Delaware River Basin Commission

Water Quality Improvements
In the Delaware River Basin

Geological Association of New Jersey
2018 Annual Meeting

Battleship New Jersey, Camden, NJ
October 19, 2018
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Delaware River Basin Commission

Compact signed 1961

Equal Members:
- Delaware
- New Jersey
- Pennsylvania
- New York
- Federal Government

Broad Responsibilities / Authorities

- Water Supply
- Drought Management
- Flood Loss Reduction
- Water Quality
  - Establish Water Quality Standards
  - Monitoring & Assessment
  - Load Reductions
- Watershed Planning
- Regulatory Review (Permitting)
- Outreach/Education
- Recreation
In this presentation...

* Historic and current estuary dissolved oxygen efforts
* Polychlorinated Biphenyls
* Nutrient Management under Special Protection Waters
* Emerging Contaminants
Historically, summer DO in estuary near Philadelphia was too low for migratory fish to reach upstream to spawn.

- DRBC adopted water quality standards (1967) & wasteload allocation (1968)
- Secondary treatment added at wastewater treatment plants 70’s & 80’s – funding CWA
Success No. 1 – Dissolved Oxygen

- 3.5 mg/L criteria near Philadelphia, Camden, & Wilmington protect fish migration (not propagation)
- By 2000’s that criteria is nearly always met
Next Phase – Dissolved Oxygen

Adopt new designated use & DO criteria to support fish propagation

- Nutrient water quality model
- Engineering evaluation & cost estimate study
- Study of species DO needs
Success No. 2 - PCBs

- PCBs are probable human carcinogen
- Human exposure from fish & water consumption
- Delaware Estuary 100 to 1000X higher than criteria
- DRBC developed TMDLs 2003 & 2006
- 90+ Point dischargers perform pollutant minimization plans – DRBC reviews
- DRBC manages all the data from PMPs
- Decades long commitment
- Stage 2 TMDL refinement

76% Reduction from top 10 point dischargers
Success No. 3 – Nutrients & Special Protection Waters

- Non-tidal River
- Keep the clean water clean
- Significant alterations, new or expanding treatment plants must demonstrate to DRBC no measurable change to existing water quality
- DRBC WQ models
- Implementing for over a decade
- 2016 DRBC Assessment showed improving nutrients since early 2000’s
- USGS report corroborated
It is the policy of the Commission that there be no measurable change in existing water quality except towards natural conditions in waters considered by the Commission to have exceptionally high scenic, recreational, ecological, and/or water supply values.

Sec 3.10.3A.2.
Monitoring & Analysis to Define Existing Water Quality
Definitions of Existing Water Quality are contained in our Water Quality Regulations.

### TABLE 21. Definition of Existing Water Quality: Easton ICP

<table>
<thead>
<tr>
<th>Parameter (Y)</th>
<th>Definition of Existing Water Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Median</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Ammonia NH3-N (mg/l) *</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Chloride (mg/l)</td>
<td>16</td>
</tr>
<tr>
<td>Chlorophyll a (mg/m^3)</td>
<td>1.45</td>
</tr>
<tr>
<td>Dissolved Oxygen (mg/l) mid-day*</td>
<td>8.10</td>
</tr>
<tr>
<td>Dissolved Oxygen Saturation (%)</td>
<td>95%</td>
</tr>
<tr>
<td>E. coli (colonies/100 ml)</td>
<td>31</td>
</tr>
<tr>
<td>Enterococcus (colonies/100 ml)</td>
<td>145</td>
</tr>
<tr>
<td>Fecal coliform (colonies/100 ml) *</td>
<td>100</td>
</tr>
<tr>
<td>Nitrate NO3-N (mg/l) *</td>
<td>0.85</td>
</tr>
<tr>
<td>Orthophosphate (mg/l)</td>
<td>0.02</td>
</tr>
<tr>
<td>pH</td>
<td>7.55</td>
</tr>
<tr>
<td>Specific Conductance (umhos/cm)</td>
<td>142</td>
</tr>
<tr>
<td>Total Dissolved Solids (mg/l)</td>
<td>110</td>
</tr>
<tr>
<td>Total Kjeldahl Nitrogen (mg/l)</td>
<td>0.35</td>
</tr>
<tr>
<td>Total Nitrogen (mg/l) *</td>
<td>1.19</td>
</tr>
<tr>
<td>Total Phosphorus (mg/l) *</td>
<td>0.05</td>
</tr>
<tr>
<td>Total Suspended Solids (mg/l)</td>
<td>4.0</td>
</tr>
<tr>
<td>Turbidity (NTU)</td>
<td>2.5</td>
</tr>
<tr>
<td>Alkalinity (mg/l)</td>
<td>34</td>
</tr>
<tr>
<td>Hardness (mg/l)</td>
<td>48</td>
</tr>
</tbody>
</table>

* Denotes significant short-term increases.
Neversink River Watershed (NY)
(\sim 20\) dischargers)

Brodhead Creek Watershed (PA)
(\sim 30\) dischargers)

Lehigh River Watershed (PA)
(\sim 65\) dischargers)

Lower Delaware River (PA/NJ)
(\sim 100\) dischargers)

Cumulative analysis with Water Quality Models
Lower Delaware QUAL2K Model

- Model to simulate nutrients and dissolved oxygen
- Steady flow, 1-D
# Summary Matrix of Measurable Changes: 440 Within-Site Comparisons at a Glance

## Site Color Key
- **Dark Blue** = Interstate Control Point (ICP)
- **Dark Red** = Pennsylvania Tributary Boundary Control Point (BCP)
- **Dark Green** = New Jersey Tributary Boundary Control Point (BCP)

## Field
- **Parameter**
  - Dissolved Oxygen (DO) mg/l
  - Dissolved Oxygen Saturation %
  - Water Temperature, degrees C
  - Ammonia Nitrogen as N, Total mg/l
  - Nitrate + Nitrite as N, Total mg/l
  - Nitrogen as N, Total (TN) mg/l
  - Nitrogen, Kjeldahl, Total (TKN) mg/l
  - Orthophosphate as P, Total mg/l
  - Phosphorus as P, Total (TP) mg/l
  - Enterococcus colonies/100 ml
  - Escherichia coli colonies/100 ml
  - Fecal coliform colonies/100 ml
  - Alkalinity as CaCO₃, Total mg/l
  - Hardness as CaCO₃, Total mg/l
  - Chloride, Total mg/l
  - Specific Conductance µmho/cm
  - Total Dissolved Solids (TDS) mg/l
  - Total Suspended Solids (TSS) mg/l
  - Turbidity NTU

## Summary Matrix of Measurable Changes:

<table>
<thead>
<tr>
<th>Site Number</th>
<th>Site Color</th>
<th>Site Name</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1343 ICP</td>
<td>Dark Blue</td>
<td>Trenton</td>
<td>Dissolved Oxygen (DO) mg/l</td>
</tr>
<tr>
<td>1416 ICP</td>
<td>Dark Blue</td>
<td>Trenton</td>
<td>Dissolved Oxygen Saturation %</td>
</tr>
<tr>
<td>1463 BCP</td>
<td>Dark Red</td>
<td>Washngtn Crossing</td>
<td>Water Temperature, degrees C</td>
</tr>
<tr>
<td>1467 ICP</td>
<td>Dark Blue</td>
<td>Washngtn Crossing</td>
<td>Ammonia Nitrogen as N, Total mg/l</td>
</tr>
<tr>
<td>1325 BCP</td>
<td>Dark Red</td>
<td>Washngtn Crossing</td>
<td>Nitrate + Nitrite as N, Total mg/l</td>
</tr>
<tr>
<td>1540 ICP</td>
<td>Dark Blue</td>
<td>Washngtn Crossing</td>
<td>Nitrogen as N, Total (TN) mg/l</td>
</tr>
<tr>
<td>1554 ICP</td>
<td>Dark Blue</td>
<td>Washngtn Crossing</td>
<td>Nitrogen, Kjeldahl, Total (TKN) mg/l</td>
</tr>
<tr>
<td>1555 BCP</td>
<td>Dark Red</td>
<td>Washngtn Crossing</td>
<td>Orthophosphate as P, Total mg/l</td>
</tr>
<tr>
<td>1570 BCP</td>
<td>Dark Blue</td>
<td>Washngtn Crossing</td>
<td>Phosphorus as P, Total (TP) mg/l</td>
</tr>
<tr>
<td>1616 BCP</td>
<td>Dark Blue</td>
<td>Washngtn Crossing</td>
<td>Enterococcus colonies/100 ml</td>
</tr>
<tr>
<td>1641 BCP</td>
<td>Dark Blue</td>
<td>Washngtn Crossing</td>
<td>Escherichia coli colonies/100 ml</td>
</tr>
<tr>
<td>1767 ICP</td>
<td>Dark Blue</td>
<td>Washngtn Crossing</td>
<td>Fecal coliform colonies/100 ml</td>
</tr>
<tr>
<td>1774 ICP</td>
<td>Dark Blue</td>
<td>Washngtn Crossing</td>
<td>Alkalinity as CaCO₃, Total mg/l</td>
</tr>
<tr>
<td>1777 BCP</td>
<td>Dark Blue</td>
<td>Washngtn Crossing</td>
<td>Hardness as CaCO₃, Total mg/l</td>
</tr>
<tr>
<td>1778 ICP</td>
<td>Dark Blue</td>
<td>Washngtn Crossing</td>
<td>Chloride, Total mg/l</td>
</tr>
<tr>
<td>1779 BCP</td>
<td>Dark Blue</td>
<td>Washngtn Crossing</td>
<td>Specific Conductance µmho/cm</td>
</tr>
<tr>
<td>1780 BCP</td>
<td>Dark Blue</td>
<td>Washngtn Crossing</td>
<td>Total Dissolved Solids (TDS) mg/l</td>
</tr>
<tr>
<td>1782 BCP</td>
<td>Dark Blue</td>
<td>Washngtn Crossing</td>
<td>Total Suspended Solids (TSS) mg/l</td>
</tr>
<tr>
<td>1783 BCP</td>
<td>Dark Blue</td>
<td>Washngtn Crossing</td>
<td>Turbidity NTU</td>
</tr>
</tbody>
</table>

**Key:**
- **~** = Weak indication of measurable water quality change toward more degraded status
- **** = Indication of measurable water quality change toward more degraded status
- **No indication of measurable change to EWQ**

**Good News:**
88% of water quality tests showed no measurable change to EWQ.

**Nutrient reductions corroborated by subsequent USGS assessment using different data, different methods**
In Each Case...

* Fundamentals of mass loading rates, exposure pathways, chemical reactions, & water column response
  - water quality modeling, engineering, & technical analysis
* Intensive monitoring
* Point sources matter
* Substantial Investment
  - Governments & grants
  - Dischargers & regulated community
* Cooperation & coordination - all pulling in the same direction
Emerging Contaminants Surveys Since 2004

- DRBC Surveys in surface water, fish and sediment
  - Pharmaceuticals and Personal Care Products (PPCP)
  - Hormones
  - Stain repellants/non-stick surfaces/fire fighting foams [PFAS]
  - Flame Retardants [PBDE]
  - Detergents [NP]
  - Plasticizers [bis-phenol A]

- Monitor Ambient Toxicity

- Close coordination with States, TAC, & EPA
  - Seeing reductions in ambient longer chain PFAS
Questions & Discussion?
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609-883-9500 x271