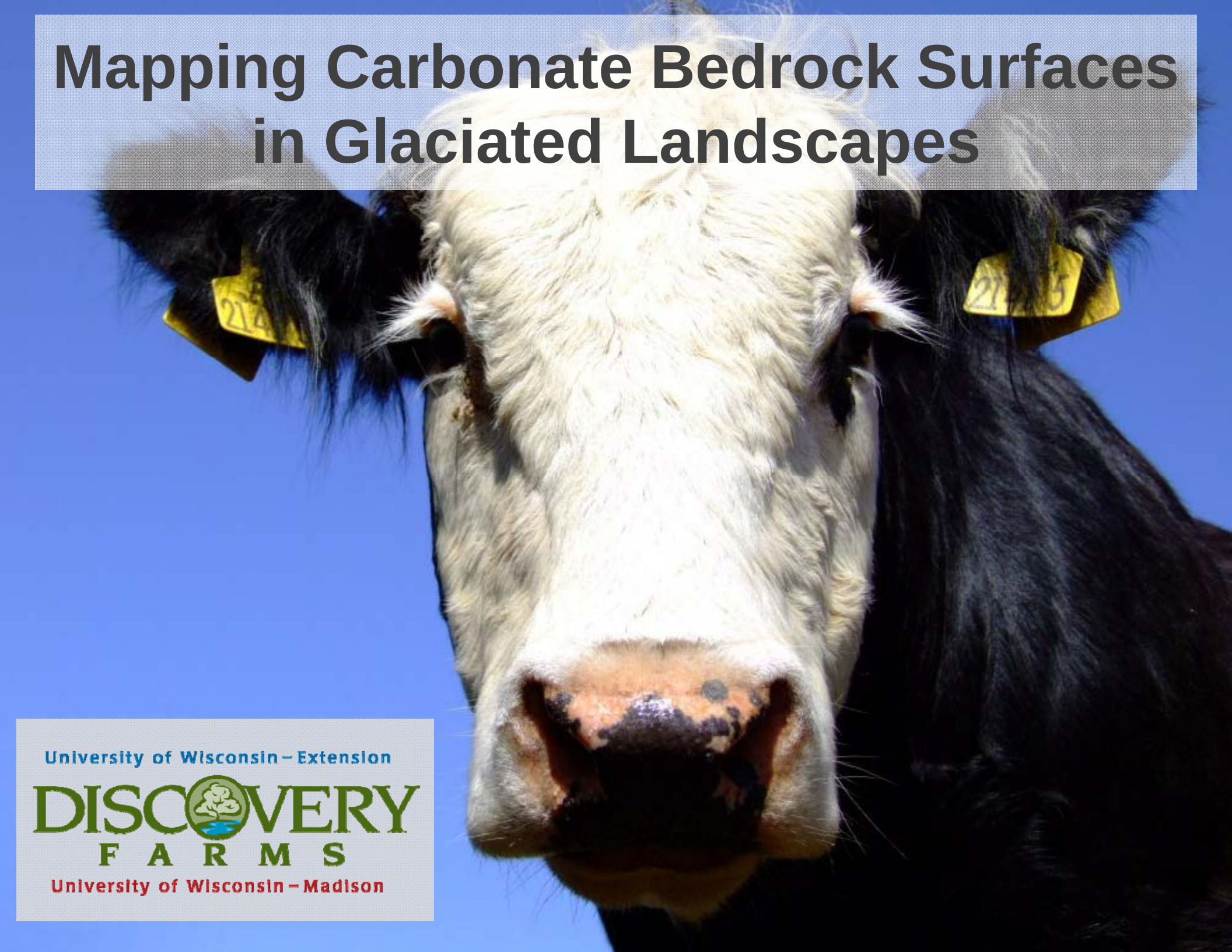
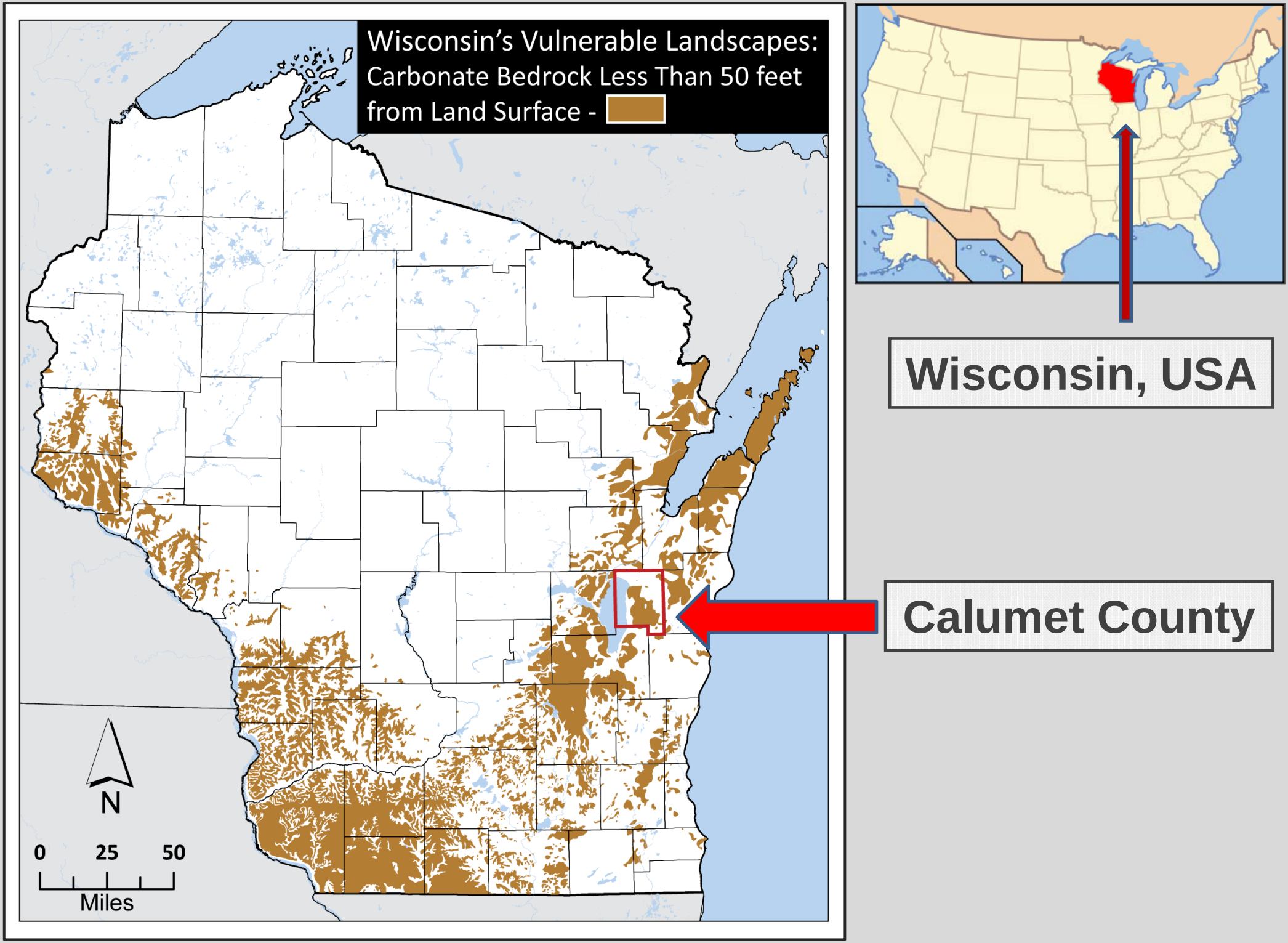
Mapping Carbonate Bedrock Surfaces in Glaciated Landscapes



University of Wisconsin – Extension

DISCOVERY FARMS

University of Wisconsin – Madison

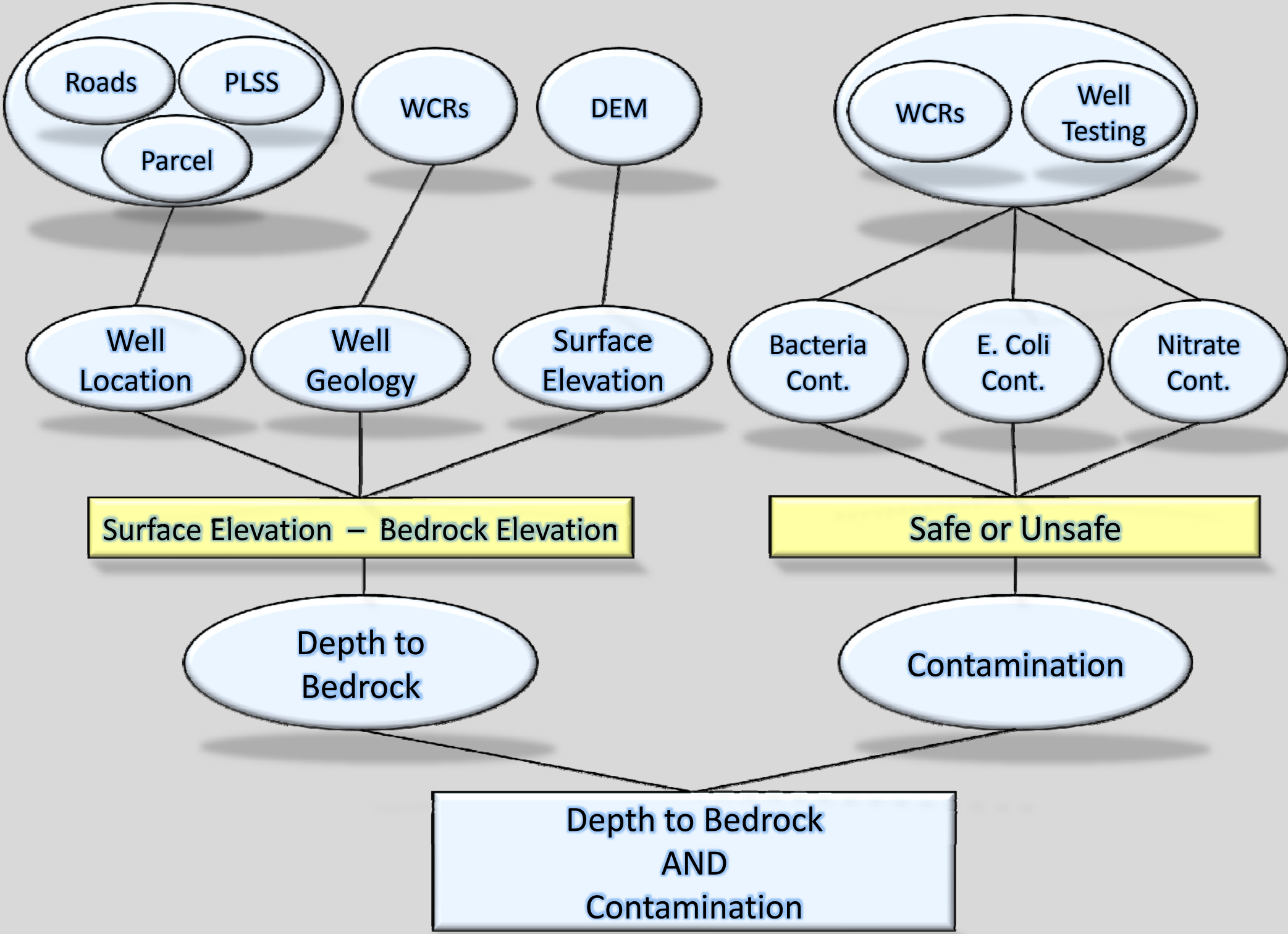

Wisconsin's Vulnerable Landscapes:
Carbonate Bedrock Less Than 50 feet
from Land Surface -
N
0
25
50
Miles
Wisconsin, USA
Calumet County

Flow Characteristics of fractured carbonate Aquifers

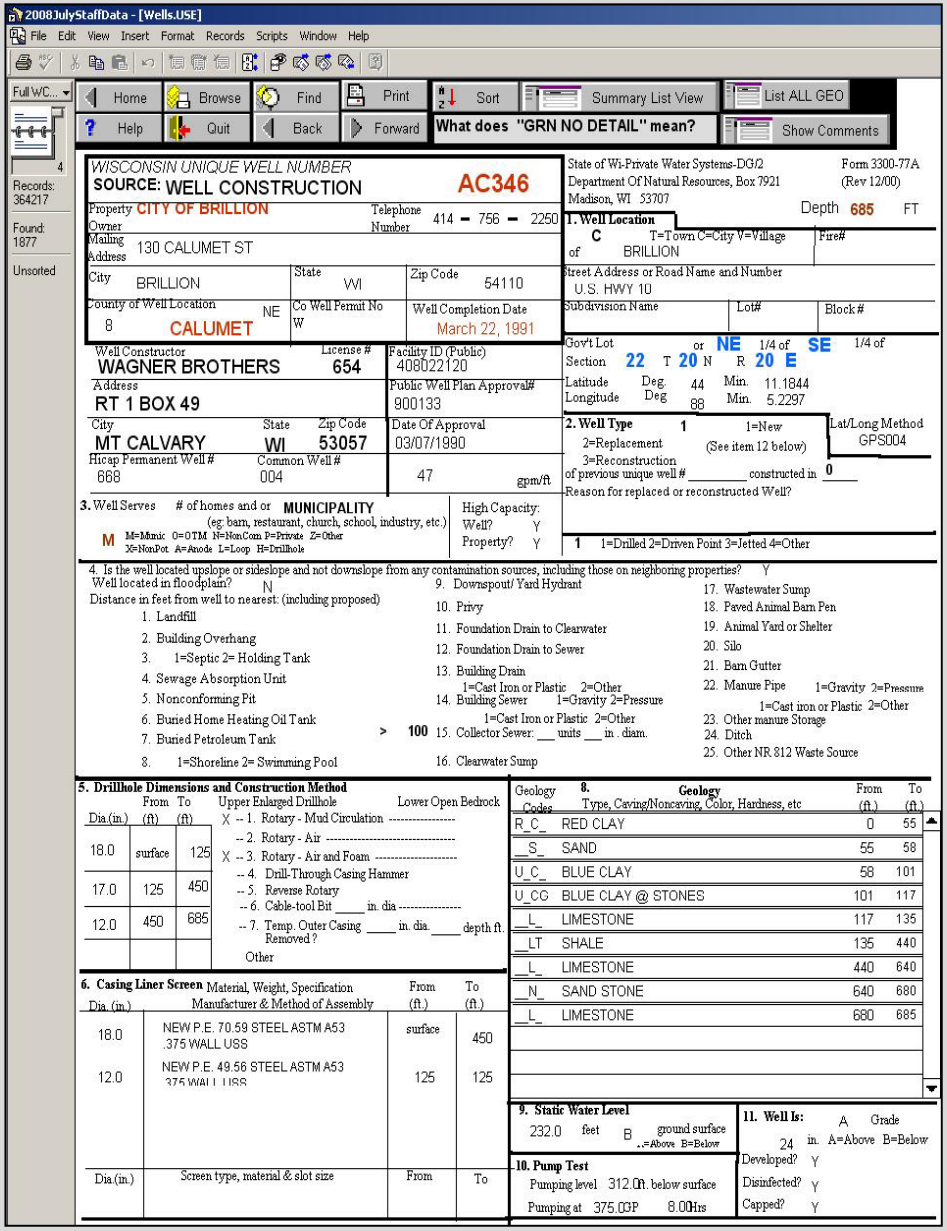
- Dense and ubiquitous fracture network
  - little surface runoff
  - water easily infiltrates to subsurface
- Recharge
  - exceedingly rapid
  - carries surface contaminants to the water table
- Flow within the aquifer occurs primarily along bedding plane fractures
  - Little to no attenuation of contaminants within the aquifer
- Flow rates vary from 10’s to 100’s of ft/day

- 14,000 dairy farms
- 1.25 million milk cows.
- Each cow produces 150 lbs of waste/day

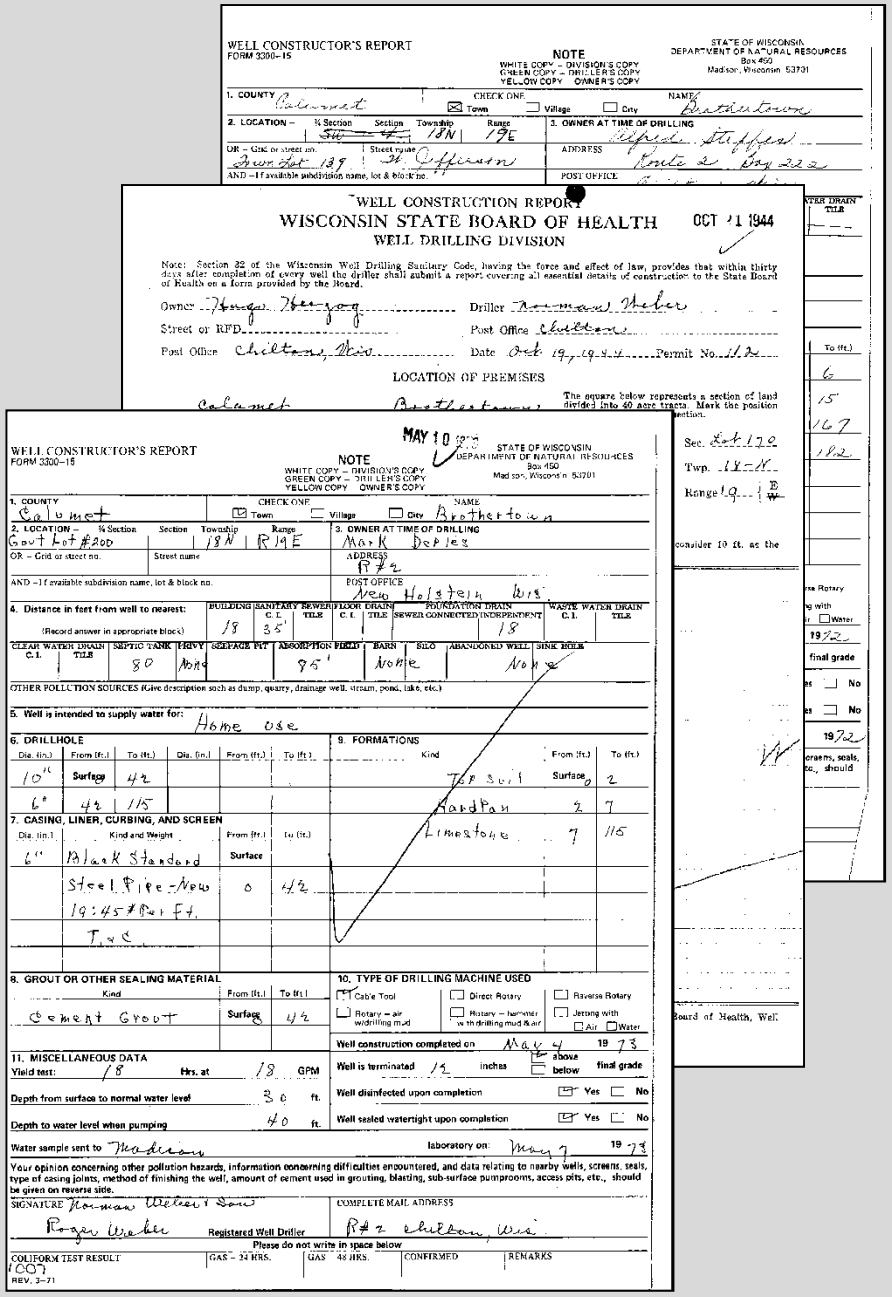
(1.25 million cows) (150 lbs. per day) (365 days)
= 34,000,000 tons of waste annually

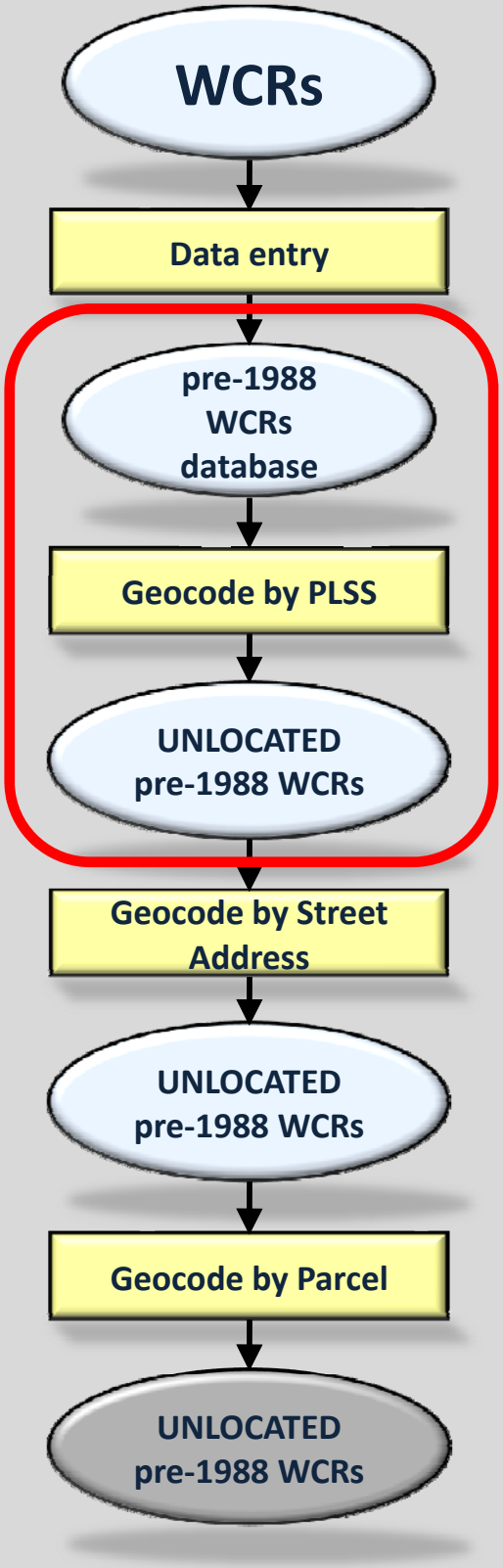

Roads
PLSS
Parcel
WCRs
DEM
WCRs
Well Testing
Well Location
Well Geology
Surface Elevation
Bacteria Cont.
E. Coli Cont.
Nitrate Cont.
Surface Elevation – Bedrock Elevation
Safe or Unsafe
Depth to Bedrock
Contamination
Depth to Bedrock AND Contamination

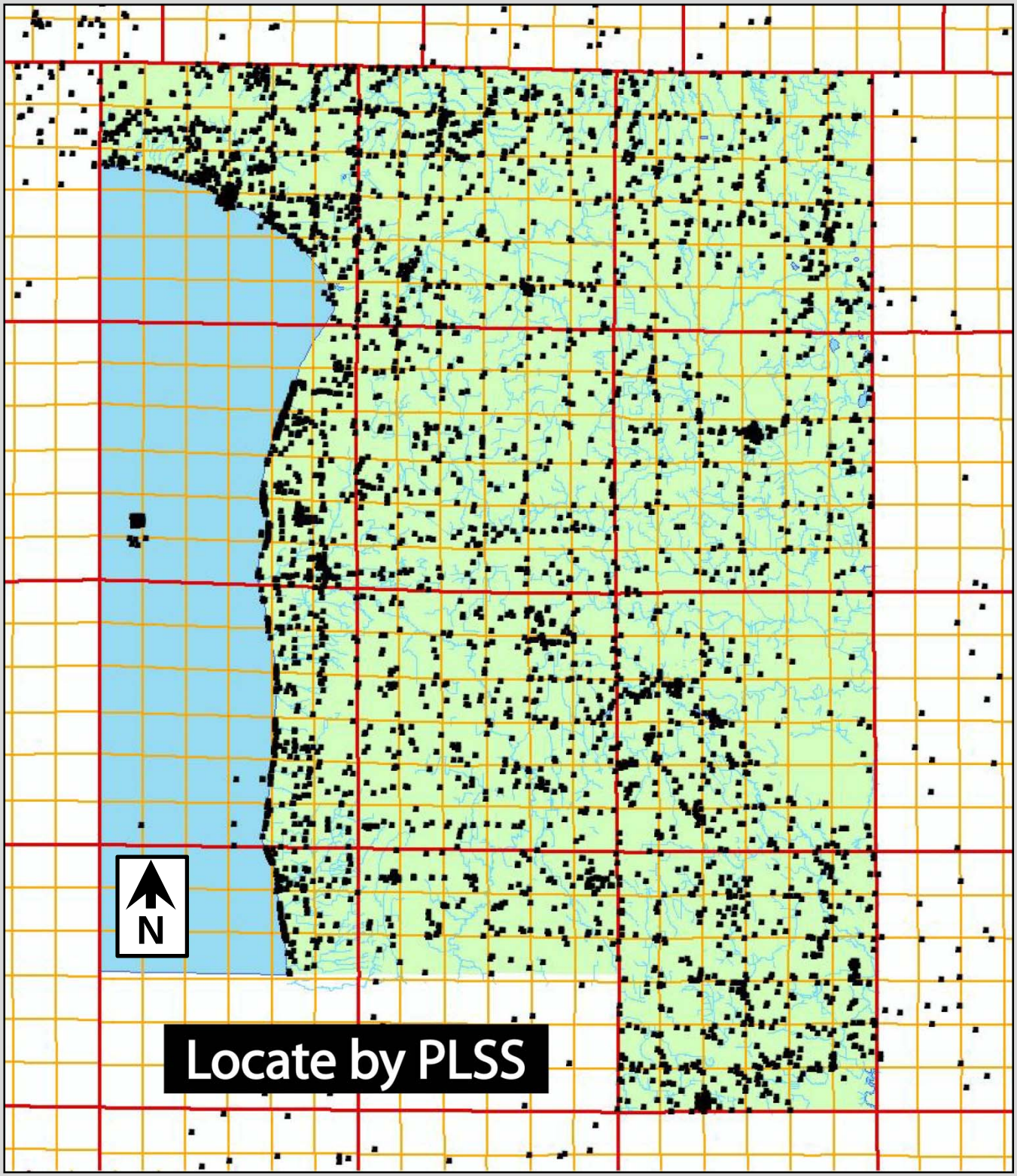
Digital Well Reports



Scanned Paper Well Reports




WCRs
Data entry
pre-1988 WCRs database
Geocode by PLSS
UNLOCATED pre-1988 WCRs
Geocode by Street Address
UNLOCATED pre-1988 WCRs
Geocode by Parcel
UNLOCATED pre-1988 WCRs


N
Locate by PLSS

WCRs

Data entry

pre-1988 WCRs database

Geocode by PLSS

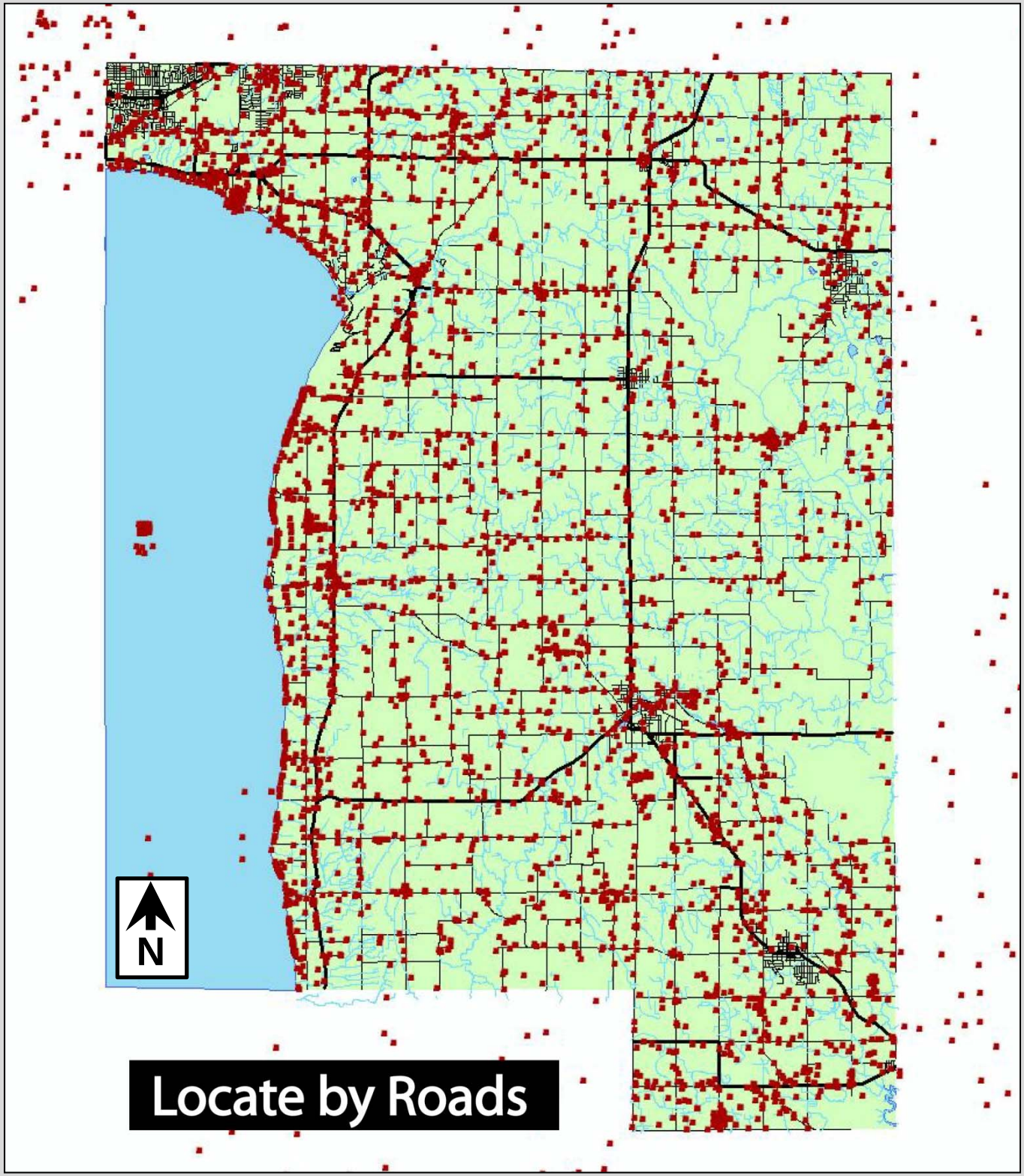
UNLOCATED pre-1988 WCRs

Geocode by Street Address

UNLOCATED pre-1988 WCRs

Geocode by Parcel

UNLOCATED pre-1988 WCRs



WCRs

Data entry

pre-1988 WCRs database

Geocode by PLSS

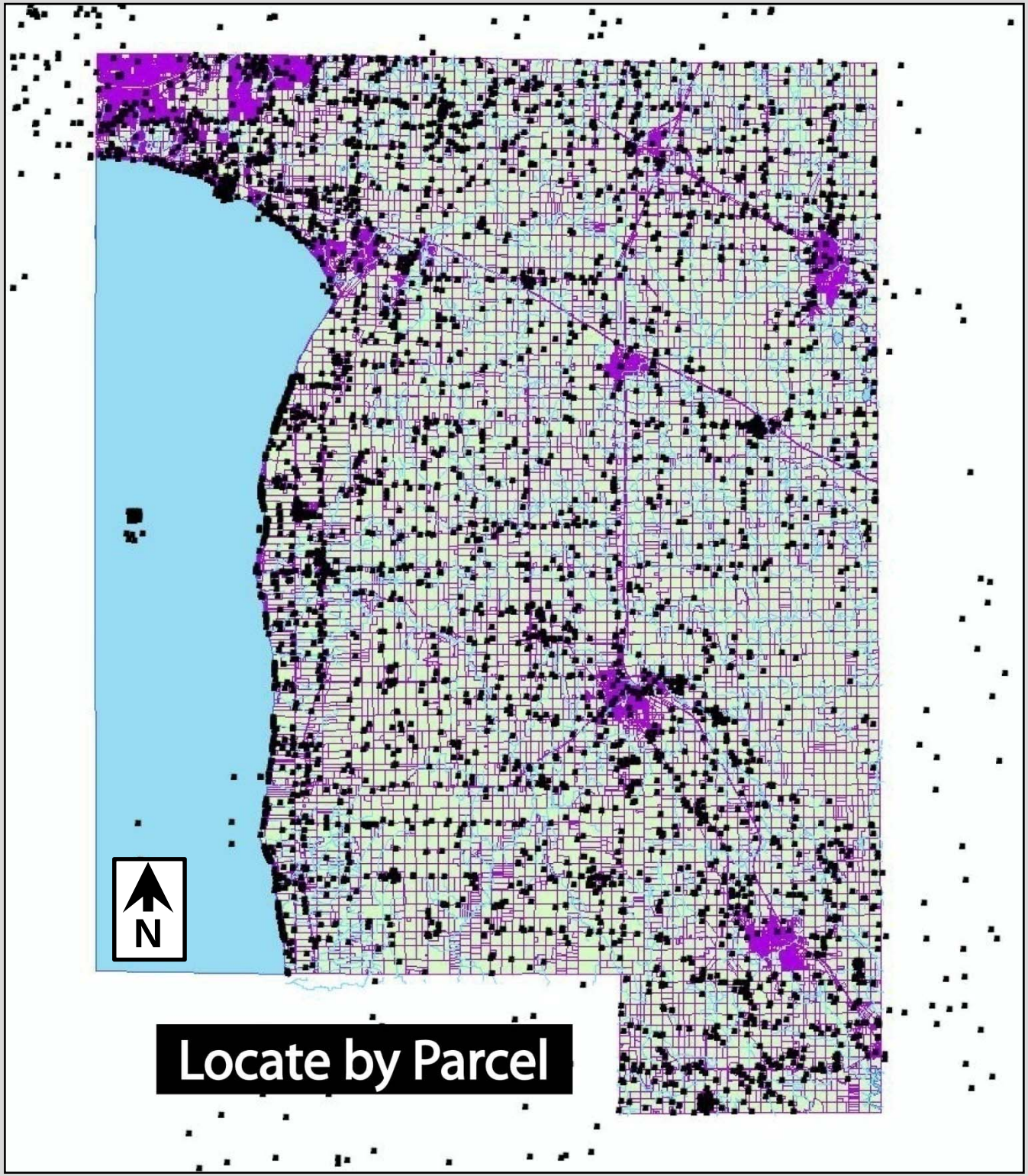
UNLOCATED pre-1988 WCRs

Geocode by Street Address

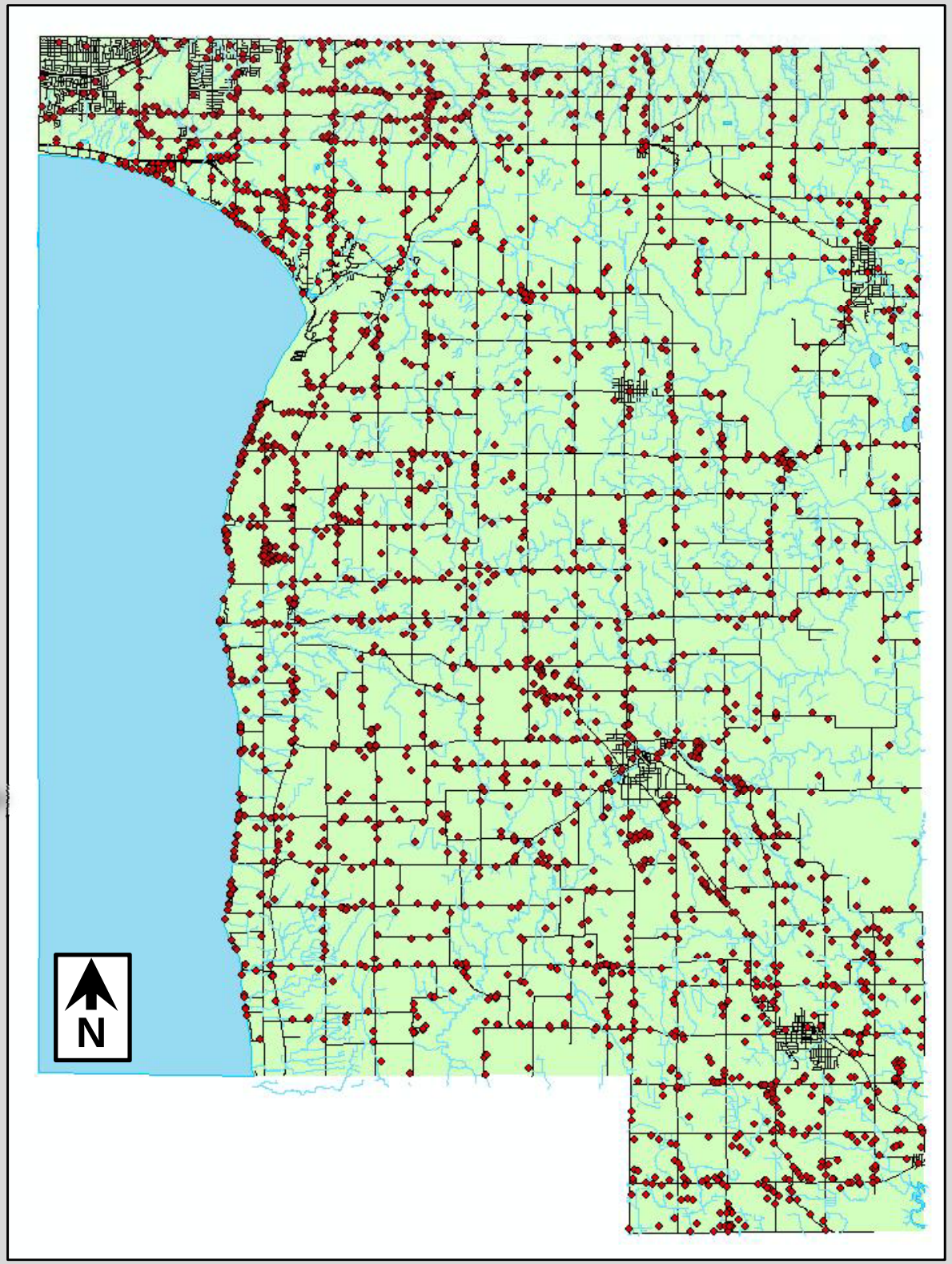
UNLOCATED pre-1988 WCRs

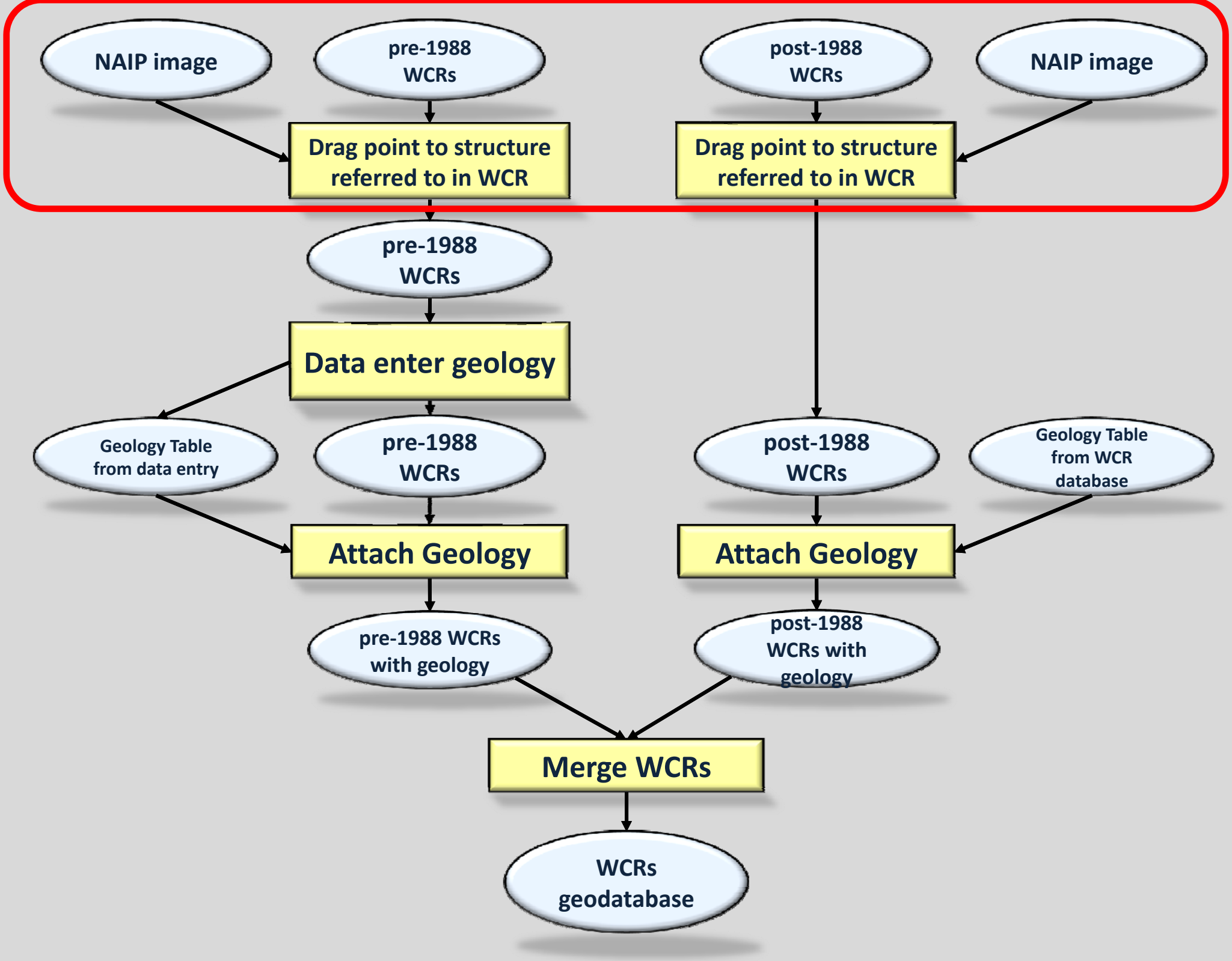
Geocode by Parcel

UNLOCATED pre-1988 WCRs



2800+
Geocoded Well
Data Points




NAIP image
pre-1988 WCRs
post-1988 WCRs
NAIP image
Drag point to structure referred to in WCR
Drag point to structure referred to in WCR
pre-1988 WCRs
Data enter geology
Geology Table from data entry
pre-1988 WCRs
post-1988 WCRs
Geology Table from WCR database
Attach Geology
Attach Geology
pre-1988 WCRs with geology
post-1988 WCRs with geology
Merge WCRs
WCRs geodatabase

NAIP image

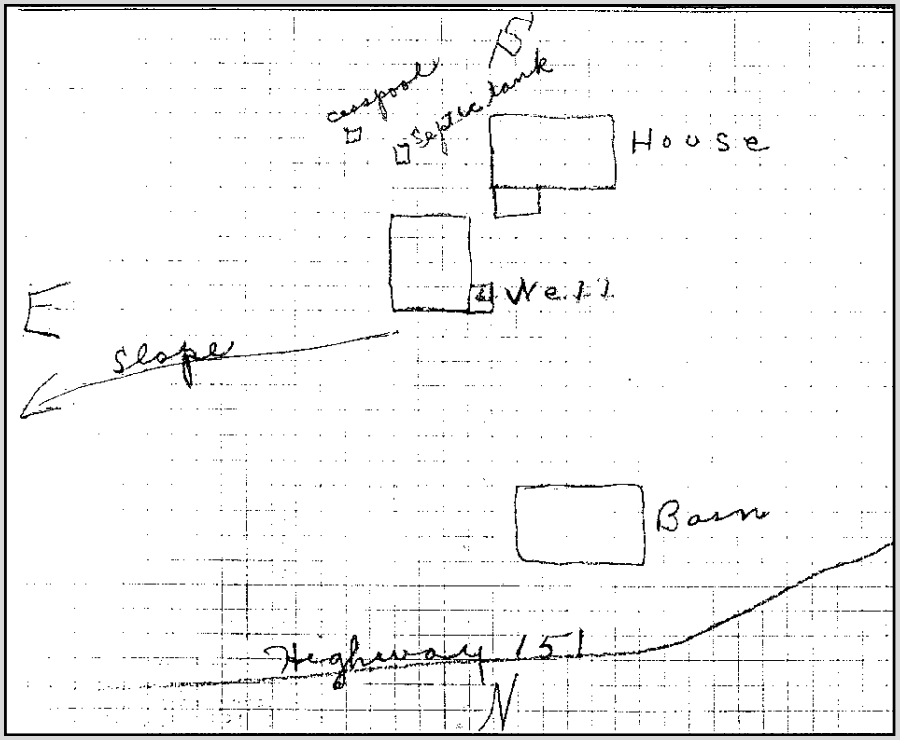
pre-1988 WCRs

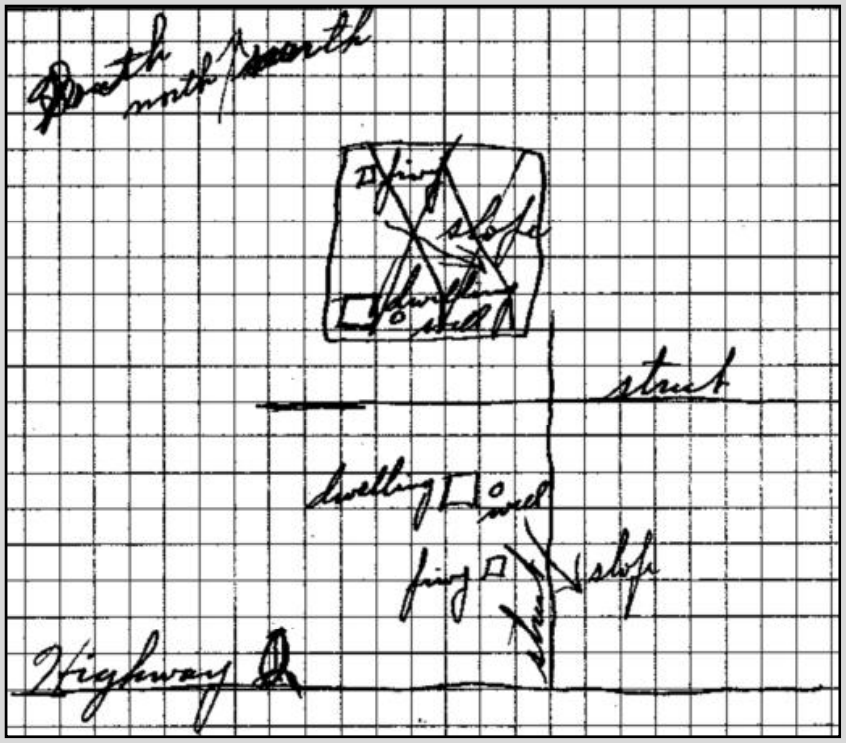
Drag point to structure referred to in WCR

post-1988 WCRs

NAIP image

Drag point to structure referred to in WCR





4. Distance in feet from well to nearest:

(Record answer in appropriate block)

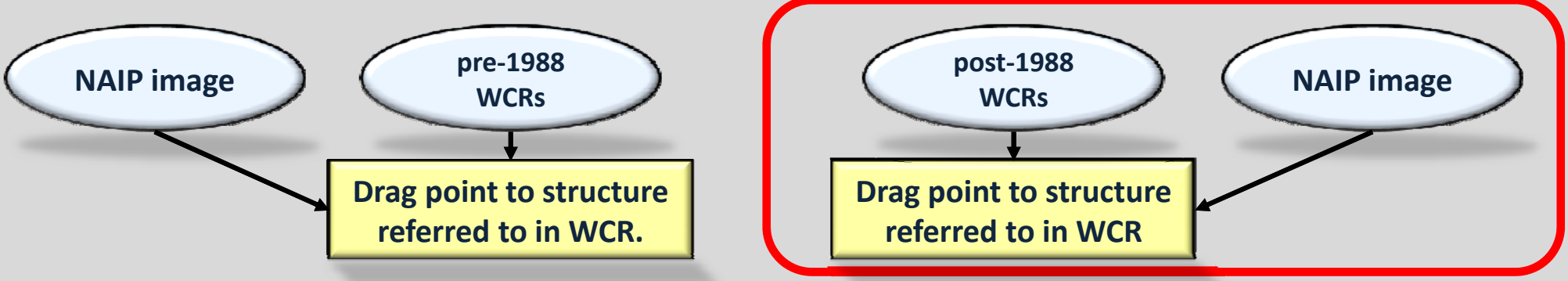
BUILDING	SANITARY SEWER C. I.	SANITARY SEWER TILE	FLOOR DRAIN C. I.	FLOOR DRAIN TILE	FOUNDATION DRAIN SEWER CONNECTED	FOUNDATION DRAIN INDEPENDENT	WASTE WATER DRAIN C. I.	WASTE WATER DRAIN TILE
8		—		—		—		—

CLEAR WATER DRAIN C. I.	CLEAR WATER DRAIN TILE	SEPTIC TANK	PRIVY	SEEPAGE PIT	ABSORPTION FIELD	BARN	SILO	ABANDONED WELL	SINK HOLE
—		70	—		100	125	150	125 cemented	—

OTHER POLLUTION SOURCES (Give description such as dump, quarry, drainage well, stream, pond, lake, etc.)

none

5. Well is intended to supply water for: farm



3. Well Serves # of homes and or **BARN**
(eg: barn, restaurant, church, school, industry, etc.)
P M=Mimic O=OTM N=NonCom P=Private Z=Other
X=NonPot A=Anode L=Loop H=Drillhole

High Capacity:
Well? N
Property? N

Reason for replaced or reconstructed Well?
NEED MORE WATER

1 1=Drilled 2=Driven Point 3=Jetted 4=Other

4. Is the well located upslope or sideslope and not downslope from any contamination sources, including those on neighboring properties? Y

Well located in floodplain? N

Distance in feet from well to nearest: (including proposed)

1. Landfill
75 2. Building Overhang
90 3. 1=Septic 2= Holding Tank
100 4. Sewage Absorption Unit
5. Nonconforming Pit
6. Buried Home Heating Oil Tank
135 7. Buried Petroleum Tank
8. 1=Shoreline 2= Swimming Pool
9. Downspout/ Yard Hydrant
10. Privy
11. Foundation Drain to Clearwater
12. Foundation Drain to Sewer
13. Building Drain 1=Cast Iron or Plastic 2=Other
14. Building Sewer 1=Gravity 2=Pressure 1=Cast Iron or Plastic 2=Other
15. Collector Sewer: ___ units ___ in . diam.
16. Clearwater Sump
17. Wastewater Sump
82 18. Paved Animal Barn Pen
102 19. Animal Yard or Shelter
140 20. Silo SEALED
135 21. Barn Gutter
22. Manure Pipe 1=Gravity 2=Pressure 1=Cast iron or Plastic 2=Other
260 23. Other manure Storage
24. Ditch
25. Other NR 812 Waste Source

3. Well Serves # of homes and or **POND**
(eg: barn, restaurant, church, school, industry, etc.)
P M=Mimic O=OTM N=NonCom P=Private Z=Other
X=NonPot A=Anode L=Loop H=Drillhole

High Capacity:
Well? N
Property? N

Reason for replaced or reconstructed Well?
POND WELL

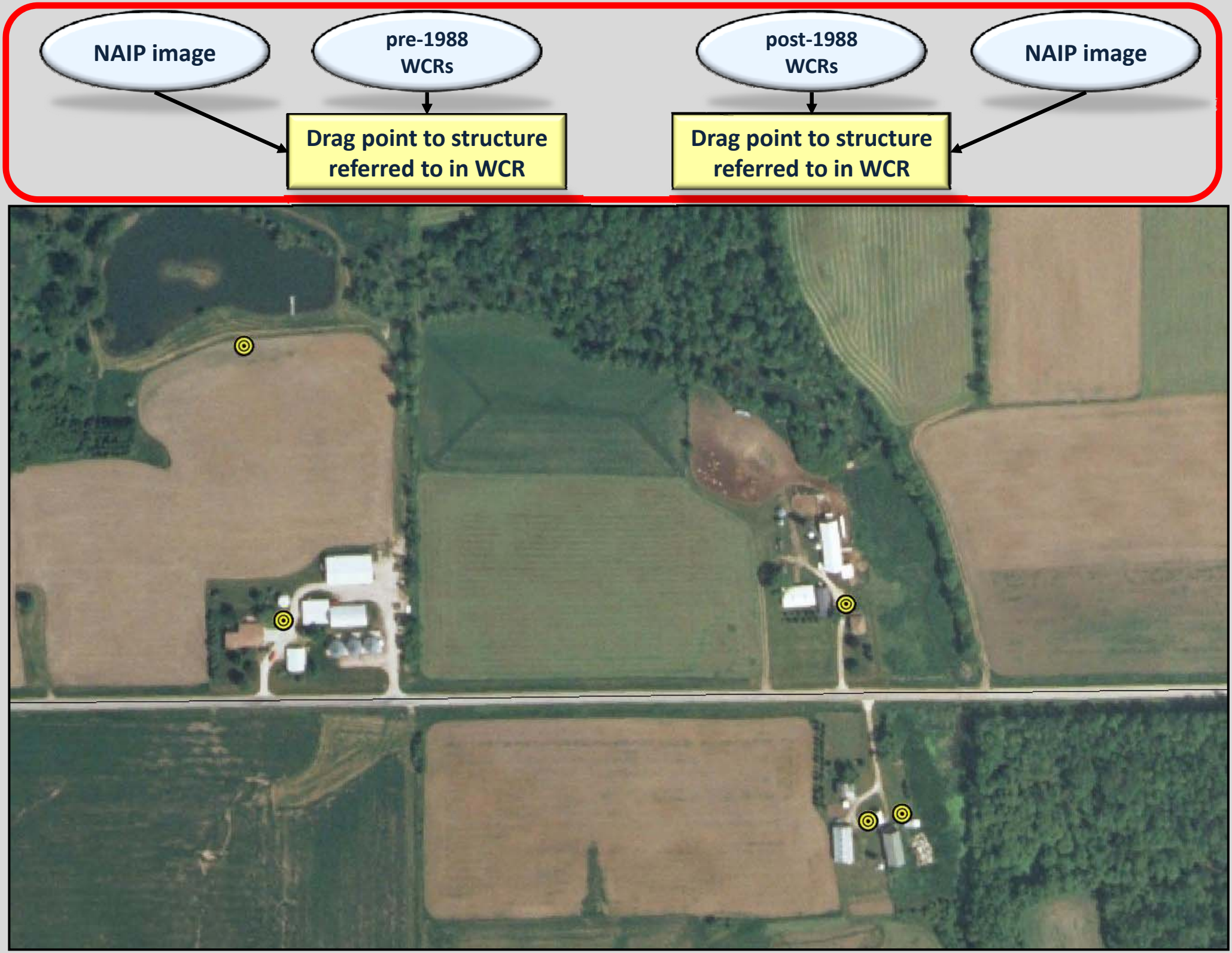
1 1=Drilled 2=Driven Point 3=Jetted 4=Other

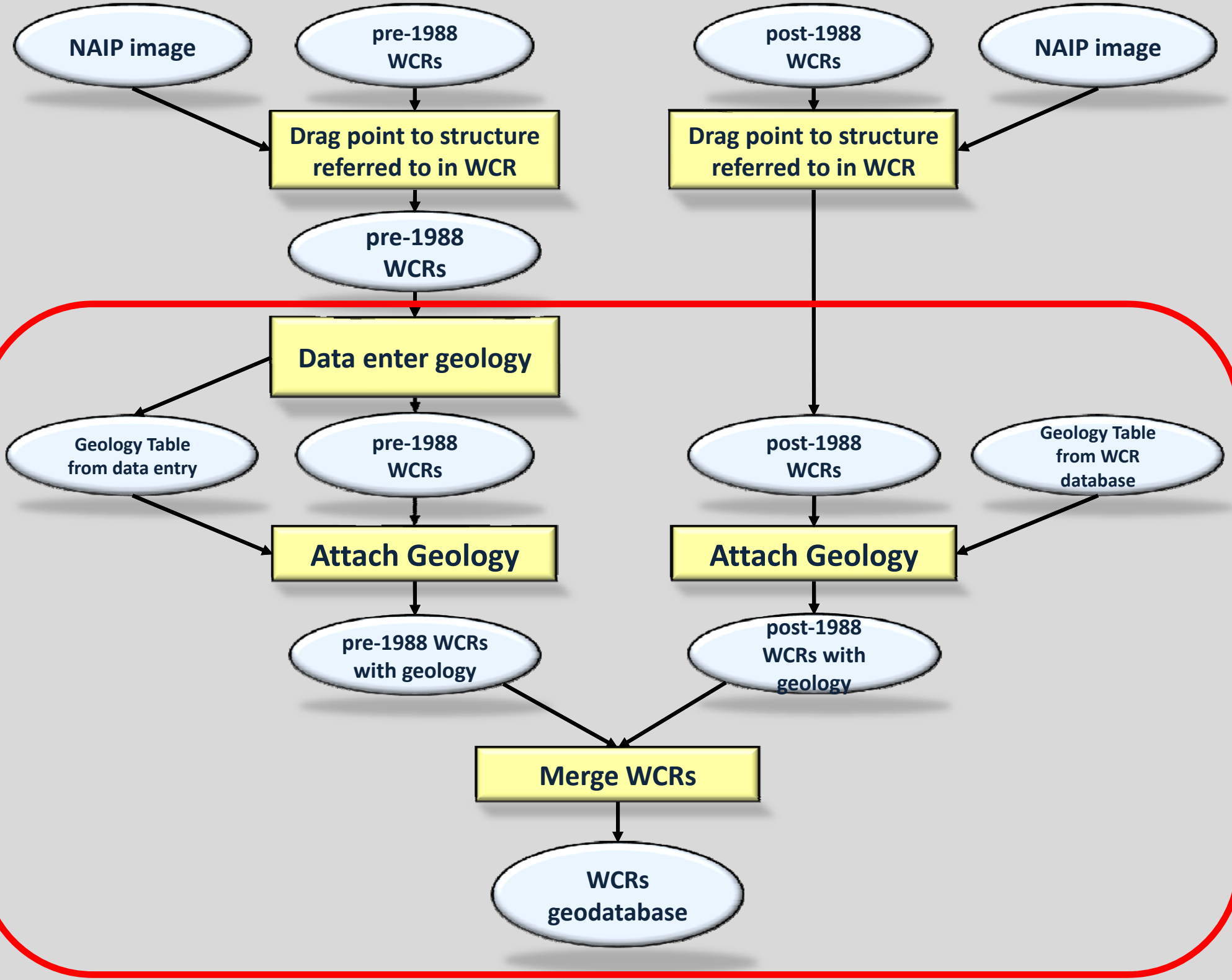
4. Is the well located upslope or sideslope and not downslope from any contamination sources, including those on neighboring properties? Y

Well located in floodplain? N

Distance in feet from well to nearest: (including proposed)

1. Landfill
300 2. Building Overhang
3. 1=Septic 2= Holding Tank
4. Sewage Absorption Unit
5. Nonconforming Pit
6. Buried Home Heating Oil Tank
7. Buried Petroleum Tank
35 8. 1=Shoreline 2= Swimming Pool
9. Downspout/ Yard Hydrant
10. Privy
11. Foundation Drain to Clearwater
12. Foundation Drain to Sewer
13. Building Drain 1=Cast Iron or Plastic 2=Other
14. Building Sewer 1=Gravity 2=Pressure 1=Cast Iron or Plastic 2=Other
15. Collector Sewer: ___ units ___ in . diam.
16. Clearwater Sump
17. Wastewater Sump
18. Paved Animal Barn Pen
19. Animal Yard or Shelter
20. Silo
21. Barn Gutter
22. Manure Pipe 1=Gravity 2=Pressure 1=Cast iron or Plastic 2=Other
23. Other manure Storage
24. Ditch
25. Other NR 812 Waste Source


NAIP image
pre-1988 WCRs
Drag point to structure referred to in WCR
post-1988 WCRs
NAIP image
Drag point to structure referred to in WCR


NAIP image
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Data enter geology
Geology Table from data entry
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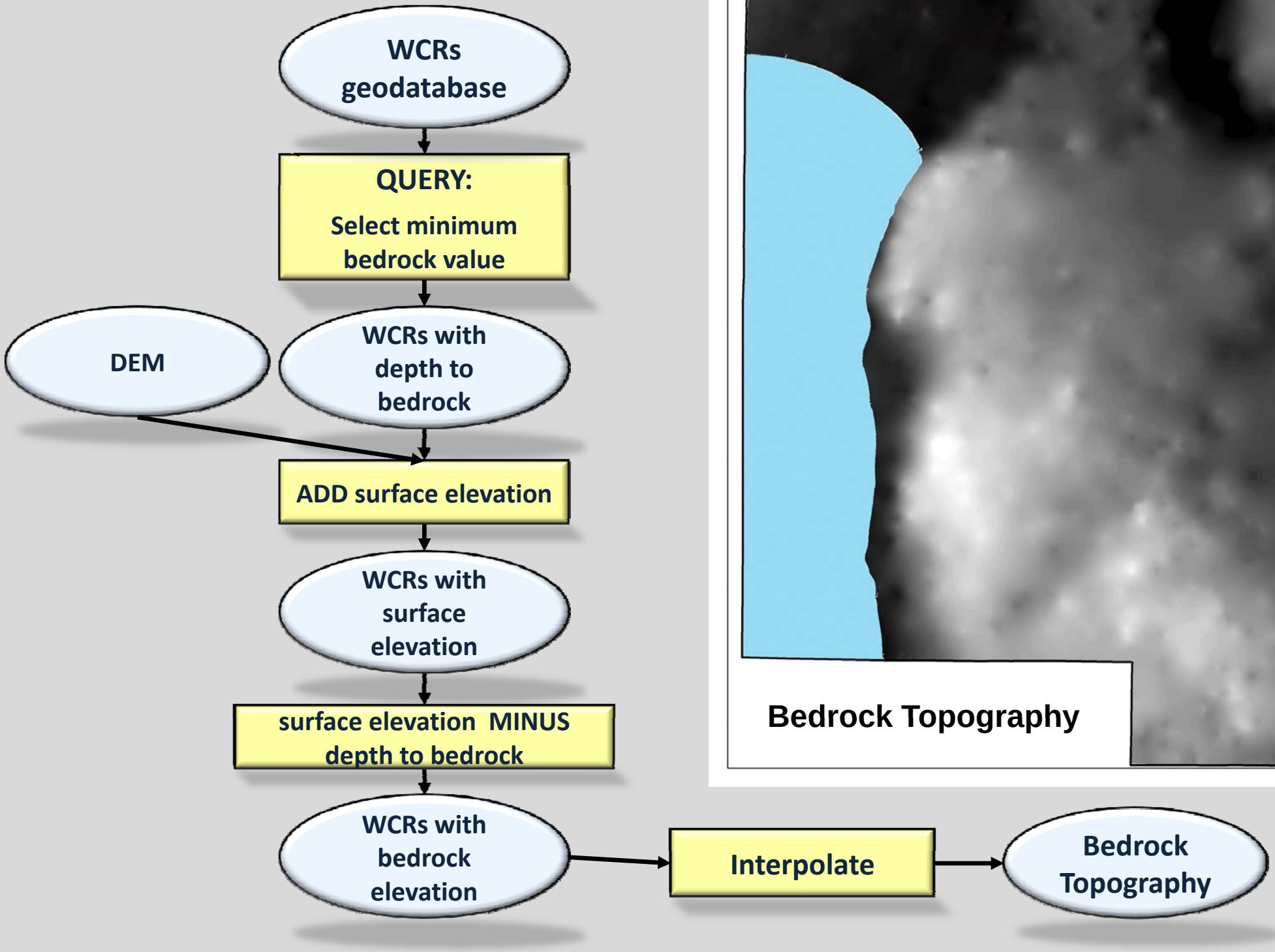
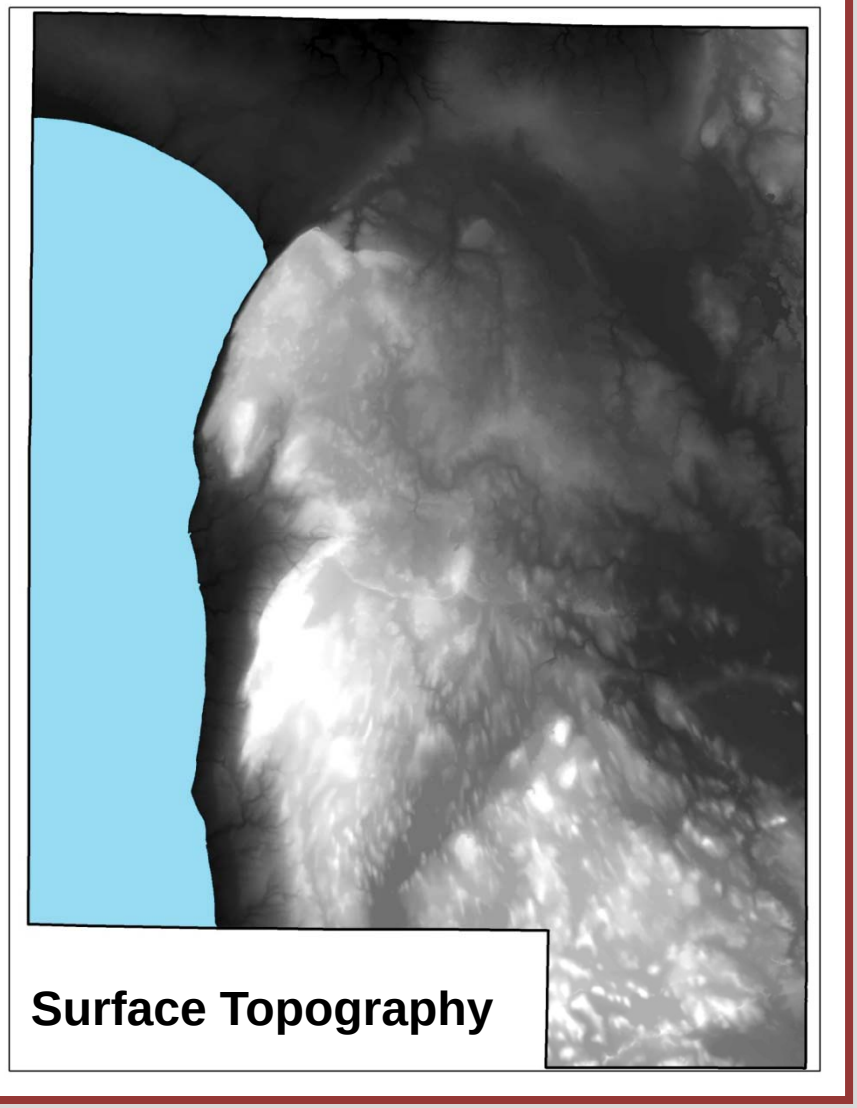
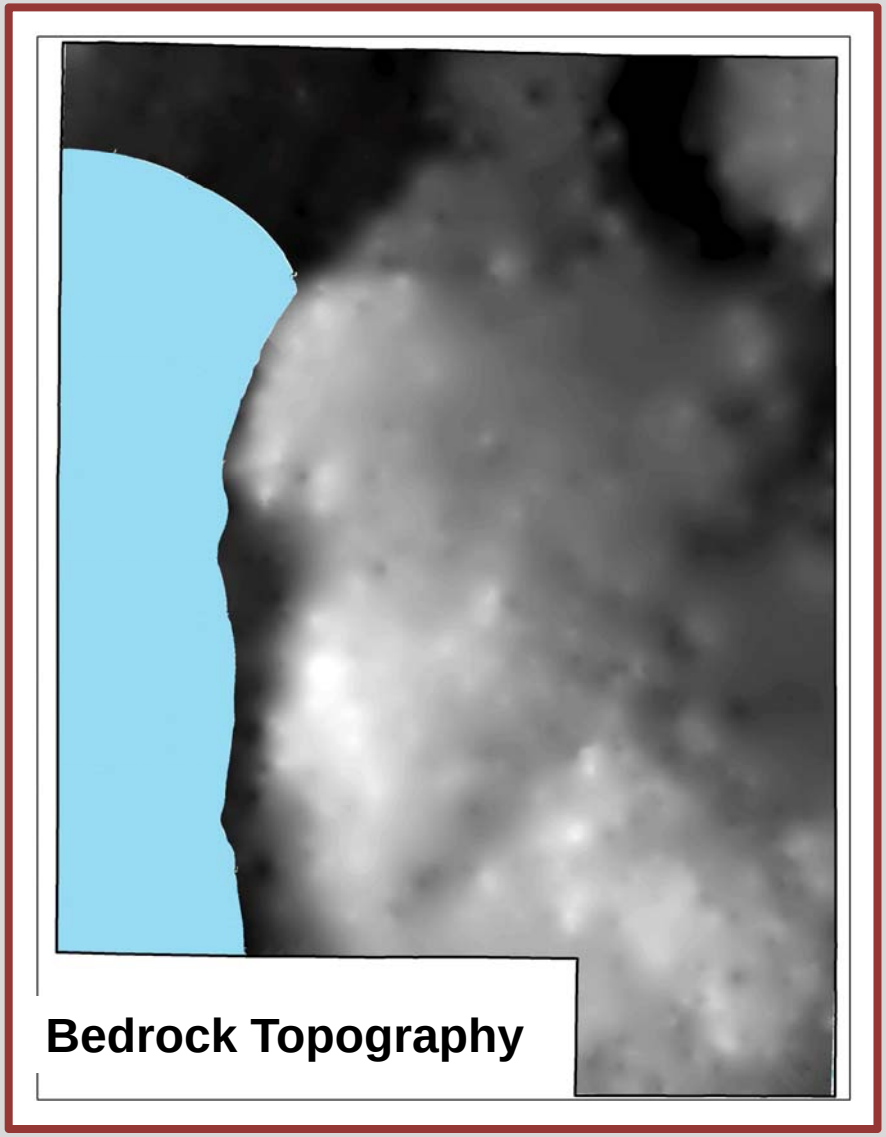
post-1988 WCRs
Geology Table from WCR database
Attach Geology
Attach Geology
pre-1988 WCRs with geology
post-1988 WCRs with geology
Merge WCRs
WCRs geodatabase

2339 Well Data Points w/geology


WCRs geodatabase
QUERY:
Select minimum bedrock value
DEM
WCRs with depth to bedrock
ADD surface elevation
WCRs with surface elevation
surface elevation MINUS depth to bedrock
WCRs with bedrock elevation
Interpolate
Bedrock Topography
Bedrock Topography



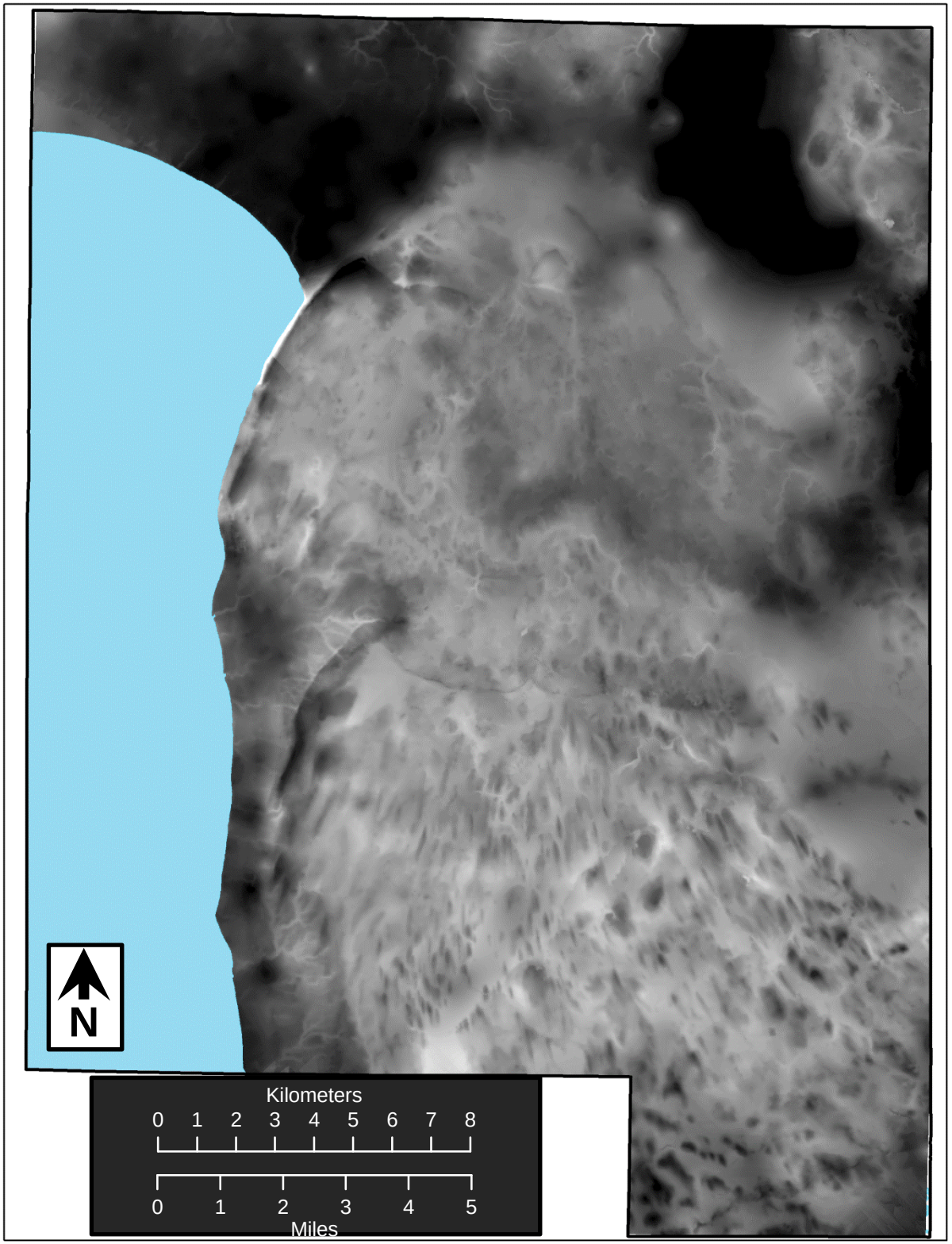
Surface Topography

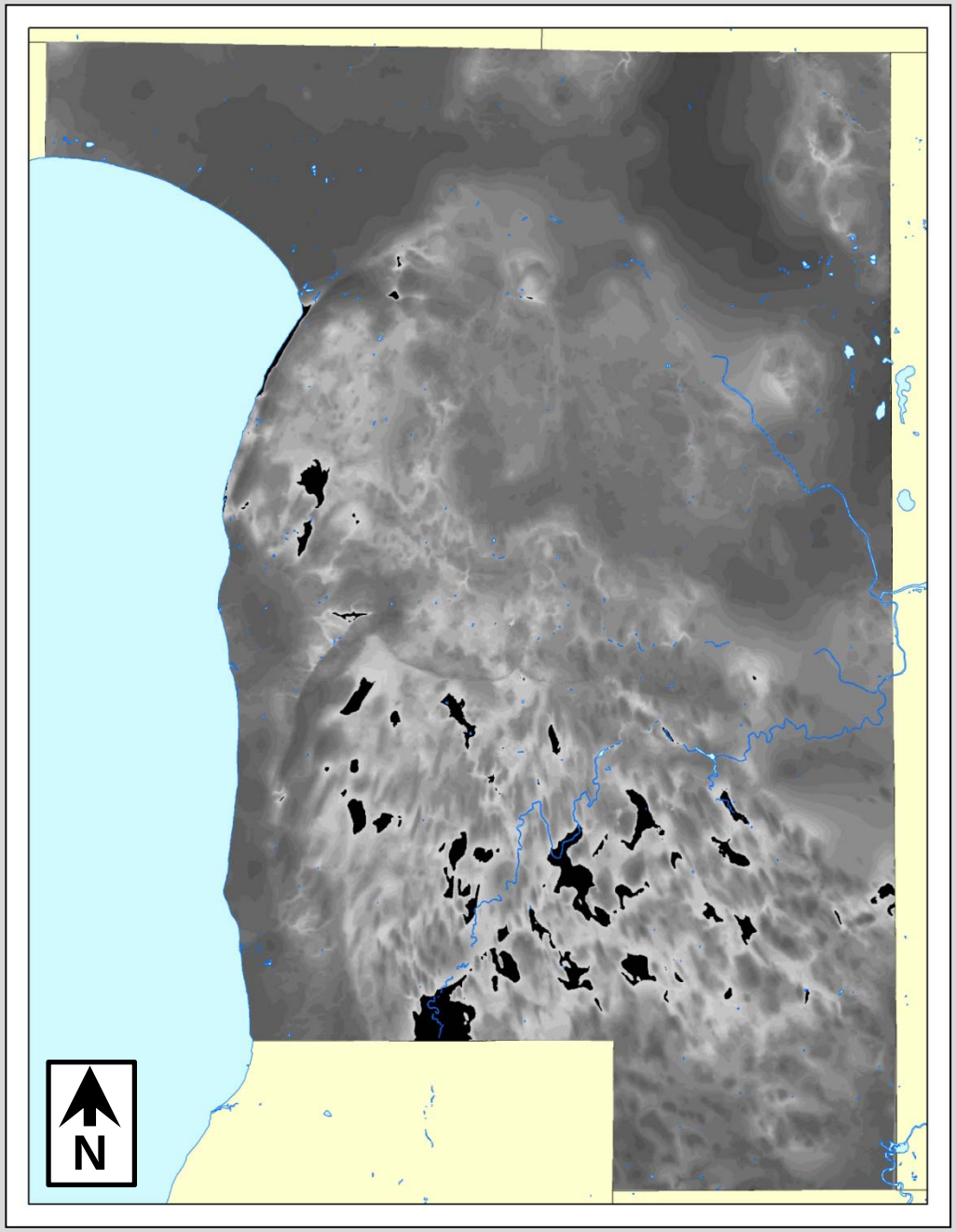


Bedrock Topography

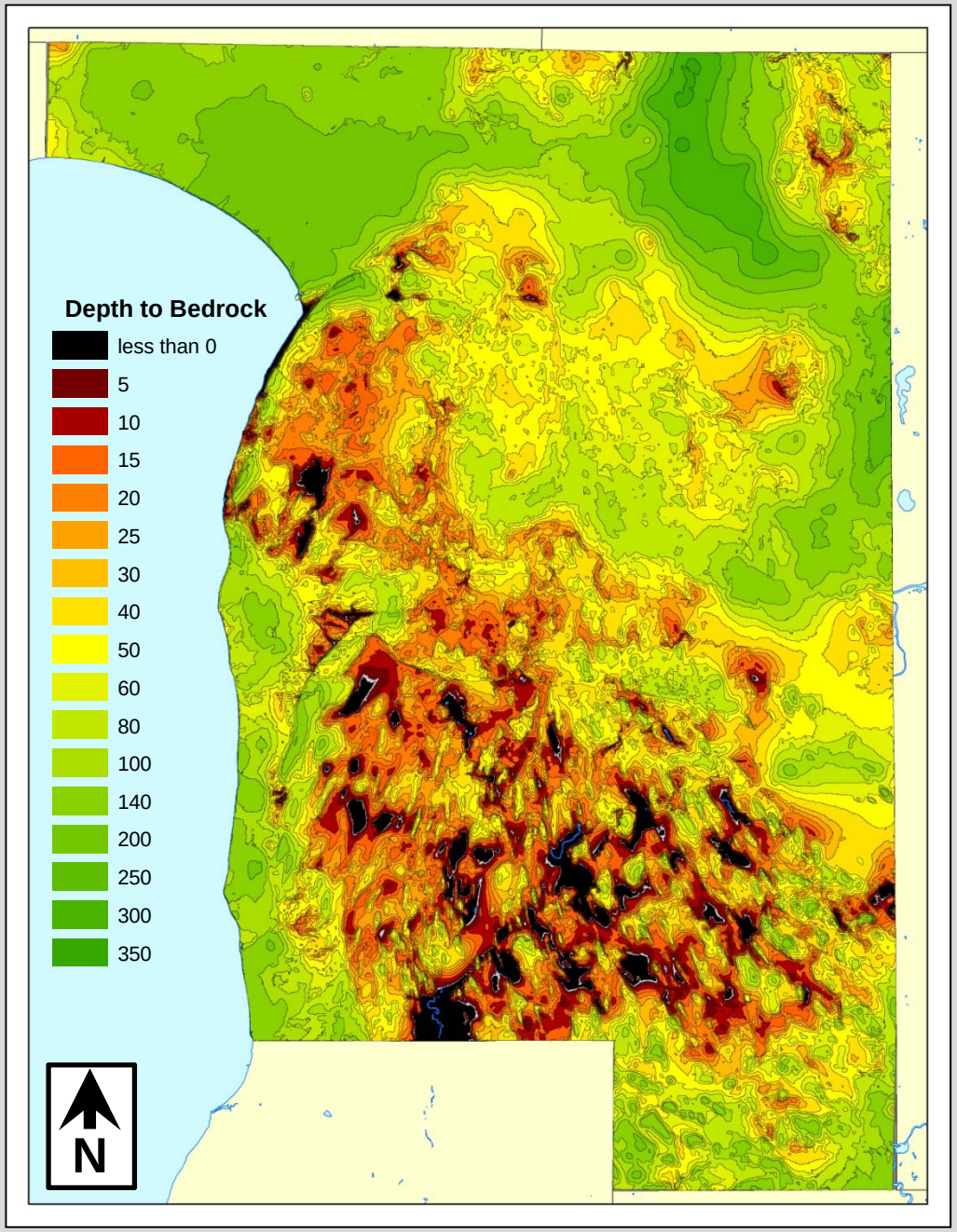
Surface Topography **MINUS** Bedrock Topography **EQUALS**

Depth to Bedrock

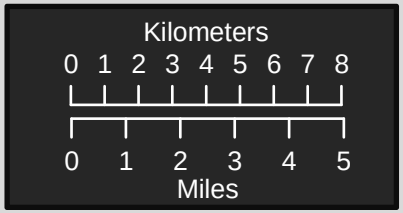


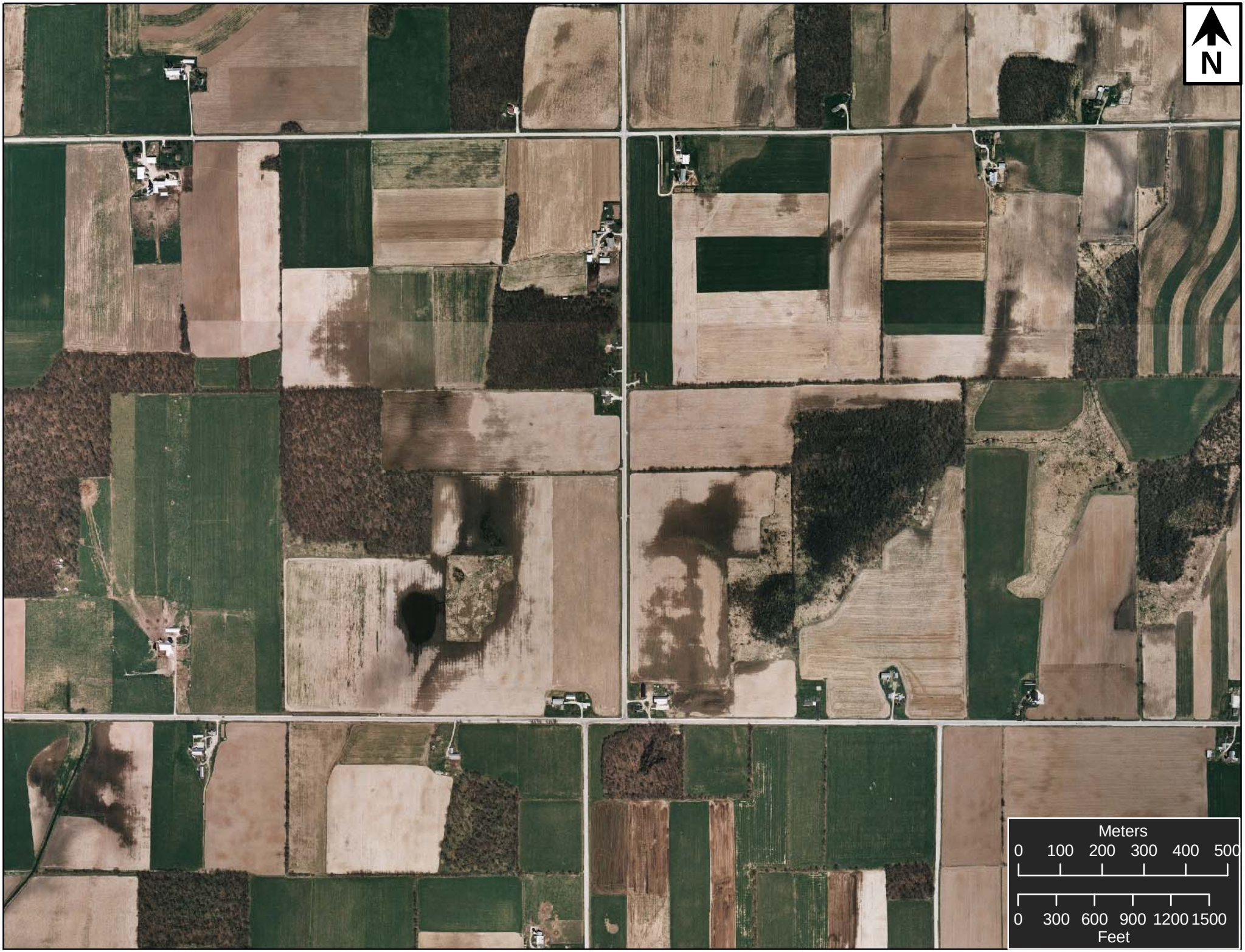


Bedrock at the land surface



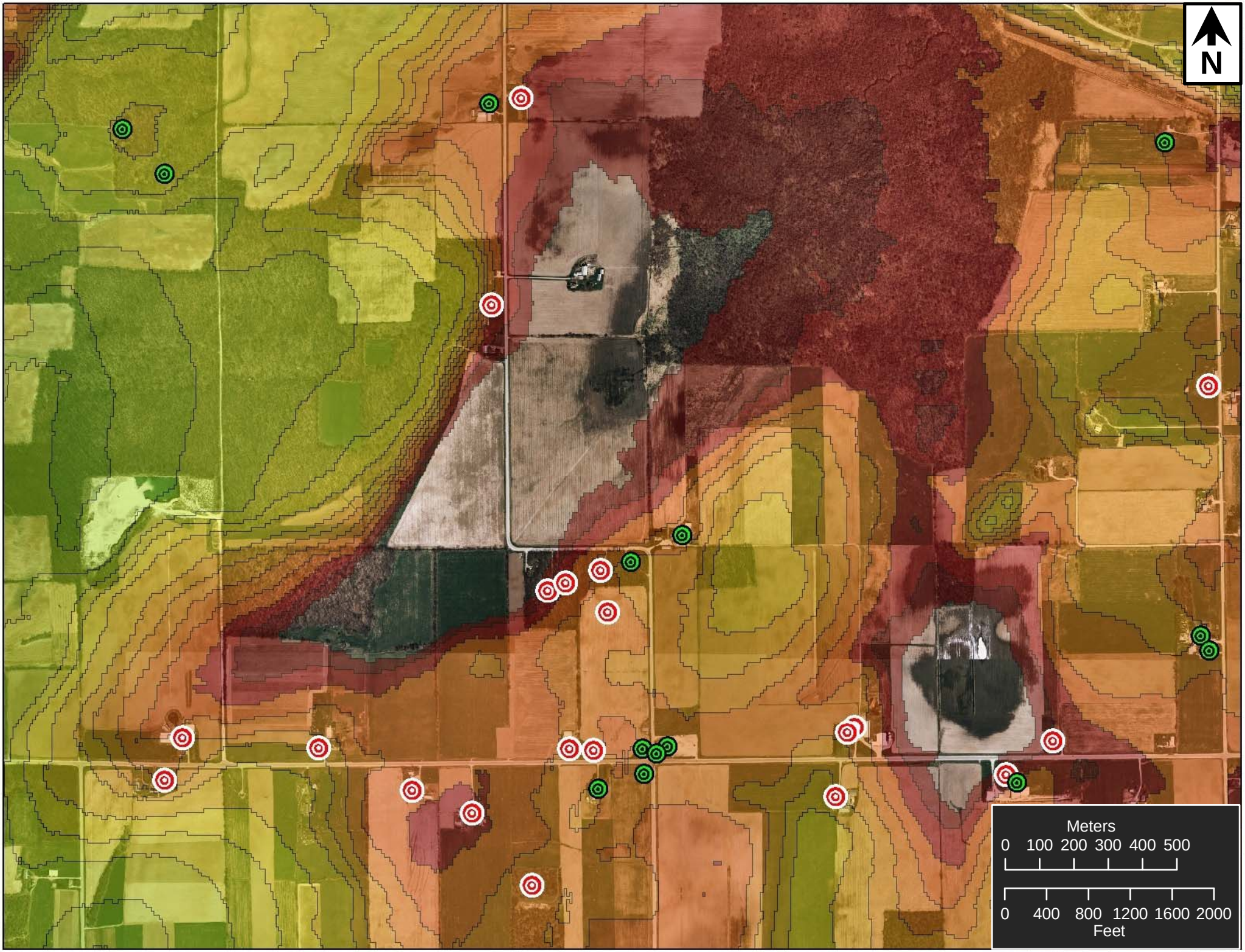
Depth to Bedrock

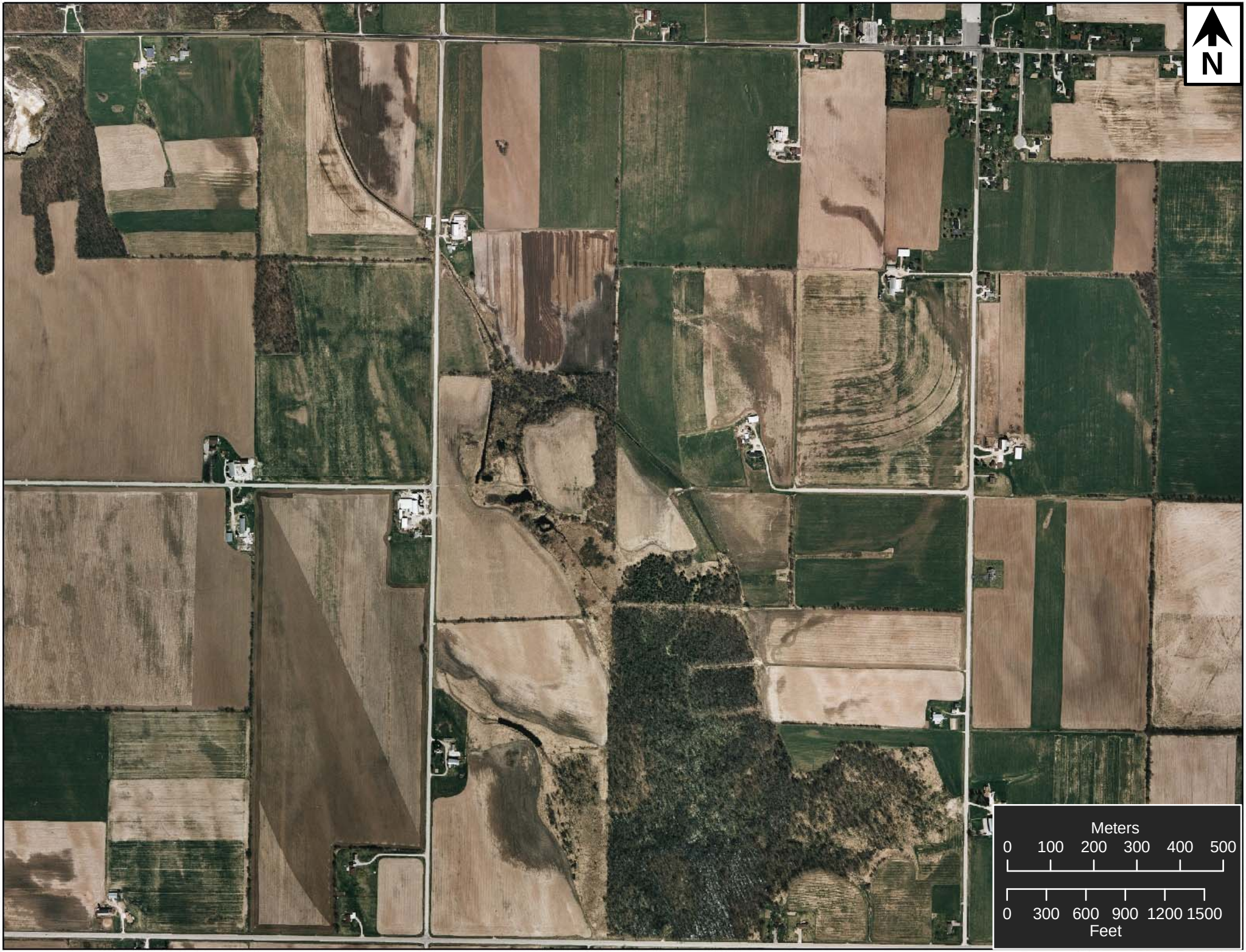


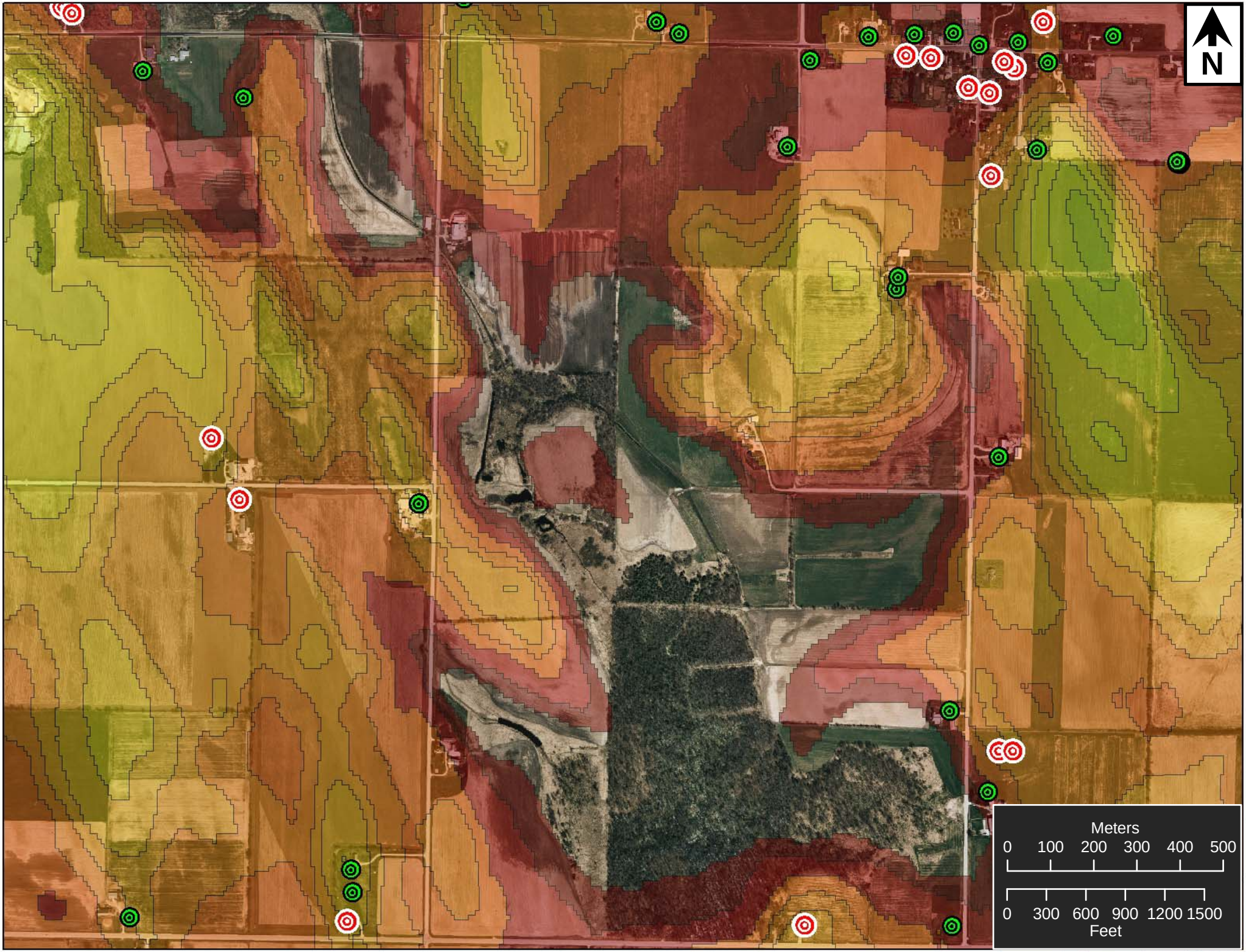

N
Meters
0 100 200 300 400 500
0 300 600 900 1200 1500
Feet

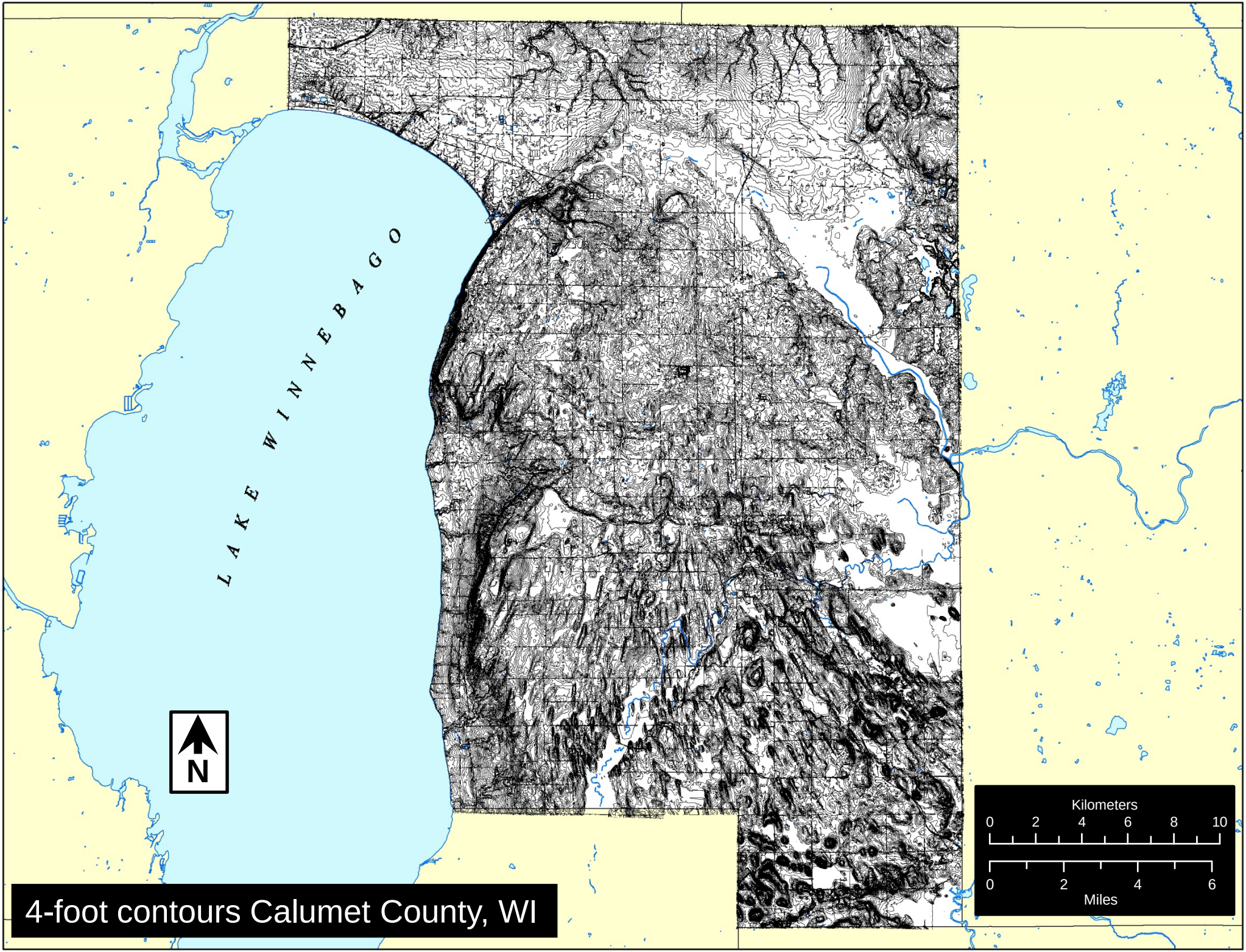

N
Meters
0 100 200 300 400 500
0 300 600 900 1200 1500
Feet

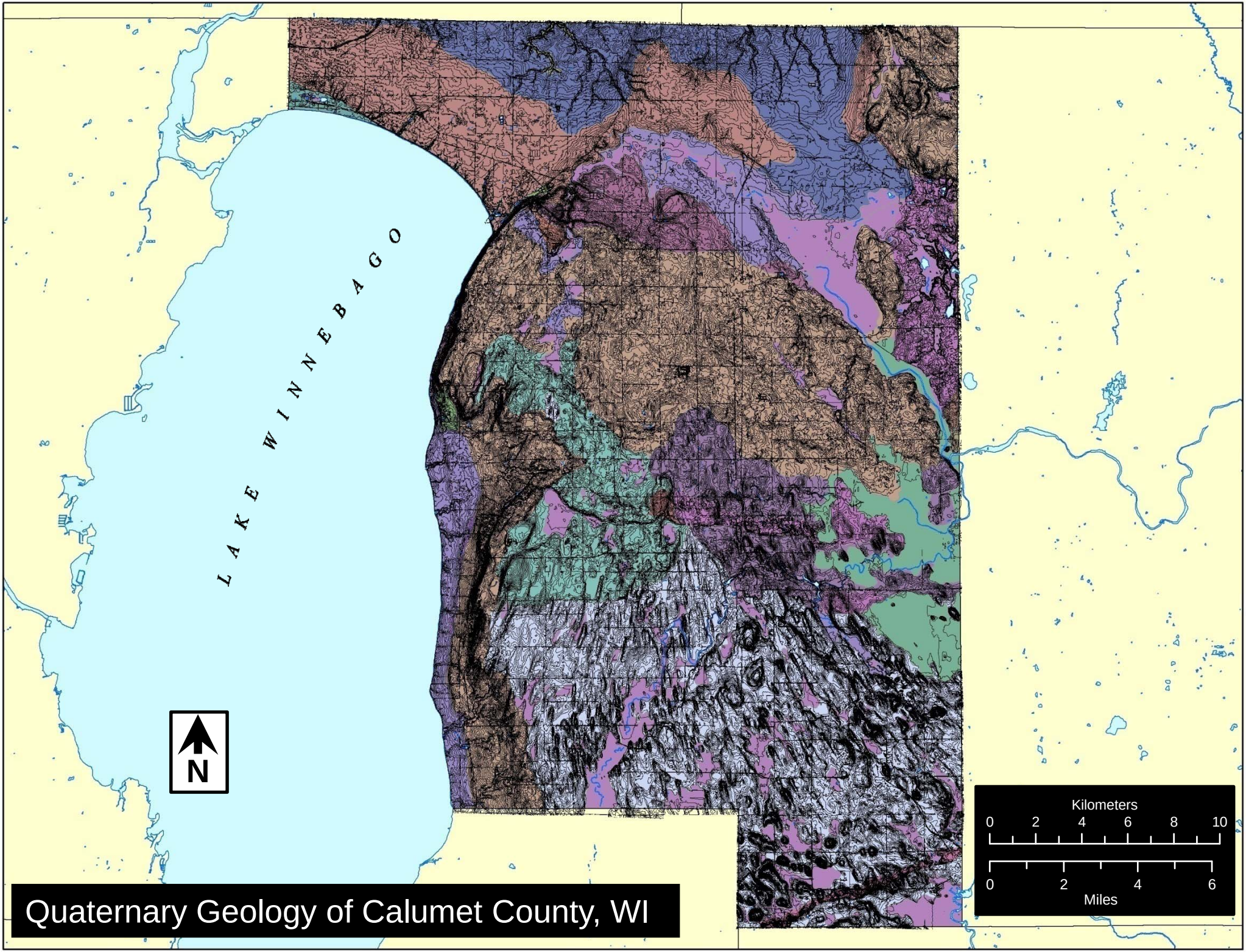

N
Meters
0 100 200 300 400 500
0 400 800 1200 1600 2000
Feet

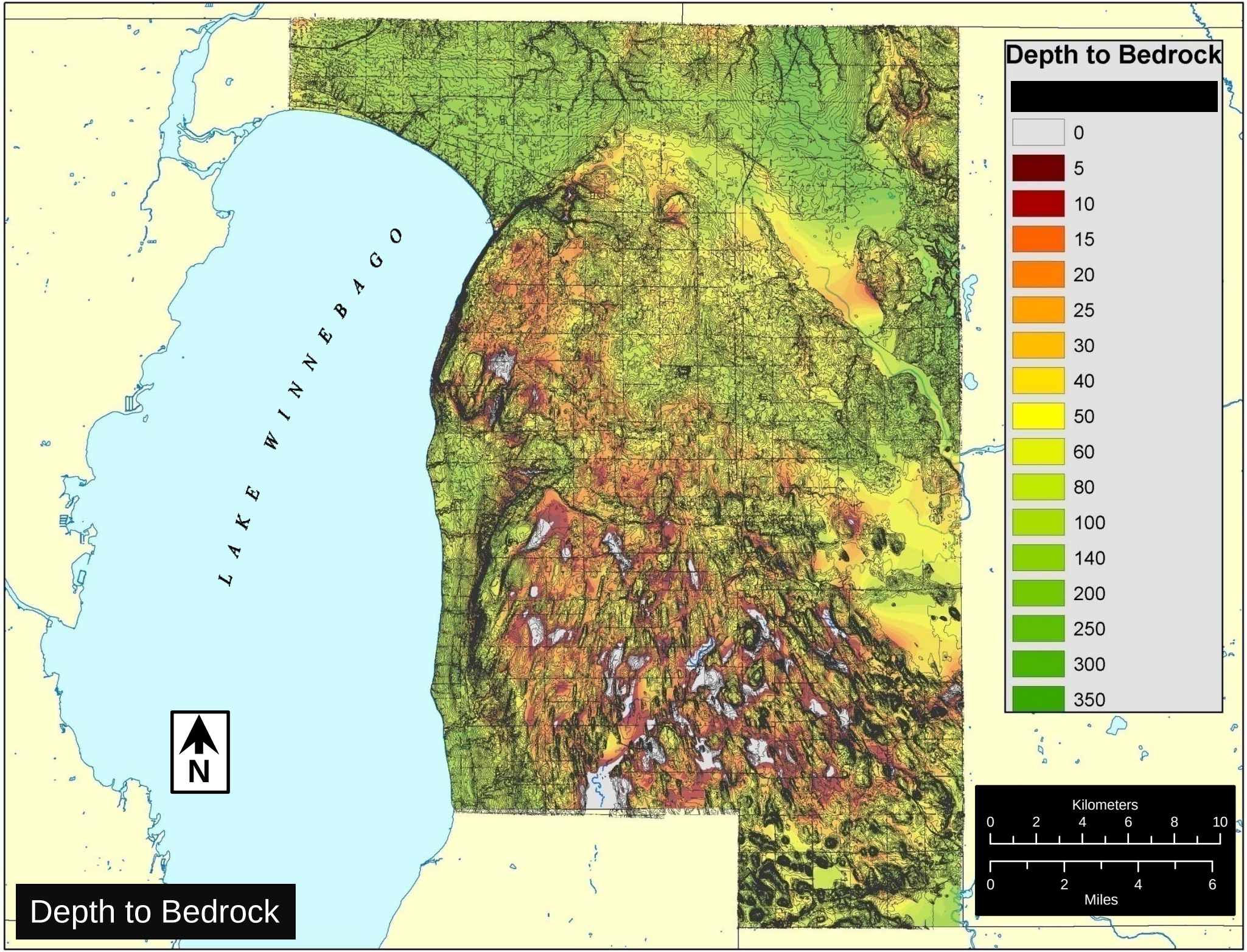

N
Meters
0 100 200 300 400 500
0 400 800 1200 1600 2000
Feet

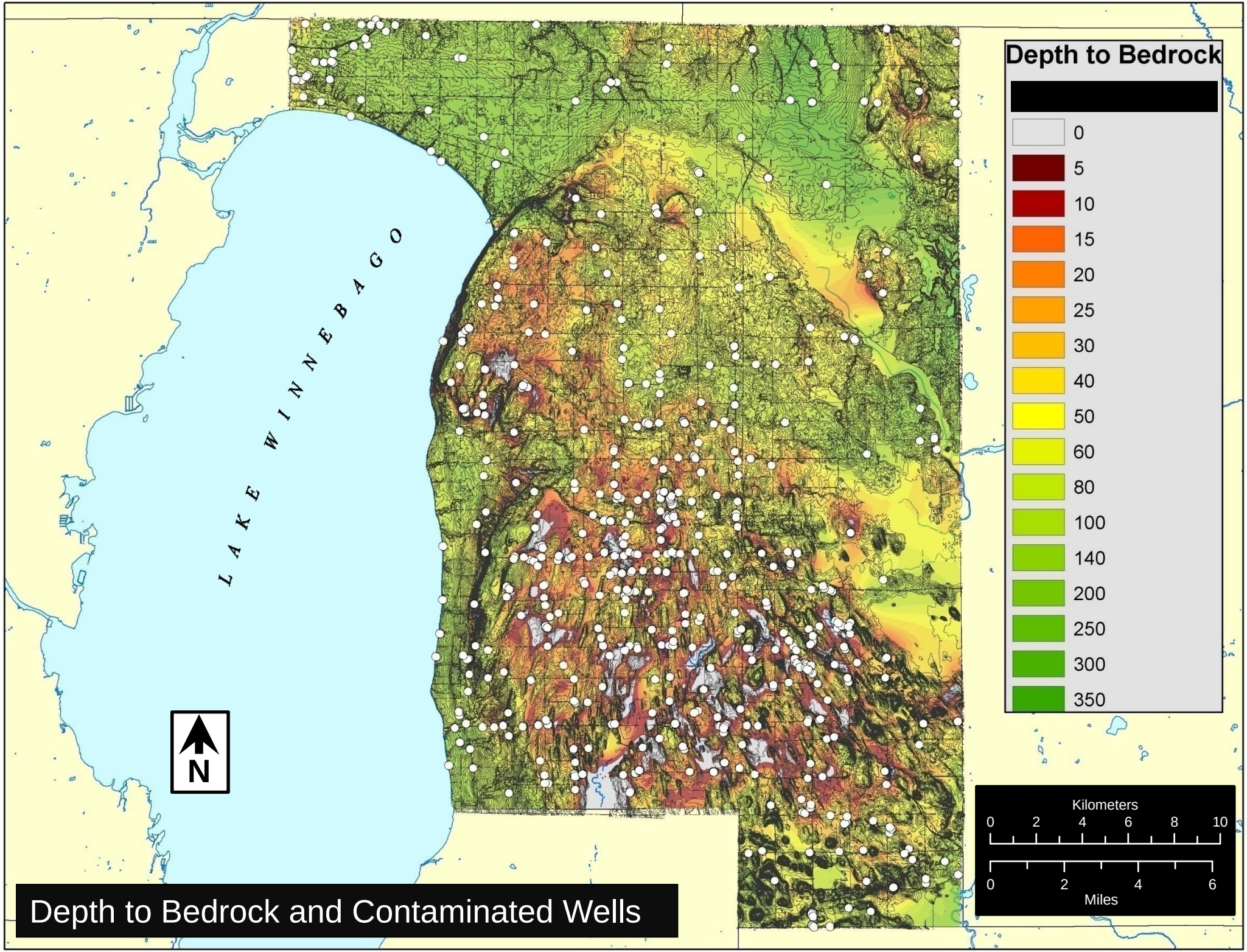

N
Meters
0 100 200 300 400 500
0 300 600 900 1200 1500
Feet


N
Meters
0 100 200 300 400 500
0 300 600 900 1200 1500
Feet

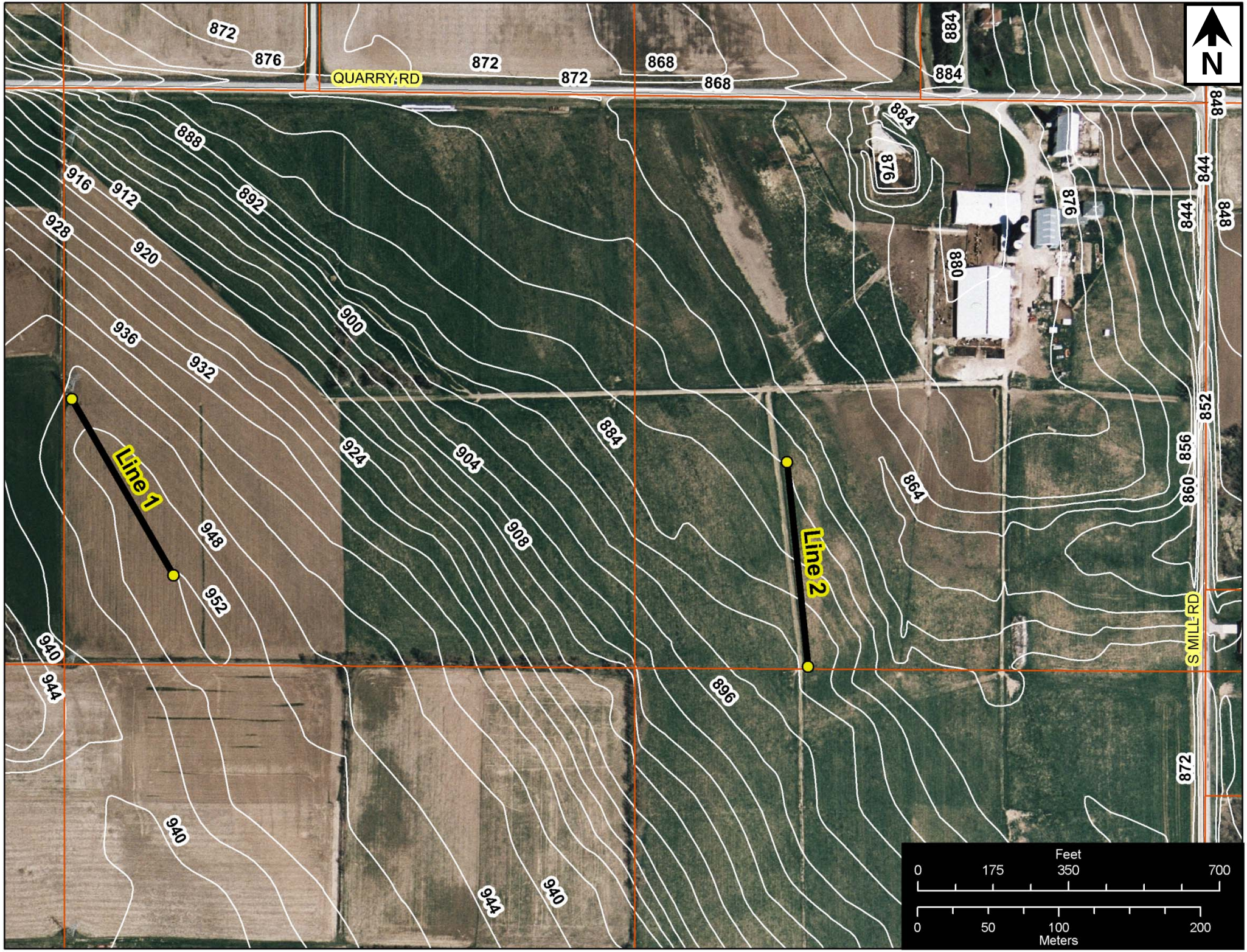

LAKE WINNEBAGO
N
Kilometers
0 2 4 6 8 10
0 2 4 6
Miles
4-foot contours Calumet County, WI

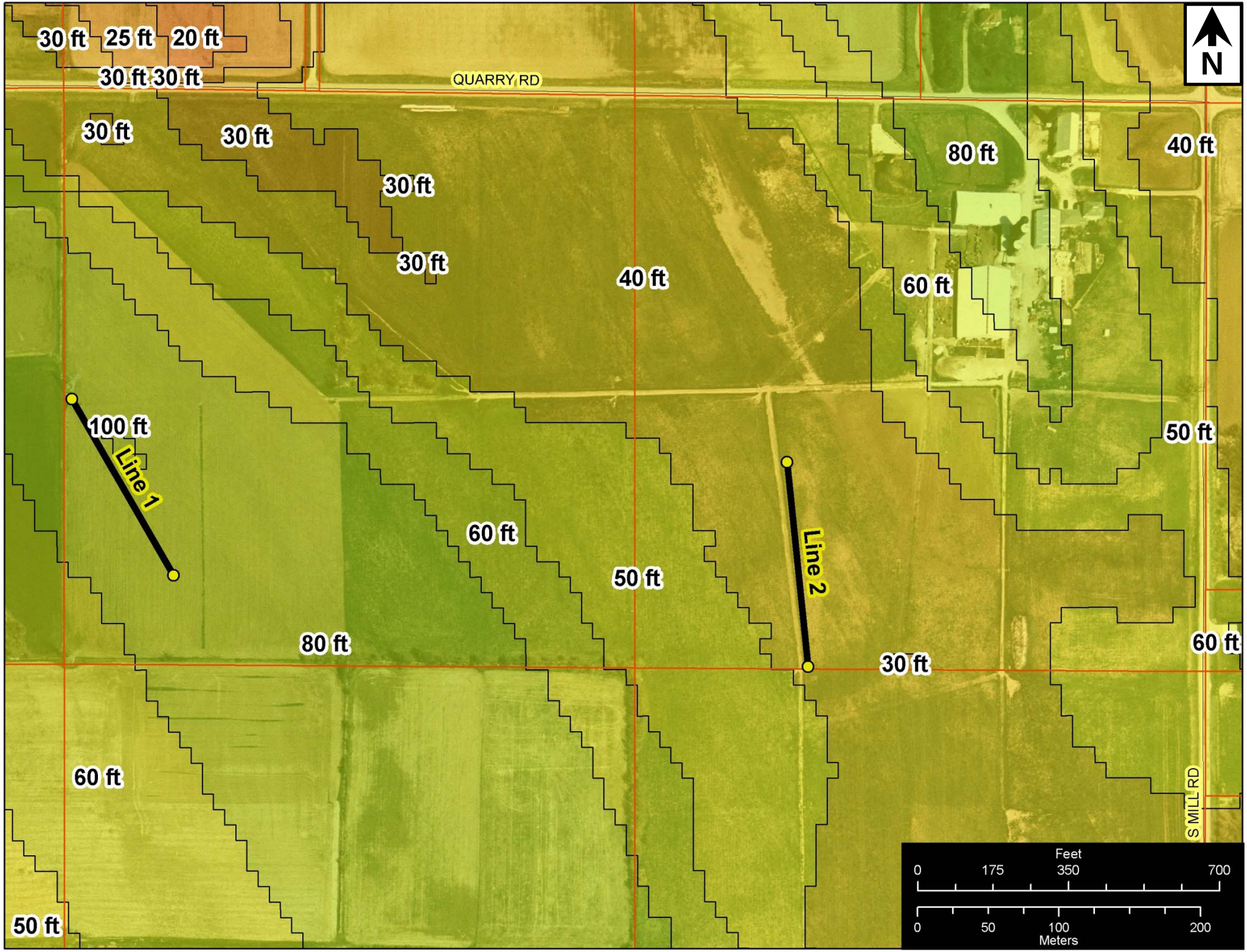

LAKE WINNEBAGO
N
Kilometers
0 2 4 6 8 10
0 2 4 6
Miles
Quaternary Geology of Calumet County, WI

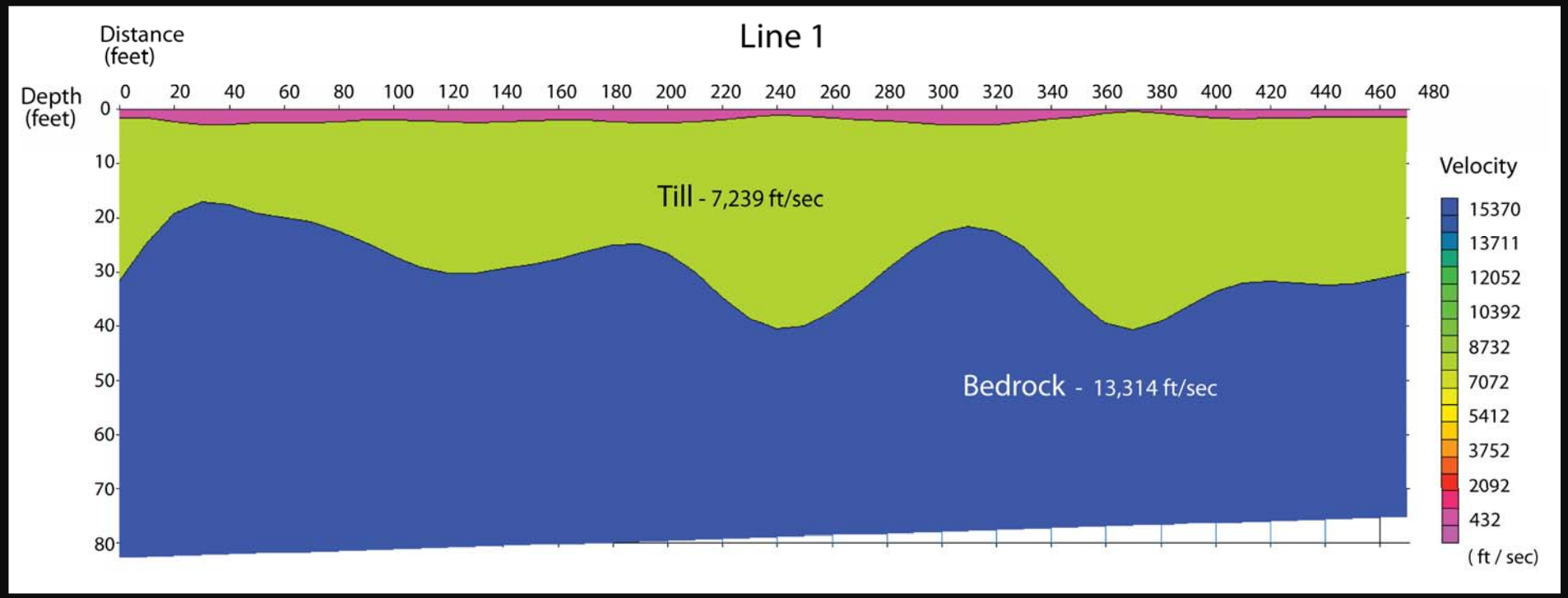

Depth to Bedrock
0
5
10
15
20
25
30
40
50
60
80
100
140
200
250
300
350
LAKE WINNEBAGO
N
Kilometers
0 2 4 6 8 10
0 2 4 6
Miles
Depth to Bedrock

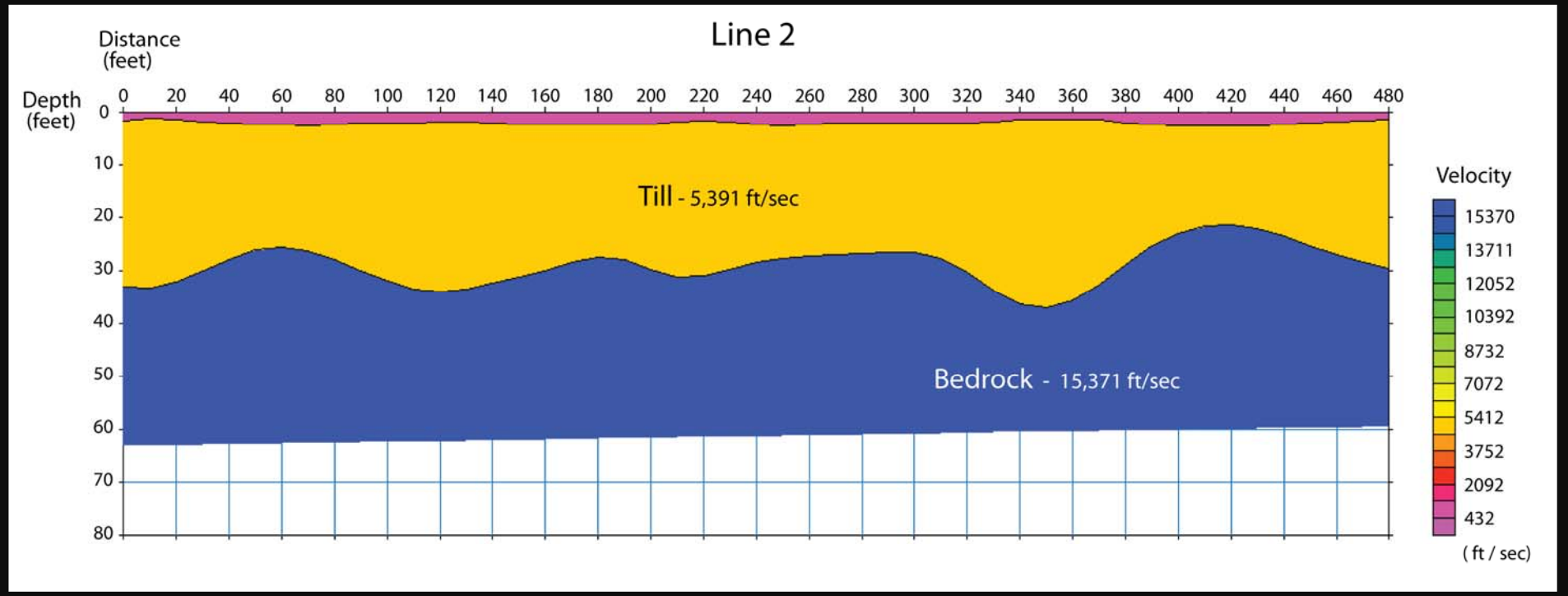

Depth to Bedrock
0
5
10
15
20
25
30
40
50
60
80
100
140
200
250
300
350
LAKE WINNEBAGO
N
Kilometers
0 2 4 6 8 10
0 2 4 6
Miles
Depth to Bedrock and Contaminated Wells


QUARRY RD
Line 1
Line 2
S MILL RD
N
Feet
0
175
350
700
0
50
100
200
Meters

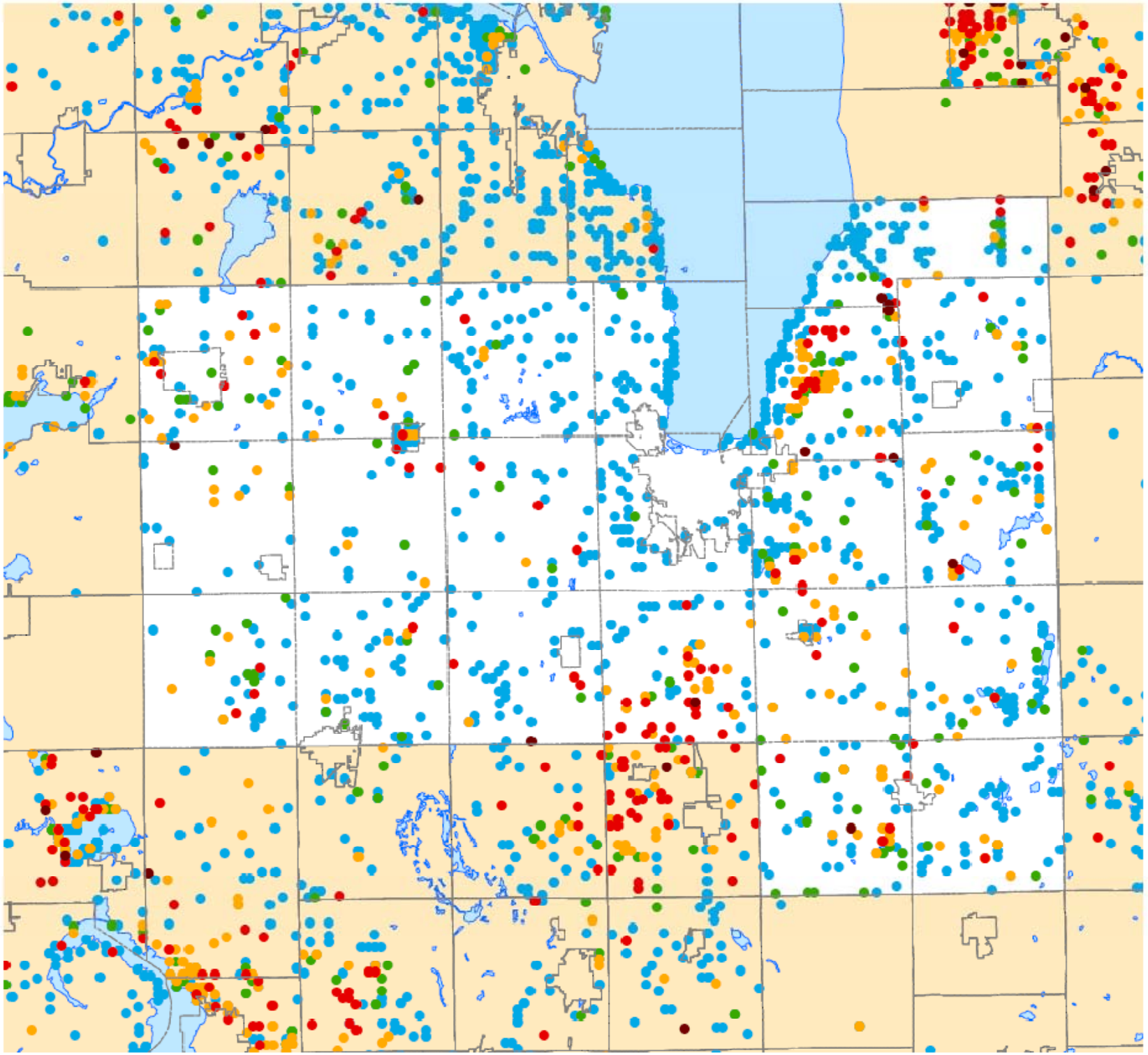

N
QUARRY RD
S MILL RD
Line 1
Line 2
872
876
872
872
868
868
884
884
884
848
844
844
848
876
876
880
888
892
916
912
928
920
900
936
932
884
924
904
908
948
952
940
944
940
944
940
896
864
856
860
852
872
Feet
0
175
350
700
0
50
100
200
Meters


30 ft
25 ft
20 ft
30 ft
30 ft
QUARRY RD
30 ft
30 ft
30 ft
30 ft
40 ft
80 ft
40 ft
60 ft
50 ft
100 ft
Line 1
60 ft
50 ft
Line 2
80 ft
30 ft
60 ft
60 ft
50 ft
S MILL RD
N
Feet
0
175
350
700
0
50
100
200
Meters





Hart, D. J., et al., 2009



Private Well Test Results

Nitrate-N Concentration (mg/L)

- 0 - 2
- 2 - 5
- 5 - 10
- 10 - 20
- > 20

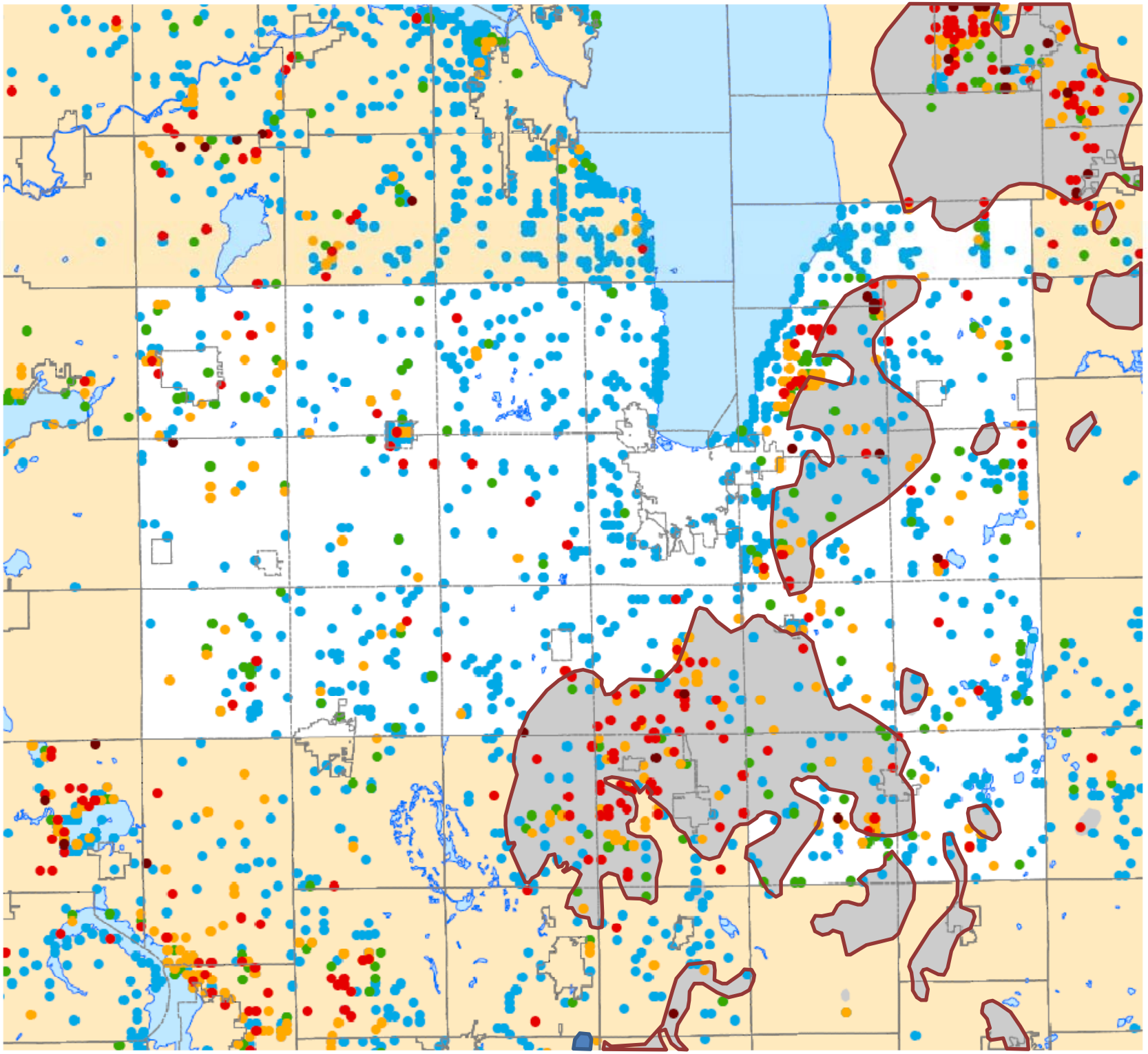
N

Center for Watershed Science and Education

2007

0 1 2 4 6 8 Miles

Disclaimer: This map for educational purposes only. It represents private well testing results in the Center for Watershed Science and Education database it does not represent a scientific study.



Private Well Test Results

Nitrate-N Concentration (mg/L)

- 0 - 2
- 2 - 5
- 5 - 10
- 10 - 20
- > 20
- Silurian <50 ft

N

Center for Watershed Science and Education

2007

0 1 2 4 6 8 Miles

Disclaimer: This map for educational purposes only. It represents private well testing results in the Center for Watershed Science and Education database it does not represent a scientific study.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Thank You !