Ecosystem Restoration
With Guerilla Tactics

Restoration of Grand Lake St. Mary’s Ecosystem Through Economic Development

Presented by:
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Executive Summary

"Critical Response Action" Achievements

Grand Lake St. Marys is a 13,500-acre lake supported by a 52 square mile watershed in north western Ohio and has been an influence on the local and regional economy within Auglaize and Mercer Counties, West Central Ohio since its creation. As the health of the lake and its native habitats has thrived, so has the economy. However, the health of the lake in recent years has felt the drastic cumulative effects of gradual land use changes, related to both growth and development surrounding the immediate lake area and the agricultural industry boom within the surrounding watershed.

In 2010 a Strategic Plan was formulated to provide a framework and timeline for restoration of the lake ecosystem utilizing various projects and economic management tools to implement solutions for current and future lake improvements and revitalization. The Strategic Plan was prefaced on the developing economic opportunities and activities that stem

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<tr>
<th>Chemical Treatments</th>
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<tr>
<td><strong>Action:</strong> Sequestration of soluble reactive phosphorus to limit availability of nutrients which fuel algal and mycotoxin development is identified as the highest priority item amongst all coordinating agencies and organizations.</td>
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<tr>
<td><strong>Achievement:</strong> Treatment of GLSM in 2011 and 2012 with alum</td>
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<td><strong>Results:</strong> No significant algal blooms since 2011</td>
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<tr>
<th>Dredge Accumulated Sediments</th>
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<td><strong>Action:</strong> Physical removal and encapsulation of nutrient laden sediments through dredging is the most effective long term means of eliminating internal nutrient loading and is the controlling factor for nutrient cycling within the lake.</td>
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<tr>
<td><strong>Achievement:</strong> State and Federal (ACOE) coordination to develop design plans for the development of Littoral Wetlands within the lake utilizing sediments. 272,000 cubic yards removed in 2011; acquisition of a $675,000 new dredge.</td>
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<td><strong>Results:</strong> Project development moving into permitting with construction initiation in Summer of 2012</td>
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<th>Beneficial Use of Organic Waste</th>
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<td><strong>Action:</strong> Develop opportunities to remove stressors on the ecological system through the application of technologies that provide sustainable processes.</td>
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<td><strong>Achievement:</strong> Inception of two private companies in the watershed that utilize agricultural organic waste as feed stock.</td>
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<td><strong>Results:</strong> Inception of private industry with a revenue and job producing solution</td>
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<th>Watershed Best Management Practices</th>
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<td><strong>Action:</strong> Establish Best Management Practices in each subwatershed draining to the lake to intercept and remove nutrient loading prior to its entry into the system.</td>
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<td><strong>Achievement:</strong> Designation of contributing drainages as Distressed Watersheds</td>
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<td><strong>Results:</strong> Increased scrutiny and funding for development of BMP’s throughout watershed</td>
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directly and/or indirectly from restoring degraded natural resources within Grand Lake St. Marys (GLSM). The creation of an economy derived from restoration of the lake within the GLSM watershed, will provide a new direction that is both environmentally sustainable and economically viable.

The Strategic Plan was integrated with ongoing efforts by the OEPA, ODNR and the GLSM LRC as part of a Consolidated Action Plan in 2011 culminating in the establishment of the Critical Response Actions necessary to initiate the Plans. These actions (described below) were embraced and nurtured by the State of Ohio resulting in significant achievements to the ecological and economic restoration of Grand Lake St. Marys.

### Rough Fish Removal
**Action:** Decrease rough fish population through removal and management actions. High densities of rough fish have been linked to water quality impairment due to the continual disturbance and re-suspension of bottom sediments.

**Achievement:** Establishment of ODNR program to remove rough fish from lake

**Results:** Removal of 18 tons of rough fish since 2011

### Statewide Lake Manager Program
**Action:** Management of the lake as an economic resource of the state with recognition of the influence it maintains over the local and regional economy

**Achievement:** Processed an Executive Order to fund GLSM Lake Restoration Manager

**Results:** Full time position Funding for GLSM lake manager position as component of Lake Restoration Commission

### Natural Resources Capital Improvement Program
**Action:** Fund the development and restoration of natural resources within the state of Ohio where the economic benefit will exceed the costs of capital investment to undertake

**Achievement:** Establishment of Lake Facilities Authority for the GLSM Impacted lake zone (pending final legislative approvals).

**Results:** Initiation of a local regulatory structure necessary to establish funding sources for lake restoration in place.

### Water Pollution Control Loan Fund
**Action:** Prioritize applications from producers within the Grand Lake St. Mary’s watershed (including the six feeding watersheds) for the Water Pollution Control Loan Fund.

**Achievement:** Approval of $8.5 million in funding of for Alum treatments on GLSM

**Results:** Estimated $90 million ROI in recognized revenue to the local economy as a result of treatment effects on lake.
The Prairie Creek Treatment Train (PCTT) was the initial large scale restoration system to be implemented by Grand Lake St. Marys Restoration Commission and Mercer County Commissioners. The PCTT intends to address nutrient loading into Grand Lake St. Marys GLSM through removal of suspended loads, and treatment of base flow and storm water discharges. The Prairie Creek watershed drains 2,310 acres of which 95 percent is in agricultural production. In-situ loading studies from adjacent drainages indicate a total phosphorus loading between 0.32 and 0.63 particles per million.

The PCTT consists of multiple Best Management Practices (BMPs) integrated by stream flows that jointly result in improvements to the quality of water discharged into Grand Lake St. Marys (GLSM) from the watershed. The “train” initiates with an integrated alum/chitosan dosing, followed by a constructed wetland to provide secondary treatment, then filtration through a restored wetland for tertiary refinement prior to entering an embayment isolated from the main lake by a berm such that biological filtration and aeration can be employed in advance of discharge into GLSM.

The elements of the PCTT have been tested in the literature and some components have already been put to use in GLSM (alum treatments, aeration, floating wetlands). The unique feature of the treatment train is that these elements will be used in sequence to polish water quality prior to water getting to the main body of the lake. Current technology is readily available to institute each element of the treatment train.

### PCTT Elements

- **Draw Line and Lift Station** (319 Grand Funded)
- **Alum and Chitosan Dosing** (USDA Grant Funded)
- **Constructed Wetlands** (319 Grant Funded)
- **Wetland Restoration** (319 Grant Funded)
- **Embayment** (319 Grant Funded)
- **Aeration** (Currently Unfunded)
- **Floating Wetland Islands** (319 Grant Funded)
- **Freshwater Mussel Beds** (Currently Unfunded)

**Constructed and Restored Wetland Area**

- 60,690 SM (15 Ac)

**Total Daily Flow**

- 290,549 gal/day

**Total P Reduction**

- (assumes 280 days/yr operation)
- 142 kg/year
GRAND LAKE

Prarie Creek Watershed

Prairie Creek Ecosystem Restoration - Prairie Creek Treatment Train

- Prairie Creek Treatment Train
- Prairie Creek Treatment Train - Expansion Area
- Wetland Restoration
- Wetland Restoration - Expansion
- Constructed Wetland - Expansion
- Constructed Wetland
- Existing Wetland
- Littoral Wetland Restoration Area
- Trail
- Streams
- Alum Dosing
- Lift Station
- Mussel Bed
- Floating Island
- Aerator
- Diverted Flow
- Dispersed Flow
- Shallow Berm

Map projected in Ohio State Plane North NAD83.
Map created 5/15/2012.
The restoration of littoral wetlands within GLSM is an integral component in the restoration of biological and ecological functions related to water quality and nutrient cycling, habitat, and wildlife utilization. Littoral wetlands are fringe wetlands that filter incoming water from contributing drainages and provide extensive aquatic habitat. The Prairie Creek Delta littoral wetland restoration area is the initial effort at restoring the historic littoral wetland ecosystem on GLSM. The project area is currently an open water area within GLSM near the confluence of the Prairie Creek drainage.

Establishment of vigorous and diverse littoral wetland vegetative communities is a major component of the restoration project, providing both ecological and water quality functions. The process of selecting plants for the restoration consisted of utilizing criteria specific to the current conditions at GLSM. Selected plants are native to Ohio with moderate to rapid growth rates, tolerant to fine soil compositions, produce long root systems, and are low in feeding preference of carp. A variety of wetland zones including: exposed islands, shallow marsh, deep marsh, coarse substrate, and pools, will provide habitat and enhance wildlife utilization for fish, waterfowl, and non-game birds.

**Project Overview**

**Prairie Creek Watershed**
- Location: South central portion of GLSM
- Drainage Area: 8.2 square miles
- Land Use:
  - Agriculture – 97%
  - Forested – 2%
  - Developed – 1%

**Littoral Wetland Restoration**
- Preliminary Plans: Estimated 85 acre restoration
- Primary Objectives:
  - Restore a functional and sustainable vegetative community
  - Improve functionality of the littoral zone to provide improved nutrient processing
  - Restore and create substrate conditions suitable for a variety of littoral wetland zones.
  - Restore and improve littoral wetland wildlife habitats.

**Design Criteria:**
- Water surface elevations and lake depth
- Wind and wave action
- Substrate condition
- Water quality
- Lake management efforts
Prairie Creek Watershed Project Overview

Lake management efforts:
- Substrate condition
- Wind and wave action
- Water surface elevations and

Primary Objectives:
- Improve functionality of the littoral zone to provide sustainable vegetative
- Improve nutrient processing
- Improve variety of littoral wetland conditions suitable for a

Lake Zone Acres:
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<tr>
<th>Wetland Zone</th>
<th>Acres</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Barrier Islands</td>
<td>4.3</td>
<td>5.1</td>
</tr>
<tr>
<td>Exposed Islands</td>
<td>9.2</td>
<td>10.9</td>
</tr>
<tr>
<td>Shallow Marsh</td>
<td>39.3</td>
<td>46.4</td>
</tr>
<tr>
<td>Deep Marsh</td>
<td>4.9</td>
<td>5.8</td>
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<tr>
<td>Open Water</td>
<td>24.2</td>
<td>28.6</td>
</tr>
<tr>
<td>Deep Pools</td>
<td>2.8</td>
<td>3.3</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>84.7</strong></td>
<td><strong>100.0</strong></td>
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Map projected in Ohio State Plan North NAD83.
Map created 5/15/2012.
The general economic outlook in the GLSM region was significantly improved in 2011 compared to previous years of 2009 and 2010.

- Our Unemployment Rate was consistently the lowest in the State of Ohio with a low last month at 4.9%.

- Local income tax collections at the city and villages within the County were all at record levels.

- Yearly sales tax collections for 2011 was 20% more than 2009. Best month last year versus the worst month in 2010 resulted in 62% increase!

- Conveyance Fee Collections (measure of property transfers) increased 32% last year over 2009. (In general, local real estate agents are indicating lake properties are moving again this year after a 2 year period in which nothing sold. The positive momentum and feelings toward the lake over the last year has spurred much more interest in the lake properties according to the realtors.)

Business Development

“Private Market Solutions” have initiated to capitalize on the utilization of the lake stressors. Two new businesses are looking to call the Grand Lake Region home in the coming year. These companies will not only turn liabilities into commodities, but the market approach will speed up the process of dealing with the Lake’s stressors.

- AgConversions recently received a Job Creation Tax Credit and a loan package from Jobs Ohio to create 60 new jobs at their proposed manure-to-organic fertilizer facility.

- Amiran Technologies is working with the Ohio Department of Natural Resources to convert the dredge material from the lake into a nutrient rich potting soil.
Tourism/Recreation

Although the County is unable to predict what effect future advisories will have on the usage of the lake and its related travel and tourism businesses, it is clear that the positive momentum this area has witnessed over the past year will continue as the State continues their efforts on projects such as the Alum Treatment. The Visitors Bureau increased their lake marketing efforts this year and with positive results from the alum treatment we are anticipating much improved numbers for 2012.

Other indicators providing evidence that the progress the State of Ohio and the GLSM Restoration Commission have made over the past 16 months include increased business activity around the lake.

► Freedom Outdoors marina reopened in 2011 while many restaurants, hotels, campgrounds and local summer events (Lake Festival, Governor’s Cup, etc.) all reported much more traffic in 2011 when compared to desolate environment we witnessed in 2009 and 2010.

► Cabin rentals and campground usage is recovering with a 2012 increase of 15% after a decrease of 45% in 2011.

► Hotel usage rebounded in 2011 with a 10% increase over the previous year due to the improved water quality after a 23% decline in 2009 and 2010 which equates to more than 11 million dollars, costing more than 550 jobs.

Economic data as of June 2012, Mercer County Economic Development
Mr. Pfeiffer is the Ecosystem Dynamics Practice leader for KCI. Since joining KCI as an environmental scientist 1988, he has actively developed KCI’s ecological restoration practice throughout the eastern seaboard and mid west. His multi-disciplined background in engineering, planning, ecology and construction has enabled him to integrate ecological restoration into evolving ecological systems with human induced stressors with focus on natural sustainability as a pillar of the restoration design approach through adaptive management. Mr. Pfeiffer applied his adaptive management approach to restoration with his development of KCI’s design/build arm called KCI Environmental Technologies and Construction Inc. Since its inception in 1998 to undertake ecological restoration projects, this venture has provided him 12 years of experience in the implementation and management of ecological systems and has refined his abilities to developed practical, constructible restoration plans which cost effectively achieve the functional objectives.