Lower Yahara River Elevation Study
September – November 2009

Friends of Lake Kegonsa Society (FOLKS)
Mike Amstadt (Vice president – Lake Affairs)
June 23, 2011
“Determine if there are one or more natural or manmade features in the Yahara River’s path that are seriously restricting the flow of water from Lake Waubesa into Lake Kegonsa”
Purpose of the Study

“Gather additional data to help determine whether there is any benefit from lowering Lake Kegonsa to increase the head between Lake Waubesa and Lake Kegonsa”
The FOLKS Board authorized an expenditure of $2,900 for equipment rentals, supplies, and professional surveyor services.

LLS members volunteered their time and equipment to conduct the study.
1. 13 day transducer study
2. Follow-up GPS study
3. Next steps
13 Day Transducer Study
September 13–25, 2009
Initial plan

- Install multiple recording transducers at sites along the Lower Yahara River
- Collect data for a two week period (Budget limitations)
The transducer used to collect data was a Micro-Diver datalogger.

The Micro-Diver is capable of collecting 48,000 pressure measurements:
- Dimensions: 18 mm x 88 mm
- Accuracy ± 1.0 cmH₂O
- Resolution ± 0.2 cmH₂O
The transducer was suspended inside a 24” PVC tube

The tube had holes drilled in it to allow water to freely enter it
Site selection criteria

- Dane County/DNR suggested sites
- Potential points of interest such as bridges or other obstructions
- Available locations to install the device
Final site selection
Installation of the transducer

- The transducer was activated
- The PVC tube was securely attached to a post or pier with clamps so the transducer was entirely under water
- GPS survey equipment was used to determine the elevation and location of the transducer
Each transducer was set to collect and store the pressure reading every 30 minutes

Each transducer collected approximately 570 pieces of data (September 13 – 25)
Transducer Data Adjustments

- Distance from top of pipe to the transducer
- Transducer calibration
- Barometric pressure & altitude
River Elevation Calculation

Elevation = GPS reading for top of tube
– distance from top to transducer
+ transducer pressure reading ftH₂O
– barometric pressure a
+ transducer calibration factor b

a Weather Underground barometric pressure at Fitchburg converted to ft H₂O
b calibration factor adjusts barometric pressure reading for elevation and compensates for differences between transducers
River Elevation Calculation

Example

Elevation = 844.93 (GPS reading)
- 1.71 (distance to transducer)
+ 34.34 (transducer pressure reading)
- 33.93 (barometric pressure)
+ .87 (transducer calibration factor)

Elevation = 844.50
13 Day Transducer Study

Results
First nine days (Sept 13 – Sept 21)
Daily Means for First 9 Days

September 13 - 21, 2009

Head = 1.85 - 2.04 feet

Distance From Waubesa Dam in Feet
Transducer 1 Problems

September 13 - 21, 2009

Head = 1.85 - 2.04 feet

Waubesa USGS

Kegonsa USGS

Exchange St Bridge

Dyreson Bridge

Hwy AB Bridge

Distance From Waubesa Dam in Feet

Elevation in feet
Scale Across Lake Kegonsa

September 13 - 21, 2009

Head = 1.85 - 2.04 feet

Distance From Waubesa Dam in Feet

Elevation in feet

Waubesa USGS

Kegonsa USGS

Exchange St Bridge

Dyreson Bridge

Hwy AB Bridge

T 10

Symbols:
- "9/13"
- "9/14"
- "9/15"
- "9/16"
- "9/17"
- "9/18"
- "9/19"
- "9/20"
- "9/21"
Varying Slopes

September 21, 2009 River Slopes

River Head = 1.85 feet
1.2 " per 1000' (T2 - T9)

Waubesa USGS

Distance From Waubesa Dam in Feet

Elevation in feet

"9/22am
"9/22pm
"9/23am
"9/23pm
"9/24pm
"9/24am
"9/25am
"9/21"
Half-Day Mean Values

Last four days (Sept 22 – 25)
2.09 inches of rain on September 22
Half Day Means for Rain Event

September 21 - 25, 2009

Head = 1.79 - 2.02 feet

Waubesa USGS

Kegonsa USGS

Distance From Waubesa Dam in Feet

Elevation in feet
September 22, 2009 pm

- **Waubesa USGS**
- **Kegonsa USGS**
- **Head = 1.79 - 2.02 feet**

2.09" rain

Elevation in feet

Distance From Waubesa Dam in Feet
September 23, 2009 pm

Head = 1.79 - 2.02 feet

Waubesa USGS

River Peaks

Kegonsa USGS

Exchange St Bridge

Dyreson Bridge

Hwy 96 Bridge

Distance From Waubesa Dam in Feet

Elevation in feet

"9/22am
"9/22pm
"9/23am
"9/24am
"9/24pm
"9/25am
"9/23pm
"9/21"
The data indicate that the slope of the river is substantially different at different points along the river.

The profile of the river appears to change during rain events.

More data is needed at “points of interest” to more fully explain the profile.
Follow-up GPS Study
November 19, 2009
GPS Study Objectives

- Investigate river elevations near the Waubesa Dam
- Obtain additional data near Exchange St. bridge
- Obtain additional data near Dyreson bridge
- Obtain additional data near Hwy AB bridge
GPS Study

Same surveyor and equipment used in original study
November 19 GPS Survey Data

November 19, 2009 GPS

Distance From Waubesa Dam in Feet

Elevation in feet

Waubesa Dam
Exchange St Bridge
Dyerson Bridge
Fish Camp
Hwy AB Bridge

"11/19 GPS
GPS Survey and Transducer Data

September 21 Transducer and November 19 GPS

Elevation in feet

Distance From Waubesa Dam in Feet

"11/19 GPS  Series9
GPS and Adjusted Transducer Data

Adjusted Transducer Profile and November 19, 2009 GPS

- Waubesa Dam
- "11/19 GPS"
- "Adjusted 9/21 T"
- Exchange St Bridge
- Dyreson Bridge
- Fish Camp
- Hwy AB Bridge

Distance From Waubesa Dam in Feet

Elevation in feet

846.0
845.5
845.0
844.5
844.0
843.5
843.0
842.5
842.0

0
5000
10000
15000
20000
25000
River Measurement Locations
Sept 13 - 25 Transducers
Nov 19 GPS measurements
River Measurement Locations
Sept 13 – 25 Transducers
Nov 19 GPS measurements

Dyreson Bridge
Apparent Profile of River

Apparent River Profile from Transducer and GPS Data

Distance From Waubesa Dam in Feet

Elevation in feet

Waubesa Dam
Exchange St Bridge
Dyreson Bridge
Fish Camp
Hwy 47 Bridge
## Interesting Information Noted

<table>
<thead>
<tr>
<th>Date</th>
<th>9/13/09</th>
<th>9/21/09</th>
<th>9/23/09 (after rain)</th>
<th>11/19/09</th>
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</thead>
<tbody>
<tr>
<td>Waubesa Elevation</td>
<td>845.20</td>
<td>845.07</td>
<td>845.31</td>
<td>844.94</td>
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<tr>
<td>Kegonsa Elevation</td>
<td>843.16</td>
<td>843.22</td>
<td>843.36</td>
<td>842.98</td>
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<tr>
<td>Head (diffs)</td>
<td>2.04</td>
<td>1.85</td>
<td>1.95</td>
<td>1.96</td>
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<tr>
<td>Waubesa Discharge (ft3/sec)</td>
<td>130</td>
<td>142</td>
<td>202</td>
<td>392</td>
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<tr>
<td>Exchange St Discharge (ft3/sec)</td>
<td>114</td>
<td>121</td>
<td>na</td>
<td>420</td>
</tr>
</tbody>
</table>
Possible Next Steps

- Look at data more closely to identify possible issues
- Look at data more closely to identify possible river profile change over time
- Conduct detailed elevation and flow studies at potential problem locations