Delaware River Basin Commission

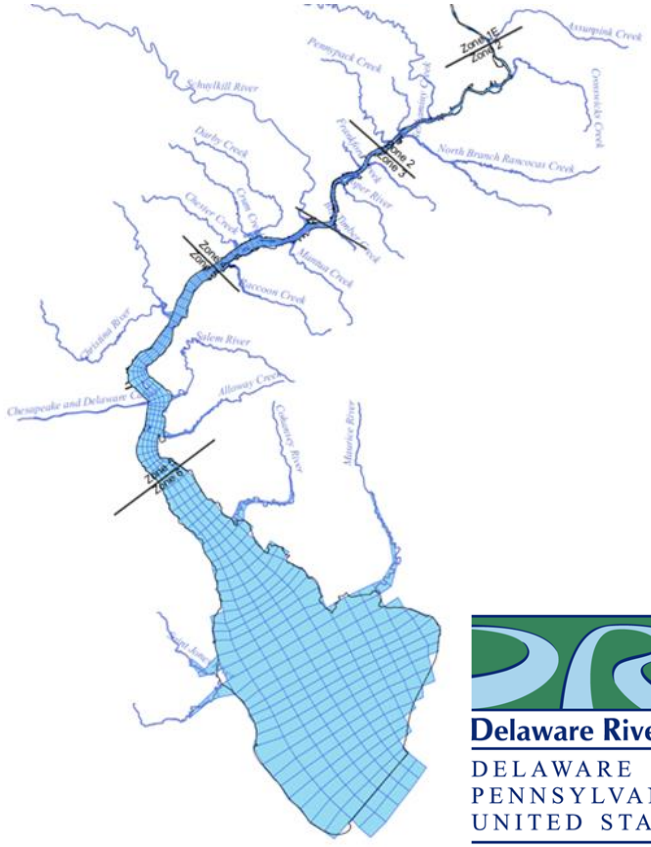
Water Quality Challenges

Namsoo Suk, Ph.D.

Director, Science and Water Quality Management

Delaware Estuary Science and Environmental Summit

January 29, 2019 Cape May, NJ



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https://iaspub.epa.gov/waters10/attains_nation_cy.control#status_of_data

National Summary
Causes of Impairment in Assessed Rivers and Streams

Description of this table

Cause of Impairment Group	Miles Threatened or Impaired
Pathogens	187,872
Sediment	138,874
Nutrients	118,831
Organic Enrichment/Oxygen Depletion	98,037
Temperature	94,488
Metals (other than Mercury)	94,384
Polychlorinated Biphenyls (PCBs)	82,311
Mercury	72,554
Habitat Alterations	63,019
Turbidity	47,750
Cause Unknown	45,318
Cause Unknown - Impaired Biota	44,900
Flow Alteration(s)	41,329
Salinity/Total Dissolved Solids/Chlorides/Sulfates	38,072

Priorities??

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Water Quality Challenges in Delaware River Basin

- Pathogens
- Nutrients / Oxygen Depletion

Challenges caused by enhanced use i.e., water quality improvements

- PCBs
- Flow Alterations
- Climate Change (Salinity/ hydrology/ Temp)

Challenges caused by impairment – restoration or antidegradation process

- Contaminants of Emerging Concerns

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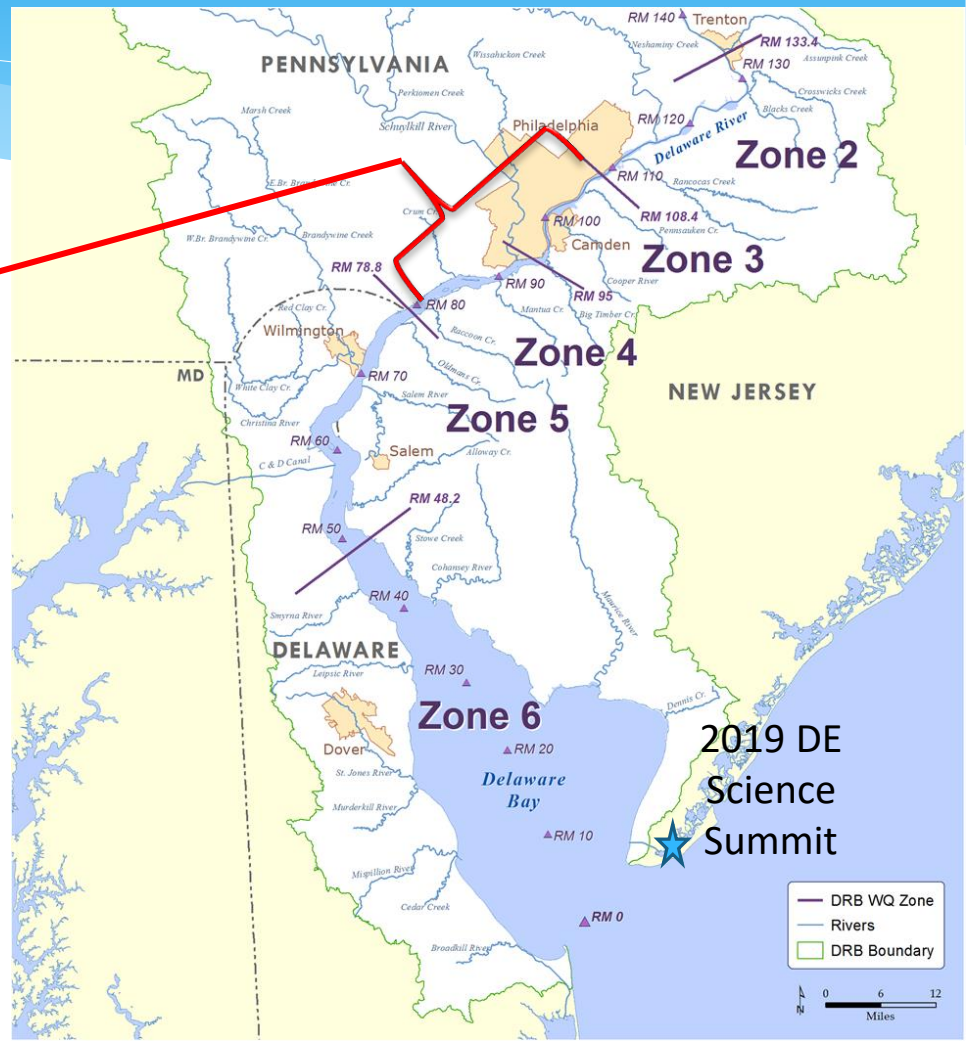
Pathogens

- Issue:
  - Entire mainstem Delaware River is designated as primary contact recreation use, except DRBC's Water Quality Management Zone 3 and upper portion of Zone 4 are designated as secondary contact recreation use
  - Primary contact recreation activities occur in Zones 3 and 4
- CWA Goal: swimmable
- DRBC Action:
  - Discussed in Water Quality Advisory Committee
  - Initiates a special bacteria monitoring program in 2019



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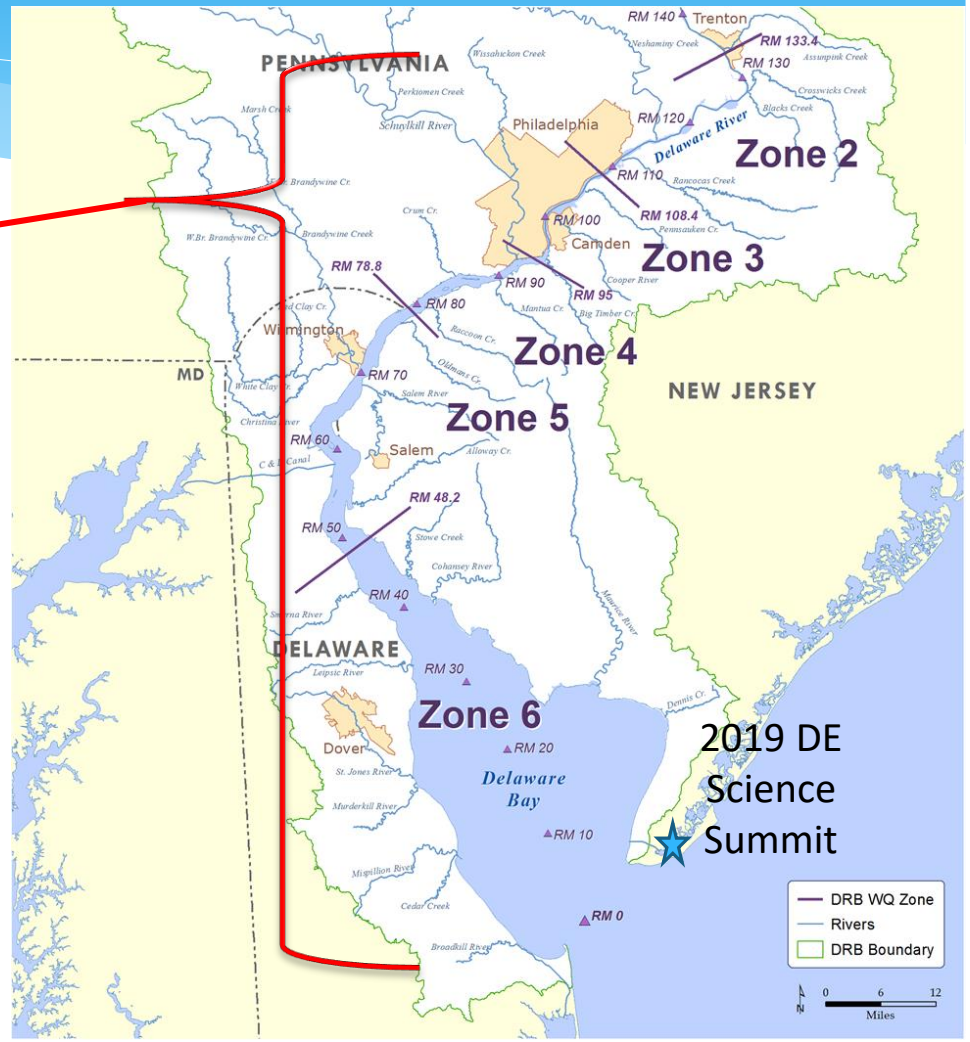
Polychlorinated Biphenyls (PCBs)

- Issue:
  - Delaware Estuary and Bay were listed as impaired by PCBs
  - Strict fish consumption advisories due to high levels of PCBs in fish tissue
- CWA Goal: fishable – unlimited fish consumption
- DRBC Action:
  - Stage 1 TMDLs developed and implemented in 2003
  - Stage 2 TMDLs developed and being reviewed by Basin states and EPA
  - Continued implementation of PCB Pollutant Minimization Plans
  - Resulted Lesser stringent fish consumption advisories



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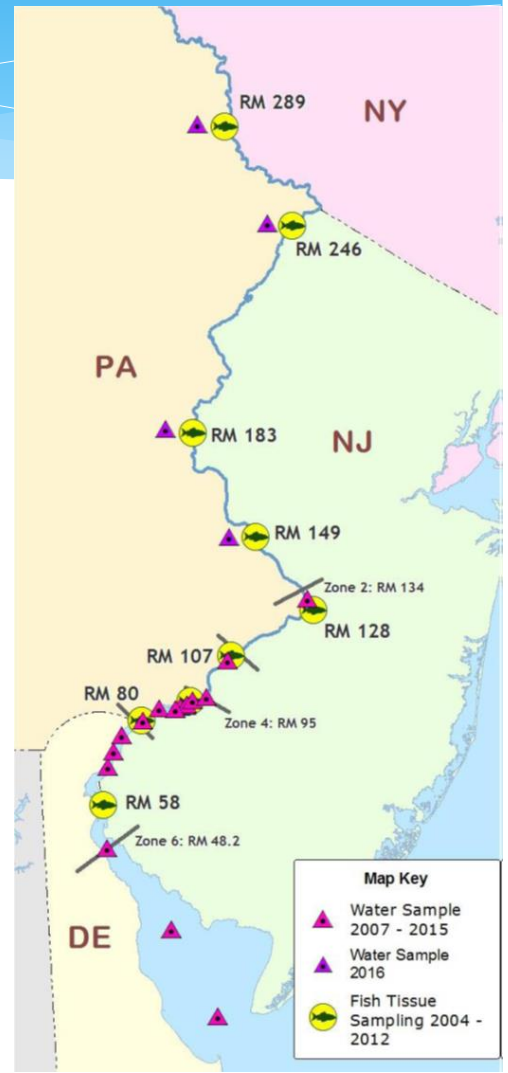
Contaminants of Emerging Concerns

- Issue: Contaminants of Emerging Concerns
- Goal: Ensure the protection of human health and aquatic life
- DRBC Action:
  - Monitoring and management strategy for microplastics and Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS)

- Surface water samples
  - Six sites in tidal for 2007, 2008, 2009
  - Fifteen sites in tidal for 2015
  - Four non-tidal in 2016
  - Longer Chain (C11, C10 and C9) and shorter chain (C7 and C6) decreasing

- Fish Species samples
  - Nine sites in tidal and non-tidal in 2004 ~ 2018
- Sediment samples
  - Thirty sites in 2016



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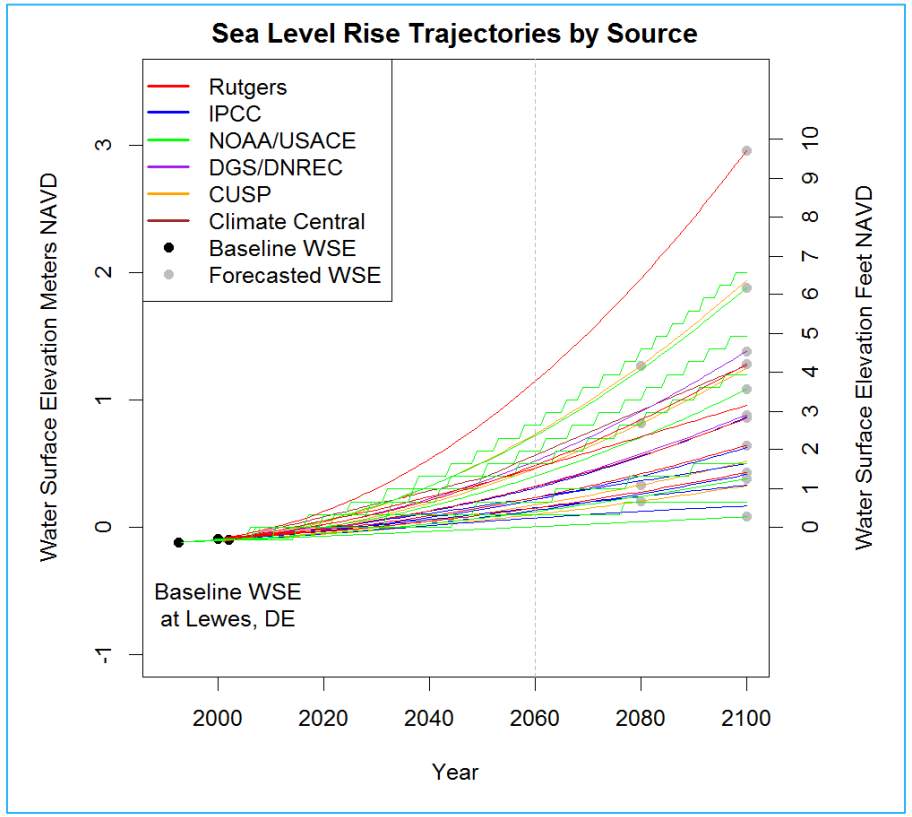
Climate Change

- Issue:
  - Sea level rise – salt intrusion
  - Hydrology changes – assimilative capacity, drought, storm
  - Increased temperature
- Goal: Sufficient and high quality waters
- DRBC Action:
  - Implement lower basin reservoir operations and releases
  - Implement lower basin drought management plans
  - Evaluate impacts of climate change on water resources and evaluate management options



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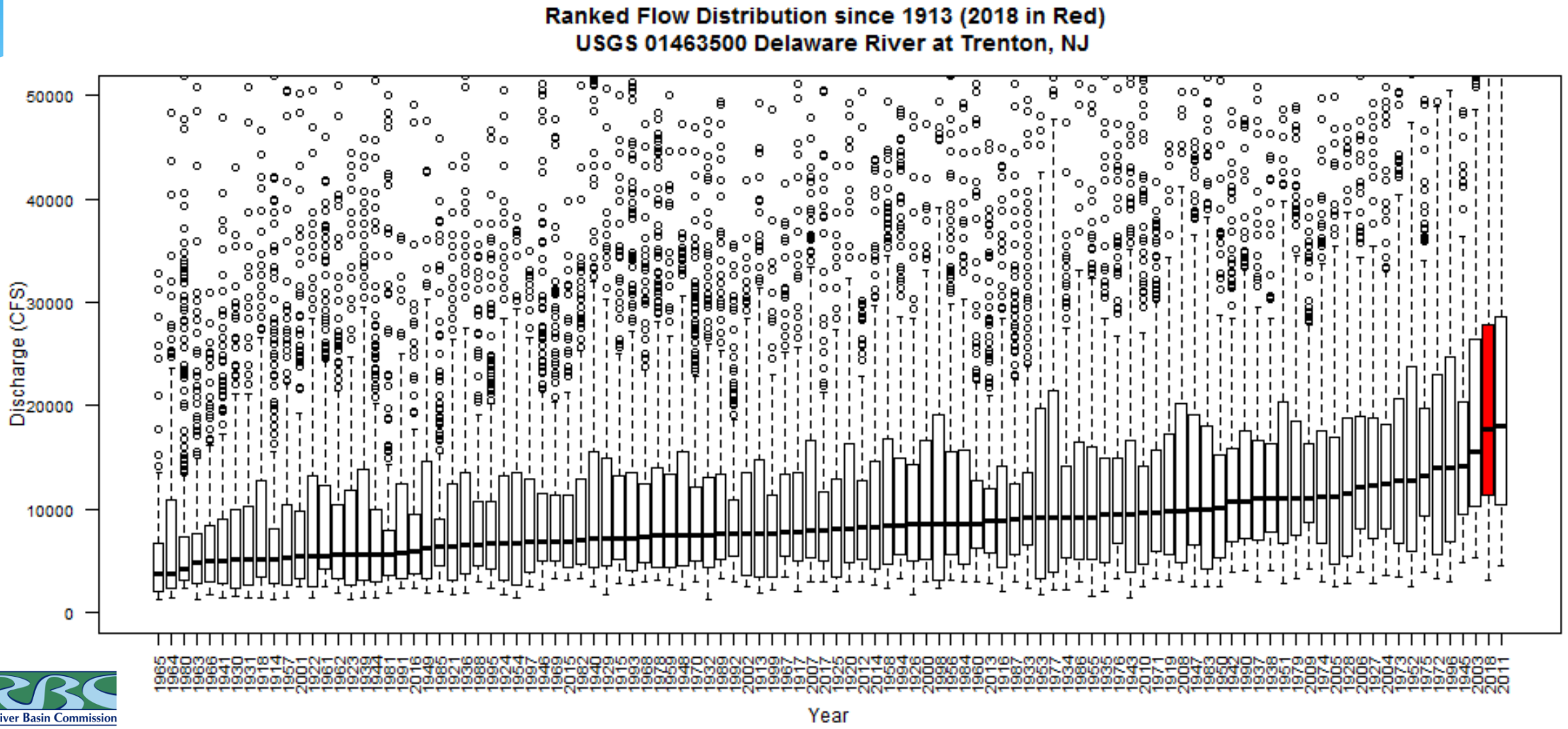
Ranked flow distribution since 1913 @ Trenton



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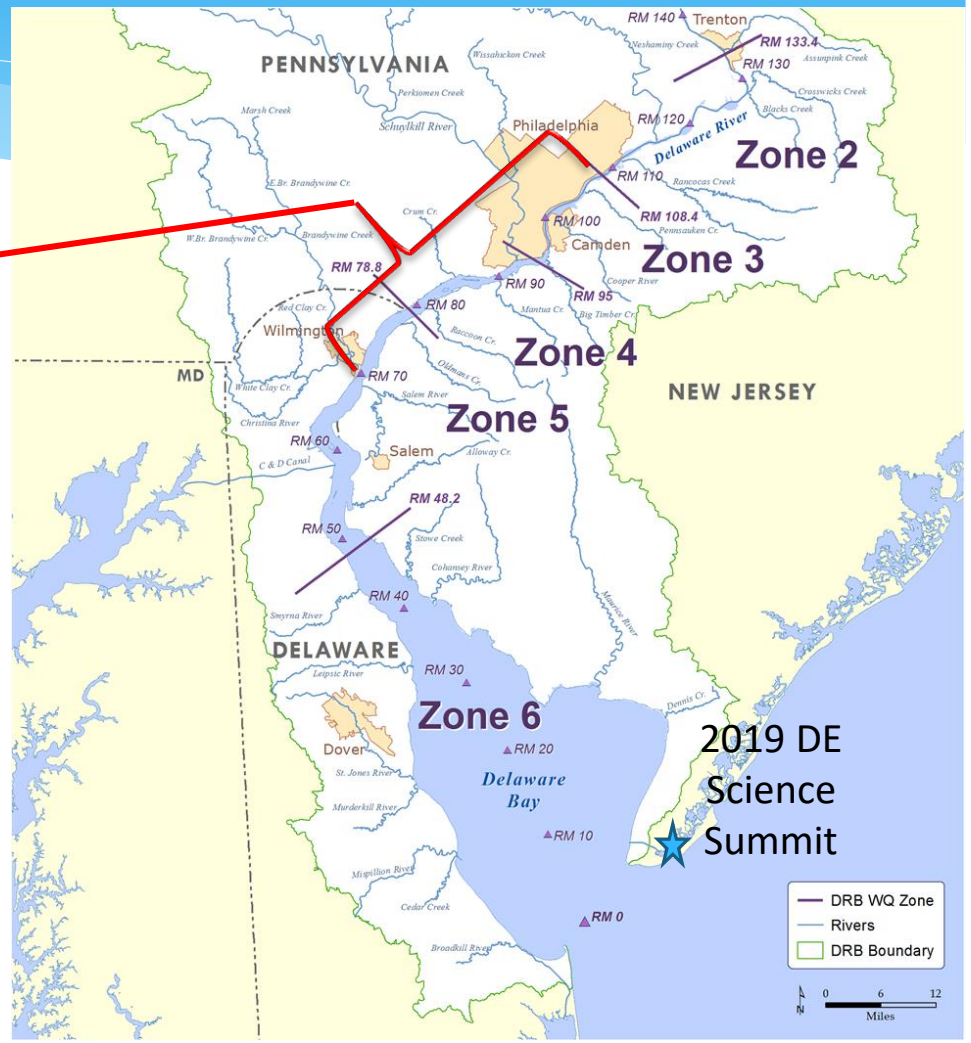
Nutrients / Oxygen Depletion

- Issue: In DRBC's Water Quality Management Zones 3, 4 and upper portion of Zone 5
  - propagation is not a designated use resulting in low dissolved oxygen criteria was adopted in 1967.
  - propagations of certain fish species have been identified (https://www.nj.gov/drbc/library/documents/ExistingUseRpt_zones3-5_sept2015.pdf)
- Goal: Adoption of
  - revised designated use including fuller propagation in urban portions of Delaware Estuary
  - associated higher DO criteria to support the Use.
- DRBC Action: Adopted Resolution 2017-4 (https://www.state.nj.us/drbc/library/documents/Res2017-04_EstuaryExistingUse.pdf)



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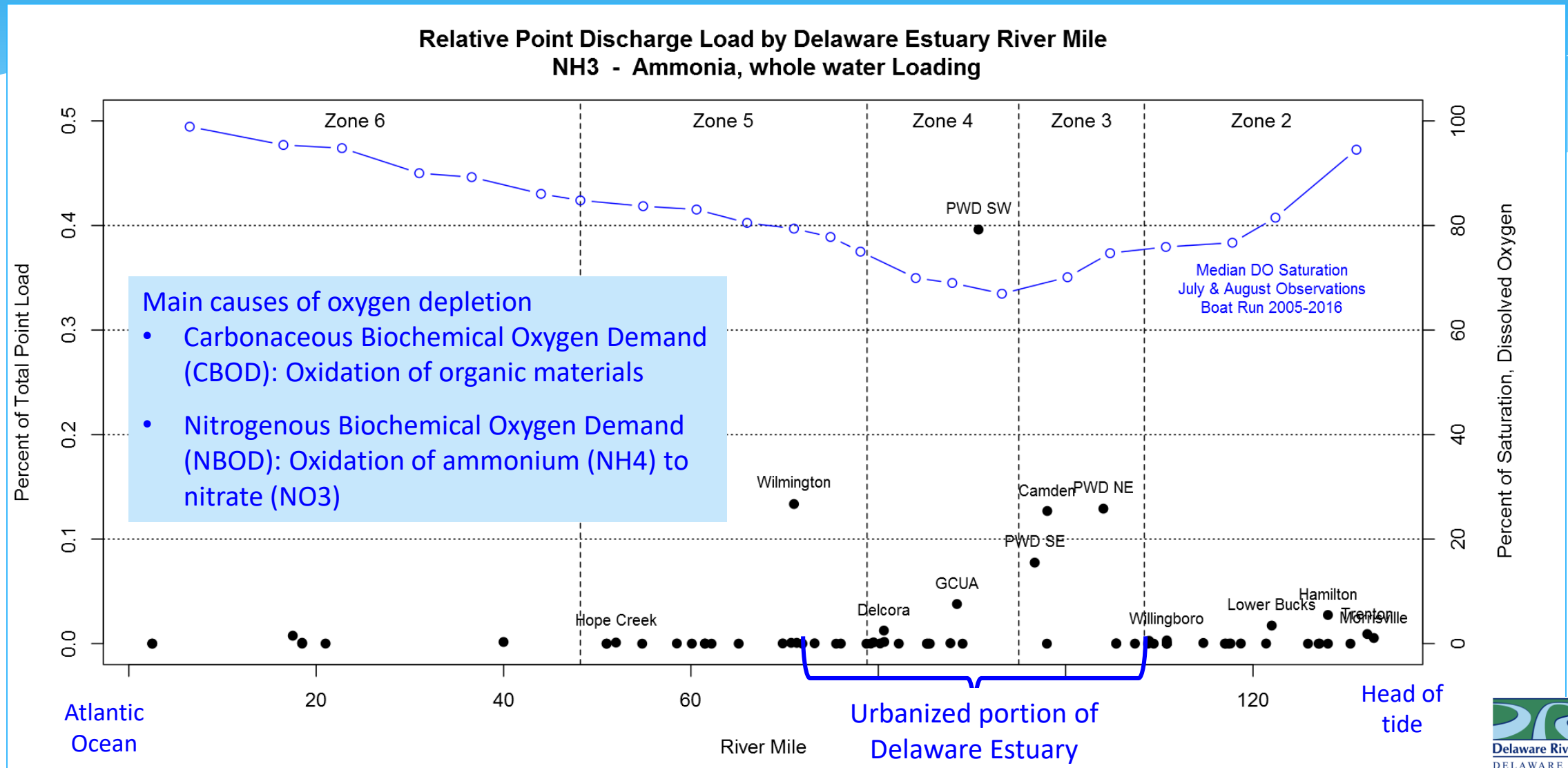
Next Phase – Dissolved Oxygen



Main causes of oxygen depletion

- Carbonaceous Biochemical Oxygen Demand (CBOD): Oxidation of organic materials
- Nitrogenous Biochemical Oxygen Demand (NBOD): Oxidation of ammonium (NH4) to nitrate (NO3)

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Actions Underway

- Enhanced monitoring:
  - Point discharge monitoring
  - BoatRun to year-round
  - Added salinity at tidal boundaries
  - Added nitrate sensors at Trenton & Chester gages
  - Extensive tributary monitoring
  - Light extinction monitoring
  - Primary productivity study

- Engineering evaluation & cost estimate for improved WWTP ammonia & TN
  - Benefit analysis
- DO needs study for Delaware Estuary Biota by ANSDU (https://www.nj.gov/drbc/library/documents/Review_DOreq_KeySensSpecies_DelEstuary_ANStoDRBCnov2018.pdf)
- Development a linked hydrodynamic and water quality model
  - Model working group (Nov. 2018)
  - Model expert panel (Mar. 2018, 2019)

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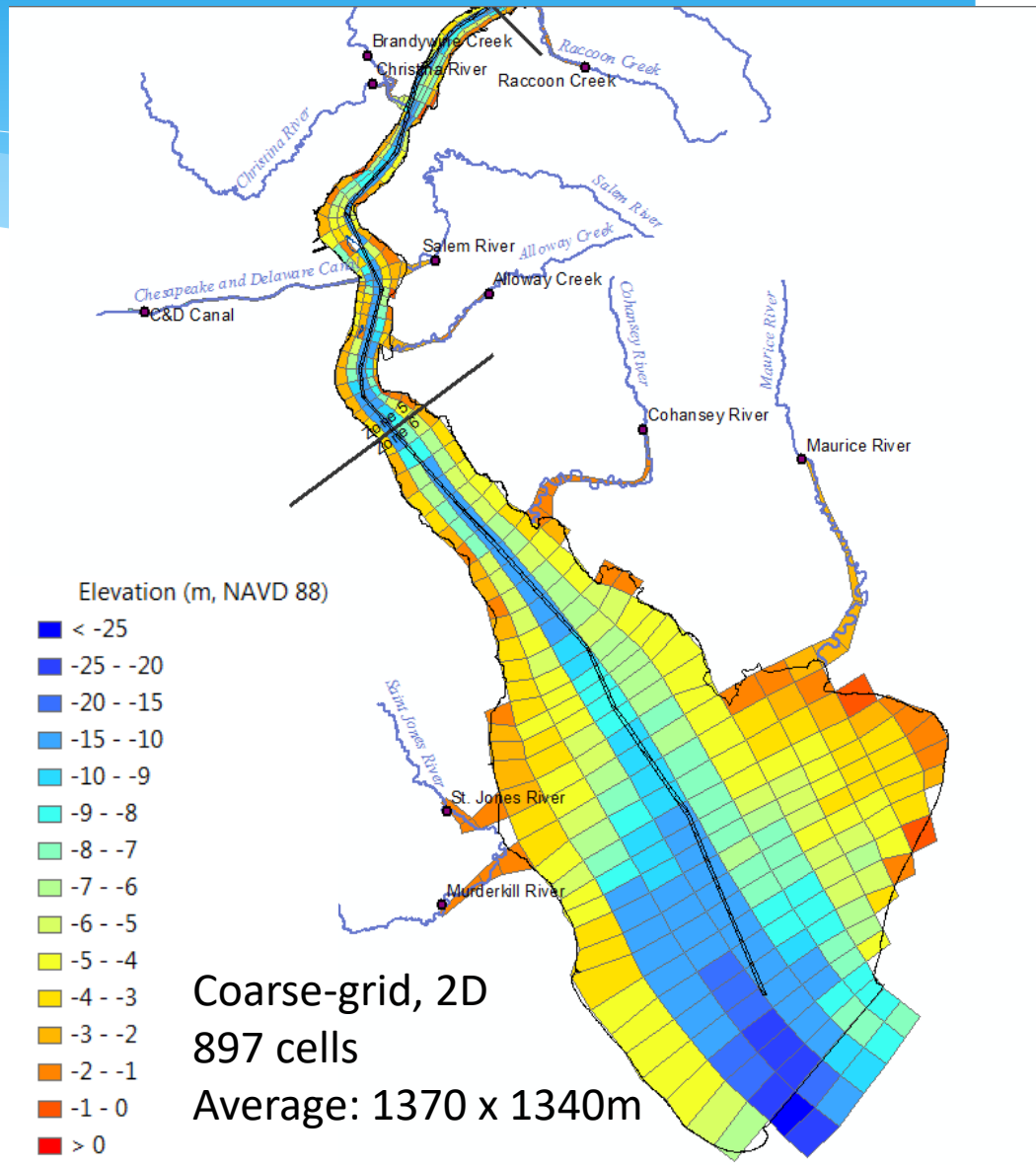
Status: Linked 2-D Hydrodynamic and WQ Model

- Multiple versions of EFDC model codes were tested
- Successfully linked coarse grid 2-D EFDC and WASP8
- Reasonably simulated water surface elevations, water temperatures
- Under predicted salinity intrusion (code validation underway)
- Review & refine turbulence model input parameters
- 3-D model development



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Linked 3-D EFDC – WASP8 Model

- Refine grid resolution
  - Better delineation of navigation channel
  - 8 vertical layers
  - Computational time step ~10 seconds
- Implementation of GVC hybrid grid
- Link 3-D fine grid EFDC and WASP8
- Initiate model calibration using 2017 – 2018 data sets
- Variable model domain and resolutions are being tested

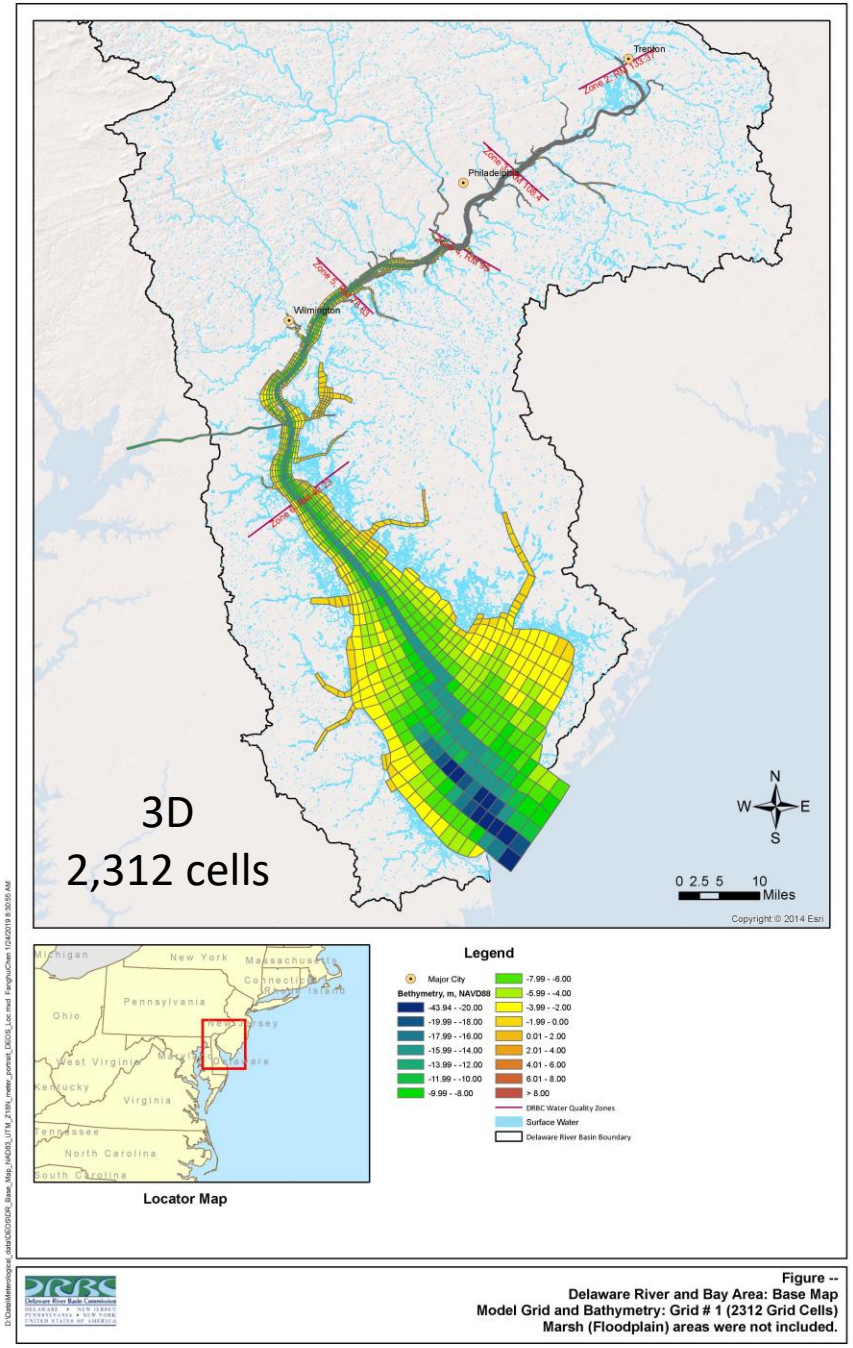

Figure --
Delaware River and Bay Area: Base Map
Model Grid and Bathymetry: Grid # 1 (2312 Grid Cells)
Marsh (Floodplain) areas were not included.

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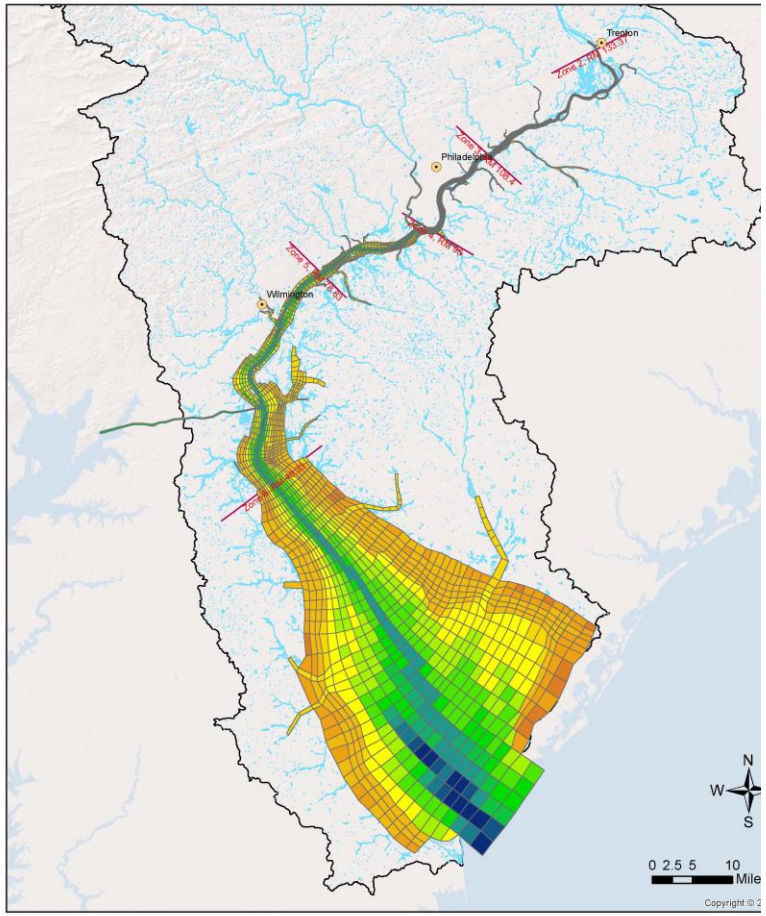
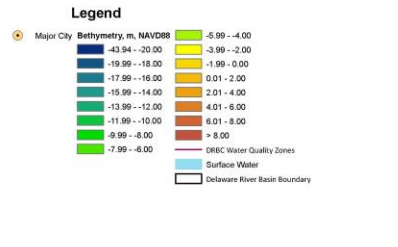


Locator Map



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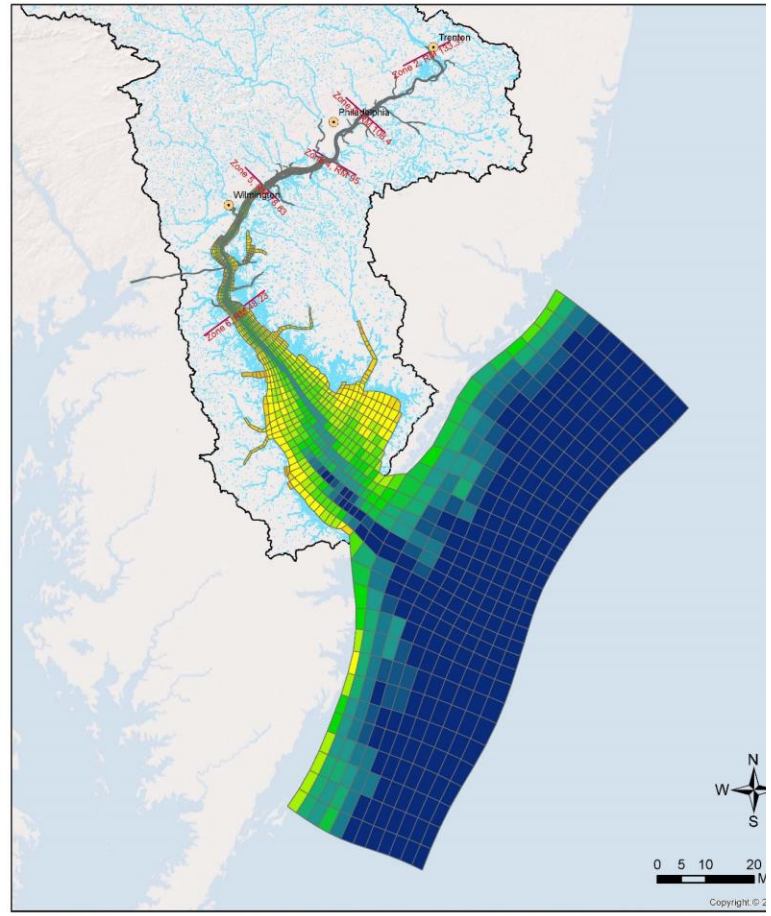
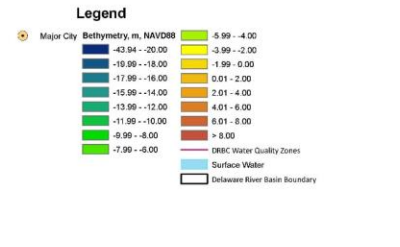
Delaware River and Bay Area: Ba
Model Grid and Bathymetry: Grid # 3 (2814 Gri
Marsh (Floodplain) areas were in



Locator Map



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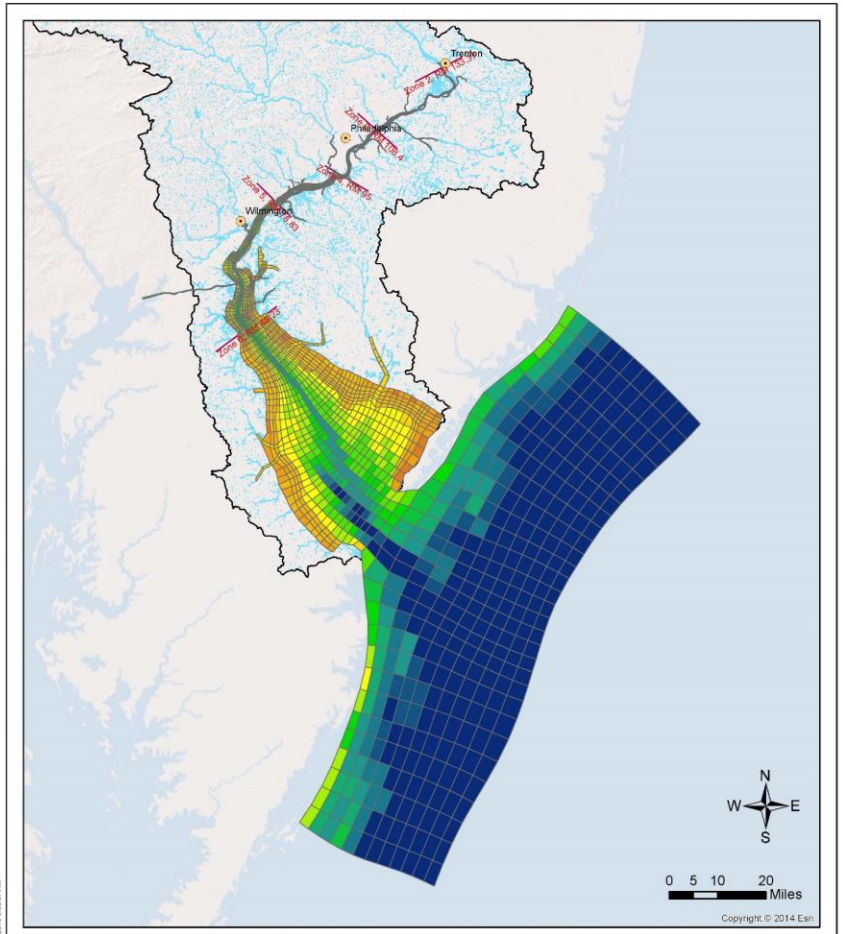
Delaware River and Bay Area: Ba
Model Grid and Bathymetry: Grid # 2 (2727 Gri
Marsh (Floodplain) areas were not included, extended domain in Atlantic



Locator Map

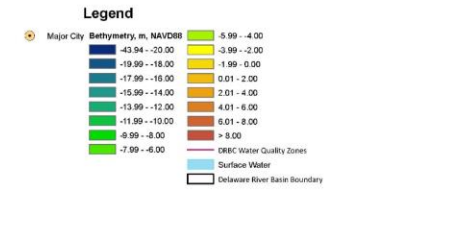
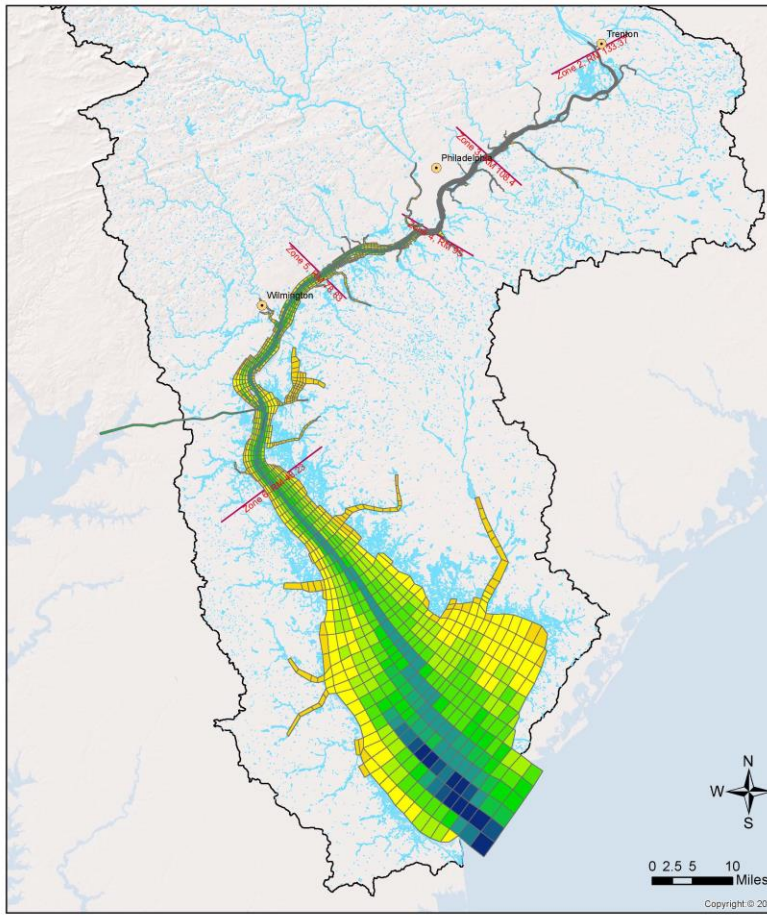


Figure --
Delaware River and Bay Area: Base Map
Model Grid and Bathymetry: Grid # 4 (3176 Grid Cells)
Marsh (Floodplain) areas were included, extended domain in Atlantic Ocean.



Locator Map

Legend

Major City

Bethymetry, m, NAVD88

-43.94 - -20.00
-19.99 - -18.00
-17.99 - -16.00
-15.99 - -14.00
-13.99 - -12.00
-11.99 - -10.00
-9.99 - -8.00
-7.99 - -6.00
-5.99 - -4.00
-3.99 - -2.00
-1.99 - 0.00
0.01 - 2.00
2.01 - 4.00
4.01 - 6.00
6.01 - 8.00
> 8.00

DRBC Water Quality Zones
Surface Water
Delaware River Basin Boundary

Fi
Delaware River and Bay Area: Bas
Model Grid and Bathymetry: Grid # 1 (2312 Grid
Marsh (Floodplain) areas were not inc

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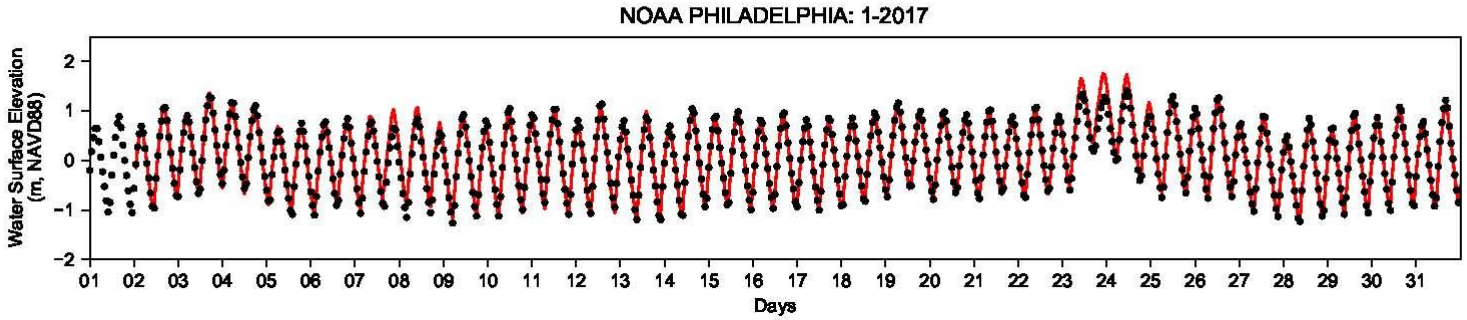

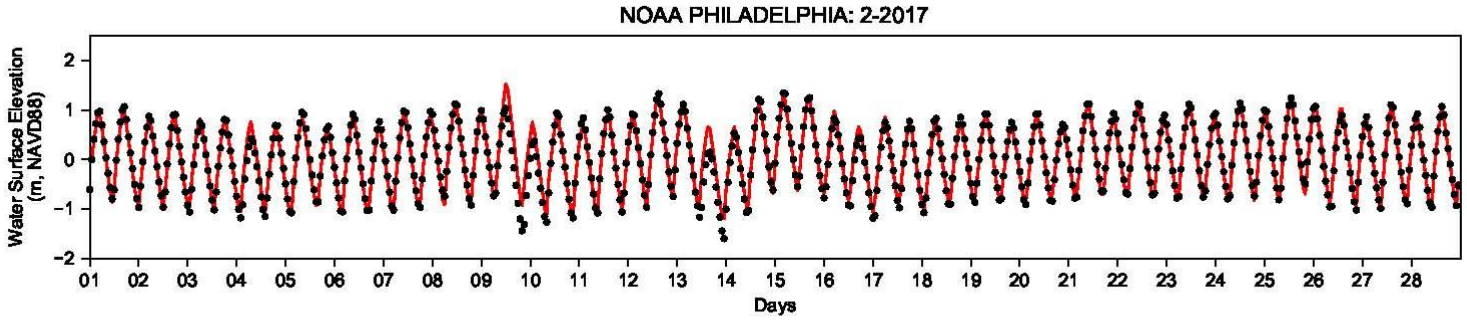

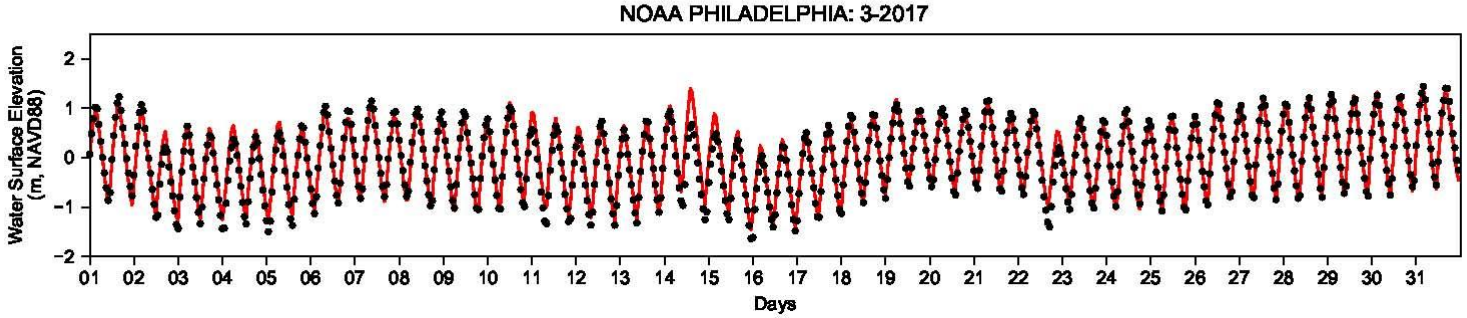

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Model Prediction
Data

Figure XX

Observed and Predicted Water Surface Elevation at NOAA PHILADELPHIA

NOAA hourly verified data were used. Station ID: 8545240
Run ID: EFDC_FGD_GVC_HYDRO_NFPNOC_1901-05, Fine grid GVC, KC =10. CTE3=3.

FC - D:\Jobs\EFDC\Analysis\Model_Output\SWSB\codelp_wse_fine_grid_gvc_2017_2018.py 1/21/2018 21:18:42

Summary (DRBC Actions)

- Pathogens: Initiate monitoring program starting 2019
- PCBs: Stage 2 TMDLs under development and continued implementation of PMPs
- Emerging contaminants of concerns: monitoring and management strategy under development
- Climate Change: compilation of local sea level rise and development tools to evaluate impacts on water resources
- Dissolved oxygen: monitoring and model development

Questions?

Contact Information:

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Namsoo Suk, Ph.D., Director

Science and Water Quality Management

E-Mail: Namsoo.Suk@drbc.gov

Phone: (609) 477-7235

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