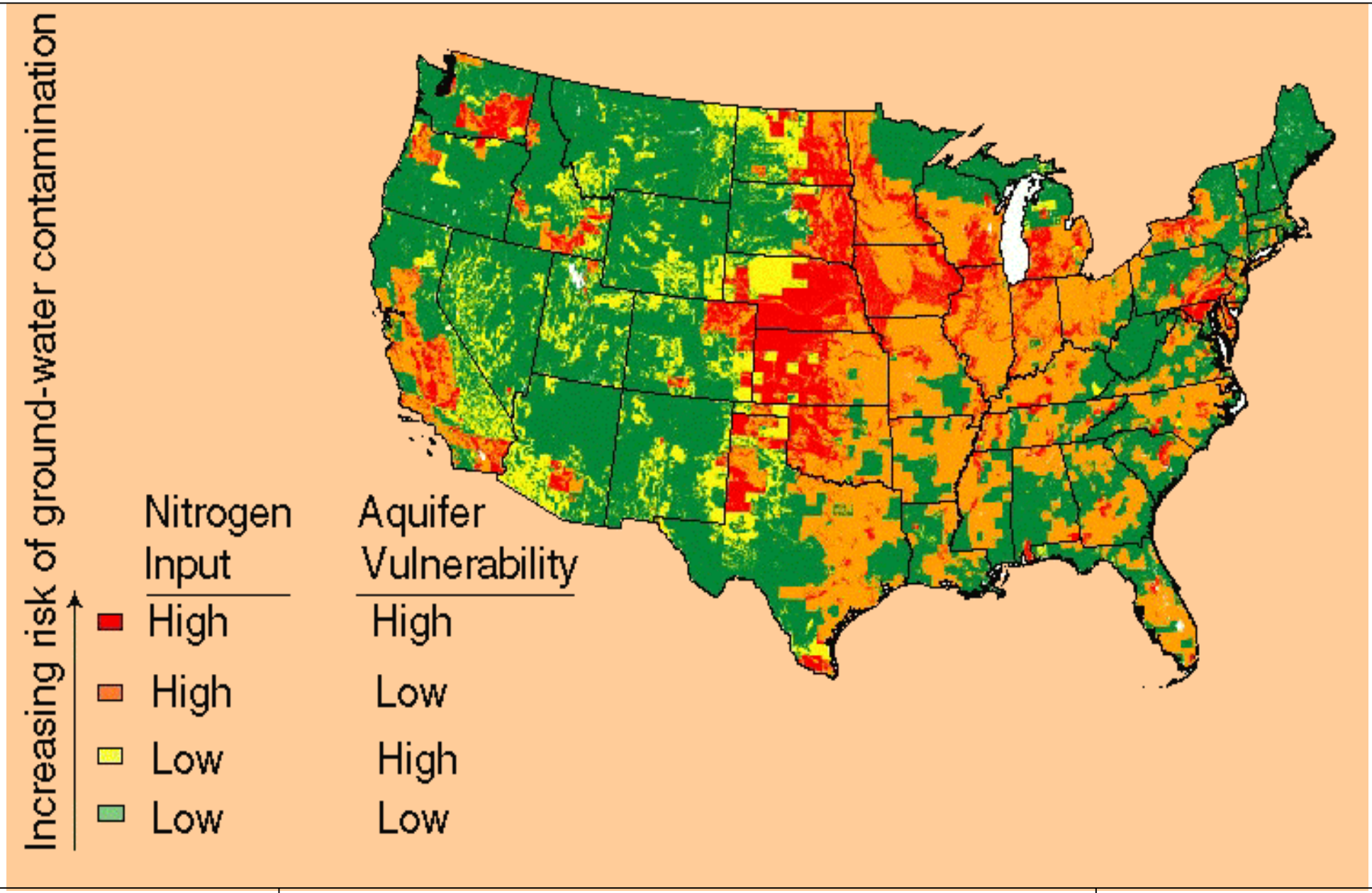
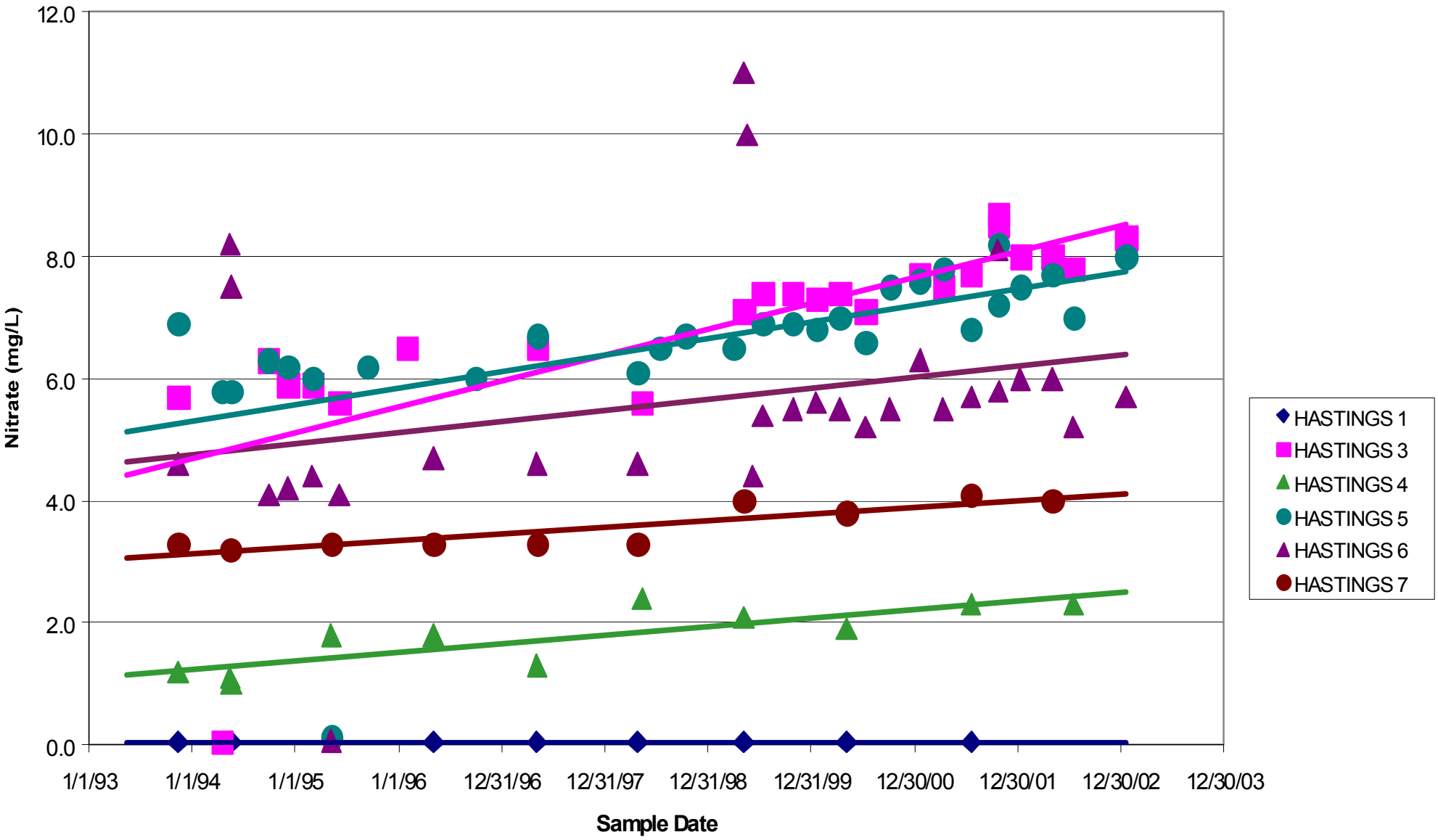


Dakota COUNTY

United States Geological Survey
National Ambient Water Quality Assessment Program
Risk of Groundwater Contamination

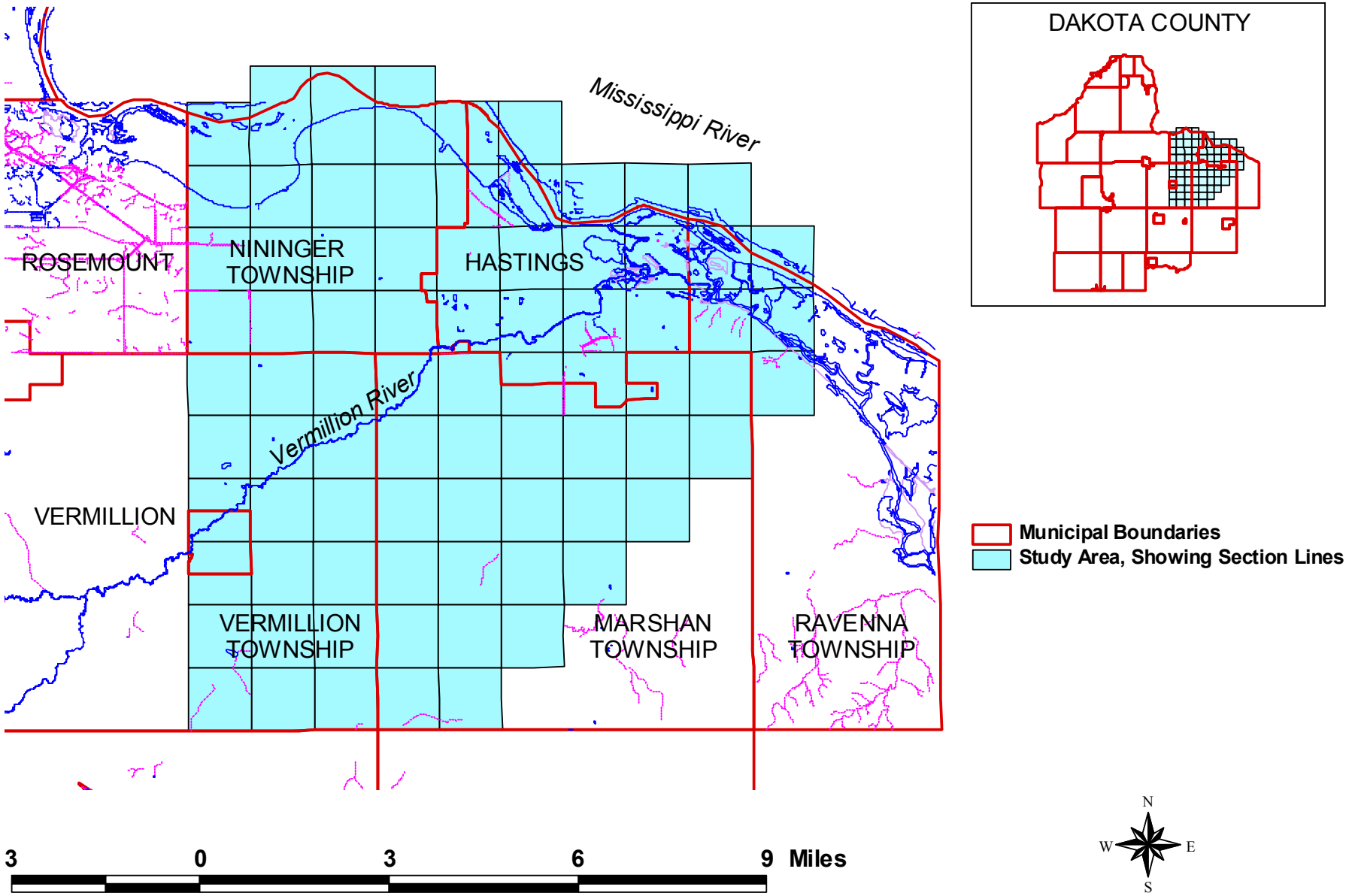
HANS Figure 1



Dakota COUNTY

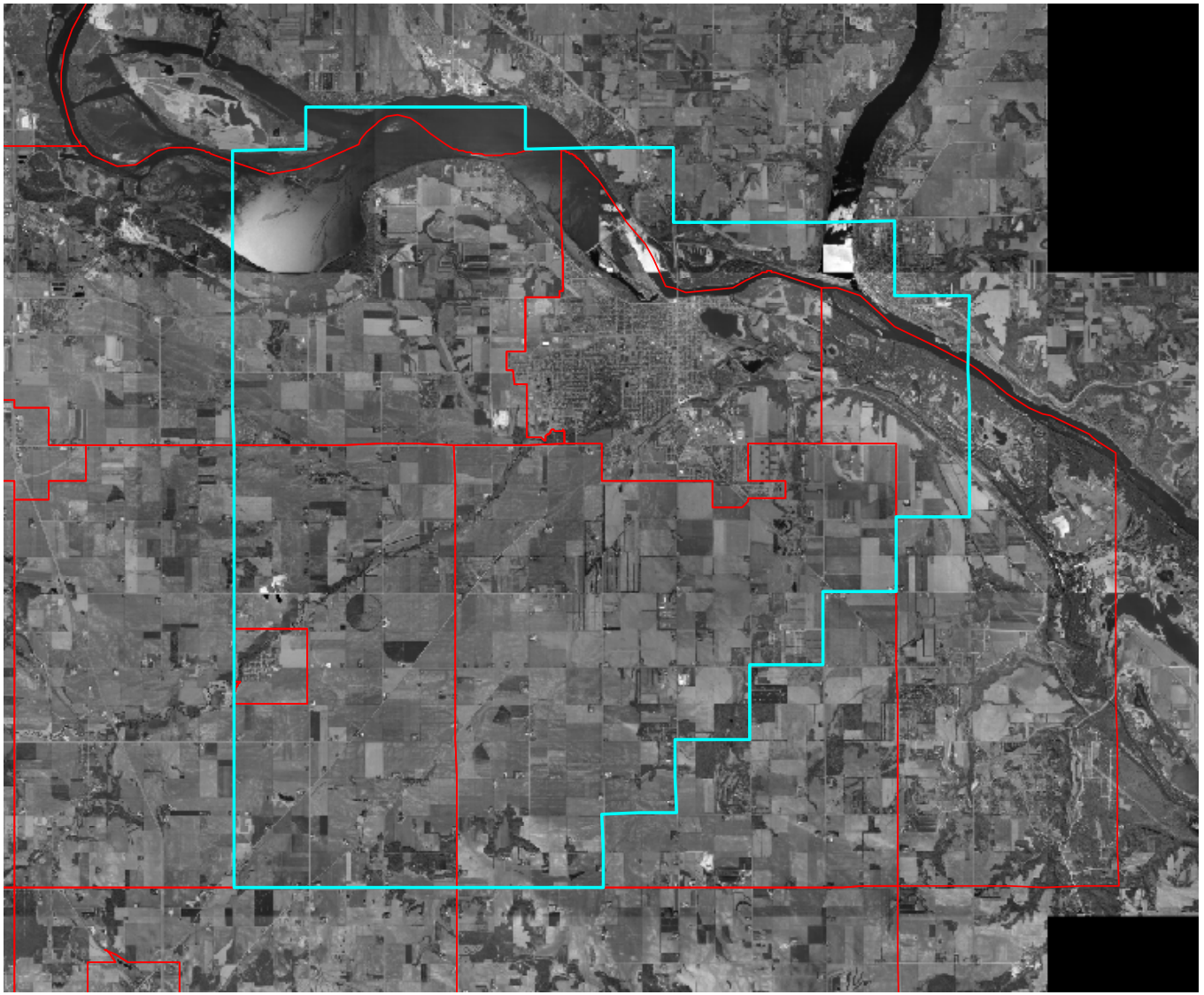
Hastings Municipal Wells
Nitrate Results 1993-2003

HANS Figure 2



Nitrate Study Area

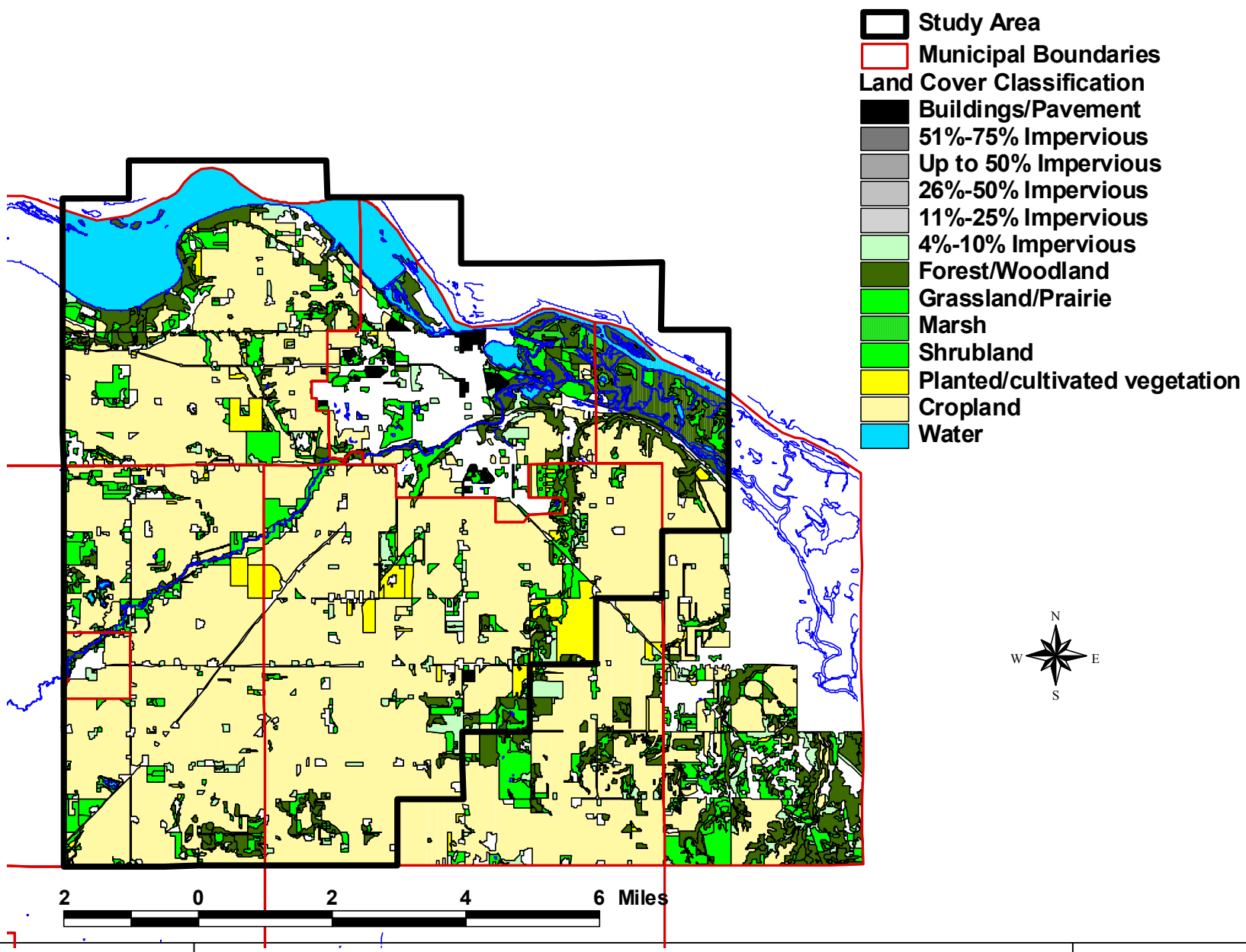
HANS Figure 3



Dakota COUNTY

2000 Digital Orthophoto

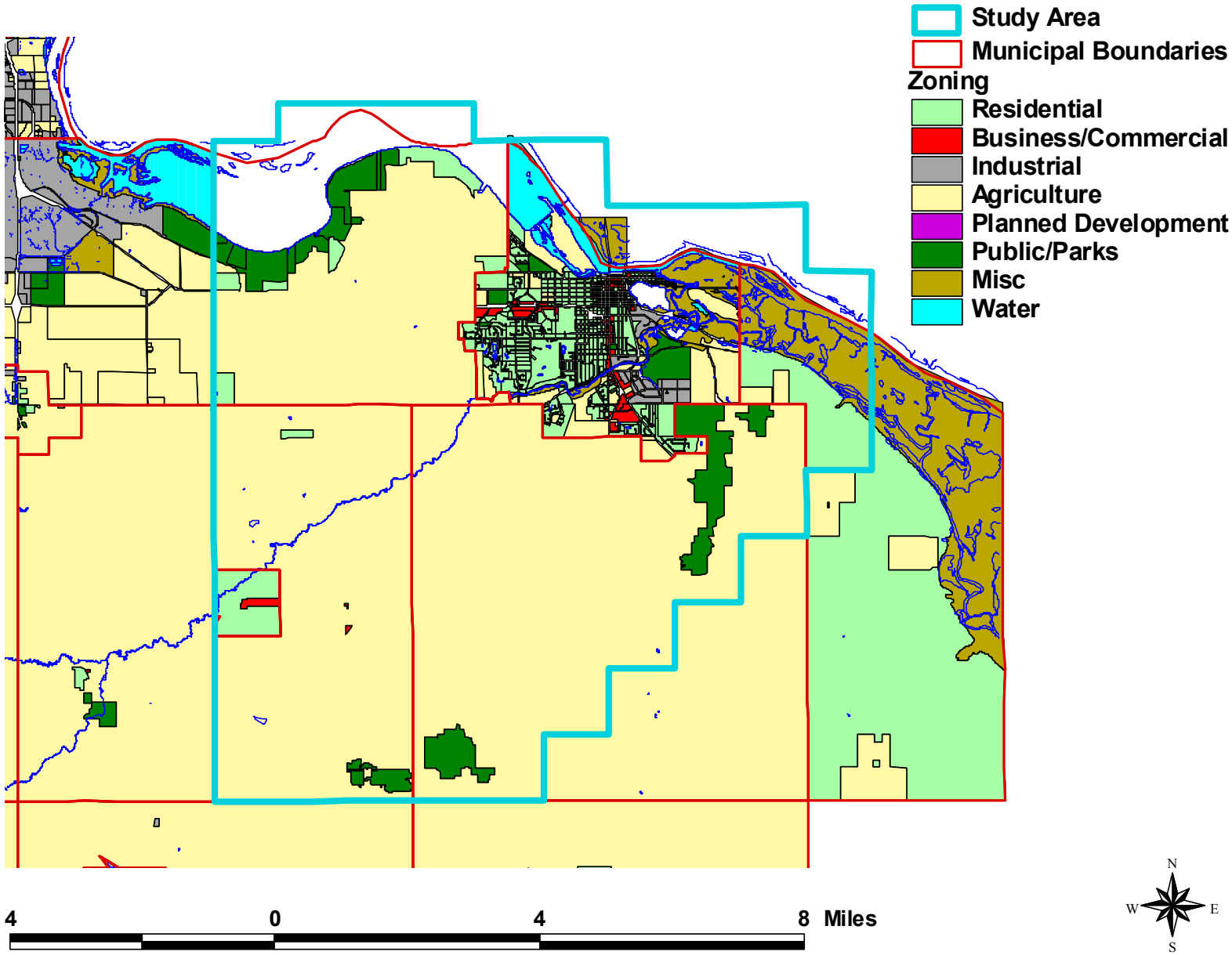
HANS Figure 4



Dakota COUNTY

2000 Land Cover Classification

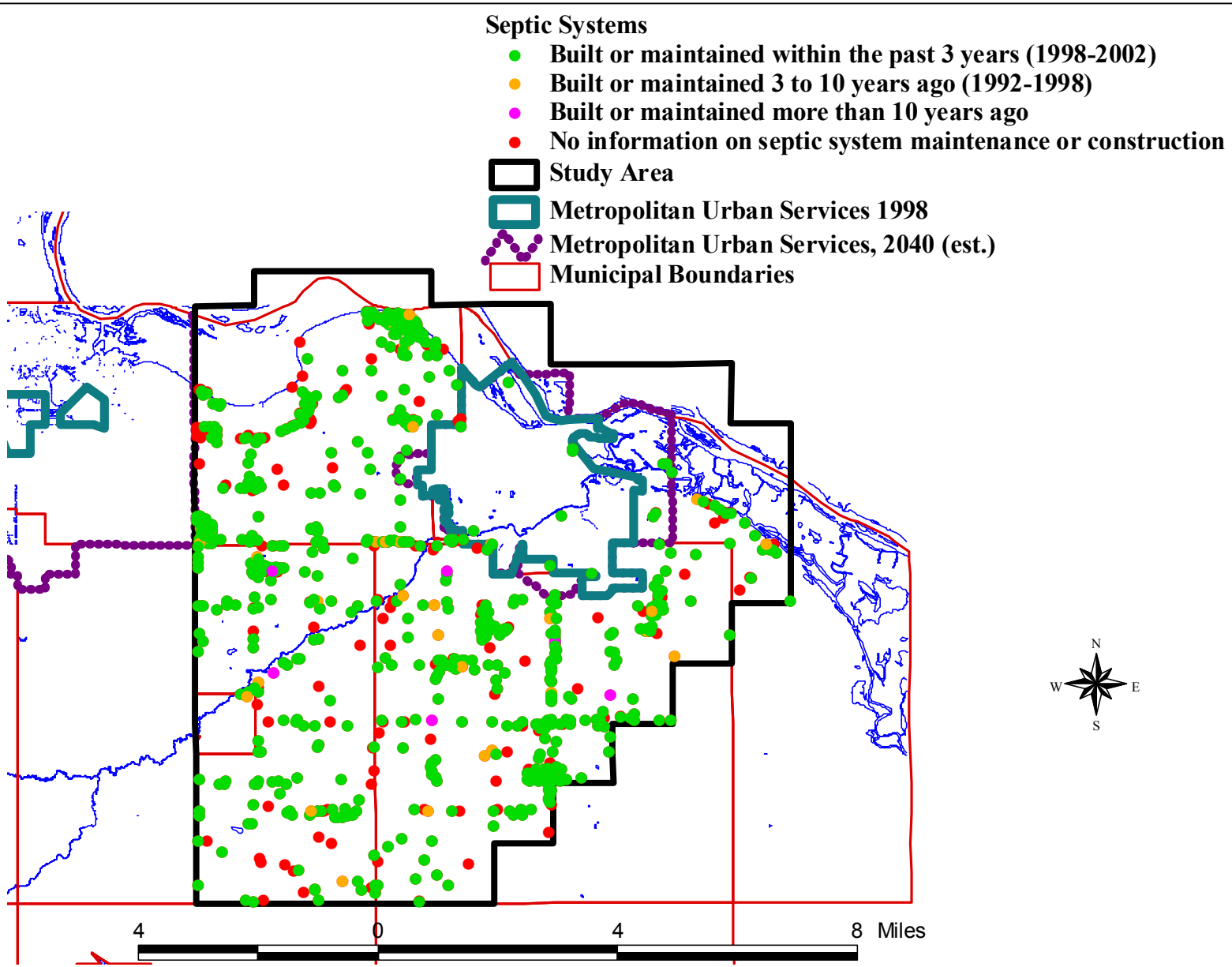
HANS Figure 5



Dakota COUNTY

Zoning

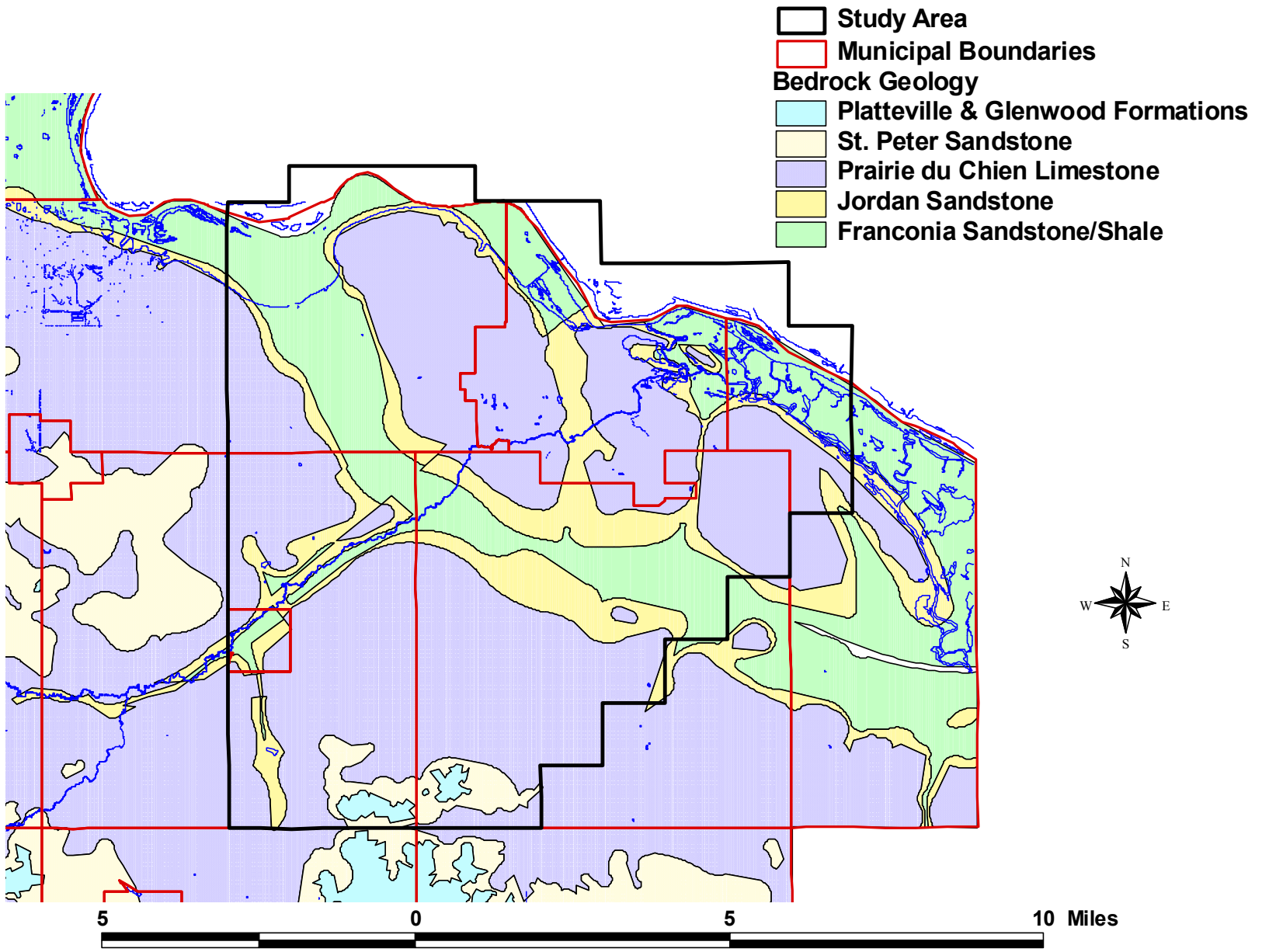
HANS Figure 6



Dakota COUNTY

Municipal Services

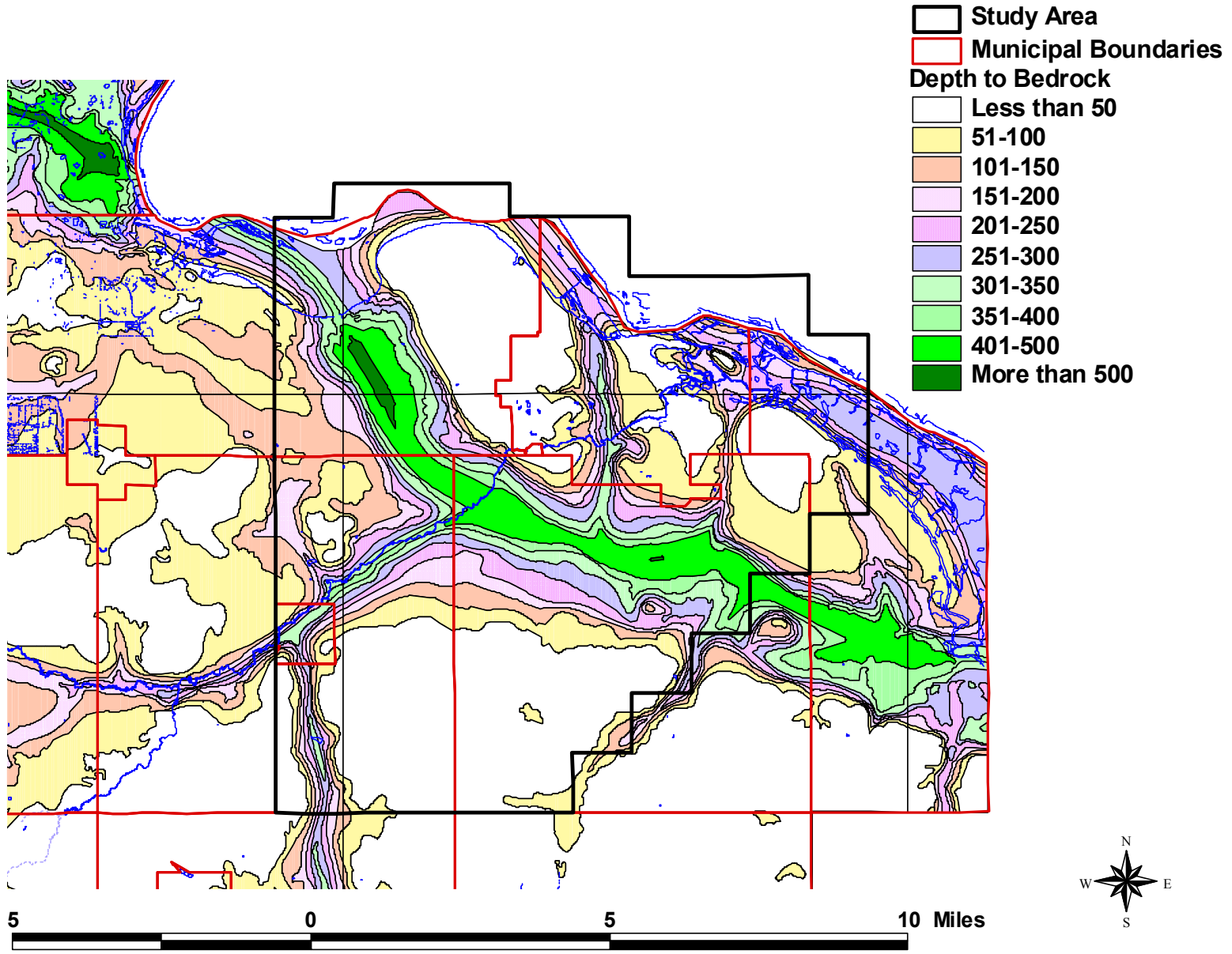
HANS Figure 7



Dakota COUNTY

Bedrock Geology

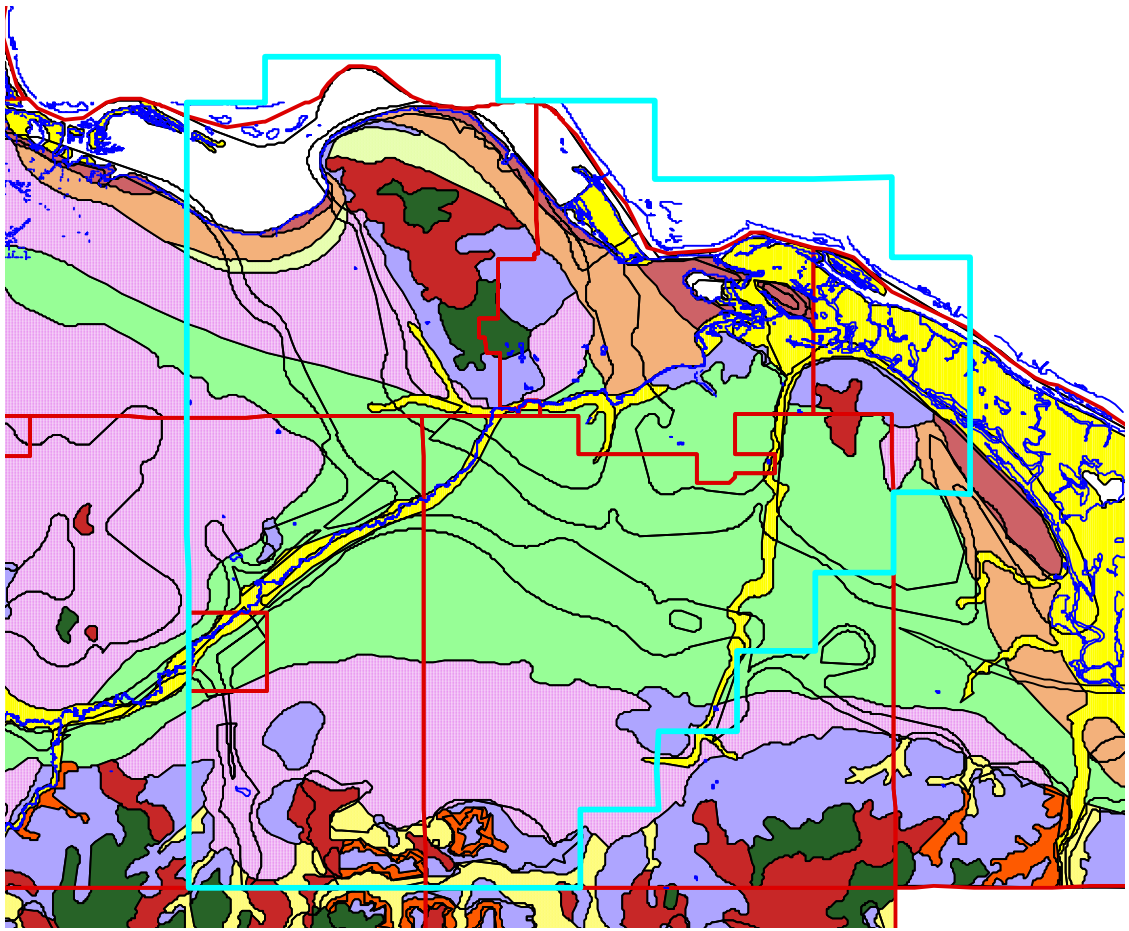
HANS Figure 8



Dakota COUNTY

Depth to Bedrock

HANS Figure 9



Study Area
Municipal Boundaries

Bedrock Geology
- Platteville & Glenwood Formations
- St. Peter Sandstone
- Prairie du Chien Limestone
- Jordan Sandstone
- Franconia Sandstone/Shale

Surficial (Quaternary) Geology
- Floodplain Alluvium
- Colluvium
- Slopewash Sand
- Lower River Terrace
- Middle River Terrace
- Upper River Terrace
- Des Moines/Superior Mixed Outwash
- Superior Outwash
- River Falls (Pre-Wisconsinan) Drift
- "Old Gray" (Pre-Wisconsinan) Till
- Bedrock
- Water

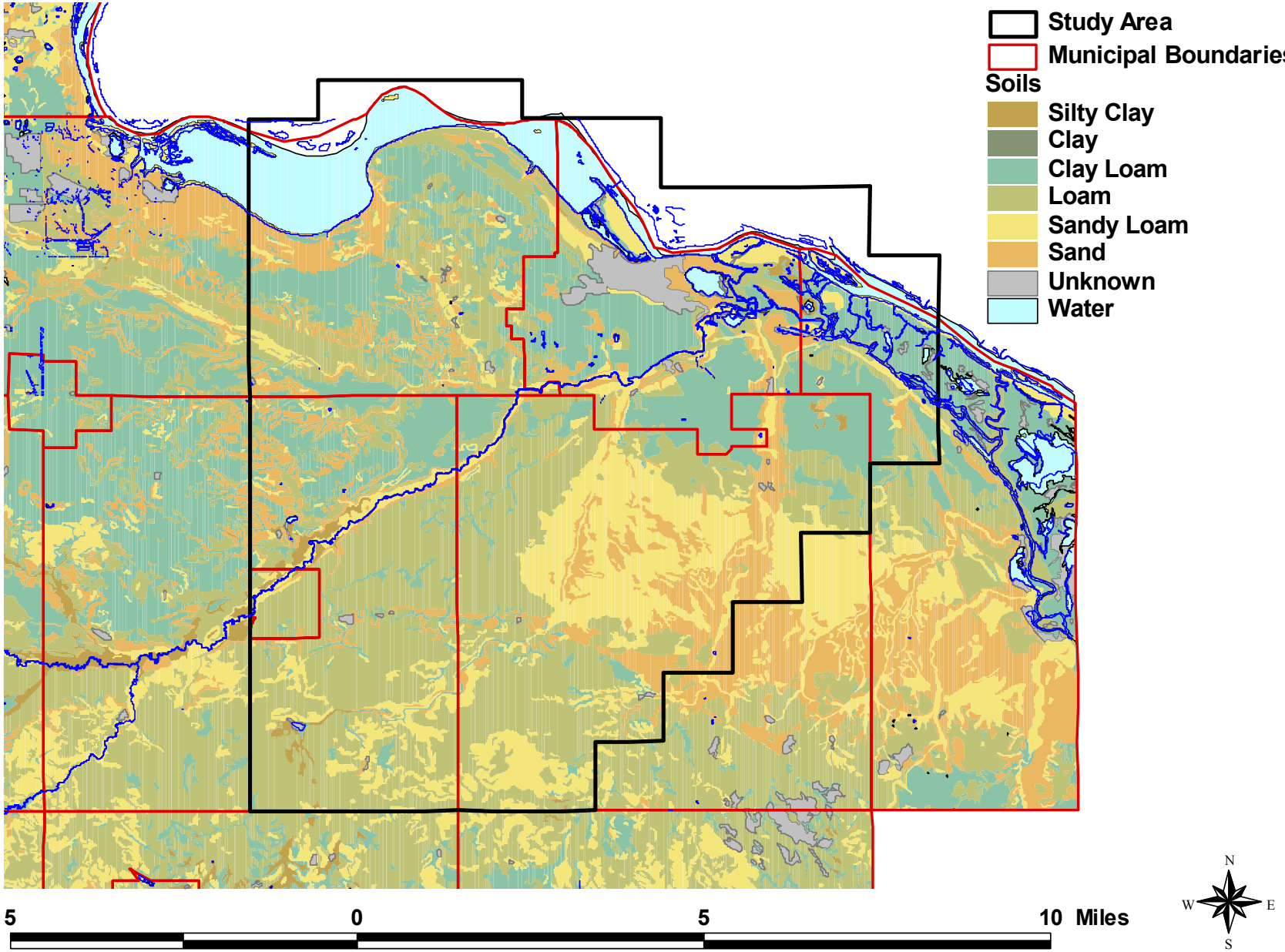
N
W E
S

4 0 4 8 Miles

Dakota COUNTY

Surficial (Quaternary) Geology

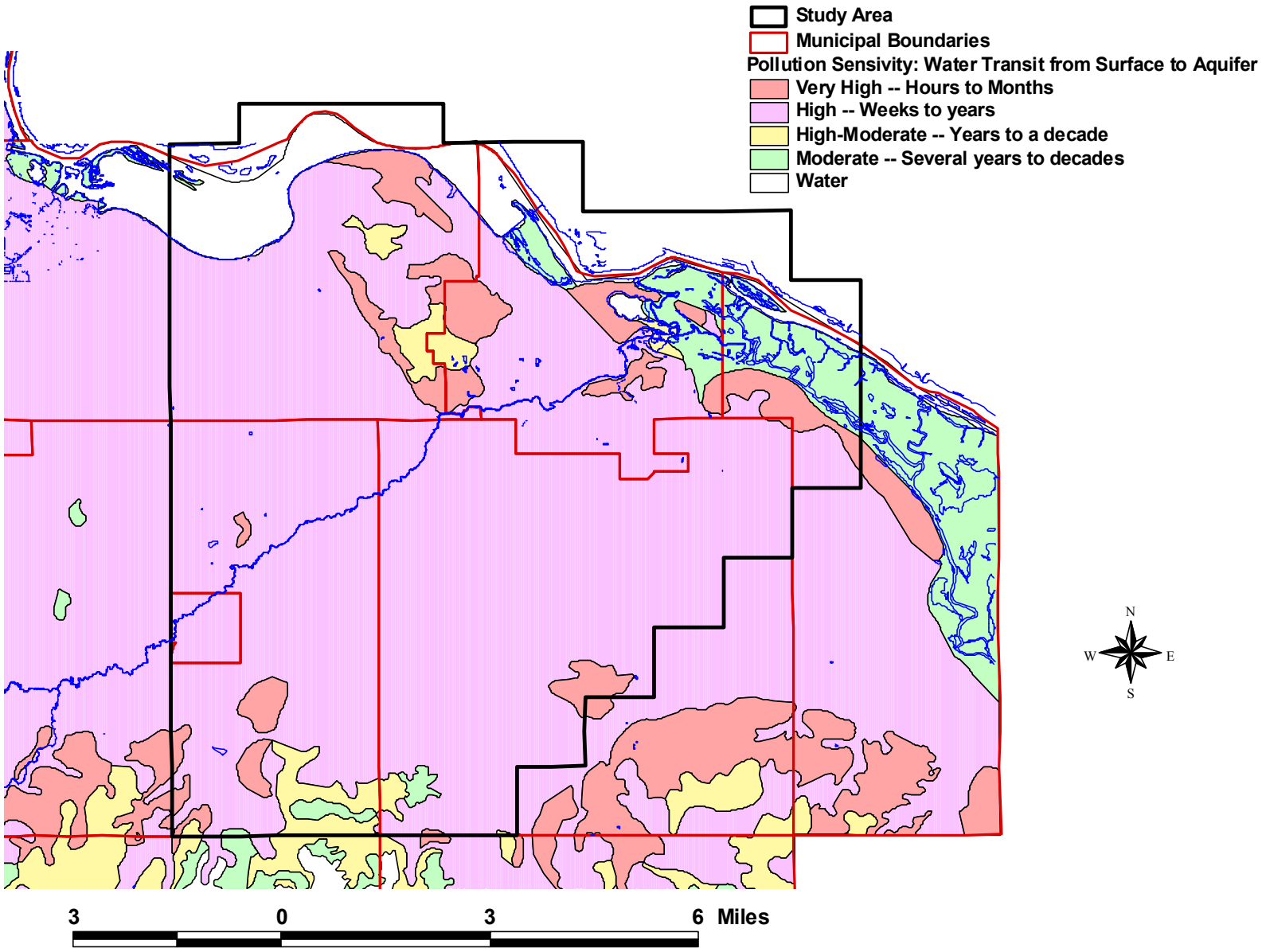
HANS Figure 10



Dakota COUNTY

General Soil Type

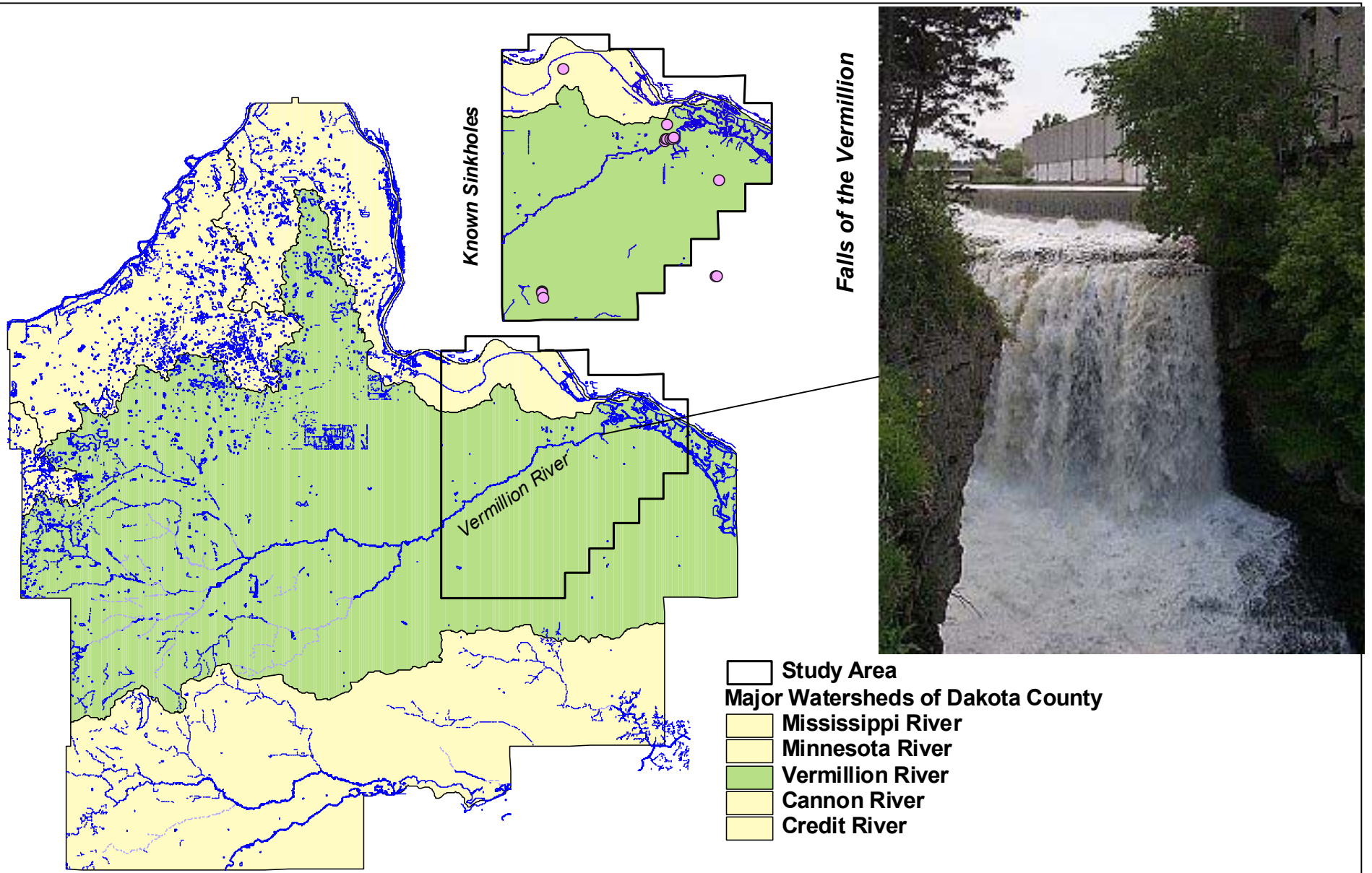
HANS Figure 11



Dakota COUNTY

Groundwater Sensitivity to Pollution

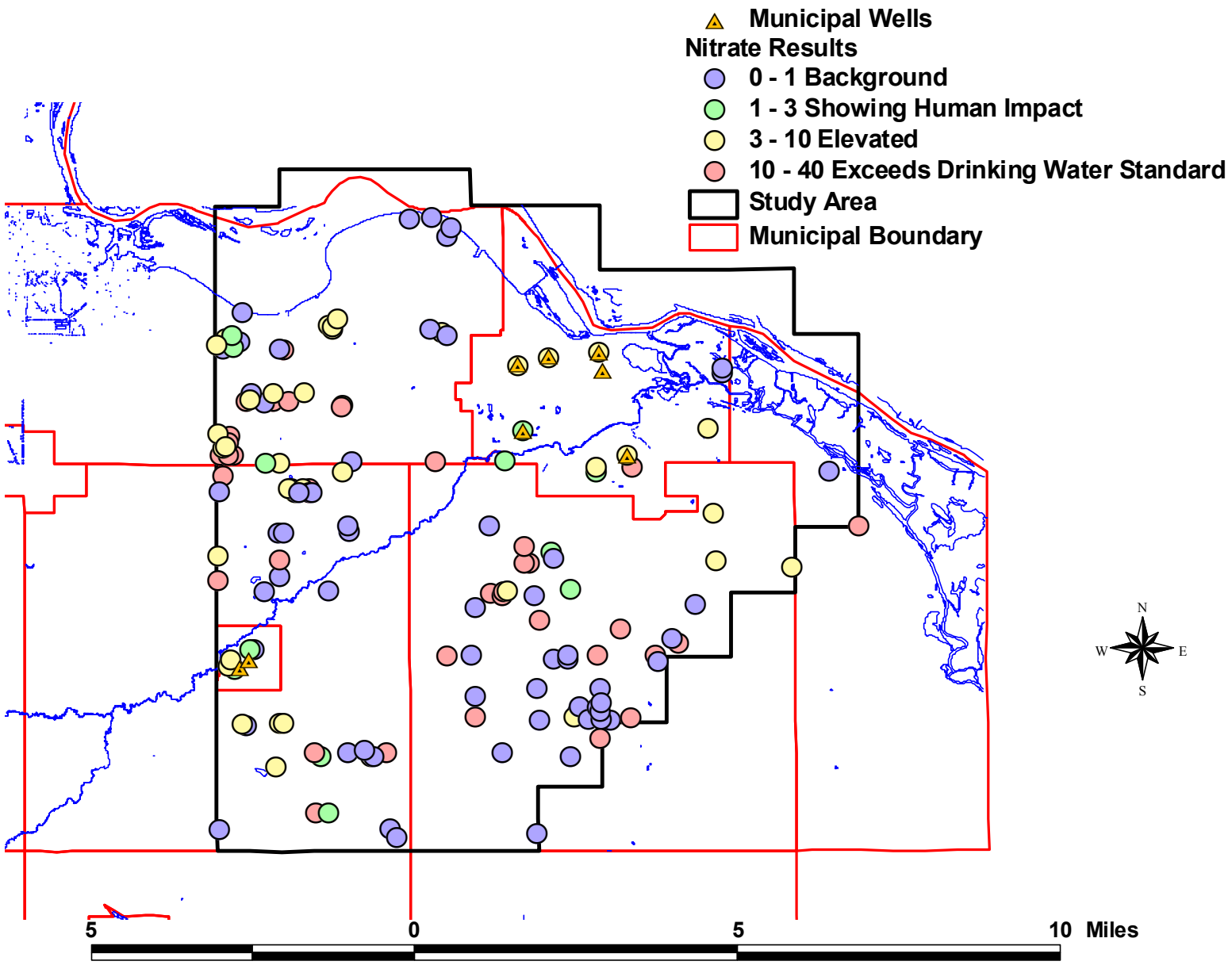
HANS Figure 12



Dakota COUNTY

Vermillion River Watershed

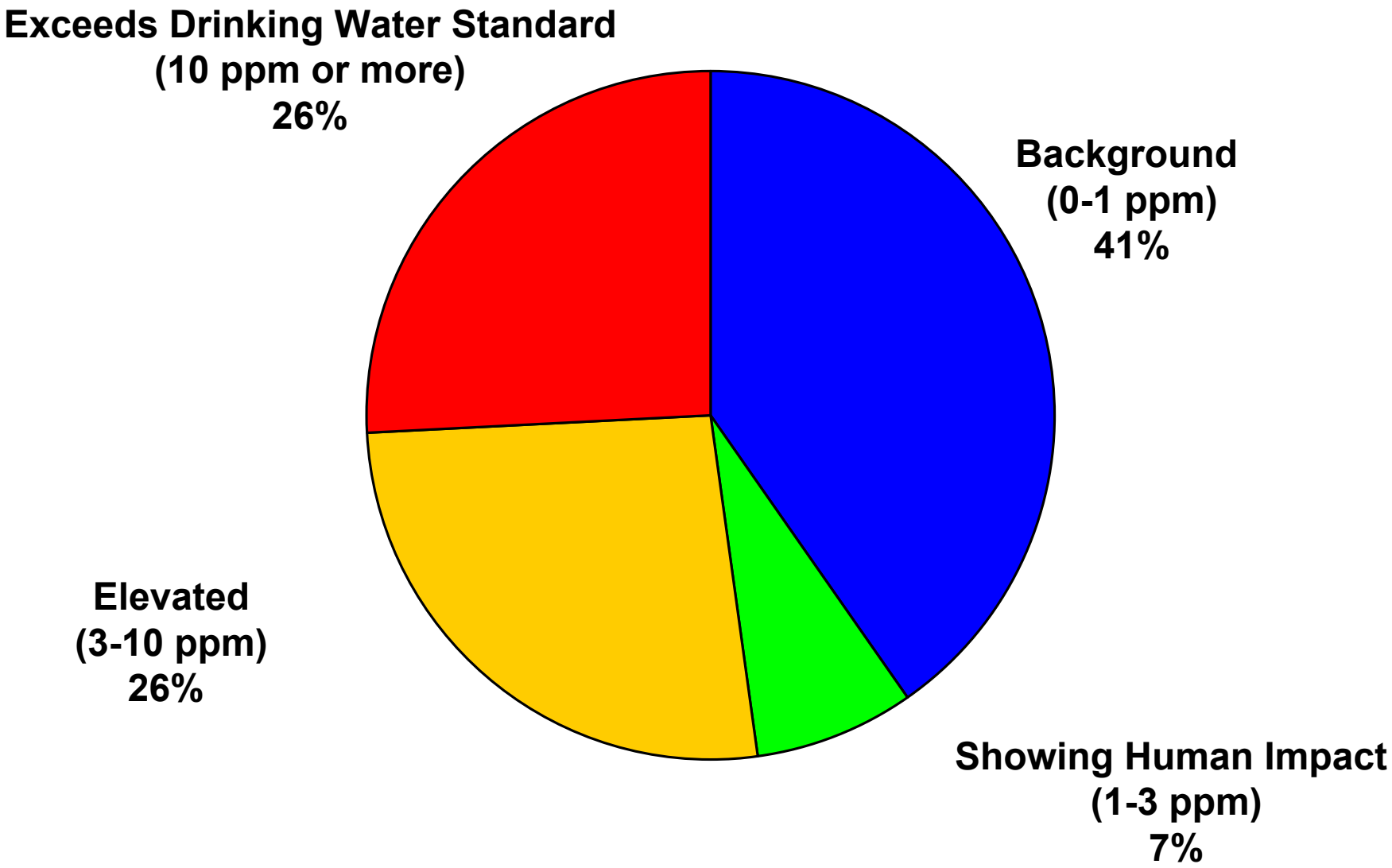
HANS Figure 13



Dakota COUNTY

Nitrate Results

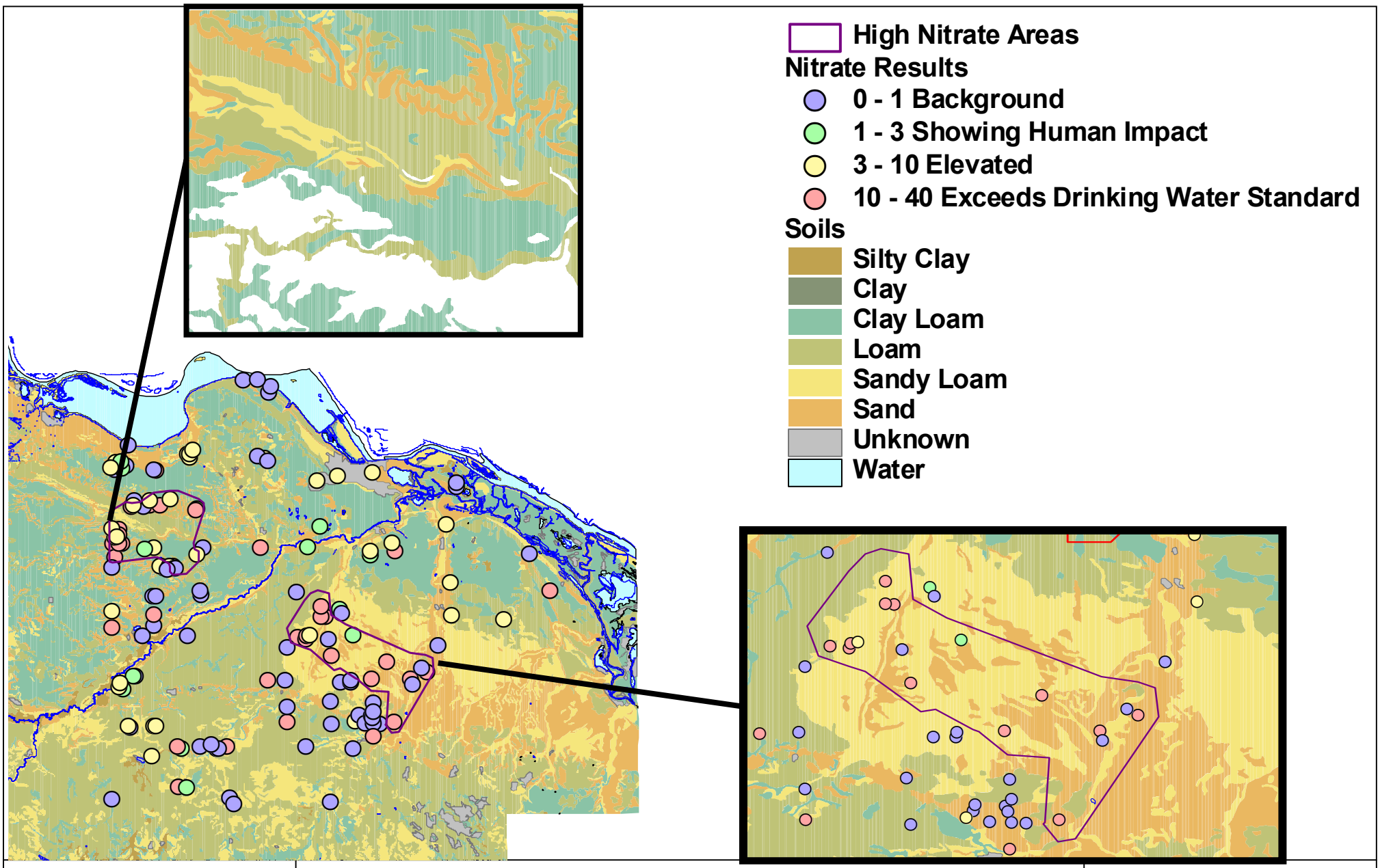
HANS Figure 14



Dakota COUNTY

Nitrate Results

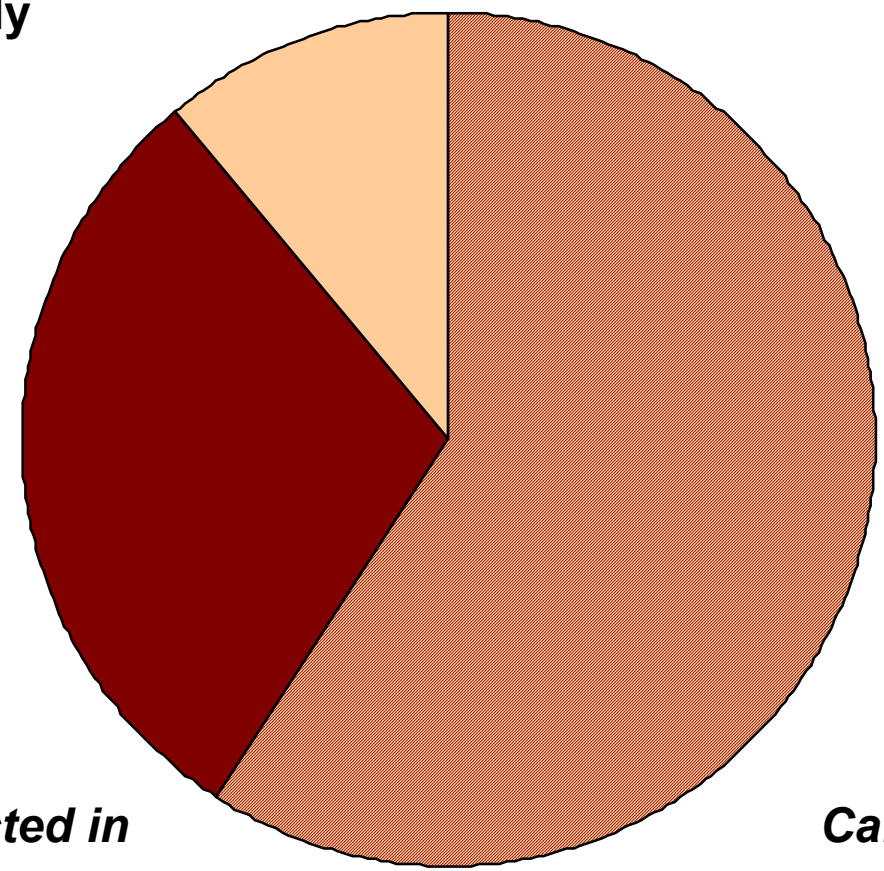
HANS Figure 15



Dakota COUNTY

High Nitrate Areas and Soil Type

HANS Figure 16



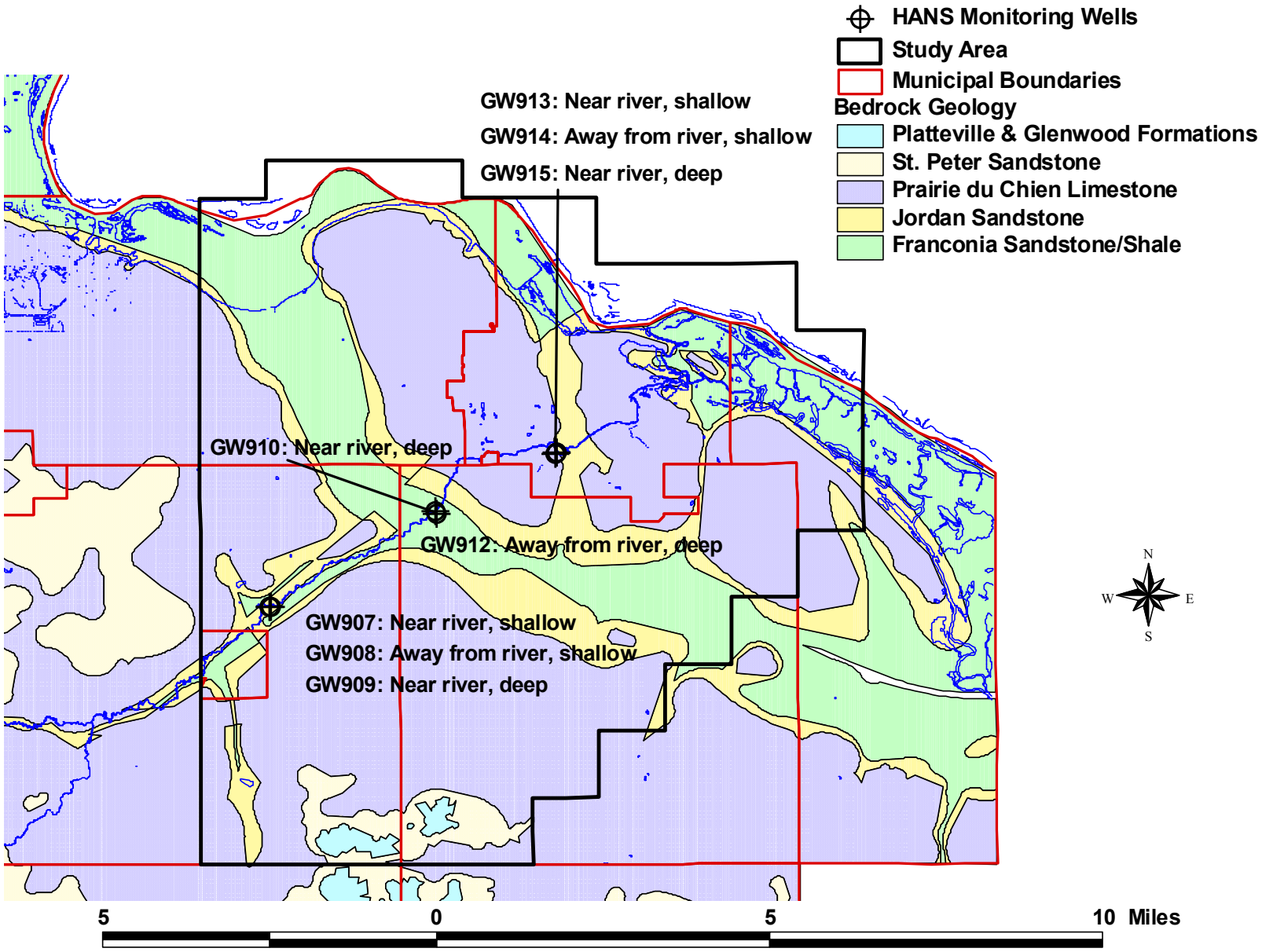
Pesticides were detected in 70% of wells sampled

Caffeine was detected in 89% of wells sampled

Dakota COUNTY

Caffeine and Pesticide Detections

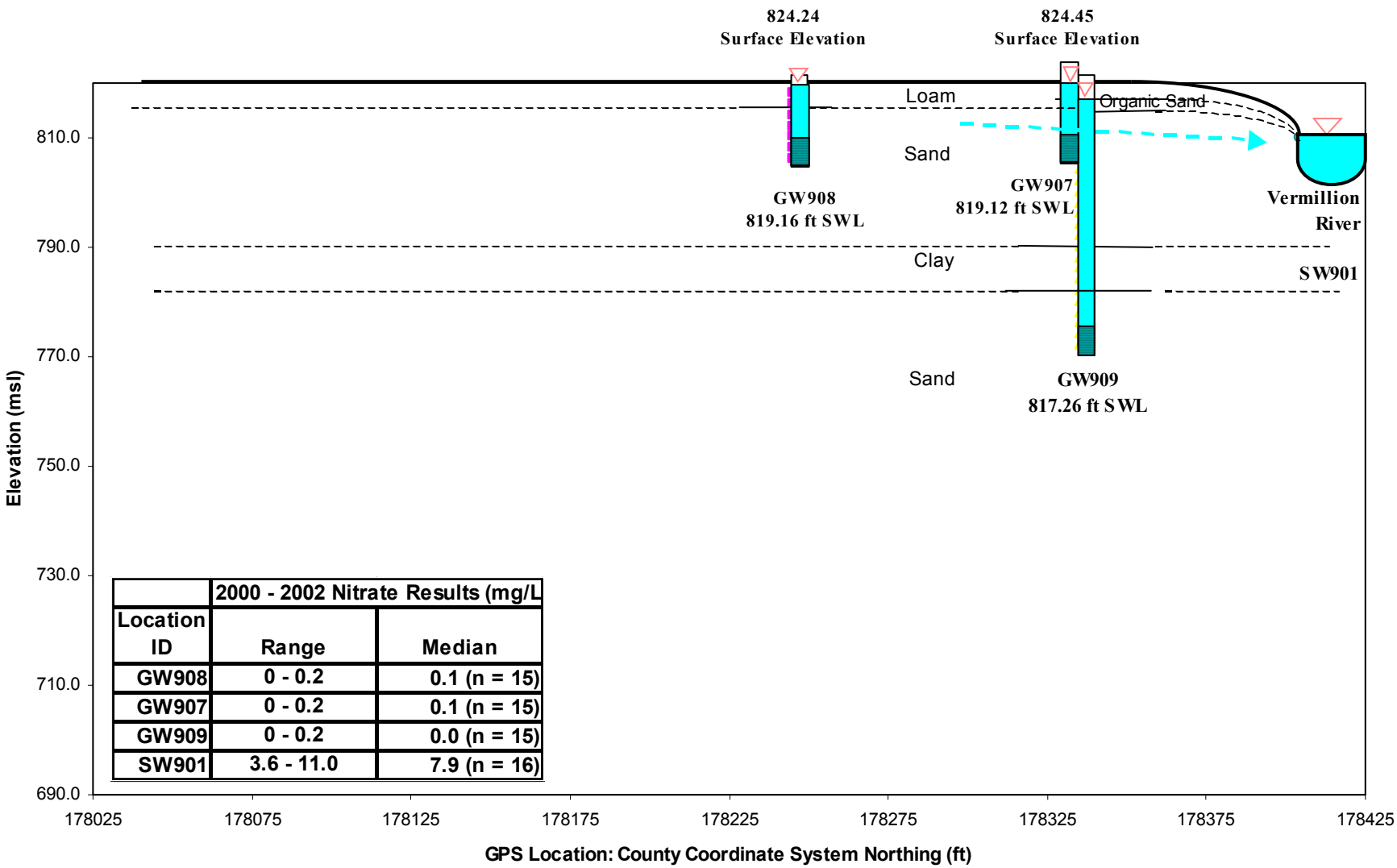
HANS Figure 17



Dakota COUNTY

Monitoring Well Locations

HANS Figure 18

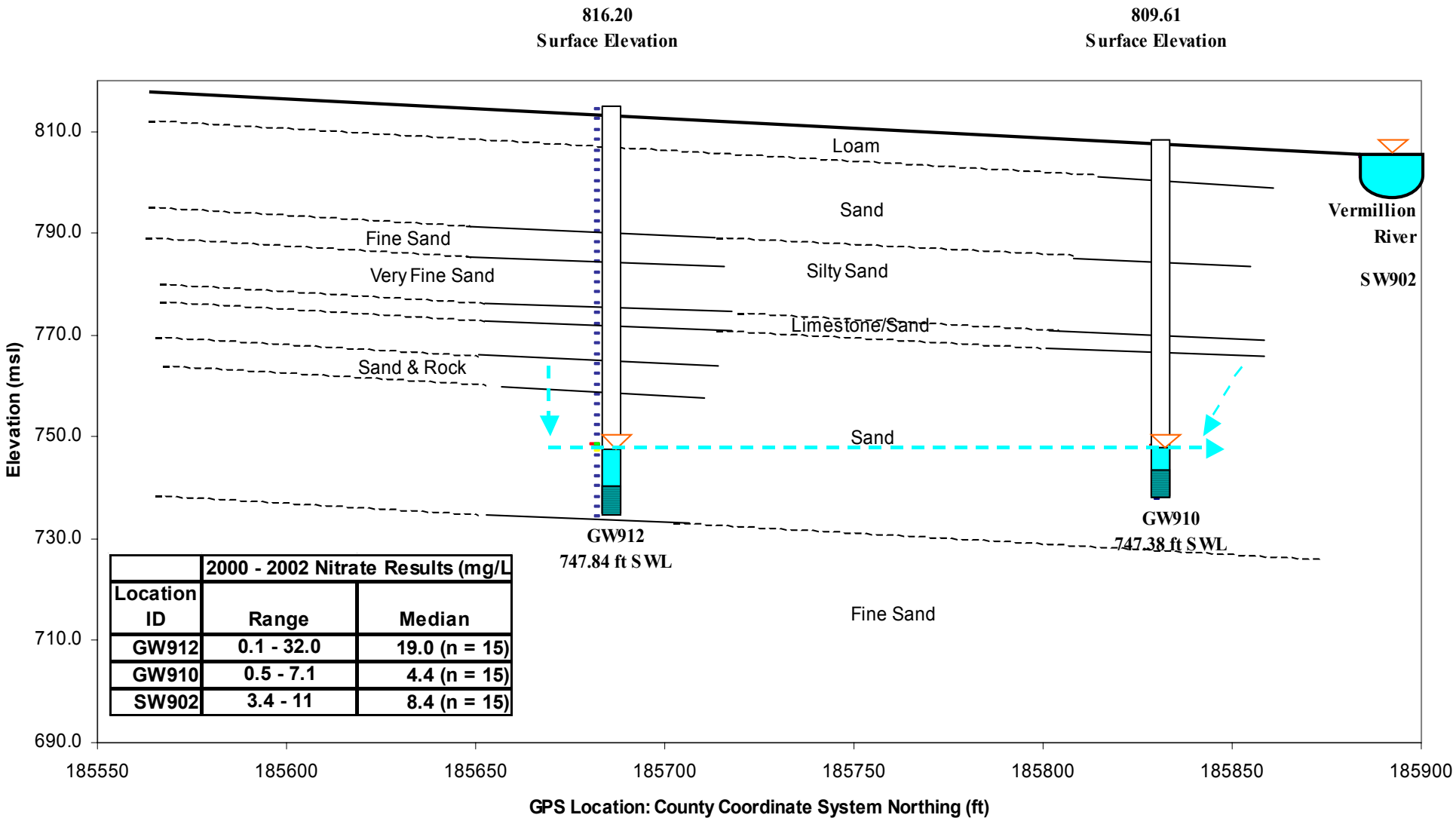


	2000 - 2002 Nitrate Results (mg/L	
Location ID	Range	Median
GW908	0 - 0.2	0.1 (n = 15)
GW907	0 - 0.2	0.1 (n = 15)
GW909	0 - 0.2	0.0 (n = 15)
SW901	3.6 - 11.0	7.9 (n = 16)

Dakota COUNTY

Upstream Monitoring Wells
Locations, Static Water Levels and Nitrate Results
September 2000 – December 2002

HANS Figure 19

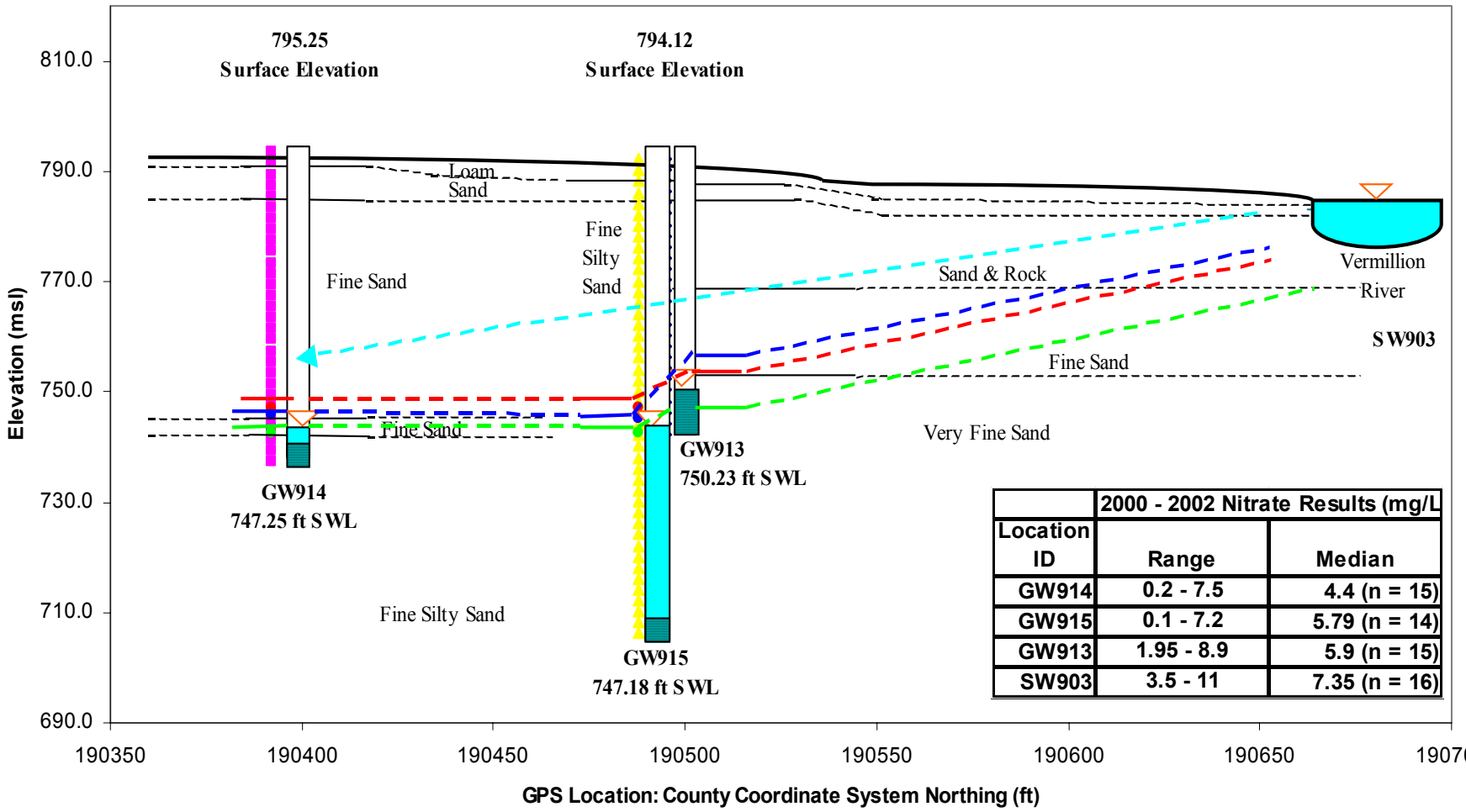


	2000 - 2002 Nitrate Results (mg/L	
Location ID	Range	Median
GW912	0.1 - 32.0	19.0 (n = 15)
GW910	0.5 - 7.1	4.4 (n = 15)
SW902	3.4 - 11	8.4 (n = 15)

Dakota County

Monitoring Wells over Buried Bedrock Valley Locations, Static Water Levels, and Nitrate Results October 2000 – December 2002

HANS Figure 20



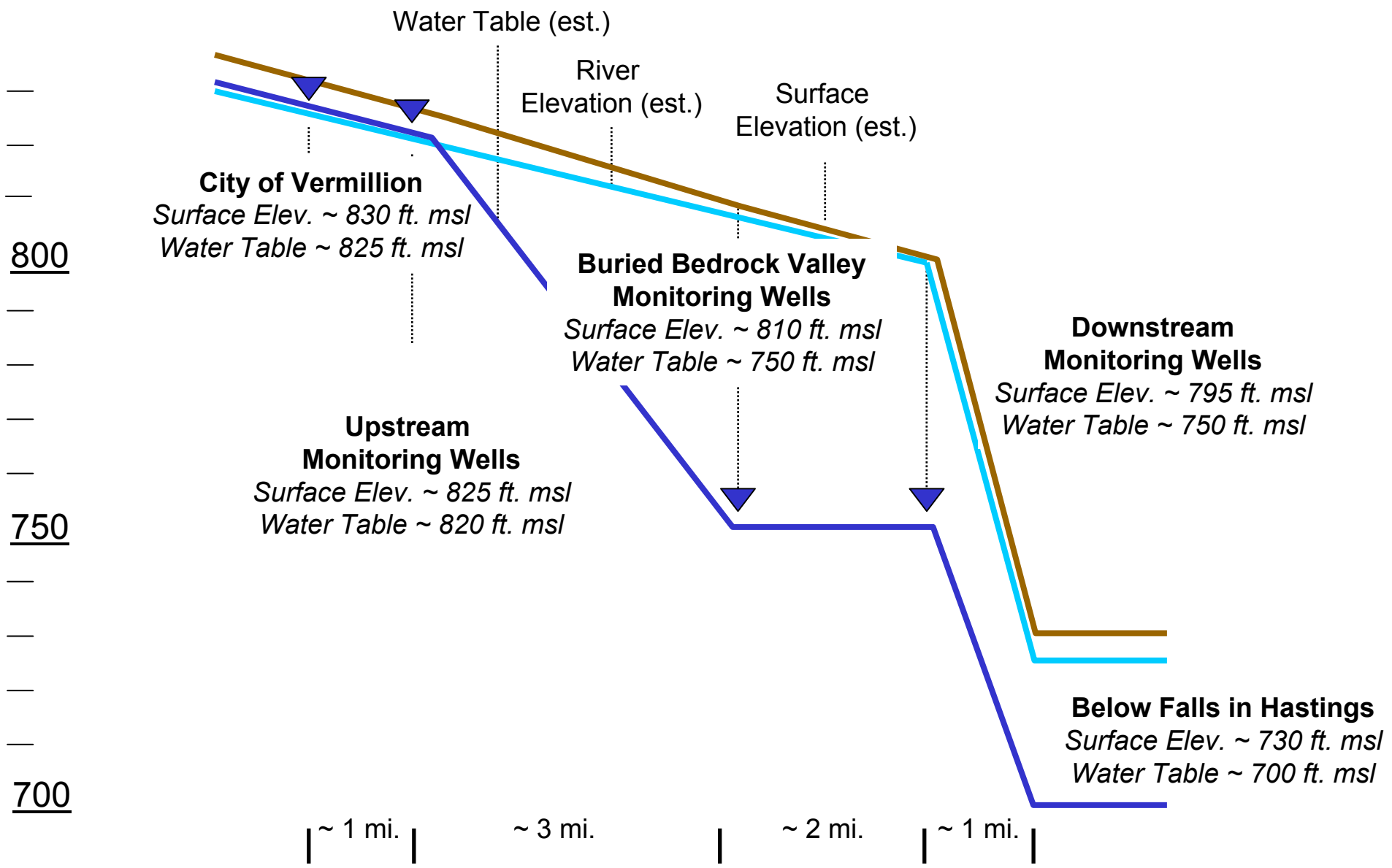
SWL Key:
March 2001
April 2001
May 2001

	2000 - 2002 Nitrate Results (mg/L	
Location ID	Range	Median
GW914	0.2 - 7.5	4.4 (n = 15)
GW915	0.1 - 7.2	5.79 (n = 14)
GW913	1.95 - 8.9	5.9 (n = 15)
SW903	3.5 - 11	7.35 (n = 16)

Dakota COUNTY

Downstream Monitoring Wells
Locations, Static Water Levels, and Nitrate Results
October 2000 – December 2002

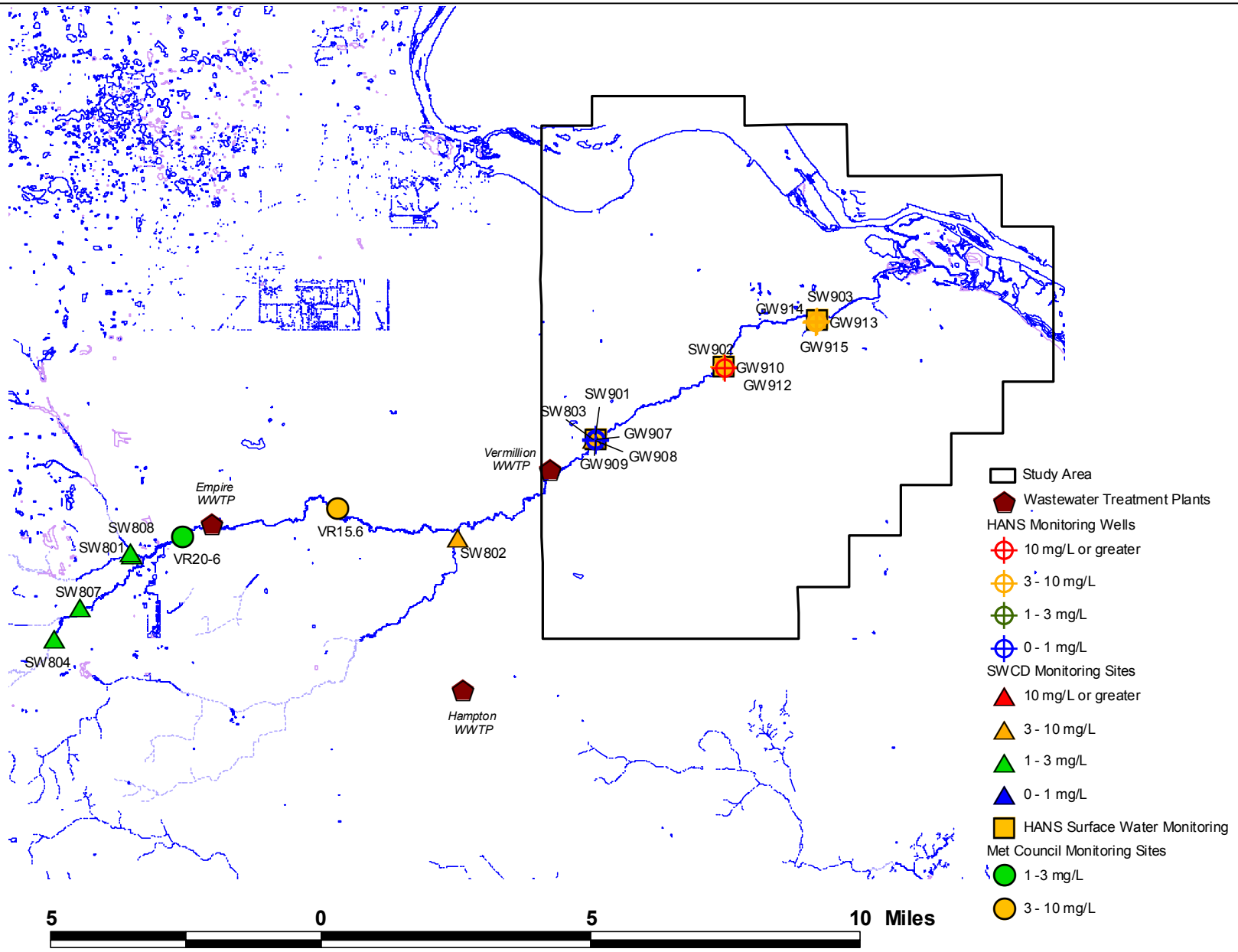
HANS Figure 21



Dakota County

Changes in Water Table vs. Vermillion River Between Vermillion and Hastings

HANS Figure 22



Dakota COUNTY

Vermillion River
2000-2002 Nitrate Results

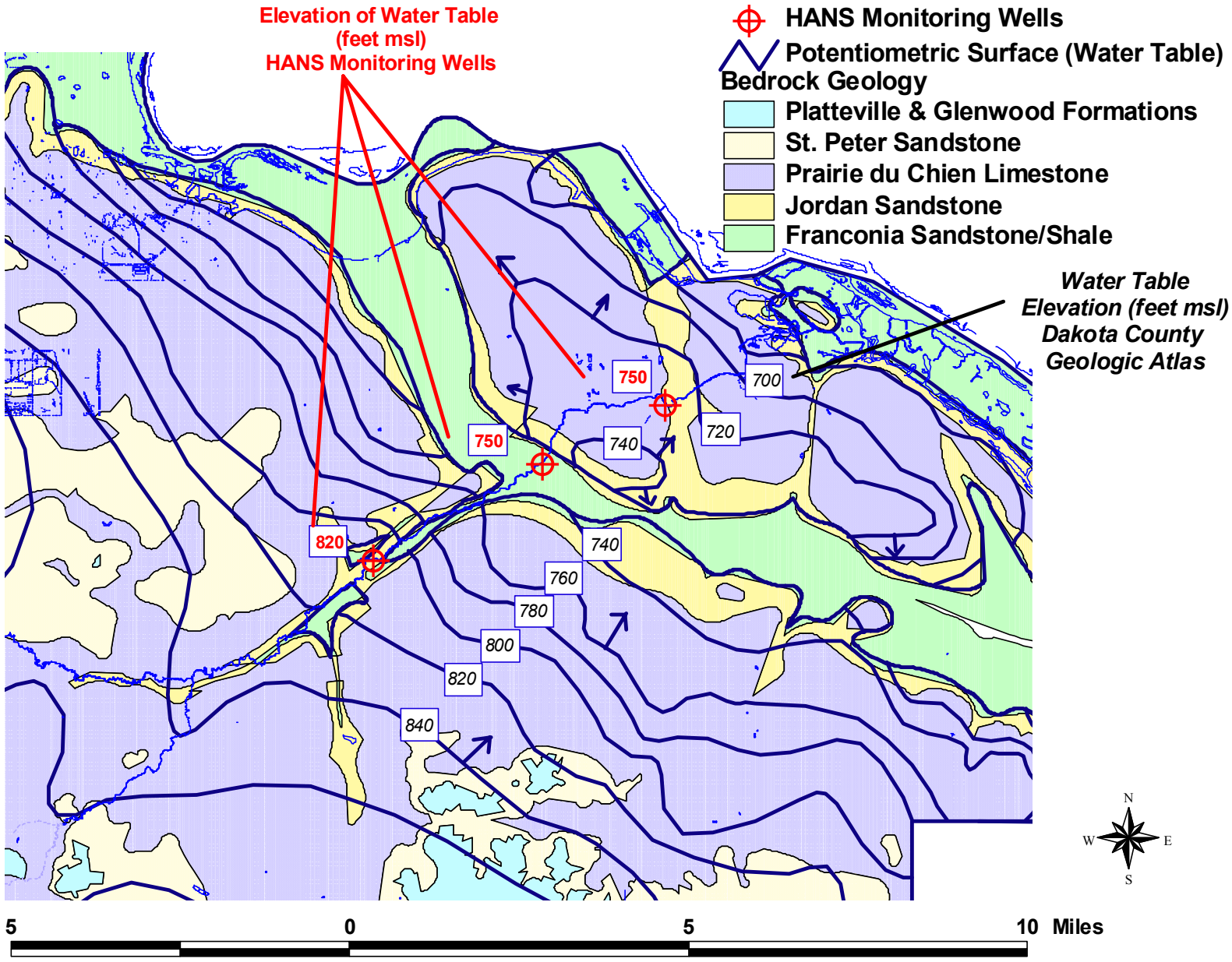
HANS Figure 23

Upstream to Downstream	Location ID	Agency	Description	Surface Water or Groundwater (SW/GW)	Data Collection Model	2000-2002 Nitrate (mg/L) Range	2000-2002 Nitrate (mg/L) Median	Median Rank (Nitrate)
1	SW804	SWCD	Vermillion River at 220th St	SW	Since Feb. 2000 -- low flow and event sampling	0.93 - 3.58	1.72 (n = 43)	6
2	SW807	SWCD	Vermillion River at Denmark Ave.	SW	Since Feb. 2000 -- low flow and event sampling	0.78 - 3.54	2.07 (n = 43)	8
3	SW808	SWCD	North Creek at Hwy. 3	SW	Since Feb. 2000 -- low flow and event sampling	0.25 - 4.96	1.06 (n = 43)	4
4	SW801	SWCD	North/Middle Creek at Hwy. 3	SW	Since Feb. 2000 -- low flow and event sampling	0.45 - 4.8	1.35 (n = 43)	5
5	VR20.6	Met Council	Mile 20.6, upstream of WWTP	SW	Since 1977 -- Bi-weekly sampling	0.08 - 8.26	1.94 (n = 69) *(1979-2001 Median = 1.82)*	7
6	VR15.6	Met Council	Mile 15.6, downstream of WWTP	SW	Since 1977 -- Bi-weekly sampling	0.08 - 14.2	5.17 (n = 69) *(1977-2001 Median = 3.86)*	12
7	SW802	SWCD	South Branch at 200th St.	SW	Since Feb. 2000 -- low flow and event sampling	1.4 - 7.8	5.0 (n = 43)	11
8	SW803	SWCD	Vermillion River at Goodwin Ave	SW	Since Feb. 2000 -- low flow and event sampling	0.89 - 9.1	5.76 (n = 43)	13
9	SW901	GWP	Vermillion River at Goodwin Ave	SW	Since Nov. 2000 -- monthly sampling	3.6 - 11.0	7.9 (n = 16)	17
10	GW909	GWP	Deep monitoring well near Vermillion River at Goodwin Ave	GW	Since Nov. 2000 -- monthly sampling	0 - 0.2	0.0 (n = 15)	1
11	GW907	GWP	Shallow monitoring well near Vermillion River at Goodwin	GW	Since Nov. 2000 -- monthly sampling	0 - 0.2	0.1 (n = 15)	2.5
12	GW908	GWP	Shallow monitoring well approx. 100 ft. from Vermillion River at Goodwin Avenue	GW	Since Nov. 2000 -- monthly sampling	0 - 0.2	0.1 (n = 15)	2.5
13	SW902	GWP	Vermillion River over buried bedrock valley	SW	Since Nov. 2000 -- monthly sampling	3.4 - 11	8.4 (n = 15)	18
14	GW910	GWP	Monitoring well near river over buried bedrock valley	GW	Since Nov. 2000 -- monthly sampling	0.5 - 7.1	4.4 (n = 15)	9.5
15	GW912	GWP	Monitoring well approx. 200 ft from river over buried bedrock valley (beside cornfield)	GW	Since Nov. 2000 -- monthly sampling	0.1 - 32.0	19.0 (n = 15)	19
16	SW903	GWP	Vermillion River in Hastings Park	SW	Since Nov. 2000 -- monthly sampling	3.5 - 11	7.35 (n = 16)	16
17	GW913	GWP	Monitoring well near river in Hastings Park	GW	Since Nov. 2000 -- monthly sampling	1.95 - 8.9	5.9 (n = 15)	15
18	GW915	GWP	Deep monitoring well near river in Hastings Park	GW	Since Nov. 2000 -- monthly sampling	0.1 - 7.2	5.79 (n = 14)	14
19	GW914	GWP	Monitoring well approx. 100 ft. from river in Hastings Park	GW	Since Nov. 2000 -- monthly sampling	0.2 - 7.5	4.4 (n = 15)	9.5

Dakota COUNTY

Vermillion River
2000-2002 Nitrate Results

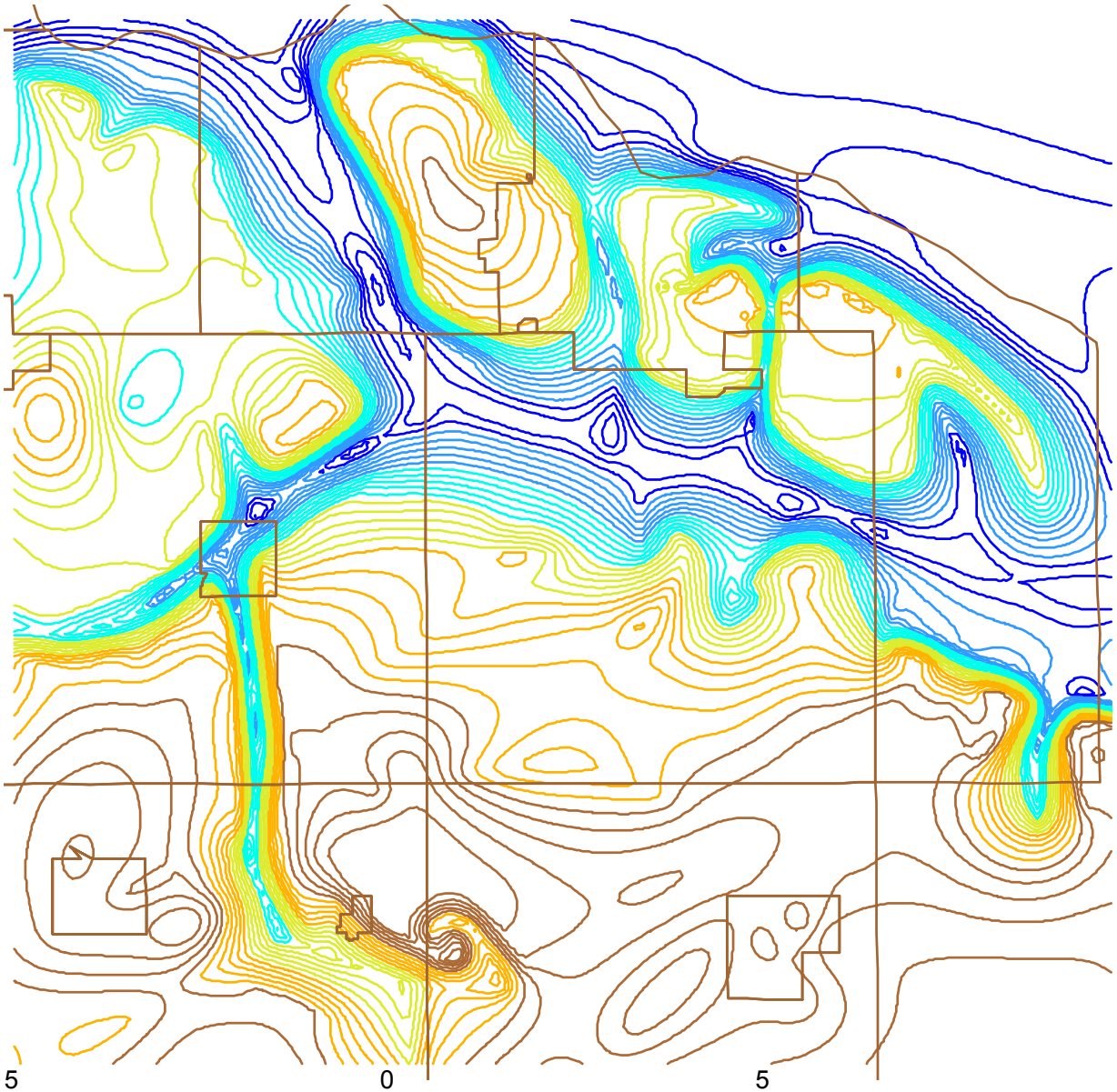
HANS Figure 24



Dakota COUNTY

Water Table:
HANS Monitoring Well Data compared to
Dakota County Geologic Atlas Piezometric Surface

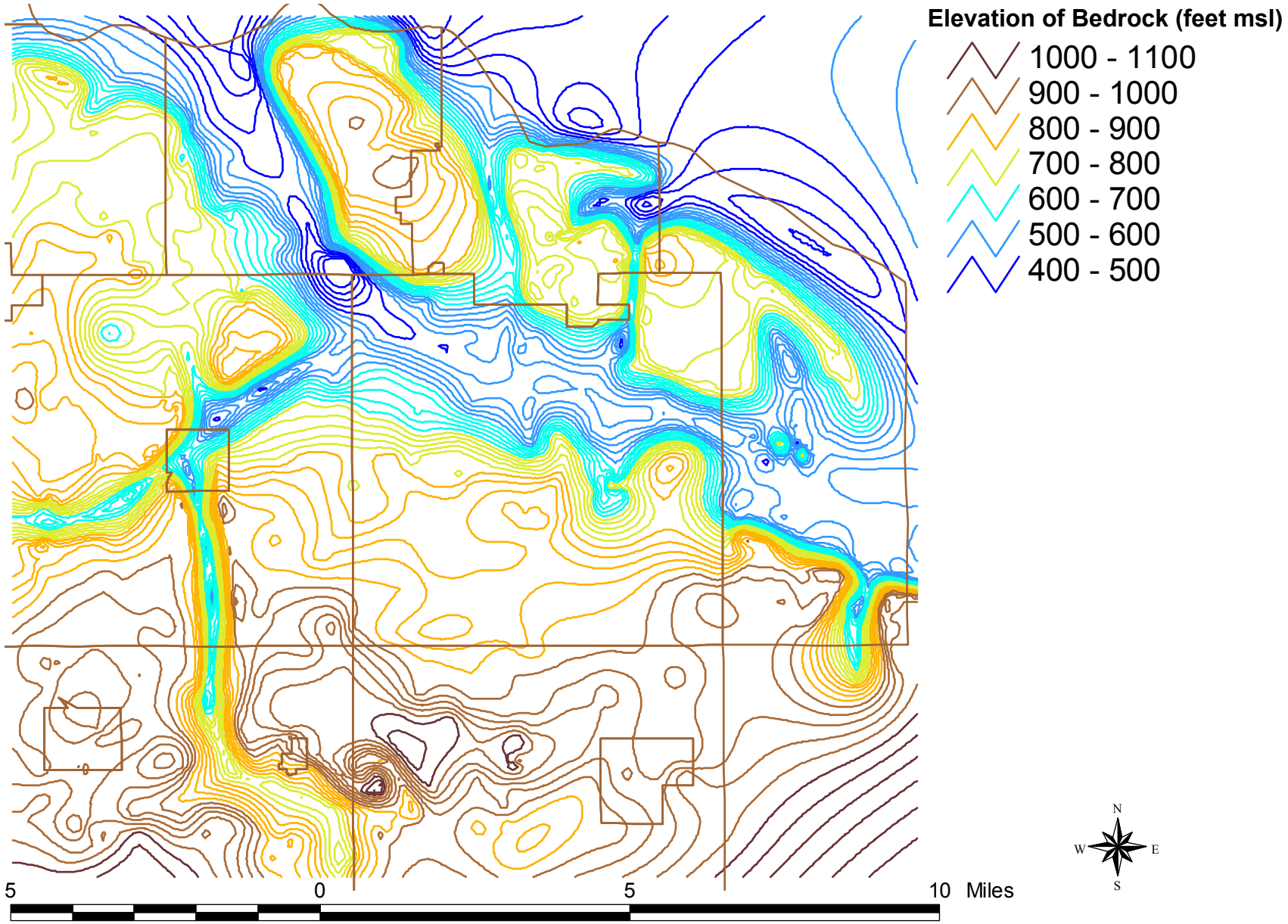
HANS Figure 25



Dakota COUNTY

Bedrock Elevation Trend Surface
Least Squared Error Fit

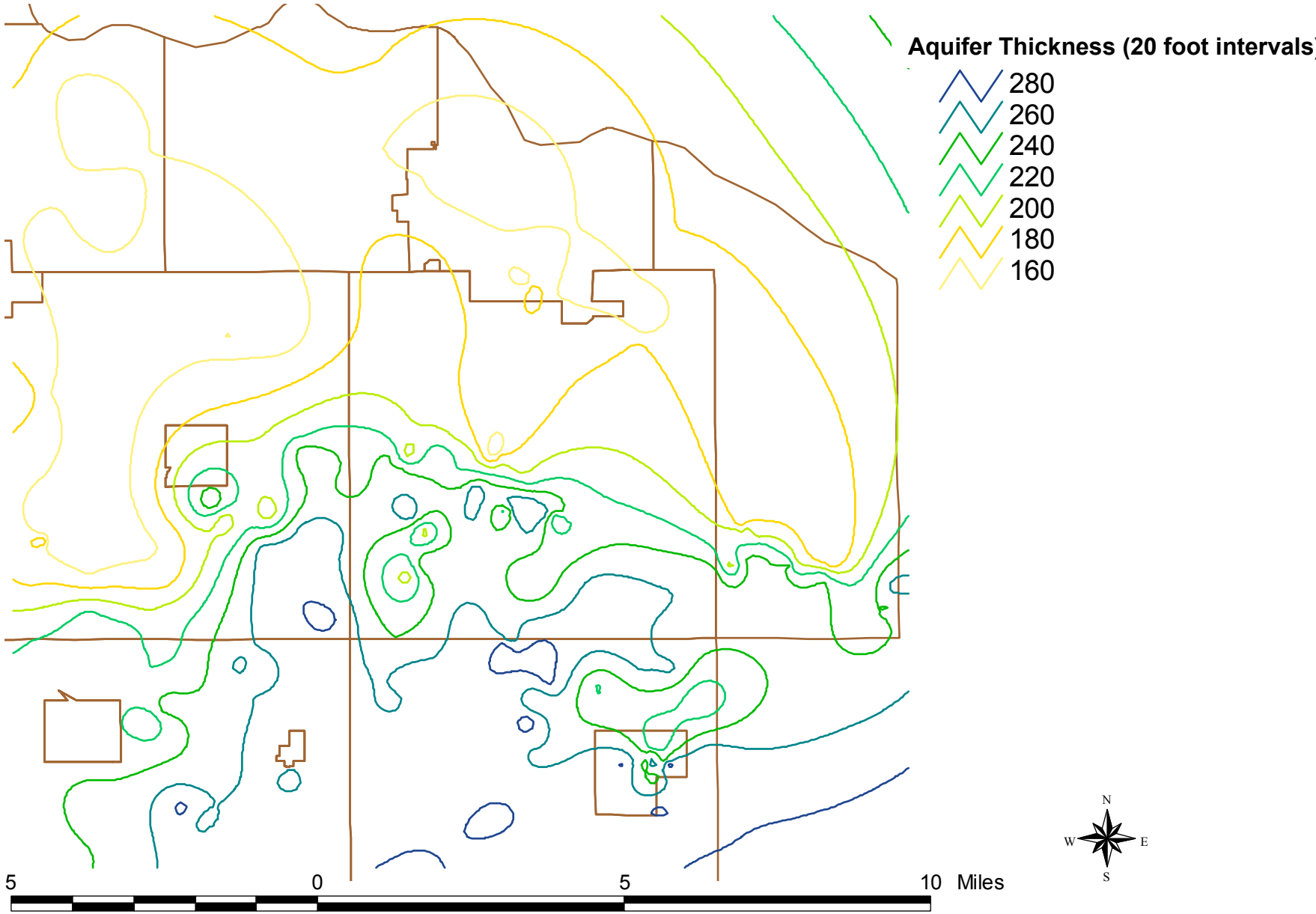
HANS Figure 26



Dakota COUNTY

Bedrock Elevation Trend Surface
Exact Fit

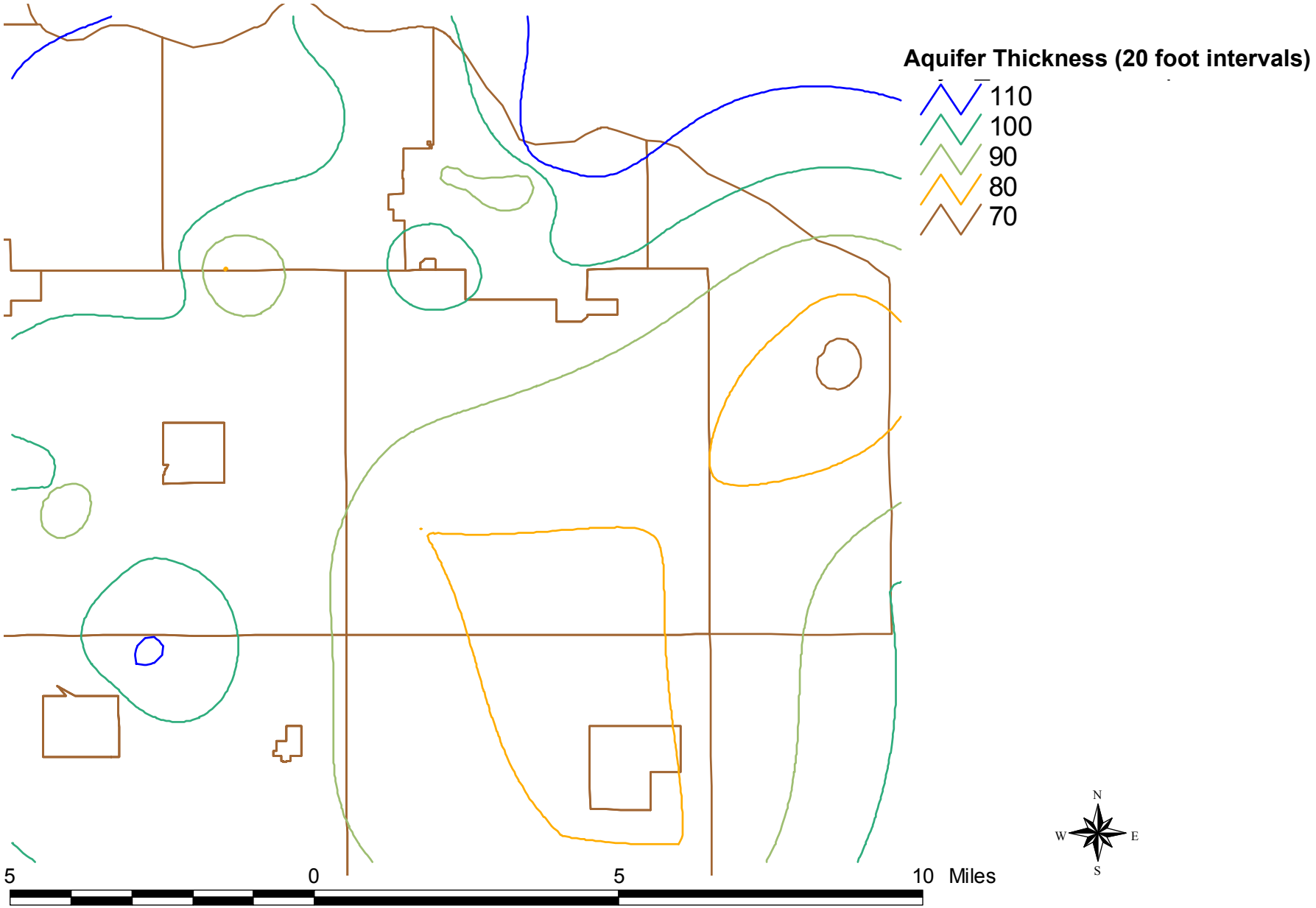
HANS Figure 27



Dakota COUNTY

Thickness of the Prairie du Chien Group (Ignoring Quaternary Erosion)

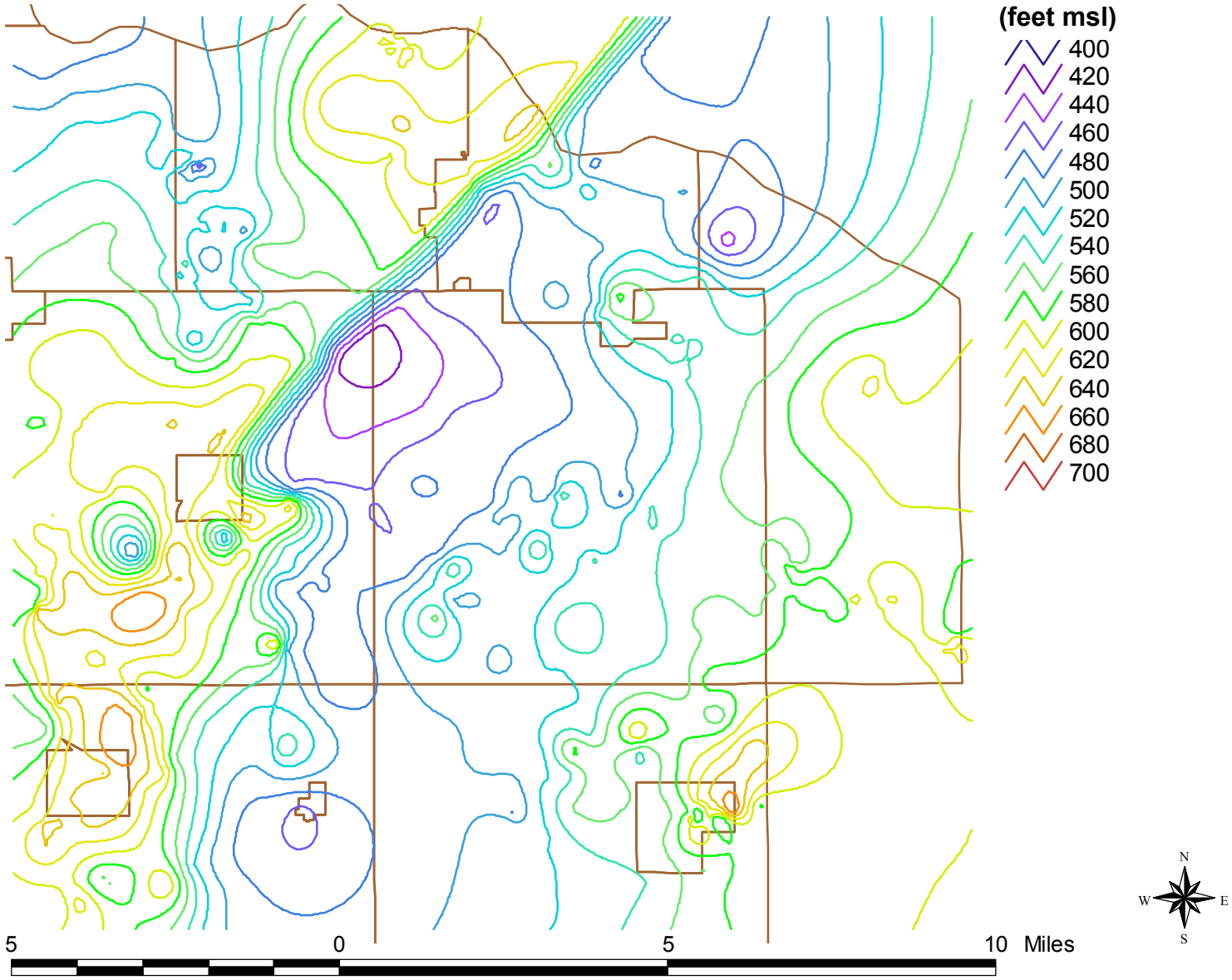
HANS Figure 28



Dakota COUNTY

Thickness of the Jordan Aquifer (Ignoring Quaternary Erosion)

HANS Figure 29

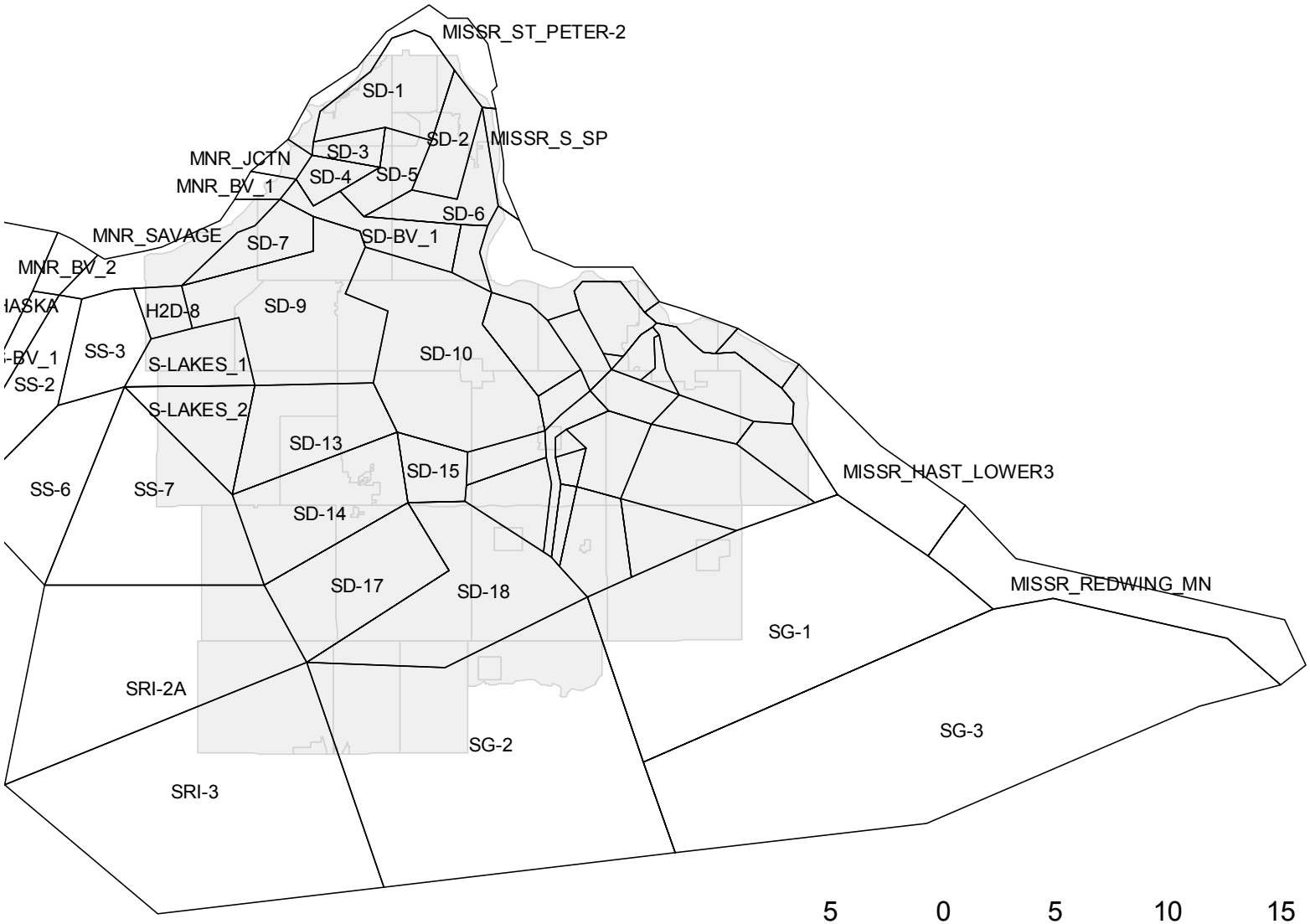


Dakota COUNTY

Base of the Jordan Aquifer (Ignoring Quaternary Erosion)

HANS Figure 30

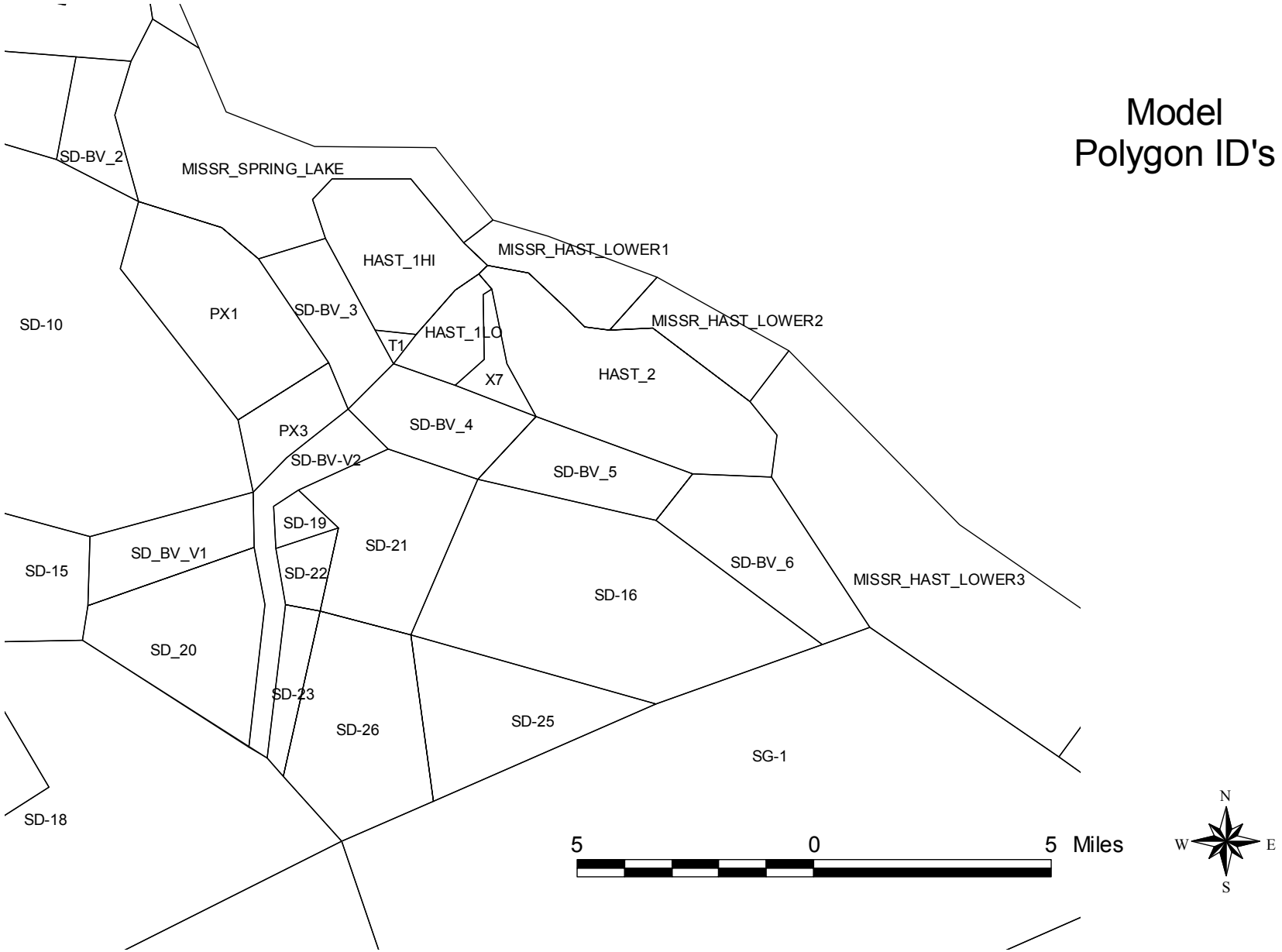
Model Polygon ID's



Dakota COUNTY

Groundwater Model: Polygon IDs 1

HANS Figure 31



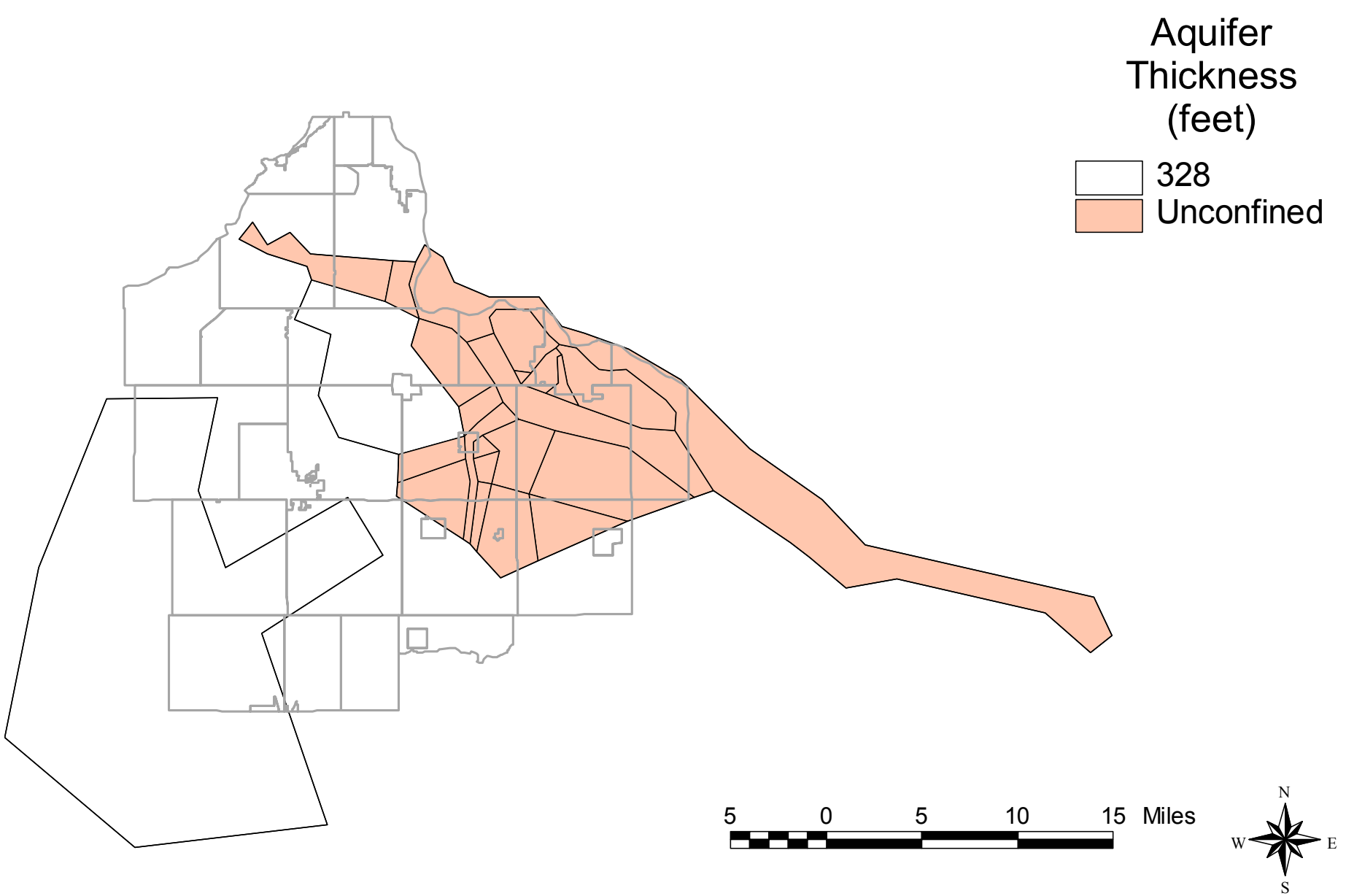
Groundwater Model: Polygon IDs 2

HANS Figure 32

Dakota COUNTY

Groundwater Model: Approximate Effective Aquifer Base

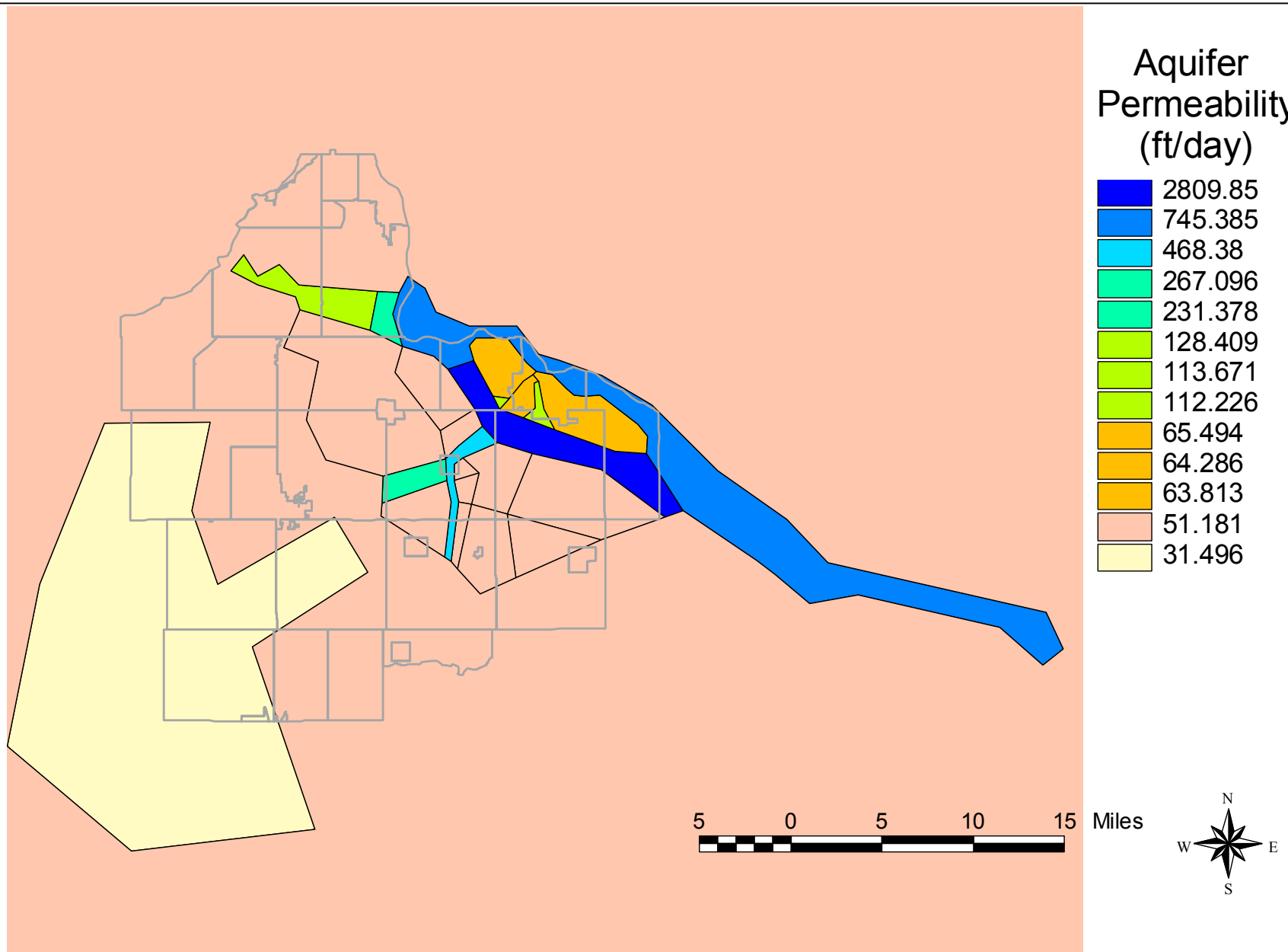
HANS Figure 33



Dakota COUNTY

Groundwater Model: Aquifer Thickness

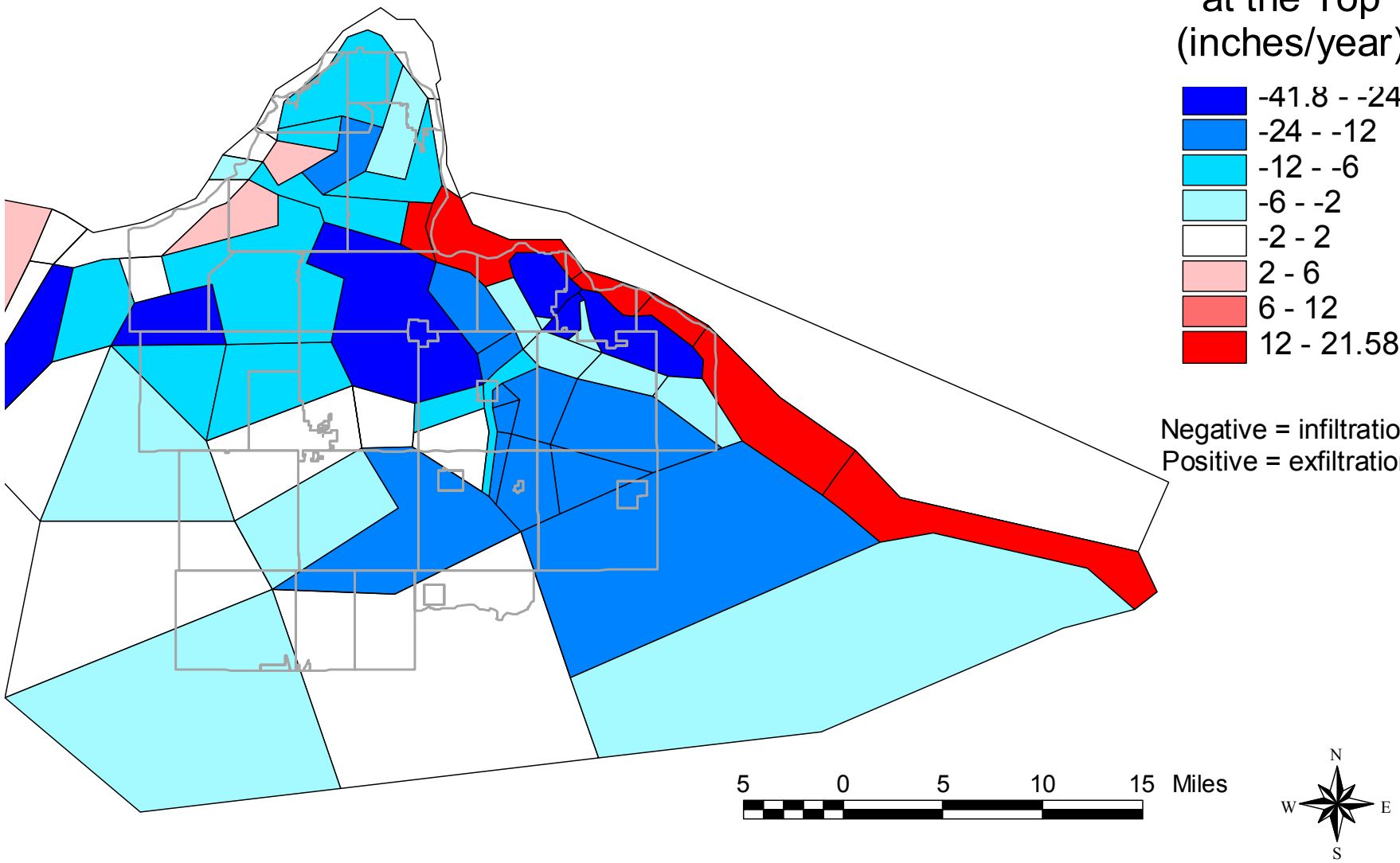
HANS Figure 34



Dakota COUNTY

Groundwater Model: Aquifer Permeability

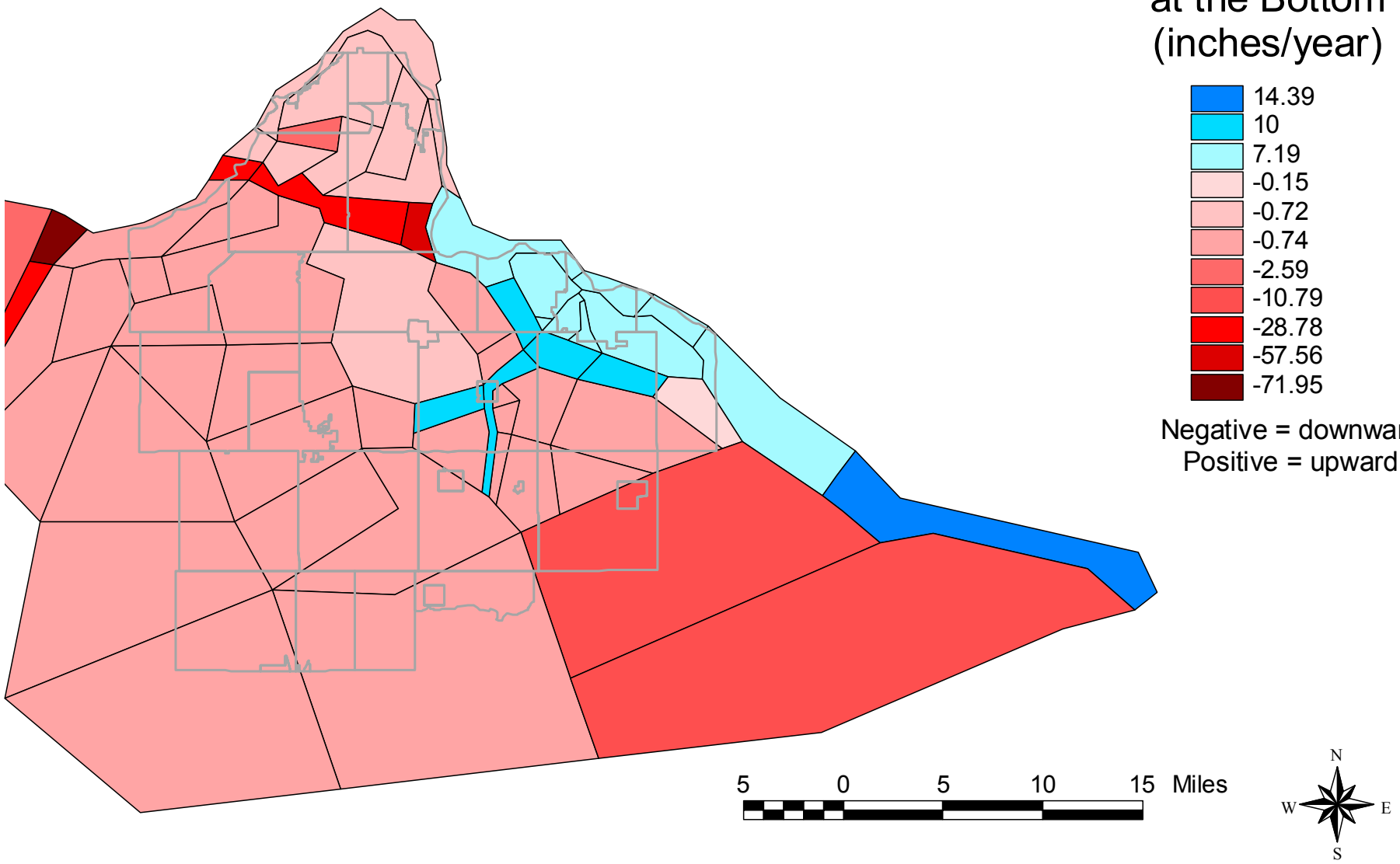
HANS Figure 35



Dakota COUNTY

Groundwater Model:
Infiltration & Exfiltration Rates at the Top of the Aquifer

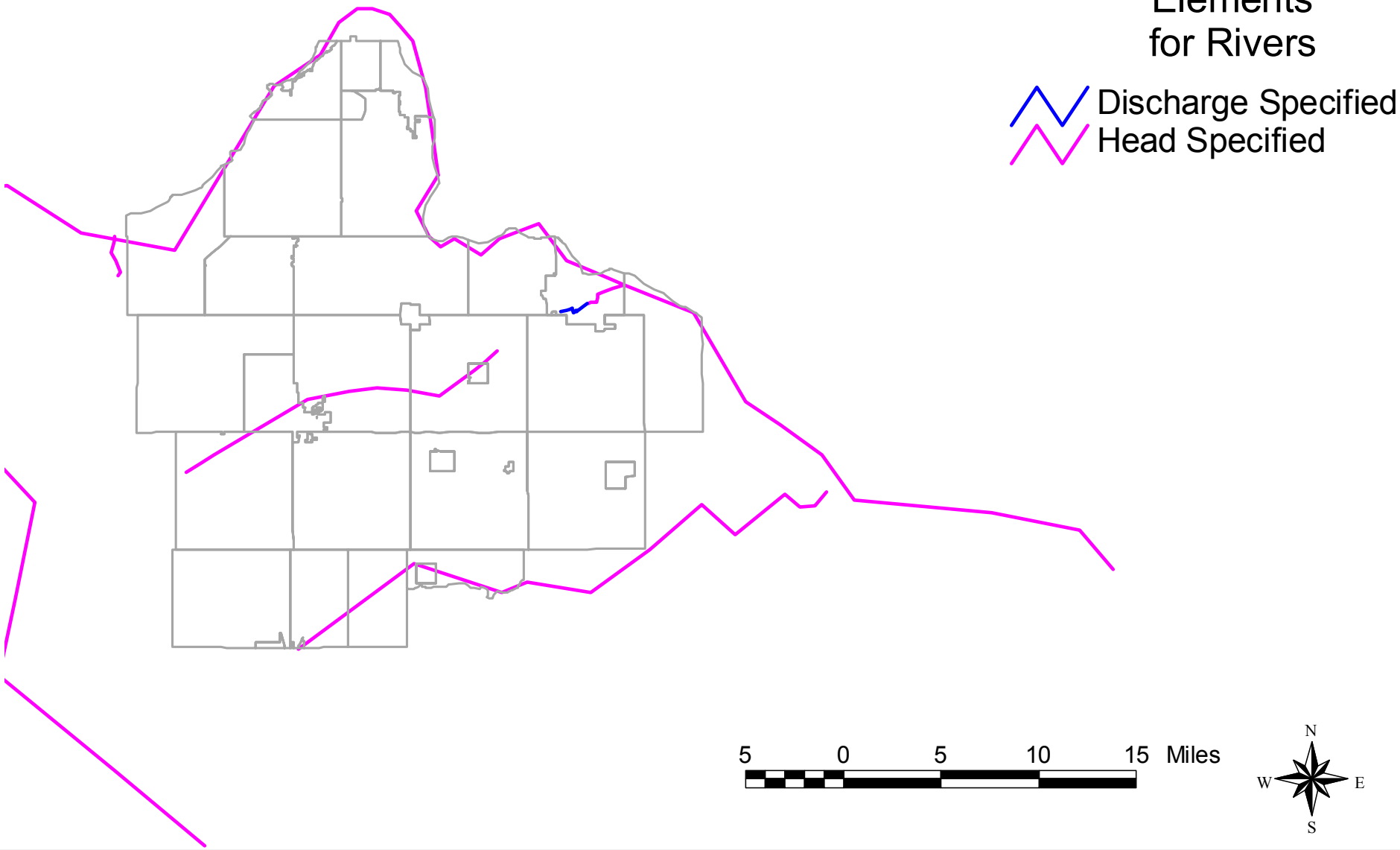
HANS Figure 36



Dakota COUNTY

Groundwater Model:
Leakage at the Bottom of the Aquifer

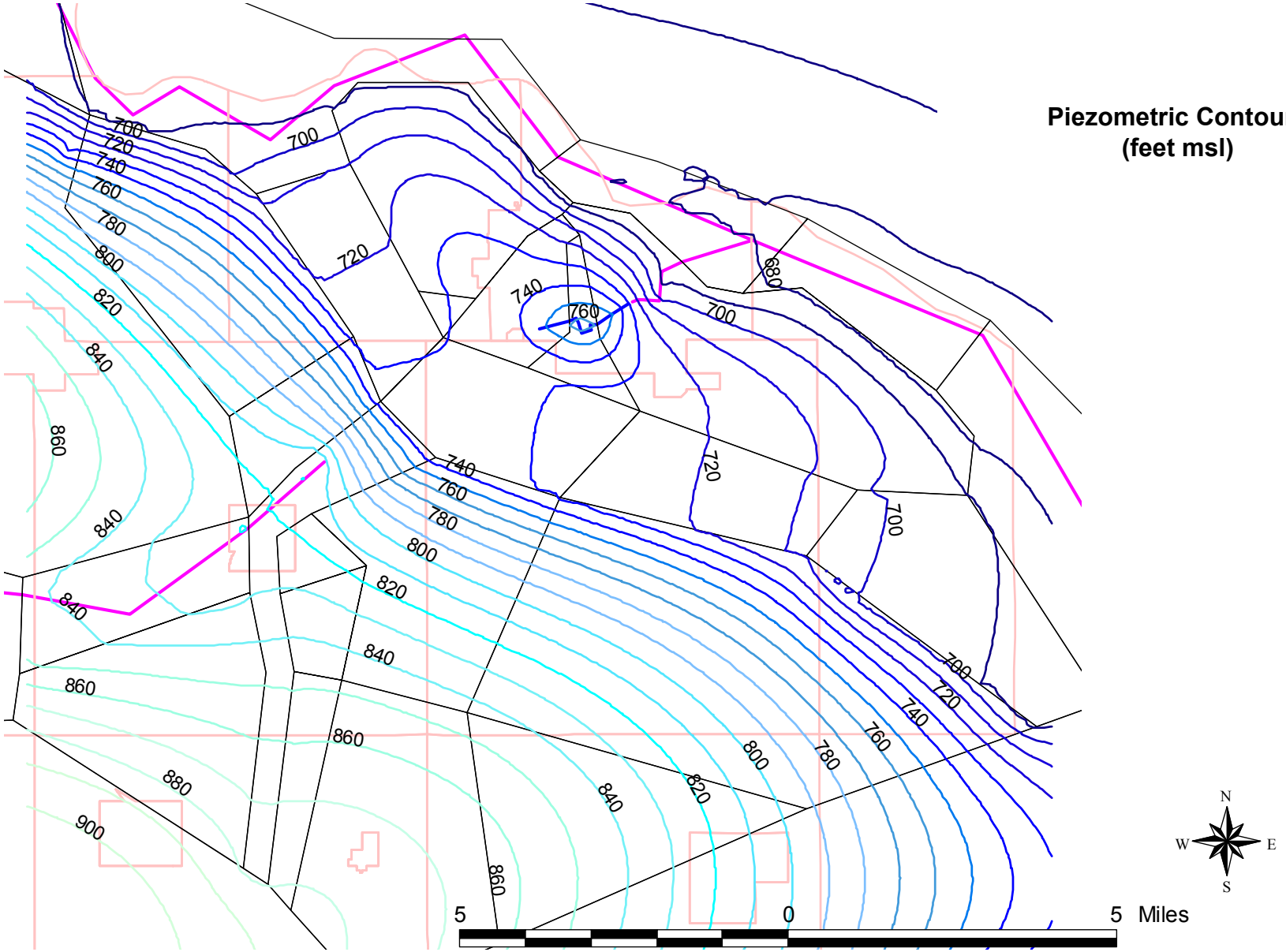
HANS Figure 37



Dakota COUNTY

Groundwater Model:
Line Elements for Rivers

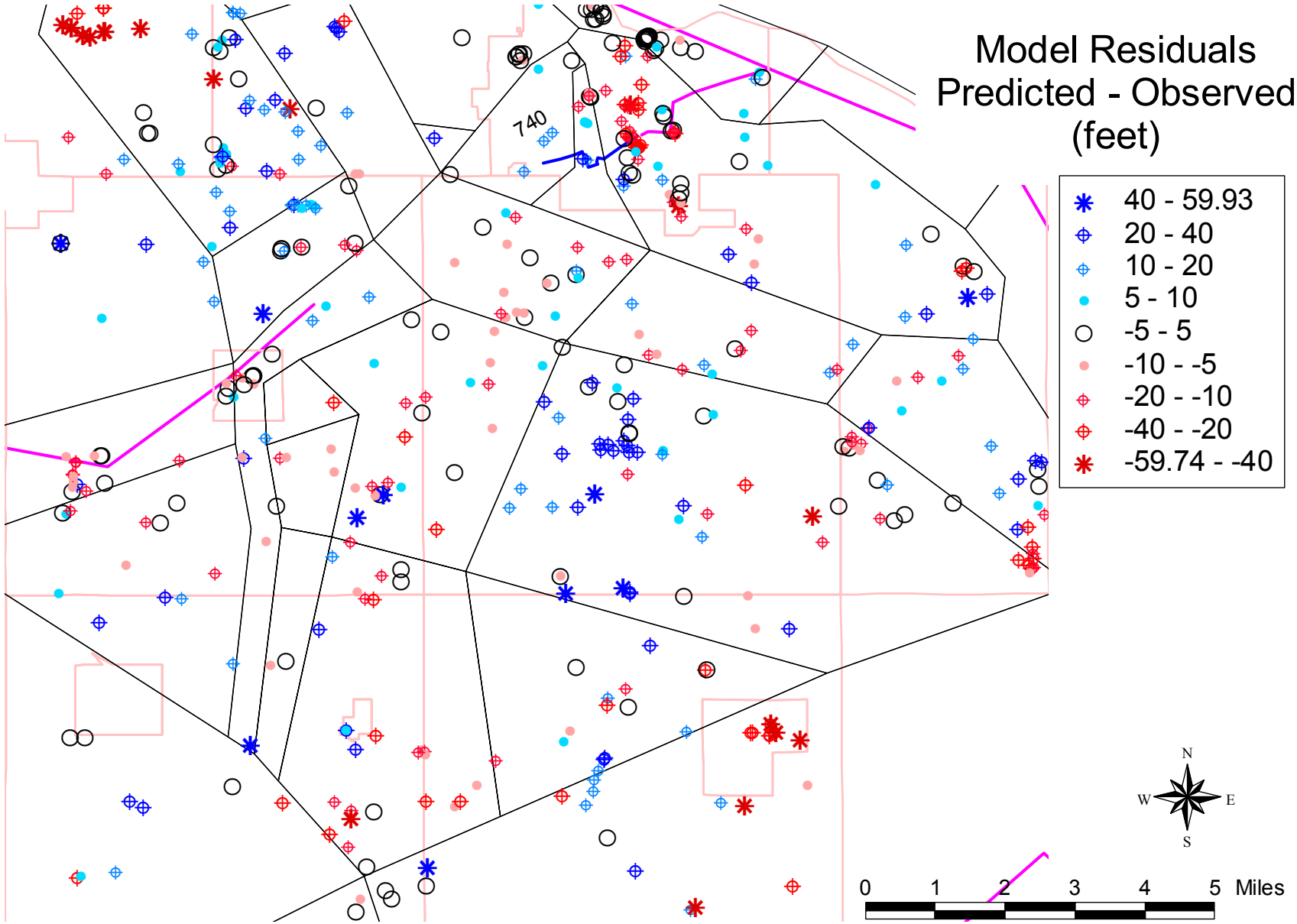
HANS Figure 38



Dakota COUNTY

Groundwater Model: Piezometric Contours

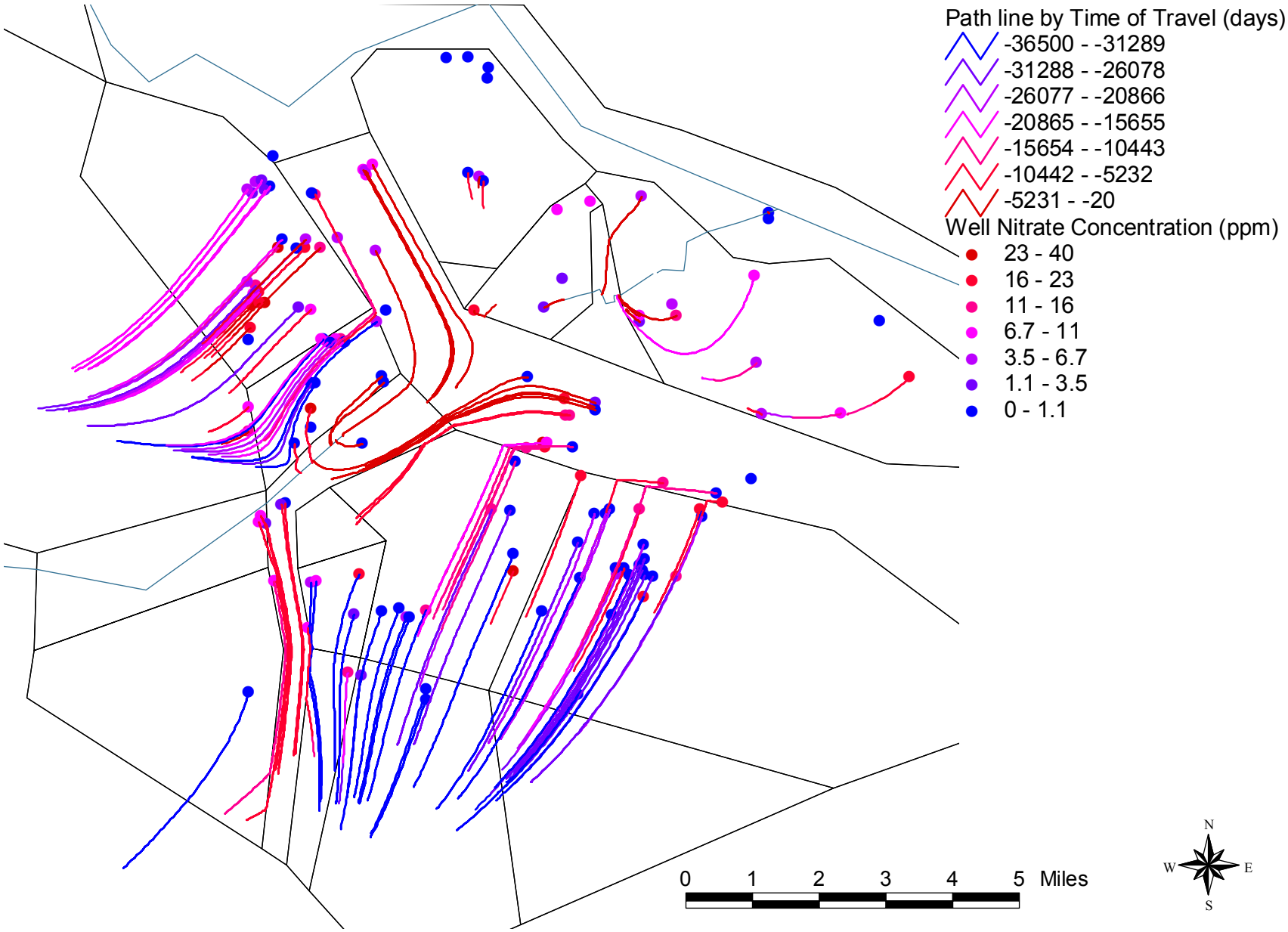
HANS Figure 39



Dakota COUNTY

Groundwater Model: Residuals to Observation Heads

HANS Figure 40



Dakota COUNTY

Groundwater Model: Estimated Flow Paths to HANS Wells

HANS Figure 41