National Water Quality Markets Workshop
Great Lakes Forum
September 15-17, 2015
University of Nebraska
USEPA – USDA NRCS

Planning & Implementing
an Adaptive Management Project:
In Lower Fox River Basin – Green Bay

Bill Hafs, Director of Environmental Programs
NEW Water – Green Bay Metropolitan Sewage District
Back Ground: The Fox River Contributes 1/3 of All Nutrients to Lake Michigan

Source: UW – Milwaukee – Val Klump

Photo credit: Steve Seilo
(www.photodynamix.com)
Distinct Gradient of Water Pollution From Fox River in Green Bay
Priority Sub Watersheds

Mouth of East River at the Fox River

Map of Lower Fox River Basin
Sources of Phosphorus in Lower Fox River (LFR) Basin

Sources of Total Suspended Solids in Lower Fox River Basin

## Total Phosphorus Loadings - TMDL

<table>
<thead>
<tr>
<th>Source</th>
<th>Total Phosphorus (lbs./yr.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Background</td>
<td>5,609</td>
</tr>
<tr>
<td>Agricultural</td>
<td>251,382</td>
</tr>
<tr>
<td>Urban (non-regulatory)</td>
<td>15,960</td>
</tr>
<tr>
<td>Urban Regulated (MS4)</td>
<td>65,829</td>
</tr>
<tr>
<td>Construction Sites</td>
<td>7,296</td>
</tr>
<tr>
<td>General Permits</td>
<td>2,041</td>
</tr>
<tr>
<td>Industrial WWTFs</td>
<td>114,426</td>
</tr>
<tr>
<td>Municipal WWTFs * (40,000 lbs/yr NEW Water .4 mg/L)</td>
<td>87,160</td>
</tr>
<tr>
<td><strong>Total In-Basin</strong></td>
<td><strong>549,703</strong></td>
</tr>
<tr>
<td>Lake Winnebago</td>
<td>716,954</td>
</tr>
<tr>
<td><strong>Total (In-Basin + Lake Winnebago)</strong></td>
<td><strong>1,266,657</strong></td>
</tr>
</tbody>
</table>

**Out fall of NEW Water into Fox River**

September 2013

NEW Water Effluent

Treat 40 million gallons/day

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 (March 2012)
Brown County total land area is 350,000 acres.

<table>
<thead>
<tr>
<th>Year</th>
<th>Land in farms*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1954</td>
<td>300,900 acres</td>
</tr>
<tr>
<td>1972</td>
<td>274,800 acres</td>
</tr>
<tr>
<td>1978</td>
<td>263,400 acres</td>
</tr>
<tr>
<td>1983</td>
<td>241,500 acres</td>
</tr>
<tr>
<td>2008</td>
<td>162,000 acres</td>
</tr>
<tr>
<td>2012</td>
<td>164,800 acres</td>
</tr>
</tbody>
</table>

Source: 1991 Brown County Farmland Preservation Plan; USDA National Agricultural Statistical Service

% Change in Total Cattle Numbers from 1983 – 2012
Data taken from 1984 and 2013 Wisconsin Agriculture Statistics

<table>
<thead>
<tr>
<th>County</th>
<th>Cattle</th>
<th>Cropland</th>
<th>Acres/Cow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown</td>
<td>105,000</td>
<td>162,000</td>
<td>1.54</td>
</tr>
<tr>
<td>Outagamie</td>
<td>85,000</td>
<td>194,700</td>
<td>2.29</td>
</tr>
<tr>
<td>Manitowoc</td>
<td>97,000</td>
<td>183,800</td>
<td>1.89</td>
</tr>
<tr>
<td>Calumet</td>
<td>60,000</td>
<td>120,900</td>
<td>2.02</td>
</tr>
</tbody>
</table>

Source: NASS.
# Hay Brown County

Source: USDA National Agricultural Statistical Service

<table>
<thead>
<tr>
<th>Year</th>
<th>Dry Hay</th>
<th>%</th>
<th>Acres</th>
<th>Corn (10 year ave.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1969</td>
<td>86,100</td>
<td>32%</td>
<td>270,000</td>
<td>1970’s - 49,062 acres</td>
</tr>
<tr>
<td>1981</td>
<td>74,000</td>
<td>30%</td>
<td>250,000</td>
<td>1980’s - 57,860 acres</td>
</tr>
<tr>
<td>1995</td>
<td>46,500</td>
<td>26%</td>
<td>180,000</td>
<td>1990’s - 57,880 acres</td>
</tr>
<tr>
<td>2008</td>
<td>33,600</td>
<td>21%</td>
<td>162,000</td>
<td>2000’s - 61,060 acres</td>
</tr>
</tbody>
</table>

2010 – 2014: 67,650 acres
Green Bay has a Dead Zone

Oxygen
July 17 thru Sept 12

Ave. DO

<table>
<thead>
<tr>
<th>Days &lt; 5 mg/L</th>
<th>mg/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990:</td>
<td>4</td>
</tr>
<tr>
<td>2005:</td>
<td>17</td>
</tr>
<tr>
<td>2009:</td>
<td>28</td>
</tr>
<tr>
<td>2010:</td>
<td>39</td>
</tr>
<tr>
<td>2011:</td>
<td>43</td>
</tr>
</tbody>
</table>

Oxygen depleted water in Green Bay has increased in size and duration.

Source: NEW Water Ambient Water Quality Monitoring, UWM.
Water Quality Trends

Fox River TP Export to Green Bay and WWTP Discharges

Source: Kevin Fermanich UWGB

(Sources: Fox R. Loads - D. Robertson, USGS; WWTP data - WDNR; graph by UWGB)
### Lower Fox River TMDL Estimated Capital Costs:

<table>
<thead>
<tr>
<th>Source</th>
<th>Estimated Costs</th>
<th>Sources P TMDL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Municipal WWTF's</td>
<td>$400 – $500 million</td>
<td>87,160 lbs/yr</td>
</tr>
<tr>
<td>NEW Water</td>
<td>($223 - $394 million)</td>
<td>31,624 lbs/yr</td>
</tr>
<tr>
<td>(capital costs 2010 and 2025)</td>
<td>(included as part of total)</td>
<td></td>
</tr>
<tr>
<td>MS4’s storm water</td>
<td>$200 - $400 million</td>
<td>65,829 lbs/yr</td>
</tr>
<tr>
<td>(2013 FWWA Conference)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial WWTF's</td>
<td>$200 million</td>
<td>114,429 lbs/yr</td>
</tr>
<tr>
<td>Agriculture</td>
<td>$</td>
<td>251,382 lbs/yr</td>
</tr>
</tbody>
</table>

**Total:** $800 Million - $1.1 Billion

**Note:** Brown County LWCD $45 million dollars on all Agriculture BMP’s, Staff, and Programs from 1983-2012.
NEW Water –
Protecting Our Most Valuable Resource, Water

NEW Water 40 MGD, 285 square miles
Discharge less than 3% P Fox/ Wolf total
$223 million est. addition treatment
9,332 lbs/ yr P reduction TMDL - improve Fox?
$370 / yr residential rate payer currently.
Wisconsin Adaptive Management.

Wisconsin only State with Adaptive Management as a regulatory compliance approach codified in State Statutes.

Adaptive Management has to be advanced by a party regulated by NR 217 (WWTF).

Opportunity to work with Municipalities and Agriculture to get lowest cost per pound for Phosphorus and potential economic benefit for Agriculture like nutrient management.
Silver Creek Pilot Project
Why Silver Creek?

• Manageable size- 4,800 acres (48 % AG).
• Representative Watershed in TMDL.
• Self Contained Watershed.
• Location to GBMSD service area.
• Oneida Tribe cooperation.
• Private Agronomists.
• WPDES permit timeframe.
• Silver Creek restoration – once was trout stream.
• Upstream of West Shore Pike habitat projects.
Adaptive Management Model - Silver Creek

- Goals: 0.075 mg/L Phosphorus
  - WQ Monitor and Model
  - Plan and Prioritize
  - Implement
  - Evaluate
  - Adjust

WQ Monitor and Model
Progress?

- Coordination of partnerships work in Pilot.
- Inventory – before and after implementation.
- Soil samples at 2.5 acre grids – 2014.
- Conservation planning – 2015, 2016. (5-7 conservation practices/field)
- GIS development - 2015.
Water Quality Monitoring: 2014 Season Averages

Silver Creek
- 124 crop fields
- 50% fields Oneida Tribe.
- Aprox. 30 private fields/County.
  123/124 agreement to conduct soil tests 99.2% participation.
  26% > 50 ppm Phosphorus in Soil tests.
Soil Sampling - Phosphorus, Biological Assessment

Jim Snitgen, Biologist - Oneida Tribe
Challenges -

• **What works:**
  – Conservation Practices that have an economic benefit to farmer. (Manure Storage, Barnyards, Nutrient Management)
  – Building one on one relationships with agriculture producers.
  – Regulation on industry – reduction in loading.
  – Buffer Strips. (Minnesota Pollution Control Agency study 3,500 streams – improve aquatic life)
  – Winter spreading plans – requirements.
  – Water quality Monitoring.
  – Partnerships. (agencies, environmental organizations, people)
  – Soil Testing.
  – Simple - Conservation Plans - Maps
Simple Conservation Plans - Maps
Wants/Needs/ Desires/Questions:

**Want**- Learn from Pilot best way to proceed.

**Want**- To collaborate with other Adaptive Management projects to provide consistent and constructive feedback to DNR as projects learn and adapt.

**Need** -Adequate staff - 1 technical staff needed per 20,000 acres cropland.

**Need** -Time, representative weather.

**Desire**- Develop framework for successful project that results in water quality and biological response.

**Desire**- Sustainable permanent decisions.

**Desire**- Spend the least amount of dollars to accomplish the greatest water quality. Benefit our rate payers, community, water quality.

**Desire**- Continue to build watershed partnerships: Industry, AG, Storm water, Wastewater, Community leaders.

**Questions**- Can we meet WQ standards in Pilot?

**Questions**- What is economic cost to Agriculture? What are economic benefits for Agriculture?
Can We Protect Lake Michigan From Green Bay?
Buffer Strips – Before/ After Installation

Source: Brown County
Before/ After

Source: Brown County
Before/After

Source: Brown County
Thank You – Questions?

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Green Bay Metropolitan Sewerage District

NEW Water
The brand of the Green Bay Metropolitan Sewerage District

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Inspirational