Water Quality Advisory Committee (WQAC)

Eutrophication Model Development Monitoring 2018

Delaware River Basin Commission

West Trenton, NJ

March 29, 2018

Delaware River Basin Commission

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Delaware River at Trenton & Schuylkill Monitoring

* Monitor twice per month at the Calhoun Street Bridge in Trenton, NJ and Falls Bridge in Philadelphia, PA;
* Started monitoring the Delaware at Calhoun Street Bridge twice per month in January 2017 and added the Schuylkill River for the intensive-monitoring period (2018-2019);
* Delaware at Trenton and Schuylkill River account for the largest freshwater inflows to the Delaware Estuary.

Delaware River at Trenton & Schuylkill Monitoring

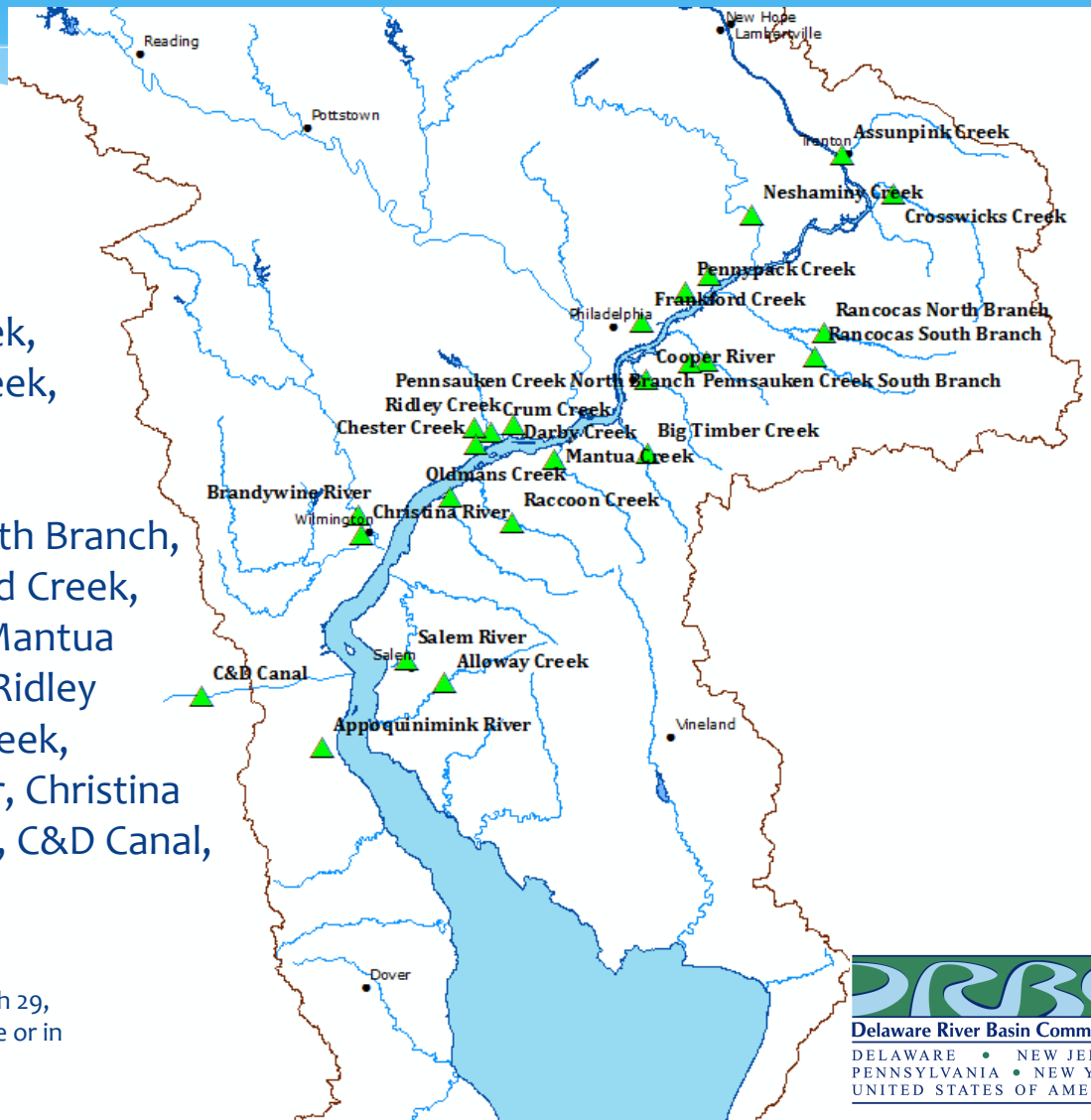
* Composite samples collected and analyzed for a number of nutrient species and conventional pollutants;
* Parameter list includes:
  * COD, Chloride, Ammonia (filtered), Nitrate + Nitrite, TKN, Alkalinity, Silica, TSS, Total Solids, TVS, Sulfate, TOC, POC, DOC, CBOD20 @ 30 degrees C, Total Phosphorus, Orthophosphate, and Particulate Inorganic Phosphorus, Chlorophyll-a
    * CBOD20 @ 30 degrees C is an amended method in order to avoid non-detects (biochemical oxygen demand in stream water is much lower vs. wastewater discharges)

Tributary Nutrient Monitoring

* Monitor once per month for 8 months (starting April and through November) at 25 sites;
* Preliminarily monitored 10 tributary sites 4 times in both 2016 and 2017 (8 monitoring events total);
  * Tributaries in Zone 6 were monitored during this time period;
* Same parameter list as the Delaware River at Trenton and Schuylkill Monitoring project.

Tributary Nutrient Monitoring

* 2018 site list:
  * Assunpink Creek, Neshaminy Creek, Crosswicks Creek, Poquessing Creek, Pennypack Creek, North Branch Pennsauken Creek, South Branch Pennsauken Creek, Rancocas North Branch, Rancocas South Branch, Frankford Creek, Cooper River, Big Timber Creek, Mantua Creek, Crum Creek, Darby Creek, Ridley Creek, Chester Creek, Raccoon Creek, Oldmans Creek, Brandywine River, Christina River, Salem River, Alloway Creek, C&D Canal, and Appoquinimink River



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Additional Point-Discharge Monitoring

* Goal is to estimate loadings of nutrients from individual facilities during model calibration period of 2018-2019;
* Round 1 of Point-Discharge Monitoring started in 2011-2015 in order to later categorize dischargers into tiers (71 facilities):
  * Tier 1 dischargers:
    * Contribute top 95% of total load for Ammonia-N, TKN, or BOD5
    * 12 facilities identified (one sample per week)
  * Tier 2 dischargers:
    * Contribute top 95% of total load for TP, SRP, Nitrate-N, or TN
    * 20 facilities identified (one sample per month)
  * Tier 3 dischargers:
    * Remaining 39 facilities
    * No additional monitoring required

Additional Point-Discharge Monitoring

Analytical Parameter	Units	Filtered, Unfiltered, or Both	Sample Type
Total Phosphorus (TP)	mg/L as P	Unfiltered	24-hour composite
Total Kjeldahl Nitrogen (TKN)	mg/L as N	Unfiltered	24-hour composite
Nitrate Nitrogen (NO_3-N)	mg/L as N	Unfiltered	24-hour composite
Nitrite (NO_2-N)	mg/L as N	Unfiltered	24-hour composite
20-day BOD (BOD_{20})	mg/L	Unfiltered	24-hour composite
20-day Carbonaceous BOD ($CBOD_{20}$) standard method	mg/L	Unfiltered	24-hour composite
20-day Carbonaceous BOD ($CBOD_{20}$) ***amended method****	mg/L	Unfiltered	24-hour composite
Chemical Oxygen Demand (COD)	mg/L	Unfiltered	24-hour composite
Total Organic Carbon (TOC)	mg/L	Unfiltered	24-hour composite
Total Suspended Solid (TSS)	mg/L	Unfiltered	24-hour composite
Soluble Reactive Phosphorus (SRP)	mg/L as P	0.45 µm membrane filter	24-hour composite
Soluble Kjeldahl Nitrogen (SKN)	mg/L as N	0.45 µm membrane filter	24-hour composite
Ammonia Nitrogen (NH_3-N)	mg/L as N	Both: 0.45 µm membrane filter & Unfiltered	24-hour composite
Discharge Flow*	MGD	N/A	24-hour mean or higher frequency
Water Temperature	°C	N/A	24-hour mean
Dissolved Oxygen	mg/L	N/A	24-hour mean
pH	1-14	N/A	24-hour mean
Specific Conductance or TDS	µS/cm or mg/L	N/A	24-hour mean

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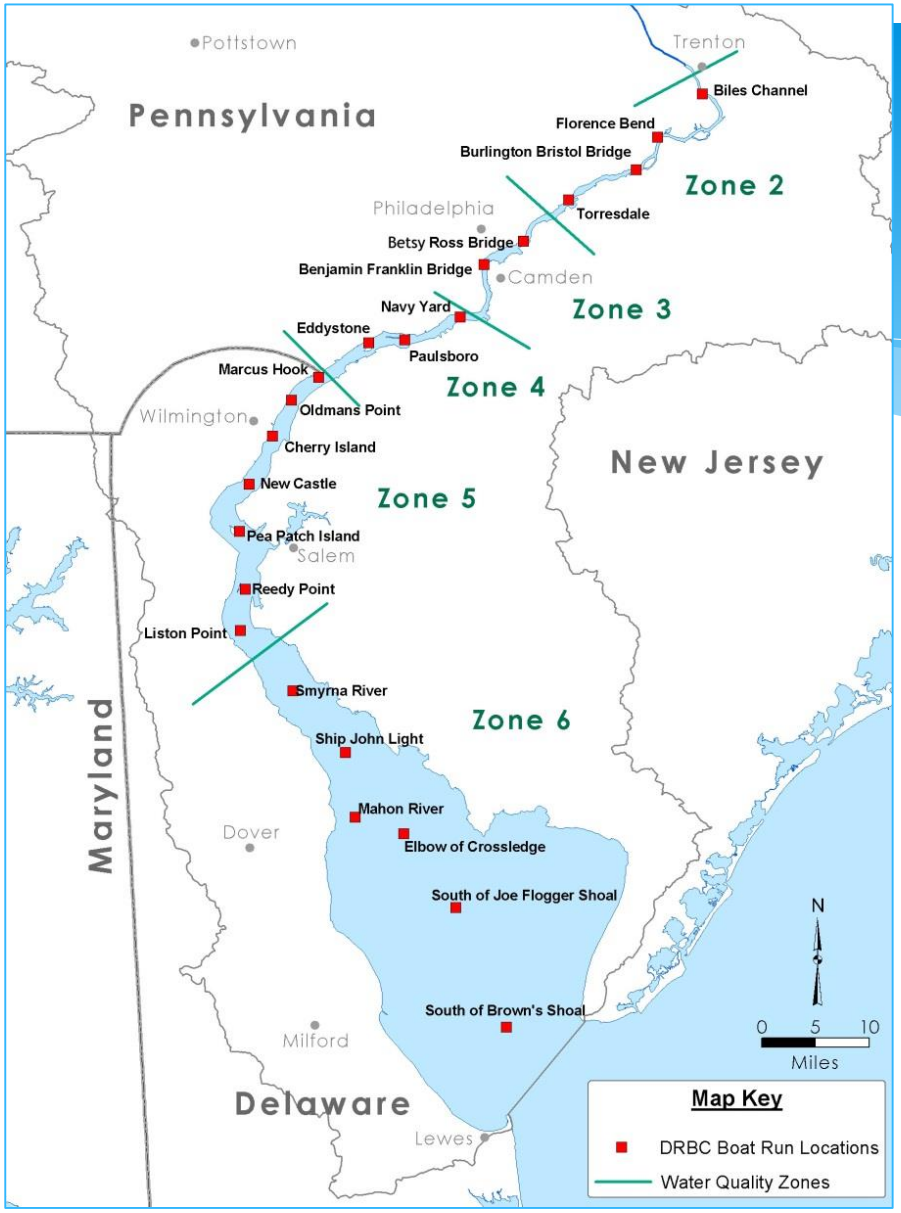
Delaware Estuary Water Quality Monitoring (Boat Run)

22 Sites, once per month



* Beginning Jan 2017 through 2019
* Year-round
  - Routine
  - Nutrients
  - Sodium, BLM & Algal params (sulfate all stations)
* April - October
  - Bacteria
  - Metals
* Other Additions
  - Iron (EPA, DE)
  - CDOM (light extinction)
  - UV254 (drinking water, under development)
  - CBOD20 @ 30 degrees C
  - TOC
  - Particulate Inorganic Phosphorus

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Boat Run Parameters

Routine, Nutrients, Algal

* Alkalinity (Titrimetric, pH 4.5)
* Carbon, Organic - Dissolved (DOC)
* Carbon, Particulate3
* Chloride, Total
* Conductance, Specific - Field
* Hardness as CaCO3
* Nitrogen, Total, Alkaline Persulfate
* Orthophosphorus, Soluble
* Oxygen, Dissolved - Membrane Electrode
* Oxygen, Dissolved - Saturation
* pH, Field
* Phosphorus, Total, Alkaline Persulfate
* Residue, Filterable (TDS)
* Residue, Nonfilterable (TSS)
* Fixed Suspended Solids (FSS)
* Salinity

* Secchi Depth in Meters
* Temperature, Air
* Temperature, Water
* Turbidity (Nephelometric)
* Ammonia as N, Dissolved
* Nitrate as N, Dissolved
* Nitrate/Nitrite as N, Dissolved
* Nitrite as N, Dissolved
* Nitrogen, Dissolved, Alkaline Persulfate
* Nitrogen, Particulate
* Phosphorus, Dissolved, Alkaline Persulfate
* Phosphorus, Particulate
* Chlorophyll-a
* Silica, Dissolved
* PAR extinction at 1-meter

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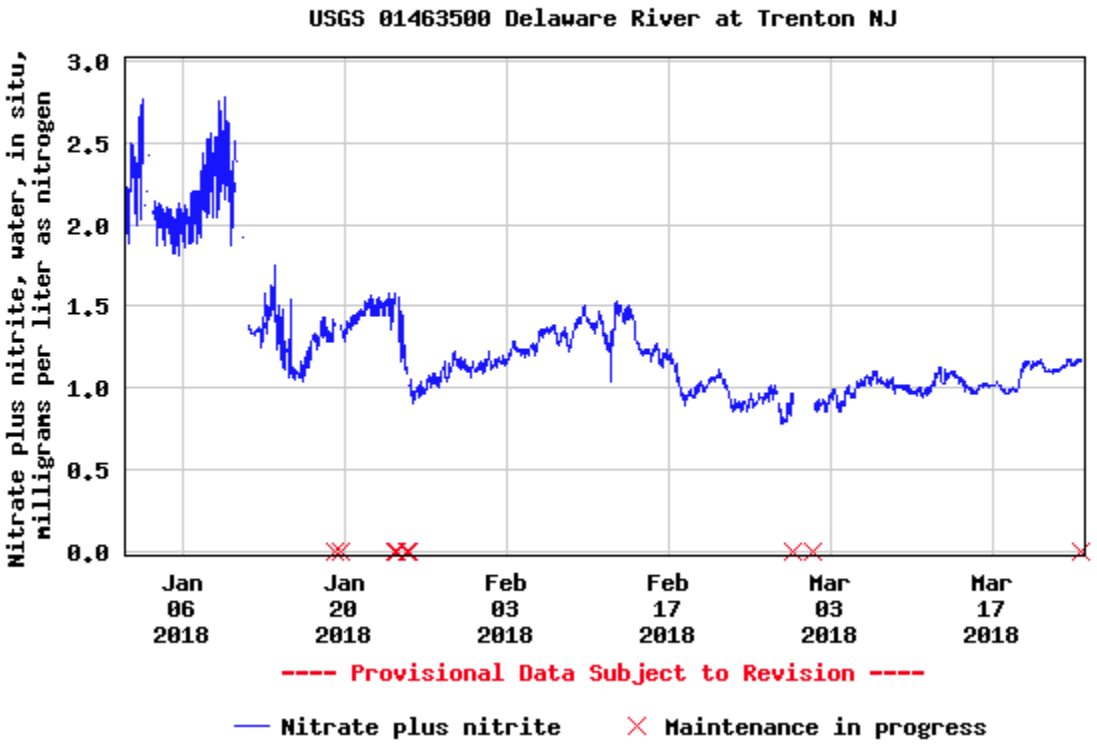
Nitrate Spectral Analyzers

* Addition of continuous real-time spectral analyzers at USGS stations Delaware River at Trenton 01463500 and Chester 01477050
  - Trenton – Nitrate + Nitrite
  - Chester – Nitrate + Nitrite and Organic Carbon
* Trenton analyzer launched 12/19/2017;
* Chester analyzer not yet launched, but tentatively April 2018

Nitrate Spectral Analyzers

Nitrate plus nitrite, water, in situ, milligrams per liter as nitrogen
Most recent instantaneous value: 0.93 03-28-2018 14:00 EDT



https://waterdata.usgs.gov/usa/nwis/uv?01463500

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Light Extinction Data Collection

* At recommendation of Estuary Eutrophication Model Expert Panel, added CDOM measurement capability
* Converted 3 loggers to CDOM
* Paired CDOM, surface and 1-meter PAR, turbidity, specific conductivity at many locations in estuary over range of conditions
* Investigate statistical model of light extinction as a function of other measured parameters
* Starting spring 2018

Ichthyoplankton Augmentation

* In 2018, Public Service Enterprise Group (PSEG) will conduct a large-scale ichthyoplankton sampling effort in the tidal Delaware River to fulfill permit requirements associated with the Salem Generating Station;
  * Target species include: Alewife, American Shad, Atlantic Croaker, Atlantic Menhaden, Atlantic Silverside, Bay Anchovy, Blueback Herring, Bluefish, Spot, Striped Bass, Weakfish, and White Perch;
  * DRBC is interested in data on distribution and reproductive success of sensitive fish species in the Delaware to help support Aquatic Life Use/Eutrophication modelling efforts.

Ichthyoplankton Augmentation

* DRBC contracted with the Academy of Natural Sciences to review the program and provide recommendations;
  * The review determined that the study methods by PSEG are sound;
  * Recommended to reallocate sampling effort in one under-sampled region in the upper part of Zone 5;
    * 3 additional samples will be collected twice monthly from April through July;
* DRBC contracted with consulting service used by PSEG to conduct this extra sampling;
  * Efficiently collecting data by piggybacking on existing PSEG monitoring efforts;
* Goal of project: To help DRBC understand the abundance and reproductive success of sensitive fish species as new dissolved oxygen regulations are developed for the tidal Delaware River.

Primary Productivity

* DRBC will collect primary productivity data in 2018;
  * Previous sampling occurred in Delaware Bay in 2014;
  * Will collect primary productivity data from the upper portion of the estuary in 2018 for use in the eutrophication model.

Primary Productivity

* Samples will be collected in early-May and mid-July;
  * Five transects spread from the upper portion of Zone 5 through Zone 2;
  * Both surface and bottom samples collected at 3 locations at each transect: right, center channel, and left (6 samples collected at each transect location);
  * Salinity, temperature, and dissolved oxygen data will be collected with each sample;
  * All collected samples will be analyzed for nutrients, chlorophyll-a, respiration, and primary productivity.

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* Discussion & Questions?

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