Modeling in Support of Water Supply Planning in Northeastern Illinois

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Overview

- Sources of water in northeastern Illinois
- Water demand in northeastern Illinois
- Assessment of resources
  - Lake Michigan
  - Fox River
  - Groundwater
- Summary
Sources of Public Water Supply in Northeastern Illinois

*Elgin and Aurora use groundwater as well as surface water

*Groundwater is also used within these areas in some cases.
Source: Chicago Metropolitan Agency for Planning
Withdrawals in Northeastern Illinois, by Water Source (Excludes Through Flow for Power Generation)

<table>
<thead>
<tr>
<th>Source</th>
<th>2005*</th>
<th>2050 (LRI)</th>
<th>2050 (BL)</th>
<th>2050 (MRI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mgd</td>
<td>%</td>
<td>Mgd</td>
<td>%</td>
</tr>
<tr>
<td>Lake Michigan</td>
<td>1,018.0</td>
<td>69</td>
<td>952.9</td>
<td>60</td>
</tr>
<tr>
<td>Inland surface</td>
<td>212.2</td>
<td>14</td>
<td>275.3</td>
<td>17</td>
</tr>
<tr>
<td>waters</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Groundwater</td>
<td>250.1</td>
<td>17</td>
<td>359.1</td>
<td>23</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1,480.3</td>
<td></td>
<td>1,587.5</td>
<td></td>
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</tbody>
</table>

*adjusted to average 1971-2000 climate

+107.2 Mgd +7.2%
+530.4 Mgd +35.8%
+949.1 Mgd +64.1%

Dziegielewski and Chowdhury, 2008
Projected Withdrawals
(Excludes Through Flow for Power Generation)

About 80% of 2005* withdrawals were used for public supply

Dziegielewski and Chowdhury, 2008
Lake Michigan Diversion, 2015-2050
Annual low flows, Fox River at Algonquin

Influenced by 4 factors (primarily)
1. Climate
2. Withdrawals (Elgin and Aurora)
3. Stratton Dam gate operations
4. Effluent (MOST IMPORTANT)

Pre-1964: Summer low flow periodically <35 Mgd
1965-present: Summer low flow almost always >65 Mgd
Ten-year low flow in 2050 (BL scenario), Fox River from near Crystal Lake to Yorkville

![Graph showing ten-year low flow in 2050 for Fox River from near Crystal Lake to Yorkville, with lines representing different scenarios such as 2050 BL growth scenario, Present-day condition, and Unaltered flow.]
Aquifers of Northeastern Illinois
Simulated Drawdown Since Predevelopment, Shallow Bedrock Aquifer

2005

2050 (BL)
Simulated Change in Natural Groundwater Discharge Since Predevelopment

2005

2050 (BL)
Simulated Drawdown Since Predevelopment, Deep Aquifers

Ancell Unit (2005)  Ancell Unit (2050, BL)
Simulated Available Head, Deep Aquifers

Ancell Unit (2005)  

Ancell Unit (2050, BL)
Summary

• **Water Demand** Excluding once-through flows for electric power generation, the region may require an increase of 107 to 949 Mgd in 2050 (7 to 64 percent) from the estimated 2005 withdrawal of 1,480 Mgd.

• **Scope of Study** Sources of water investigated include Lake Michigan, the Fox River, shallow aquifers within the Fox River basin, and deep aquifers underlying the entire region.

• **Lake Michigan** Illinois’ Lake Michigan water allocation program can accommodate growing demand in the existing Lake Michigan service area as well as additional demand of 50 to 75 Mgd and *probably* remain in compliance with Supreme Court decreed limit.
Summary

- **Fox River** Depending on the demand scenario, the Fox River can accommodate projected 2050 demand by Elgin and Aurora as well as 14 to 58 Mgd in additional withdrawals.

- **Groundwater** Computer simulation of plausible scenarios of future groundwater demand, using existing well locations, suggests that additional drawdown, reduction in stream base flow, and changes in the quality of groundwater withdrawn from deep wells are all possible in parts of the 11-county study area before 2050.
Summary

- **Groundwater** Limited areas of partial to complete desaturation (draining of pore spaces) of the Ancell Unit will develop by 2050.

- **Groundwater** Model simulations suggest that, in 2005, pumping had reduced natural groundwater discharge within the Illinois portion of the Fox River watershed by about 10 percent. Simulation of future pumping scenarios suggests that natural groundwater discharge in the Illinois portion of the Fox River basin could be reduced to rates that are 10 to 14 percent less than predevelopment rates in 2050.
Summary

- **Future Work** Surface water and groundwater models can be used for further analysis.

- **Future Work** Models can be improved with new observations, revision of pumping forecasts, and adaptation to continually improving modeling codes.
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