

Monitoring Advisory and Coordination Committee (MACC)

Presented to an advisory committee of the DRBC on November 2, 2017.
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Delaware River Basin Commission

West Trenton, NJ
November 2, 2017



Delaware River Basin Commission

DELAWARE • NEW JERSEY
PENNSYLVANIA • NEW YORK
UNITED STATES OF AMERICA



Scenic Rivers Monitoring Program (Monitoring for SPW)

- * Monitoring of Special Protection Waters (197-mile non-tidal stretch);
 - * Involves coordination with the National Park Service;
 - * DRBC monitors the “Lower Delaware” which extends from just below the Delaware Gap at Portland, PA (RM 209.5) to Calhoun Street Bridge at Trenton, NJ (RM 134.3). The Middle Delaware and Upper Delaware are monitored by our National Park Service partners;
 - * In 2017, DRBC and NPS monitored 9 locations (5 tributaries and 4 mainstem Delaware River sites);
 - * Started May 9, 2017 and ended September 19, 2017 sampling twice per month.

Scenic Rivers Monitoring Program (Monitoring for SPW)

- * The purpose of the Scenic Rivers Monitoring Program (SRMP) is to ensure that DRBC's SPW program is working to "keep clean water clean";
 - * Existing Water Quality (EWQ) defined for 85 sites as of 2016 (57 tributary watershed locations and 28 mainstem Delaware River sites);
 - * The objective is to evaluate assessment periods for measurable changes to water quality parameters;
 - * Defined EWQ is site-specific, which allows for direct assessments, rather than reach-wide;
 - * In 2016, Robert Limbeck performed an assessment for the Lower Delaware River and found that 80% of the parameters either decreased or stayed the same (EWQ period of 2000-2004 with assessment period of 2009-2011);
 - * The parameters that appear to have increased in concentration are mostly chloride and specific conductance, which may be linked to road salt usage;
 - * Overall, SRMP is worth the effort to ensure water quality of SPW areas are maintained;
 - * Plans for 2018 have yet to be determined.

Delaware River at Trenton – Nutrient Monitoring

- * Monitoring of the Delaware River at Trenton for nutrient data;
 - * Development of Delaware Estuary eutrophication model to define relationship between nutrient loadings and dissolved oxygen response;
 - * Delaware River at Trenton accounts for largest nutrient loading input to the Delaware Estuary, thus is necessary to accurately represent this portion of the basin.

Delaware River at Trenton – Nutrient Monitoring

- * Composite samples collected from the Calhoun Street Bridge between Trenton, NJ and Morrisville, PA twice per month;
 - * Started monitoring January 2017 and currently have 4 more sampling runs for 2017;
 - * Coordination with USGS’s Quarterly and NAWQA program;
 - * Goal is to have “staggered” samples in order to compare laboratory data on samples collected the same day, but also cover time periods when samples are not collected;
- * In 2018, DRBC will continue to monitor the Delaware River at Trenton twice per month in addition to the Schuylkill River at Falls Bridge in Philadelphia, PA;
 - * This effort will begin in January 2018 and extend through December 2018;
 - * Monitoring parameters will mostly stay the same, but some may be added or dropped out after internal discussion.

Delaware River at Trenton – Nutrient Monitoring

* Parameters analyzed in 2017:

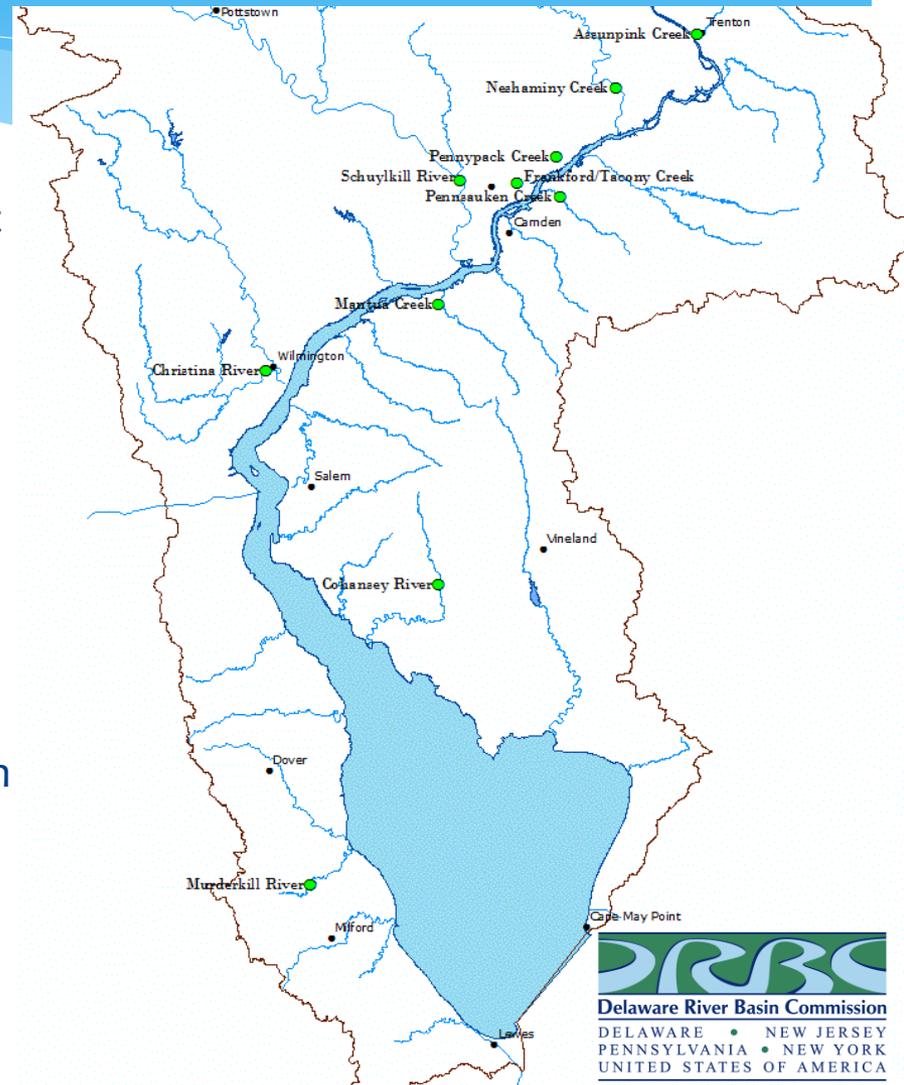
- COD (Chemical Oxygen Demand), Chloride, NO₂ + NO₃ (as N), Ammonia, TKN (Total Kjeldahl Nitrogen), Total Phosphorus, Orthophosphate, TSS (Total Suspended Solids), TVS (Total Volatile Solids), Alkalinity, TOC (Total Organic Carbon), DOC (Dissolved Organic Carbon), Sulfate, Silica, and Chlorophyll a;
- Chlorophyll-a analyzed by the Academy of Natural Sciences, and the remainder of the parameters analyzed by NJDOH.

Estuary Tributary Nutrient Monitoring

- * The objective is to cross-check nutrient loading predictions made by USGS SPARROW (SPATIally-Referenced Regression On Watershed attributes) model;
 - * This is one of the first steps toward defining tributary nutrient loadings for the Eutrophication Model as part of the DRBC Nutrient Criteria Development Plan.
- * Ten estuary sample locations in 2017
 - * Assunpink Creek, Neshaminy Creek, Mantua Creek, Christina River, Murderkill River, Pennypack Creek, Pennsauken Creek, Cohansey River, Schuylkill River, and Frankford/Tacony Creek.

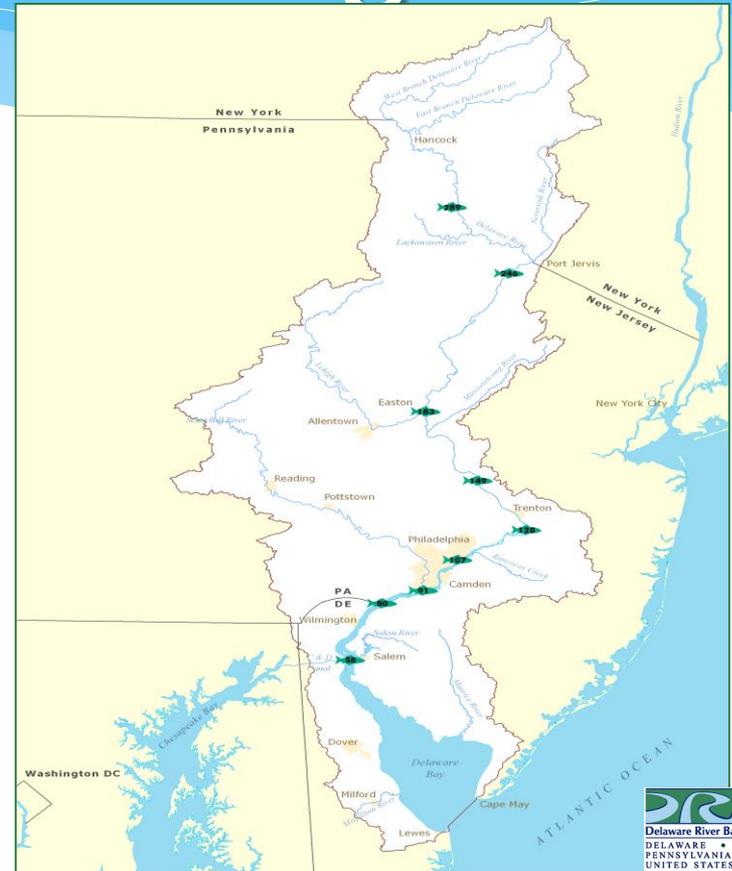
Estuary Tributary Nutrient Monitoring

- * Samples collected June through August;
 - * Four sampling events in total;
 - * Aimed to sample near end of falling tide at tidal sites;
 - * Parameters analyzed: COD (Chemical Oxygen Demand), Chloride, NO₂+NO₃, Ammonia, TKN (Total Kjeldahl Nitrogen), Total Phosphorus, Orthophosphate, and Alkalinity.
- * More intensive monitoring scheduled for 2018;
 - * 25 sites planned with 8 sampling events;
 - * Schuylkill River has been monitored as part of this effort for 2016 & 2017, but will be part of the bi-weekly monitoring along with the Delaware River at Trenton.



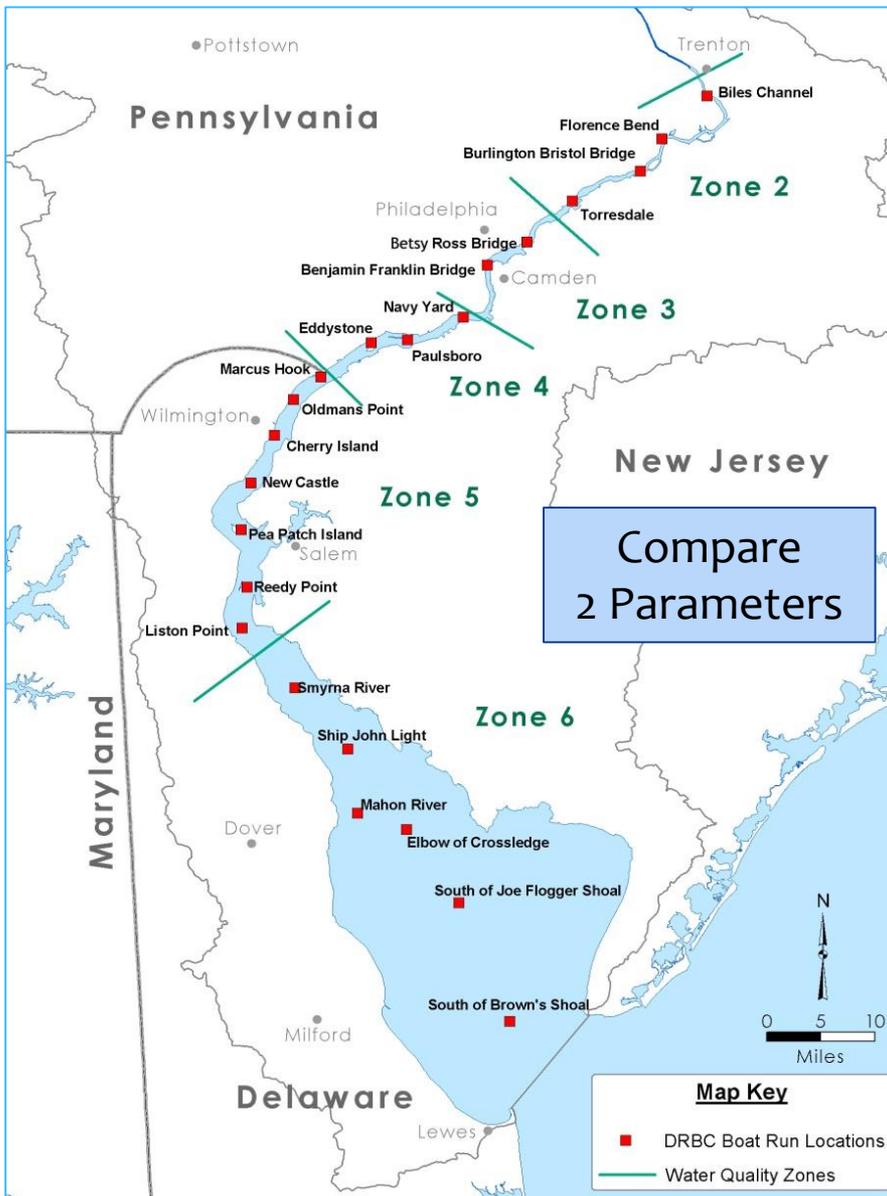
Fish Tissue Monitoring

- * Tidal (5 sites) and non-tidal (4 sites) in Delaware River.
- * Frequency: Yearly 2000 - 2007, 2010, 2012, 2015, 2016 (Bay), 2018 (planned)
- * Two fish species at each site
 - Tidal: white perch, channel catfish
 - Non-tidal: smallmouth bass, white sucker
- * PCBs, Mercury, Methylmercury, Chlorinated pesticides, Dioxins/Furans, PFAS, Metals
- * Data used for fish consumption advisories in NJ



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)

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

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

Nitrate Spectral Analyzers

- * Addition of continuous real-time spectral analyzers at USGS stations Delaware River at Trenton 01463500 and Chester 01477050
 - Trenton – Nitrate
 - Chester – Nitrate and Organic Carbon
- * Target – January 2018

Primary Productivity in Upper Estuary

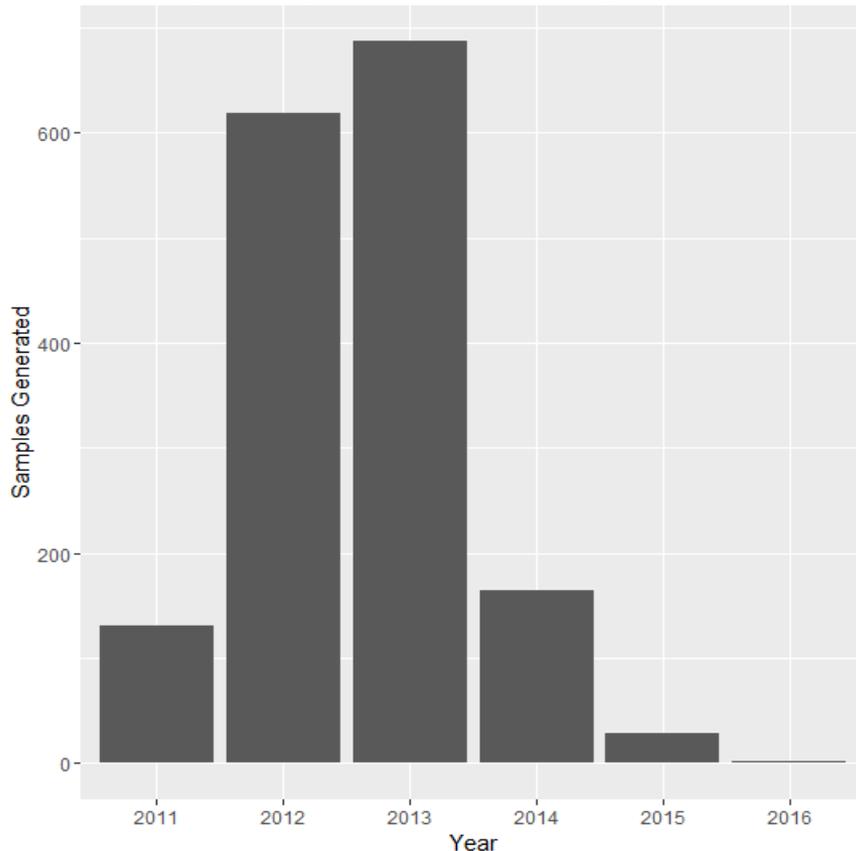
- * Upper Estuary (Zones 2, 3, 4, & upper 5) in summer 2018
- * Primary Productivity, Respiration, & nutrients
- * University of Maryland Center for Environmental Science, Horn Point Lab (Dr. Tom Fisher, Anne Gustafson)
- * Previous report from Zones 5 & 6, 2014 at http://www.nj.gov/drbc/library/documents/nutrients/nutrients-chlor-a_DelawareBay_UMd2015.pdf

Previous Point Discharge Monitoring

- * Facilities < 1 MGD: quarterly for 2 years (28 facilities)
- * Facilities > 1 MGD: monthly for 2 years (55 facilities) for:
 - * Phosphorus: Total Phosphorus, Soluble Reactive Phosphorus (SRP)
 - * Nitrogen: Ammonia, NO₃, NO₂, TKN, SKN
 - * BOD₅, CBOD₅, BOD₂₀
 - * Discharge flow (Q), Temperature, D.O., Conductivity, pH
 - * Ultimate BOD (UBOD) by the 21 discharges with largest BOD loads twice (1 summer, 1 winter)

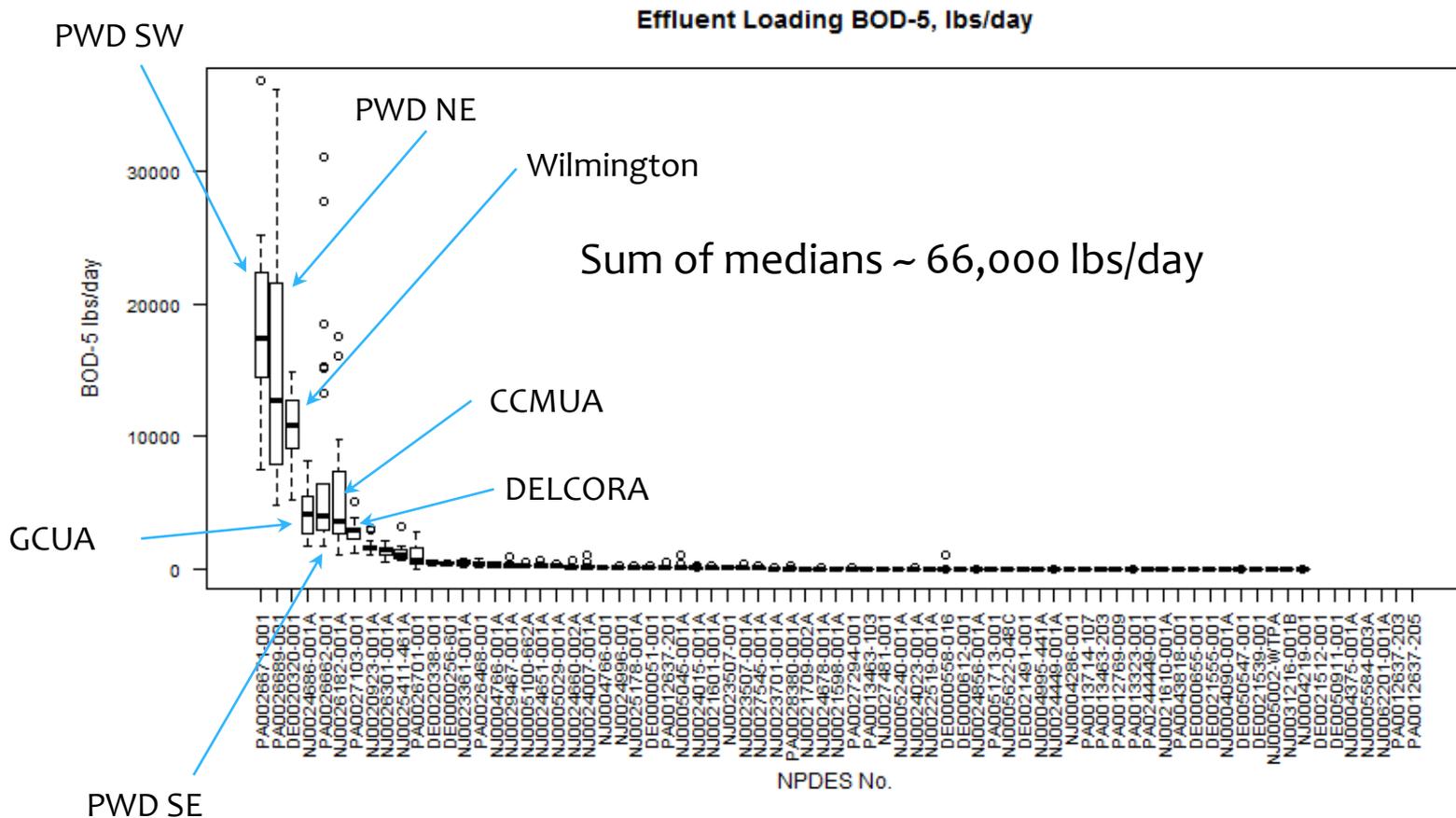
DRBC Effluent Nutrient Data Set

Sample Sets per Year, Point Discharge Nutrient Data



- * 71 facilities discharging to estuary
- * Also looked at AEMR and ICIS data sets
- * this data set is more complete

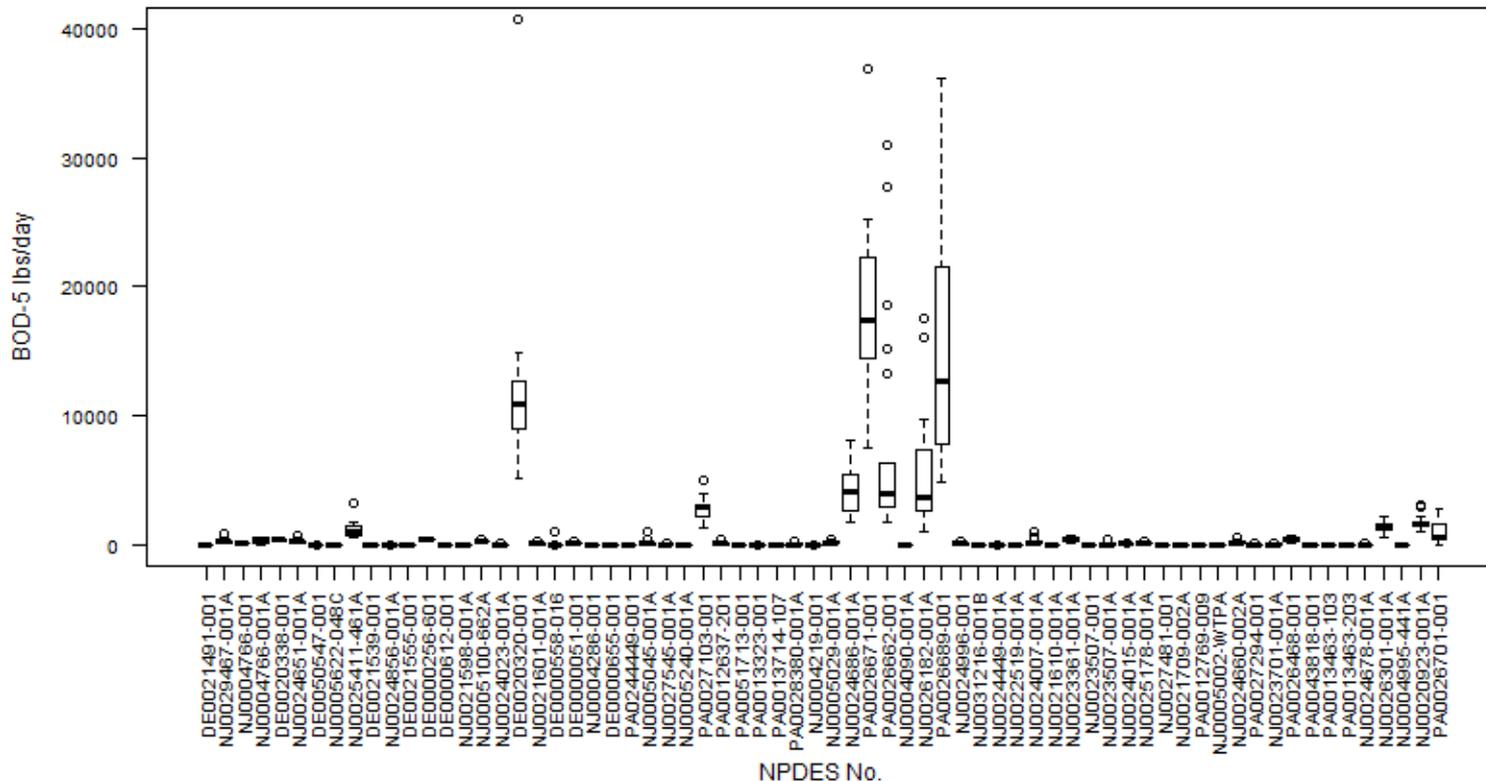
BOD5 Loadings (lbs/day)



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BOD5 Loadings sorted by River Mile

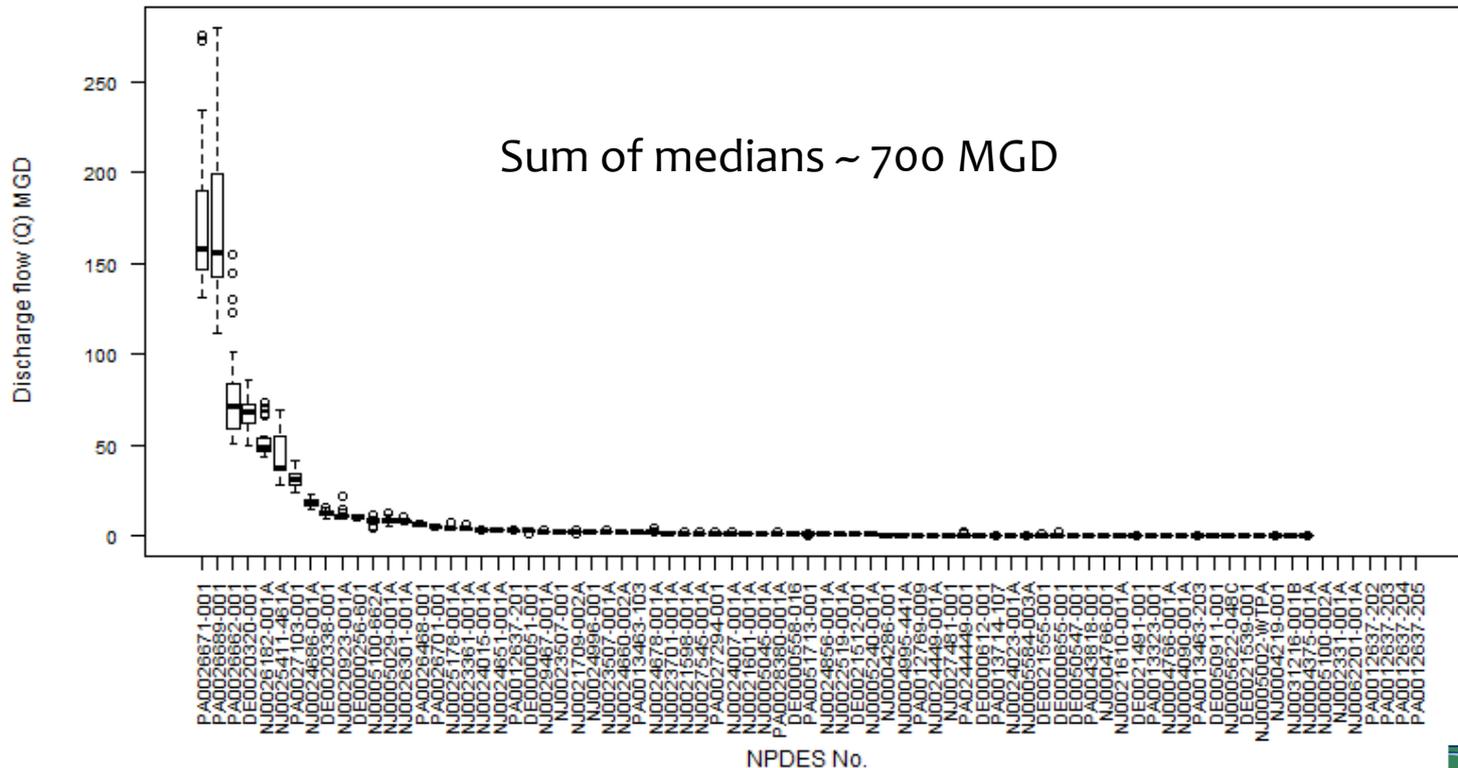
Effluent Loading BOD-5 , lbs/day, by River Mile



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Discharge flow MGD

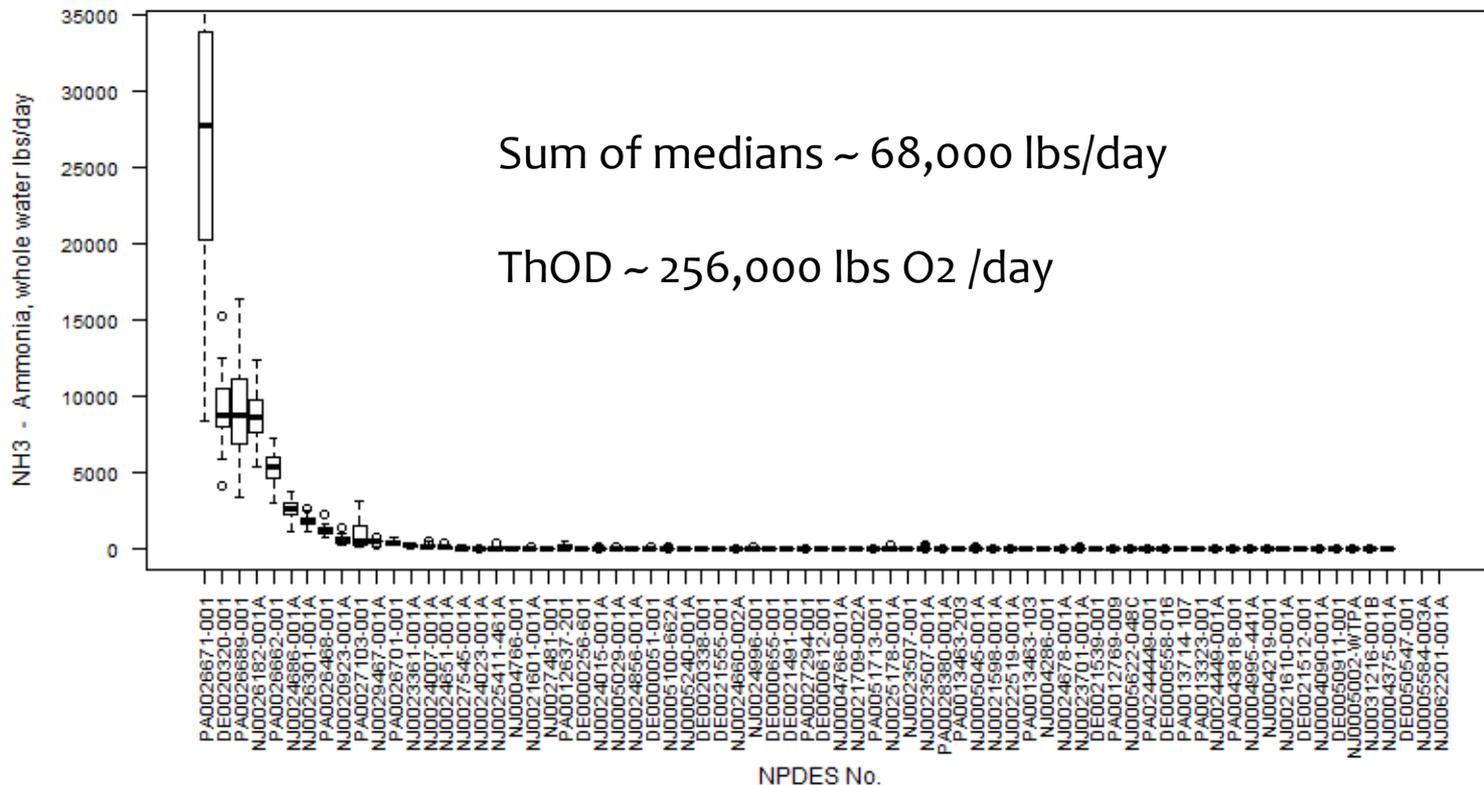
Effluent Discharge flow (Q) MGD



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Ammonia Loadings (lbs/day)

Effluent Loading NH3 - Ammonia, whole water, lbs/day



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Additional Monitoring in 2018-2019

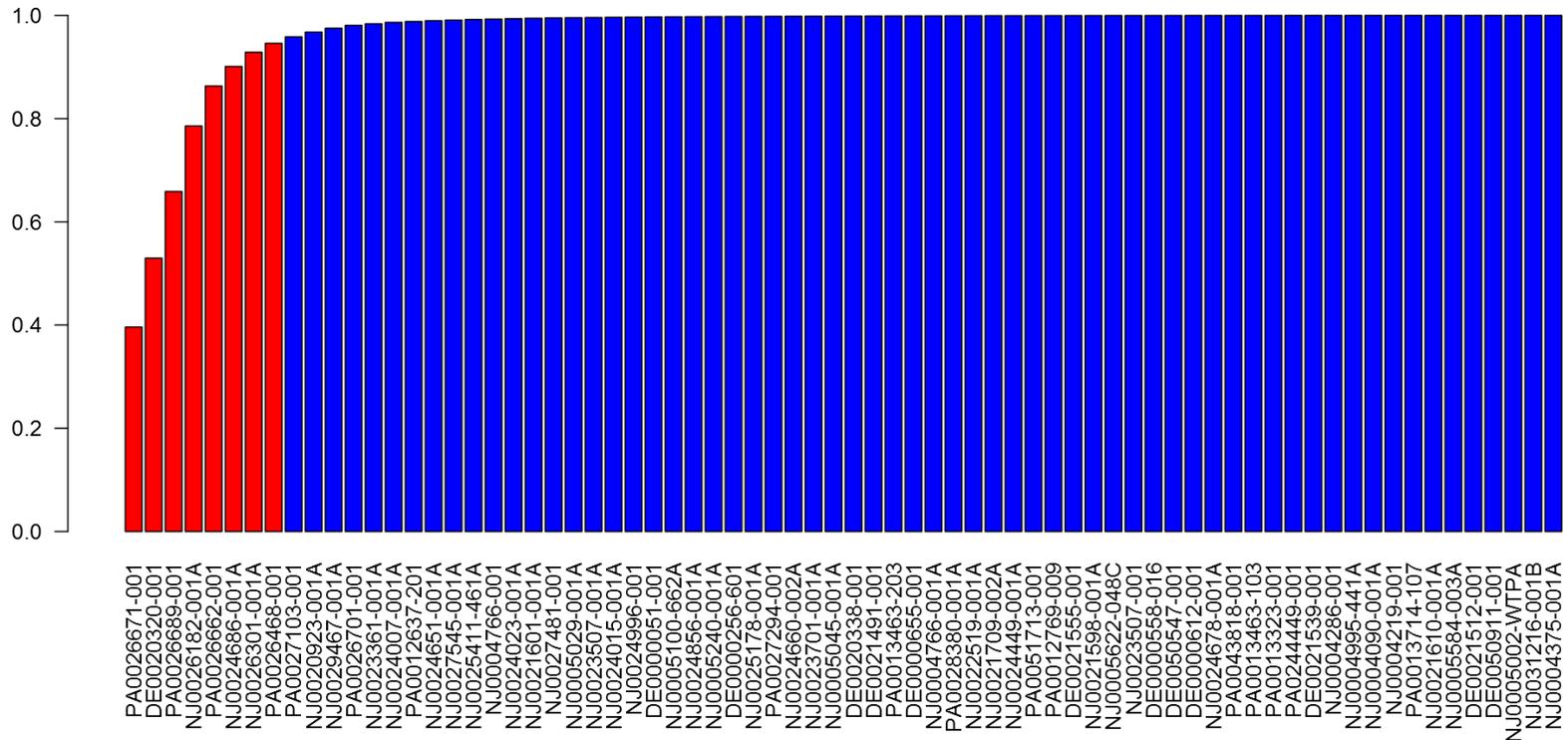
- * Need some additional monitoring in 2018 and 2019
 - * Concurrent with enhanced ambient monitoring
 - * Concurrent with model calibration period
- * One recommendation for intensive monitoring as per Chesapeake Bay TMDL
- * Selection process description and proposed parameters

Steps for Additional Monitoring Evaluation

- * Prioritization of Parameter Groups
 1. Ammonia, TKN, BOD₅
 2. Phosphorus, SRP, Nitrate, TN
- * Identify facilities contributing 95% cumulative point discharge load for 1. and 2.
- * Plot by RM
- * Recommendations for 3 tiers of monitoring intensity

Ammonia Incremental Cumulative Load

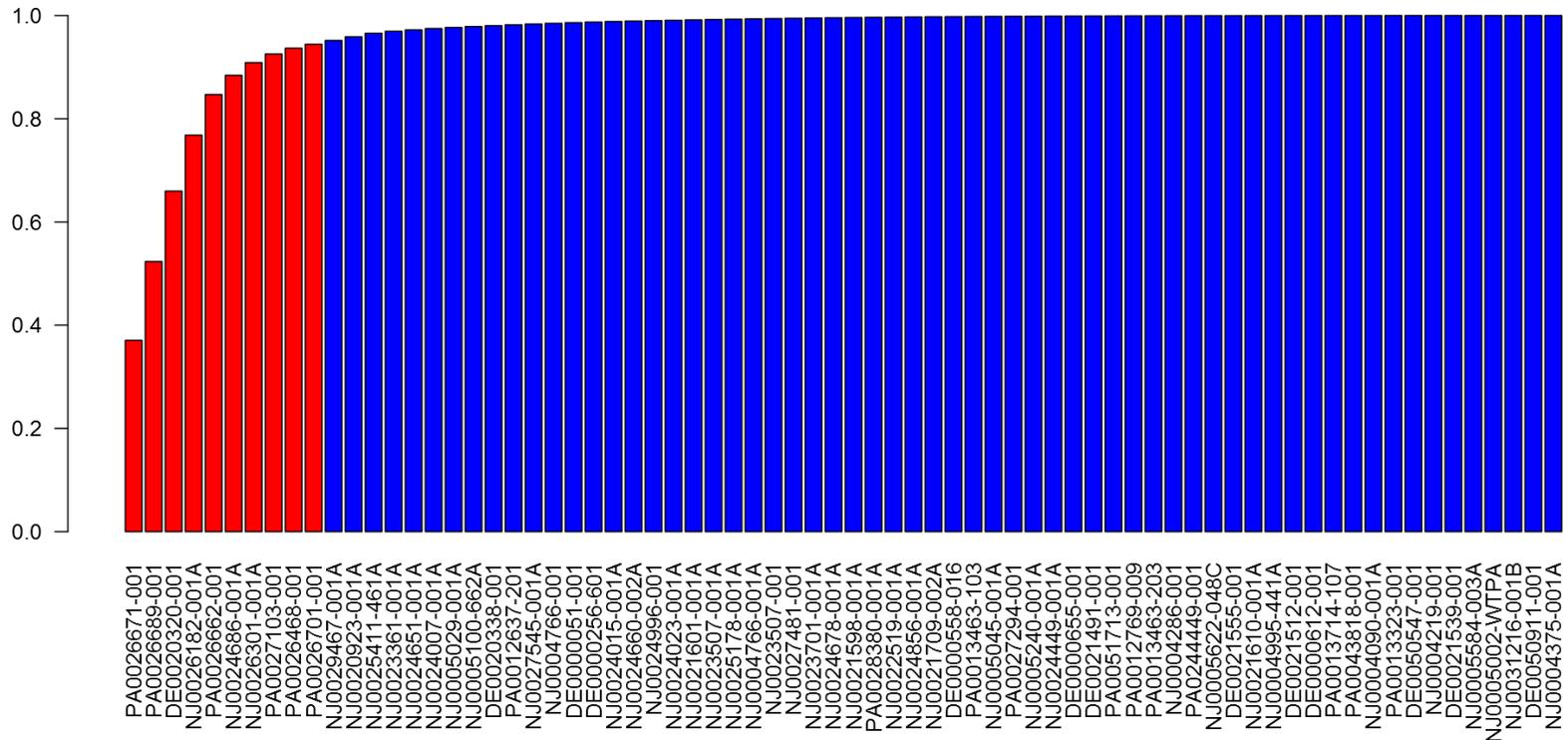
Incremental Cumulative Load NH3 - Ammonia, whole water



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TKN Incremental Cumulative Load

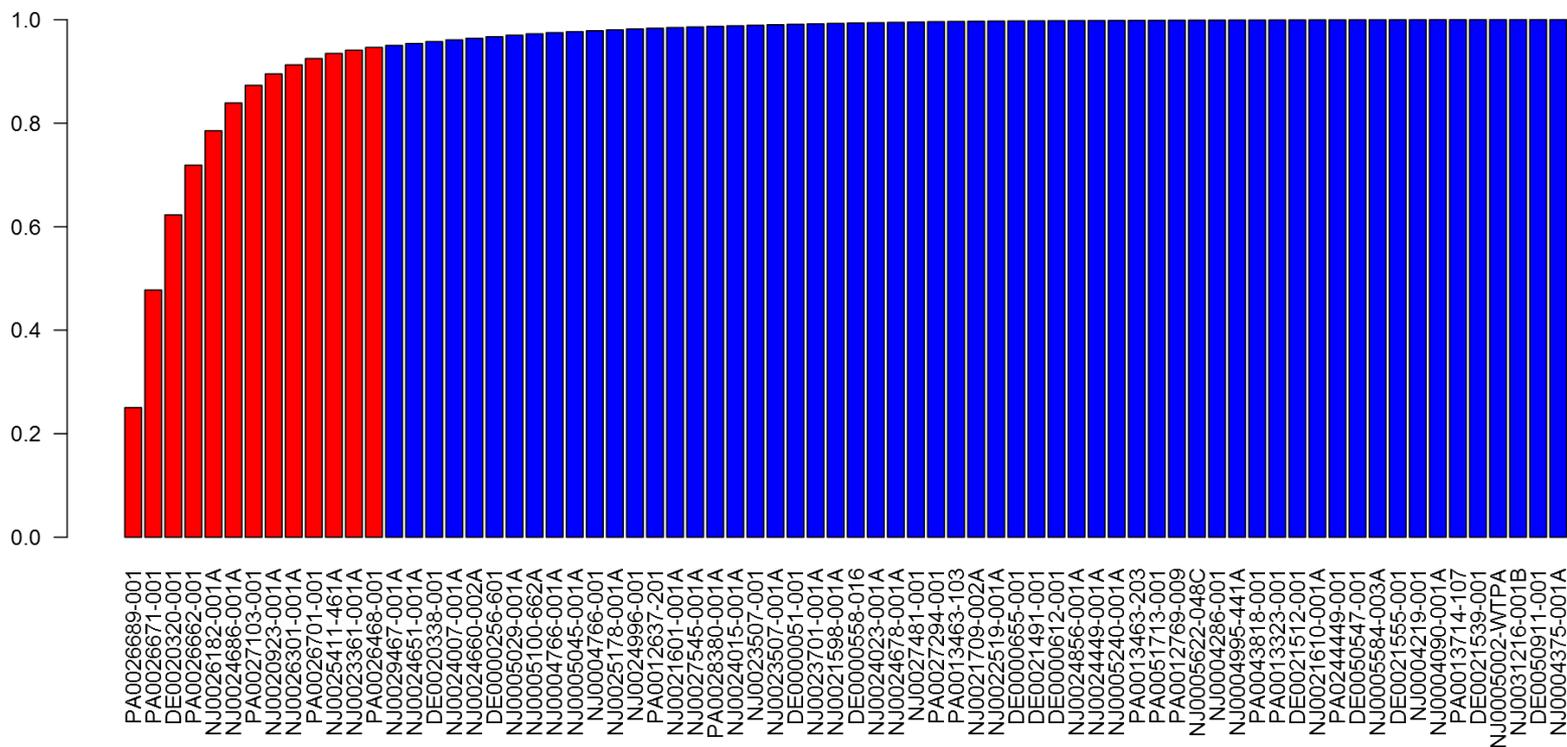
Incremental Cumulative Load TKN - Total Kjeldahl Nitrogen



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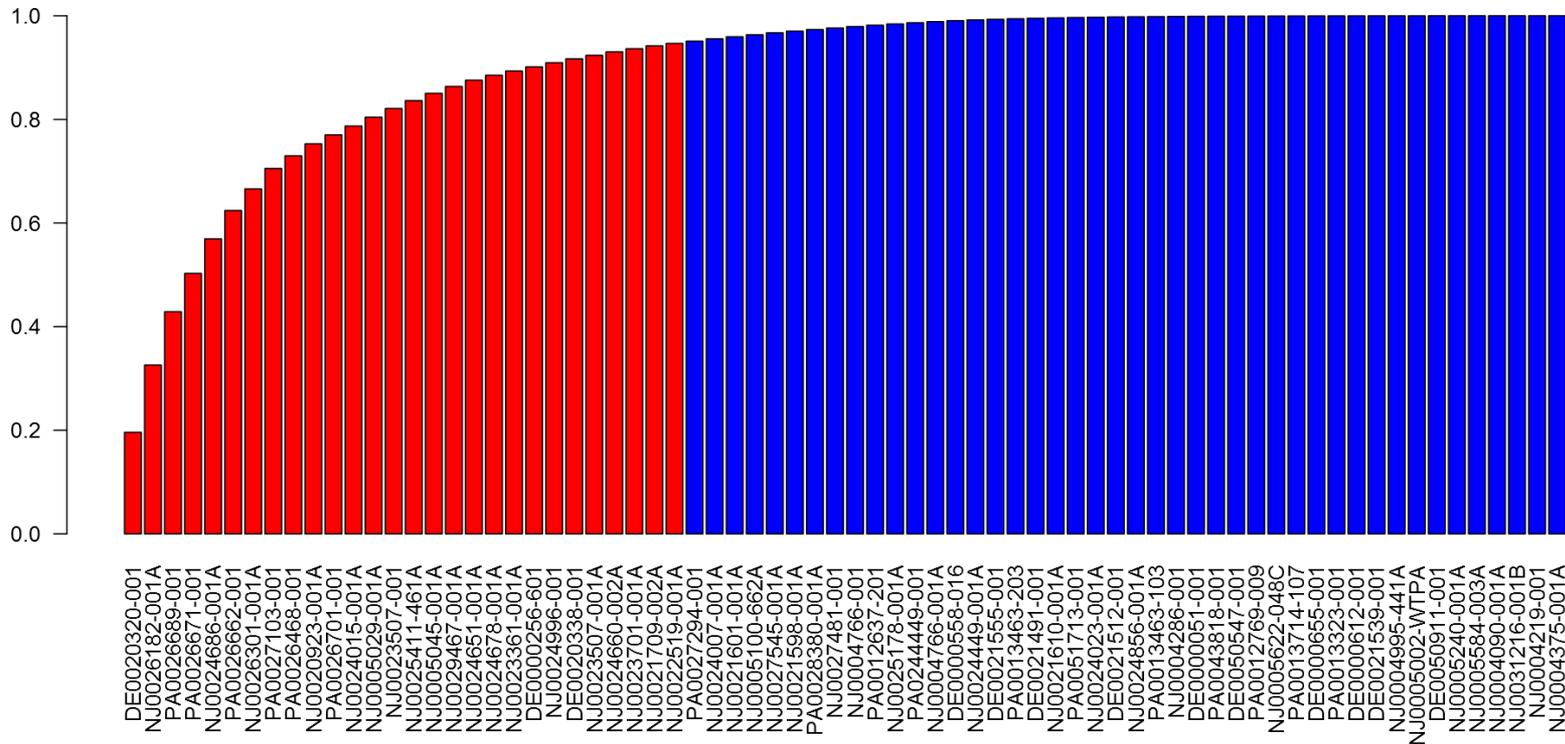
BOD₅ Incremental Cumulative Load

Incremental Cumulative Load BOD-5



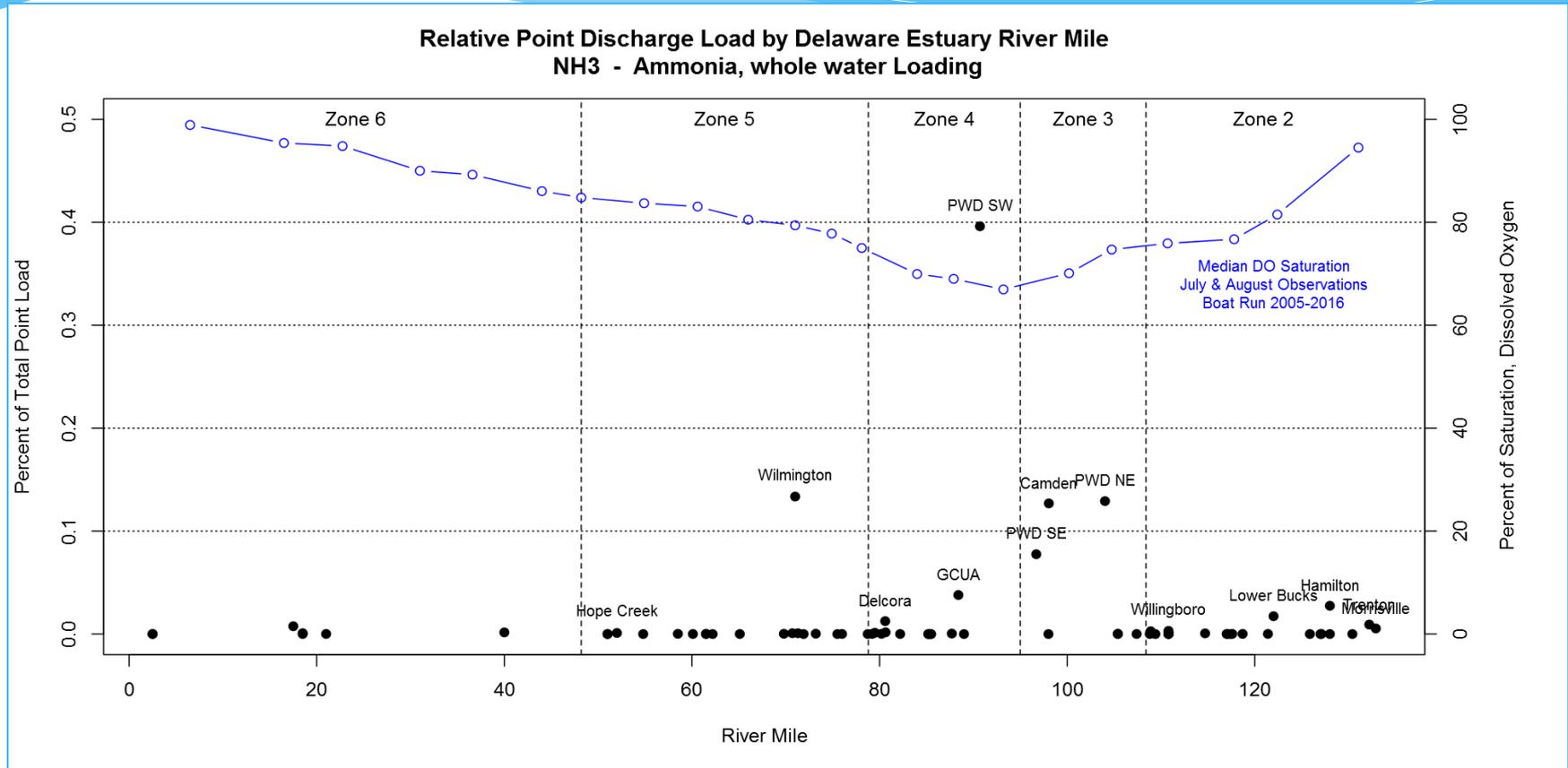
Phosphorus Incremental Cumulative Load

Incremental Cumulative Load TP - Total Phosphorus



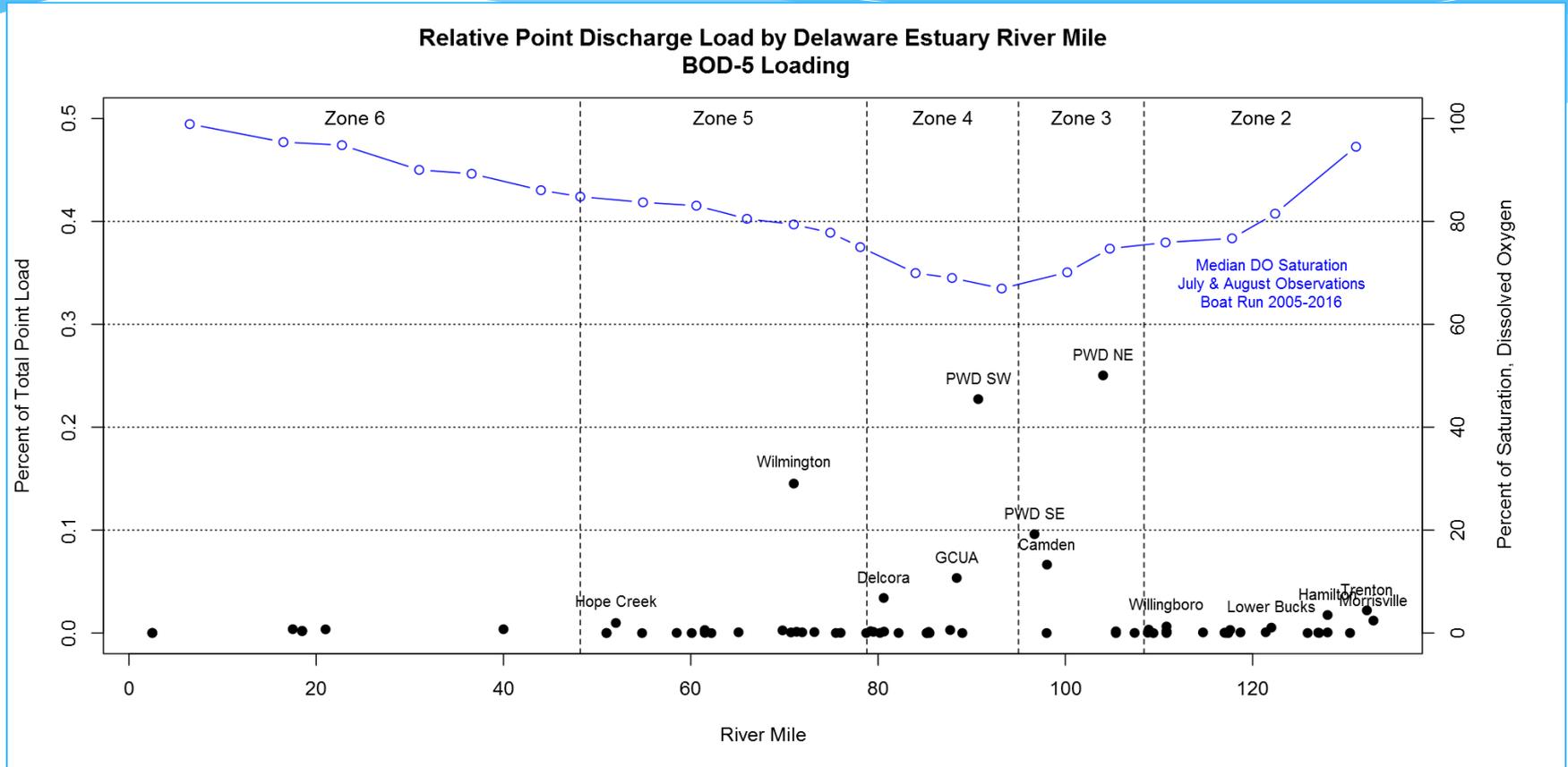
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Ammonia Percent of Total Point Load by River Mile



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BOD₅ Percent of Total Point Load by River Mile



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Questions & Discussion

- * Longer versions of previous slides were presented at Water Quality Advisory Committee Meetings and are available at:

http://www.nj.gov/drbc/library/documents/WQAC/051117/yagecic_point-source-nut-mon.pdf

http://www.nj.gov/drbc/library/documents/WQAC/082417/yagecic_point-source-monitoring.pdf