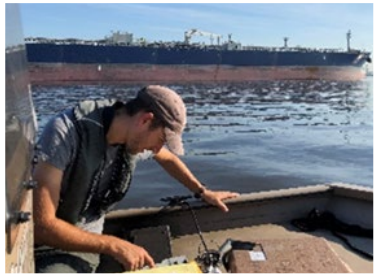

A Strategy to Implement New Dissolved Oxygen Criteria in the Delaware River Estuary

Water Quality Advisory Committee

Thomas Amidon, WRM Manager

December 4, 2025

Zoom Webinar

Delaware River Basin Commission

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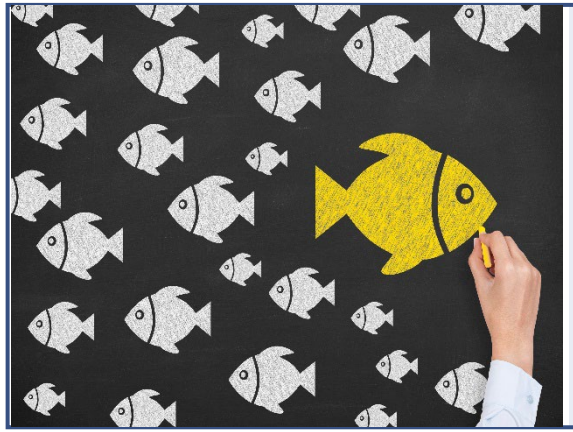
Big Picture

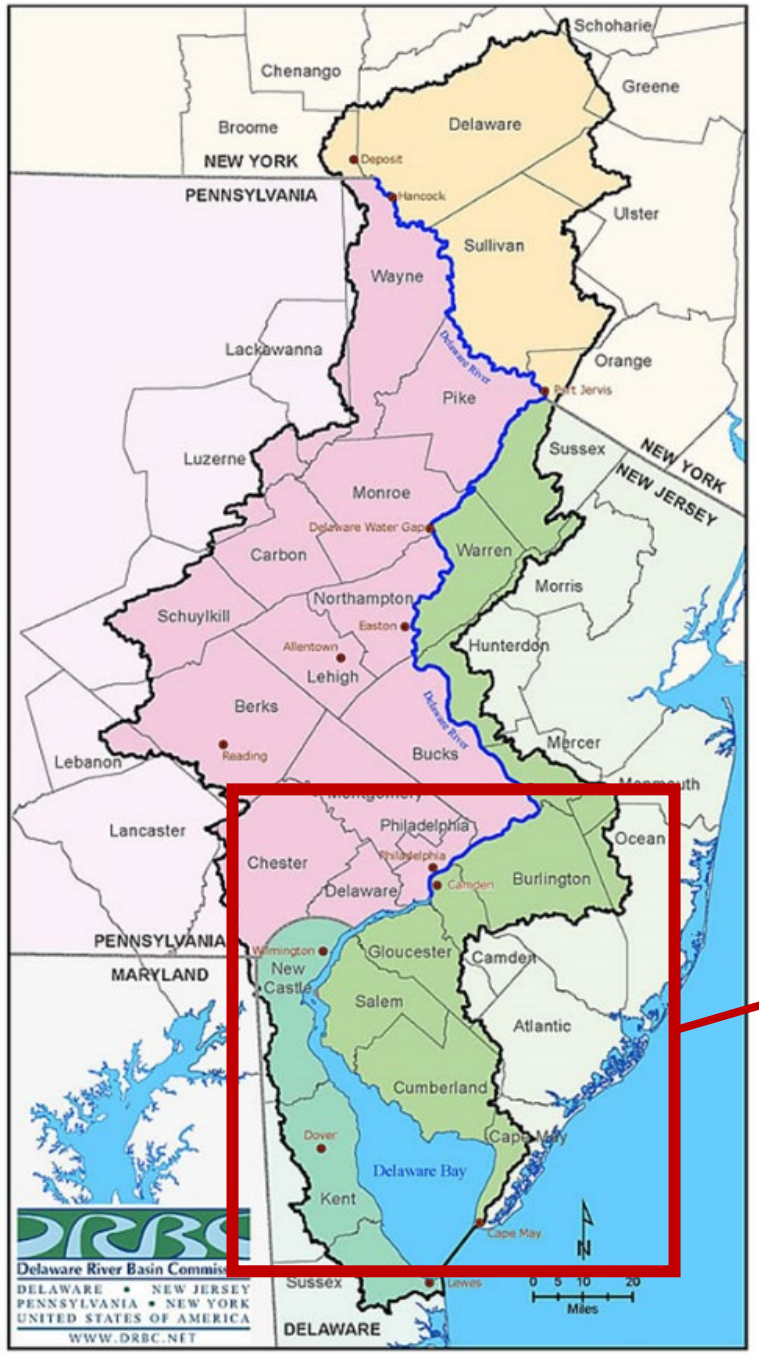


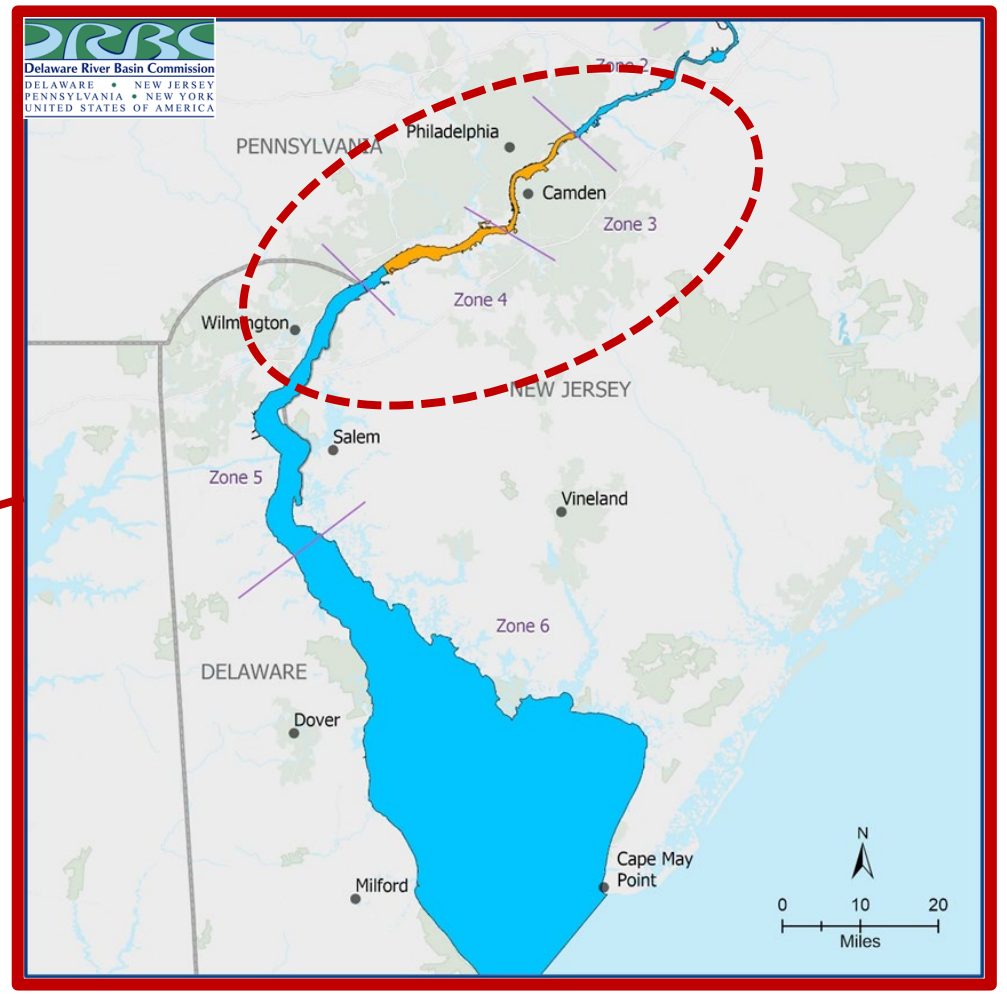
Implementation Strategy

Big Picture

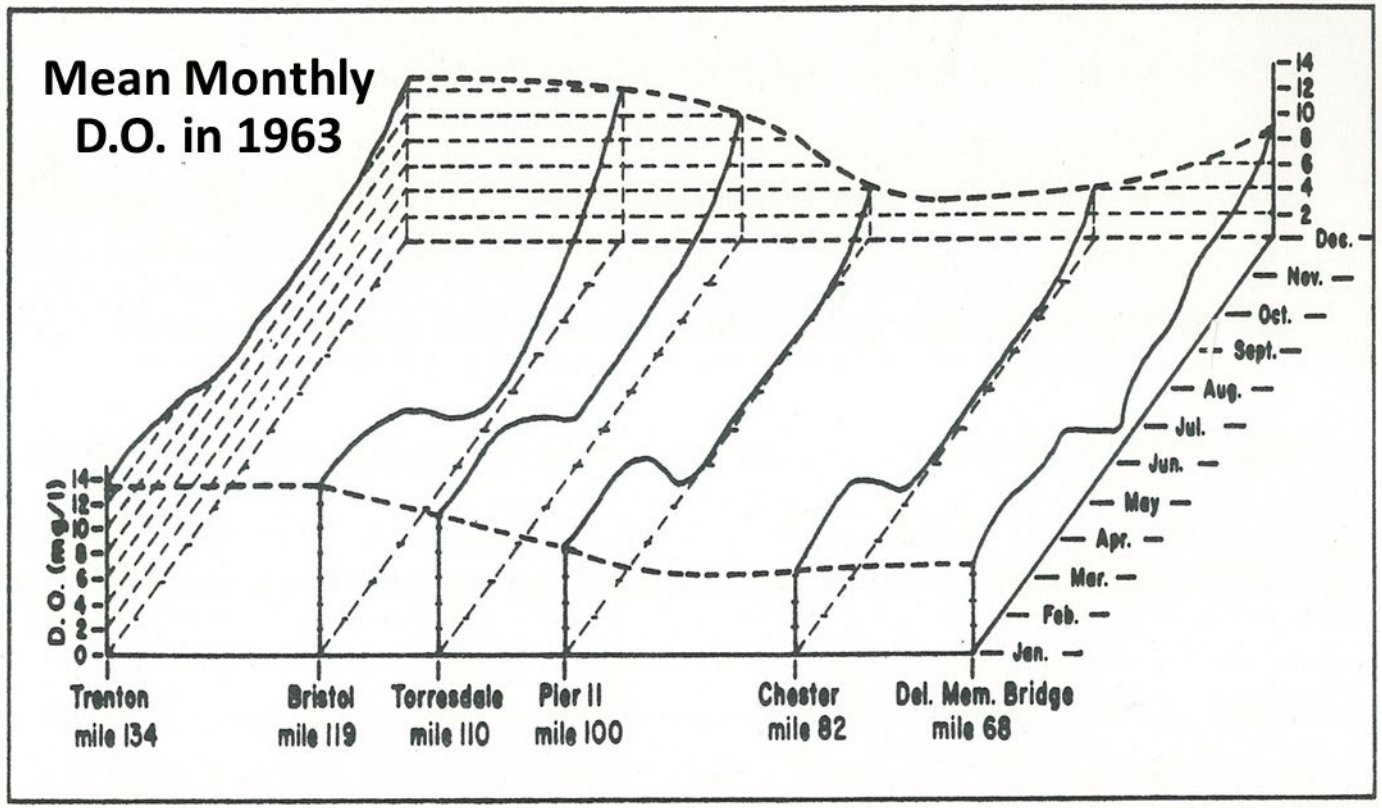
Implementation Strategy

This presentation will focus on water quality in the Delaware River Estuary





Water Quality in mid-1900s in Delaware Estuary



- Historically, Estuary was anoxic throughout the summer from Ben Franklin Bridge to Chester
- Caused by human and industrial wastes
  - CBOD: oxidation of carbon
  - NBOD: oxidation of ammonia
- DRBC established
  - Water Quality Standards in 1967*
  - CBOD wasteload allocations in 1968
- Federal grants provided under Clean Water Act

*** Goal for urban estuary was fish maintenance with ≥ 3.5 mg/L DO**

Historical dissolved oxygen recovery driven by carbon reductions

- DRBC wastewater CBOD allocations in 1968
- Federal Clean Water Act grants for improved wastewater treatment

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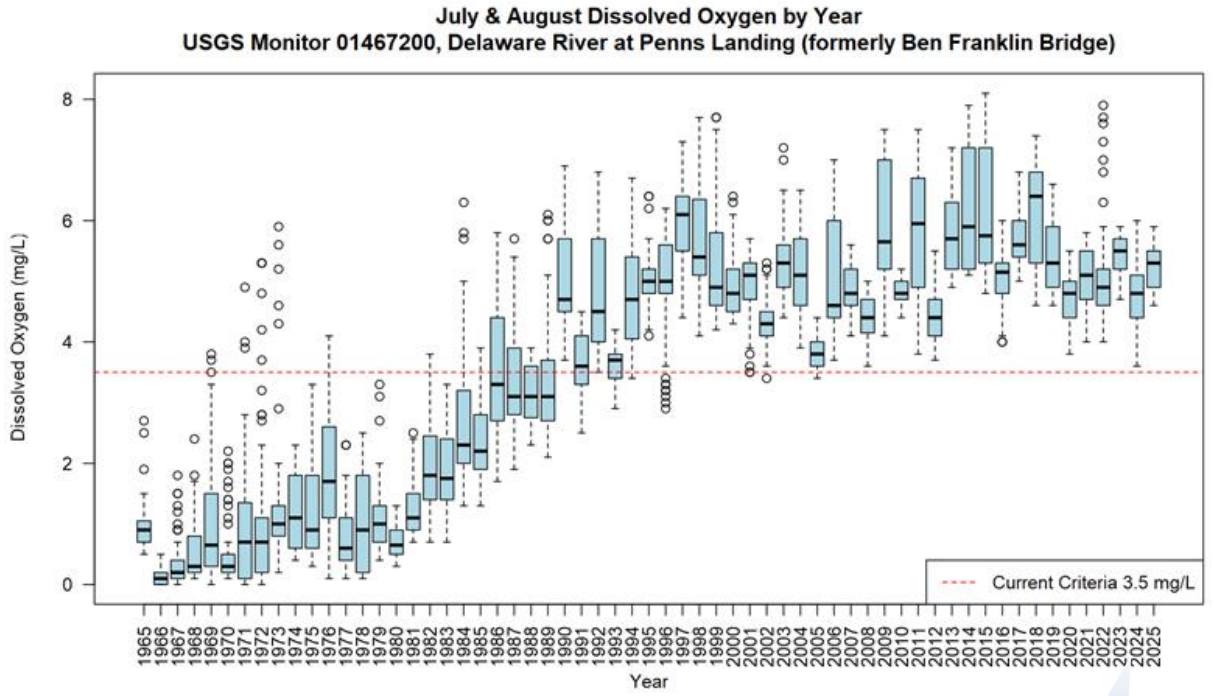

Graphs prepared by John Yagecic, DRBC

Historical Dissolved Oxygen Recovery

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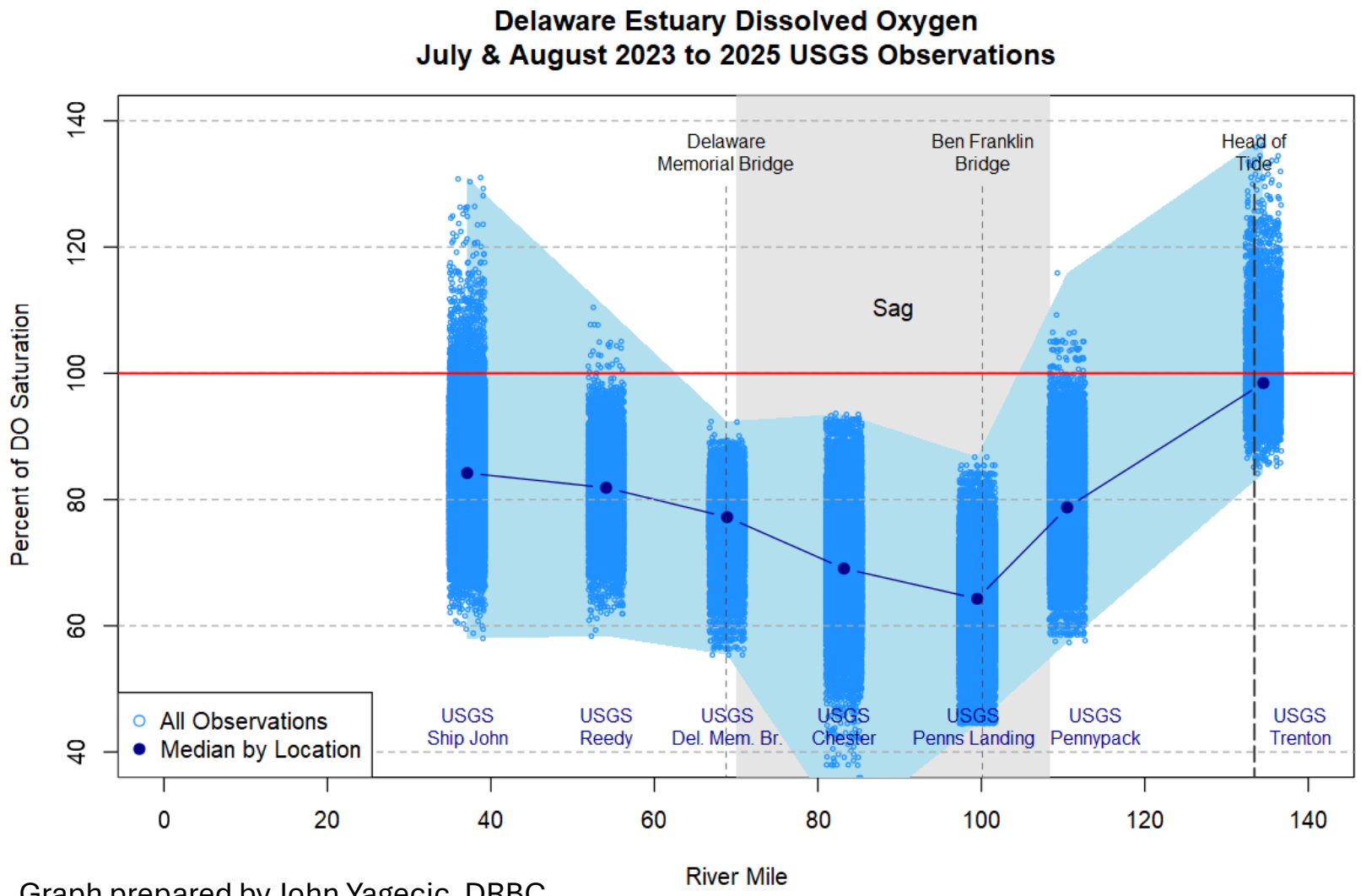
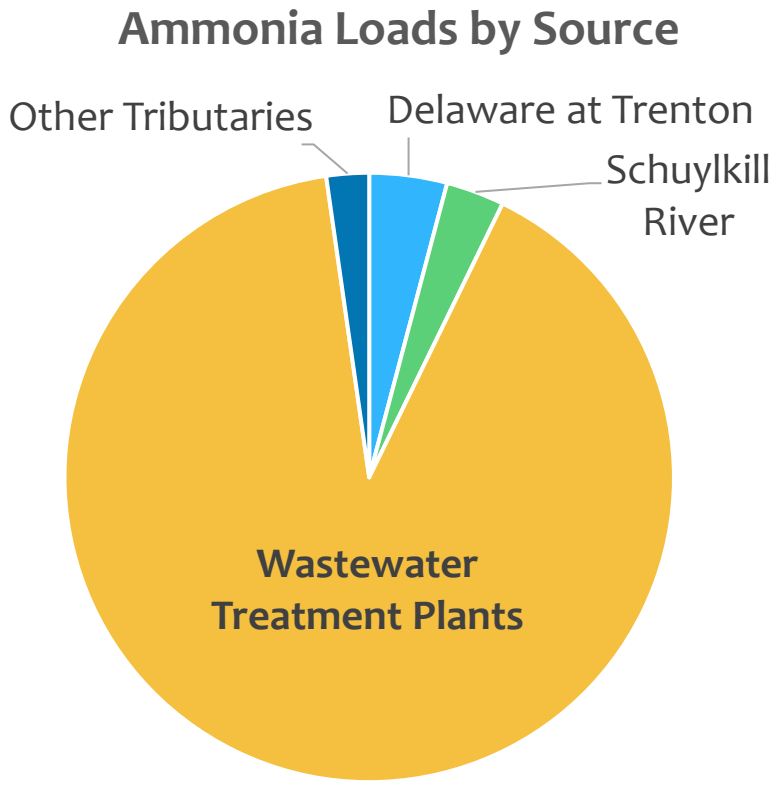
“DO sag” still persists and is driven by ammonia discharges from a relatively small number of WWTPs





Graph prepared by John Yagecic, DRBC

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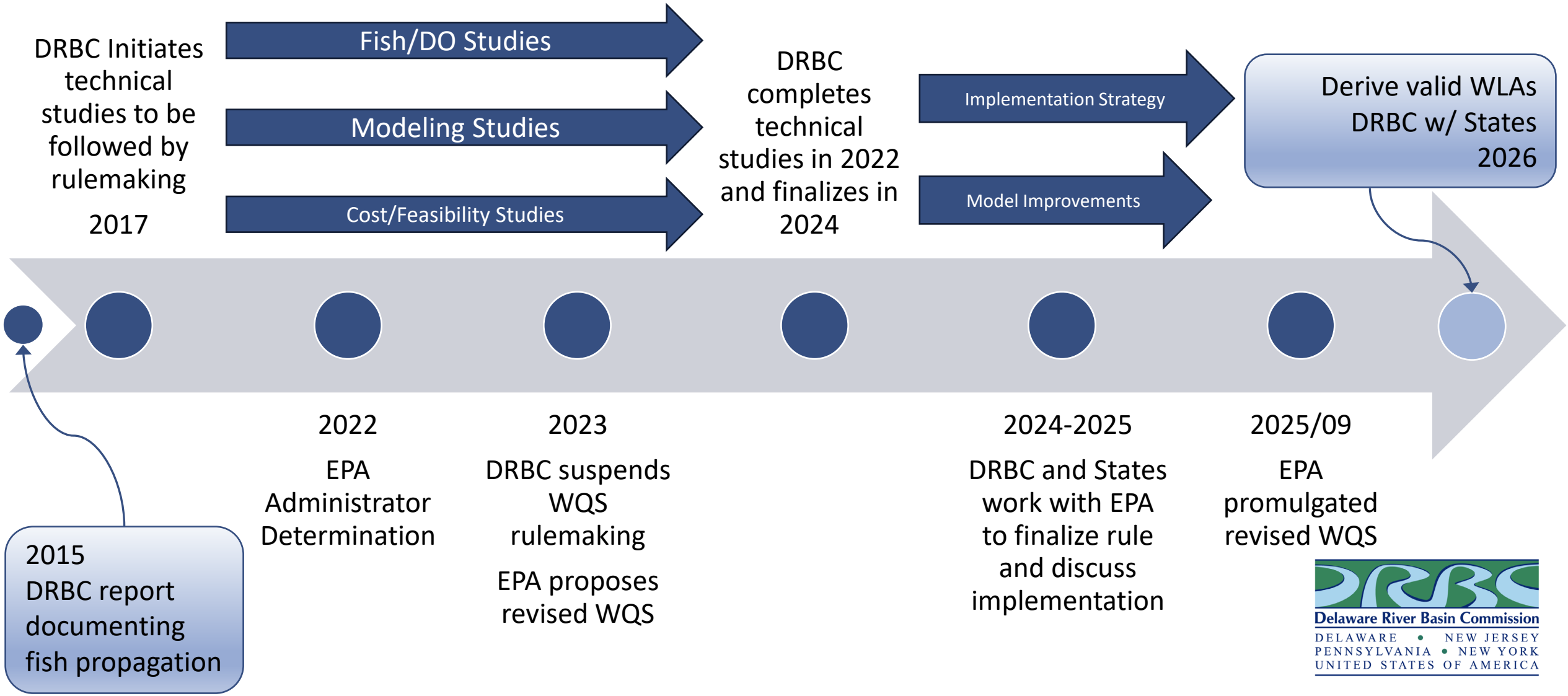
DO criteria implementation is the next step of the ongoing effort to improve dissolved oxygen in the Estuary



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Implementation strategy follows significant technical and administrative activity by DRBC over 15 years

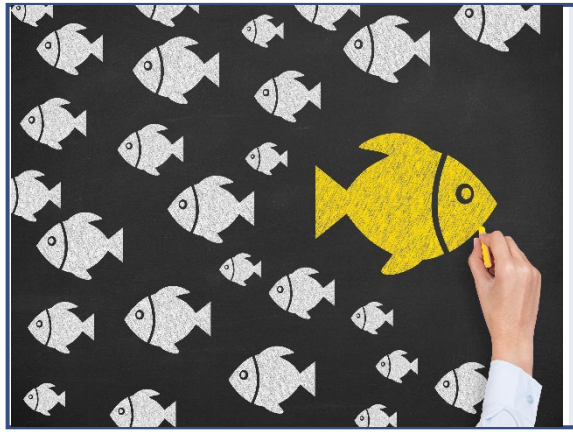
Resolutions

Date	Directive
Jul-2010	Nutrient monitoring of point source discharges (Phase 1)
Dec-2012	Formation of Model Expert Panel
Jul-2013	Analysis of primary productivity by UMD (Phase 1)
Sep-2014	Study of effects of low DO on Atlantic sturgeon
Mar-2017	Consultation services for model development from LimnoTech
Sep-2017	Initiated DRBCs Aquatic Life Designated Use study
Sep-2017	Nutrient monitoring of point source discharges (Phase 2)
Dec-2017	Analysis of primary productivity by UMD (Phase 2)
Jun-2018	Feasibility and cost evaluation services from Kleinfelder
Jun-2019	Hydrodynamic model consultation services from GHD
Dec-2019	Algal composition analysis by Academy of Natural Sciences Drexel
Sep-2020	Extension of project period due to C19 and budget constraints
Jun-2021	Collection of information to evaluate social and economic factors
Mar-2022	Professional services from Environmental Finance Center at UMD
Sep-2023	Suspend rulemaking and prepare implementation strategy

Technical Studies

Date	Report
Sep-2015	Existing Use Evaluation for Propagation in Zones 3, 4, & 5
Mar-2018	Methodology for Evaluating DO Requirements of Estuary Species
Nov-2018	Review of DO Requirements for Sensitive Species
Jan-2019	Analysis of Primary Productivity in May and July 2014
Feb-2019	Analysis of Primary Productivity in May and July 2018
Sep-2020	Analysis of Primary Productivity in May and July 2019
Jan-2021	Nitrogen Reduction Cost Estimation Study
Sep-2022	Draft Analysis of Attainability Report
Sep-2022	Nitrogen Reduction Cost Estimation Study Addendum
Aug-2023	Nitrogen Reduction Cost Estimation Study Addendum #2
Sep-2024	Hydrodynamic Model Calibration Report
Sep-2024	Water Quality Model Calibration Report
Sep-2024	A Pathway for Continued Restoration
Future	***Supplemental Water Quality Model Report***
Future	***WLA Stady to Implement DO Criteria***

Big Picture



Implementation Strategy

A Strategy to Implement New Dissolved Oxygen Criteria in the Delaware River Estuary

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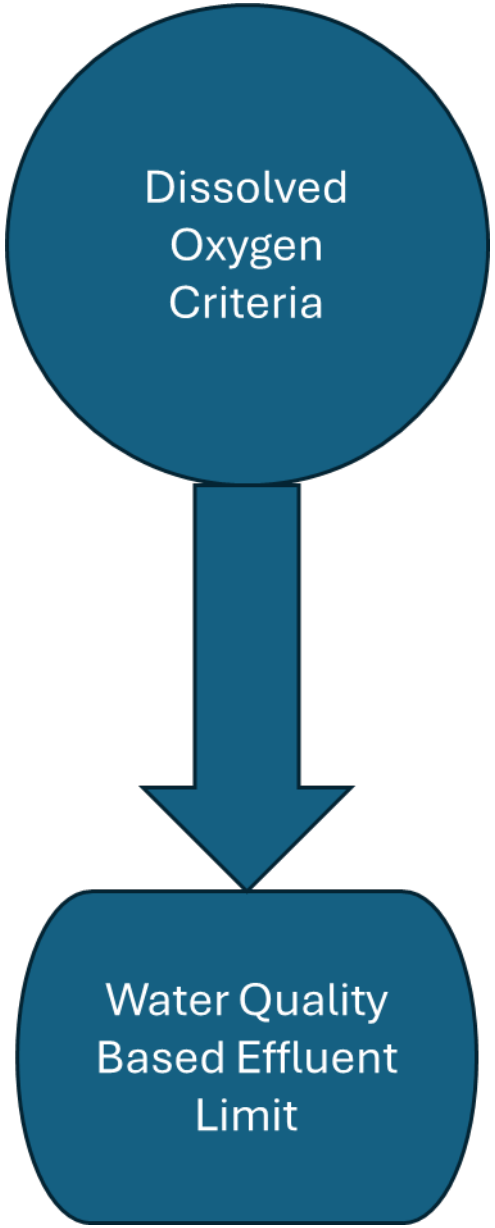
- Background
  - A new DO criteria is established
    - CWA requires implementation
  - Multiple discharges in a complex tidal environment must be evaluated together
- Core Elements of Strategy
  - DRBC will perform a WLA Study **in coordination with States** (and WQAC) and EPA
  - Study will provide technical basis for States to derive and impose WQBELs
  - Translates DO criteria into specific allocations of ammonia, CBOD, etc
  - Components include design condition, nonpoint source quantification, reserve capacity
- Strategy document available on DRBC website

Assigning a WQBEL for any given facility is no simple task

- What pollutants from this facility have the potential to impact DO in the areas of concern?
- How can I determine a WQBEL for this facility independent of all the others that also impact DO?
- If only we had a state-of-the-art water quality model and a means of allocating loads among dischargers in three different States …



What is a wasteload allocation?

What do we expect the WLA Study process to look like?

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- Wasteload allocation
  - Amount of pollutant that can be discharged from a facility while still achieving water quality standards
  - Ammonia is primary pollutant, but CBOD and effluent DO will also be evaluated case by case
  - Provides **defensible** basis for State NPDES WQBELs
- WLA Study Process
  - Co-Regulators Workgroup
    - Meetings approximately every 4-6 weeks
    - Resolve technical issues (e.g., WLA design conditions)
    - Consideration of each states' policies
  - Water Quality Advisory Committee
    - Plan to meet 4-6 times in next 18 months
    - Provide updates and solicit input

Key facts regarding costs to implement new DO criteria

- Monthly average ammonia thresholds anticipated for selected WWTPs
  - Winter limits not expected
  - TN limits not expected
  - Monthly average is the temporal scale expected to drive WLAs
- Cost estimates (adjusted for inflation) are conservative (on the high side)
  - Based on proven technologies applied uniformly based on plant types
  - Lower cost alternatives could be identified

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Recap

- **Big Picture:** The addition of feasible treatment to remove ammonia from a relatively small number of WWTPs would improve the level of DO in the urban estuary, resulting in a significant ecological uplift.
- **Model Improvements:** DRBC is finalizing model improvements that will allow us to dynamically simulate sediment interactions and changes, thereby allowing us to better understand future sediment impacts.
- **Model Application:** DRBC is working directly with the estuary States and USEPA to calculate the individual wasteload allocations required to implement DO criteria in the estuary.

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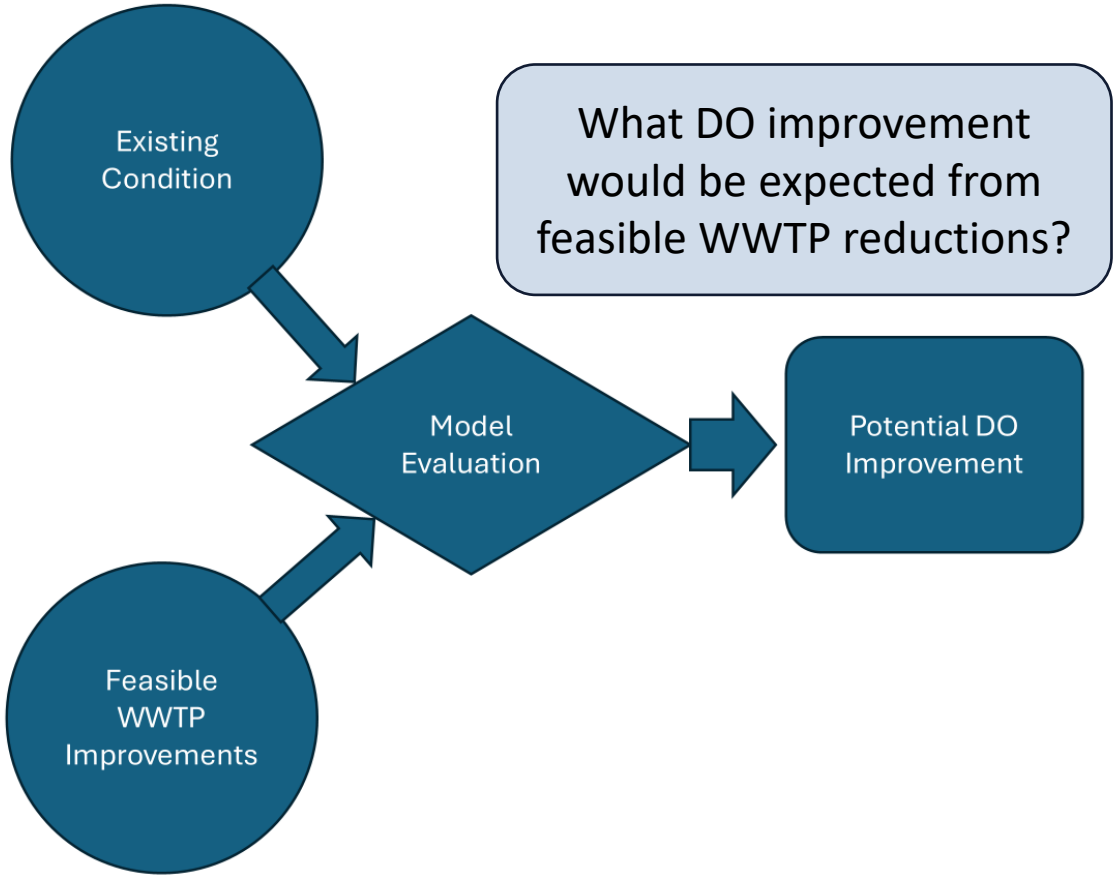
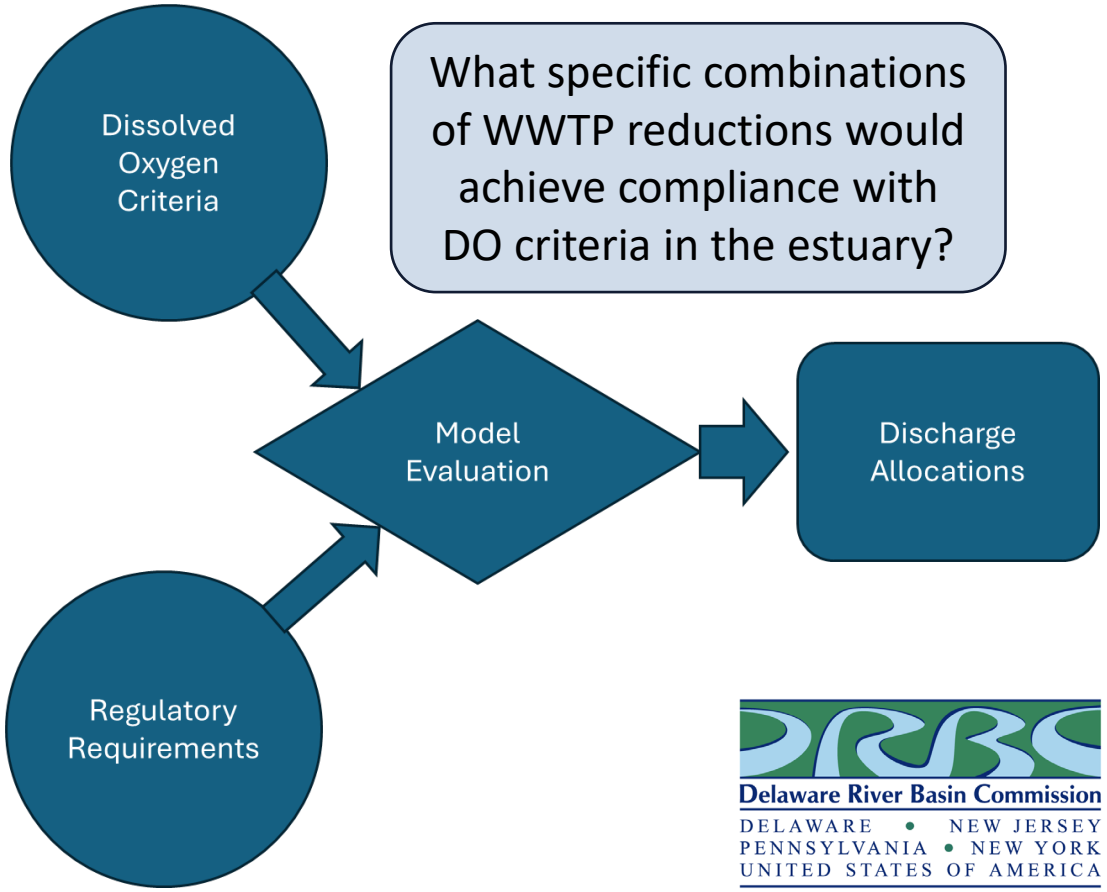
Can’t DRBC’s “Pathway” study provide the basis for implementation?

“Pathway” Analysis



WLA Study



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