Statewide Mapping of the Water Table Surface

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Source Water Assessment

- The water table mapping project is part of the MDEQ Source Water Assessment Program that will:
  - Identify the areas that supply public tap water.
  - Inventory contaminants and assess water system susceptibility to contamination.
  - Inform the public of the results.
The potential and known sources of contamination are assessed during the SWA process conducted by local public health officials, but three critical factors are not taken into account:

- How deep is the water table (*the receiving ground water for most contaminants, except in the case of abandoned wells*)?
- Relative to the contaminant sources, is the water table sloping toward the well or away from well?
- What is the gradient of the water table?
Water Table Mapping

- Very few actual observations of the water table elevation are available, most are clustered:
  - sewage permit investigations done by public health sanitarians
  - shallow piezometers installed around solid waste disposal sites
  - shallow piezometers installed at UST / LUST sites.

- This project is based on the simple concept that most hydrographic features in the Michigan landscape (i.e. lakes, streams and wetlands) are associated with the water table.
Water Table Mapping

Ephemeral stream
Intermittent stream
Perennial stream
Ephemeral flow zone
Intermittent flow zone
Perennial flow zone

Wet season water table
Dry season water table

Ephemeral
Intermittent
Perennial
Water Table Mapping

- Intersecting these hydrographic features with a DEM provides numerous estimates of the elevation of the water table.

- The best-available spatial resolution for DEMs throughout Michigan is currently 30 meters.
  - Derive water-table elevation estimates every 30 meters along stream channels, across lakes and palustrine wetlands.

- Where available, SSURGO digital soil data are processed to provide estimates of the depth to the seasonally low water table.
Water Table Mapping

Shiawassee County

Perennial lakes and streams
Water Table Mapping

Shiawassee County

30 m DEM
Water Table Mapping

Shiawassee County

Enlargement showing lakes and perennial streams and the 30 m elevation postings derived from the DEM.

Bad elevation points edited out
Water Table Mapping
SSURGO / MIRIS Digital Soil Data
SSURGO / MIRIS Digital Soil Data

For counties dominated by somewhat poorly drained and poorly drained soils, there are a large number of water table points.

Ingham County
SSURGO / MIRIS Digital Soil Data
Data Points for Interpolated Water Table Surface

30 meter horizontal posting

**Lakes**
\( (DEM_{val} - 0) \)

**Wet Soils**
\( (DEM_{val} - wtdepth) \)
\( [wtdepth \text{ range} = 0 – 6 \text{ ft}] \)

**Perennial Streams**
\( (DEM_{val} - 0) \)
SSURGO / MIRIS soils data are not available yet for many counties, but National Wetlands Inventory data are available statewide.

To be conservative, only the Palustrine systems are used.

Shiawassee County
National Wetlands Inventory

The elevations of the Palustrine areas are derived from the DEM every 30 m, but are set equal to (DEM elevation – 1 ft)
Water Table Mapping

For counties lacking digital soil data, the initial combined elevation point file, incorporated lakes, perennial streams and palustrine wetlands.
Water Table Mapping

- These point data from lakes, perennial streams and palustrine areas were imported into the SURFER program and the water table surface was interpolated using the linear kriging algorithm.

- Error assessment was performed by subtracting the interpolated water-table surface from the DEM surface.

  - Negative values show places where the interpolated water-table surface is above the land surface – an obvious boo boo.
Water Table Mapping

Legend:
- Wtd30m
- < - 10 feet
- -10 - -6 feet
- -5 - -1 feet
- 0 - 15 feet
- 16 - 30 feet
- 31 - 45 feet
- 46 - 60 feet
- 61 - 75 feet
- 76 - 83 feet
- No Data

AWWA 14th Ground Water Conference
February 25, 2003  David P. Lusch, Ph.D.
Water Table Mapping

- One solution was to provide a denser input point array for the kriging interpolator to react to.
  - We used intermittent streams for these additional points.
  - Their elevations were set to: (DEM value – 6.5 ft)
Water Table Mapping

Shiawassee County

Intermittent streams
Shiawassee County

Enlargement showing lakes, perennial streams and intermittent streams and the 30 m elevation postings derived from the DEM.
Water Table Mapping

- The enhanced point data set included:
  - lakes
  - perennial streams
  - intermittent streams
  - either wet soils or palustrine areas

- These (x, y, z) points were imported into the SURFER program and the water table surface was interpolated using the linear kriging algorithm.

- Error assessment shows many fewer errors and those that remain are smaller in magnitude.
Water Table Mapping

Including the intermittent streams to obtain many additional points of control greatly improved the interpolated surface.
Water Table Mapping

Shiawassee County

Interpolated water table surface.
Water Table Mapping

Current status

Status of SWAP
Water Table Processing

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Water Table Mapping

Two map products will be delivered to the local health departments:

1. Depth to the water table.
2. Water table surface contours making gradient magnitude and flow direction more obvious.
Water Table Mapping

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1. Depth to the water table.
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In support of watershed studies, the data are now being reprocessed using a six-mile buffer of additional points from adjacent counties.
Water Table Mapping

- Six-mile buffer of additional points from adjacent counties.
Water Table Mapping

- Six-mile buffer of additional points from adjacent counties.

Red = contours from Ingham County
Blue = contours from Jackson County

SW corner of Ingham County
Water Table Mapping
Water Table Mapping

The End

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This presentation is available at:
http://www.crs.msu.edu/datadocs.htm