PROCEEDINGS OF THE BROWN COUNTY
LAND CONSERVATION SUBCOMMITTEE

Pursuant to Section 18.94 Wis. Stats., a regular meeting of the **Brown County Land Conservation Subcommittee** was held on Monday, November 25, 2013 in Room 161, UW Extension, 1150 Bellevue Street , Green Bay, WI

Present: Chairman Dantinne, Supervisor Bernie Erickson, Supervisor Tom Sieber, Supervisor Dave Landwehr, Norb VanDeHei
Excused: Supervisor Dave Kaster
Also Present: Jim Jolly, Jon Bechle, John Kennedy, and other interested parties

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I. Call Meeting to Order
The meeting was called to order by Chairman Dantinne at 6:00 p.m.

II. Approve/Modify Agenda.

Motion made by Norb VandeHei, seconded by Supervisor Landwehr to approve. Vote taken. MOTION CARRIED UNANIMOUSLY.

III. Approve/modify minutes of Land Conversation Subcommittee of October 28, 2013.

Motion made by Supervisor Erickson, seconded by Supervisor Sieber to approve. Vote taken. MOTION CARRIED UNANIMOUSLY.

IV. Discussion regarding December Land Conservation Subcommittee meeting.

Motion made by Supervisor Landwehr, seconded by Supervisor Erickson to forgo December Land Con meeting, pending critical items. Vote taken. MOTION CARRIED UNANIMOUSLY.

Comments from the Public

1. Budget Status Financial Report for September 30, 2013.
Jim Jolly referred to the financial report for September stating that the department is on track.

Motion made by Supervisor Sieber, seconded by Norb Vande Hei to receive and place on file. Vote taken. MOTION CARRIED UNANIMOUSLY.

2. Presentation by John Kennedy of NEW Water regarding "Dead Zones in Green Bay"
John Kennedy presented information related to increased hypoxia in the lower Green Bay during the period covering 2009 to 2011. He explained that wind driven transport of surface water out of the bay initiates a return flow of cold Lake Michigan water below the termocline causing increased vertical mixing with surface water. A program was authorized in 1986 to monitor the ambient water quality with a mission to monitor and collect environmental data and assess the impact of the MSD's influence on the river and bay. Problems include excess phosphorus from land runoff and point source polluters; suspended solids from soil erosion; persistent

contaminants; non-native species introductions; in addition to habitat destruction. (See attached information for details)

Questions related to a possible increase in water rates were addressed with Mr. Kennedy stating that more definitive answers are expected within the next several years. (Informational)

3. Director's Report.

Jim Jolly reported that the department has been taking a proactive approach with regard to manure status, stating that although 60 farms have been investigated, approximately 40 or more are left to complete. Weather has presented a slow down with this process.

Jolly also reported that on the West Shore and Pike Habitat Program stating that the NRDA is interested in a more long-term relationship in terms of funding with the possibility of a four year deal.

Motion made by Supervisor Sieber, seconded by Norb Vande Hei to receive and place on file. Vote taken. MOTION CARRIED UNANIMOUSLY.

4. Adjourn.

Motion made by Supervisor Sieber, seconded by Norb Dantinne to adjourn at 6:47 p.m. Vote taken. MOTION CARRIED UNANIMOUSLY.

Respectfully submitted,

Alicia A. Loehlein
Recording Secretary

Rae Knippel
Transcription

Hypoxia in Green Bay

John Kennedy
Watershed Programs Manager

November 25, 2013

History and Mission of the Ambient Water Quality Monitoring Program (AWQMP)

- Program was authorized in 1986
- Mission
  - GBMSD has long served as an Environmental Steward in the region
  - Monitor and Collect Environmental Data
    - Assess impact of GBMSD's effluent on the river and bay
    - Collect data that may be of importance to research and regulatory community
- 6 Stations in Fox and East Rivers
- 15 Stations in Green Bay
- Deployment of 2 continuous monitors
- Collaboration with others

NEW Water
The brand of the Green Bay
Metropolitan Sewerage District

Runoff Event - April 12, 2012

What Are Our Problems

- Excess phosphorus from land runoff and point source polluters
- Suspended solids from soil erosion
- Persistent contaminants
- Non-native species introductions
- Habitat Destruction

NEW Water
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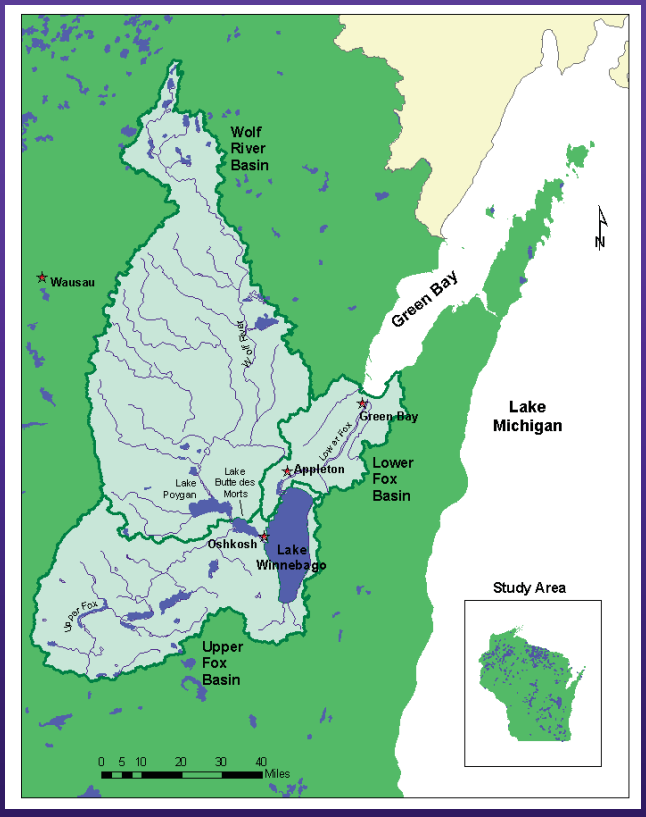


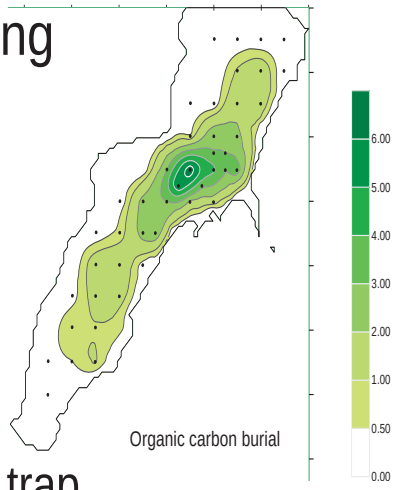
Fox-Wolf River Basin
- Wolf & Upper Fox Rivers
- Lower Fox River
  - Highest concentration of pulp paper mills in world (24 mills on 24.km)

Lake Michigan's Green Bay
- Whole system drains into GB
- Largest freshwater estuary in the Great Lakes
- "Area of Concern" International Joint Comm.
- Rebuilding of Cat Island Chain

Lake Winnebago
- Largest WI inland lake 534 sq km
- 45km long, 5-15 km wide, 2.1 m average depth
- Serves water supply needs for 4 communities

Sediment and Phosphorus Loads

- **132,000 metric tons** of sediment entering Green Bay annually (Klump et al 2009)
  - Most of the load - 60% is delivered in 13-15 days in spring
  - 70% of phosphorus retained within Green Bay
  - Green Bay acts as nutrient and sediment trap



Graphic Courtesy of GLWI

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Total Phosphorous Loadings

549,703 lbs/year - LFR

716,945 lbs/yr – Lake Winnebago

Source	Total Phosphorus (lbs/yr)
Natural Background	5,609
Agricultural	251,382
Urban (non-regulatory)	15,960
Urban Regulated (MS4)	65,829
Construction Sites	7,296
General Permits	2,041
Industrial WWTFs	114,426
Municipal WWTFs	87,160
Total In-Basin	549,703
Lake Winnebago	716,954
Total (In-Basin + Lake Winnebago	1,266,657

Source of tables: Total Maximum Daily Load and Watershed Management Plan for Total Phosphorus and Total Suspended Solids in the Lower Fox River Basin and Lower Green Bay (June 2010)

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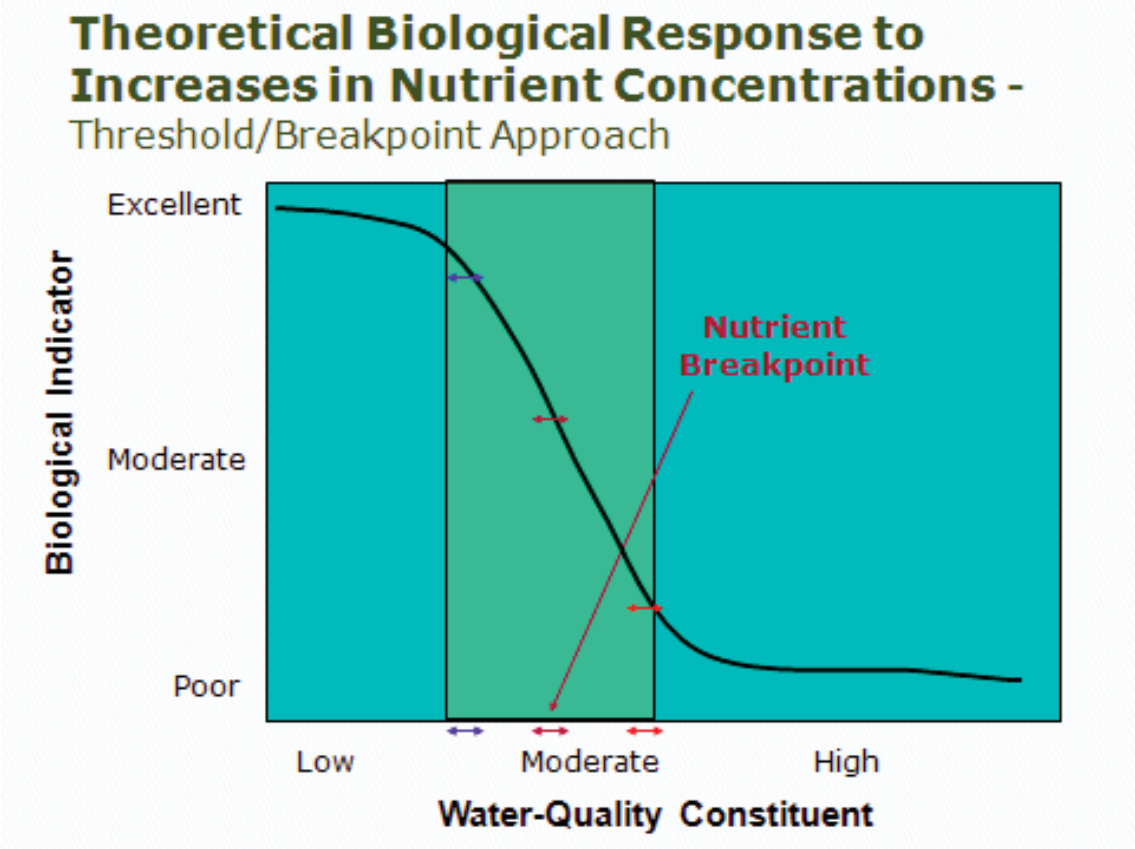
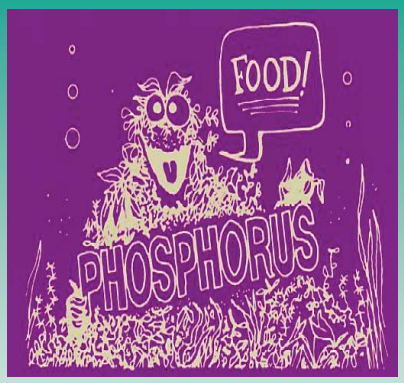
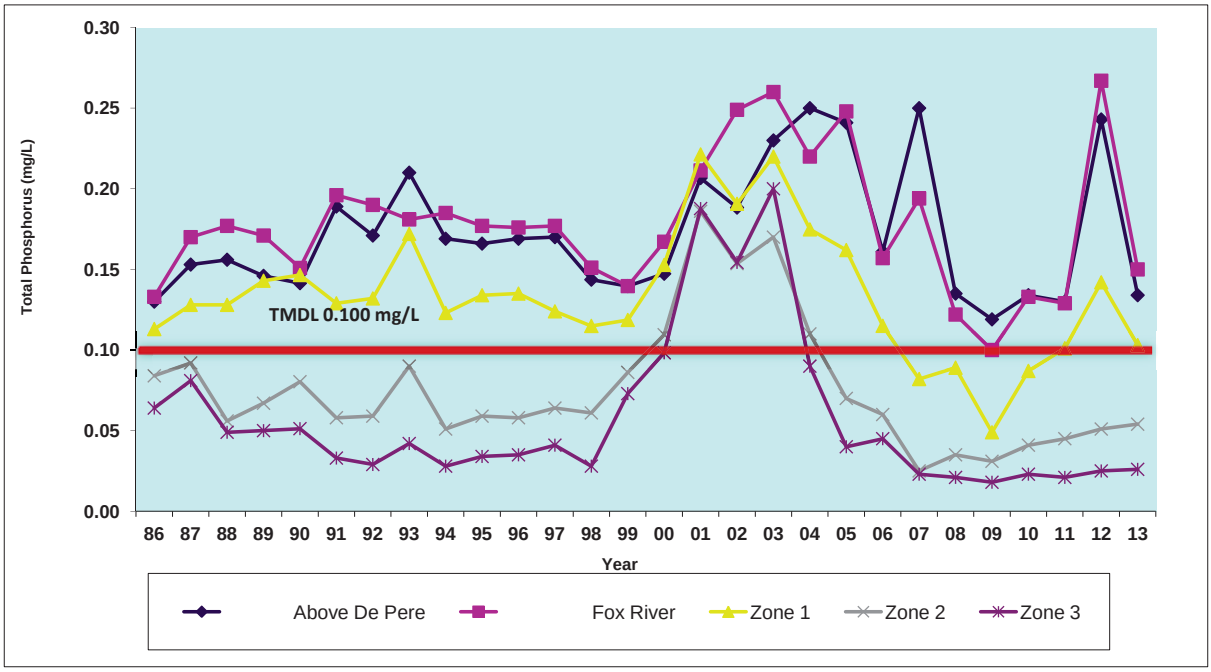


Impacts of Phosphorus Loads

- Excessive/nuisance algae growth (eutrophication)
- Poor aesthetics
- Lost tourism
- Lower property values
- Drinking water taste & odor problem
- Altered food webs
- DO fluctuations
- Ammonia and blue-green algae toxicity



Long-Term Phosphorous Trend



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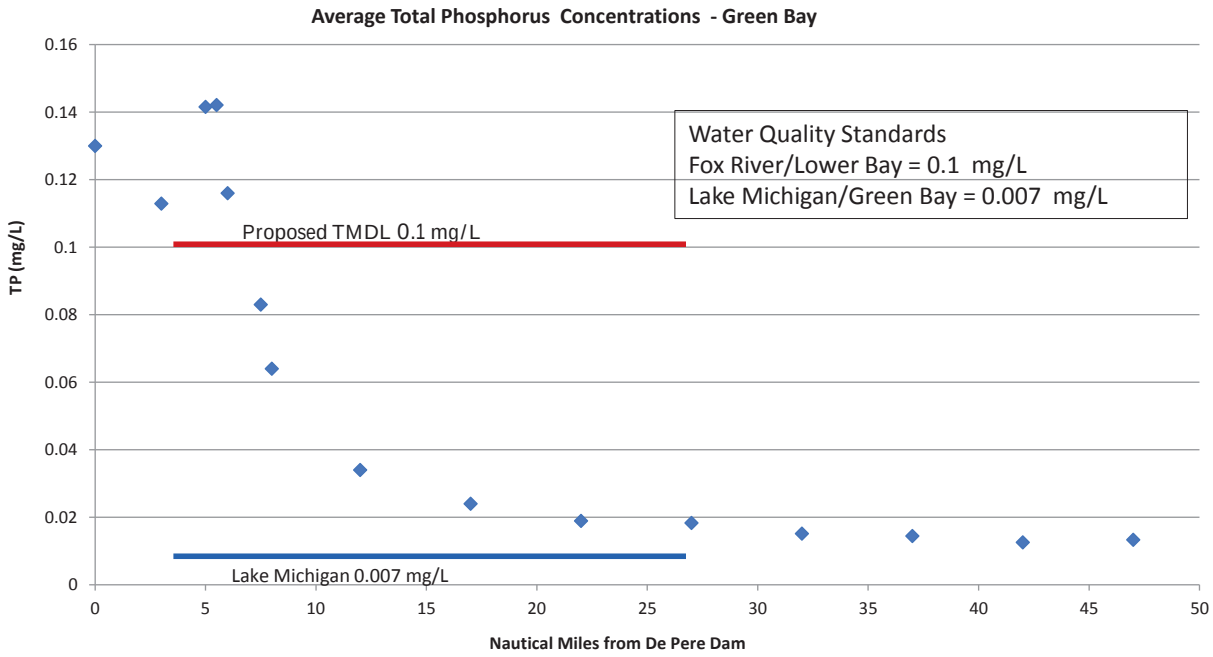
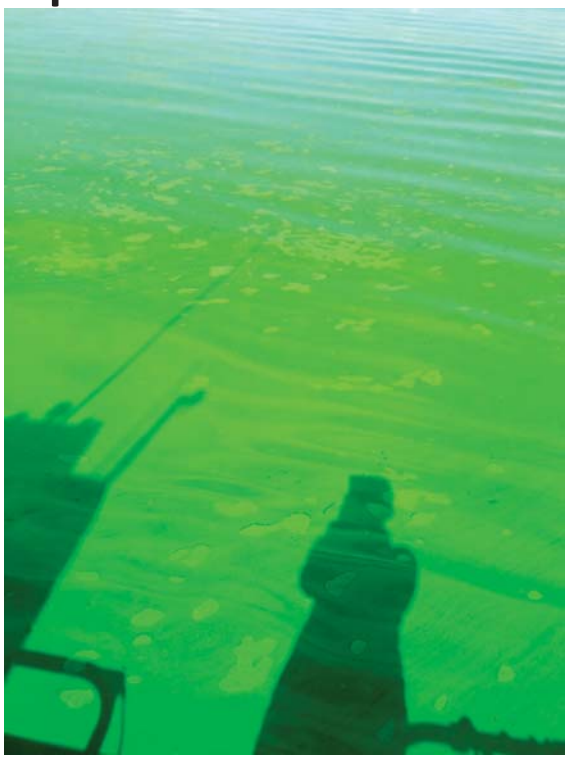
2011 Total Phosphorus Concentrations

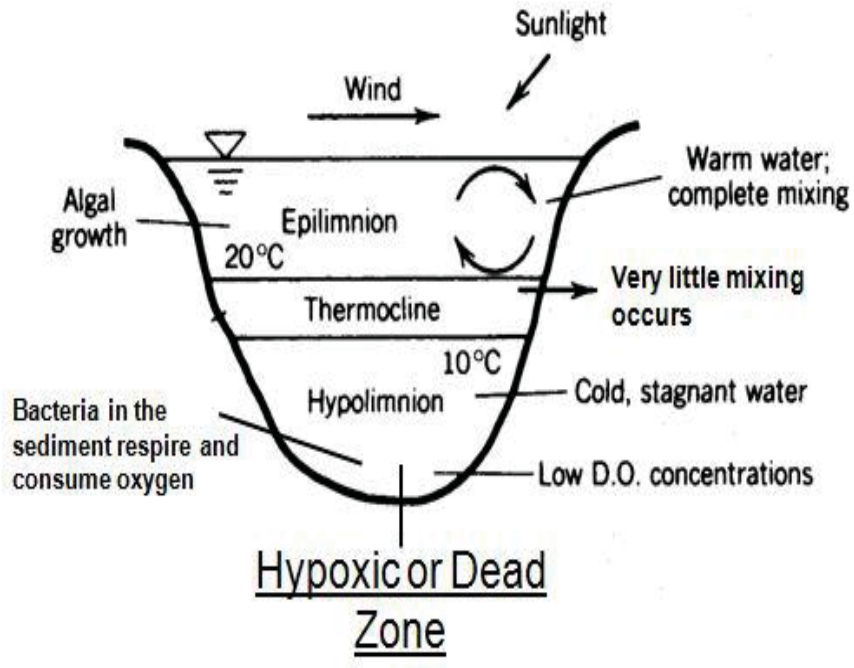


Cultural Eutrophication

- NPP usually limited by some factor:
  - Temperature
  - Sunlight availability/intensity
  - Predation
  - Nutrients
- ***Limiting Nutrients***
  - Chemicals that can control the productivity
  - Possible limiting nutrients: N, P, Si (for diatoms), Fe
  - Terrestrial NPP is often limited by N
  - Marine NPP is often limited by N and sometimes Fe
  - Freshwater NPP is often limited by P
- So cultural eutrophication is caused by "extra" sources of limiting nutrients to aquatic ecosystems
  - Major sources of nutrient pollution: sewage discharges, chemical fertilizer, livestock waste, NOx emission followed by atmospheric deposition of nitrate PM



Nutrient-Driven Hypoxia



Signs of Hypoxia

Received a call from the DNR reporting Gobies “beaching” themselves on the eastern shore of Green Bay near Bayshore Park on Aug. 2005 and 2011:

- *“Upon arrival, there were still 10,000's of these little fish lethargically hanging around. According to the caller there were many fewer when Pat and I arrived then there had been when he originally called. They were almost all gobies… probably 99% or more gobies. These fish were all clumped up, often resting on large rocks in such dense concentrations that you couldn't see the rock. In these clumps, they were usually all stacked up, all their heads pointing in the same direction, like scales on a fish. If we got real close to one of these concentrations they would disperse… In other areas they were tight up against the shoreline nose to shore, shoulder to shoulder.”*

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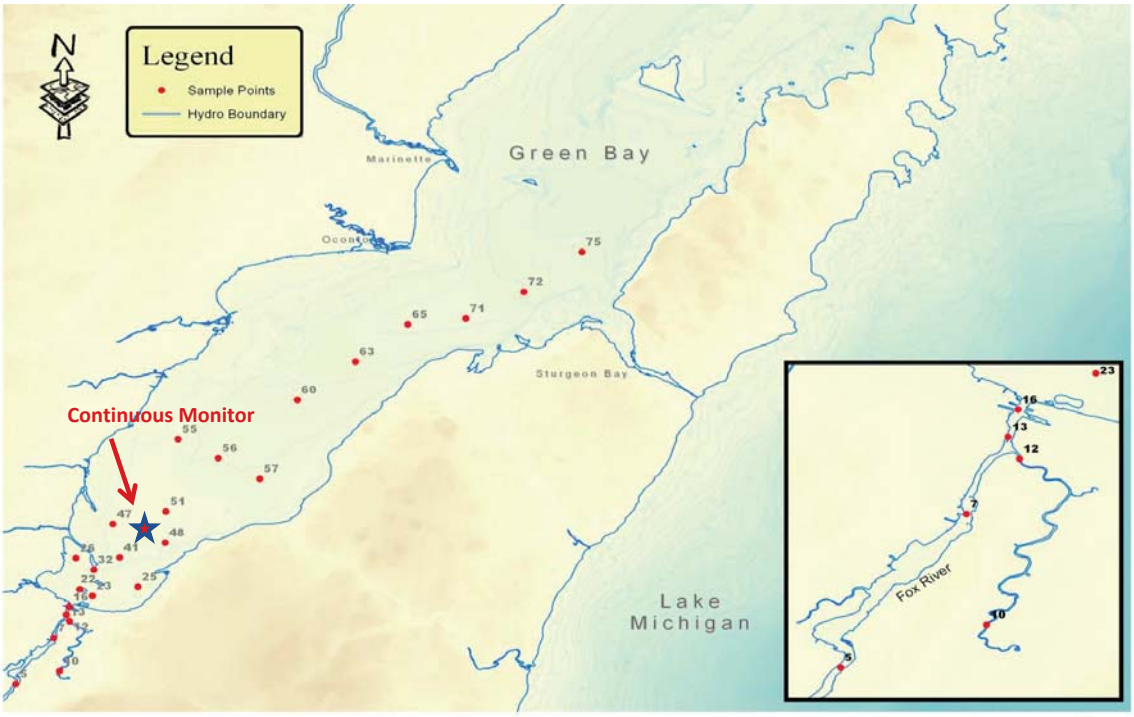
Impact on the Biota

- BUI - Burrowing mayfly (Hexagenia) populations return to the AOC in stable annual abundances between 100-400 nymphs/m2 (measured as a 3-year running average) or as otherwise indicative of adequate levels of dissolved oxygen in overlying waters
- Burrowing Mayflies were once abundant and piled up by the bushel under electric lights in Green Bay have not been found in Green Bay since 1955.
- In 1955 one burrowing mayfly nymph “was noted” at a station near the mouth of the Oconto River.

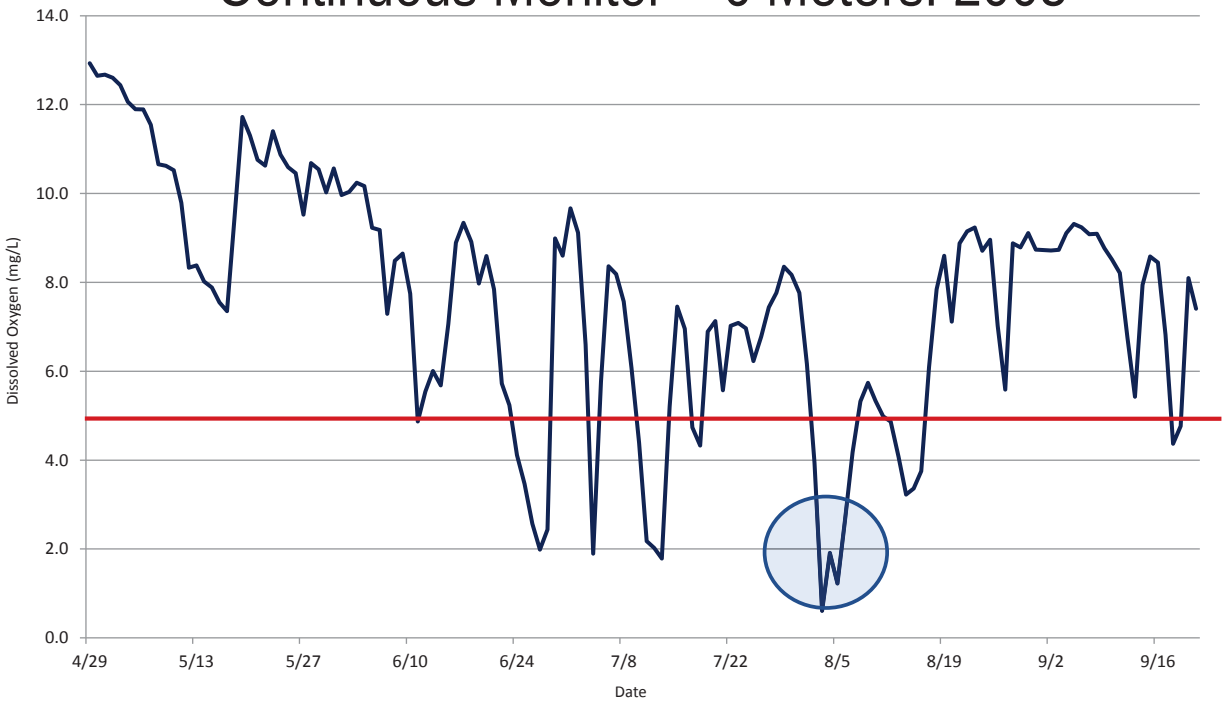
NEW Water Monitoring Sites



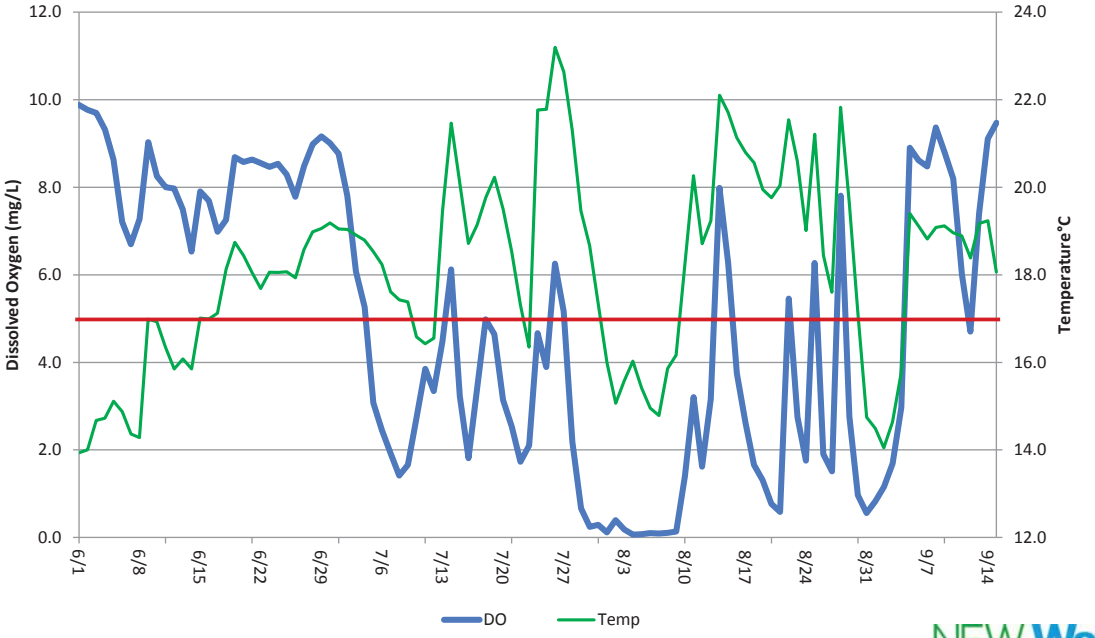
NEW Water Sample Points Bay of Green Bay & the Fox River

Dissolved Oxygen Entrance Light

Continuous Monitor – 6 Meters: 2005

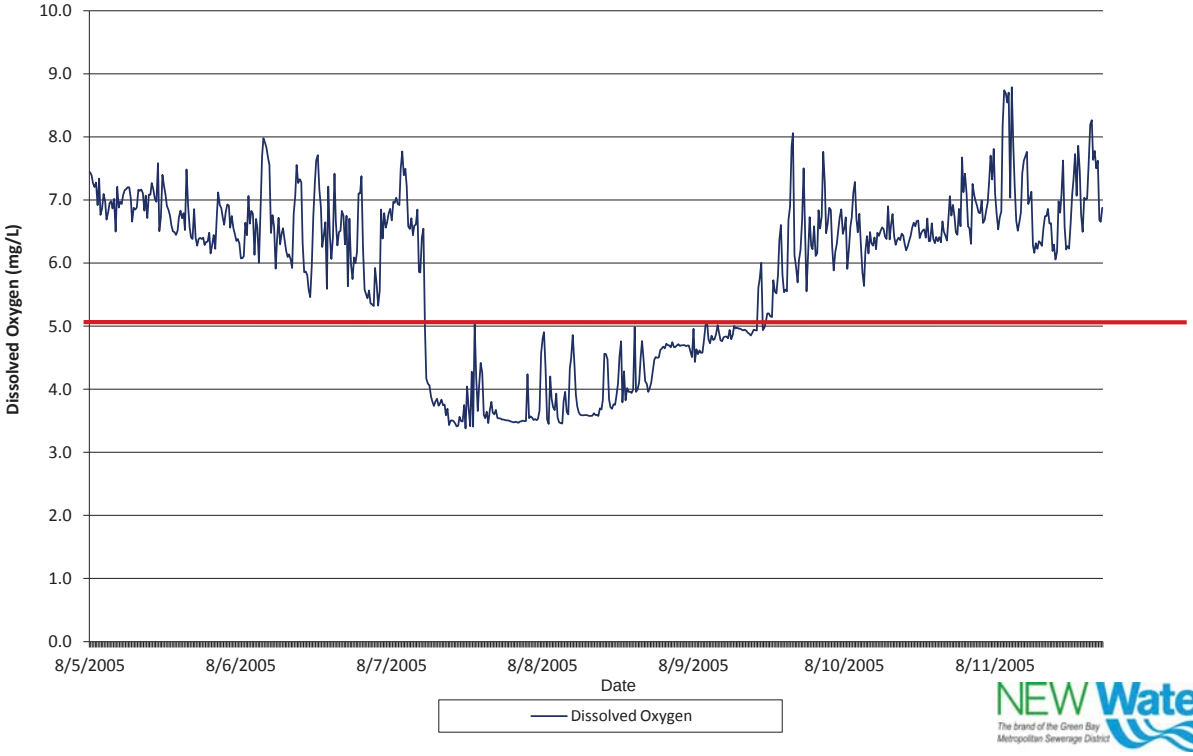


2011 Entrance Light- 6 meters

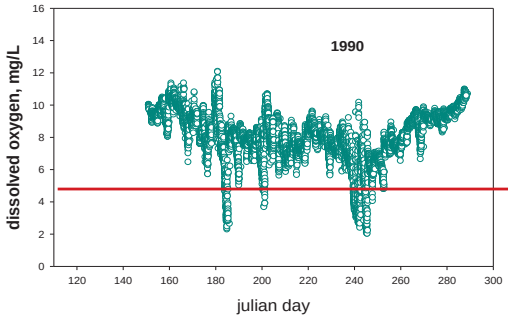


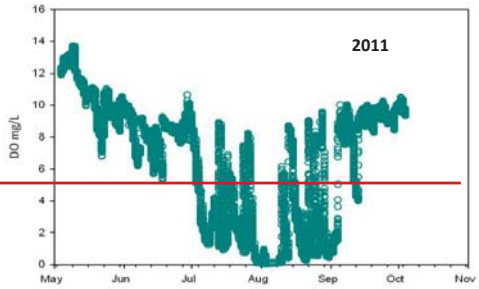
Dissolved Oxygen Fox River Mouth

6 Meters: 8/5/2005



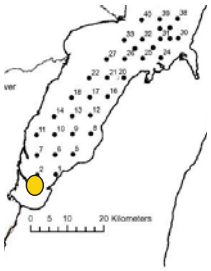
Increased Hypoxia in Lower Green Bay





Increased hypoxia ?

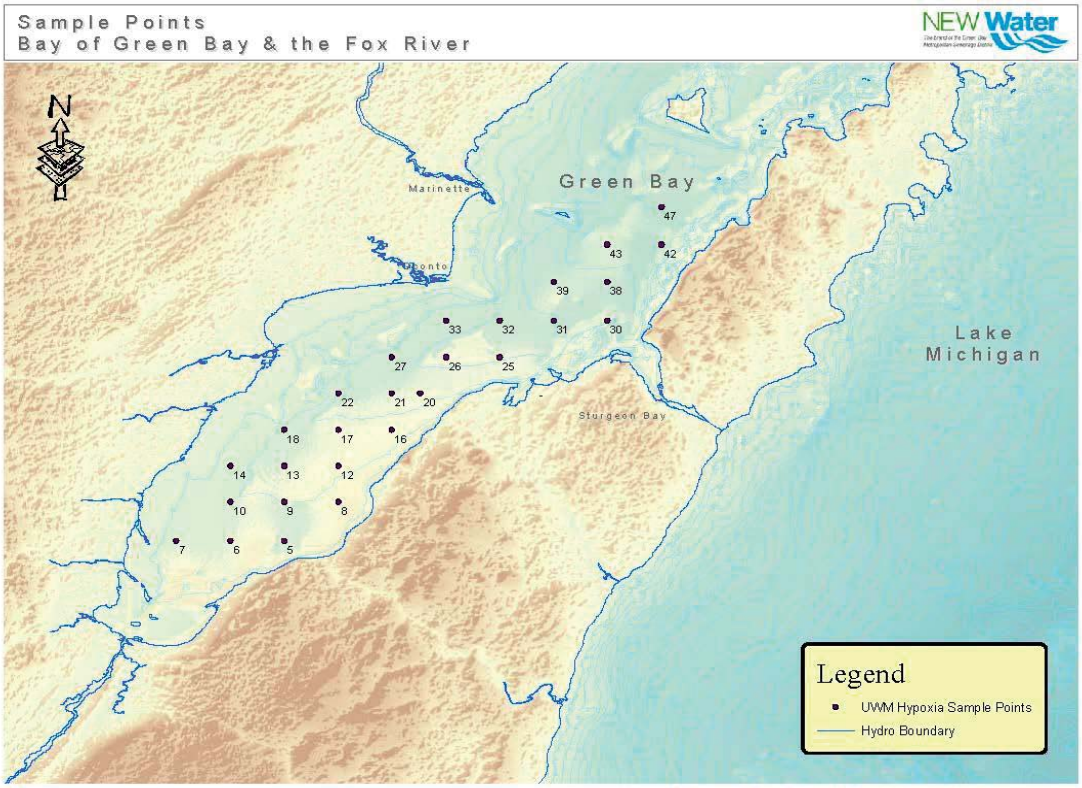
17 July thru 12 Sept:



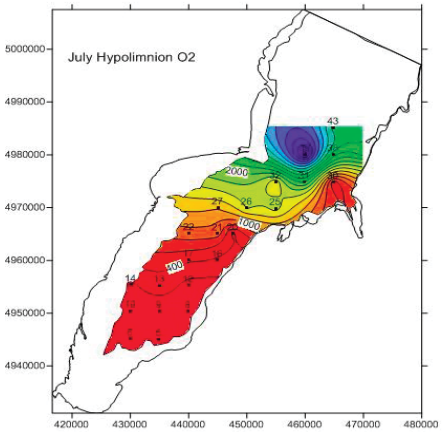
	days < 5mg/L	%	Ave DO
1990:	**4**	**7%**	**3.8 mg/L**
2005:	**17**	**31%**	**3.1 mg/L**
2009:	**28**	**39%**	**3.5 mg/L**
2010:	**39**	**54%**	**1.7 mg/L**
2011:	**43**	**60%**	**1.7 mg/L**

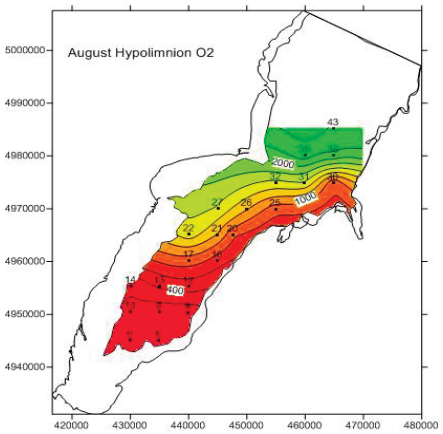
Graphs courtesy GLWI, Val Klump, et al

Hypoxia Study Stations 2009-2011



2010 Green Bay Hypolimnion O2





Oxygen Depletion Rate 2010

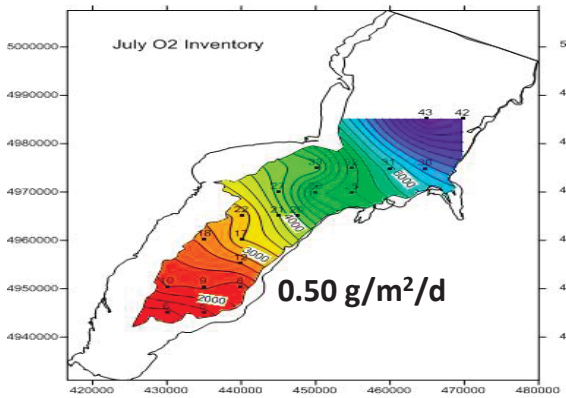
June – July
6.9 mmol/m^2/d or **0.22 g/m^2/d**

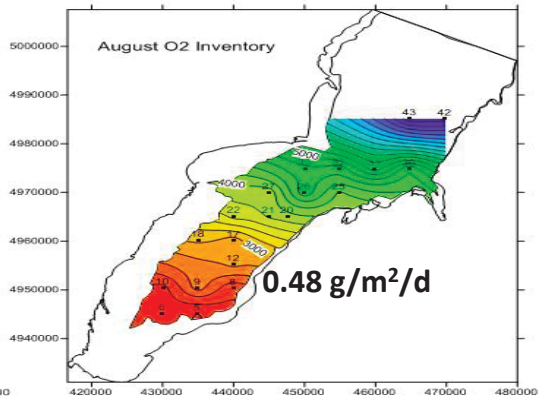
June – August
7.8 mmol/m^2/d or **0.25 g/m^2/d**

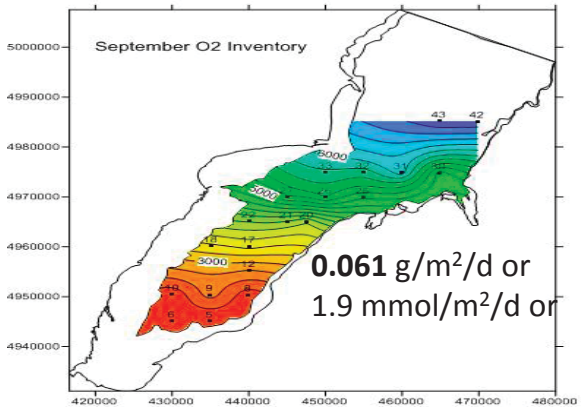
Georgian Bay	0.24 (g/m^2/d)
Central Basin Lake Erie	0.33 (g/m^2/d)
Eastern Basin Lake Erie *Charlton, 1980	0.61 (g/m^2/d)

*Charlton, M.N. 1980. *Hypolimnion oxygen consumption in lakes: discussion of productivity* and morphometry effects. Can. J. Fish. Aquat. Sci. 37: 1531-1539.

2011 Green Bay O2 Inventory

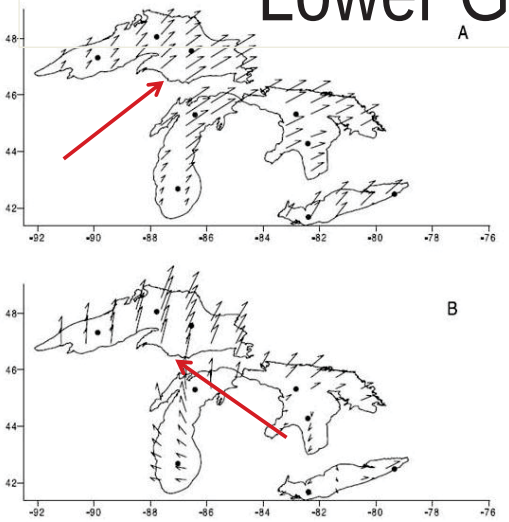






Georgian Bay	0.24 (g/m^2/d)
Central Basin Lake Erie	0.33 (g/m^2/d)
Eastern Basin Lake Erie *Charlton, 1980	0.61 (g/m^2/d)

Prevailing Winds and Lower Green Bay Hypoxia



GEOPHYSICAL RESEARCH LETTERS, VOL. 29, NO. 8, 10.1029/2001GL014564, 2002

Biophysical effects of a decadal shift in summer wind direction over the Laurentian Great Lakes

James T. Waples and J. Val Klump
Great Lakes WATER Institute, University of Wisconsin–Milwaukee, Milwaukee, Wisconsin, USA

Received 12 December 2001; revised 21 December 2001; accepted 16 January 2002; published 19 April 2002.

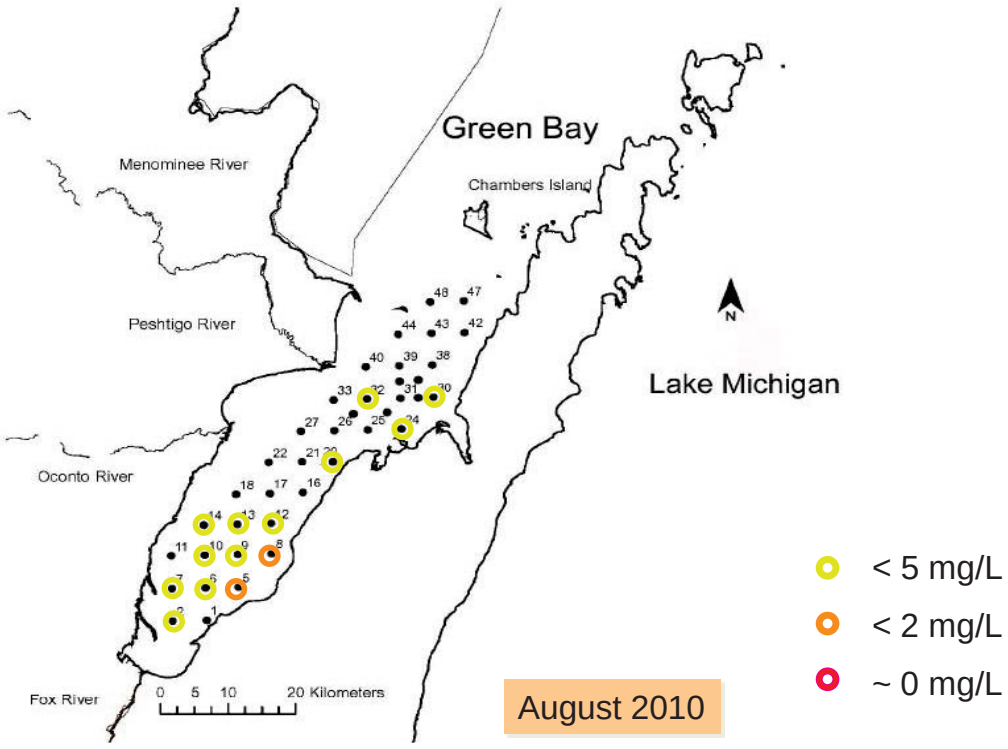
- Summer of 1994 average wind field SSW in bottom temps (18.1 to 11.4 °C)

- Wind driven transport of surface water out of bay initiates a return flow of cold Lake Michigan water below the thermocline

- Inhibits vertical mixing with surface water
  - ✓ Increase stratification
  - ✓ Increase of hypoxia

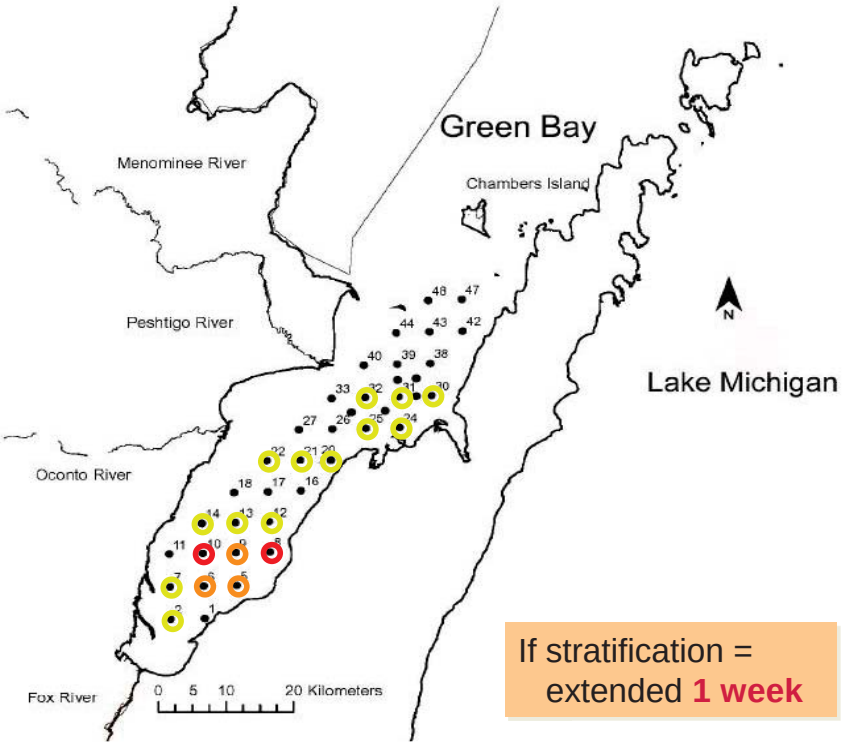
- Summer of 1995 average wind field SSE in bottom temps (13.7 to 22.3 °C)

- Halts water mass exchange with Lake Michigan



August 2010

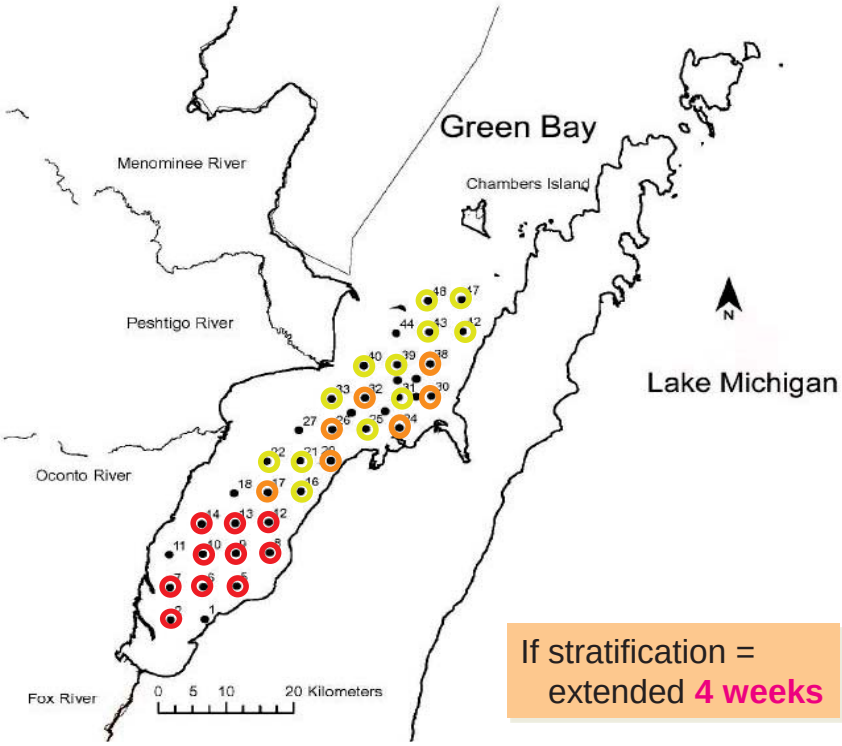
50% < 5 mg/L



If stratification = extended **1 week**

- < 5 mg/L
- < 2 mg/L
- ~ 0 mg/L

60% < 5 mg/L
20% < 2 mg/L



If stratification = extended **4 weeks**

- < 5 mg/L
- < 2 mg/L
- ~ 0 mg/L

97% < 5 mg/L
50% < 2 mg/L

Future Research and Response

- Continue UWM research project on Green Bay
- Lower Fox River TMDL implementation
- Implementation of phosphorus rules to reduce loadings from both point and nonpoint sources (i.e. Adaptive Management; pollutant trading)
- Biological investigations to help understand impacts at the organism and/or population level

NEW Water
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Questions….