Nutrient Trends in Delaware Surface Waters 1998-2014

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Delaware Center for the Inland Bays STAC Meeting 12/11/15

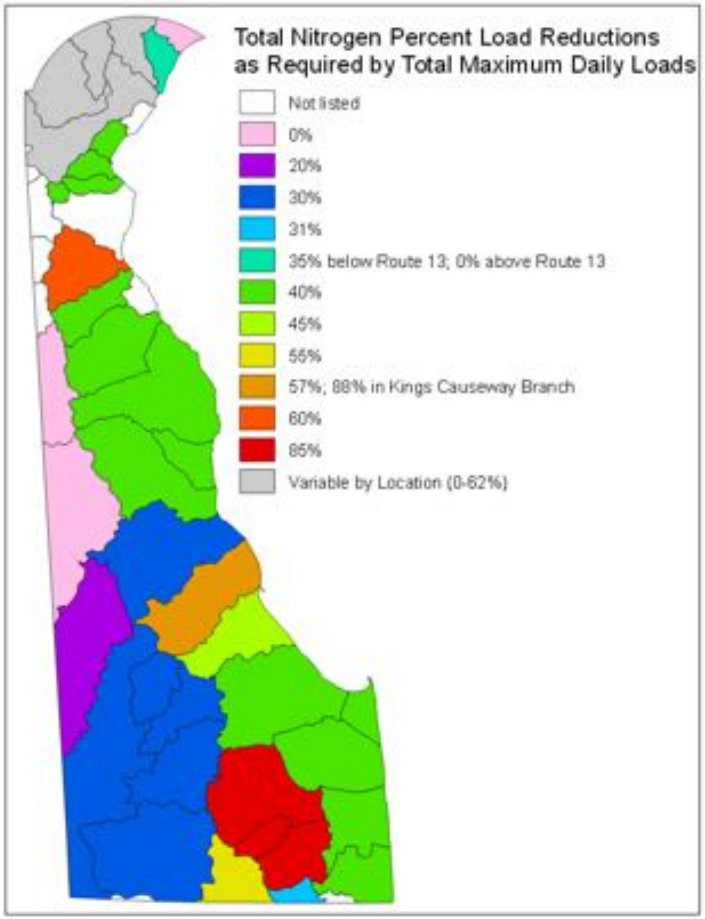
Numeric Nutrient Criteria Development Plan

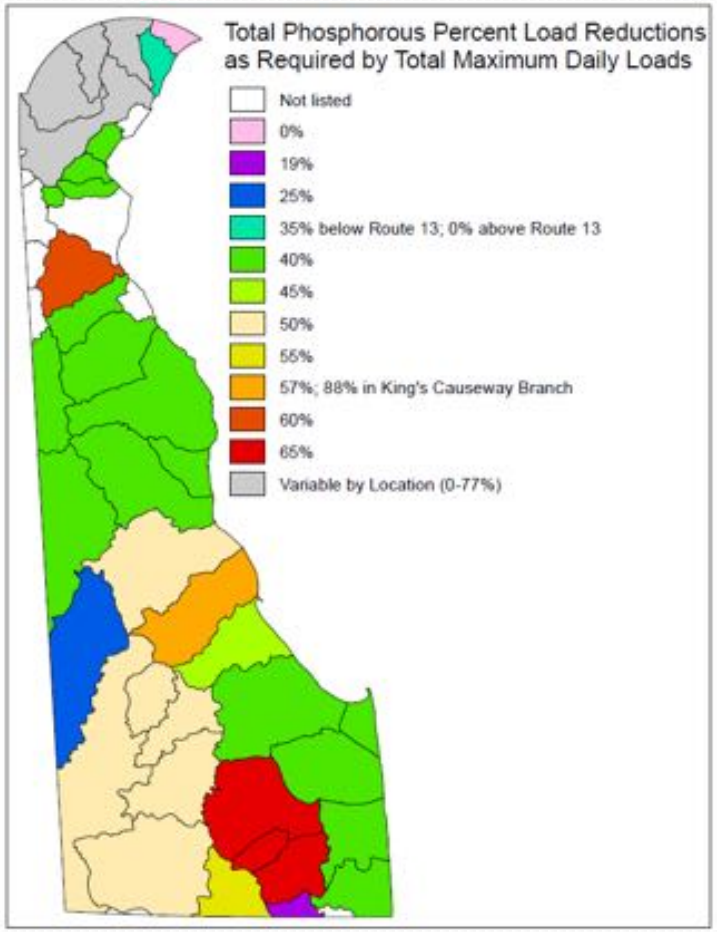
Nutrient Water Quality Management Framework

Nutrient Criteria in Place:

- Inland Bays Since- 1990
  - Average DIN 0.14 mg/l-N and DIP 0.01mg/l-P
- Chesapeake Bay Tidal Nanticoke- 2004
  - Refined Uses, Seasonal DO and Chlorphyll-a
- Tidal Murderkill River
  - Special use and Summer Low DO

TMDL Reductions for Nutrients



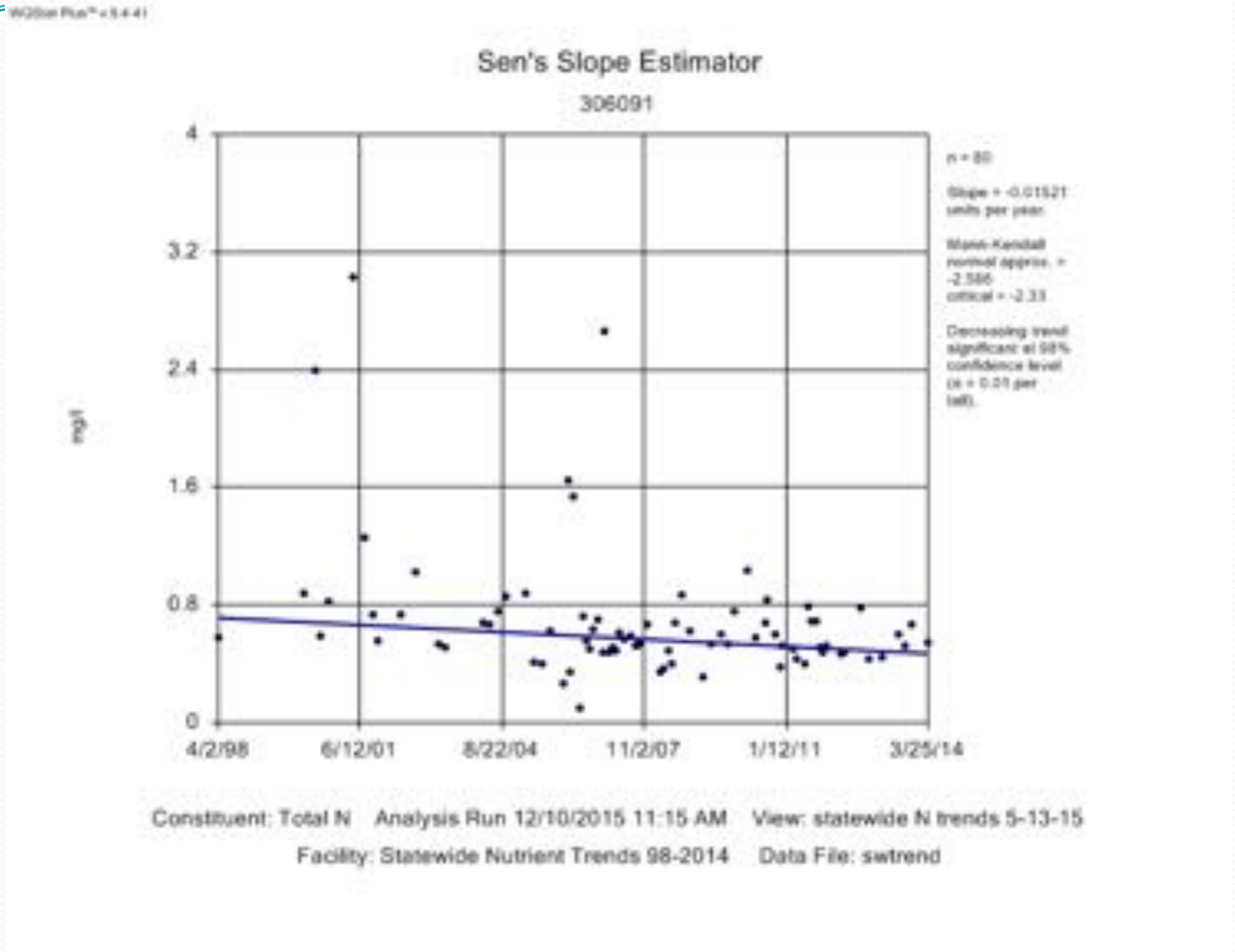


Other Nutrient Efforts

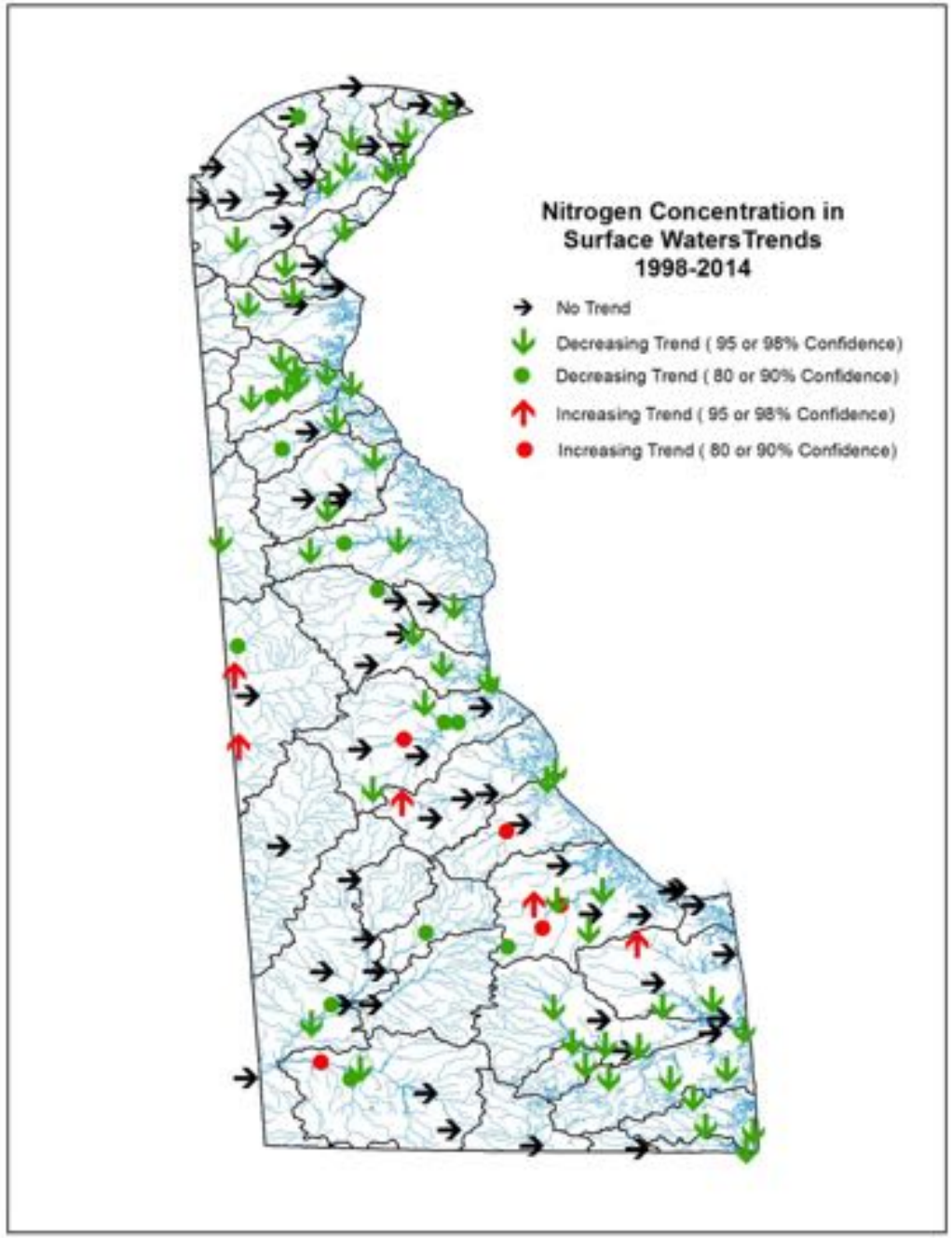
- Delaware Nutrient Management Program 1999
  - Relocation Program
  - Planning Program
  - Certification
- Chesapeake Bay WIP
- Onsite Wastwater Treatment Regulation Updates
- Municipal Separate Stormwater Systems (MS4s)

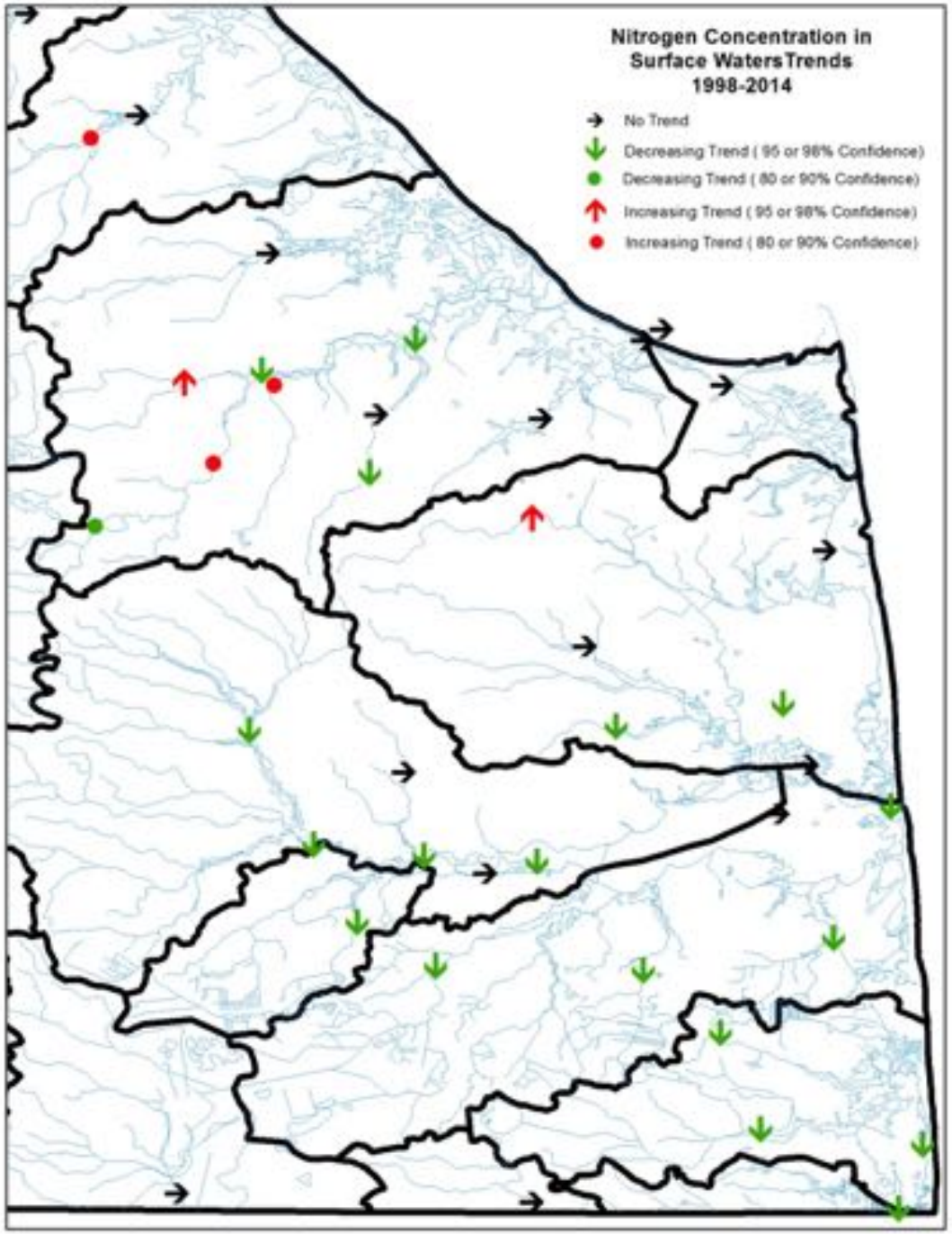
Nutrient Trends at 133 Stations

- 1998-2014
- 40 or more data points
- 133 Stations for P
  - 45 with trends
  - 22 downward
  - 23 upward
- 132 Stations for N
  - 76 with trends
  - 66 Downward
  - 10 upward


Sen's Slope Estimator
306091
4
3.2
2.4
1.6
0.8
0
mg/l
4/2/98
6/12/01
8/22/04
11/2/07
1/12/11
3/25/14
n = 80
Slope = -0.01521 units per year.
Mann-Kendall normal approx. = -2.586
critical = -2.33
Decreasing trend significant at 98% confidence level (a = 0.01 per tail).
Constituent: Total N Analysis Run 12/10/2015 11:15 AM View: statewide N trends 5-13-15
Facility: Statewide Nutrient Trends 98-2014 Data File: swtrend

Confidence	Statistically Significant Decreases for Total Phosphorus	Statistically Significant Increases for Total Phosphorous	Statistically Significant Decreases for Total Nitrogen	Statistically Significant Increases for Total Nitrogen
80%	4	4	6	5
90%	6	8	7	--
95% or 98%	12	11	53	5
Totals	22	23	66	10


Nitrogen Concentration in
Surface Waters Trends
1998-2014
No Trend
Decreasing Trend (95 or 98% Confidence)
Decreasing Trend (80 or 90% Confidence)
Increasing Trend (95 or 98% Confidence)
Increasing Trend (80 or 90% Confidence)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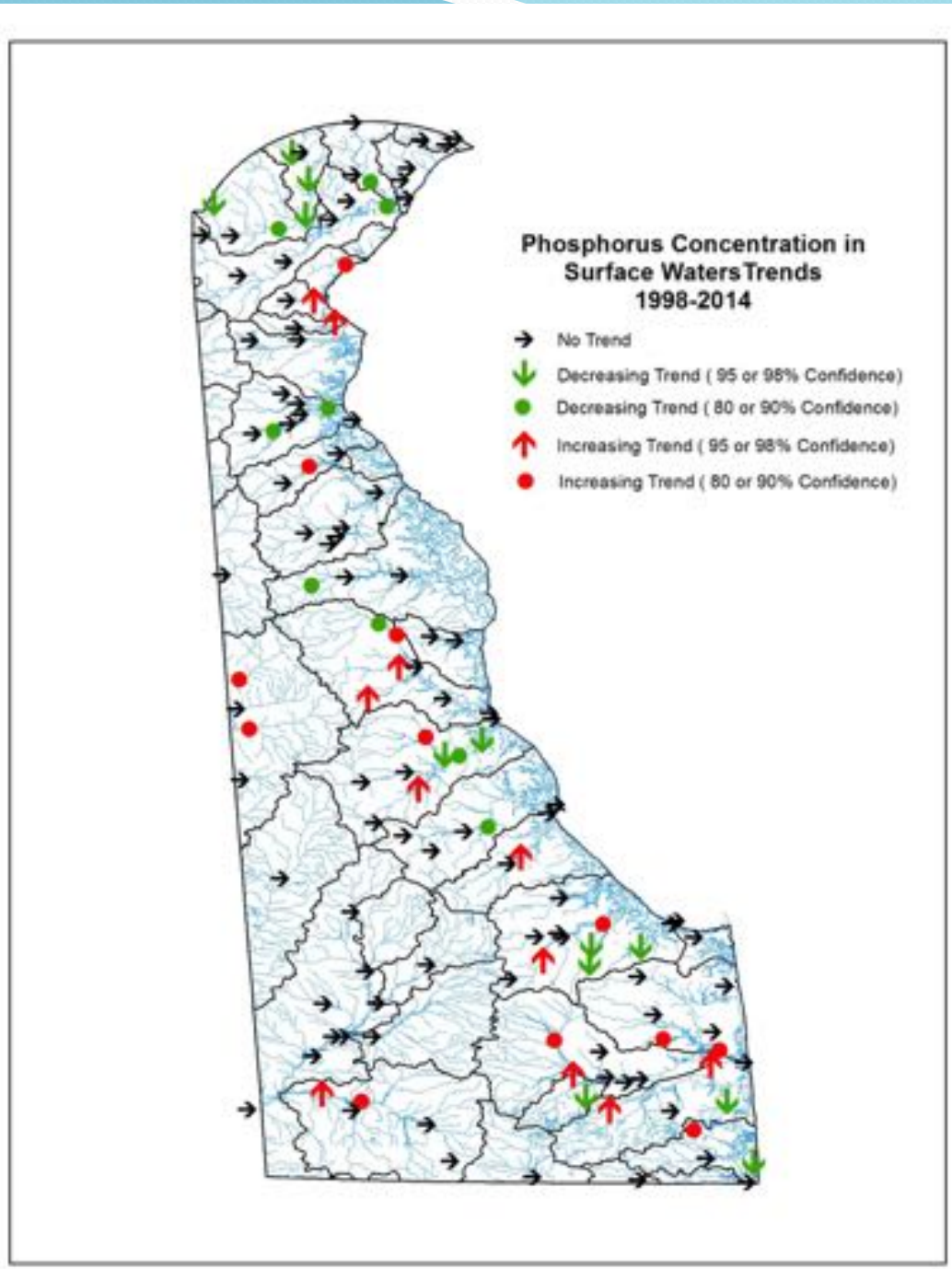
Phosphorus Concentration in
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Decreasing Trend (80 or 90% Confidence)
Increasing Trend (95 or 98% Confidence)
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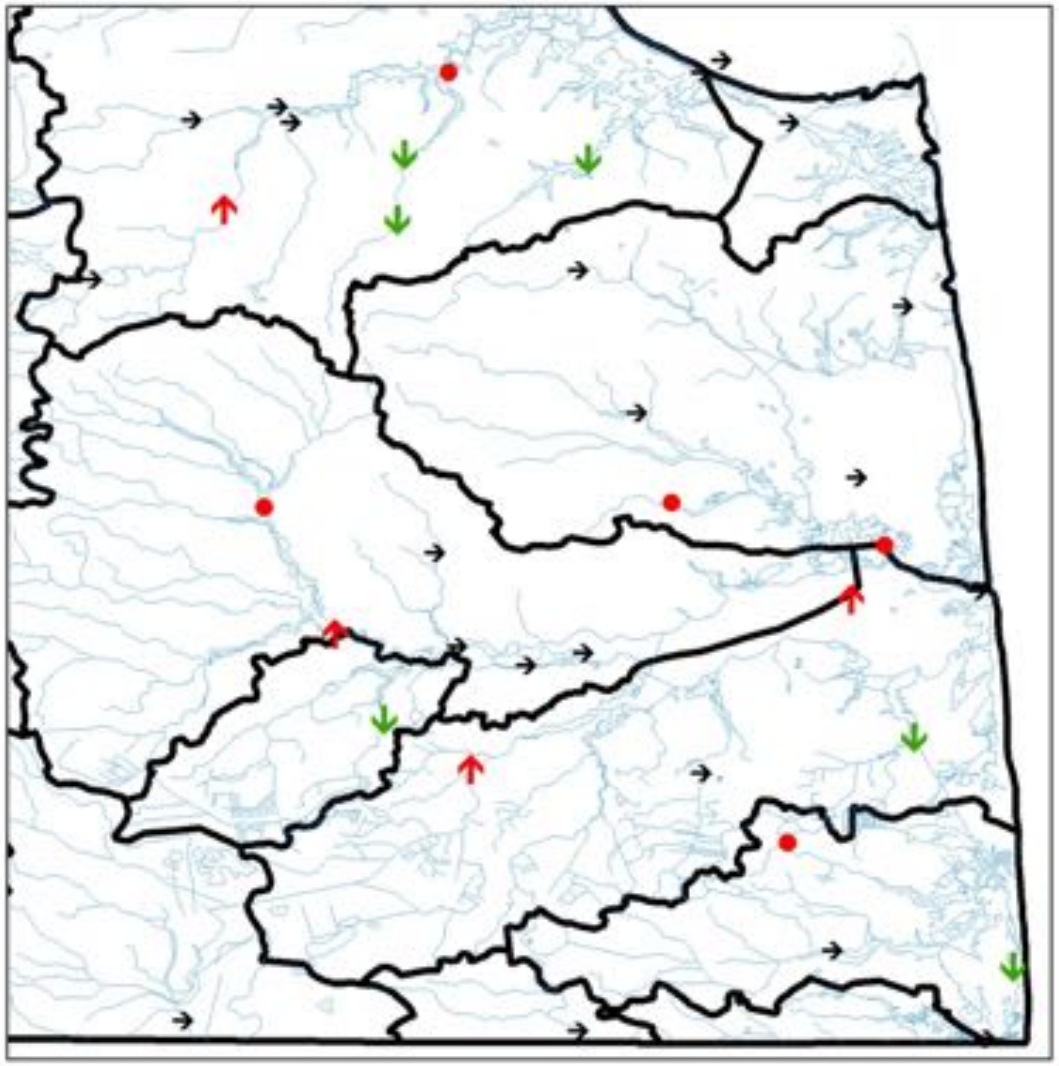
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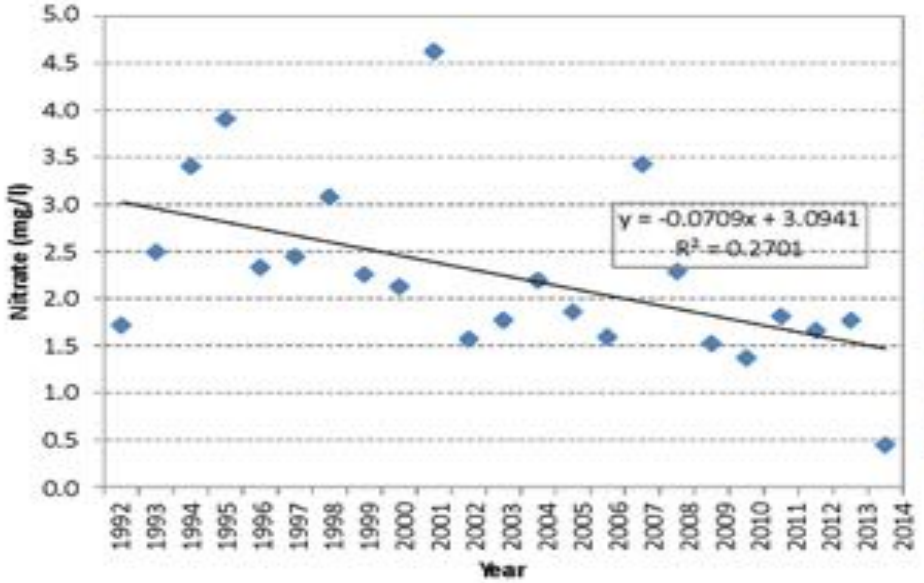
Annual-average Nitrate in Wet Deposition

(NOAA NADP site at UD's Lewes Campus)



Conclusions

- Progress is a good start for N Statewide and in the Bays
  - The work we're doing is working!
  - Plenty more to do
- Mixed for P, Statewide and the Bays
  - May be due to geochemistry, where reductions in N result in releases of P?

"We've never been in danger of over regulating nutrients"~Chesapeake Bay Politician

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