Chain O' Lakes Watershed Plan
Findings
&
Implementation Recommendations

Agenda

- Watershed Plan Background and Goals
- Watershed Characteristics
- Results and Findings
- Recommendations and Actions
- Targets, Critical Areas and Cost
- Summary
- Questions

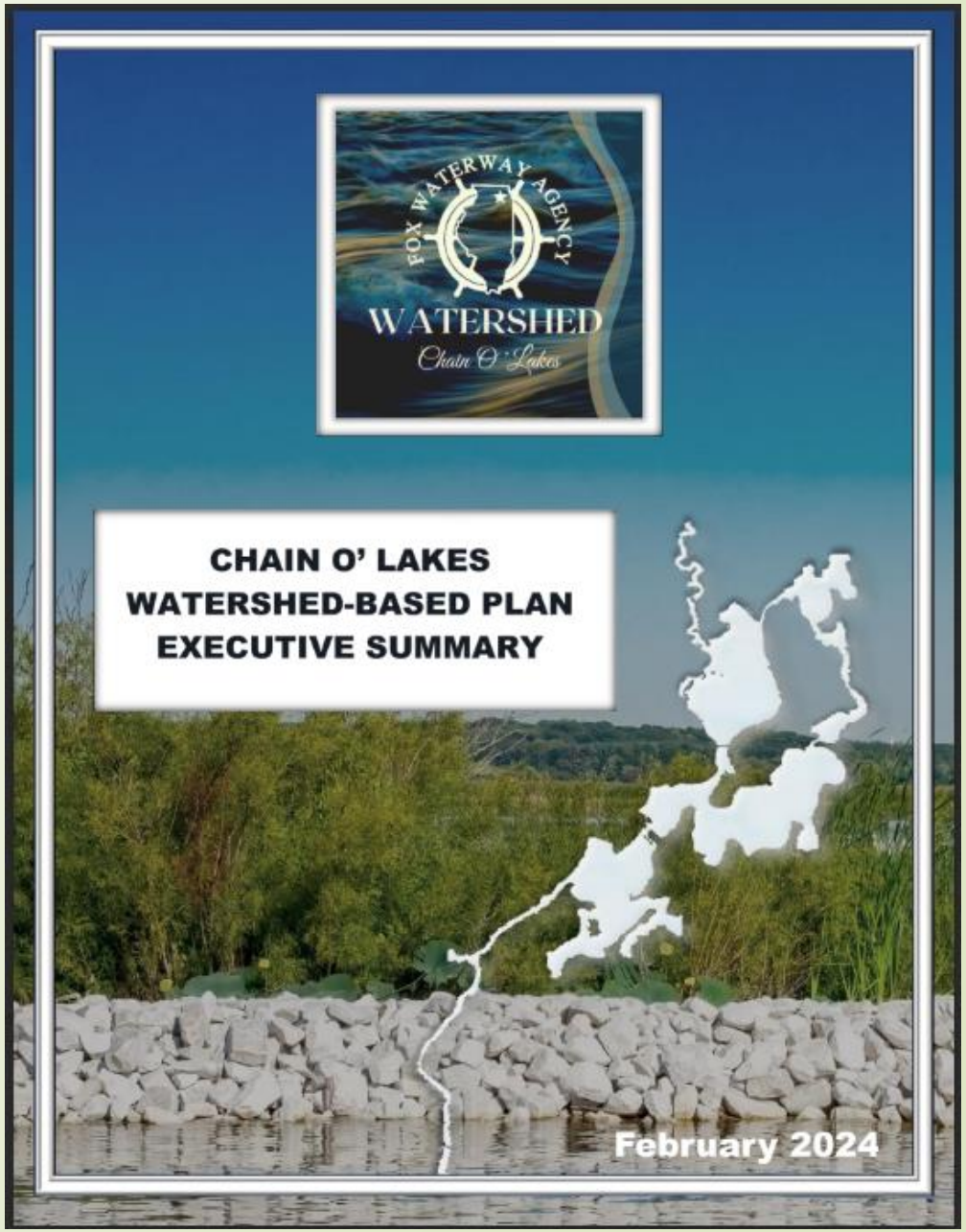
Chain O' Lakes Watershed Plan History

- Watershed plans identify a path forward to address water quality impairment from non-point pollution
- Fox Water Agency identified the need and on the second attempt received IEPA grant funding to develop a plan
  - Funding granted in July 2022
  - Plan approved in February 2024
- Plans detail findings and identify the most applicable best management practices, BMPs, to improve water quality
- Practices that will have the biggest impact are unique to each plan, while the practices themselves are standard

The Watershed Plan

- It is a Reference Doc. – 314 pages
- Detailed study of the planned area
  - Field observations
  - Historical data
    - Land use and water quality
  - Community Input
- Detailed analysis
- Characterizes top sources of non-point pollutants contributing to water quality impairment
- Identifies a path forward to address water quality impairment

Today



Goals of Chain O' Lakes Watershed Plan

- Our water is **clear** enough that you can see the bottom in shallow water.
- Our water is **free of excessive nutrients** so algae growth does not turn our water green.
- Our water is **clean** enough that there are no recreational restrictions for boating, swimming and fishing.
- Our **community** and stakeholders are **knowledgeable** and **engaged** in the preservation of our watershed.
- Our communities have **land** within the watershed, so activities to monitor, maintain and improve water quality can be implemented.

Current Condition

- EPA identified impairments for recreational water
  - **Aesthetic Quality**
    - Phosphorous
      - Aquatic Plants and Algae
    - Suspended Solids
  - **Fish Consumption – Limited**
    - Mercury
    - Polychlorinated Biphenyls
- Impairment is driven by
  - Inflow loading
    - Into the watershed area
    - Within the watershed area
    - Internal Loading

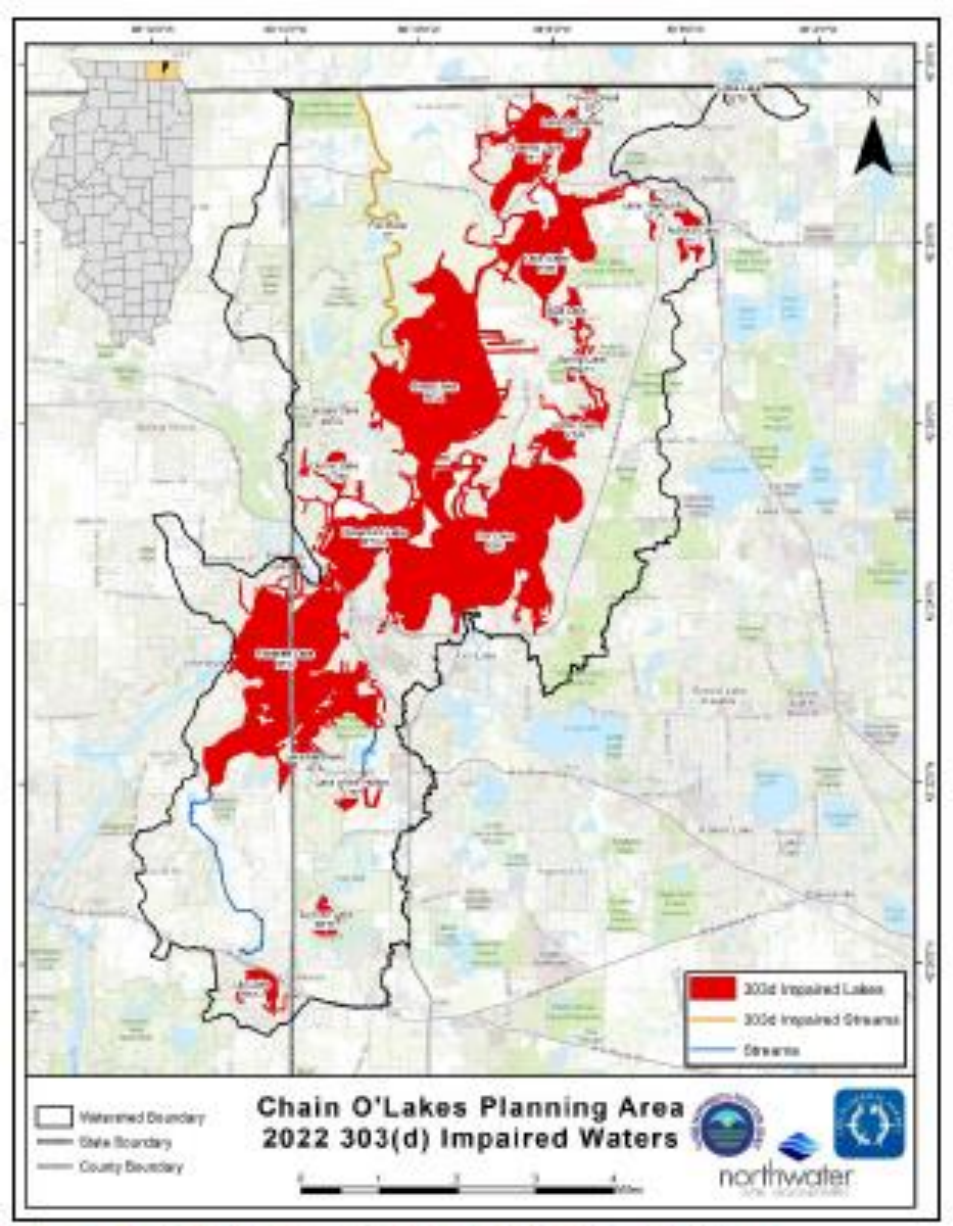


Figure 1-4: Chain O' Lakes 2020/2022 303(d) Impaired Waters

Total Maximum Daily Load - TMDL

- Estimate of acceptable inflow of pollutants to address impairment
- Nitrogen – 45% - IL Nutrient Loss Reduction Strategy
  - To reduce plant and algae growth
- Phosphorus - 82 % reduction – TMDL 2020
  - To reduce plant and algae growth
  - Prevent Harmful Algae Blooms - HAB
- Total Suspended Solids – 68% - Load Reduction Strategy
  - To reduce nitrogen and phosphorous
  - To improve water clarity and navigation
- Bacteria Loading – 70% - TMDL - Extrapolated Number
  - To eliminate restrictions on recreation

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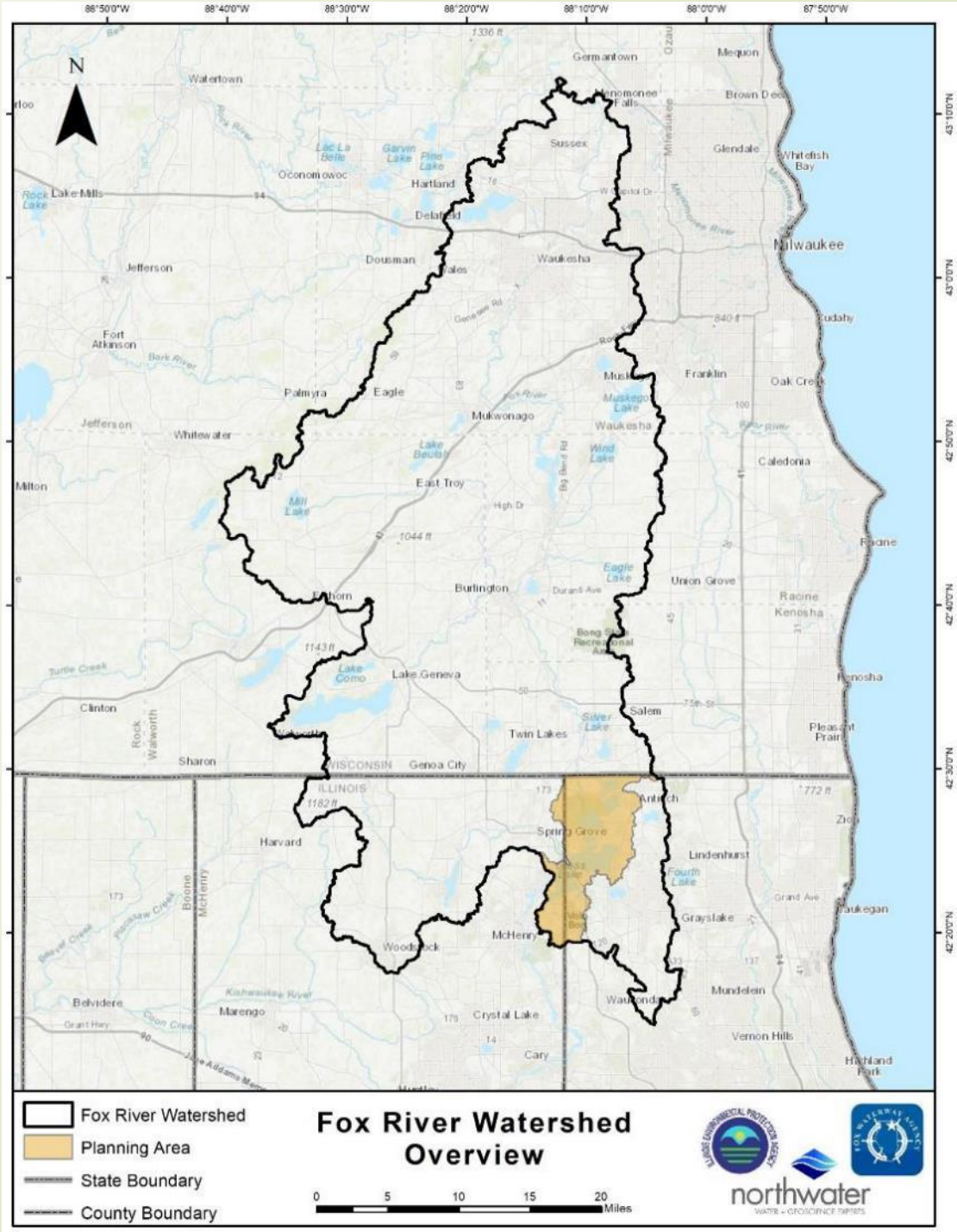
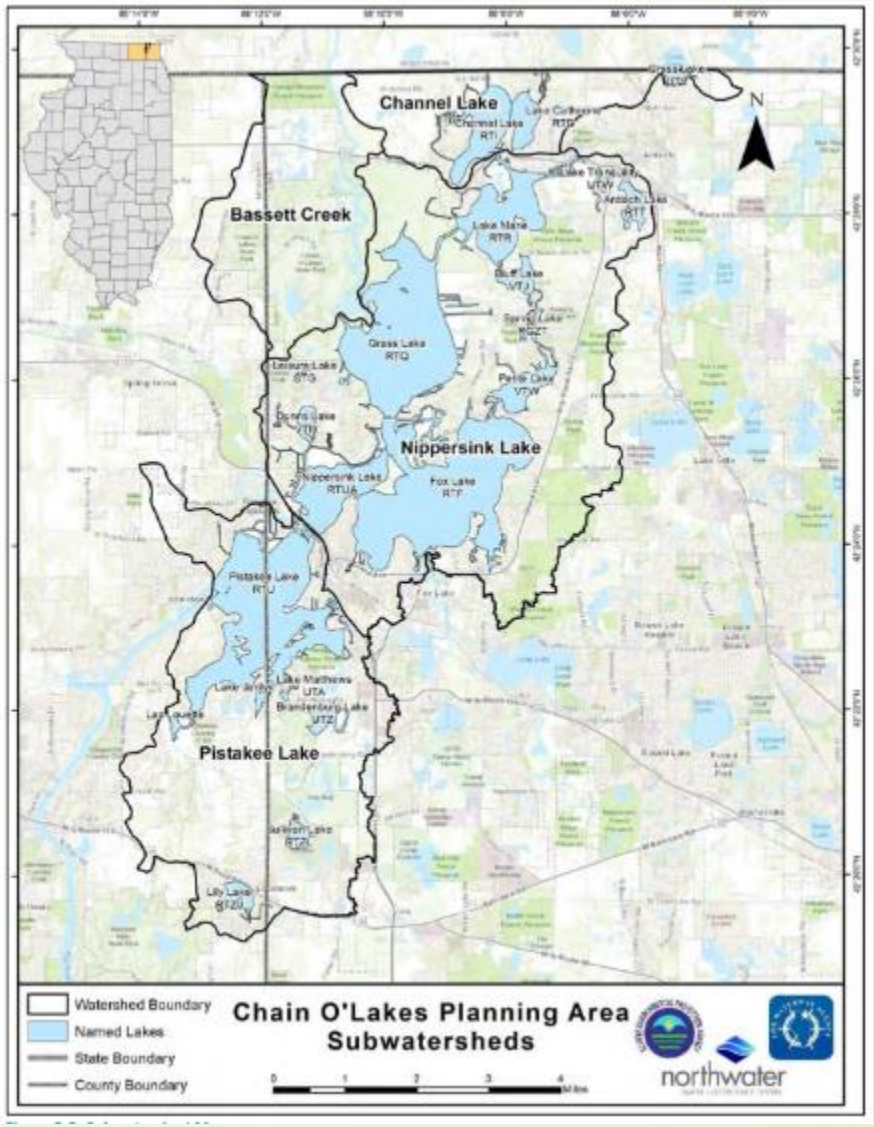
Watershed Characterization

WATERSHED & PLANNING AREA

- 13 interconnected lakes
- Part of the Fox River Watershed
  - 1,200 Square miles of upstream drainage from Wisconsin
- Planning area = 32,922 aces from the state line – Less than 2% of the Fox River Watershed
- 13 Municipalities/Communities
- Lake and McHenry County – majority in Lake



Our Plan Area



- Watersheds are divided up into local areas
- Identified by Hydrologic Unit Codes – HUC

- Channel Lake,
- Bassett Creek/Fox River
- Nippersink Lake/Fox River
- Pistakee Lake/Fox River

- 18 Miles of stream

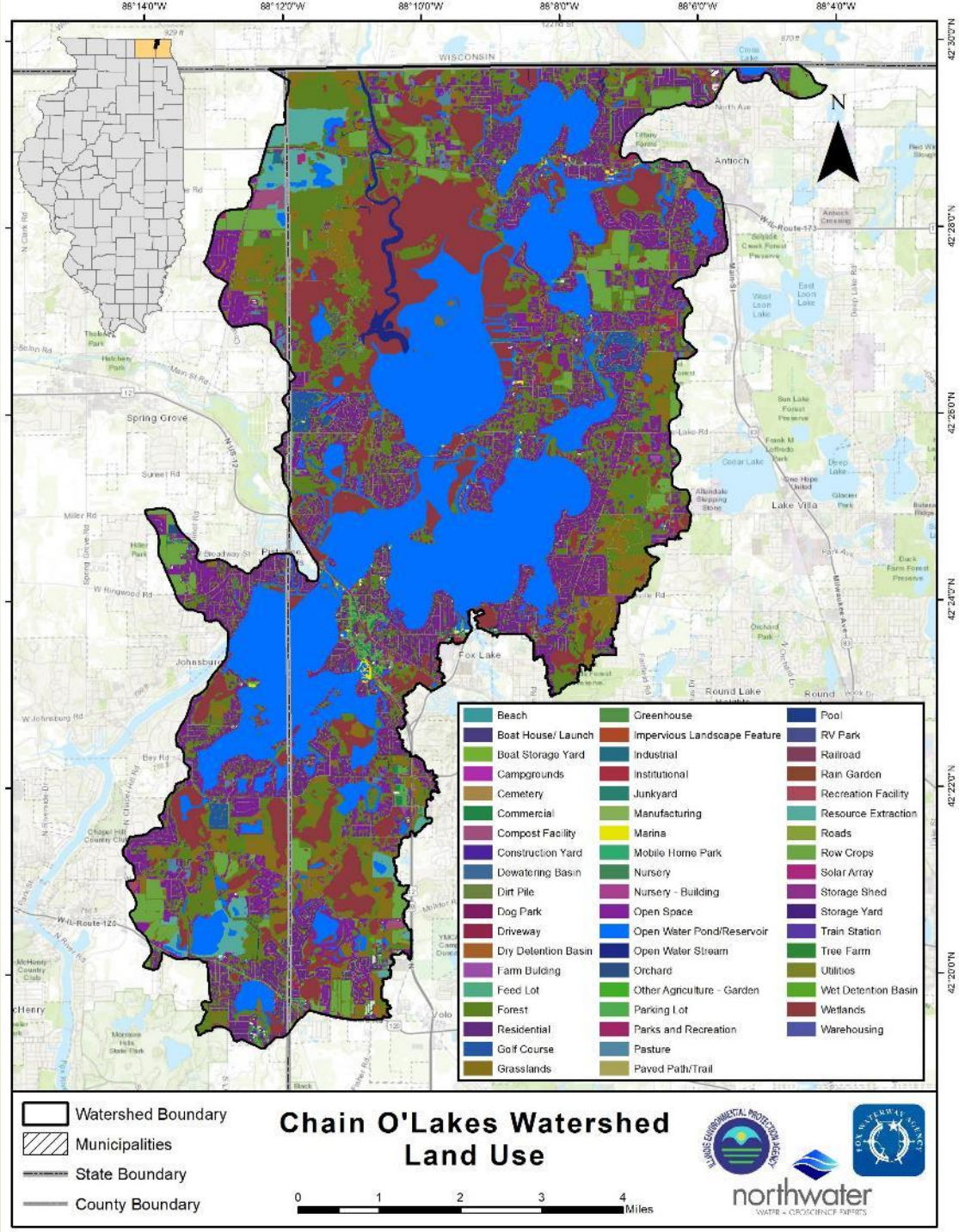
- 210 miles of shoreline

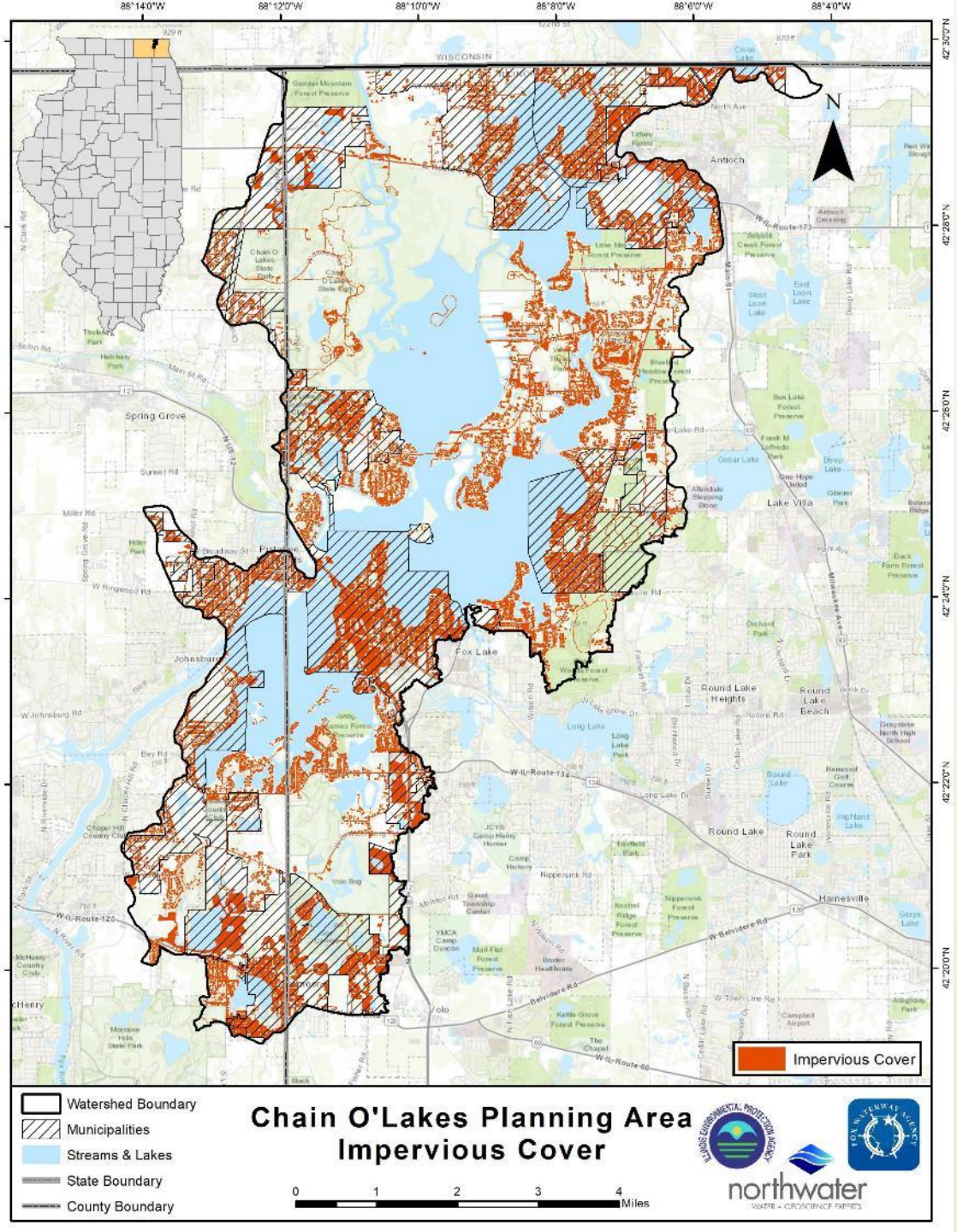
- **Local** actions to address **local** problems

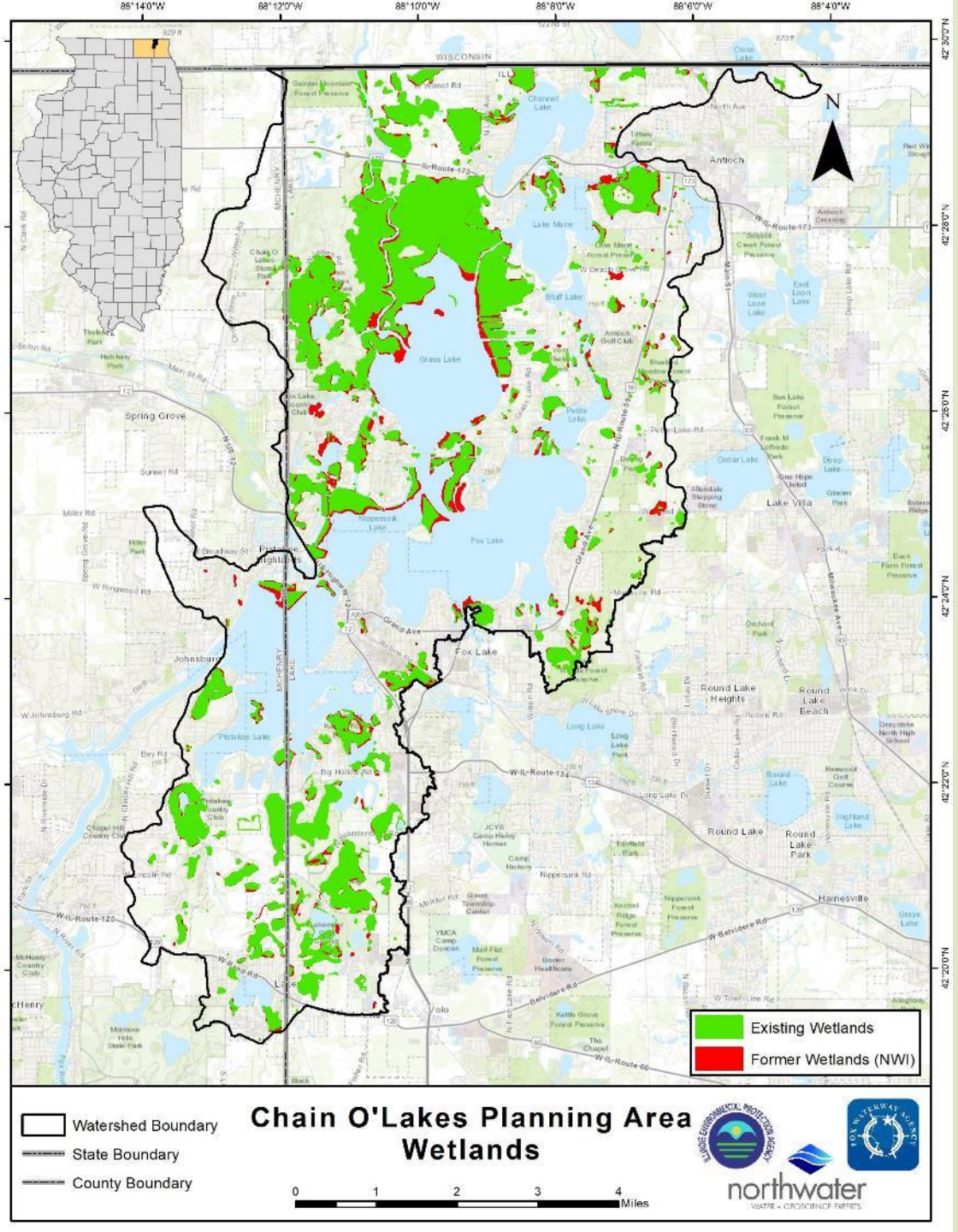
- Part of a much larger watershed
  - Both upstream and downstream

Land Use

- 8,238 acres of open water (25%)
- 5,840 aces of forest (18%)
- 4,854 aces of open space (15%)
- 4,411 aces of open water wetlands (13%)
- 4,139 aces of impervious surfaces (13%)
  - Highest % in Pistakee Lake and Channel Lake sub-watersheds at 15%

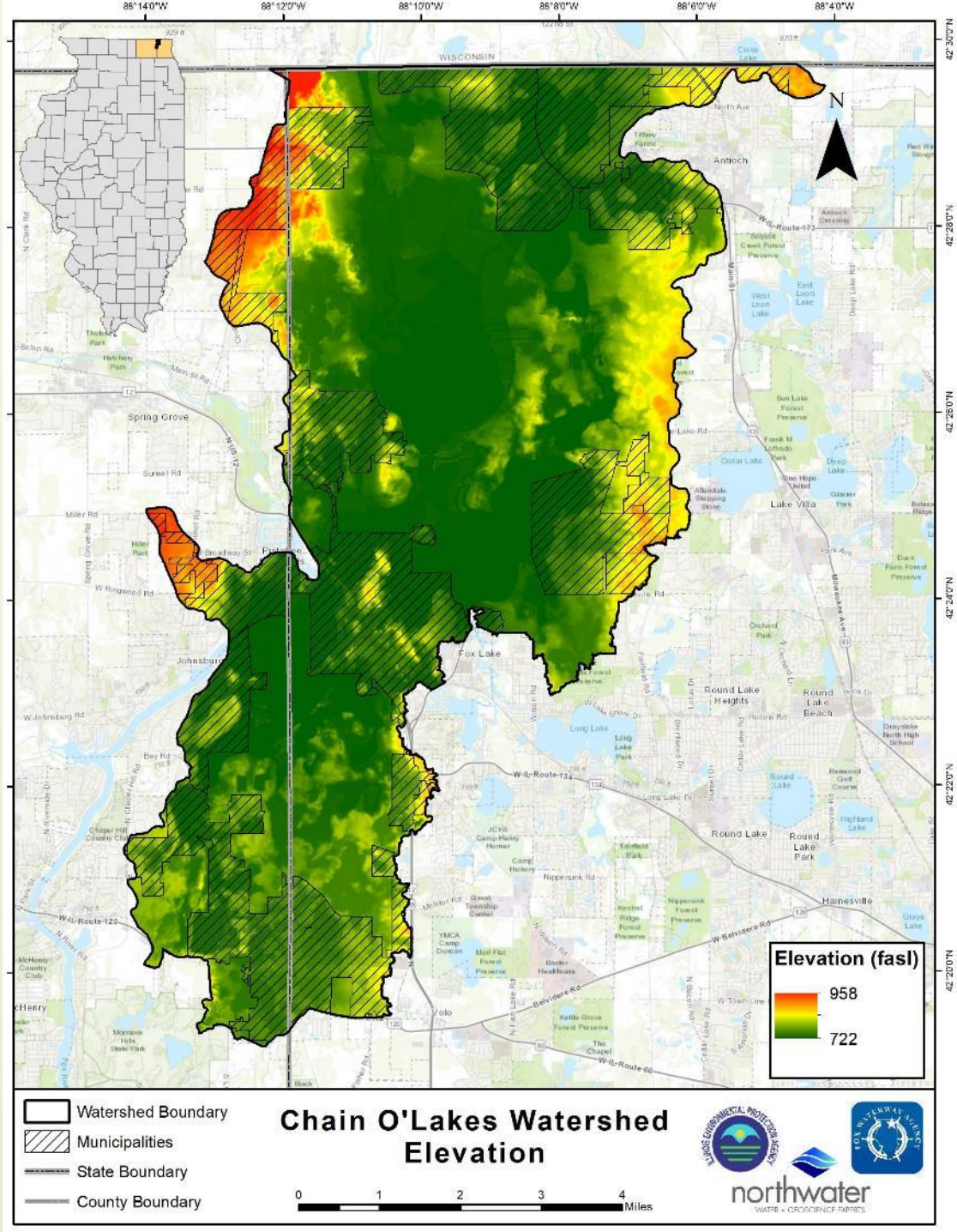



Impervious Cover
Watershed Boundary
Municipalities
Streams & Lakes
State Boundary
County Boundary
Chain O'Lakes Planning Area
Impervious Cover
0 1 2 3 4 Miles
northwater


Existing Wetlands
Former Wetlands (NWI)
Watershed Boundary
State Boundary
County Boundary
Chain O'Lakes Planning Area
Wetlands
0 1 2 3 4 Miles
northwater

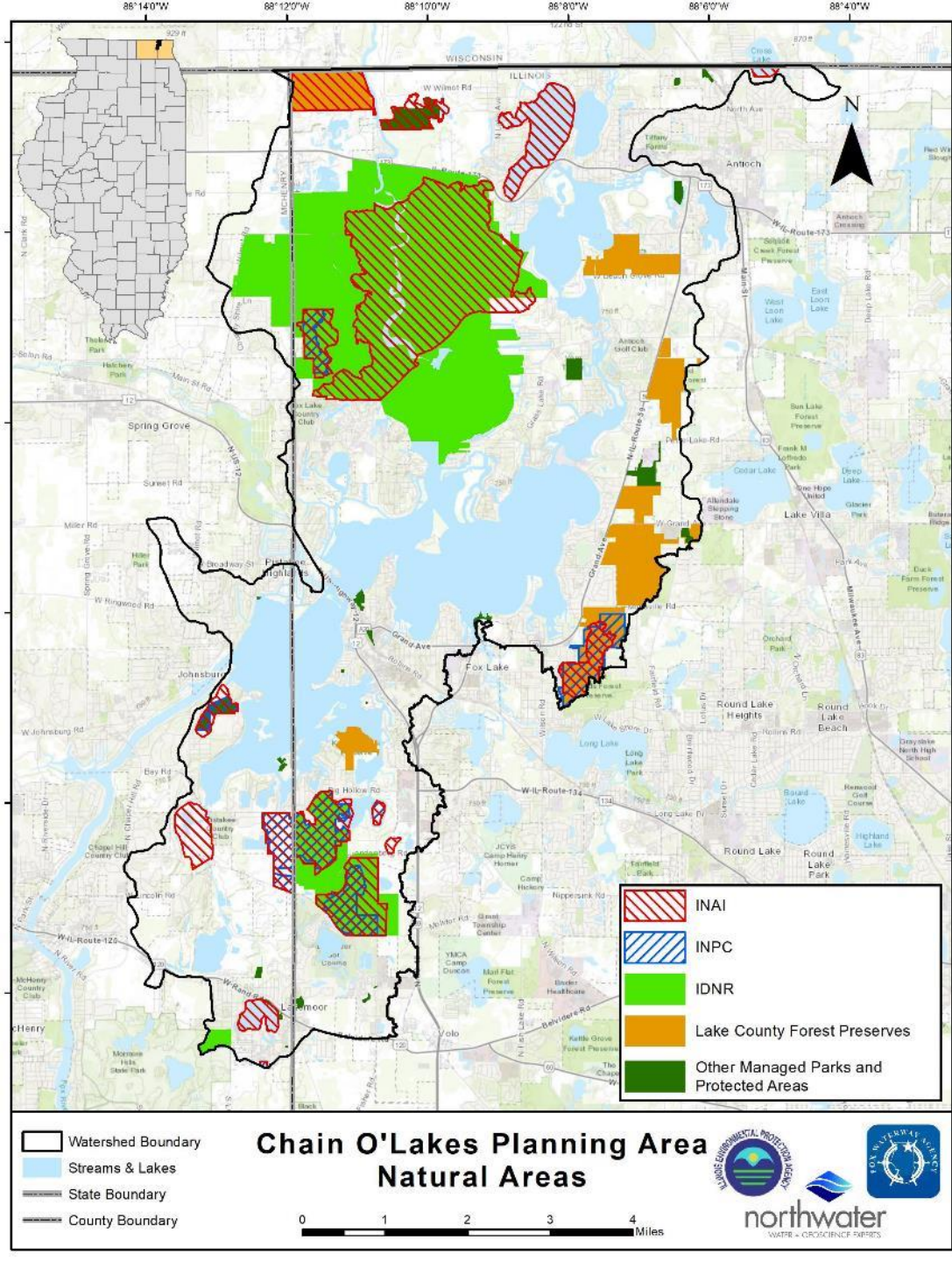
Soil & Slope

- 7,481 aces of wetland (23%)
- 5,220 aces of erodible soils (16%)
- 9,330 aces of soils with moderate runoff potential (28%)
- Average elevation of 759 feet above sea level
- Average slope of 5.9% - flat



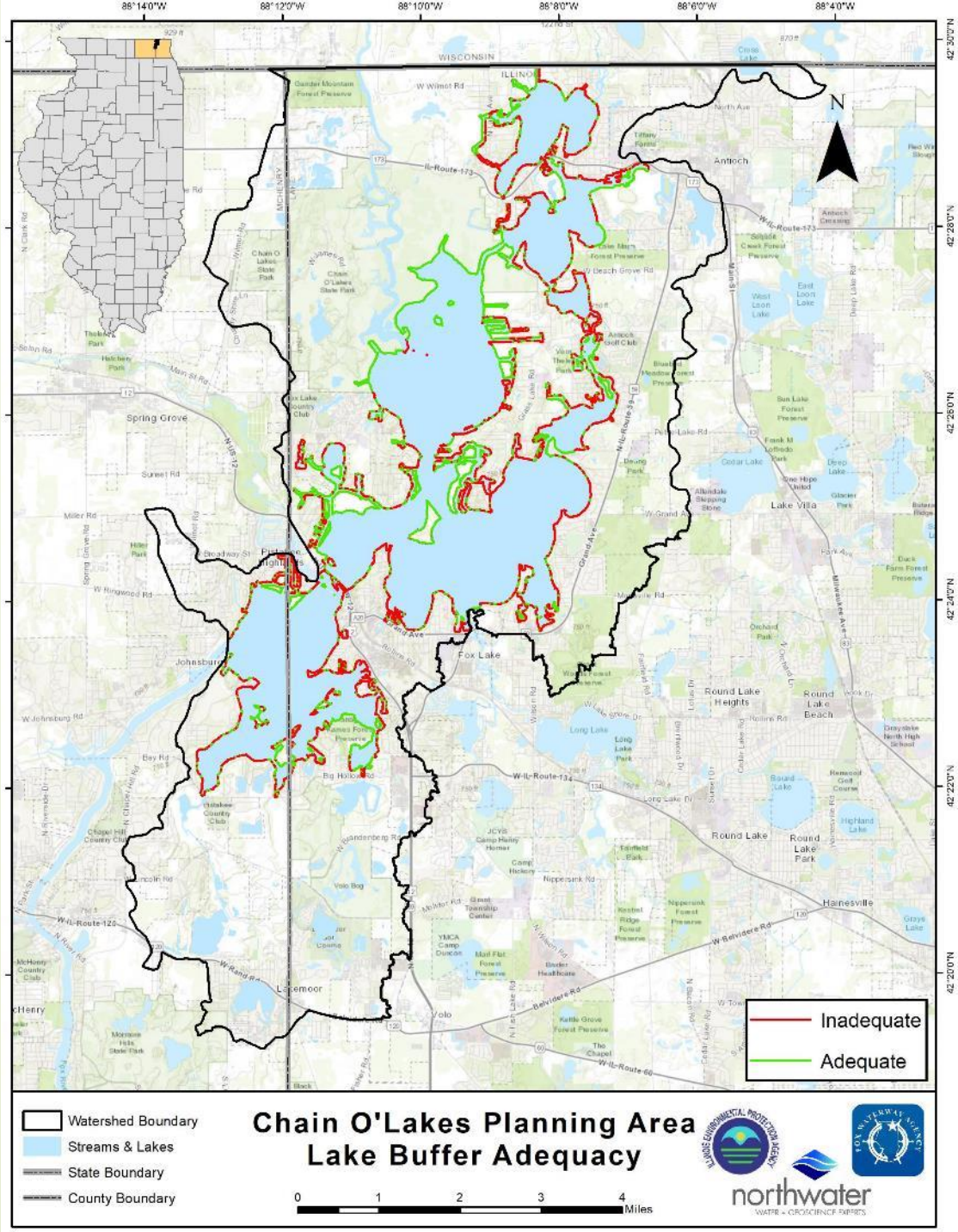
Protected/Natural Areas

- 7,831 aces of managed parks, forest preserves and other natural areas
- 5,931 aces managed by the state, mostly Chain O' Lakes State Park at 5,087 aces
- 5 forest preserves - 1,602 acres



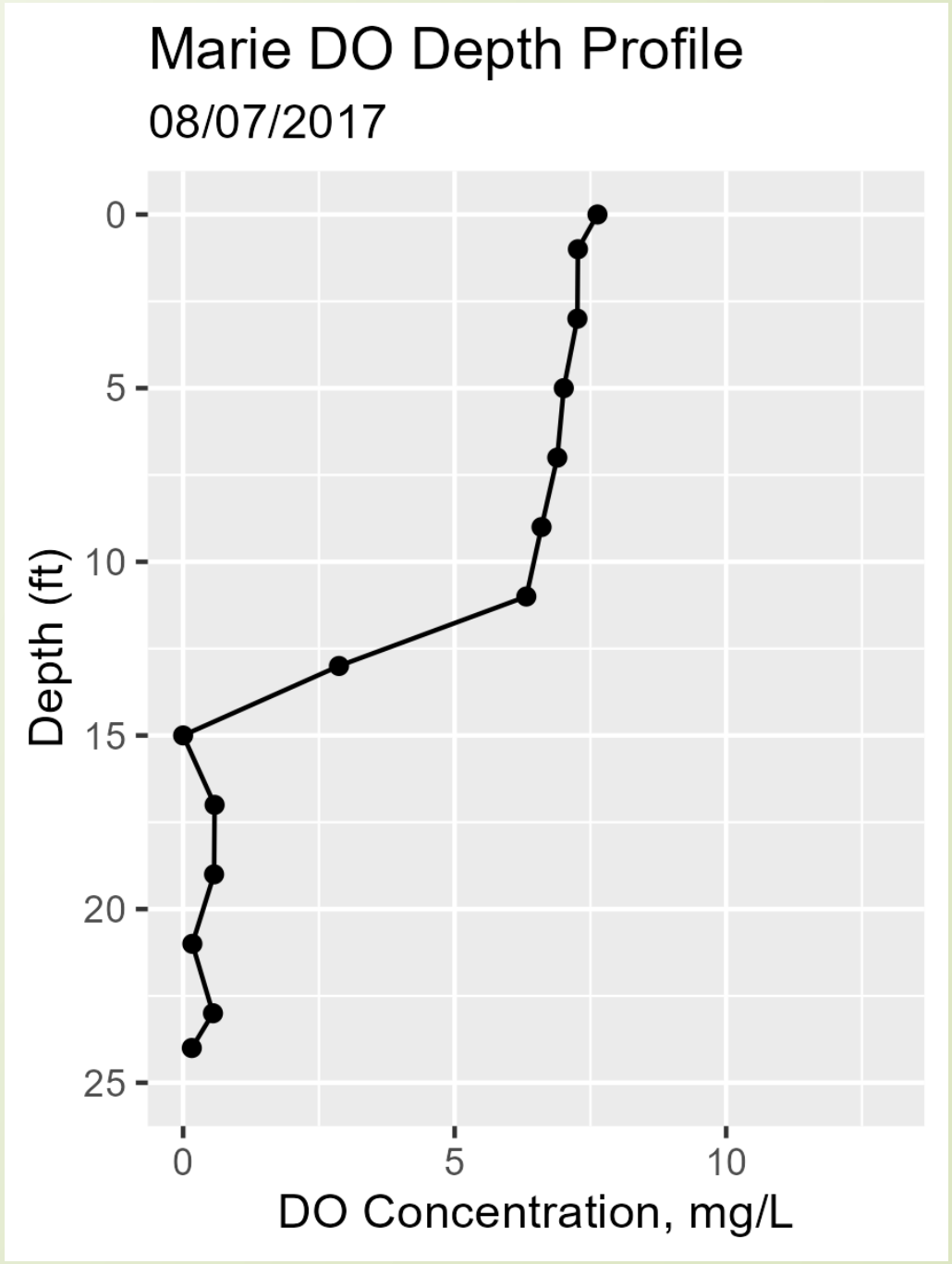
Lake & Stream Buffers

- 79% of streams adequately buffered
  - 37% is forest and 36% is wetlands
- 49% of lake shorelines adequately buffered so over 50% are not
  - Inadequate = Residential, lawns and other developed areas
  - Lawns and residential areas make up 40% of the shorelines



Water Chemistry

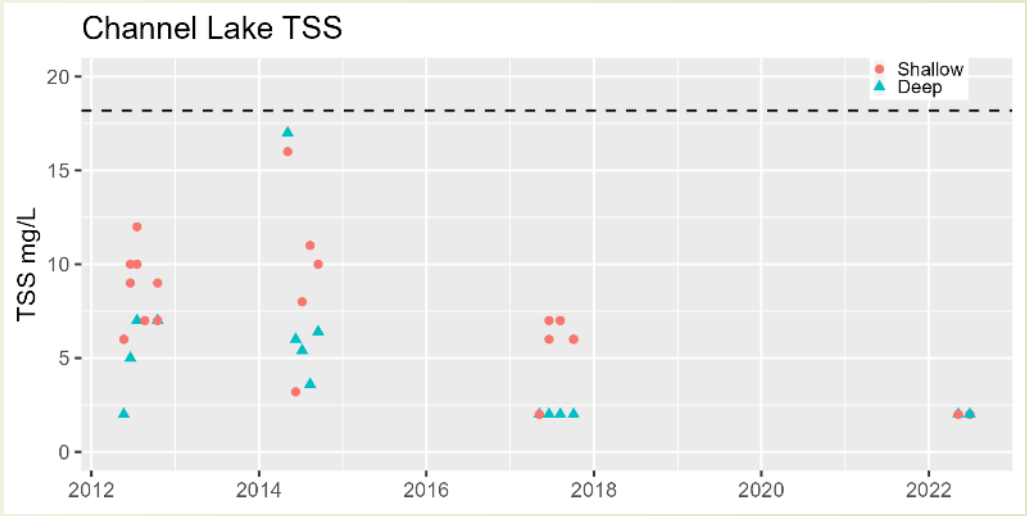
- Issues: sediment, algal blooms, aquatic plants, low dissolved oxygen, bacteria
- A nutrient rich system – **phosphorous** and nitrogen
- Internal nutrient release from low dissolved oxygen
- Nutrient re-suspension
- High external loading

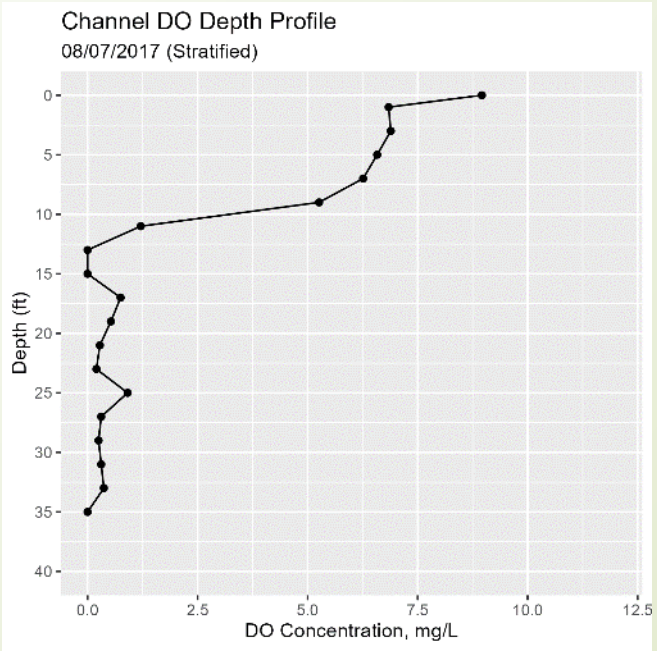


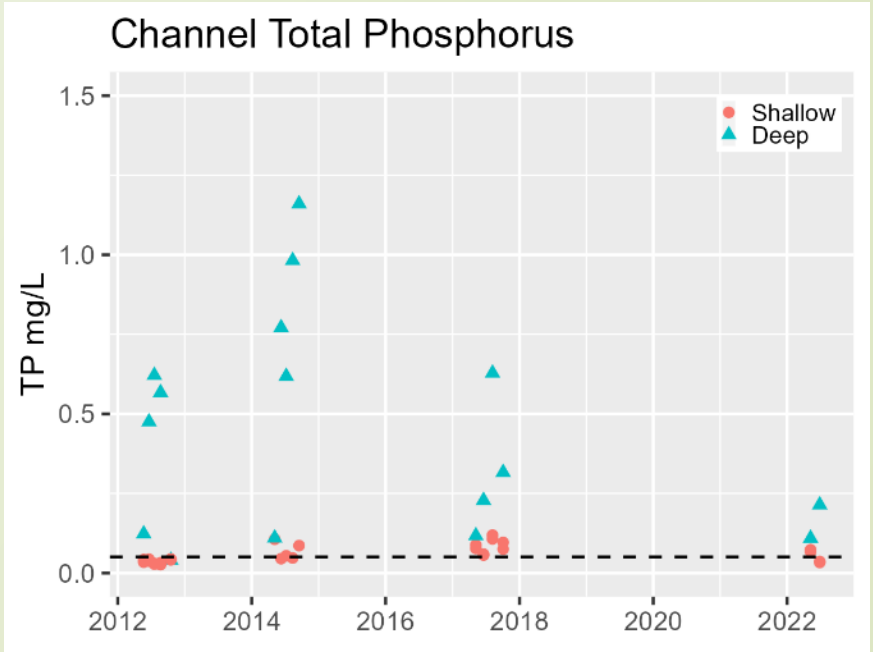
Channel Lake

- Elevated Phosphorus
  - Stratification releases additional P
- TSS appears to be dropping over time

Lake	Total P Load	Internal Load	Watershed Load	Upstream Lake Load	Point Source Load
Channel	13.4	2.8	10.6		







Results & Findings

Key Takeaways

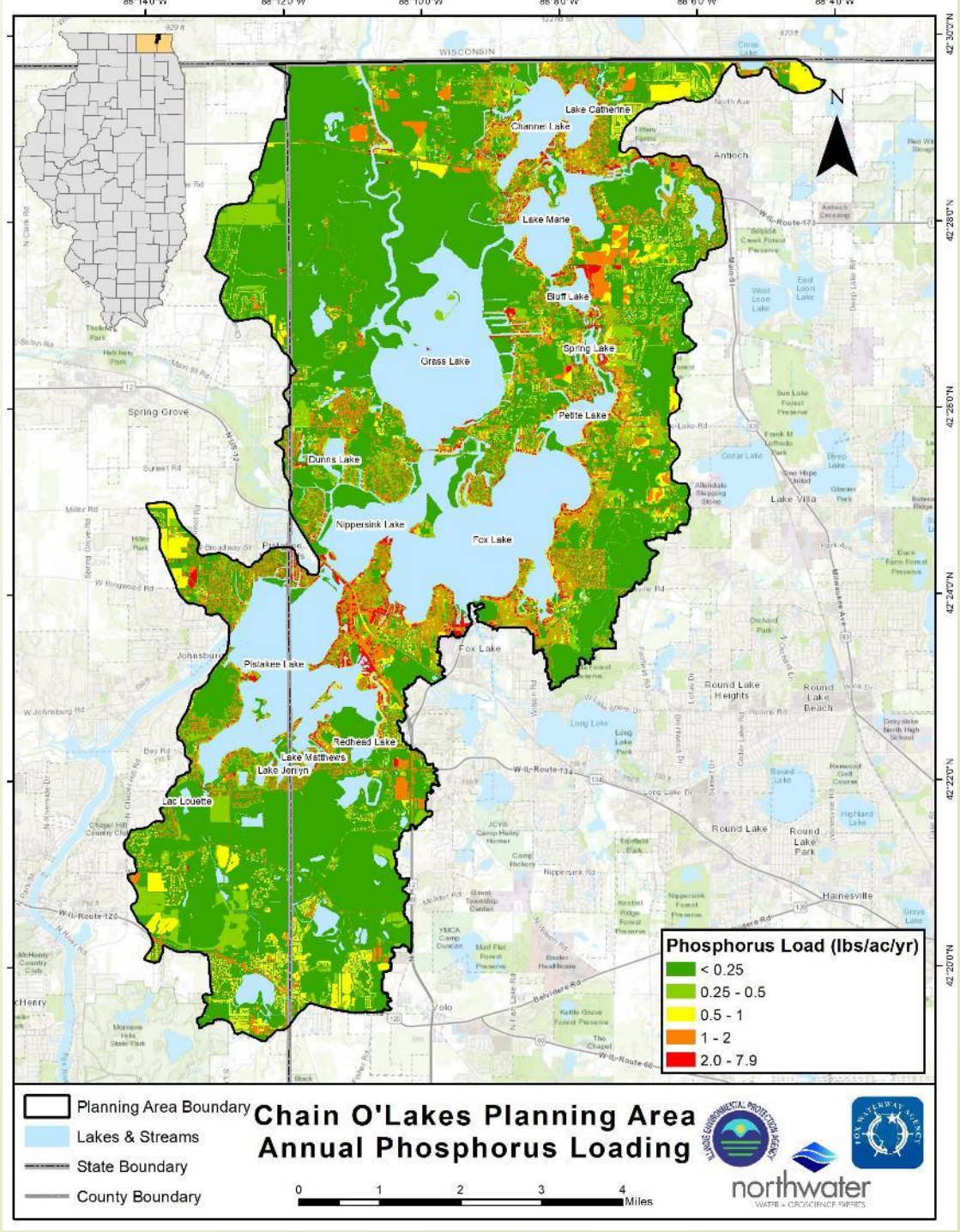
- Loading comes from 3 sources: external, internal and the release of trapped nutrients
- Phosphorous elevated throughout with nitrogen trending lower
- The chain is a sink for external sources of sediment, nutrients and bacteria
- Bacteria found at beaches, but more monitoring is needed
- Nutrient re-suspension and internal loading are a major source
- Potentially failing septic systems may be a major source of bacteria and source of phosphorus
- Lake shoreline erosion is a major source of sediment

External Sources

- Primary Sources: Fox River, Sequoit Creek, Manitou Creek, Nippersink Creek, Camp Creek/Trevor Creek
- Total external loading
  - 389,412 lbs Phosphorus
  - 6,960,034 lbs Nitrogen
  - 43,716 tons Sediment
- The chain traps each year up to:
  - 216,132 lbs of Phosphorus
  - 1,582,034 lbs of nitrogen
  - 9,792 Tons of Sediment

Planning Area Loading

- Total annual loading from within the planning area:
  - 334,533 lbs nitrogen
  - 50,044 lbs phosphorus
  - 6,678 tons sediment
  - 1,072,696 billion CFU bacteria
- Sources:
  - Direct runoff
  - Shoreline, gully and streambank erosion
  - Septic systems
  - Internal nutrient release

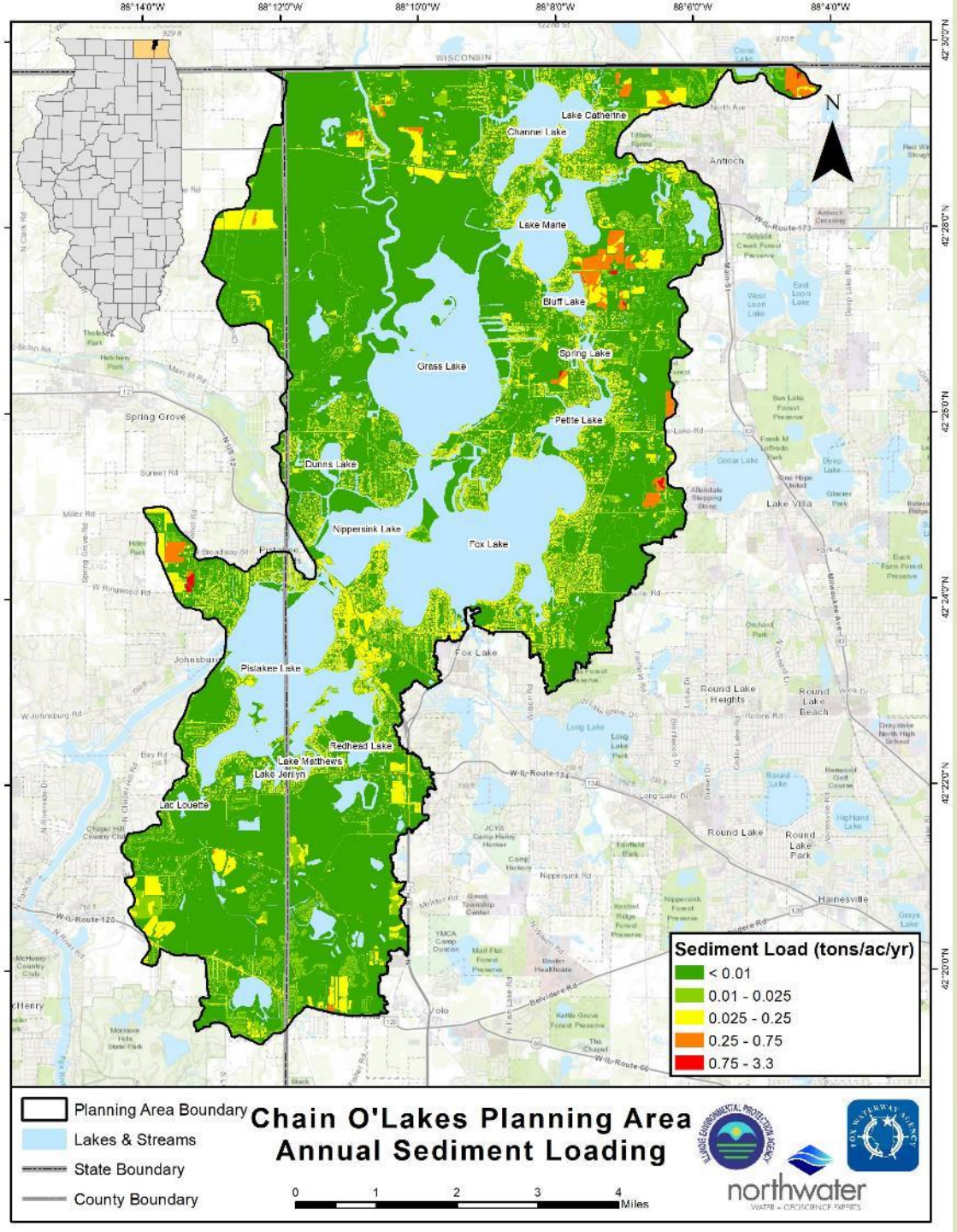


Sources	Nitrogen Load (% Planning Area Total)	Phosphorus Load (% Planning Area Total)	Sediment Load (% Planning Area Total)	Bacteria Load (% Planning Area Total)
Agriculture	7%	1.9%	4%	0.1%
Developed/Impervious	14%	12%	2.3%	0.9%
Livestock/Equestrian	0.3%	0.2%	0.02%	0.03%
Natural/Urban Open Space	8.9%	4.6%	0.7%	0.2%
Resource Extraction	0.2%	0.2%	0.02%	0.01%
Water/Wetlands	18%	6.2%	0.3%	0.8%
Direct Runoff Subtotal	***48%***	*25%*	*7.3%*	*2%*
Lake Shoreline Erosion	43%	9.1%	**88%**	N/A
Streambank Erosion	1.9%	0.4%	4.4%	N/A
Gully Erosion	0.01%	0.03%	0.4%	N/A
Septic Systems	7.3%	19%	N/A	**98%**
Internal Lake Loading	N/A	**47%**	N/A	N/A

From Table 4-8, **Pollution Loading**, in Chain O'Lakes Watershed Plan

Direct Runoff Yield

- Nitrogen: 4.9 lbs/ac/yr
- Phosphorus: 0.38 lbs/ac/yr
- Sediment: 0.015 tons/ac/yr
- Bacteria: 0.66 billion cfu/yr
- Greatest yield by subwatershed
  - Nitrogen – Channel Lake
  - Phosphorus – Channel/Nippersink Lake
  - Sediment – Channel Lake
  - Bacteria - Channel/Nippersink Lake
    Why Channel and Nippersink?
    - Developed/Impervious services
    - Agricultural Areas (sediment)



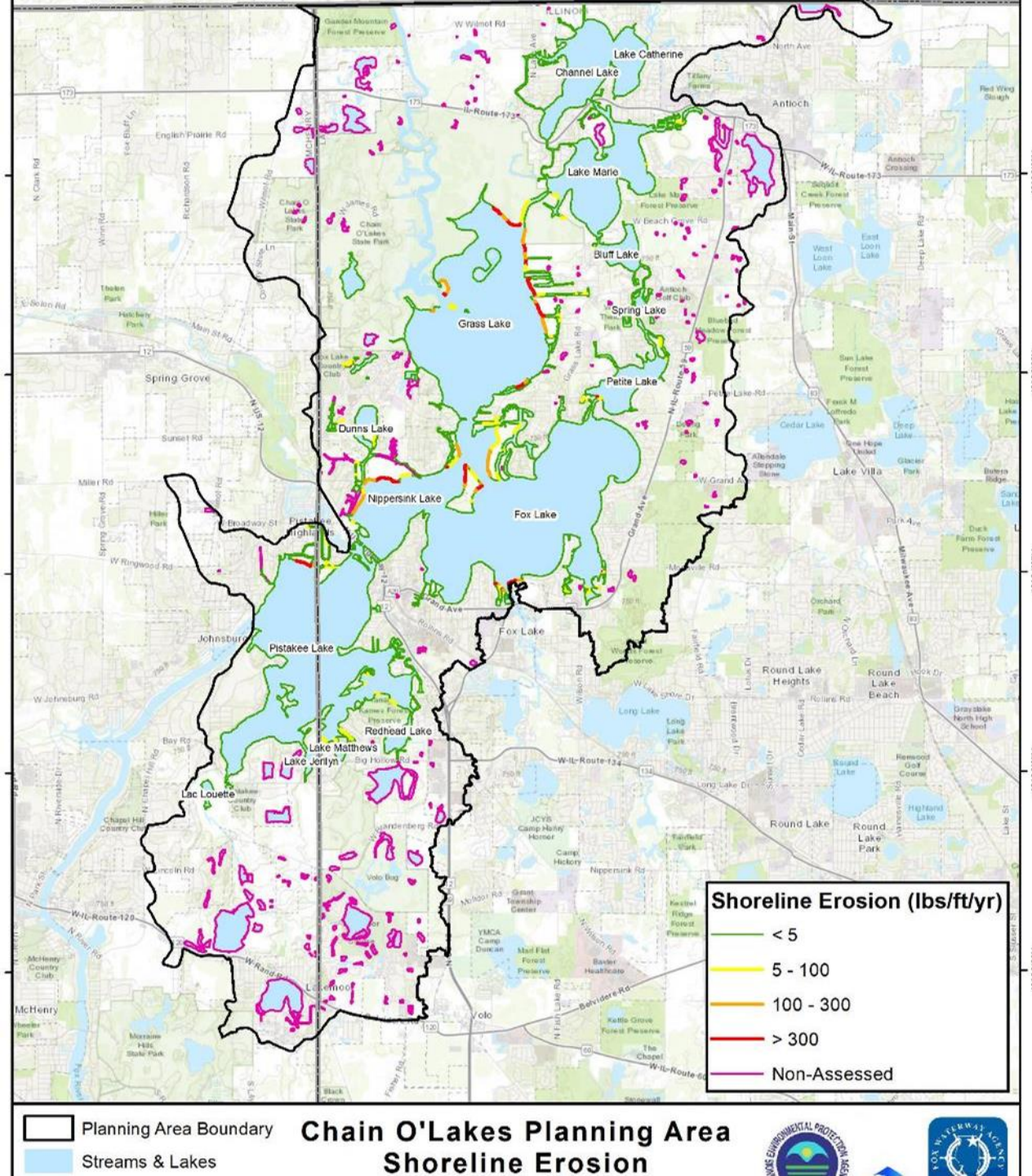
Shoreline Erosion

- Annual Sediment Load
  - 5,800 + tons
- Annual Nitrogen Load
  - 143,000 + lbs
- Annual Phosphorus Load
  - 4,500+ lbs
- Average of 40 tons of sediment per bank mile or 24 lbs/foot.

- Most (90%) from Nippersink Lake subwatershed
- Least (1%) from Channel Lake subwatershed

Shoreline Erosion

- 2,070 ft of bank eroding at over 1,000 lbs/ft for 1,227 TONS
  - So, 0.26% of banks contributing 20% of the entire sediment load.
- 4.95 miles of banks eroding at 100 lbs/ft or greater are responsible for 91% of the entire sediment load.
  - 3.3% of banks responsible for most of the sediment!!!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Dunns Lake
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Fox Lake
Pistakee Lake
Redhead Lake
Lake Matthews
Lake Jenlyn
Lac Louette
Spring Grove
Antioch
Lake Villa
Round Lake
Round Lake Heights
Round Lake Beach
Round Lake Park
McHenry
Volo
Fox Lake
Shoreline Erosion (lbs/ft/yr)
< 5
5 - 100
100 - 300
> 300
Non-Assessed
Planning Area Boundary
Streams & Lakes
Chain O'Lakes Planning Area
Shoreline Erosion

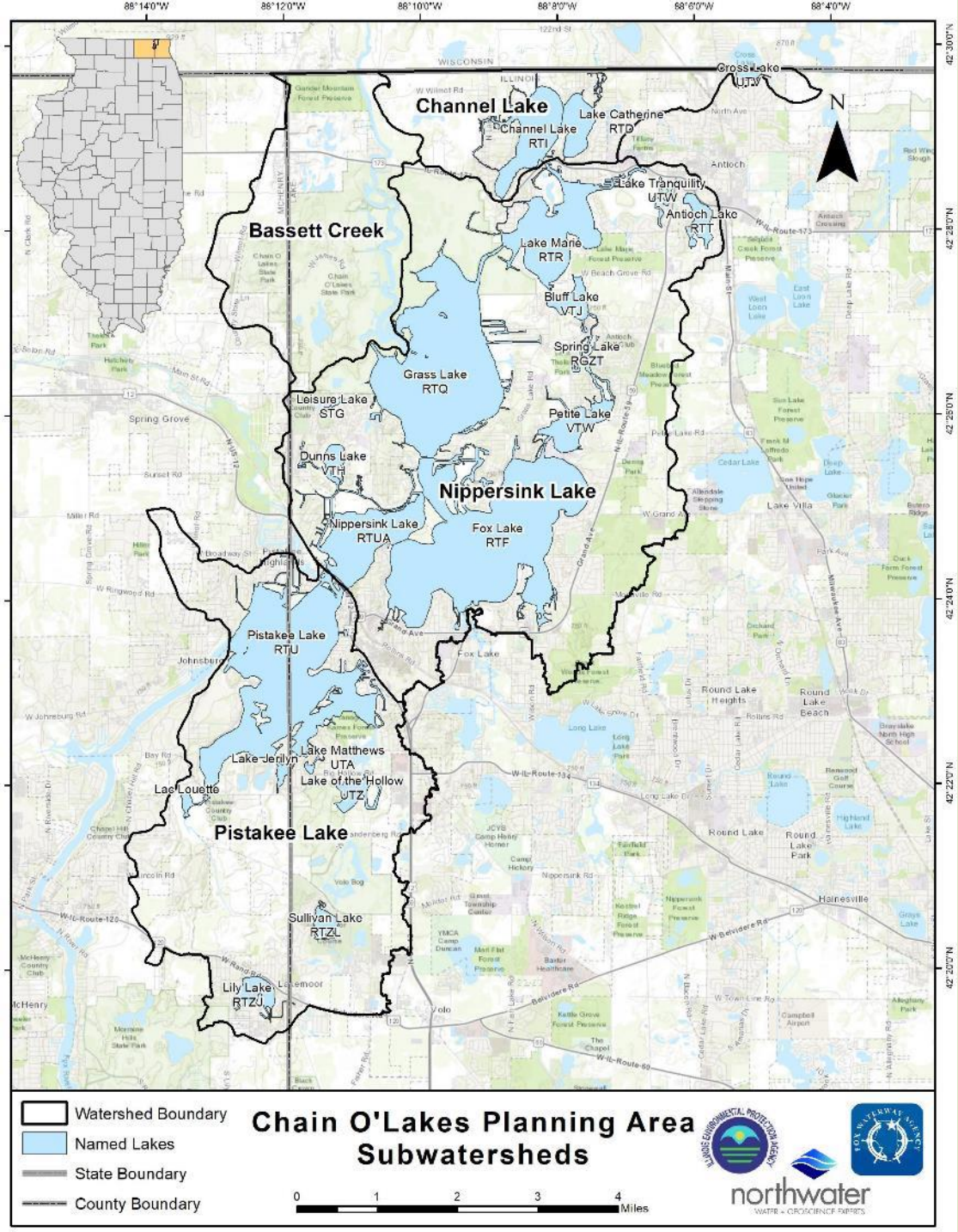

Crabapple Island
42°28'0"N
42°26'0"N
42°24'0"N
42°22'0"N
42°20'0"N

Septic Systems

- 5 of 8 Municipalities have some level of sewer
- 5 of 9 Unincorporated areas do not have sewer
- Fox Lake has most connections
- 8,872 septic systems, 86% within 1,000 ft of a lake
- 579 ft from lake on average
- 754 possibly failing
  - 24,353 lbs/yr nitrogen
  - 9,534 lb/yr phosphorous
  - 1,051,064 billion cfu/yr
- 2 New sewer service areas proposed:
  - Channel Lake/Lake – 1,900 connections
  - Grass Lake/Petite Lake – 2,400 connections

Internal Nutrient Release

- Released from deposited sediment during low oxygen conditions
- Released from sediment from re-suspension due to boat traffic and wave action
- Phosphorus: 23,399 lbs/yr
- Nitrogen: No data available to make estimate
- 92% from Nippersink Lake subwatershed



Recommendations & Actions

Watershed Wide Recommendations & Policies

- Reduce, store and filter runoff.
- Support sewer expansion and conduct septic system maintenance education.
- Expand water quality monitoring program.
- Coordinate with entities/organizations outside the planning area.
- Coordinate with panning area communities to adopt a plan and implement site-specific actions and policies that improve water quality.
- Seek out and secure funding.
- Hire a watershed coordinator and expand education/outreach and volunteer opportunities.

Urban/Stormwater & Agricultural Best Practices

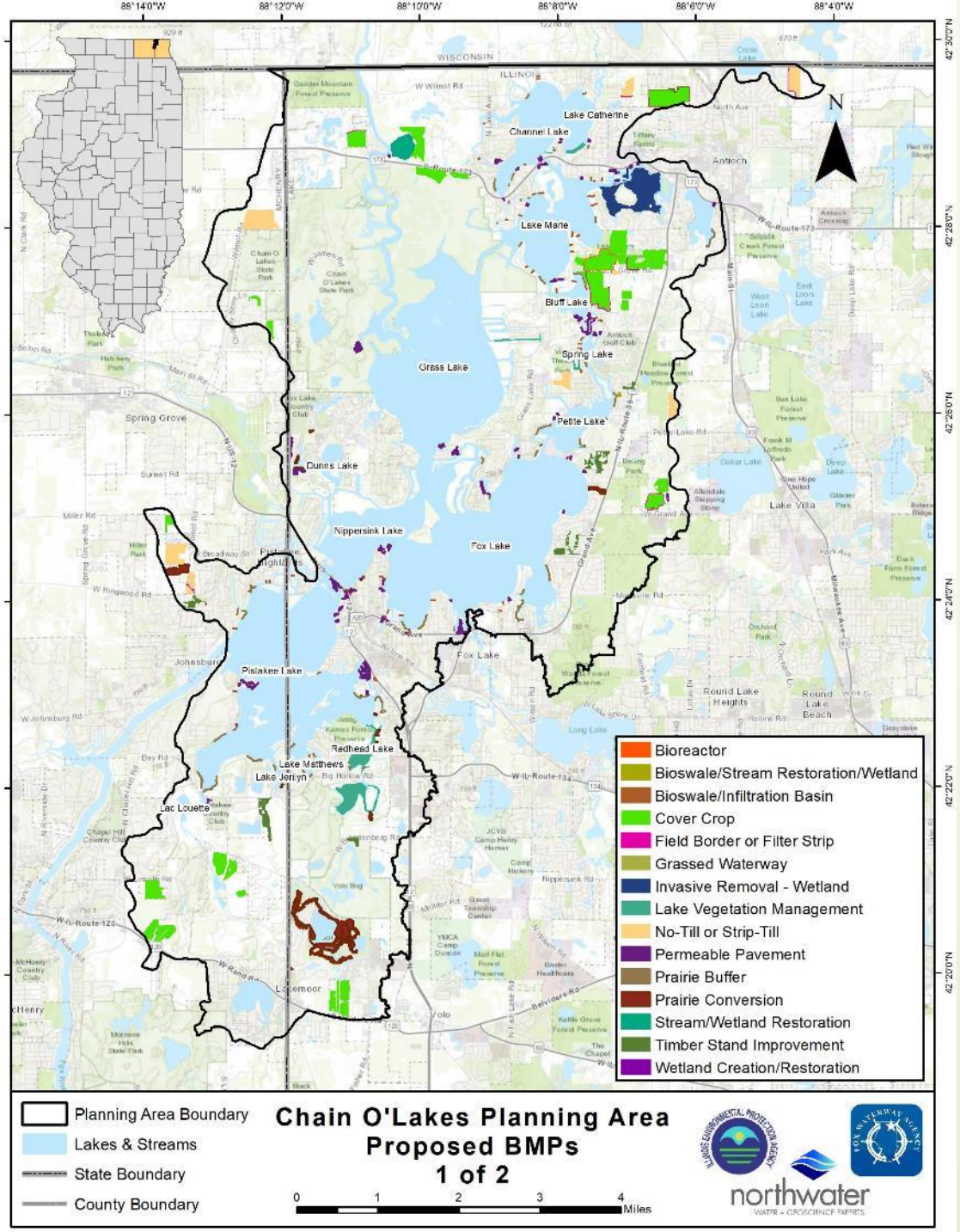
- Native buffers
- Rain gardens, green roofs, and permeable pavement
- Bioswales
- Wetlands/detention
- Sediment traps
- Agricultural:
  - Cover crops, field borders, filter strip, no-till, waterways, basins
- Education and outreach (septic)

In-Lakes Practices

- Sediment removal
- Aeration
- Shoreline stabilization

Site-Specific Project Summary by Stakeholder

- 3,135 total projects identified
  - **Community led projects**
    - 55 bioswales, 6.5 acres
    - 60 native buffers, 20 acres
    - 13 detention basins
    - Permeable pavement, 70 acres
    - 2 Sewer Expansions
      - Connecting 4000 homes
  - **Homeowner & HOA's**
    - 1,000s of green neighborhood practices – blue dots
    - 1,000s of rain gardens
    - Septic maintenance – estimate of over 700 failing systems
  - **Fox Waterway Agency**
    - 17 dredging locations
  - **Shoreline owners**
    - 78 shoreline stabilization sites, 35,000 ft
  - **Lake communities**
    - 57 lake aerators
  - **Farmland owners**
    - 797 acres of cover crops
    - 3 acres grassed waterways
  - **Natural area owners**
    - Wetland expansion 25, 20 acres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Redhead Lake
Lake Matthews
Lake Jerilyn
Lac Louette
Round Lake Heights
Round Lake Beach
Lakemoor
Volo
Bioreactor
Bioswale/Stream Restoration/Wetland
Bioswale/Infiltration Basin
Cover Crop
Field Border or Filter Strip
Grassed Waterway
Invasive Removal - Wetland
Lake Vegetation Management
No-Till or Strip-Till
Permeable Pavement
Prairie Buffer
Prairie Conversion
Stream/Wetland Restoration
Timber Stand Improvement
Wetland Creation/Restoration
Planning Area Boundary
Lakes & Streams
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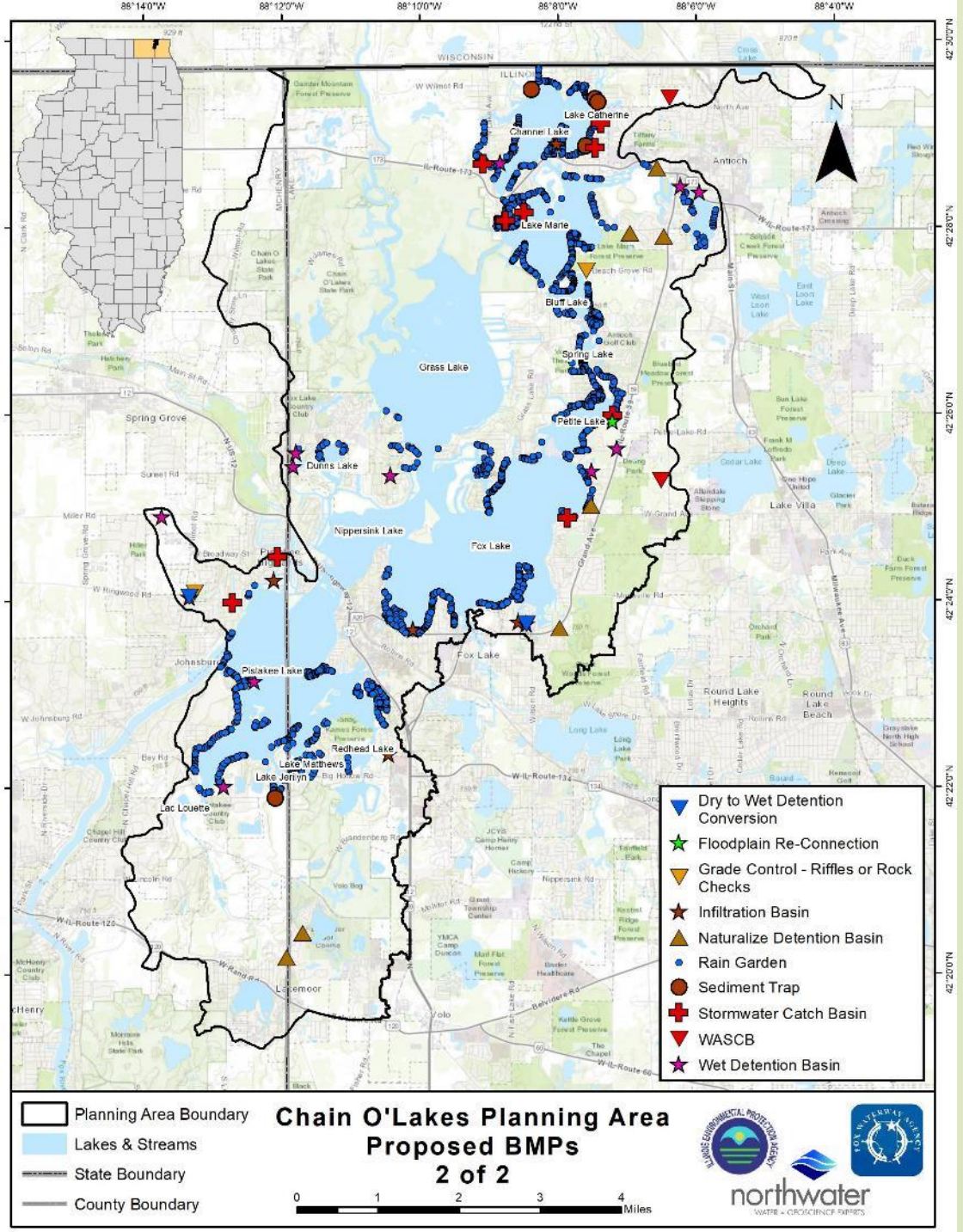
Chain O'Lakes Planning Area
Proposed BMPs
1 of 2
0 1 2 3 4 Miles
northwater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Dry to Wet Detention Conversion
Floodplain Re-Connection
Grade Control - Riffles or Rock Checks
Infiltration Basin
Naturalize Detention Basin
Rain Garden
Sediment Trap
Stormwater Catch Basin
WASCB
Wet Detention Basin
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2 of 2
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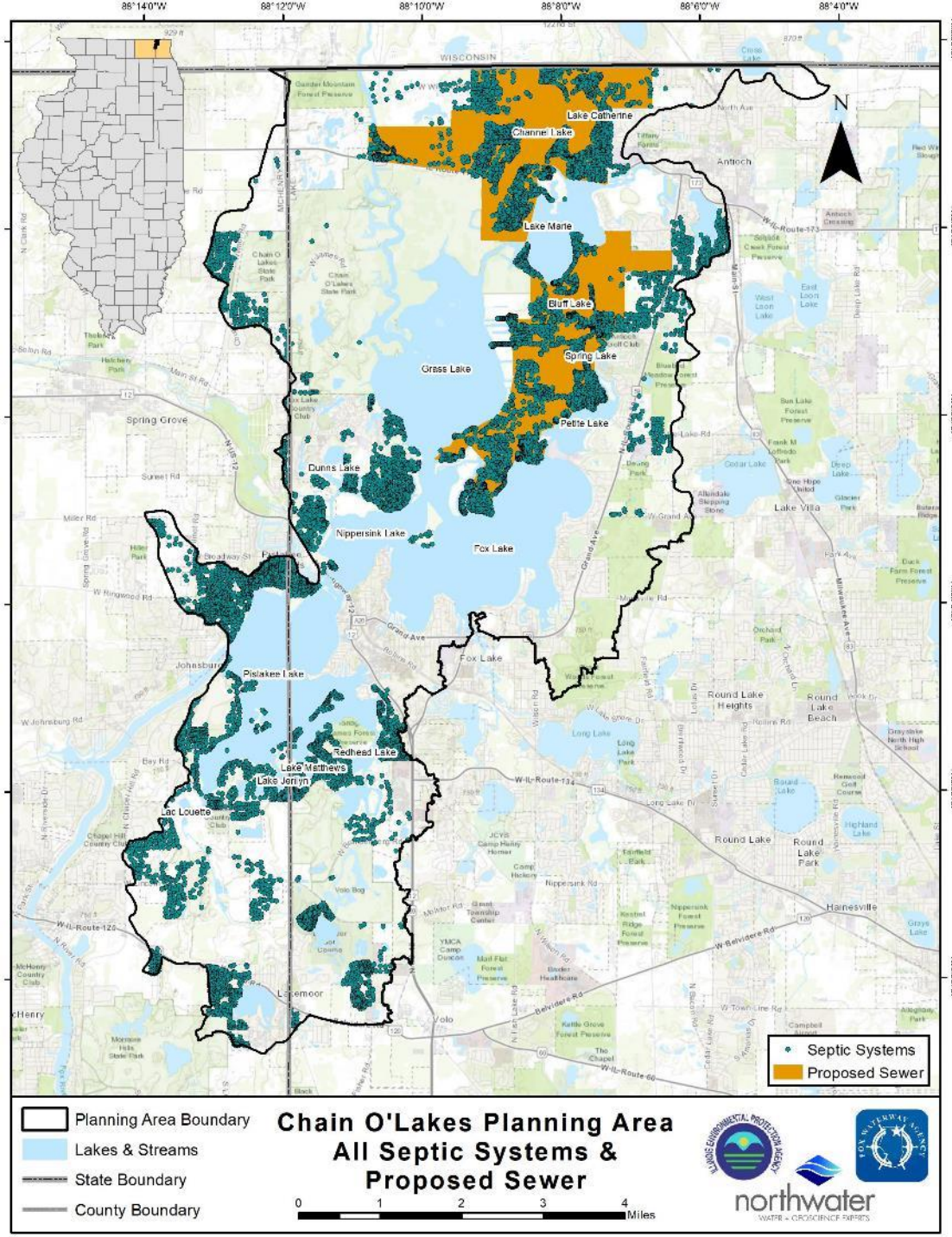
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Johnsburg
WISCONSIN
ILLINOIS
N
Septic Systems
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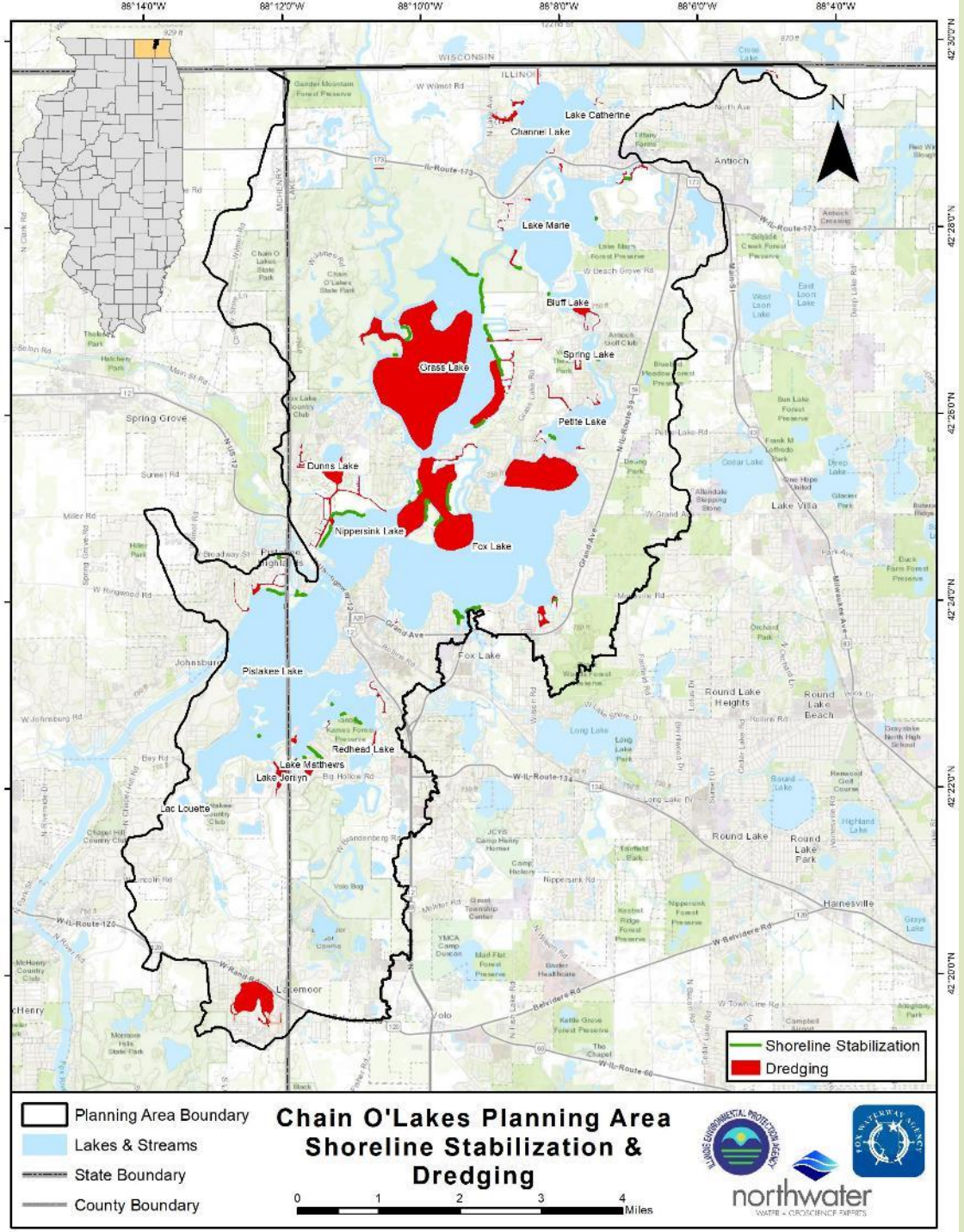
WATER + GEOSCIENCE EXPERTS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WISCONSIN
ILLINOIS
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Shoreline Stabilization
Dredging
Planning Area Boundary
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State Boundary
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Chain O'Lakes Planning Area
Shoreline Stabilization &
Dredging
0 1 2 3 4 Miles
northwater
WATER + GEOSCIENCE EXPERTS

Targets

Expected Load Reductions

Critical Areas

Costs

Water Quality Targets

- Percent reduction targets to remove water quality impairments in the chain or to align with Illinois nutrient loss reduction strategy
- An 82% reduction in phosphorous
- A 45% reduction in nitrogen
- A 68% reduction in sediment
- A 70% reduction in bacteria
- Note: The same percentage will be needed from outside of the Chain planning area

Expected Load Reductions

- If all recommended site-specific practices were implemented, they would reduce:
  - 177,885 lbs/yr Nitrogen
  - 18,175 lbs/yrs Phosphorus
  - 5,724 tons/yr sediment
  - 1,053,044 billion CFU/yr
- All recommended dredging would remove an additional 8,728,982 cubic yards of sediment
  - Associated phosphorus reductions unknown

Pollutant	Total Estimated Pollutant Loading	Estimated Annual Pollutant Load Reductions (Total)	Estimated Annual Pollutant Load Reductions (%)
Nitrogen (lbs/yr)	334,533	177,885	53% (target met)
Phosphorus (lbs/yr)	50,044	18,175	36% (target not met)
Sediment (tons/yr)	6,678	5,724	86% (target exceeded)
Bacteria (billion CFU/yr)	1,072,696	1,053,044	98% (target met)

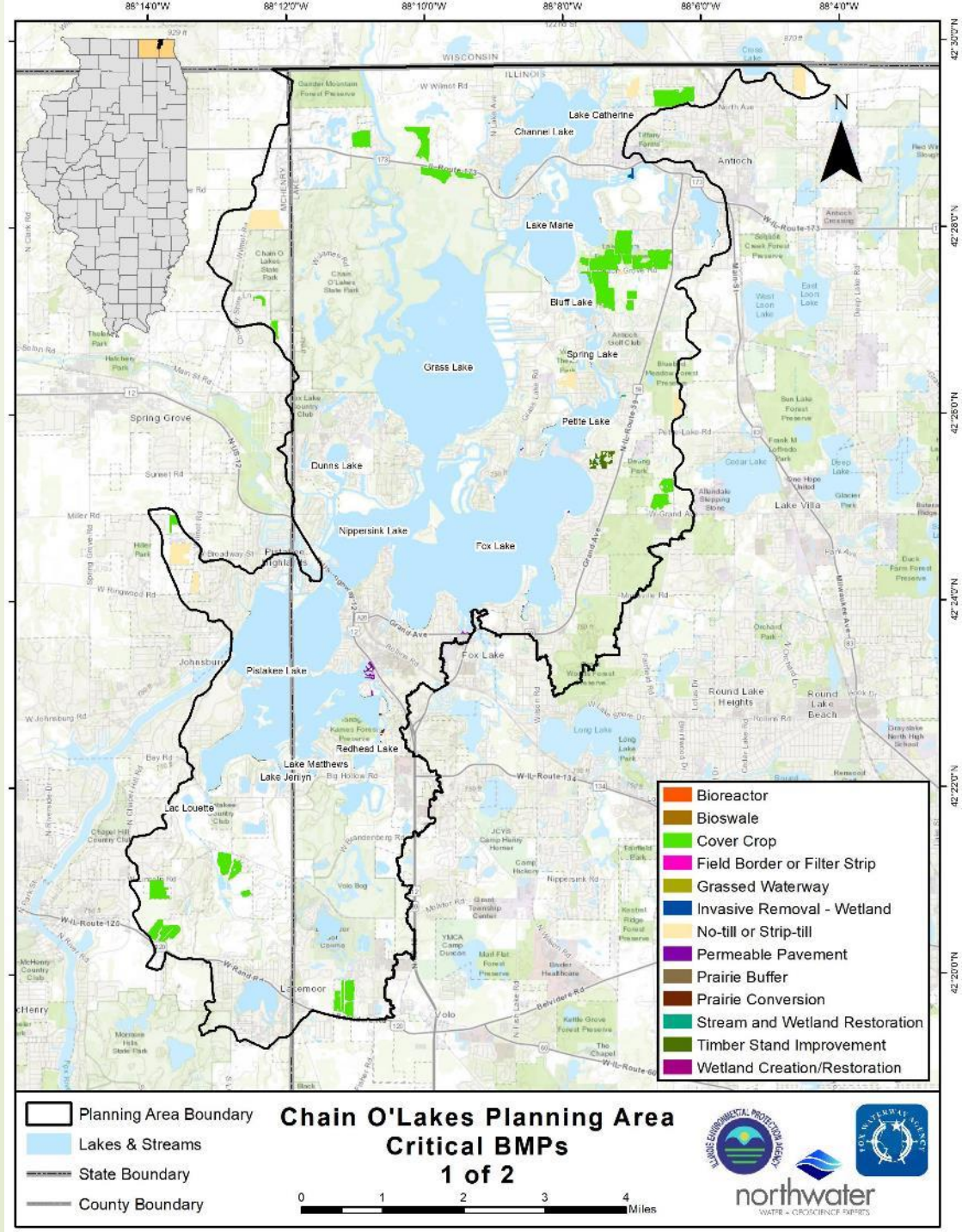
- Additional practices and policies needed to meet the phosphorus target:
  - Substantial sediment removal
  - Limits resuspension of lake sediments from boat traffic and wind action
  - Significant challenge to initiate large scale project
- Bacteria can only be met with both new sewer service areas and additional elimination of failing septic systems

Estimated Cost

- Runoff and shoreline projects
  - $89,000,000
    - Agricultural practices are cost effective for sediment and nitrogen
    - Includes $46,000,000 of permeable pavement – cost versus impact is lower
- Sediment removal
  - $875,000,000
- Sewer systems:
  - $185,000,000
- Funding will be a significant challenge
  - Sources and methods for funding will have to be investigated
    - This does not fit into the FWA budget
  - Obtaining grants needs to be a priority but projects require matching funding
    - 319 – 60% funded
  - Scale and combine projects for efficiency

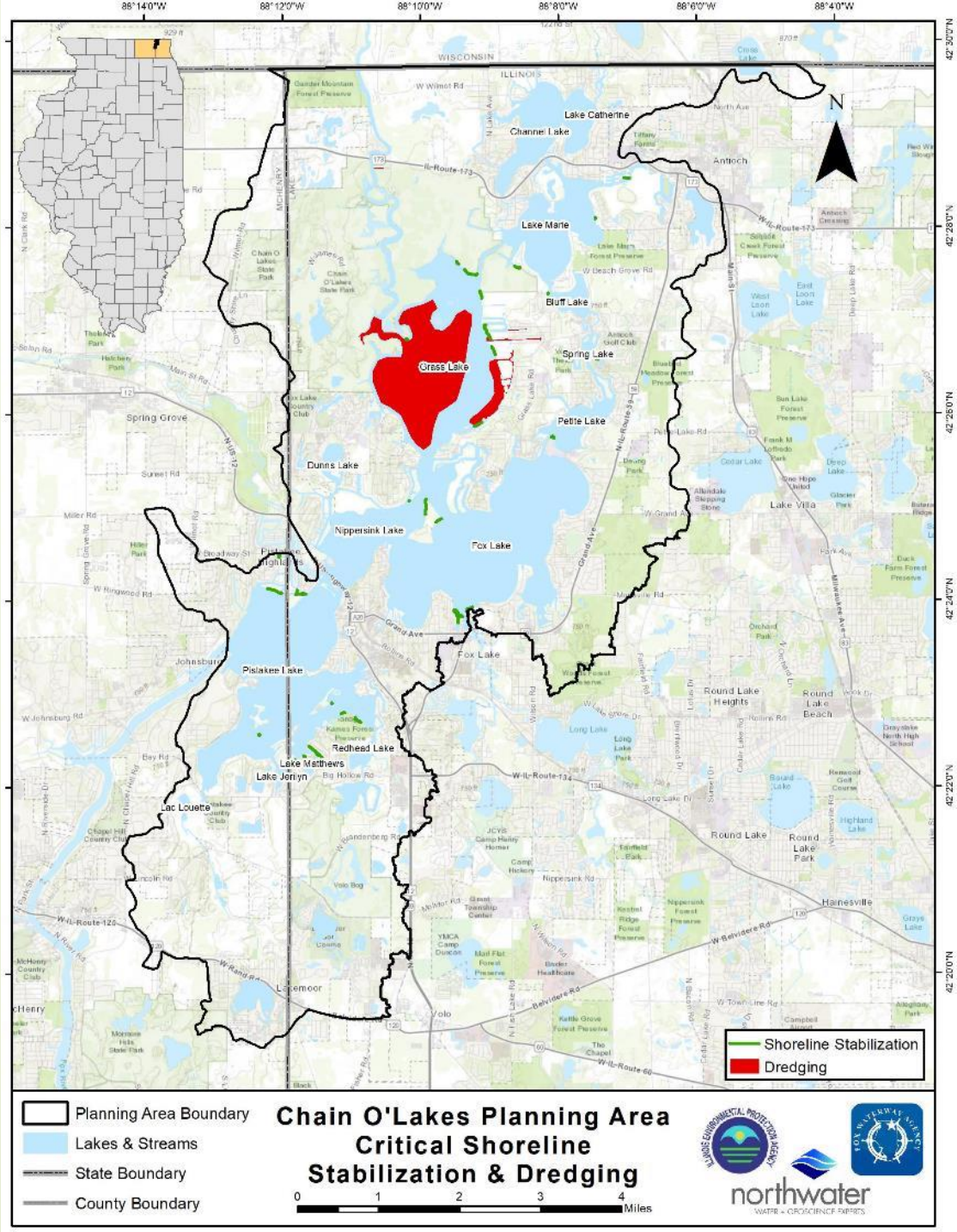
Critical Areas

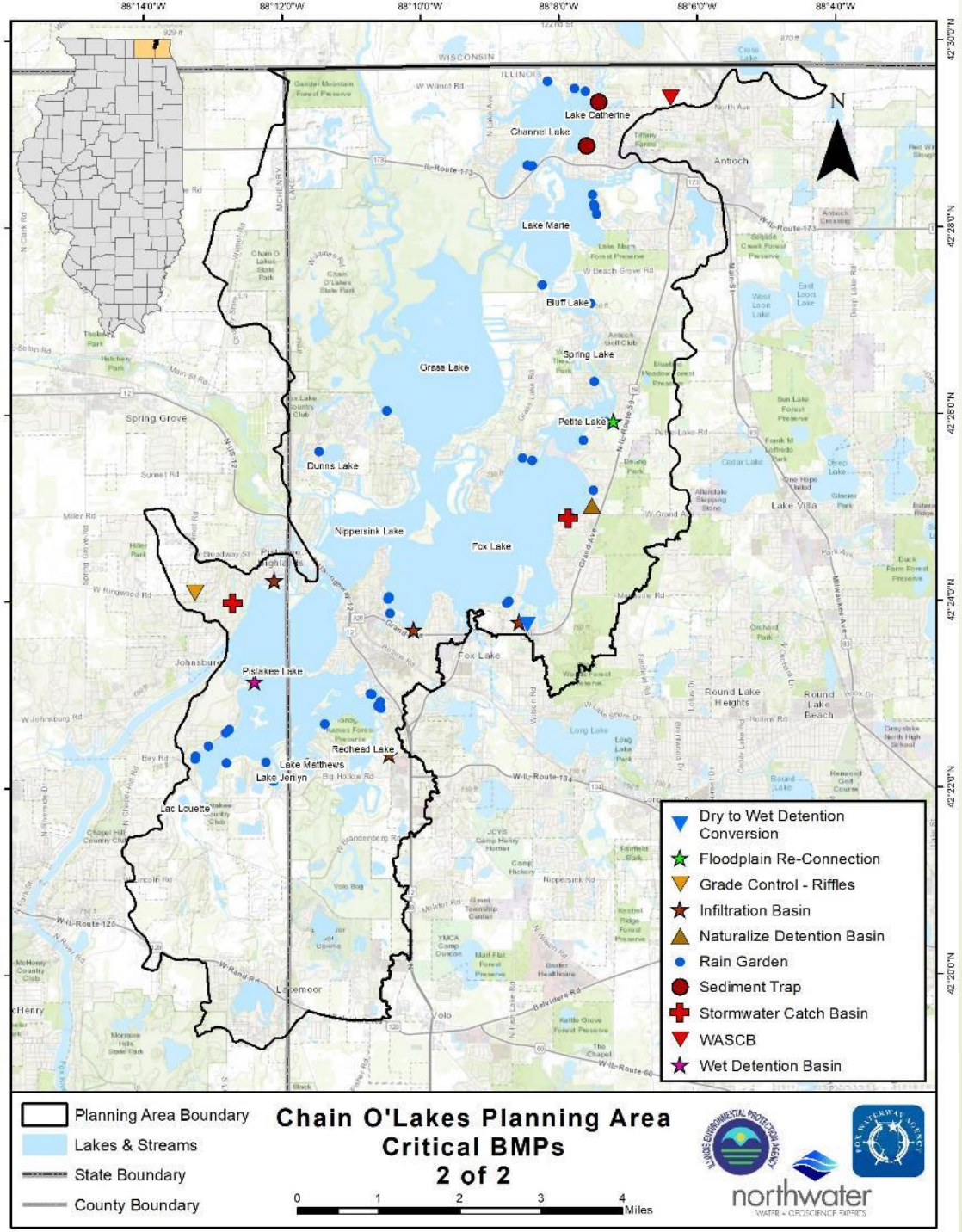
- Site specific projects that will achieve the greatest reduction at the lowest unit cost
- 294 out of 3,135 recommended
- At 15% of the total cost(Excluding dredging and sewer system)
  - Achieve 61% of total expected nitrogen reduction
  - 45% of the total expected phosphorous
  - 64% of the total expected sediment
  - 46% of the expected bacteria

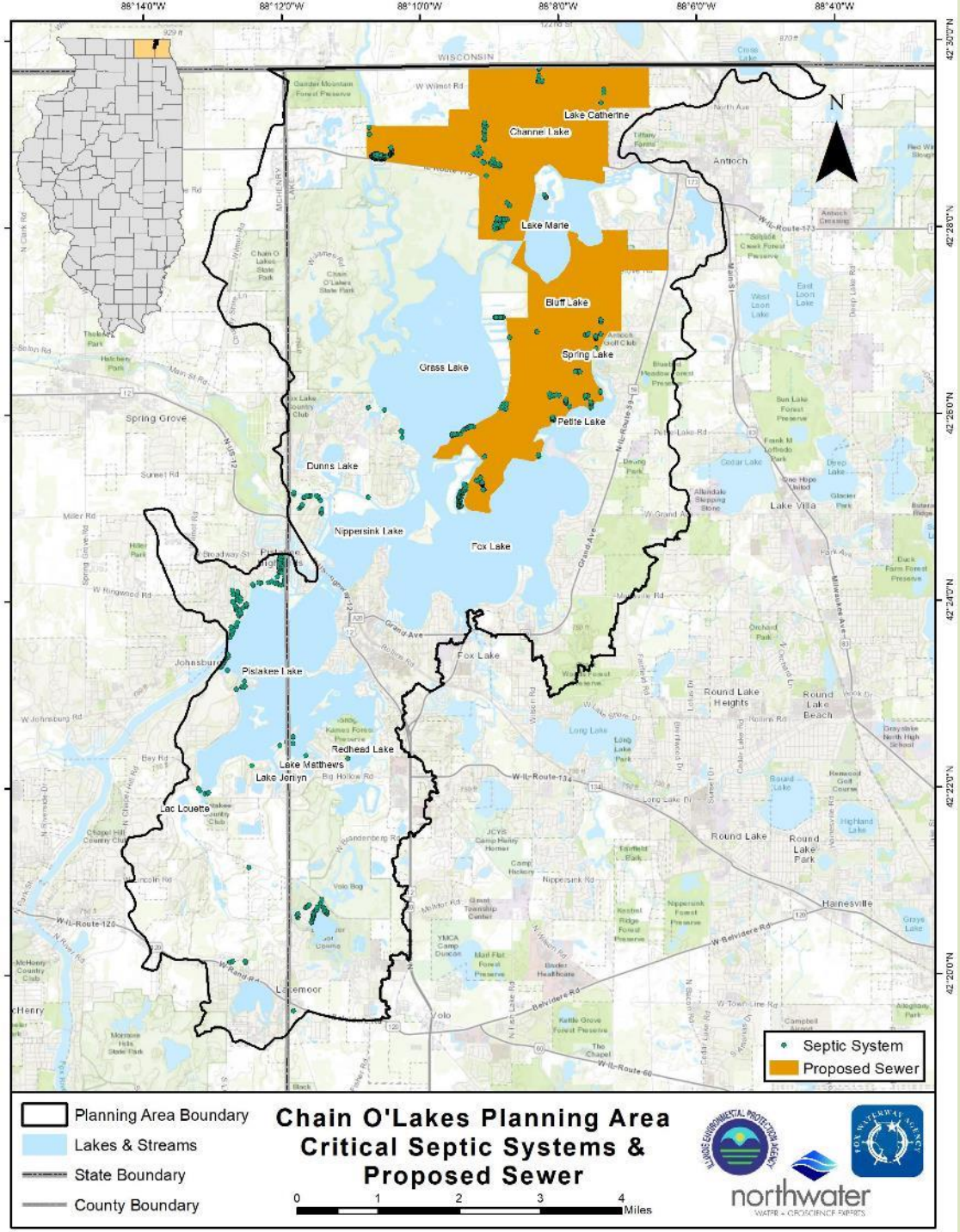


Critical Areas

- 1 Critical dredging area – Grass Lake
  - Will act as a "trap" for sediment from the Fox River
- Critical areas for addressing potentially failing septic systems should focus on homes near lakes and on hydric (wetland) soil
- Focus lake aeration in Channel Lake, Lake Catherine, and Lake Marie
- Despite a relatively low amount of agricultural grounds, significant reduction in sediment and nutrient can be achieved at a low cost




Lake Catherine
Channel Lake
Lake Marie
Bluff Lake
Grass Lake
Spring Lake
Petite Lake
Dunns Lake
Nippersink Lake
Fox Lake
Pistakee Lake
Redhead Lake
Lake Matthews
Lake Jerilyn
Lac Louette
Spring Grove
Antioch
Lake Villa
Johnsburg
Round Lake Heights
Round Lake Beach
Round Lake
Round Lake Park
Hainesville
Lakemoor
Volo
Dry to Wet Detention Conversion
Floodplain Re-Connection
Grade Control - Riffles
Infiltration Basin
Naturalize Detention Basin
Rain Garden
Sediment Trap
Stormwater Catch Basin
WASCB
Wet Detention Basin
Planning Area Boundary
Lakes & Streams
State Boundary
County Boundary
Chain O'Lakes Planning Area
Critical BMPs
2 of 2
0 1 2 3 4 Miles
northwater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Lakemoor
Volo
Septic System
Proposed Sewer
Planning Area Boundary
Lakes & Streams
State Boundary
County Boundary
Chain O'Lakes Planning Area
Critical Septic Systems &
Proposed Sewer
0 1 2 3 4 Miles
northwater

Key Takeaways

- A coordinated effort between units of government, stakeholders and the Fox Waterway Agency is critical
- More funding is needed
  - None of this work is support by the FWA budget
- Education and outreach needed to change behaviors and actions – structural practices alone can't do it
- The chain is a complex system, and improvements will be costly and take time to realize

Transitioning to Implementation

Implementation Pillars

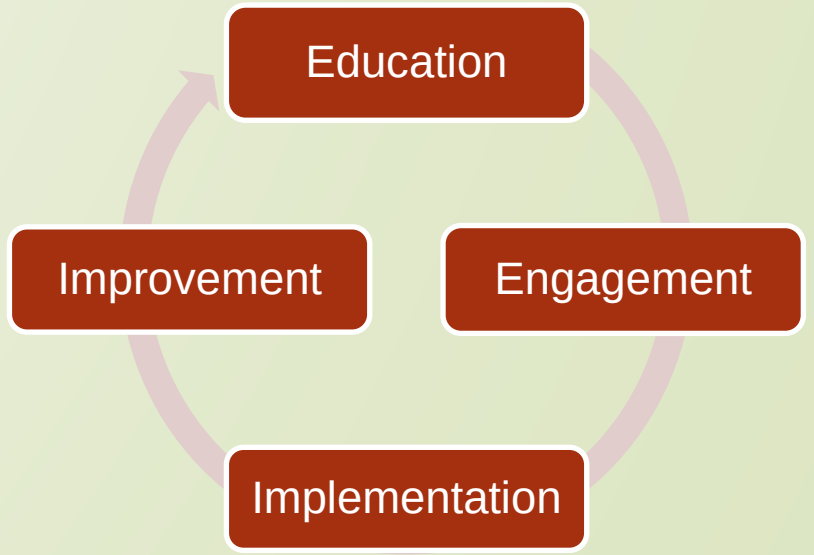
- **Four Legs of a Stool**
- **Community Engagement**
  - Watershed work group
  - Education
- **Projects**
  - Community and individual projects
- **Policies and Practices**
  - Guide behaviors addressing nonpoint pollution
- **Monitoring**
  - Further guide where and what to work on
  - Measure the impact of our actions

Community Engagement

- **Community engagement is the fuel for implementing the plan**

- **Communities**
  - Commit at least one resource to the watershed work group
  - Promote water quality education

- **Homeowners**
  - Attend education sessions
  - Join the watershed group, yet to be formed
  - Volunteer
    - Education, Monitoring, Communication, Organizing, etc



Projects - Actions

- **Communities**
  - Pass a resolution committing to supporting the Chain O' Lakes watershed plan
  - Review the mapping tool for projects in your area
  - Identify and initiate a project annually
  - Support the planning, funding and implementation of sanitary sewer projects
- **Home Owners**
  - Learn about the green neighborhood practices
  - Pick one to implement
  - Be an advocate for conversion to sanitary sewer

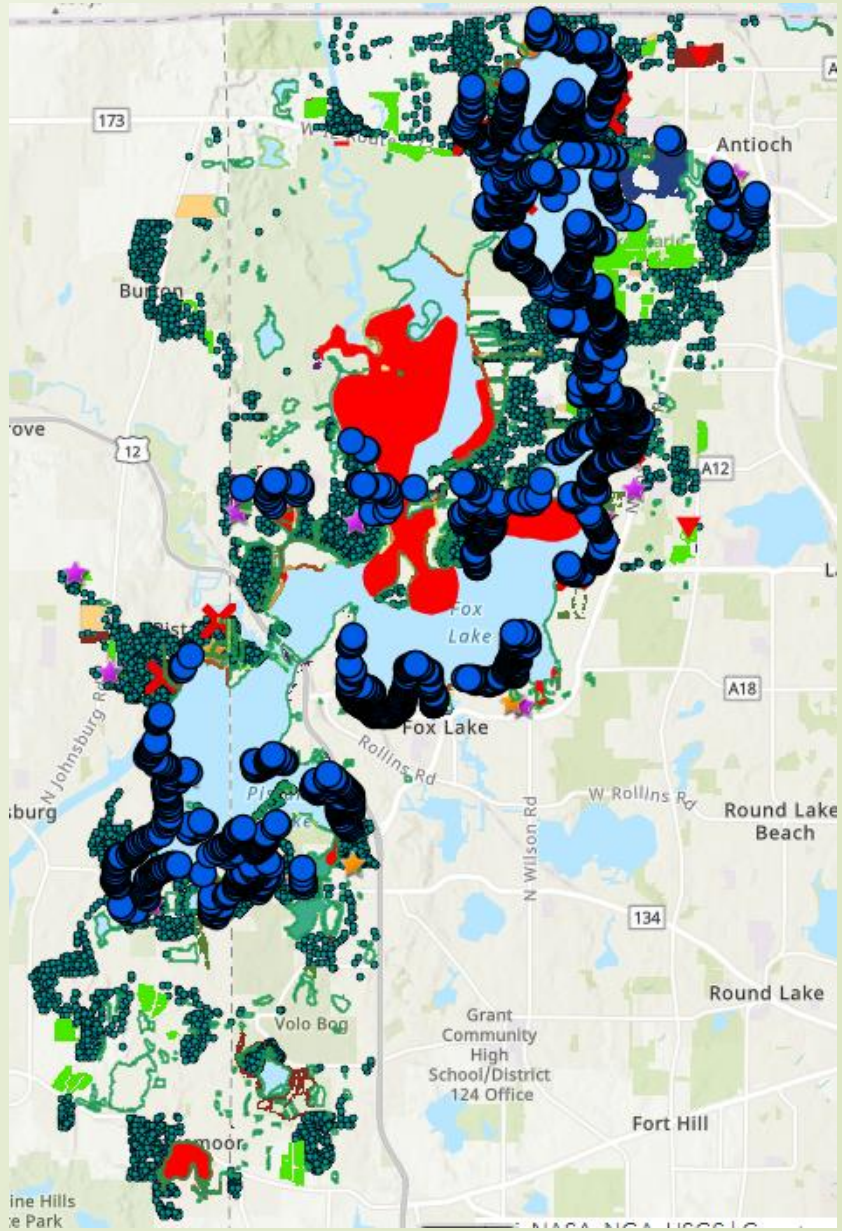
Resolve

to

Support

Project Mapping

- All potential projects have been loaded into the Lake County Maps system
- You can zoom in to see recommendations for your community, neighborhood or home



https://lakecountyil.maps.arcgis.com/apps/webappviewer/index.html?id=20c7a25b4c844f21b8127637030252c7

Accumulated Impact

- **Communities**
  - 8 municipality/villages
  - 9 unincorporated areas
  - 7 townships
  - If each community did one run off project per year for 10 years
    - 240 projects complete
  - Add water quality features into other community projects and vise verse to make it cost effective
- **Home Owners**
  - Goal of 2,000 homeowner projects
    - Primary focus on those closest to the water
    - Disconnect, Rain Barrel, Shoreline Vegetation, Rain Garden, Permeable Surfaces

Policies and Practices

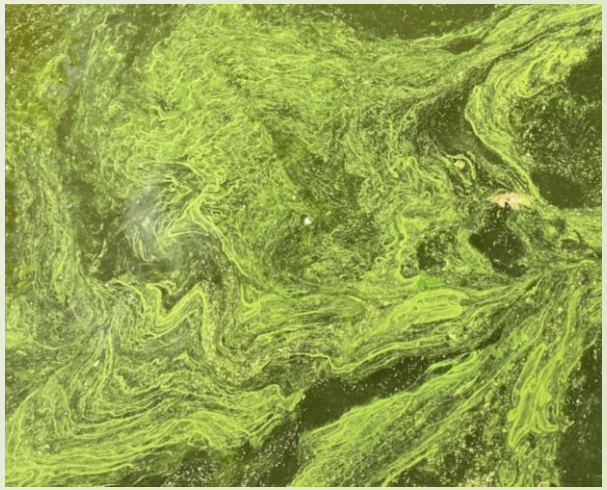
- Promote practices and services that reduce nutrient and sediment loading
- **Communities**
  - Yard waste pick up
  - Fall leaf pick up
  - Storm sewer cleaning
  - Road salt practices
  - Permeable surfaces
- **Home Owners**
  - Fertilizing practices
  - Yard waste practices
  - Septic system maintenance

Monitoring

- Guides where and what to work on
- Measures the impact of our actions
- **Communities**
  - Support monitoring with your labs
    - Successfully done by the Fox River Group
- **Individual**
  - Volunteer to gather samples
  - Support data entry
  - Support data analysis and summarization
  - Support data driven decisions

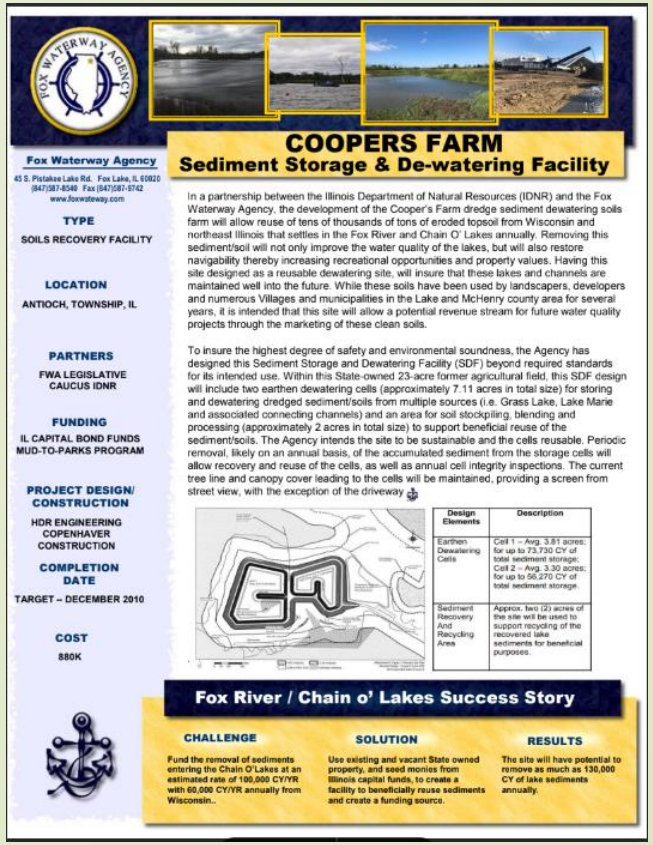
Impacting Our Goals

- Clear water
  - Shoreline erosion
  - Sediment removal/basin
- Free of excess nutrients
  - Shoreline erosion
  - Sediment removal
  - Run off
- Clean Water
  - Septic maintenance
  - Sanitary sewers
  - Sediment removal



Impacting Our Goals

- Knowledgeable and engaged community
  - Watershed work group
  - Volunteers
  - Monitoring program
- Land accessible to monitor, maintain and improve
  - Partnerships with land owners big and small

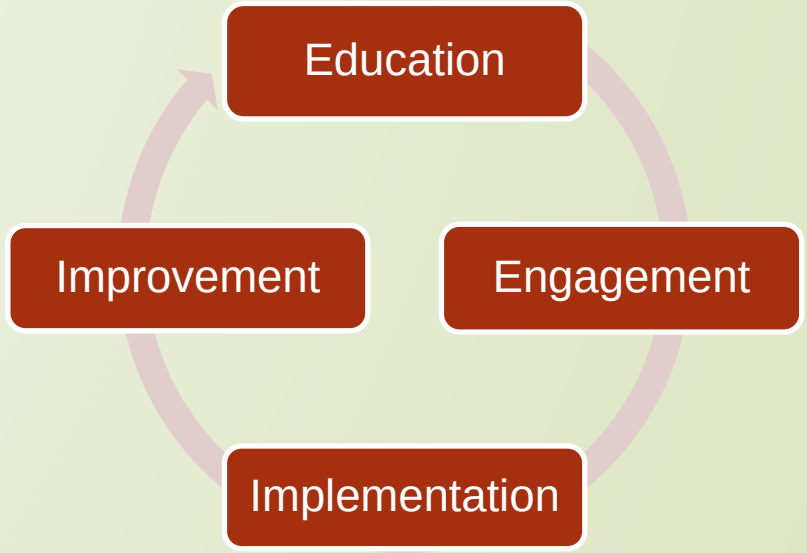


Improving Water Quality for our Community

- The Chain O' Lakes is an economic driver in the community
  - It's like having a major employer
- Impaired water quality has direct impact
  - Recreation on the lakes
  - Businesses support recreation
- Indirect impact
  - Community businesses
  - Service providers in the community
- Water quality does impact real estate value

Summary

- We need the entire community behind the watershed plan
- Think of one thing you can do personally
- Think of one thing you will be an advocate for
- Think of one person you will share information with
- Take action
- We are here to support you



Questions?

Thank You for Coming…….

The end