Establishing Nutrient Trends in Iowa's Rivers in Support of Iowa's Nutrient Reduction Strategy

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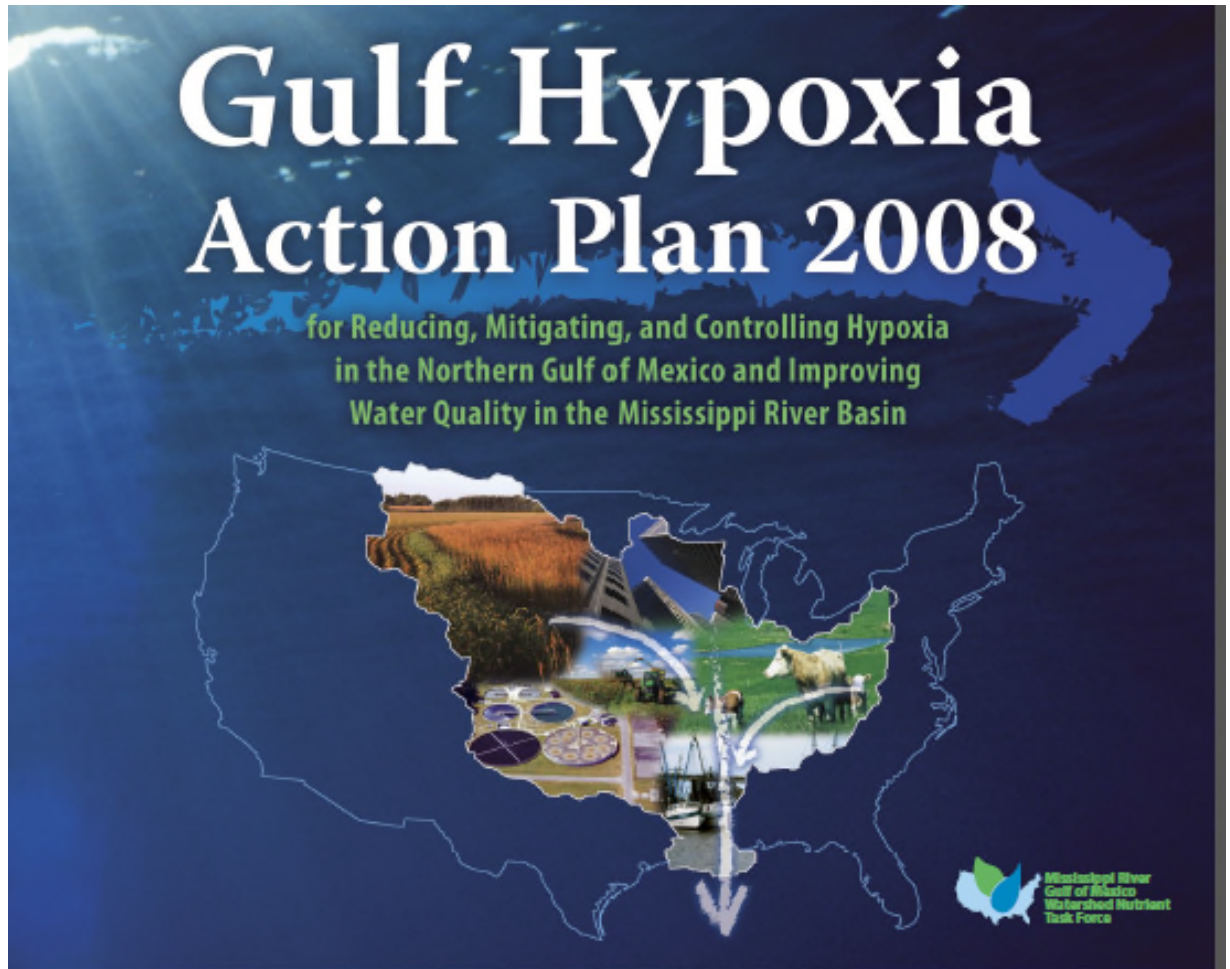
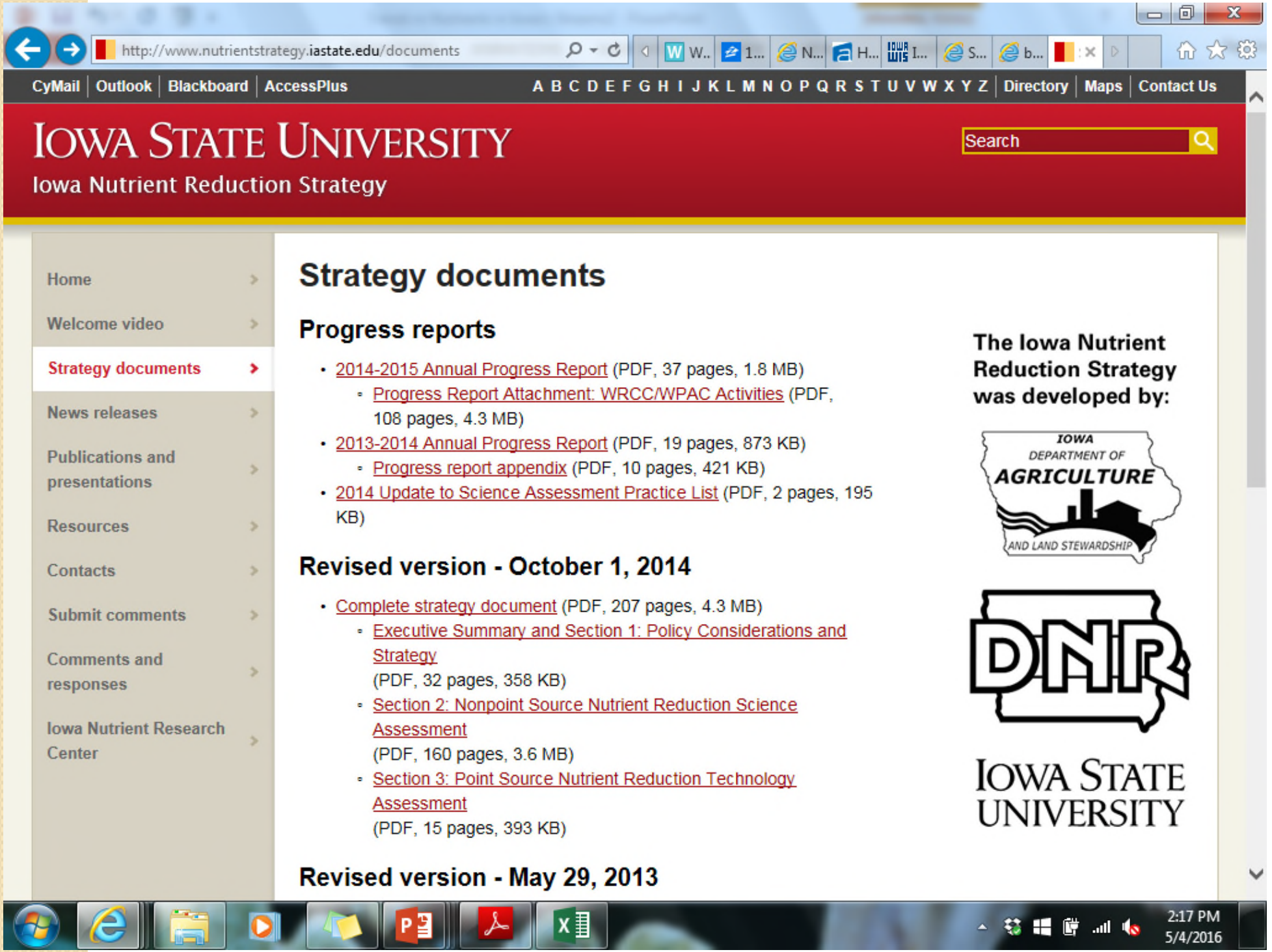
Tampa, FL

Background

- November 2012, Iowa releases the Nutrient Reduction Strategy in response to the Gulf Hypoxia Action Plan 2008, which called for the 12 states along the Mississippi River to reduce delivery of nutrients to the Gulf by 45%.





http://www.nutrientstrategy.iastate.edu/documents

The strategy is a science and technology based approach to reducing nutrients in Iowa's water and is based on two science assessments to guide and formulate the policy for Iowa.

"The Iowa strategy proposes a pragmatic, strategic and coordinated approach for reducing nutrient loads discharged from the state's largest wastewater treatment plants, in combination with targeted practices designed to reduce loads from nonpoint sources now while evaluating the need for nutrient water quality standards long-term."

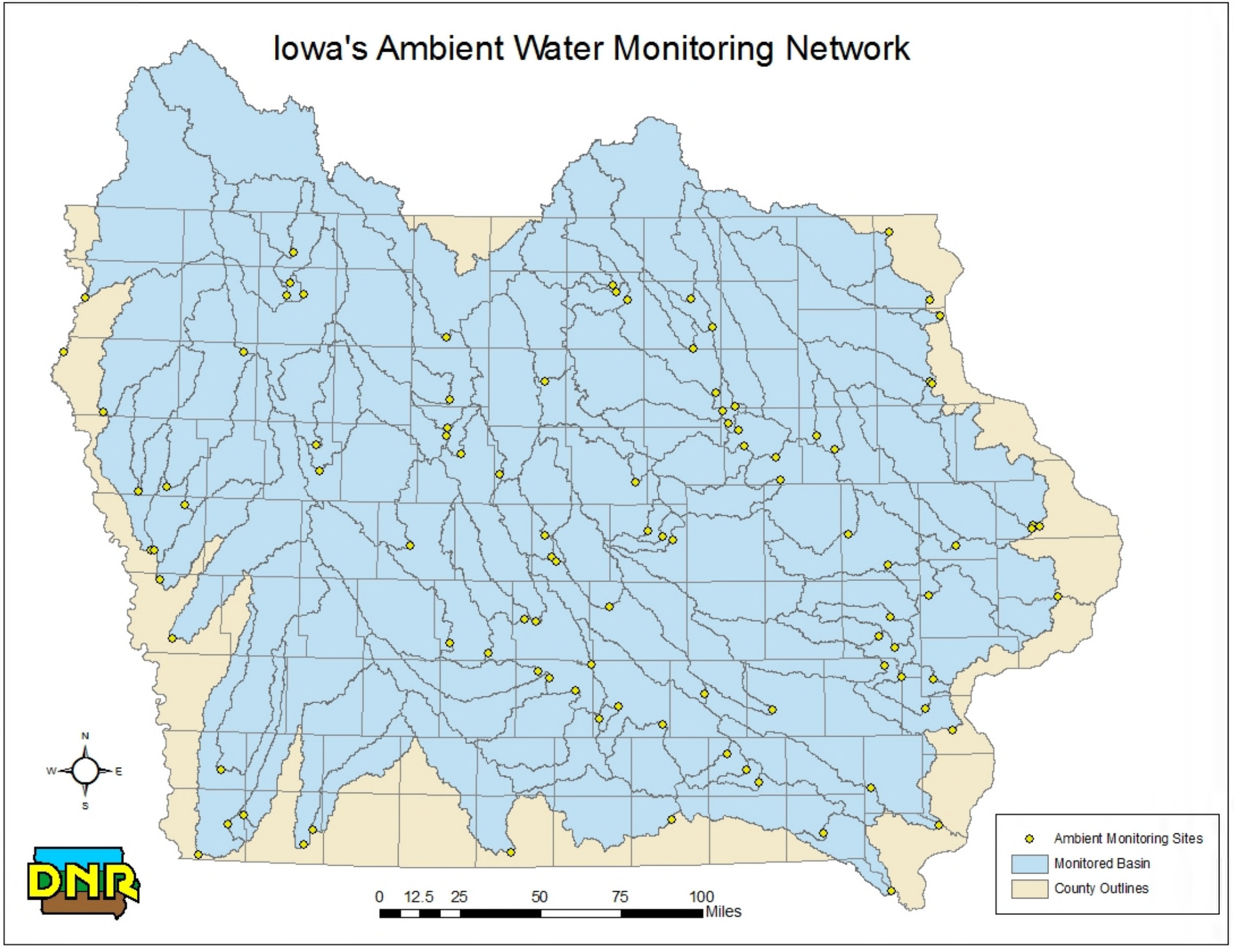
Water Quality Monitoring was a key component in developing the nutrient reduction strategy:

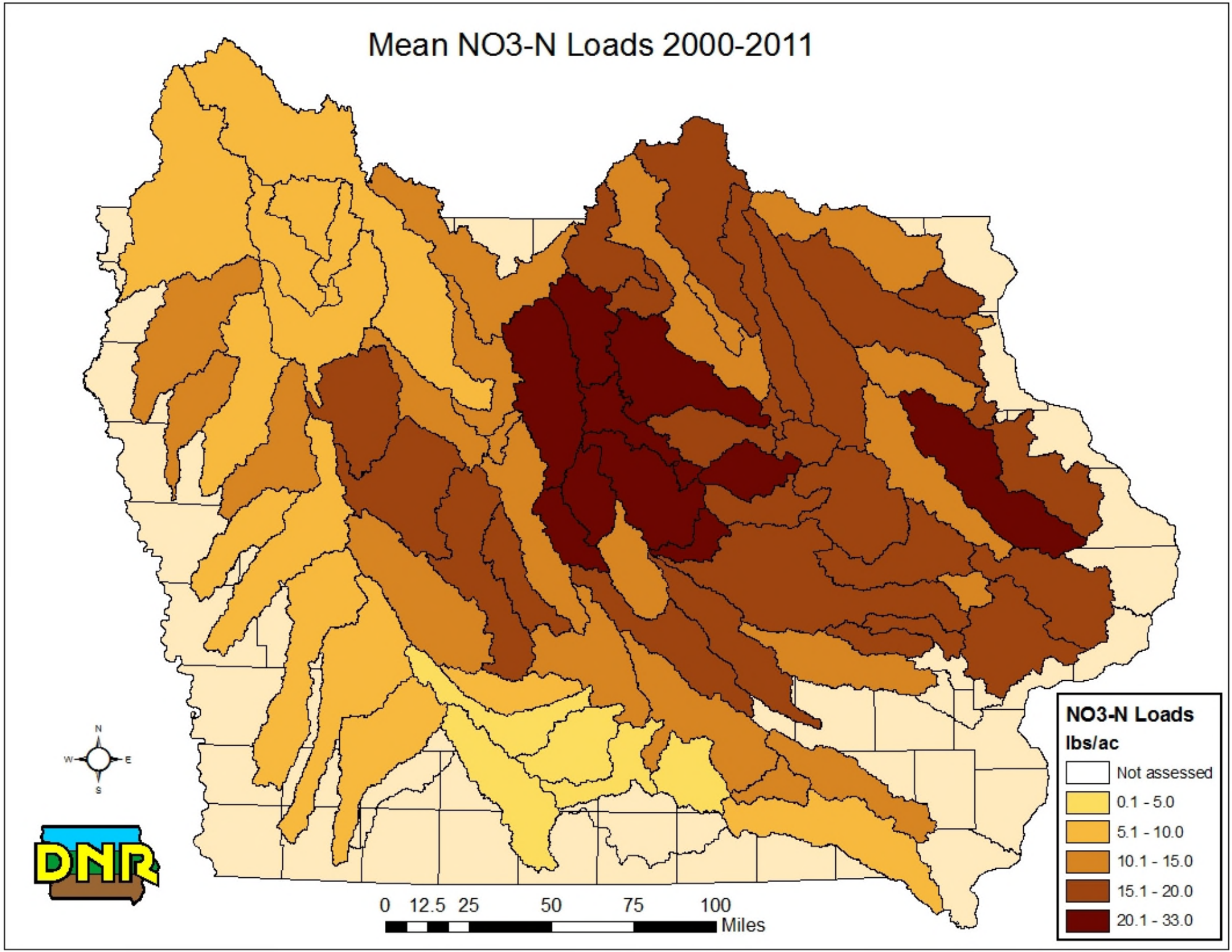
1. What are the baseline conditions?
2. How will know if we are making progress?

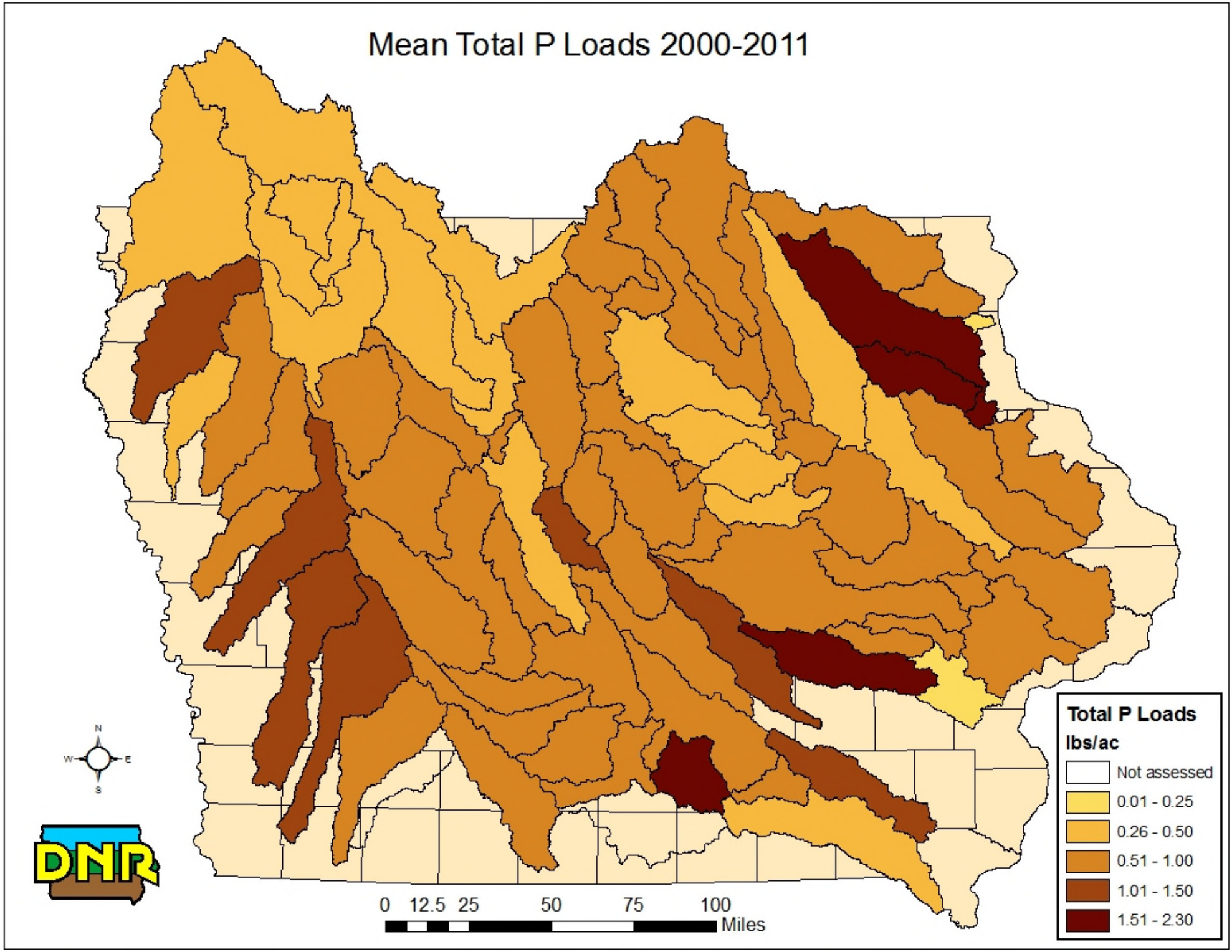
Step 1: Establishing the Baseline Iowa's Ambient Monitoring Network

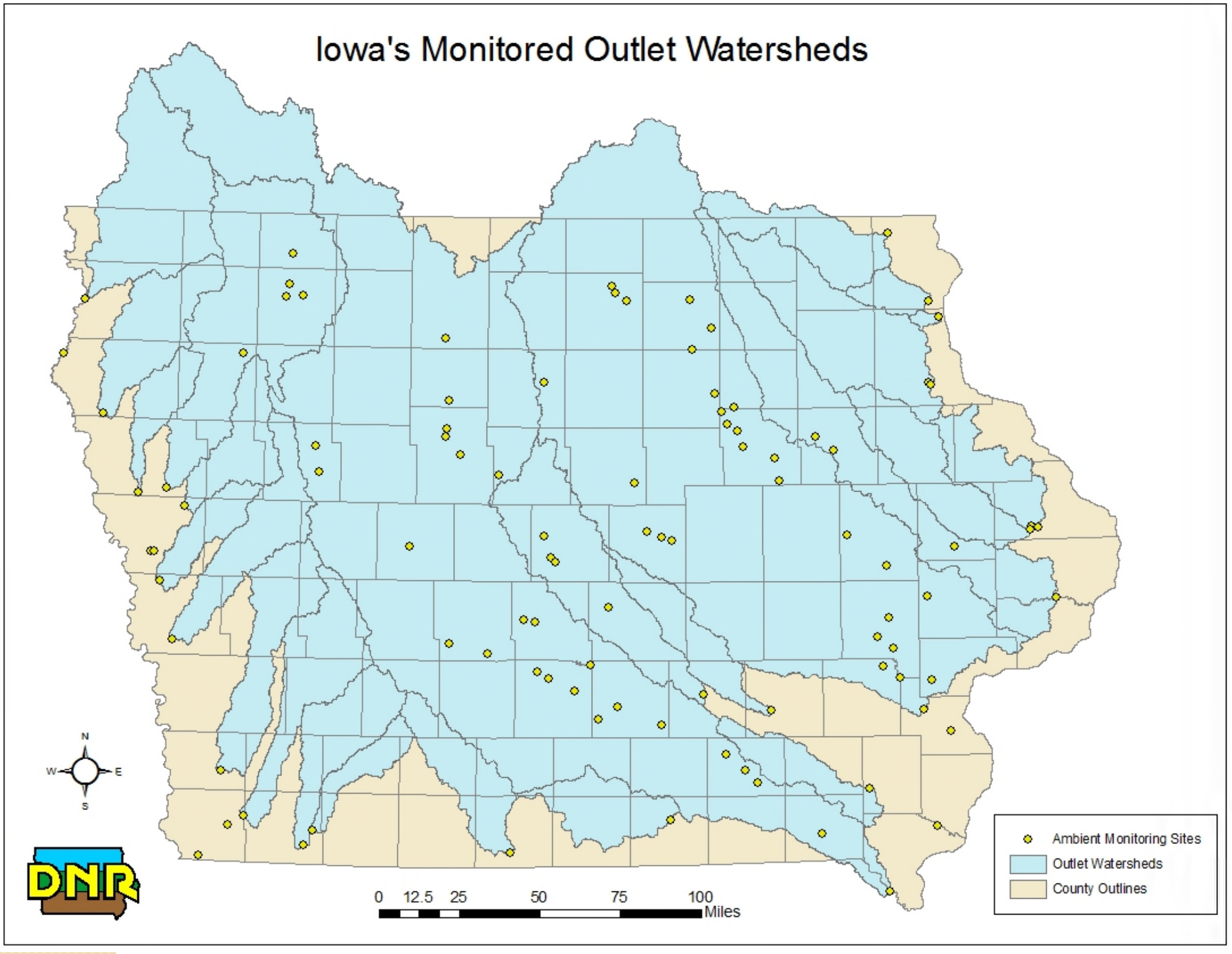
- 98 Sites in Iowa – varying consistency of sampling through time.
- Includes Sites Upstream and Downstream of Urban Centers
- Monitored on a fixed, monthly basis
- Mostly paired with USGS Gage locations
- Data from 2000-2011
- Only sites with "nearby" USGS gages, covering the length of record desired (2000-2011) were included. Using three load estimation methods.

Iowa's Ambient Water Monitoring Network




Mean NO3-N Loads 2000-2011
N
W
E
S
DNR
0 12.5 25 50 75 100
Miles
NO3-N Loads
lbs/ac
Not assessed
0.1 - 5.0
5.1 - 10.0
10.1 - 15.0
15.1 - 20.0
20.1 - 33.0


Mean Total P Loads 2000-2011
Total P Loads
lbs/ac
Not assessed
0.01 - 0.25
0.26 - 0.50
0.51 - 1.00
1.01 - 1.50
1.51 - 2.30
0 12.5 25 50 75 100
Miles
N
W
E
S
DNR


Iowa's Monitored Outlet Watersheds
N
W
E
S
DNR
0 12.5 25 50 75 100
Miles
Ambient Monitoring Sites
Outlet Watersheds
County Outlines

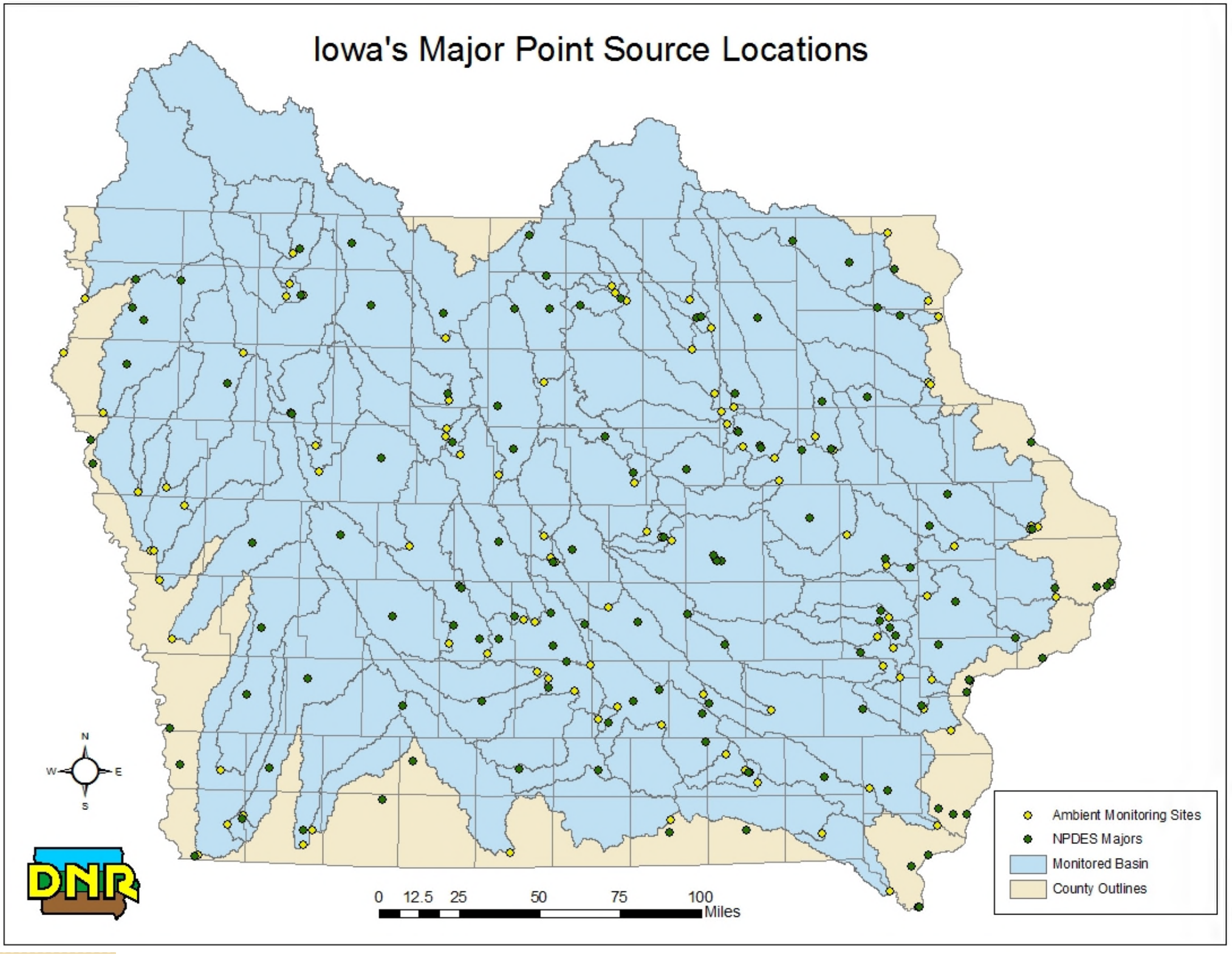
Total N and P Loads for Iowa

- Sum up loads for 24 outer basins
- Total N = NO3-N/0.82
- Sum area of outer basins (83% of state)
- Scale up to State area

	Stream load Tons/yr	Nutrient Yield Lbs/ac	Concentration (mg/l)
Total N	280,000	16.0	7.9
Total P	13,800	0.77	0.38

Point Source Load Calculation

- For 102 Major Municipal and 28 Industrial Facilities
- Load = Flow * Concentration
- Use Average Annual Flow = 2/3 Wet Weather Design Flow
- Use 25 ppm N and 4 ppm P in discharge from "Wastewater Engineering" Metcalf & Eddy


Iowa's Major Point Source Locations
N
W
E
S
DNR
0 12.5 25 50 75 100
Miles
Ambient Monitoring Sites
NPDES Majors
Monitored Basin
County Outlines

Non-point Source Calculation

- Total State Load minus Point Source Load

	Total stream load	NPDES load	Non-point source load
Tons N/yr	280,000	18,300 (6.5%)	261,700 (93.5%)
Tons P/yr	13,800	2,900 (21%)	10,900 (79%)

Final Nonpoint Sources Reduction Goals:

Total Nitrogen 41%

Total Phosphorus 29%

The Nutrient Reduction Strategy Contained Two Key Components:

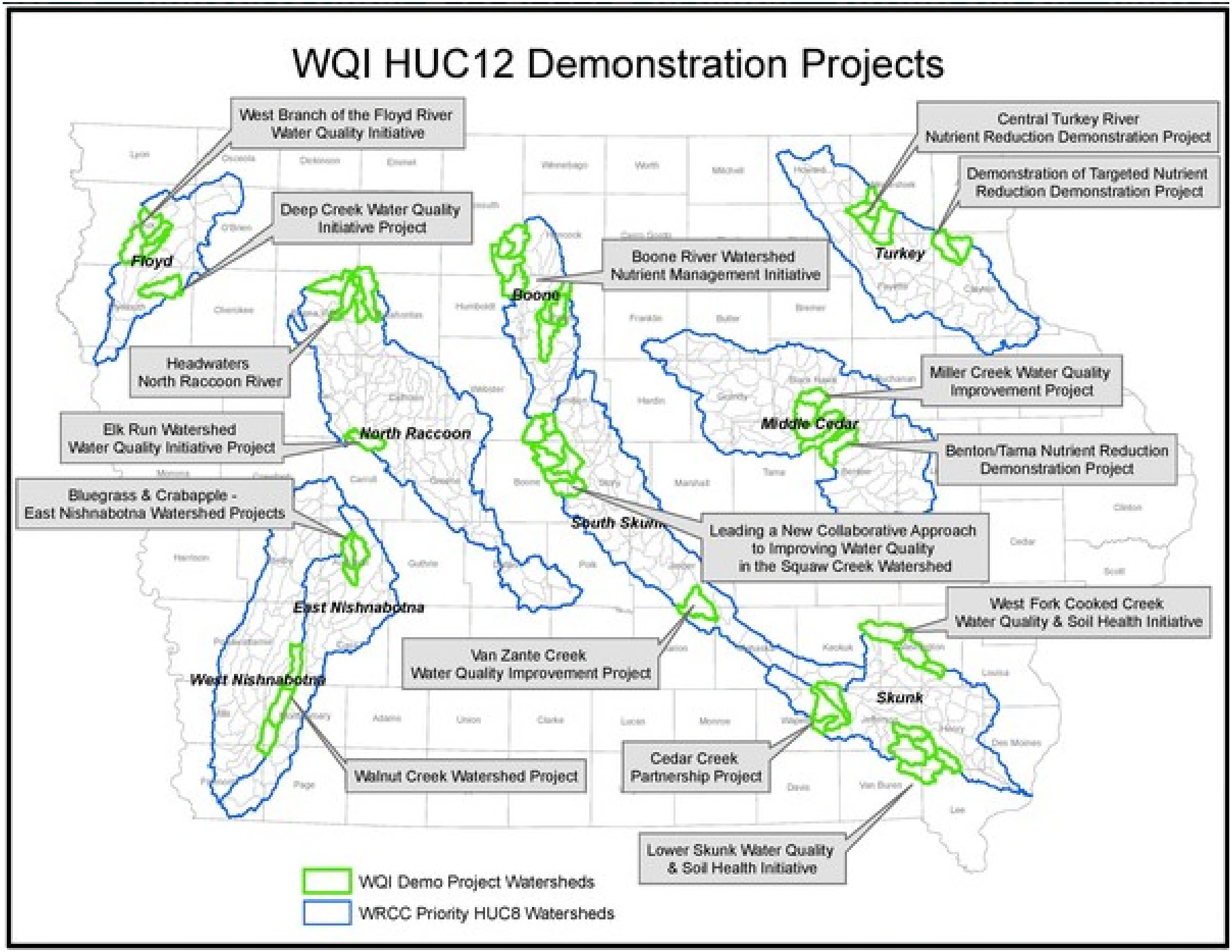
1. *The Water Resources Coordinating Council (WRCC) will prioritize watersheds for nitrogen and phosphorus reduction.*

WRCC convened a subgroup to identify "priority" HUC8s for Water Quality Initiative Funding.

Subgroup identified the following factors to set priorities:

1. Elevated N and P loads
2. "Significant" Urban Impact
3. Geographic Distribution
4. Existing Watershed groups OR watersheds with little activity to date.

HUC 8 Priority Watersheds



2. *The Water Resources Coordinating Council will set measures of success and relate these to watershed improvement based on a mutually agreed upon set of indicators.*

Task Force Team was convened to identify how Iowa would measure load reduction/progress

- Iowa Department of Natural Resources
- Iowa Department of Agriculture and Land Stewardship
- University of Iowa
- Iowa State University
- USGS
- Iowa Soybean Association

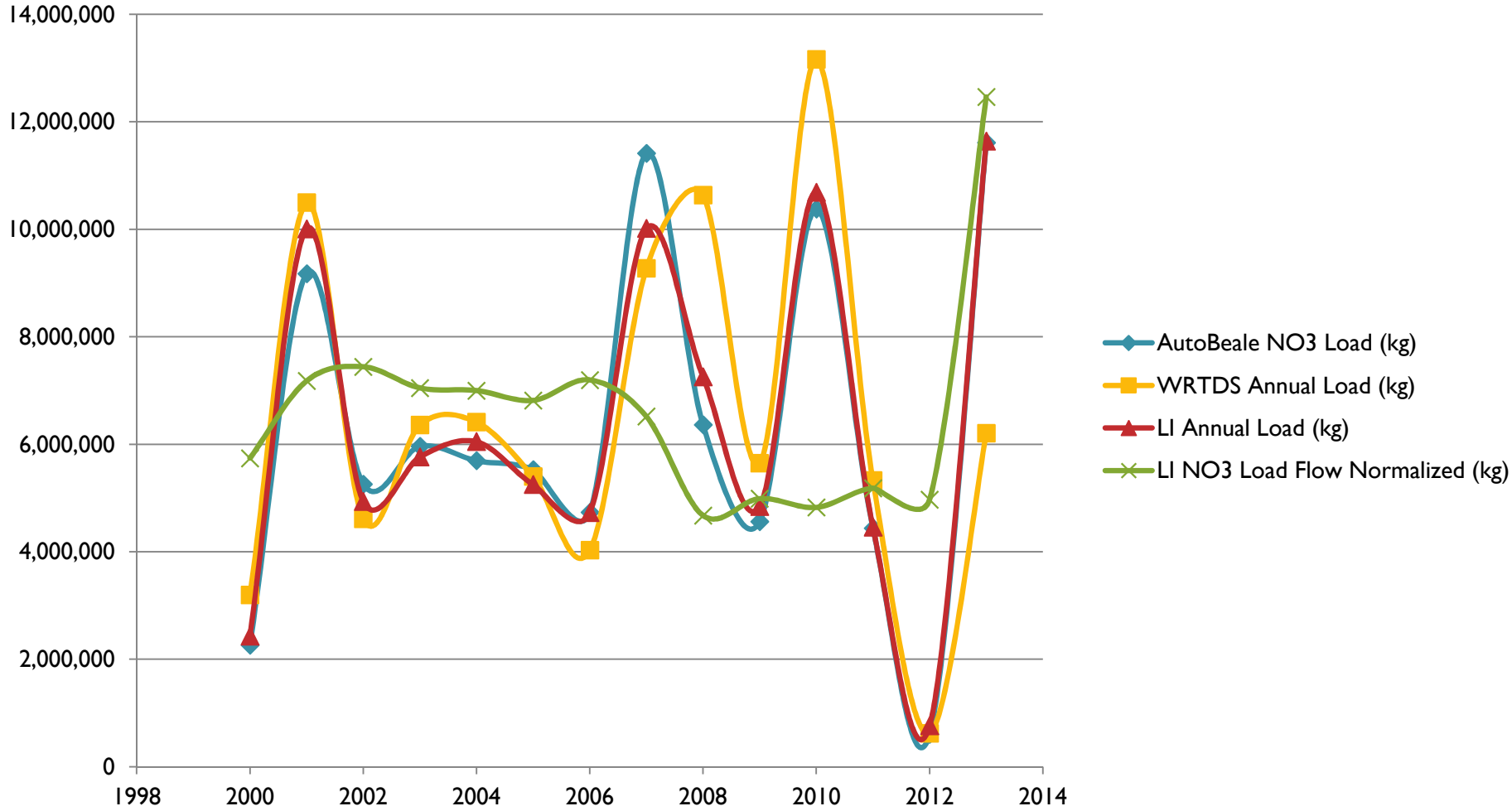
The team examined three different load estimation techniques:

1. Weighted Regression on Time, Discharge and Season
2. AutoBeale Ratio Estimator (Richards, 1998)
3. Linear Interpolation

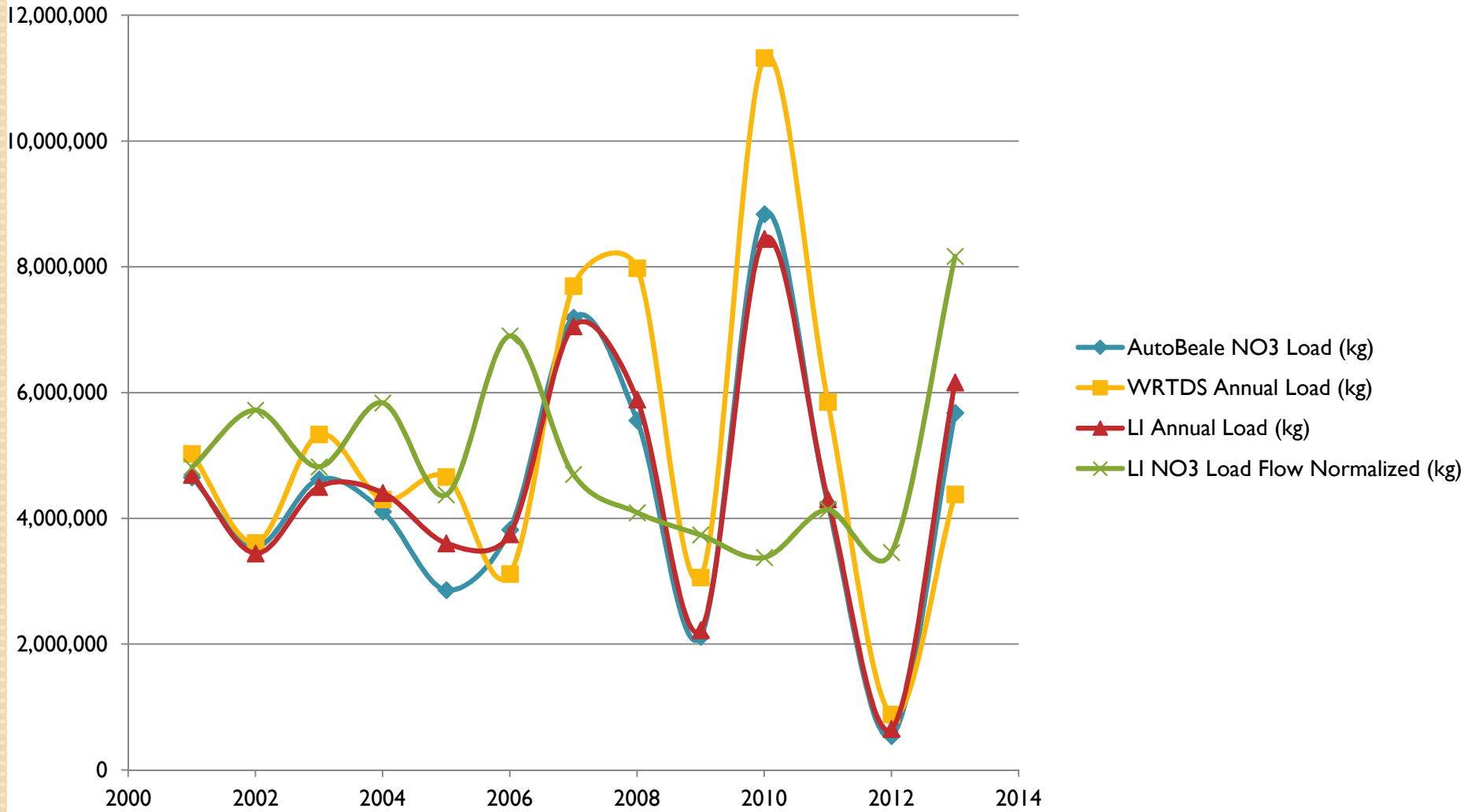
Evaluation of Method was Based on:

1. Ease of Use (ability to generate loads and trends annually)
2. Accessible to non-technical audiences
3. "One" answer
4. How "stable" the answer is…

Boone River at Webster City, IA



North Raccoon River at Sac City, IA



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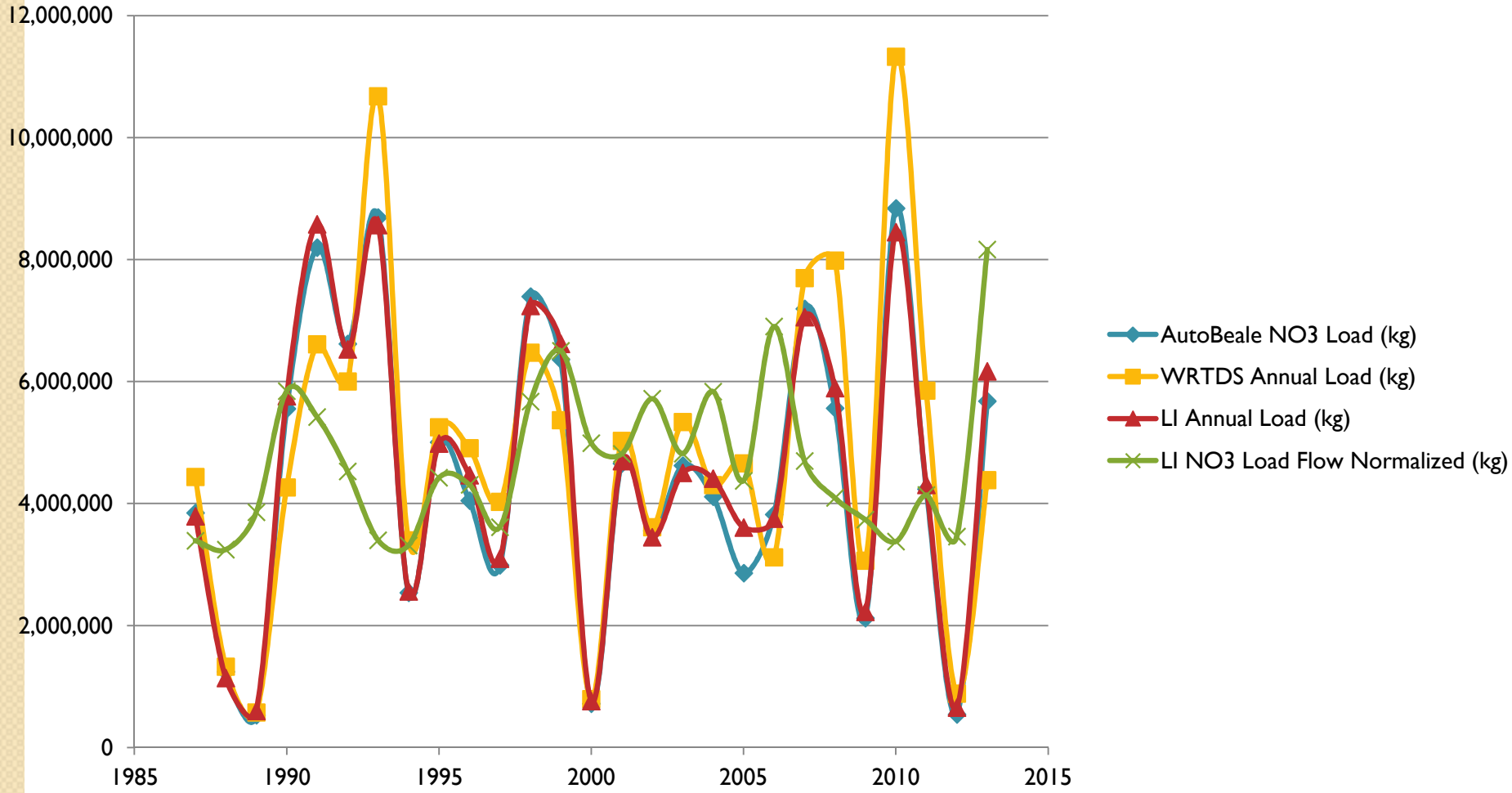

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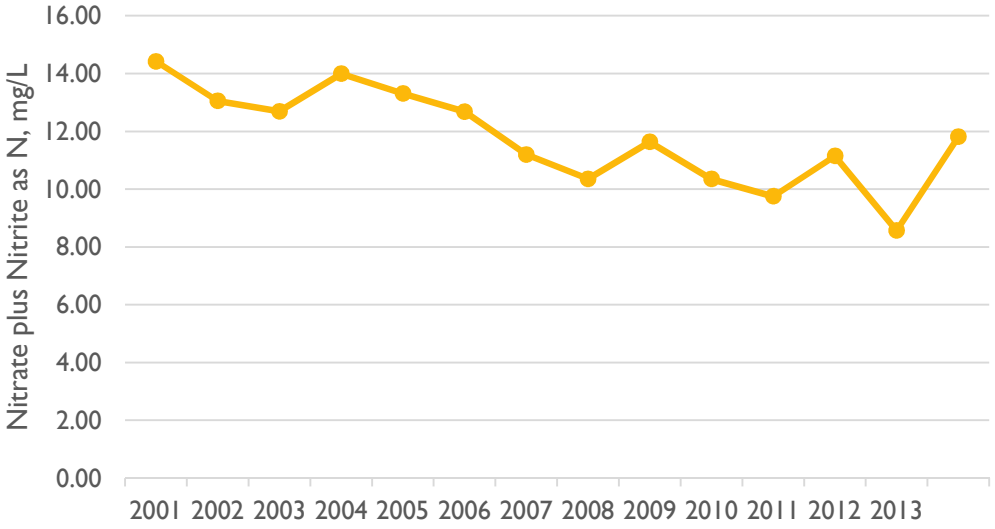
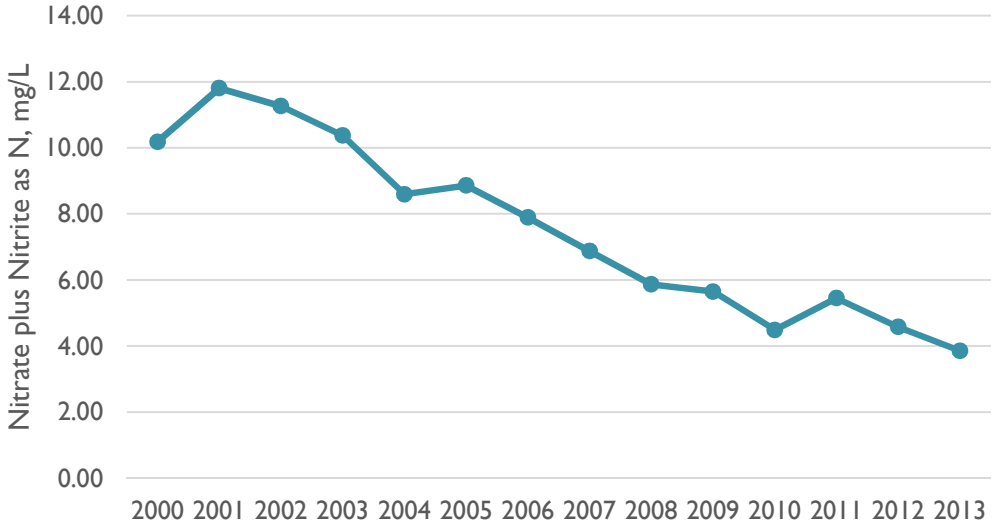
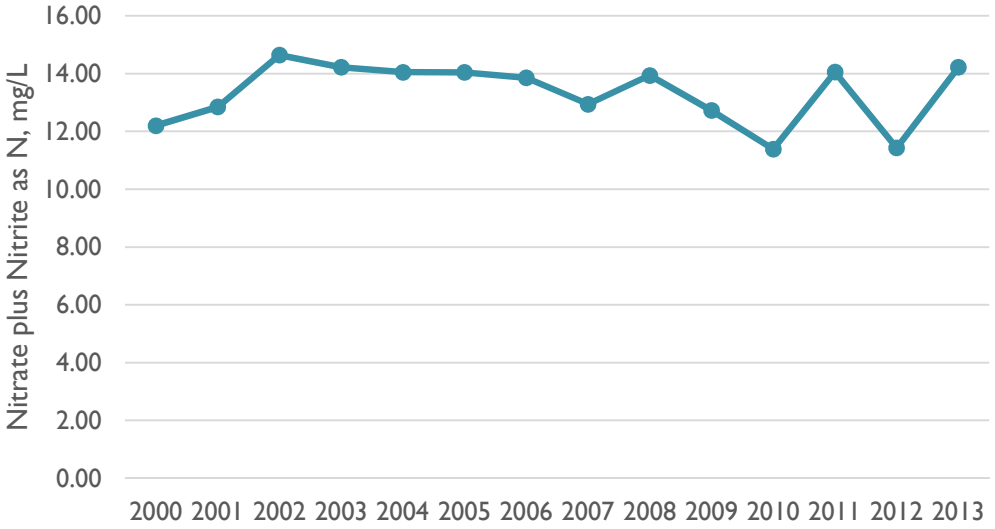


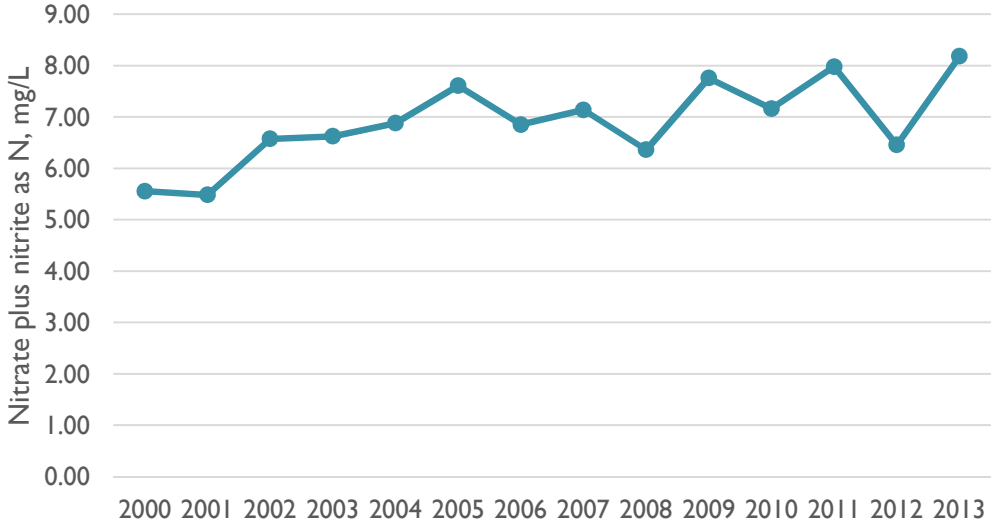
Indian Creek at Colfax, IA

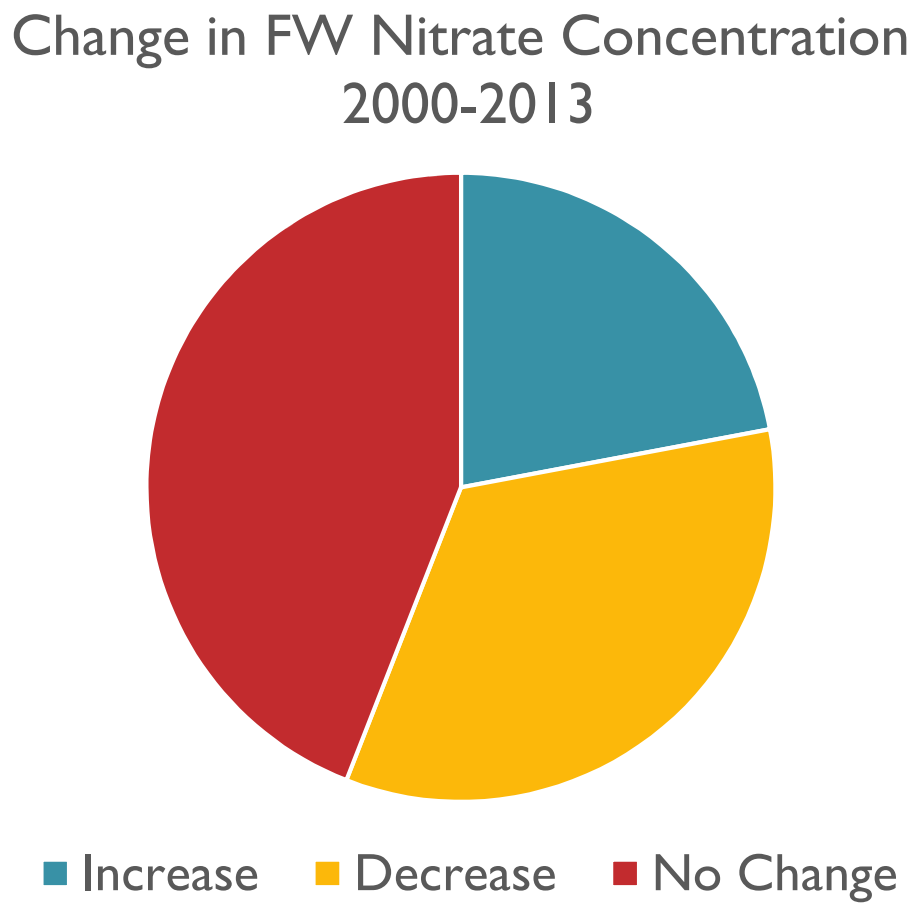


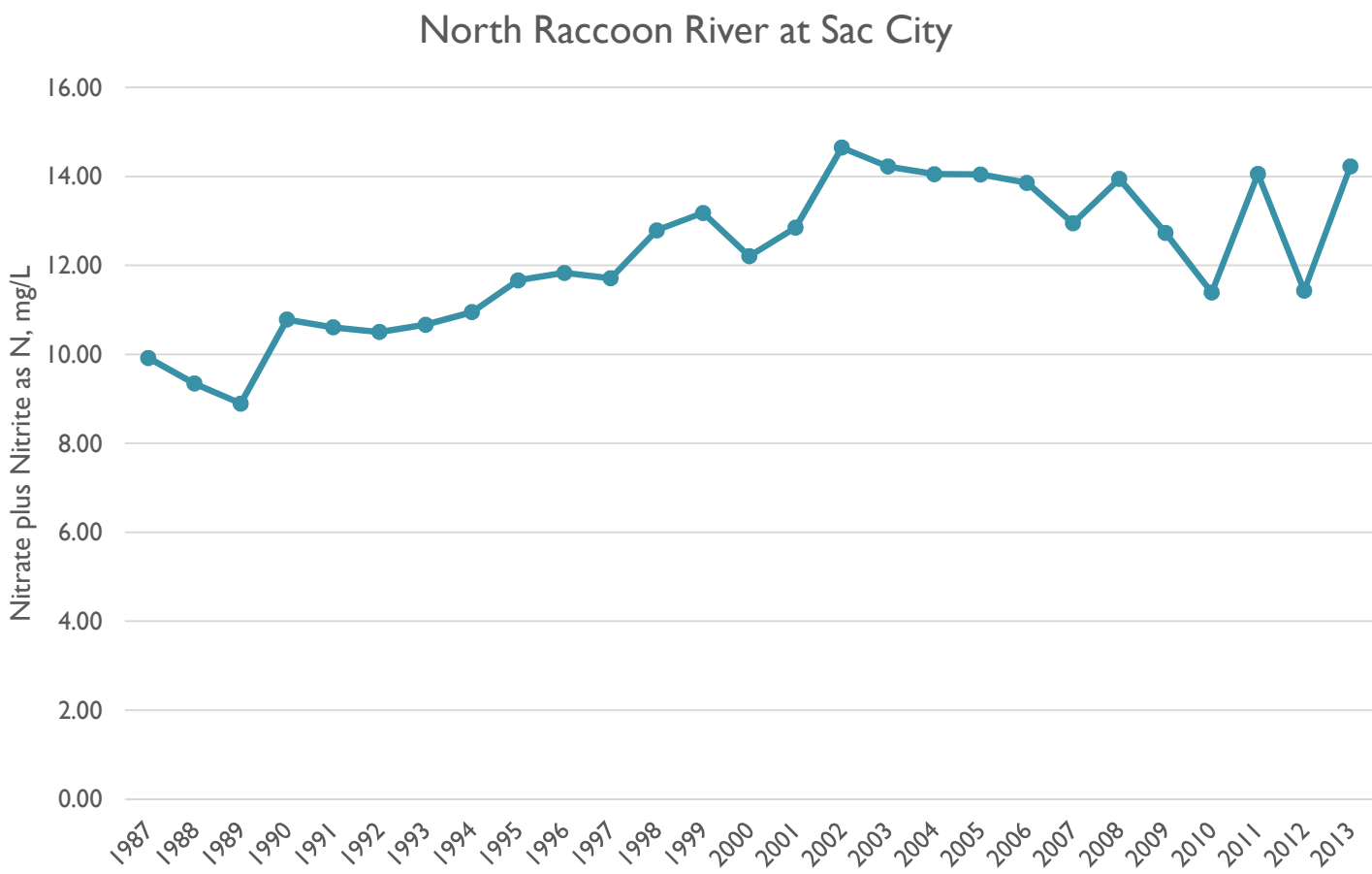
North Raccoon River at Sac City



Boyer River at Logan, IA




Change in FW Nitrate Concentration
2000-2013
Increase
Decrease
No Change

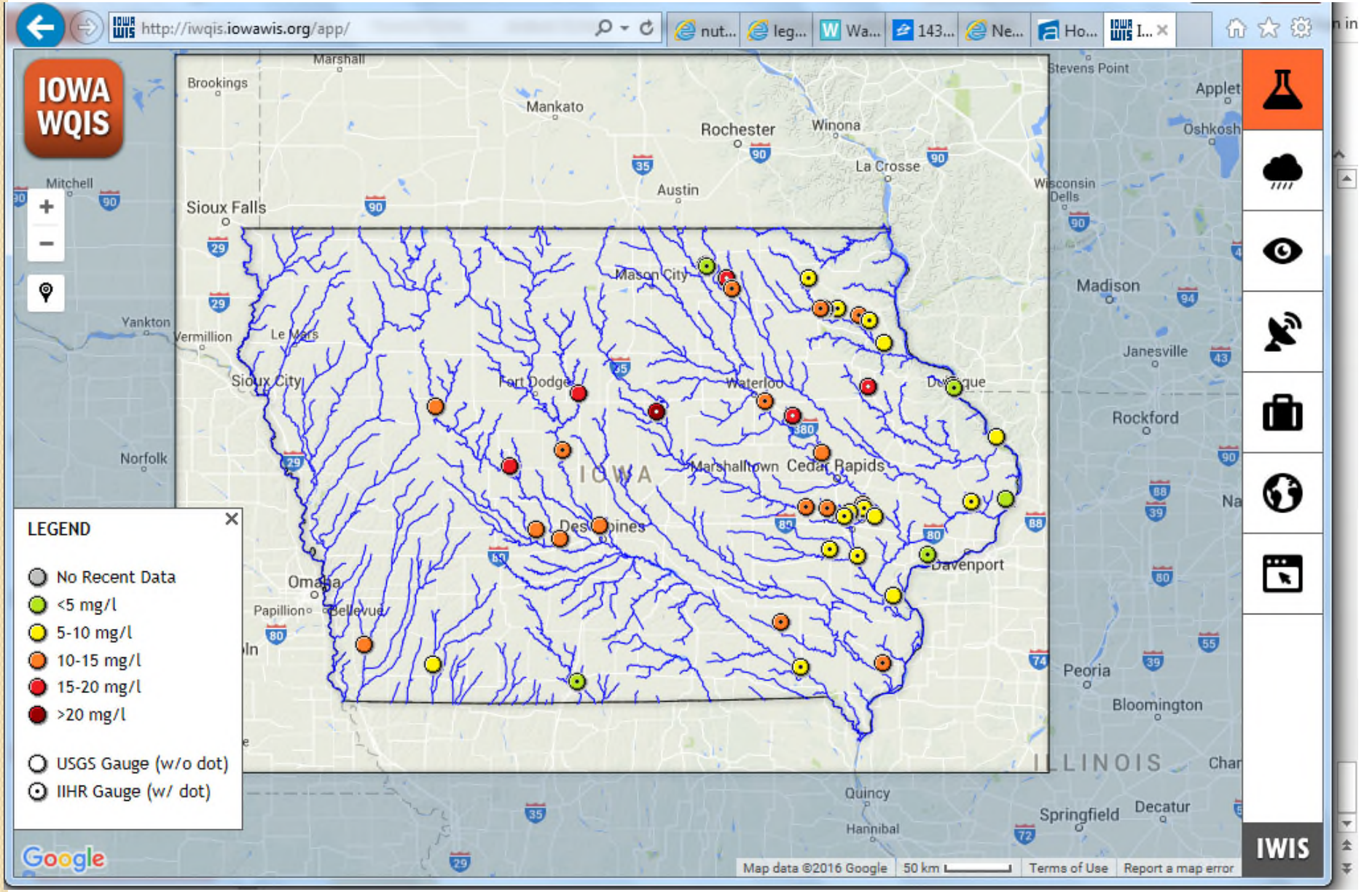

North Raccoon River at Sac City
Nitrate plus Nitrite as N, mg/L
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013

Next Steps

1. Continue to Revise/Refine Load Estimation Methods
2. Explore use of surrogate measures for Total P
3. Expand Sensor Networks

Iowa Nutrient Sensor Network

Iowa WQIS (http://iwqis.iowawis.org/)



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