Nutrient Impacts on Ohio's Drinking Water Quality

Ohio Nutrient Forum

November 14, 2012

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Ohio EPA - DDAGW

Akron's Drinking Water Supply 2011

Nutrient Impacts to Drinking Water

- **Nitrogen: Nitrate and Ammonia**
- **Phosphorus- Linked to Algal Blooms:**
  - Cyanotoxins
  - Taste and Odor Compounds
  - Total Organic Carbon Loads
  - Disinfection Byproducts
- **Associated Pesticide and Soil Runoff**

Ohio EPA
40 years and moving forward

Drinking Water Treatment Issues

- **Conventional Drinking Water Treatment**
  - Does not remove Nitrates or Pesticides; high concentrations of Cyanotoxins; Taste and Odor Compounds.

- **Advanced Carbon Treatment**
  - Does not remove Nitrates; GAC quickly exhausted during HABs; High doses of PAC often required for complete Cyanotoxin and Taste and Odor Compound removal; expensive.

- **Reverse Osmosis & Ion Exchange**
  - Removes Nitrates, but can be cost-prohibitive on large scale, algae can cause membranes to foul; creates residual waste disposal concerns (e.g. high TDS).

Ohio EPA 40 years and moving forward

Nitrate Impacts to Surface Water Sources of Drinking Water

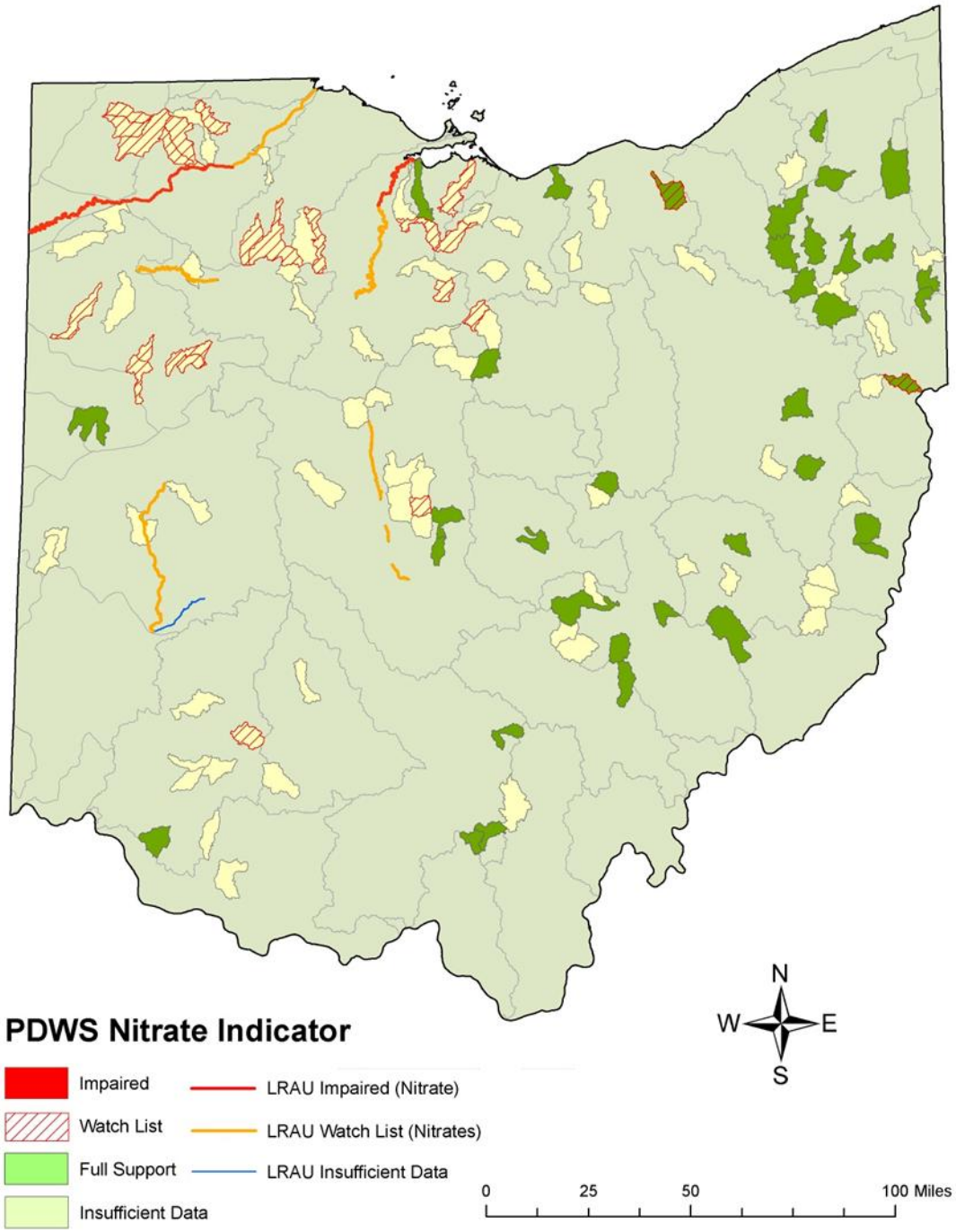
2012 Integrated Water Quality Report

Impaired waters:
Maumee and Sandusky Rivers

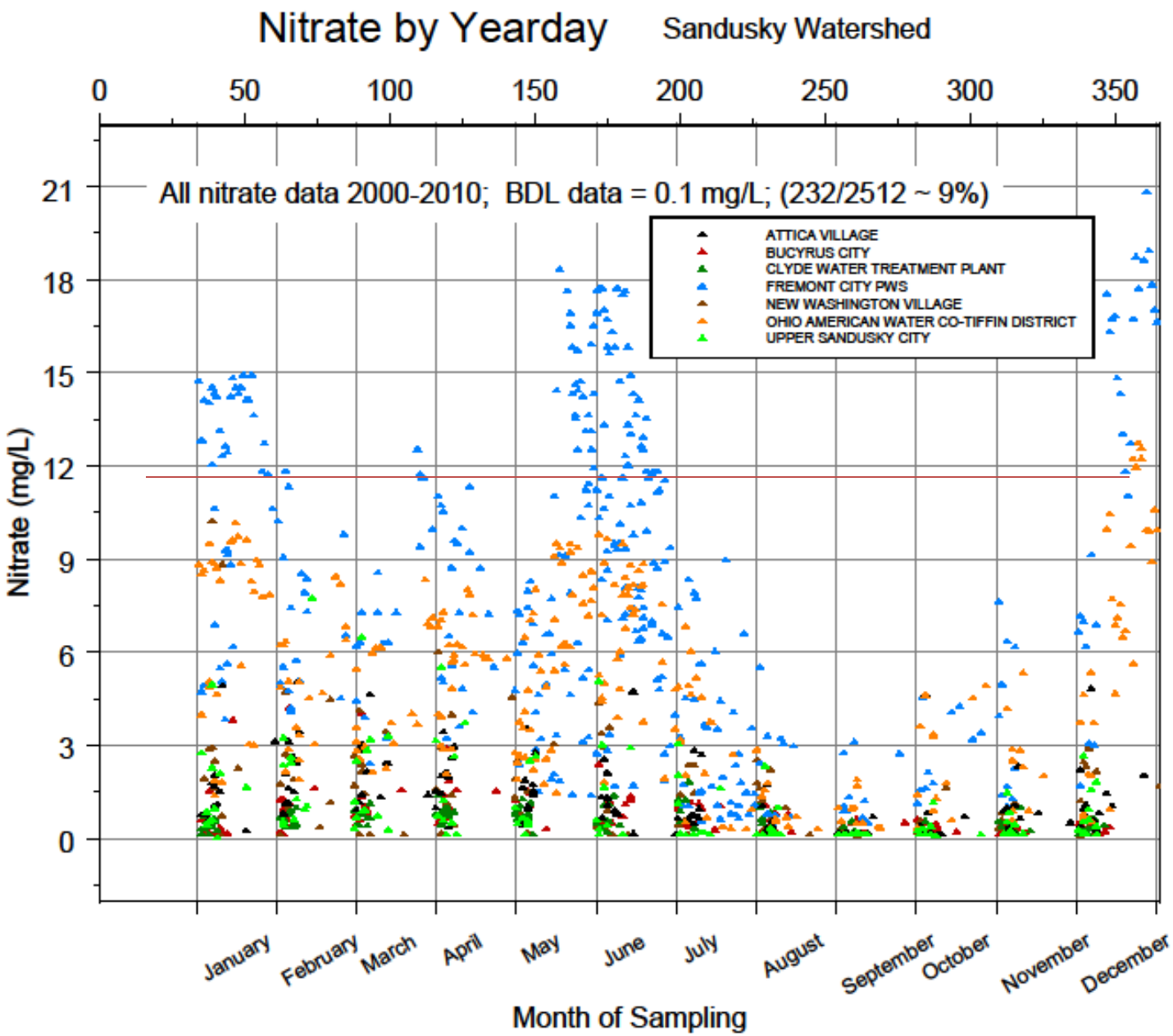
Impaired = 2 or more detections >10 mg/L (MCL)

Watch List waters:
63% of Evaluated Source Streams

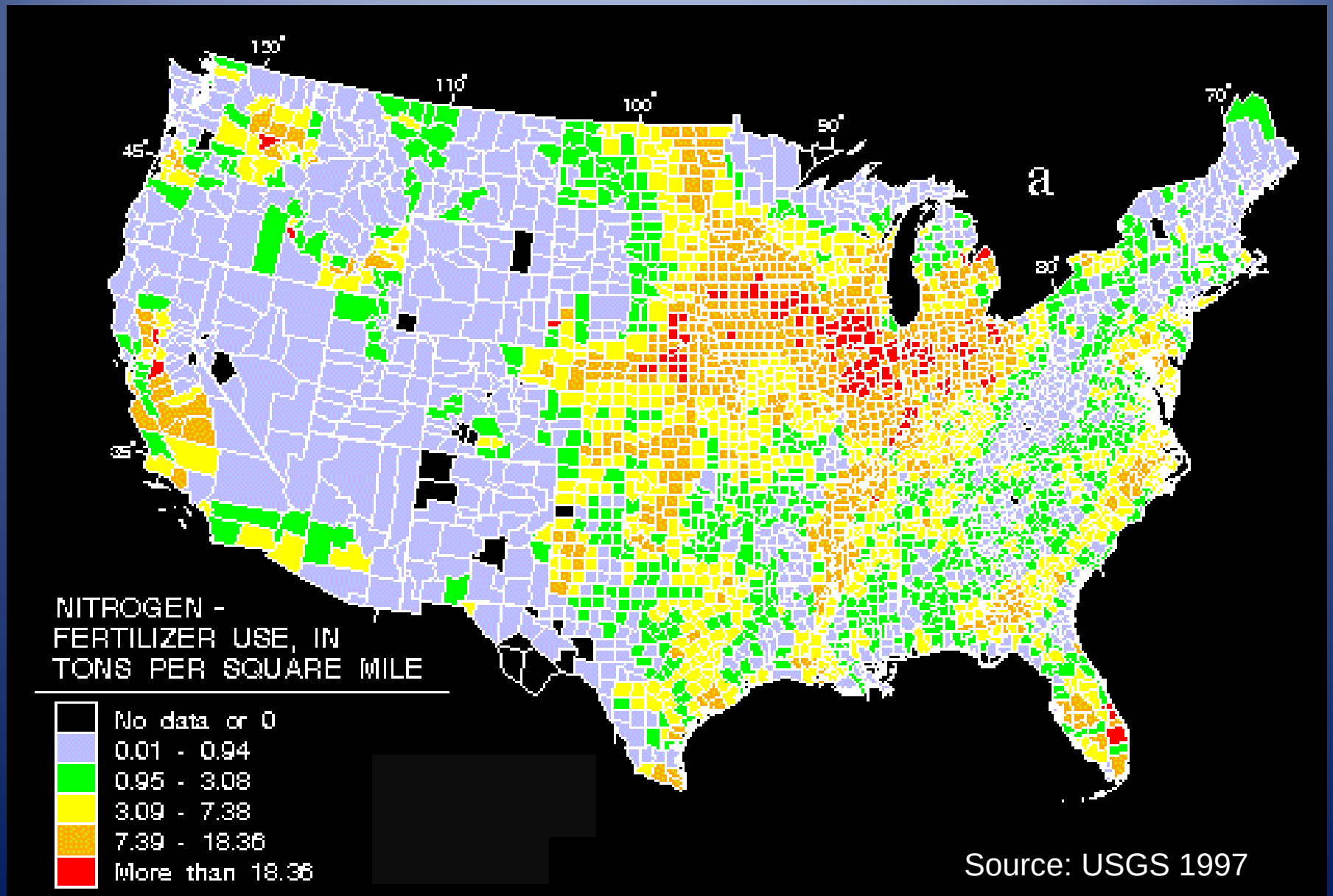
"watch list" = >8 mg/L



Nitrate is a Seasonal Problem for Surface Water Sources



Nitrate Impacts to Surface Water Sources Correspond With Regions of High Nitrogen-Fertilizer Use



Source: USGS 1997

Economic Impacts of High Nitrate Levels to Surface Water Systems

- **Fremont -** Population (18,000). Spending ~ $30 million for upground reservoir due to high nitrates in the Sandusky River.

- **Marysville -** Population (22,800). Installed wells to blend ground water with their high-nitrate surface water source to reduce nitrate levels. Installed $24 million dollar reservoir, in part, to further reduce nitrate levels in treated drinking water.

- **Columbus -** Population (>1,150,000). Monitors source water daily and avoids pumping from Scioto River when nitrate levels are > MCL. Evaluating cost effect measures to reduce nitrate levels.

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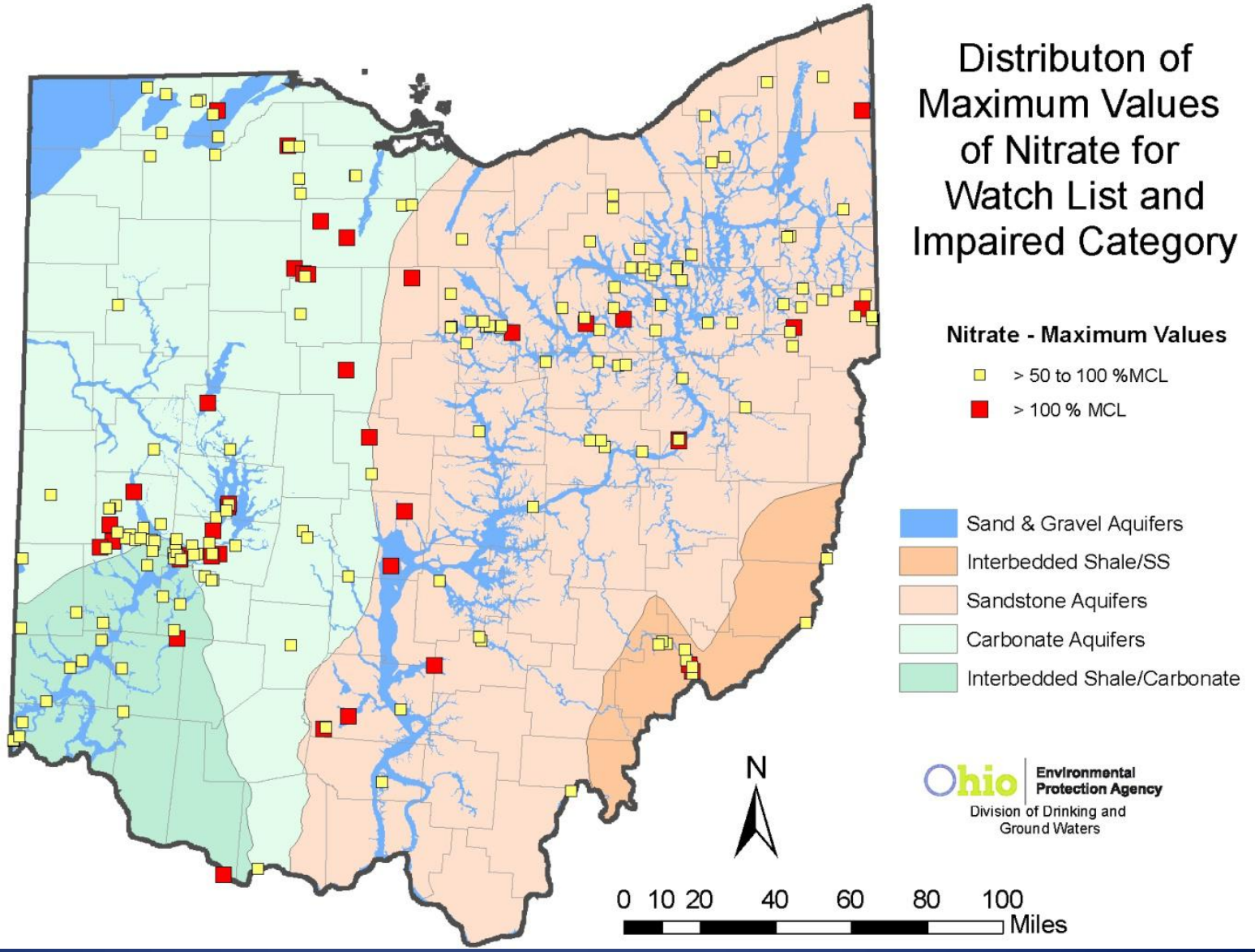
Nitrate Also Impacts Public and Private Water Systems that Use Ground Water

2012 Integrated Water Quality Report

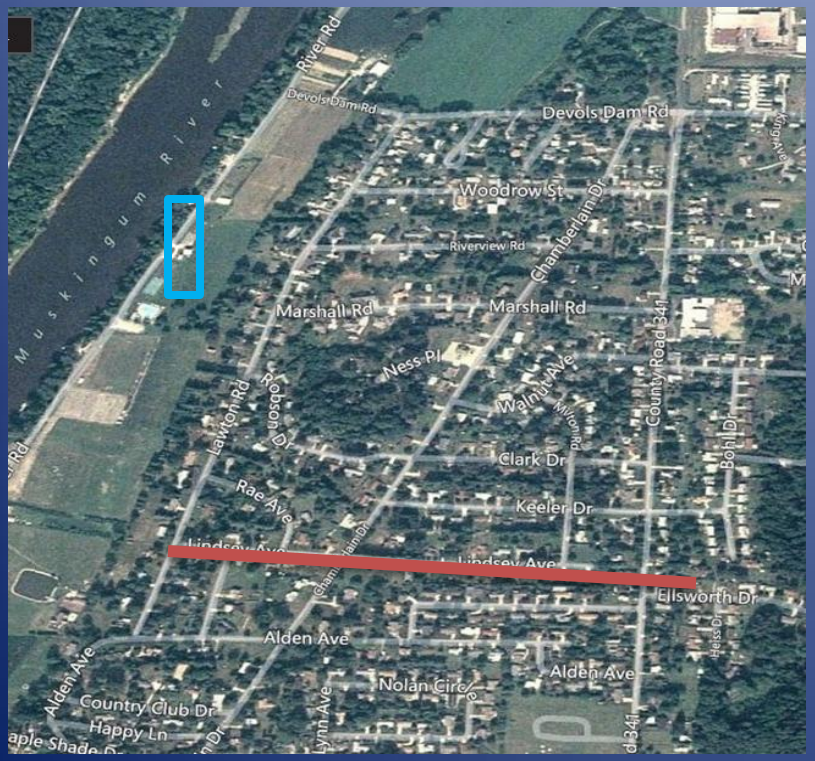
Over the past 10 years 40 PWSs using ground water have exceeded the nitrate MCL.

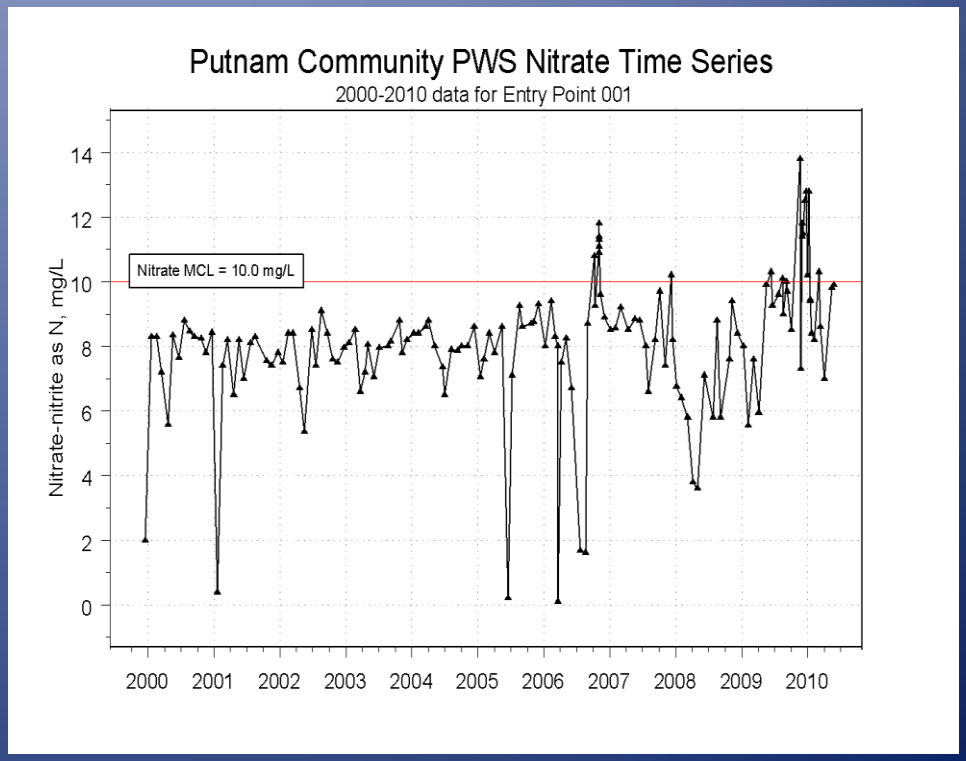
227 PWSs have exceeded 50% of the MCL.



Economic Impacts of High Nitrate Levels in Ground Water

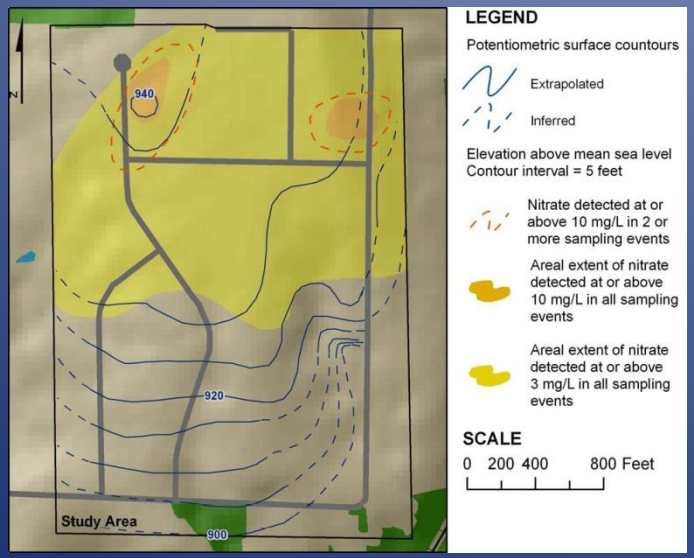
- **Putnam PWS, Devola, OH -** Population (2,700). Installing $2 million dollar reverse osmosis treatment system in response to nitrate MCL violations. County Commissioners agreed to submit plans for sewage improvements or other methods to correct pollution concerns.





Economic Impacts of High Nitrate Levels in Ground Water

- **Private Water Systems (Wayne CO) -** localized nitrate/bacteria contamination caused by placement of household sewage treatment systems into or immediately above shallow fractured bedrock.
- Installation of sewer system to address contamination.



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Economic Impacts of High Nitrate Levels in Ground Water

- **Public and Private Water Systems (Wyandot CO) -** Regional nitrate aquifer contamination forced a church to install a reverse osmosis treatment system; has affected many private wells in the area

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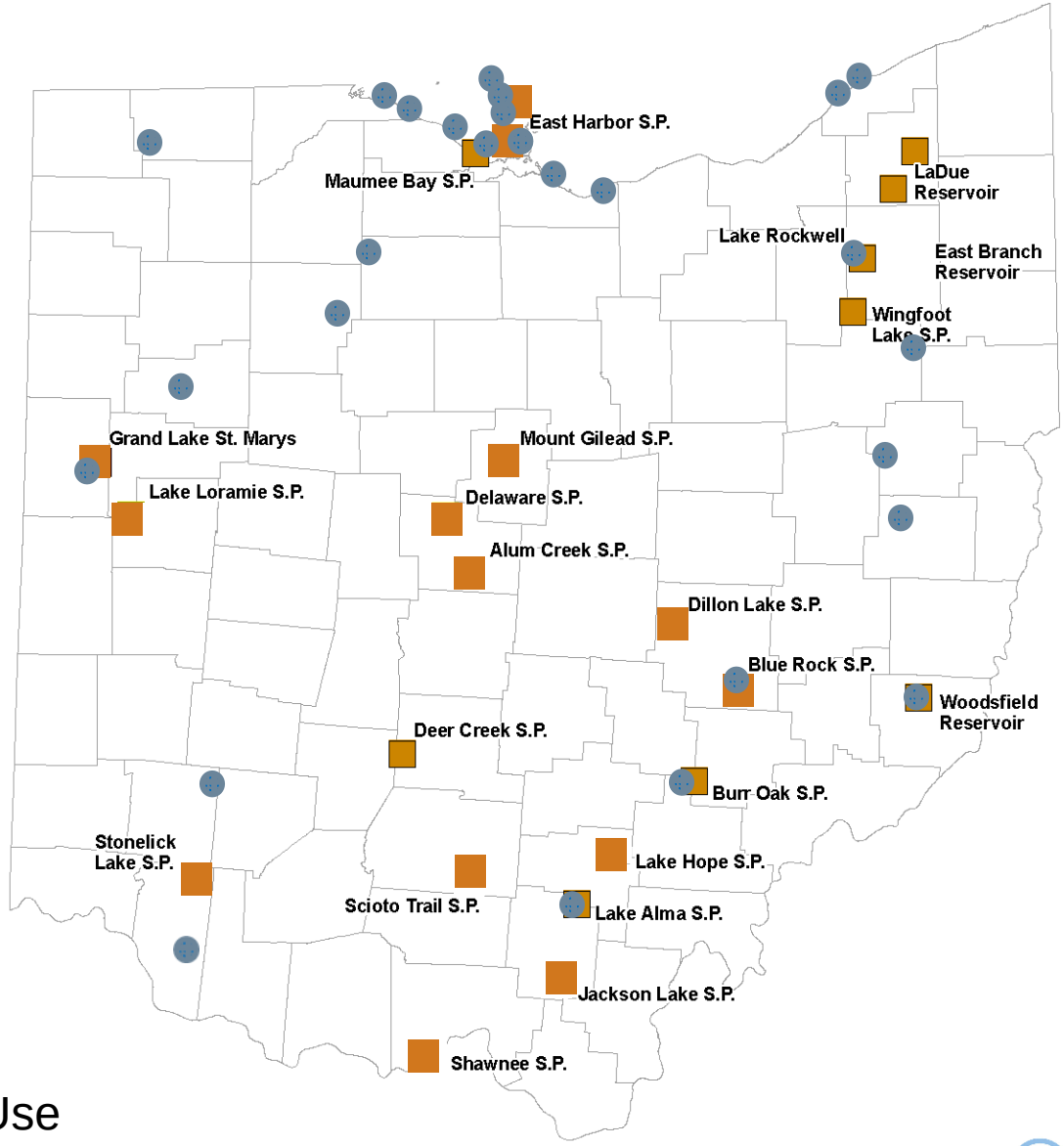
Ohio Harmful Algal Blooms (2010-2012)



20 Public Water Systems with toxins in raw water

No Drinking Water Advisories

- Intakes with HABs
- Recreation Use Advisories

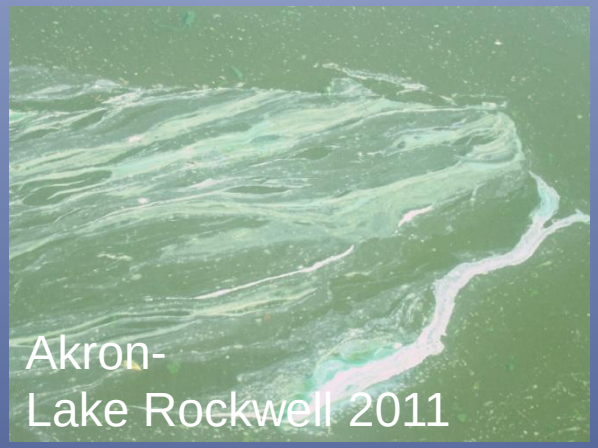
Ohio Environmental Protection Agency

Examples of Harmful Algal Bloom on Ohio's Inland Public Water Supply Lakes and Reservoirs

Celina- GLSM 2010

Wilmington -Caesar Creek Lake 2011

Welston- Lake Alma 2010

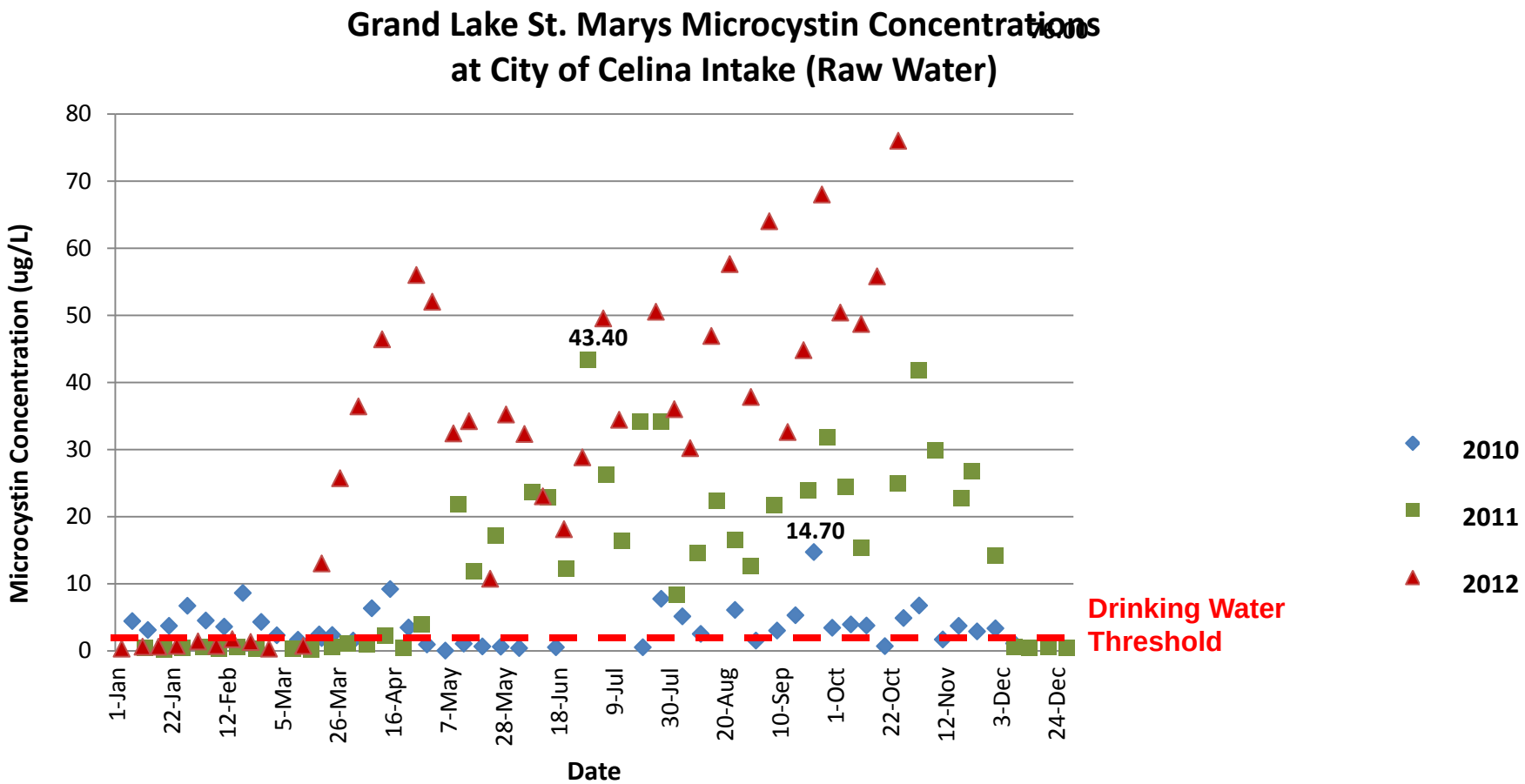

Akron-
Lake Rockwell 2011

Findlay 2012

Bur Oak 2010

Lima 2011

Clermont CO-
Harsha Lake 2012



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Lake Erie 2011

Worst Cyanobacteria Bloom in 30 Years

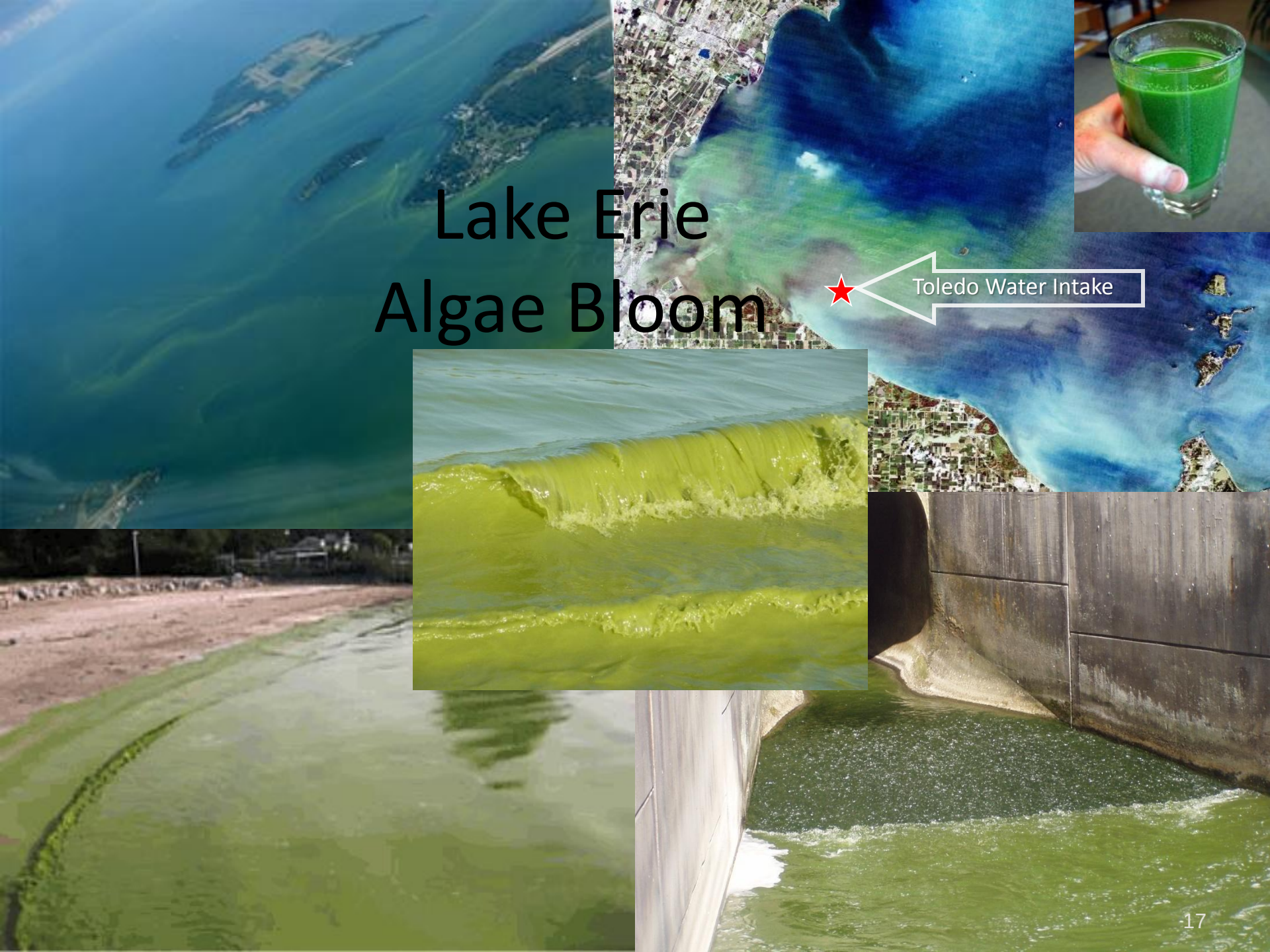
Western Basin

- Microcystin >1000 ppb
- PWS Raw Water >5 ppb,
- PWS Finished: non-detect
- 10 PWSs in Western Basin

Central Basin

- First Source Water Microcystin Detections
  (>100 ppb)
- 13 PWSs in Central Basin

Lake Erie Algae Bloom



MODIS True Color Image 10/09/11

Economic Impacts of Algal Blooms to Surface Water Systems

- **Toledo -** Population (450,000). Spends $100- $200K/month on carbon to address Algae/HABs. Many Lake Erie water systems routinely add carbon to address algae related issues.

- **Clermont County –** Population (117,000). In response to increasing THM levels/Algae, spent approximately $6 million in capital costs for new GAC facility and anticipates spending $660,000/year on GAC filter media.

- **Akron -** Population (333,000). Spent over $200,000 in one month on carbon to treat an algae bloom that was causing taste and odor impacts.

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Economic Impacts of Algal Blooms to Surface Water Systems

- **Celina –** Population (11,700). Spent $7.2 million in capital costs for new GAC facility and spends $340K /year on GAC filter media to address disinfection byproducts and HAB concerns.

- **Columbus -** Population (>1,150,000). Spends $2 million/year on PAC to reduce TOC (linked to algae and soil runoff).

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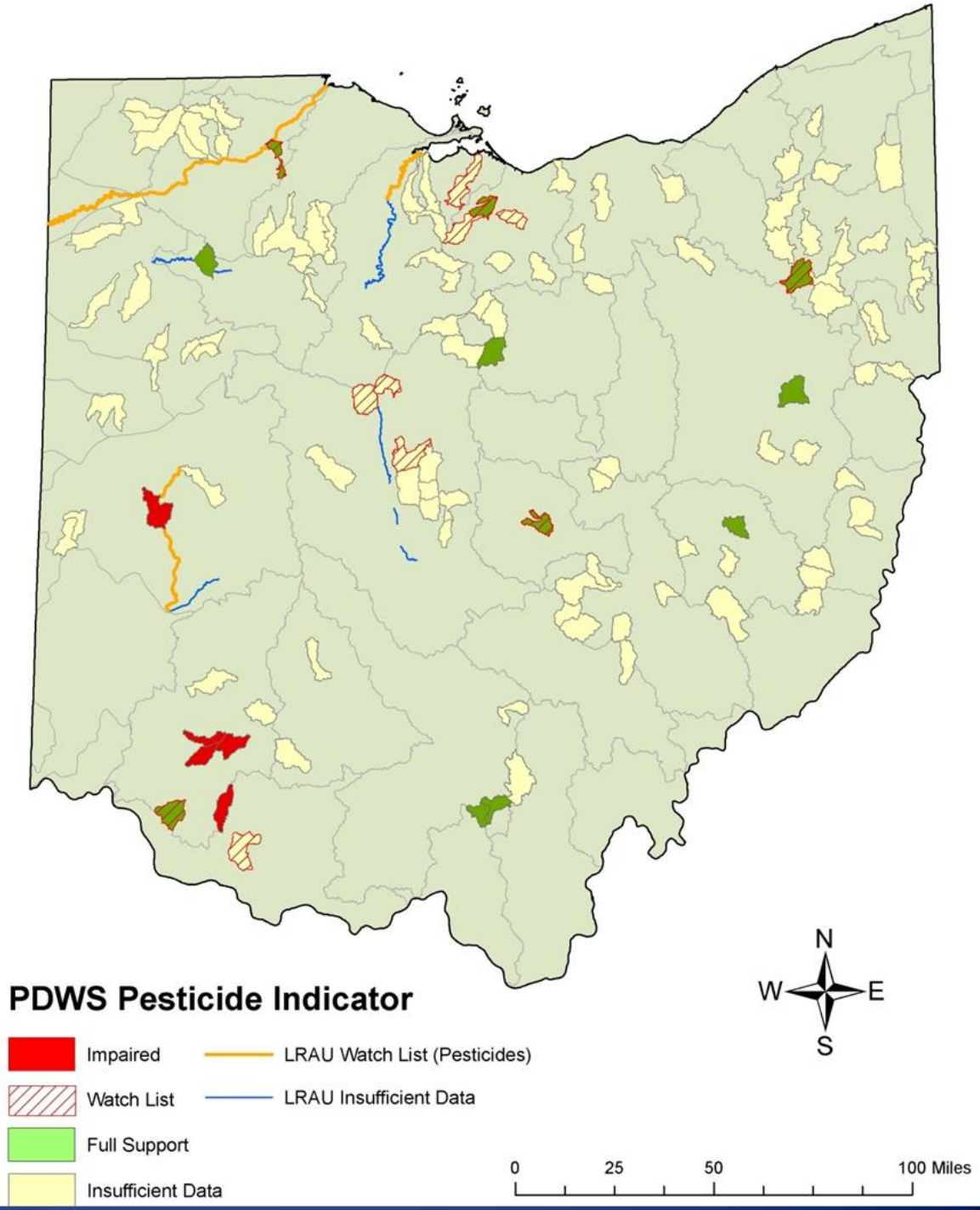
Pesticide Impacts to Surface Water Sources of Drinking Water

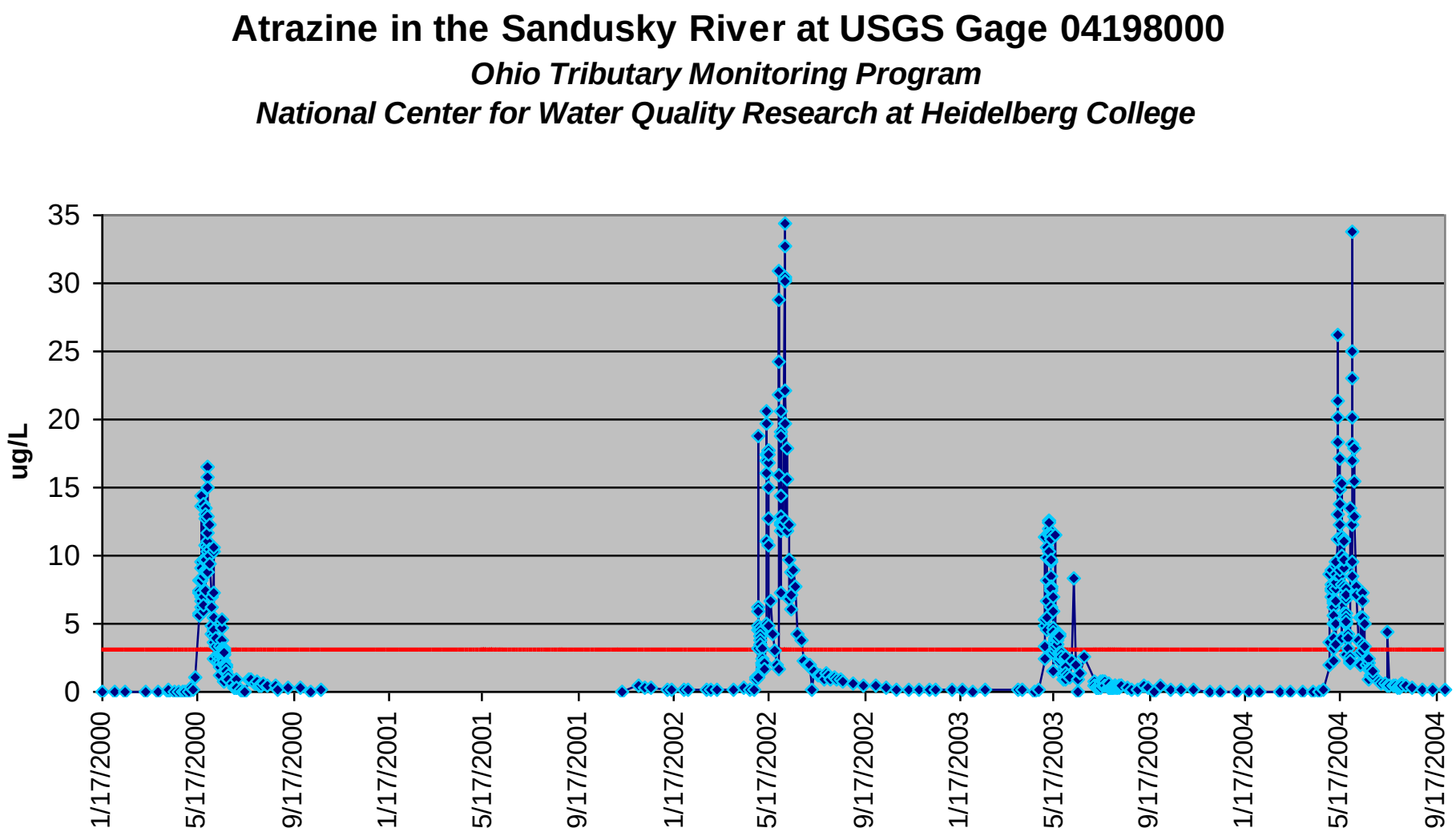
2012 Integrated Water Quality Report

Impaired waters are being included in DSW TMDLs: **Mt. Orab, Piqua and Blanchester**

Impaired = annual avg >3 ug/L, **"watch list"** = qtr avg > 3 ug/L, or single detect >4X MCL)



Pesticides - Seasonal Problem for Surface Water Sources



Importance of Spring Storm Event Sampling

Spring 2012 Blanchester Atrazine Data (ug/L)

	(April) **Storm**	(April) **Storm**	(May) **Survey**
West Fork	84.4	56.0	4.65
Stonelick	0.38	75.0	2.82
Whitacre	0.32	0.40	0.33

West Fork during April Storm Event Sampling

MCL = 3 ug/L, Based on Annual Average

Economic Impacts of High Pesticide Levels to Surface Water Systems

- **Mt. Orab.** Population (3,600). Spent >$6 million for activated carbon system to remove atrazine. Spends $25,000/year to **replenish GAC media.**

- **Columbus.** Population (>1,150,000). Spends approximately $100K /year on carbon to reduce pesticides in treated water. Monitors atrazine far upstream to optimize use of PAC when atrazine concentrations are highest.

- **Piqua.** Population (20,500) Spends $25,000/year on PAC to reduce atrazine concentrations.

Summary

- Nitrates and Cyanotoxins pose Acute health risks and Disinfection Byproducts and Pesticides pose long-term health risks.
- Public Water Systems provide safe drinking water to consumers, but often requires advanced treatment.
- Removal of Nitrates, Cyanotoxins, Taste and Odor Compounds, Disinfection Byproducts, and Pesticides place an economic burden on many Ohio communities resulting in increased capital expenses and annual operating costs.

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