Fox River Implementation Plan Update

Fox River Study Group Annual Meeting
October 29, 2015

Cindy Skrukrud, Chair
Fox River Study Group
• What is the FRIP?
• FRIP Focus and Findings
• FRIP Implementation
What is the FRIP?
What is the FRIP?

• FRIP = Fox River Implementation Plan

• An undertaking by the FRSG to resolve the dissolved oxygen (DO) and algal impairments of the Fox River
  • This is a subset of the initial problems identified from the investigation of water quality issues of the Fox River in 2004.

• An alternative to a TMDL clean-up plan (which is mandated by the Clean Water Act)
The FRIP Study Area

- Fox Watershed is 938 sq. mi. in WI, 1,720 sq. mi. in IL
- FRIP focuses on 98 miles of river downstream of the Stratton Dam, with a watershed area of about 1,405 sq. mi.
Listed Impairments
• State’s 303(d) list includes multiple impairments
• The FRIP focuses on DO, phosphorus and algae impairments
• Multiple reaches are listed for these impairments

<table>
<thead>
<tr>
<th>Reach ID and Description</th>
<th>Length (mi)</th>
<th>Listed Cause of Impairment</th>
<th>Downstream River Mile</th>
<th>Upstream River Mile</th>
</tr>
</thead>
<tbody>
<tr>
<td>IL_DT-35 From: Grass Lake To: IL/WI state line</td>
<td>5.03</td>
<td>aquatic algae</td>
<td>110.1</td>
<td>115.1</td>
</tr>
<tr>
<td>IL_DT-23 From: about 0.52 miles downstream Stratton Dam To: Pistakee Lake</td>
<td>7.77</td>
<td>aquatic algae</td>
<td>97.7</td>
<td>105</td>
</tr>
<tr>
<td>IL_DT-22 From: Confluence with Flint Creek To: Stratton Dam</td>
<td>7.86</td>
<td>aquatic algae</td>
<td>98.2</td>
<td>97.7</td>
</tr>
<tr>
<td>IL_DT-06 From: Crystal Lake Outlet To: Flint Creek</td>
<td>8.06</td>
<td>DO, aquatic algae</td>
<td>84.55</td>
<td>92.6</td>
</tr>
<tr>
<td>IL_DT-20 From: Confluence with Jelkes Creek To: Confluence with Crystal Lake Outlet</td>
<td>9.95</td>
<td>DO</td>
<td>74.6</td>
<td>84.55</td>
</tr>
<tr>
<td>IL_DT-18 From: Confluence with Poplar Creek To: Confluence with Jelkes Creek</td>
<td>5.8</td>
<td>DO</td>
<td>68.8</td>
<td>74.6</td>
</tr>
<tr>
<td>IL_DT-09 From: Confluence with Ferson Creek To: Confluence with Jelkes Creek</td>
<td>7.9</td>
<td>total phosphorus, aquatic algae</td>
<td>60.9</td>
<td>68.8</td>
</tr>
<tr>
<td>IL_DT-58 From: Confluence with Whites Creek To: Confluence with Ferson Creek</td>
<td>3.76</td>
<td>DO</td>
<td>59.5</td>
<td>63.25</td>
</tr>
<tr>
<td>IL_DT-69 From: Confluence with Mill Creek To: Confluence with Whites Creek</td>
<td>4.51</td>
<td>total phosphorus, aquatic algae</td>
<td>55</td>
<td>59.5</td>
</tr>
<tr>
<td>IL_DT-38 From: Confluence with Waubonsee Creek To: Mill Creek</td>
<td>12.3</td>
<td>total phosphorus, aquatic algae</td>
<td>42.7</td>
<td>55</td>
</tr>
<tr>
<td>IL_DT-03 From: Confluence with Blackberry Creek To: Confluence with Waubonsee Creek</td>
<td>7.1</td>
<td>DO, total phosphorus, aquatic algae</td>
<td>35.6</td>
<td>42.7</td>
</tr>
<tr>
<td>IL_DT-11 From: Confluence with Big Rock Creek To: Confluence with Blackberry Creek</td>
<td>4.6</td>
<td>total phosphorus, aquatic algae</td>
<td>31.0</td>
<td>35.6</td>
</tr>
</tbody>
</table>
Why Phosphorus?

• The FRIP focuses on reduction of phosphorus loading to the river

• Phosphorus is an essential nutrient for aquatic plants

• Too much phosphorus can lead to excessive growth of algae and aquatic plants, causing nuisance conditions and potentially impairing habitat

• Excess algae and plants consume oxygen at night, dropping oxygen to levels unhealthy for aquatic life
Phosphorus Sources

- The FRIP study area includes agricultural areas which contribute phosphorus in storm water runoff
Phosphorus Sources

• Urban lands also contribute phosphorus in storm water runoff

• MS4 communities are areas where urban runoff is delivered to the Fox River and its tributaries though Municipal Separate Storm Sewer Systems
Phosphorus Sources

- Wastewater treatment plants contribute the largest portion of phosphorus (more than half on an annual basis)
Phosphorus Sources

Fox Total, long-term average annual TP load

- Urban: 53%
- Agriculture: 26%
- Others: 9%
- Point Sources: 6%
- Upstream Boundary: 6%
Impact of Dams

• Dams can make the problem worse
• Slows the flow which can increase plant and algal growth
• Deeper water in dam pools can be more susceptible to low DO
Impact of Dams

• Dams also reduce habitat and limit the range of aquatic organisms.
**Data and Tools**

- The FRSG has been working on these issues for more than a decade
- Supported extensive data collection
- Computer models developed by the Illinois State Water Survey include
  - Watershed models (HSPF)
  - Water quality model (QUAL2K)
- These models were used to develop the FRIP
Alternatives Considered in the FRIP

• A range of potential actions
  • Enhanced nutrient removal at WWTPs
  • Reduction of upstream phosphorus loading through the TMDL process
  • Reduction of non-point source phosphorus loading from MS4s and agricultural areas
  • Dam removal
• The FRIP lays out an implementation plan for the next decade
FRIP Focus and Findings
The FRIP Focuses On:

- Reduction of phosphorus loading from
  - WWTPs
  - MS4s
  - Agricultural areas
- Mitigation of factors that contribute to the problem
  - Dams
The FRIP Focuses On:

• Summer low flow conditions
  • Lower flows in river
  • Longer days (more sunlight leads to more plant growth)
  • Warmer temperatures (also promotes plant growth and decay)
Summer Baseline Condition – Total Phosphorus:
Summer Baseline Condition – Min. Dissolved Oxygen:

Note: model results for dissolved oxygen are subject to revision due to uncertainty in the current model calibration; see Section 3.2.3 in the Fox River Implementation Plan.
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Summer Baseline Condition – Phytoplankton:

[Graph showing average phytoplankton (ugP/L) along the Fox River Mainstem River Mile, with data points and labels for various locations such as Algonquin, Cary, E. Dundee, FRWRD-N., FRWRD-S., St Charles, Geneva, Batavia, Fox Metro, YBSD, Sheridan, etc.]
• The FRIP uses the Fox River water quality model to evaluate alternatives
  • Look at how each alternative improves DO or reduces algae
• Some limitations with model calibration
Model Calibration – Total Phosphorus:

Data (dots) and model (line) are close together, indicating a good calibration
Model Calibration – Min. Dissolved Oxygen:

Model results (line) are significantly higher than data (squares) in several locations, indicating calibration problems.
Model Calibration – Avg Phytoplankton:

Data (dots) and model (line) are close together, indicating a good calibration.
Because of model limitations:

• Can’t rely on model results for minimum DO
  • Model appears to over-predict minimum DO, based on calibration results
  • Minimum DO in model also appears to be relatively insensitive to phosphorus load reductions and other changes

• FRSG is planning to revisit modeling after draft FRIP is completed
Runoff Reduction Scenario – Total Phosphorus:

[Graph showing varying levels of phosphorus levels along the Fox River Mainstem River Mile, with markers for Tributary, WWTP, Dam, Summer Baseline, 25%_red, and 50%_red. The graph illustrates the reduction in phosphorus levels across different segments of the river.]
Wastewater Reduction Scenarios – Phosphorus & Algae:
Upstream Reduction Scenarios – Phosphorus & Algae:

![Graph showing average total phosphorus and phytoplankton levels along the Fox River Mainstem River Mile.](image)
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Dam Removal Scenario – Min. DO & Algae:

Note: model results for dissolved oxygen are subject to revision due to uncertainty in the current model calibration; see Section 3.2.3 in the Fox River Implementation Plan.
Dam Removal Scenario:

• Model predicts an overall reduction in minimum DO in river as a result of dam removal

• This prediction appears to be the result of increased benthic algae in model, which leads to DO depletion

• This finding needs to be revisited with improved model and verified with field observations and when dam removal occurs on the Fox River
Key Findings:

• Summer low flow conditions are critical
• Non-point sources play little role during summer low flow, but are important at other times of the year
• Reducing phosphorus from WWTPs and upstream sources will significantly reduce the amount of phosphorus in the system
• Modeling results for dam removal show some unexpected results
Most Aggressive Alternative:
• WWTP effluent TP = 0.1 mg/L
• All dams from Carpentersville to Montgomery removed
• Upstream TP reduced to 0.05 mg/L
Most Aggressive Alternative – Total Phosphorus:
Most Aggressive Alternative – Avg Phytoplankton:

![Graph showing average phytoplankton levels along the Fox River Mainstem River Mile. The graph includes points for towns such as Cary, Algonquin, E. Dundee, FRWRD-N, FRWRD-S, St. Charles, Geneva, Batavia, Fox River, YBSO, and Sheridan. The x-axis represents the Fox River Mainstem River Mile, while the y-axis represents the average phytoplankton level in ugP/L.]
Most Aggressive Alternative – Min. Dissolved Oxygen:

Note: model results for dissolved oxygen are subject to revision due to uncertainty in the current model calibration; see Section 3.2.3 in the Fox River Implementation Plan.
FRIP Implementation
FRIP Implementation – Near Term Actions:

• WWTP effluent TP limits = 1.0 mg/L
• Potential removal of Carpentersville and North Aurora Dams
• TMDLs established for upstream TP
Near-Term Actions – Total Phosphorus (July & August):
Near-Term Actions – Avg Phytoplankton (July & August):

- July Baseline:
  - July_Carp_and_NAur_USB(0.05)_WWTP(1.0)

- August Baseline:
  - Aug_Carp_and_NAur_USB(0.05)_WWTP(1.0)
Near-Term Actions – Min. DO (July & August):

Note: model results for dissolved oxygen are subject to revision due to uncertainty in the current model calibration; see Section 3.2.3 in the Fox River Implementation Plan.
FRIP Implementation – Near Term Actions:
• Additional monitoring
• Model improvement
• NPS project tracking
Non-Point Source Scenario Planning Tool

- Spreadsheet tool to allow “what-if” scenario testing
- Two versions: MS4s and tributary watersheds
Non-Point Source Project Tracking Tool

- Spreadsheet tool to simplify tracking and reporting of projects by MS4s

### MS4 Non-Point Source Control Measure Tracking Tool
Fox River Watershed, Illinois

<table>
<thead>
<tr>
<th>MS4</th>
<th>Project Name</th>
<th>Project Cost</th>
<th>Project Type</th>
<th>Total Area Captured (acres)</th>
<th>% Urban High Dens</th>
<th>% Low-Medium Dens</th>
<th>% Urban Open Space</th>
<th>Area-Weighted UAL (lb/acre)</th>
<th>Load (lb)</th>
<th>Removal Efficiency</th>
<th>Total Load Removed (lb/yr)</th>
<th>Cost per Pound P Removed ($/lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elgin</td>
<td>Project 2015-01</td>
<td>$100,000</td>
<td>Wet detention</td>
<td>100</td>
<td>10%</td>
<td>25%</td>
<td>30%</td>
<td>0.287</td>
<td>28.67924</td>
<td>68%</td>
<td>19.50</td>
<td>$5,128</td>
</tr>
</tbody>
</table>
Next Steps:

• Finalize FRIP and submit to IEPA (December)
  • Next draft available by Nov. 19 FRSG board meeting
  • FRIP will be available on line. Permittees with requirement to provide FRIP to IEPA by Dec. 31 need only email IEPA with link.
  • FRSG meets with USEPA (January/February – date TBD)

• Webinar to introduce spreadsheet tools for NPS scenario planning & tracking (November – date TBD)
Questions?