

Sources of Water for Communities in Northeastern Illinois

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Evolution of Community Water Supplies

Multiple groundwater and surface water resources in northeastern Illinois supply water to more than 290 communities (Figure 1, Table 1). Additional water is used from Lake Michigan for navigation and water quality purposes, from rivers for cooling water, and from groundwater for irrigation and domestic wells. Many communities use a combination of sources depending on the availability of shallow groundwater or access to either Lake Michigan or one of the inland rivers.

Since the early 1900s there has been a significant change in use from groundwater to surface water as the aquifers have become more stressed or more difficult to treat to stricter water quality standards. Prior to development of a community's water system, the existing rural residents relied on shallow wells and cisterns. In many unincorporated areas or less densely populated suburbs, such as Barrington Hills or Inverness, water is still obtained by individual wells at each home. Communities away from Lake Michigan all started using groundwater for their public systems with a preference for the glacial sand and gravel or shallow bedrock aquifers. Where there were no shallow aquifers or the water quality was poor, communities were forced to use the deep sandstone aquifers which are significantly more expensive to develop. As the suburban population grew throughout the 20th century, more communities further away from Chicago switched to Lake Michigan water. The

biggest switches to lake water occurred in the 1980s in northwestern and southern Cook County and in the 1990s in DuPage County and central Lake County. The most recent switches occurred in the early 2000s in Will County.

Table 1: Reported 2012 public and industrial water use in million gallons per day (Mgd)

	<i>Public</i>	<i>Industrial</i>	<i>Total</i>
Lake Michigan	942	12	954
Inland rivers	22	100	122
Sand and gravel aq.	35	2	37
Shallow bedrock aq.	32	5	37
Deep sandstone aq.	70	20	90
Total	1,101	139	1,240

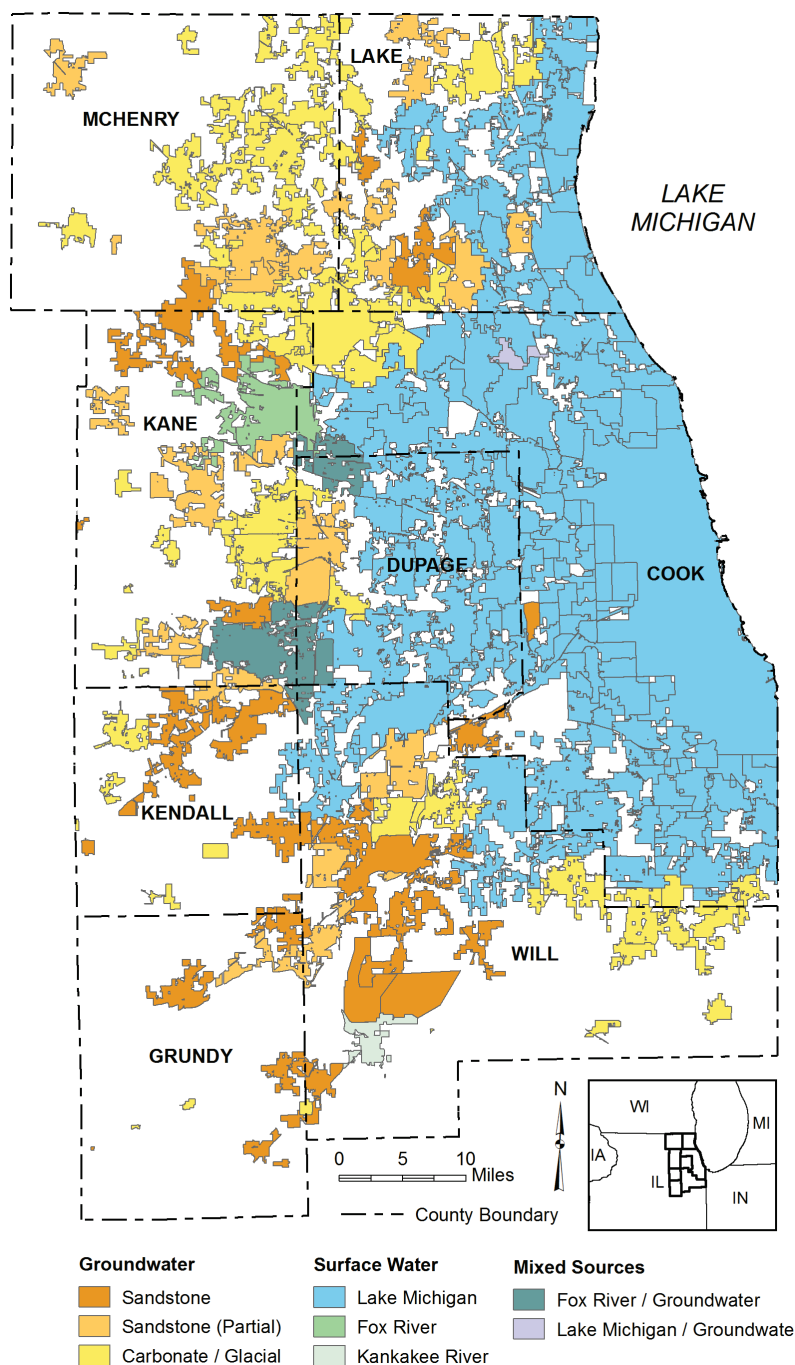
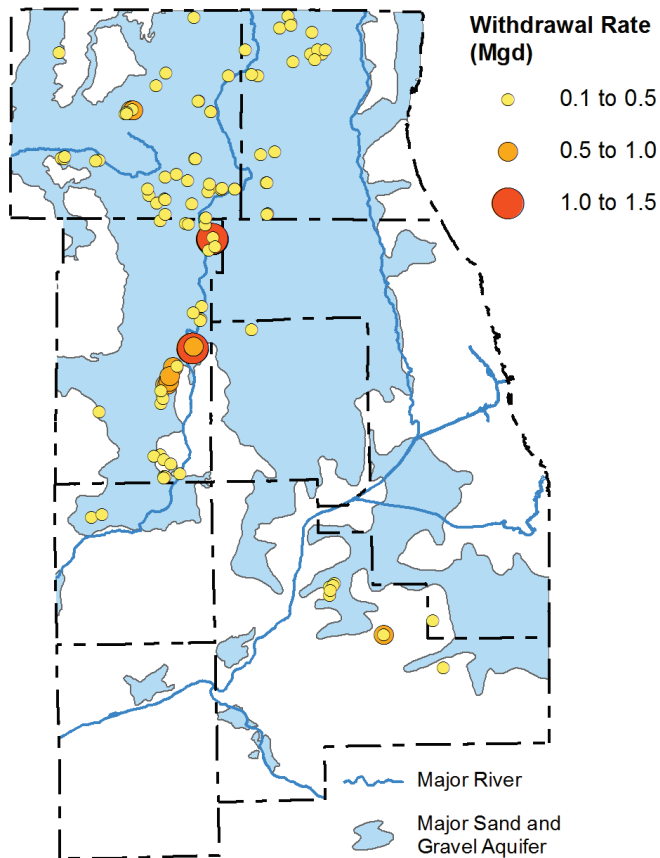


Figure 1: Sources of community water in 2012.

Sand and Gravel Aquifer



Carbonate Aquifer

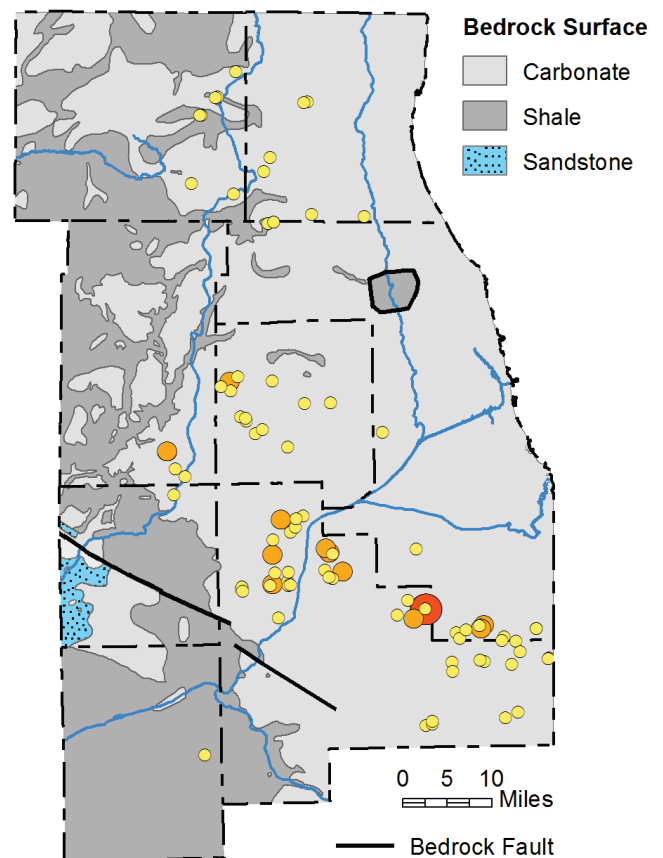


Figure 2: Shallow groundwater withdrawals for public and industrial water use in 2012 (Mgd).

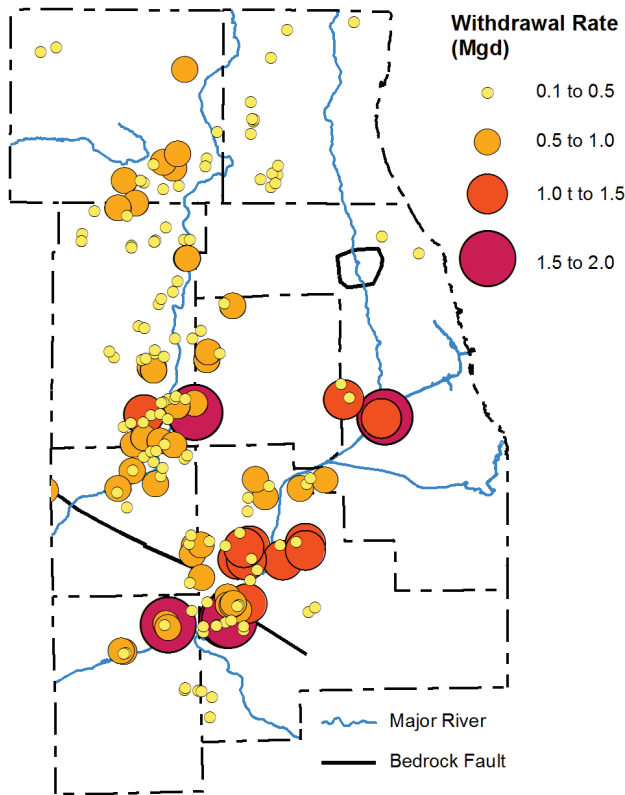
Sand and Gravel Aquifers

Outwash from melting Pleistocene glaciers left thick sand and gravel deposits in many of the major bedrock valleys of Illinois. In northeastern Illinois these deposits form aquifers that are used in McHenry and Lake Counties and along the St Charles bedrock valley in Kane and Kendall Counties (Figure 2). These aquifers can be highly permeable and are often at or near the land surface where they are hydraulically connected to a stream; hence they can sustainably support very high-capacity wells (> 1.5 Mgd). A 30-foot thick saturated sand and gravel aquifer can have a permeability that is 50 times that of the deeper sandstone aquifers, although the available drawdown is considerably less. The sand and gravel aquifers in Cook and DuPage Counties have proven insufficient for significant water supplies, but they likely contribute to the water availability in the underlying Silurian-Devonian carbonates. Those few wells that fall outside of the major sand and gravel aquifers are likely within very thin lenses of sand and gravel; as a result, the withdrawal rates for these wells generally do not exceed 0.5 Mgd.

Shallow Carbonate Aquifers

The Silurian-Devonian carbonate units have been subjected to weathering and dissolution in the geologic past that resulted in the development of significant secondary porosity, especially within the upper 25 to 125 feet of the bedrock surface. Where the carbonates form a productive aquifer is reflected in the distribution of production wells (Figure 2) because use of the carbonate aquifer is generally preferred to the deeper sandstones, absent any water quality issues. Wells completed in the carbonates can be highly productive if they intersect large dissolution cavities along vertical fractures or bedding planes. The highly permeable zone in the Silurian-Devonian aquifer follows a band through southwestern Lake, central DuPage, and northeastern Will Counties. This zone corresponds with overlying sand and gravels and higher bedrock elevations. The carbonates have a much lower transmissivity in central Cook County and historically have never been able to support any sizable withdrawals. The deeper Galena-Platteville carbonates have not been significantly weathered in the region so they do not form an aquifer.

Sandstone Aquifer



Lakes and Rivers

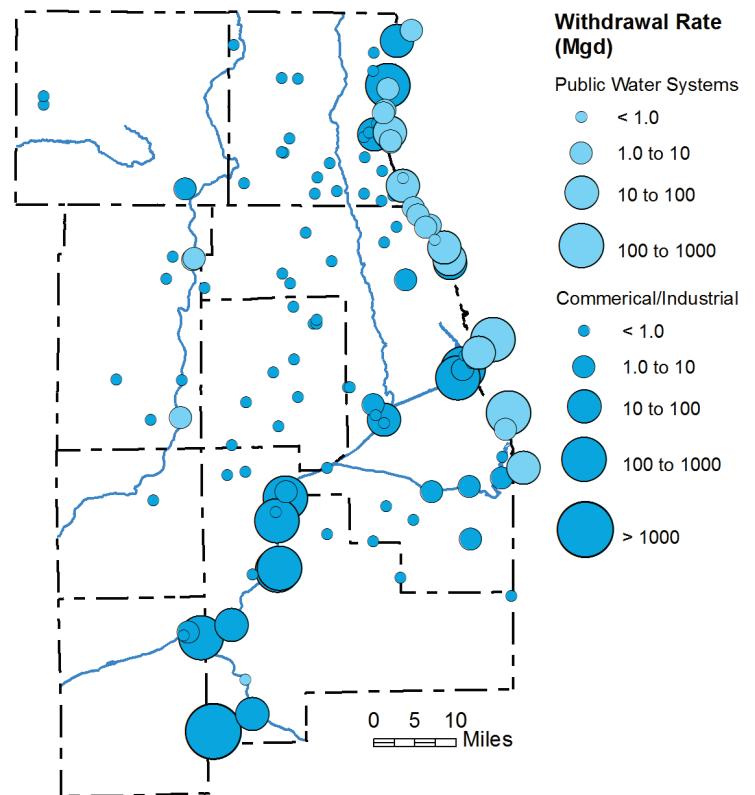


Figure 3: Deep groundwater and surface water withdrawals for public and industrial water use in 2012 (Mgd).

Sandstone Aquifers

The Cambrian-Ordovician sandstone aquifer consists of two principal units, the St. Peter and the Ironton-Galesville Sandstones. Each unit is roughly 200 feet thick and dips to the south and east from outcrops in north-central Illinois where most of the recharge is likely occurring. Typical sandstone well depths in northeastern Illinois are 1,200 to 1,600 feet. The great depth results in hundreds of feet of available drawdown at a well, which allows for pumping rates of over 1 Mgd. Because the deep wells are expensive to drill and develop, they are mostly found in areas where thick sand and gravels do not exist or the carbonate unit is relatively impermeable.

As discussed in the full report by Abrams et al. (2015), water levels in the sandstone aquifer have declined by as much as 800 feet in Will County. This decline has resulted in some desaturation of the St. Peter Sandstone which may put some of the supply wells at risk. The use of the deep aquifer may also be impaired by naturally high levels of radium which requires treatment for the public systems.

Lakes and Rivers

The surface water withdrawals for public supplies occur along the shore of Lake Michigan, from the Fox River at Elgin and Aurora, and from the Kankakee River at Wilmington. Large industrial withdrawals occur mainly along the ship canals and the Des Plaines River. The largest withdrawals (>1,000 Mgd) represent largely non-consumptive use of recirculated surface water for cooling at power plants.

Lake Michigan water is withdrawn from 14 major intakes by the North Shore communities in Lake and northern Cook Counties, four by the City of Chicago, and one by the City of Hammond, Indiana. The current distribution network of this water is shown in Figure 4 for 2012 and is shaded by the major distribution networks. An analysis of the allocation of Lake Michigan water by Meyer et al. (2012) indicates that there is enough water available for additional communities to switch from groundwater to Lake Michigan water, although future expansions may be limited by the size of the existing pipelines and infrastructure.

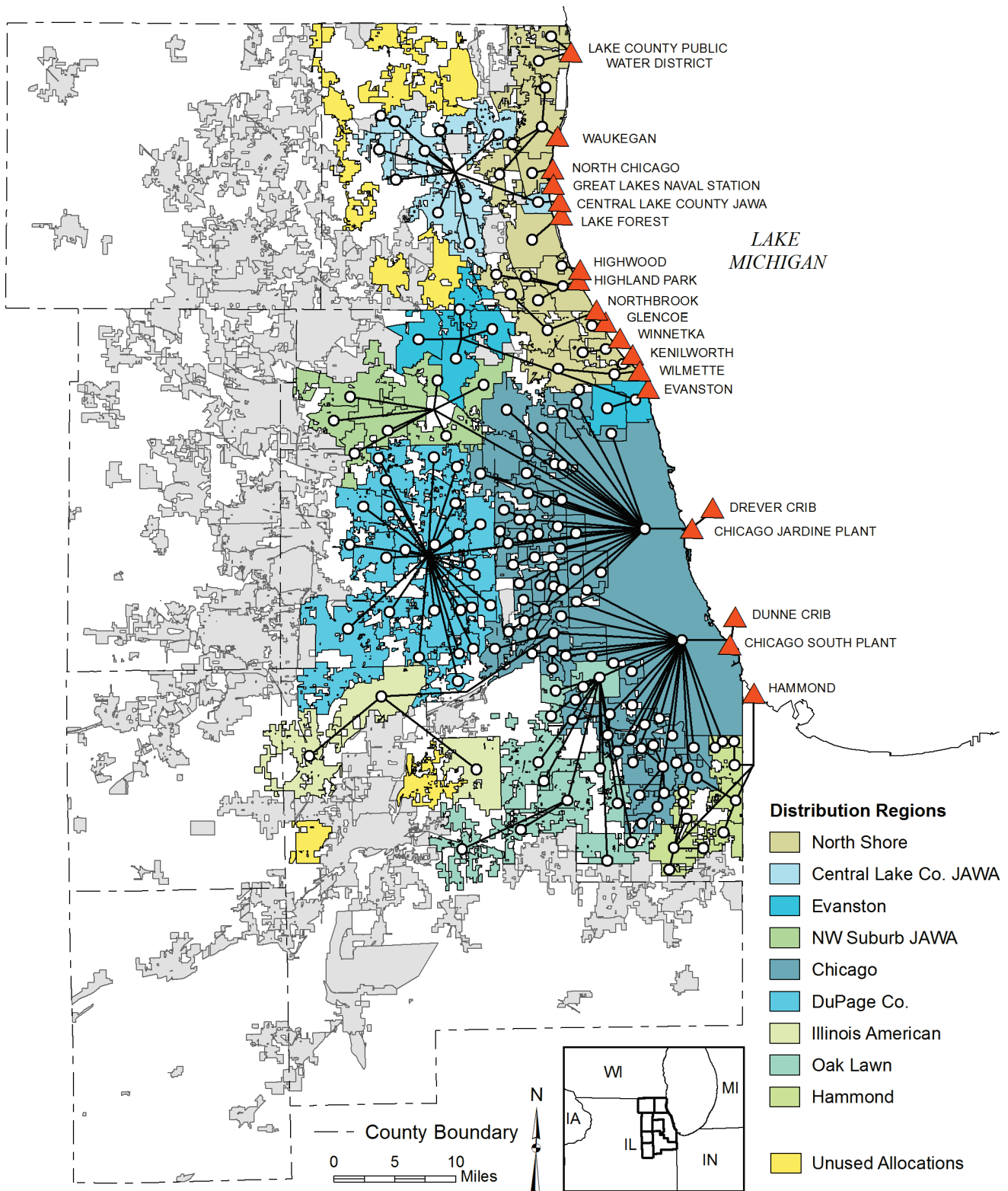


Figure 4: Lake Michigan water distribution network in northeastern Illinois for 2012. Connecting lines are illustrative and do not represent the physical pipelines.

References

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Meyer, S.C., H.A. Wehrmann, H.V. Knapp, Y.F. Lin, F.E. Glatfelter, J. Angel, J. Thomason, and D.A. Injerd. 2012. *Northeastern Illinois Water Supply Planning Investigations: Opportunities and Challenges of Meeting Water Demand in Northeastern Illinois*. Illinois State Water Survey Contract Report 2012-03, Champaign, IL.