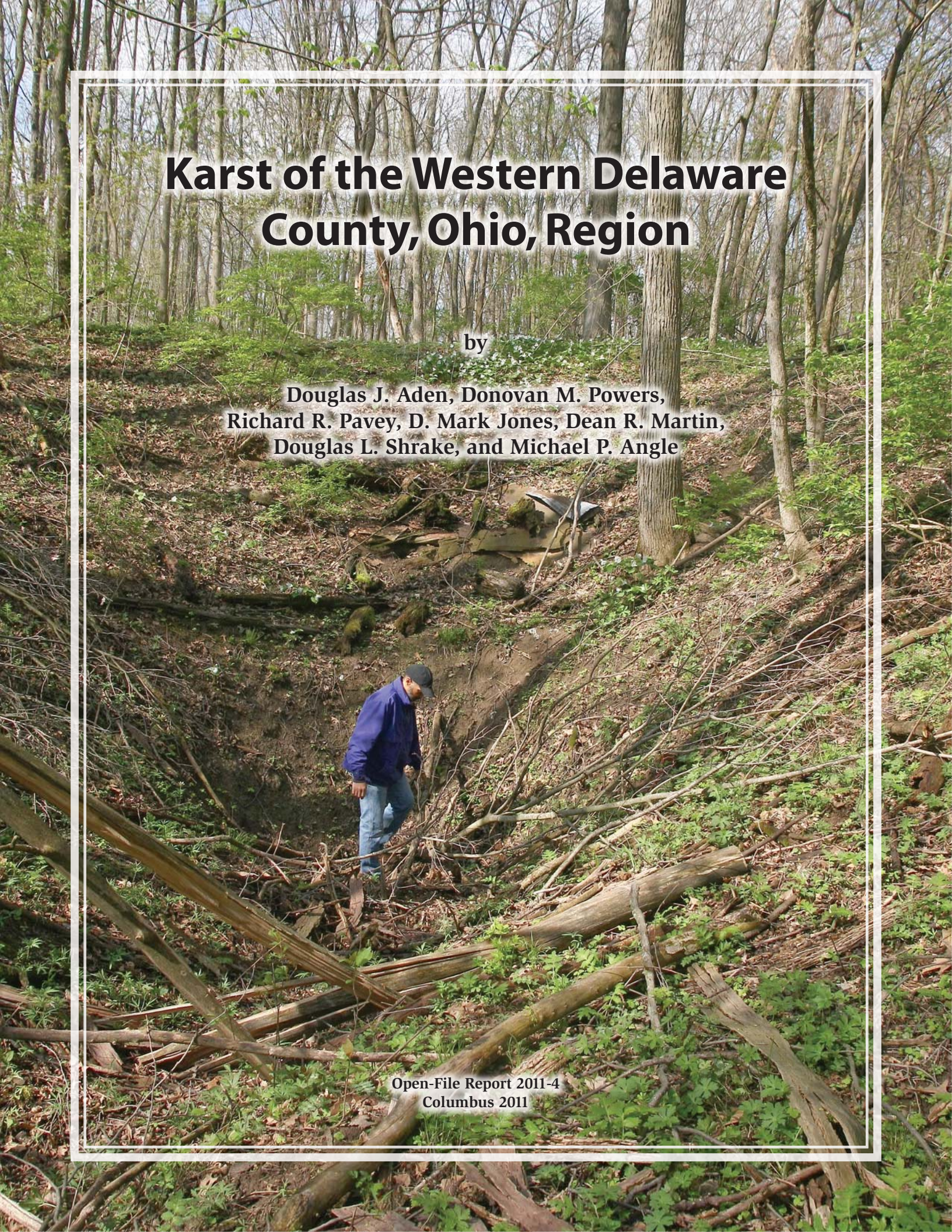
Karst of the Western Delaware County, Ohio, Region

by

Douglas J. Aden, Donovan M. Powers,
Richard R. Pavey, D. Mark Jones, Dean R. Martin,
Douglas L. Shrake, and Michael P. Angle



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Karst terrain forms by dissolution of carbonate rocks (e.g., limestone or dolomite) and occasionally evaporites (e.g., gypsum or salt) and is characterized by features such as sinkholes, disappearing streams, caves, and springs. The many passageways formed in karst terrain allow for high connectivity between the land surface and the water table and can bypass soil and rock layers that filter out contaminants. Consequently, when compounds such as fertilizers, pesticides, and waste enter sinkholes, they are rapidly transported to the water table and quickly pollute water wells, streams, and rivers. Karst also poses infrastructure complications: roads, utilities, houses, and other facilities built in karst areas are at risk of subsidence, collapse, or other damage.

Karst areas have been studied in Ohio for many years. In the 1980s and 1990s, karst was researched for the proposed Superconducting Super Collider and mapped statewide to determine areas suitable for storage of low-level nuclear byproducts. Ohio's preliminary map of karst features was completed in 1997 and released in 1999; it since has been updated with new data in 2003, 2005, and 2007 and soon will be updated again. In the spring of 2008, severe karst-related flooding occurred in Bellevue leading to additional research and increased concern regarding Ohio's geohazards. Finally in the fall of 2008, the Ohio Department of Natural Resources (ODNR), Division of Geological Survey met with the Delaware Soil and Water Conservation District and the Upper Scioto River Watershed Project to discuss mutual projects involving karst features in the Scioto River corridor in Delaware County. Rapidly developing and known to contain karst, this area is close to both the ODNR Division of Geological Survey's main office and its H. R. Collins Laboratory at Alum Creek State Park, thus field verification was easily accomplished while sinkhole-locating methods were refined.

To locate sinkholes, LiDAR (Light Detection And Ranging) was used to create a map layer that identified low, enclosed areas. These low spots were cross referenced with known karst points, bedrock geology, aerial photography of multiple sources and ages, soil maps, drift thickness, and water well logs to locate potential sinkholes. Suspect locations then were visited in the field, evaluated, and photographed. Through this process we quickly learned that many of the LiDAR returns were not sinkholes; features such as building foundations, broken field tile, steep-walled streams, and road culverts often produced enclosed areas similar in shape to sinkholes. Many of these features were eliminated using both 6-inches-per-pixel aerial photography and experience from field verification. The resulting map, which is divided into 255 two-km^2 tiles, of which 35 tiles contain sinkholes, identifies about 400 sinkholes. The map and related collection of photographs can be used to monitor the growth of preexisting sinkholes and development of new karst features. Furthermore, areas of land development should be carefully planned in regions of dense karst since they are highly susceptible to pollution and subsidence.

The following documents provide additional information on karst and its effects in Ohio and beyond.

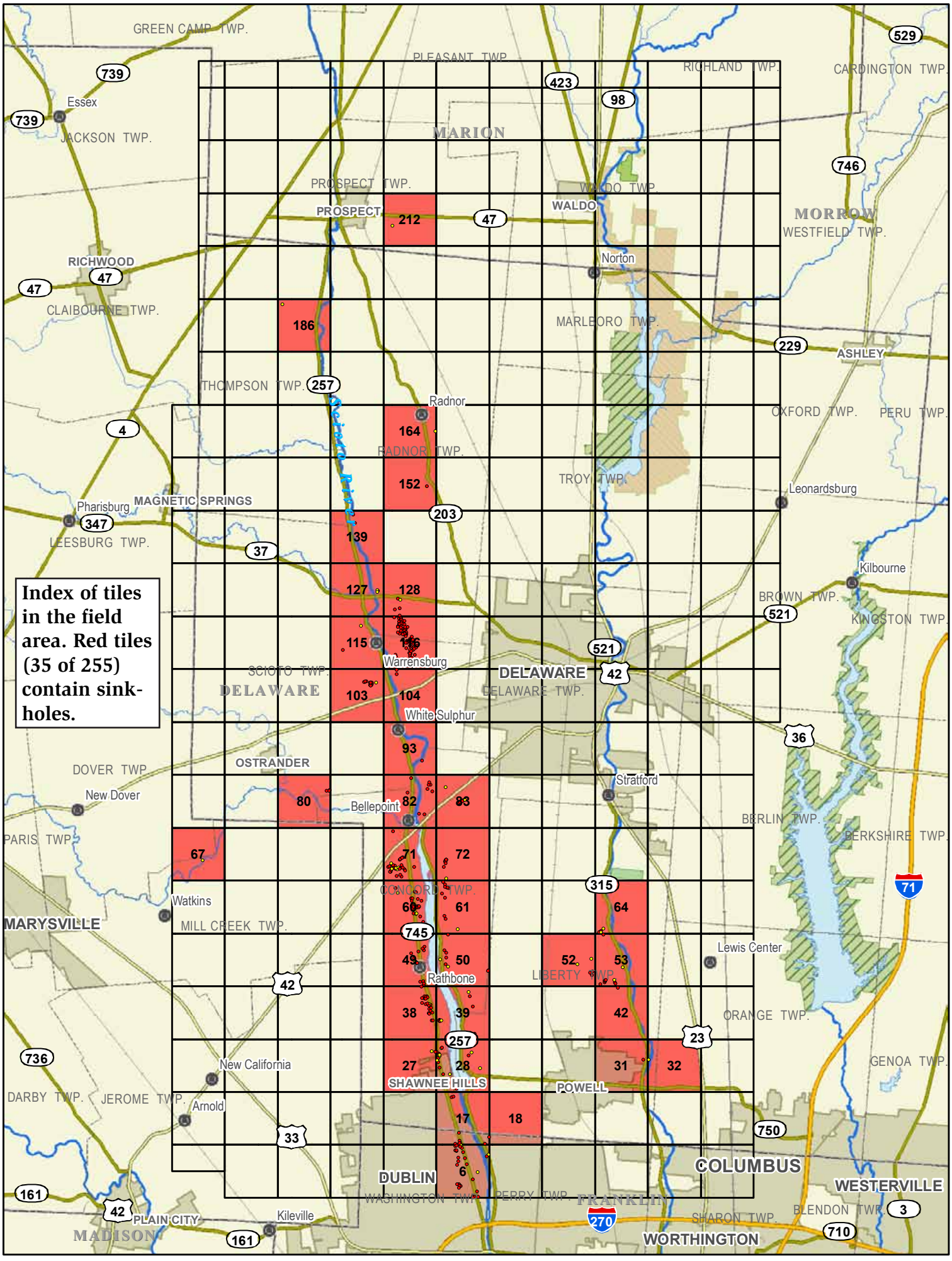
ODNR

- "Revised Ohio Karst Map Helps Homeowners, Developers and Land-use Planners Define Areas of Possible Groundwater Pollution and Unstable Terrain," press release dated October 30, 2007, accessible at < http://ohiodnr.com/home_page/NewsReleases/tabid/18276/EntryId/204/10-29-07-Revised-Ohio-Karst-Map.aspx > .

- *Ground Water Induced Flooding in the Bellevue Ohio Area, Spring and Summer 2008*, ODNR Division of Water Technical Report of Investigation 2009-1, accessible at < http://www.dnr.state.oh.us/Portals/7/pubs/reports/Bellevue_Final_Report.pdf > .

American Geological Institute

- *Living With Karst—A Fragile Foundation,* AGI Environmental Awareness Series, no. 4, accessible at < http://www.agiweb.org/environment/publications/karst.pdf > .


Index of tiles in the field area. Red tiles (35 of 255) contain sink-holes.
GREEN CAMP TWP.
PLEASANT TWP.
RICHLAND TWP.
CARDINGTON TWP.
Essex
JACKSON TWP.
MARION
PROSPECT TWP.
WALDO TWP.
PROSPECT
WALDO
MORROW
WESTFIELD TWP.
RICHWOOD
Norton
CLAIBOURNE TWP.
MARLBORO TWP.
ASHLEY
THOMPSON TWP.
Radnor
OXFORD TWP.
PERU TWP.
RADNOR TWP.
TROY TWP.
Leonardsburg
Pharisburg
MAGNETIC SPRINGS
LEESBURG TWP.
Kilbourne
BROWN TWP.
KINGSTON TWP.
Warrensburg
SCIOTO TWP.
DELAWARE
DELAWARE TWP.
White Sulphur
OSTRANDER
DOVER TWP.
Stratford
New Dover
Bellepoint
BERLIN TWP.
BERKSHIRE TWP.
PARIS TWP.
CONCORD TWP.
Watkins
MARYSVILLE
MILL CREEK TWP.
Lewis Center
Rathbone
LIBERTY TWP.
ORANGE TWP.
GENOA TWP.
New California
SHAWNEE HILLS
POWELL
DARBY TWP.
JEROME TWP.
Arnold
DUBLIN
COLUMBUS
WESTERVILLE
WASHINGTON TWP.
PERRY TWP.
FRANKLIN
SHARON TWP.
BLENDON TWP.
PLAIN CITY
Kileville
MADISON
WORTHINGTON
186
212
164
152
139
127
128
115
116
103
104
93
80
82
83
67
71
72
60
61
64
45
50
52
53
38
39
42
27
28
31
32
17
18
6
529
739
423
98
746
47
229
257
4
203
37
347
521
42
36
315
745
23
750
736
161
270
710
3
71

Tile Number: 6

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July 20, 2011

US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

Scale - 1:12,000

0 0.5 Miles

0 1 Kilometers

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe

Tile Number: 17

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July 20, 2011

US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

Scale - 1:12,000

0 0.5 Miles

0 1 Kilometers

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe

Tile Number: 18

BACK TO INDEX

July 20, 2011

US National Grid

100,000-m Square ID

LE

Grid Zone Designation

17T

Datum = NAD 1983, 12,000-m USNG

Final map series created June 2011

Scale - 1:12,000

0 0.5 Miles

0 1 Kilometers

Karst Feature

- Field Verified - Yes
- Field Verified - Maybe

Tile Number: 27

BACK TO INDEX

July 20, 2011

US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

Scale - 1:12,000

0 0.5 Miles

0 1 Kilometers

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe

Tile Number: 28

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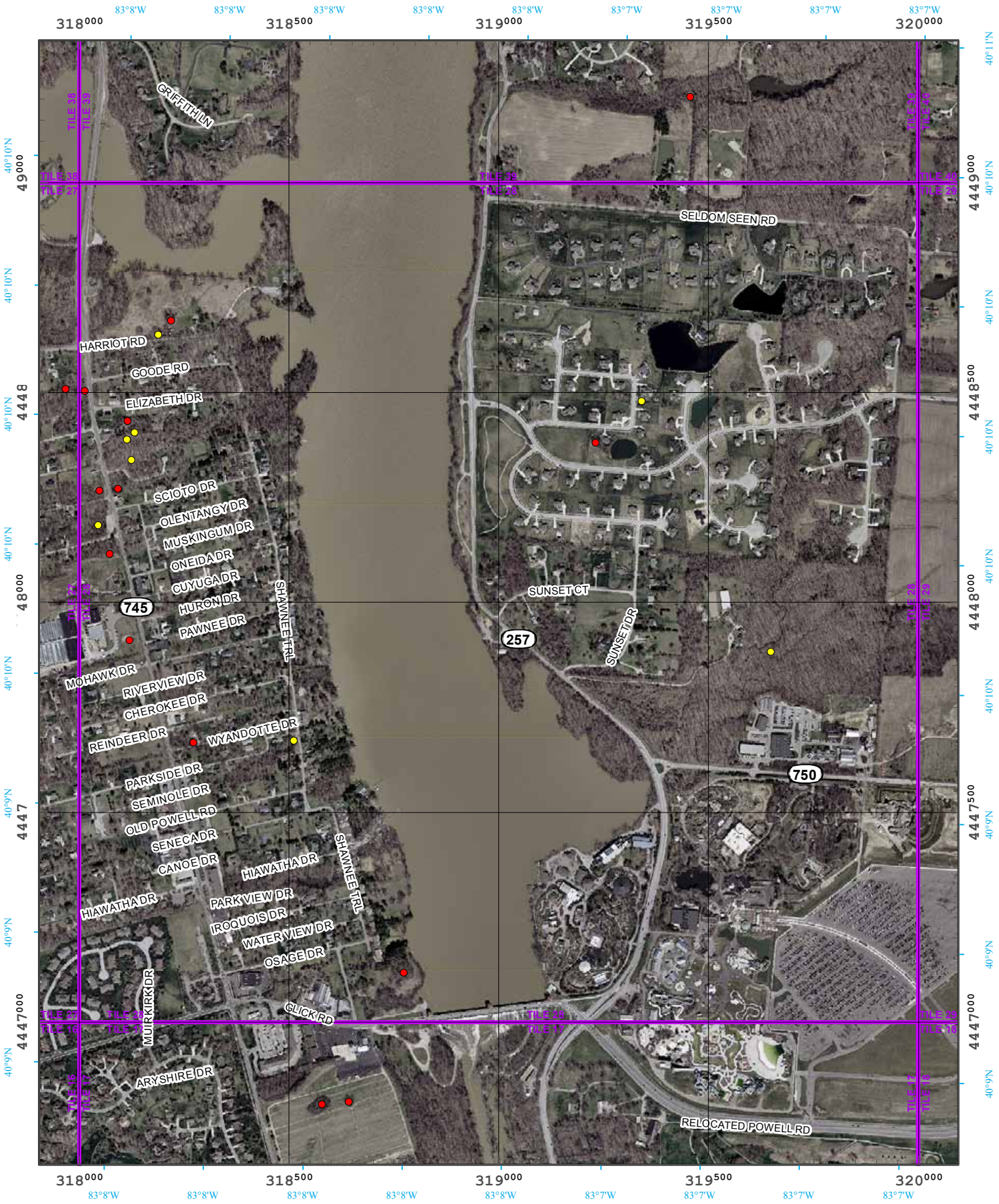
July 20, 2011



US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

0 0.5 Miles

0 1 Kilometers

Scale - 1:12,000

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe

Tile Number: 31

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July 20, 2011

US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

Scale - 1:12,000

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe

0 0.5 Miles

0 1 Kilometers

Tile Number: 32

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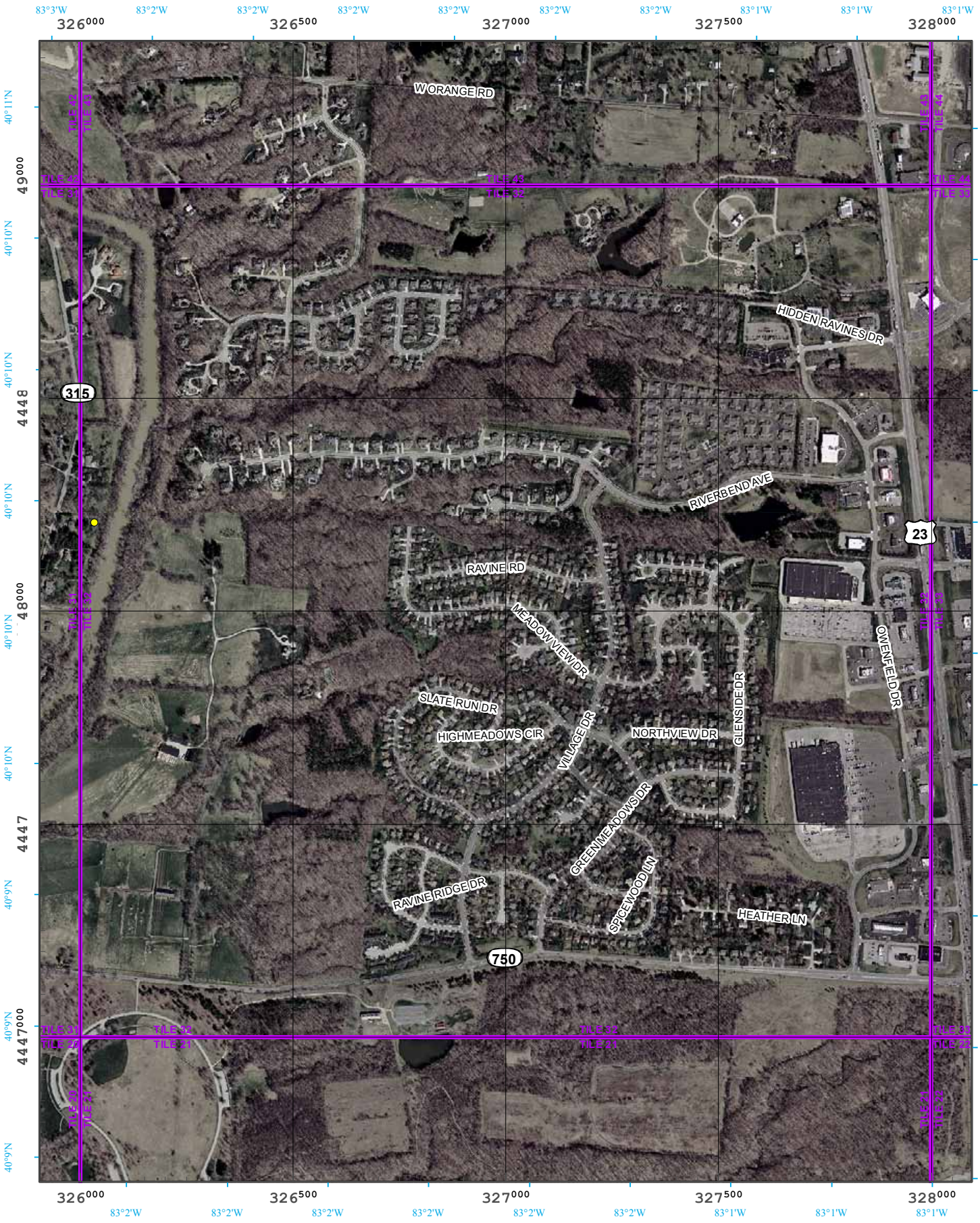
July 20, 2011



US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

Scale - 1:12,000

0 0.5 Miles

0 1 Kilometers

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe

Tile Number: 38

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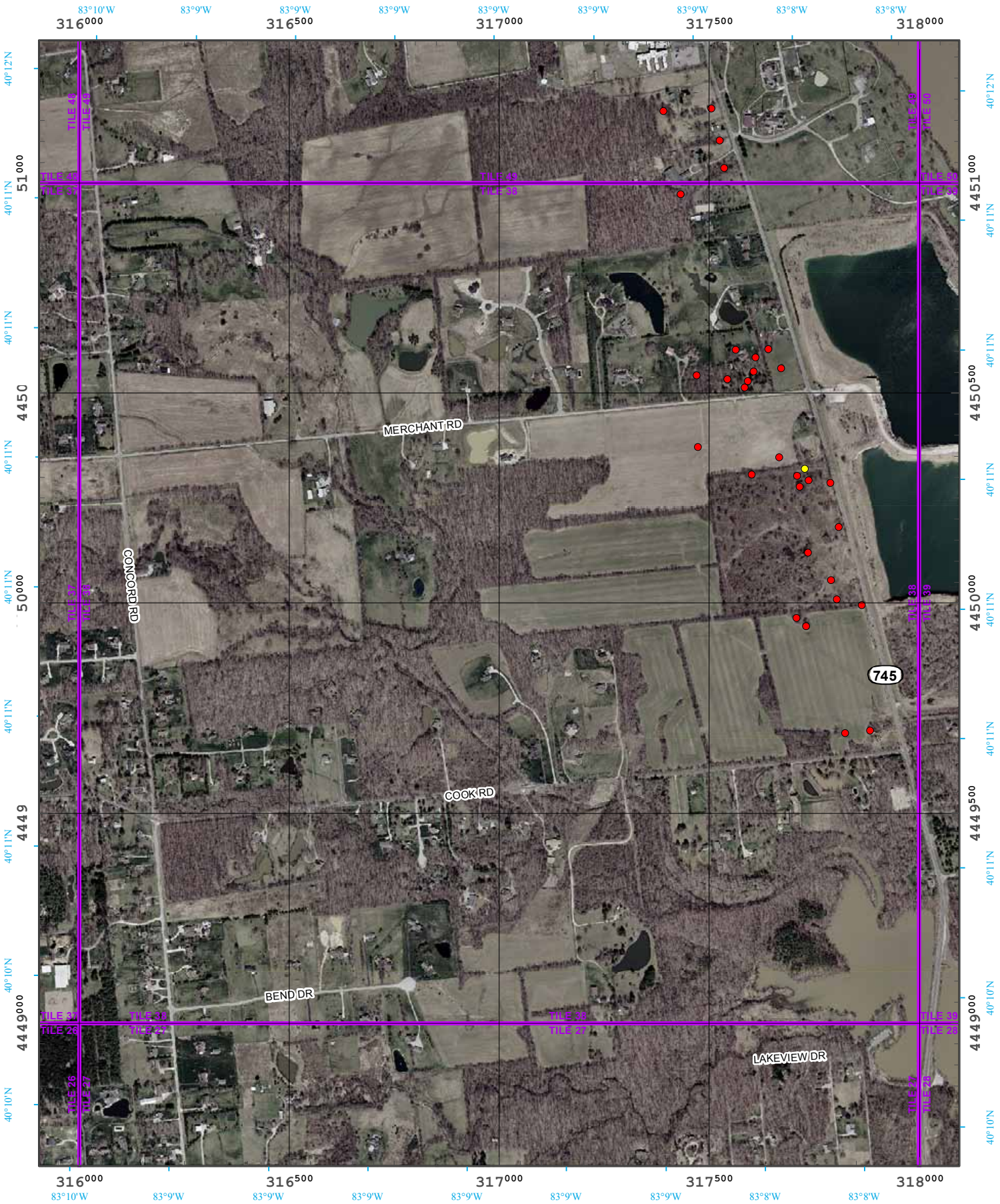
July 20, 2011



US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

Scale - 1:12,000

0 0.5 Miles

0 1 Kilometers

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe

Tile Number: 39

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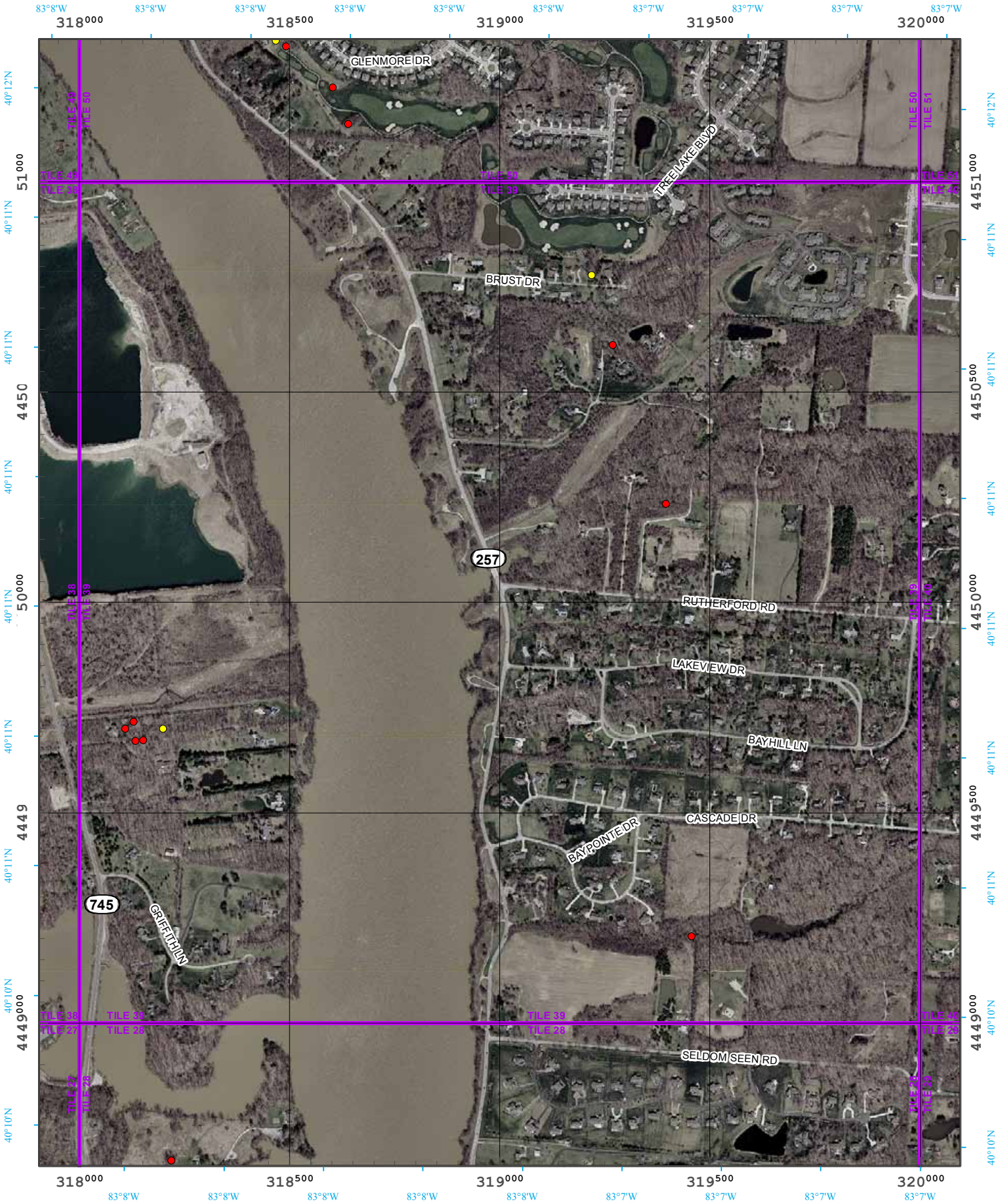
July 20, 2011



US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

0 0.5 Miles

0 1 Kilometers

Scale - 1:12,000

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe

Tile Number: 42

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July 20, 2011

US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

Scale - 1:12,000

0 0.5 Miles

0 1 Kilometers

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe

Tile Number: 49

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July 20, 2011

US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

Scale - 1:12,000

0 0.5 Miles

0 1 Kilometers

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe

Tile Number: 50

BACK TO INDEX

July 20, 2011

US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

Scale - 1:12,000

0 0.5 Miles

0 1 Kilometers

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe

Tile Number: 52

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July 20, 2011

US National Grid

100,000-m Square ID

LE

Grid Zone Designation

17T

Datum = NAD 1983, 12,000-m USNG

Final map series created June 2011

Scale - 1:12,000

0 0.5 Miles

0 1 Kilometers

Karst Feature

- Field Verified - Yes
- Field Verified - Maybe

Tile Number: 53

BACK TO INDEX

July 20, 2011

US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

0 0.5 Miles

0 1 Kilometers

Scale - 1:12,000

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe

Tile Number: 60

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July 20, 2011

US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

Scale - 1:12,000

0 0.5 Miles

0 1 Kilometers

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe

Tile Number: 61

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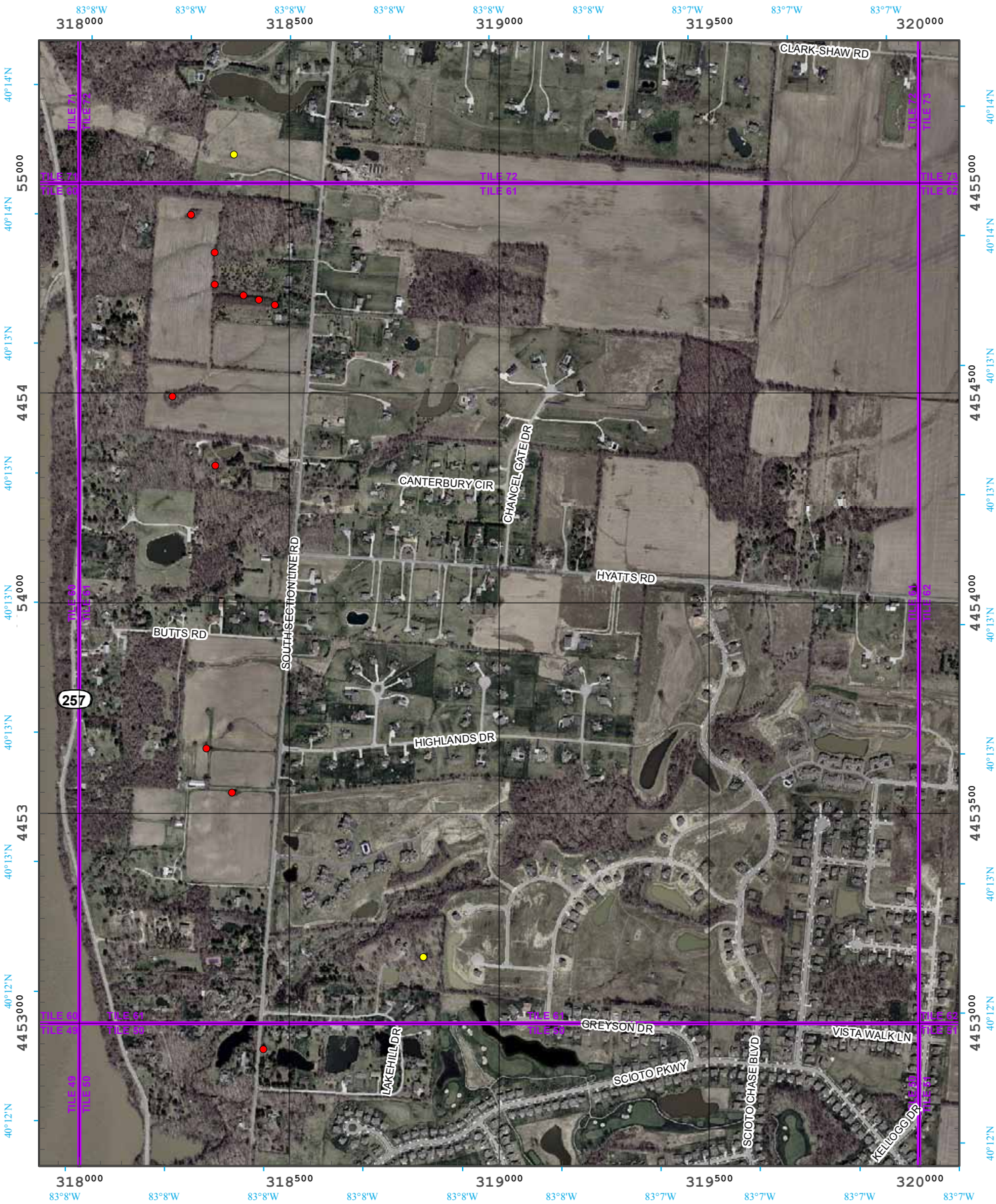
July 20, 2011



US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

Scale - 1:12,000

0 0.5 Miles

0 1 Kilometers

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe

Tile Number: 64

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July 20, 2011

US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

Scale - 1:12,000

0 0.5 Miles

0 1 Kilometers

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe

Tile Number: 67

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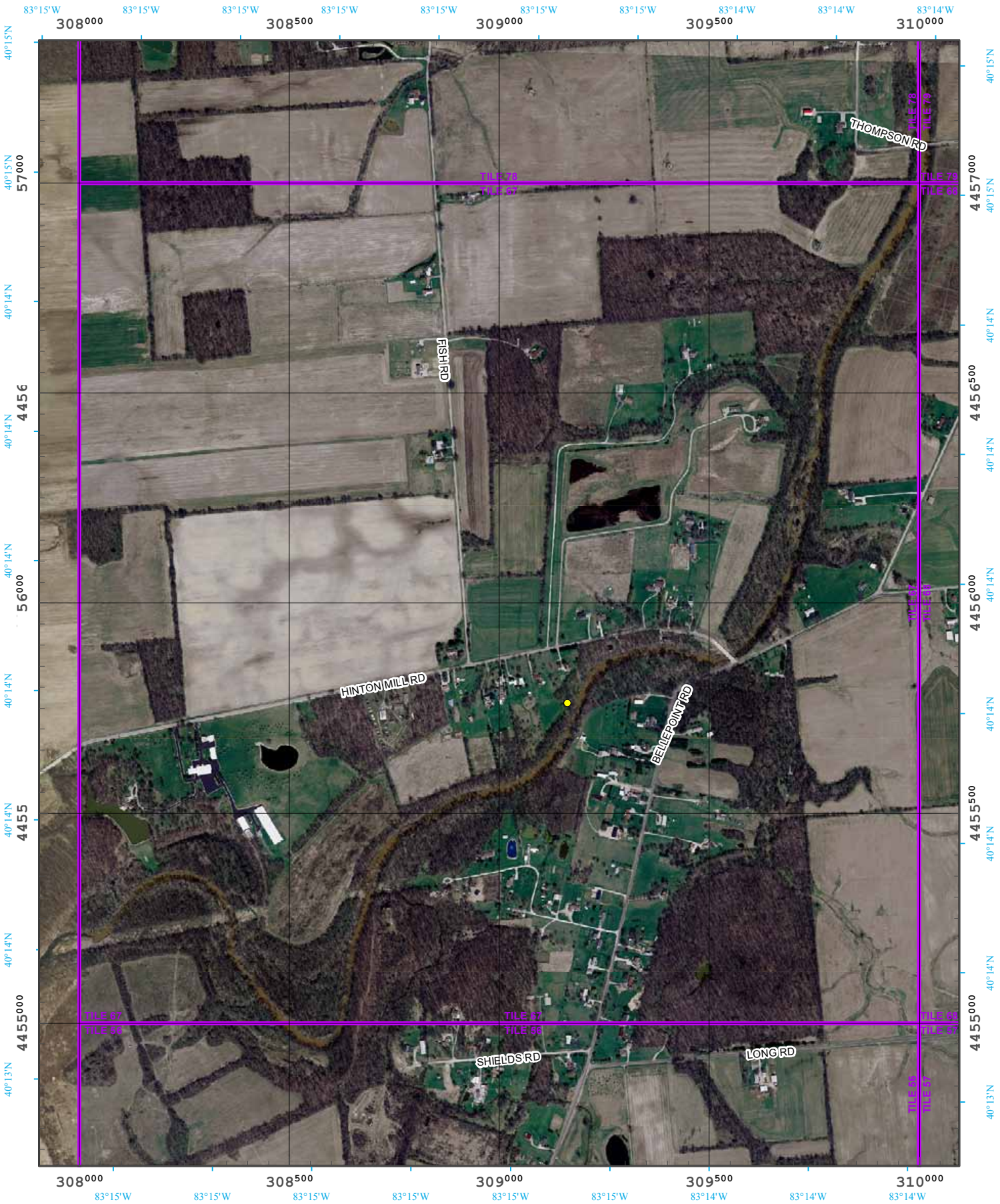
July 20, 2011



US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

Scale - 1:12,000

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe

0 0.5 Miles

0 1 Kilometers

Tile Number: 71

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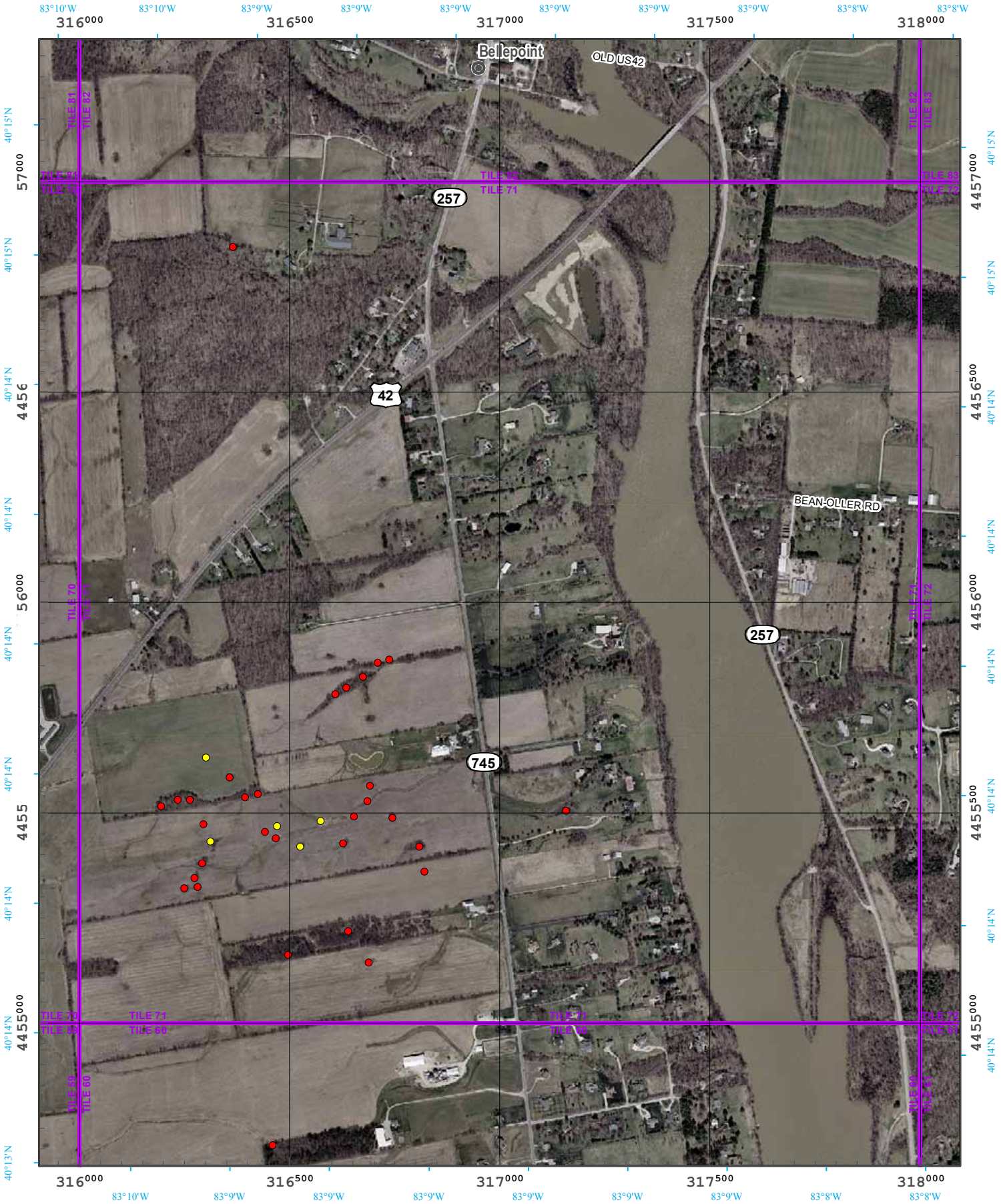
July 20, 2011



US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

Scale - 1:12,000

0 0.5 Miles

0 1 Kilometers

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe

Tile Number: 72

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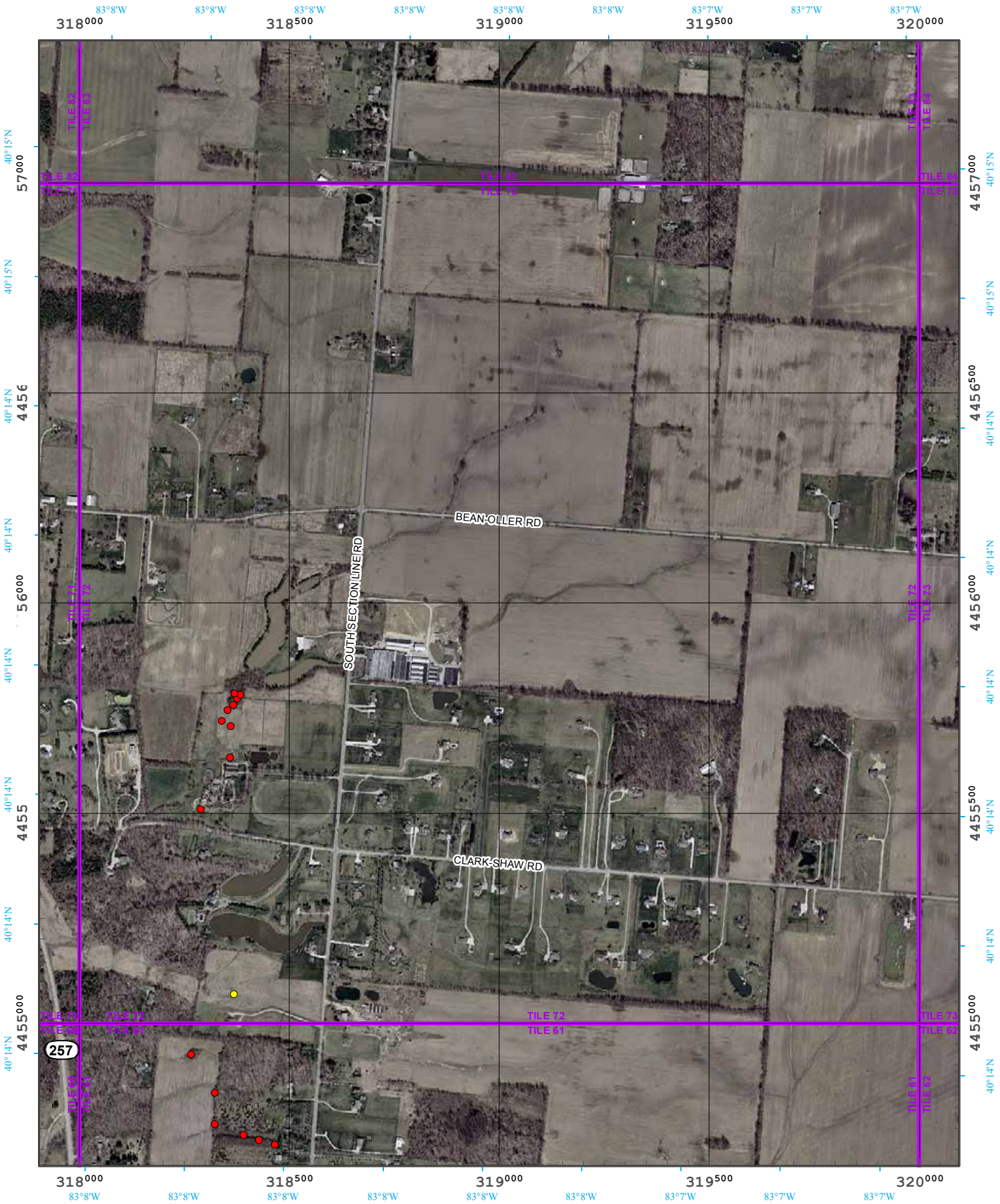
July 20, 2011



US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

Scale - 1:12,000

0 0.5 Miles

0 1 Kilometers

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe

Tile Number: 80

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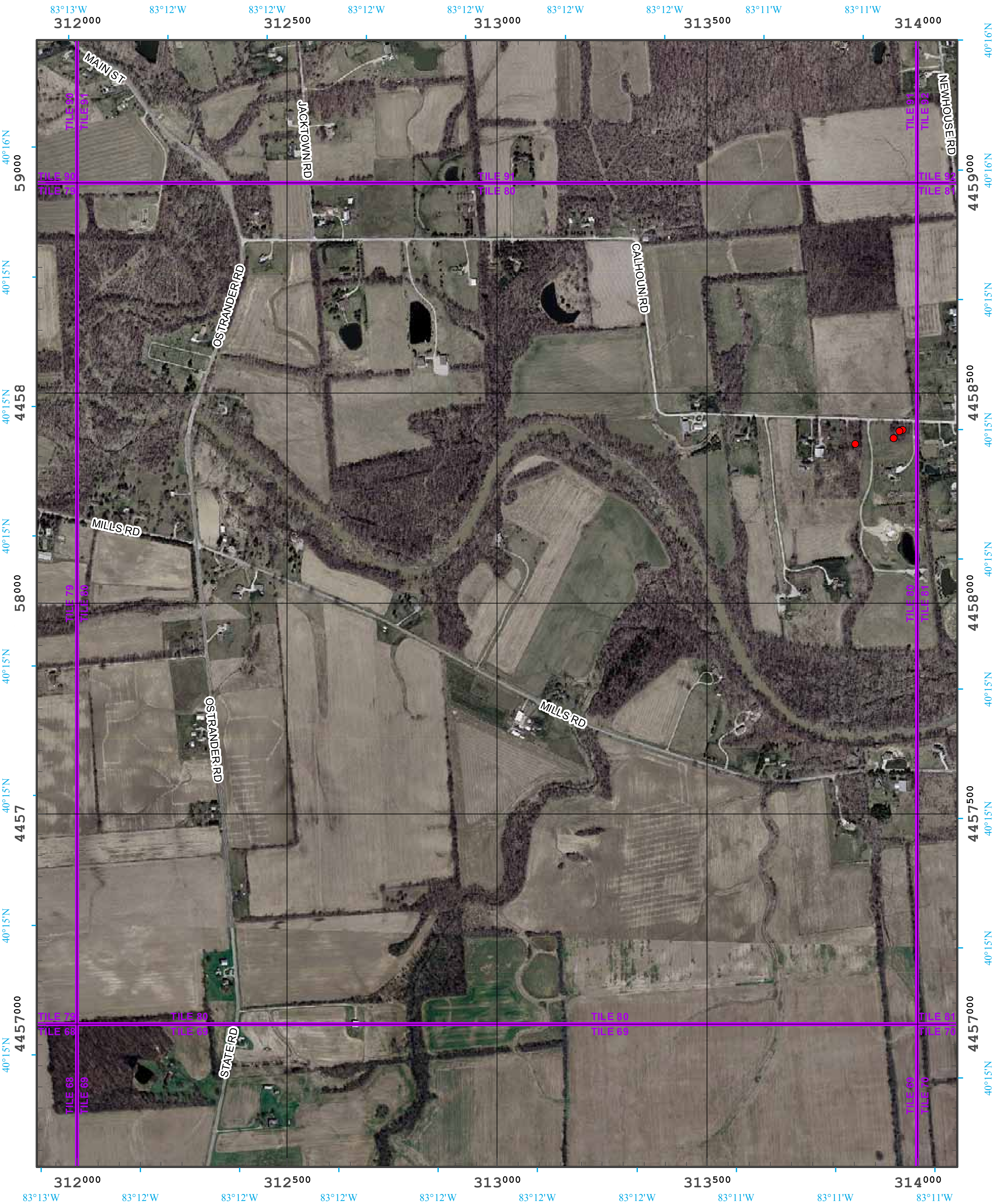
July 20, 2011



US National Grid

100,000-m Square ID

LE

Grid Zone Designation

17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

0 0.5 Miles

0 1 Kilometers

Scale - 1:12,000

Karst Feature

Field Verified - Yes

Field Verified - Maybe

Tile Number: 82

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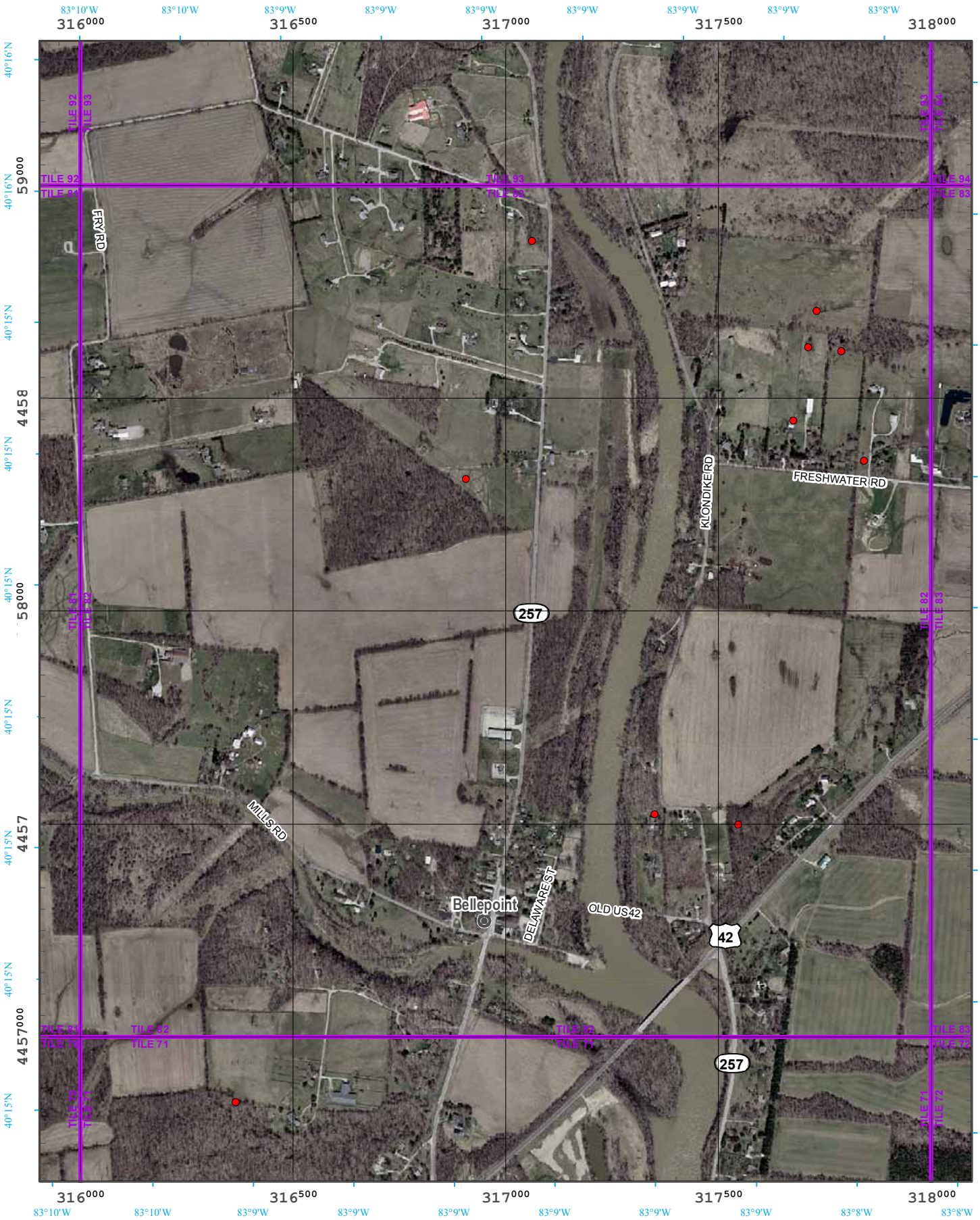
July 20, 2011



US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

Scale - 1:12,000

0 0.5 Miles

0 1 Kilometers

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe

Tile Number: 83

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July 20, 2011

US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

Scale - 1:12,000

0 0.5 Miles

0 1 Kilometers

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe

Tile Number: 93

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July 20, 2011

US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

Scale - 1:12,000

0 0.5 Miles

0 1 Kilometers

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe

Tile Number: 103

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July 20, 2011

US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

Scale - 1:12,000

0 0.5 Miles

0 1 Kilometers

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe

Tile Number: 104

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July 20, 2011

US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

Scale - 1:12,000

0 0.5 Miles

0 1 Kilometers

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe

Tile Number: 115

BACK TO INDEX

July 20, 2011

US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

0 0.5 Miles

0 1 Kilometers

Scale - 1:12,000

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe

Tile Number: 116

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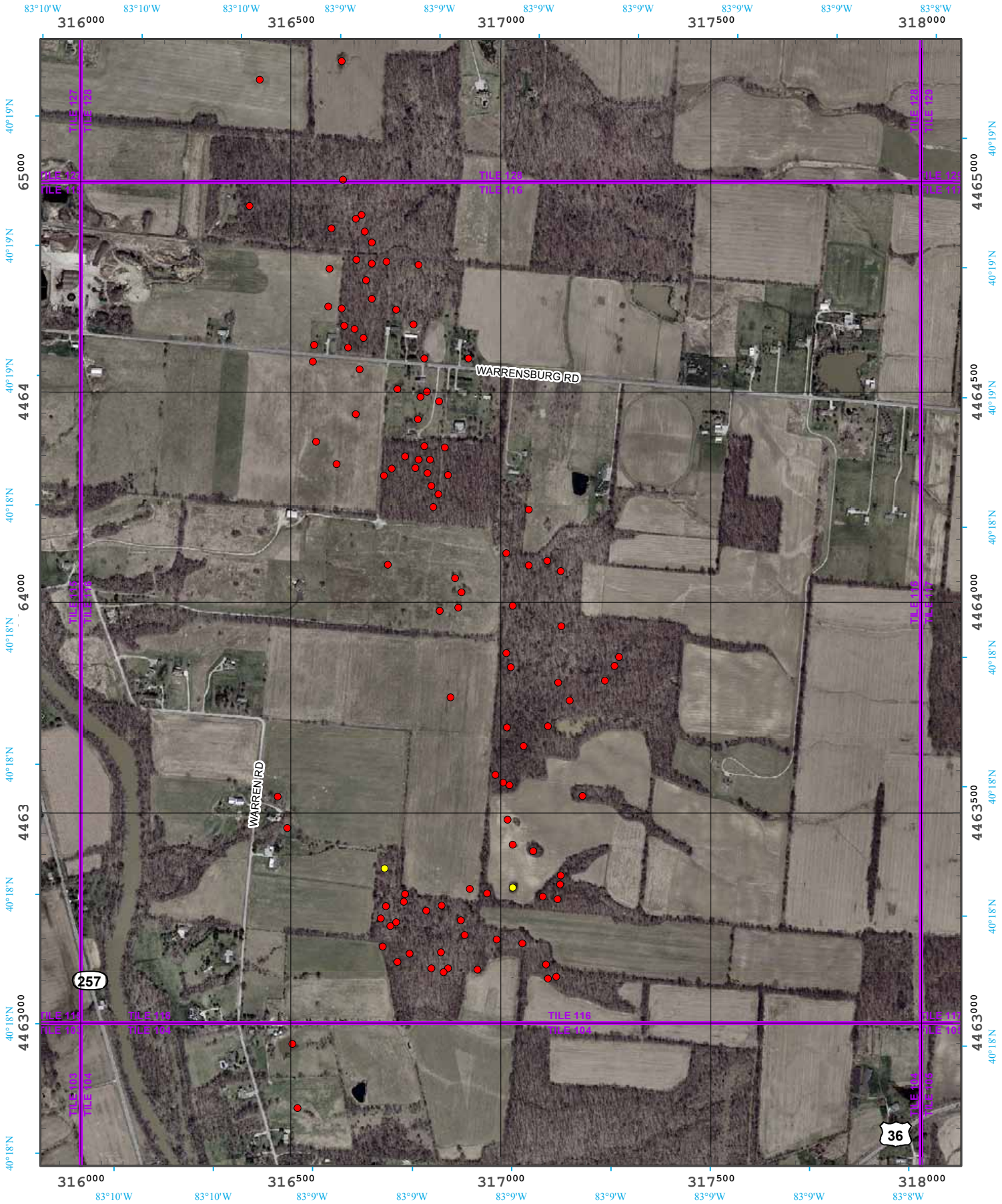

US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

Scale - 1:12,000

0 0.5 Miles

0 1 Kilometers

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe

Tile Number: 127

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July 20, 2011

US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

Scale - 1:12,000

0 0.5 Miles

0 1 Kilometers

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe

Tile Number: 128

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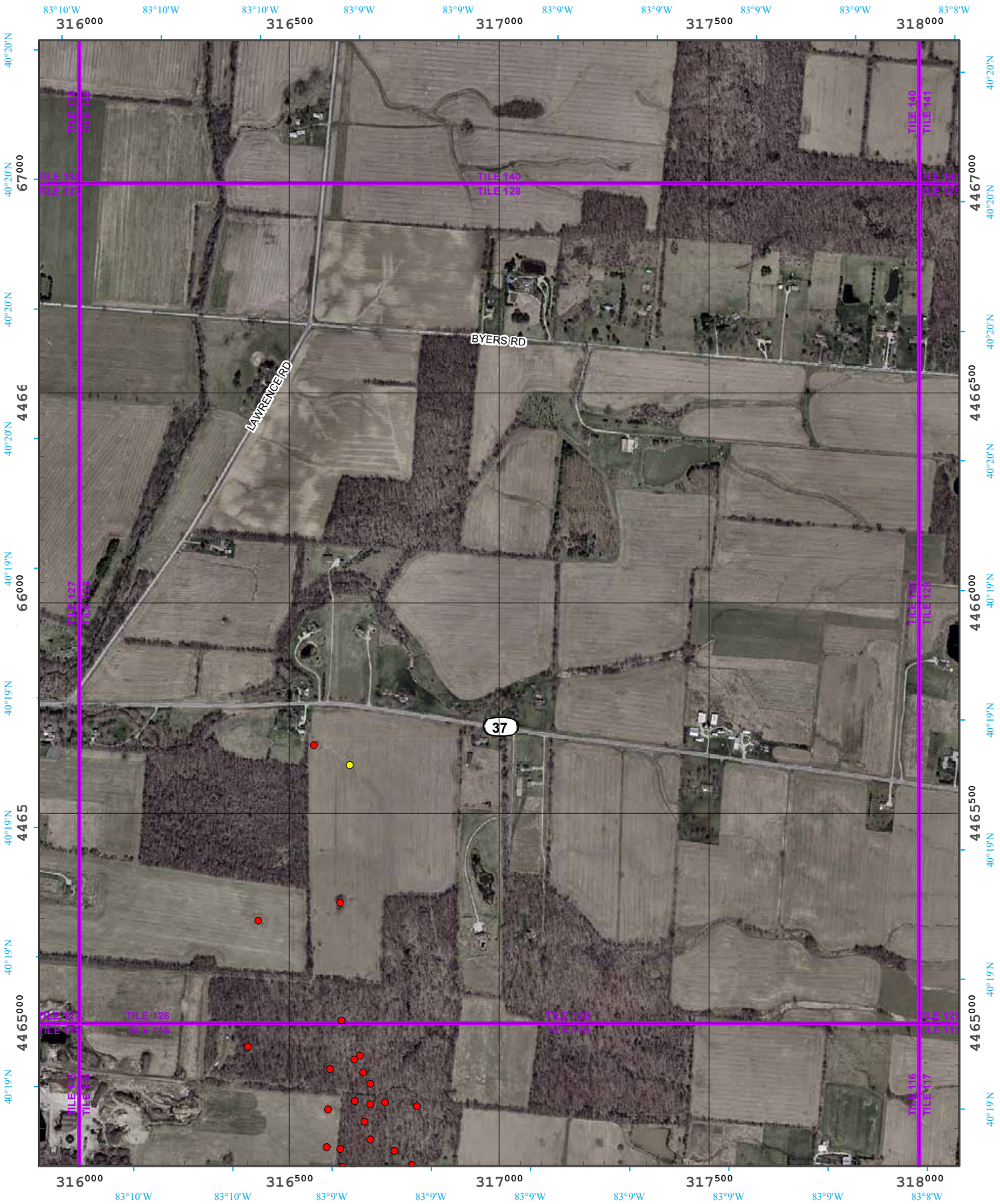
July 20, 2011



US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

Scale - 1:12,000

0 0.5 Miles

0 1 Kilometers

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe

Tile Number: 139

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July 20, 2011

US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

Scale - 1:12,000

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe

0 0.5 Miles

0 1 Kilometers

Tile Number: 152

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July 20, 2011

US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

Scale - 1:12,000

0 0.5 Miles

0 1 Kilometers

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe

Tile Number: 164

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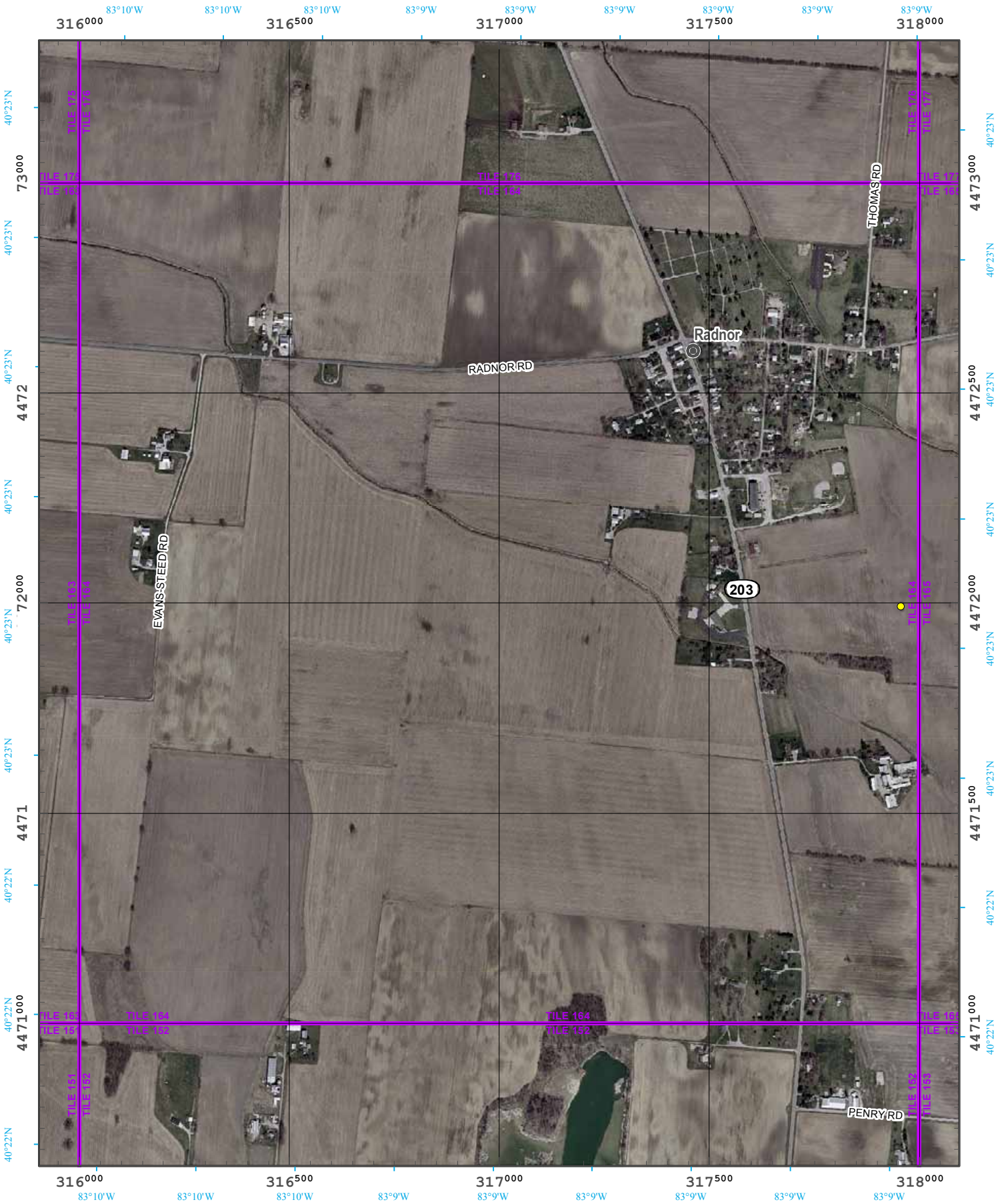
July 20, 2011



US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

Scale - 1:12,000

0 0.5 Miles

0 1 Kilometers

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe

Tile Number: 186

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July 20, 2011

US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

Scale - 1:12,000

0 0.5 Miles

0 1 Kilometers

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe

Tile Number: 212

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July 20, 2011

US National Grid
100,000-m Square ID
LE

Grid Zone Designation
17T

Datum = NAD 1983, 12,000-m USNG
Final map series created June 2011

Scale - 1:12,000

0 0.5 Miles

0 1 Kilometers

Karst Feature
- Field Verified - Yes
- Field Verified - Maybe