
A case study from the Great Lakes Geologic Mapping Coalition

Jason F. Thomason
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Great Lakes Geologic Mapping Coalition (GLGMC) Mapping Priority Areas

- **Wisconsin**: Flooding susceptibility, groundwater resources and contamination studies in the Lower Wisconsin River Valley and Grant County.
- **Michigan**: 3D glacial geologic mapping in the western and southern part of the state, karst feature mapping in the Eastern Upper Peninsula, USGS cooperatively working with Michigan.
- **New York**: 3D glacial geologic mapping in the central and southeastern areas of the state.
- **Ohio**: Karst mapping, surficial geologic mapping, and development of till stratigraphic model in northern and central part of the state. Three counties in NW Ohio are part of a multi-state GIS analysis being done in association with the proposed Michigan Sole Source Aquifer Assessment.
- **Pennsylvania**: Development of the water-well database and drift thickness mapping in the northwestern part of the state.

**Map Explanation**
- Dark brown: 10-year priority mapping area
- Light blue: Long-range priority mapping area

Compiled August 2010
GLGMC-Funded 3-D Mapping Projects in Illinois
Water Supplies in Northeast Illinois

• McHenry County’s need for science-based, sustainable water supply management.
  – 100% groundwater-dependent (~75% sand-gravel aquifers)

• Responded to County’s Water Resources Management Strategy.
  – Tied to public education and involvement.
  – Recognized need to update geologic and aquifer resource and contamination potential.

• Develop a 3D geologic map(s) of shallow sand and gravel aquifer systems in the county.
  – Support of groundwater-flow modeling efforts.
  – Support county and municipal water-management decisions.

*Figure from Abrams et al., 2015, Changing groundwater levels in the sandstone aquifers of northern Illinois and southern Wisconsin: Impacts on available water supply, Illinois State Water Survey Contract Report 2015-02*
Shallow Sand and Gravel Aquifers
0-300 ft deep

Bedrock Aquifers
100-1200 ft deep
Shallow Sand and Gravel Aquifers
0-300 ft deep

Bedrock Aquifers
100-1200 ft deep
Shallow Sand and Gravel Aquifers
0-300 ft deep

Upper Aquifer (Silurian Limestone/Dolomite)
Maquoketa Shale/Galena - Platteville Dolomite

Bedrock Aquifers
100-1200 ft deep

St. Peter Sandstone Aquifer
Prairie du Chien Group/Potosi Dolomite
Ironton-Galesville Sandstone Aquifer
Eau Claire Group (sandstone, siltstone, shale)

Schematic Cross Section-Geologic Units
3-D Mapping Methodology

• **Field Data Acquisition**
  – Drilling (Wireline and direct-push, 2-D Geophysics (Electrical Resistivity and Seismic)

• **Database Management**
  – Water-well log lithologic standardization and location correction

• **3D Visualization**
  – ArcGIS, Geovisionary, GSI3D, Subsurface Viewer MX

• **Geologic Interpretation**
  – ArcGIS (ArcScene), GSI3D, Subsurface Viewer MX, Adobe

• **3D Mapping/Modeling**
  – ArcGIS, GSI3D, Subsurface Viewer MX, GoCAD

• **3D Map Product Development**
  – Cartographic Software, Subsurface Viewer, others...
Multi-scale 3-D Geologic Mapping
3D Geologic Map-Cross Section Network
Viewed from Southwest
Section-based 3-D mapping- Regional
Section-based 3-D mapping- Regional
Section-based 3-D mapping - Regional
Section-based 3-D mapping - Regional
Multiscale 3D Mapping
Multiscale 3D Mapping

[Diagram showing 3D mapping of different locations such as Harvard, Woodstock, McHenry, Crystal Lake, and Marengo with labels for Proximal Outwash, Medial Outwash, Distal Outwash, Buried Coarse Facies, and Gravel Terraces.]
Multiscale 3D Mapping
Applications of 3-D Geologic Information in McHenry County

- Revised contamination potential maps and new planning tools
- Predictive flow modeling for long-term water supply
- Modeling impacts of irrigation wells
- Siting new water supply well(s)
- VOC contamination site
- Assessing changes in water levels of recreational lake(s)
Contamination Potential and Sensitive Aquifer Recharge Area (SARA) Map
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Contamination Potential and Sensitive Aquifer Recharge Area (SARA) Map

McHenry County SARA Map
Three-dimensional Geologic Mapping for McHenry County

Jason F. Thomason and Donald A. Keefer

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November, 2013
Haeger-Beverly Aquifer

Simulated Drawdown 2009, 2030, & 2050

Illinois State Water Survey
Meyer, et al., 2013
Ashmore Aquifer

Simulated Drawdown 2009, 2030, & 2050

Illinois State Water Survey
Meyer, et al., 2013
Lower Glasford Aquifer

Simulated Drawdown 2009, 2030, & 2050

Illinois State Water Survey
Meyer, et al., 2013
Illinois State Water Survey
Meyer, et al., 2013
Impacts and Applications
Capture-zone modeling of irrigation wells
Capture zone modeling of irrigation wells

Seipel et al., 2016, Journal of Geoscience and Environmental Protection
Impacts and Applications

Marengo Water Supply
Impacts and Applications

Marengo Water Supply

NORTHWEST HERALD

Marengo finds new water supply

By STEPHEN DI BENEDETTO - sdibenedetto@shawmedia.com

MARENGO - A newly discovered water supply on Marengo's west side could broaden the city's expansion plans by helping it recruit industrial companies, City Manager Gary Boden said.

HR Green, a planning firm contacted by the city, discovered the large, shallow aquifer as city administrators were looking to replace a malfunctioning well on the east side of town.

Industries that rely on water, such as food-processing plants, could find Marengo attractive, Boden said.

"Our position is evolving. Our development is going to be a little bit more diversified. We are going to look at industrial, as well as commercial and residential," he said.

Marengo recently revealed a plan to expand the city to the south and west. It hinges on the city's ability to court the Illinois State Toll Highway Authority and get an interchange at Route 23 and Interstate 90. Officials have been talking with the state agency and others, such as Huntley, to secure its full interchange under construction at Route 47 and I-90.

The new water supply is so plentiful that officials are contemplating selling water to other communities and using it for Marengo's system, Boden said.

Marengo's current water supply has been an asset during the summer drought. Residents have had unrestricted water use, while neighboring communities limited usage.
Impacts and Applications
Volatile organic compound (VOC) contamination site
Volatile organic compound (VOC) contamination site
State Health Department Recommends Water Well Testing for Private Wells Near Marengo

SPRINGFIELD, Ill. - The Illinois Department of Public Health (IDPH) is advising residents who obtain their drinking water from private wells in the Marengo (McHenry County) area to test their water for possible groundwater contamination. Routine testing of Marengo’s community water supply wells by the Illinois Environmental Protection Agency (IEPA) indicates contaminants could be present in the area’s private wells.

The contaminants benzene and methyl tert-butyl ether (MTBE) were detected at levels lower than the Illinois Groundwater Standard. Although the contaminants’ levels were lower than the standard, this is the same groundwater that serves private wells and it is possible the levels of the contaminants may be higher in private wells.

Resident well private wells located within the area (map below) north of U. S. 20, east of Illinois 25, south of the Kishwaukee River, and west of the Marengo eastern city limits are encouraged to have their water tested for volatile organic compounds by a private laboratory.

For a list of laboratories certified to analyze drinking water for volatile organic compounds, interpretation of test results, contaminant health effects information, and recommendations for individuals who regularly consume well water, contact Joe O’Connor, IDPH West Chicago Regional Office, 241 West Roosevelt Road, Suite 3, West Chicago, Ill. 60185, phone (630) 293-6000 or jsc@illinois.gov.

The risk of adverse health effects depends on the levels of contaminants in the water and the length of exposure. Long-term exposure to these chemicals may result in an increased health risk to the liver and kidneys.

No violations of State of Illinois or federal drinking water standards have occurred in Marengo’s community water supply. For information concerning the community water supply contact Dean James at 217-338-6280 or via email at dean.james@illinois.gov.

This information has been compiled from historic data and is provided to the public to ensure full disclosure of state records.
State Health Department Recommends Water Well Testing for Private Wells Near Marengo

SPRINGFIELD, Ill. — The Illinois Department of Public Health (IDPH) is advising residents who obtain their drinking water from private wells as the Marengo (McHenry County) area test their water for possible groundwater contamination. Routine testing of Marengo’s community water supply wells by the Illinois Environmental Protection Agency (IEPA) indicates contaminants could be present in the area’s private wells.

The contaminants—bacteria and modified test-bytest kit (MTBE)—were detected at levels lower than the Illinois Groundwater Standard. Although the contaminants’ levels were lower than the standard, this is the same groundwater that serves private wells and it is possible the levels of the contaminants may be higher in private wells.

Residents with private wells located within the area (map below) north of US 20, east of Illinois 23, south of the Kishwaukee River, and west of the Marengo western city limit are encouraged to have their water tested for volatile organic compounds by a private laboratory.

For a list of laboratories certified to analyze drinking water for volatile organic compounds, interpretation of test results, contaminant health effects information, and recommendations for individuals who regularly consume well water, contact Joe O’Connor, IDPH West Chicago Regional Office, 251 West Roosevelt Road, Suite 5, West Chicago, IL 60185; phone (800) 293-4000 or e-mail: jarome@illinois.gov.

The risk of adverse health effects depends on the levels of contaminants in the water and the length of exposure. Long-term exposure to these chemicals may result in an increased health risk to the liver and kidneys.

No violations of state or federal drinking water standards have occurred in Marengo’s community water supply. For information concerning the community water supply contact Dean Smith at 217-538-5280 or via email at dean.smith@illinois.gov.

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City of Marengo Notification Area

Volatile organic compound (VOC) contamination site
State Health Department Recommends Water Well Testing for Private Wells Near Marengo

SPRINGFIELD, III. The Illinois Department of Public Health (IDPH) is advising residents who obtain their drinking water from private wells near the Marengo (McHenry County) area to test their water for possible groundwater contamination. Routine testing of Marengo’s community water supply wells by the Illinois Environmental Protection Agency (IDPA) indicates contaminants could be present in the area’s private wells.

The contaminants benzoic and methyl nitrite (MNBK) were detected at levels lower than the Illinois Groundwater Standard. Although the contaminants’ levels were lower than the standard, this is the same groundwater that serves private wells and it is possible the levels of the contaminants may be higher in private wells.

Residents with private wells located within the area (map below) south of U.S. 20 and east of Illinois 13, south of the Kishwaukee River, and west of the Marengo eastern city limits are encouraged to have their water tested for volatile organic compounds by a private laboratory.

For a list of laboratories certified to analyze drinking water for volatile organic compounds, interpretation of test results, contaminant health effects information, and recommendations for individuals who routinely consume well water, contact Joe O’Connor, IDPH West Chicago Regional Office, 265 West Roosevelt Road, Ridge 9, West Chicago, IL 60185, phone (630) 293-4000 or e-mail: joe.oconnor@illinois.gov.

The risk of adverse health effects depends on the levels of contaminants in the water and the length of exposure. Long-term exposure to these chemicals may result in an increased health risk to the liver and kidneys.

No violations of State or federal drinking water standards have occurred in Marengo’s community water supply. For information concerning the community water supply contact Dean瞬间 at 217-336-3500 or via email at dean.stainton@illinois.com.

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The Marengo-Union Times

News

Six Private Wells Contaminated

July 05, 2012
By Staff

In a press release on June 14, attorney General Lisa Madigan’s office stated that it had “obtained a court order to ensure that several Marengo, IL residents with private wells have immediate access to safe drinking water.”

“Recent tests indicate that elevated levels of cancer-causing agents, including chloroform/chlorite (TOC) and vinyl chloride, were present in area groundwater near the Kishwaukee Technologies Corporation at 300 North Street,” the statement continued. “According to the Illinois Environmental Protection Agency (IEPA), Arnold previously used dissolved solvents in its production process at a building located at the northwestern corner of the site.”

“The order, entered in McHenry County Circuit Court, supplies that Arnold and the property’s owner, 300 West LLC, provide drinking water to the owners of private wells located at four Ritz Road and two Railroad Street addresses in Marengo,” the statement said. “The court specifically ordered the defendants to confirm arrangements with the affected property owners to provide bottled water until the defendants receive written authorization from Madigan’s office, and the IEPA, that they may cease distributing.”

“Additionally, the court ordered the defendants to conduct water samples from at least one drinking water wells located on Ritz Road and Railroad Street in Marengo,” the release also stated. “The tests will sample for a number of chemicals, including TOC and vinyl chloride that may have seeped into the nearby wells.”

“This court order will ensure that the residents with private wells are supplied with safe drinking water by the defendants,” Madigan said in a statement. “I strongly advise residents to use the bottled water until the all clear signal is given that the wells are safe to use again.”

Marengo water contamination settlement discussed at public meeting

By SACHA BROWN sbrown@chicagoherald.com

MARENGO — The public met Thursday night to discuss terms of a proposed settlement for an ongoing dispute in Marengo involving contaminated groundwater.

Under the proposed terms of the settlement, the defendants — Arnold Engineering and 300 West — would be responsible for cleaning up the polluted groundwater and would provide filtration systems to some houses with wells that use contaminated water during the cleaning process.

Several parties were on hand to provide public updates, including the Illinois Attorney General’s Office, state Sen. Pam Althus, and McHenry County and Arnold Engineering, and many other public officials attended to hear the discussion.

“The point of this evening’s meeting is to allow you to know what this proposal is and add your comments,” Althus said.

State Rep. Jack Franks, D-Marengo, also helped organize the meeting but couldn’t be present because of important votes on the state budget in Springfield.

Kathryn Pantarle, who is handling the case for the Illinois Attorney General’s Office, said her office has not decided whether it would accept the proposed settlement terms as they currently stand because they still are being evaluated by the Illinois Environmental Protection Agency.

However, public response to the meeting would be among the factors that would determine whether the settlement is accepted, she said.

“We understand your frustrations. Our goal here is to obtain a safe drinking water remedy and to get the groundwater contamination cleaned up at the site,” Pantarle said.

Under the terms of the proposal, as related by 300 West attorney Movie Jablonski, the defendants would provide filtration systems to all properties that exceed IEPA standards for safe drinking water, currently limited to the Ritz Road homes and one on Railroad Road.

“We are taking full responsibility for the filtration systems — for their installation, for their maintenance and for their costs,” Jablonski said. “Filtration would be in place until groundwater meets acceptable testing standards.”

Other houses in the area, which currently receive bottled water from the defendants as part of an earlier court order, would not receive filtration systems unless future tests indicate the level of contaminants present exceeds acceptable IEPA standards.

Many residents were opposed to the condition that contamination levels need to exceed IEPA standards before affected residents receive a filtration system.

“I’ve damaged out properties, and I think that the only way to take back that damage is to give every house in that area safe water,” said Ritz Road resident Ann Anthony.

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Impacts and Applications
Flow modeling of recreational lake level fluctuations
Three-Oaks Recreation Area (TORA)

Figure 5. Map of computed groundwater levels in the upper sand and gravel aquifer from the TORA model showing the groundwater flow direction from northwest to southeast towards the Fox River. Measurements at USGS observation wells in May 2016 are shown in parentheses. Measured lake levels are displayed within the lakes boundaries. Contour interval is 5 feet.

Figure 7. Cross-section of the TORA model from north to south depicting the quarry lakes and the underlying glacial material and bedrock. Lake cells were allowed to interact with the surrounding sand and gravel aquifer and receive precipitation. Lake levels were then calculated in the model.

Figure 8. Plot of model computed water levels versus measured water levels. Computed water

from Hadley et. al., 2016, Illinois State Water Survey Contract Report to the City of Crystal Lake, Illinois
Three-Oaks Recreation Area (TORA)

Figure 5. Map of computed groundwater levels in the upper sand and gravel aquifer from the TORA model showing the groundwater flow direction from northwest to southeast towards the Fox River. Measurements at USGS observation wells in May 2016 are shown in parentheses. Measured lake levels are displayed within the lakes boundaries. Contour interval is 5 feet.

Figure 6. Cross-section of the TORA model from north to south depicting the quarry lakes and the underlying glacial material and bedrock. Lake cells were allowed to interact with the surrounding sand and gravel aquifer and receive precipitation. Lake levels were then calculated in the model.

Figure 8. Plot of model computed water levels versus measured water levels. Computed water
Online viewers/data services
Online viewers/data services

Online interactive products

McHenry  www.maps.isgs.illinois.edu/vxs/mchenry