

An aerial topographic map of the Lake Michigan basin. The map shows the terrain with elevation contours and the five Great Lakes (Superior, Michigan, Huron, Erie, and Ontario) in dark blue. Several red dots are scattered across the landmass, indicating monitoring locations. The text is overlaid on the map in a light yellow, serif font.

Lake Michigan National Monitoring Network Demonstration Pilot

Preliminary Results and Future Plans

National Monitoring Conference

April 27th, 2010

Presentation outline

- Lake Michigan Information
- Lake Michigan Pilot Study
 - Differences between Great Lakes and other Coasts
 - Monitoring Inventory
- Lake Michigan Demonstration Effort
 - 2008 – nutrients in water column (partial year) and Semi-permeable membrane devices for polar organics at 20 sites
 - 2009 – nutrients in water column at 20 sites (full year)
 - 2010 – test automated underwater vehicle in near shore and tributary mouth for field parameters
- Other coordinated monitoring efforts

Lake Michigan Basin



Size Statistics (Lake Michigan)

Length:	307 miles
Width:	118 miles
Land Drainage Area:	45,600 square miles
Depth:	925 feet maximum depth 279 feet average depth
Shoreline:	1,660 miles

Primary Management Issues in the Lake Michigan Basin

- Aquatic invasive species
- Nutrient enrichment
- Beach Health
- Contaminants – in Sediments, Fish and Drinking Water
- Nuisance algal blooms
- Habitat degradation
- Loss and Alteration of Coastal Wetlands
- Fisheries and food web changes



Lake Michigan Pilot

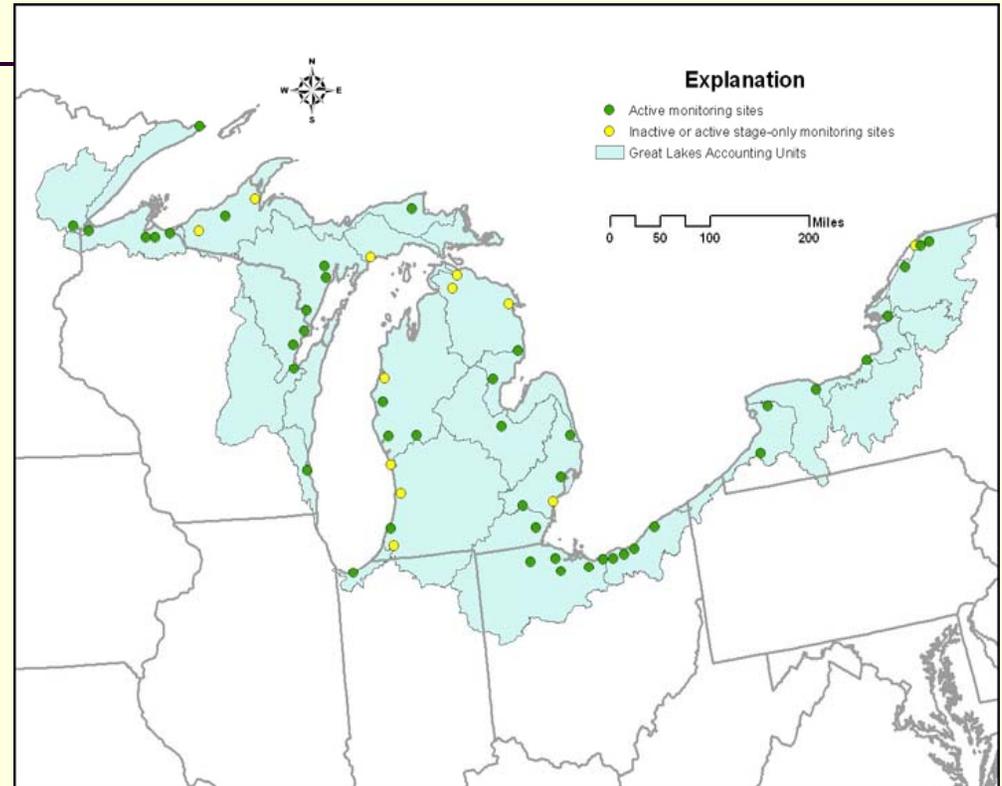
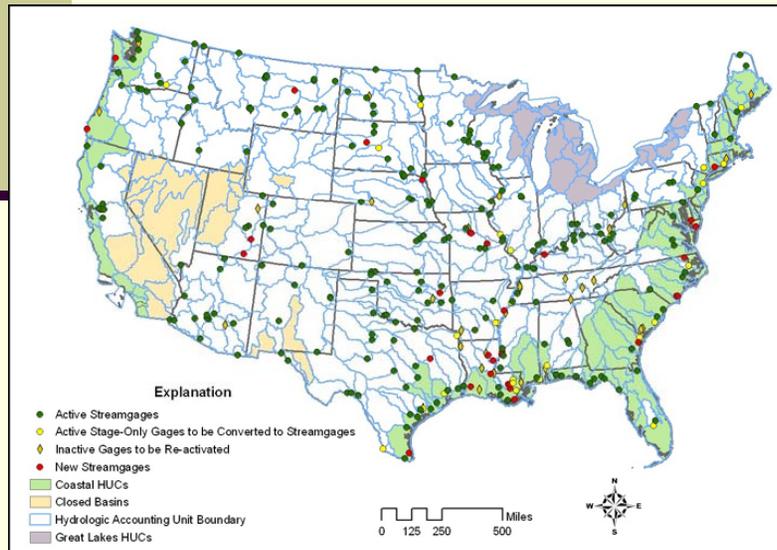
- Lake Michigan Monitoring Coordination Council coordinated the pilot study via nine resource component work groups
- The Great Lakes Commission (GLC) led the effort
- Work group members represented:
 - States (ILEPA, INDEM, MIDEQ, WIDNR, WI GNHS), Feds (USEPA, USGS, NPS, NOAA), Universities (Sea Grant, MSU, UW Milwaukee, Purdue), GLOS, and others
- Only pilot conducted in the Great Lakes. There are some NMN design differences between the Great Lakes coast and other coasts

NMN Compartments vs. the Great Lakes “Fresh Coast” Compartments

- **Estuaries**
 - **Nearshore**
 - **Offshore**
 - **Great Lakes**
 - Rivers
 - Ground Water
 - Atmospheric Deposition
 - Beaches
 - Wetlands
- **Fresh Water Embayments**
 - **GL Shallow Nearshore**
 - **GL Medium Nearshore**
 - **GL Offshore**
 - Rivers
 - Ground Water
 - Atmospheric Deposition
 - Beaches
 - Wetlands

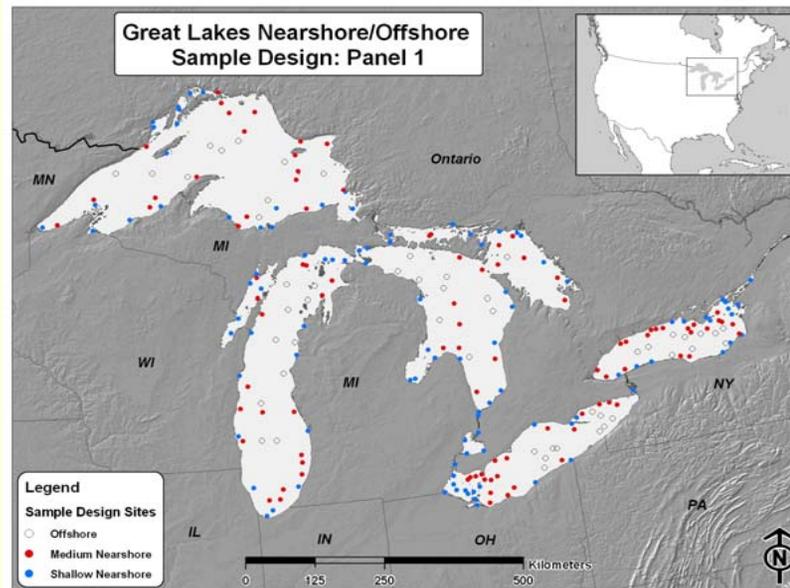
NMN Design Rivers

- National design based on Hydrologic Unit Code (HUC) 6
- Great Lakes and Lake Michigan on HUC 8



Great Lakes Near-shore/Off-shore

Lake	Shallow/Medium Near-shore Boundary (m)	% of Area	Near shore/Off-shore Boundary (m)	% of area within Near-shore	Mean Depth (m)
Superior	30	10.0	150	50.0	149
Michigan	30	25.9	80	51.4	85
Huron	20	25.1	50	51.9	59
Erie	10	19.5	20	54.8	19
Ontario	30	24.0	80	50.4	86



Great Lakes Monitoring Inventory

- Conducted by the Great Lakes Commission in 2004, indicated:
 - Approximately 300 programs have conducted monitoring in some portion of the Lake Michigan Basin
 - A large majority of the monitoring programs were/are conducted by State and Federal Agencies

Lake Michigan Monitoring

	Major effort	Minor effort
Estuaries/Embayments		11
Near-shore		6
Off-shore		3
Rivers	3	8
Ground Water		5
Atmospheric deposition	1	5
Wetlands	3	6
Beaches	1	5

Cost: Major is over \$1.0 million. Minor is less than \$1.0 million

Duration: Major is three or more years of ongoing monitoring. Minor is less than three years in duration.

Geographic Extent: Major indicates that an organization uses standard procedures and protocols over large areas

Lake Michigan Demonstration Effort

2008

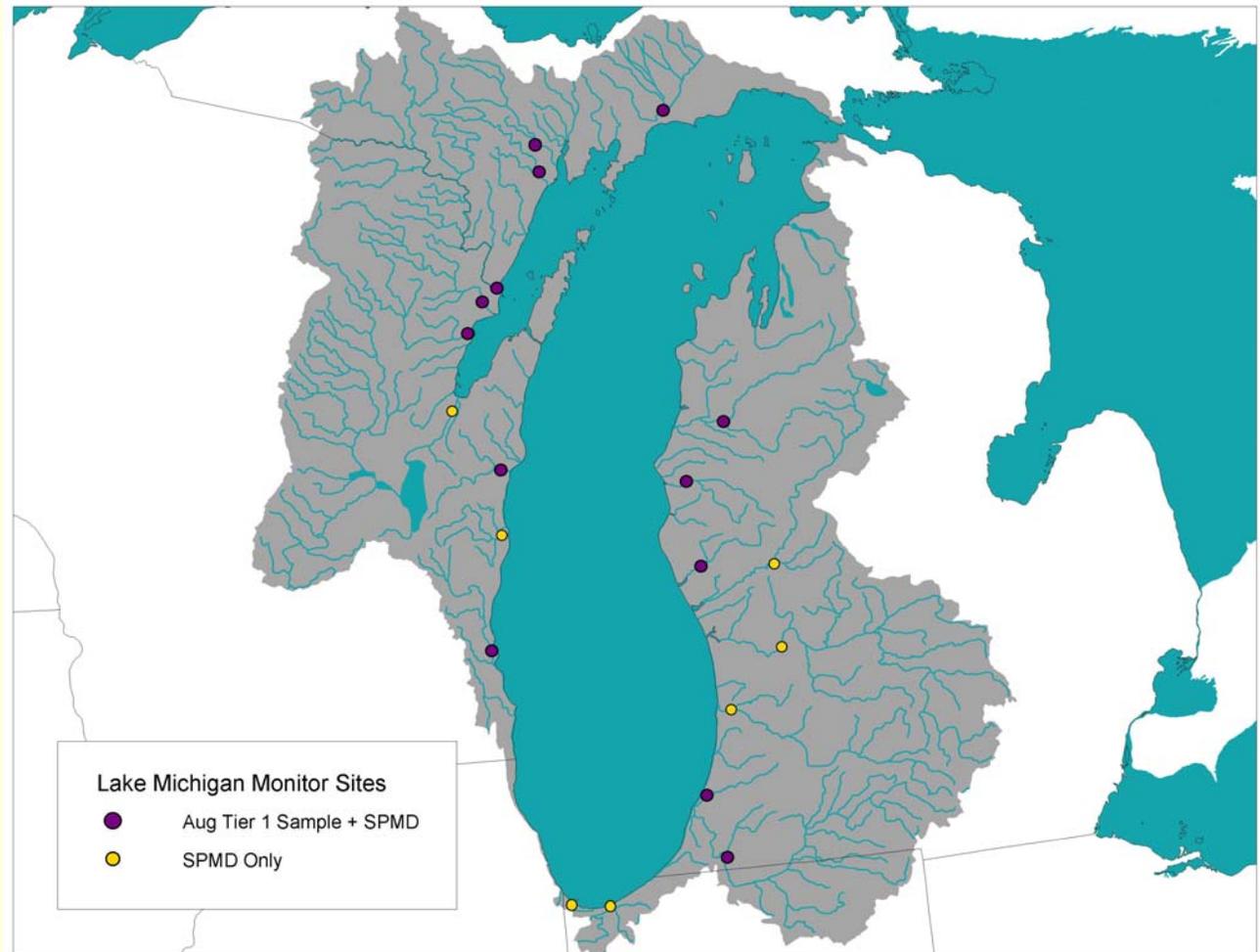
- All 20 river sites were sampled at the proposed NMN Tier 1 monitoring design for nutrient constituents and frequency
- Semi Permeable Membrane Devices (SPMDs) deployed at 20 sites for one month during base flow. SPMDs are passive samplers for assessing trace levels of hydrophobic organic contaminants - designed to mimic biological membranes, such as the gills of fish.

2009

- All 20 river sites were sampled at the proposed NMN Tier 1 monitoring design for nutrient constituents.
- Completed full year of sampling monthly and for 6 storm events. Only completed 6 months during FY08 due to late start.
- Provides sufficient information for statistics and load estimates for Lake Michigan basin

Lake Michigan Rivers Network

- Twenty sites
- Includes a representative variety of land uses
- Includes 72% of tributary inflow, relative to 90% for NMN on other coasts



Lake Michigan Tributary Demonstration Project

Summary statistics — Peshtigo River

Analyte	Maximum	Minimum	Mean
Silica, mg/l	11.7	7.1	9.271
Ammonia, mg/l as N	0.274	<0.020	0.055
NO ₃ +NO ₂ , mg/l as N	0.82	0.12	0.424
Nitrite, mg/l as N	0.026	0.002	0.007
Orthophosphate, mg/l as P	0.011	<0.016	0.007
Phosphorus, diss mg/l	0.016	0.006	0.011
Phosphorus, tot mg/l	0.031	0.012	0.02
Total nitrogen, diss mg/l	1.16	0.5	0.781
Total nitrogen, tot mg/l	1.12	0.57	0.845

Lake Michigan Tributary Demonstration Project

Summary statistics — Fox River at Mouth

Analyte	Maximum	Minimum	Mean
Silica, mg/l	22.4	3.1	13.929
Ammonia, mg/l as N	0.278	0.025	0.158
NO ₃ +NO ₂ , mg/l as N	0.8	0.34	0.529
Nitrite, mg/l as N	0.041	0.018	0.026
Orthophosphate, mg/l as P	0.063	0.004	0.04
Phosphorus, diss mg/l	0.09	0.014	0.056
Phosphorus, tot mg/l	0.151	0.061	0.104
Total nitrogen, diss mg/l	1.49	1.04	1.294
Total nitrogen, tot mg/l	1.9	1.26	1.55

Results of the Microtox acute toxicity screening of replicate SPMDs

- Manitowoc and Escanaba SPMDs lost to vandals.
- Of 18 remaining sites, only the Grand River had total PAHs above the reporting limit.
- Only Grand River, Paw Paw and White River indicated some toxicity. The source of toxicity is more than likely other than PAHs.
- Anticipated that more sites would show toxicity.

Planned 2010 Activity

- Test approaches to connect water chemistry in tributaries to embayment and near shore (Milwaukee and Green Bay areas)
 - Autonomous Underwater Vehicle (AUV)
 - Water Quality Monitoring Survey (3-D)
 - Bathymetric Survey



Water Quality Sensor Suite

- Turbidity
- Temperature
- Conductivity
- Chlorophyll
- Dissolved Oxygen
- pH
- ORP



Other Coordinated Lake Michigan Monitoring Activities in 2010

- Near Shore Monitoring (NeMo) work group formed to organize a coordinated tributary, embayment, near shore effort
 - EPA National Coastal Assessment
 - WI, IN, MI State tributary monitoring
 - EPA medium near-shore Triaxis Tow
 - University near shore activities
- Great Lakes Restoration Initiative (GLRI) tributary monitoring at all 59 NMN sites
 - Nutrients at 30 sites
 - Emerging contaminants (15 sites) and water borne viruses (8 sites)
 - Passive samplers and wet chemistry for legacy and emerging contaminants at 59 sites – will get concentration information from passives
 - Sensors for surrogate regression development 30 sites
 - Beach Health and other embayment and near-shore monitoring by Federal Agencies and others
 - Develop Chromofurmic Dissolved Organic Matter (CDOM) sensor technology for embayment and near-shore chemistry
 - Coordinated database development

Lake Michigan Monitoring Coordination Council

■ Special Thanks To:

- **GLC: John Hummer**
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- **MDEQ: Gary Kohlhepp, Tracy Collin, Julie Sims**
- **IEPA: Gregg Good, Joe Marencik**
- **UW-Milwaukee: Harvey Bootsma**
- **And others**