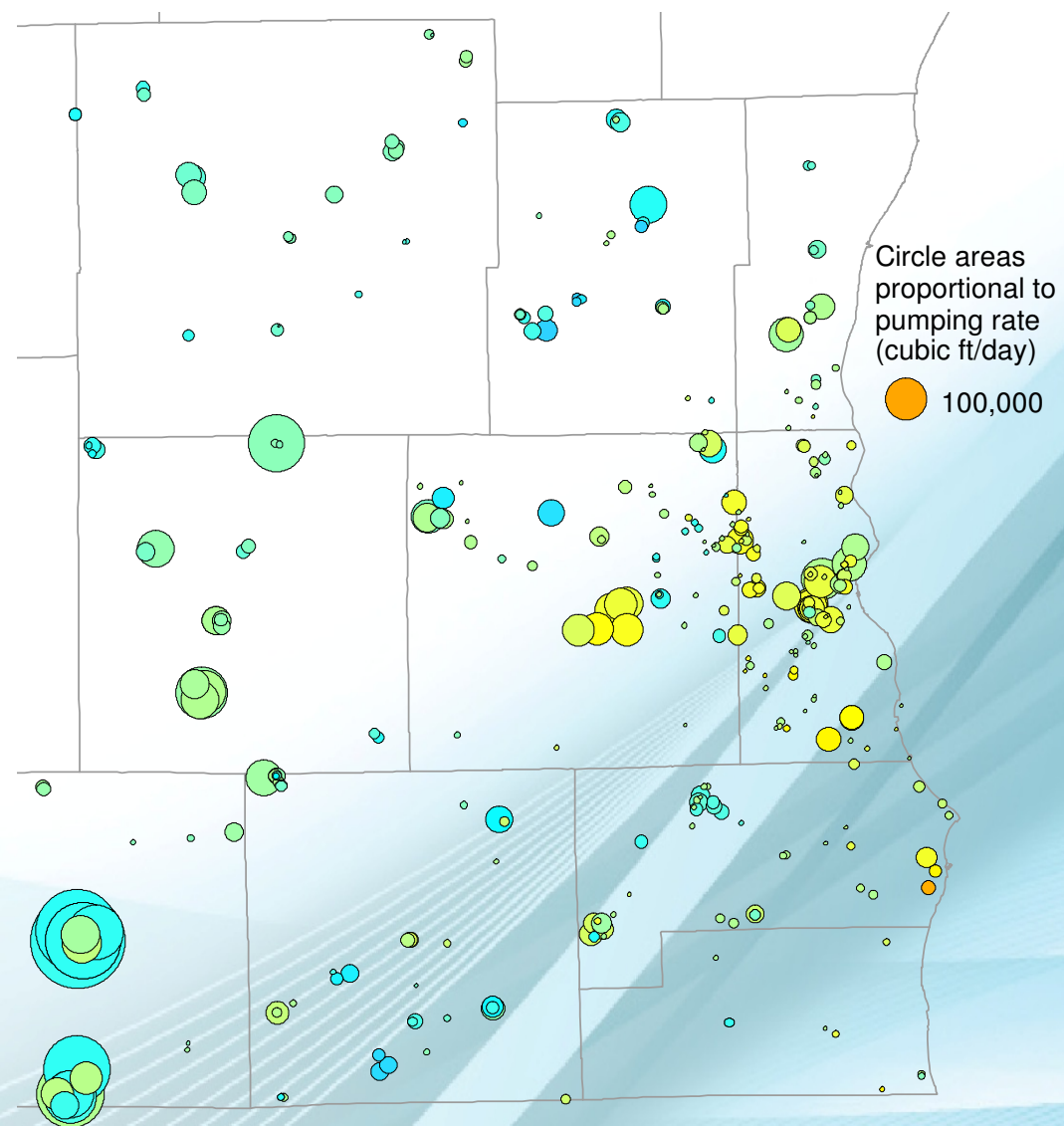


Water Levels in the Sandstone Aquifer
(feet above sea level)

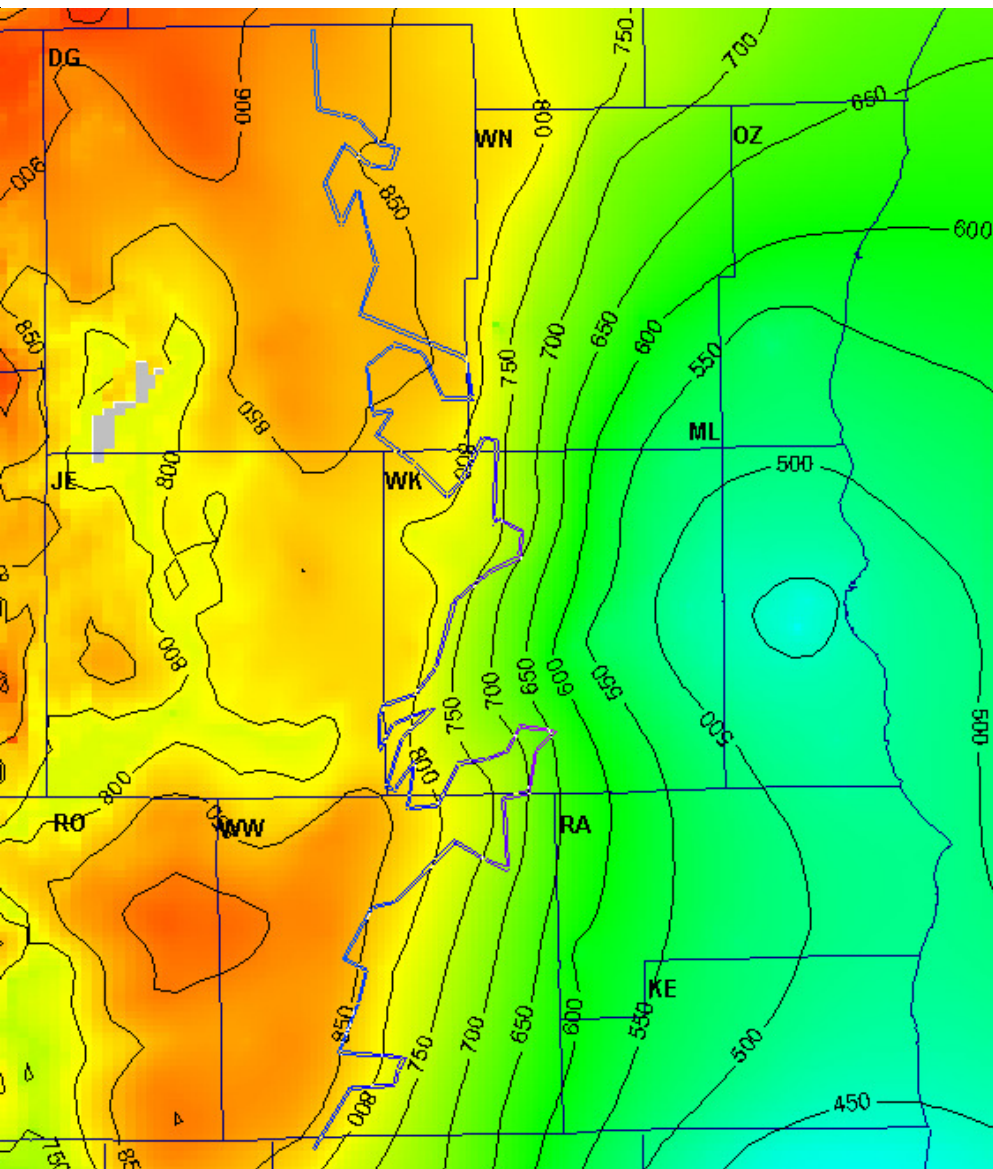


Well Locations and Pumping Rates

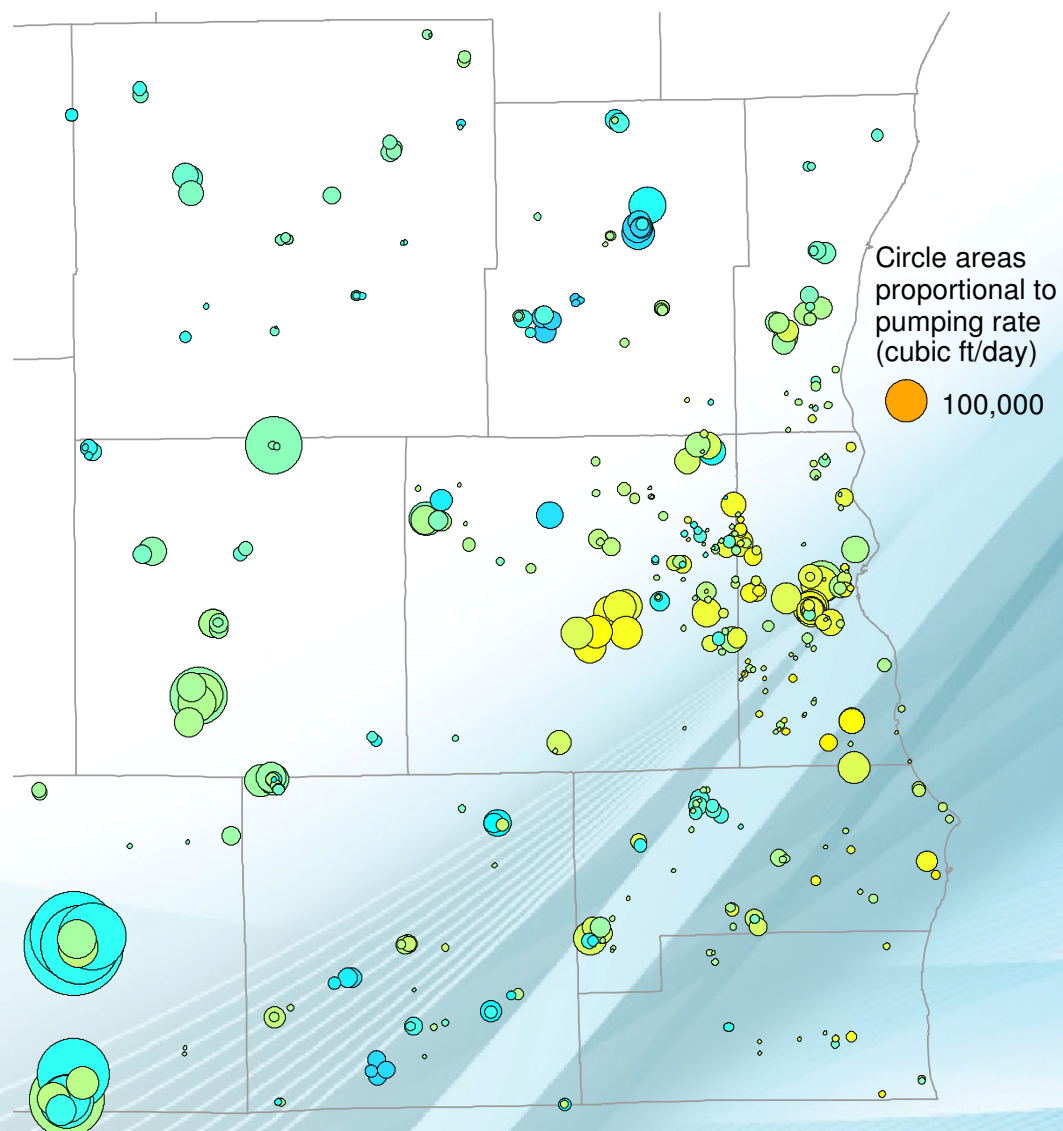
Shallow

Deep

1961-1965



Water Levels in the Sandstone Aquifer
(feet above sea level)

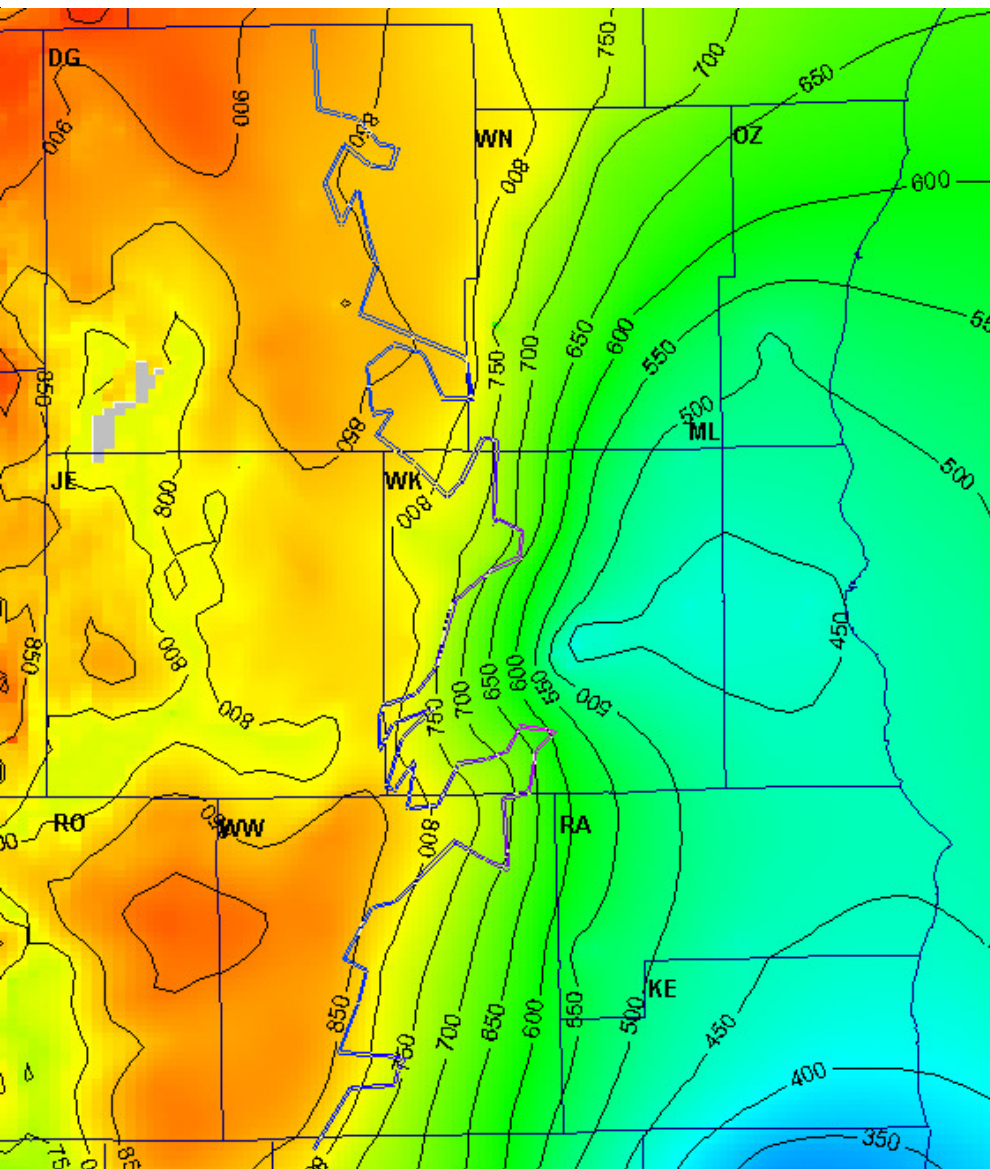


Well Locations and Pumping Rates

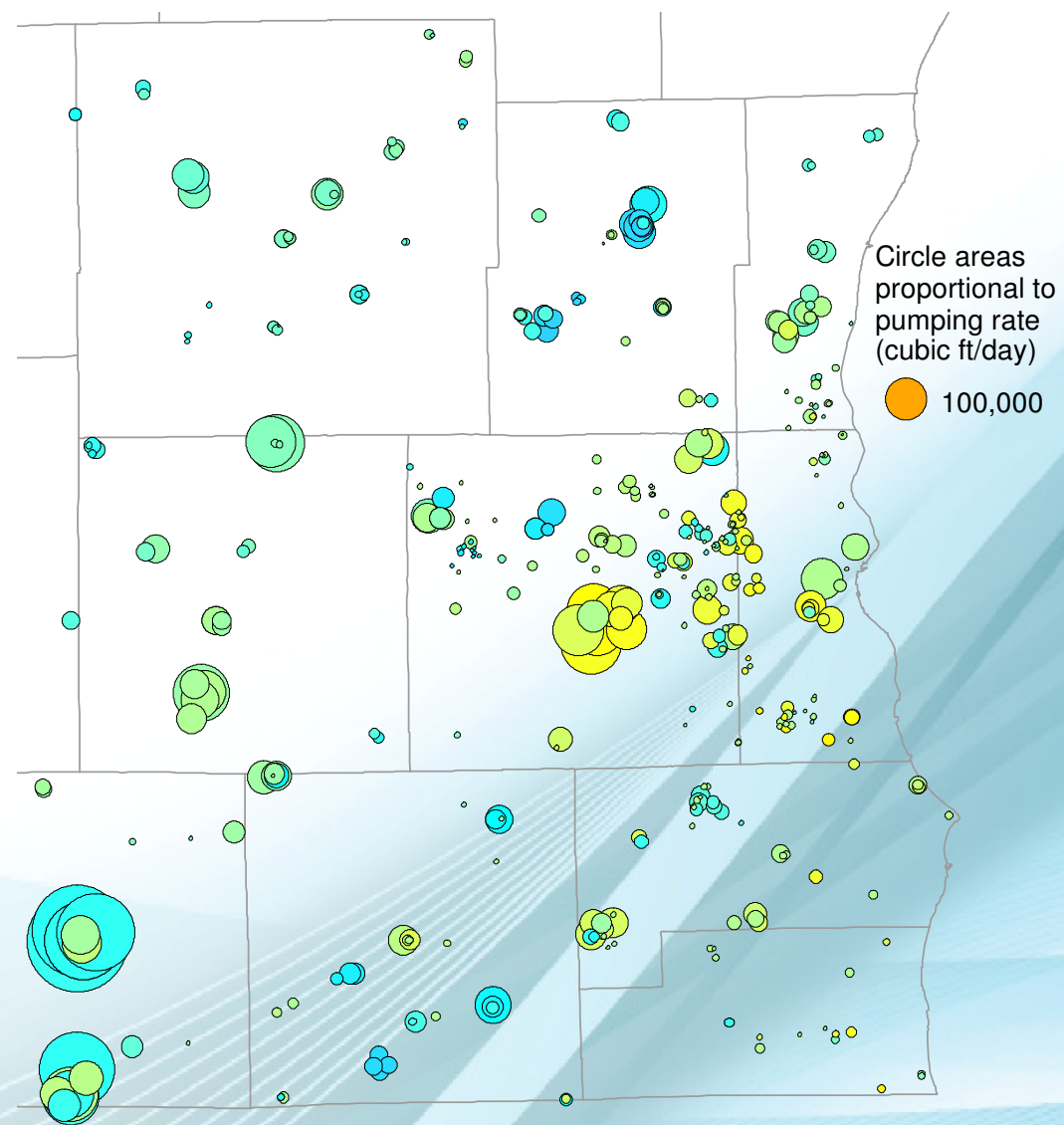
Shallow

Deep

1965-1970



Water Levels in the Sandstone Aquifer
(feet above sea level)

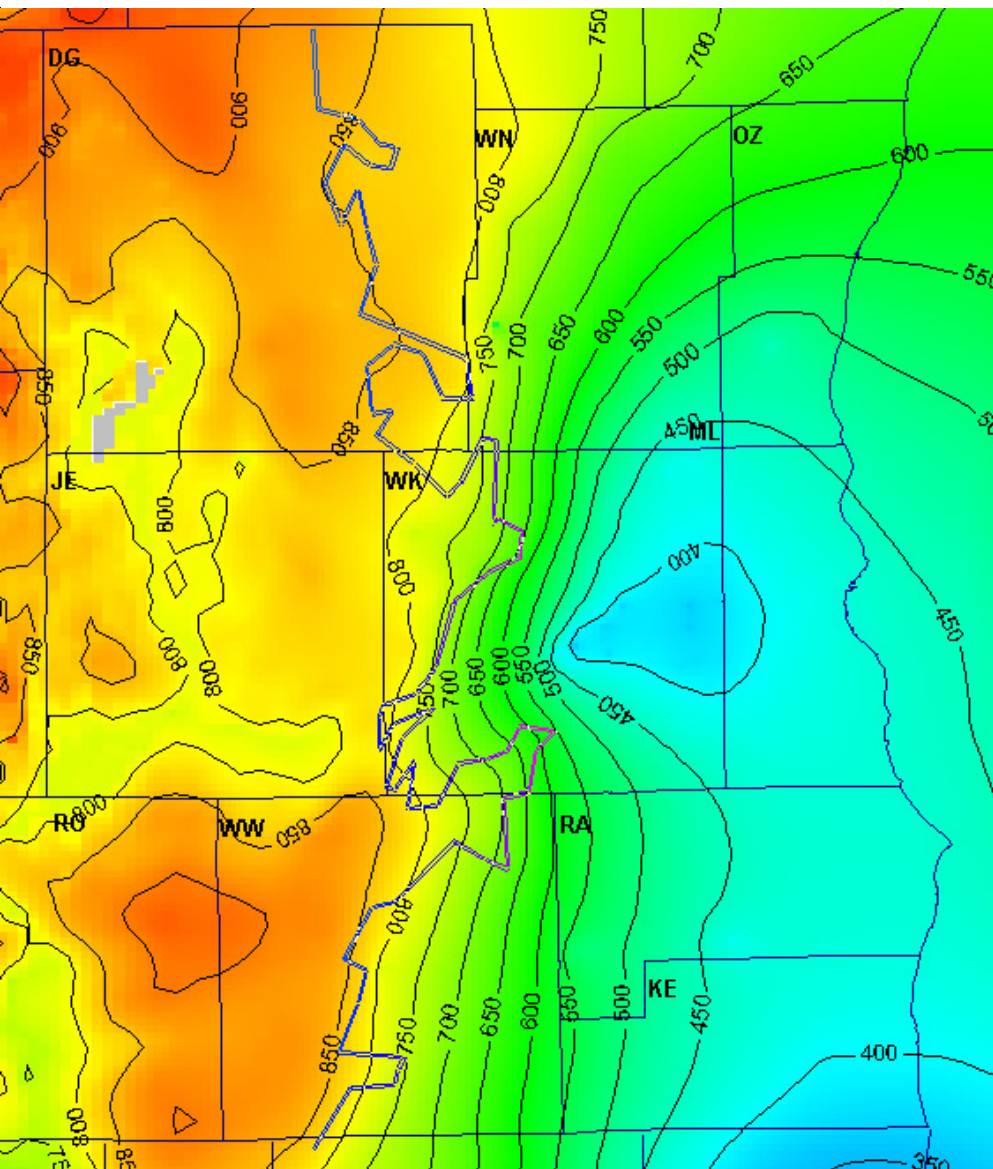


Well Locations and Pumping Rates

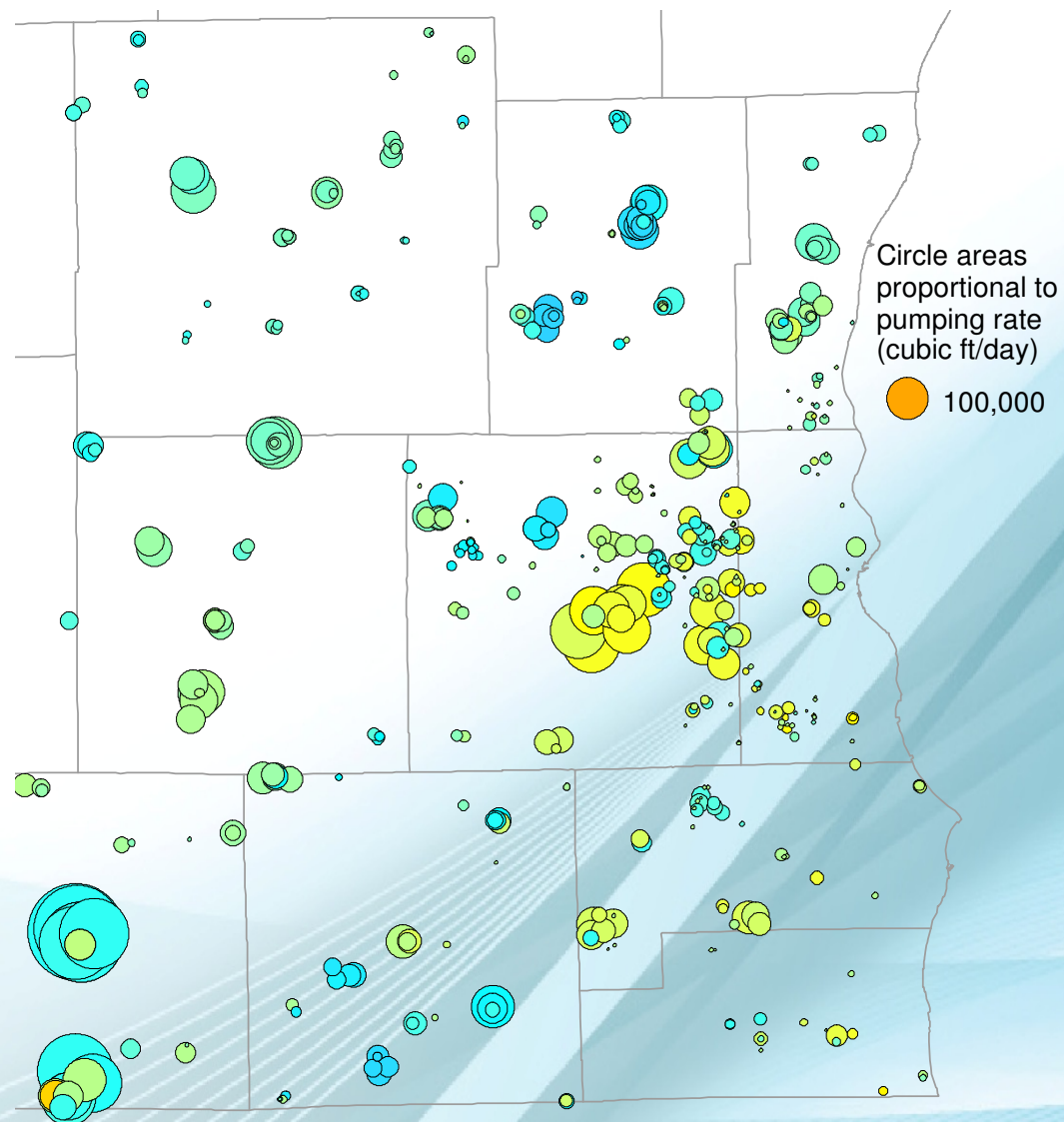
Shallow

Deep

1970-1980



Water Levels in the Sandstone Aquifer
(feet above sea level)

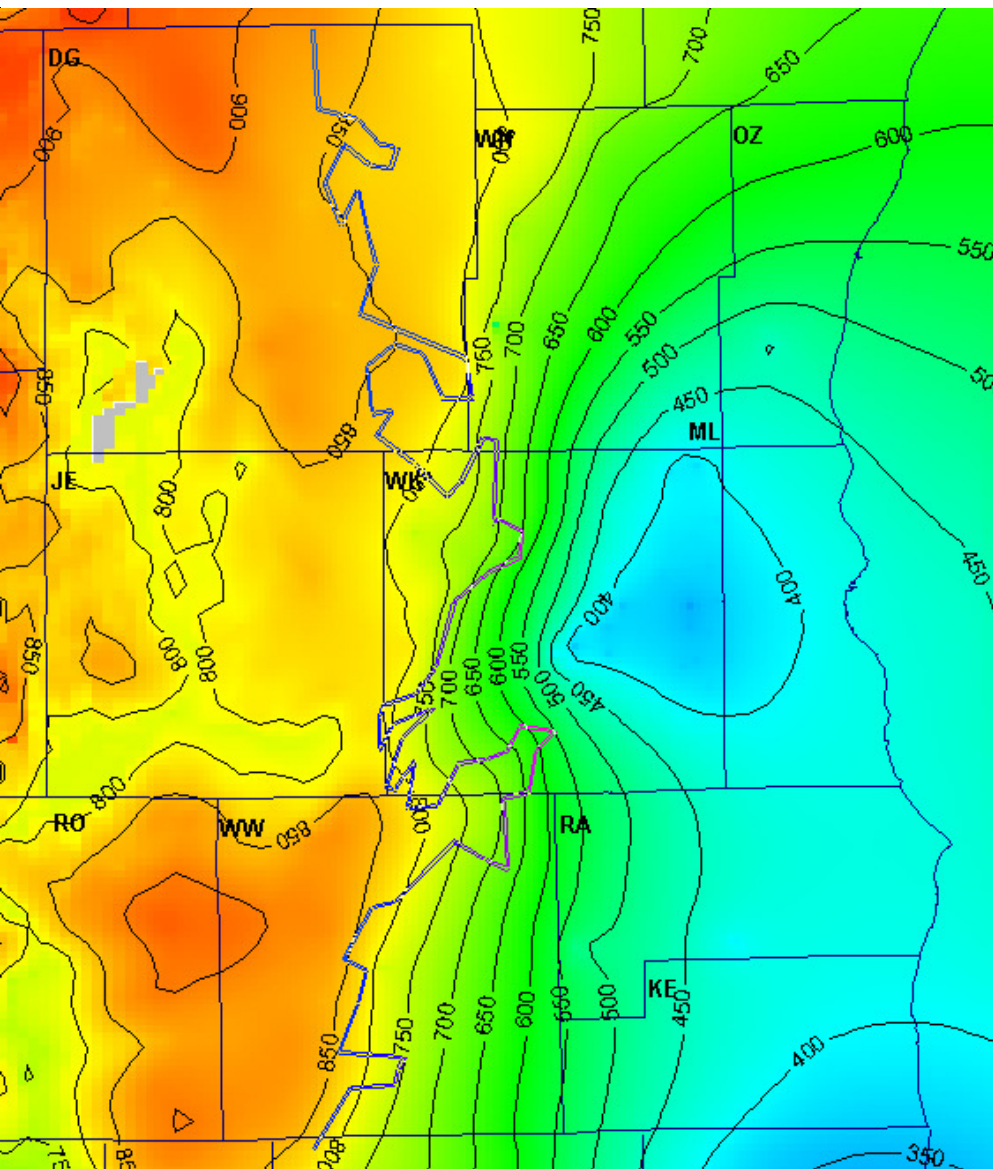


Well Locations and Pumping Rates

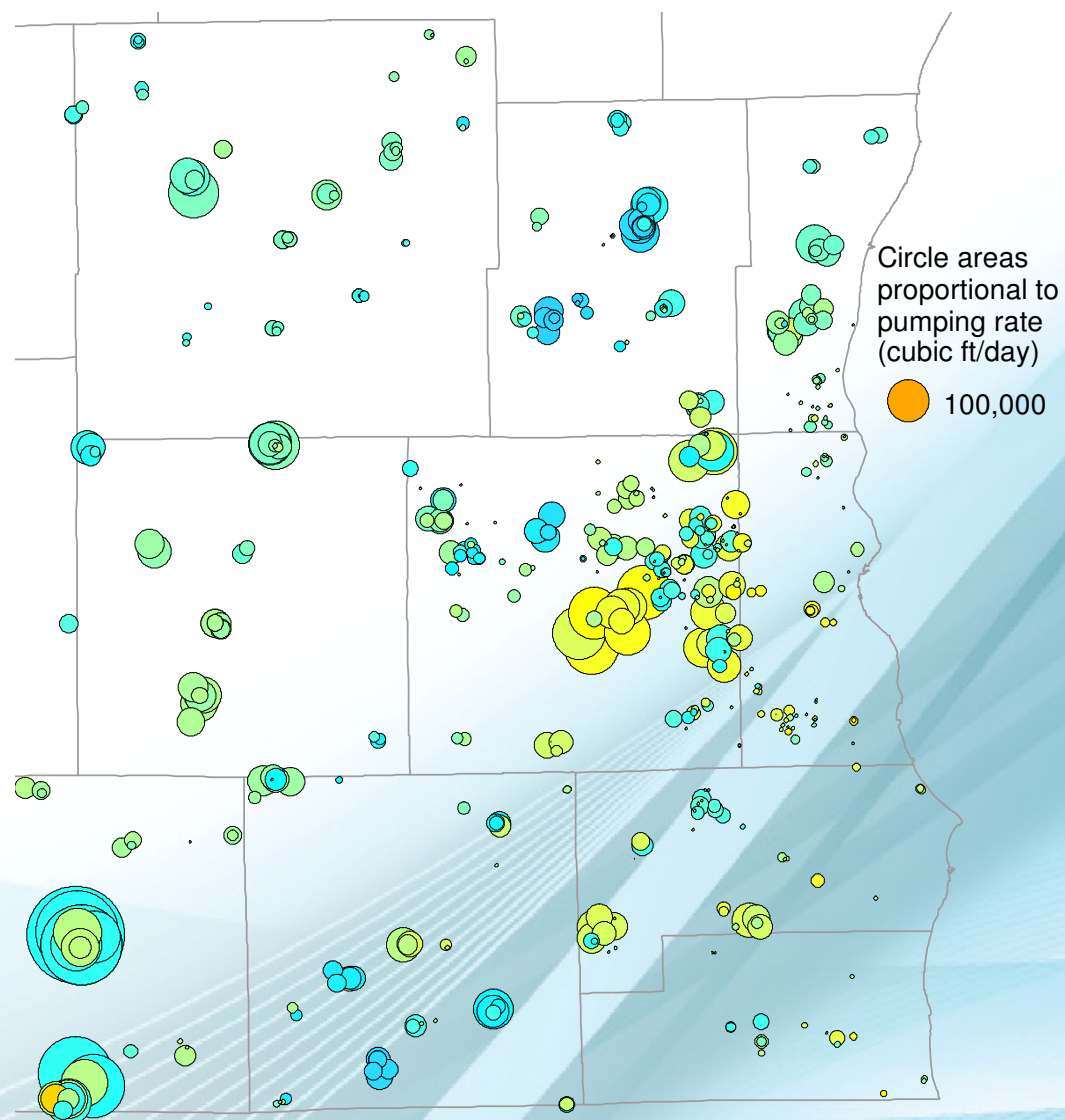
Shallow

Deep

1980-1985



Water Levels in the Sandstone Aquifer
(feet above sea level)

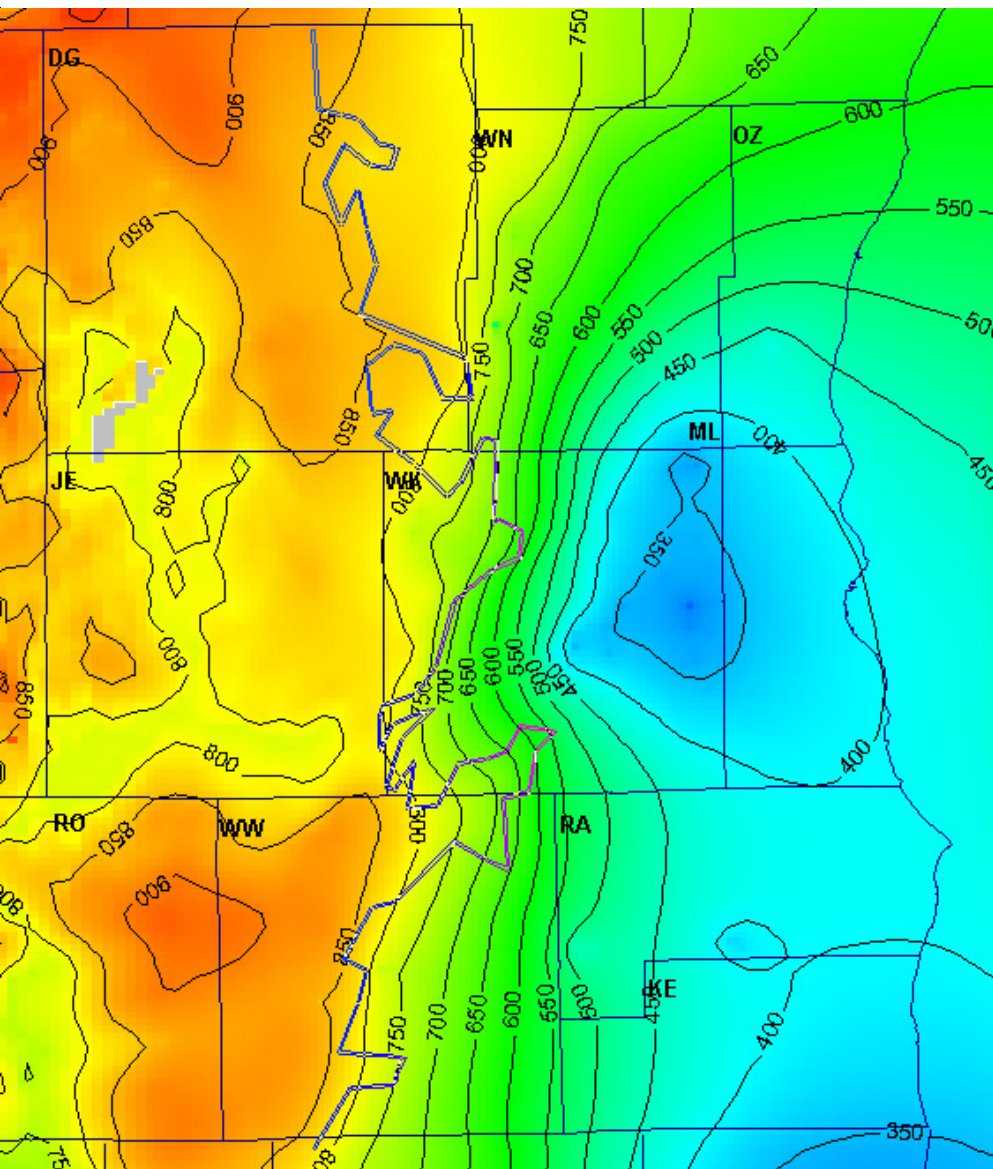


Well Locations and Pumping Rates

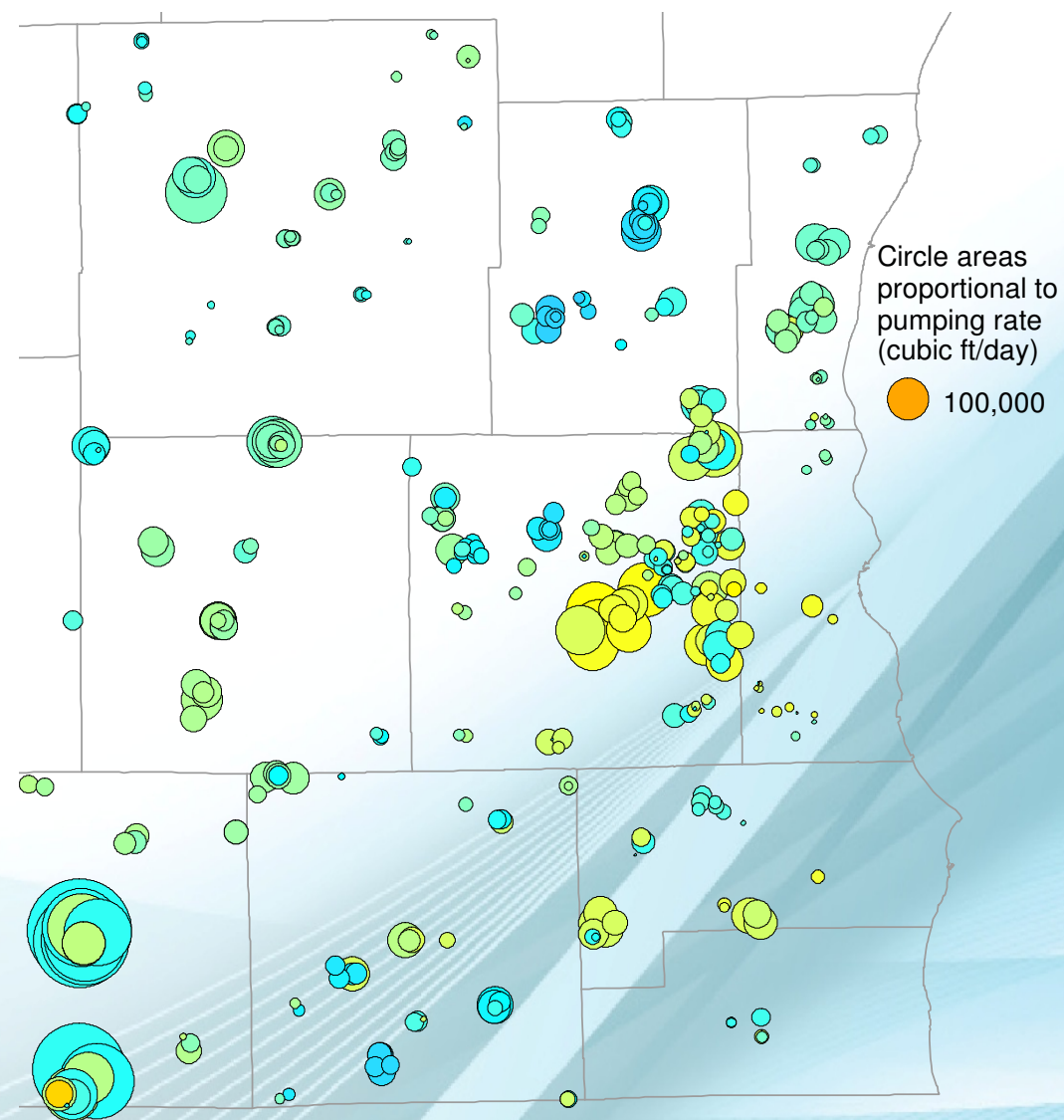
Shallow

Deep

1985-1990



Water Levels in the Sandstone Aquifer
(feet above sea level)

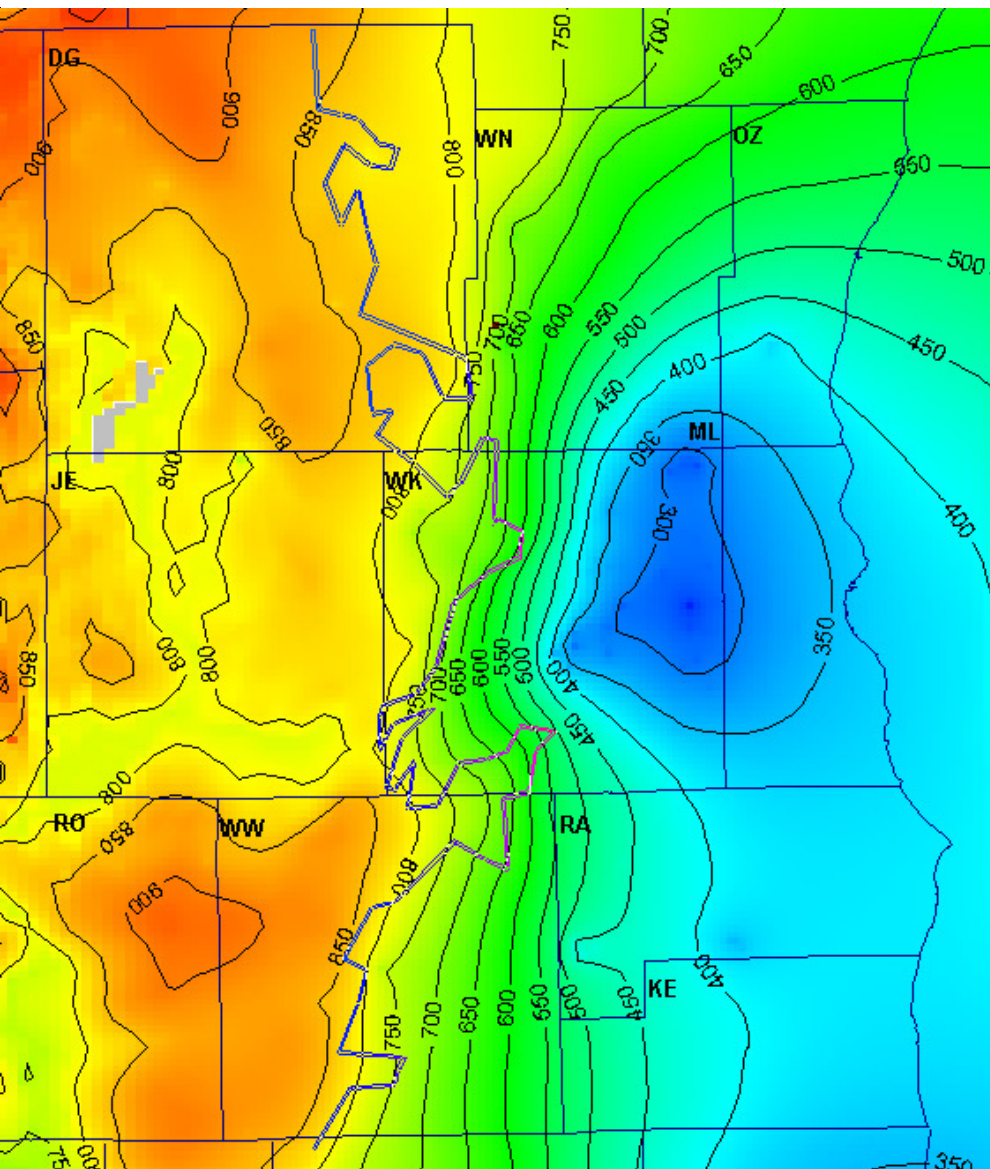


Well Locations and Pumping Rates

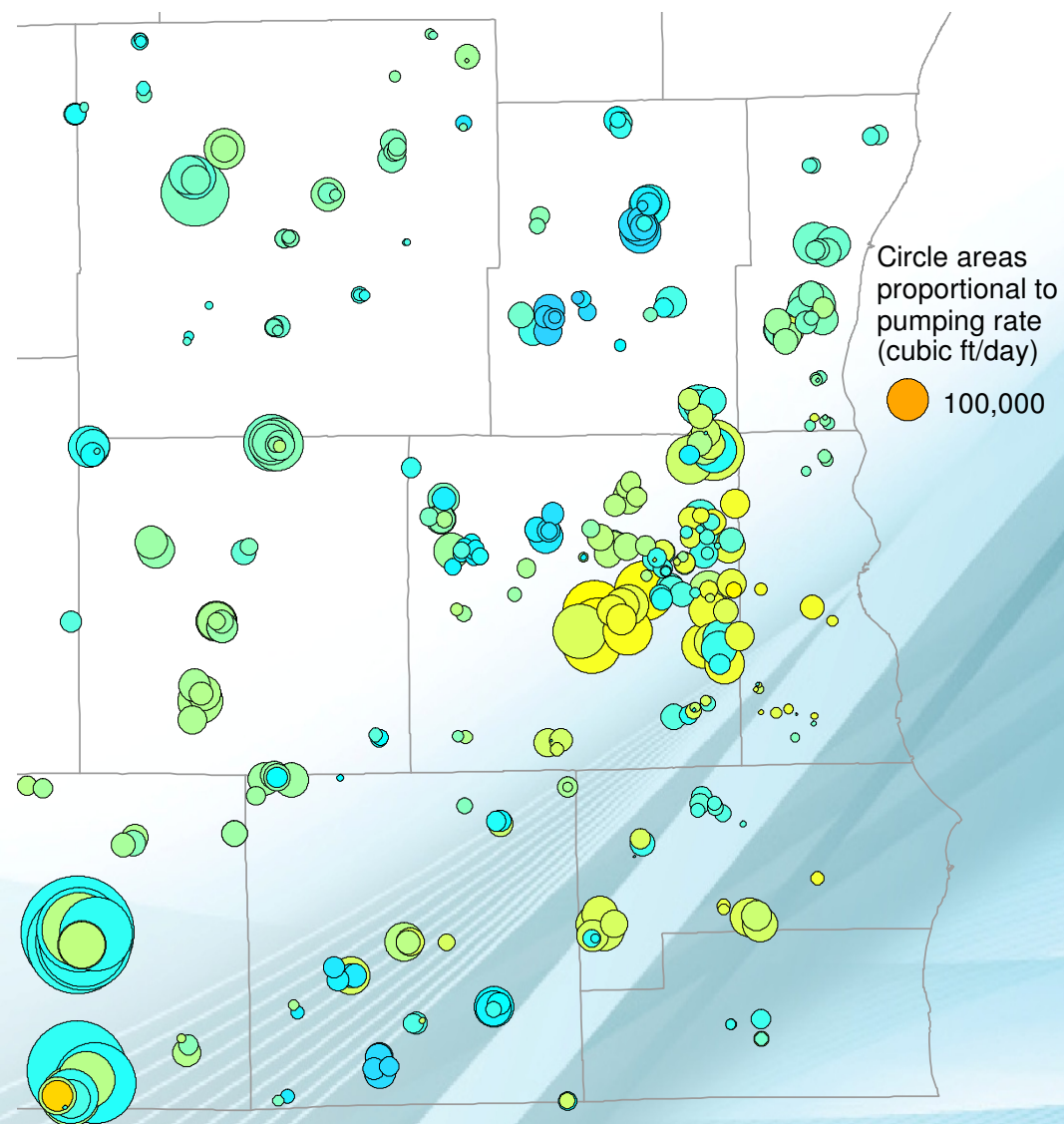
Shallow

Deep

1990-2000



Water Levels in the Sandstone Aquifer
(feet above sea level)

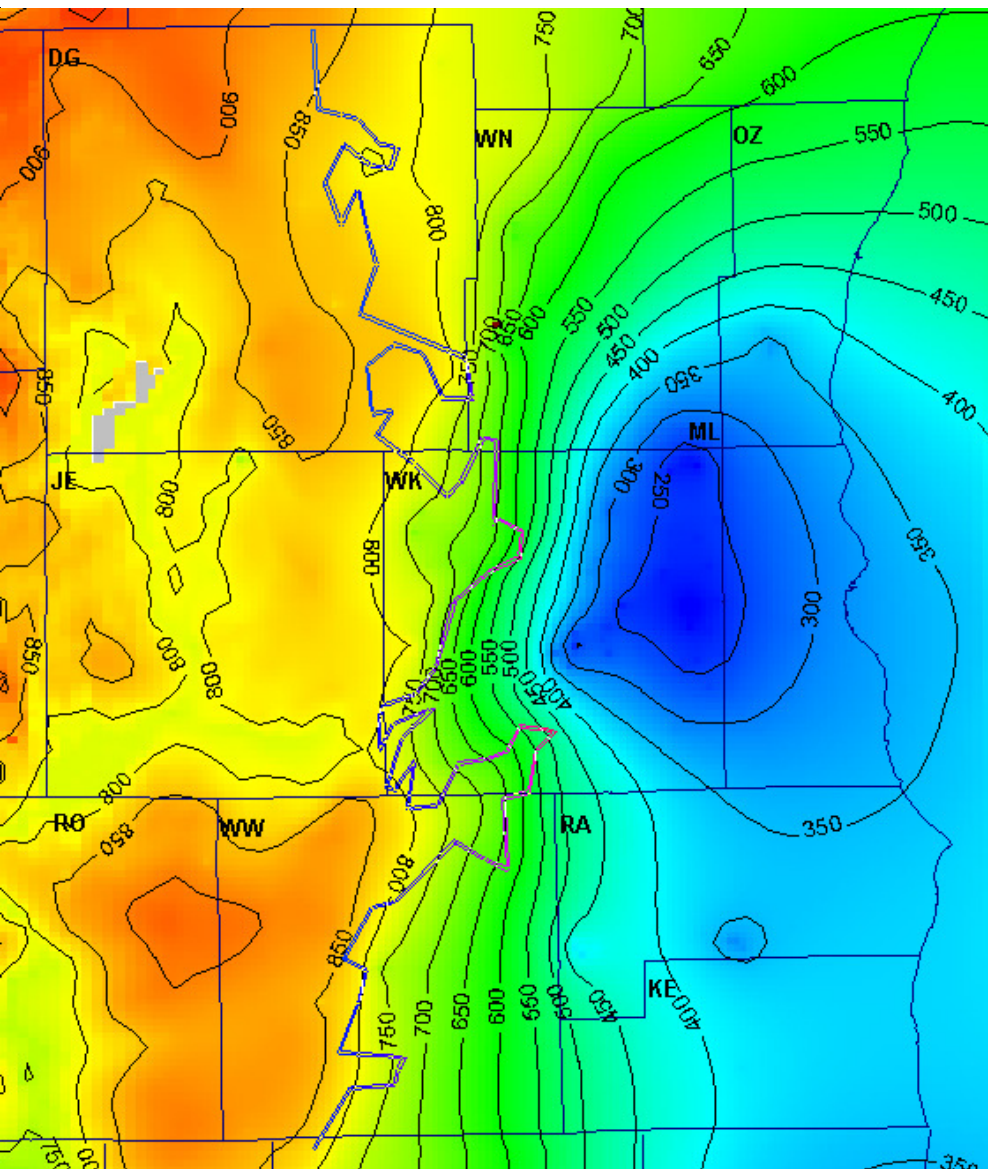


Well Locations and Pumping Rates

Shallow

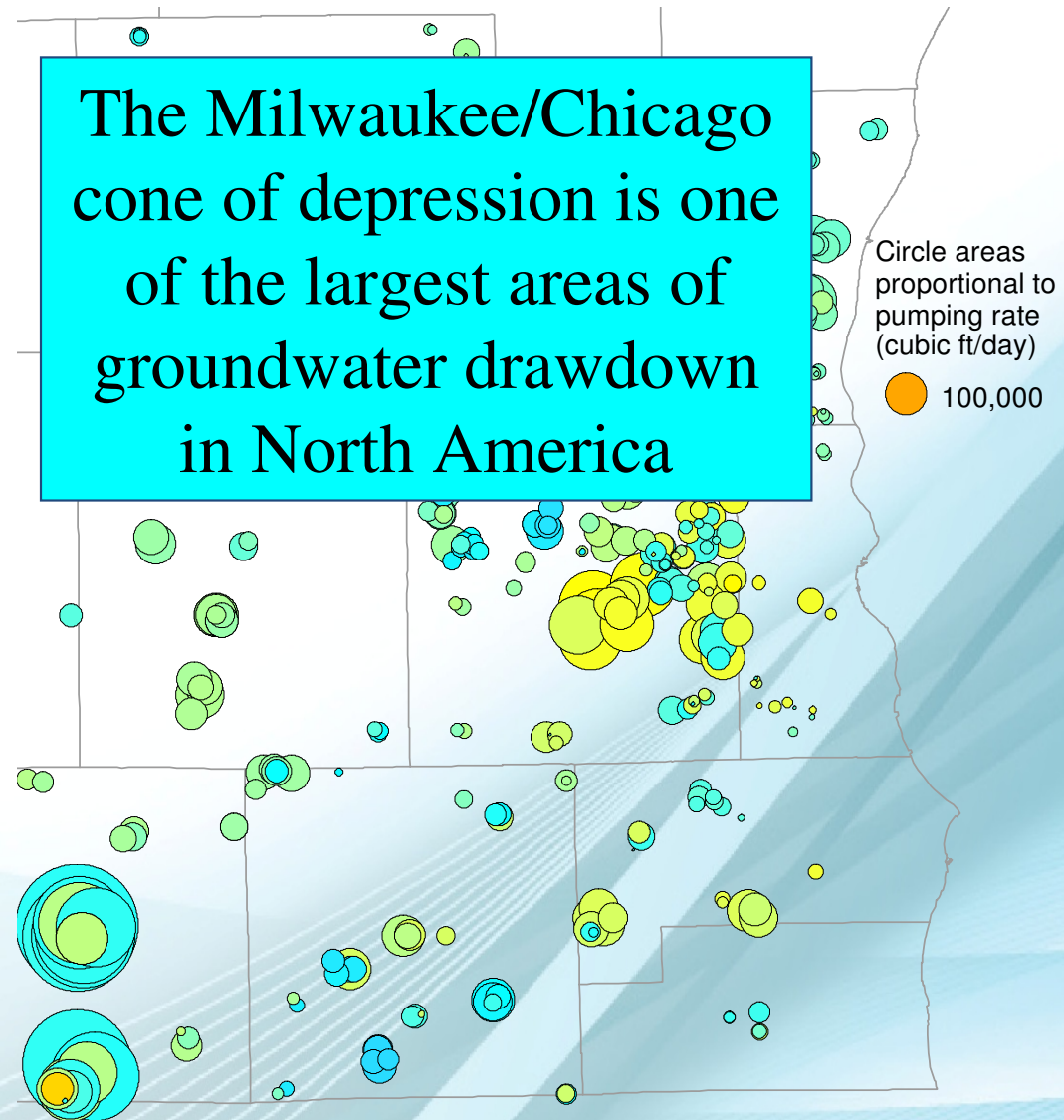
Deep

2000-2010



Water Levels in the Sandstone Aquifer
(feet above sea level)

The Milwaukee/Chicago
cone of depression is one
of the largest areas of
groundwater drawdown
in North America



Well Locations and Pumping Rates

Shallow

Deep

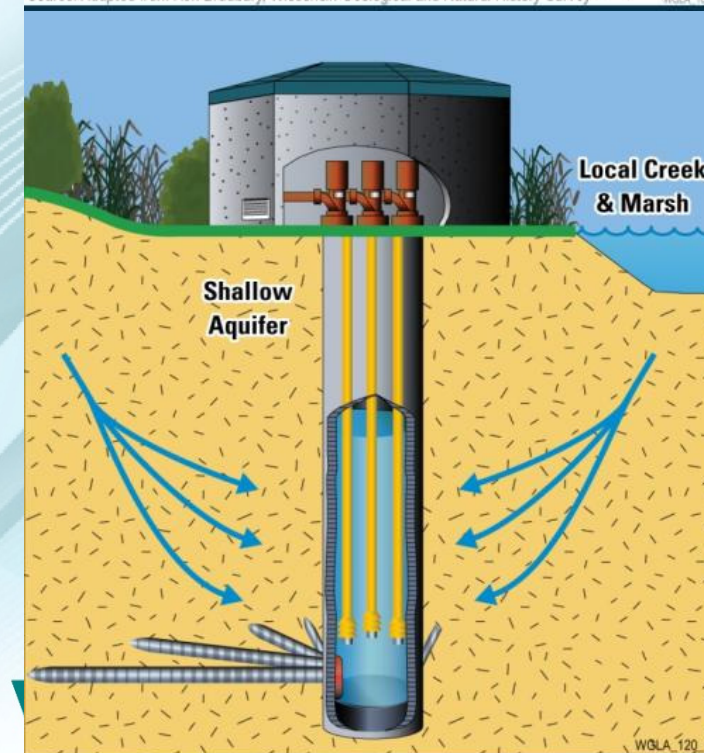
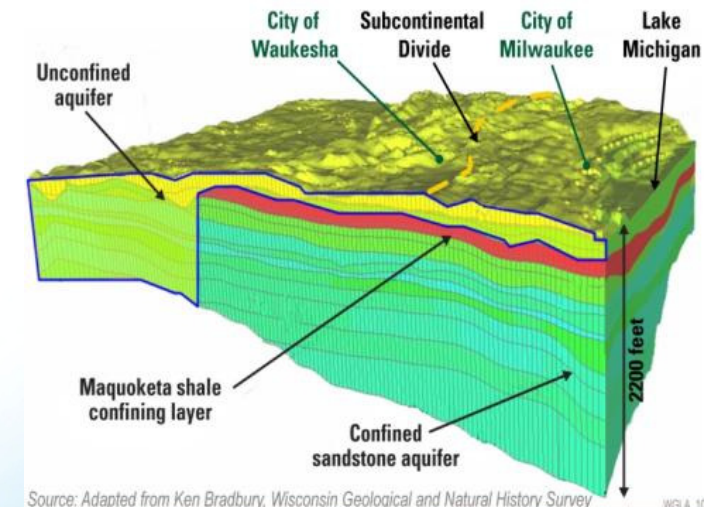
2010-2020

LEGISLATIVE AND LEGAL IMPACTS

- Act 310 – Groundwater Quantity Act (2003)
 - Groundwater Advisory Committee (Completed 2007)
- Great Lakes Compact
 - Wisconsin Implementation Legislation
- Lake Beulah Management District
 - State Supreme Court Decision
 - DNR Must consider impacts when issuing high capacity well permits
- Shallow Test Wells
 - Town of Waukesha Action
- All New Water Supply Alternatives are Outside the Current City Limits

OUR NEED FOR WATER

- Deep groundwater levels are declining (over 600 ft below ground) and capacity decreasing.
- Deep groundwater water quality is getting worse (High radium, salts). Court order to comply with radium by 2018.
- Deep groundwater wells are old (30 to 60 years). Several are no longer usable.
- Deep groundwater is not sustainable for the long-term.
- Shallow wells treat for iron/manganese, and recently arsenic has been discovered.
- Pumping shallow wells adversely impact wetlands and streams.
- Conservation has reduced water demand, but Waukesha needs more water for the future.



WHAT ALTERNATIVES HAVE BEEN EVALUATED?

Water Supply Alternatives Screening

14 Alternatives Considered

Deep Confined Aquifer
Deep Unconfined Aquifer
Shallow Groundwater
Dolomite Aquifer
Fox River
Rock River
Lake Michigan
Dam On The Fox or Rock River
Waukesha Quarry
Waukesha Springs
Pewaukee Lake
Milwaukee River
Wastewater Reuse
Conservation

Initial screening for water quantity or major environmental and regulatory issues. Eliminated 9 alternatives

5 Alternatives after Initial Screening

Lake Michigan
Shallow Aquifer
Deep Confined Aquifer
Deep Unconfined Aquifer
Shallow/Deep Aquifer

Eliminated 2 alternatives based on adverse environmental impact to Great Lakes ecosystem unsustainability, public health, and implementability.

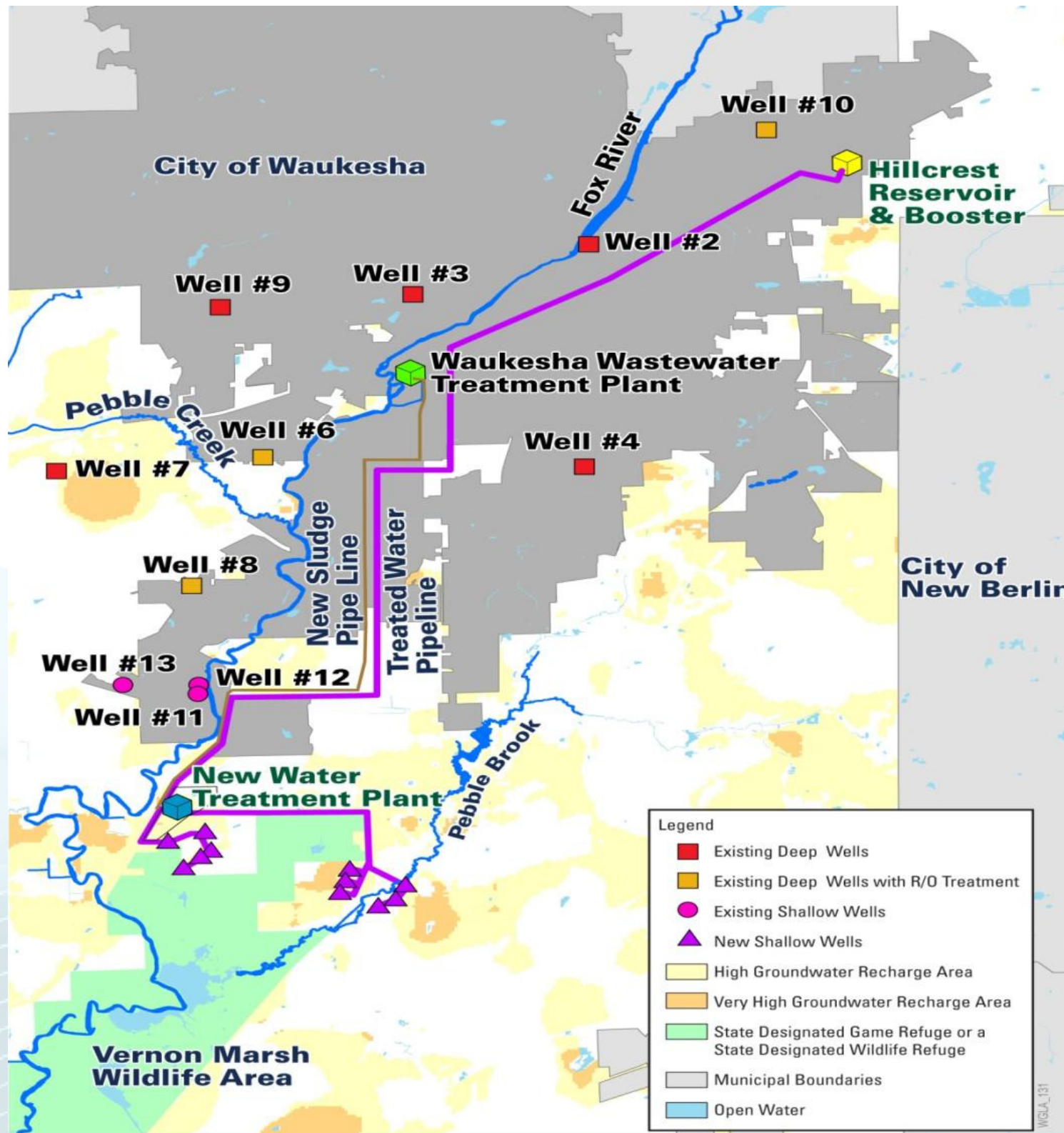
Alternatives Evaluated Further

Shallow/Deep Aquifer
Shallow Aquifer and RBI
Unconfined Deep Aquifer
Multiple Source
Lake Michigan/Shallow Aquifer
Lake Michigan

WATER SUPPLY ALTERNATIVE 1 – DEEP AND SHALLOW AQUIFER

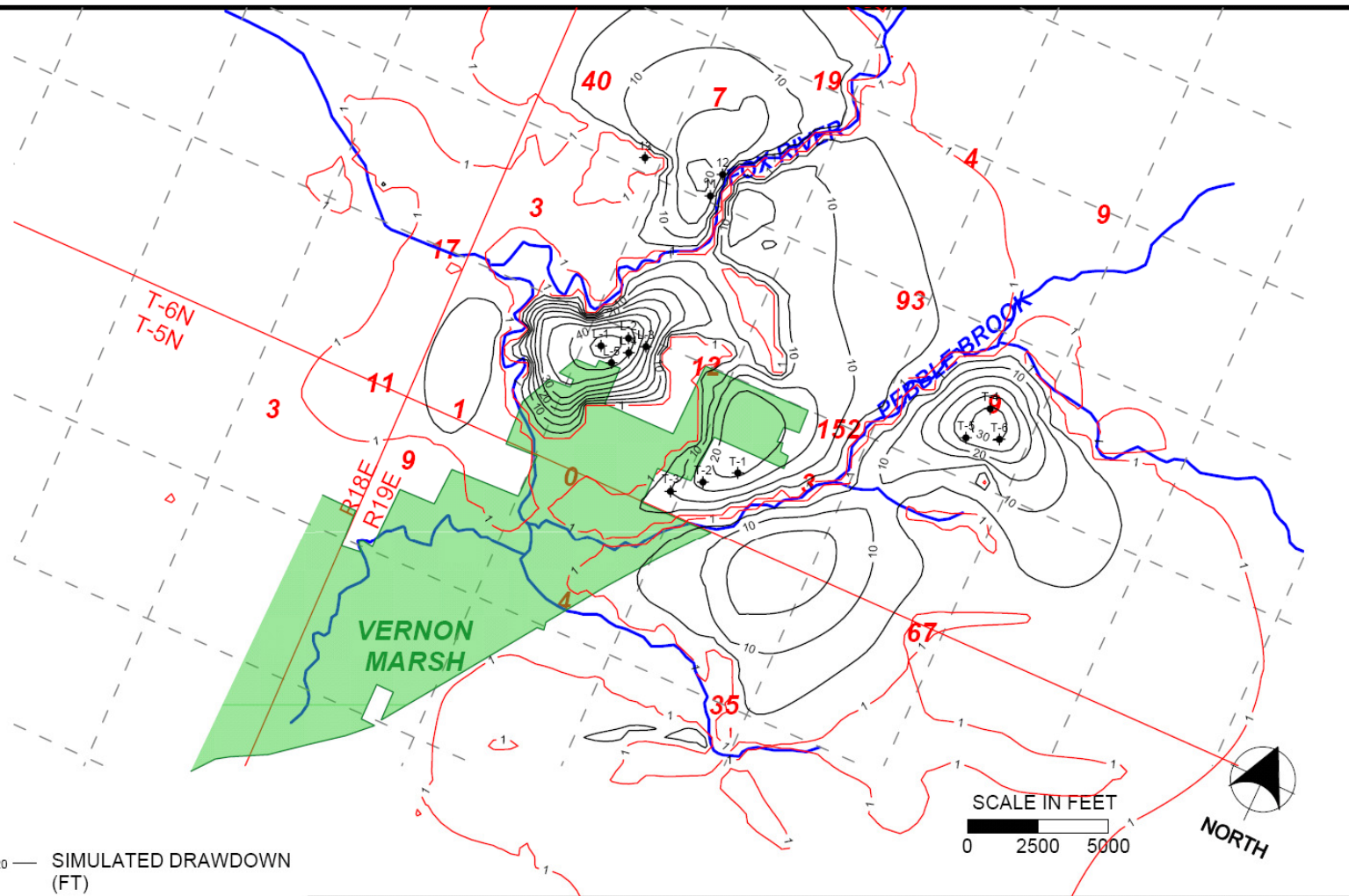
(\$189 MILLION)

- Continued use of deep wells with additional treatment.
- Develop shallow wells south of Waukesha near Vernon Marsh
- New groundwater treatment plants



Shallow/ Deep Combination

6.4 MGD Total Shallow (4.5 MGD Deep) – 1.9 MGD Lathers, 1.1 MGD Existing Wells, 3.4 MGD New Wells



- Maximum Drawdown exceeds 50 feet
- Baseflow Reduction to Fox River greater than 140%
- Baseflow Reduction to Pebble Brook greater than 60%
- Pebble Brook is designated a trout stream and is given special protections by Wisconsin Law

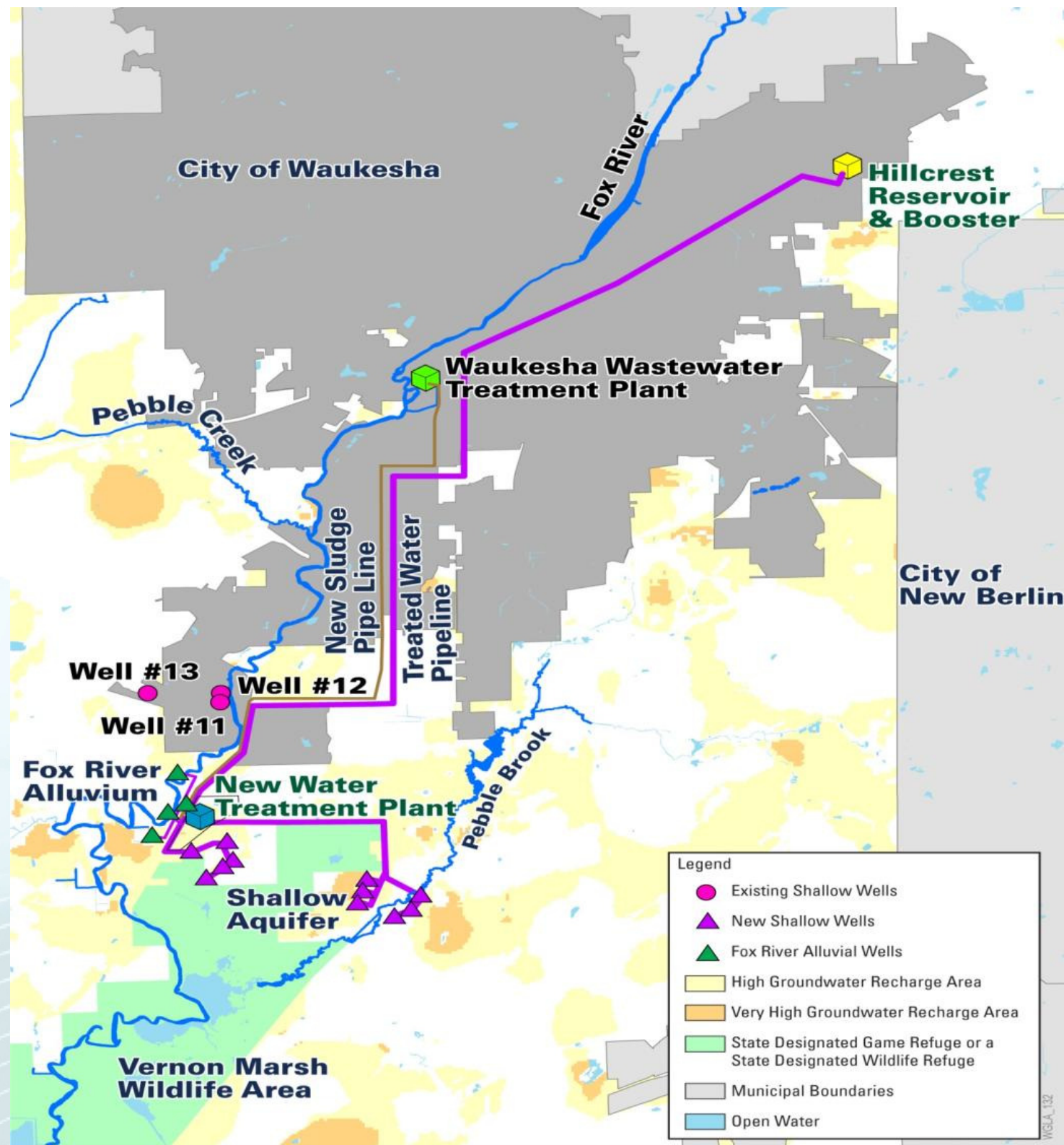


CITY OF WAUKESHA WAUKESHA, WISCONSIN DRAWDOWN SCENARIO 1-2			FIGURE 2
DRAWN BY	PROJ. No.	DATE	FILE
RN	10-201	24 MAR 10	RUN 1-2 DDN

WATER SUPPLY ALTERNATIVE 2 – SHALLOW AQUIFER AND RBI

\$184 MILLION

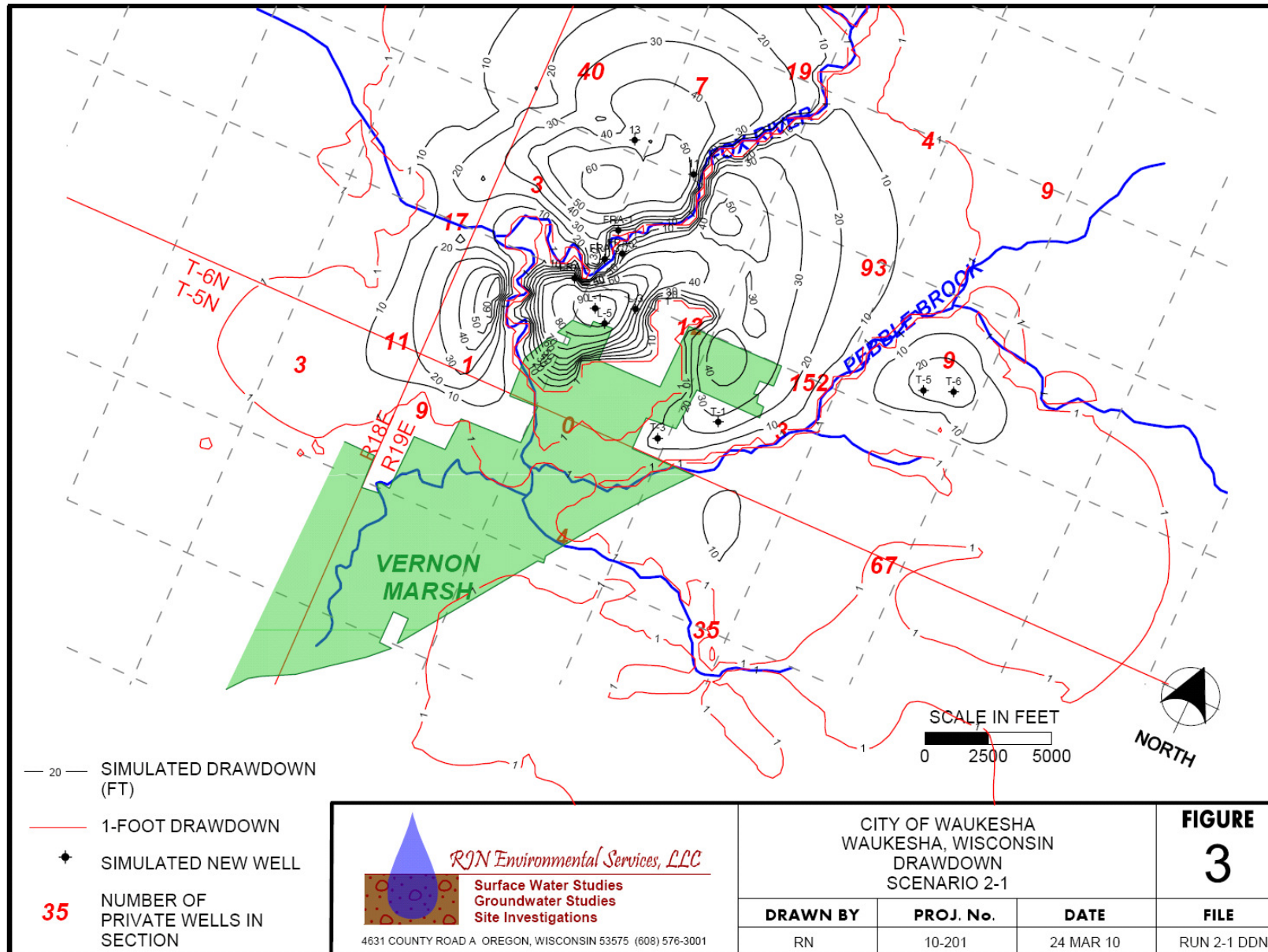
- Discontinue use of deep wells
- Add shallow wellfield South of Waukesha near Vernon Marsh and along the Fox River
- New central treatment plant



Shallow/RBI Combination

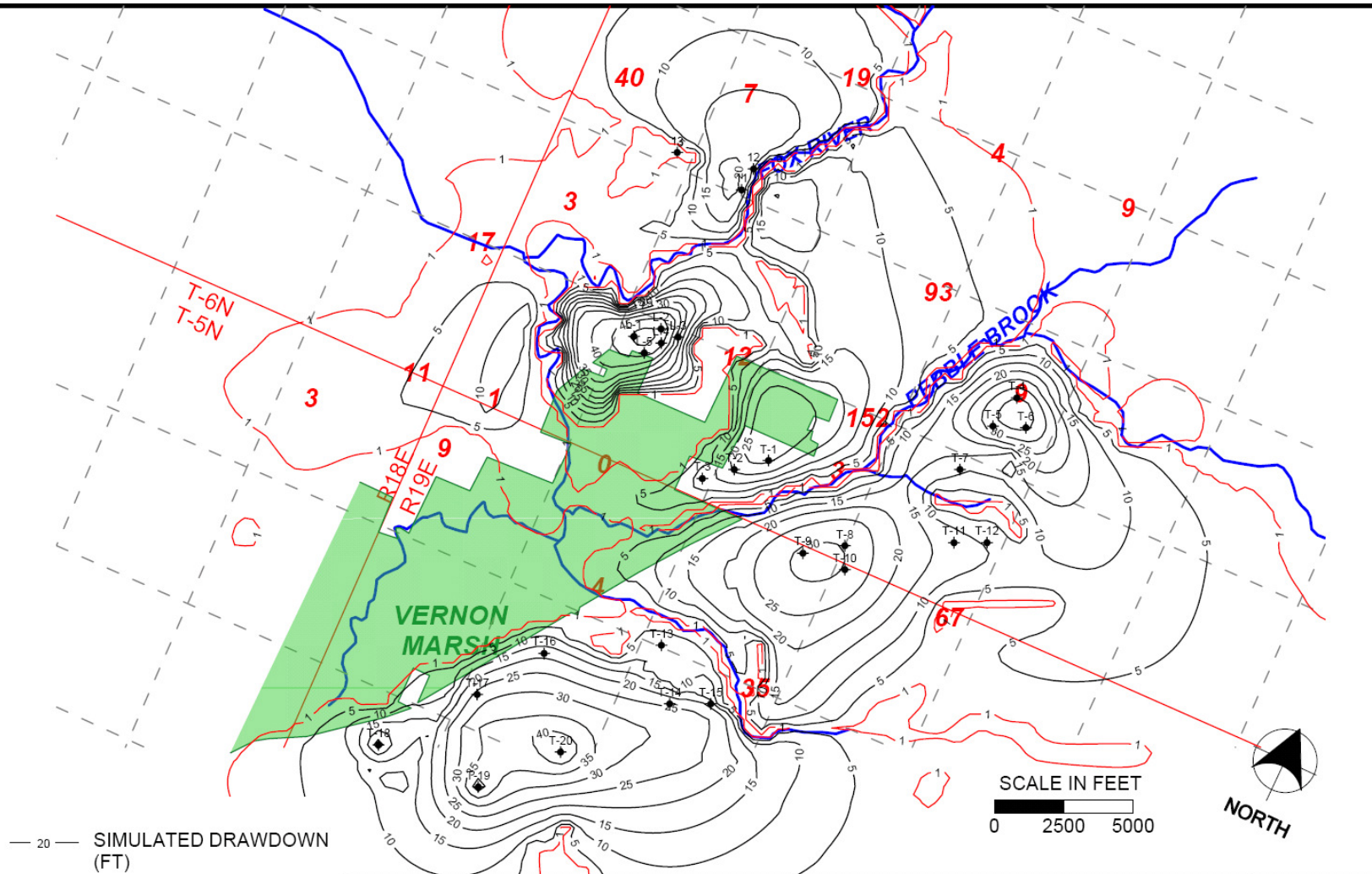
10.9 MGD Total – 3 MGD Lathers, 1.2 MGD Existing Wells,
2.2 MGD New Wells, 4.5 MGD Fox River Alluvium

- Maximum Drawdown exceeds 100 feet
- Baseflow Reduction to Fox River greater than 340%
- Baseflow Reduction to Pebble Brook greater than 50%
- Pebble Brook is designated a trout stream and is given special protections by Wisconsin Law
- Vernon Marsh and Mill Brook are significantly impacted



Shallow Well Alternative 10.9 MGD Total – 1.95 MGD Lathers, 1.2 MGD Existing Wells, 7.8 MGD New Wells

- Maximum Drawdown exceeds 55 feet
- Baseflow Reduction to Fox River greater than 150%
- Baseflow Reduction to Pebble Brook greater than 80%
- Pebble Brook is designated a trout stream and is given special protections by Wisconsin Law
- Vernon Marsh and Mill Brook are significantly impacted



20 SIMULATED DRAWDOWN (FT)
1-FOOT DRAWDOWN
SIMULATED NEW WELL
35 NUMBER OF PRIVATE WELLS IN SECTION

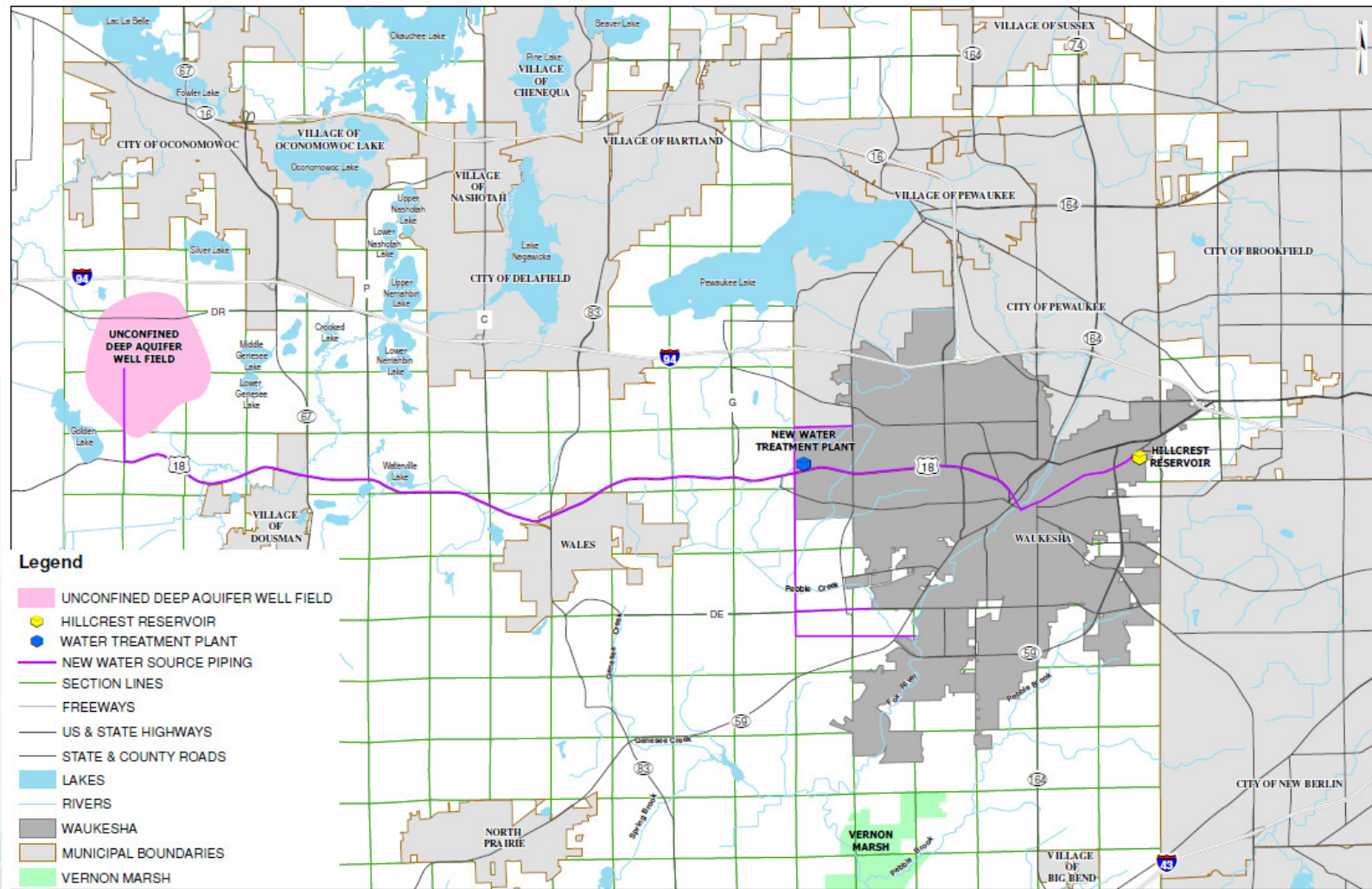
R/N Environmental Services, LLC
Surface Water Studies
Groundwater Studies
Site Investigations
4631 COUNTY ROAD A OREGON, WISCONSIN 53575 (608) 576-3001

CITY OF WAUKESHA WAUKESHA, WISCONSIN DRAWDOWN SCENARIO 2-2			FIGURE 4
DRAWN BY	PROJ. No.	DATE	FILE
RN	10-201	24 MAR 10	RUN 2-2 DDN

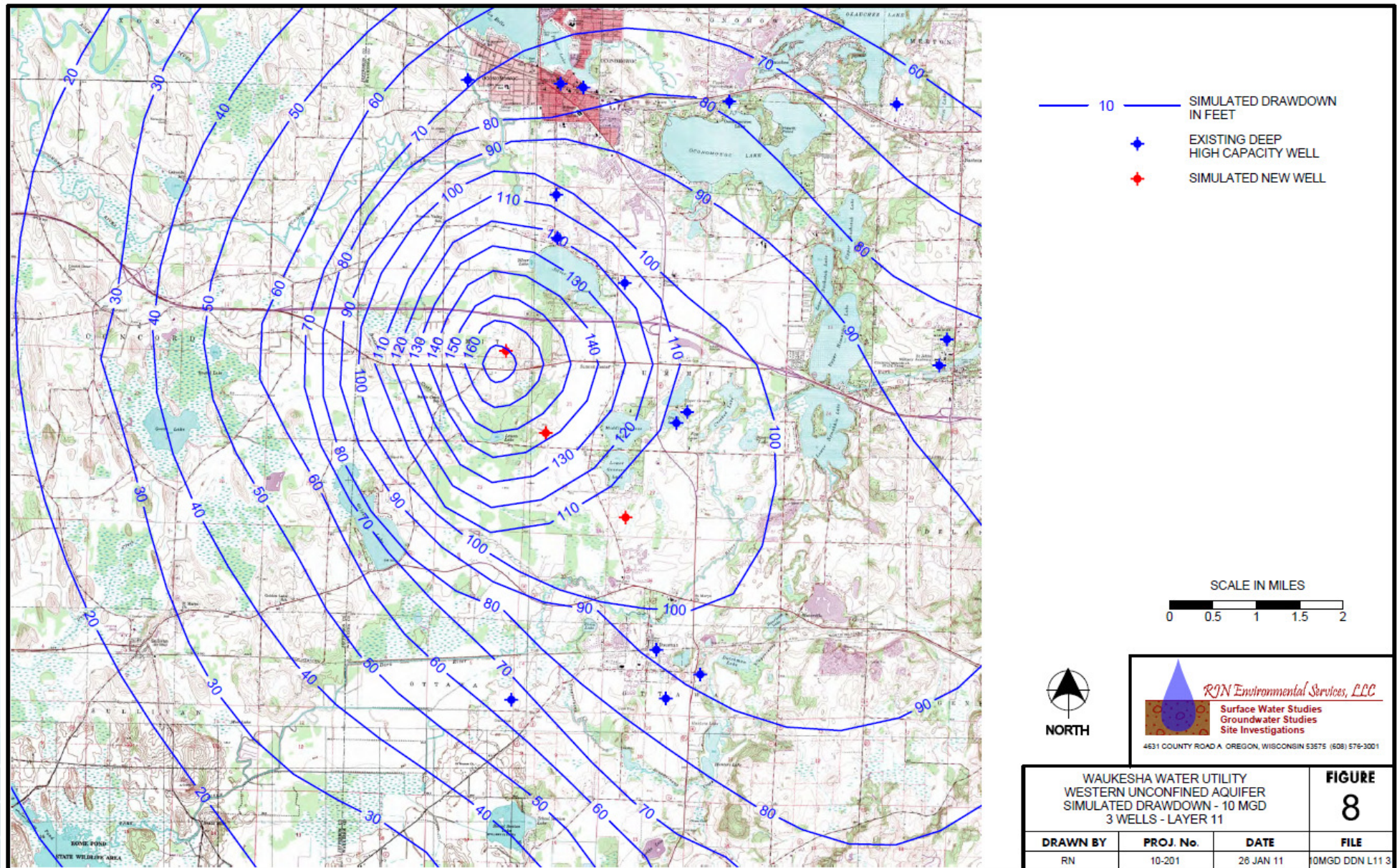
WATER SUPPLY ALTERNATIVE 3 – UNCONFINED DEEP AQUIFER

\$228 MILLION

- Supply pipeline from Unconfined Aquifer West of Waukesha
- New water pump station
- New water supply main
- New water treatment plant
- New distribution system infrastructure



Western Unconfined Aquifer 10 MGD from 3 High Capacity Wells Deep Aquifer Impacts



Western Unconfined Aquifer 10 MGD from 3 High Capacity Wells Shallow Aquifer Impacts

