

MEMORANDUM ON RAKES BAY AND SHORELINE EROSION PROJECT TO REDUCE NONPOINT POLLUTION

BACKGROUND, NEED, FEASIBILITY, MAINTENANCE AND ELIGIBILITY FOR RECEIPT OF CORONAVIRUS LOCAL FISCAL RECOVERY FUNDS

By: Lisa L. Derr and William Foley



Figure 1. Beaver Dam Lake



Figure 2. Beaver Dam Lake and Rakes Bay

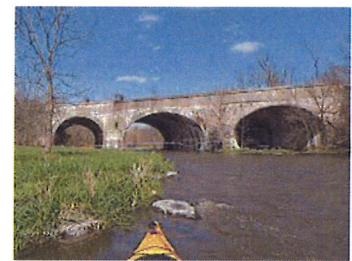


Figure 3. Beaver Dam River

I. BACKGROUND AND NEED

Beaver Dam Lake and Beaver Dam River. Rakes Bay is a tributary feeding into Beaver Dam Lake, the 15th largest lake in Wisconsin. The lake and river are a source of fishing, boating, swimming, ice fishing, and tourism for the county. It flows into the Beaver Dam River which continues through Lowell, meanders south just east of Reeseville, and joins Chub Lake after which it merges with the Crawfish River on the southwest part of Dodge County. The Crawfish River is a tributary of the Rock River which merges with the Mississippi at Rock Island, Illinois.

Agricultural Runoff. The lake has a significant phosphorus load exacerbated by a large number of carp. Agricultural runoff with erosion of soil and water is the most significant cause (45%) of this heavy phosphorus load. There are a number of agricultural producers in Dodge County who are applying best practices (no till, cover crops, etc.) which reduces erosion and preserves the most valuable asset, their topsoil. Best cropping practices also increase soil health. Many agricultural producers are enrolled in state and federal cost-sharing programs where they are paid to implement best practices to reduce agricultural runoff. To qualify, producers must often create a “Nutrient Management Plan” which by testing informs them of how much fertilizer (phosphorus) is actually in the soil and create a plan to manage it. Some producers without nutrient management plans pay for fertilizer they do not even need.

Carp. The high number of carp is a significant biosource of phosphorus as well. People may wonder if there's no oxygen, and fish are dying, why are there so *many* carp?

Unfortunately, carp are extraordinarily fish which can change the structure of their gills to avoid becoming anoxic (permanent damage from lack of oxygen). Unlike game fish, they can live for months without oxygen.¹ In winter, they stop eating and in spring lay eggs in shallow marshes (similar to Rakes Bay.) However, both the DNR as well as the Beaver Dam Lake Improvement Association regularly stock the lake with game fish.

In this low-oxygen environment, as other fish struggle to survive, the carp reproduce. This exacerbates the problem as they root around for food in the soil which 1) releases embedded and impacted phosphorus from the soil and 2) increases the turbidity (cloudiness) further reducing the sunlight necessary for healthy plant life. As of 2017, the phosphorus load in Beaver Dam Lake from living and dead carp as well as carp feces is 33% of the total load.²



Figure 4. Carp 1

In response, algae blooms explode during hot weather blocking the sunlight which minimizes the ability of other plants and fish to survive. Those blooms are unhealthy for people. They produce a terrible smell which prevents county residents and tourists from



Figure 5. Algae Bloom Example

using the lake for swimming and boating. Tourism increases when the lake is healthier with fishing for game fish rather than carp. In addition, without taking action to improve the lake, lower property values will affect the owners who will not get as much for their property. That reduced revenue could also impact school districts, cities, Dodge County, and the state by over \$900,000.

No Natural Drought. Dodge County has had significant rainfall over the last decade and has no complete natural droughts as the lake receives water from Fox Lake. An occasional natural drought is healthy. With a natural drought, the water would dramatically lower, significant numbers of carp would die, the soil sediment would be compacted (trapping residual phosphorus), dormant seeds on the lakebed for healthy aquatic life would receive sunlight and grow. With the fish temporarily reduced, the zooplankton population would rebound *reducing* algae levels with a clearer lake and more

¹ Society for Experimental Biology. "Don't Hold Your Breath: Carp Can Manage Without Oxygen for Months." ScienceDaily. ScienceDaily, 7 April 2006.

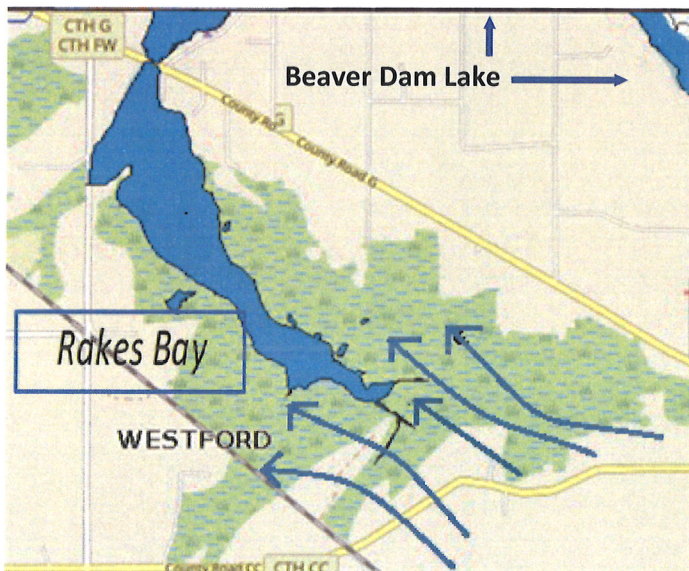
² Water Resources Management Practicum Report. "Addressing Impairment in Beaver Dam Lake and Beaver Creek." 2017. Nelson Institute for Environmental Studies - University of Wisconsin

aquatic plant growth. With significant carp reduced, pike and perch would better reproduce after the winterkill from the drought.

Phosphorus. For all the bad press, Phosphorus is critical for growth and fundamental to all living things (DNA, cell membranes and even teeth and bones in humans.) It is a “limiting” nutrient because without phosphorus, growth cannot occur. When applied to soil that is depleted, it will jump start growth. That is why it is a main part of agricultural and home fertilizers. In the natural environment, the availability of phosphorus is *limited*, which also limits algae growth in lakes. But applying excessive amounts of phosphorus is harmful to a lake’s natural balance. Excessive plant and algae growth deplete oxygen from the water causing death of fish and other animals.

II. PROJECT BACKGROUND

Years ago, rainwater used to *slowly* flow into Rakes Bay from the southeast and much of the sediment and phosphorus was captured by the wetlands (green area on Figure 6) as the



water spread out. This minimized the amount of phosphorus to the lake.

The Beaver Dam Lake Improvement Association suspected high levels of phosphorus coming into the lake. A UW Madison study in 2017 confirmed that Beaver Dam lake’s phosphorus load exceeded naturally occurring levels.

As of 2018, Beaver Dam Lake’s phosphorus load was 138 tons. But which one of the three main tributaries that fed the lake was the

main source? To determine that, for five years the BD Lake Improvement Association compared the phosphorus from the lake to samples from the three tributaries (one of which was Rakes Bay) where each entered Beaver Dam Lake.

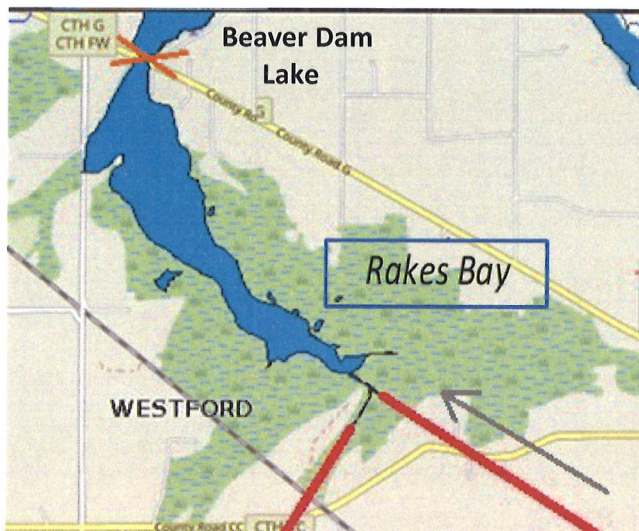


Figure 7. Straight Ditches (red lines)

With heavy rain, those two ditches carry fast running water in the direction of the grey arrow (Figure 7). That water flows into Rakes Bay like “a chute at the Dells.” Without time to slow down, the water carries significantly more runoff (phosphorus) and valuable topsoil from to the lake. These two ditches coming into Rakes Bay are the *primary source* of phosphorus runoff into Rakes Bay which is the primary source of phosphorus in the lake.

After years of data, it was clear that the Rakes Bay samples had *significantly* higher levels of phosphorus than the other two main tributaries which fed into the lake. (Figure 7 at the orange “X.”)

Rakes Bay was the *primary* source of phosphorus entering the lake. Where on the land was that coming from? Recall that years ago, the some of the runoff was naturally absorbed into the wetlands through meandering streams. Years ago, a prior owner straightened the creeks creating two straight ditches. (Figure 7, red lines).

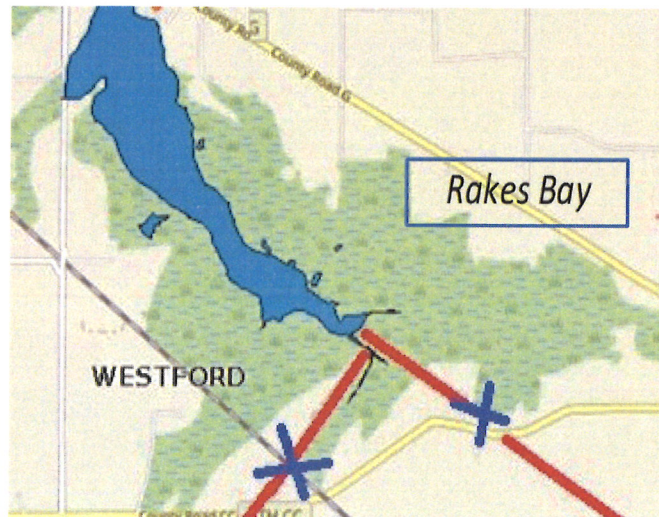


Figure 8. Ditch Testing sites

In May of 2021, BD Lake Improvement Association again retained an engineering firm to monitor the phosphorus levels farther away (upland) from Rakes Bay. (Figure 8, purple “x’s”). The resulting high phosphorus levels in the ditches demonstrated how that area was the most significant sources of phosphorus runoff for the *whole* lake. Now that the primary source was identified, BD Lake Improvement Association could create a solution.

III. PROJECT OVERVIEW AND FEASIBILITY

With the assistance of an engineering firm, BD Lake Improvement Association planned the Rakes Bay and Shoreline Restoration project which has three stages.

Stage 1. The first stage is to do upland work *expanding* the ditch areas allowing more surface water area which increases evaporation and slows down the water retained in the wetlands as it used to be years ago. The engineering firm estimated this cost at \$200,000.

Stage 2. Some shoreline owners have tentatively agreed to repair their deteriorating rip rap which also prevents shoreline erosion into the lake. The engineering firm estimated this cost at \$100,000. (It would not be a 100% contribution; the homeowners would do a cost share like agricultural producers).

Stage 3. Most impactful, Rakes Bay (4 to 5 ft deep) would be drawn down to mimic a natural drought which would provide the benefits explained above. The area would be cordoned off with a barrier (berm) to prevent the drawdown from impacting the rest of the lake. The water would be pumped out and maintained for the entire installation period of approximately 18 months depending on rainfall. (Heavy rainfall would take longer for draining and a less rainfall would be quicker.) The carp remains will disintegrate into the sediment which will be compacted. In addition to cleaner water, and more aquatic plants, we will have had a significant carp kill that will negatively affect reproduction thereafter. (See attached Exhibit A.) The engineering firm estimated this cost at \$452,000.

This type of project has been successfully implemented in Wisconsin and in different counties. It is stable and long-lasting.

IV. MAINTENANCE

By expanding (e.g., abandoning and rerouting) the ditches, water will flow more slowly reducing runoff and sediment into Rakes Bay. The structural ditch changes will remain for many years without maintenance. In addition, with implementing upland best agricultural practices, the reduced level of phosphorus will be maintained.

V. ELIGIBILITY FOR CORONAVIRUS LOCAL FISCAL RECOVERY FUNDS

Project Eligibility. This project is eligible for Coronavirus Local Fiscal Recovery Funds (CLFRF) which means that local taxpayers will not be funding the project through tax levy. Eligible uses of the money include projects for *water*, sewer, and broadband infrastructure. Presumably because the federal government does not want to slow down the implementation of these funds, there is no requirement for US Treasury Department to preapprove projects.³ Instead, local governments are directed to the Clean Water State Revolving Funds to decide if a water project is eligible.⁴ *In other words, if the county board finds that the project would be eligible for funding through the Clean Water State Revolving Funds (CWSRF's), then it is eligible for the Dodge County Local Fiscal Recovery Funds.*

³ Section 6.7 Corona Virus State and Local Fiscal Recovery Funds Frequently Asked Questions, as of July 19, 2021.

⁴ Section 6.7 Corona Virus State and Local Fiscal Recovery Funds Frequently Asked Questions, as of July 19, 2021.

To find that out, we must review the EPA document “Overview of Clean Water State Revolving Fund Eligibilities” (2016, May) which describes eleven eligible projects. Two that specifically apply to the Rakes Bay Project are “Agricultural Best Management Practices” and “Surface Water Protection and Restoration.”

The first category of Agricultural Best Management includes projects which address runoff and erosion from agricultural cropland and animal feeding operations. This includes the project “streambank stabilization” as well as riprapping for shoreland owners both of which are a key part of Rake’s Bay project. It also specifically includes projects developed to address nonpoint sources of pollution.⁵

Surface Water Protection and Restoration includes restoring wetlands, reestablishing riparian vegetation, and reestablishing aquatic vegetation . . . In that category, an eligible project specifically includes “efforts to develop or implement watershed partnerships to address nonpoint sources of pollution.”⁶ A “Watershed partnership” includes efforts to demonstrate cooperative ways to address nonpoint sources of pollution to reduce adverse impacts on water quality.”⁷ That describes this project. BD Lake Improvement Association would partner with lake owners and the DNR for this project.

County May Transfer Funds To BDLIA. The Treasury Rule allows a county to receive and transfer funds to a “private nonprofit organization . . .”⁸ Therefore, as a 501(c)(3) corporation, the Beaver Dam Lake Improvement Association is eligible to receive funds from Dodge County for covered purposes.

In conclusion, BDLIA has done significant research to locate the primary source of phosphorus entering the lake and engaged in significant planning over years to make the highest impact with the available funds. There is a significant need, and the project is feasible having successfully been successfully implemented elsewhere. It is also cost-effective providing many years of benefits with minimal maintenance.

⁵ Overview of Clean Water State Revolving Fund Eligibilities (2016, May, p. 16 and Title VI of the Social Security Act Section 603(c)(7))

⁶ Overview of Clean Water State Revolving Fund Eligibilities (2016, May, p. 21 and Title VI of the Social Security Act Section 603(c)(7)).

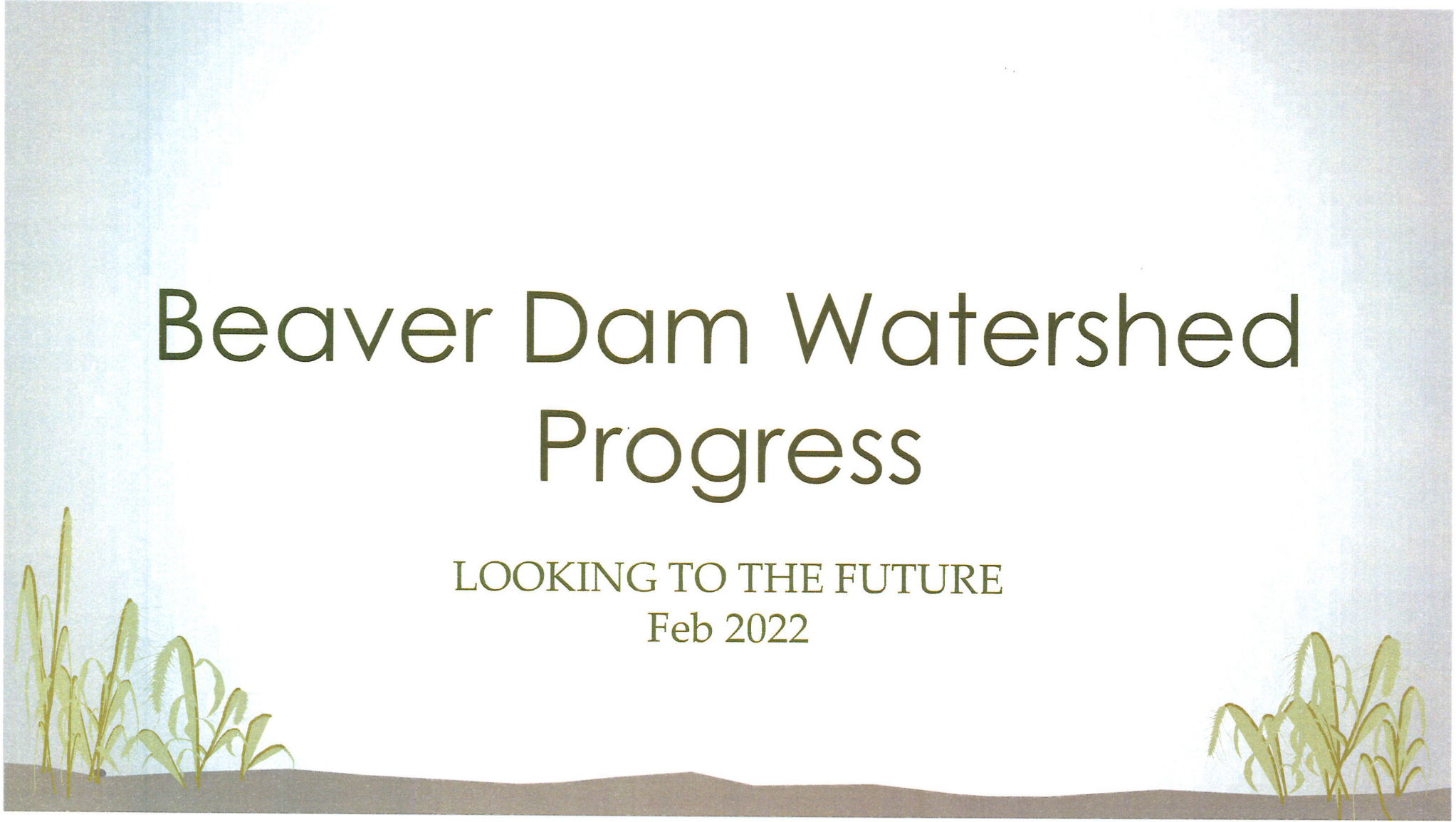
⁷ Overview of Clean Water State Revolving Fund Eligibilities (2016, May, p. 6) and Title VI of the Social Security Act Section 603(c)(7)).

⁸Title VI of the Social Security Act Section 603(c)(3) [42 U.S.C. 803] authorizes a transfer of funds from a county to a private nonprofit organization as cited in Corona Virus State and Local Fiscal Recovery Funds Frequently Asked Questions, Section 1.8, July 19, 2021.

Beaver Dam Watershed Progress

LOOKING TO THE FUTURE

Feb 2022

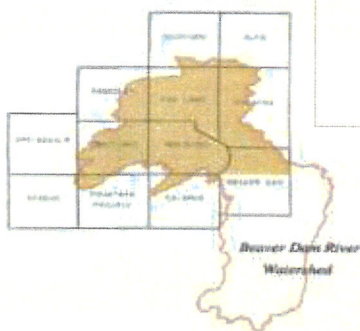


Landowners and Drained Wetlands in the Upper Part of the Beaver Dam River Watershed

Explanation

- Landowner Boundary
- Hydrography
- Road
- Drained Wetland
- Existing Wetland
- Deep Open Water

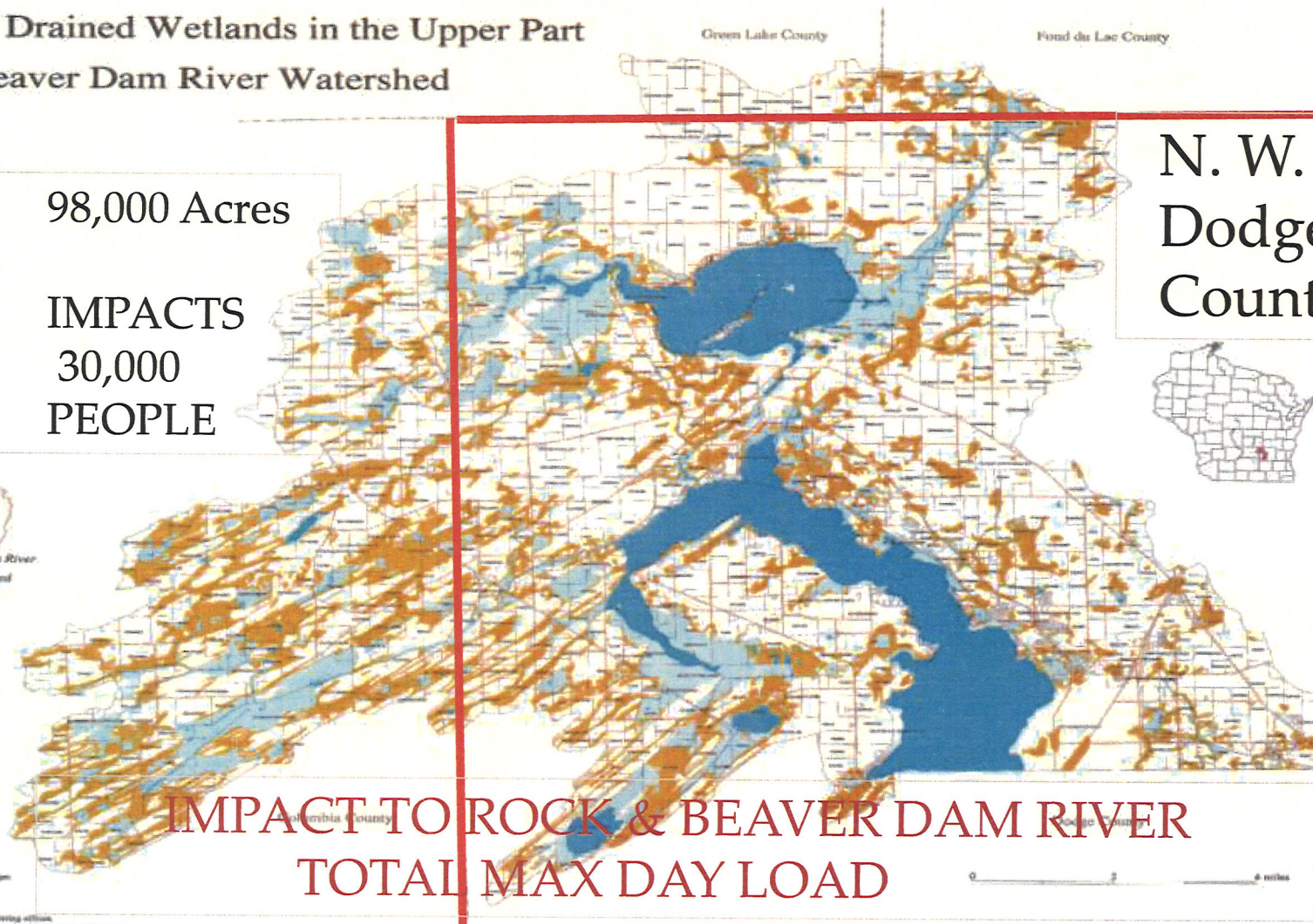
Civil Town Index



98,000 Acres

IMPACTS
30,000
PEOPLE

N. W.
Dodge
County



IMPACT TO ROCK & BEAVER DAM RIVER
TOTAL MAX DAY LOAD

Landowner lot numbers are shown for ownership of 50 acres or larger.

Source:
Landowner boundaries from 1992 - 1999 tax parcel data of the
Coltsville, Dodge, Green Lake, and Fond du Lac County tax filing offices.

0 2 4 miles

Water Quality

EPA Impaired 303

Eutrophication may be defined as the process of nutrient enrichment of water bodies and the subsequent overgrowth of plants on the surface of water.

High P

Decaying fish and algae

Blue Green Toxic Algae

No Fish

Limit of light penetration

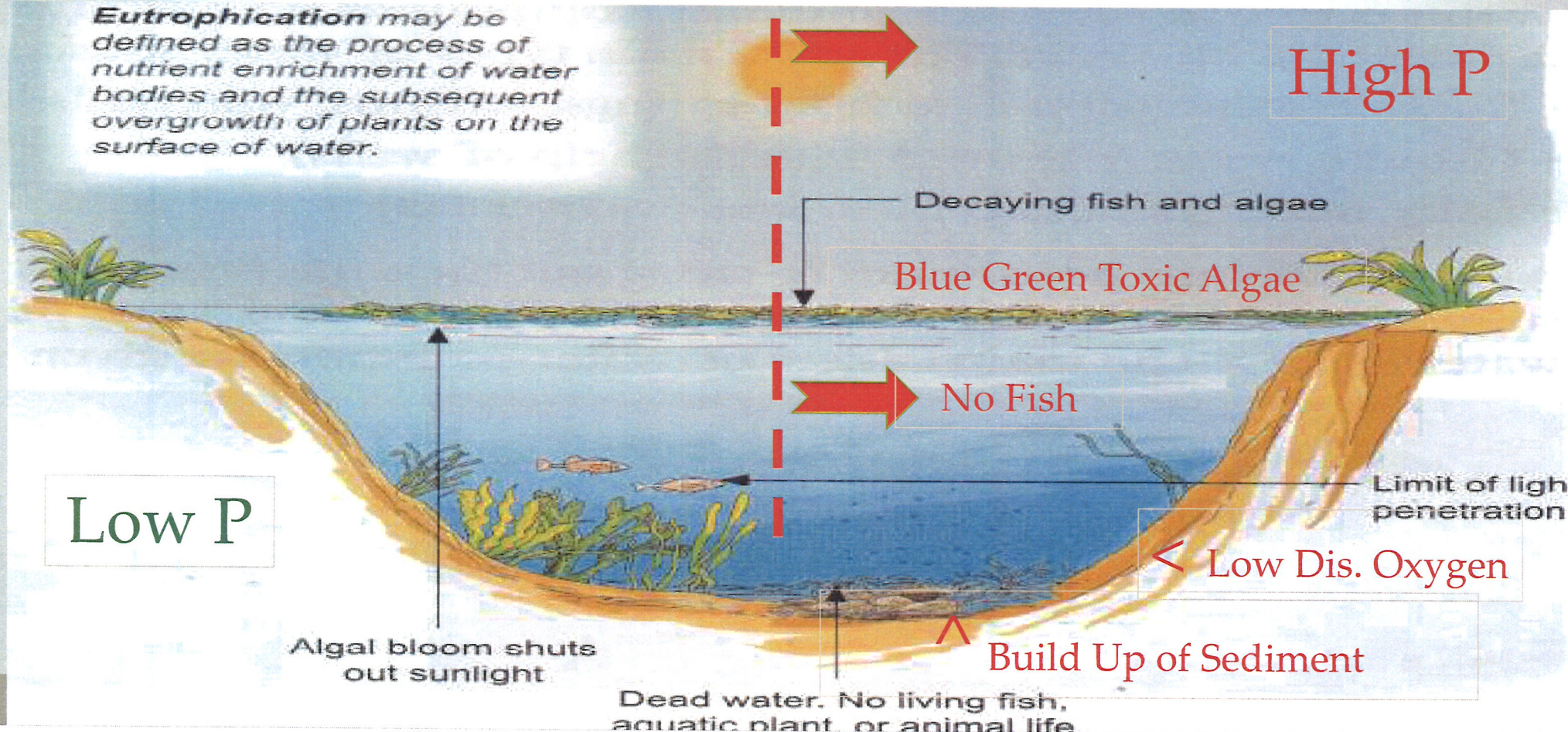
< Low Dis. Oxygen

Build Up of Sediment

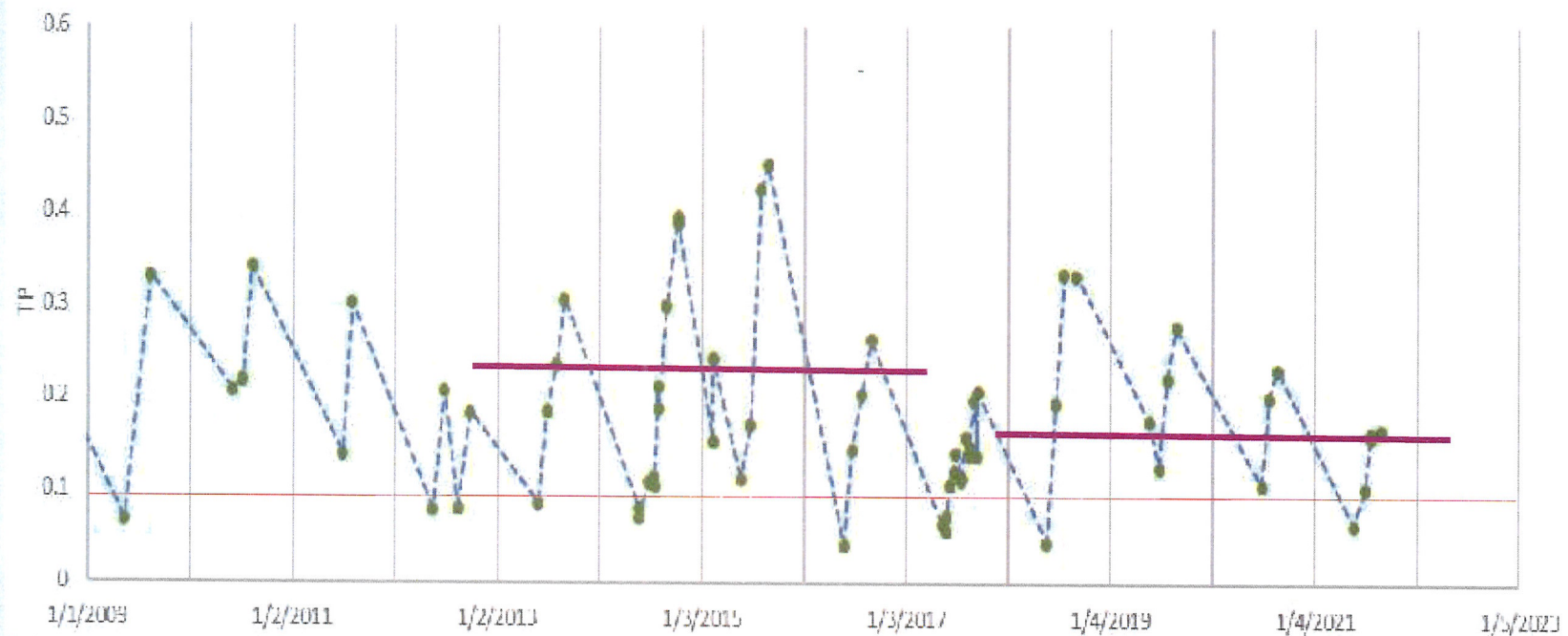
Low P

Algal bloom shuts out sunlight

Dead water. No living fish, aquatic plant, or animal life



Phosphorus Level Analysis Wi State Hygiene Lab.



Source: Dr. P McGinley UW SP

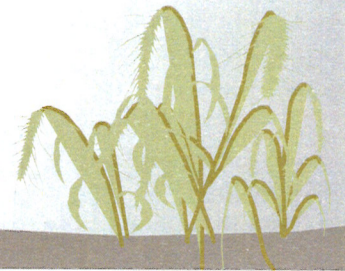
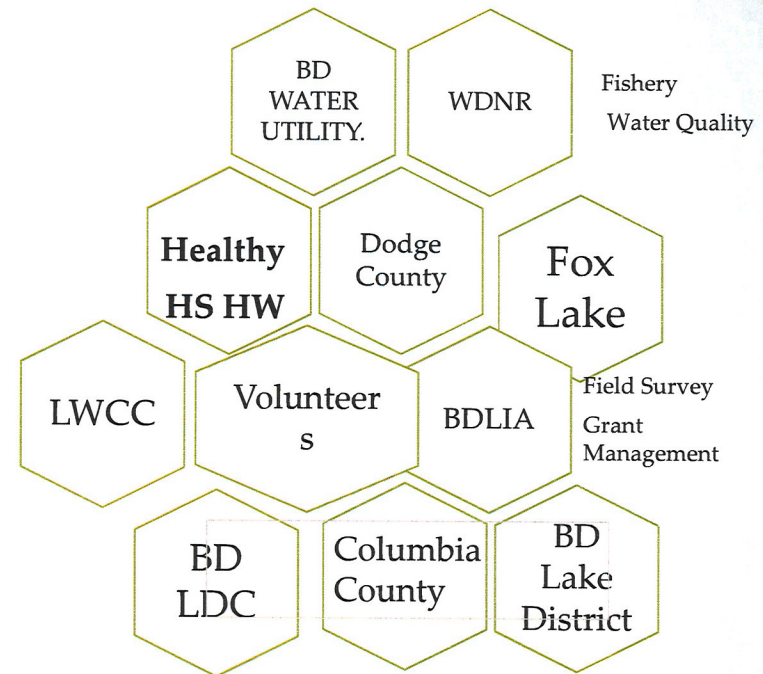
Is Shallow Lake Restoration Feasible? Beaver Dam I

Attribute			
Ext. Nutrient Load	< 1 g/m ² /yr	1-2 g/m ² /yr	> 2 g/m ² /yr
Inlake TP	< 100 ug/l	100-250 ug/l	> 250 ug/l
Sediment Resuspension	< 500 acres	500-5,000 acres	> 5,000 acres
Hydrologic Connectivity	Muti-basinal isolated waterbodies	↔	Direct Connection Floodplain/Riverine
Aquatic Plant Potential	> 50% surface area	↔	< 20% surface area
Fish Biomass	High (> 400 lbs/acre)	↔	Low (< 100 lbs/acre)
Fish Community	High Abundance Benthivores/Planktivores	↔	Low Abundance Benthivores/Planktivores

YES !

Collaboration A Must!

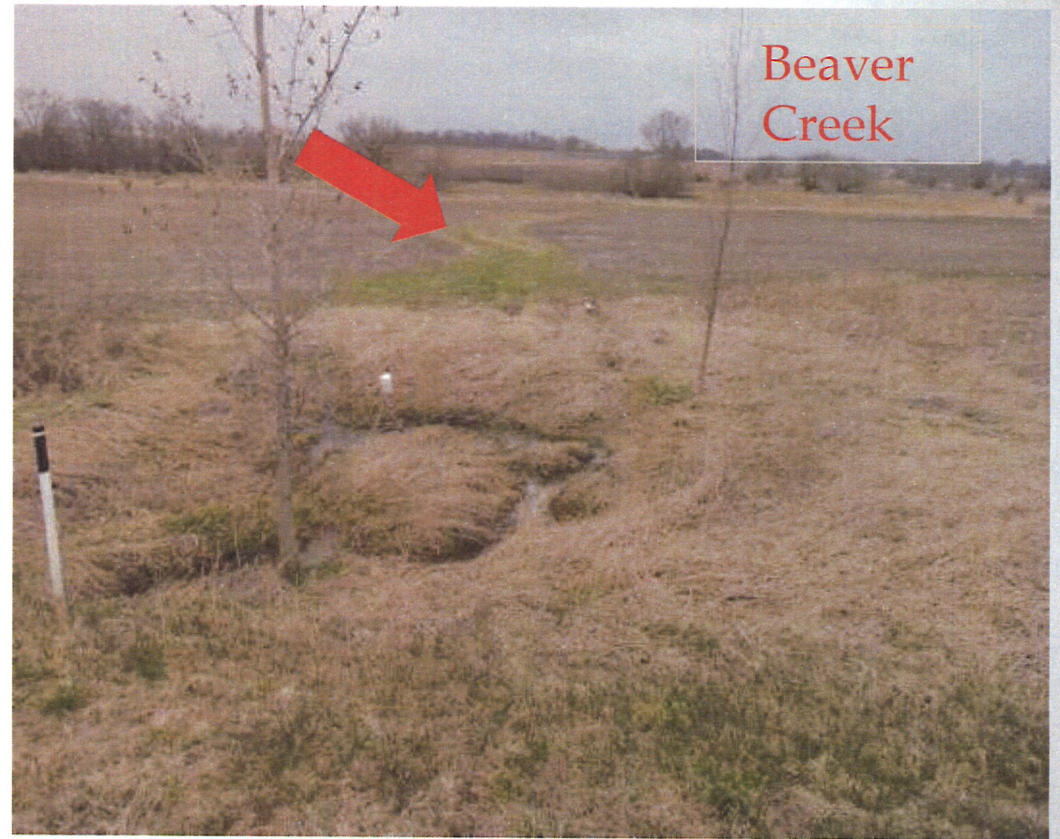
We can't solve problems
by using the same kind
of thinking we used
when we created them.



Progress Not Always Seen **** Producer Steps Up

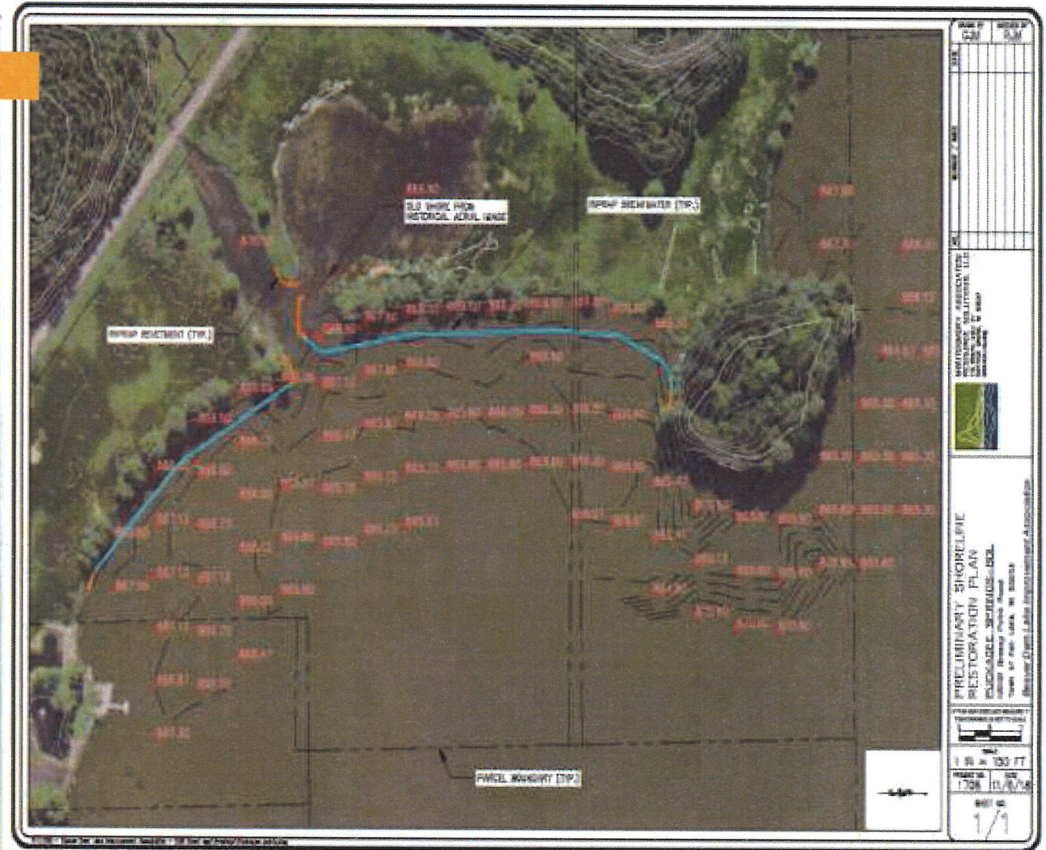
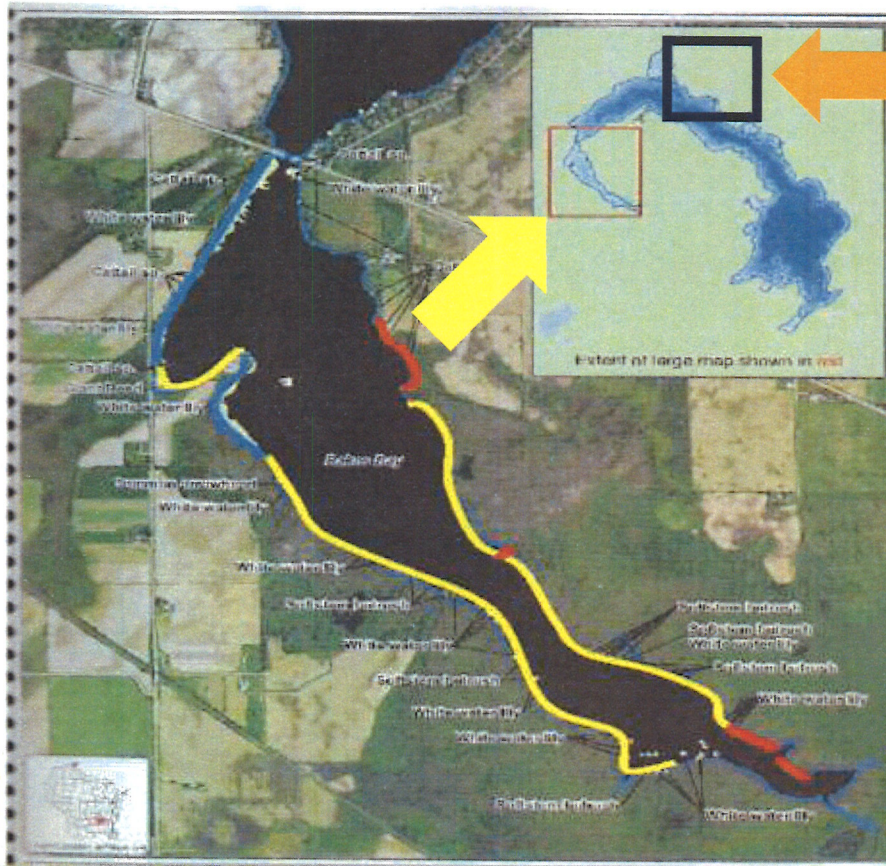


2019



2020

Must Be 'Watershed Approach'



9 % Area 20+ % of Phosphorus

In Progress 2022 - 2023

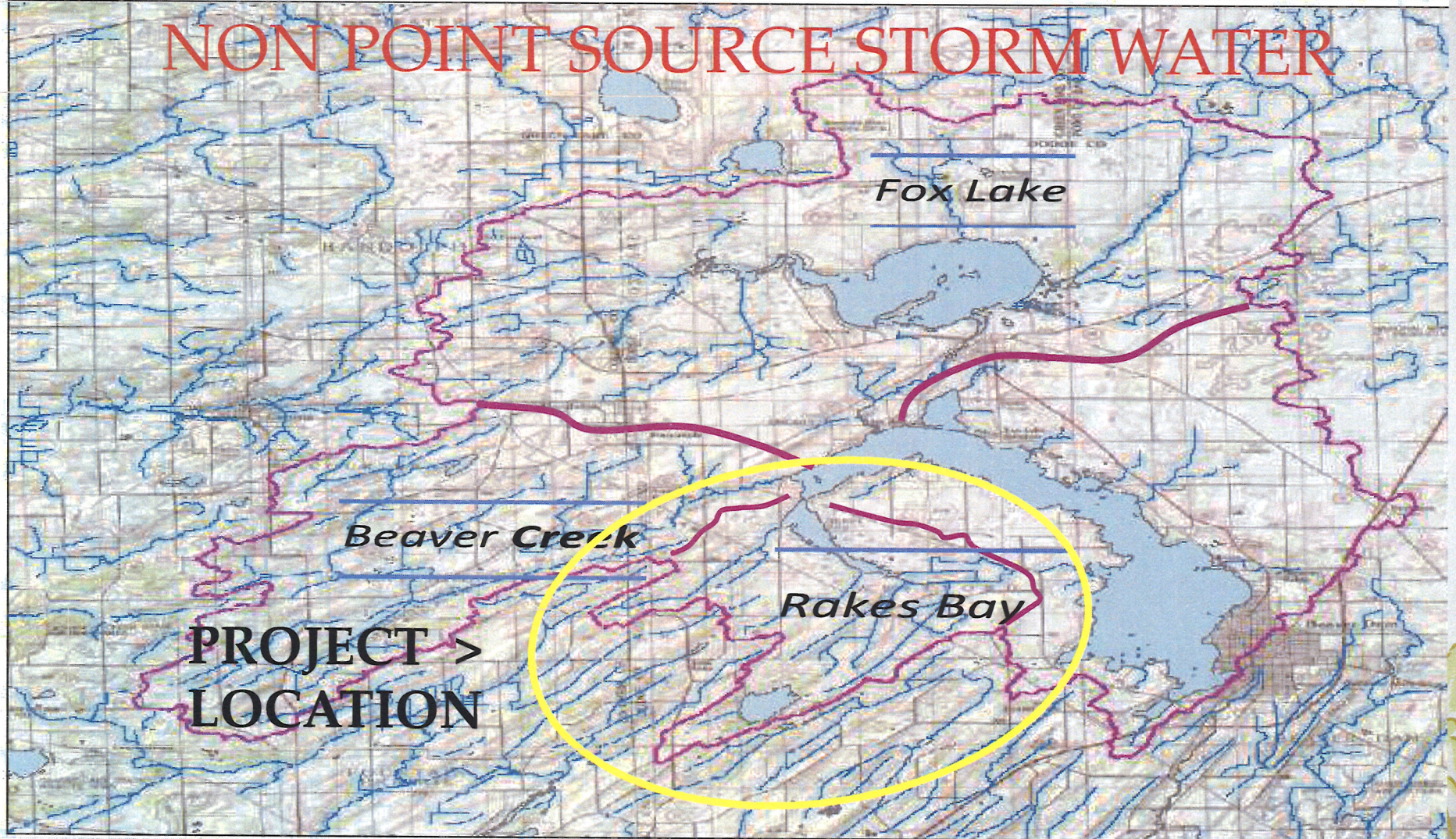
NON POINT SOURCE STORM WATER

Fox Lake

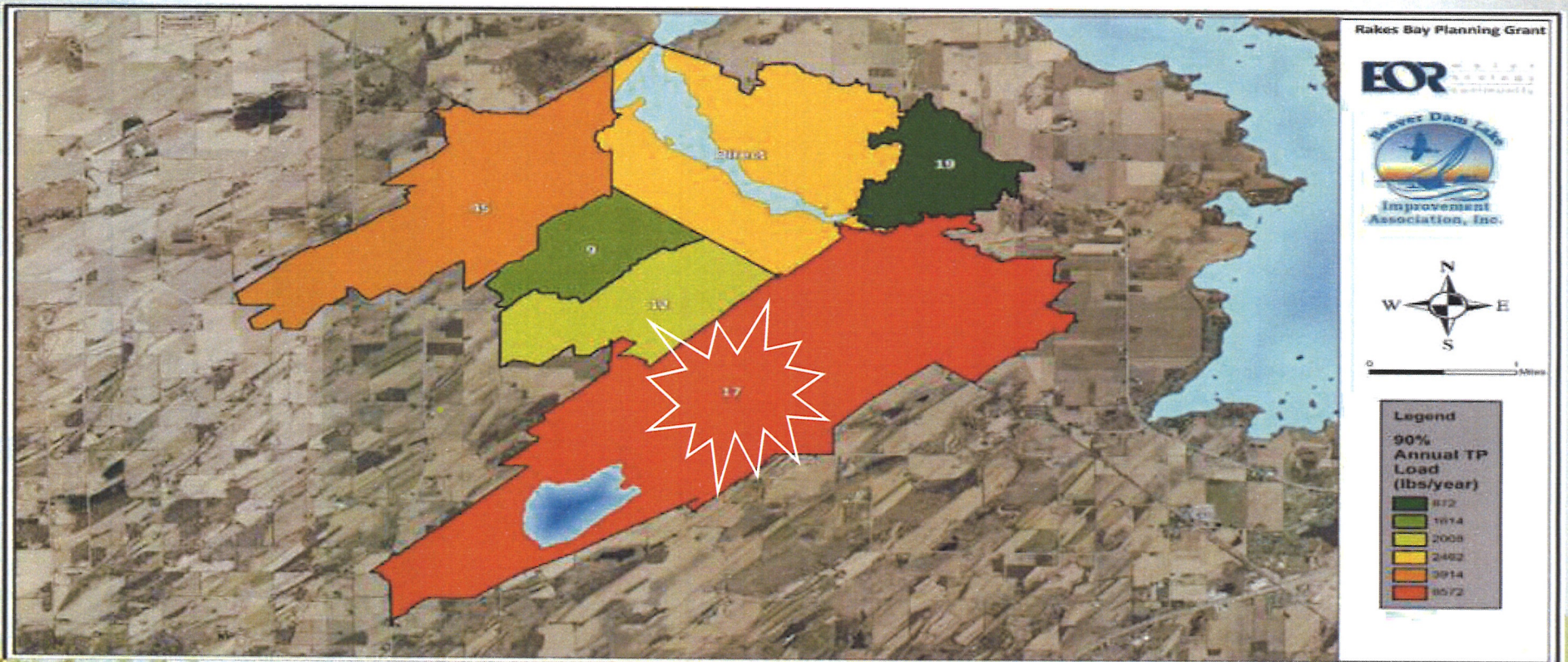
Beaver Creek

Rakes Bay

**PROJECT >
LOCATION**

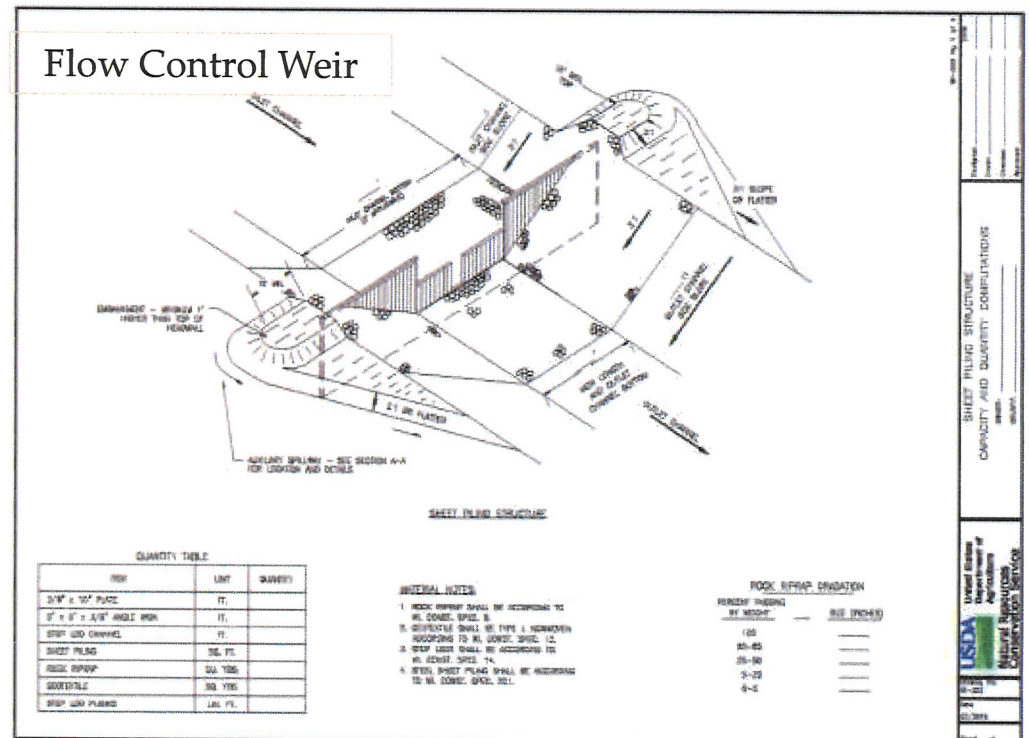
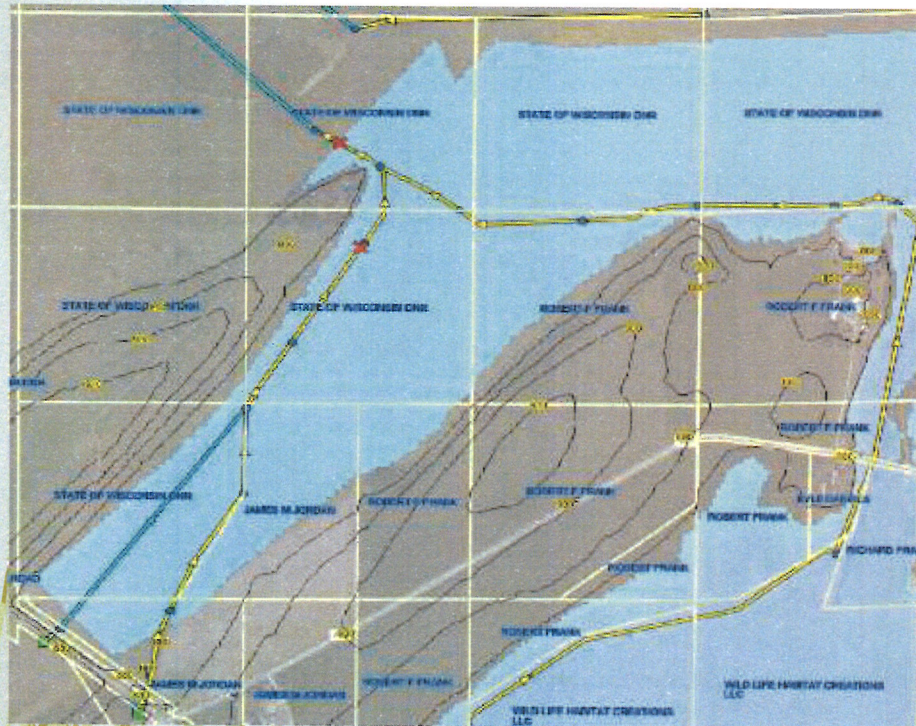


Rakes Bay Subwatershed



19,580 # Phosphorus Inflow per Year

Project is Shovel Ready

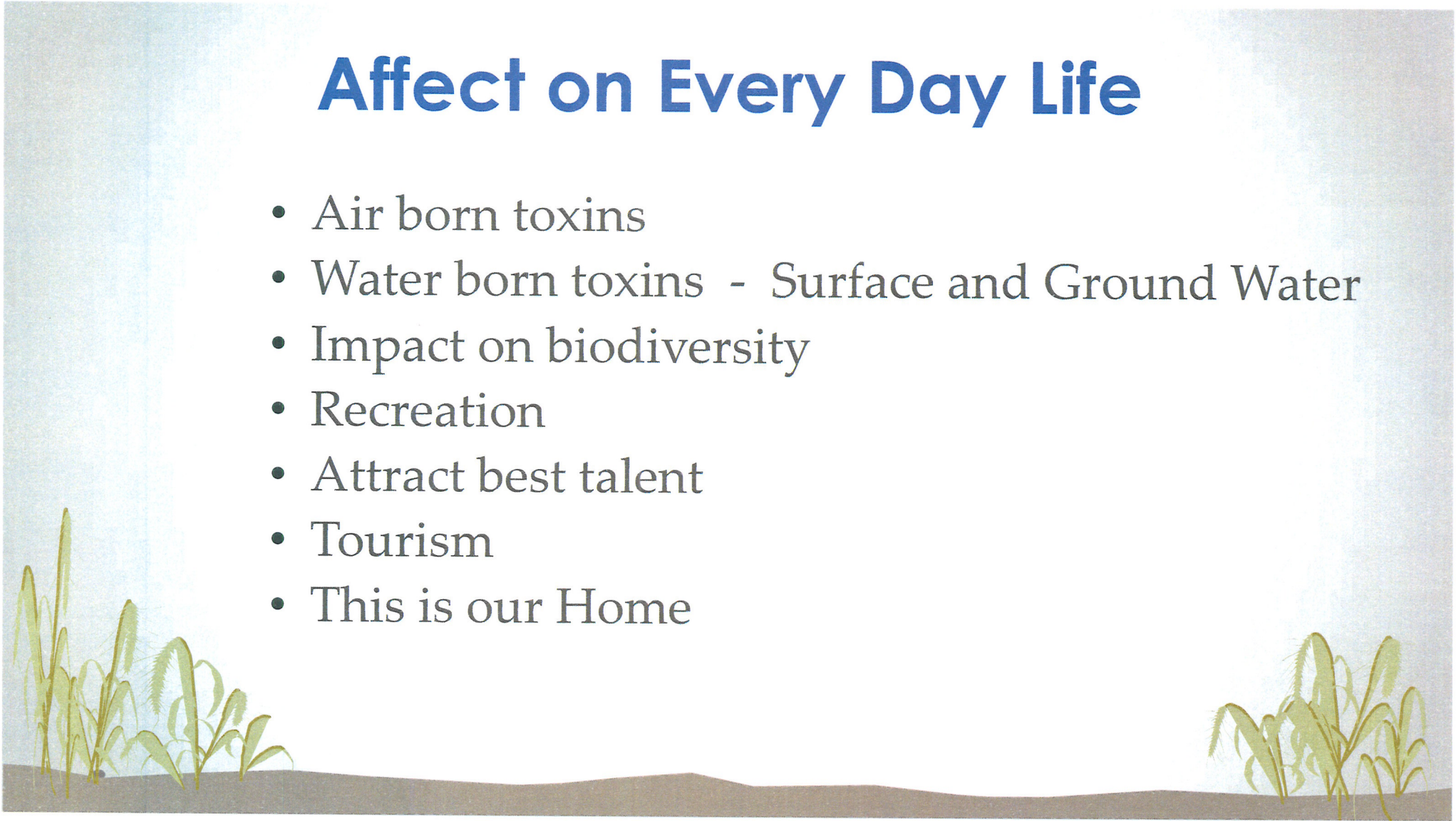


Source: EOR Dec 2021

WATERSHED H/H PILOT PROJECT

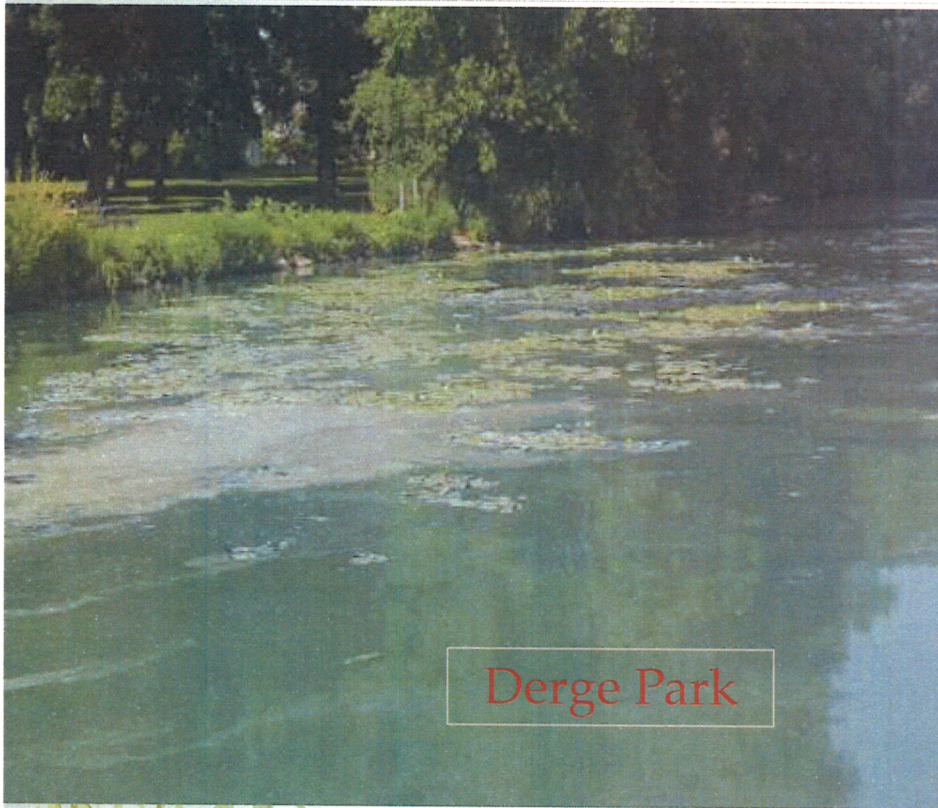
Affect on Every Day Life

- Air born toxins
- Water born toxins - Surface and Ground Water
- Impact on biodiversity
- Recreation
- Attract best talent
- Tourism
- This is our Home



AIRBORN CYNO-BACTERIA

FILTER & SANITIZER



Derge Park

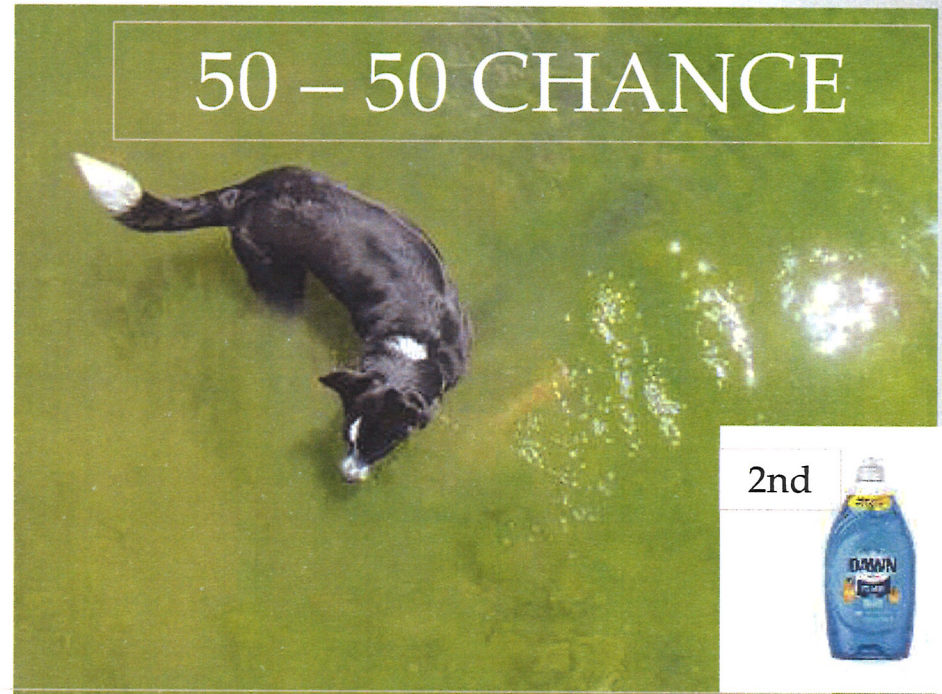
Beaver Dam July 13th



BLUE GREEN BACTERIA



MD



DVM

50 – 50 CHANCE

2nd



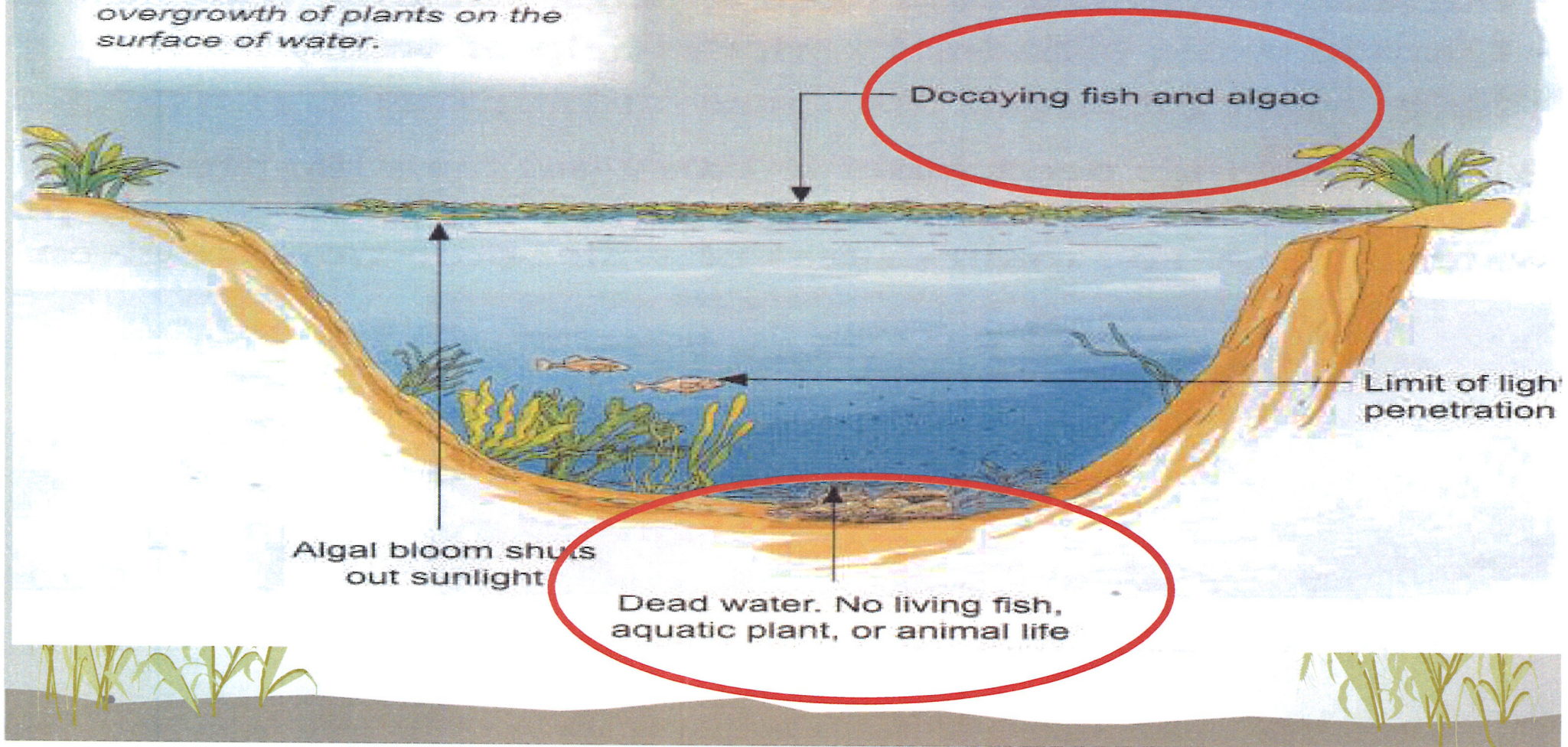
1st



Wisconsin Dept. of Health Services (DHS.Wisconsin.gov)
CDC (Vet. Reference Cyanobacteria & Human Associated Illness)

Eutrophication may be defined as the process of nutrient enrichment of water bodies and the subsequent overgrowth of plants on the surface of water.

Habitat & Recreation



Every Day Enjoyment



'WE CAN NO LONGER AFFORD TO TAKE WATER FOR GRANTED.'

Doug Larsen, Ducks Unlimited (3/2020)

Community Image



OLD



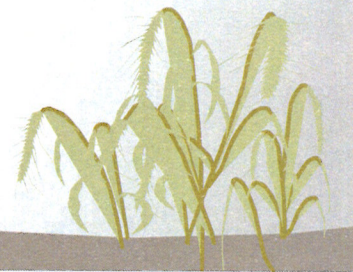
NEW

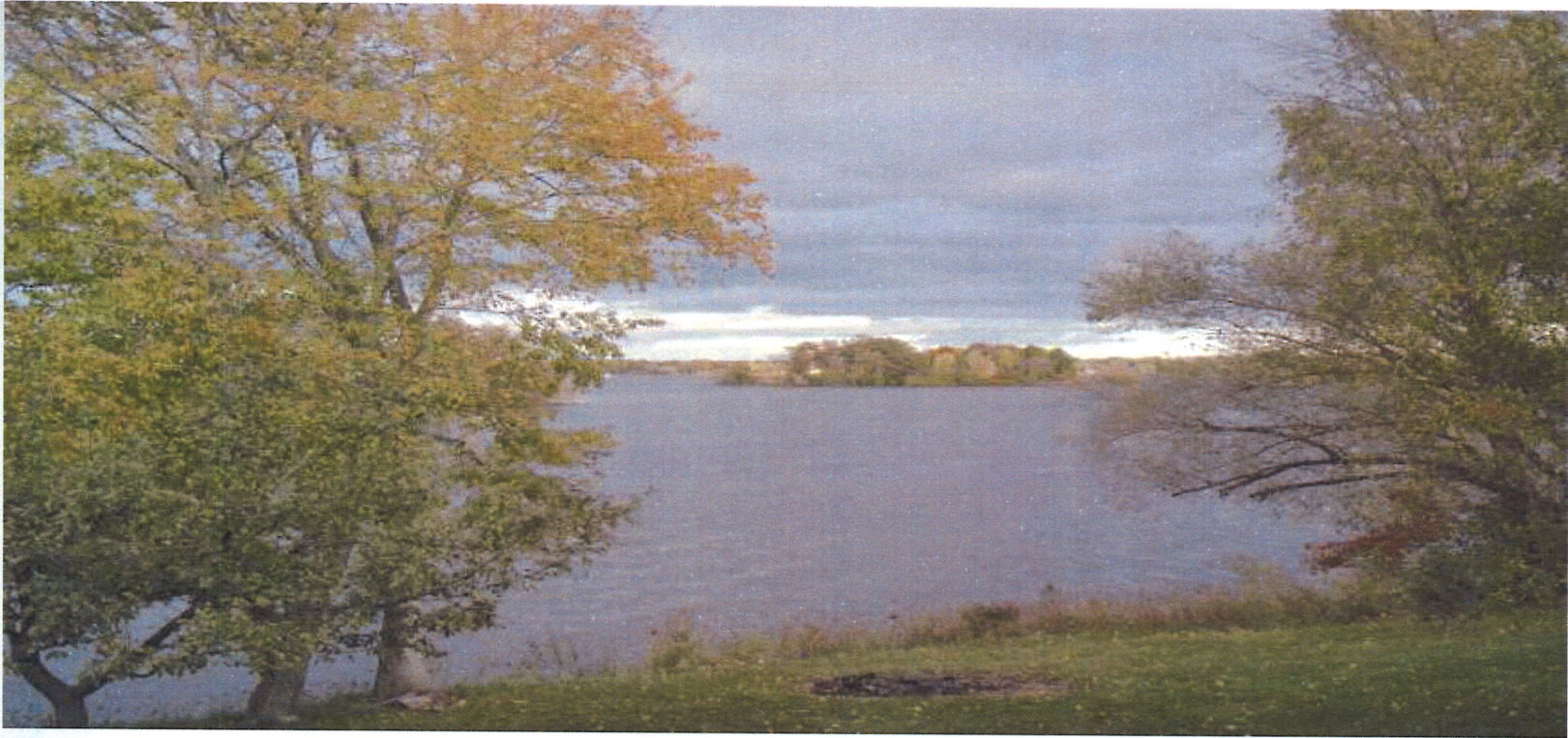


FUTURE



*A
GREAT
DAY
FOR
THE
FAMILY*





The Future Can Be Bright For the Lake !

