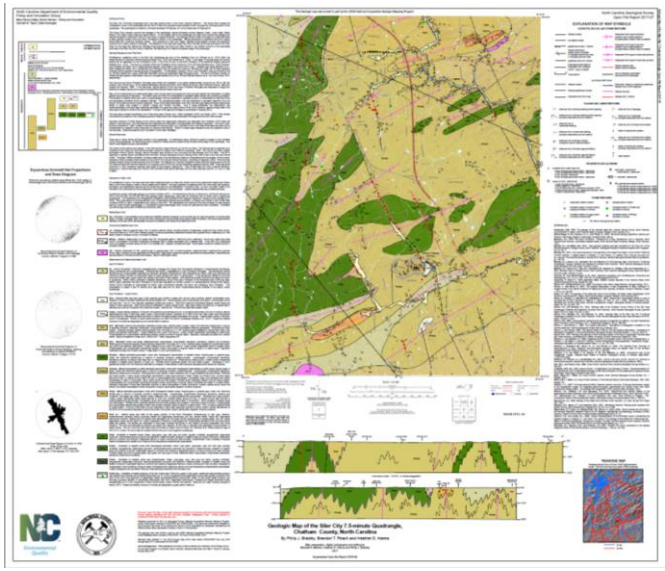
Groundwater Features Map of Chatham County:
- A Product of Geologic Mapping



North Carolina Department of Environmental Quality
Division of Energy, Mineral and Land Resources
Dr. Kenneth B. Taylor, PG, State Geologist

Preliminary Groundwater Features Map of Chatham County, North Carolina.

North Carolina Geological Survey
Manuscript map – March 2019
Draft

Figure 1

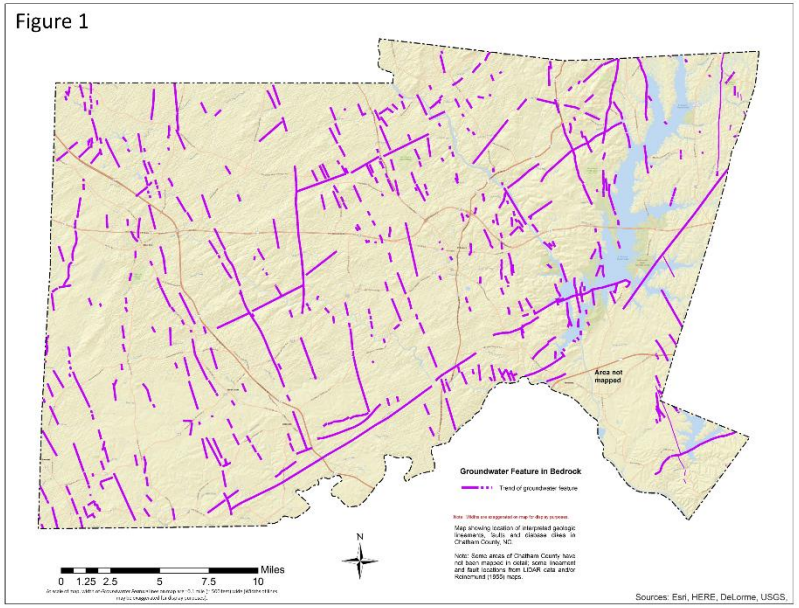
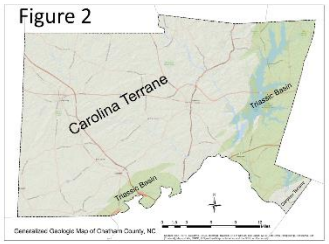


Figure 2



Chatham County Groundwater Conceptual Models

Figure 3a

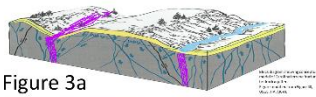
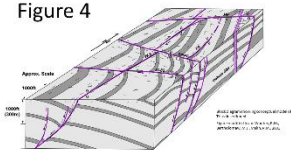


Figure 3b

Figure 3c

Figure 4



NORTH CAROLINA
Department of Environmental Quality

GEOLOGICAL SURVEY N.C. 1823

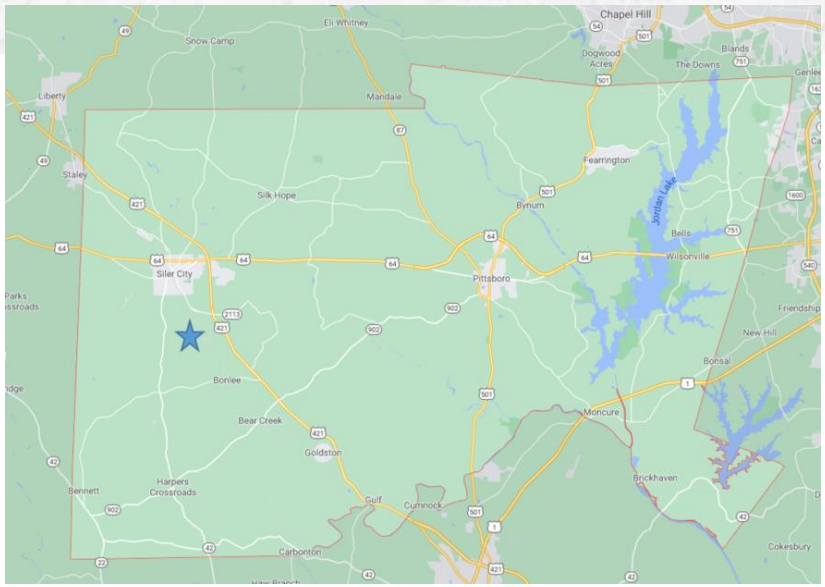
Contact info:
Phil Bradley
Assistant Section Chief / Senior Piedmont Geologist
North Carolina Geological Survey
N.C. Dept. of Environmental Quality
(919) 707-9241 (o)| pbradley@ncdenr.gov

Explore → MOUNT VERNON SPRINGS HISTORIC DISTRICT

Location

Mount Vernon Springs Historic District

Address: just south of Siler City off Old US Rte 421 on Mount Vernon Springs Rd Bonlee, NC 27213



https://chathamhistory.org/pdfs/MtVernonSpringsHealthandBeauty.pdf

Mt. Vernon Springs:
Health and Beauty Face a Rapidly Changing Chatham

by Fred J. Vatter
2007

Just a few miles south of Siler City near Old US Route 421 on Mt. Vernon Springs Road there is a concrete basin holding two pipes pouring clean mineral waters from twin springs. One flow was once marked "Health" and the other was labeled "Beauty." These designations are no longer there and it would be prudent to fill a cup from each source. This peaceful area is all that remains of a once famous health spa, Mt. Vernon Springs, that attracted ailing people from far and wide. From modest beginnings in the 1830's the resort reached its heyday just before and after the turn of the century, only to decline and finally cease operations in 1931.

Changing times caused the demise of the resort – better roads, faster trains, and the easier accessibility of alternative resorts and sources of recreation all played a part, with a final blow given by the Great Depression. The abandoned buildings were gradually stripped of their valuable hand-hewn timber to be used for new homes and restoring old homes in Chatham and nearby Lee County. The surrounding woodlands again embraced the grounds, helping to protect the purity of the springs.

Legend has it that Native Americans used the springs, followed by early Quaker settlers coming down from the Cane Creek area. Chatham County Court minutes in 1777 mentioned a Quaker road in adjacent Ore Hill by the iron furnace. Early names for the area were Indian Springs, Quaker Springs, Dixon Springs, Healing Springs, and Hickory Springs.

Some folk apparently visited the springs for their healing benefits as early as 1817, but by 1837 a War of 1812 veteran named William Bowen built a small inn and cottages there and advertised it with testimonials. His clientele had to travel via a very rough seven mile road from the Raleigh-Salisbury Highway, but they came.

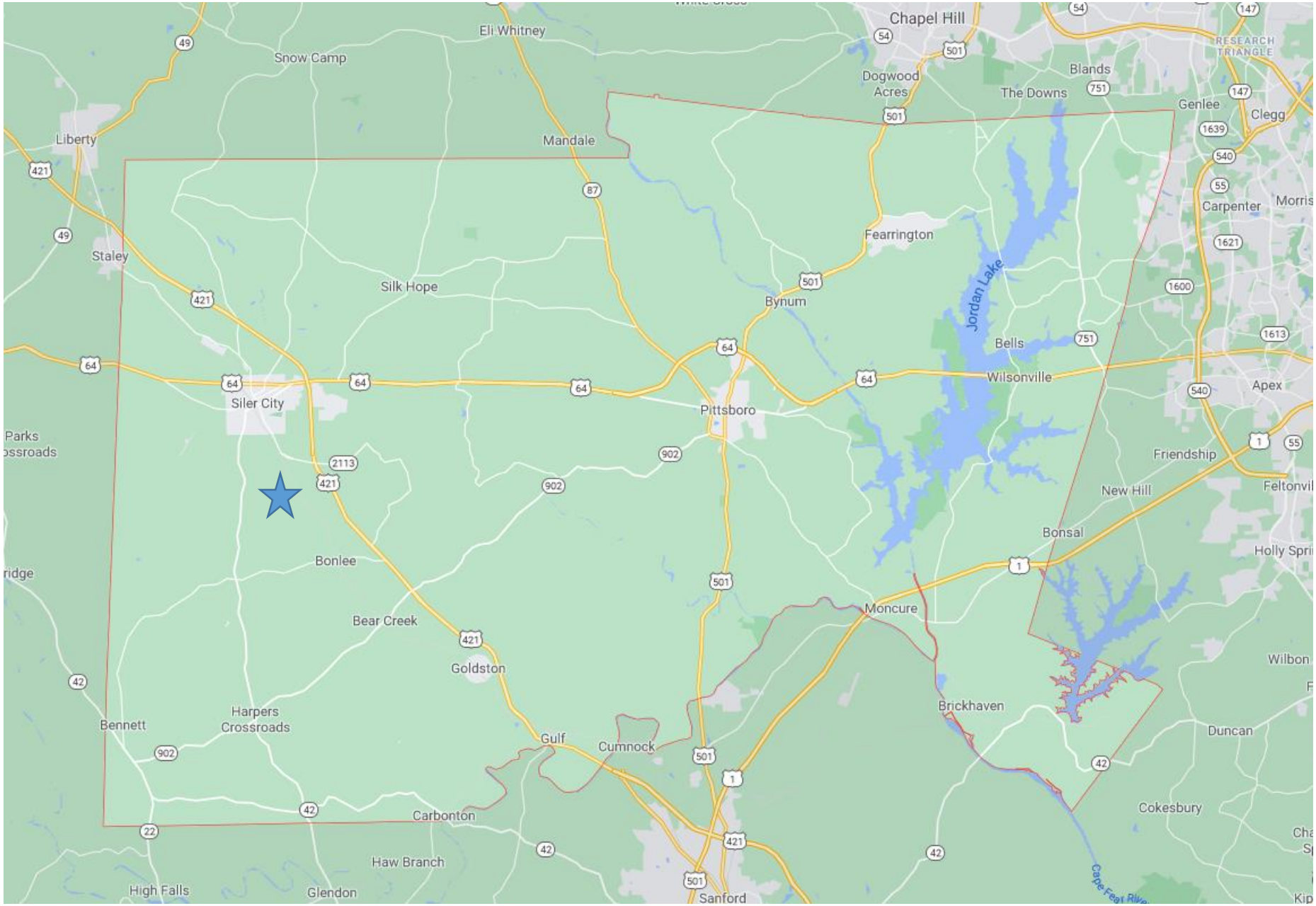
Pittsboro-Siler City
CONVENTION & VISITORS BUREAU
Serving all of Chatham County

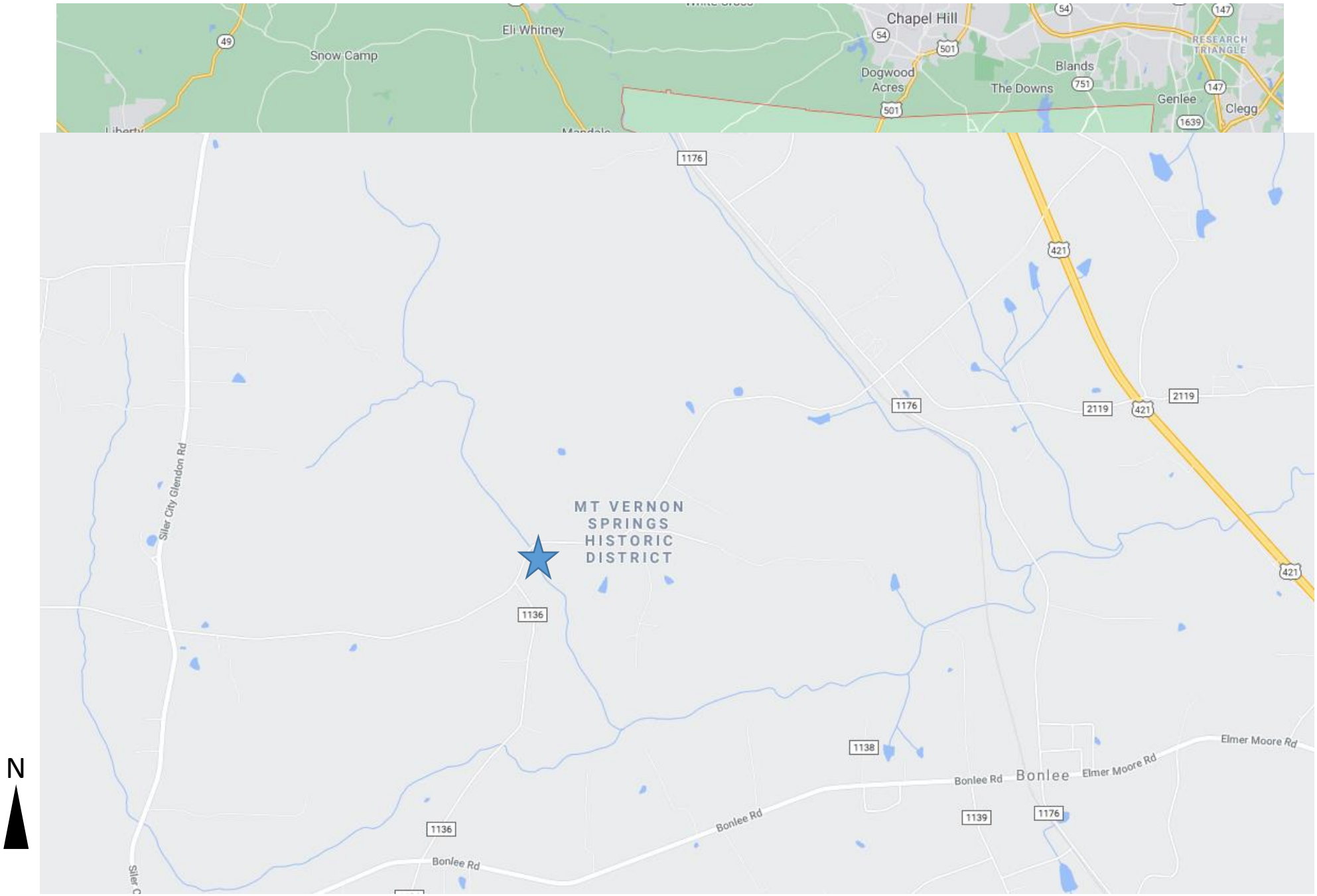
STAY EXPLO

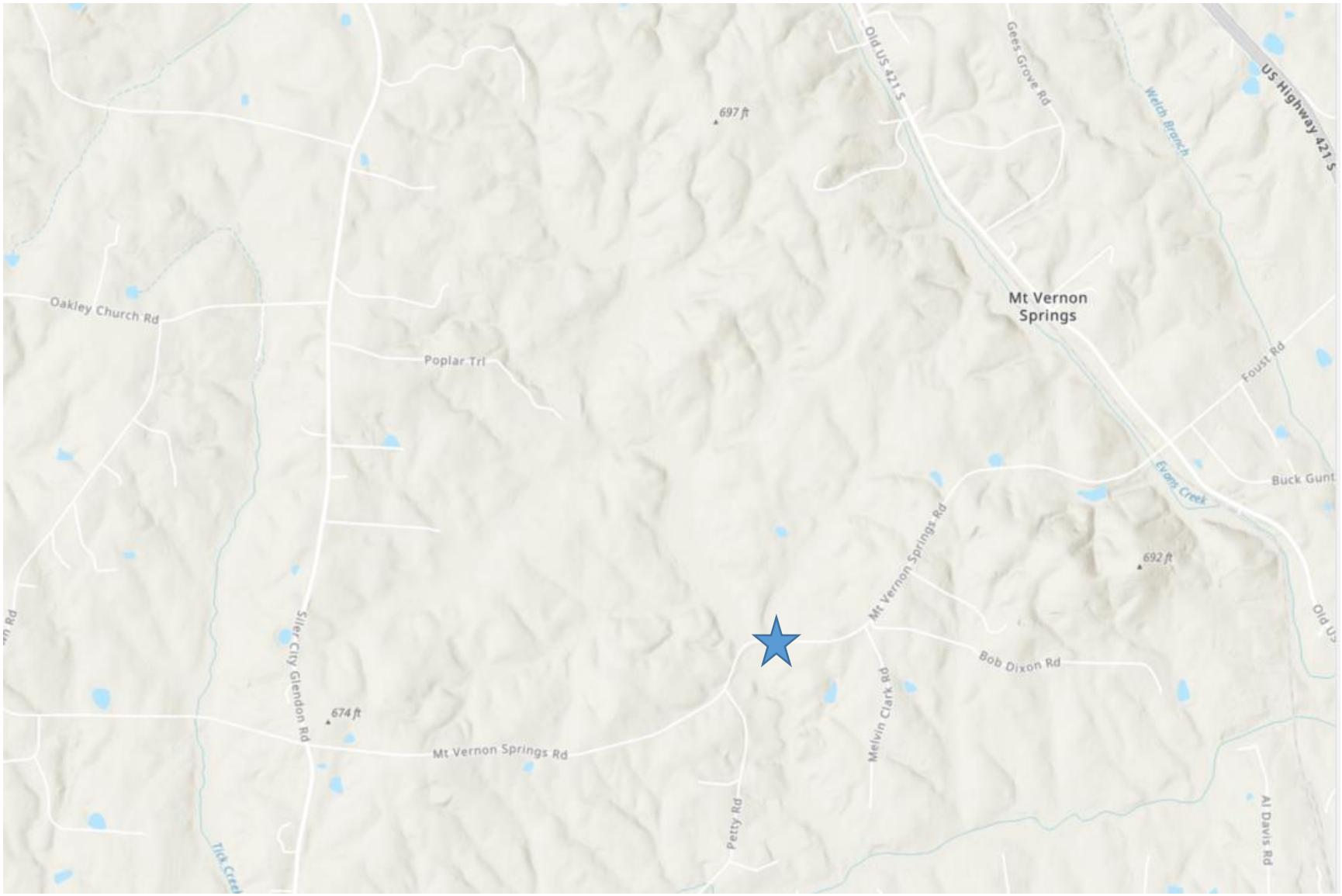
Explore → MOUNT VERNON DISTRICT

A, VIEW AT MOUNT VERNON SPRINGS, N. C.

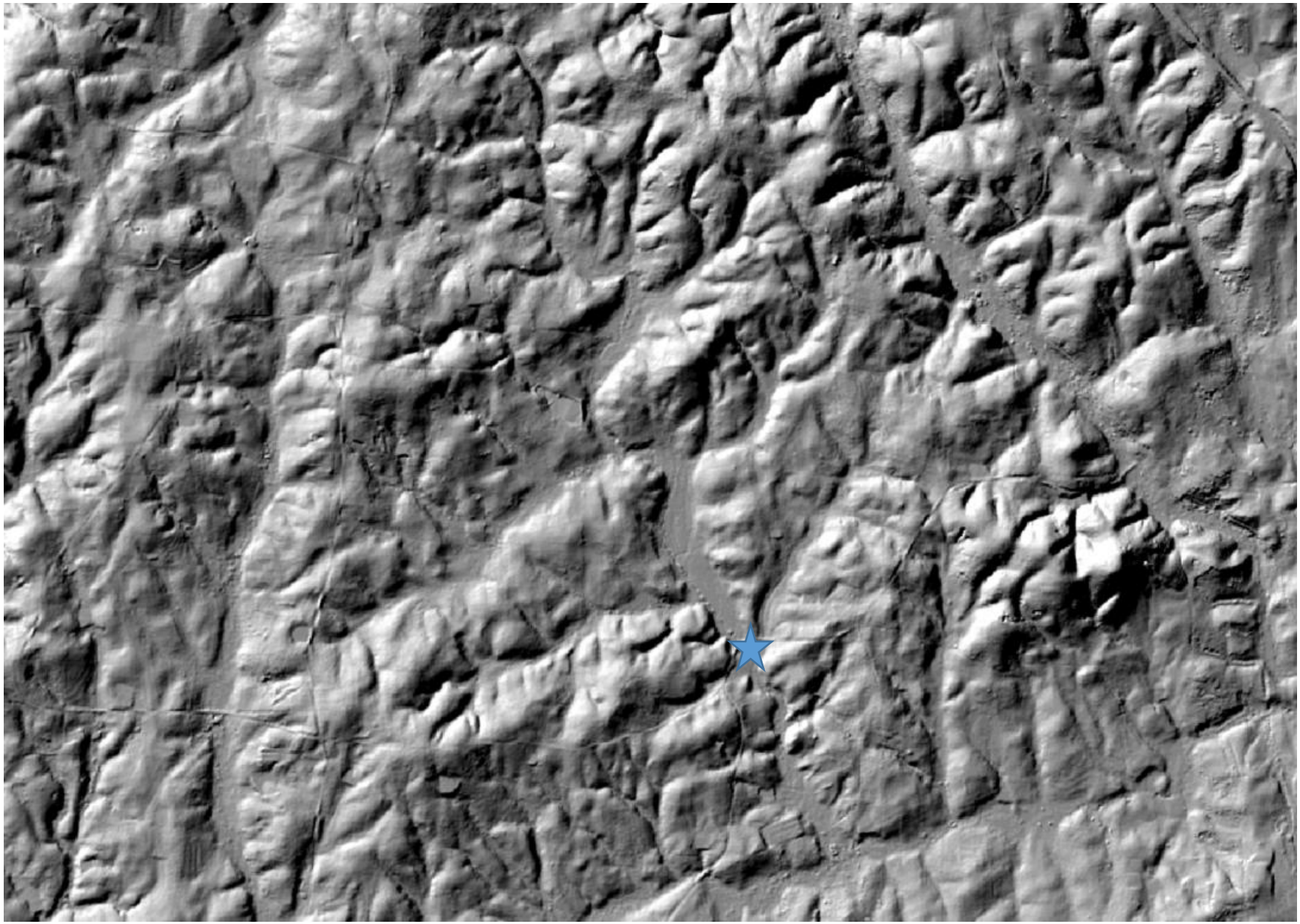
B, HOTEL AT MOUNT VERNON SPRINGS, N. C.


Chapel Hill
Eli Whitney
Snow Camp
Dogwood Acres
Blands
The Downs
Genlee
Clegg
Liberty
Mandale
Carpenter
Morris
Fearrington
Staley
Silk Hope
Bynum
Jordan Lake
Bells
Wilsonville
Apex
Siler City
Pittsboro
Friendship
New Hill
Bonsal
Bonlee
Moncure
Bear Creek
Goldston
Wilbon
Brickhaven
Duncan
Harpers Crossroads
Bennett
Gulf
Cumnock
Carbonton
Cokesbury
Haw Branch
High Falls
Glendon
Sanford
N


Chapel Hill
Eli Whitney
Snow Camp
Dogwood Acres
The Downs
Blands
Genlee
Clegg
RESEARCH TRIANGLE
MT VERNON SPRINGS HISTORIC DISTRICT
Siler City Glendon Rd
Bonlee Rd
Bonlee
Elmer Moore Rd
1176
1136
1138
1139
2119
421
54
501
751
147
1639
49
N


Old US 421 S
Gees Grove Rd
Welch Branch
US Highway 421 S
697 ft
Mt Vernon Springs
Oakley Church Rd
Poplar Trl
Foust Rd
Evans Creek
Buck Gunt
Mt Vernon Springs Rd
692 ft
Old U
Bob Dixon Rd
Melvin Clark Rd
Siler City Glendon Rd
674 ft
Mt Vernon Springs Rd
Petty Rd
Al Davis Rd
N

LiDAR – (**Light Detection and Ranging**) Hillshade Topography Data



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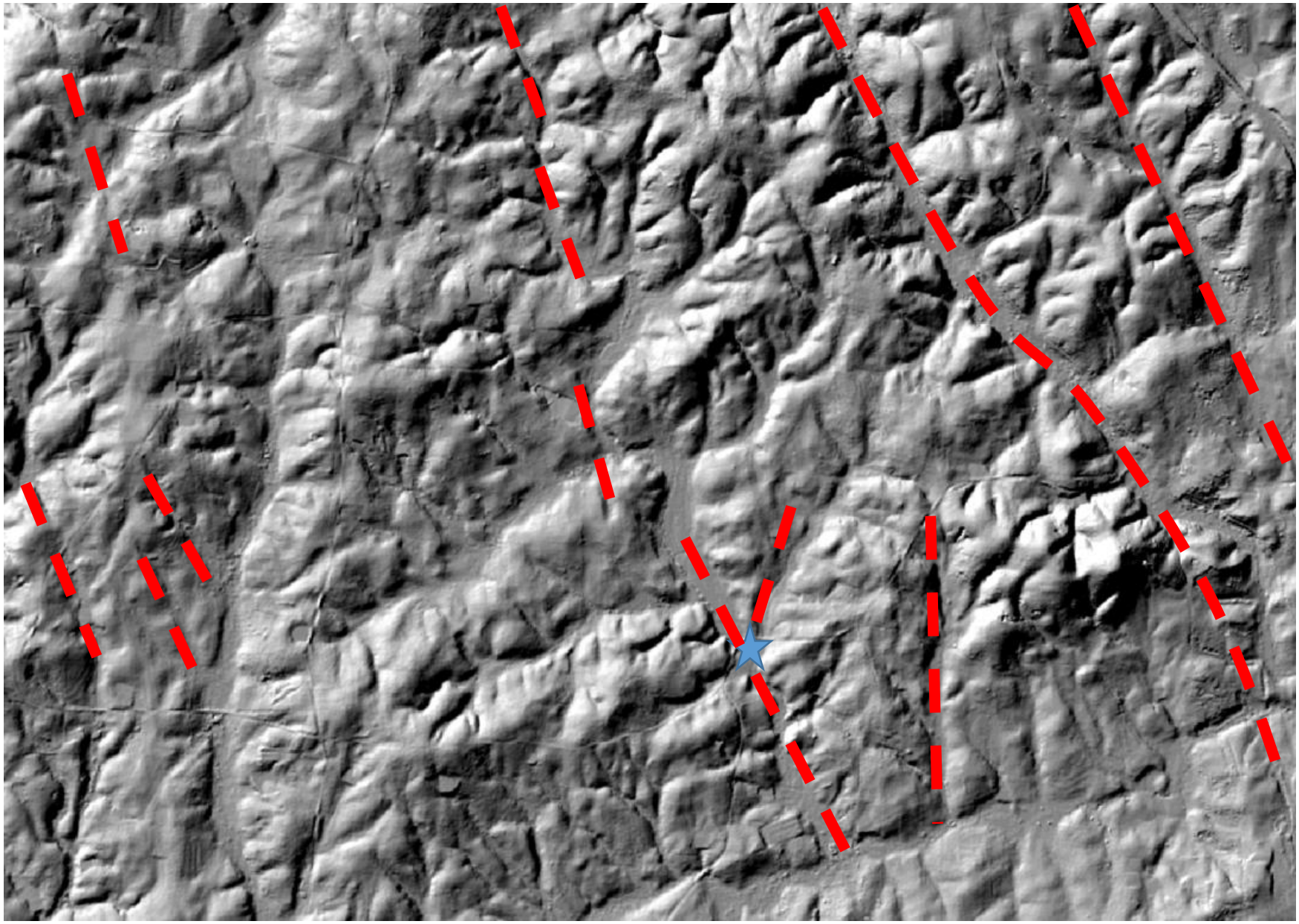
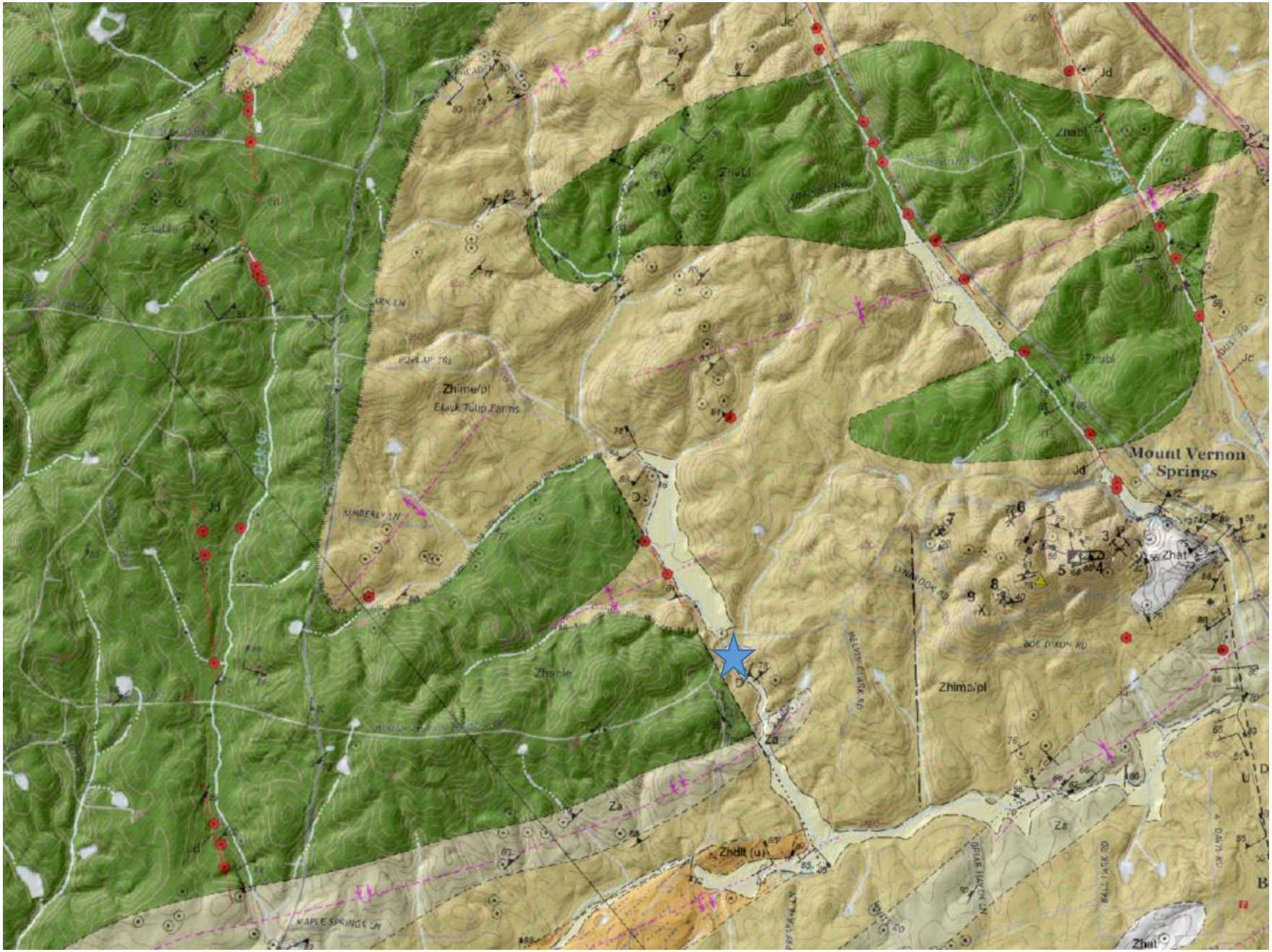
LiDAR – (**Light Detection and Ranging**) Hillshade Topography Data

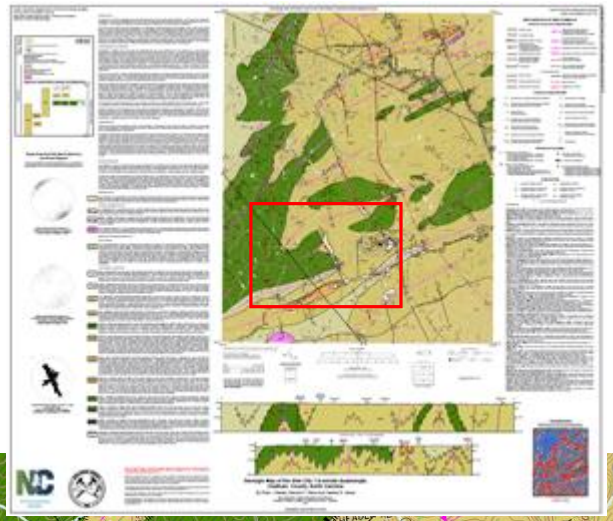


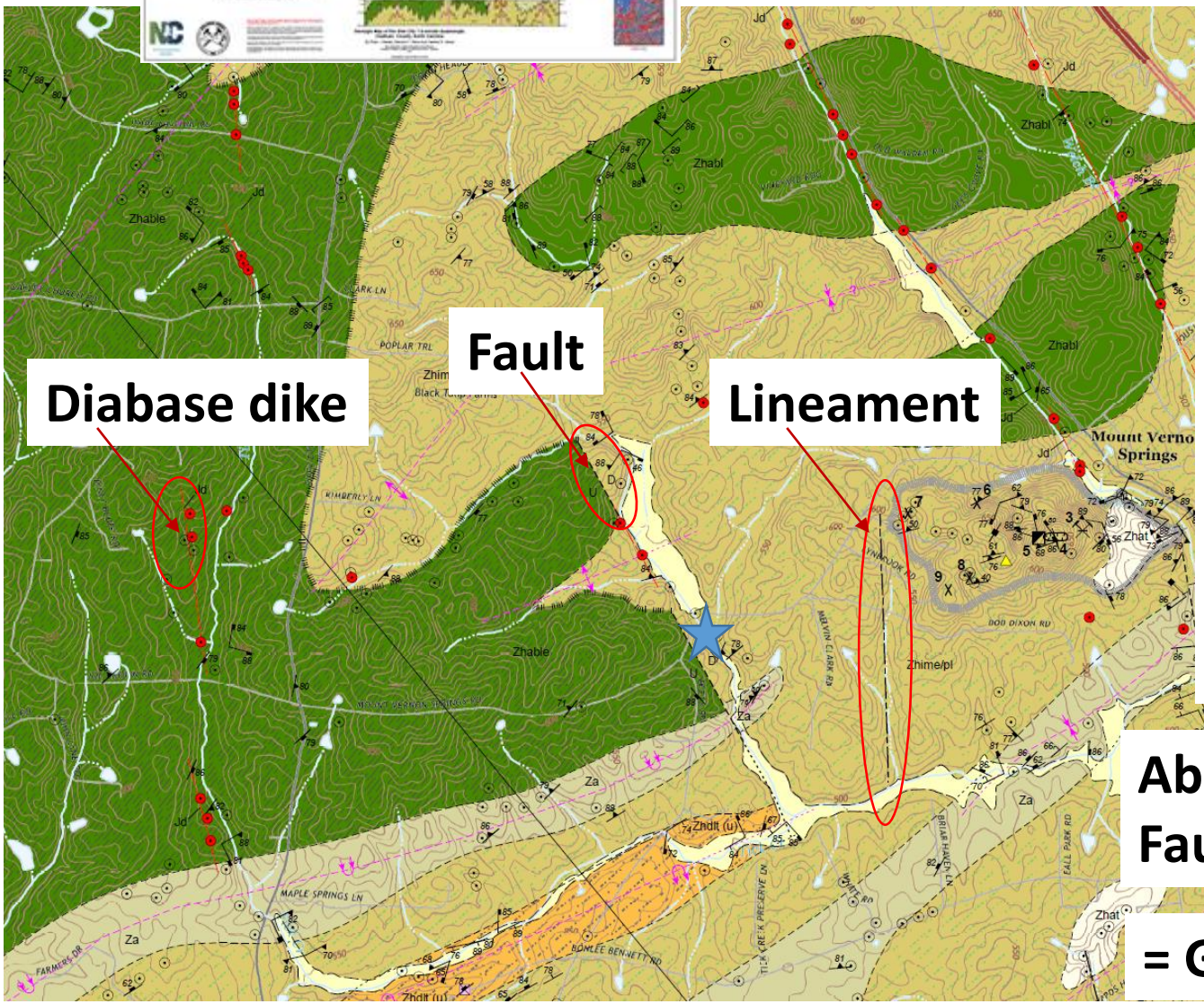
N


Mount Vernon
Springs
N


Mount Vernon
Springs
Zhime/pl
Black Tulip Farms
Zhime/pl
Zhdlt (u)
Zhal
Zhabl
Zhubl
Jd
Jc
Zs
N


Zhabl
Zhabl
Zhabl
Zhabl
Zhime/pl
Black Tulip Farms
Zhime/pl
Zhaole
Zhaole
Zhdlt (u)
Jc
Jd
Jd
Jd
Jd
Jd
Jc
Za
Za
Za
Mount Vernon
Springs
Nick Cir
POPLAR TRL
UMBERLY LN
LYNNBROOK RD
BOE D'SON RD
MELVIN FLASK RD
BRIAR HAVEN LN
BALL PARK RD
N





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Open-file Reports and Maps

Open-File Reports and Maps - Present to 2005
Several Geologic Maps are available in GeoPDF Format

Geopdfs are an electronic map product that have all the same features of regular pdfs but also have location information as part of the map attributes. Using the Avenza Maps App, geopdfs of topographic maps, geologic maps, and other maps in geopdf format can be viewed on the iphone, ipad, and Android devices.

For information about the Avenza application see: Iphone/Ipad Android Devices

The main advantage of using geopdfs on iphone, ipad, or an Android device is that you do not need a data connection to access the maps. All of the map data is on the device.

Important note for ipad and other tablet users, the basic model tablets may not have a built in GPS.

If you have any problems with the GeoPDF's, please email Michael.Medina@ncdenr.gov or pbradley@ncdenr.gov

NCGS Publications

- 1985 Geologic Map of NC
- Bulletins
- Information Circulars
- Open-file Reports and Maps
- Field Trip Guidebooks
- Open-File Reports and Maps - 2004 to 1943
- Geologic Map Series
- Special Publications
- Regional Geologic Map Series
- How to Order Maps & Publications

Map	Preview	Description	Purchase	Digital Download (PDF)
OFR 2018-01		Confirmation of hydrocarbon shows and helium in the Walnut Cove Formation: Triassic rift / lacustrine Dan River basin (Stokes and Rockingham counties), North Carolina – A potential new helium province in the Eastern United States?		PDF Download Panel 1 PDF Download Panel 2
OFR 2017-16		Compiled Geologic Map of the Hyco Shear Zone and Adjacent Portions of the Cluster Springs and Roxboro 7.5-Minute Quadrangles, Person County, North Carolina	Purchase	PDF Download
OFR-2017-15		Compiled Geologic Map of the Hyco Shear Zone and Adjacent Portions of the Alton and Olive Hill 7.5-Minute Quadrangles, Person County, North Carolina	Purchase	PDF Download
OFR-2017-14		Compiled Geologic Map of the Hyco Shear Zone Portions of the Milton and Leasburg 7.5-Minute Quadrangles, Caswell	Purchase	PDF Download

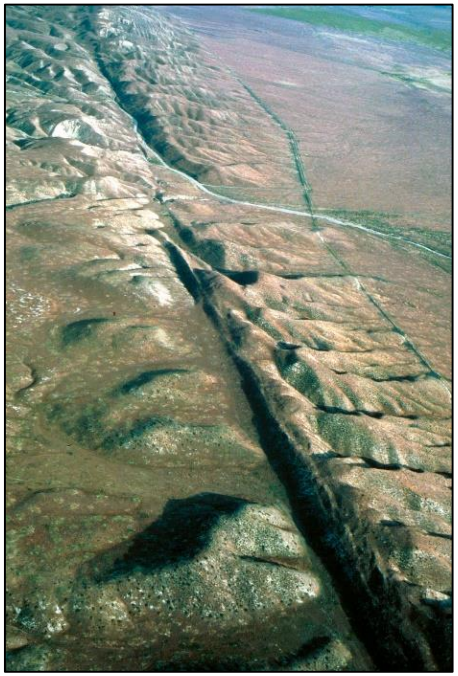
Abundant -
Faults, dikes and lineaments

= Groundwater Features

Faults, dikes and lineaments

Fault, in geology, a planar fracture in the rocks of the Earth's crust…. Faults range in length from a few centimeters to many hundreds of kilometers…..

Source: https://www.britannica.com/science/fault-geology

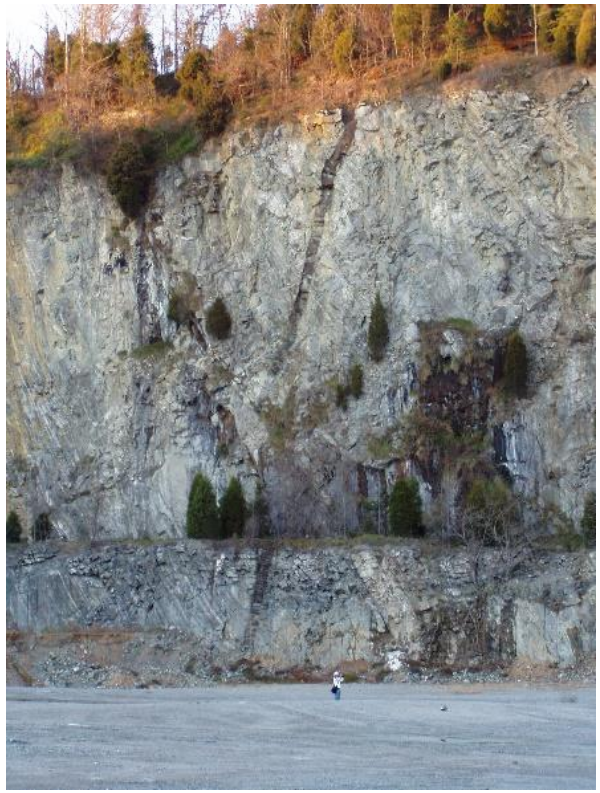


San Andreas Fault, California – Source USGS

Dike, also called **geological dike**, in geology, tabular or sheetlike igneous body that is often oriented vertically or steeply inclined to the bedding of preexisting intruded rocks……..

https://www.britannica.com/science/dike-igneous-rock

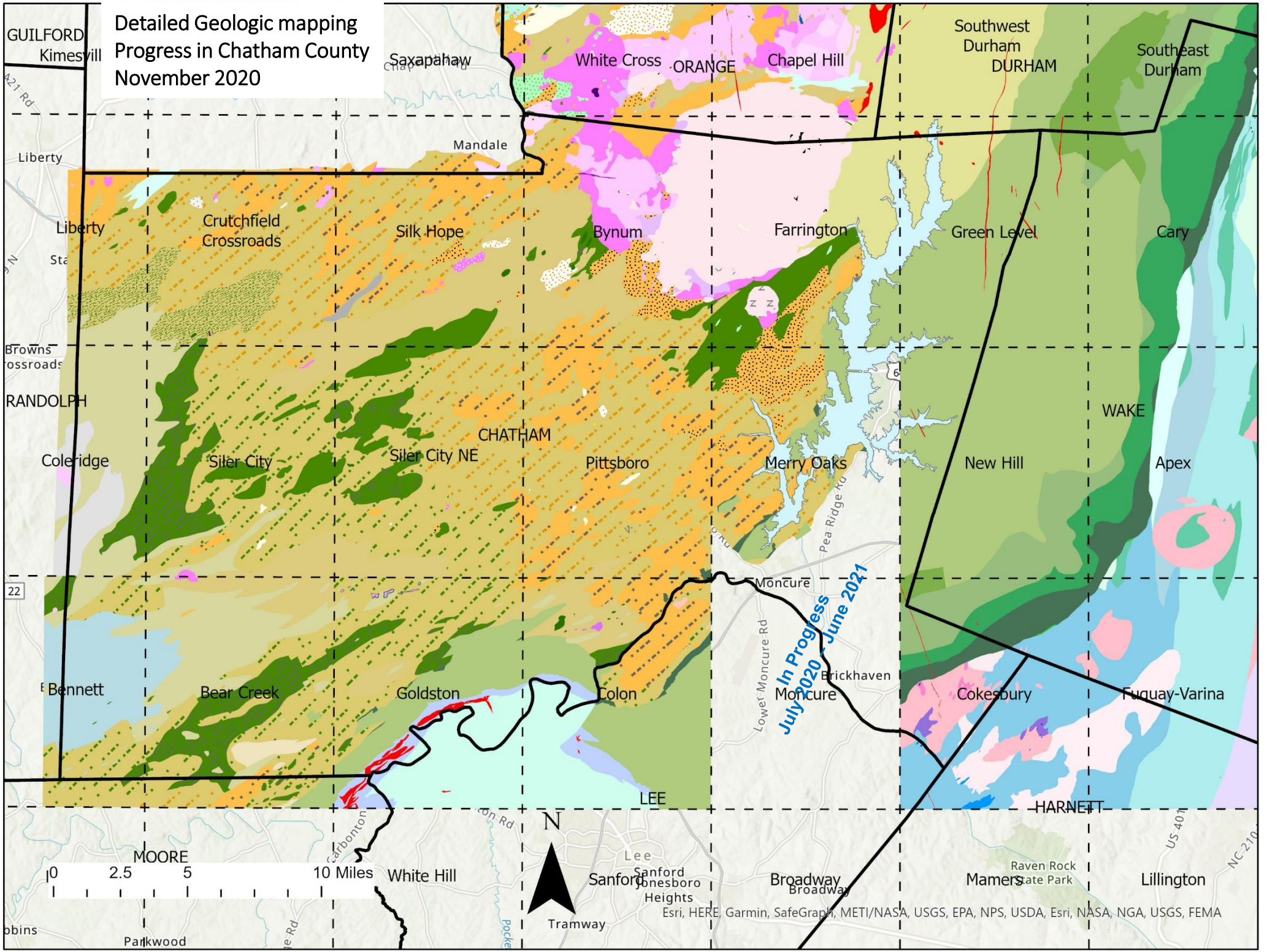
Dike of the rock type diabase in quarry. South Boston, Va.

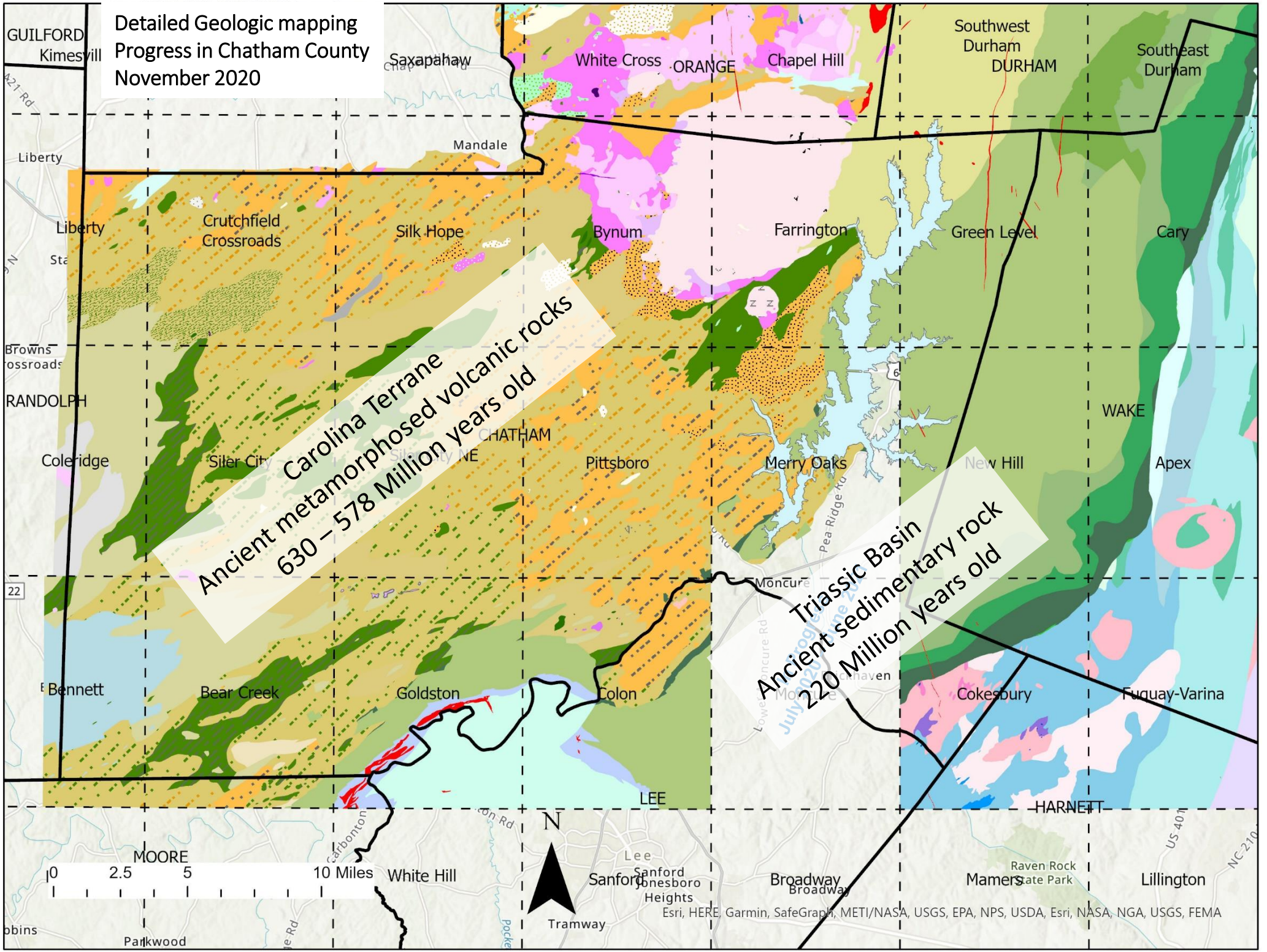


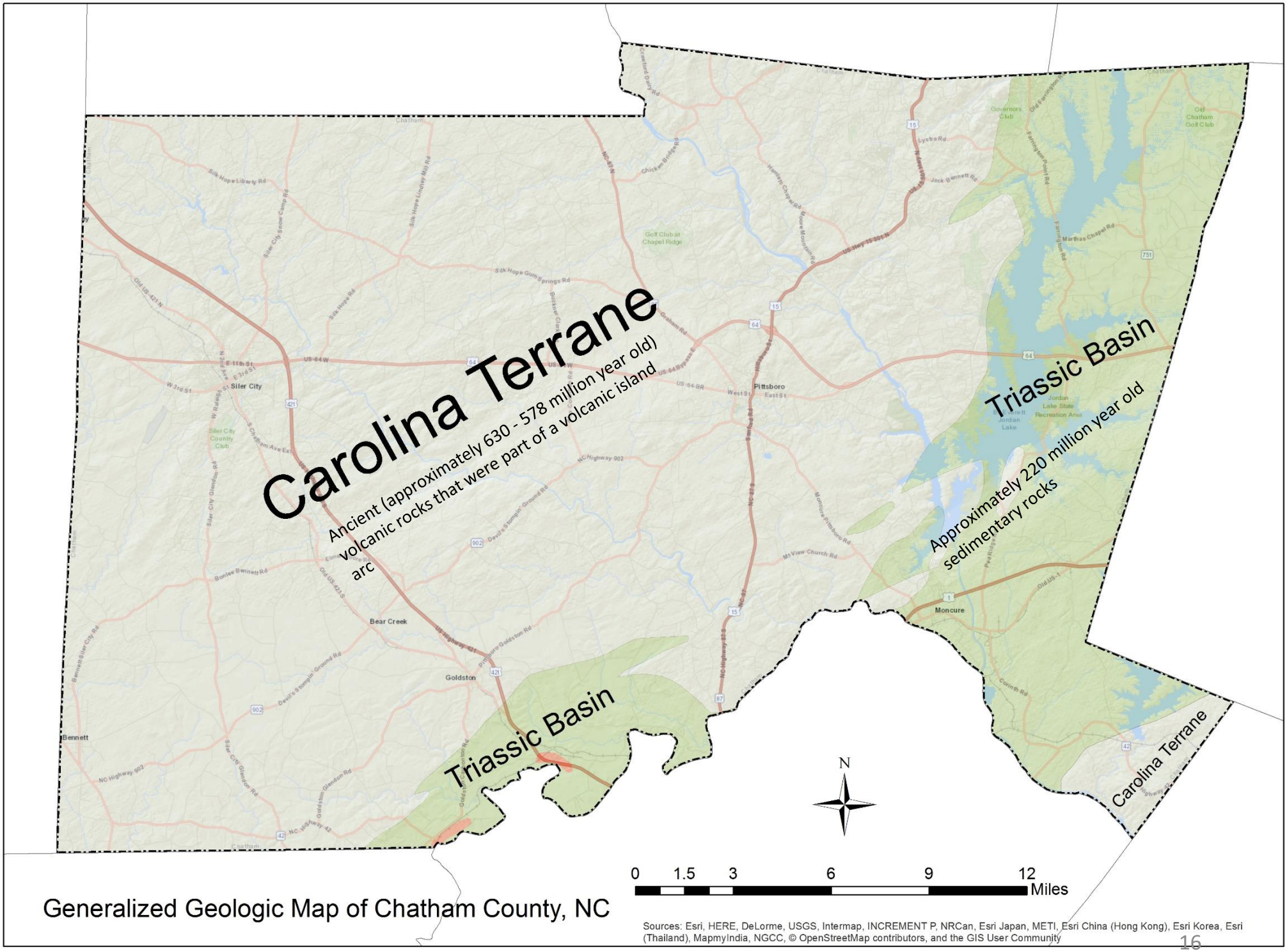
Lineament (in geology)

a linear topographic feature that reveals a characteristic (such as a fault or the subsurface structure)……

https://www.merriam-webster.com/dictionary/lineament


Detailed Geologic mapping
Progress in Chatham County
November 2020
GUILFORD
Kimesville
Saxapahaw
White Cross
ORANGE
Chapel Hill
Southwest
Durham
DURHAM
Southeast
Durham
Mandale
Liberty
Liberty
Crutchfield
Crossroads
Silk Hope
Bynum
Farrington
Green Level
Cary
Browns
Crossroads
RANDOLPH
CHATHAM
WAKE
Coleridge
Siler City
Siler City NE
Pittsboro
Merry Oaks
New Hill
Apex
Pea Ridge Rd
Moncure
Lower Moncure Rd
In Progress
July 2020 - June 2021
Bennett
Bear Creek
Goldston
Colon
Brickhaven
Moncure
Cokesbury
Fuquay-Varina
LEE
HARNETT
MOORE
White Hill
Sanford
Lee
Sanford
Jonesboro
Heights
Broadway
Broadway
Mamers
Raven Rock
State Park
Lillington
Tramway
Parkwood
Carbonton
US 401
NC-210
N
0 2.5 5 10 Miles
Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, Esri, NASA, NGA, USGS, FEMA

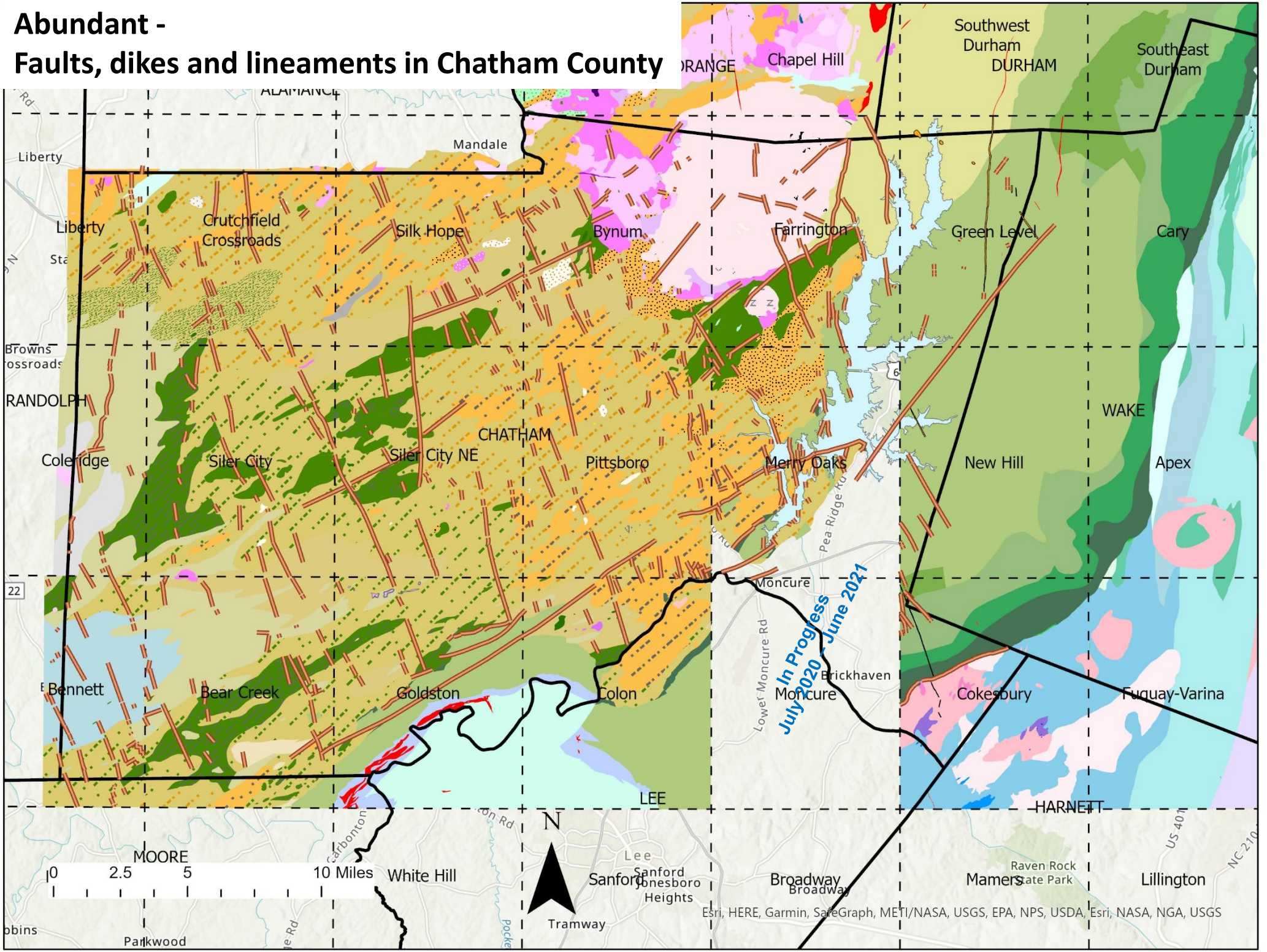

Detailed Geologic mapping
Progress in Chatham County
November 2020
Carolina Terrane
Ancient metamorphosed volcanic rocks
630 – 578 Million years old
Triassic Basin
Ancient sedimentary rock
220 Million years old
GUILFORD
Kimesville
Saxapahaw
White Cross
ORANGE
Chapel Hill
Southwest Durham
DURHAM
Southeast Durham
Mandale
Liberty
Crutchfield Crossroads
Silk Hope
Bynum
Farrington
Green Level
Cary
Browns Crossroads
RANDOLPH
CHATHAM
WAKE
Coleridge
Siler City
Pittsboro
Merry Oaks
New Hill
Apex
Moncure
Bennett
Bear Creek
Goldston
Colon
Cokesbury
Fuquay-Varina
LEE
HARNETT
MOORE
White Hill
Sanford
Lee
Sanford
Jonesboro Heights
Broadway
Broadway
Mamers
Raven Rock State Park
Lillington
Tramway
Parkwood
0 2.5 5 10 Miles
N
Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, Esri, NASA, NGA, USGS, FEMA



Generalized Geologic Map of Chatham County, NC

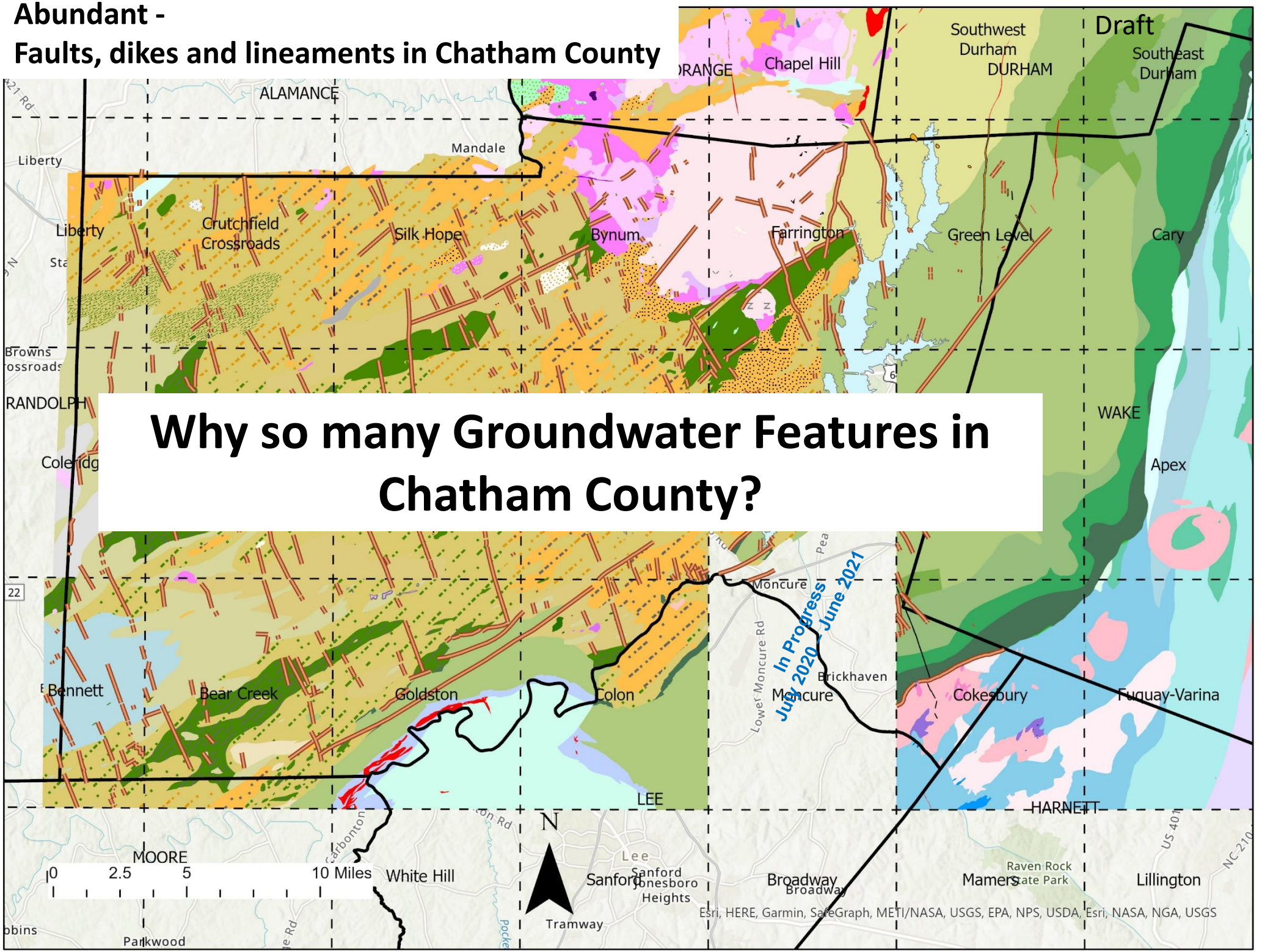
Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Abundant -
Faults, dikes and lineaments in Chatham County

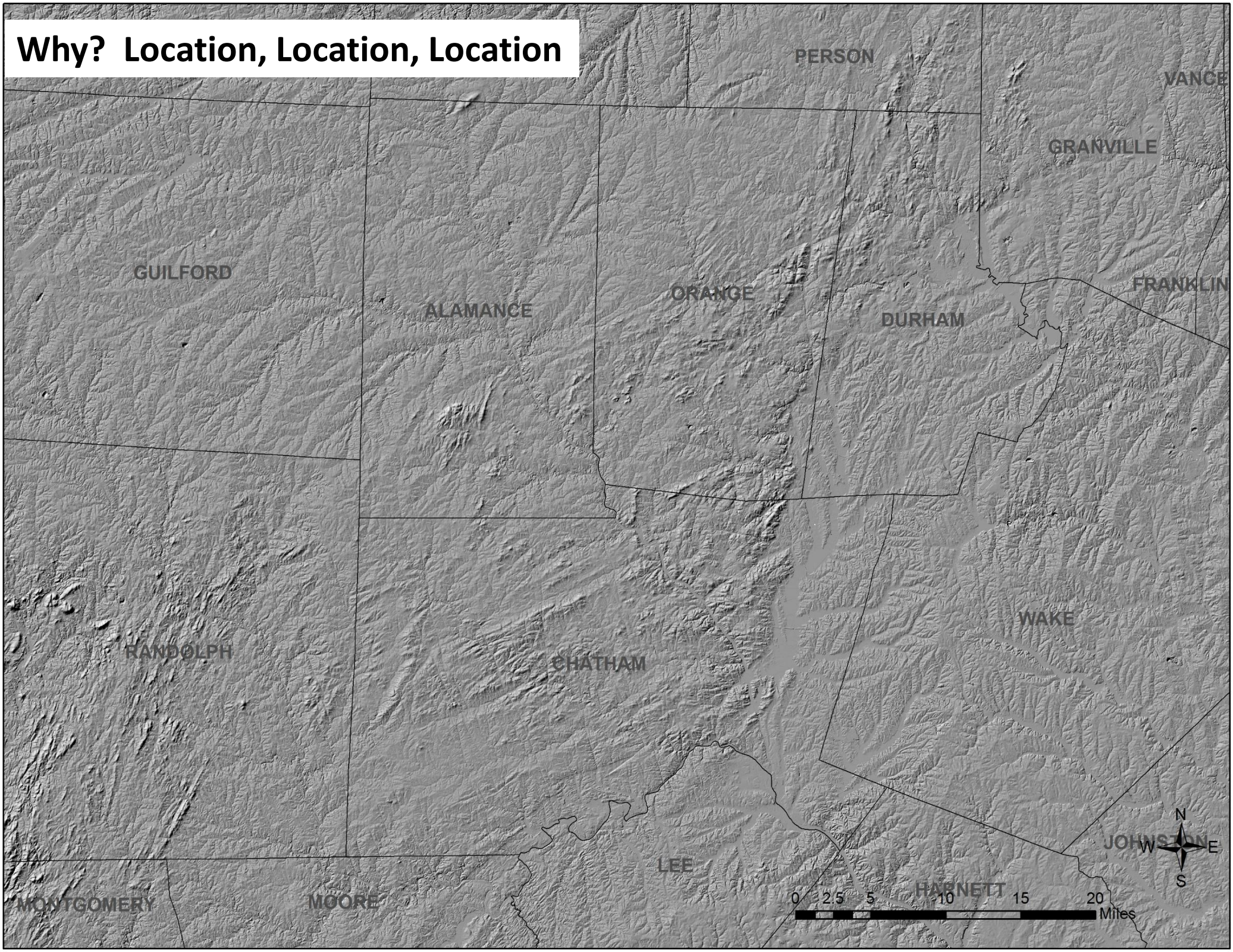


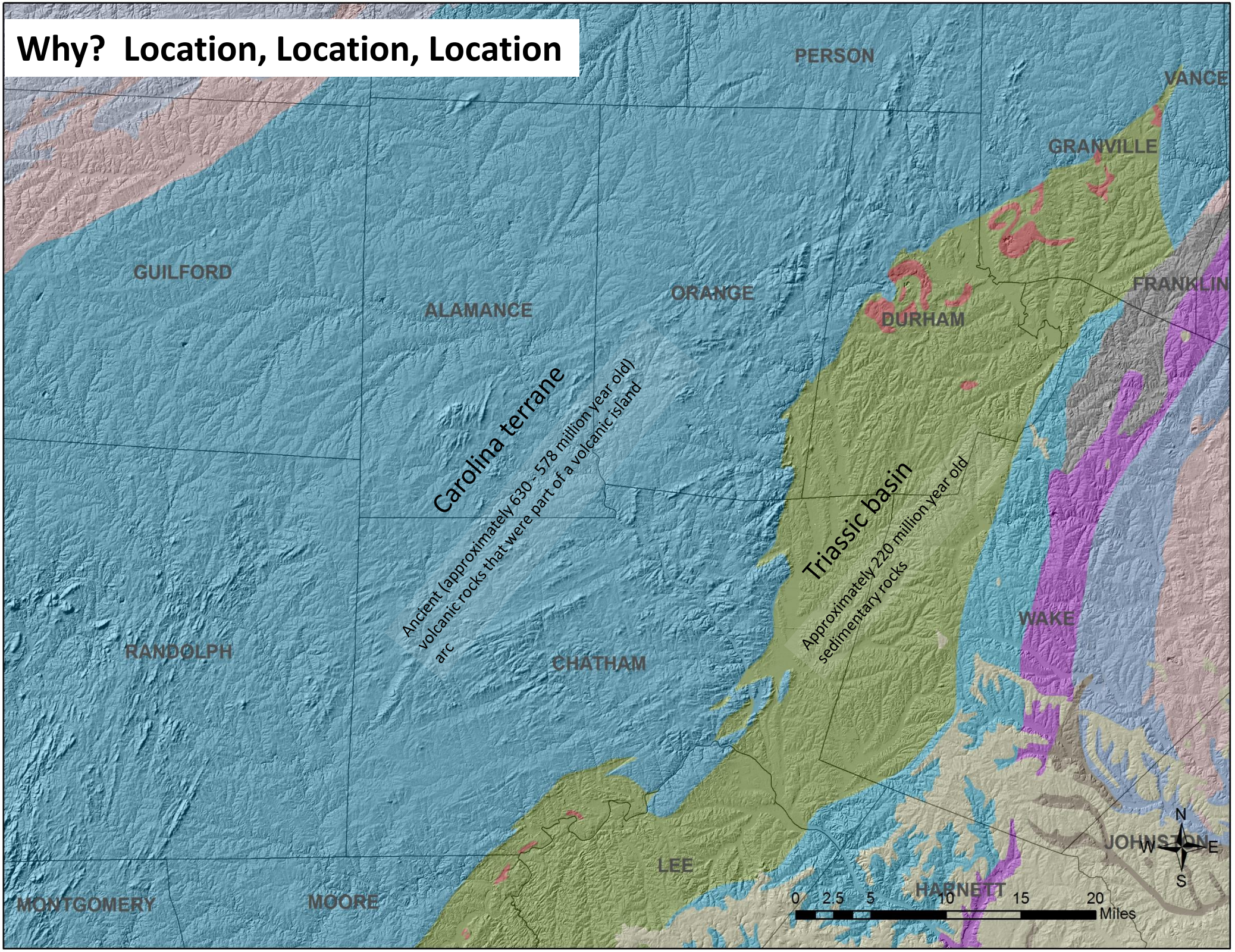
Abundant -

Faults, dikes and lineaments in Chatham County

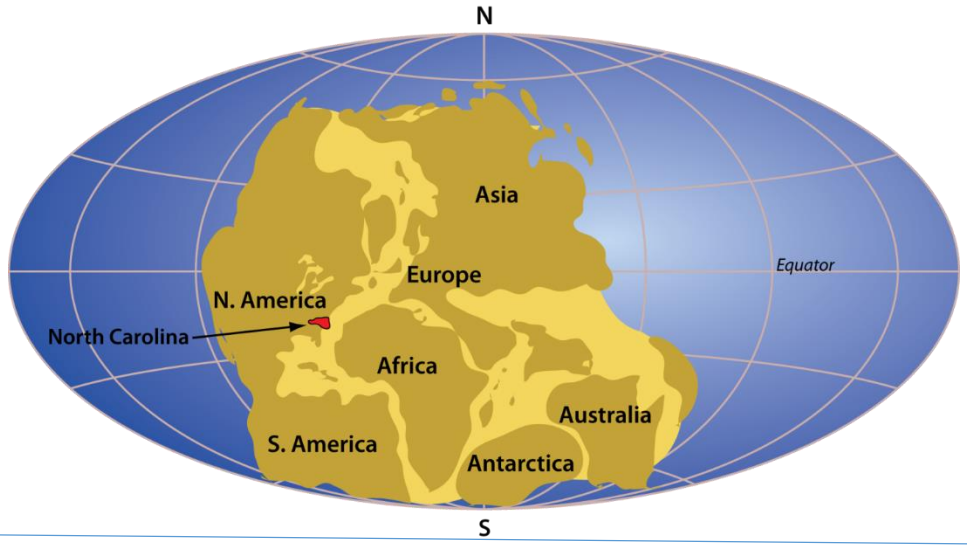


Why so many Groundwater Features in Chatham County?

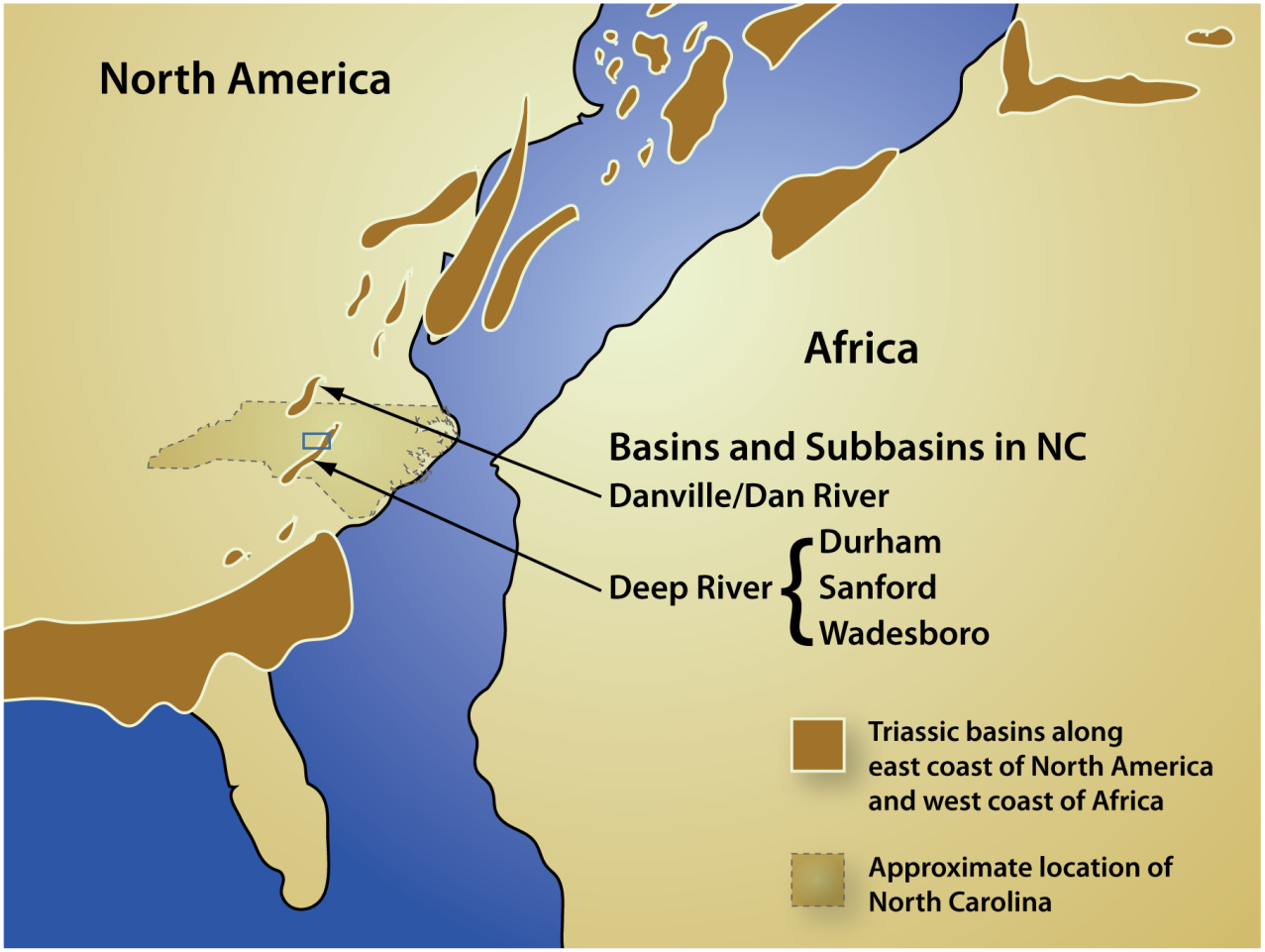

Why? Location, Location, Location
PERSON
VANCE
GRANVILLE
GUILFORD
ALAMANCE
ORANGE
DURHAM
FRANKLIN
WAKE
RANDOLPH
CHATHAM
LEE
JOHNSTON
HARNETT
MONTGOMERY
MOORE
N
W
E
S
0 2.5 5 10 15 20
Miles


Why? Location, Location, Location
PERSON
VANCE
GRANVILLE
FRANKLIN
GUILFORD
ALAMANCE
ORANGE
DURHAM
Carolina terrane
Ancient (approximately 630 - 578 million year old) volcanic rocks that were part of a volcanic island arc
Triassic basin
Approximately 220 million year old sedimentary rocks
WAKE
RANDOLPH
CHATHAM
LEE
JOHNSTON
HARNETT
MOORE
MONTGOMERY
N
W
E
S
0 2.5 5 10 15 20
Miles

Ca. 300 ma – Pangea

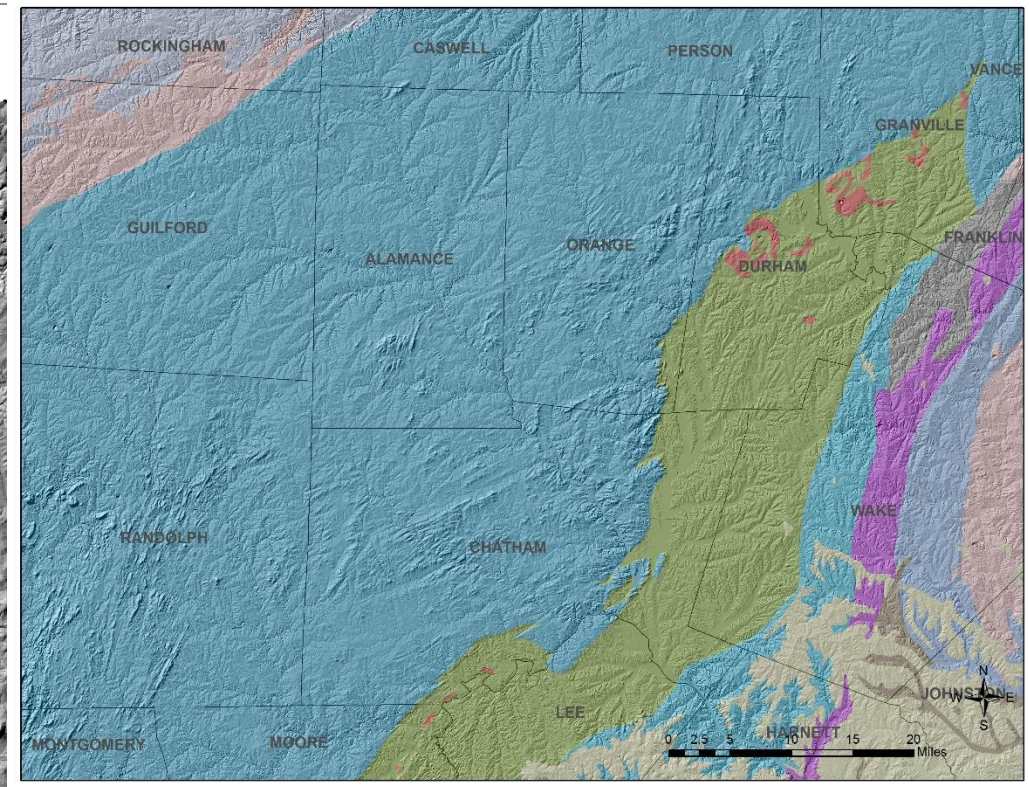


Ca. 220 ma
Pangea Breakup



(Modified from Ralph Lewis, Connecticut Geological Survey, www.wesleyan.edu/ctgeology/CtLandscapes/).

Why? Location, Location, Location

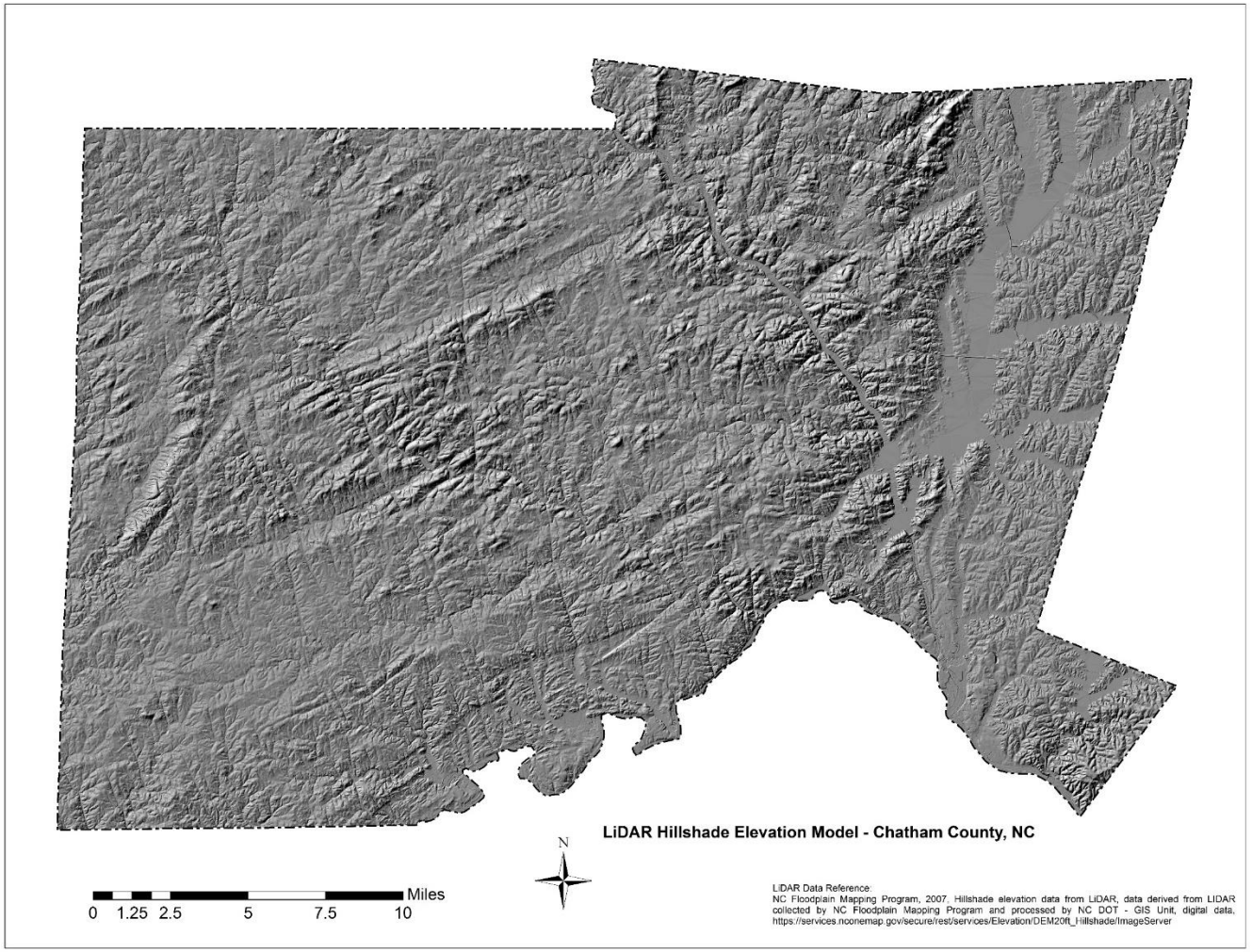


LiDAR Hillshade Elevation Model - Chatham County, NC

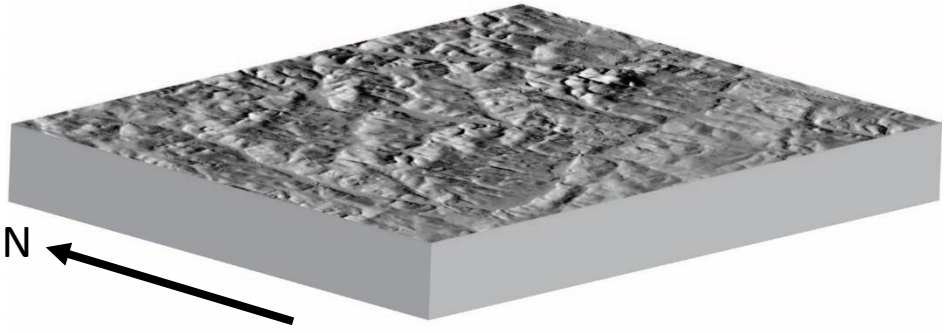
N

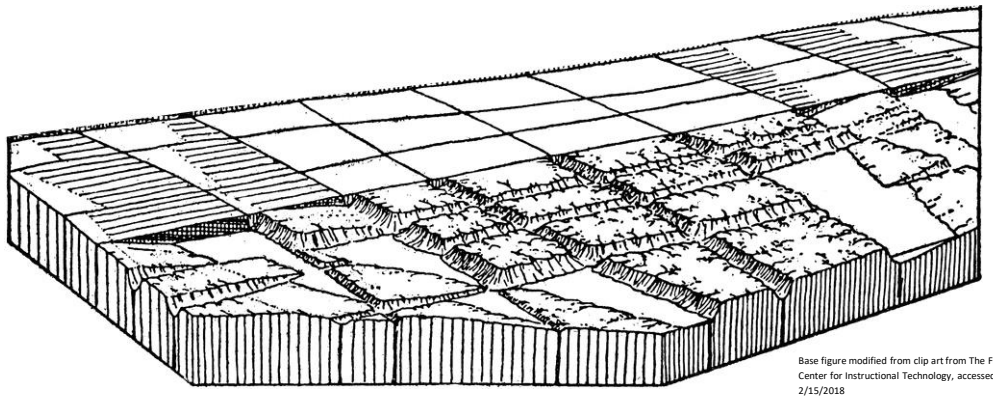
0 1.25 2.5 5 7.5 10 Miles

LiDAR Data Reference:
NC Floodplain Mapping Program, 2007, Hillshade elevation data from LiDAR, data derived from LIDAR collected by NC Floodplain Mapping Program and processed by NC DOT - GIS Unit, digital data, https://services.nconemap.gov/secure/rest/services/Elevation/DEM20ft_Hillshade/ImageServer

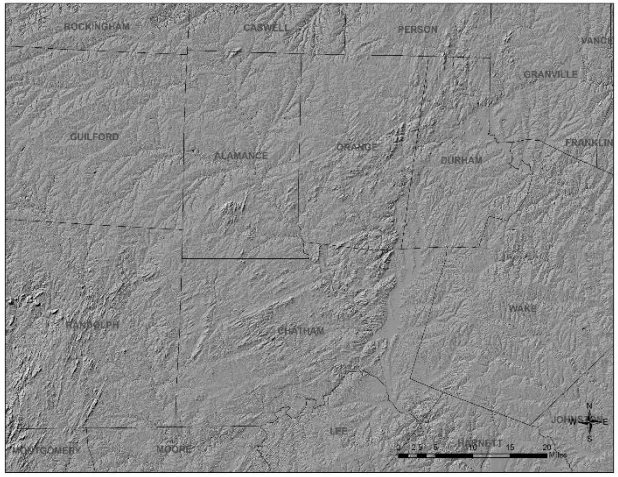


Perspective view of hillshade LiDAR looking toward northeast of lineament network





Base figure modified from clip art from The Florida Center for Instructional Technology, accessed on 2/15/2018


ROCKINGHAM
CASWELL
PERSON
VANCE
GRANVILLE
GUILFORD
ALAMANCE
ORANGE
DURHAM
FRANKLIN
WAKE
RANDOLPH
CHATHAM
LEE
JOHNSTON
HARNETT
MONTGOMERY
MOORE
N
W
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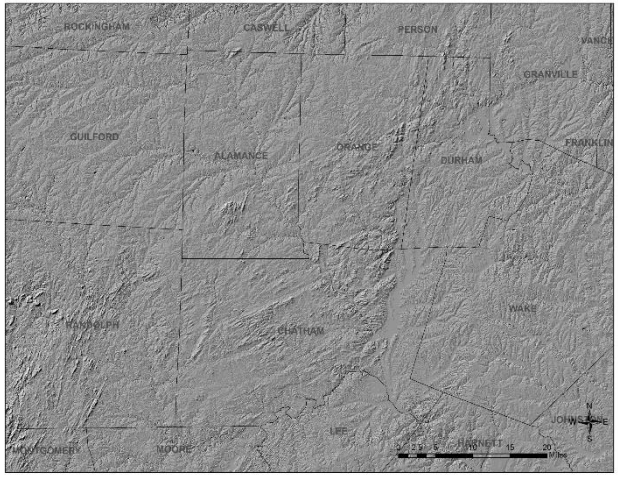
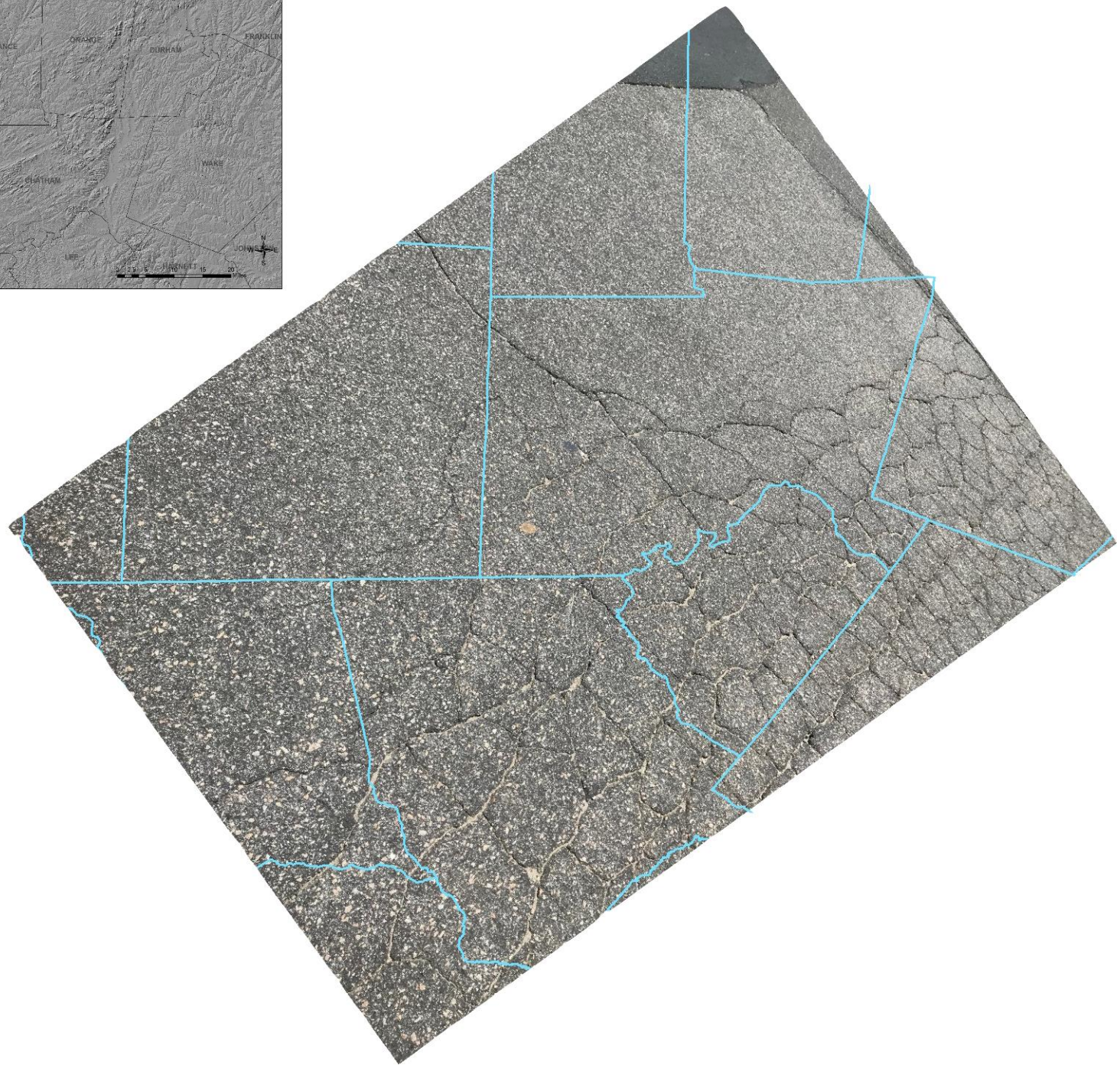
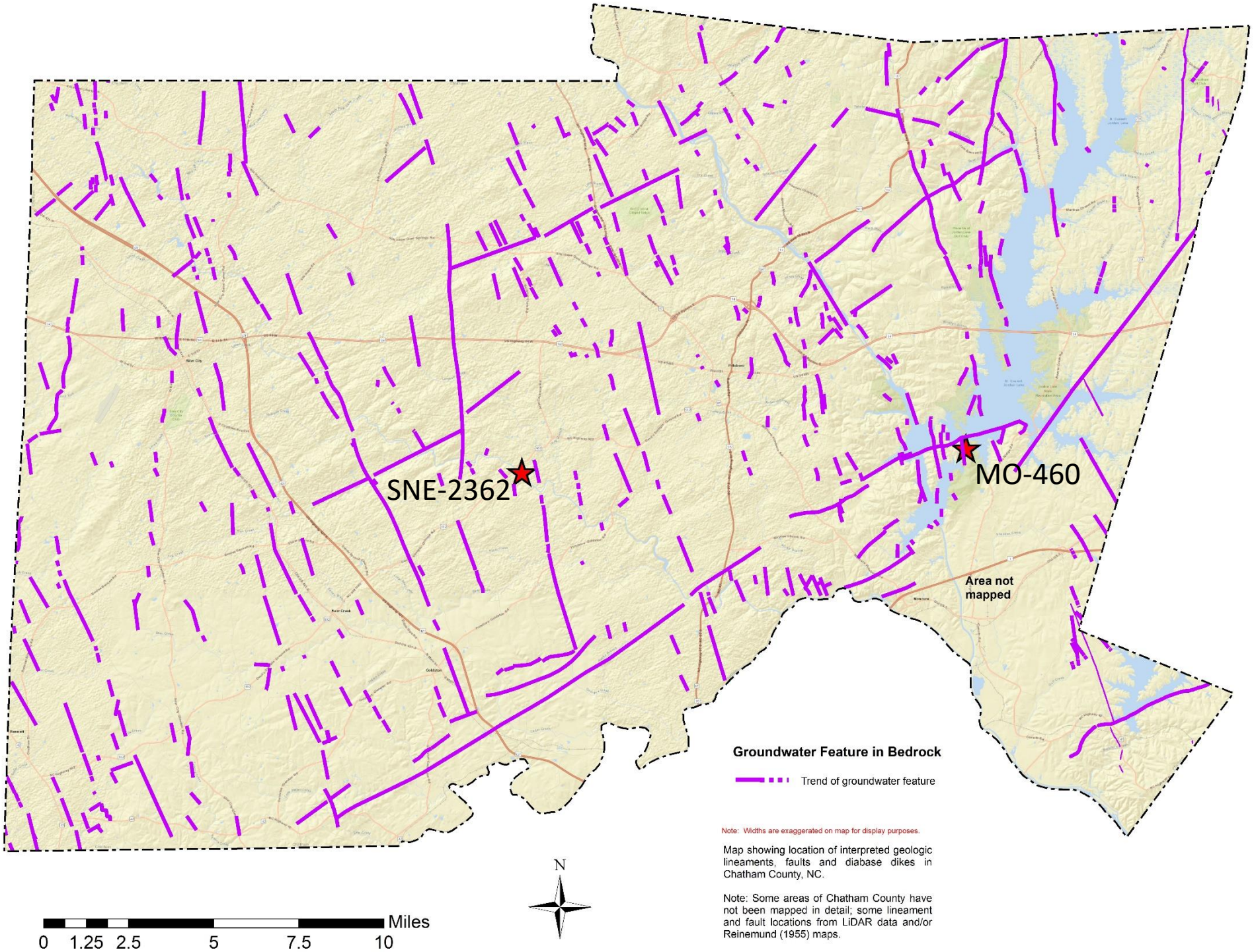
S
0 2.5 5 10 15 20
Miles


ROCKINGHAM
CASWELL
PERSON
VANCE
GRANVILLE
GUILFORD
ALAMANCE
ORANGE
DURHAM
FRANKLIN
RANDOLPH
CHATHAM
WAKE
JOHNSTON
LEE
HARNETT
MONTGOMERY
MOORE
N
S
0 2.5 5 10 15 20
Miles




SNE-2362
MO-460
Area not mapped
Groundwater Feature in Bedrock
Trend of groundwater feature
Note: Widths are exaggerated on map for display purposes.
Map showing location of interpreted geologic lineaments, faults and diabase dikes in Chatham County, NC.
Note: Some areas of Chatham County have not been mapped in detail; some lineament and fault locations from LiDAR data and/or Reinemund (1955) maps.
N
0 1.25 2.5 5 7.5 10
Miles
Sources: Esri, HERE, DeLorme, USGS,

SNE-2362

MO-460

Area not mapped

Groundwater Feature in Bedrock

Trend of groundwater feature

Note: Widths are exaggerated on map for display purposes.

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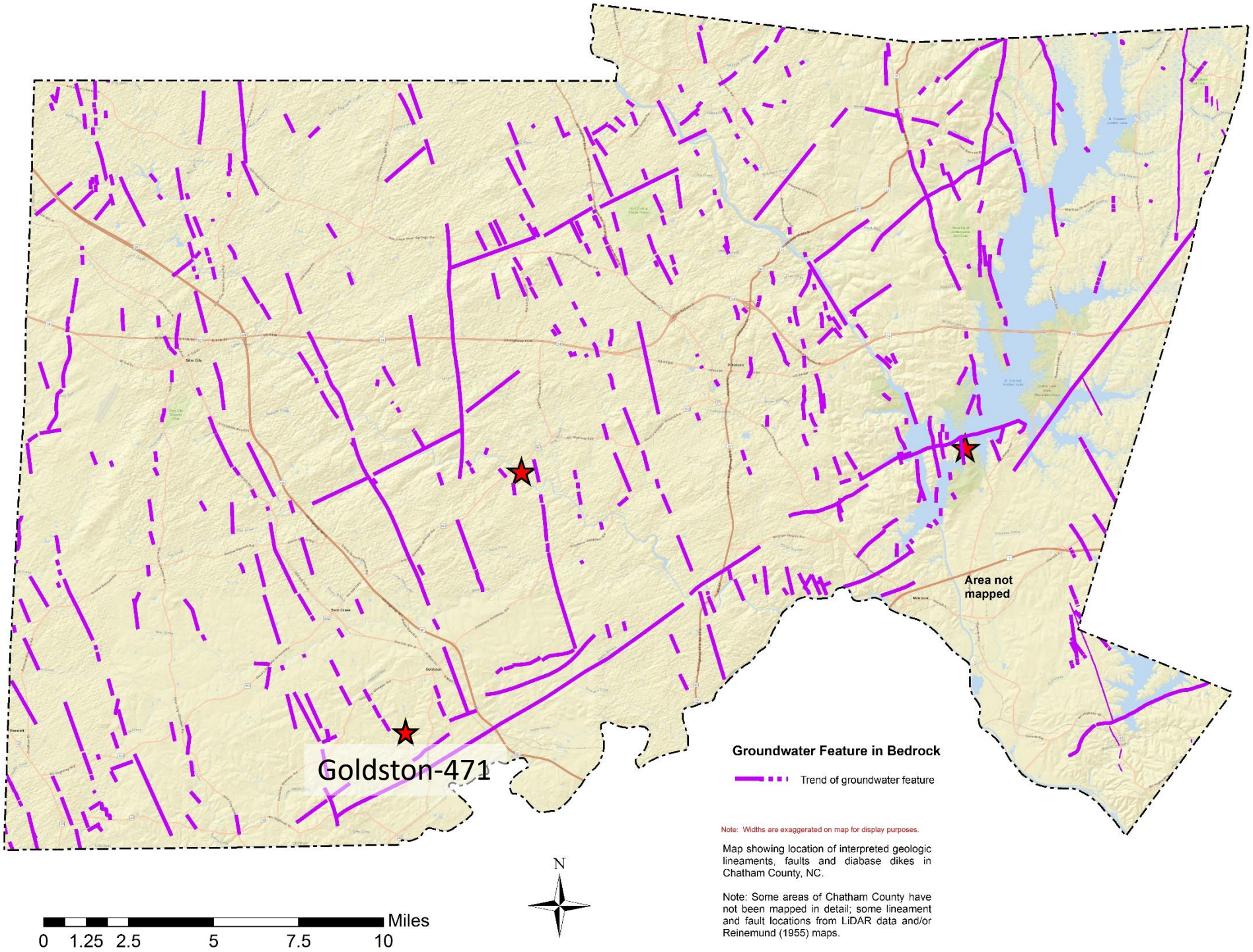
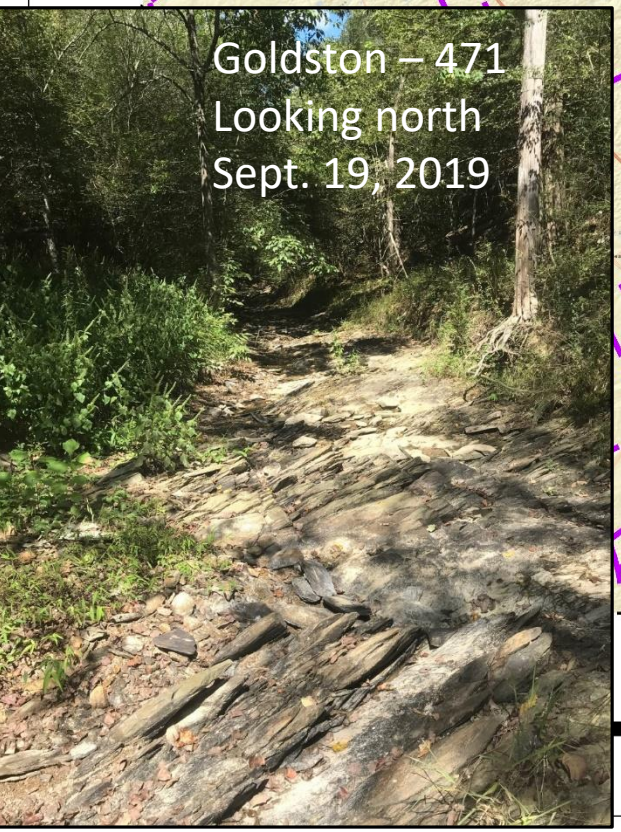
N

0 1.25 2.5 5 7.5 10 Miles

Sources: Esri, HERE, DeLorme, USGS,


Goldston-471
Area not mapped
Groundwater Feature in Bedrock
Trend of groundwater feature
Note: Widths are exaggerated on map for display purposes.
Map showing location of interpreted geologic lineaments, faults and diabase dikes in Chatham County, NC.
Note: Some areas of Chatham County have not been mapped in detail; some lineament and fault locations from LiDAR data and/or Reinemund (1955) maps.
N
Miles
0 1.25 2.5 5 7.5 10
Sources: Esri, HERE, DeLorme, USGS,



Goldston-471

Miles
10

Sources: Esri, HERE, DeLorme, USGS,

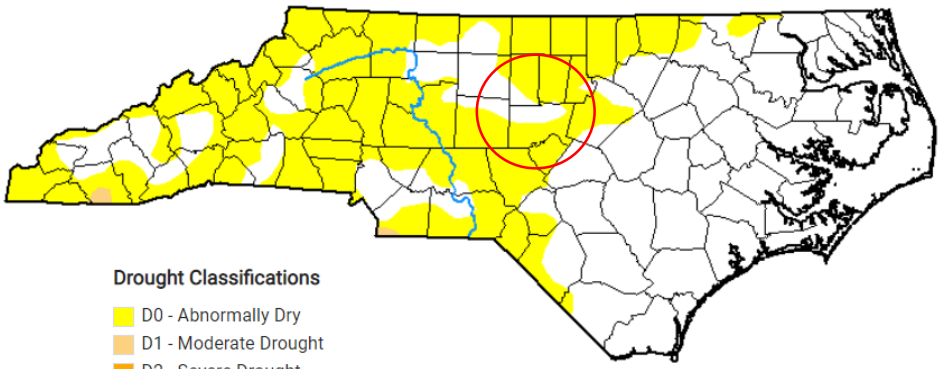
North Carolina
Drought Management Advisory Council

CURRENT CONDITIONS › NEWS & UPDATES MAP ARCHIVES EDUCATION

Current Conditions

as of September 17, 2019 at 8am ET

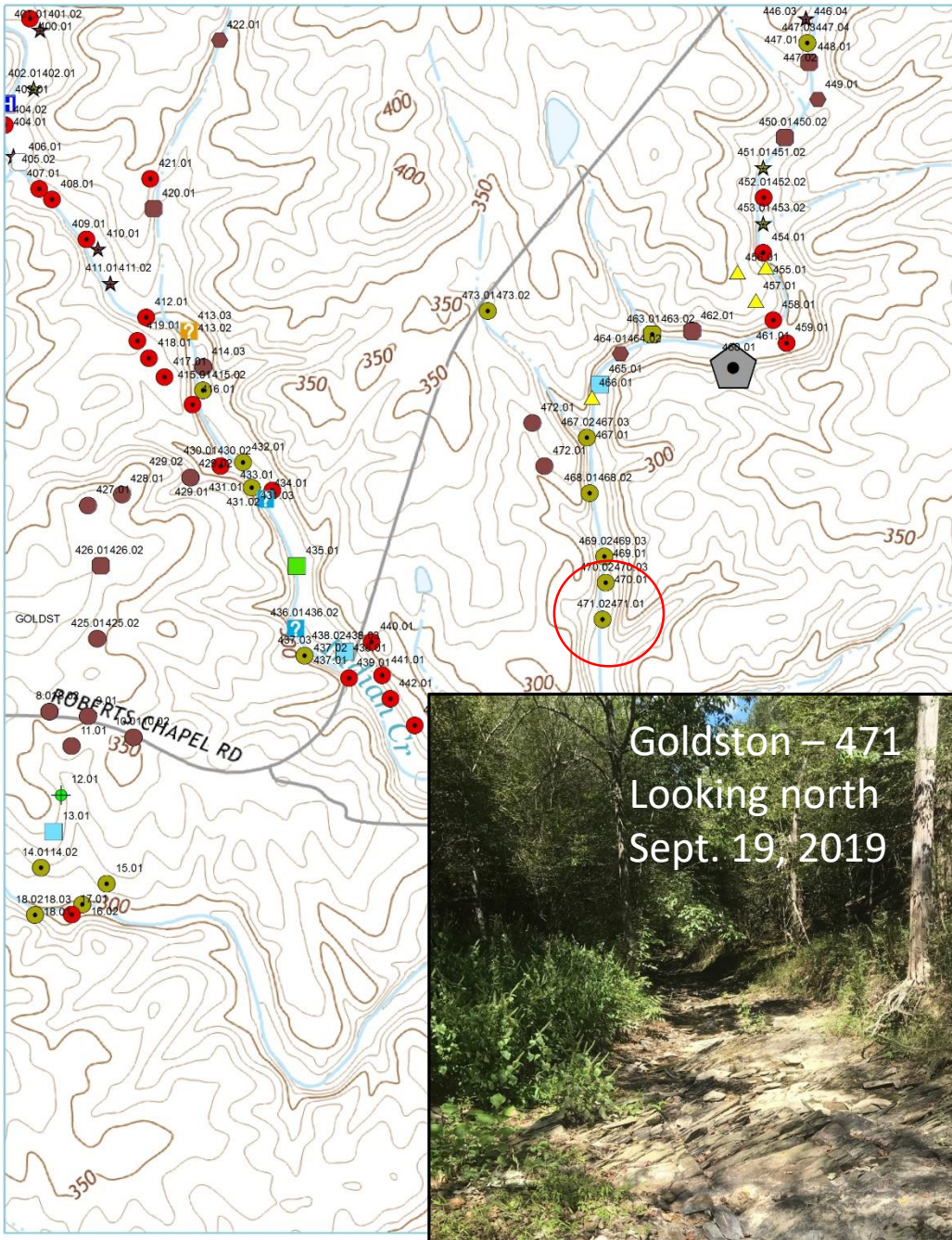
US Drought Monitor of
North Carolina

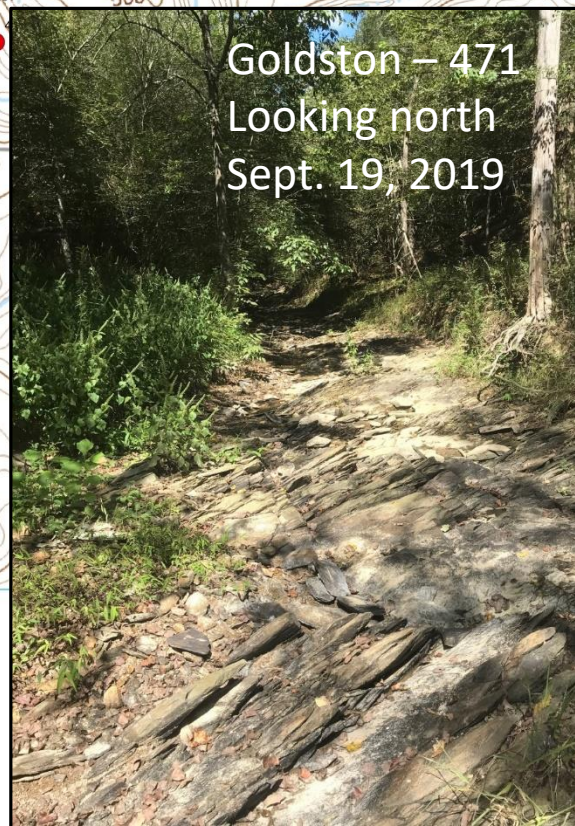


Drought Classifications

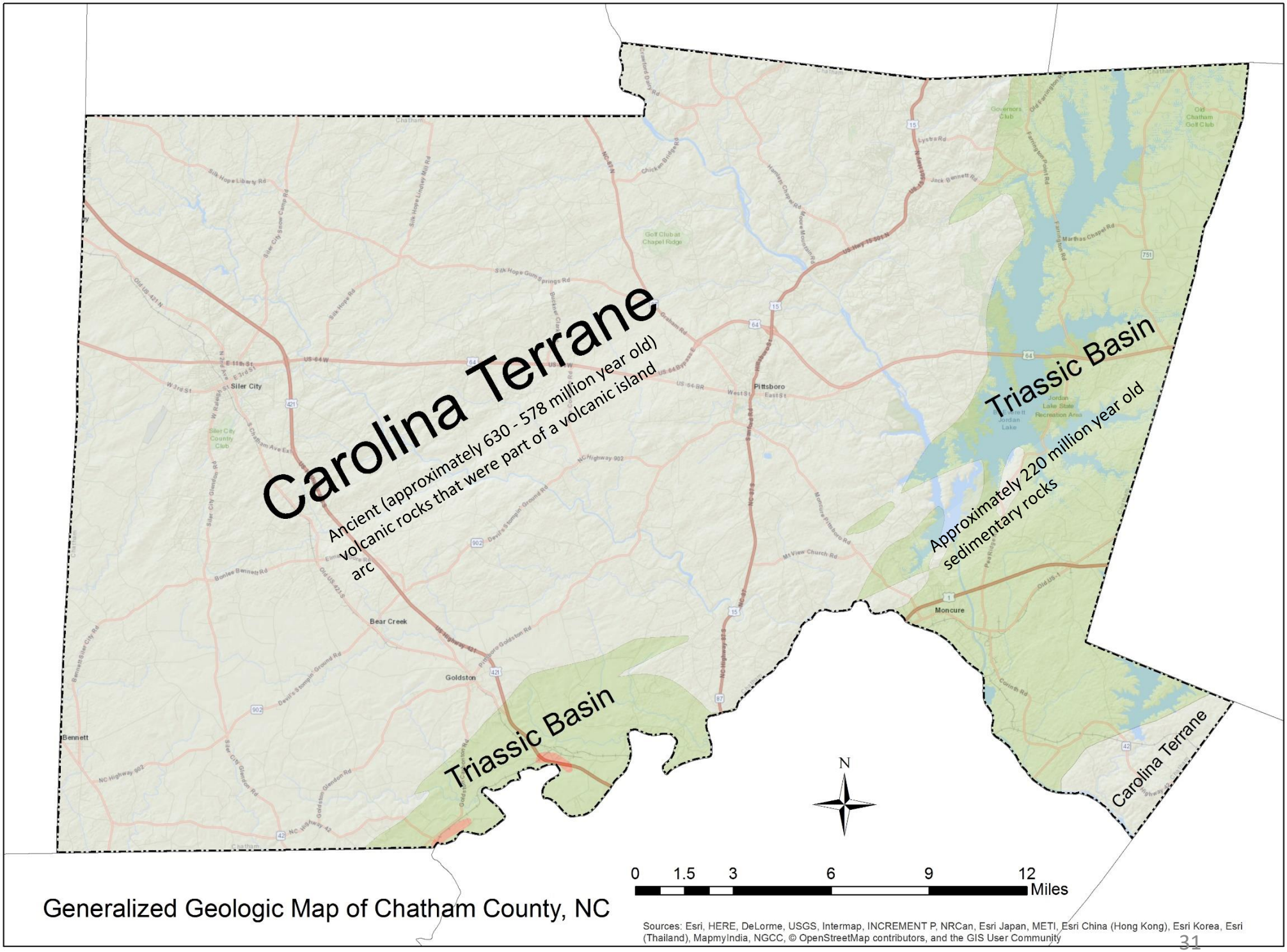
- D0 - Abnormally Dry
- D1 - Moderate Drought
- D2 - Severe Drought
- D3 - Extreme Drought
- D4 - Exceptional Drought

S - Short-Term impacts, typically less than 6 months (e.g. agriculture, grasslands
L - Long-Term impacts, typically greater than 6 months (e.g. hydrology, ecology)





Chatham County Groundwater Conceptual Models – Carolina terrane

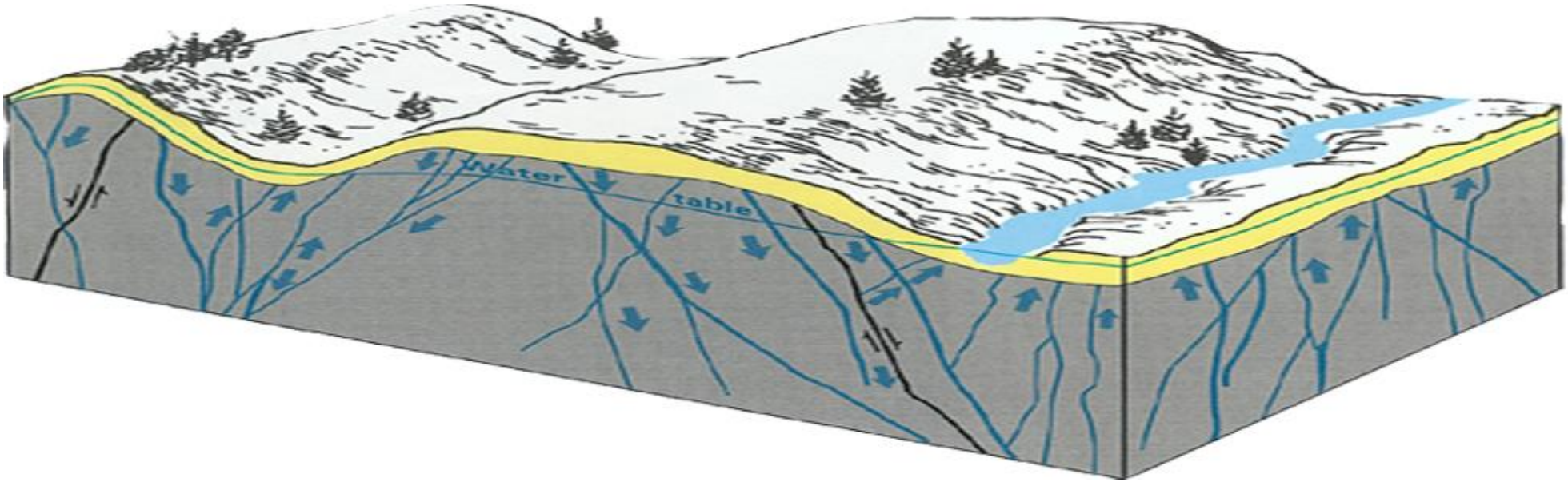


Generalized Geologic Map of Chatham County, NC

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

DRAFT

Piedmont Groundwater Conceptual Model



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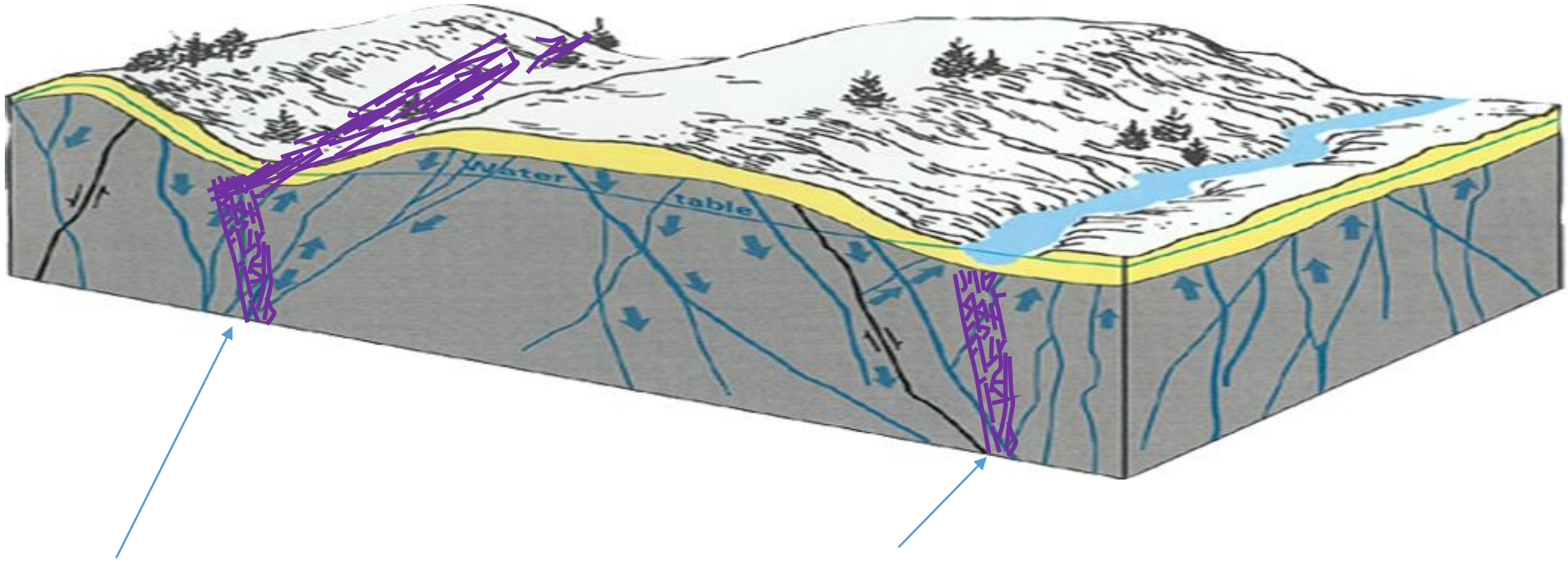
Chatham County Groundwater Conceptual Model

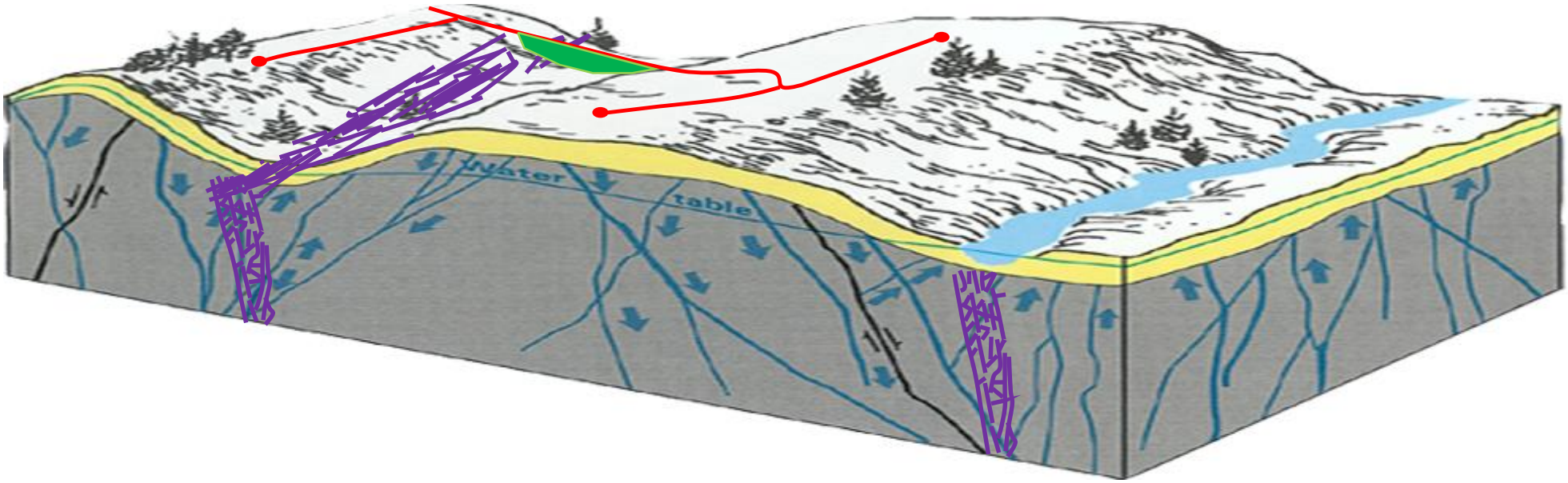
Strong preferential pathways for groundwater flow and contaminant transport may exist proximal to lineaments, faults and diabase dikes



Zone of increased permeability and groundwater flow
(lineaments, faults and diabase dikes)

DRAFT

Scenario 1 New residential area with wells of varying gallons per minute due to varying fracture density



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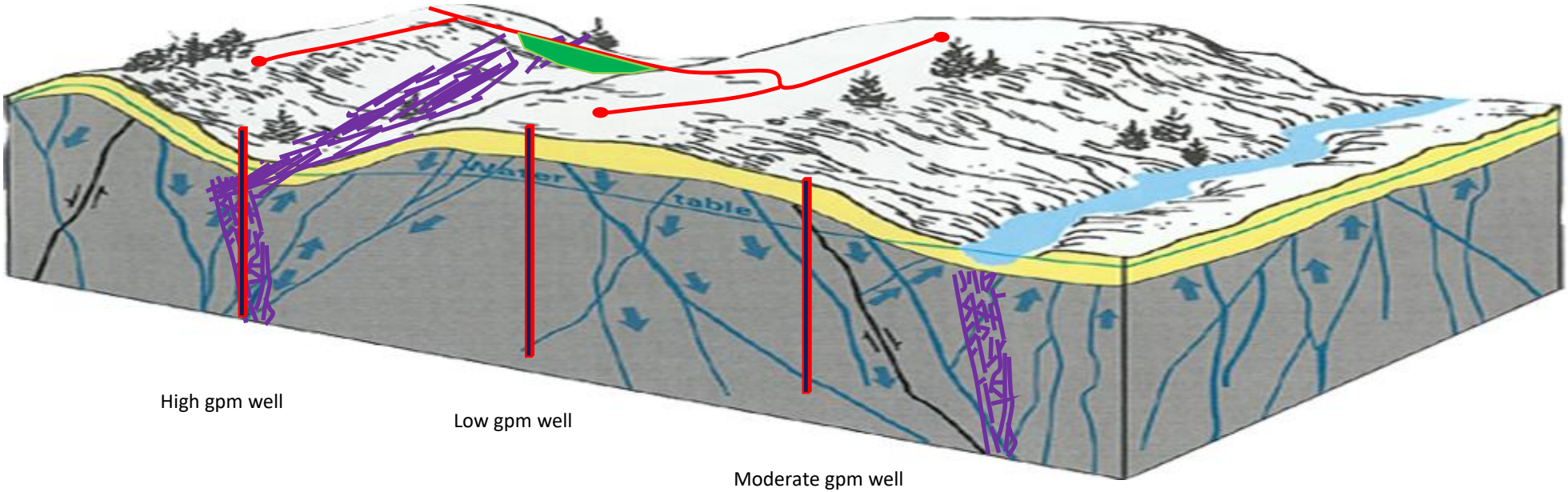
Scenario 1 New residential area with wells of varying gallons per minute due to varying fracture density



Siting of groundwater wells: This dataset can help land owners, environmental professionals, well drillers, and other stakeholders to site productive groundwater wells. Wells installed within zones of increased fractures (a *Groundwater Feature*) will have a higher likelihood of being a productive well.

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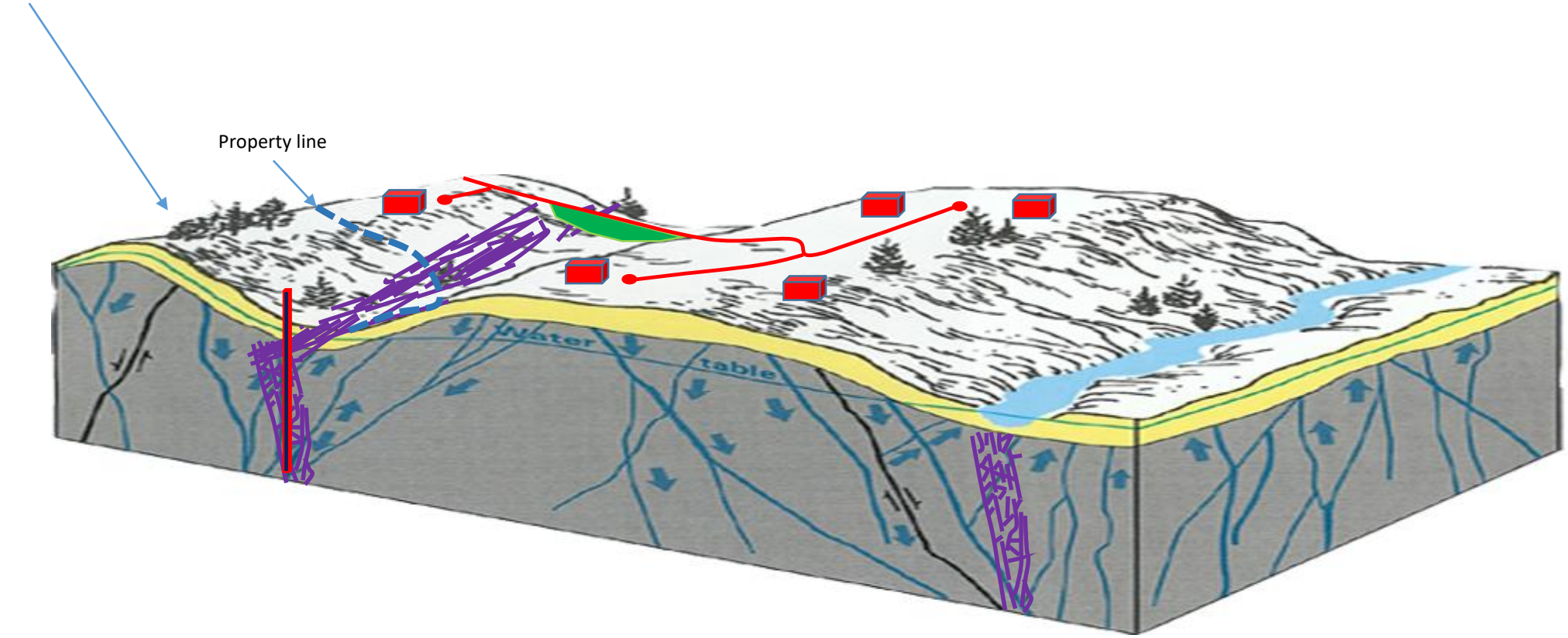
Scenario 2 Pre-existing high capacity well on adjacent land and possible competition from new high capacity well

Farm with high capacity well



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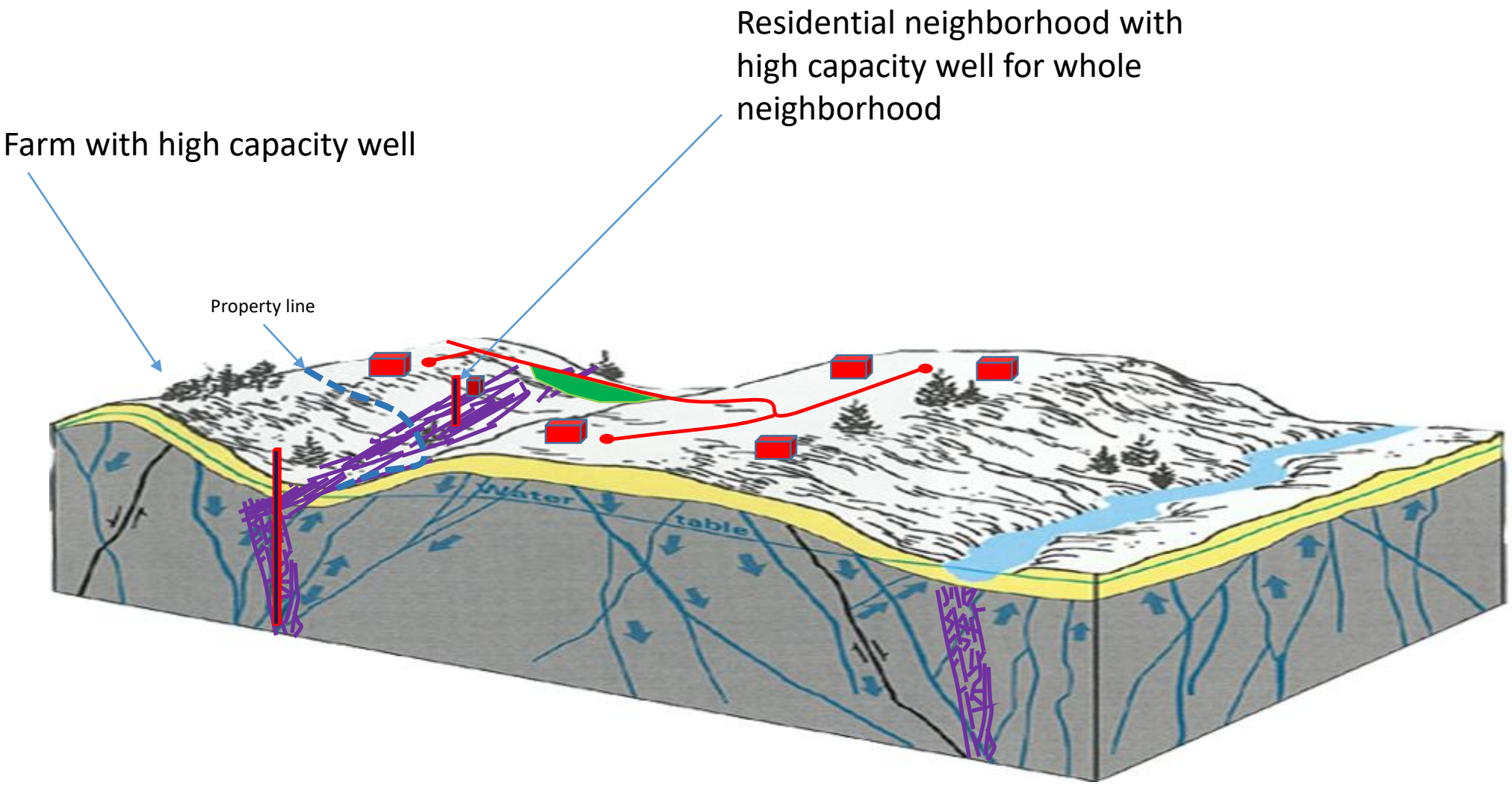
Scenario 2 Pre-existing high capacity well on adjacent land and possible competition from new high capacity well



Mitigating the impact of well interference: Pumping a well removes groundwater and lowers the water level in the well and nearby rock as water is diverted toward the well. If multiple wells are installed in a fractured bedrock aquifer, they may compete for water and cause an enhanced lowering of the water table. In locations in the vicinity of *Groundwater Features*, the lowering of the water table may be more pronounced and may extend in a preferred direction due to the linear nature of the *Groundwater Feature*. Understanding the relationship of the location of water wells and the bedrock fracture network is important to avoid and/or help mitigate well interference issues.

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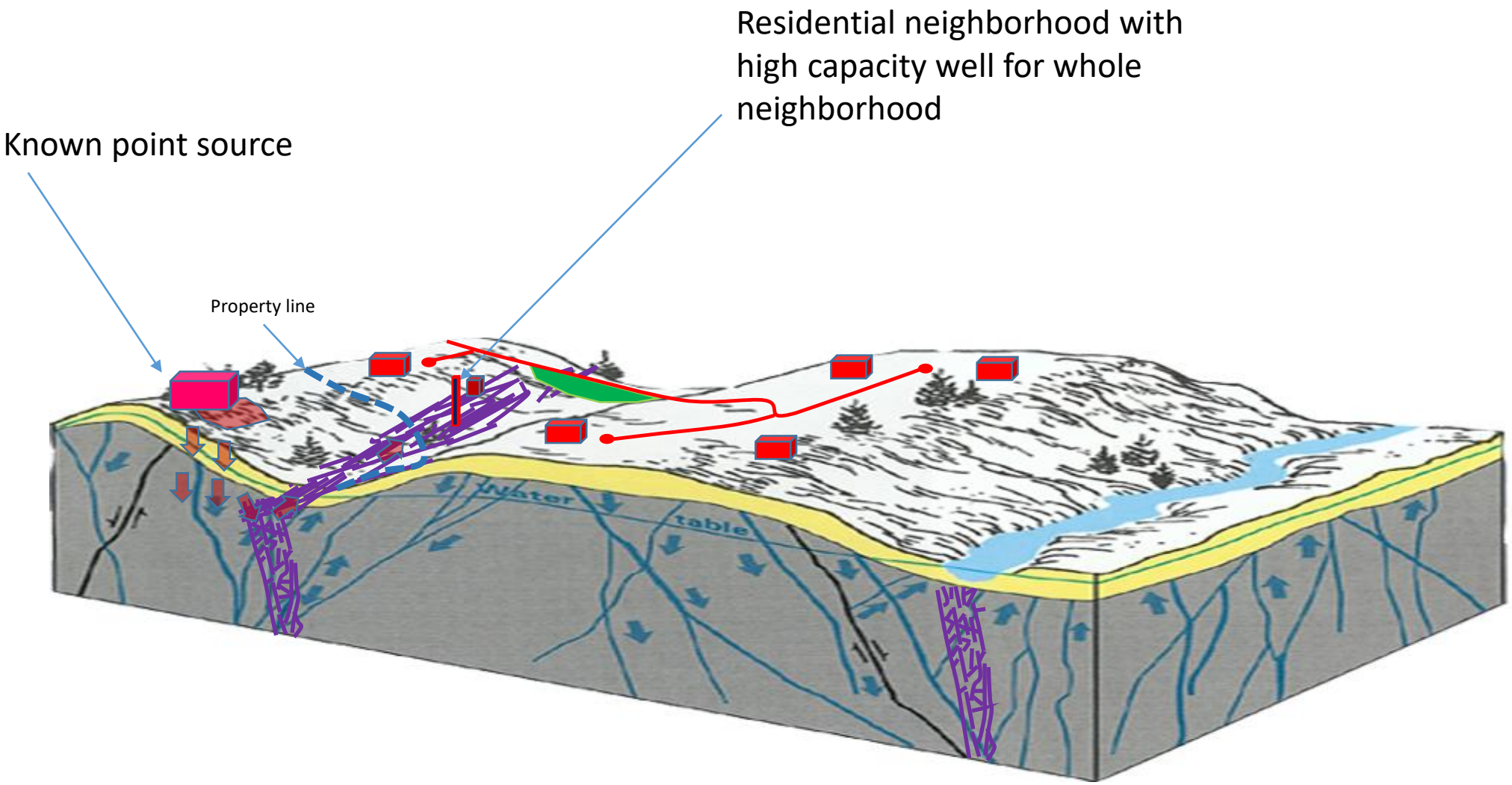
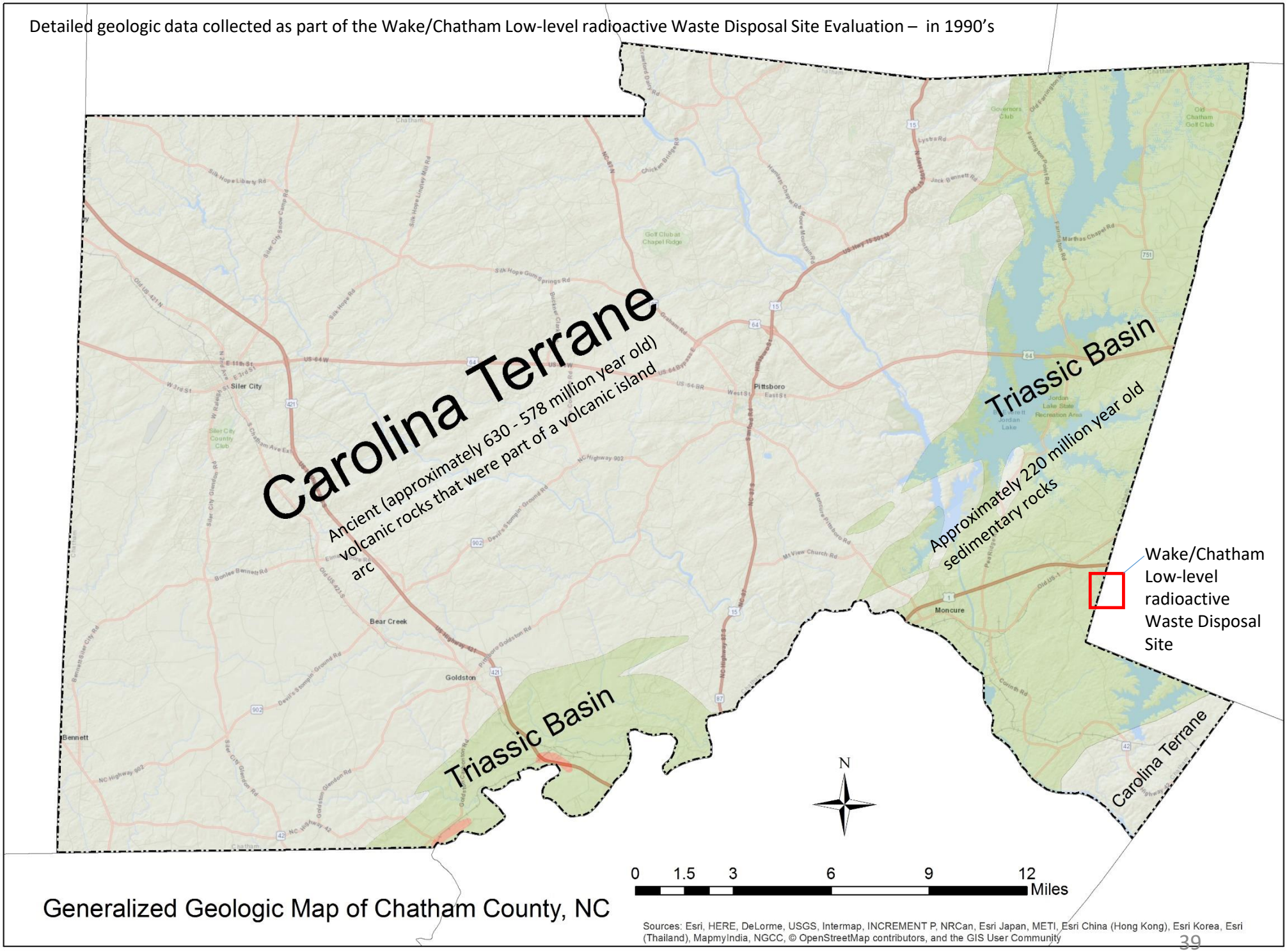
Scenario 3 Known point source of groundwater contamination



Chatham County Groundwater Conceptual Models – Triassic Basin

Detailed geologic data collected as part of the Wake/Chatham Low-level radioactive Waste Disposal Site Evaluation – in 1990's



Generalized Geologic Map of Chatham County, NC

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Triassic basin – Groundwater Conceptual Model:

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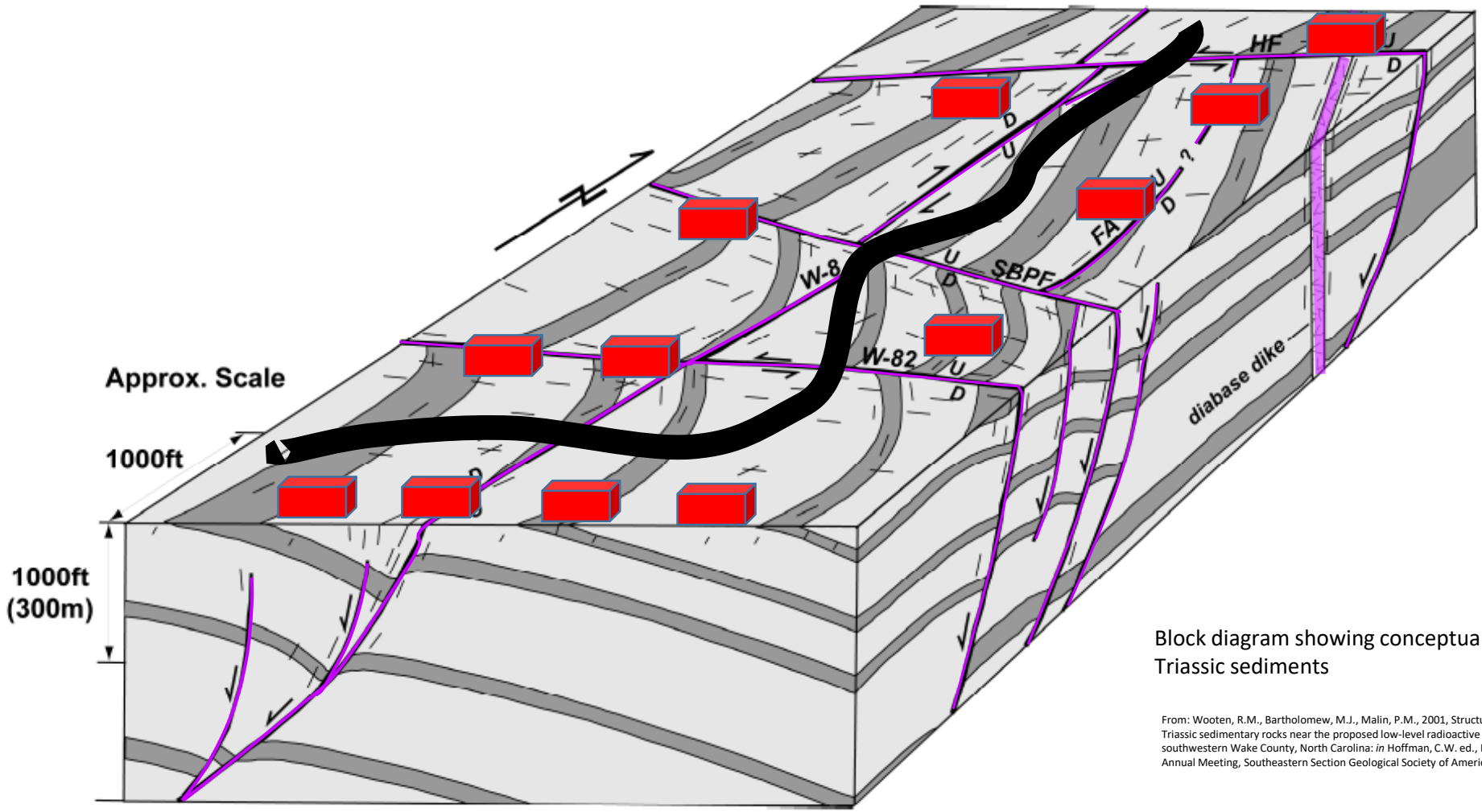
Groundwater flow is a combination of fractured flow and a small component of saturated flow in the poorly lithified sedimentary rocks.

Strong preferential pathways for groundwater flow and contaminant transport may exist proximal to lineaments, faults and diabase dikes



Block diagram showing conceptual model of Triassic sediments

From: Wooten, R.M., Bartholomew, M.J., Malin, P.M., 2001, Structural features exposed in Triassic sedimentary rocks near the proposed low-level radioactive waste disposal site, southwestern Wake County, North Carolina: *in* Hoffman, C.W. ed., Field Trip Guidebook 50th Annual Meeting, Southeastern Section Geological Society of America, April 2001, p. 51-74.

Groundwater Resources

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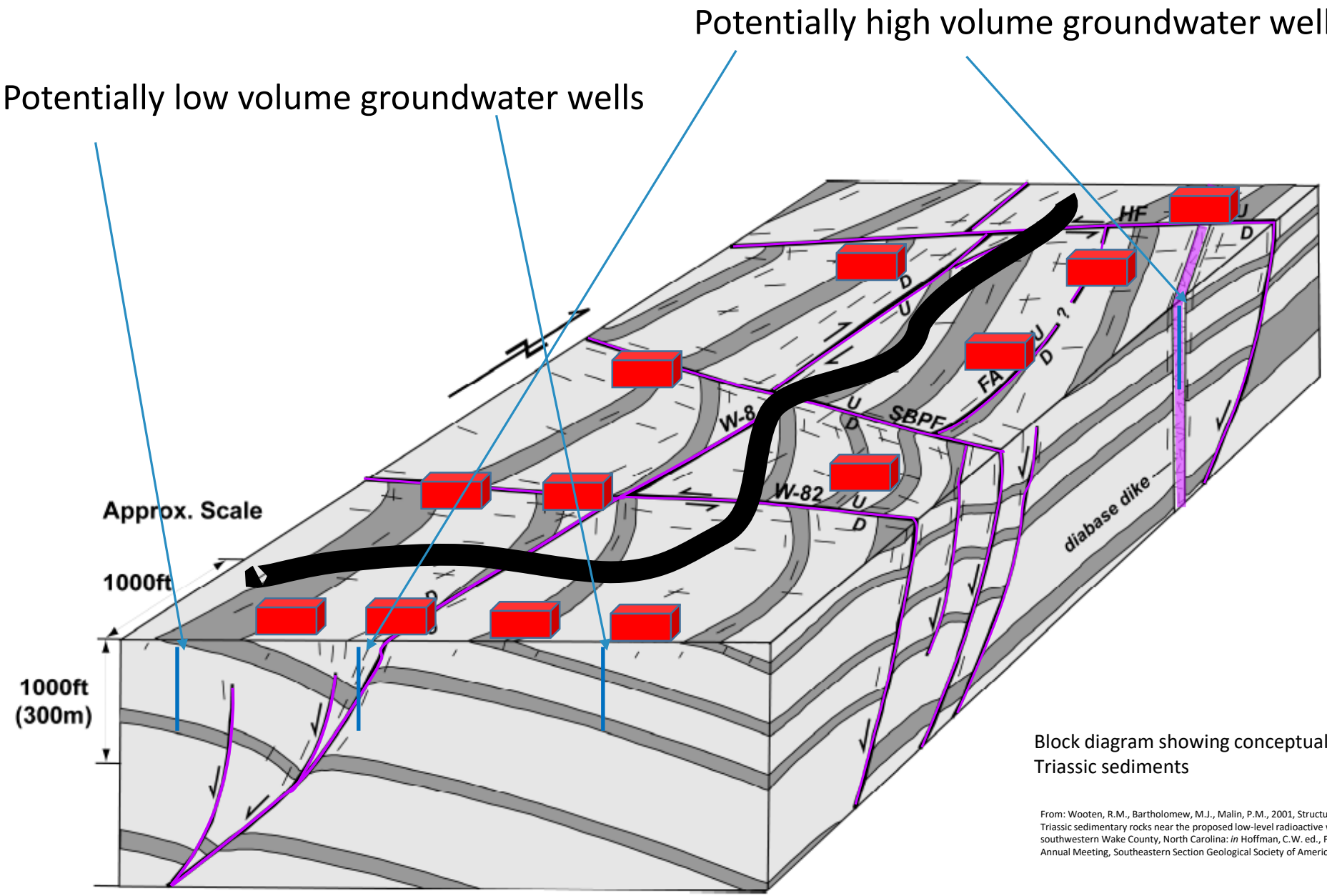
Example



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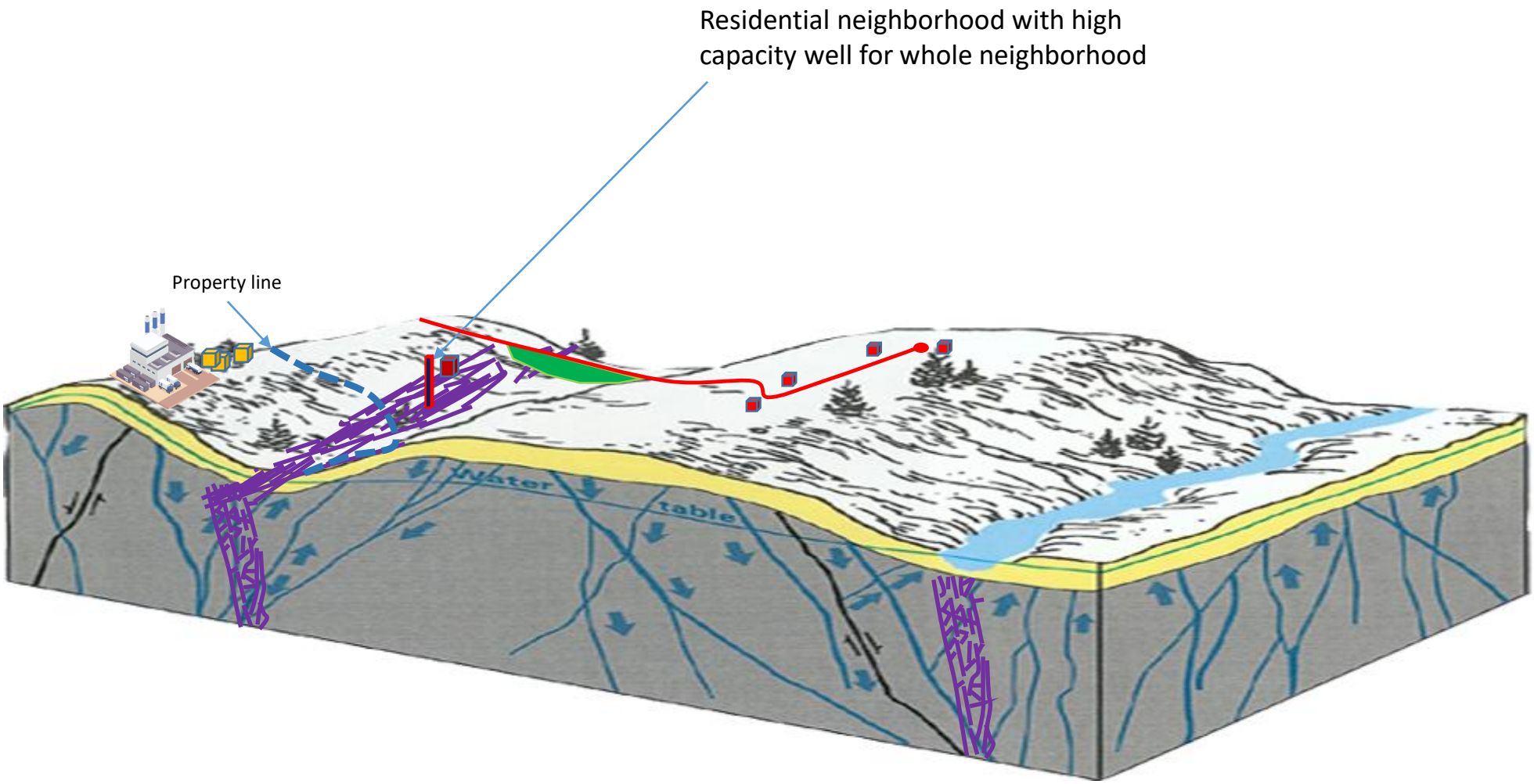
Scenario 4 Manufacturing plant with chemical storage



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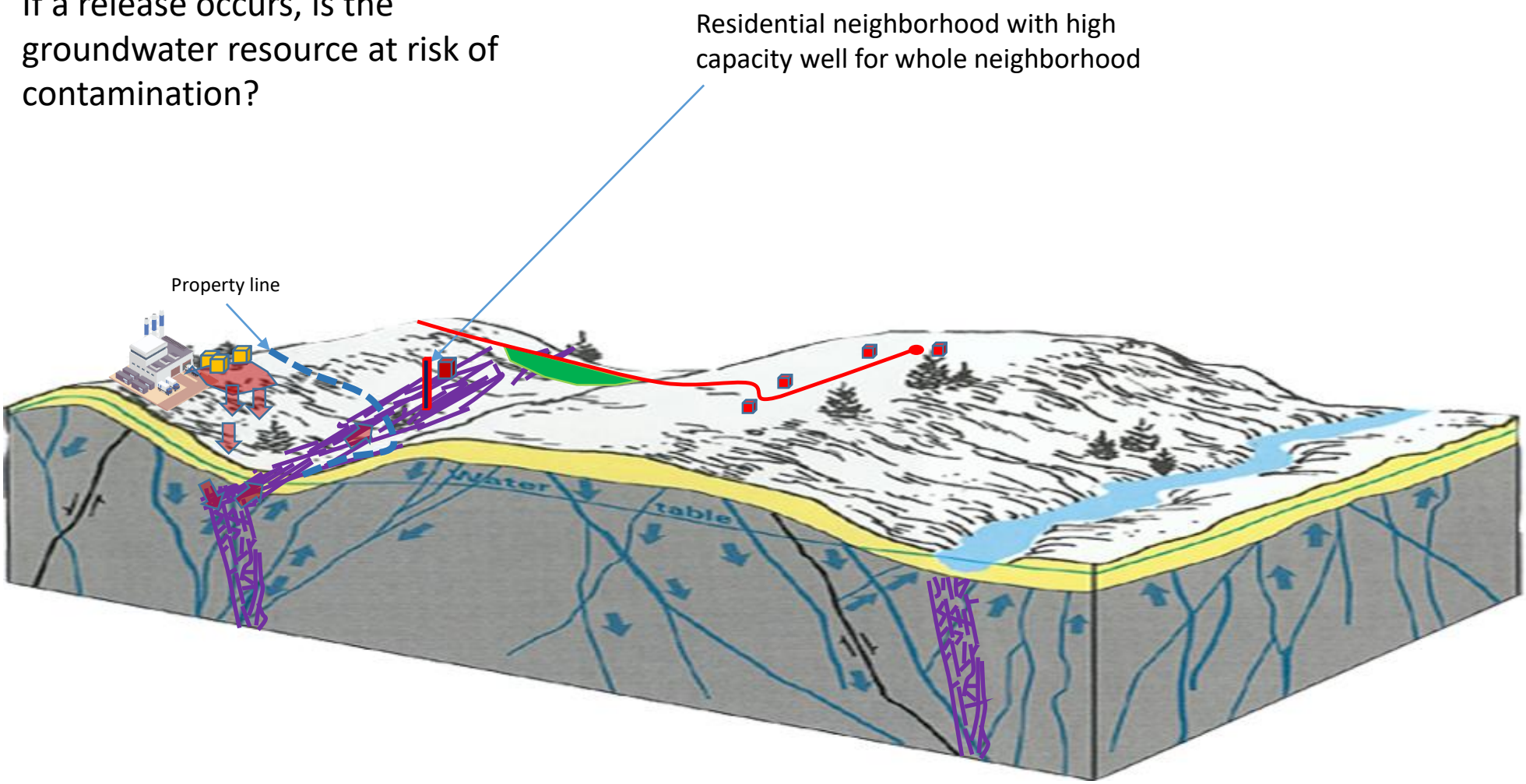
Scenario 4 Manufacturing plant with chemical storage

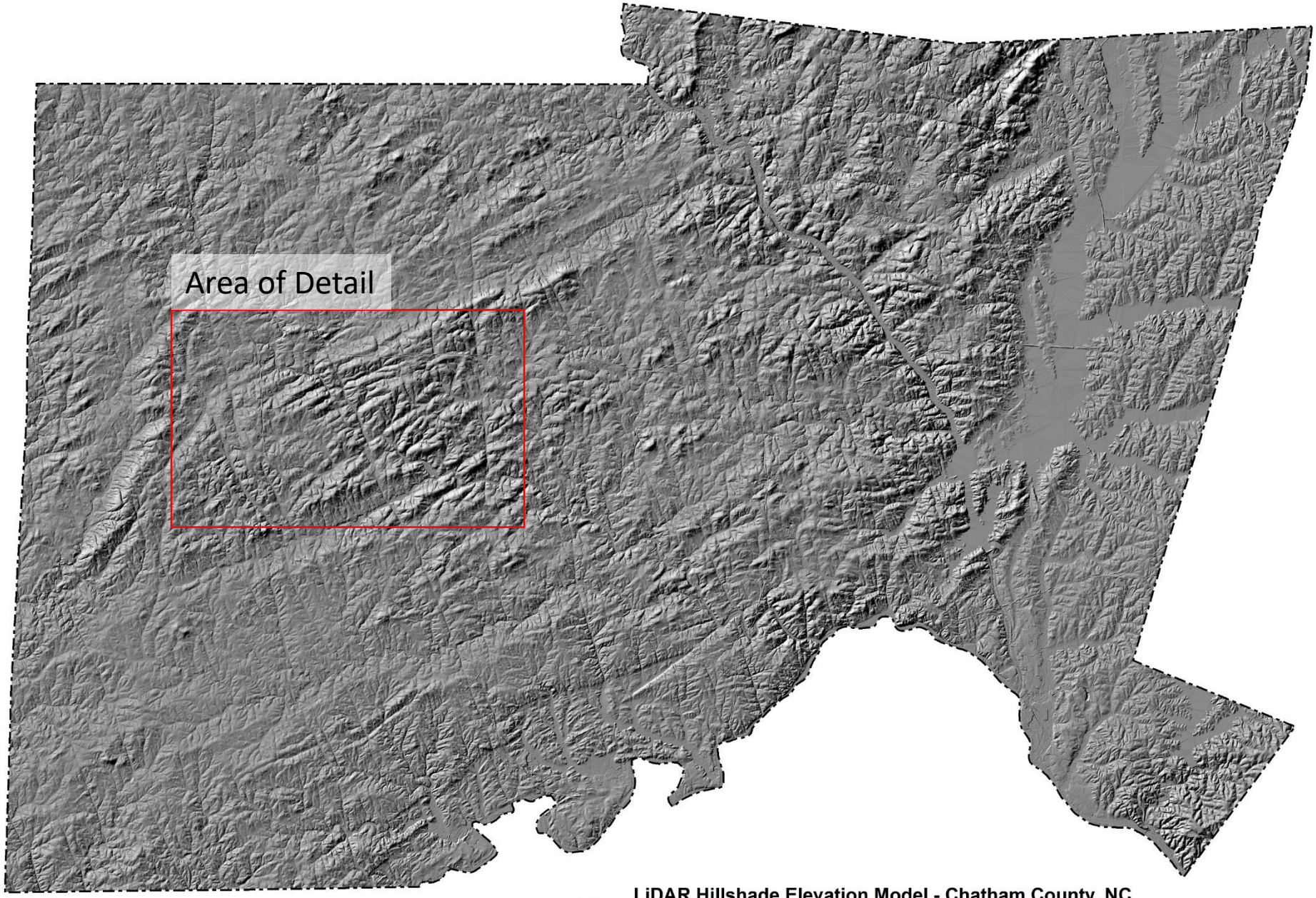
What if?

If a release occurs, is the groundwater resource at risk of contamination?



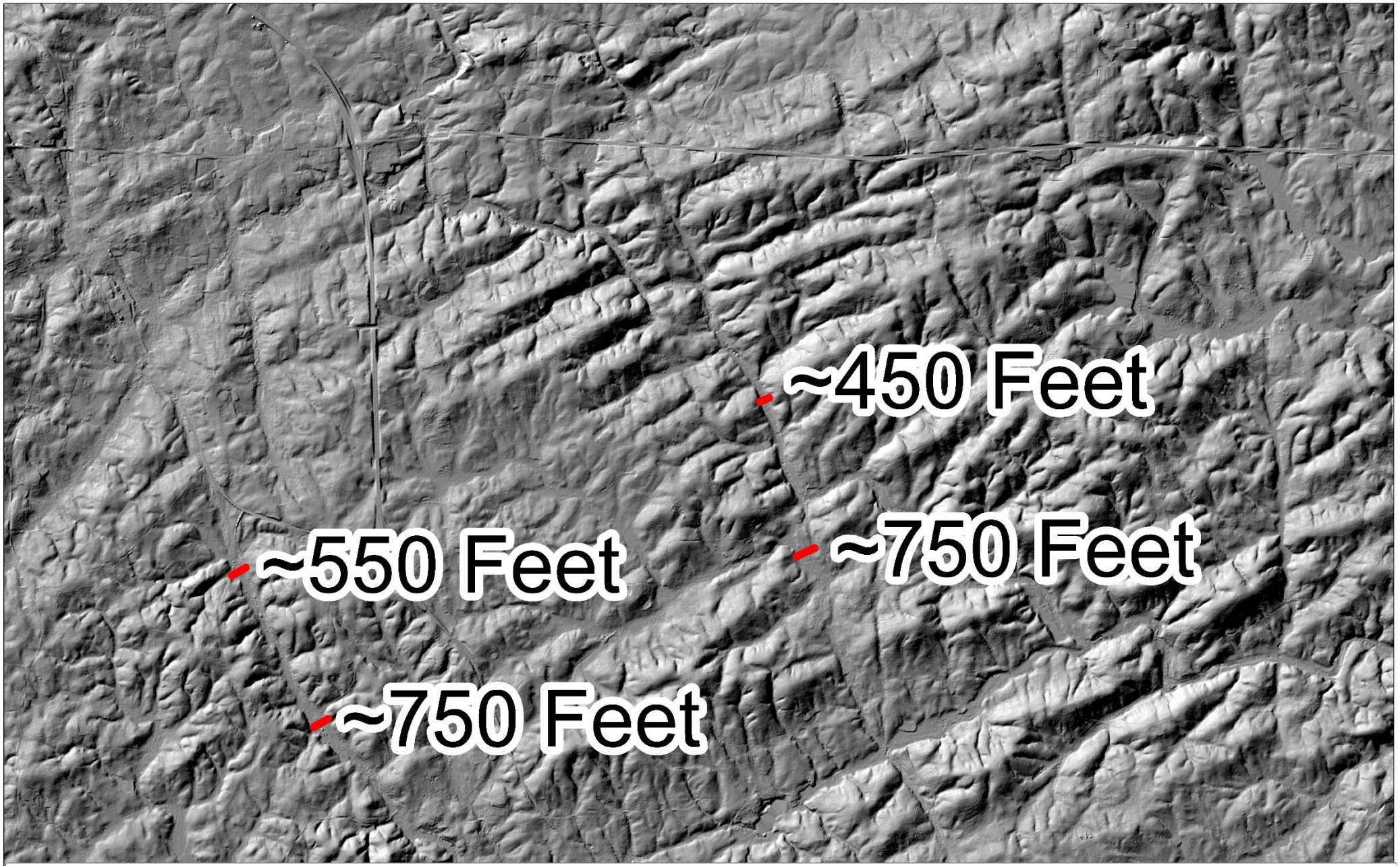
Pathways for contaminants exist but is the groundwater vulnerable?

Groundwater vulnerability studies may be needed.



LiDAR Hillshade Elevation Model - Chatham County, NC

LiDAR Data Reference:
NC Floodplain Mapping Program, 2007, Hillshade elevation data from LiDAR, data derived from LIDAR collected by NC Floodplain Mapping Program and processed by NC DOT - GIS Unit, digital data, https://services.nconemap.gov/secure/rest/services/Elevation/DEM20ft_Hillshade/ImageServer



0 0.5 1 2 3 4 Miles

0 2,000 4,000 8,000 12,000 Feet

N

Example Estimated Widths of Groundwater Features

LiDAR Hillshade Elevation Model - Chatham County, NC

LiDAR Data Reference:
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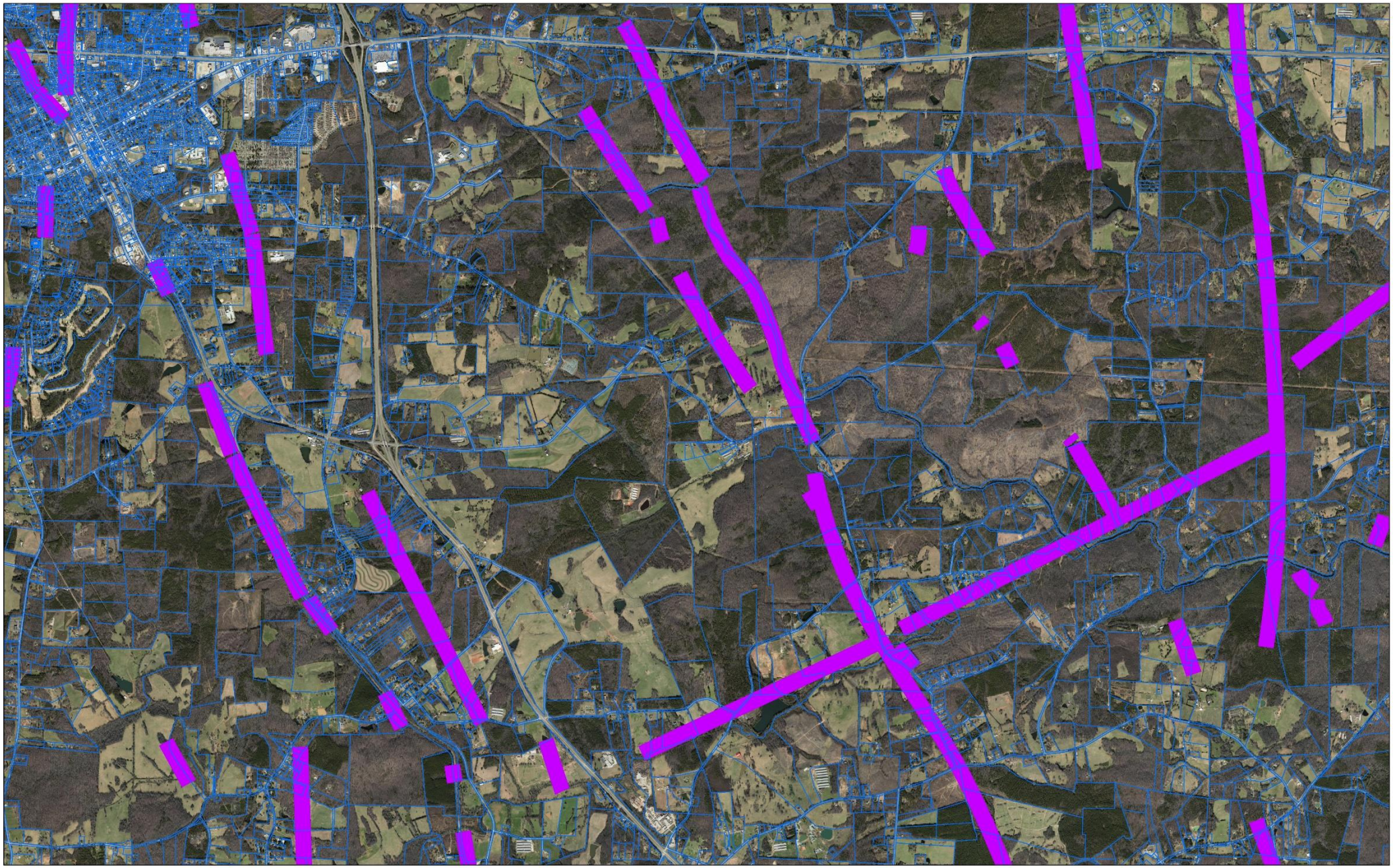
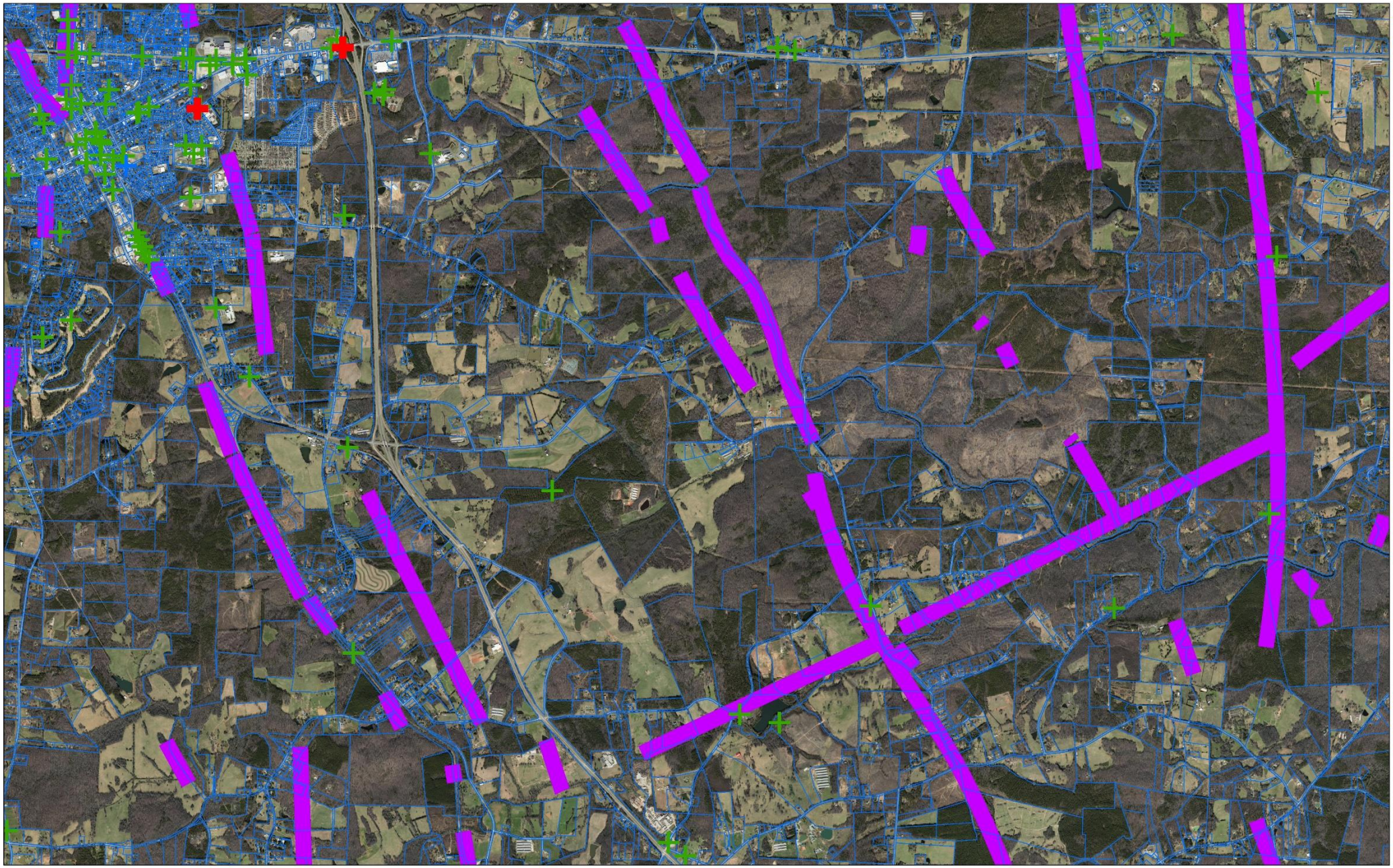


0 0.5 1 2 3 4 Miles

0 2,000 4,000 8,000 12,000 Feet

N

Groundwater Features with Tax Parcel Data



Groundwater Feature in Bedrock

Trend of groundwater feature

0 0.5 1 2 3 4 Miles

0 2,000 4,000 8,000 12,000 Feet

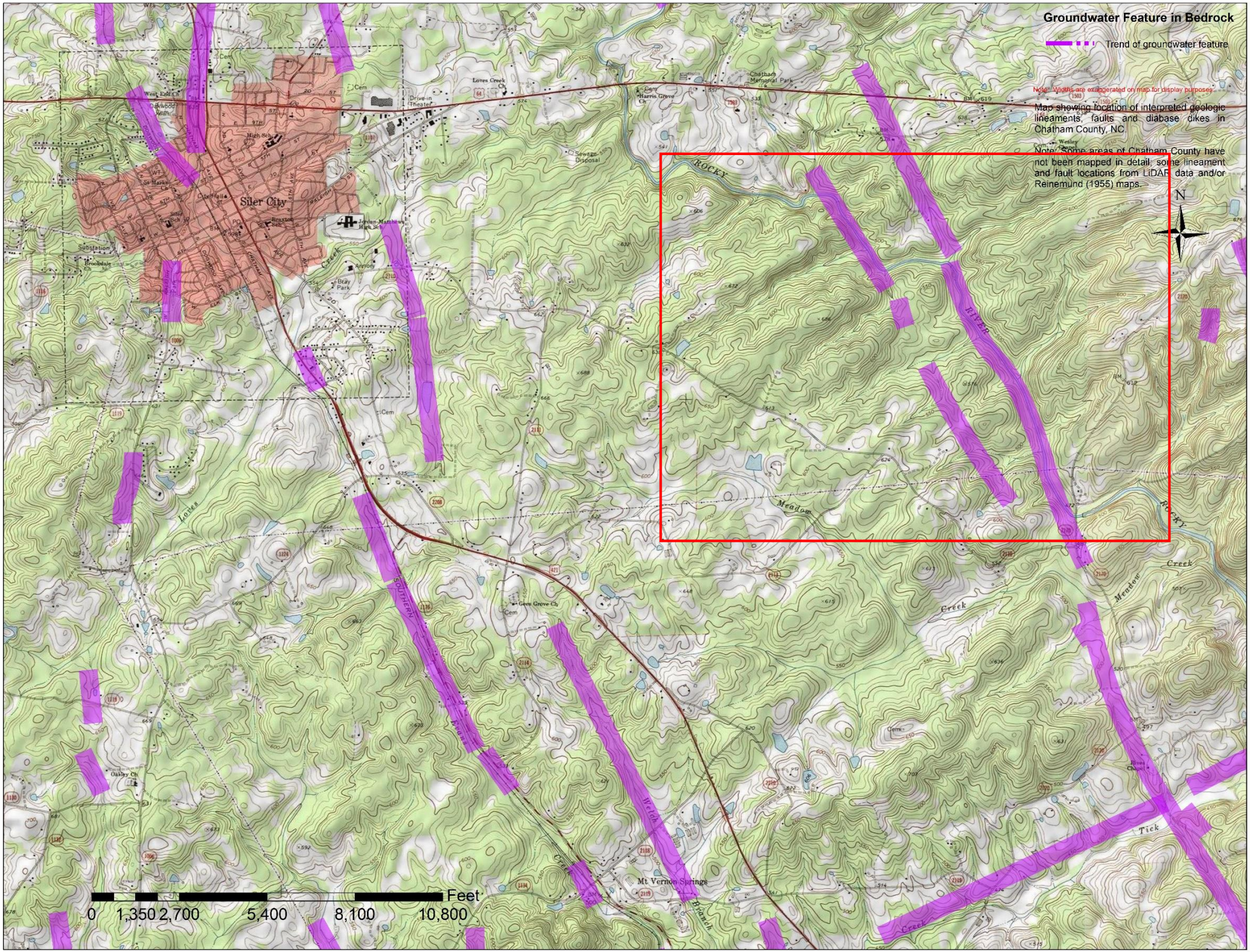
N

Example Regulated Sites

2012 database - other sites may exist

- HazardousWaste_Sites
- InactiveHazardous_Sites
- RCRA

Regulated Facilities with Groundwater Features and Tax Parcel Data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Trend of groundwater feature
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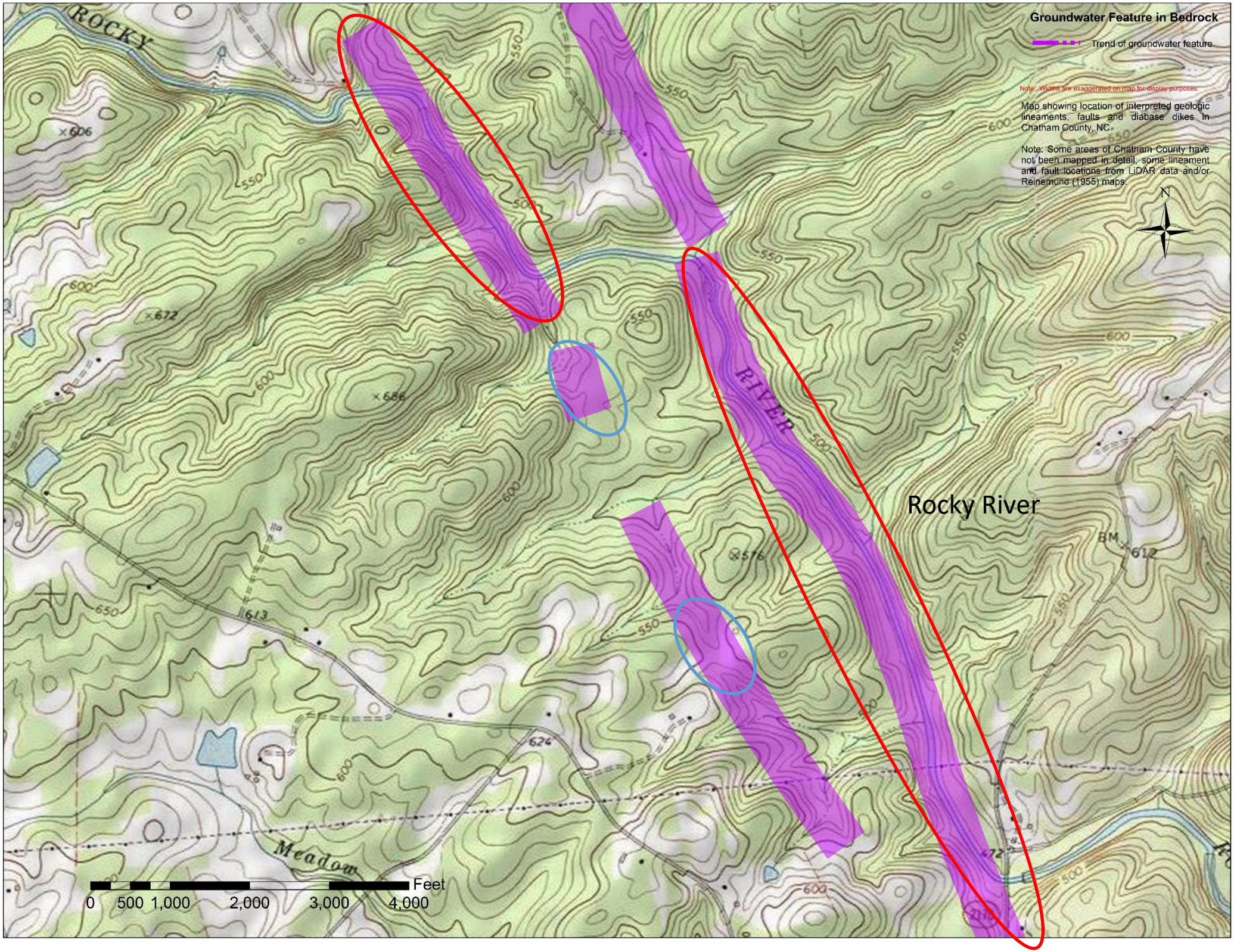
N
Siler City
Loves Creek Ch
Chatham Memorial Park
Harris Grove Ch
Sewage Disposal
Jordan-Matthews High Sch
Bray Park
Armory
Substation
Brookdale Ch
Glass Grove Ch
Oakley Ch
Mt Vernon Springs
ROCKY
RIVER
Meadow
Creek
Loves
SOUTHERN
Evans
Welch
Tick
Feet
0
1,350
2,700
5,400
8,100
10,800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N
Rocky River
ROCKY
RIVER
Meadow
0 500 1,000 2,000 3,000 4,000 Feet