Water Withdrawals in the Delaware River Basin: Past Trends and Future Planning

2014 AWRA Annual Water Resources Conference

Tyson's Corner, VA

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Today's Talk …

… is about:

- Where we have come from regarding water use in the DRB
- What are the current trends
- Where might we may be heading

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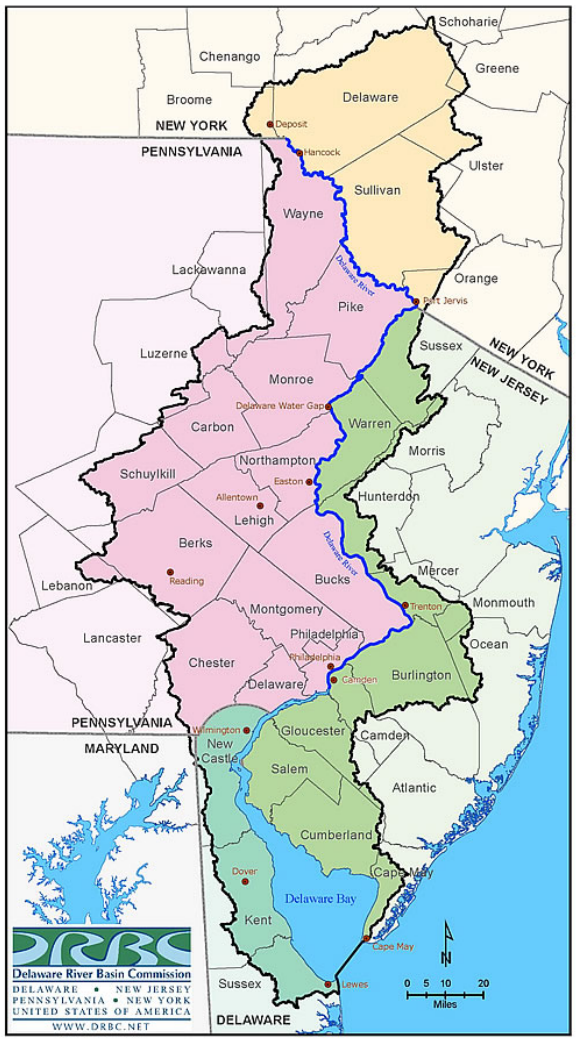
“A river is more than an amenity, it is a treasure”

-US Supreme Court Justice
Oliver Wendell Holmes

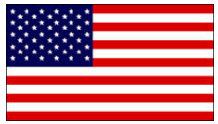


Fast Facts:

- Delaware River Main stem river is **330 miles long**
- **Drains 13,539 square miles** of watershed.
- **15+ million people** (about 5% of the U.S. population) rely on the waters of the Delaware River Basin
- Water **withdrawal** in the Basin = **8.3 billion gallons a day**
- **Contributes over $21B in economic value** to the Region.

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

U. S. ESTIMATES 1950 - 2005

U.S. POPULATION TRENDS AND GROWTH IN TOTAL WATER DEMAND

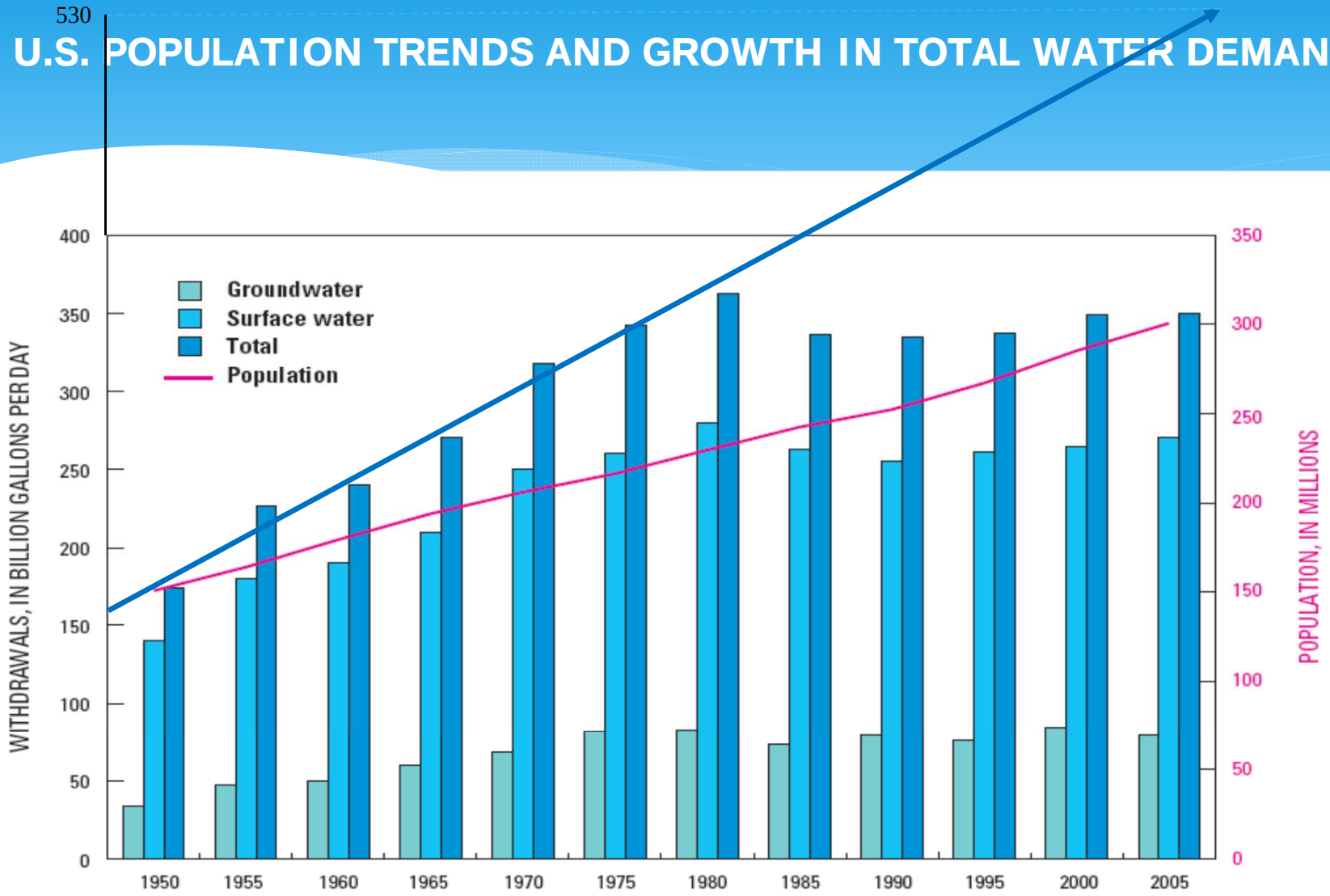
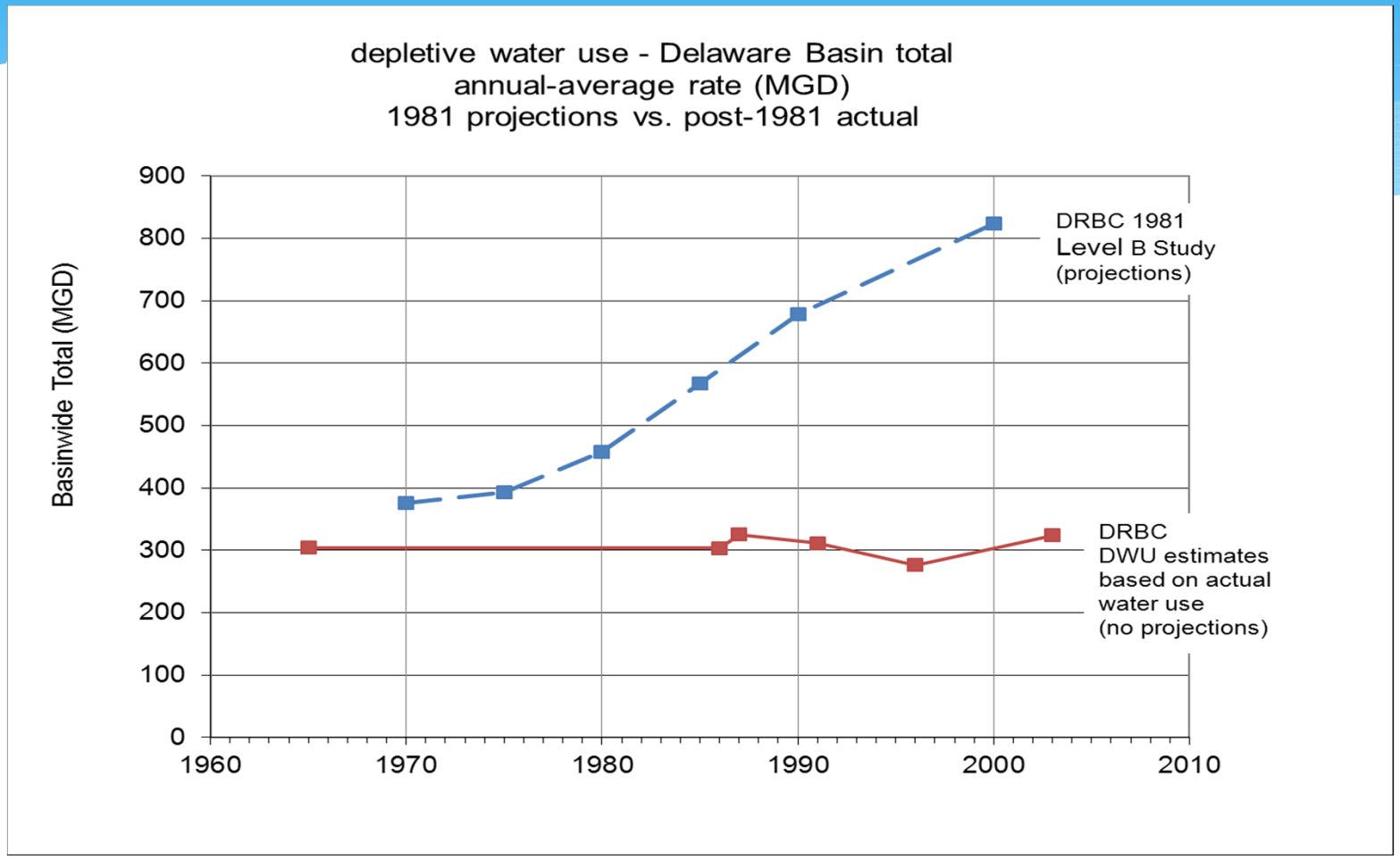


Figure 13. Trends in population and freshwater withdrawals by source, 1950–2005.

USGS report: Estimated use of water in the United States in 2005

TRENDS IN DEPLETIVE USE IN THE DELAWARE RIVER BASIN



The Delaware Basin total DWU shown in the above figure:

- corresponds to the whole basin and includes DWU from surface water and groundwater sources
- does not include out-of-basin diversions to NYC (via Rondout reservoir) and NJ (via the Delaware & Raritan Canal)

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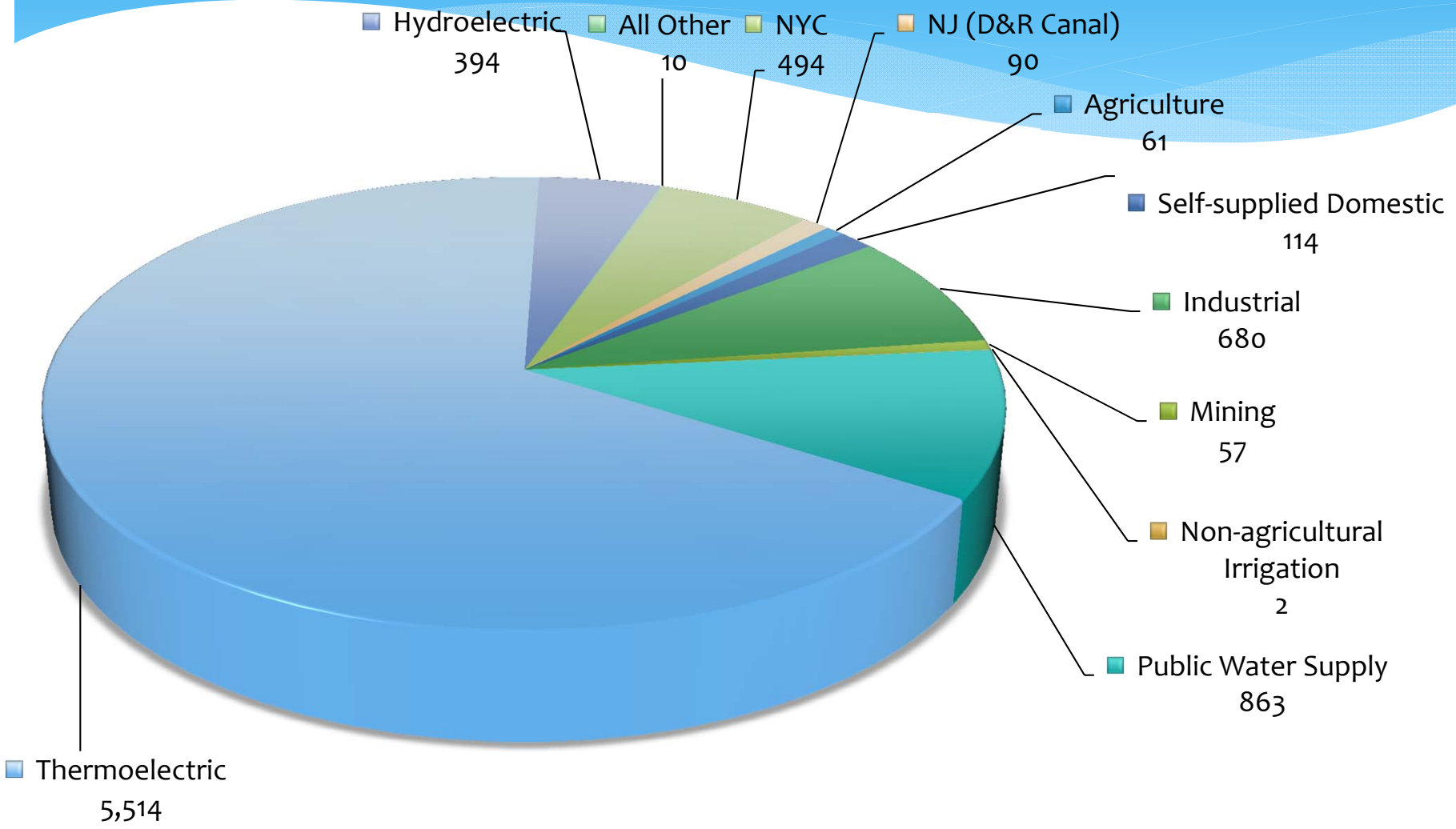
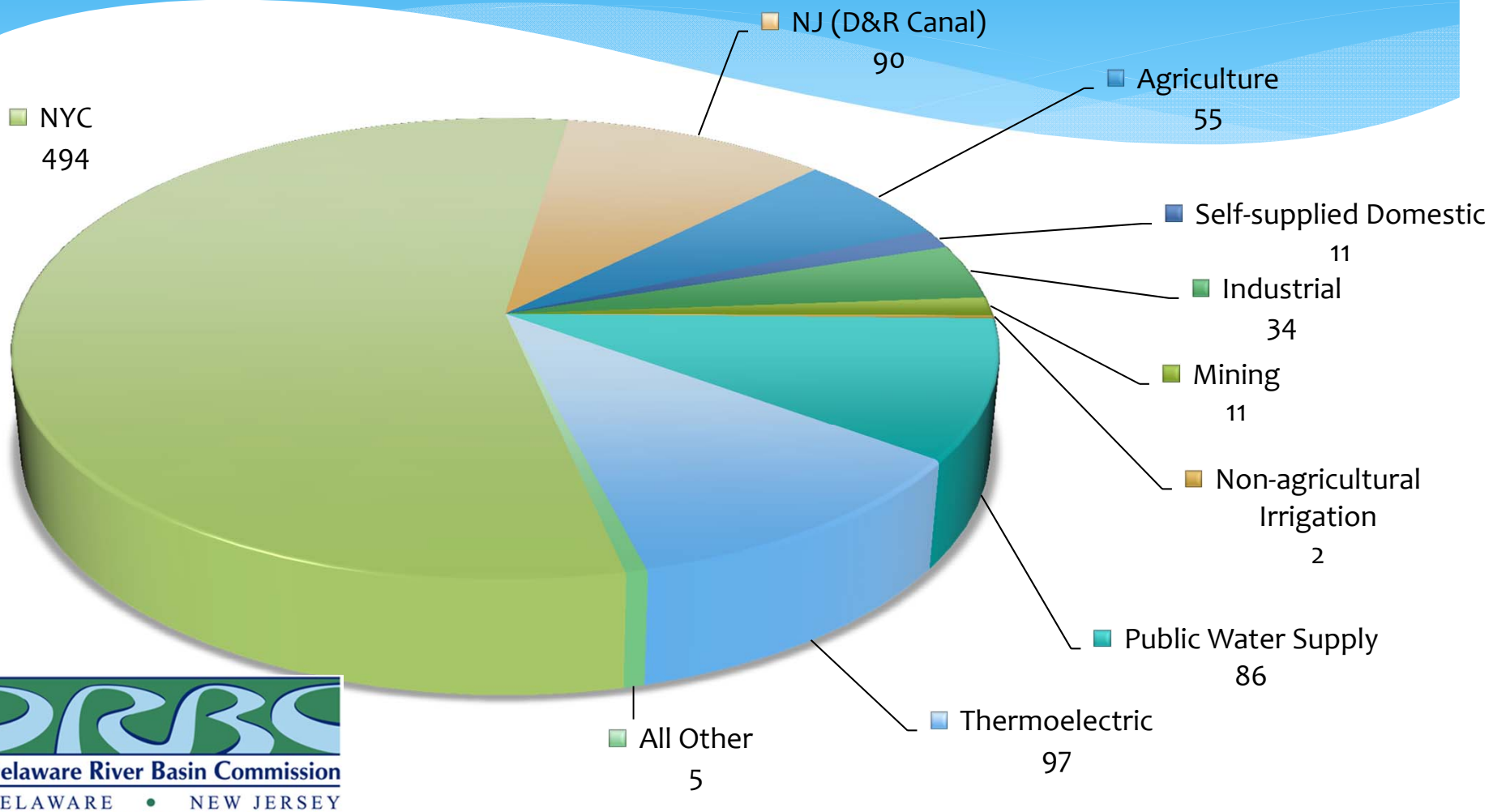
DRB – Total Withdrawals

8,279 Million Gallons / Day



DRB – Total Consumptive Withdrawals

886 Million Gallons / Day



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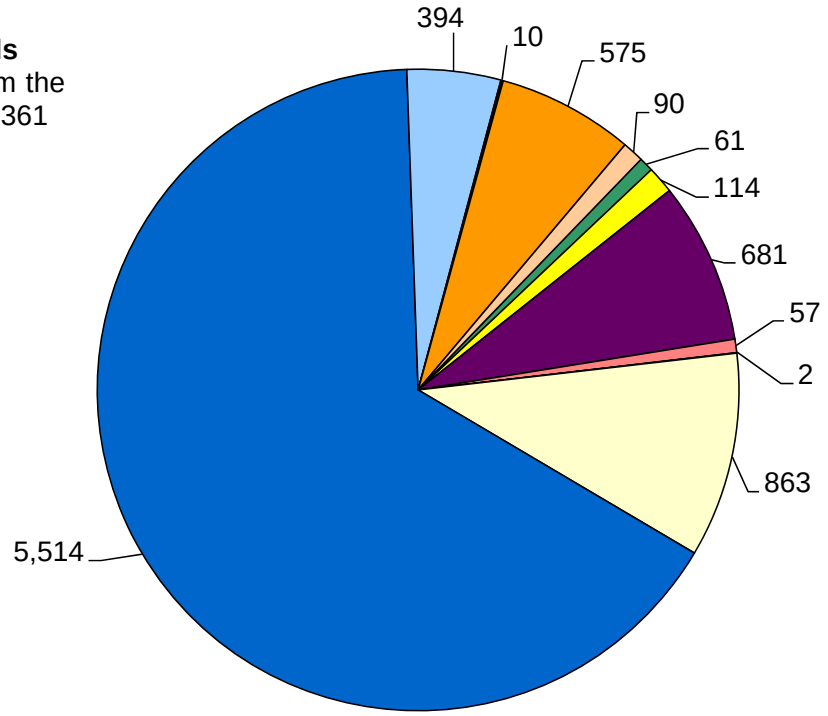
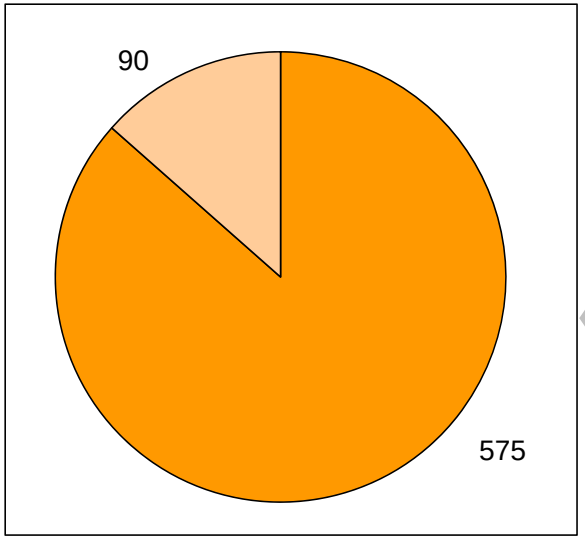
Daily Water Withdrawals, Exports and Consumptive Use in the Delaware River Basin

Total Water Withdrawals (ground and surface) from the Delaware River Basin: 8,361 mgd

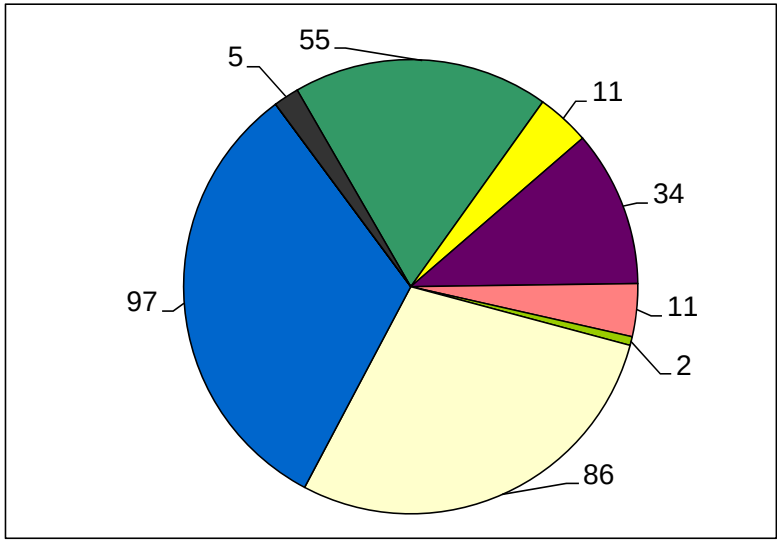


- Agriculture
- Self-supplied Domestic
- Industrial
- Mining
- Non-agricultural Irrigation
- Public Water Supply
- Thermoelectric
- Hydroelectric
- All Other
- NYC
- NJ (D&R Canal)

Major **Exports** from the Delaware River Basin: 665 mgd



Consumptive Use in the Delaware River Basin: 302 mgd

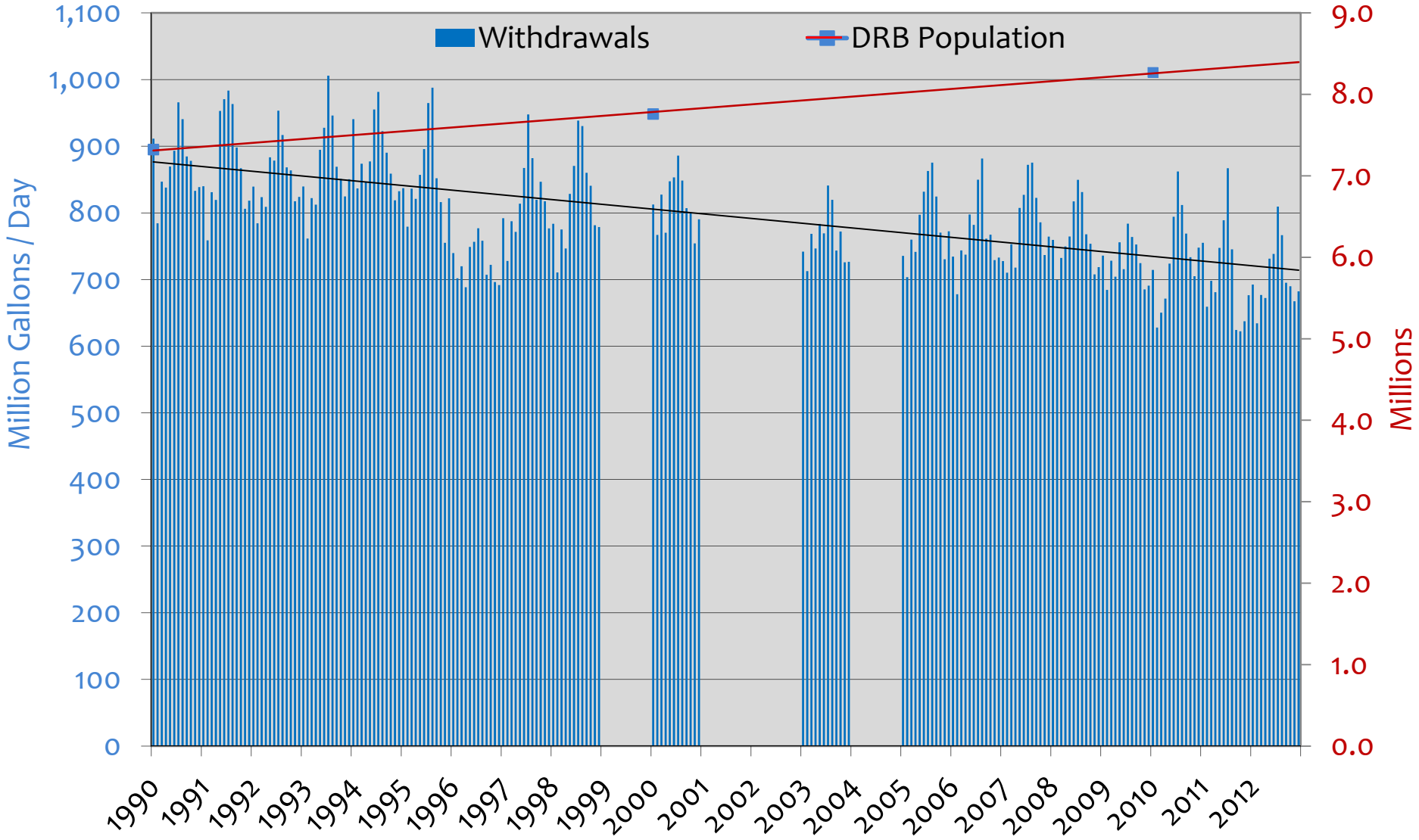


Pie chart values in mgd (million gallons per day)

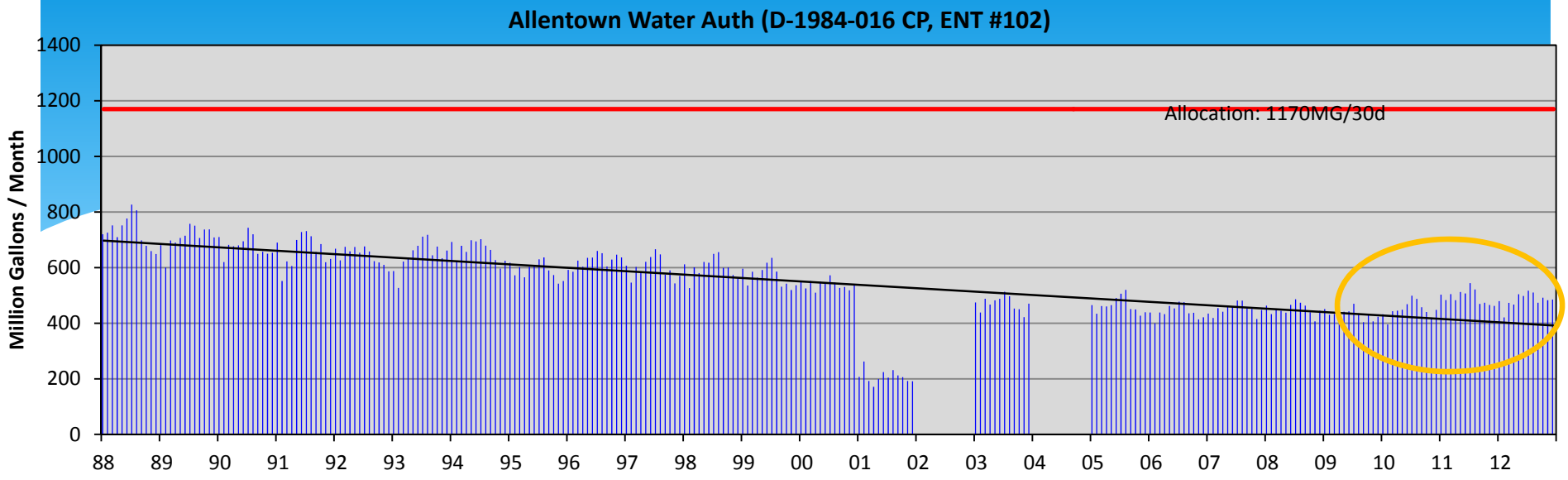
Public Water Supply

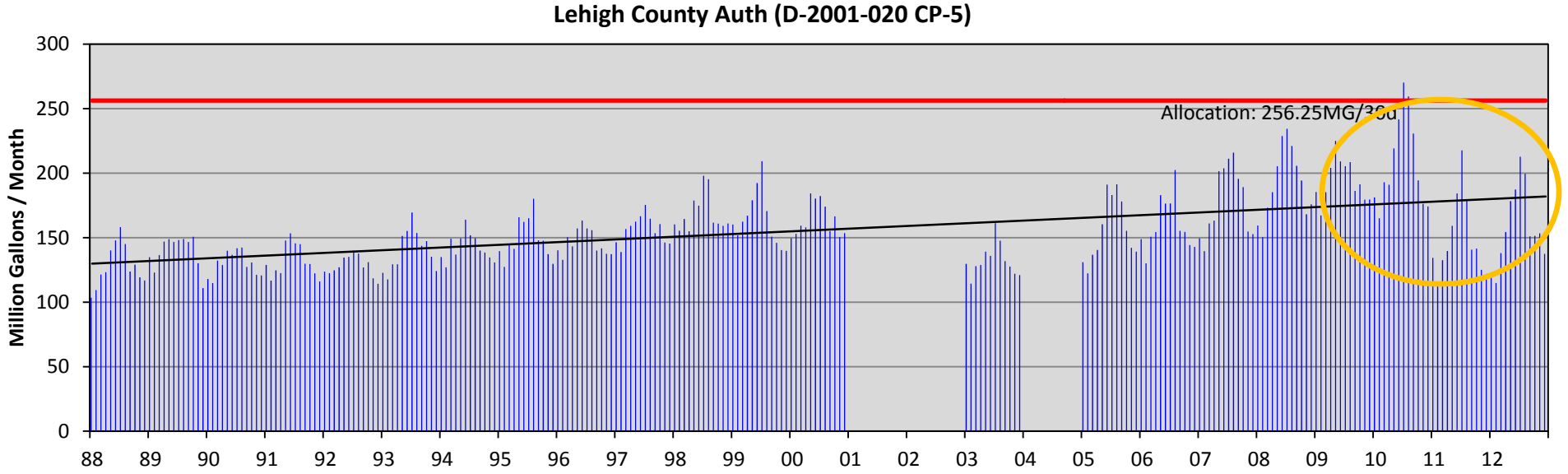
Drinking water fountain in Portland, Oregon. Photo from Creative Commons by Zervas/flickr.

Aggregate Withdrawals of 40 Public Water Supply Systems in the DRB (Million Gallons/Day)



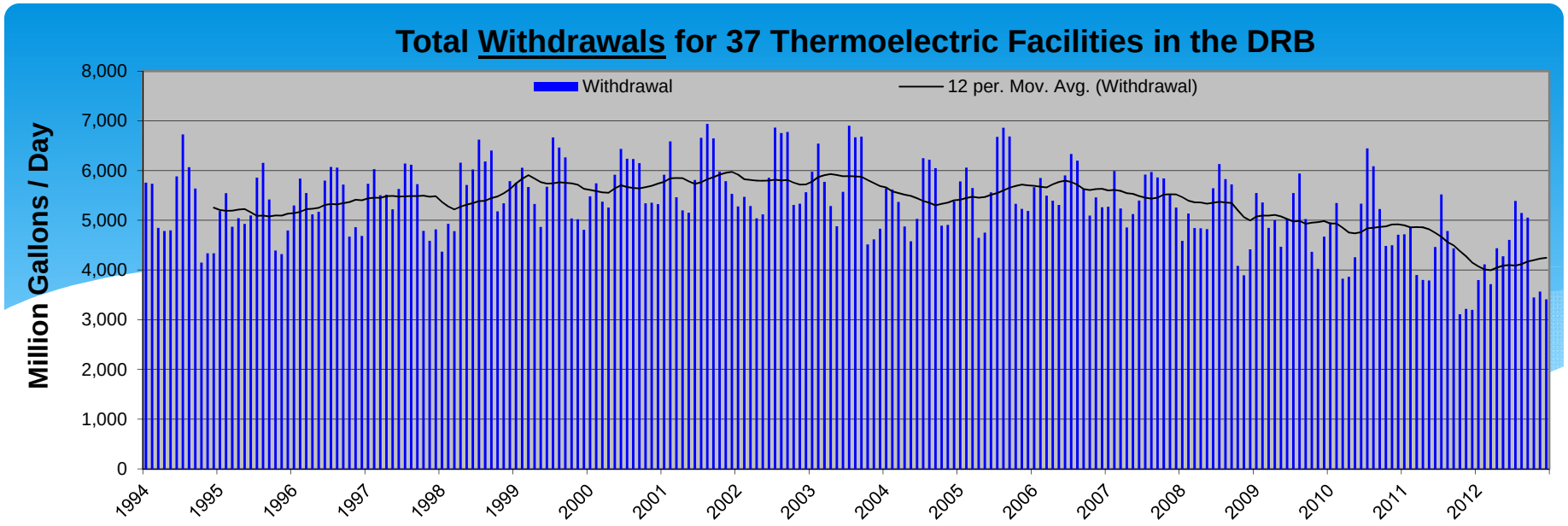
Example of Urban vs Suburban Trends

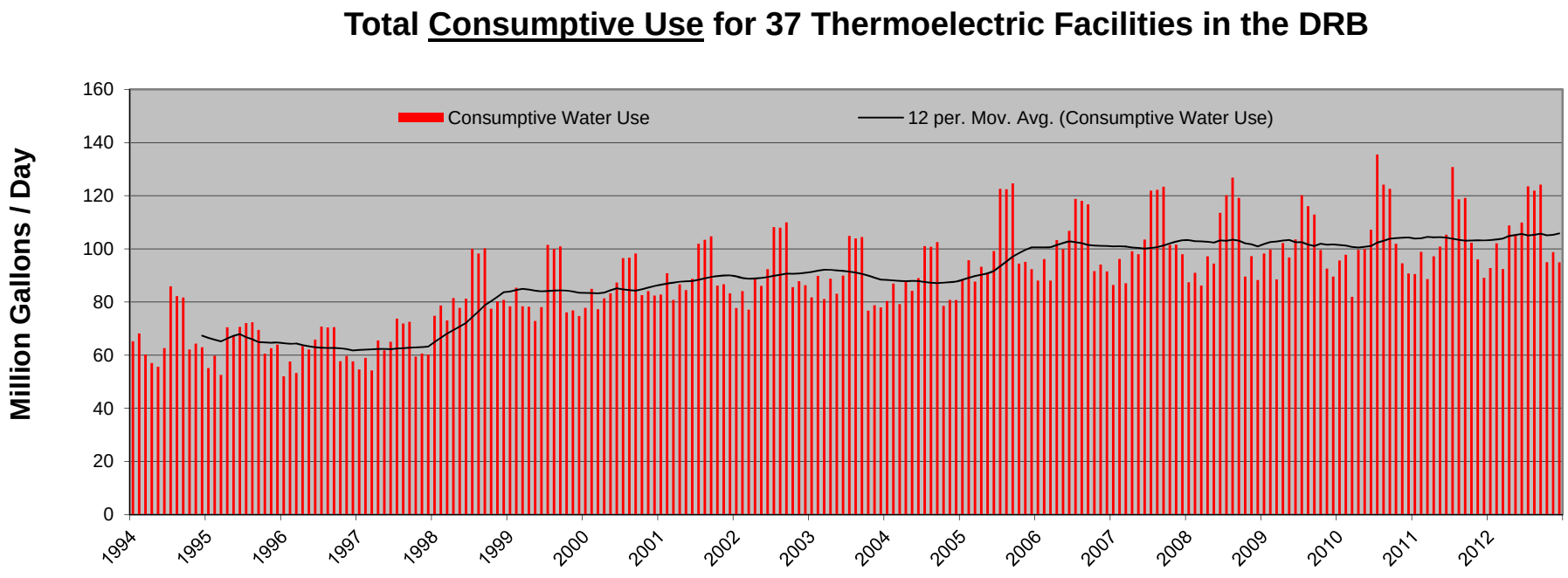




Power Generation

Exelon's Cromby Station; courtesy of Exelon Corp.


Total Withdrawals for 37 Thermoelectric Facilities in the DRB
Million Gallons / Day
Withdrawal
12 per. Mov. Avg. (Withdrawal)
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012


Total Consumptive Use for 37 Thermoelectric Facilities in the DRB
Million Gallons / Day
Consumptive Water Use
12 per. Mov. Avg. (Consumptive Water Use)
160
140
120
100
80
60
40
20
0
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012

Thermoelectric: Cooling systems

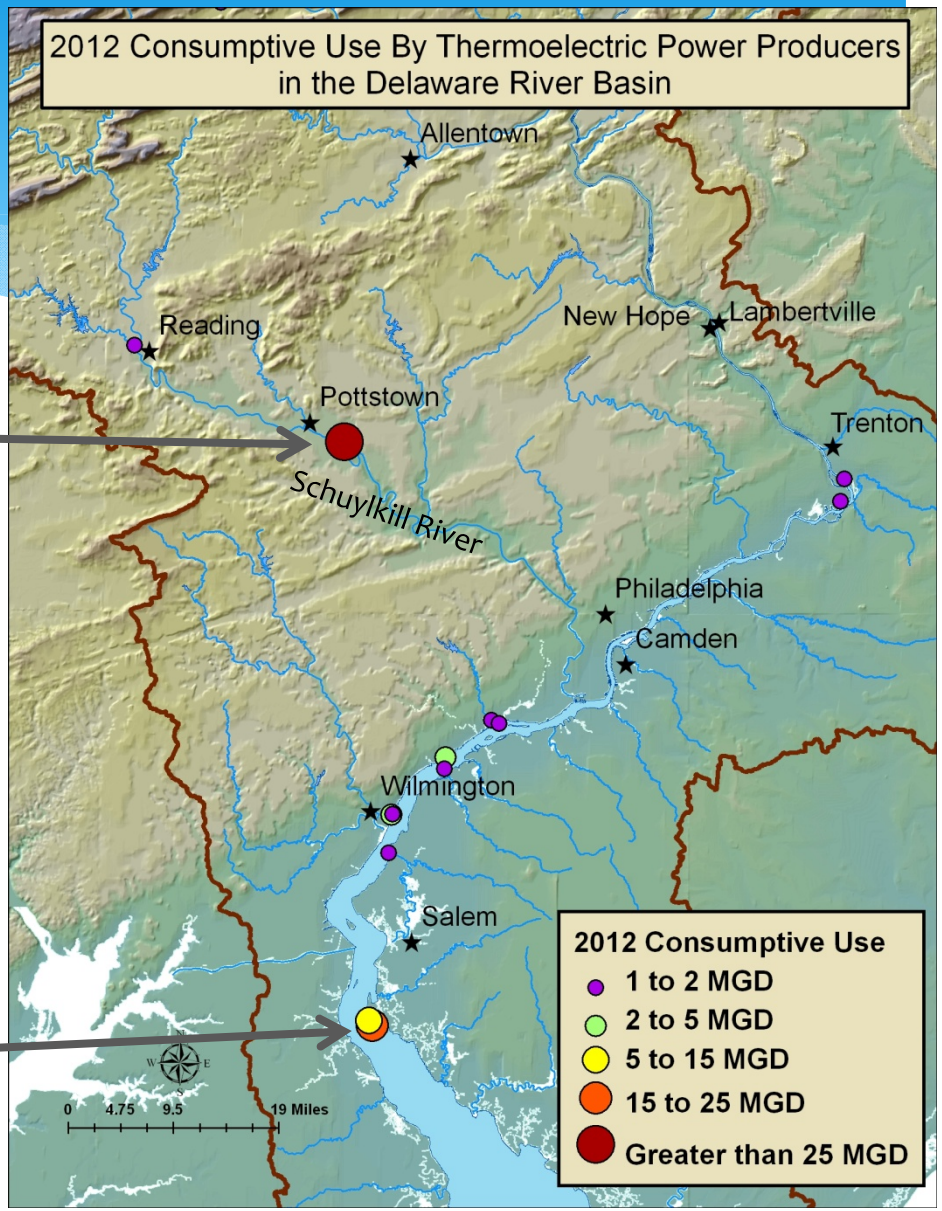
Exelon - Limerick, PA (Evaporative Cooling)

2,295 MW
40 MG/d withdrawal;
32 MG/d consumptive use

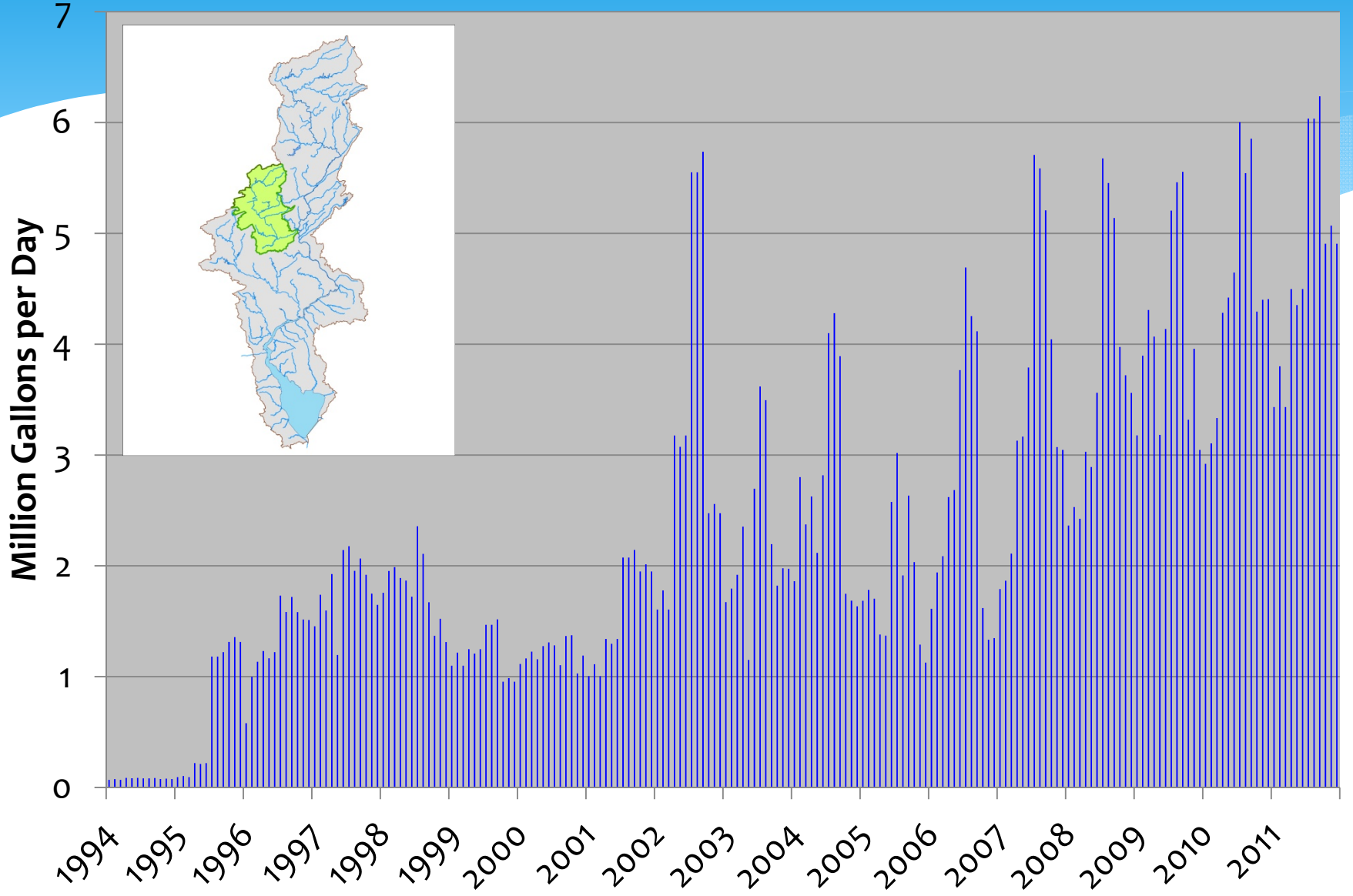
Limerick Generating Station, Unit 1; credit www.nrc.gov

PSEG – Salem, NJ (Once Through Cooling)

2,380 MW
3,100 MG/d withdrawal;
21 MG/d consumptive use

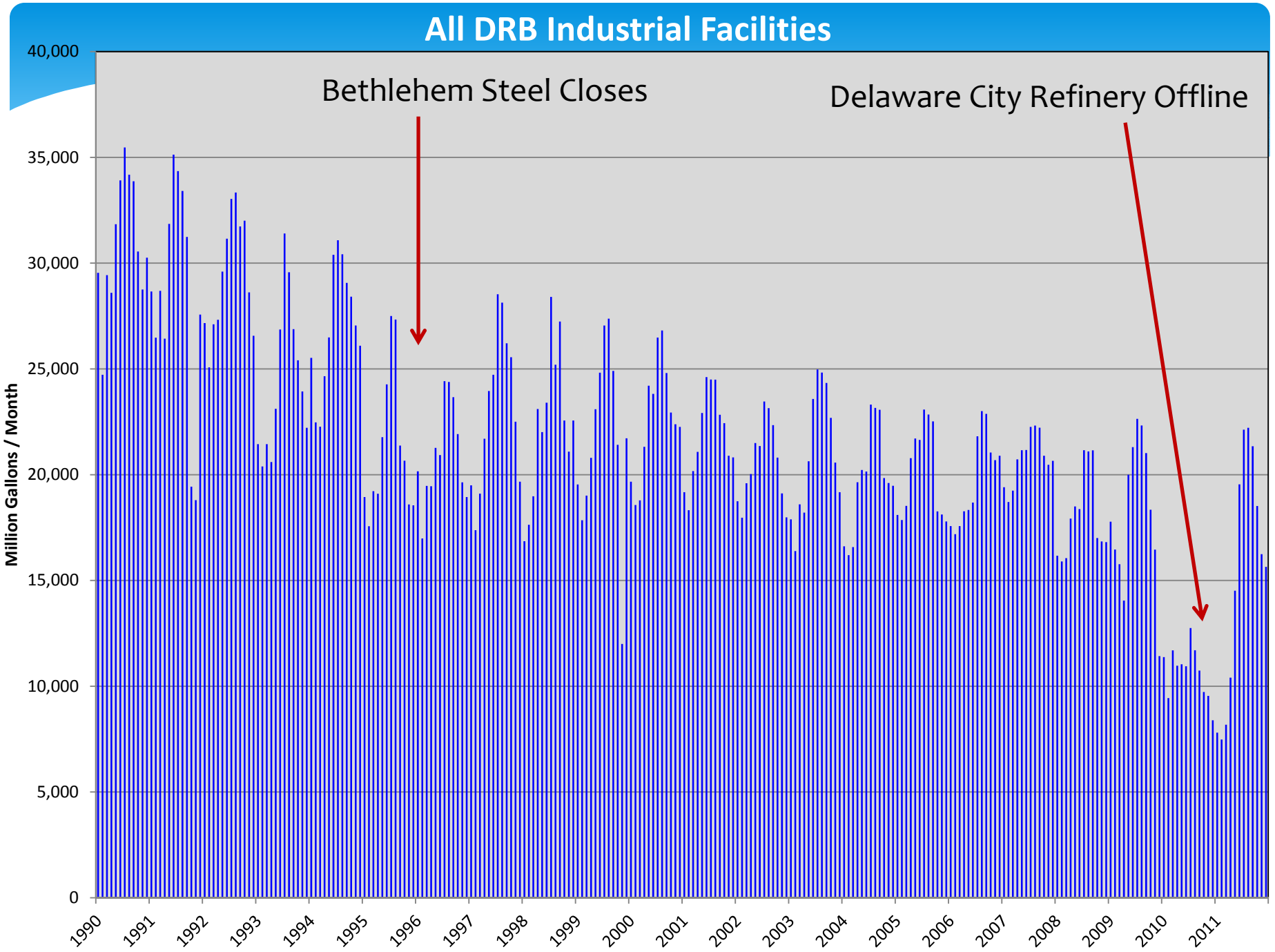


Lehigh Watershed Thermoelectric
Monthly Water Withdrawals in Million Gallons per Day

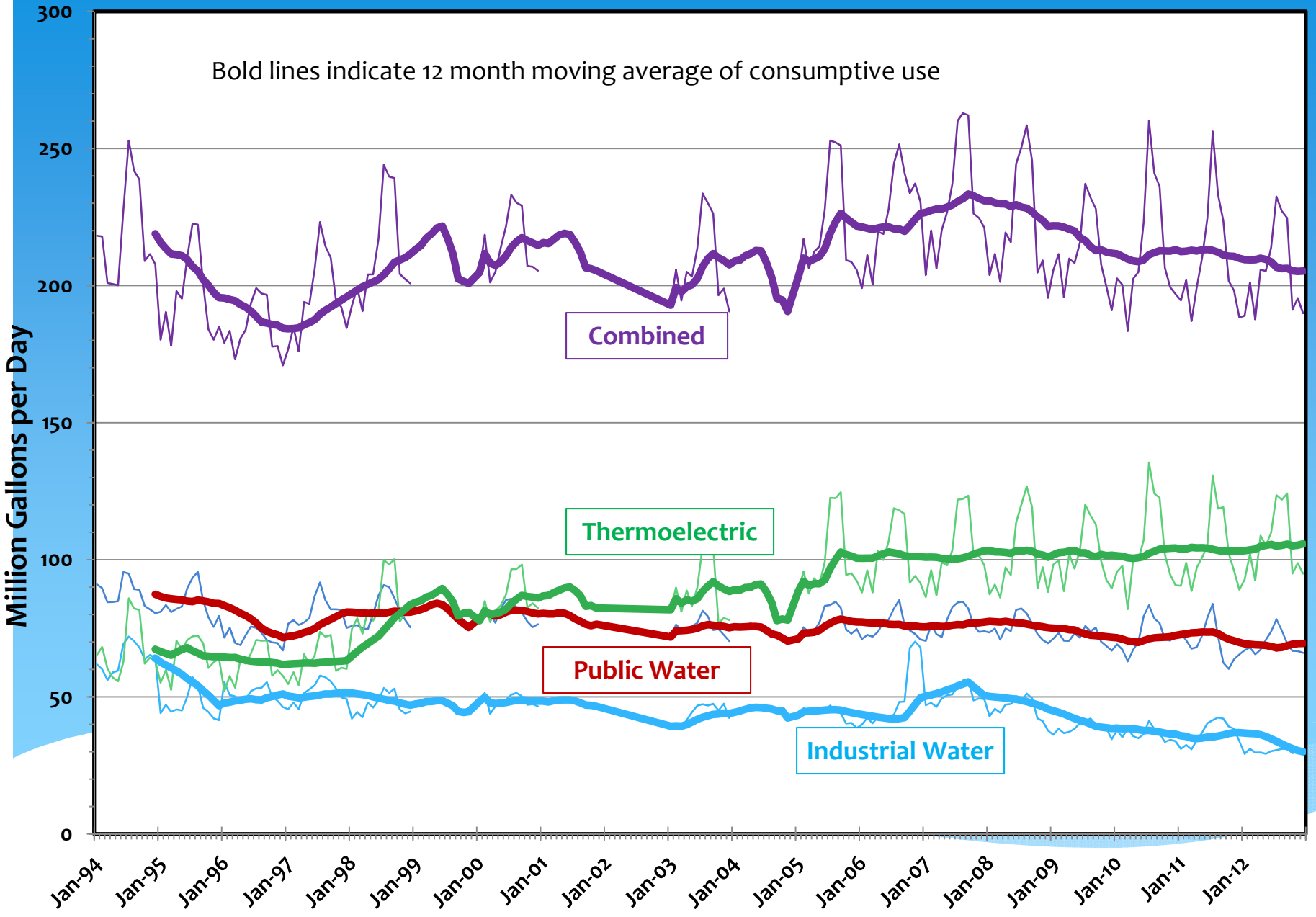


Industry

Delaware City Refinery ; Credit PFB Energy website


All DRB Industrial Facilities
Bethlehem Steel Closes
Delaware City Refinery Offline
Million Gallons / Month
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011

Consumptive Use Trends 1994 - 2012



What does it all mean?

* **Big picture:** Relatively flat demand w/localized demand pressures (geographically and by sector)
* **PWS**:
  * Conservation efforts have helped to offset population growth
* **Power**:
  * Trend away from Once Through Cooling to Evaporative Cooling
  * Evaporative Cooling – potentially allows consumptive use to move upstream/tributaries (compared to Once-Through)
* **Industry**:
  * Decreased water use over time, sensitive to loss of large facilities
  * Refineries in the Basin have gone through a period of great uncertainty, appear to be stabilizing for the moment

Future Water Use Planning

Mega-Trends

- **Demographics:** Certain watersheds experience higher demands while others drop; inter-watershed transfers increase
- **Climate Change:** Droughts require flexible conservation schemes and additional short-term storage strategies
- **Water Efficiency:** Additional conservation measures may provide public water use reductions
- **Ecological Flows:** Determination of actual aquatic needs may alter water withdrawals and reservoir operations

Future Water Use Planning

Energy/Water Nexus

- **Energy Demand** may continue to climb resulting in higher consumptive use from cooling towers
- Possible **Shale Gas** Development: May threaten base flows in small streams in the Upper Delaware
- **Natural Gas** power plants and new customer markets: Will require pipelines cutting across natural landscapes to deliver natural gas
- **Energy Exports** from estuary ports: Ditto plus increased navigation use

Thank You

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