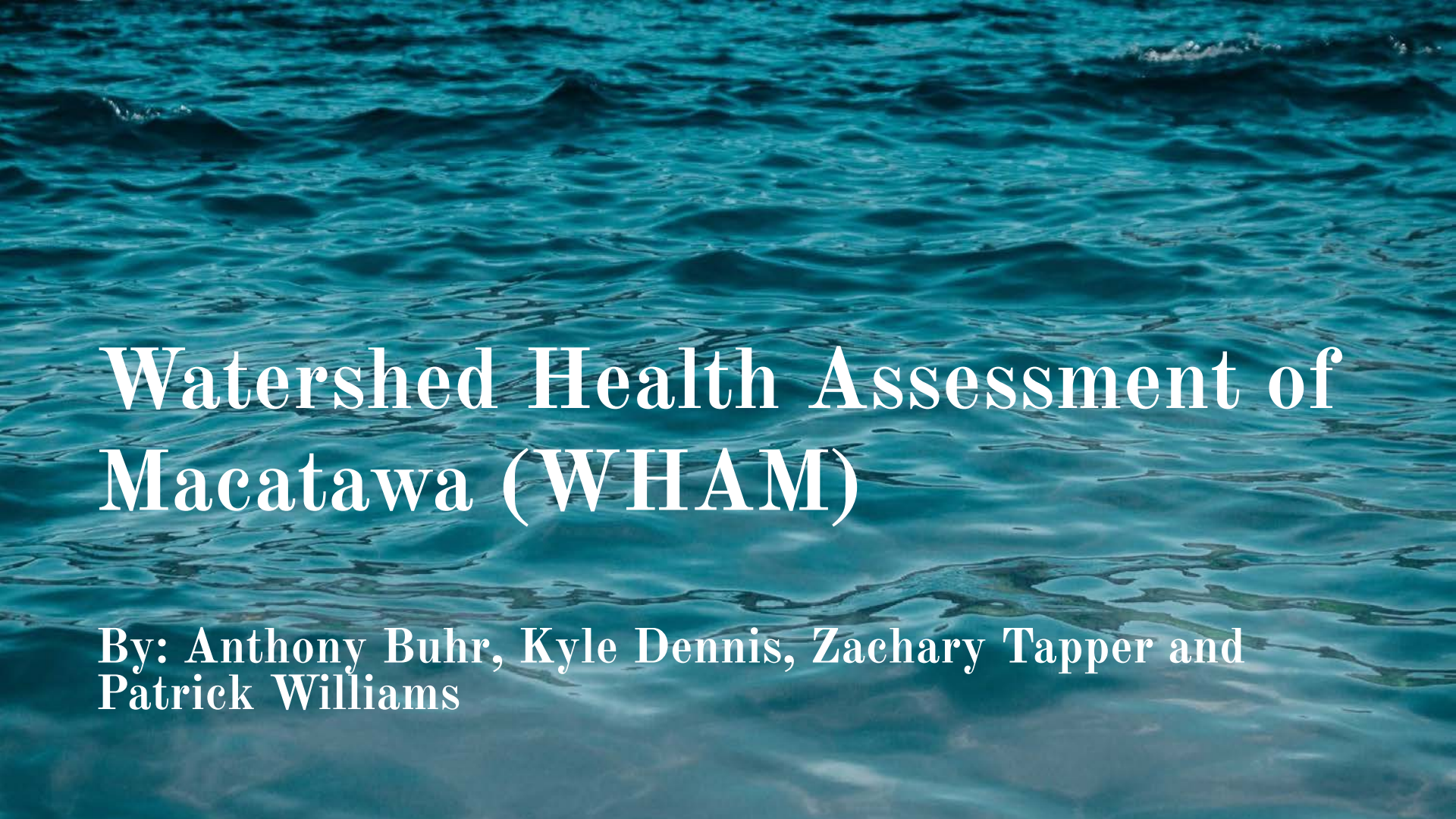

Watershed Health Assessment of Macatawa (WHAM)

By: Anthony Buhr, Kyle Dennis, Zachary Tapper and Patrick Williams

Outline

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Mission Statement

WHAM's mission is to continue the trend of improving conditions in the Macatawa Watershed and moving on from the hypereutrophic conditions that have defined the lake's past.

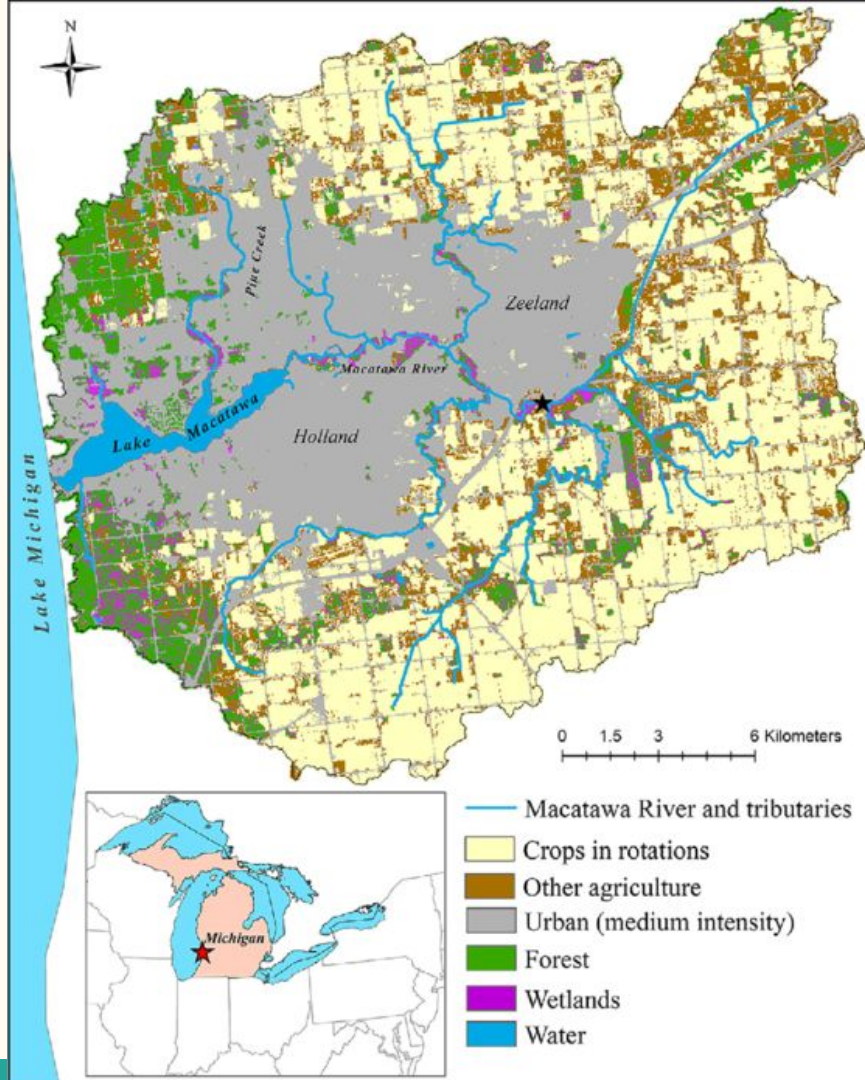
WHAM recognizes the many problems that agricultural runoff brings to Lake Macatawa and aims to educate farmers, tourists, and residents on how they can make a difference by implementing best management practices and conserving water. Also, WHAM wants to shine a spotlight on bioaccumulation of mercury in the fish in the lake to protect the health of people in the watershed.

Map of Lake Macatawa, MI

- Lake Macatawa is located next to the Michigan town of Holland, in Ottawa County
  - Considered a hypereutrophic waterbody (**>100µg/L P**)

- Lake Macatawa Watershed covers **175 mi²**
  - Land use is mostly agricultural and urban, **46%** and **33%** respectively

- While usually a center for beach travel and fishery, Lake Macatawa has faced beach closures and fishkills in recent years due to increased surface pollution



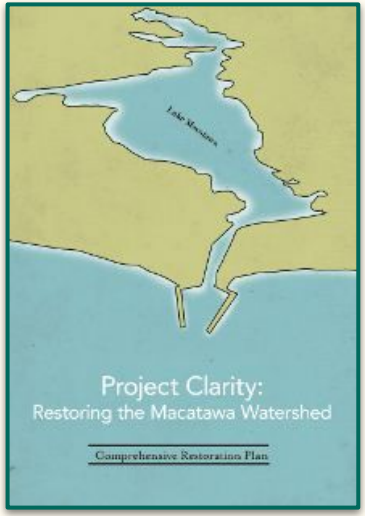
History of Lake Macatawa

- Indigenous History: The Odawa people originally inhabited the area, using the lake for fishing and transportation.
  - "Macatawa" derives from the Odawa word for "Black"
- 1847: Dutch settlers founded Holland, using the lake for transportation and logging
- 19th–20th Centuries: Industrialization led to the construction of Holland Harbor and a canal by the U.S. Army Corps of Engineers, connecting the lake to Lake Michigan
- Mid-20th Century: Pollution crisis from industrial waste, agricultural runoff, and sewage

Boardwalk Lake Macatawa Michigan Postcard, circa 1910

Governance of the Macatawa Watershed

- ODC Network and Project Clarity
  - Non-profit org that manages the Macatawa watershed and educates public about watershed health and best management practices (BMPs) through outreach programs
  - Partners with City of Holland, City of Zeeland, Ottawa County Parks and Rec and other organizations
- Total Maximum Daily Load (TMDL) approved by EPA
  - Allows **55000 lbs/year** of phosphorus (**35,000** for nonpoint source and **20,000** pounds for point source), also identifies nonpoint source as being target of reduction
- Great Lakes Restoration Initiative
  - Federal program managed by the GLRI governmental taskforce led by the EPA with the purpose of protecting and restoring the Great Lakes Ecosystem.
- Michigan NREPA Act Part 31(Water Resources Protection Act)
  - Michigan's primary pollution control statute with a major focus on waste-water disposal.
- Great Lakes Critical Programs Act of 1990
  - Title 1: Great Lakes: Requires the Administrator of the environmental Protection agency to publish water quality guidance for the great lakes system.



Policy Actors & Affected Stakeholders

- Formal Actors:
  - Michigan Department of Environment, Great Lakes, and Energy (EGLE)
  - Macatawa Area Coordinating Council (MACC)
  - US Environmental Protection Agency (EPA)
- Informal Actors:
  - ODC Network (Outdoor Discovery Center Network)
  - Residents of Holland, Michigan and other surrounding municipalities
  - Farmers
  - Tourists

Environmental Issues Within the Lake Macatawa Watershed

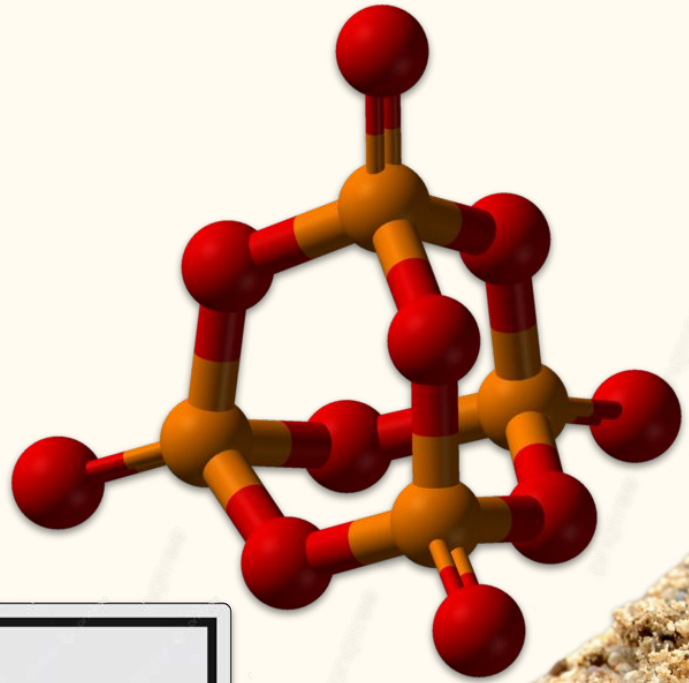
1) Excessive Phosphorus Level
    a) High P → Eutrophic conditions; Algal blooms degrade water quality
2) Sedimentation
    a) Urban Development erosion results in large sediment deposits in lake, impairing water quality, disrupting aquatic habitats
3) Bio-accumulated Mercury
    a) Atmospheric deposition of mercury → accumulation of the metal in wildlife tissue

Outline of Goals

- **By 2050, we will decrease Phosphorus levels to desirable level of 50 micrograms/L**

- **By 2050, we plan to improve water quality to a Secchi disk depth of 2m**

- **By 2050, we will educate residents about bioaccumulation of mercury levels**



Problem #1: Phosphorus Levels

- Phosphorus levels in the watershed have been historically very high
  - Decreased slightly between 2018-2021 to around **90 µg/L**, but has increased to **109µg/L** in 2022
- Nonpoint source pollution from agriculture is the primary reason for excess P in waterways
  - Surface application of fertilizers (especially prior to rainfall event), overirrigation, lack of buffers
- Excessive phosphorus → algal bloom → hypoxic conditions → fishkills

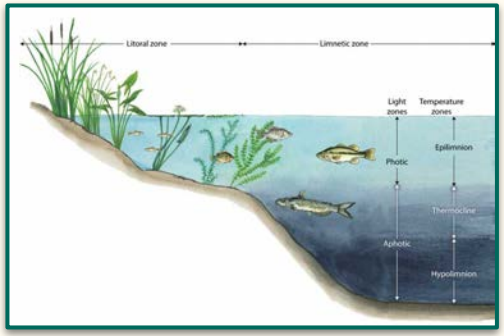
Goal: Reduce Phosphorus Levels

Goal: Reduce phosphorus levels in Lake Macatawa to **50µg/L** by **2050**

- **25µg/L** would be desirable level, but historically hypereutrophic levels of Lake Macatawa mean such a reduction may be far-fetched within set time

Solutions:

- Encouraging farmers to implement BMPs for reducing runoff
  - Reduce surface application of fertilizer especially before rainfall events
  - Planting cover crops instead of leaving fields bare to reduce erosion and nutrient loss
- Planting native plants along the littoral zone of Lake Macatawa



Problem #2: Water Clarity

- Excessive sediment runoff reduces clarity of water
  - Could affect how lake goers and other people in the area view the waterway (it's murky, it's dirty)
- Secchi disk depths (measure of water quality) since **1972** have been below **1m**, indicating low water clarity in the lake
- We want to engage with urban residents and lake goers to improve water clarity
  - Clarity of the water jeopardize tourism, as Lake Macatawa has numerous beaches and campsites

GOAL: Improve Water Clarity

- We want to implement techniques in municipalities surrounding Lake Macatawa to increase **Secchi Disk depth** to **2m** by **2050**
- Towns surrounding the lake are medium density and suburban → lots of impermeable surfaces
- Solutions:
  - Introduce green infrastructure such as living pavement and rain gardens to capture sediment and improve urban drainage
  - Educate residents about how they individually can reduce runoff (i.e. use less water for lawns and other aesthetic purposes)

Problem #3: Mercury

- Excess amounts of mercury in a water body can pose a threat to humans when aquatic bacteria mixes with mercury and converts it into **methylmercury (CH_3Hg),** a highly toxic substance that is incredibly dangerous to humans. Current gaseous mercury levels in Lake Michigan are estimated at 1.65 ± 0.61 ng/m3, according to a 2021 report. EPA data suggests the median concentration of mercury in Lake Michigan fish fluctuates, but remains below 0.5 μg/g, the current regional guideline standard.

- Mercury enters bodies of water through 2 main channels:

    - **Bioaccumulation**, wherein natural causes like larger fish eating smaller fish that contain mercury increases the natural presence of mercury

    - **Human Disposal,** like with improper disposal of fluorescent bulbs, a mercury-containing product. Often these methods lead to discharge into the atmosphere

GOAL: Maintain decrease Mercury levels by 2050

- **Bioaccumulation:** Monitoring is the only measure against a natural phenomenon like bioaccumulation. Remaining aware of the natural rate of mercury deposition, while not something that can be regulated, does give us an important benchmark for comparison when measuring man-polluted mercury

- **Human Disposal:** Awareness to proper disposal methods, promotion of mercury-free alternative products, increased regulations, and the usage of activated carbon filters to clean currently contaminated water, are all measures we recommend to decrease the current levels of mercury in the Macatawa area.

Conclusion

Currently, Lake Macatawa and other streams within the watershed are still impaired. However, the watershed has seen steady progress over the last 50 years. Phosphorus and sediment levels, while still not ideal, have begun to slowly move towards desirable conditions. WHAM hopes to continue this progress by involving agricultural and residential stakeholders from the area and educating them on best management practices and other ways to be more sustainable. Together, we will make great progress in the next 25 years in achieving a cleaner Macatawa.

Questions?

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