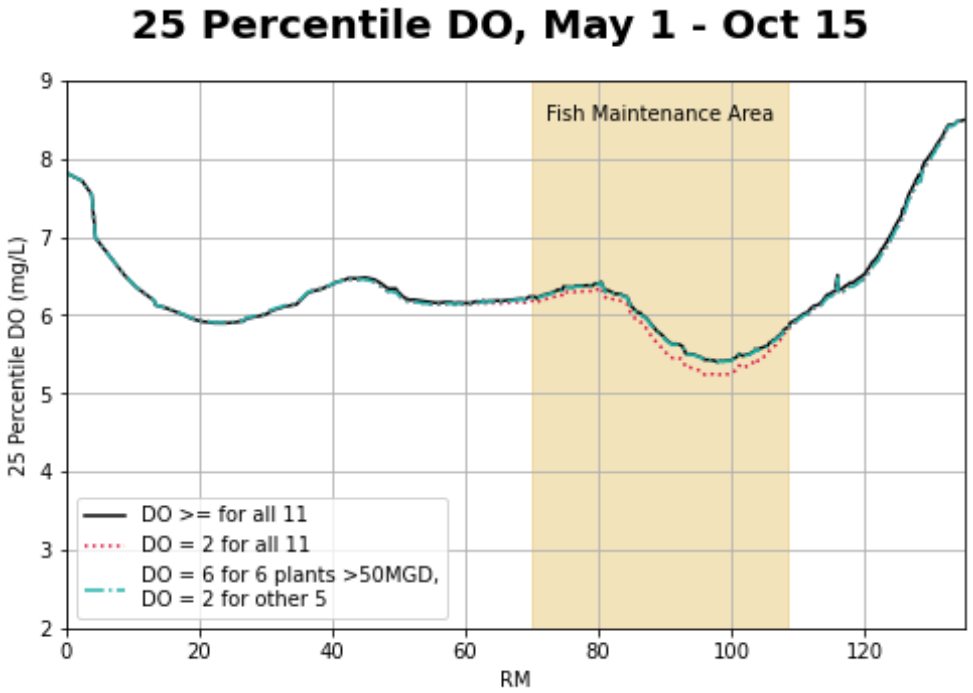
Reducing effluent DO to 2 for all reduces DO in the sag by ~0.25 mg/L

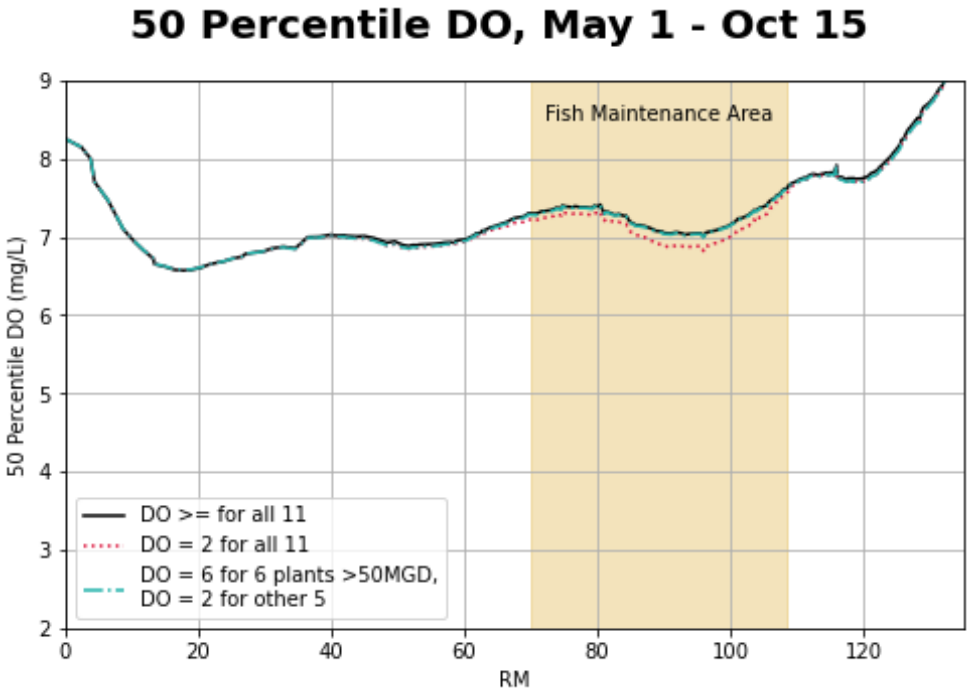
Using 50+ MGD cutoff for DO = 6 makes up the difference

It is very possible that impact of effluent DO is caused by fewer than the six largest. Tests underway.









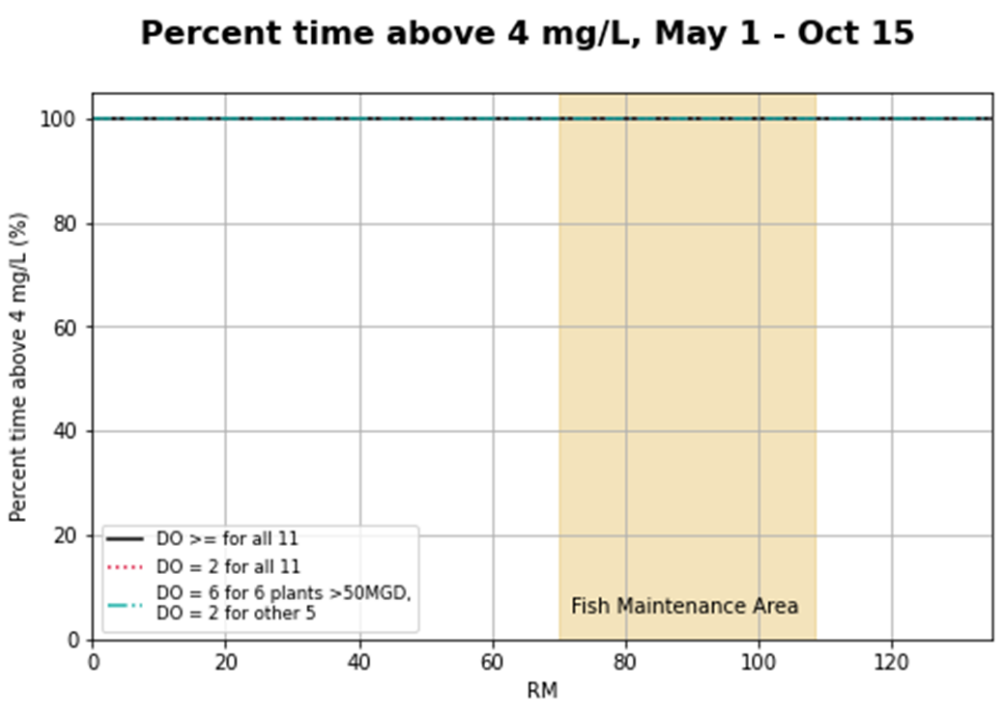
Percent time above 4, 5, 6, 7 mg/L

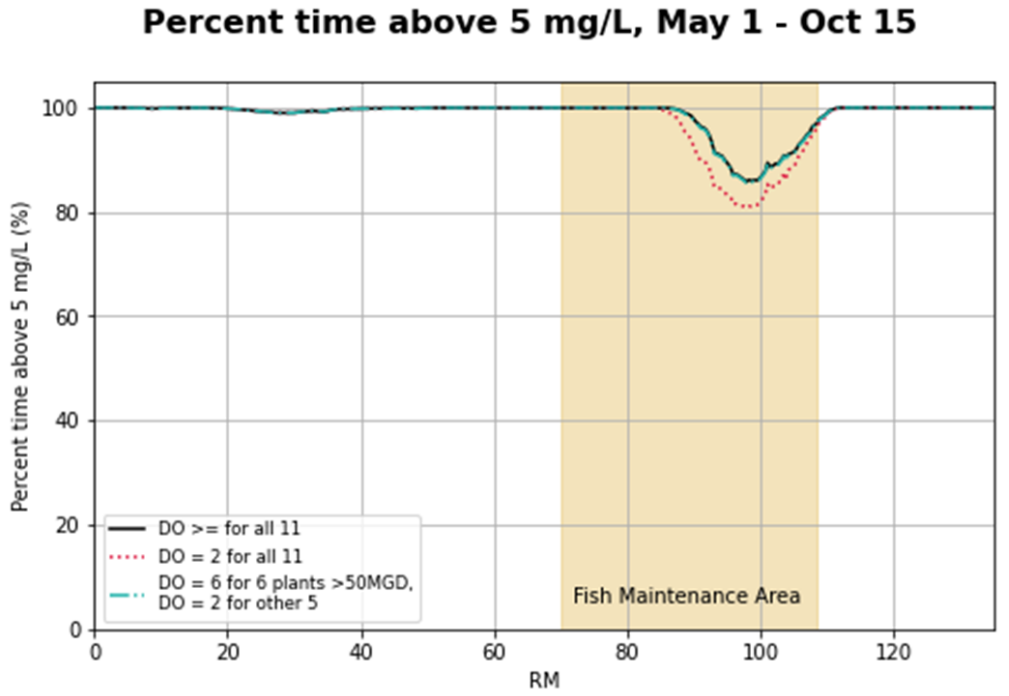
May 1 to Oct 15

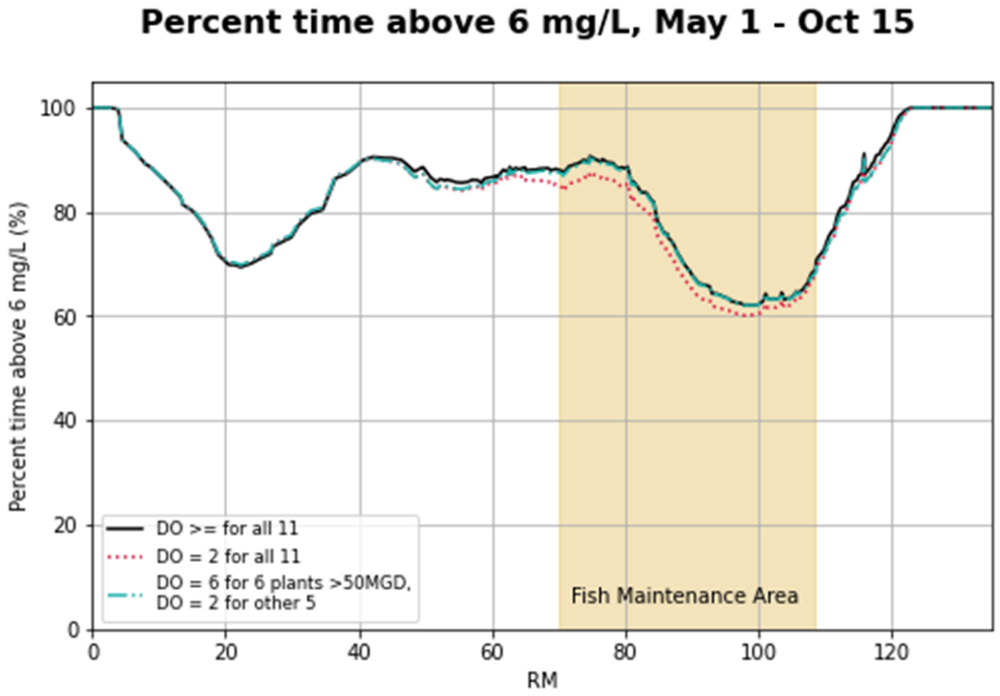
Reducing effluent DO to 2 for all reduces the time DO is >6 throught FMA by a few percentage points

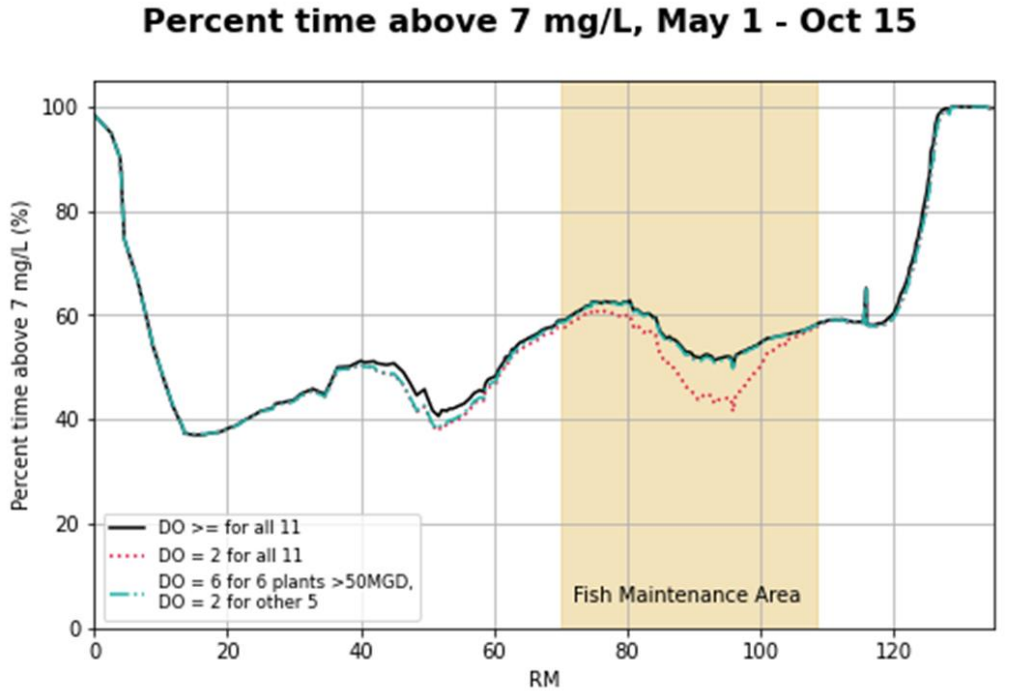
Using 50+ MGD cutoff for DO = 6 makes up the difference

It is very possible that impact of effluent DO is caused by fewer than the six largest. Tests underway.









Candidate Scenarios to be characterized
(under development)

Effluent Ammonia

- Baseline design condition – this represents protection of existing water quality / uses
- All "Class A" plants set to summer levels
  - Ammonia = 10 mg/L
  - Ammonia = 5.0 mg/L
  - Ammonia = 1.5 mg/L
  - Total nitrogen = 4 mg/L
- Recommended Scenario(s)
  - Some subset of dischargers set to ammonia level of 1.5 mg/L
  - Another subset of dischargers set to ammonia level of 5.0 or 3.0 mg/

Other Characteristics

- CSO loads reduced by 85%
- Effluent DO minimum for largest plants
  - To be discussed
  - Not costed out
  - Likely will wait for now
- Reserve capacity by zone
  - 5-10% of summer loads in recommended scenario for all dischargers

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What's Next

Next Steps

- Analysis of Attainability
  - Finalize scenario simulations
  - Narrow down candidate scenarios
  - Assemble costs
  - Characterize affordability
  - Prepare recommendation

Documentation

- Final hydrodynamics model calibration report
  - Targeted Friday 9/2
- Draft water quality model calibration report
  - Complete draft under review by the MEP by 8/31
  - Target to be issued concurrently with AA Report
- Draft Socioeconomic evaluation study report
  - Generic evaluation report is finalized
  - Will be issued concurrently with AA Report
- Linking aquatic life uses with DO conditions
  - 2nd draft report asap, targeted 9/16
- Draft analysis of attainability
  - Due by September 30, 2022

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Schedule after September 2022

- Solicit input from WQAC and co-regulators on
  - Draft analysis of attainability report
  - Draft water quality model report
  - 2nd draft Linking aquatic life uses with DO conditions report*
  - Draft socioeconomic evaluation study report
- Implementation Strategy
  - Criteria development
    - DRBC initiate criteria development based on Analysis of Attainability (HADO)
  - Point source implementation approach
    - Consideration of alternative permitting strategies (e.g. bubble permits, etc)
    - Consideration of prioritizing of dischargers
- Preparation and Initiation of Rulemaking Process

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