

# Delaware River Basin Commission

## Water Planning at the Interstate Basin Commissions

**Steve Tambini, P.E.**  
**DRBC Executive Director**

*National Leadership Institute for State  
Officials*

*AWRA, Baltimore, MD  
November 8, 2018*



**Delaware River Basin Commission**

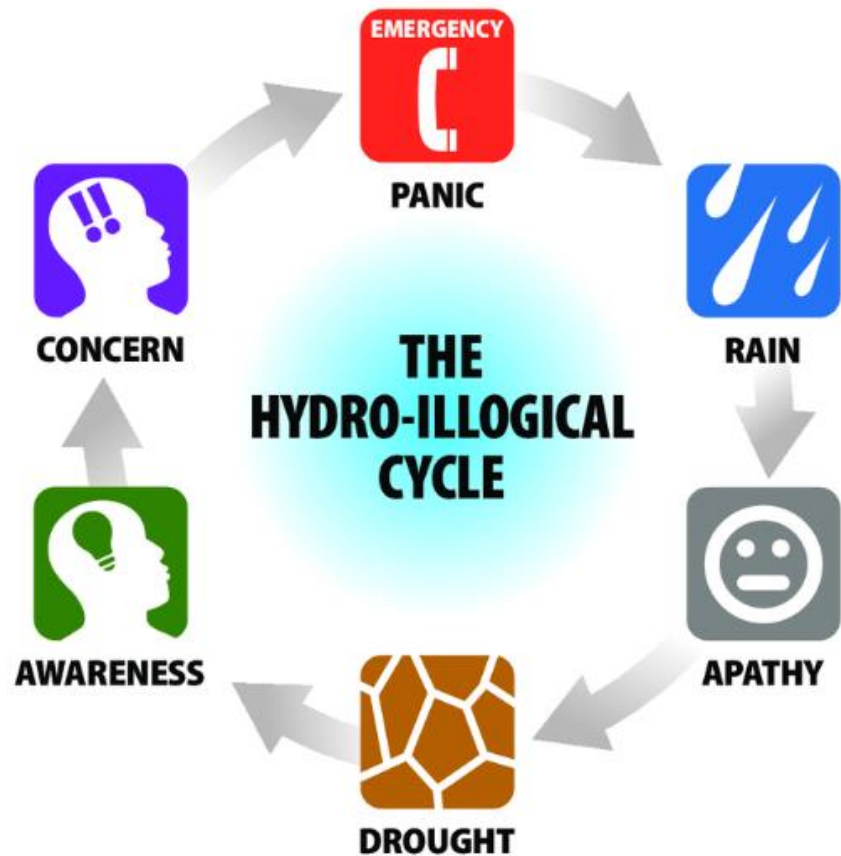
DELAWARE • NEW JERSEY  
PENNSYLVANIA • NEW YORK  
UNITED STATES OF AMERICA

# 1960's Drought Delaware River @ Trenton, NJ



# Planning for the future

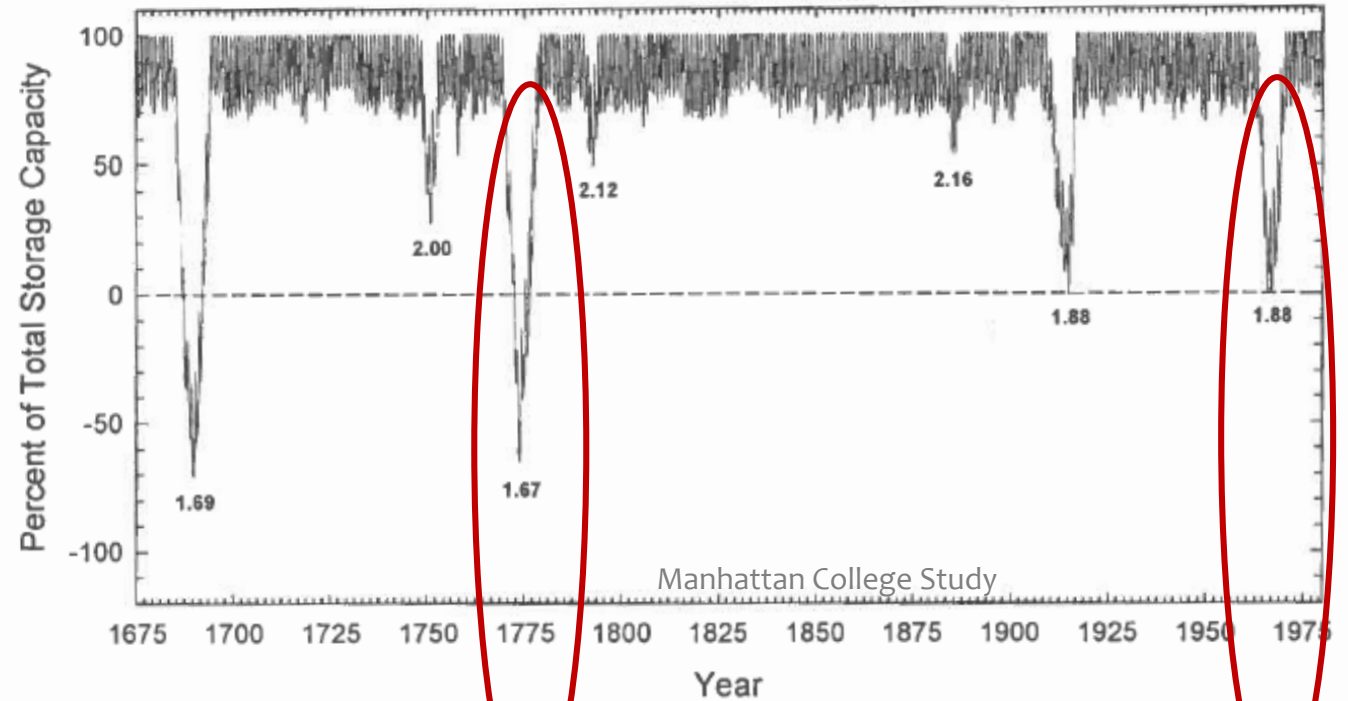
## Break the “Hydro-Illogical cycle”



“When the well’s  
dry, we know the  
worth of water.”  
- Benjamin  
Franklin



# Have we seen the Drought of Record?



**Figure S 4. Monthly Inflow Model –Tree-Ring Reconstructed Monthly Inflow Data Obtained by Disaggregation (1675 – 1980). The total storage capacity of the system is 547.5 BG. The bold numbers represent the total system yields associated with the selected droughts. The outflow from the system is set to that corresponding to the total system yield for the 1960s drought (1.88 BGD). Therefore, any droughts with a lower total system yield than 1.88 BGD will result in negative storage capacities.**

Photo: Henri D. Grissino-Mayer  
 Department of Geography,  
 The University of Tennessee

Department of Environmental Engineering, Manhattan College, Kaitlin J. Bars, Kevin R. Ellenwood, Joseph J. Nemes, Kevin J. Rader. Tree Ring Analysis as a predictor of pre-1927 reservoir inflows, April 26, 2004

# Objectives



Photo: Nicholas A. Tonelli

- Overview of DRBC
- What is driving planning efforts in the Delaware River Basin?
- Who is driving planning efforts in the Delaware River Basin?

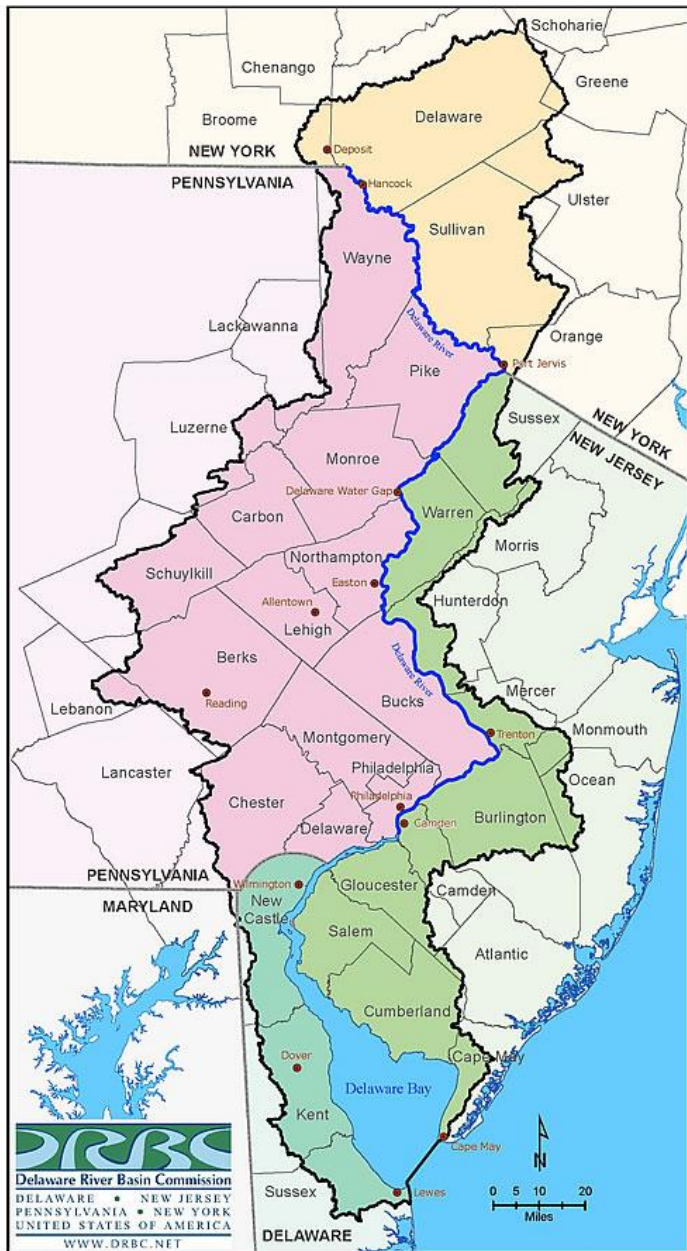


“A river is more than an amenity, it is a treasure”

-US Supreme Court Justice  
Oliver Wendell Holmes

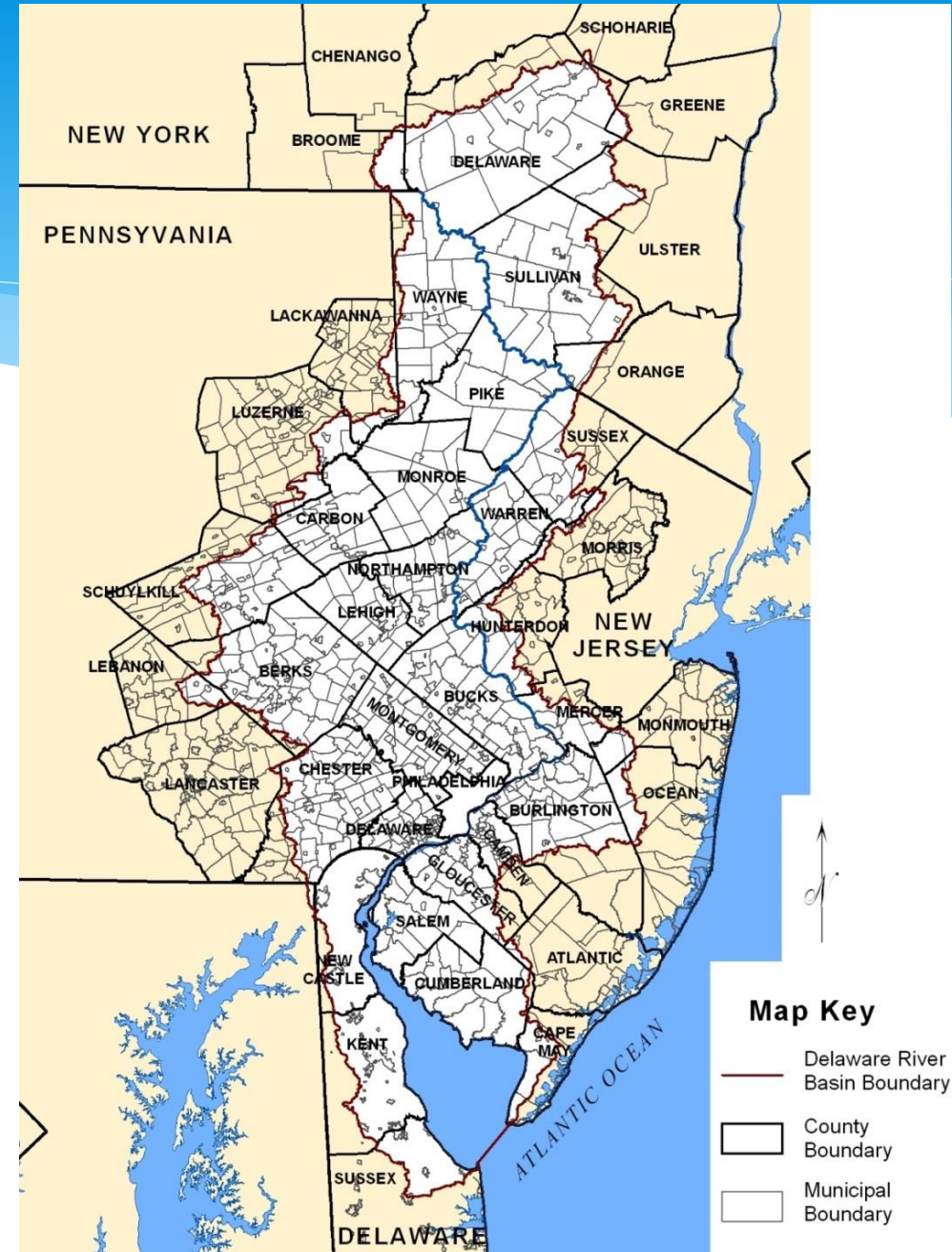
### Fast Facts:

- Delaware River Main stem river is **330 miles long**
- Delaware River forms an interstate boundary over its entire length
- **~15 million people** (about 5% of the U.S. population) rely on the waters of the Delaware River Basin
- **Drains 13,539 square miles** of watershed in 4 states.
- Water **withdrawal** in the Basin = **6.4 billion gallons a day**
- **Significant Exports: NYC (up to 800 MGD) and NJ (up to 100 MGD)**
- Longest, un-dammed U.S. river east of the Mississippi (dams are located on tributaries, not the main stem Delaware)
- **Contributes over \$21B in economic value** to the Region.



# The Need for Basin-Scale Planning and Management

- 4 States
- 42 Counties
- 838 Municipalities
- NY City
- 330 Miles of Interstate River



# Delaware River Basin Commission Founded by Compact in 1961

## Five Equal Members:

- Delaware
- New Jersey
- Pennsylvania
- New York
- Federal Government



Note: New York City and Philadelphia are “advisors” and not members



# DRB Compact Basic “Charges”

## *From the Compact Preamble:*

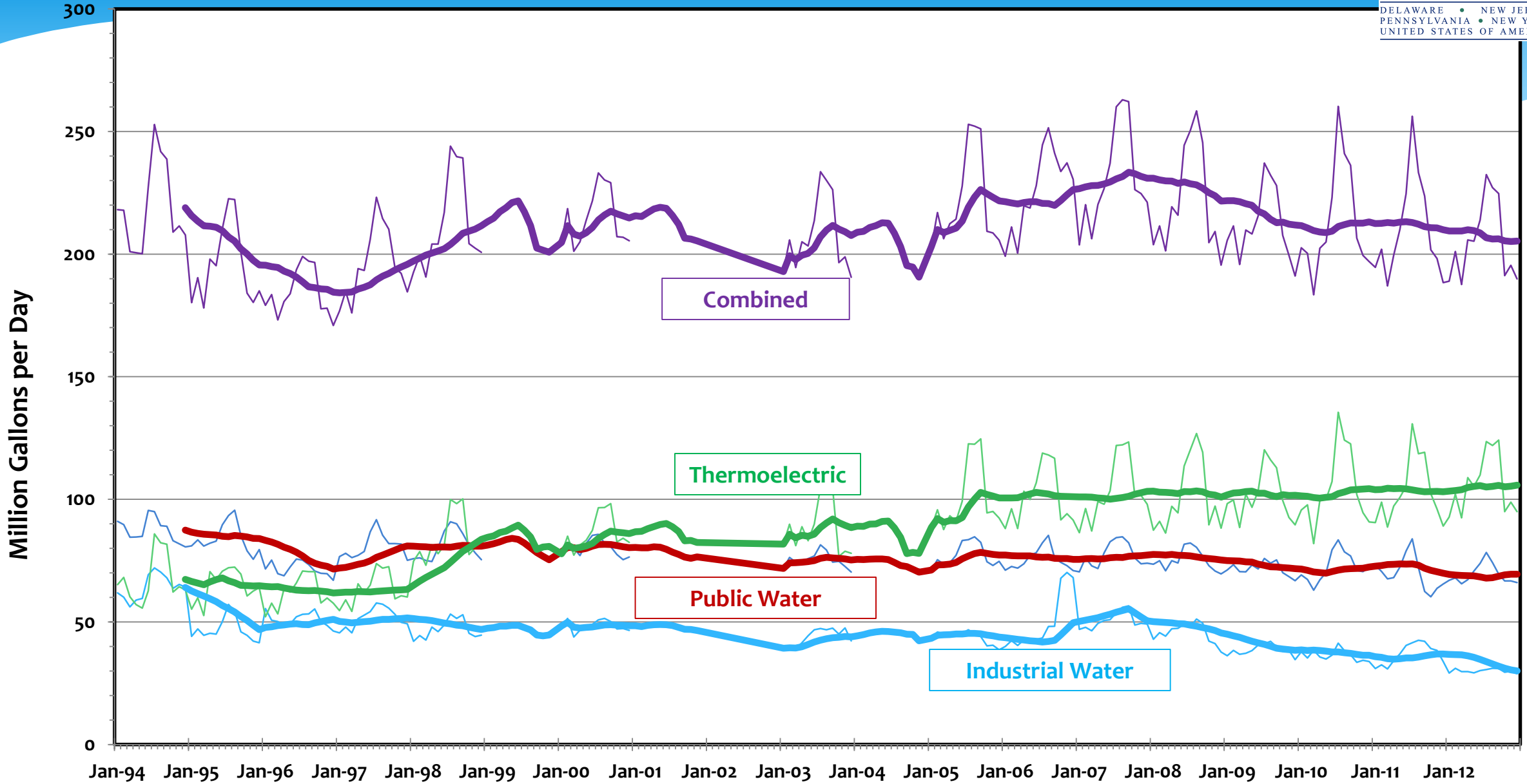
- a **Comprehensive Plan** administered by a basin wide agency will provide
  - ✓ **flood damage** reduction;
  - ✓ conservation and **development of ground and surface water supply...;**
  - ✓ development of **recreational facilities;**
  - ✓ **propagation of fish and game;**
  - ✓ promotion of related... **watershed projects;**
  - ✓ **protection to fisheries...;**
  - ✓ development of **hydroelectric power;**
  - ✓ **control of movement salt water;**
  - ✓ **abatement and control of stream pollution;**
  - ✓ **and regulation** towards the attainment of these goals.

# 2030 / 2060 Planning Scenarios

	Baseline	2030 / 2060
<b>Water Demands</b>	Existing	Projected
<b>Water Efficiency</b>	Existing	Higher Standards
<b>Climate: Precipitation/ Runoff/ and Use</b>	<b>DROUGHT of Record</b>	<b>IPCC / USGS Scenarios</b>
<b>Climate: Sea Level Rise</b>	<b>Existing Trends</b>	<b>IPCC + Regional Studies</b>
<b>Pass-by flows and Conservation Releases</b>	Existing	EcoFlow Scenarios
<b>Consumptive Use Make Up Water</b>	Existing	EcoFlow Scenarios
<b>Drought Operating Rules</b>	FFMP / DRBC Water Code	FFMP / DRBC Water Code

IPCC = Intergovernmental Panel on Climate Change

# Consumptive Use Trends 1994 - 2012

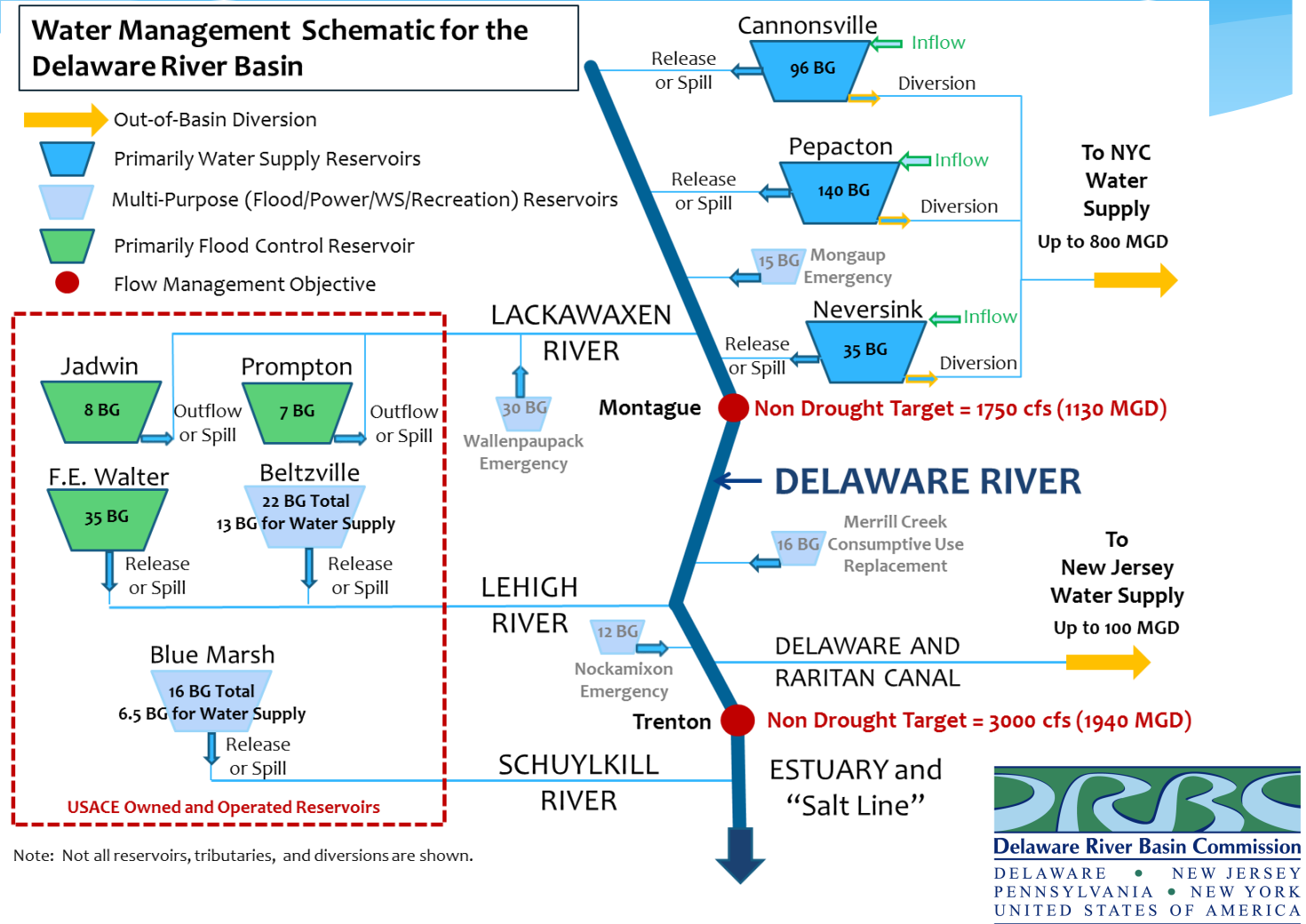


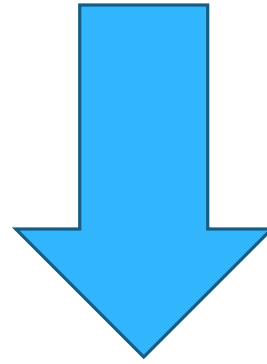
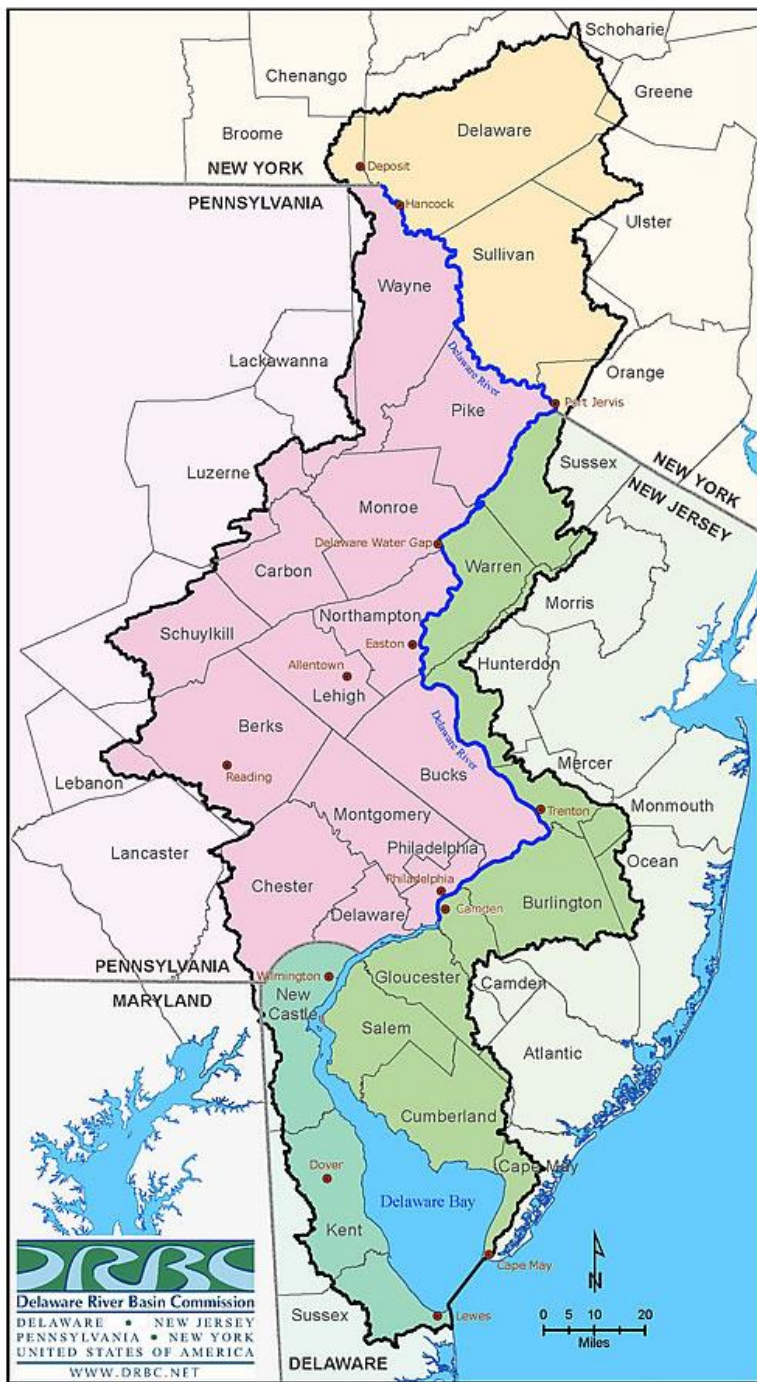


# 2060 Planning Questions

## Water Availability

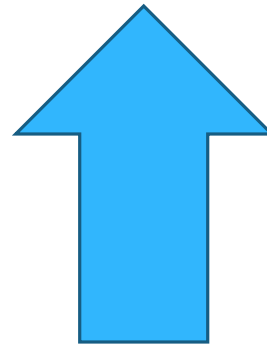
- Adequacy of available storage?
- Adequacy of emergency storage?
- Drought Frequency?
- Adequacy of flow objectives?





## Freshwater Hydrologic Climate Considerations:

- Precipitation
  - Flow
- Temperature
  - Evapotranspiration
  - Snowpack



## Salt Water Climate Considerations:

- Sea Level Rise

# Climate Change in New Jersey



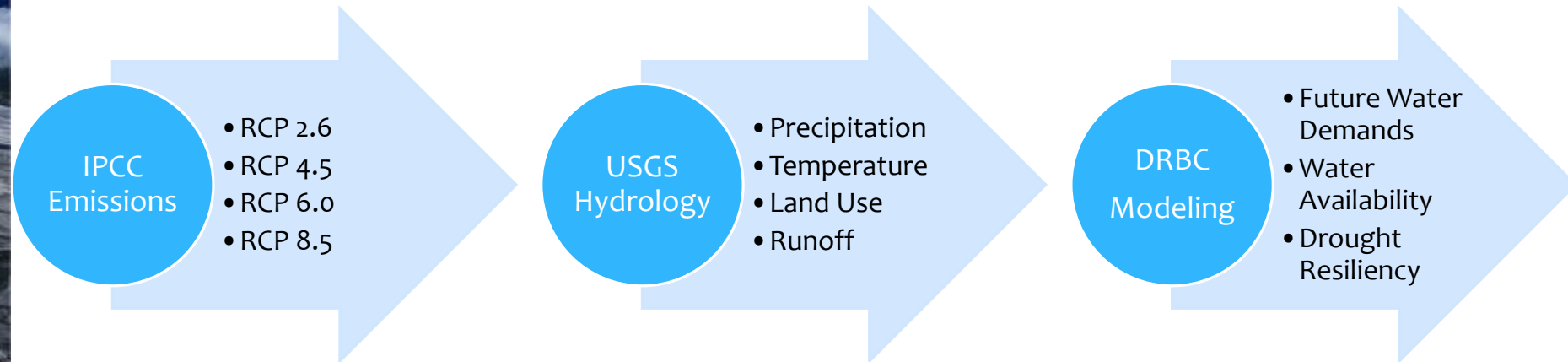
- More warm extremes and fewer cold extremes
- Heavy rains become more intense
- More frequent dry spells
- Rising sea level with increased frequency and intensity of coastal flooding

*From RCI Co-Director **Tony Broccoli** featured at September 27, 2017 statewide conference *Climate Change Policy in New Jersey: Advancing Opportunities to make New Jersey Safer, Greener, Healthier and More Prosperous* , sponsored by the [New Jersey Climate Adaptation Alliance](#).*



# Climate Scenarios

## Temperature and Precipitation



IPCC = Intergovernmental Panel on Climate Change

RCP = Representative Concentration Pathways  
(Carbon Dioxide Emissions)

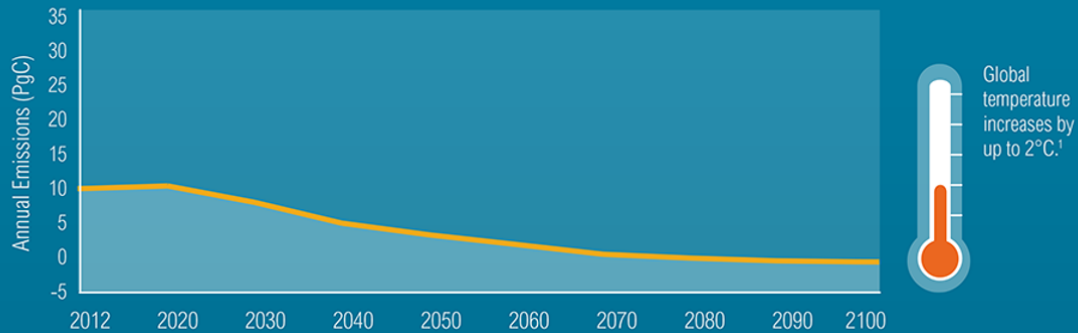
<http://www.ipcc.ch/report/ar5/wg1/>

# Representative Concentration Pathways (RCPs)

<http://www.wri.org/ipcc-infographics>

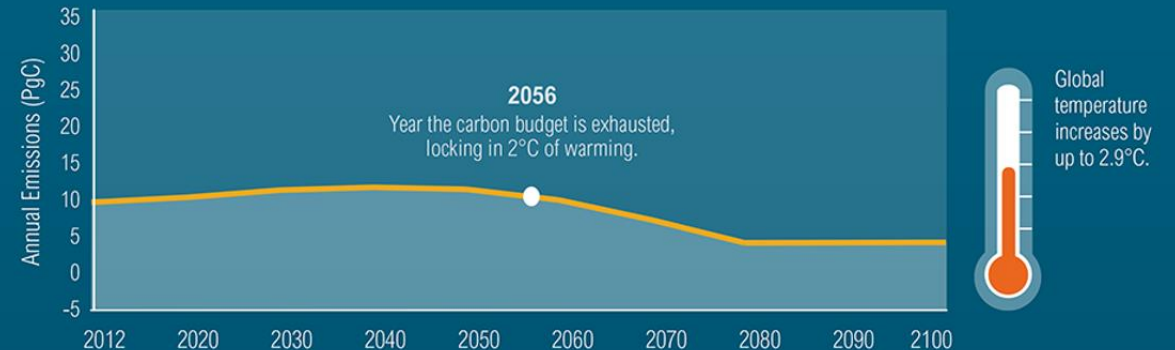
## LOW EMISSIONS PATHWAY RCP 2.6

Carbon dioxide emissions peak by 2020 and then drop 66 percent below 2010 levels by 2050. While the world will still experience some climate impacts under this pathway, they grow exponentially worse under higher emissions scenarios.



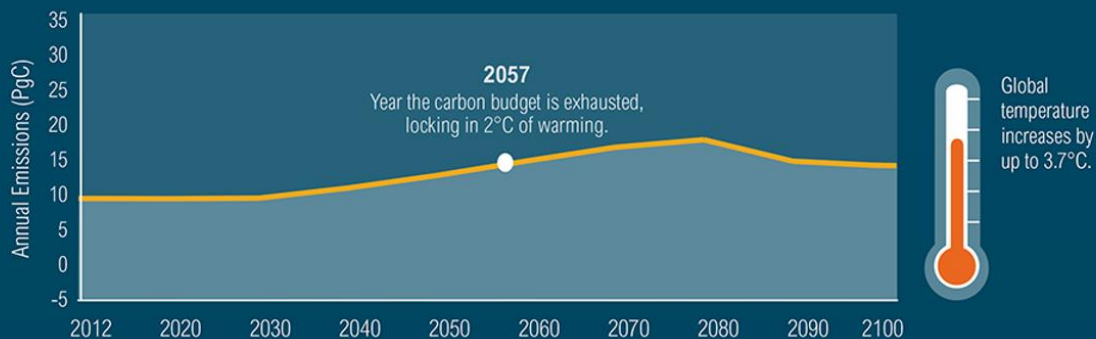
## MEDIUM EMISSIONS PATHWAY RCP 4.5

Carbon dioxide emissions peak by 2040, but still rise 19 percent above 2010 levels by 2050.



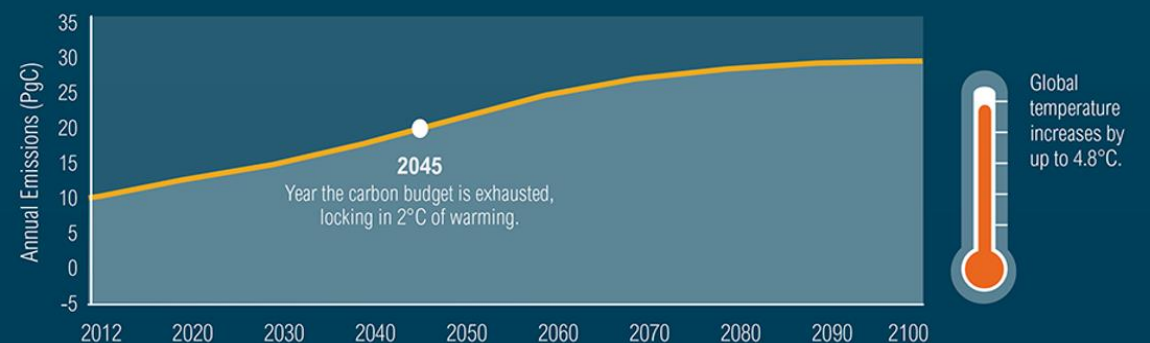
## HIGH EMISSIONS PATHWAY RCP 6.0

Carbon dioxide emissions peak by 2080, but still rise 34 percent above 2010 levels by 2050.



## HIGHEST EMISSIONS SCENARIO RCP 8.5

Annual carbon dioxide emissions continue to rise through 2100, rising 108 percent above 2010 levels by 2050.



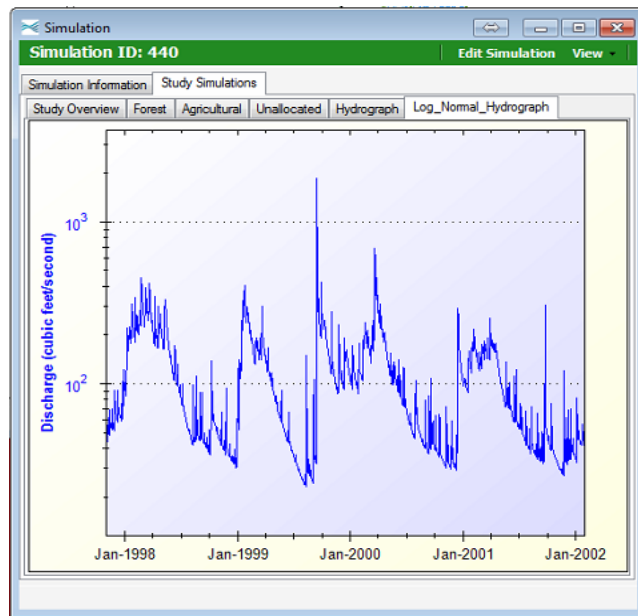
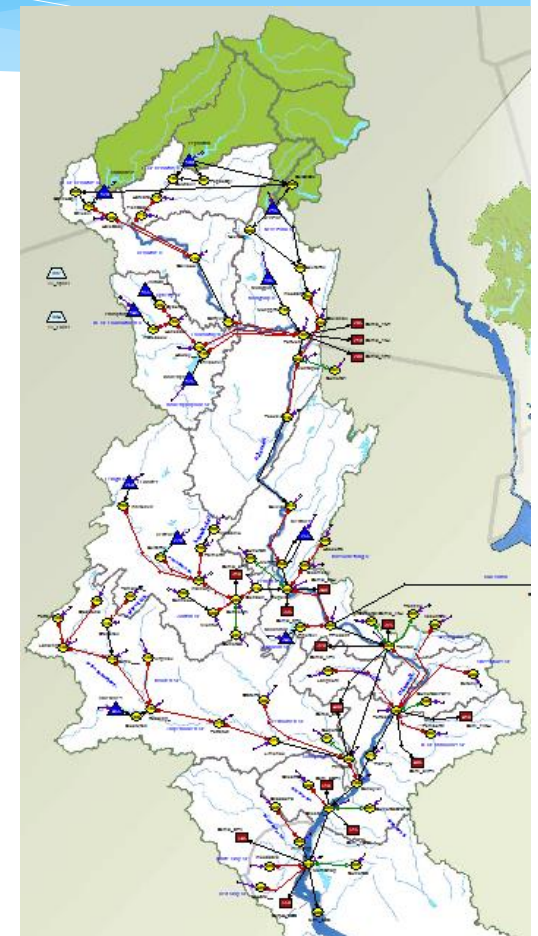
# Models

## DRBC Model

### Inflows

### Water Use Data

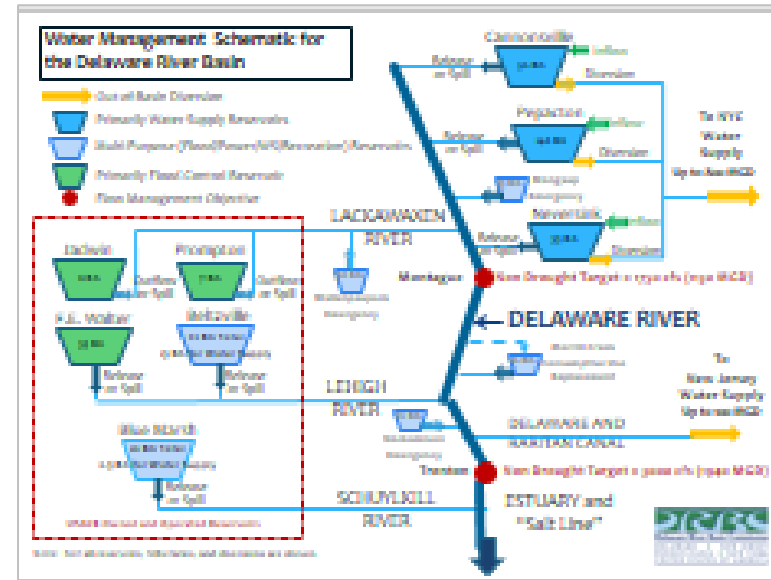
### Flow Management Rules



USGS WATER



DRBC, States



Water Code, FFMP, Dockets

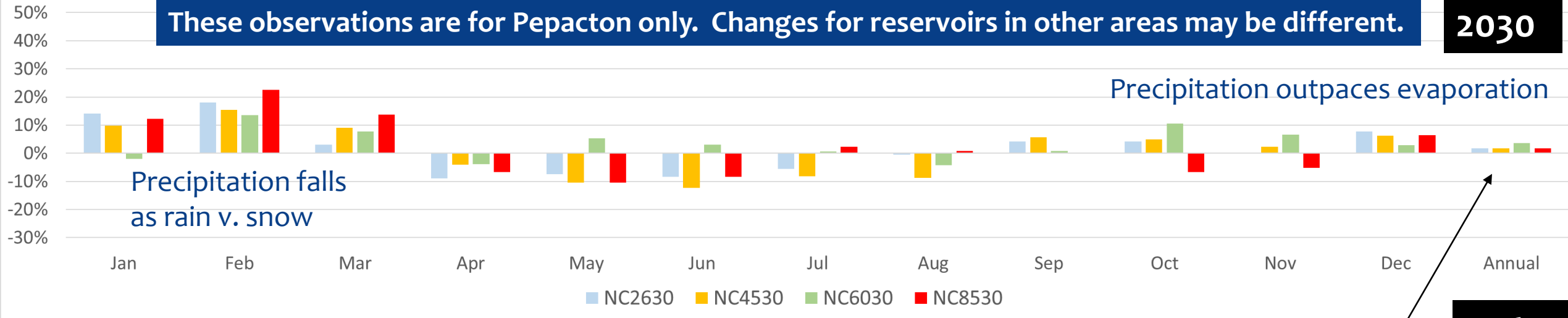


**PRELIMINARY**

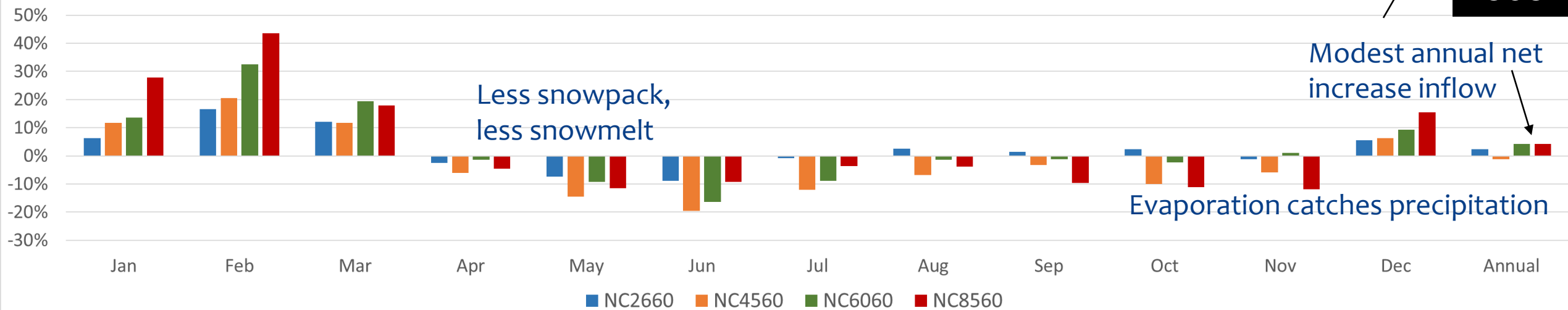
# Changes in Reservoir Inflows (Pepacton)

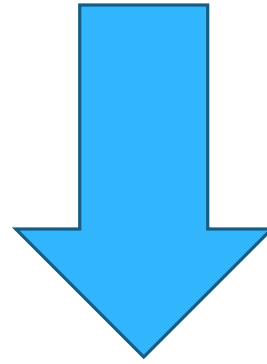
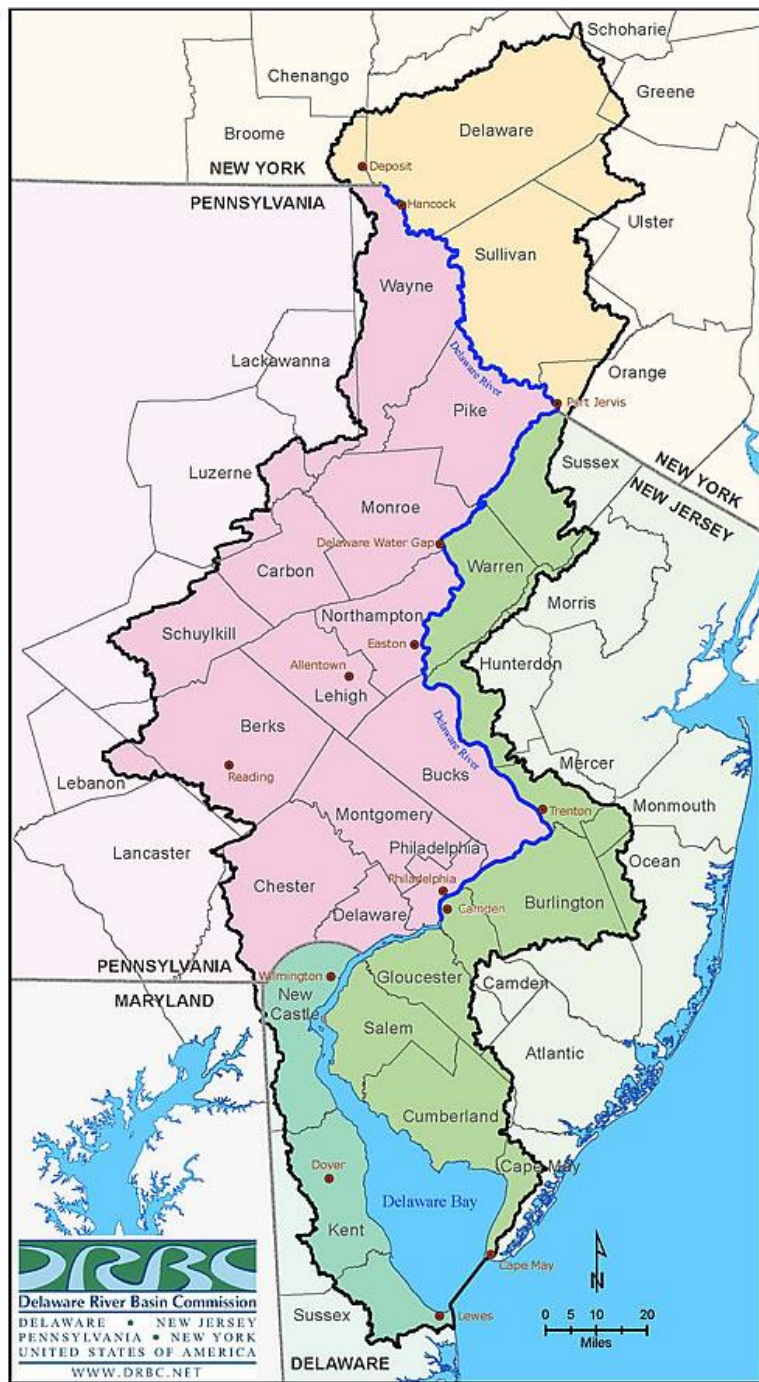
**These observations are for Pepacton only. Changes for reservoirs in other areas may be different.**

**2030**



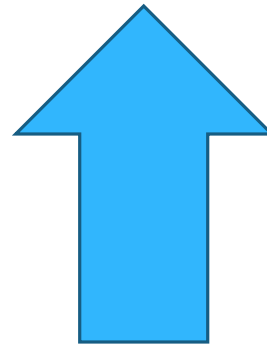
**2060**





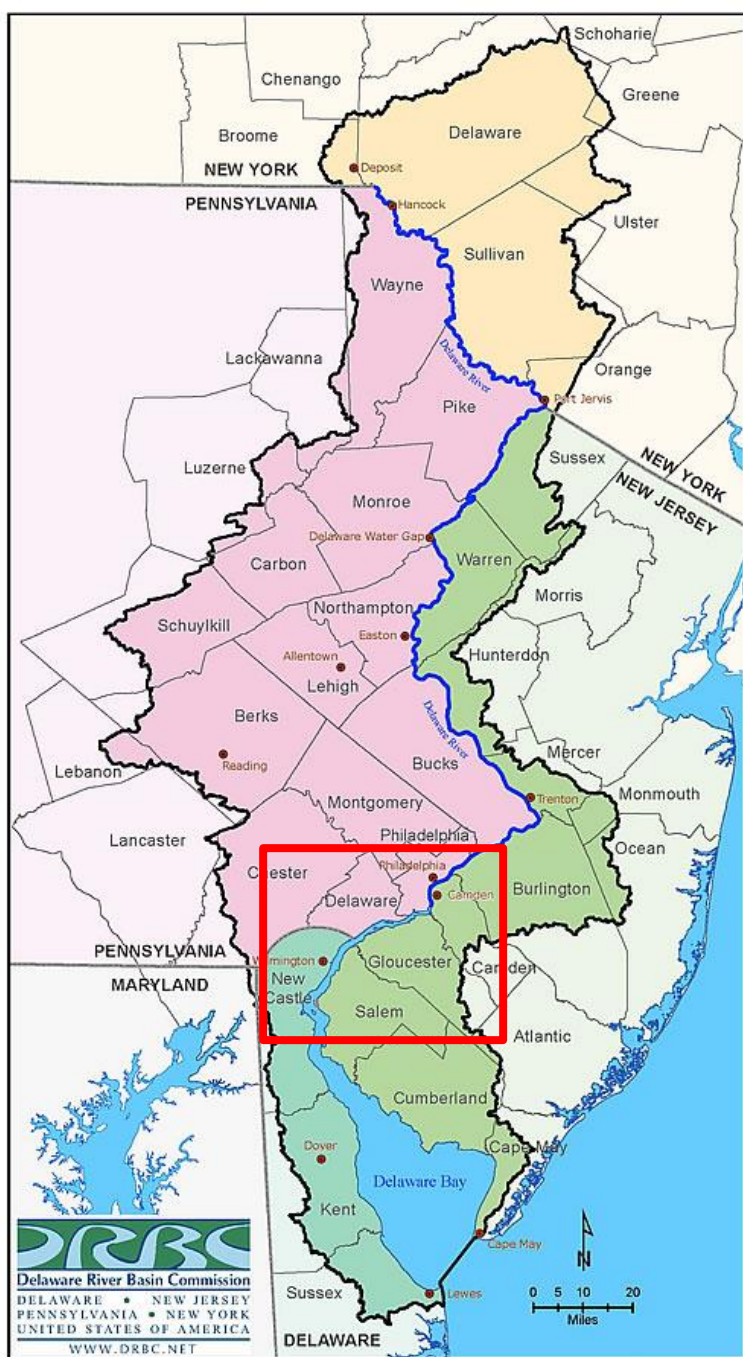
## Freshwater Hydrologic Climate Considerations:

- Precipitation
  - Flow
- Temperature
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  - Snowpack



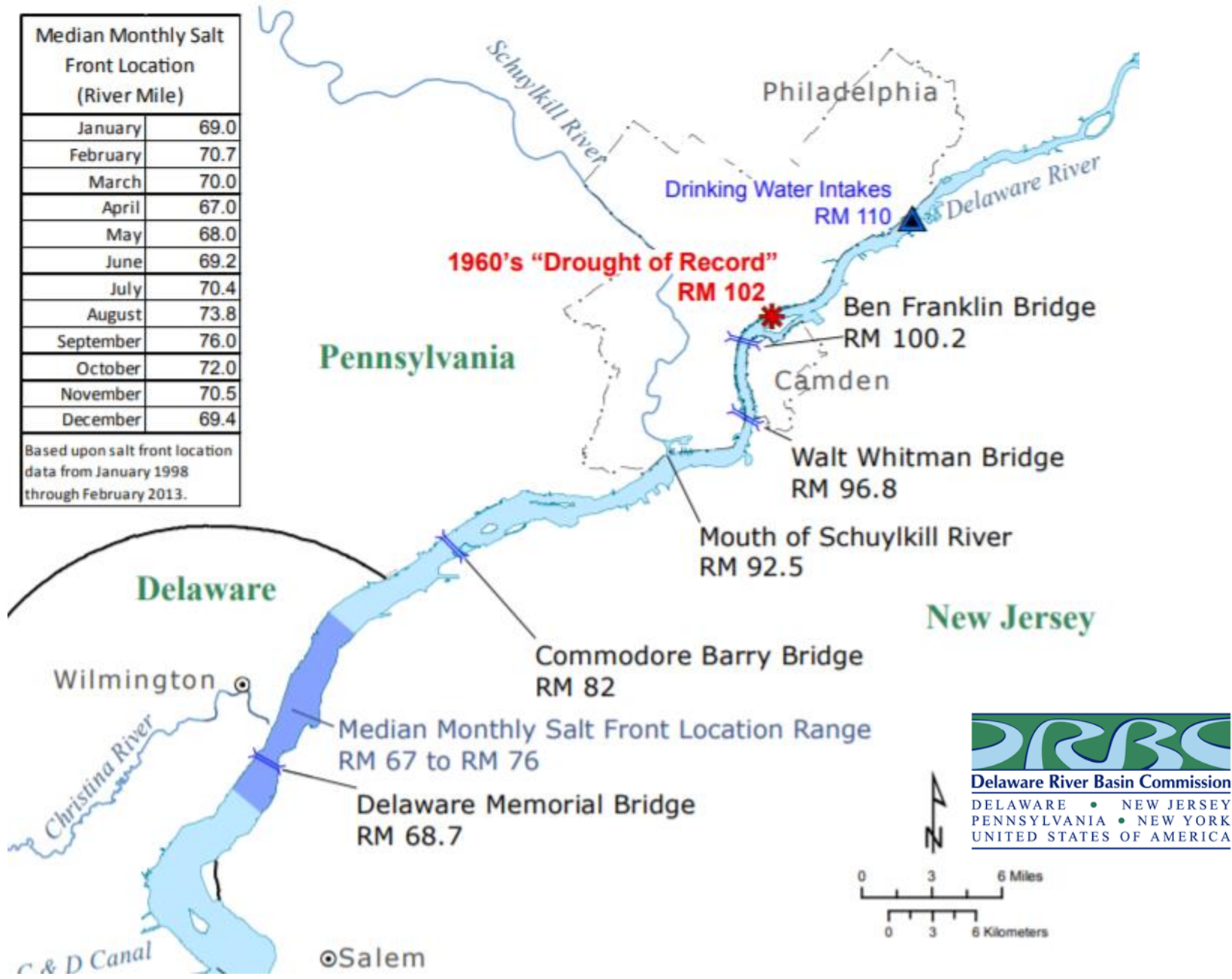
## Salt Water Climate Considerations:

- Sea Level Rise



Median Monthly Salt Front Location (River Mile)	
January	69.0
February	70.7
March	70.0
April	67.0
May	68.0
June	69.2
July	70.4
August	73.8
September	76.0
October	72.0
November	70.5
December	69.4

Based upon salt front location data from January 1998 through February 2013.



Median Monthly Salt Front Location (River Mile)	
January	69.0
February	70.7
March	70.0
April	67.0
May	68.0
June	69.2
July	70.4
August	73.8
September	76.0
October	72.0
November	70.5
December	69.4

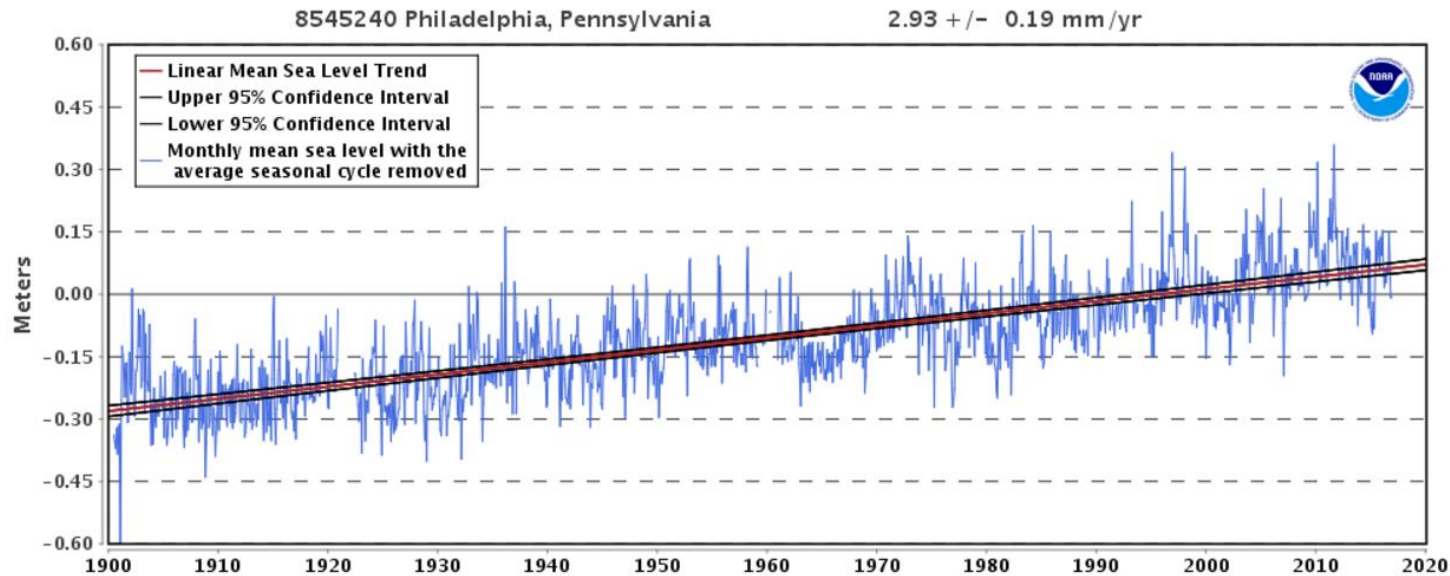
Based upon salt front location data from January 1998 through February 2013.



# Sea Level Rise

“**Regional Sea Level Change Projections:** It is very likely that in the 21st century and beyond, **sea level change will have a strong regional pattern**, with some places experiencing significant deviations of local and regional sea level change from the global mean change.” -IPCC 2013

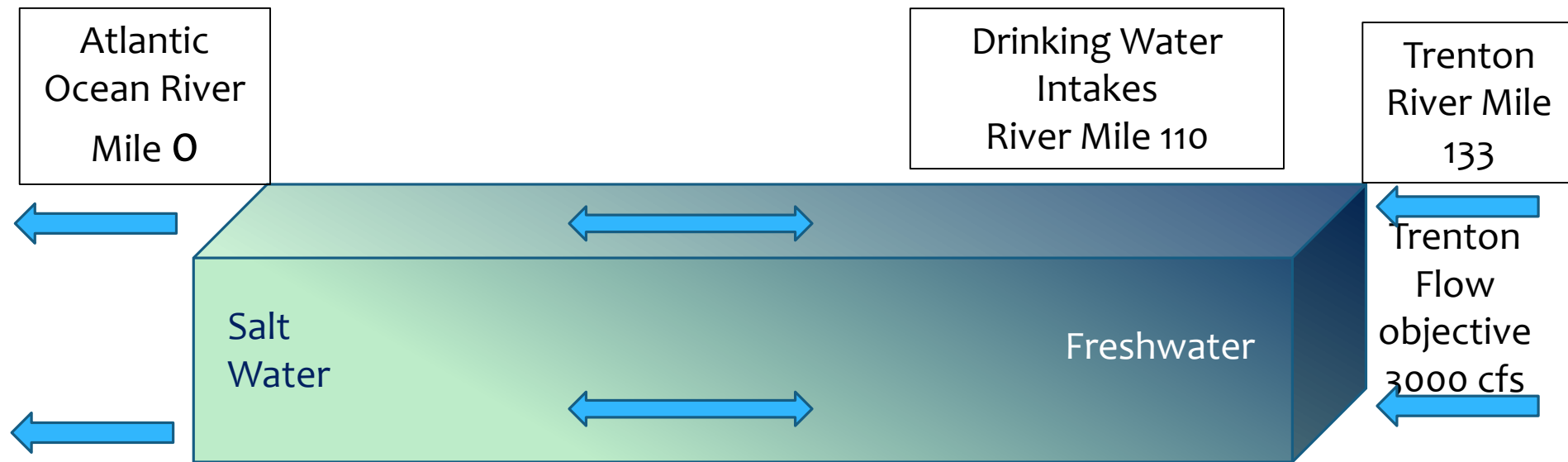
Mean Sea Level Trend  
8545240 Philadelphia, Pennsylvania



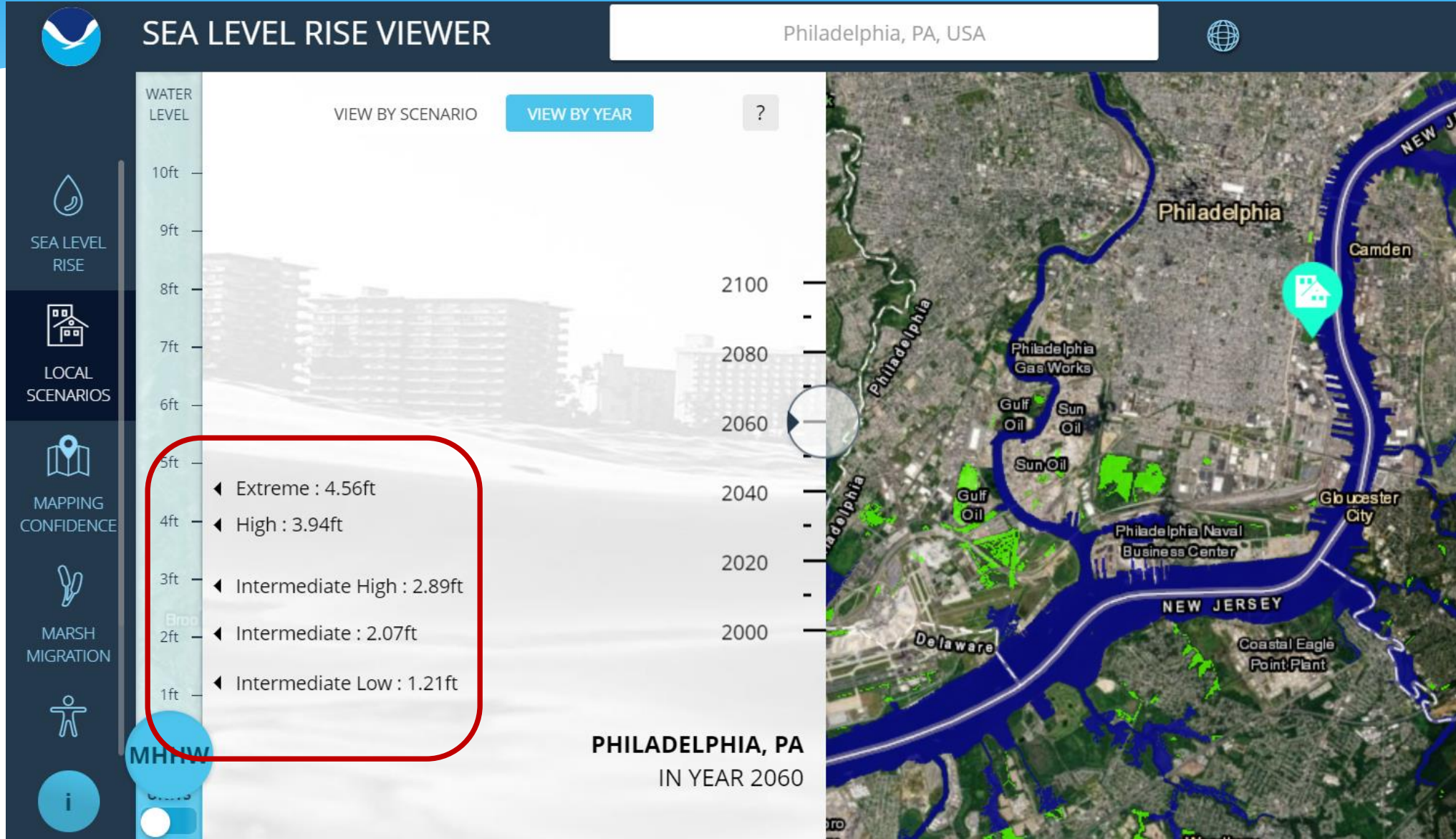
Philadelphia, PA  
2.93 mm / year  
0.96 ft. / 100 years



# Sea Level Rise and Salinity

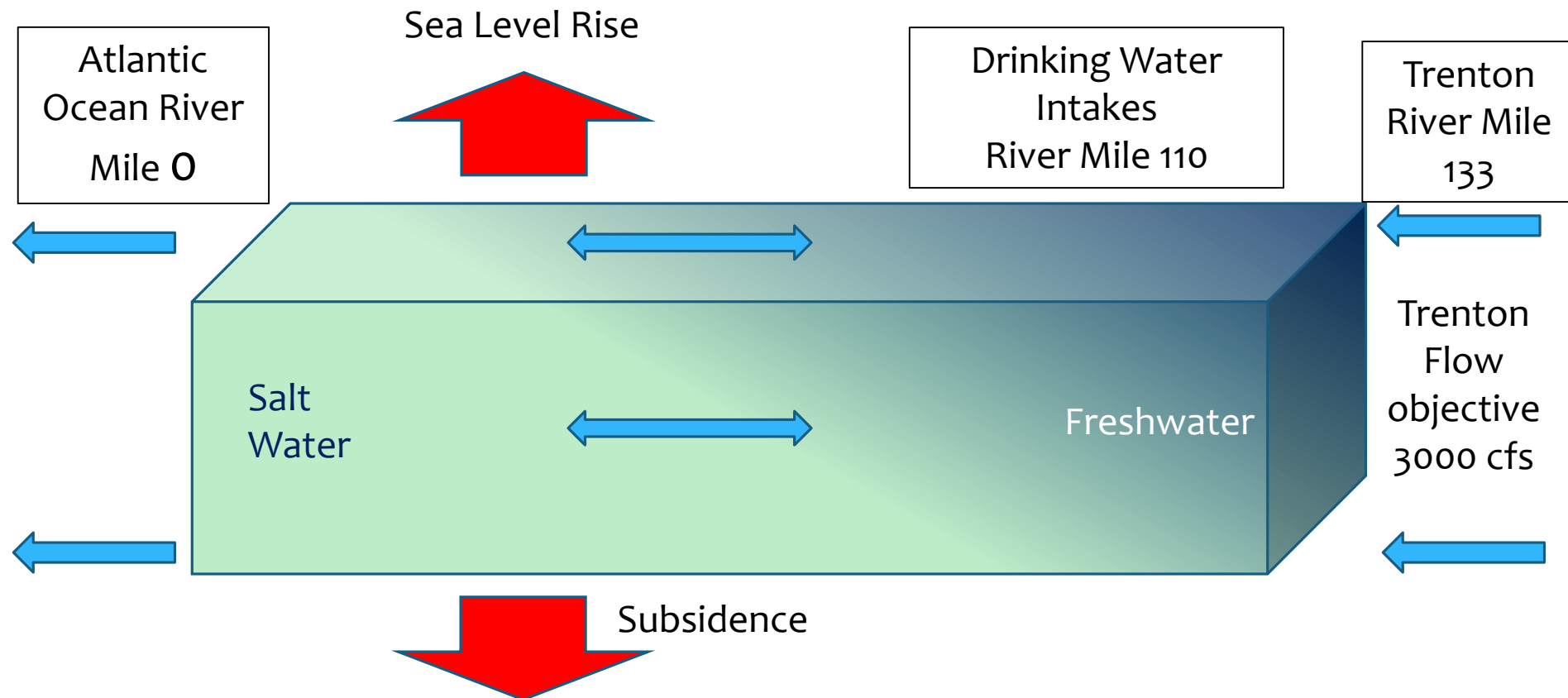


# NOAA Sea Level Rise Viewer Philadelphia, PA @ 2060

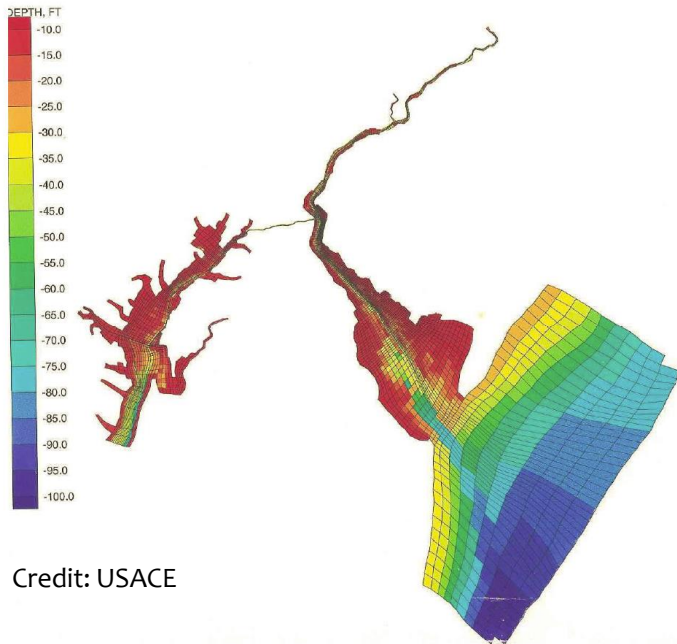


# Sea Level Rise and Salinity

? Future Ocean and River Salinities ?



# Sea Level Rise Modeling



## June 2010 Report: Application of the Delaware Bay and River 3D Hydrodynamic Model to Assess the Impact of Sea Level Rise on Salinity

- U.S. Army Corps of Engineers (USACE)
- Two Channel Depths (40 and 45 feet)
- Rises of 1, 2 and 3 feet\*
- Conclusions: SLR has a greater impact on salinity than channel deepening

\* NOTE: Current indications are that Sea Level Rise may be 4 feet by 2060 (NOAA SLR Viewer, Beta 3)





# Shad making a big comeback in Delaware River

<https://www.mcall.com/news/local/easton/mc-nws-shad-repopulation-20171101-story.html>

## There's good news for one of N.J.'s most endangered fish



Updated Oct 28, 2017; Posted Oct 28, 2017

[https://www.nj.com/news/index.ssf/2017/10/atlantic\\_sturgeon\\_still\\_depleted\\_but\\_slowly\\_recover.html](https://www.nj.com/news/index.ssf/2017/10/atlantic_sturgeon_still_depleted_but_slowly_recover.html)

### NEW JERSEY, DELAWARE EASE ADVISORIES ON CERTAIN FISH

TOM JOHNSON | FEBRUARY 21, 2018

<https://www.njspotlight.com/stories/18/02/20/new-jersey-delaware-ease-advisories-on-certain-fish/>

## Mapping the Delaware River Waterfront's building boom

*Big changes are coming to the waterfront*

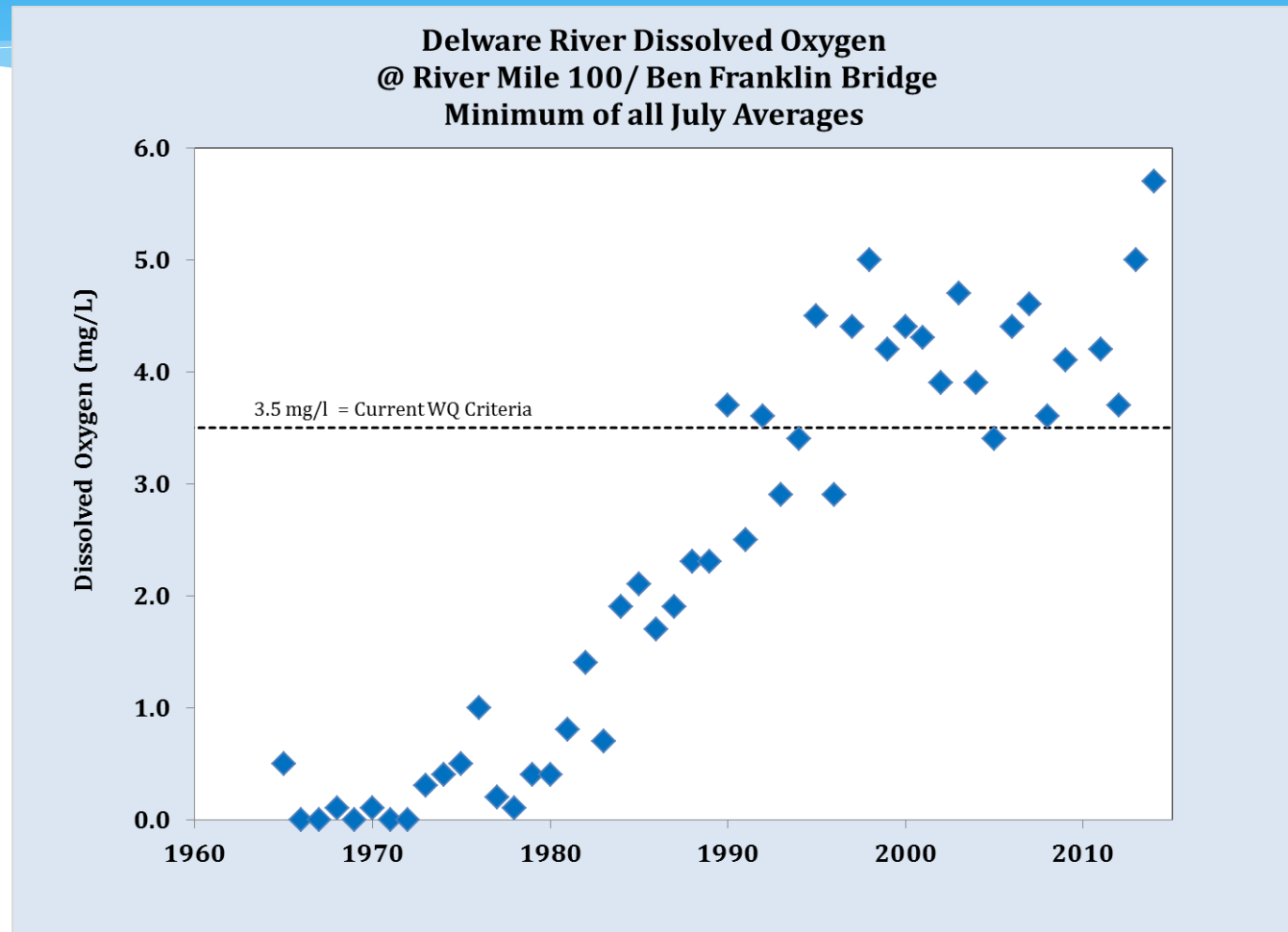
By **Melissa Romero** and **Anna Merriman** | Updated Sep 26, 2018, 5:30pm EDT

<https://philly.curbed.com/maps/delaware-river-philadelphia-development-projects>

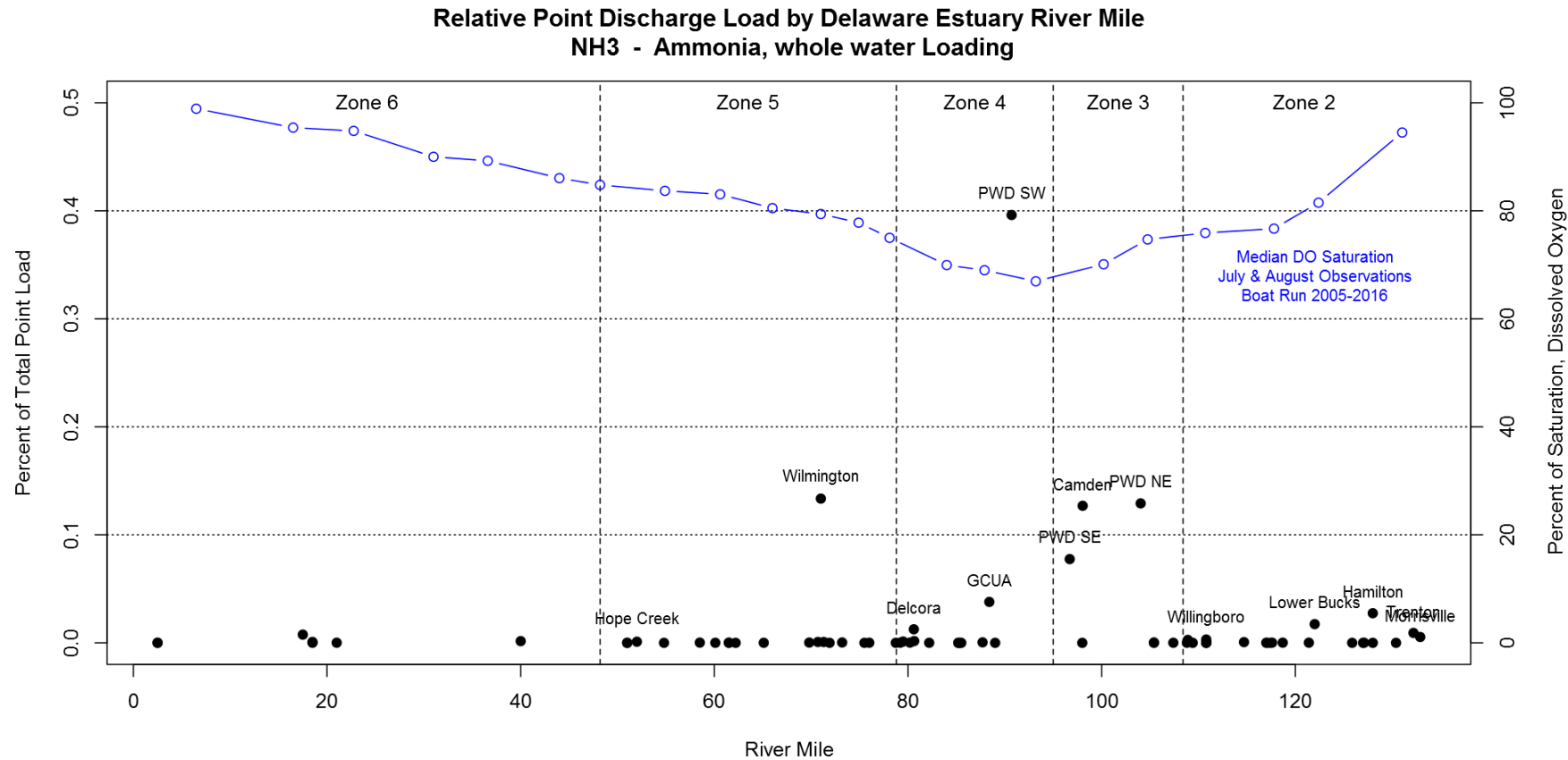
# Water Quality - A “dead” river zone restored...and more

## Value-added management examples:

- **Dissolved Oxygen** – 30 mile “dead zone” near Philadelphia pre-DRBC
- ✓ Pre Clean Water Act WQ Standards
- ✓ CWA and Treatment @ POTWs
- ✓ Delaware River designated uses and Criteria set in 1967 surpassed
- ✓ American Shad returning
- ✓ Atlantic Sturgeon spawning
- ✓ Designated use in the Estuary needs to be revisited



# Delaware Estuary DO Sag



The Dissolved Oxygen “sag” in the Estuary is primary influenced by point source discharges

# Review of Aquatic Life Uses in the Estuary

- **September 2017. DRBC Commissioners approves Resolution to Review Aquatic Life Uses in Delaware River Estuary in Recognition of Improved Water Quality.**
  - Conduct additional **studies** of the occurrence, spatial and temporal distribution of the **life stages of important fish species** that utilize the estuary.
  - Determine the dissolved oxygen requirements the **oxygen-depleting nutrient loadings** from point (end-of-pipe) and nonpoint (runoff) sources that can be discharged into the tidal river while maintaining the dissolved oxygen levels in the water.
    - \* Develop a Eutrophication Model for the Estuary.
    - \* Formed a model expert Panel and engaged a modeling consultant to assist staff.
    - \* Developed and implemented a two year intensive nutrient modeling plan for with additional estuary monitoring points and additional tiered monitoring at key point sources



# Review of Aquatic Life Uses in the Estuary

- Conduct an engineering analysis to determine the **attainability of the dissolved oxygen requirements** and water quality standards that would result in an upgrade in the designated aquatic life use in this 38-mile stretch of the tidal Delaware River, **including technical, social, and economic factors**; and
- Identify and evaluate **opportunities for early action** to reduce oxygen-depleting discharges in the short term.



WATERSHED PROTECTION

William Penn Foundation gives \$42M to protect Delaware River, bringing total to \$100M

Posted: Wednesday, April 4, 2018

<http://www2.philly.com/philly/health/environment/william-penn-foundation-delaware-river-watershed-cleanup-20180404.html>

Source: Philadelphia Inquirer



U.S. Fish & Wildlife Service

## Delaware River Basin Restoration Program

*A conservation action partnership*

New fund launched to support Delaware watershed conservation efforts



Office of the  
**Delaware River  
Master**

**Flexible Flow Management Program**



Coalition *for the*  
**Delaware River  
Watershed**



Delaware River Watershed Initiative

# Steve Tambini, Executive Director

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*www.drbc.gov*



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

*Managing Our Shared Water  
Resources since 1961*