

**Firelands Wind, LLC**  
**Case No. 18-1607-EL-BGN**

**Application Part 5 of 17**

**Part 5 includes:**

- **Exhibit E**                      **Groundwater, Hydrogeological, and Geotechnical Report**
- **Exhibit F**                      **Socioeconomic Report**

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# **Exhibit E**

## **Groundwater, Hydrogeological, and Geotechnical Report**

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January 17, 2019

Mr. John Arehart  
Apex Clean Energy, Inc.  
310 4<sup>th</sup> Street NE, Suite 200  
Charlottesville, VA 22902

Re: Groundwater Hydrogeological and Geotechnical Desktop Document Review Summary Report for the Proposed Emerson Creek Wind Project Located in Erie, Huron, and Seneca Counties; ACX006.0002.

Dear Mr. Arehart:

Hull & Associates, Inc. (Hull) is pleased to provide Apex Clean Energy, Inc (Client) with this Desktop Document Review of readily available geologic, hydrogeologic, and geotechnical information that was reviewed for the proposed Emerson Creek Wind Project located in Erie, Huron, and Seneca Counties, Ohio. The Client is pursuing the development of a 300-megawatt wind energy facility located in rural Erie and Huron Counties, Ohio (Facility). Development of the Facility will include construction of up to 87 wind turbines, along with associated infrastructure such as operations and maintenance buildings, access roads, electrical collection lines, substation(s), construction staging areas, and meteorological towers.

For this summary report, the following definitions have been used when describing the project pursuant to the Ohio Power Siting Board's (OPSB's) current Ohio Administrative Code (OAC) rules (Chapter 4906-1-01):

- **Project Area:** "all land within a contiguous geographic boundary that contains the facility, associated setbacks, and properties under lease or agreement that contain any components of the facility" (OAC 4906-1-01(GG)). Additionally, pursuant to OAC 4906-4-08(C)(2), each of the turbine Sites will have an established setback to the nearest habitable residential structure located on adjacent properties at the time of the certification application. This area is synonymous with the term "Project Area" used in the OPSB Application, and includes portions of Erie, Huron and Seneca Counties.
- **Facility:** "the proposed major utility facility and all associated facilities" (OAC 4901-1-01(W)). The Facility includes all the turbines, collection lines, access roads, any associated substations, and all other associated equipment. All the components for the Facility are located in Huron and Erie Counties.
- The **Project Boundary:** was established by the Client.
- The **Study Area:** is defined by Hull to better describe the region outside of the Project Boundary that was included during database searches of available public information.

## PROJECT APPROACH

The Desktop Document Review was completed to gather the applicable geologic, hydrogeological, and geotechnical information specified in the OPSB's current OAC rules (Chapter 4906-4) concerning certificate applications for electric generation facilities. The information was gathered by completing a literature search of existing and readily available documents related to the hydrogeological and geotechnical conditions of the Study Area. This information was then reviewed to develop a generalized understanding of the suitability of conditions within the Study Area for the proposed construction within the Project Boundary. The information summarized below was obtained from available on-line databases and/or documents maintained or produced by the following federal, state and local agencies:

1. Federal Emergency Management Administration (FEMA);
2. Ohio Department of Agriculture (ODA);
3. Ohio Department of Natural Resources (ODNR);
4. Ohio Environmental Protection Agency (Ohio EPA);
5. Ohio Department of Transportation (ODOT) Districts 2 and 3;
6. The Ohio State University, Agricultural Extension Office;
7. Erie and Huron County Engineers;
8. United States Department of Agriculture (USDA) Soil Conservation Service Soil Survey of Erie, Huron, and Seneca Counties; and
9. United States Geological Survey (USGS).

No environmental studies or structural evaluations were performed as part of this scope of work, and therefore no recommendations relative to environmental or structural issues are included in this report.

## **FACILITY LOCATION**

As shown on Figure 1 and as previously stated, the Facility is located in Erie and Huron Counties. The currently proposed Project Boundary is shown on Figure 1 and subsequent figures discussed below.

## **INFORMATION REVIEW AND ANALYSIS**

The following provides a summary of the information reviewed and its applicability to the proposed project.

### **Geology and Seismology**

The Project Boundary lies entirely within the Central Ohio Clayey Till Plain, Erie Lake Plain, and Bellevue-Castalia Karst Plains Regions of the Huron-Erie Lake Plains and Till Plains Sections of the Central Lowland Physiographic Province (Figure 2). The southern portion of the Project Boundary lies within the Central Ohio Clayey Till Plain, which is characterized as having a surface of clayey till with well-defined moraines, intervening flat-lying ground moraine, and intermorainal lake basins. The region straddles the Huron-Erie Lake Plains (northern portion of the Project Boundary) and Till Plains (southern portion of the Project Boundary). Surface elevations range from approximately 700 feet to 1,150 feet above mean sea level (msl).

The north portion of the Project Boundary is composed of the Erie Lake Plain Region and is characterized as the edge of a very low-relief Ice-Age lake basin separated from modern Lake Erie by shoreline cliffs and major streams in deep gorges. Low physiographic relief (about 10 feet) is generally present in this region. Surface elevations range from approximately 570 to 800 feet above msl.

The extreme northwestern portion of the Project Boundary is composed of the Bellevue-Castalia Karst Plains Region and is characterized as a hummocky plain of rock knobs and numerous sinkholes, large solution features, caves, and springs. Moderate to high physiographic relief (about 25 feet) is generally present in this region. Surface elevations range from approximately 570 to 825 feet above msl. (Ohio Division of Geological Survey, 1998).

The surface topography within the Project Boundary is the result of ice-deposited ground moraine, which was planed by waves in glacial lakes following deposition, resulting in a relatively flat surficial topography. Small areas of lake-deposited (i.e. lacustrine) sand, silt, or clay are present on the surface in the extreme northeastern portion of the Project Boundary. These lacustrine deposits are generally laminated and were formed in the calm waters of glacial lakes (Pavey *et. al.*, 1999). Lacustrine deposits are a heterogeneous mixture of all sizes of soil particles inclusive of clay, silt, sand, and gravel. Lacustrine deposits may also contain streaks, seams, layers or lenses of sand and gravel, which may or may not be water-bearing. The deposits have a greater thickness to bedrock (up to 147 feet) on the western portion of the Project Boundary,



than they do on the eastern portion (less than 10 feet). The area was passed over by both Pre-Illinoian and Wisconsinian glaciers.

The uppermost bedrock unit, located in the western portion of the Project Boundary, is the Devonian Columbus Limestone. The unit consists predominantly of limestone and dolomite; gray to brown, with massive bedding. The upper two thirds of the formation are a fossiliferous gray limestone, and the lower third is a brown dolomite which is subject to karst formations. Thickness ranges from 0 to 105 feet (Slucher *et. al.* 2006). The Delaware Limestone is deposited beneath the Columbus Limestone and is also located on the western portion of the Project Boundary. The Delaware Limestone is gray to brown in color and has thin to massive bedding. The limestone has argillaceous partings, nodules, and layers. It is carbonaceous and has a petroliferous odor. The formation can be as thick as 45 feet. The west-central portion of the Project Boundary is composed of Devonian units: Olentangy Shale, Prout Limestone and Plum Brook Shale. The remaining eastern portion of the Project Boundary is composed of the Devonian Ohio Shale. The unit consists of brownish-black to greenish-gray shale that is commonly characterized by thin bedded laminations and fissile parting. The bedrock topographic surface is shown on Figure 3. Reviewing ODNr water well logs, bedrock (typically a black to gray shale) has been documented as being encountered during the installation of several domestic water wells in the western portion of the Project Boundary at depths ranging between four (4) and 30 feet bgs. In the eastern portion of the Project Boundary, bedrock was encountered at depths ranging between 30 and 70 feet bgs. Based on the inferred bedrock topography within the Project Boundary, the depth to bedrock appears to vary between approximate depths of four (4) and 70 feet. Depending on the installation depth of the proposed underground electrical collection lines, bedrock may be encountered during installation on the western portion of the Project Boundary.

Information obtained from ODNr Division of Geological Survey indicates that the portion of the western limits of the Project Boundary lie within a probable karst area. Six (6) of the proposed turbine locations appear to be located in the probable karst area. Probable karst areas and known karsts are presented in Figure 4. The Ohio Geological Survey completed mapping and field verifications of karst features and depths of karst depressions for the Bellevue Quadrangle and portions of the Clyde and Castalia Quadrangles (2013) and the Fireside Quadrangle and portions of the Flat Rock and Clyde Quadrangles (2014). These in-depth studies produced detailed karst maps of 2-km<sup>2</sup> tiles of the quadrangles and cover the eastern portion of the Project Boundary. The Ohio Geological Survey indicates that the majority of the Karst features are formed by dissolution of the Columbus Limestone and portions of the Salina undifferentiated formations (Aden, 2013 and Aden, 2014). The studies are presented in Appendix A. Although it is not uncommon to construct turbines within known karst areas, additional assessment will be required within these six proposed turbine locations to ensure safe conditions exist for construction of the turbines and associated support structures, as well as minimizing potential negative impact to the karst geology in these locations.

Geologic structural and seismic information were assessed for the Study Area. Structural features and earthquake epicenters within Ohio are shown on Figure 5. A review of the information showed that no epicenters lie within the Project Boundary. However, the Tiffin Fault extends to approximately 15 miles from the western Project Boundary. The Seneca Anomaly also lies approximately eight (8) miles west of the Project Boundary. Other faults and fault systems in the vicinity of the Project Boundary include the Outlet Fault, part of the Bowling Green Fault System, situated approximately 25 miles west-southwest at its closest proximity to the Project Boundary.

Recorded seismic information shows that no earthquakes have originated in Erie County. However, two earthquakes occurred in Huron County in 1998 and 2001 and produced a magnitude of 3.2 and 2.7 *m<sub>b</sub>L<sub>g</sub>*, respectively. The closest seismic event to the Project Boundary was in 1936 when a 3.1-magnitude earthquake occurred in Seneca County, Ohio. The epicenter was located approximately 18 miles west of the Project Boundary.

### **Hydrology and Hydrogeology**

Surface water flow within the Project Boundary is generally to the northeast. The entire Project Boundary is located within the Lake Erie Drainage Basin. Surface water bodies present within the Project Boundary include several small streams, ditches, ponds, and above ground reservoirs. The streams generally flow from the southwest to the northeast. The majority of the surface water inside the Project Boundary flows into Megginson Creek and Seymour Creek, located in the central northern portion of the Project Boundary. These water bodies connect to the West Branch Huron River, before connecting to the Huron River which discharges into Lake Erie. Several small un-named tributaries in the northwestern portion of the Project Boundary, connect to the Mills Creek, which parallels the western Project Boundary, before discharging into Lake Erie.

Figure 6 contains the location of 100-year floodplains in the Project Boundary, which was prepared using information obtained from the ODNR and FEMA. Several 100-year floodplains are located within the Project Boundary, mostly surrounding portions of Megginson Creek, as well as several un-named tributaries in the south-central portion of the Project Boundary and portions of Mills Creek in the northwestern portion of the Project Boundary. None of the Turbines appear to be located in the 100-year floodplains. However, since several underground electrical collection lines may pass through streams and 100-year flood plains, proper steps should be taken during the installation of these lines when crossing streams and flood plains, in accordance with Nationwide and State Regulations.

The principal groundwater source within the Project Boundary is a carbonate limestone bedrock aquifer. Groundwater yields of up to 500 gallons per minute (gpm) have reportedly been measured in wells at depths less than 200 feet. Agricultural and domestic supplies of about 10 to 15 gpm can reportedly be developed from wells at depths less than 100 feet. The presence of hydrogen sulfide is common in these wells (Schmidt, 1982).

The Tiffin Thin Upland Aquifer yields less than 5 gpm and the Tiffin Ground Moraine Aquifer, Sandusky River Alluvial Aquifer, Lake Maumee Lacustrine Aquifer, Lake Maumee Lacustrine Aquifer, Galion Ground Moraine Aquifer and Defiance End Moraine Aquifer all yield between 5 to 25 gpm. These aquifers are all shown on Figure 7.

The Project Boundary lies within a rural area. Property owners within the Project Boundary utilize private wells to supply potable water. Water well locations are shown on Figure 7, which was compiled from well location information provided by ODNR, Ohio EPA, and the Erie, Huron and Seneca County Health Departments. Hull has not reviewed specific information such as depth, boring logs, or construction associated with any of the wells depicted on the figure, nor has there been an attempt to verify whether these private wells were completed within the carbonate aquifer, unconsolidated aquifers, or some other aquifer.

The presence of Source Water Protection Areas (SWPAs) for public water systems within the Project Boundary was evaluated. SWPAs are areas defined and approved by the Ohio EPA for the purpose of protecting drinking water resources. Numerous SWPAs have been established in Erie, Huron, and Seneca Counties, a ground water protection area is located on the western portion of the Project Boundary (Capital Aluminum and Glass SWPA, Figure 7), protecting the groundwater associated with the karst formations of the Columbus Limestone. Four turbines are located inside the Capital Aluminum and Glass SWPA. Due to the high groundwater flow rates (3,500-8,600 ft./day) and a relatively high vulnerability (shallow depth to bedrock, sinkholes and rapid flow of groundwater), the Ohio EPA delineated the entire region contributing water via the karst system as a SWPA. The Capital Aluminum and Glass SWPA is a non-transient, non-community public water system located near Bellevue. The system operates one well and pumps approximately 2,600 gallons per day from the carbonate bedrock aquifer.

Additionally, there are six (6) Inland Surface Water Protection Areas located in the eastern (City of Bellevue) and southeastern (Monroeville Village) portions of the Project Boundary, as presented in Figure 7. The Bellevue City Inland SWPA encompasses two surface water intakes. Frink Run and Berry Creek serve as the surface water sources for the City of Bellevue. Frink Run is approximately 16.1 miles long, has a drainage

area of 29.8 square miles and flows into the West Branch Huron River. The protection area covers approximately 25.8 square miles. Two (2) of the turbines are located within these Surface Water Protection Areas.

The Monroeville Village Inland SWPA encompasses the West Branch Huron River, which serves as the surface water source for the Village of Monroeville. The West Branch Huron River is approximately 46 miles long and has a drainage area of 262 square miles. The West Branch Huron River flows into the Huron River. The water system intake is located approximately 8.52 miles from the mouth of the Huron River. The protection area covers approximately 217 square miles and 40 turbines are located within the Surface Water Protection Area.

The Aqua Ohio – Tiffin, City of Fremont and the Attica Village Inland SWPAs all overlap in the southwest corner of the Project Boundary. The Aqua Ohio – Tiffin protection area covers approximately 961 square miles; the City of Fremont protection area covers approximately 1,255 square miles; and the Attica Village protection area covers approximately 76 square miles. There are three turbines located within these SWPAs.

Environmental regulatory programs within the Ohio EPA, as well as other regulatory agencies such as the Ohio Bureau of Underground Storage Regulations (BUSTR), have adopted regulations that restrict specific activities within SWPAs. These activities include concentrated animal feeding operations, wastewater treatment land application systems, industrial, municipal and residual waste landfills, leaking underground storage tanks (LUSTs) and voluntary action program (VAP) cleanups. The restrictions typically apply to SWPAs relying on groundwater as their drinking water source. Hull has reviewed the range of programs which have adopted rules related to the presence of SWPAs and have concluded that construction of the proposed wind turbine facility will not constitute an activity that would be restricted within either a surface water or groundwater SWPA. By employing best management practices during construction and operation of the turbines and support structures, it is not anticipated that construction and operation of the turbines should negatively impact the SWPA.

### **Well Survey**

Hull mailed a brief survey to the property owners within the Project Area that were under contract with the Client at the time the hydrogeology review commenced in March 2018. A list of names and addresses for the property owners was provided to Hull by the Client. The survey included multiple questions regarding the number, depth, installation date and construction of the wells. Additional information was requested regarding the aquifer type, depth to water and yield of each well. The survey also requested information regarding any problems experienced by the property owners with their wells.

The survey was mailed to 140 separate property owners in the Project Area. At the time this Desktop Document Review was completed, Hull had received 94 responses to the survey. Copies of the well surveys are attached in Appendix B. It should be noted that Hull has not matched the addresses of the property owners that responded to the survey to well or turbine locations shown on the figures.

Of the 93 survey respondents, 50 respondents had no wells on their property. Forty-three respondents reported they had at least one well on their property. Of these 43 respondents, 22 reported that they had one well, while 14 respondents noted two wells, and seven (7) reported three or more wells. The wells provided potable water for the residents, as well as water for livestock and agricultural uses. Forty-three other respondents indicated that they were connected to a municipal water supply.

Approximately half of the respondents who indicated that they had a well on their property were able to provide information regarding the well diameter, total depth, producing formation, depth to water, and well yield. Drilled well diameters were generally 3 to 8 inches, several dug wells were reported being 3 to 6 feet in diameter. Reported well depths ranged between 16 and 200 feet. Most respondents indicated that their well was completed in an unspecified bedrock unit. Respondents that provided information as to the

depth to water in their wells indicated that water depths varied between 8 and 100 feet. Well yields were reported to vary between 4 and 50 gpm.

Respondents were also asked whether they had ever experienced problems with their wells related to the water table being lowered or poor yield. Four respondents indicated poor water yield, one of which described that the low yields were due to a drought year.

### **Soil Survey**

The USDA Soil Conservation Service Soil Surveys of Erie, Huron, and Seneca Counties were reviewed (USDA, 1992, 1987, and 1977, respectively). Soil surveys furnish surface soil maps and provide general descriptions and potentials of the soil to support specific uses, and can be used to compare the suitability of large areas for general land uses. The majority of the surface soils of the Project Boundary are comprised of the Pewamo Silty Clay Loams (Pm & PcA) covering approximately 23.4% of the Project Boundary. The Bennington Silt Loam (BgA and BgB) covers approximately 31.0% of the Project Boundary. The remainder of the Project Boundary is covered by various clay, silt, and sand loams as presented in the soils map, Figure 8. The soil survey information suggests the Pewamo Silty Clay Loams have a 0 to 2% slope and are very poorly drained soils. The permeability of the soil is moderately slow, the available water capacity is high and the seasonal high water table is near or slightly above the surface during extended wet periods. The Bennington Silt Loam has a 2 to 5% slope and somewhat poorly drained soils. The permeability of the soil is slow, the available water capacity is moderate and the seasonal high water table is 12 to 30 inches bgs. The Hornell Silty Clay Loam has a 0 to 2% slope and are somewhat poorly drained soils. The permeability of the soil is very slow to slow, the water capacity is high and the seasonal high water table is 0.5 foot to 1.5 feet. The soil surveys indicate that these soils do not frequently flood, however the Pewamo Silty Clay Loams frequently pond surface water runoff.

### **Underground and Surface Mines**

Information obtained from the ODNR, Division of Geological Survey and phone discussions with ODOT District 2 and District 3 and the Erie, Huron and Seneca County Engineer's Offices indicated that there is no information available that suggests that underground mines are located within the Project Boundary. Soil survey information provided by ODNR and the USDA indicates that there is one surface mine quarry located in the northwestern portion of the Project Boundary, The Hanson Midwest Aggregates, LLC Sandusky Crushed Stone limestone quarry. Furthermore, two active surface quarries are located just outside of the western Project Boundary, the Heitsche North Shore Limestone Quarry and the Hanson Aggregates, LLC Flat Rock Site. An additional inactive small surface quarry is located northwest of the City of Bellevue. Figure 9 illustrates that no known abandoned mines shafts or probable abandoned mines are located within the Project Boundary.

### **PROJECT BOUNDARY RECONNAISSANCE**

In addition to the desktop study, Hull completed a field reconnaissance on October 22, 2018, at representative points within the Project Boundary to observe geotechnical-related conditions including topography, surface geologic features, and surface water conditions. The areas within proximity of the Project Boundary predominantly consist of agricultural fields. In general, the Project Boundary appears to be adequately drained. Standing water was not observed, although the Project Boundary did not receive any significant rainfall in the days prior to the date of field reconnaissance. Construction of gravel access roads will be necessary to access all turbine locations from the Township and County roads. Several Township Roads may require improvements to provide access to turbine locations due to poor pavement conditions and narrow road width. No information was available from ODOT or the County Engineer's office concerning rockfalls or landslides within the Project Boundary. Based on a review of the existing topography of the Project Boundary and the visual observations completed by Hull during the reconnaissance, it is anticipated that the potential for rockfalls and landslides are very low due to the relatively low relief of the Project Boundary. In addition, though Hull did not observe any sinkholes or depressions within the Project Boundary, karst features are known to exist within the northwest portion of the Project Boundary.

Representative photographs from the field reconnaissance are presented in Appendix C to illustrate the general Project Boundary conditions.

## **AGENCY INTERVIEWS**

Hull contacted the Erie County Engineer's Office regarding their knowledge and experience of previous construction projects, subsurface conditions, and maintenance history in the vicinity the Project Boundary. A response was received indicating that sinkholes are the primary geotechnical issue encountered within the area. For many municipalities, sinkholes function as the primary source for drainage. The Erie County Engineer's Office indicated that the only roadway issues encountered have been flooding associated with sinkholes.

Hull contacted ODOT District 2 in order to discuss typical maintenance issues encountered in Seneca County. Bryan Spero, Transportation Manager for Seneca County, ODOT District 2 indicated that the most common geotechnical issue encountered in and adjacent to the Project Boundary are sinkholes resulting from karstic features. These sinkholes are typically encountered within agricultural fields and have not impacted ODOT roads to Mr. Spero's knowledge. Mr. Spero further indicated that a sinkhole developed south of Bloomville, Ohio years ago but no new sinkholes have been reported within the last several years. Mr. Spero indicated that historical use of injection wells by industrial operations within the district may have enhanced or contributed to the development of karst. Finally, Mr. Spero mentioned that an "underground river" associated with the cave system in the area flows between Bloomville and Bellevue, Ohio.

Hull contacted the Huron and Seneca County Engineer's Offices on several occasions but has not received a response to date.

## **PRELIMINARY CONSTRUCTION CONSIDERATIONS**

Based on our experience with earthwork in the region, conventional, shallow foundations typical for turbines of similar size may be able to support the structures. However, this assumption will need to be confirmed by a detailed geotechnical exploration and evaluation for each turbine-site (e.g., each turbine and associated access road locations). If it is determined that shallow foundations are not suitable for structural support, extended foundation systems (such as driven H-piles, micropiles, or auger cast piles) may be necessary to bear in suitable material or on bedrock. Additionally, other suitable foundation types may be utilized according to their compatibility with the geotechnical parameters of the specified turbine site.

The geotechnical engineer, or a designated representative, should examine foundation designs and compatibility with the supporting soils and approve the work prior to placement of foundation components.

Based on the information collected to date, provided that the subgrade is prepared properly, it is anticipated that the risk associated with constructing the access roads will be minimal. However, this assumption will need to be confirmed by a detailed geotechnical exploration and evaluation of each access road location. Proper preparation of the subgrade is critical to the performance of the access road to support construction, operational, and maintenance activities of the turbines. At a minimum, the site earthwork contractor should proof roll the site subgrades using a fully-loaded, tandem-axle dump truck (or equivalent) after performing site stripping and exposing the subgrade surface and prior to fill, pavement, or slab placement. The purpose of the proof roll is to identify potential soft, yielding subgrade areas. Soft spots identified during the proof roll should be undercut to firm, stable conditions or otherwise stabilized (e.g., disk, aerating/drying, recompacting, use of geosynthetic reinforcement, chemical stabilization, etc.) prior to placing controlled fill to finished subgrade elevation. The severity of soft, very moist subgrade conditions will depend on the time of year earthwork is performed, and the amount of moisture within the subgrade soils. It is expected that fewer problems with soft subgrade will be encountered if the earthwork and mass grading operations are performed during drier times of year (i.e., late spring, summer, and early fall).



Adequate surface water run-off drainage should be established at each turbine site, access road and the substation location to minimize any increase in the moisture content of the subgrade material. Positive drainage of each turbine site and access road location should be created by gently sloping the surface toward existing or proposed drainage swales. Surface water runoff should be properly controlled and drained away from the work area. It should be noted that the subgrade soils are subject to shrinking and swelling with variation in seasonal moisture content and consideration should be given during constructability reviews to determine how best to deal with potential moisture fluctuations.

The contractors should be prepared to deal with any seepage or surface water that may accumulate in excavations. Site dewatering may be required during construction if excavations extend below the water table, or significant precipitation events occur when the foundation excavations are exposed. The contractor should be able to minimize the amount of excavation exposed at one time, especially when precipitation is forecasted. Fluctuations in the groundwater level may occur seasonally and due to variations in rainfall, construction activity, surface runoff, and other factors. Because such variation is anticipated, we recommend that design drawings and specifications accommodate such possibilities and that construction planning be based on the assumption that such variation can occur.

The foundations and excavations are to be designed by the Client's structural designer. The contractor should be solely responsible for constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. All excavations should comply with applicable local, state, and federal safety regulations including the current Occupational Safety and Health Administration (OSHA) Excavation and Trench Safety Standards (29 CFR Part 1926).

As mentioned above, due to the glacial history and presence of karst topography within the Study Area, the depth to bedrock varies considerably throughout. Bedrock is generally shallower within the western portion of the Project Boundary (evidenced by the presence of limestone quarries and karst) and deeper within the eastern portion (evidenced by thick deposits of glacial drift). Consequently, foundation considerations vary depending on the location of each turbine.

Based on a review of the soil survey information and our experience with earthwork in the Study Area, the soils should be suitable for grading, compaction, and drainage when each turbine site is prepared as discussed in the final geotechnical exploration report. Due to the anticipated depth of bedrock, excavation within bedrock may be necessary in the western portion of the Site to install foundations. Furthermore, karst areas may include sinkholes, solution cavities, and cave systems. These voids may need to be grouted in order to provide adequate foundation support. These assumptions must be confirmed with geotechnical test borings prior to construction.

Additional considerations relative to site preparation, suitability of fill materials, fill placement, and weather limitations are presented in Appendix D for reference. These considerations are provided as general guidelines and the contractor is responsible for selecting and implementing the most appropriate construction techniques (e.g., construction means, methods, sequences or procedures, and safety precautions or programs) for each site-specific condition(s).

## **SUMMARY**

Based on the information reviewed to date and the field reconnaissance, it does not appear that the local geology and/or hydrogeology will be prohibitive regarding construction of the proposed wind turbines, access roads, and/or substations. Likewise, based on Hull's knowledge of typical wind turbine foundation construction, it does not appear that the construction of the proposed wind turbines will have a significant impact on the local geology and/or hydrogeology of the Project Boundary. Therefore, based on the information presented herein and the associated analysis, construction of the wind turbines, or other project components, are not anticipated to result in any significant negative impact to the property owner's wells.

It is Hull's understanding that there is a minimum setback distance which will be established from each turbine to the nearest residential structure. Although the exact location of each potable use well cannot be determined with the information obtained to date, it is assumed that the potable wells are located in close proximity to each property owners' residence. Therefore, based on the information presented herein and the associated analysis, construction of the wind turbines, or other project components, are not anticipated to result in any significant negative impact to the property owners' wells.

Based on the information reviewed and the field reconnaissance, it appears that the primary geotechnical issue for the Facilities, access roads, and substation location that should be considered during construction is variable subsurface conditions (i.e., depth to bedrock and karst) and the poor drainage of the surface soils within the Project Boundary. As previously discussed, adequate surface water drainage should be established at each Project Area, access road, and substation location to minimize any increase in the moisture content of the subgrade material. Surface water drainage can be managed by implementing techniques such as surface water swales, drainage berms, etc. Furthermore, foundation system design for each turbine location should consider the findings and recommendations of the geotechnical subsurface investigation and laboratory testing.

Site-specific geotechnical information should be obtained by the Client prior to design of the turbine foundations, and prior to preparation of construction specifications and design plans. This may require, but not be limited to, completion of geotechnical explorations to further evaluate the *in-situ* materials at each Facility. A generalized scope of work template for the geotechnical explorations has been provided in Appendix E, which can be used to prepare detailed Requests for Proposals for the individual Facilities.

The conclusions included in this Desktop Document Review are based on general summaries available through the resources previously listed. There may be anomalies in the hydrogeology or geotechnical conditions of a specific Facility that cannot be resolved at the scale of the publicly available data used in this study. As noted previously, site-specific geotechnical information should be obtained prior to final turbine foundation design.

## **STANDARD OF CARE**

Hull has performed its services using that degree of care and skill ordinarily exercised under similar conditions by reputable members of its profession practicing in the same or similar locality at the time of service. No other warranty, expressed or implied, is made or intended by our proposal or by our oral or written reports. The work does not attempt to evaluate past or present compliance with federal, state, or local environmental or land use laws or regulations. Conclusions presented by Hull regarding the area within the Project Boundary are consistent with the Scope of Work, level of effort specified, and investigative techniques employed. Reports, opinions, letters, and other documents do not evaluate the presence or absence of any condition not specifically analyzed and reported. Hull makes no guarantees regarding the completeness or accuracy of any information obtained from public or private files or information provided by subcontractors.

If you have any questions regarding the summary and conclusions presented in this Desktop Document Review Report, please do not hesitate to contact either of the undersigned at your convenience.

Sincerely,



Cory E. Schoonover  
Project Manager

Mr. John Arehart  
ACX006.0002  
January 17, 2019  
Page 10

A handwritten signature in black ink, reading "Rob Corzatt". The signature is fluid and cursive, with a long horizontal stroke extending from the end of the name.

Rob Corzatt  
Senior Project Manager

Attachments

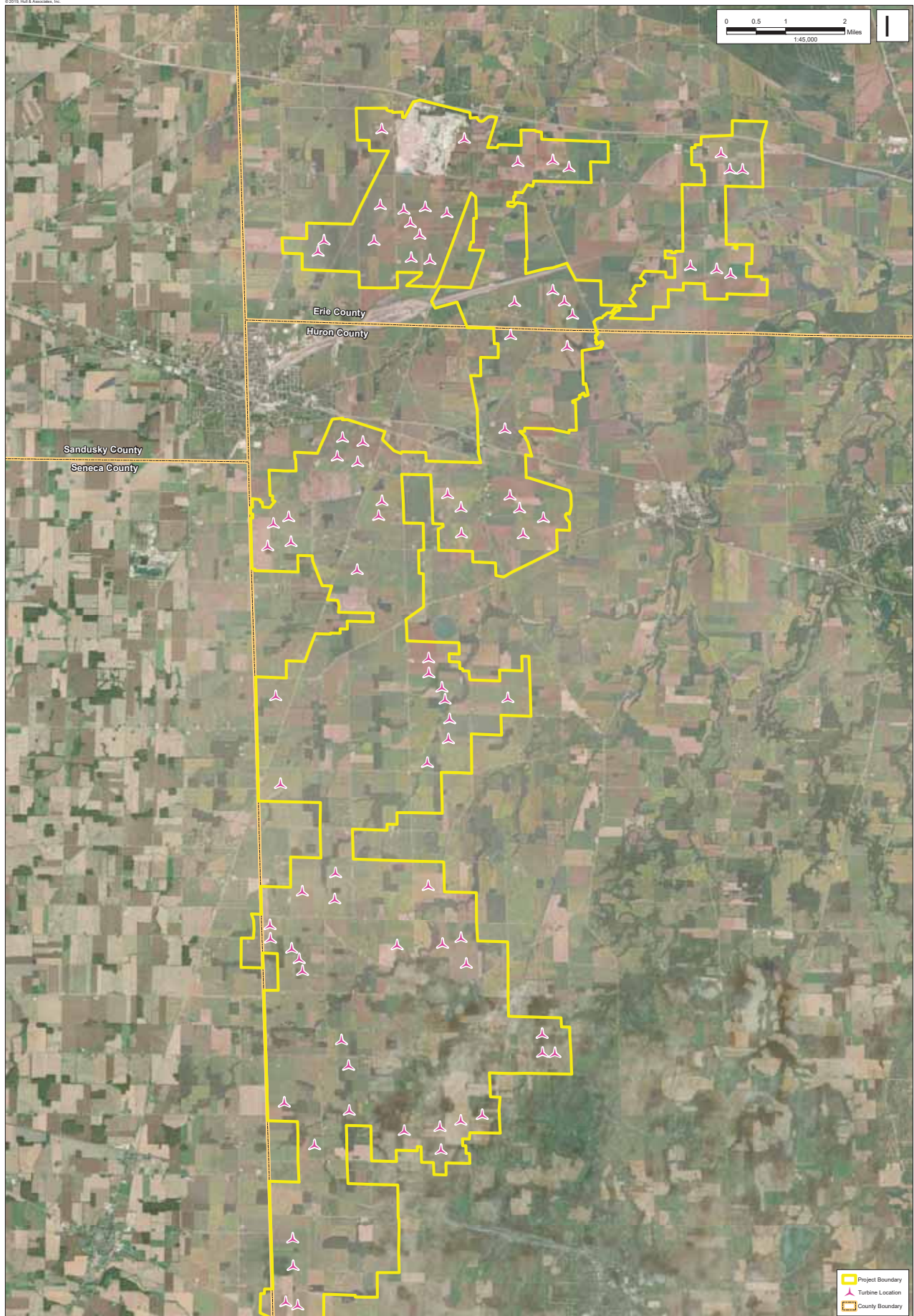


## REFERENCES

## REFERENCES

1. Aden, Douglas J., 2013, Karst of the Bellevue Quadrangle and portions of the Clyde and Castalia Quadrangles, Ohio.
2. Aden, Douglas J., 2014, Karst of the Fireside Quadrangle and portions of the Flat Rock and Clyde Quadrangles, Ohio.
3. Ohio Department of Natural Resources. *Water Well Log and Drilling Report*. Retrieved March 15<sup>th</sup>, 2018, from Division of Water Web-site: <https://apps.ohiodnr.gov/water/maptechs/wellogs/app/>.
4. Ohio Division of Geological Survey, 1998, Physiographic regions of Ohio: Ohio Department of Natural Resources, Division of Geological Survey, page-size map with text, 2p., scale 1:2,100,00.
5. Pavey, R.R., Goldthwait, R.P., Brockman, C.S., Hull, D.N., Swinford, E.M., and Van Horn, R.G., 1999, Quaternary Geology of Ohio, Ohio Department of Natural Resources, Division of Geological Survey, Map No. 2.
6. Slucher, E.R. (principal compiler), Swinford, E.M., Larsen, G.E., and others, with GIS production and cartography by Powers, D.M., 2006, *Bedrock Geologic Map of Ohio*: Ohio Division of Geological Survey Map BG-1, version 6.0, scale 1:500,000.
7. United States Department of Agriculture, Soil Conservation Service, *Soil Survey of Erie County*, 1992.
8. United States Department of Agriculture, Soil Conservation Service, *Soil Survey of Huron County*, 1987.

## FIGURES



**Notes:**  
The aerial photo was acquired through the ESRI Imagery web service. Aerial photography dated 2015.



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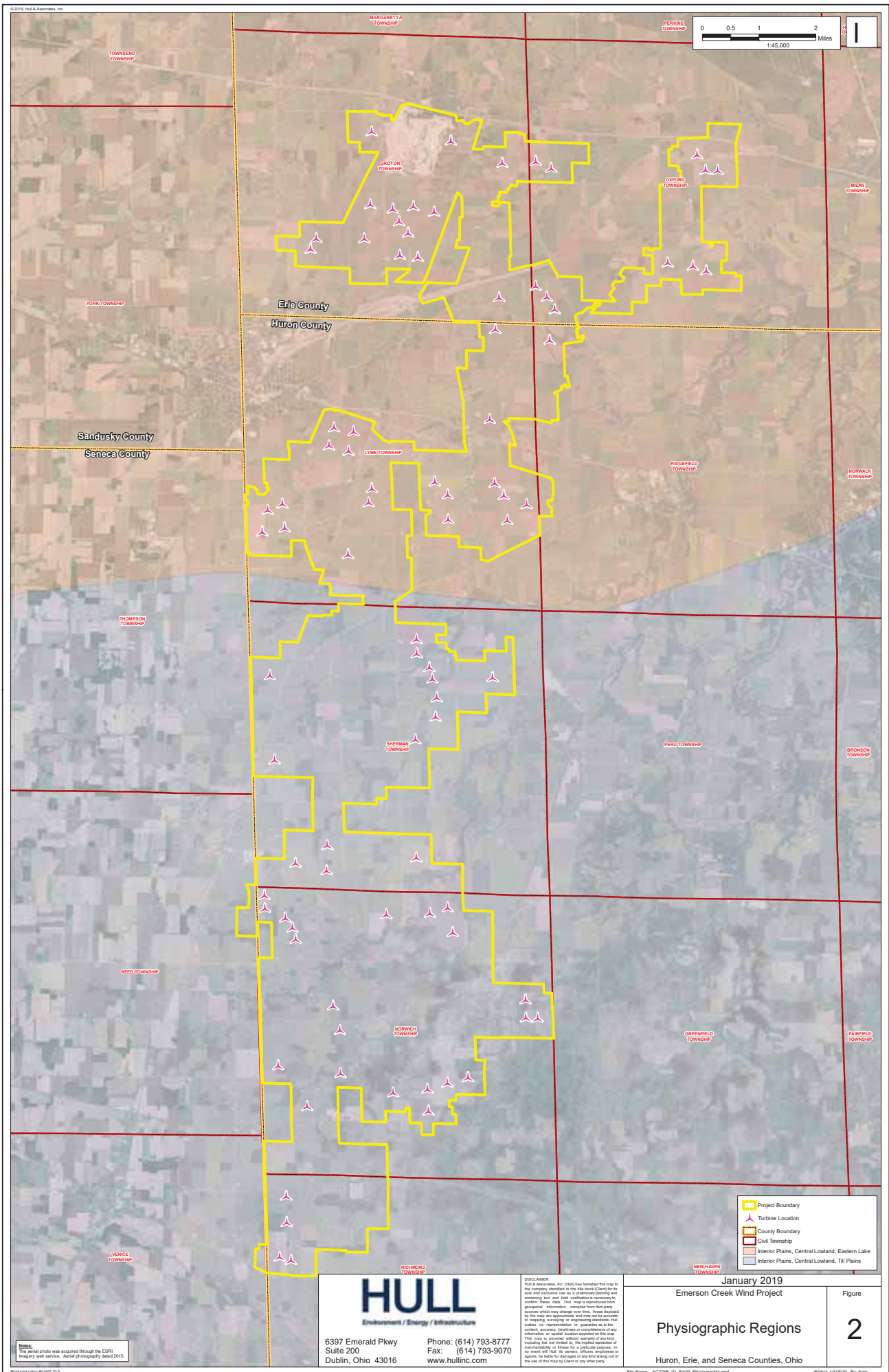
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**Project Boundary with  
Proposed Turbine Locations**

Huron, Erie, and Seneca Counties, Ohio

Figure  
**1**





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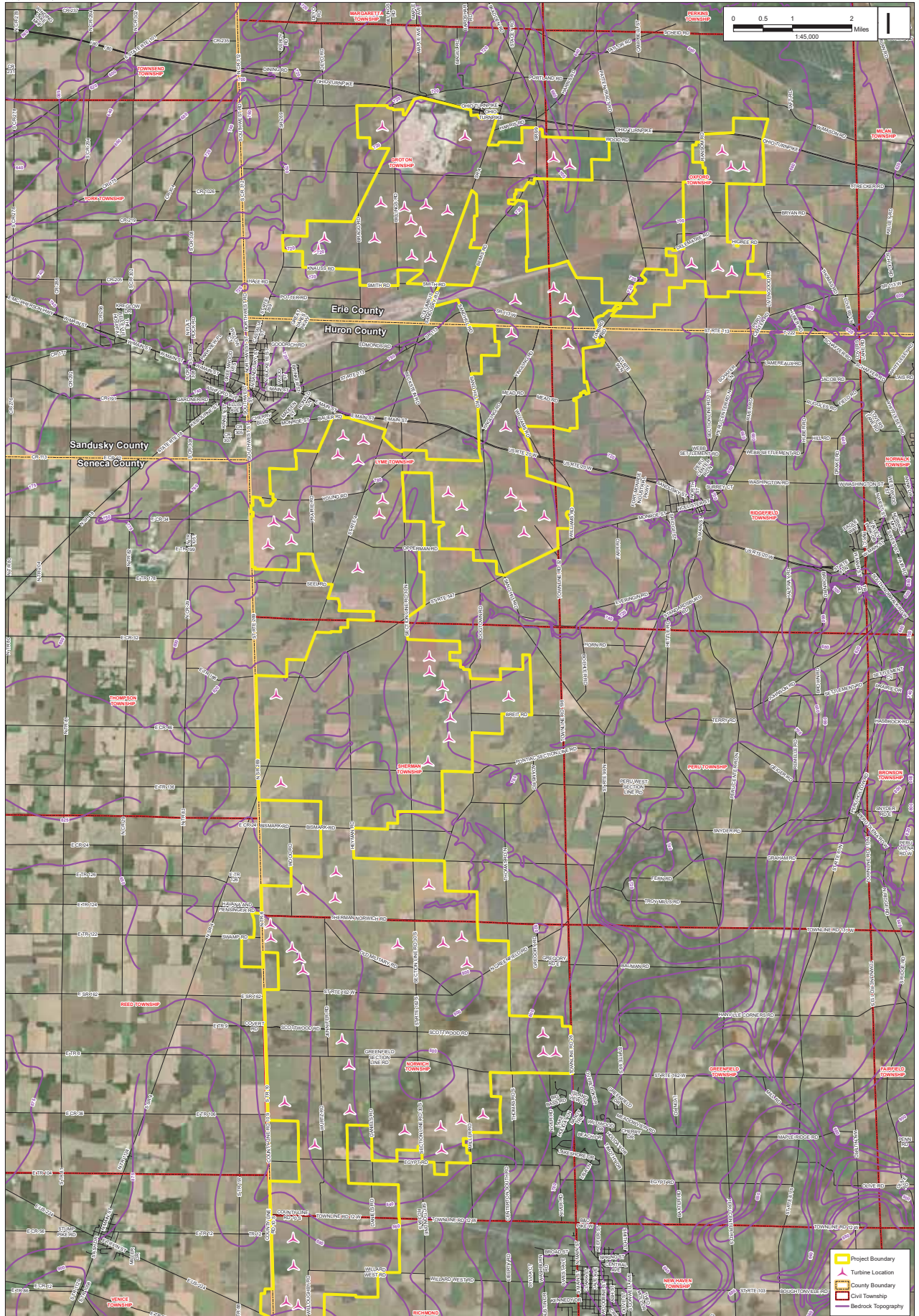
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**Physiographic Regions**  
Huron, Erie, and Seneca Counties, Ohio

Figure  
**2**





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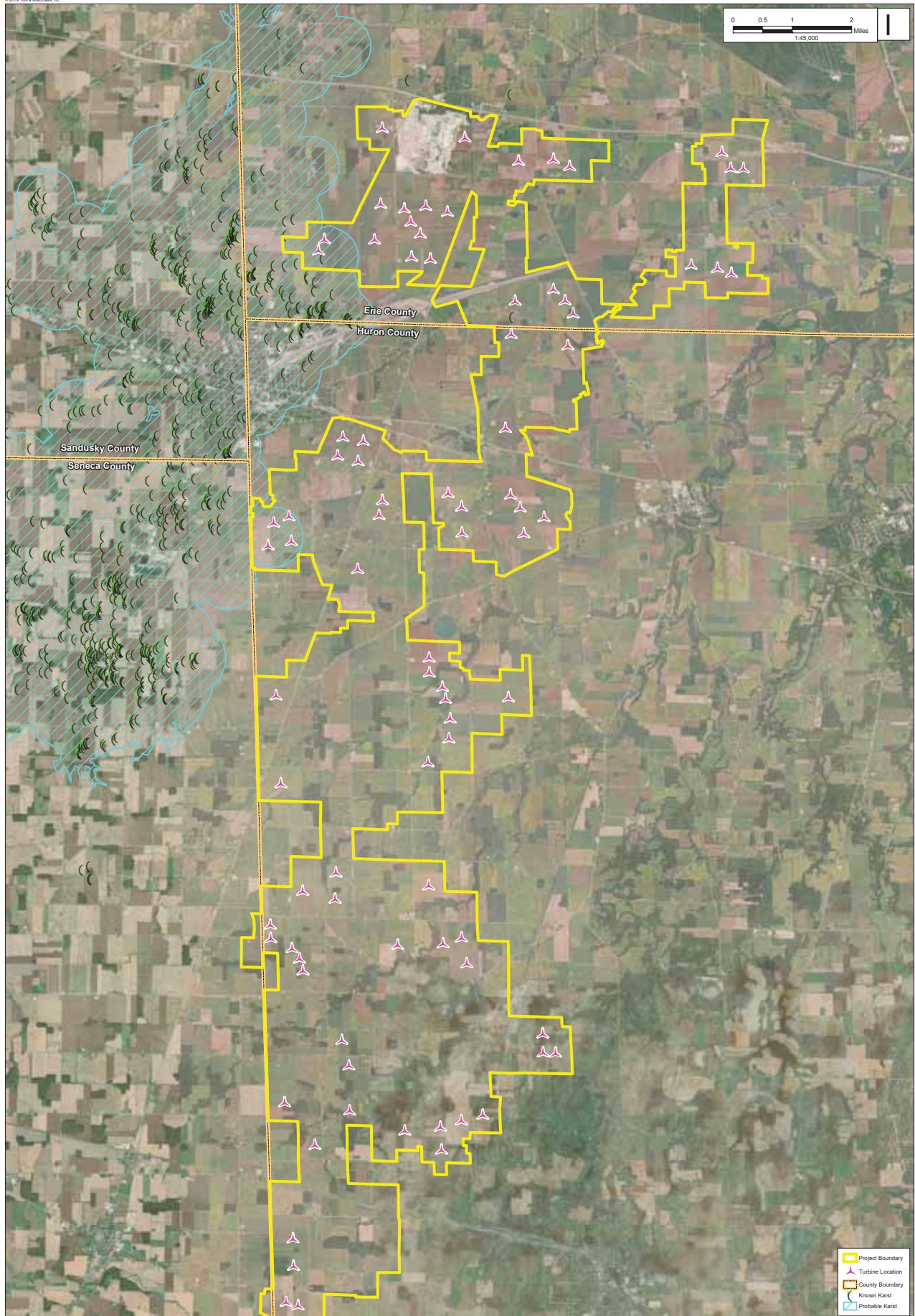
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**Bedrock Topography**

Huron, Erie, and Seneca Counties, Ohio

Figure  
**3**





**Notes:**  
The aerial photo was acquired through the USGS  
Imagery web service. Aerial photography dated 2015.

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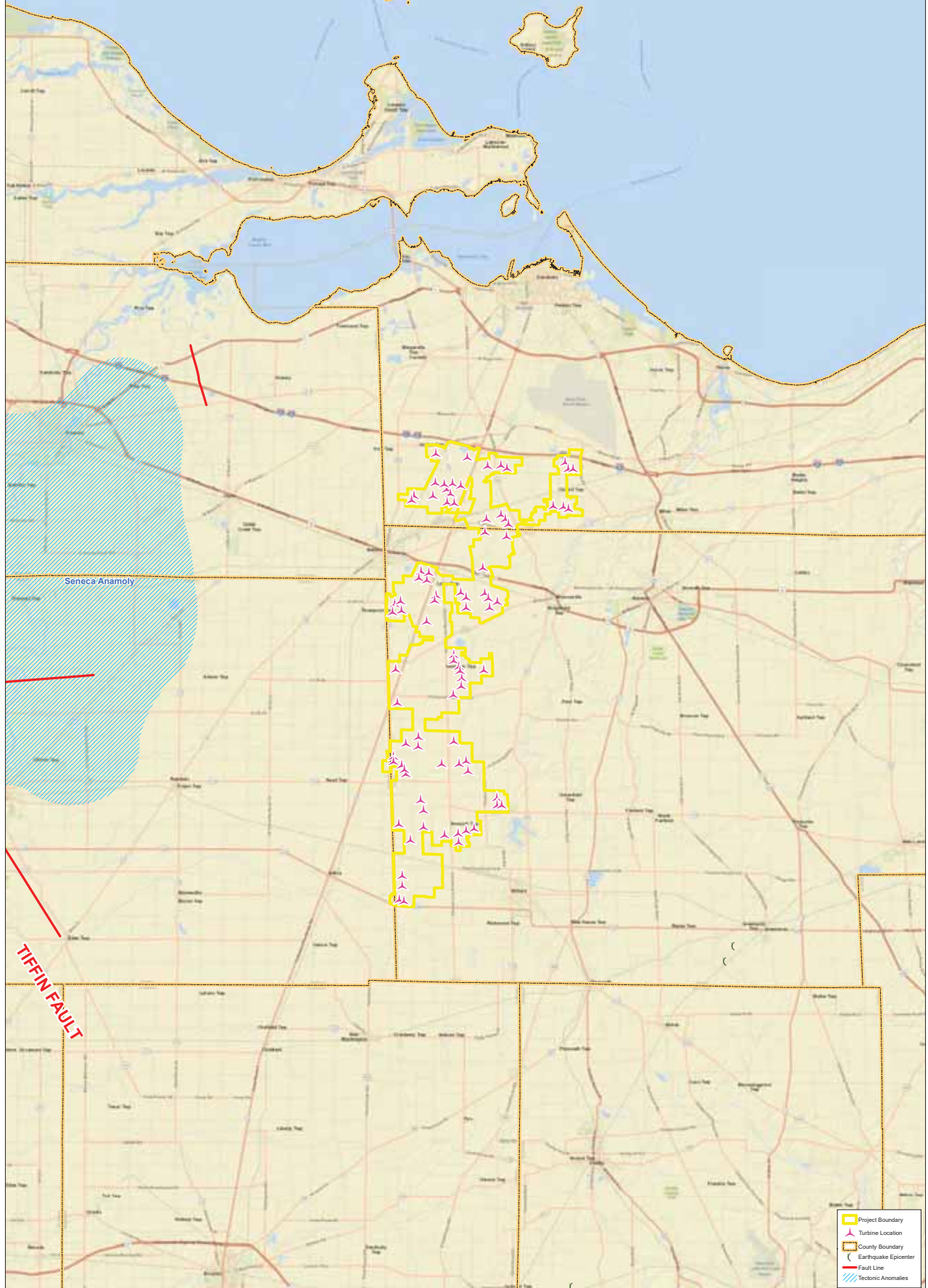
Karst Map

Huron, Erie, and Seneca Counties, Ohio

Figure

4





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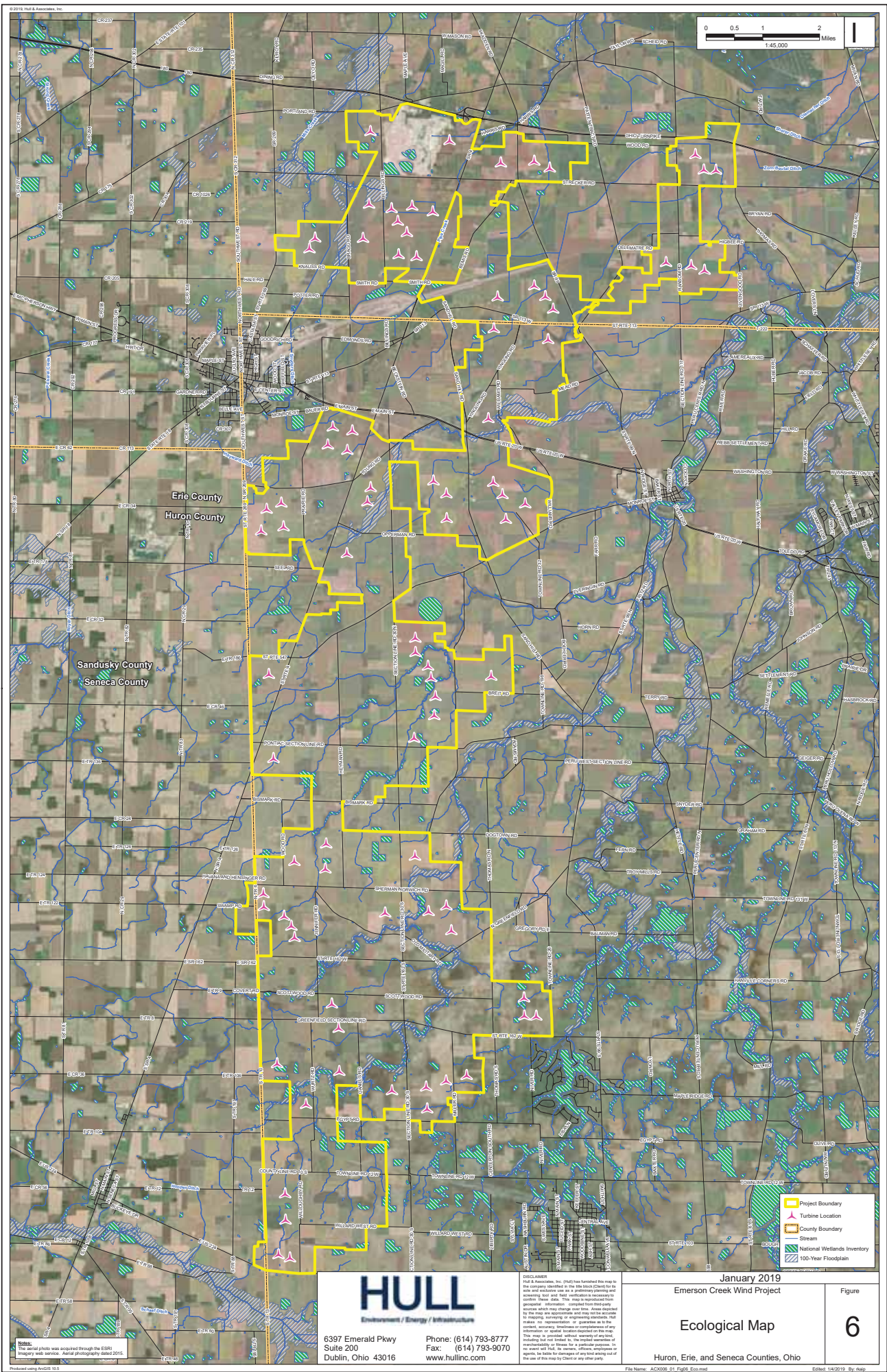
Geophysical Map

Huron, Erie, and Seneca Counties, Ohio

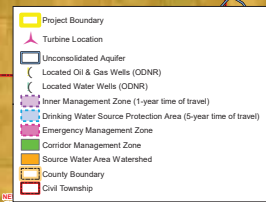
Figure

5









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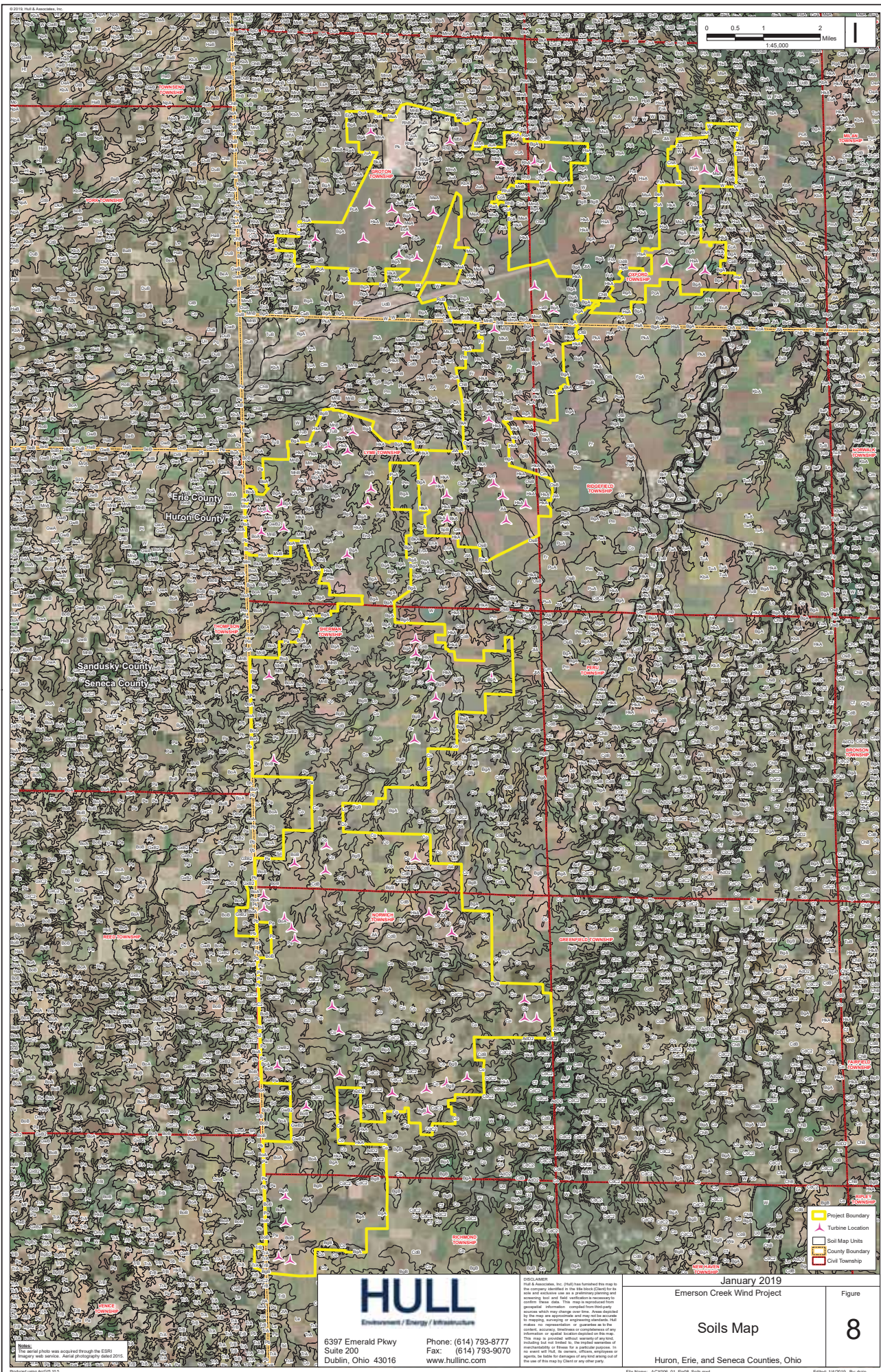
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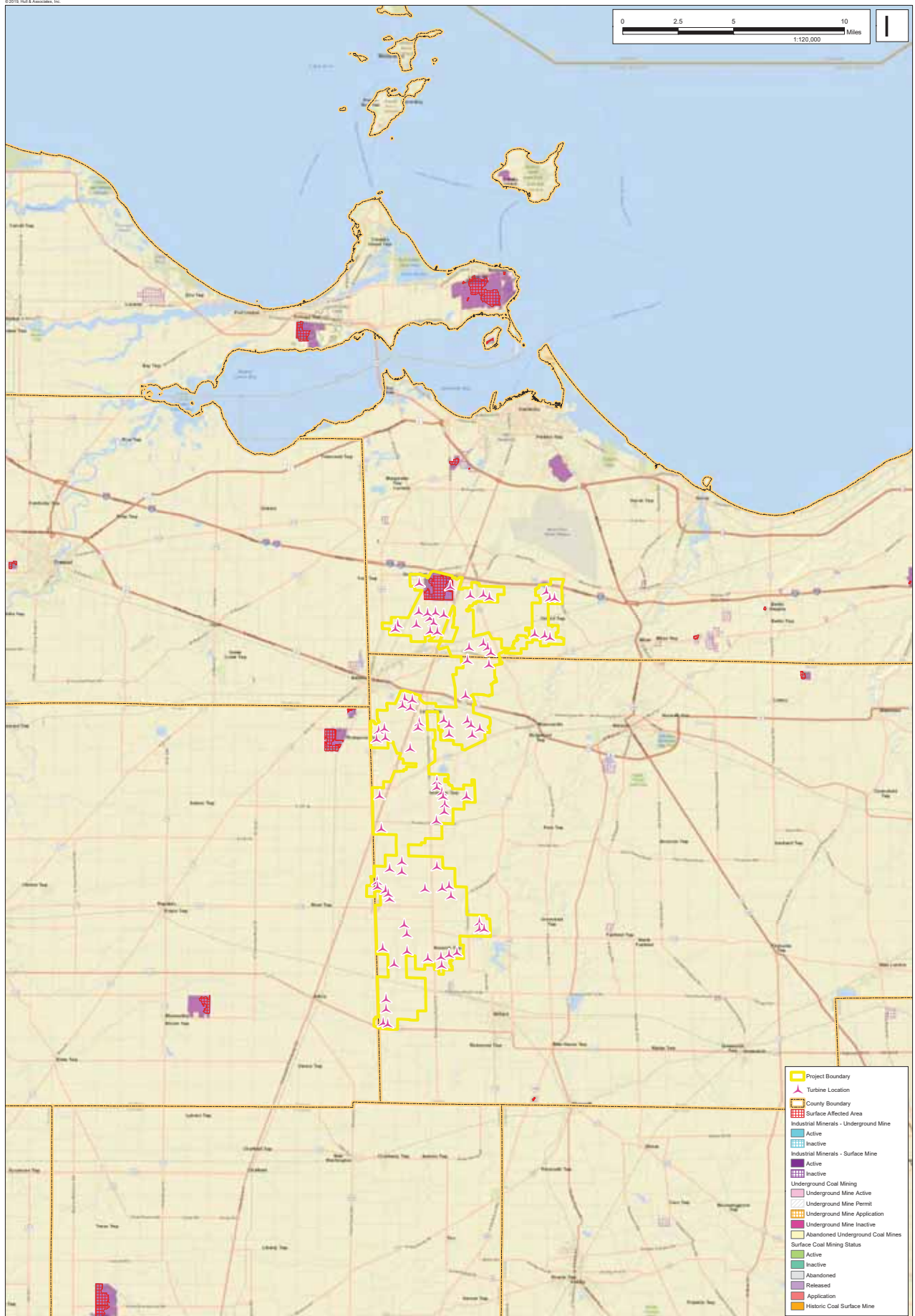
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January 2019 Emerson Creek Wind Project	Figure
Aquifers and Wells	7
Huron, Erie, and Seneca Counties, Ohio	









- Project Boundary
- ▲ Turbine Location
- County Boundary
- Surface Affected Area
- Industrial Minerals - Underground Mine
- Inactive
- Industrial Minerals - Surface Mine
- Active
- Inactive
- Underground Coal Mining
- Underground Mine Active
- Underground Mine Permit
- Underground Mine Application
- Underground Mine Inactive
- Abandoned Underground Coal Mines
- Surface Coal Mining Status
- Active
- Inactive
- Abandoned
- Released
- Application
- Historic Coal Surface Mine



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**Mining Map**

Huron, Erie, and Seneca Counties, Ohio

Figure  
**9**

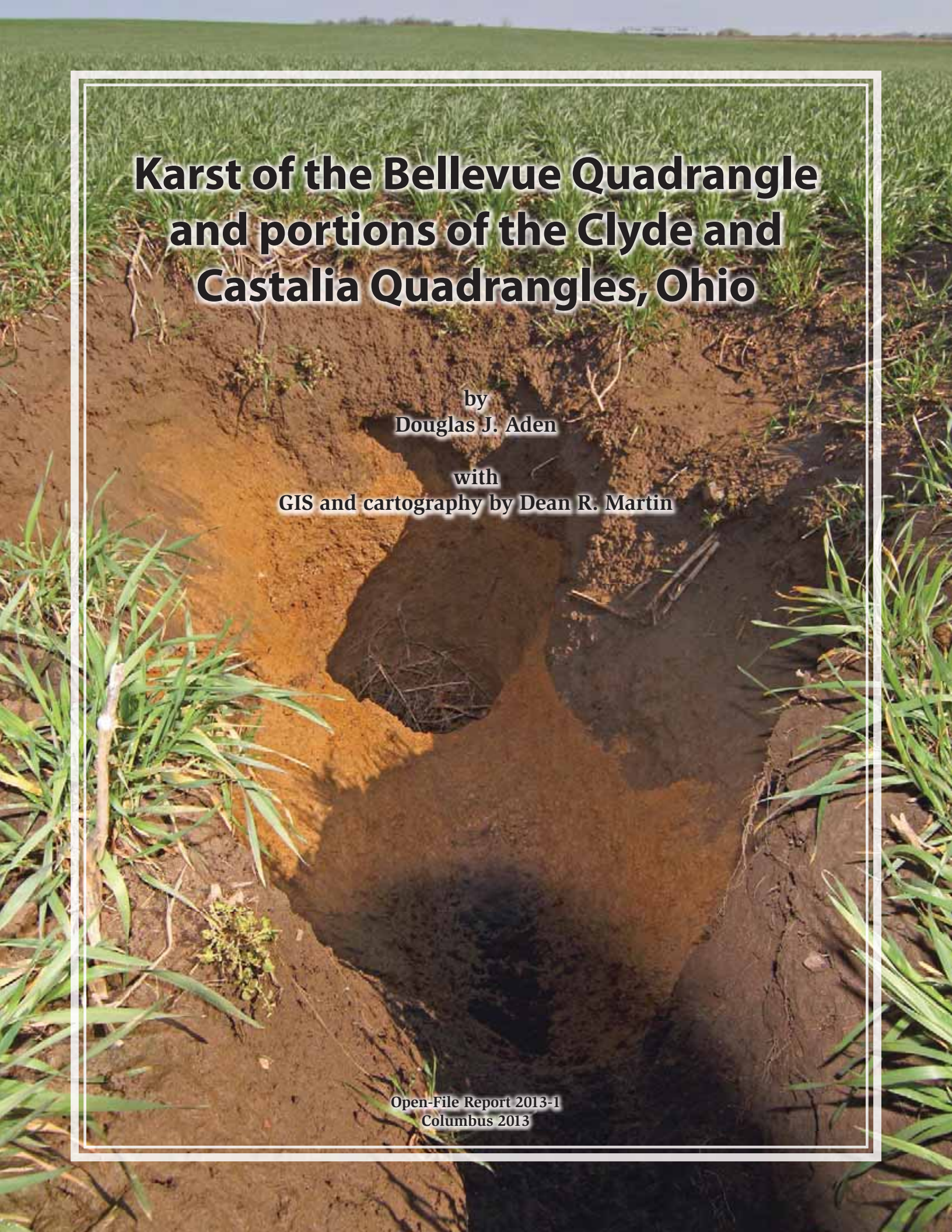
## **APPENDIX A**

### **Karst Studies:**

Karst of the Bellevue Quadrangle and portions of the  
Clyde and Castalia Quadrangles, OH (Aden 2013)

Karst of the Fireside Quadrangle and portions of the  
Flat Rock and Clyde Quadrangles, OH (Aden 2014)





# **Karst of the Bellevue Quadrangle and portions of the Clyde and Castalia Quadrangles, Ohio**

by  
**Douglas J. Aden**

with  
GIS and cartography by Dean R. Martin

Open-File Report 2013-1  
Columbus 2013





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*Cover image:* At about 6 ft deep, this sink has formed since the winter wheat was planted eight months prior. Brown top soil is visible above the orange till and plant material has been washed in by rain and fills the sink throat. Photo faces north and a truck can be seen on Interstate 80 on the horizon. Eighty-five feet SW of this sink is an intermittent disappearing stream that aligns with the trend of the much larger depression containing these features. The overall depression is 10 ft deep (with the pictured sink another 6 ft deeper) about 1.25 mi long, 1000 ft wide, and bisected by the Interstate.

*Recommended citation:* Aden, D.J., 2013, Karst of the Bellevue Quadrangle and portions of the Clyde and Castalia Quadrangles, Ohio: Columbus, Ohio Department of Natural Resources, Division of Geological Survey Open-File Report 2013-1, 4 p., 59 maps.

# Karst of the Bellevue Quadrangle and portions of the Clyde and Castalia Quadrangles, Ohio

by

Douglas J. Aden, with GIS and cartography by Dean R. Martin

## Introduction

Karst terrain forms by dissolution of carbonate rocks, such as limestone or dolomite, or evaporites, such as gypsum or salt, and is characterized by features including sinkholes, disappearing streams, caves, and springs. *Sinkholes* (or *sinks*) are enclosed depressions that do not usually hold water; they often have a “throat” or opening at the bottom where they drain to the subsurface. When a stream flows into a sinkhole, it is known as a *disappearing stream* or *losing stream*. Water flowing into the ground can cause solution enlargement of natural fractures in the rock and eventually can grow into caves. In Ohio, a *cave* is defined as “...a naturally occurring void, cavity, recess, or system of interconnecting passages beneath the surface of the earth or within a cliff or ledge...” (State of Ohio, 1989).

The many passageways formed in karst terrain allow for high connectivity between the land surface and the water table. These passageways permit water to 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. When water exits these solutional features, a *spring* is formed. Such springs enable release of these contaminants at the surface.

The different types of karst features may pose infrastructure complications; roads, utilities, houses, and other facilities built in karst areas are at risk of subsidence, collapse, or other damage. In order to provide a reference for future planning on both the local and regional scale, the Ohio Geological Survey has produced this map book identifying the known and suspected karst areas in the vicinity of Bellevue, Ohio.

## Previous Work

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 was mapped statewide to determine areas suitable for storage of low-level nuclear byproducts. Ohio’s preliminary map of karst features (Pavey and others, 1999) was completed in 1997 and released in 1999; it since has been updated with new data in 2003, 2005, and 2007 and will be updated again in the near future.

In the spring of 2008, severe karst-related flooding occurred in Bellevue and initiated increased concern regarding Ohio’s geohazards (Raab and others, 2009; Pavey and others, 2012). From 2011 to 2012, karst was mapped in the Delaware County region (Aden and others, 2011) and in the Springfield and Donnelsville 7.5-minute quadrangles (Aden 2012). Finally, from fall 2012 to spring 2013 karst was mapped in the Bellevue 7.5-minute quadrangle and parts of the Clyde and Castalia quadrangles.

## Methodology

A digital elevation map (DEM), generated from LiDAR (Light Detection and Ranging) data, was used to create a map layer that identified low, enclosed areas. To locate potential sinkholes, these low spots were cross referenced with known karst points, bedrock geology, aerial photography of multiple sources and ages, soil maps, glacial drift thickness maps, and water well logs. Suspect locations were then visited in the field, evaluated, and photographed. Through this process many of the LiDAR returns were found not to be sinkholes; features such as building foundations, broken field tiles, steep-walled streams, road culverts, and glacial features often produced enclosed areas



similar in shape to sinkholes. Many of these misleading features were eliminated remotely using both 6-inches-per-pixel aerial photography and experience from past field verification. However, many points remained that could not be distinguished remotely and these were visited in the field.

## Results

The resulting karst feature data set was overlain on four different geologic data sets—the Land Surface, the Bedrock Geology, the Bedrock Topography, and the Drift Thickness maps—to show how the features are related to the local geology. The first of these is the Land Surface map (p. 5), which shows the 107 two-km<sup>2</sup> tiles and the 7.5-minute quadrangles that form the project area overlain on the DEM of the land surface. The Bellevue quad was the core project area. However, some adjacent points were mapped as time allowed, particularly in Clyde and Castalia; these areas will be completed as part of next year's project. The land surface map shows that in Bellevue sinks are concentrated to the south and east while springs are found down gradient north and west.

On the Land Surface map, tiles outlined in red contain the karst features identified through this project. No karst was identified in black-outline tiles. In total there are 997 karst features, including 29 springs, in 107 tiles. On the top left of each aerial imagery page (p. 9–68) is a Tile Number that references the corresponding numbered tile on the four overlay maps.

There are four types of karst features identified on each map:

- ♦ Red circles indicate field-verified features, i.e., those that have been visited in the field and confirmed as karst.
- ♦ Orange circles indicate sites that were visited but could not be verified at the time, for example a suspicious depression that is flooded or that lacks an active sink throat and cannot be clearly classified.
- ♦ Yellow circles represent areas with suspect characteristics, such as a distinct LiDAR depression, but where access to the property could not be gained or where there was not enough time to check the point.
- ♦ Blue squares represent springs, including “blue holes,” where water was found flowing from the subsurface, primarily to the north.

The next overlay map is the Bedrock Geology map (p. 6). This map shows that the karst features are forming primarily by dissolution of the Columbus Limestone; however, it is thought that the Salina undifferentiated below is also affecting the sinks. The Salina contains beds of the mineral anhydrite, which alters to gypsum by hydration. This change causes swelling of about 40 percent (Boggs, 2006), which could help to fracture surrounding rocks; but more importantly, gypsum is easily dissolved by additional ground water, removing roof support and leading to collapse. In the Bellevue region there are two main ways that karst is expressed: one where catastrophic collapse forms a steep-walled, cone-shaped depression with active sinking and a second that is much more broad and shallow and may or may not have an active sink throat where water is draining into it.

Eight hundred and twenty three of the 997 karst features are within the Columbus Limestone (**Dc** on the Bedrock Geology map) with the majority of the remaining features in the Bass Islands Dolomite or Salina undifferentiated (within the **Sbi** or **Ssu**). These formations and the others on the Bedrock Geology map are buried in many places by surficial glacial materials. The elevation of the bedrock below the surficial materials is called Bedrock Topography and is shown on page 7. The elevations of the bedrock surface were subtracted from the DEM (p. 5) to create the Drift Thickness map (p. 8). Knowing the drift thickness is useful because where the drift is shallow—about 25 ft or less—sinkholes are commonly expressed. Other sinkholes may exist but were either buried beneath the glacial drift or prevented from forming by thick drift. The Drift Thickness map clearly shows that in the Bellevue area the sinkholes are concentrated along areas of thin glacial drift.

## Conclusions

Of the 997 mapped karst features, 415 have photos and 838 appear on LiDAR. Of the 29 springs, nine have a LiDAR response while 20 do not. Springs do not typically show up as depressions unless a catch basin was built and subsequently failed or a build-up of material deposits from carbonate-rich spring waters forms a mound. The large number of sinks and springs found without LiDAR attests to the need for spending time in the field near known karst areas, looking for new features and talking to the public; many of the

springs in the Bellevue area were reported by a local resident, Jim Norrocky. Farmers and other land holders are still one of the best sources of local information, particularly for historical features, such as drained ponds, old mill races, and even sinkholes that have been periodically filled in.

In addition to this map book, a DVD containing the GIS data, metadata, LiDAR depressions, and photographs of many of the features is available. The GIS data contains details such as the location of each point and a brief description of what was found there. The metadata provides information on the sources and quality of the data used in this project. The LiDAR depressions layer records the depth and area for many of the sinkholes. In addition, the collection of photographs captured for many of these features can be used to monitor the growth of preexisting sinkholes and development of new karst features, as well as assisting in identification. Identification is important because karst regions are highly susceptible to pollution and structures built near them may subside. Furthermore, in the Bellevue region, low-lying karst features may be subject to flooding during periods of unusually high precipitation when the water table rises above the land surface. The maps in this report will allow areas of land development near karst features to be better planned and maintained.

## Acknowledgments

The Bellevue project, the Delaware County region project, and the Springfield project were funded by the Great Lakes Geologic Mapping Coalition surficial mapping grant program.

## References Cited

- Aden, D.J., 2012, Karst of Springfield, Ohio: Ohio Department of Natural Resources, Division of Geological Survey Open-File Report 2012-2, 3 p., 25 maps, accessible at <[http://geosurvey.ohiodnr.gov/portals/geosurvey/PDFs/OpenFileReports/OFR\\_2012-2.pdf](http://geosurvey.ohiodnr.gov/portals/geosurvey/PDFs/OpenFileReports/OFR_2012-2.pdf)> .
- Aden, D.J., Powers, D.M., Pavey, R.R., Jones, D.M., Martin, D.R., Shrake, D.L., and Angle, M.P., 2011, Karst of the western Delaware County, Ohio, region: Ohio Department of Natural Resources, Division of Geological Survey Open-File Report 2011-4, 2 p., 35 maps, accessible at <[http://geosurvey.ohiodnr.gov/portals/geosurvey/PDFs/OpenFileReports/OFR\\_2011-4.pdf](http://geosurvey.ohiodnr.gov/portals/geosurvey/PDFs/OpenFileReports/OFR_2011-4.pdf)> .
- Boggs, Sam, Jr., 2006, Principles of sedimentology and stratigraphy (4th ed.): Upper Saddle River, NJ, Pearson Prentice Hall, p.199.
- State of Ohio, 1989, Ohio Revised Code 1517.21 Cave definitions, *in* chap. 1517 of Title 15 Conservation of Natural Resources: State of Ohio, Ohio Revised Code, accessible at <<http://codes.ohio.gov/orc/1517.21>> .
- Pavey, R.R., Angle, M.P., Powers, D.M., Swinford, E.M., 2012, Karst flooding in Bellevue, Ohio, and vicinity—2008: Ohio Department of Natural Resources, Division of Geological Survey Map EG-5, scale 1:24,000.
- Pavey, R.R., Hull, D.N., Brockman, C.S., Schumacher, G.A., Stith, D.A., Swinford, E.M., Sole, T.L., Vorbau, K.E., Kallini, K.D., Evans, E.E., Slucher, E.R., and Van Horn, R.G., with GIS and cartography by Powers, D.M., and Vogt, K.L., 1999, Known and probable karst in Ohio: Ohio Department of Natural Resources, Division of Geological Survey Map EG-1, scale 1:500,000. [Revised 2002, 2004, 2007.]
- Raab, James, Haiker, Bill, Jones, Wayne, Angle, Michael, Pavey, Rick, Swinford, Mac, and Powers, Donovan, 2009, Ground water induced flooding in the Bellevue Ohio area, spring and summer 2008: Ohio Department of Natural Resources, Division of Water Technical Report of Investigation 2009-1, 19 p., accessible at <[http://geosurvey.ohiodnr.gov/portals/geosurvey/PDFs/Karst/Bellevue\\_Final\\_Report.pdf](http://geosurvey.ohiodnr.gov/portals/geosurvey/PDFs/Karst/Bellevue_Final_Report.pdf)> .

## Further Reading

For more information on karst in Ohio, visit the Ohio Geological Survey website, **OhioGeology.com**. The following resources also provide additional information on karst and its effects in Ohio and beyond.

### Ohio Department of Natural Resources

*Ground Water Induced Flooding in the Bellevue Ohio Area Spring and Summer 2008*, ODNr Division of Water Technical Report of Investigation 2009-1, 19 p.

*Karst Flooding in Bellevue, Ohio, and Vicinity—2008*, ODNr Division of Geological Survey Map EG-5, 2012, scale 1:24,000.

*Known and Probable Karst in Ohio*, ODNR Division of Geological Survey Map EG-1, generalized page-size version with text, 2 p., scale 1:2,000,000.

American Geological Institute

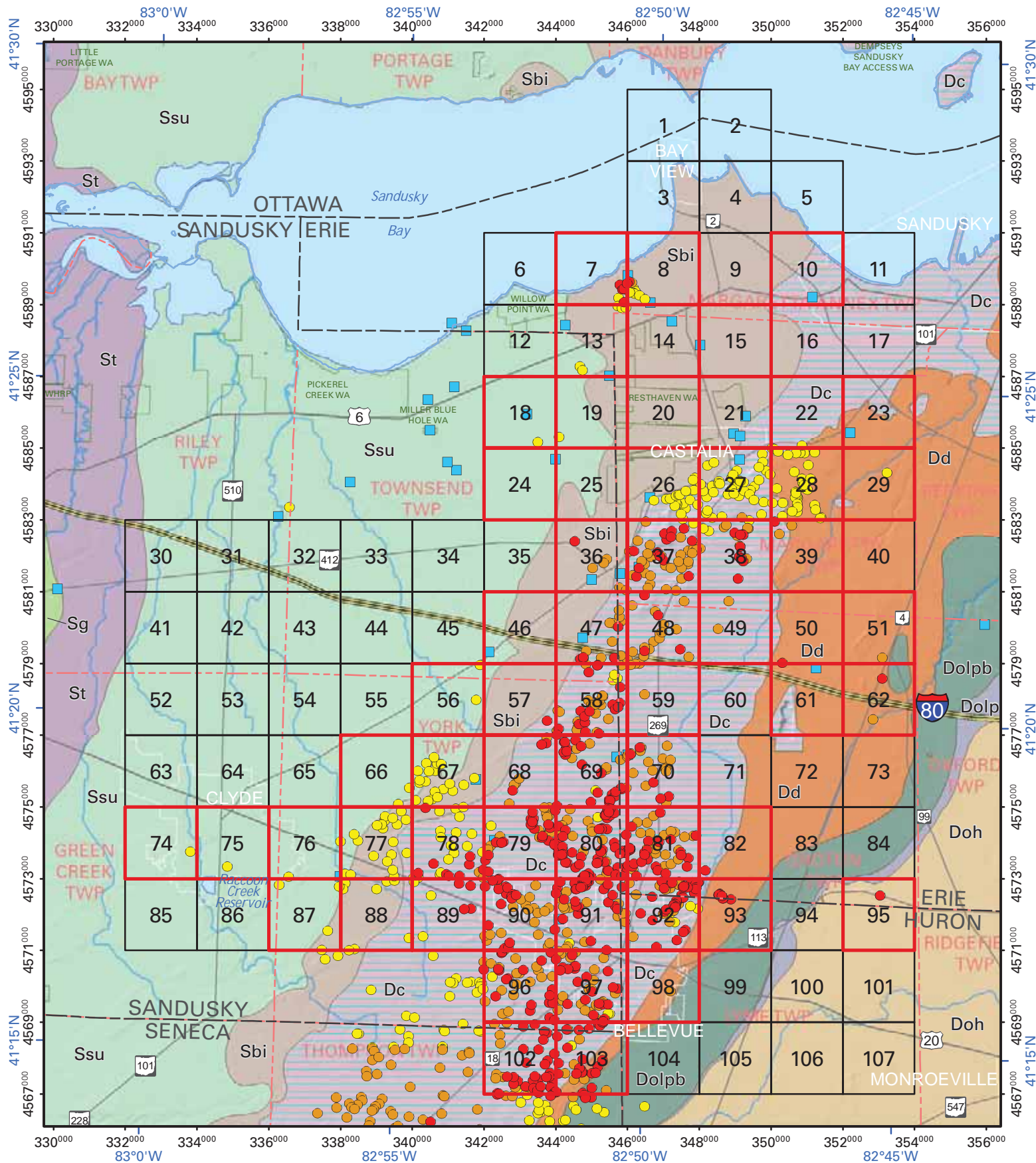
*Living with Karst—A Fragile Foundation*, AGI Environmental Awareness Series, no. 4, accessible at < <http://www.agiweb.org/environment/publications/karst.pdf> > .

U.S. Geological Survey

*USGS Groundwater Information, Karst and the USGS*, accessible at < <http://water.usgs.gov/ogw/karst/> > .







- Tiles containing karst features
- US National Grid

0 5 miles

0 10 kilometers

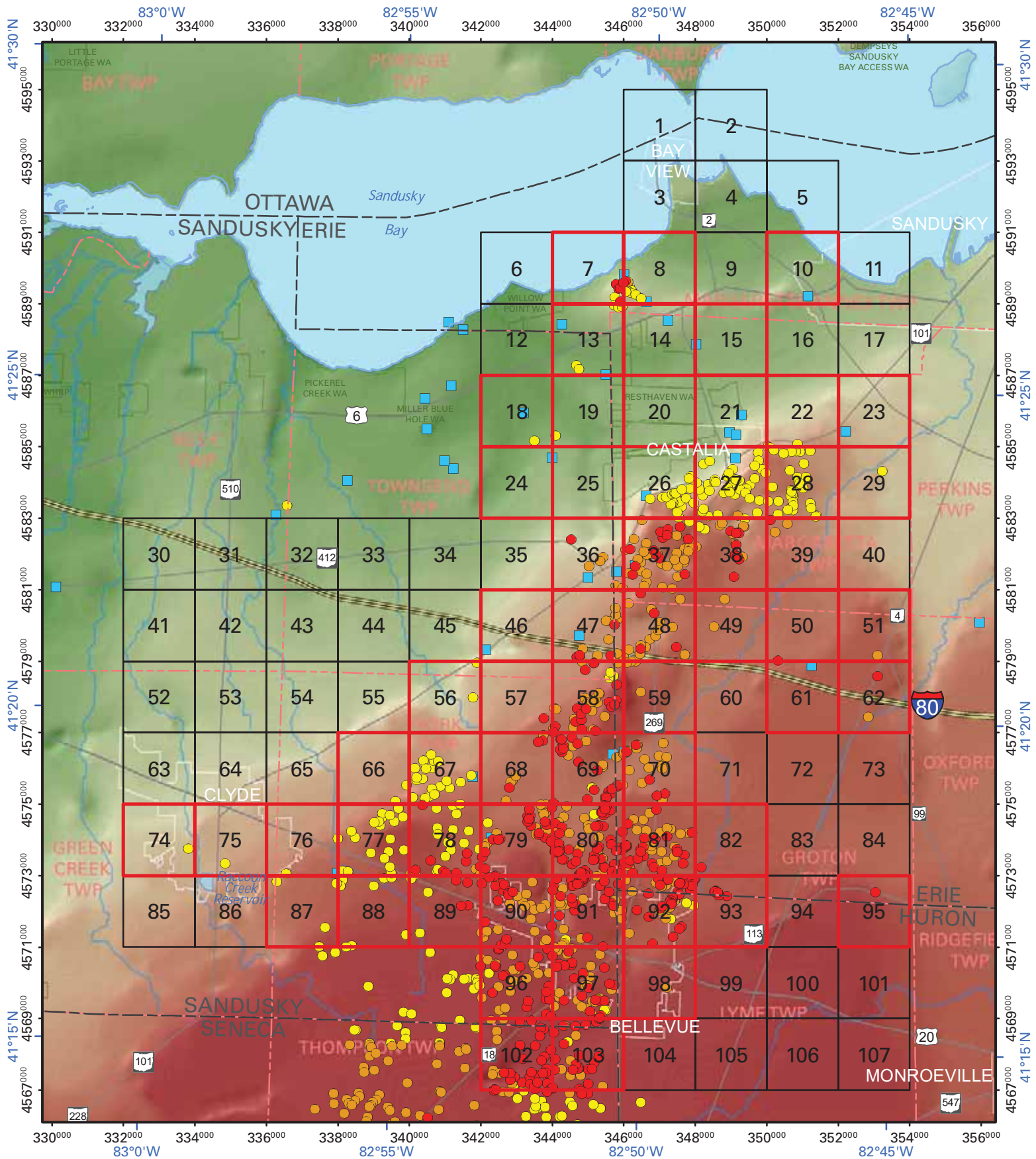
Scale 1:140,000  
Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.

#### KARST FEATURE

- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

#### BEDROCK GEOLOGY

- |  |               |  |                  |
|--|---------------|--|------------------|
| <span style="background-color: #f4a460; border: 1px solid black; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> Doh   | Ohio Sh       | <span style="background-color: #d9c7a7; border: 1px solid black; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> Sbi | Bass Islands Dol |
| <span style="background-color: #a6a6a6; border: 1px solid black; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> Dolp  | Prout Ls      | <span style="background-color: #c7e9c0; border: 1px solid black; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> Ssu | Salina undiff    |
| <span style="background-color: #4f81bd; border: 1px solid black; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> Dolpb | Plum Brook Sh | <span style="background-color: #d9c7a7; border: 1px solid black; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> St  | Tymochtee Dol    |
| <span style="background-color: #f4a460; border: 1px solid black; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> Dd    | Delaware Ls   | <span style="background-color: #c7e9c0; border: 1px solid black; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> Sg  | Greenfield Dol   |
| <span style="background-color: #d9c7a7; border: 1px solid black; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> Dc    | Columbus Ls   |  |                  |



- Tiles containing karst features
- US National Grid

0 5 miles

0 10 kilometers

Scale 1:140,000

Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.

#### KARST FEATURE

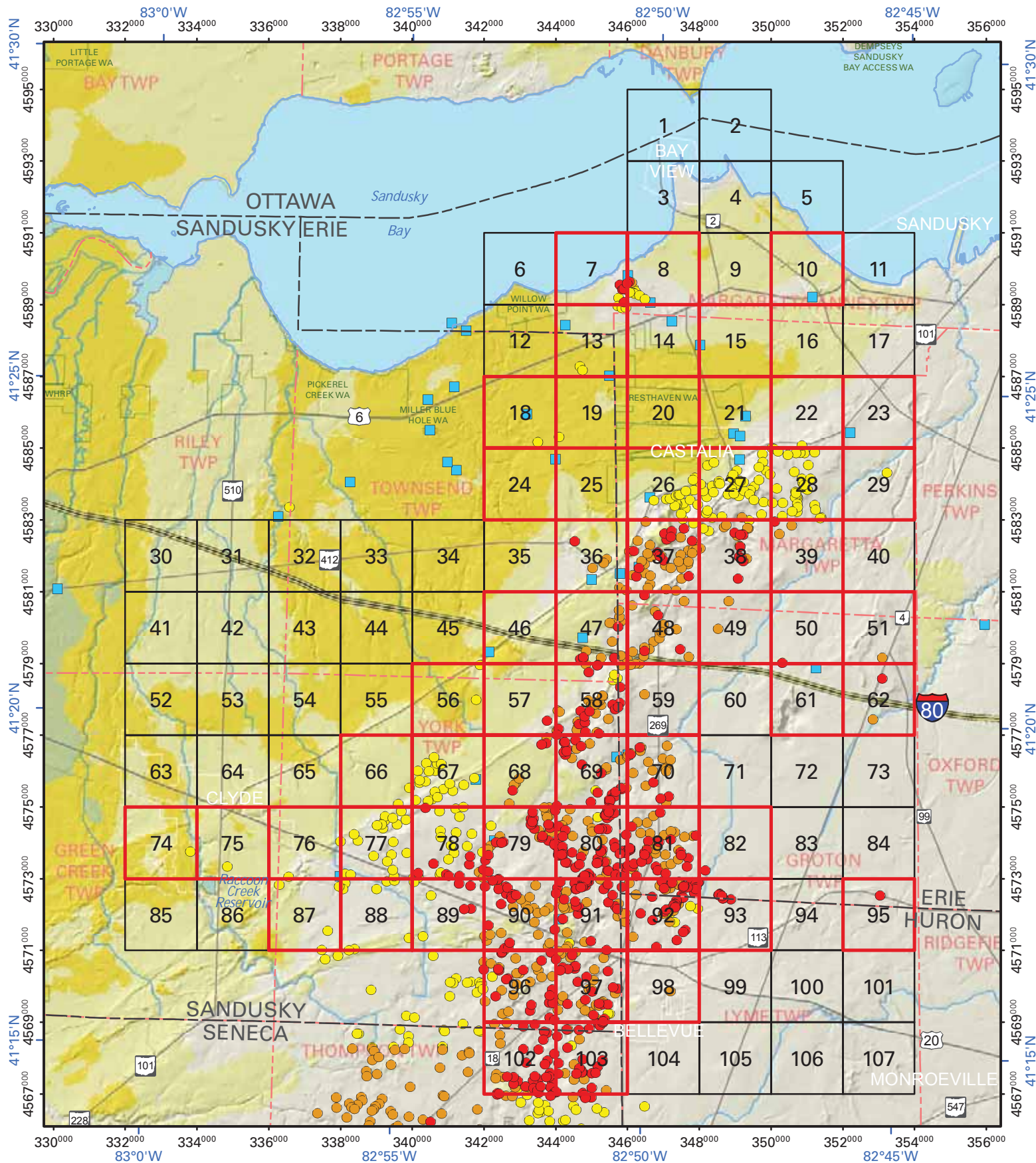
- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

#### BEDROCK TOPOGRAPHY Elevation in feet

High : 797

Low : 467





Tiles containing karst features

US National Grid

0 5 miles

0 10 kilometers

Scale 1:140,000

Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.

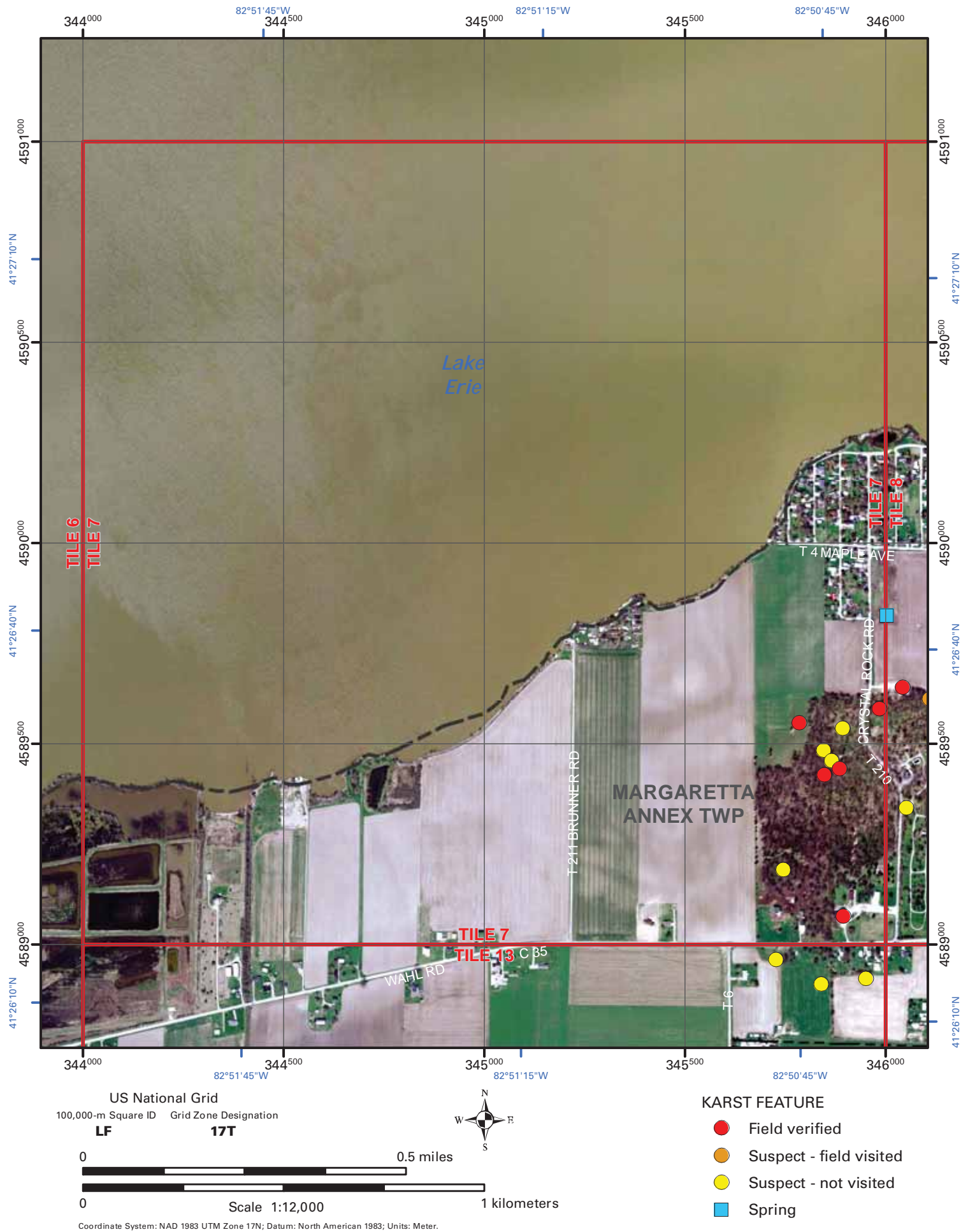
#### KARST FEATURE

- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

#### DRIFT THICKNESS in feet

- <30
- 30—60
- 60—100
- >100

Tile Number: 7





Tile Number: 8





Tile Number: 10



US National Grid  
100,000-m Square ID    Grid Zone Designation  
**LF**                      **17T**



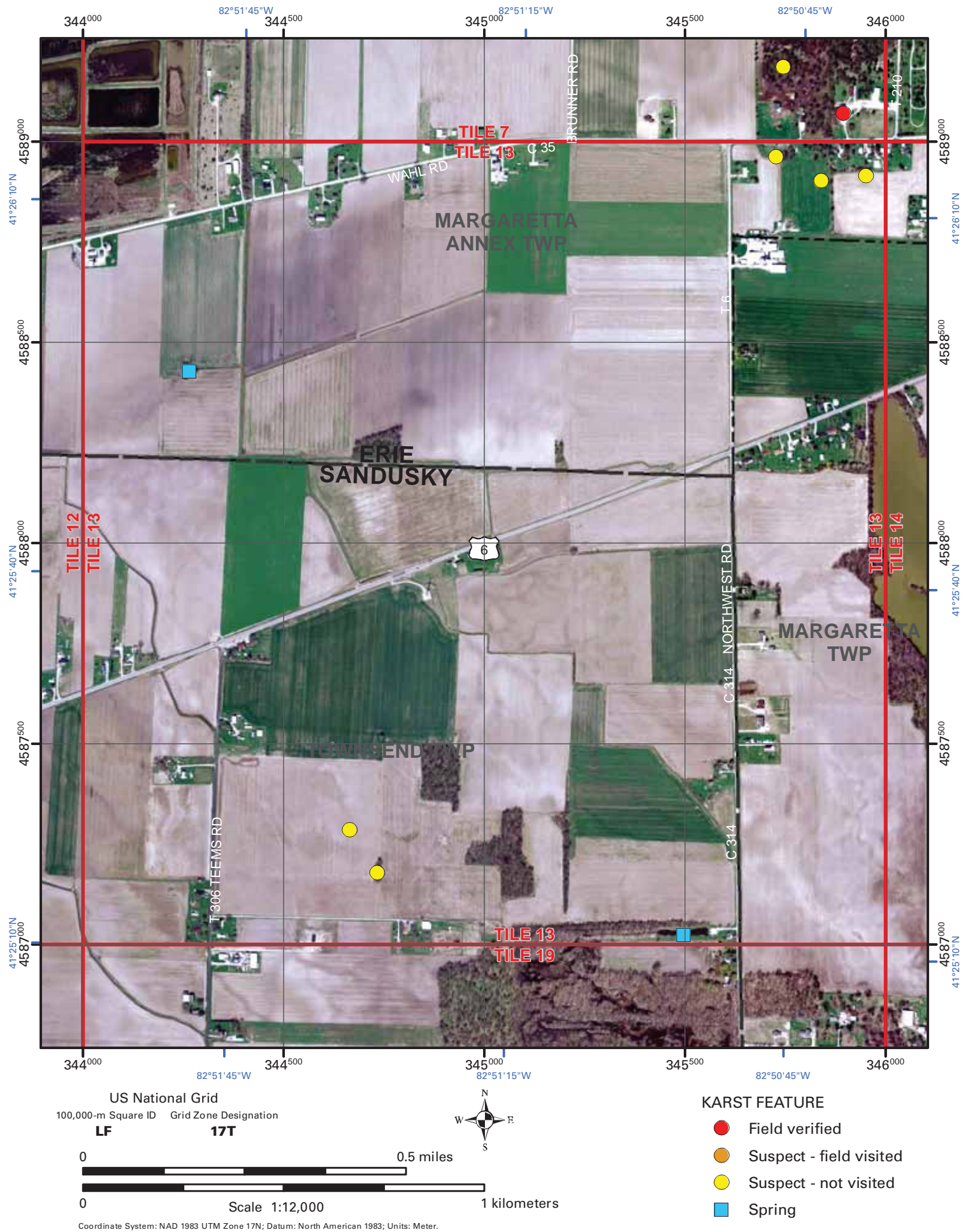
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  - Spring

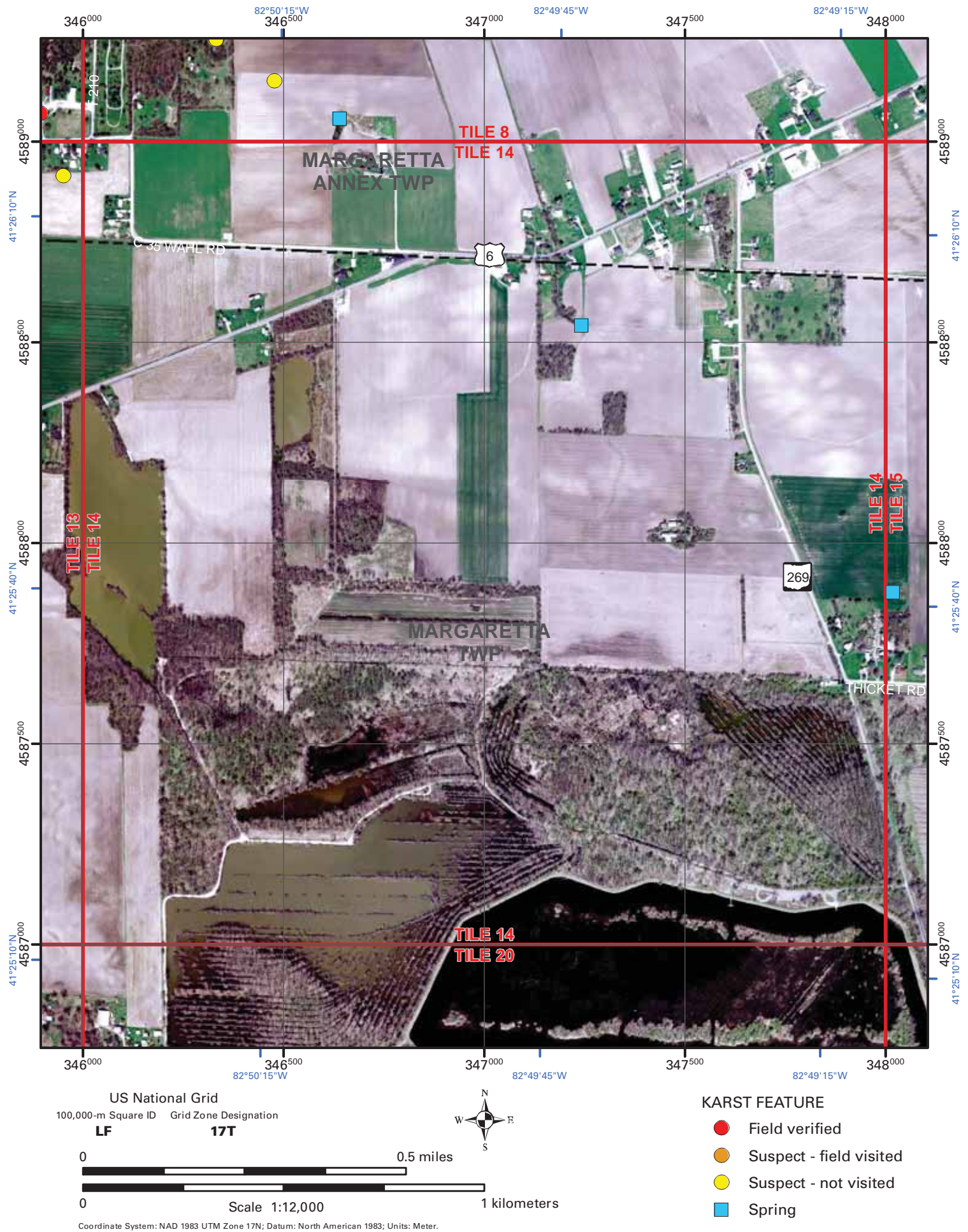


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Tile Number: 14





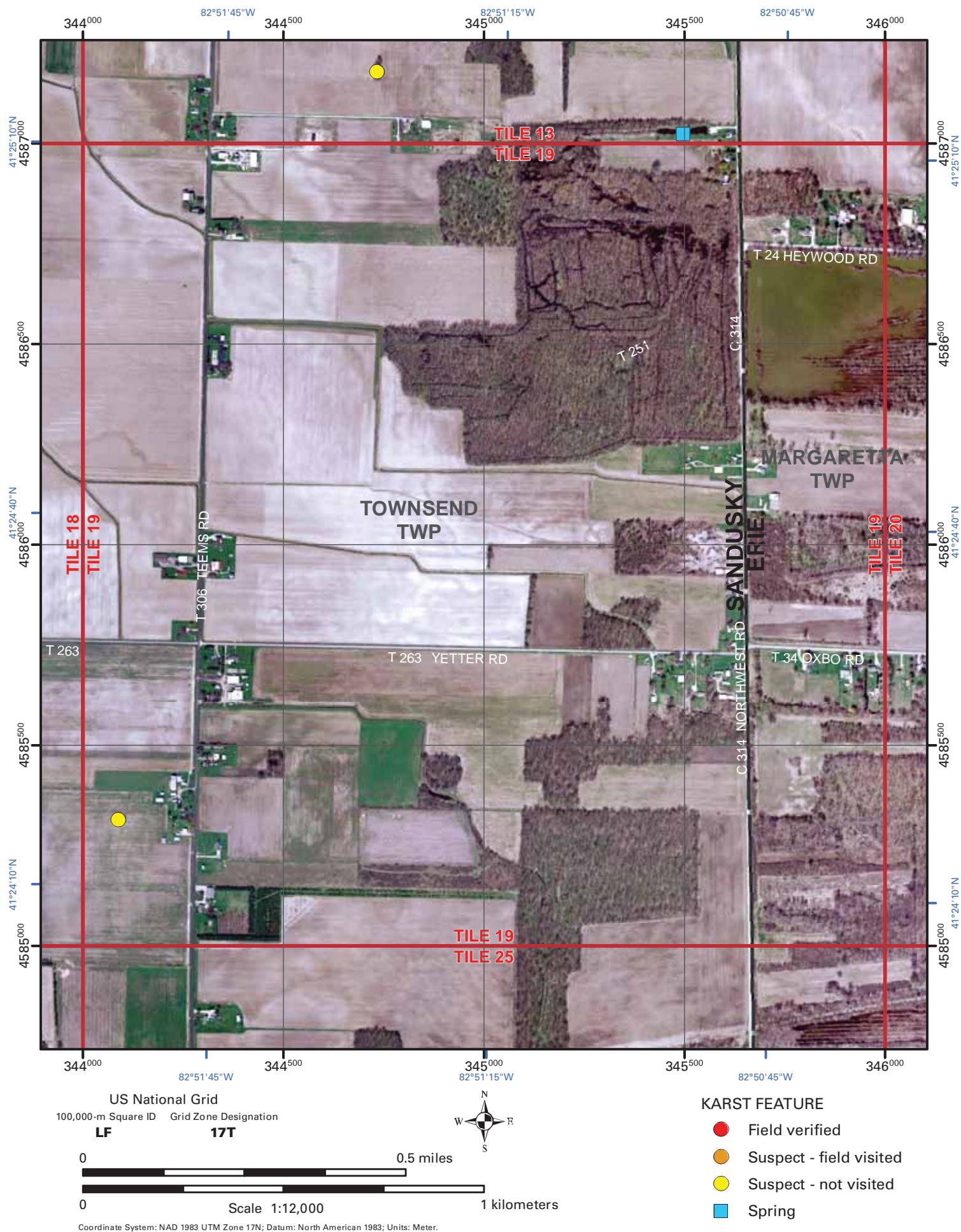
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Tile Number: 18







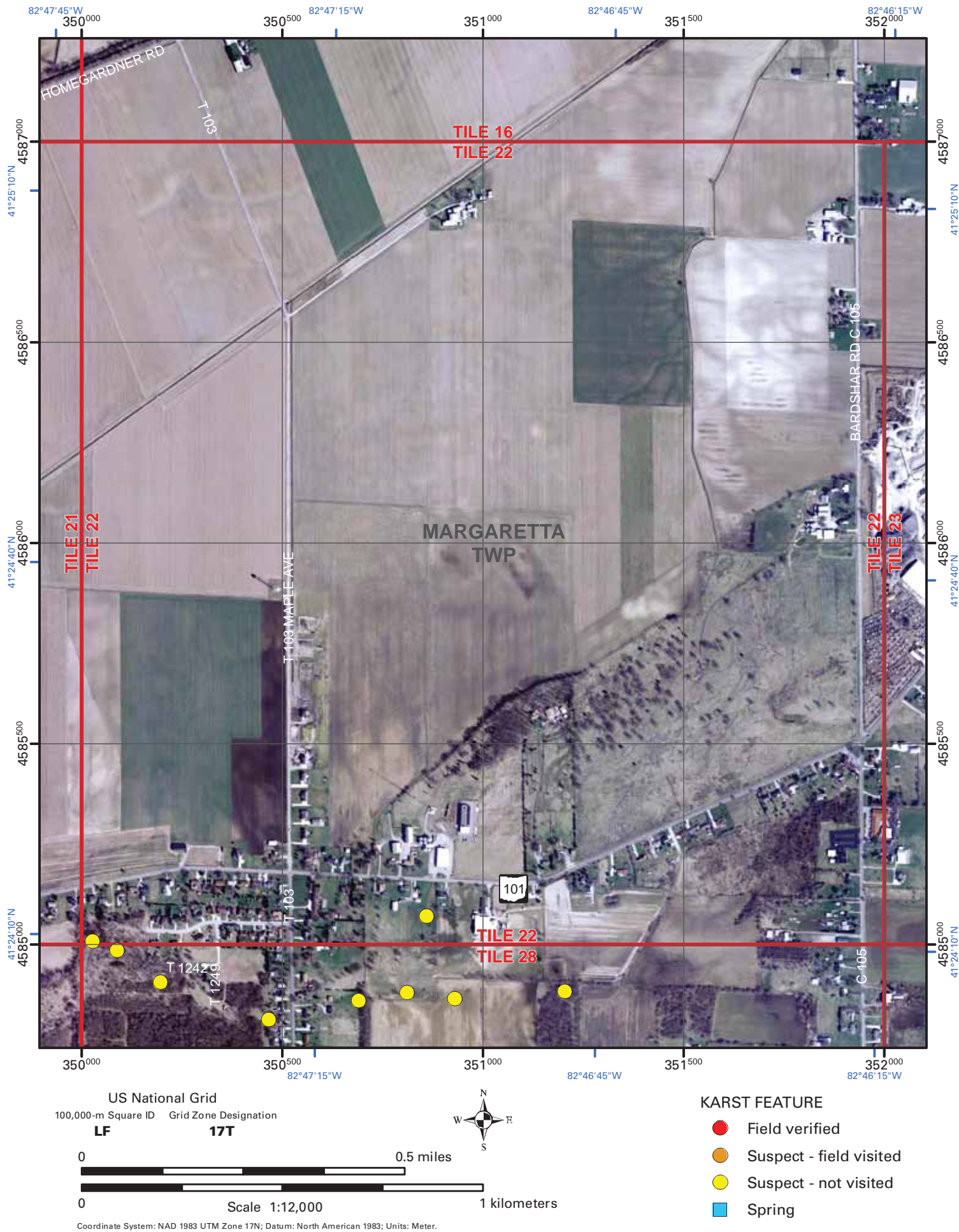


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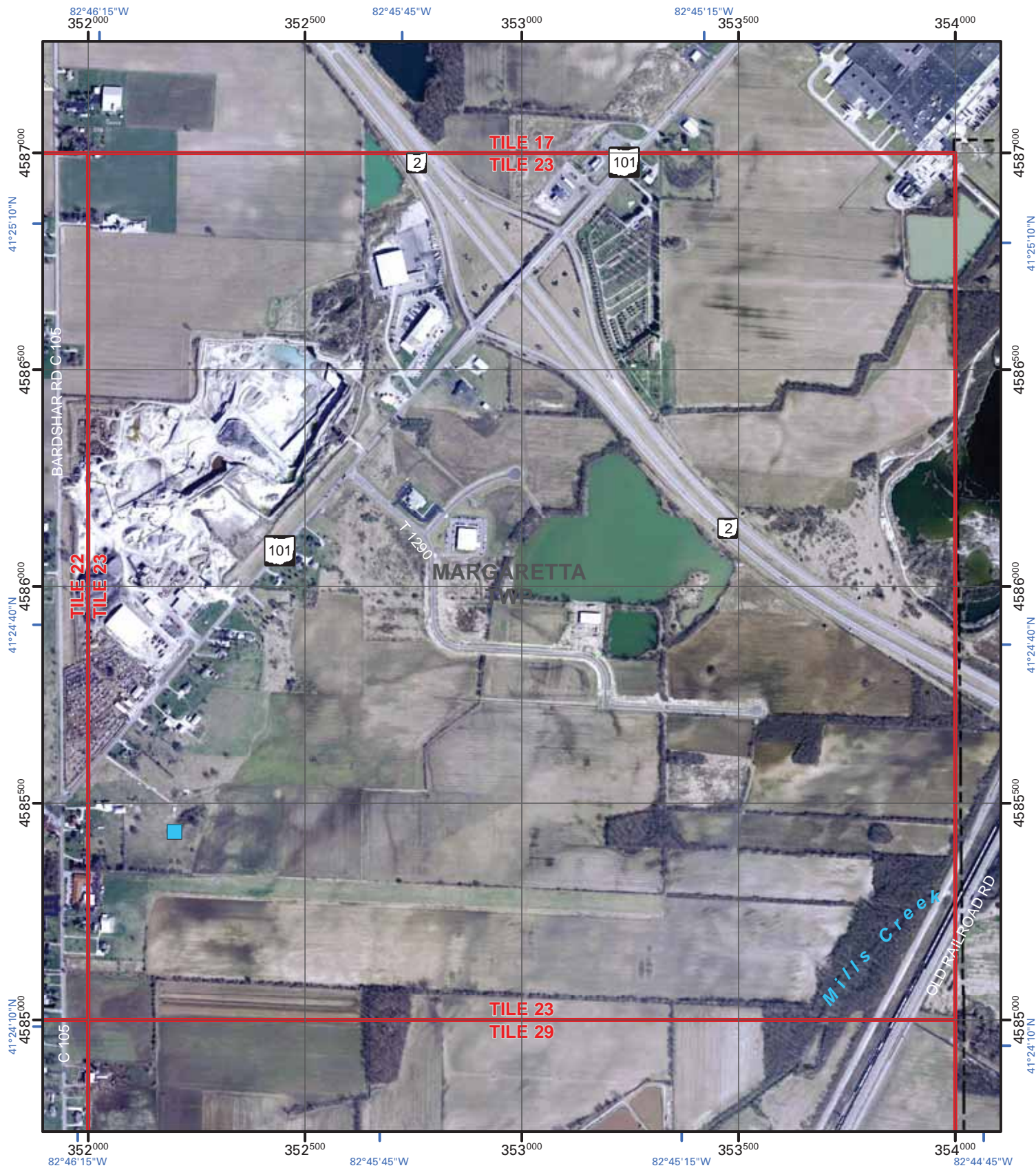


Tile Number: 22





Tile Number: 23



US National Grid  
100,000-m Square ID    Grid Zone Designation  
**LF**                      **17T**



Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.



- KARST FEATURE**
- Field verified
  - Suspect - field visited
  - Suspect - not visited
  - Spring

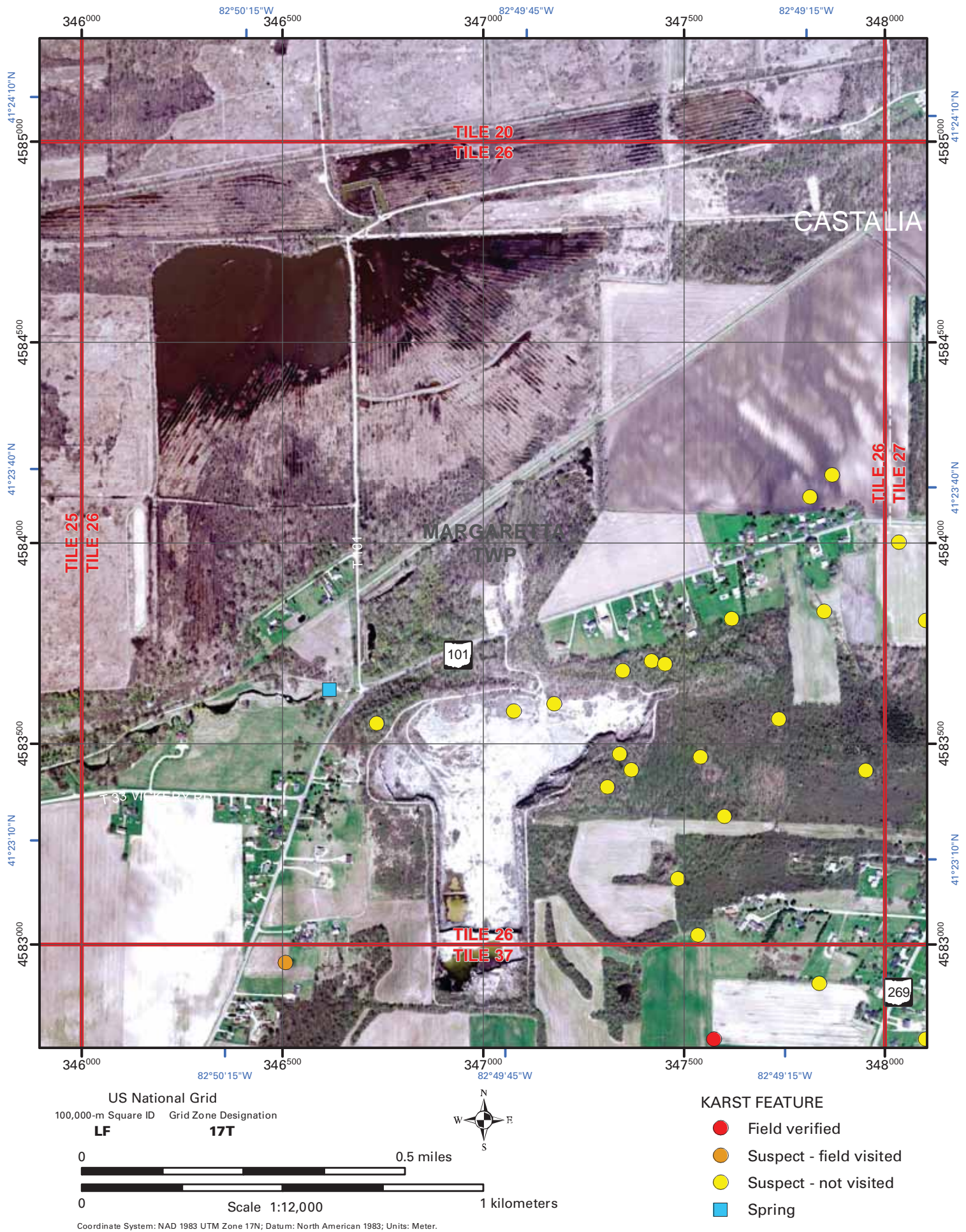


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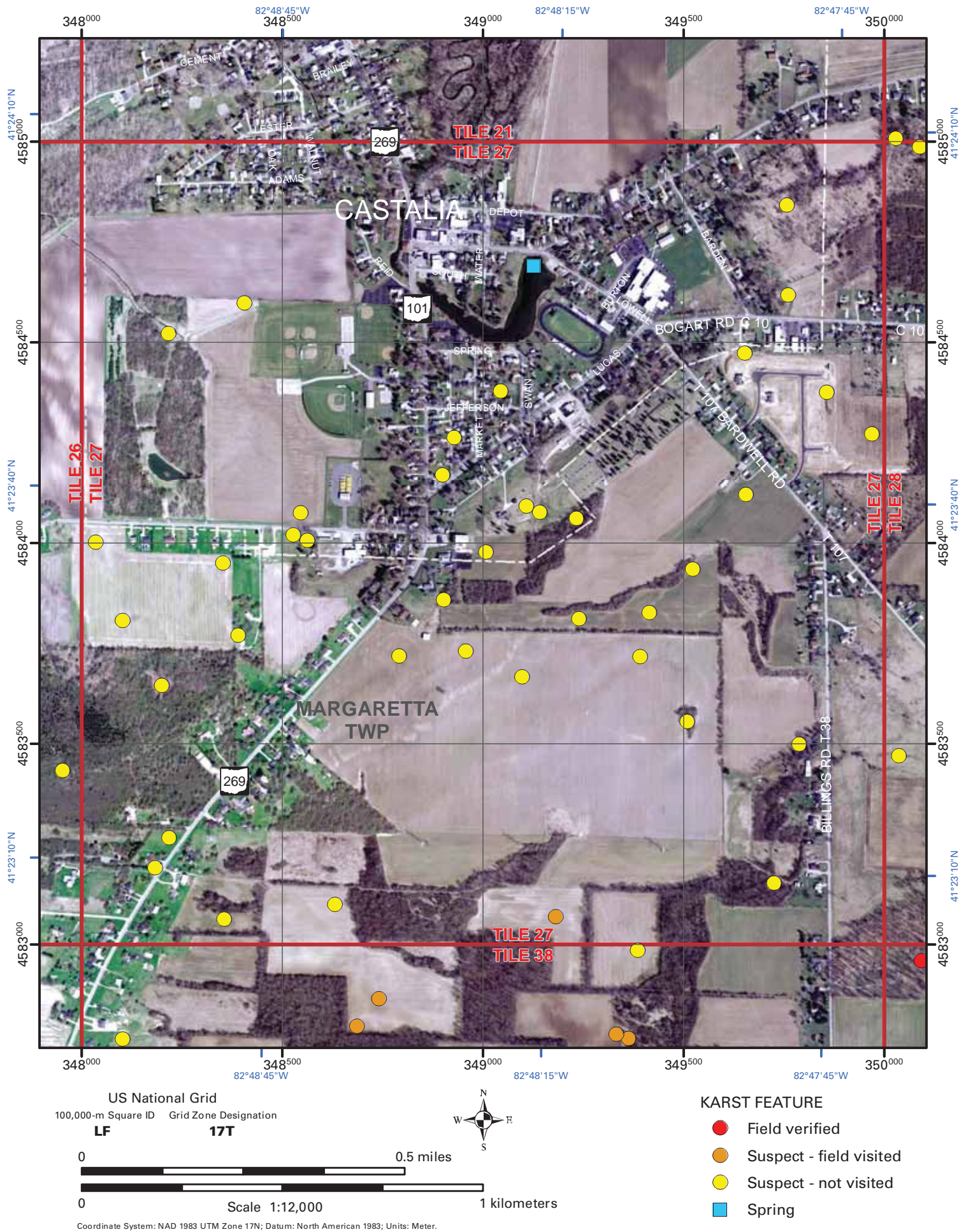


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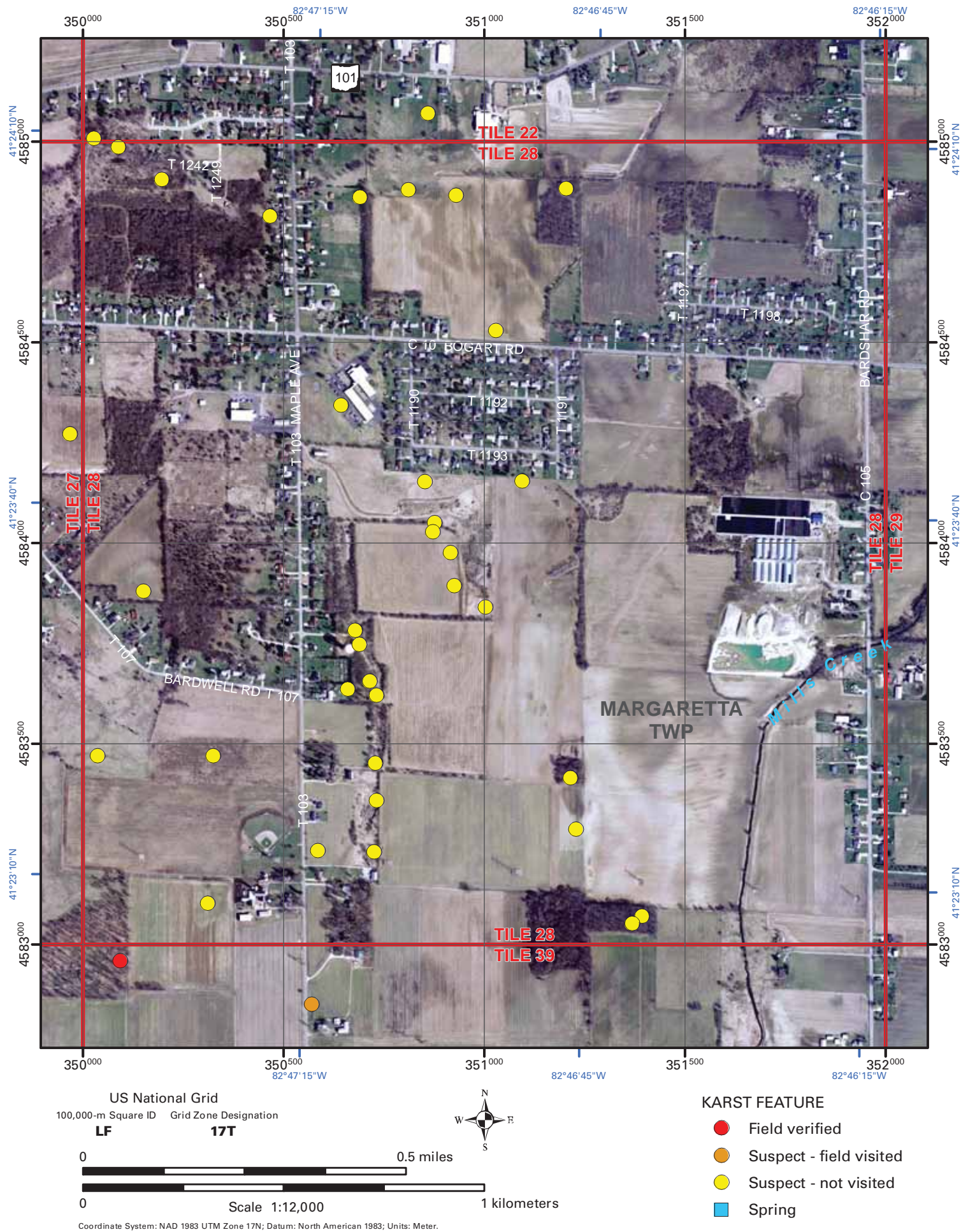


Tile Number: 27





Tile Number: 28





Tile Number: 29



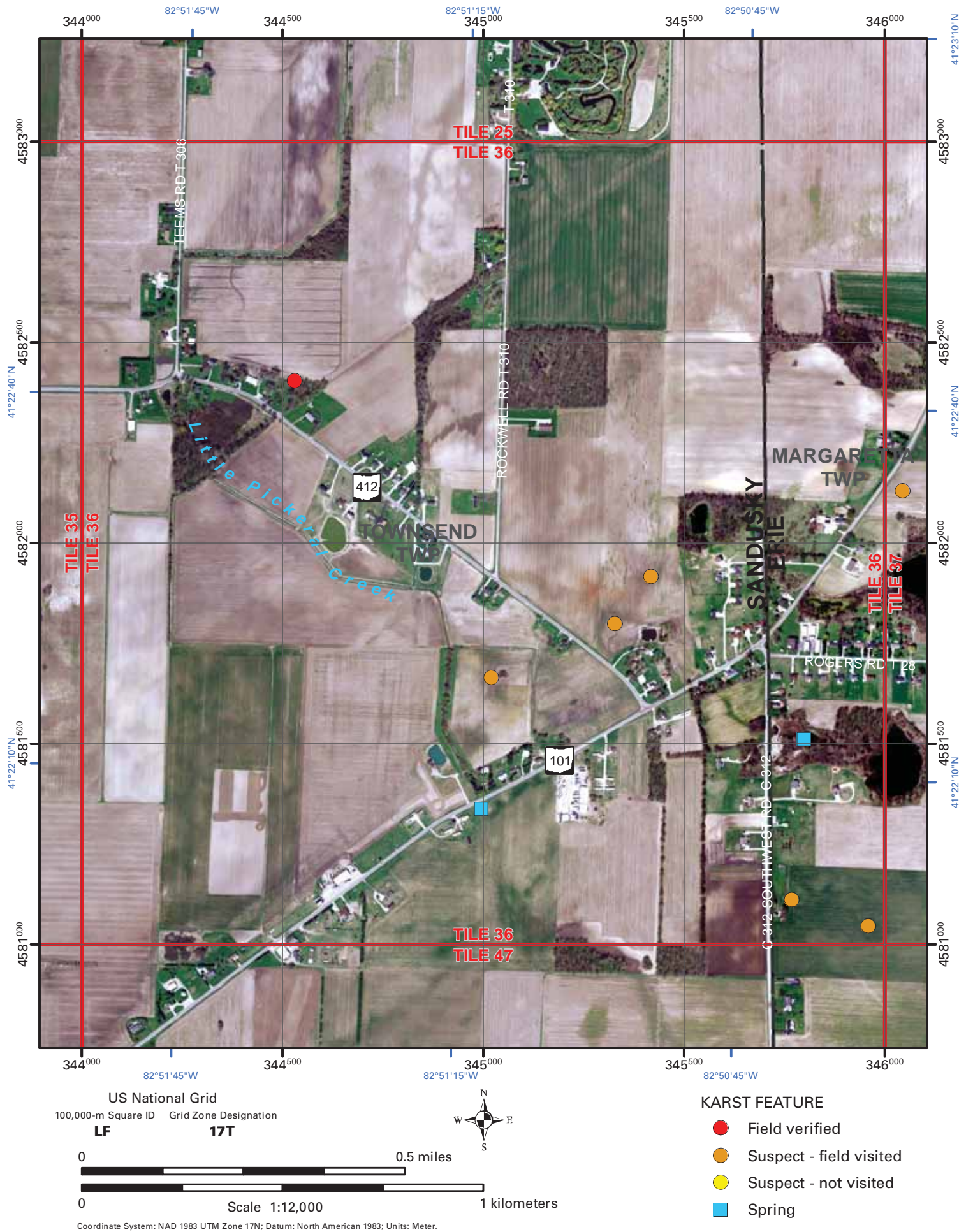
US National Grid  
100,000-m Square ID    Grid Zone Designation  
**LF**                      **17T**



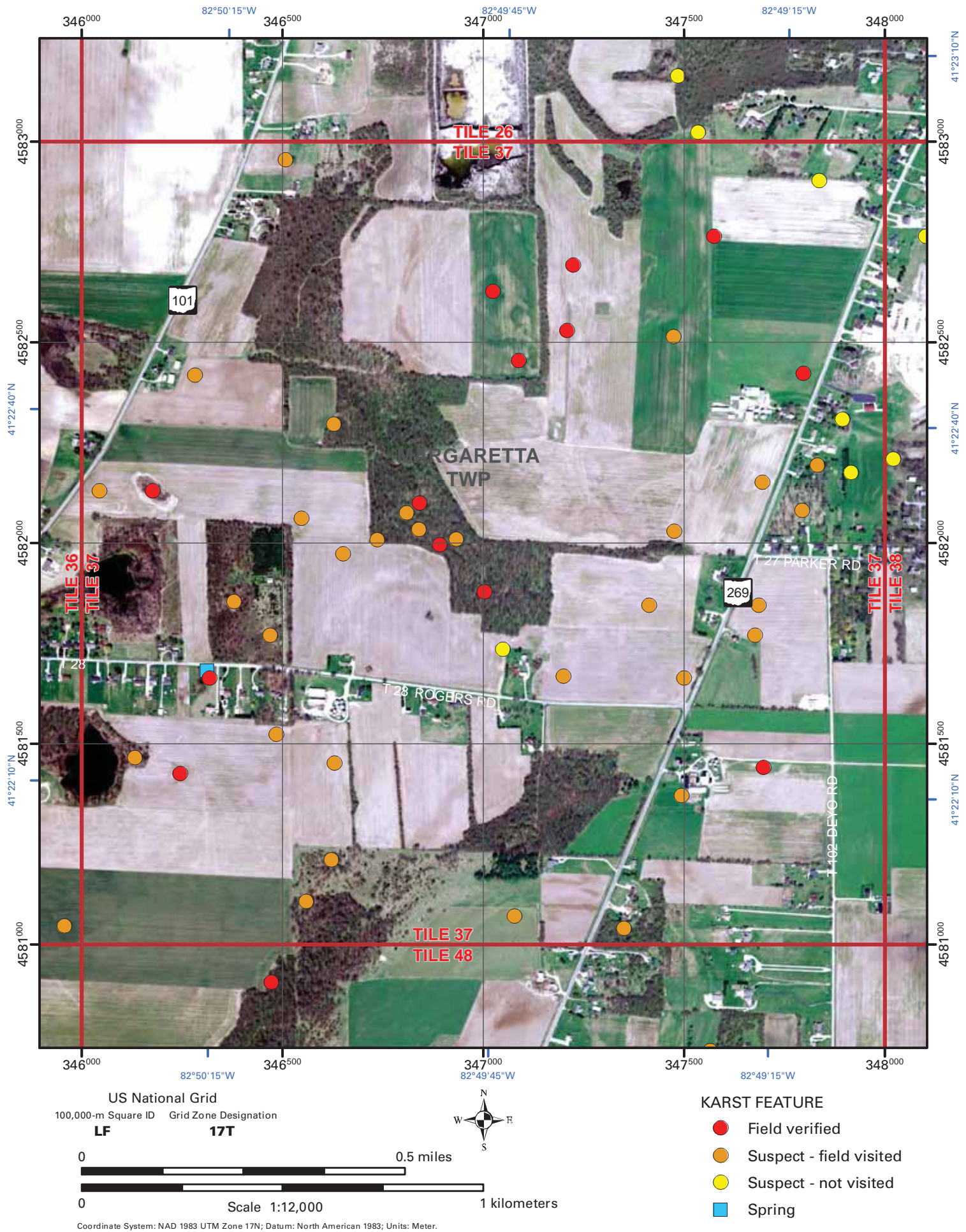
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- KARST FEATURE**
- Field verified
  - Suspect - field visited
  - Suspect - not visited
  - Spring

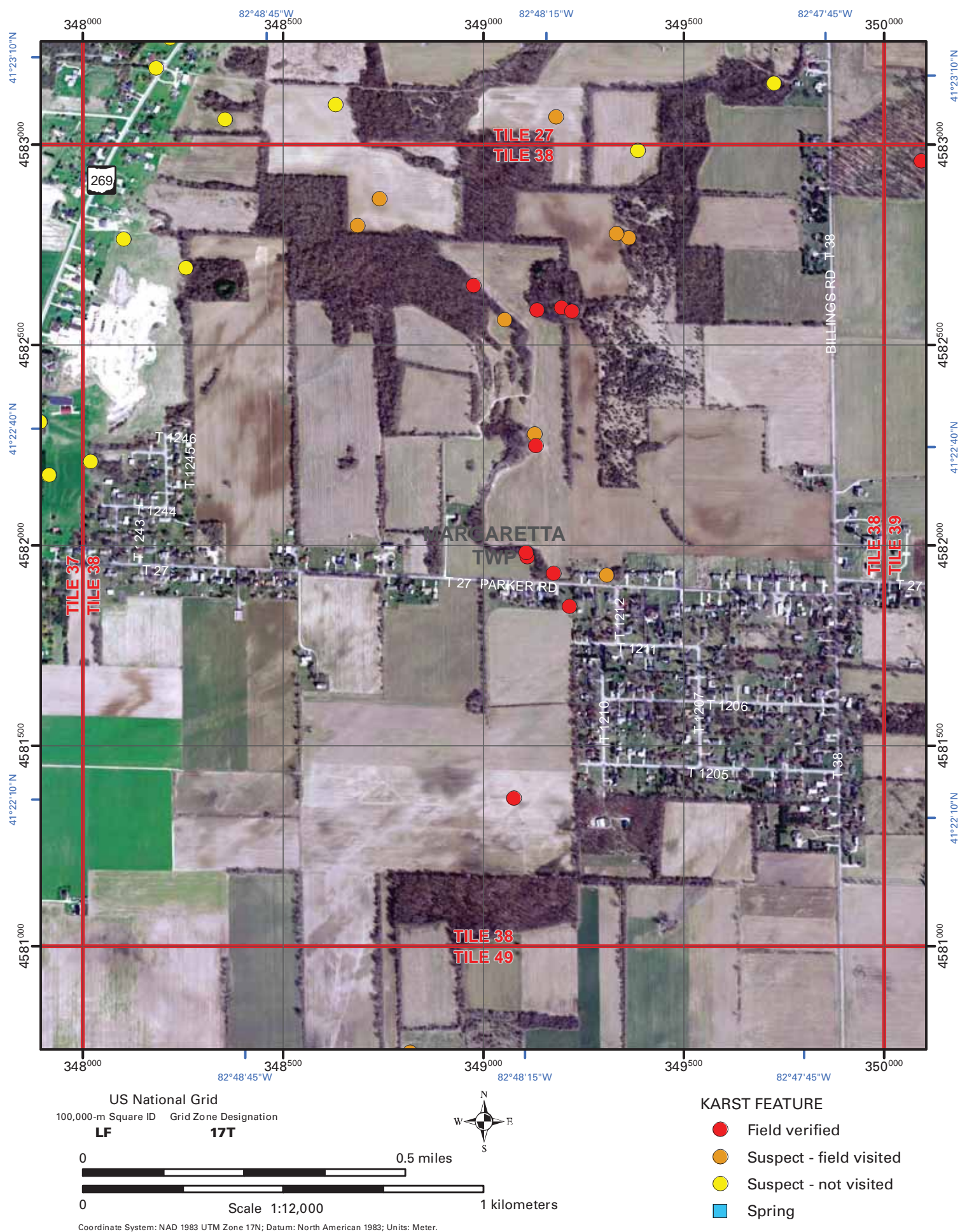






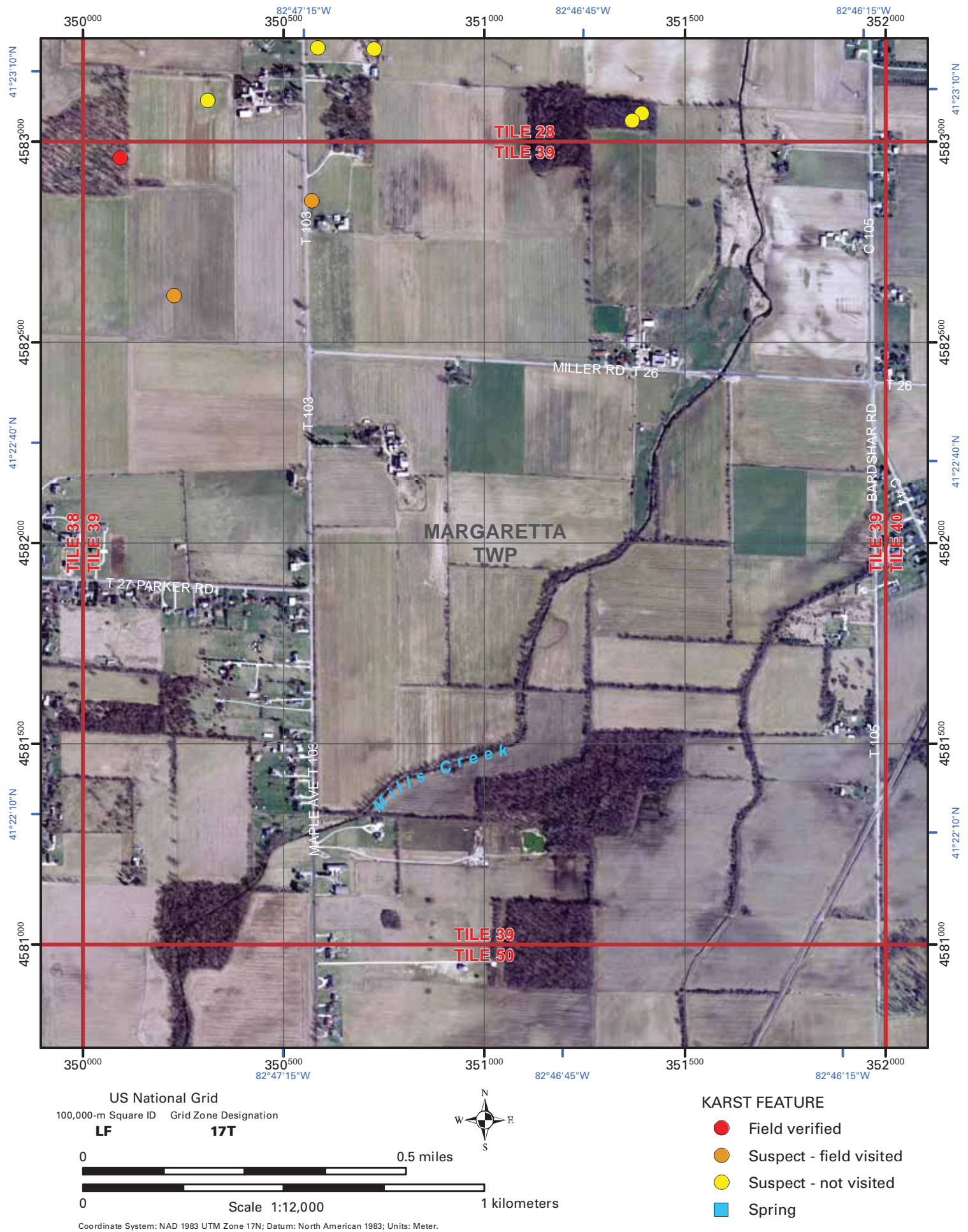








Tile Number: 39



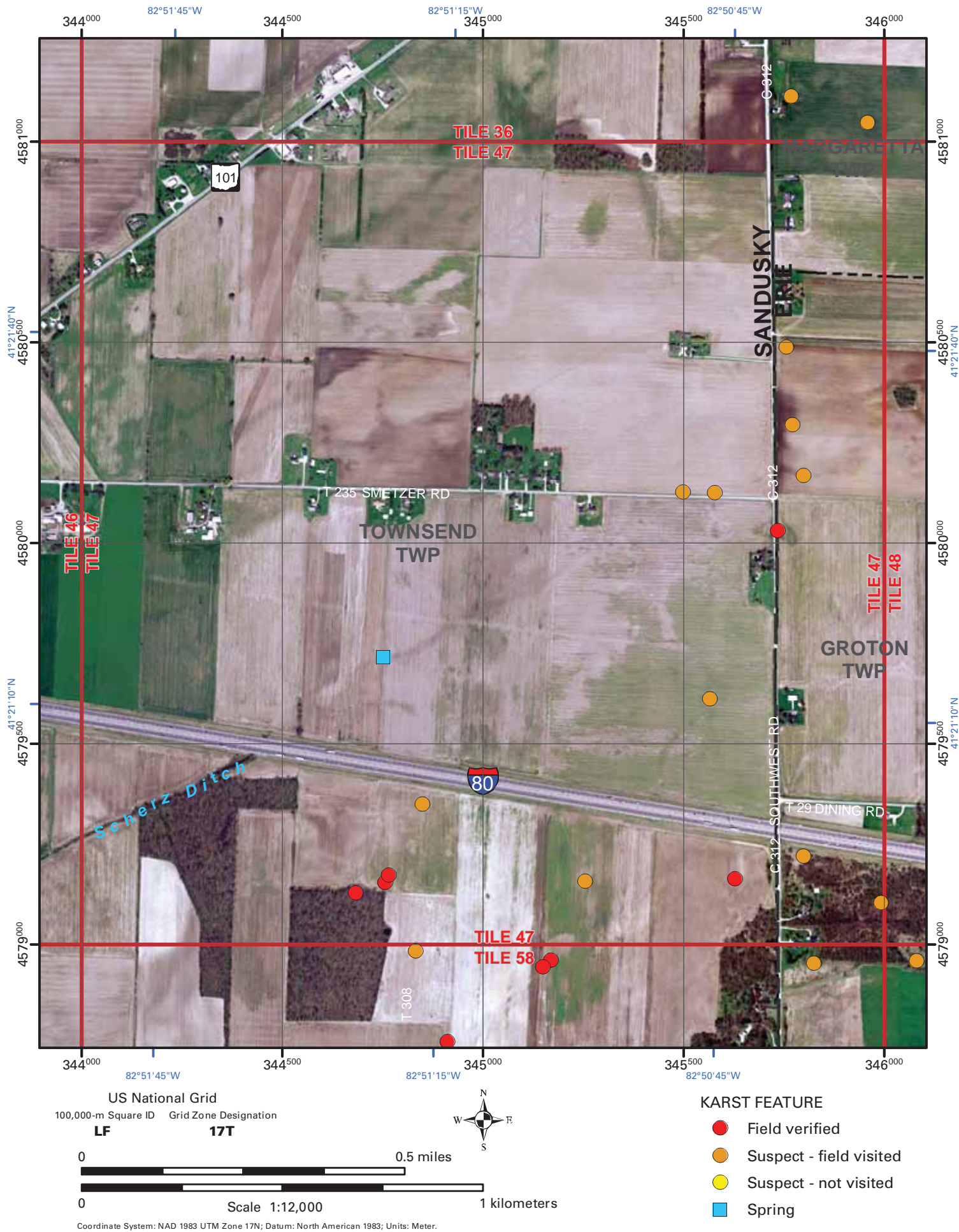


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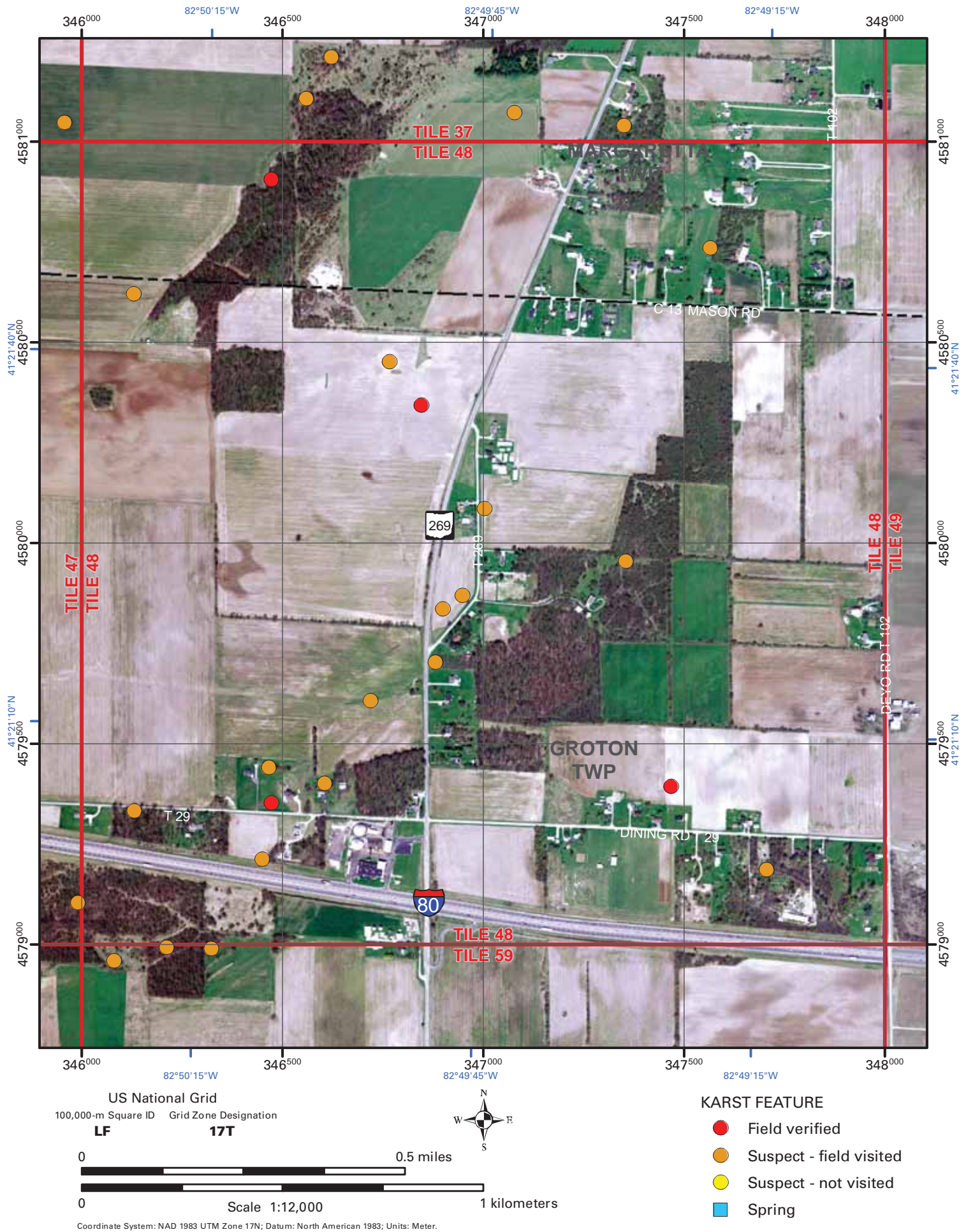


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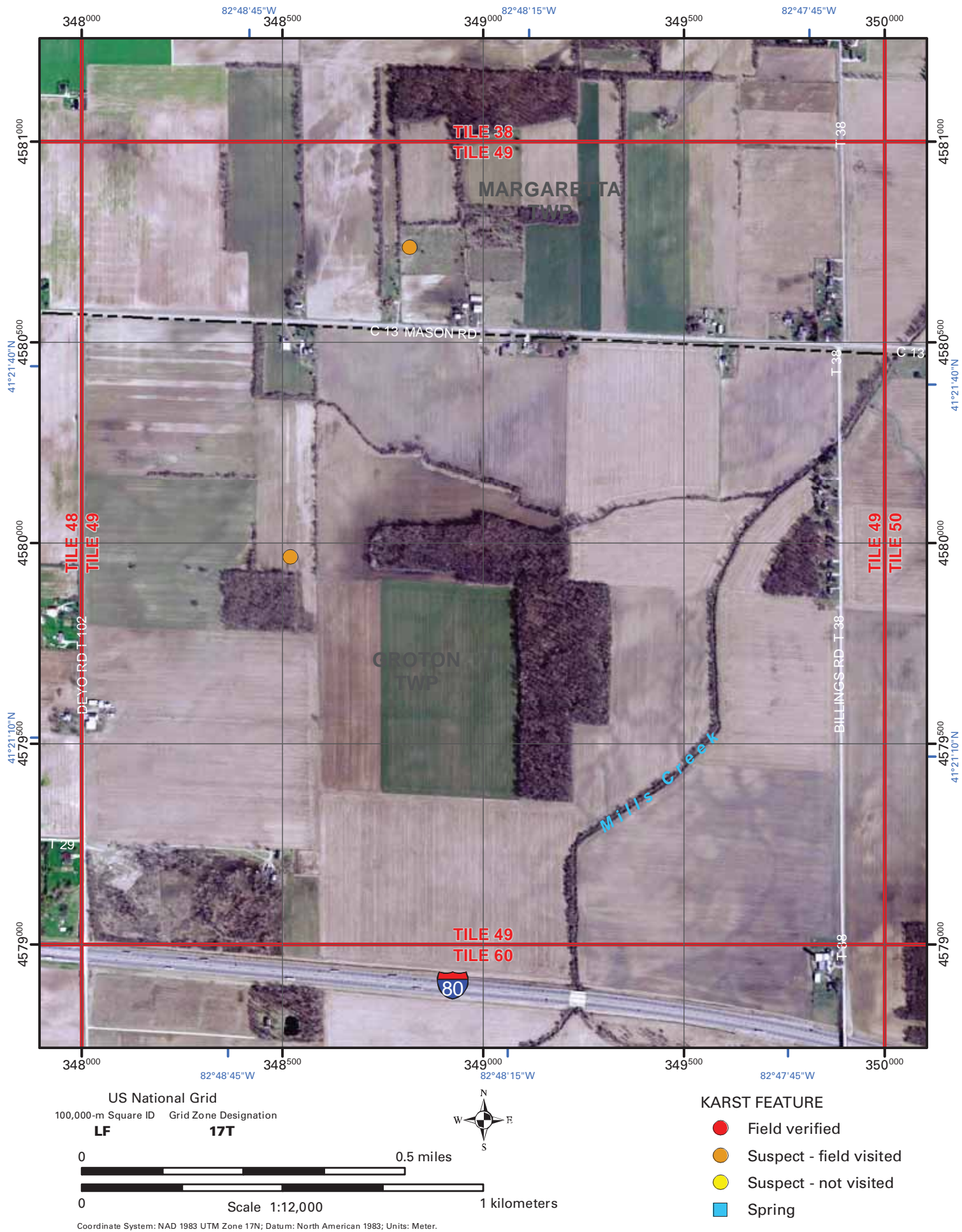


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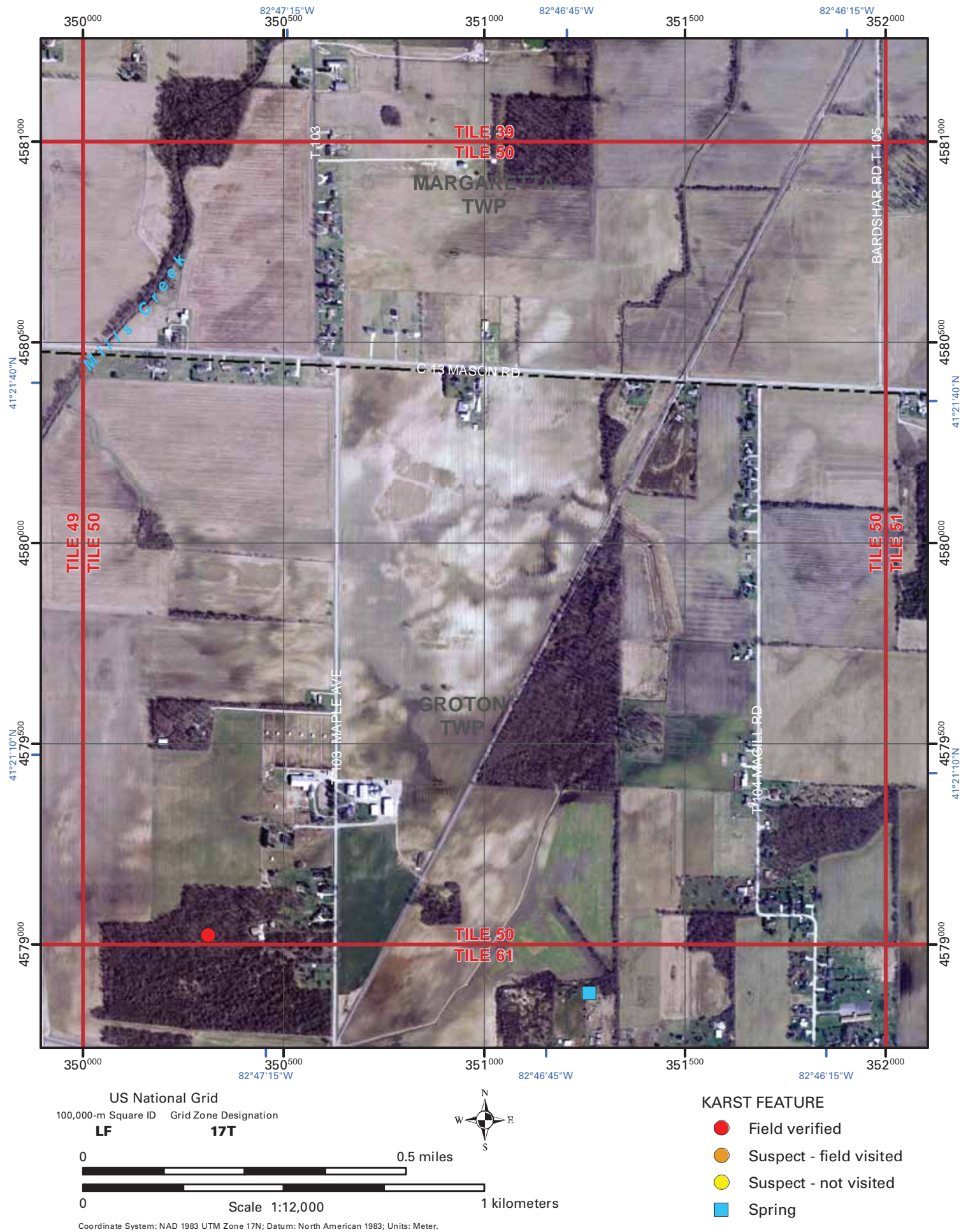


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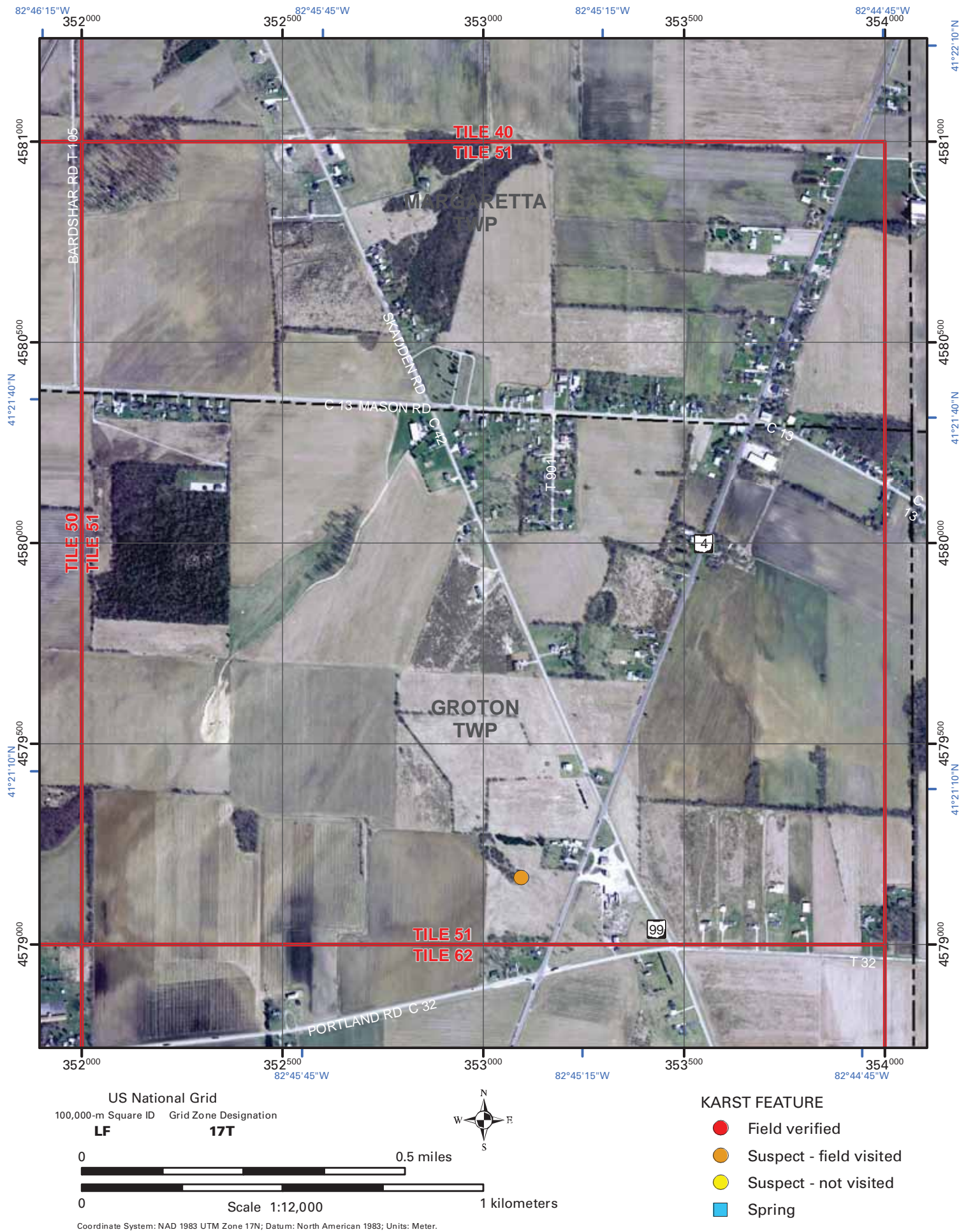


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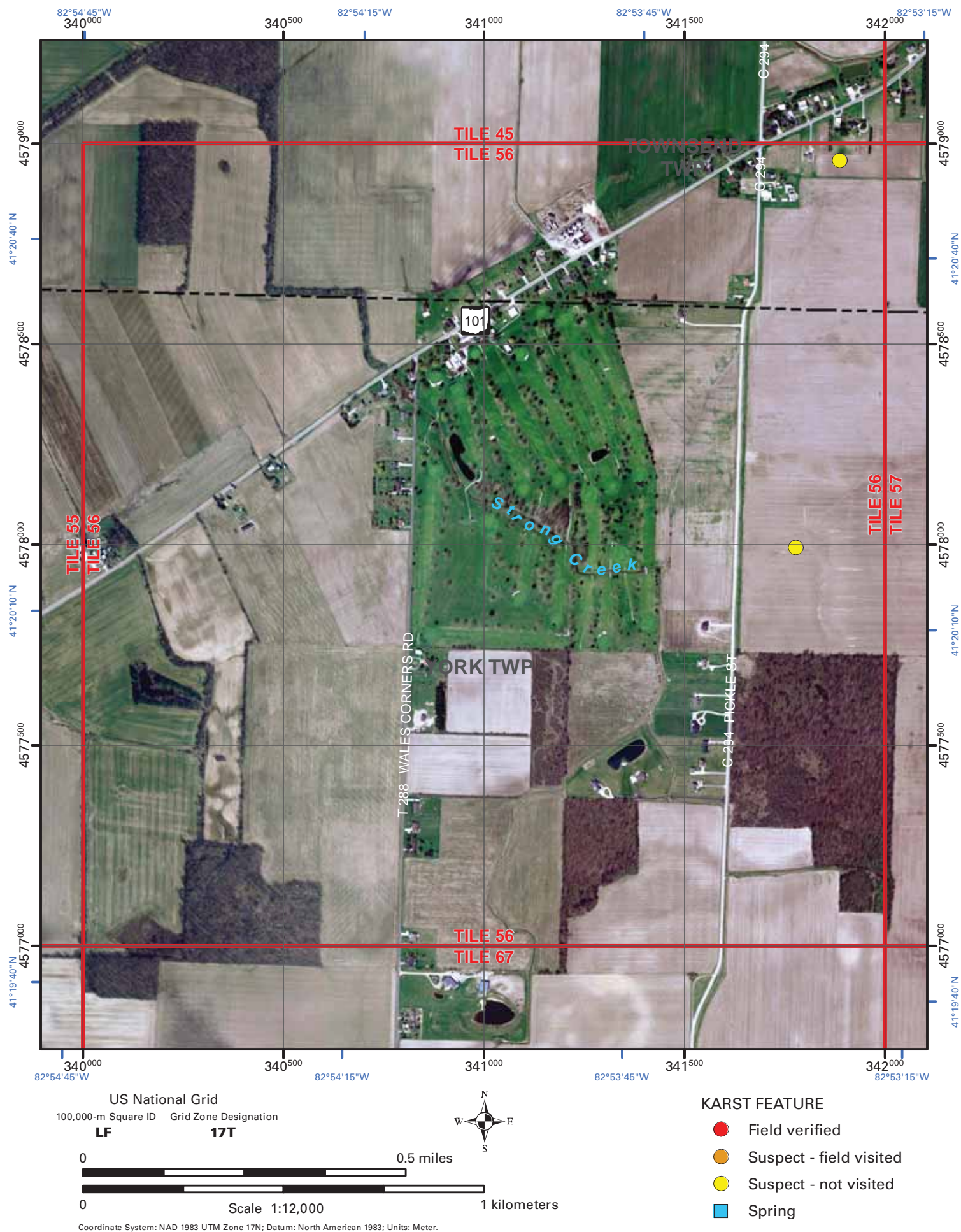




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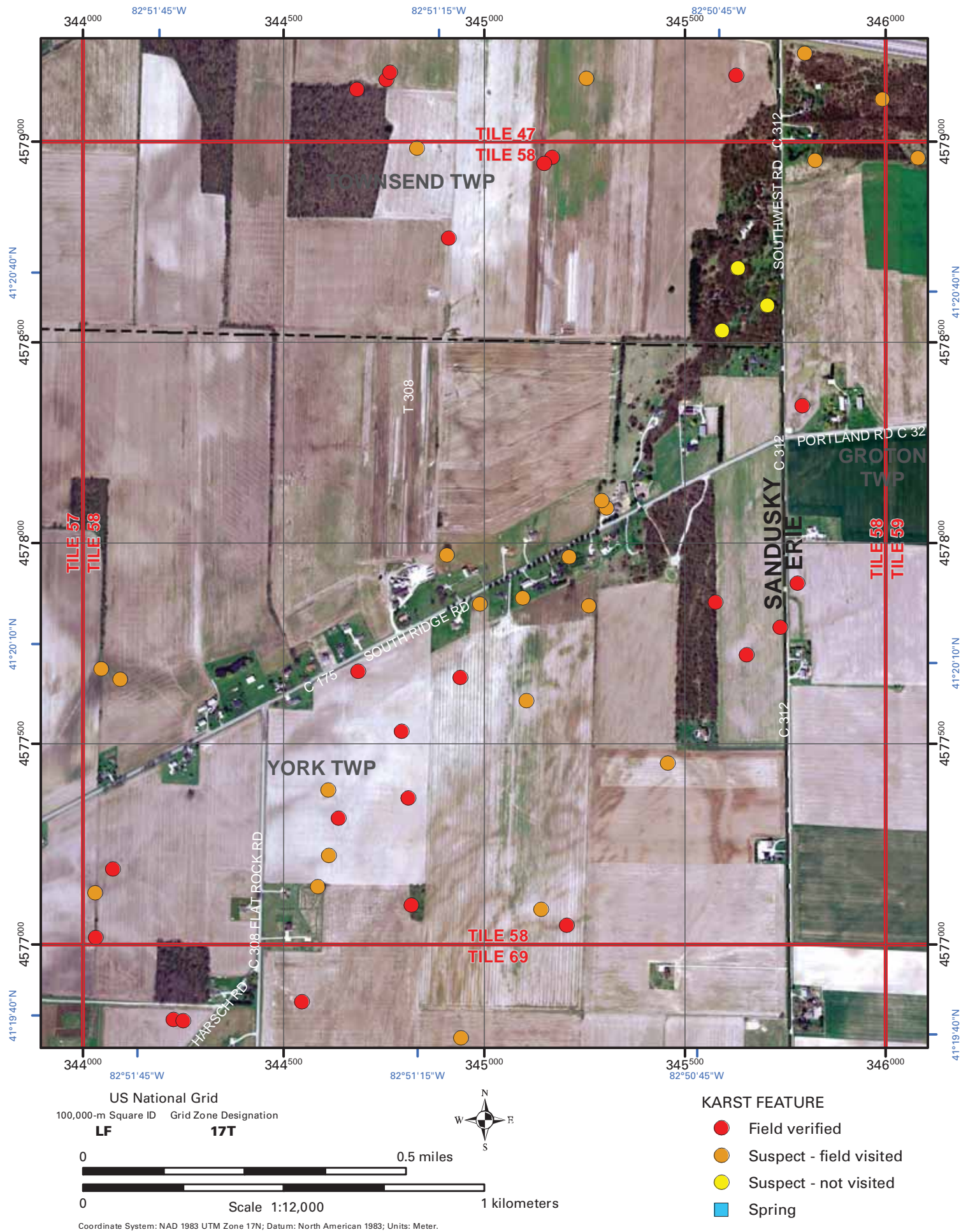


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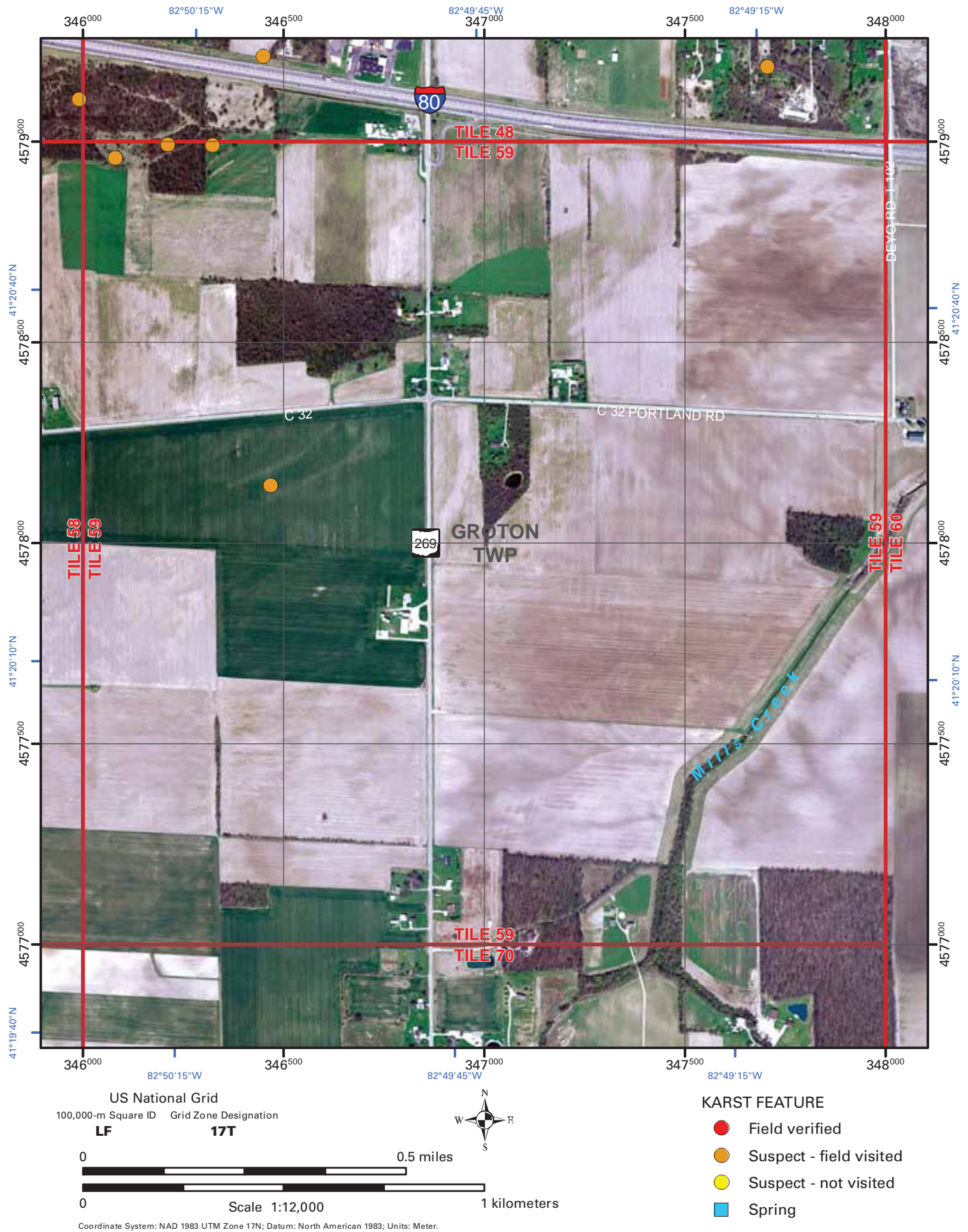


Tile Number: 58





Tile Number: 59



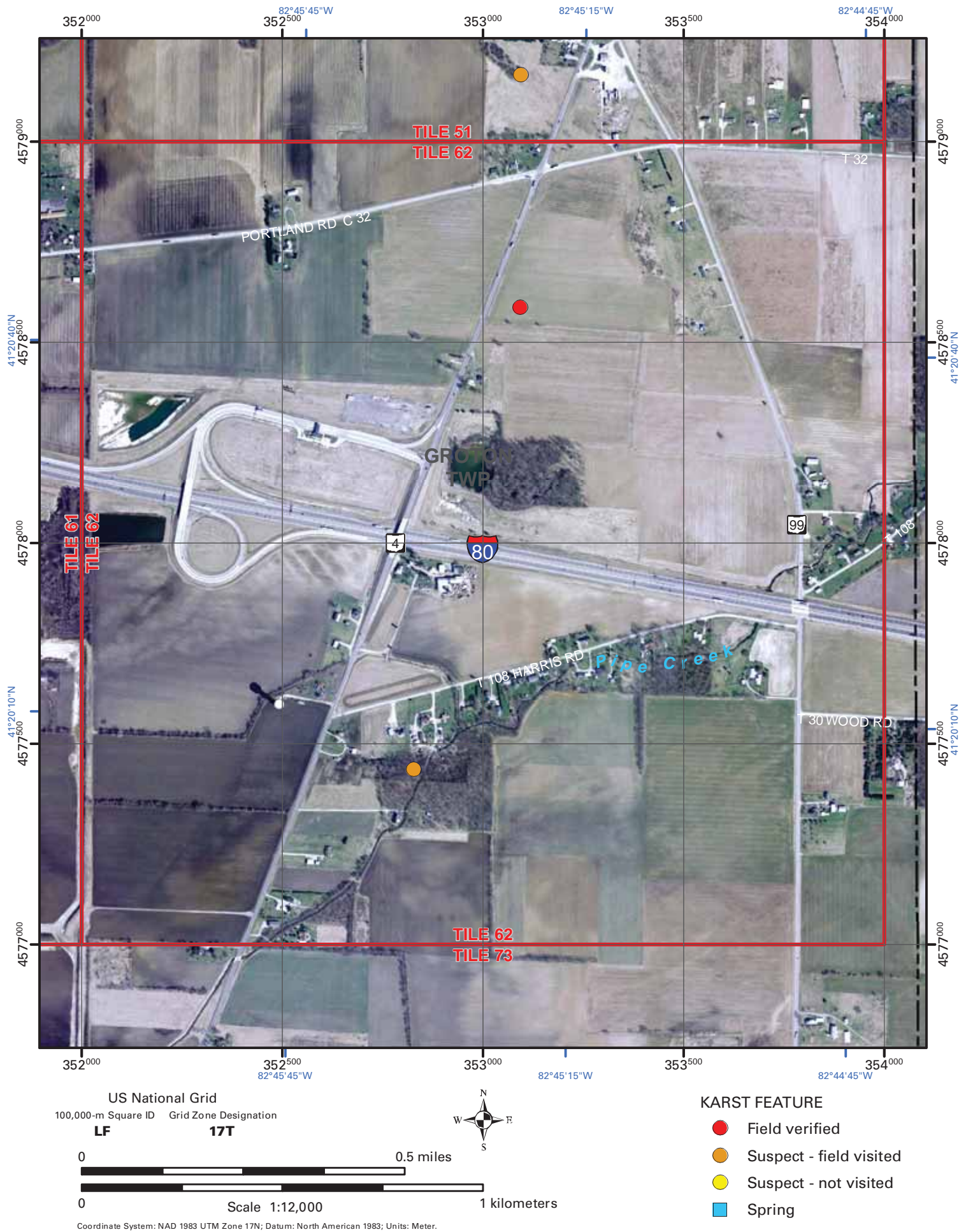


Tile Number: 61

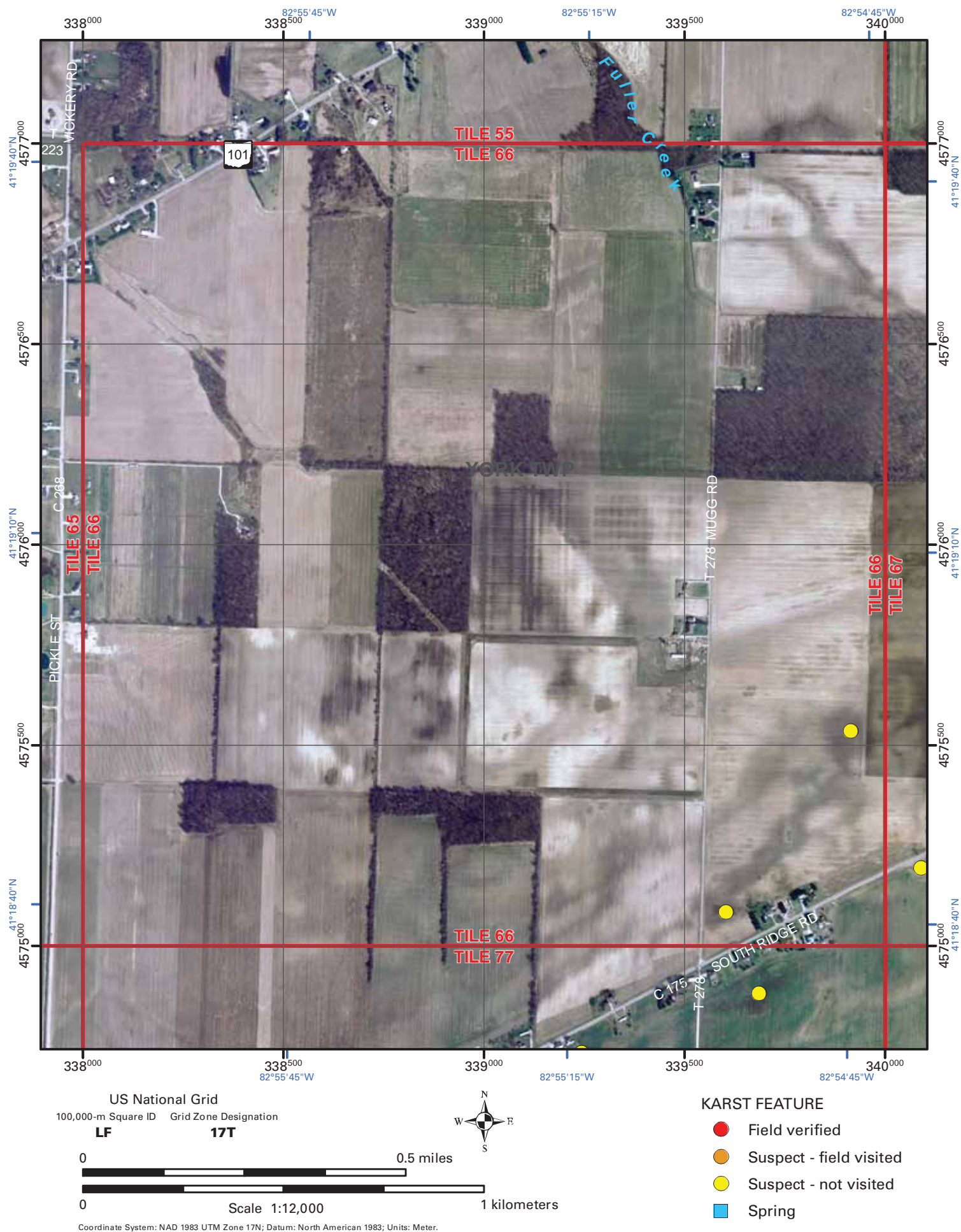




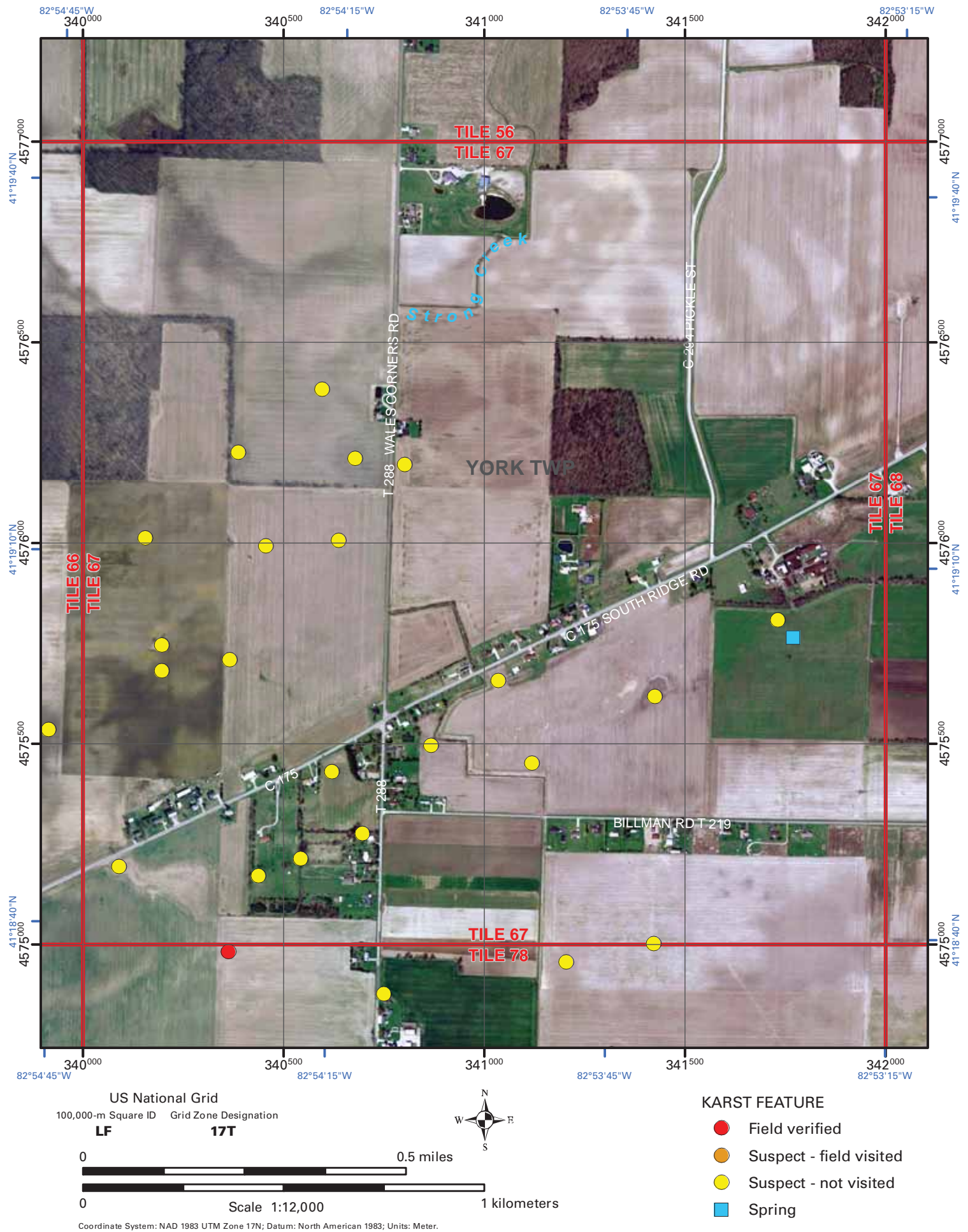
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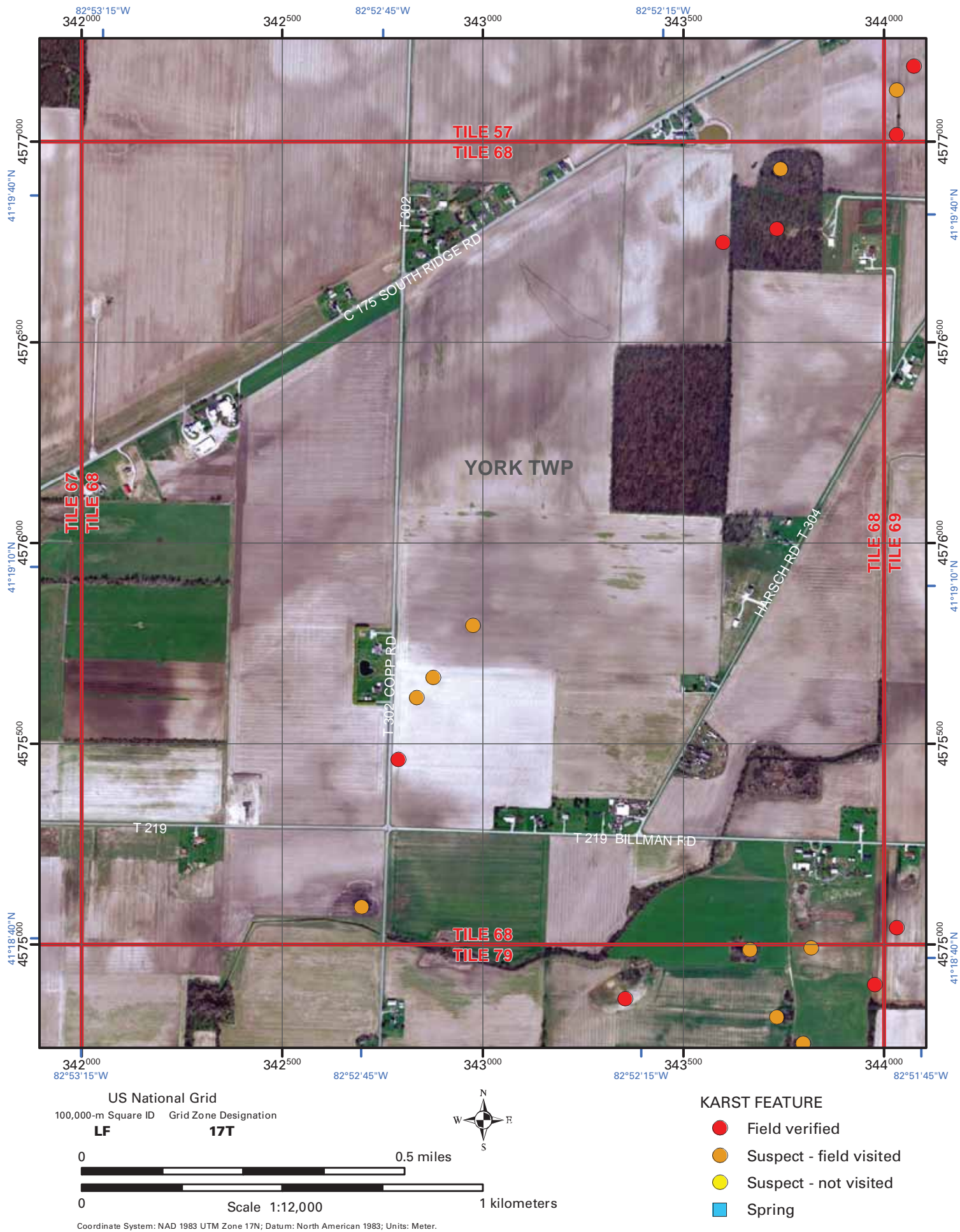


Tile Number: 67





Tile Number: 68



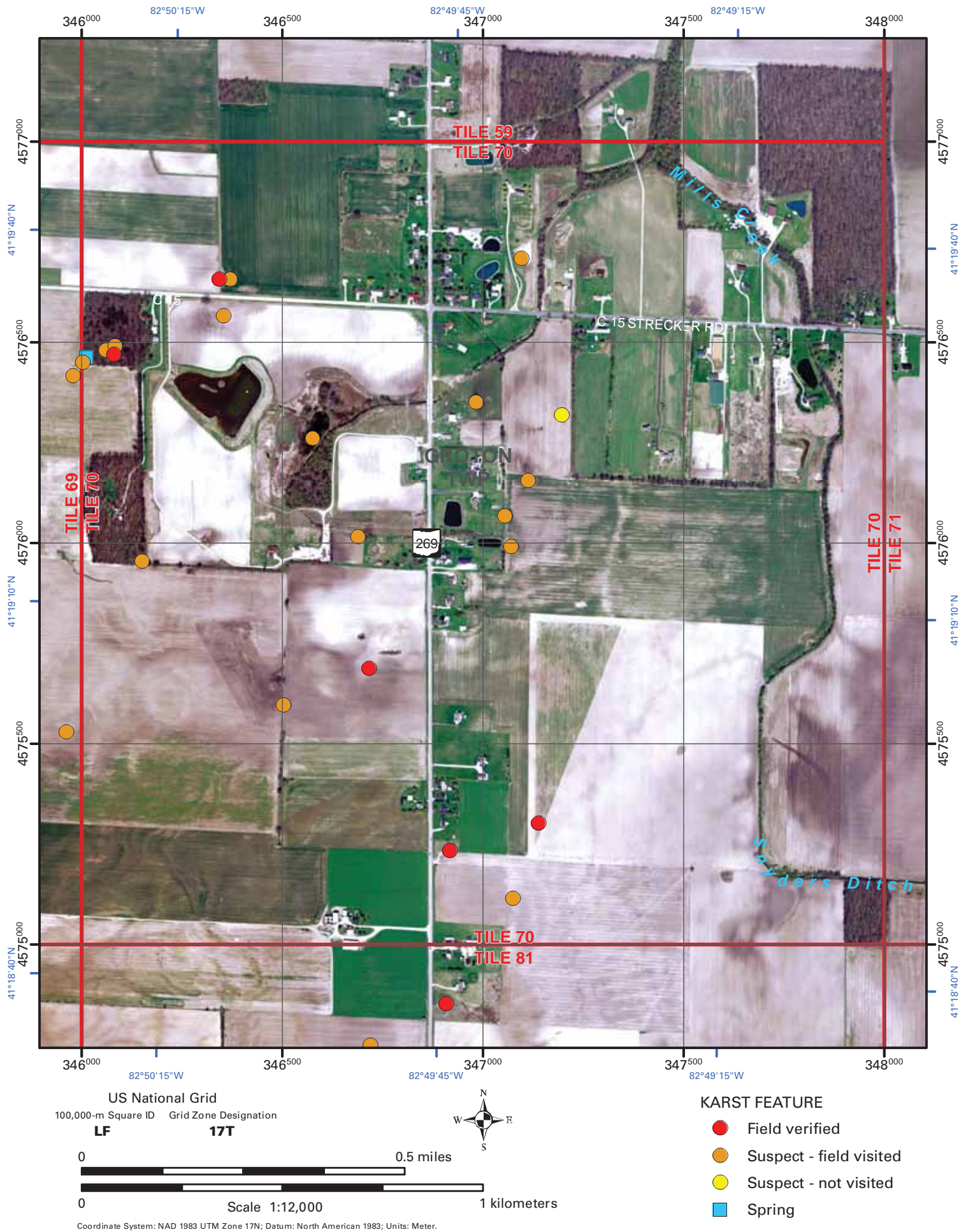


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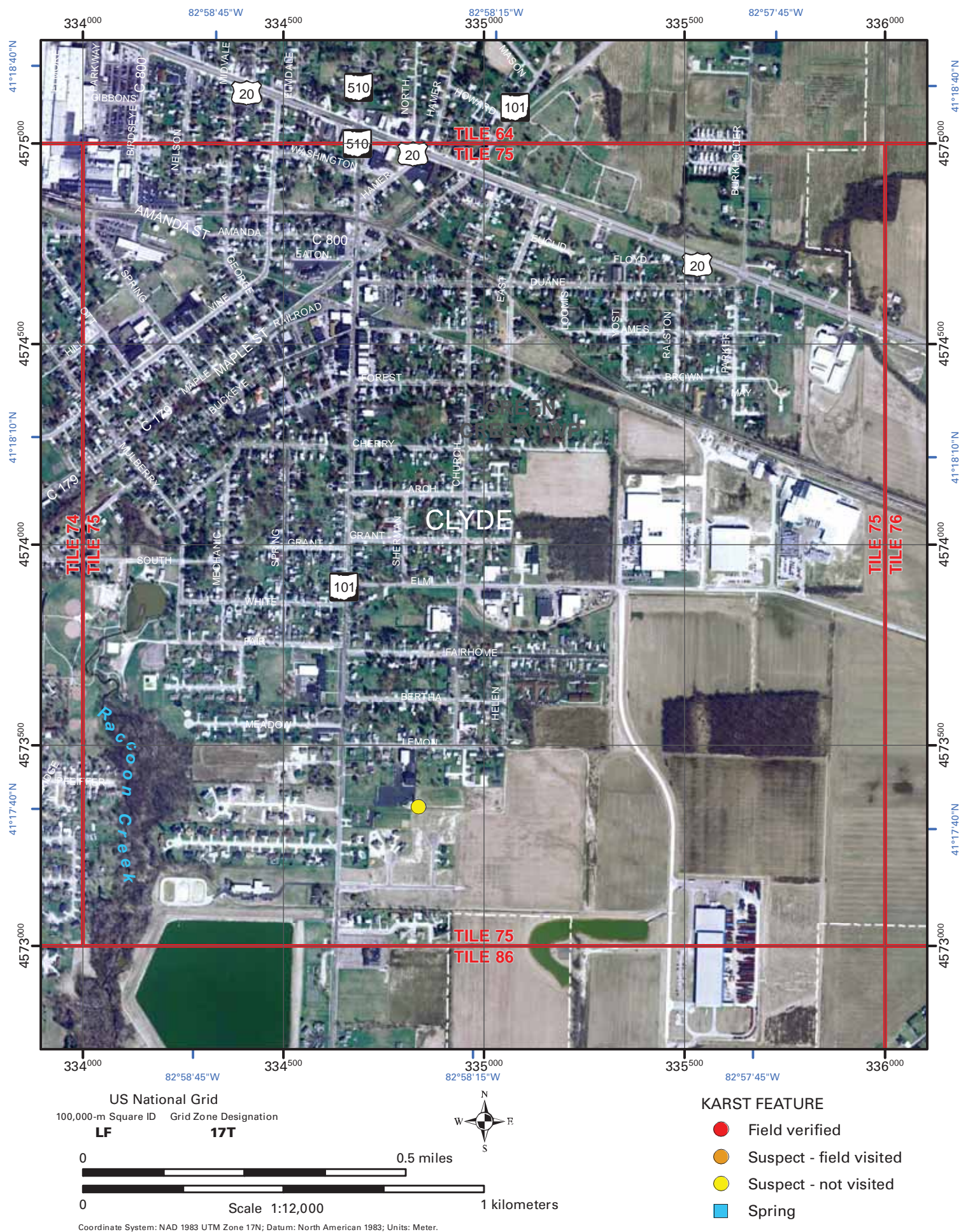
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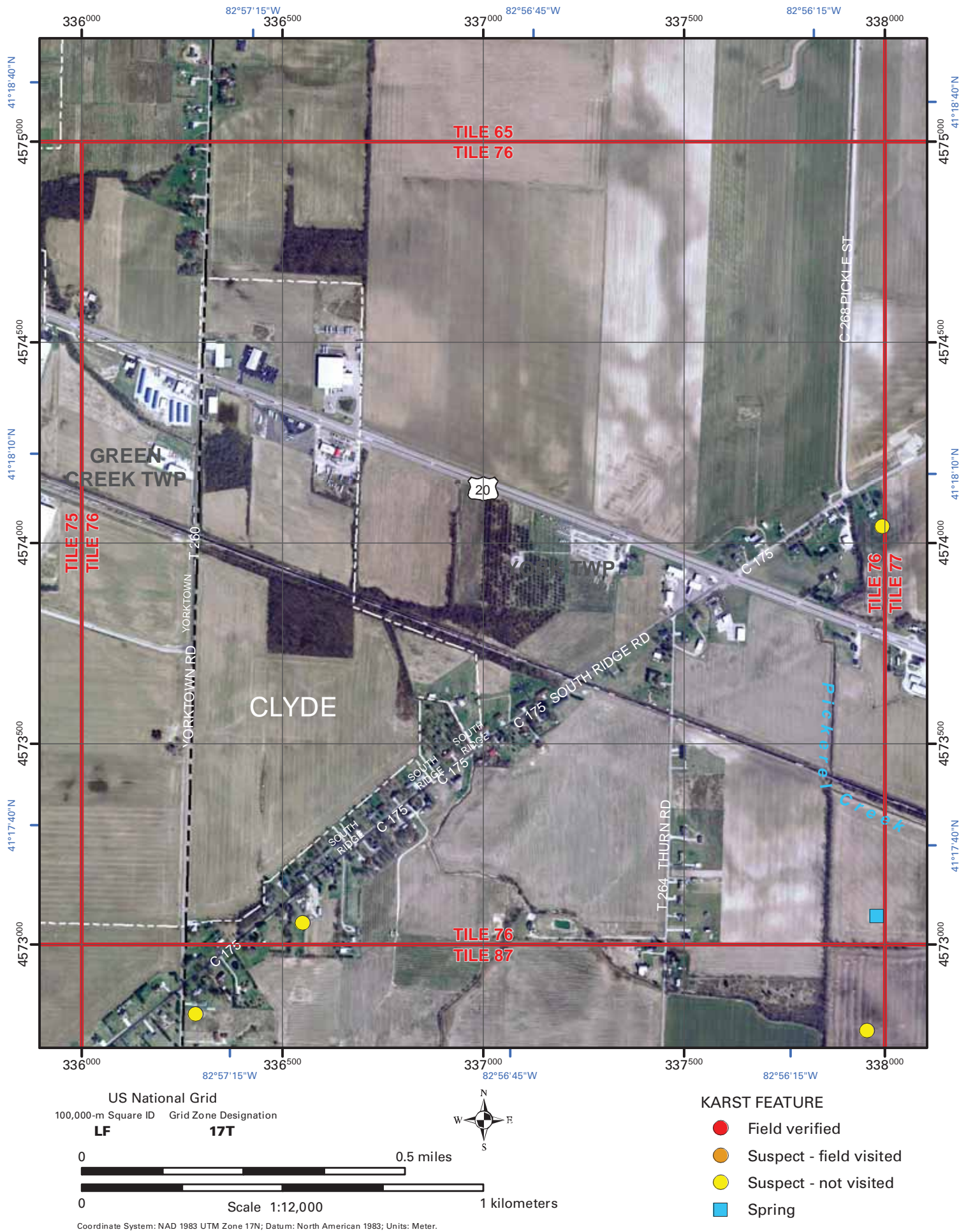






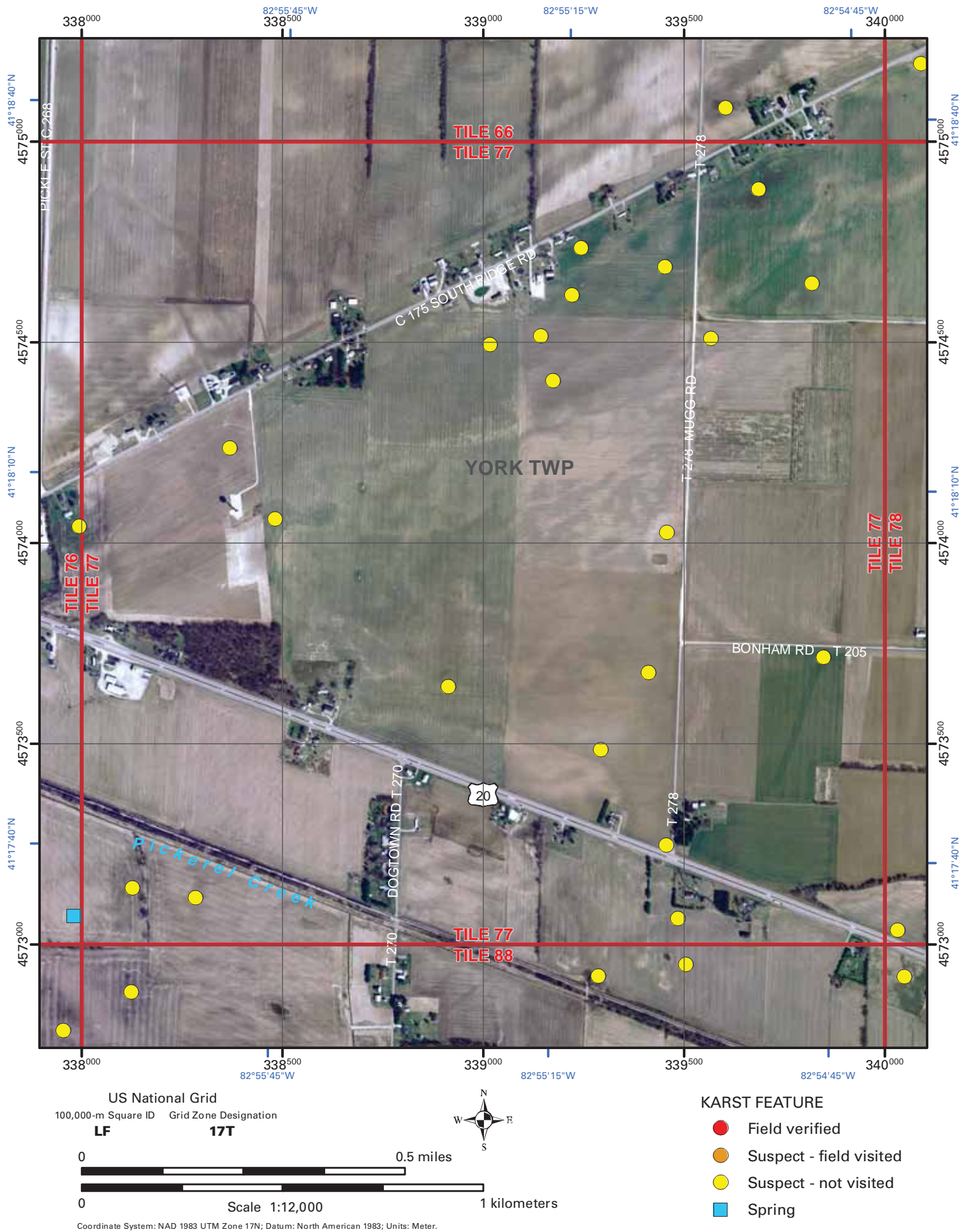


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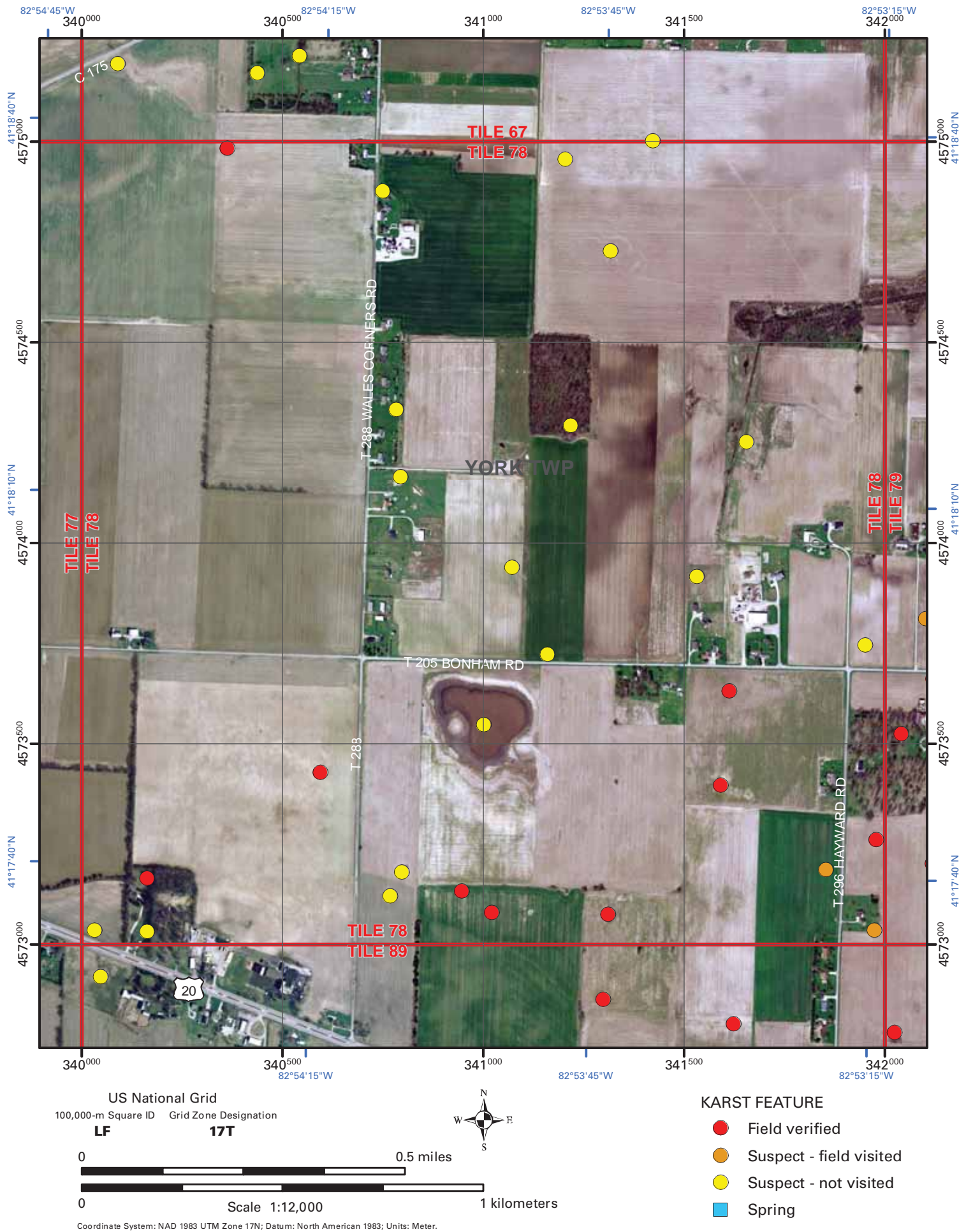




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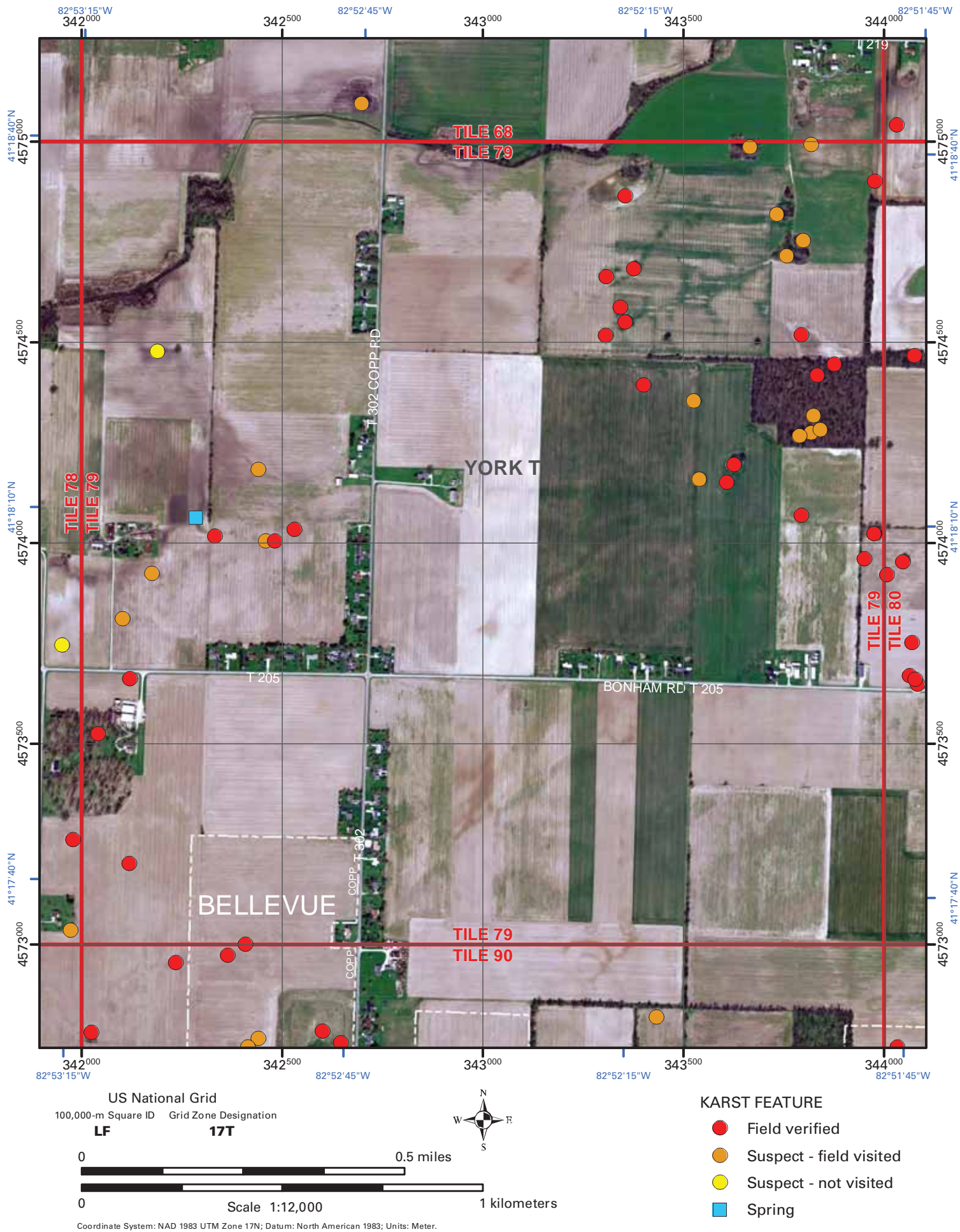


Tile Number: 78



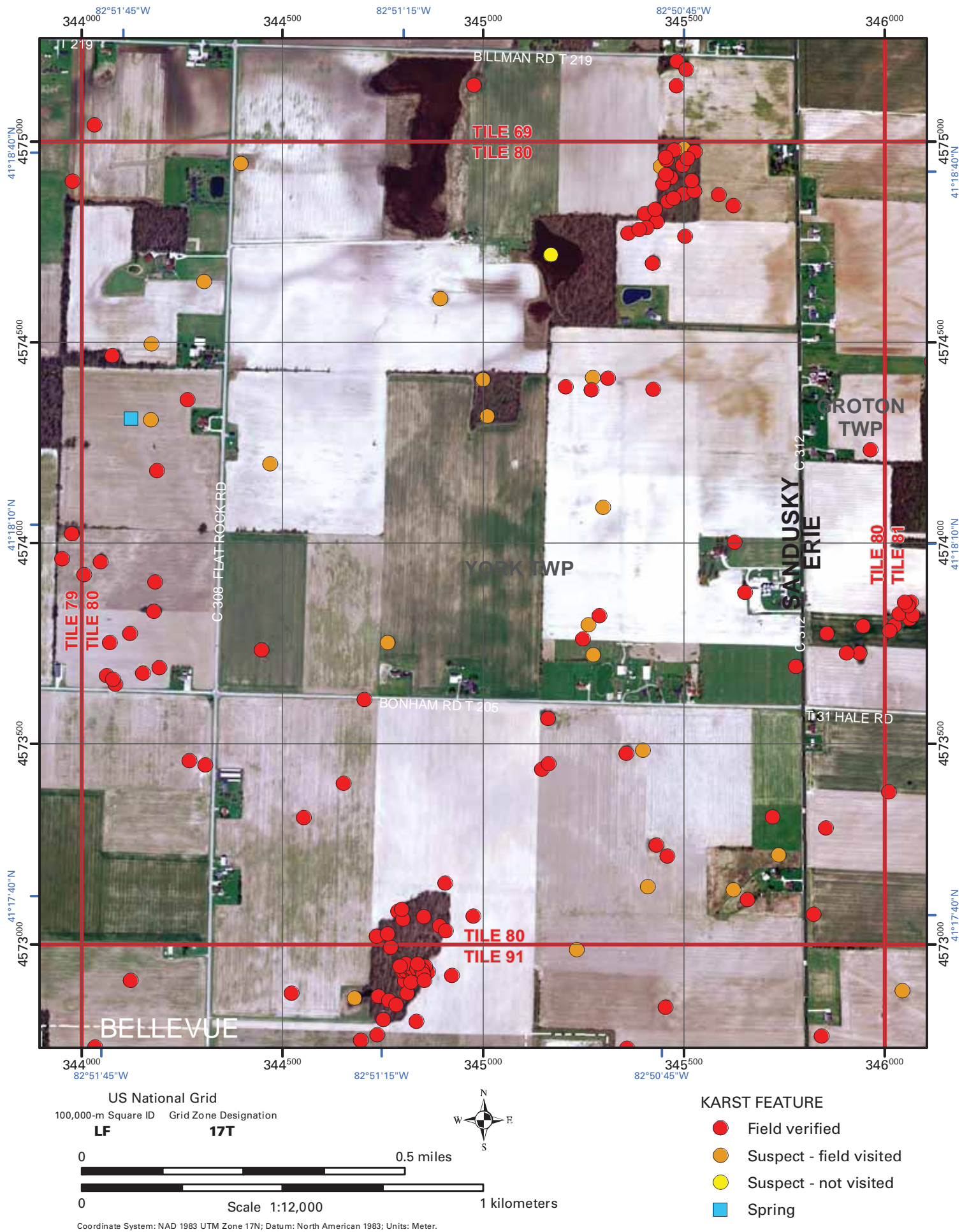


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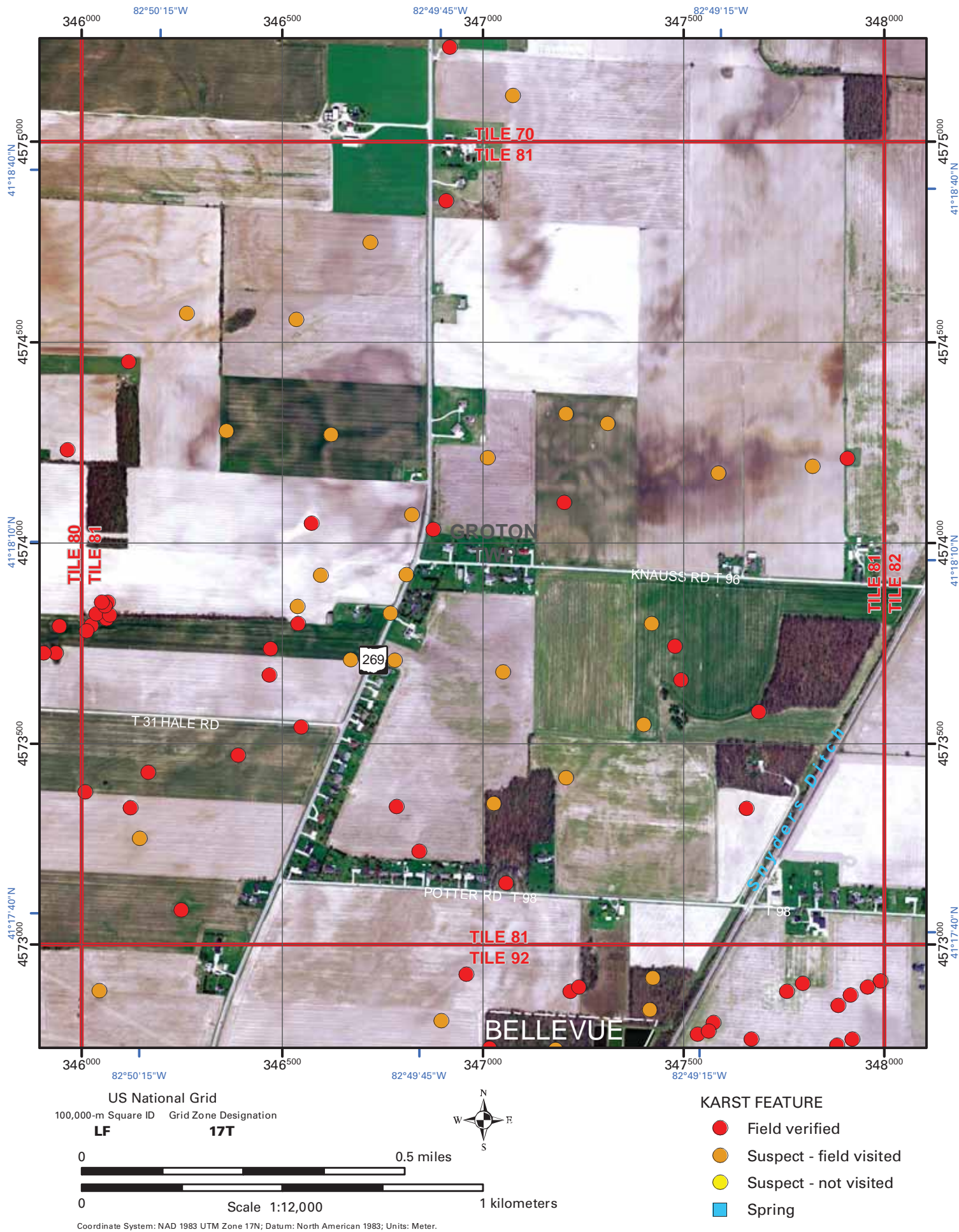


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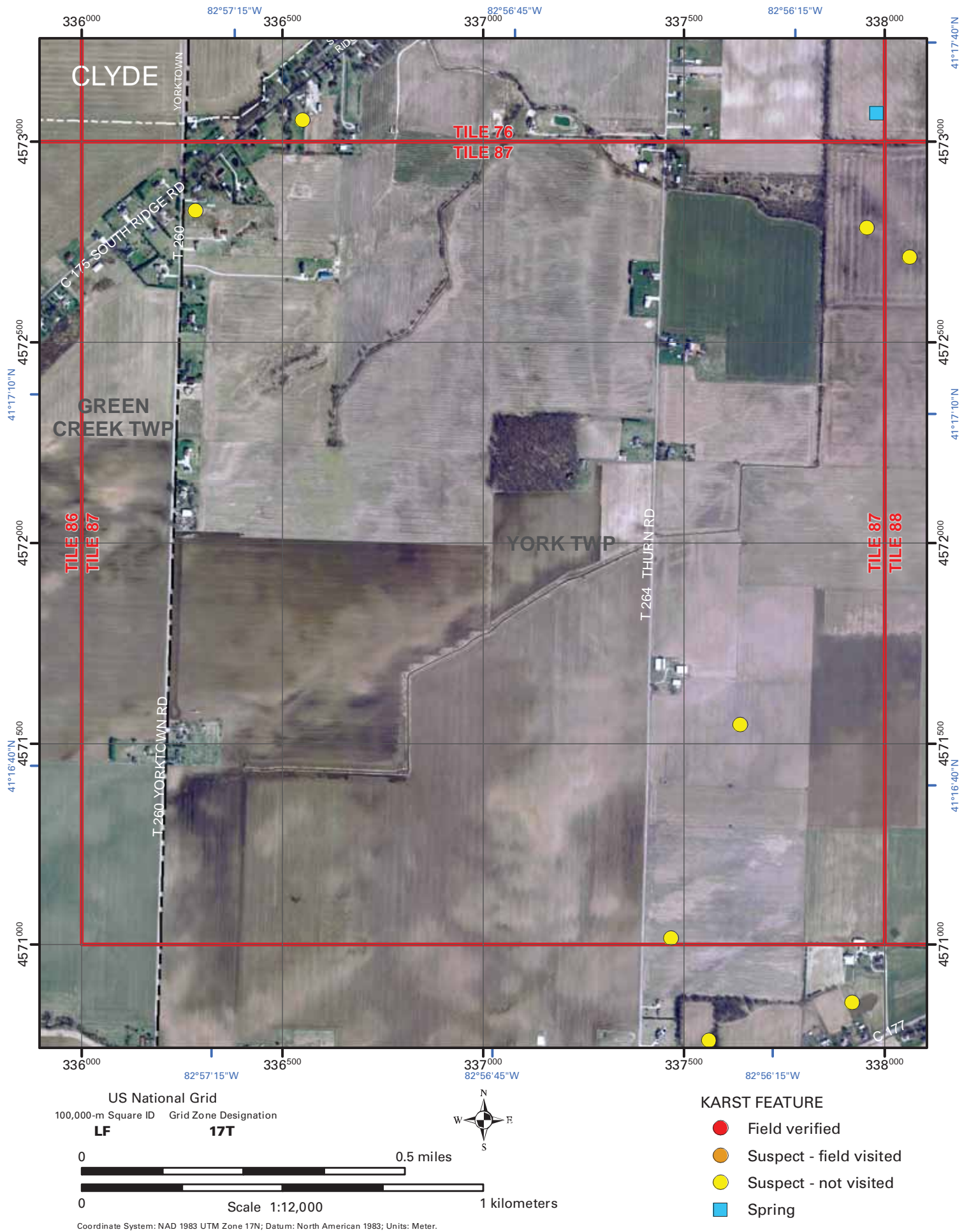


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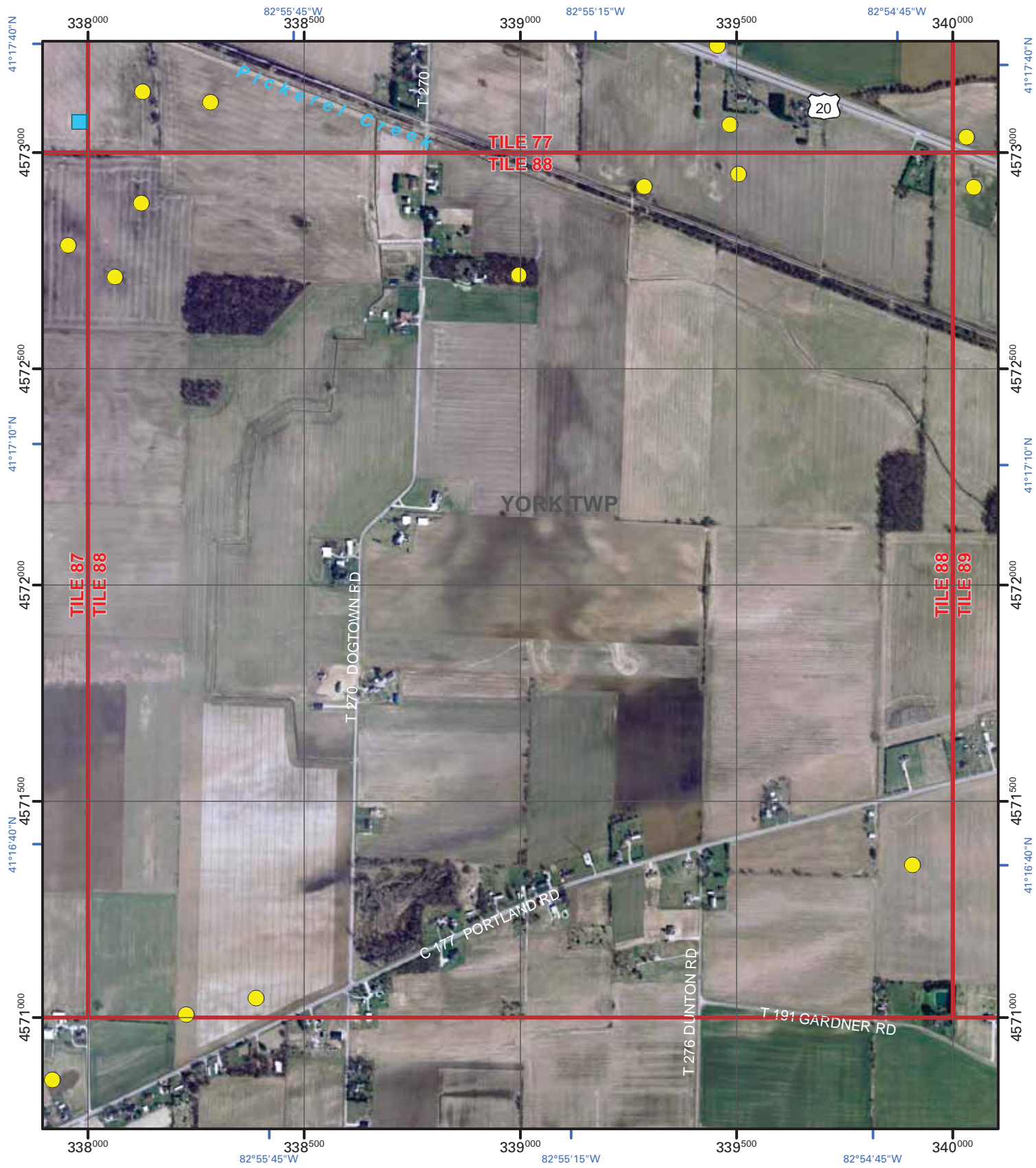








Tile Number: 88



US National Grid  
100,000-m Square ID    Grid Zone Designation  
**LF**                      **17T**

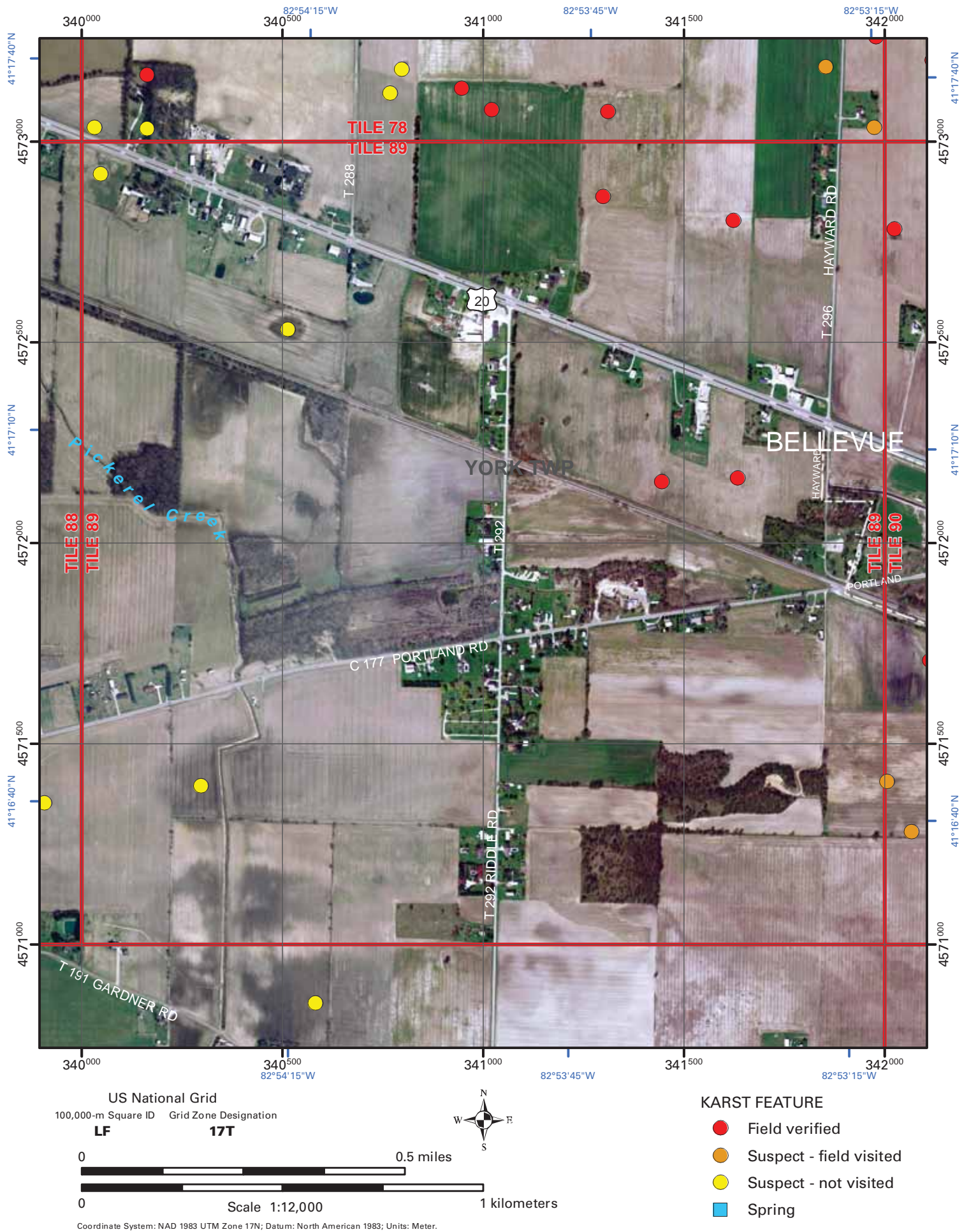


Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.

- KARST FEATURE**
- Field verified
  - Suspect - field visited
  - Suspect - not visited
  - Spring

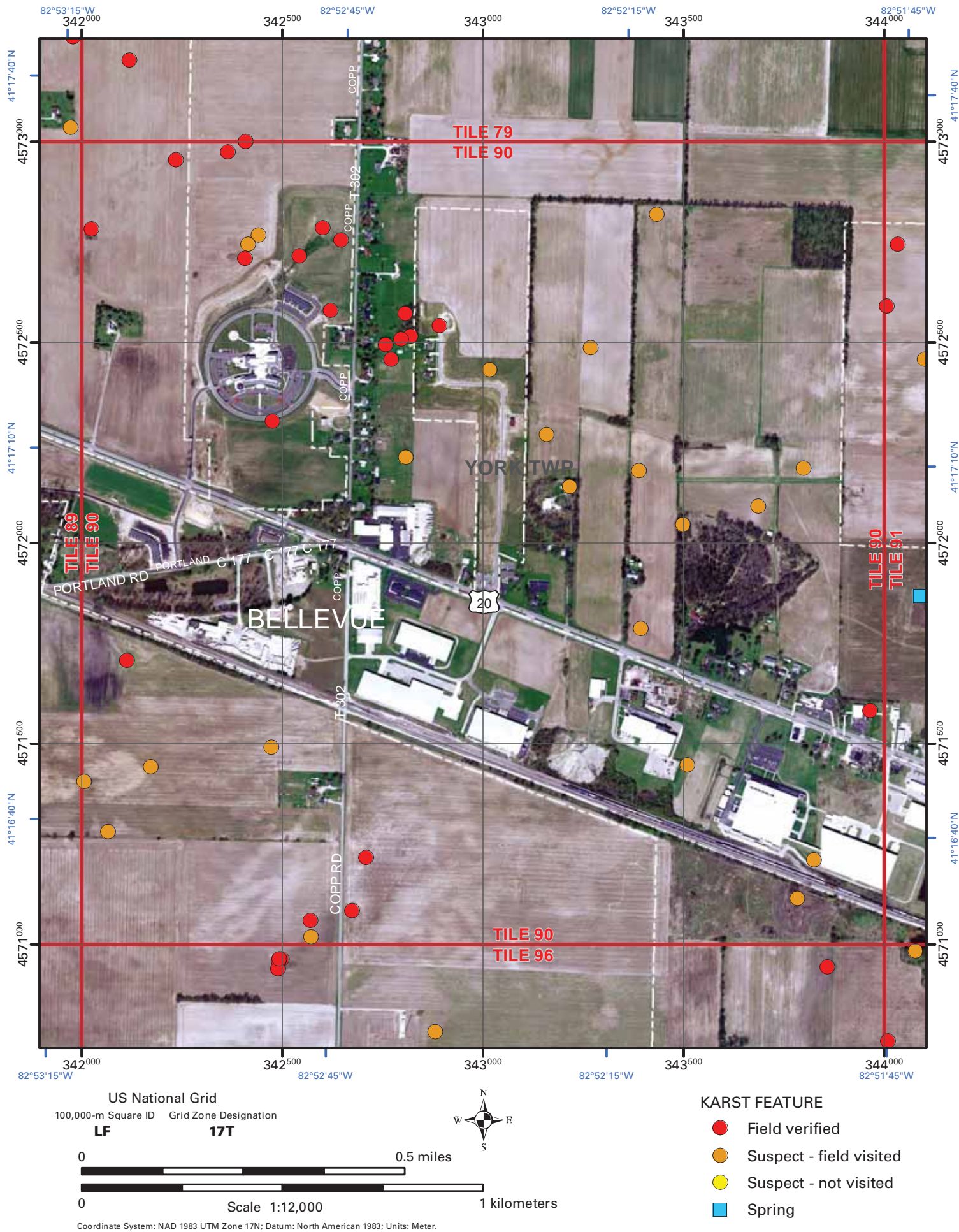


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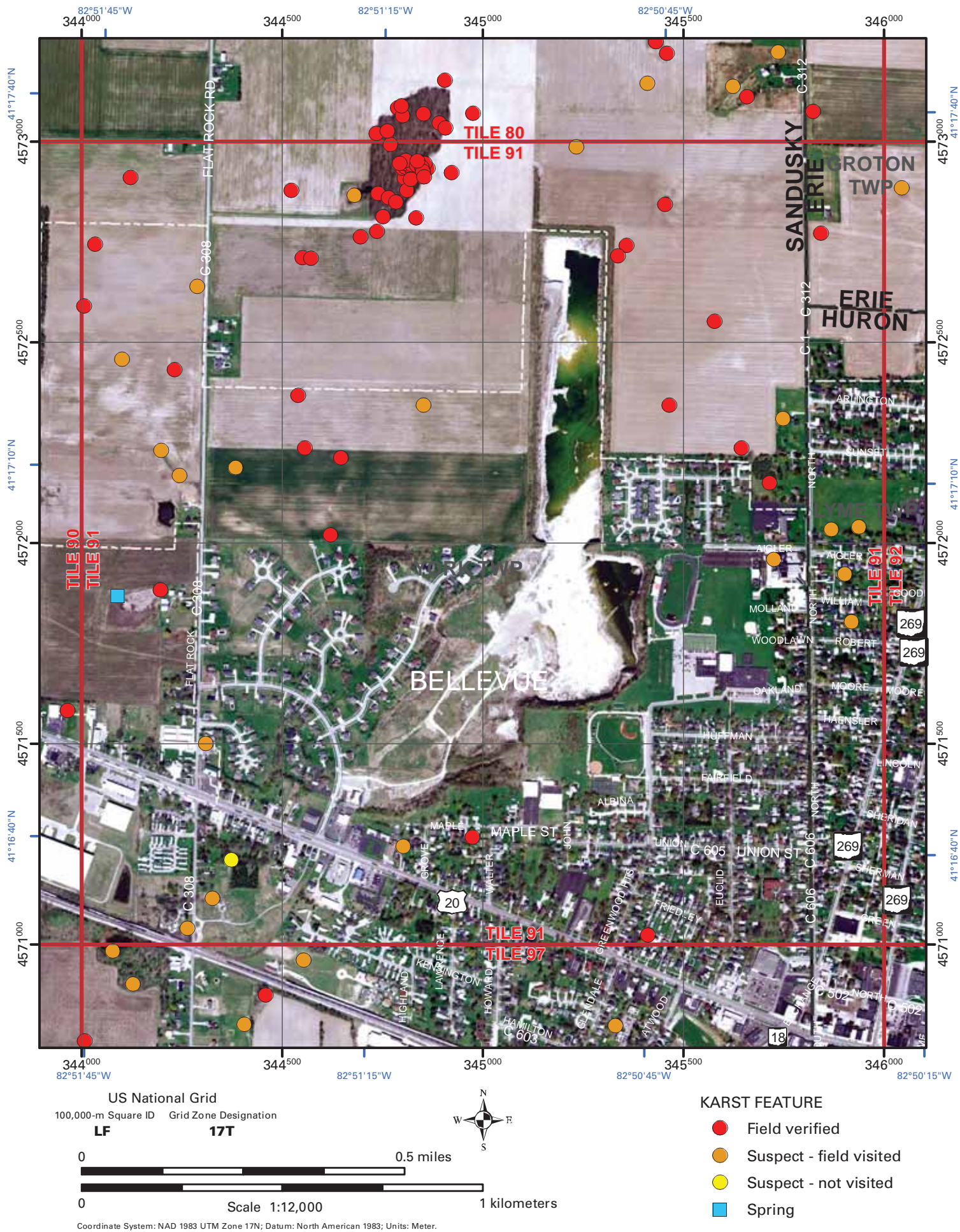


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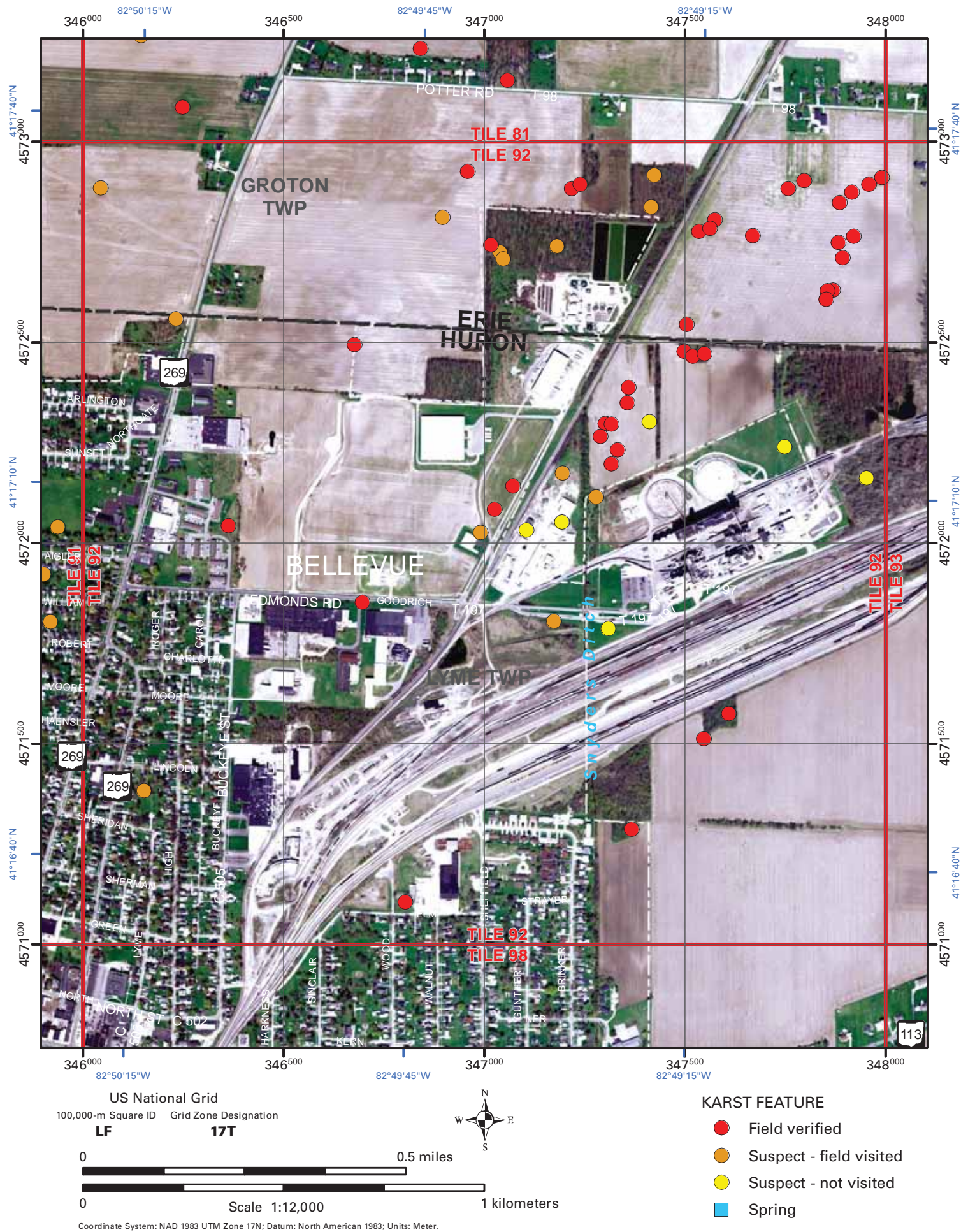


Tile Number: 91





Tile Number: 92



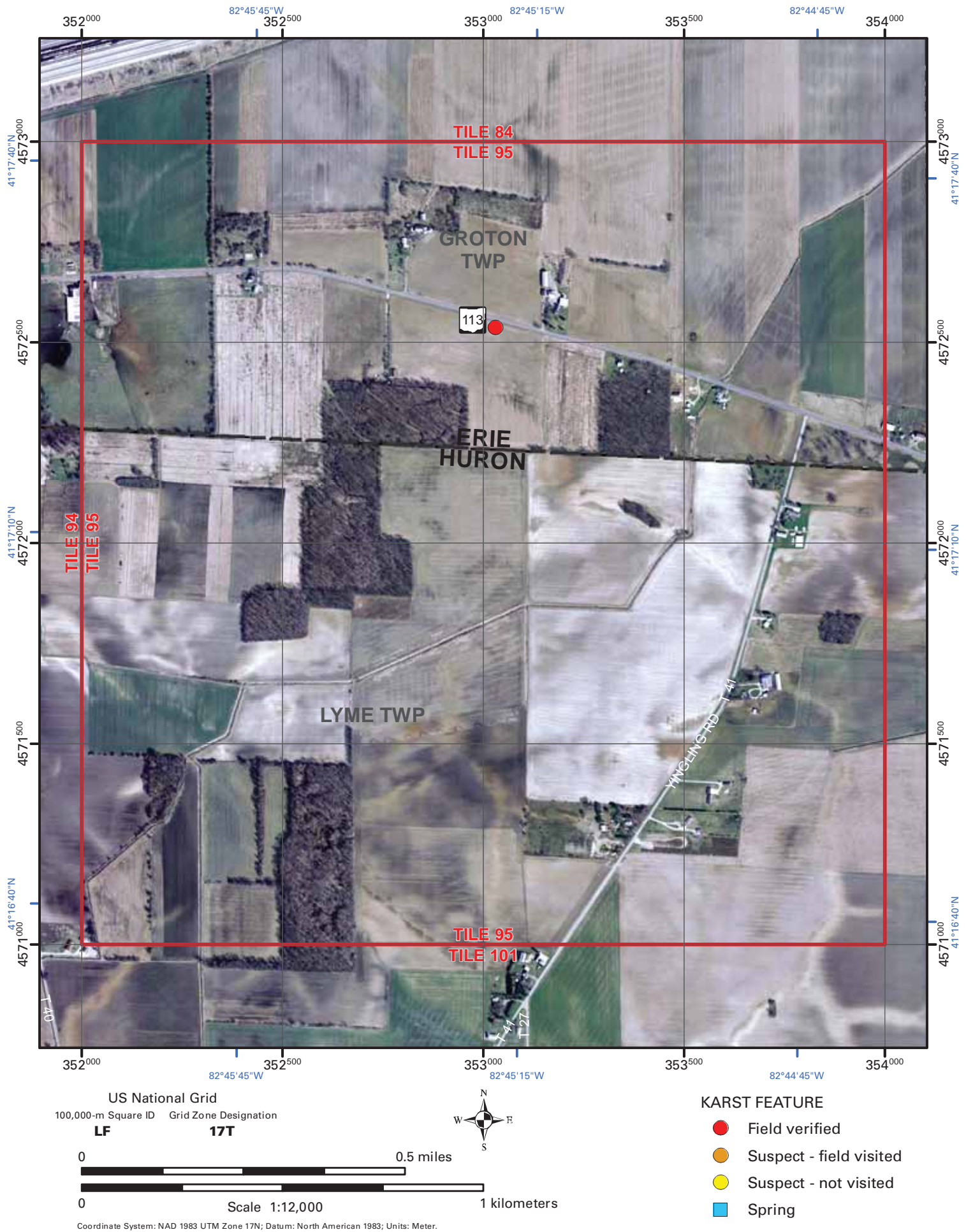


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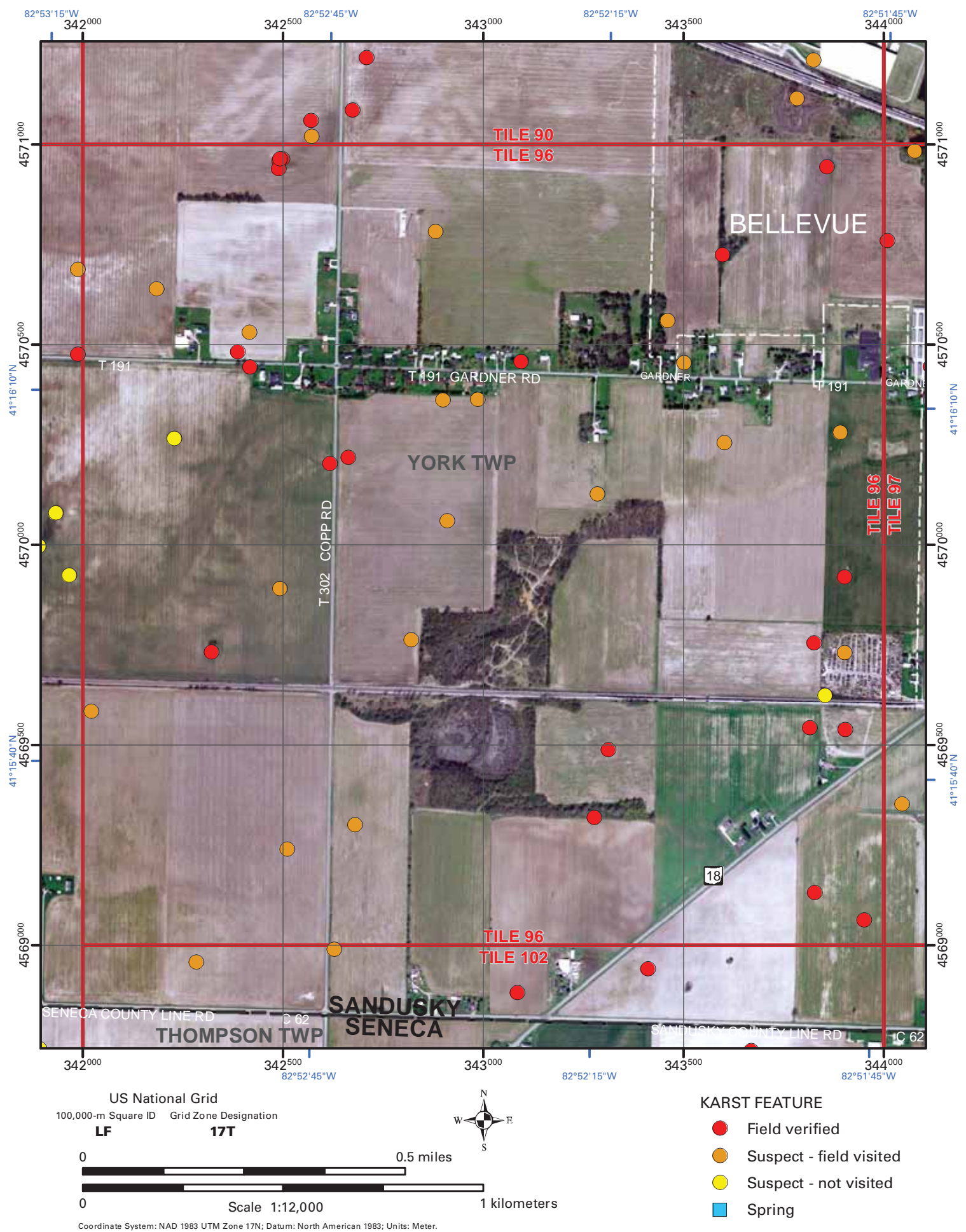


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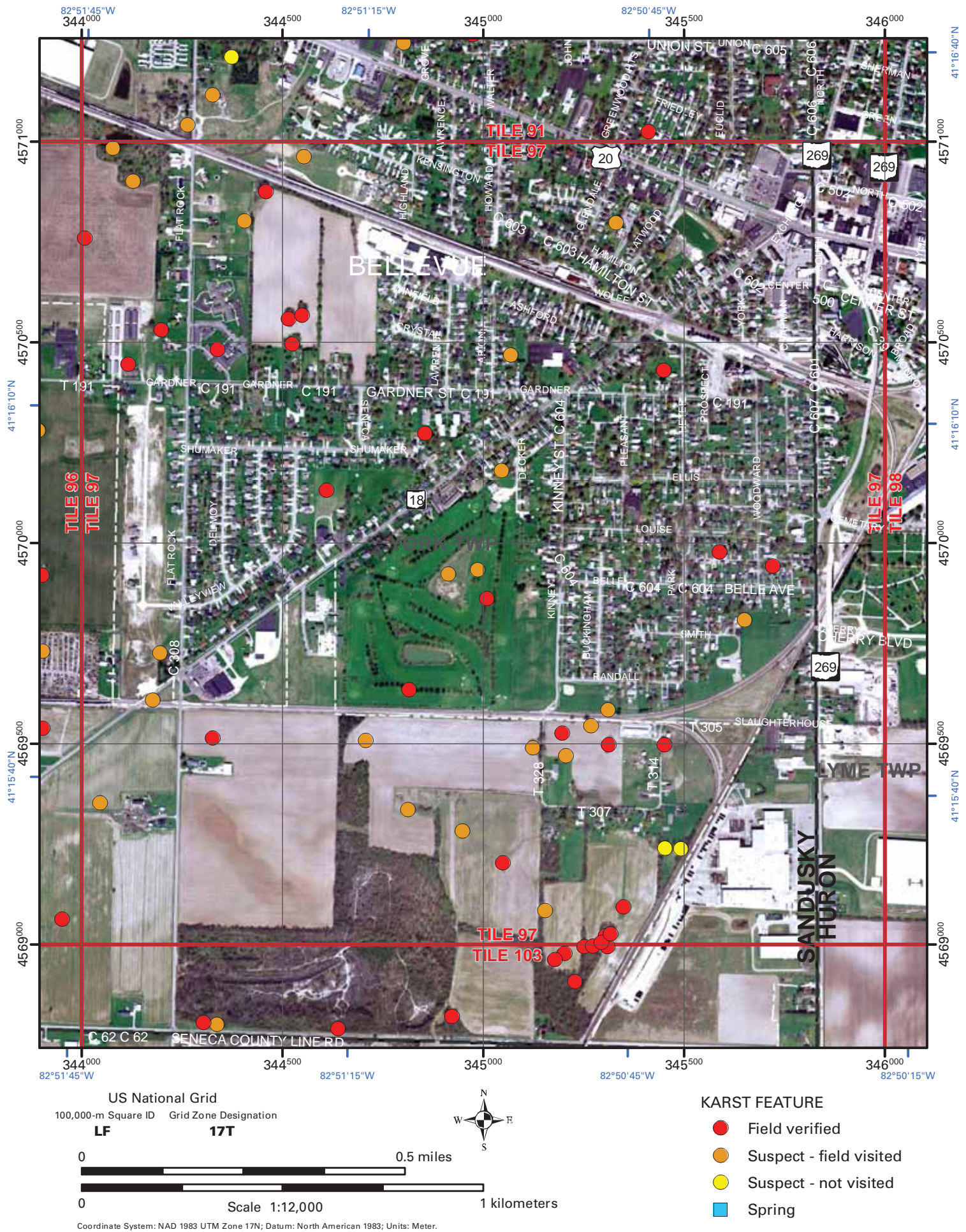


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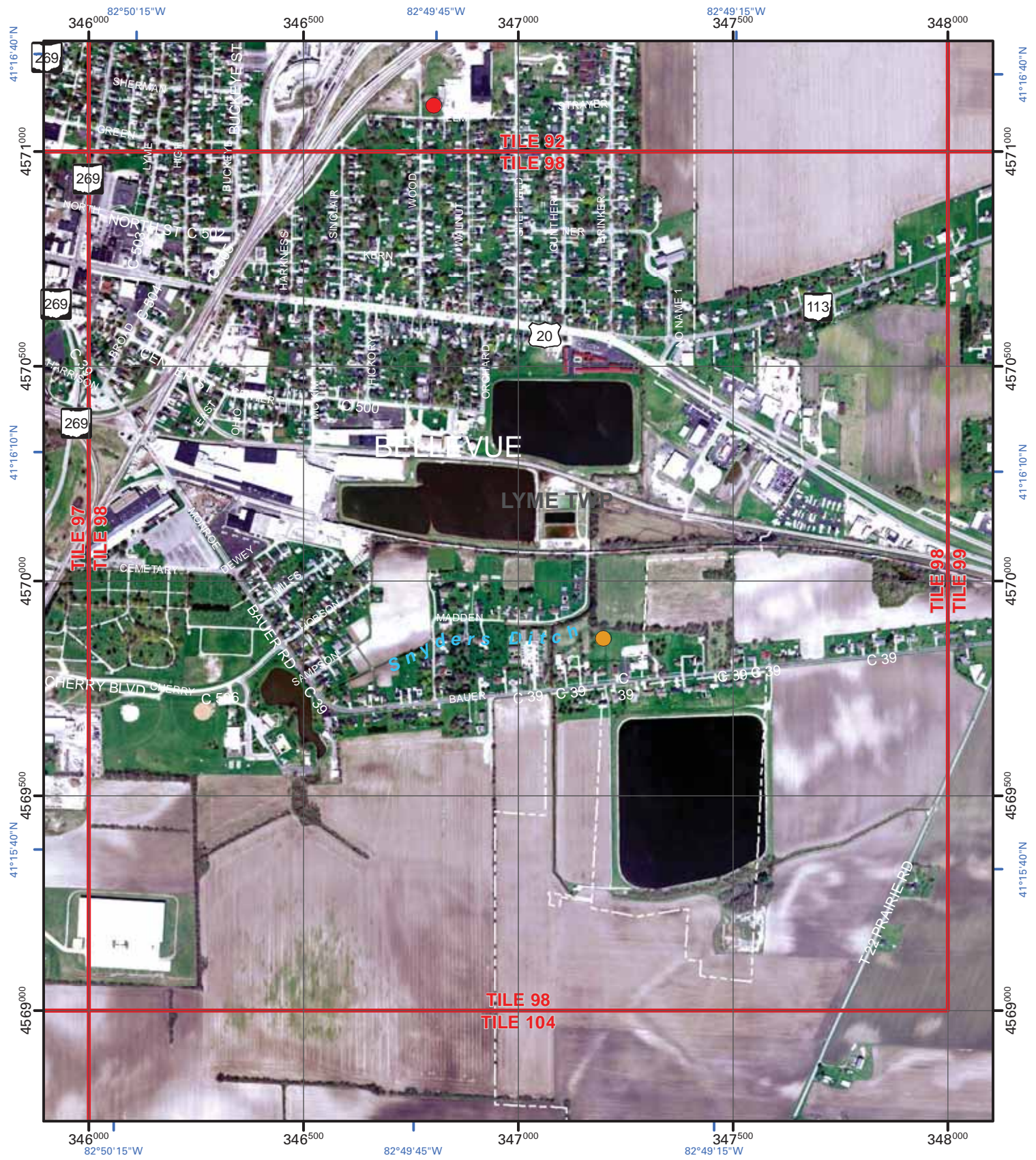


Tile Number: 97





Tile Number: 98



US National Grid  
100,000-m Square ID    Grid Zone Designation  
**LF**                      **17T**



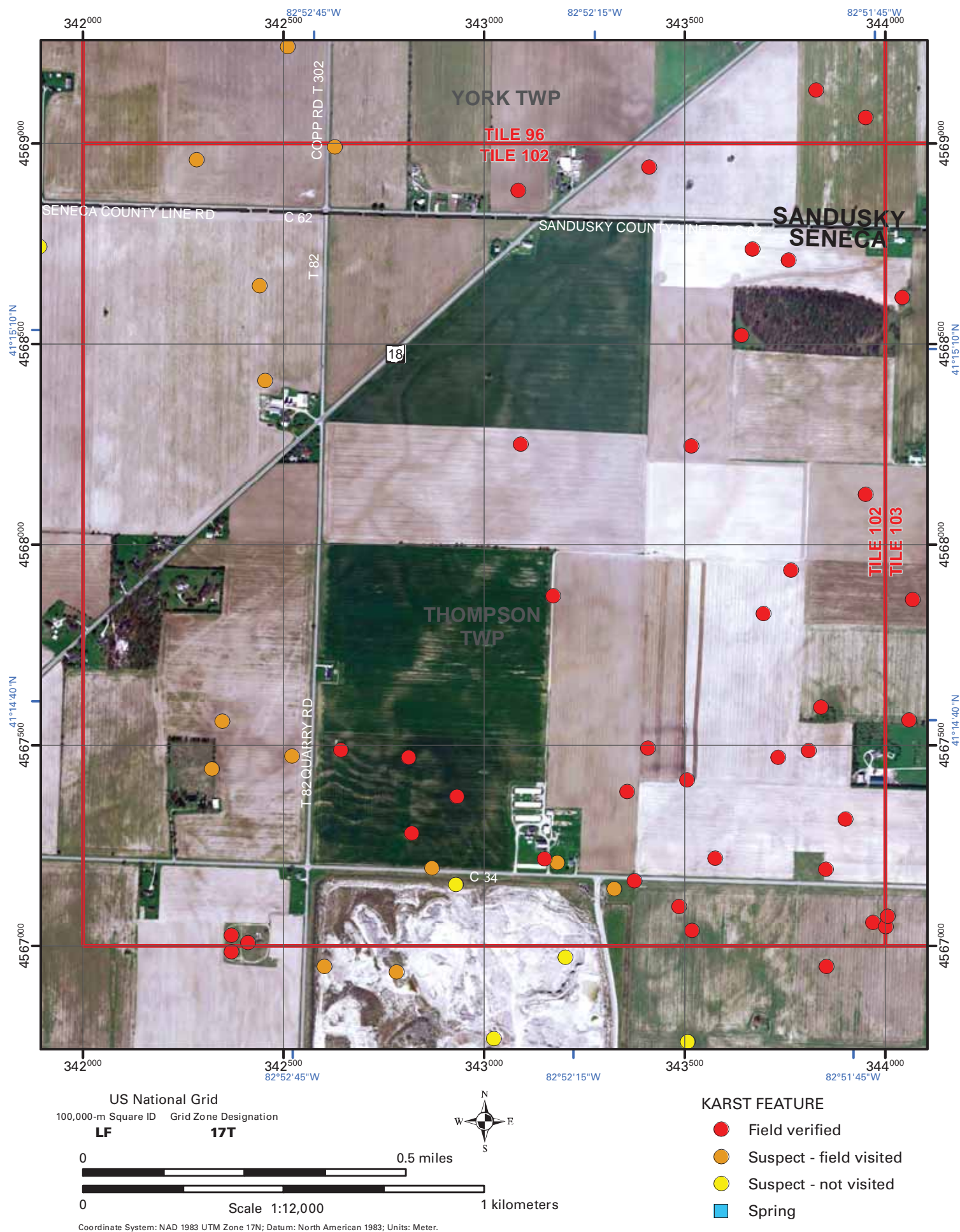
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- KARST FEATURE**
- Field verified
  - Suspect - field visited
  - Suspect - not visited
  - Spring

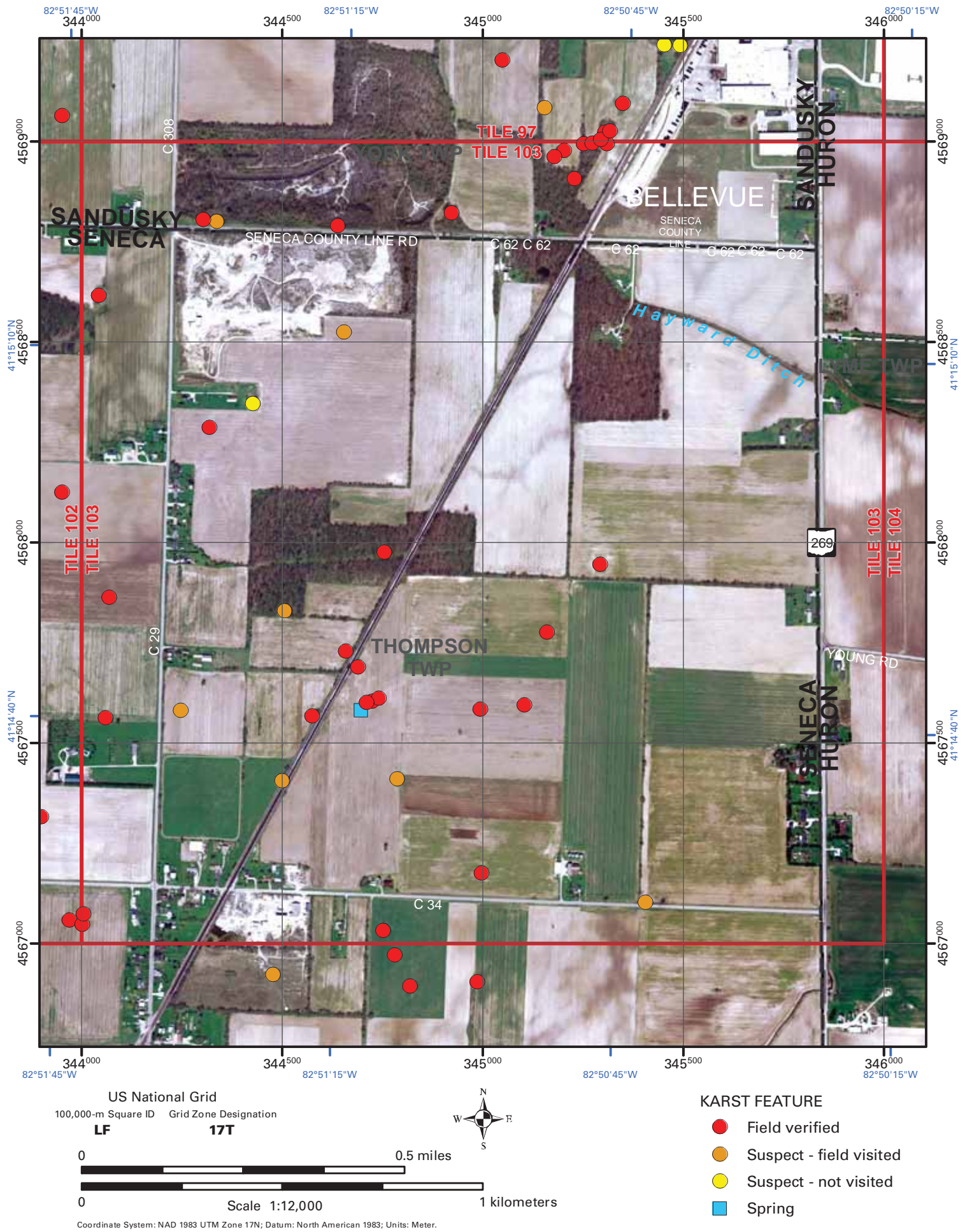


**Tile Number: 102**





Tile Number: 103







# **Karst of the Fireside Quadrangle and Portions of the Flat Rock and Clyde Quadrangles, Ohio**

by  
**Douglas J. Aden**

with  
GIS and cartography by Dean R. Martin

Open-File Report 2014-1  
Columbus 2014





### **DISCLAIMER**

The information contained herein has not been reviewed for technical accuracy and conformity with current ODNR Division of Geological Survey standards for published or open-file materials. The ODNR Division of Geological Survey does not guarantee this information to be free from errors, omissions, or inaccuracies and disclaims any responsibility or liability for interpretations or decisions based thereon.

*Cover image:* With a diameter varying from 2 ft at the bottom lip of the surface cone to 3 ft below the overhanging rim, this 4-ft deep sinkhole in Seneca County has an unusual eastward plunging shape that widens in the subsurface. Formed in glacial till above the Devonian-age Delaware limestone, there are 15 active sinkholes within 250 ft of this feature. Three houses and a barn sit within 500 ft of this sinkhole. View is east-northeast and Seneca Caverns is about one mile north.

*Recommended citation:* Aden, D.J., 2014, Karst of the Fireside Quadrangle and portions of the Flat Rock and Clyde Quadrangles, Ohio: Columbus, Ohio Department of Natural Resources, Division of Geological Survey Open-File Report 2014-1, 4 p., 42 maps.

# Karst of the Fireside Quadrangle and Portions of the Flat Rock and Clyde Quadrangles, Ohio

by

Douglas J. Aden, with GIS and cartography by Dean R. Martin

## Introduction

Karst terrain forms by dissolution of carbonate rocks, such as limestone or dolomite, or evaporites, such as gypsum or salt, and is characterized by features including sinkholes, disappearing streams, caves, and springs. *Sinkholes* (or *sinks*) are enclosed depressions that do not usually hold water; they often have a “throat” or opening at the bottom where they drain to the subsurface. When a stream flows into a sinkhole, it is known as a *disappearing stream* or *losing stream*. Water flowing into the ground can cause solution enlargement of natural fractures in the rock and eventually can grow into caves. In Ohio, a *cave* is defined as “...a naturally occurring void, cavity, recess, or system of interconnecting passages beneath the surface of the earth or within a cliff or ledge...” (State of Ohio, 1989).

The many passageways formed in karst terrain allow for high connectivity between the land surface and the water table. These passageways permit water to 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. When water exits these solutional features, a *spring* is formed. Such springs enable release of these contaminants at the surface.

The different types of karst features may pose infrastructure complications; roads, utilities, houses, and other facilities built in karst areas are at risk of subsidence, collapse, or other damage. In order to provide a reference for future planning on both the local and regional scale, the Ohio Geological Survey has produced this map book identifying the known and suspected karst areas in the vicinity of Bellevue, Ohio, including portions of Erie, Huron, Sandusky, and Seneca Counties.

## Previous Work

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 was mapped statewide to determine areas suitable for storage of low-level nuclear byproducts. Ohio’s preliminary map of karst features (Pavey and others, 1999) was completed in 1997 and released in 1999; it since has been updated with new data in 2003, 2005, and 2007 and will be updated again in the near future.

In the spring of 2008, severe karst-related flooding occurred in Bellevue and initiated increased concern regarding Ohio’s geohazards (Raab and others, 2009; Pavey and others, 2012). From 2011 to 2012, karst was mapped in the Delaware County region (Aden and others, 2011) and in the Springfield and Donnelsville 7.5-minute quadrangles (Aden, 2012). Next, from fall 2012 to spring 2013 karst was mapped in the Bellevue 7.5-minute quadrangle and parts of the Clyde and Castalia quadrangles (Aden, 2013). Finally, mapping was completed near Bellevue, Ohio, from fall 2013 to spring 2014 in the Fireside and Flat Rock 7.5-minute quadrangles and the remaining portion of the Clyde quadrangle.

## Methodology

A digital elevation map (DEM), generated from LiDAR (Light Detection and Ranging) data, was used to create a map layer that identified low, enclosed areas. To locate potential sinkholes, these low spots were cross referenced with known karst points, bedrock geology, aerial photography of multiple sources and ages, soil maps, glacial drift thickness maps, and water well logs. Suspect locations were then visited in the field, evaluated, and photographed. Through this process some of the LiDAR returns were found not to be sinkholes; features such as building foundations, broken field tiles, steep-walled streams, road culverts, and glacial features often produced enclosed areas similar in shape to sinkholes. Many of these misleading features were eliminated remotely using both 6-inches-per-pixel aerial photography and experience from past field verification. However, many points remained that



could not be distinguished remotely and these were visited in the field.

## Results

The resulting karst feature data set was overlain on four different geologic data sets—the Land Surface, the Bedrock Geology, the Bedrock Topography, and the Drift Thickness maps—to show how the features are related to the local geology. The first of these is the Land Surface map (p. 5), which shows the 87 two-km<sup>2</sup> tiles and the 7.5-minute quadrangles that form the project area overlain on the DEM of the land surface. The Fireside quadrangle was the core project area. However, some adjacent points were mapped to edge match last year's project, particularly in Flat Rock and Clyde quadrangles. The Land Surface map shows that south of Bellevue, sinks are concentrated near the Fireside and Flat Rock quadrangle boundary and trend south-west to north-east.

On the Land Surface map, tiles outlined in red contain the karst features identified through this project. No karst was identified in black-outline tiles. In total, there are 975 karst features, including 1 spring, in 87 tiles. On the top left of each aerial imagery page (p. 9–50) is a Tile Number that references the corresponding numbered tile on the four overlay maps.

There are four types of karst features identified on each map:

- ♦ Red circles indicate field-verified features, i.e., those that have been visited in the field and confirmed as karst.
- ♦ Orange circles indicate sites that were visited but could not be verified at the time, for example a suspicious depression that is flooded or that lacks an active sink throat and cannot be clearly classified.
- ♦ Yellow circles represent areas with suspect characteristics, such as a subtle LiDAR depression, a location where access to the property could not be gained, or where there was not enough time to field check the point.
- ♦ Blue squares represent springs, where water was found flowing from the subsurface.

The next overlay map is the Bedrock Geology map (p. 6). This map shows that the karst features are forming primarily by dissolution of the Columbus Limestone; however, it is thought that the Salina undifferentiated below is also affecting the sinks. The

Salina contains beds of the mineral anhydrite, which alters to gypsum by hydration. This change causes swelling of about 40 percent (Boggs, 2006), which could help to fracture surrounding rocks; but more importantly, gypsum is easily dissolved by additional ground water, removing roof support and leading to collapse. In the Bellevue region, there are two main ways that karst is expressed: one where catastrophic collapse forms a steep-walled, cone-shaped depression with active sinking and a second that is much more broad and shallow and may or may not have an active sink throat where water is draining into it. It should be noted that there are karst points on 'shale' according to this map; this means one of two things. Either the shale is very thin and the sinks are forming through it or the bedrock map needs to be refined.

Six hundred and eighty seven (687) of the 975 karst features are within the Columbus Limestone (**Dc** on the Bedrock Geology map) and 111 are within the Delaware Limestone (**Dd**). Regarding the shale there are 152 points within the Olentangy and Plumbrook shales (**Dol** and **Dolpb**). The majority of the remaining features in the Bass Islands Dolomite or Salina undifferentiated (within the **Sbi** or **Ssu**). These formations and the others on the Bedrock Geology map are buried in many places by surficial glacial materials. The elevation of the bedrock below the surficial materials is called Bedrock Topography and is shown on page 7. The elevations of the bedrock surface were subtracted from the DEM (p. 5) to create the Drift Thickness map (p. 8). Knowing the drift thickness is useful because where the drift is shallow—about 25 ft or less—sinkholes are commonly expressed. Other sinkholes may exist but were either buried beneath the glacial drift or prevented from forming by thick drift. The Drift Thickness map clearly shows that in the Bellevue area the sinkholes are concentrated along areas of thin glacial drift.

Following the four overlay maps are the detailed two-km<sup>2</sup> map tiles (p. 9–50) that contain specific karst feature locations. Also included on these maps are karst depressions represented by yellow to red topographic lines. Each concentric ring represents a one foot drop in elevation toward the low point of an internally drained area.

## Conclusions

Of the 975 mapped karst features, 468 have photos

(from multiple angles for interesting features) and 834 appear on LiDAR. Very few springs were located in this area—reemergence is almost exclusively to the north in the direction of subterranean drainage. Furthermore, springs do not typically show up as depressions unless a catch basin was built and subsequently failed or a build-up of material deposits from carbonate-rich spring waters forms a mound. The large number of sinks found without LiDAR attests to the need for spending time in the field near known karst areas, looking for new features and talking to the public. Farmers and other land holders are still some of the best sources of local information, particularly for historical features, such as drained ponds, old mill races, and even sinkholes that have been periodically filled in.

In addition to this map book, a DVD containing the GIS data, metadata, LiDAR depressions, and photographs of many of the features is available. The GIS data contains details such as the location of each point and a brief description of what was found there. The metadata provides information on the sources and quality of the data used in this project. The LiDAR depressions layer records the depths and areas for many of the sinkholes. In addition, the collection of photographs captured for many of these features can be used to monitor the growth of preexisting sinkholes and development of new karst features, as well as assisting in identification. Identification is important because karst regions are highly susceptible to pollution and structures built near them may subside. Furthermore, in the Bellevue region, low-lying karst features may be subject to flooding during periods of unusually high precipitation when the water table rises above the land surface. The maps in this report will allow areas of land development near karst features to be better planned and maintained.

## Acknowledgments

The Bellevue projects, the Delaware County region project, and the Springfield project were funded by the Great Lakes Geologic Mapping Coalition surficial mapping grant program.

## References Cited

Aden, D.J., 2013, Karst of the Bellevue Quadrangle and portions of the Clyde and Castalia Quadrangles, Ohio: Ohio Department of Natural Resources,

Division of Geological Survey Open-File Report 2013-1, 4 p., 59 maps, accessible at < [http://geosurvey.ohiodnr.gov/portals/geosurvey/PDFs/OpenFileReports/OFR\\_2013-1.pdf](http://geosurvey.ohiodnr.gov/portals/geosurvey/PDFs/OpenFileReports/OFR_2013-1.pdf) > .

Aden, D.J., 2012, Karst of Springfield, Ohio: Ohio Department of Natural Resources, Division of Geological Survey Open-File Report 2012-2, 3 p., 25 maps, accessible at < [http://geosurvey.ohiodnr.gov/portals/geosurvey/PDFs/OpenFileReports/OFR\\_2012-2.pdf](http://geosurvey.ohiodnr.gov/portals/geosurvey/PDFs/OpenFileReports/OFR_2012-2.pdf) > .

Aden, D.J., Powers, D.M., Pavey, R.R., Jones, D.M., Martin, D.R., Shrake, D.L., and Angle, M.P., 2011, Karst of the western Delaware County, Ohio, region: Ohio Department of Natural Resources, Division of Geological Survey Open-File Report 2011-4, 2 p., 35 maps, accessible at < [http://geosurvey.ohiodnr.gov/portals/geosurvey/PDFs/OpenFileReports/OFR\\_2011-4.pdf](http://geosurvey.ohiodnr.gov/portals/geosurvey/PDFs/OpenFileReports/OFR_2011-4.pdf) > .

Boggs, Sam, Jr., 2006, Principles of sedimentology and stratigraphy (4th ed.): Upper Saddle River, NJ, Pearson Prentice Hall, p.199.

State of Ohio, 1989, Ohio Revised Code 1517.21 Cave definitions, *in* chap. 1517 of Title 15 Conservation of Natural Resources: State of Ohio, Ohio Revised Code, accessible at < <http://codes.ohio.gov/orc/1517.21> > .

Pavey, R.R., Angle, M.P., Powers, D.M., Swinford, E.M., 2012, Karst flooding in Bellevue, Ohio, and vicinity—2008: Ohio Department of Natural Resources, Division of Geological Survey Map EG-5, scale 1:24,000.

Pavey, R.R., Hull, D.N., Brockman, C.S., Schumacher, G.A., Stith, D.A., Swinford, E.M., Sole, T.L., Vorbau, K.E., Kallini, K.D., Evans, E.E., Slucher, E.R., and Van Horn, R.G., with GIS and cartography by Powers, D.M., and Vogt, K.L., 1999, Known and probable karst in Ohio: Ohio Department of Natural Resources, Division of Geological Survey Map EG-1, scale 1:500,000. [Revised 2002, 2004, 2007.]

Raab, James, Haiker, Bill, Jones, Wayne, Angle, Michael, Pavey, Rick, Swinford, Mac, and Powers, Donovan, 2009, Ground water induced flooding in the Bellevue Ohio area, spring and summer 2008: Ohio Department of Natural Resources, Division of Water Technical Report of Investigation 2009-1, 19 p., accessible at < [http://geosurvey.ohiodnr.gov/portals/geosurvey/PDFs/Karst/Bellevue\\_Final\\_Report.pdf](http://geosurvey.ohiodnr.gov/portals/geosurvey/PDFs/Karst/Bellevue_Final_Report.pdf) > .



## Further Reading

For more information on karst in Ohio, visit the Ohio Geological Survey website, **OhioGeology.com**. The following resources also provide additional information on karst and its effects in Ohio and beyond.

### Ohio Department of Natural Resources

*Ground Water Induced Flooding in the Bellevue Ohio Area Spring and Summer 2008*, ODNR Division of Water Technical Report of Investigation 2009-1, 19 p.

*Karst Flooding in Bellevue, Ohio, and Vicinity—2008*, ODNR Division of Geological Survey Map EG-5, 2012, scale 1:24,000.

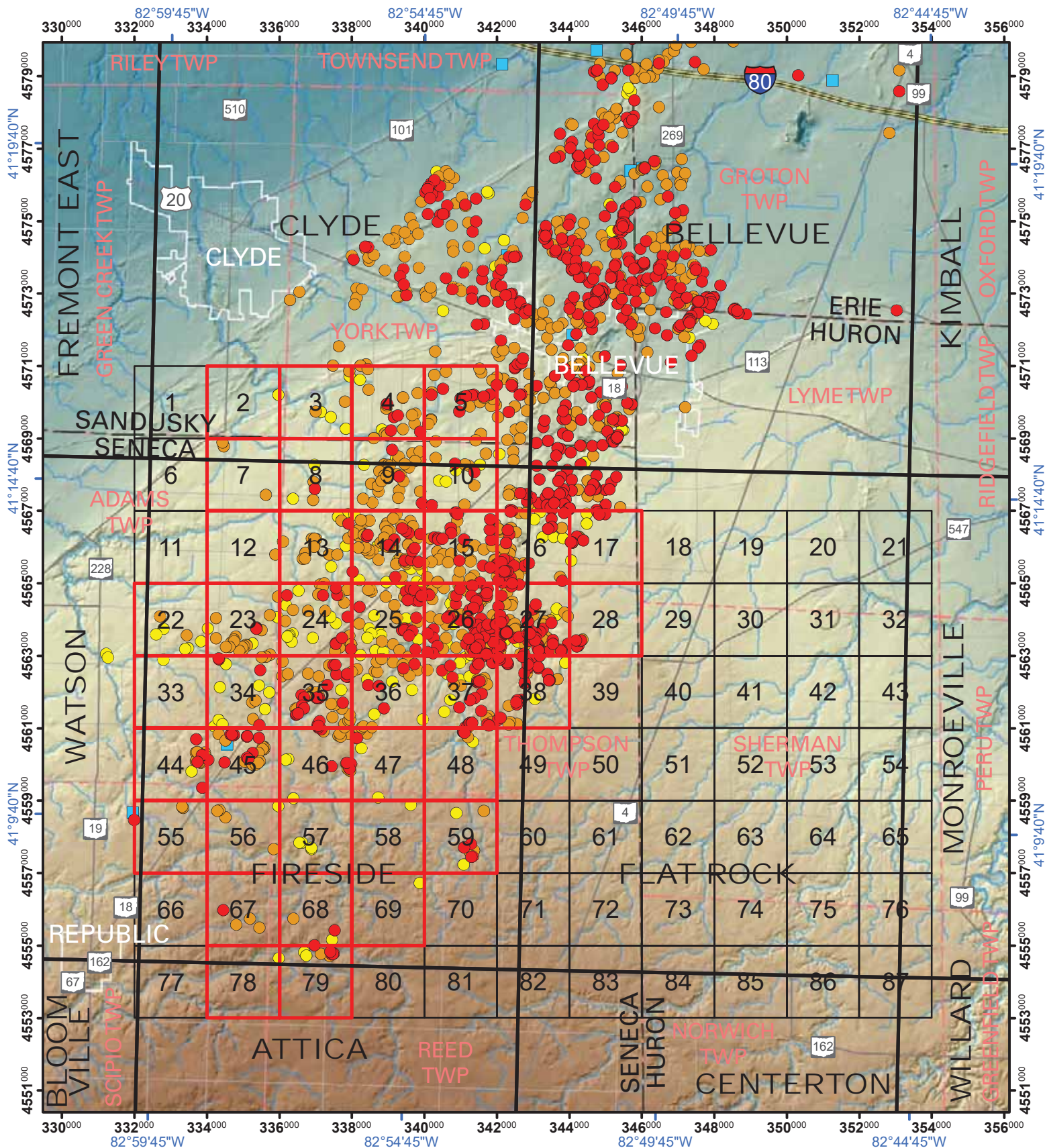
*Known and Probable Karst in Ohio*, ODNR Division of Geological Survey Map EG-1, generalized page-size version with text, 2 p., scale 1:2,000,000.

### 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> > .

### U.S. Geological Survey

*USGS Groundwater Information, Karst and the USGS*, accessible at < <http://water.usgs.gov/ogw/karst/> > .



- Tiles containing karst features
- U.S. National Grid

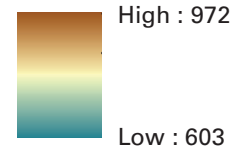


Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.

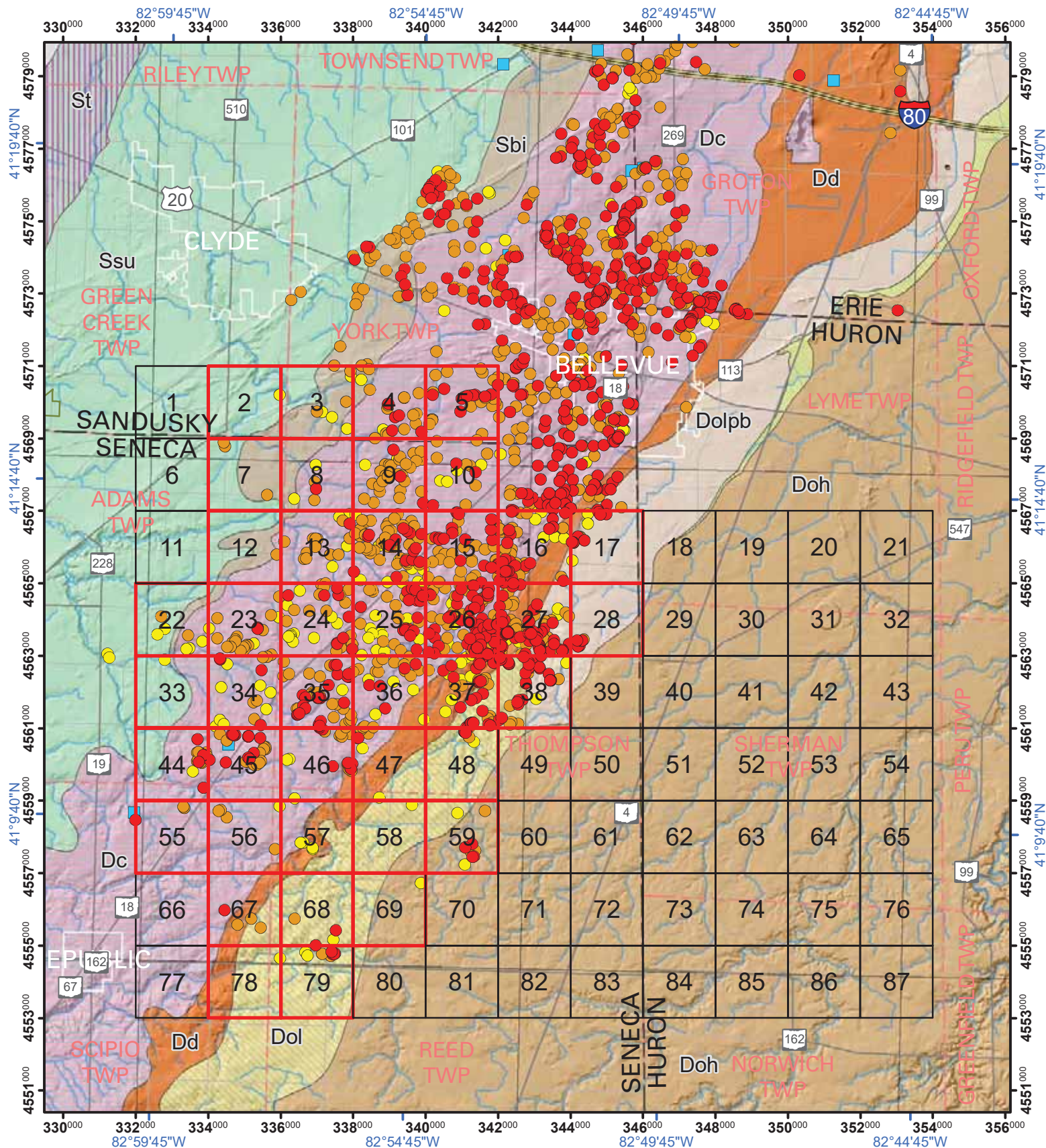
#### KARST FEATURE

- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

#### ELEVATION in feet







- Tiles containing karst features
- U.S. National Grid

0 5 miles

0 10 kilometers

Scale 1:140,000

Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.

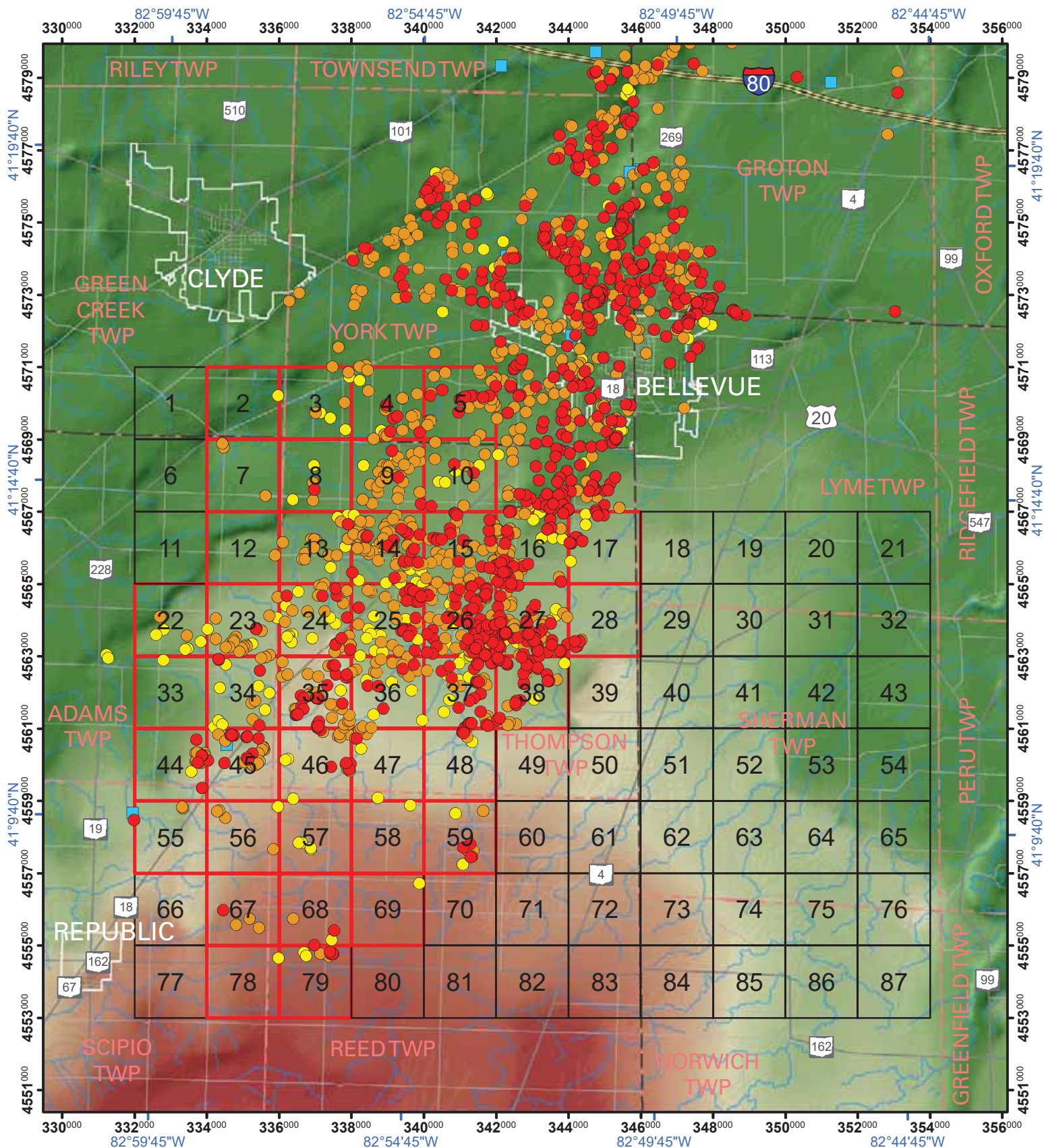
#### KARST FEATURE

- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

#### BEDROCK GEOLOGY

- |  |   |
|--|---|
| <span style="background-color: #f4a460; border: 1px solid black; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> Doh Ohio Sh         | <span style="background-color: #d8bfd8; border: 1px solid black; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> Dc Columbus Ls       |
| <span style="background-color: #90ee90; border: 1px solid black; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> Dolp Prout Ls       | <span style="background-color: #d2b48c; border: 1px solid black; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> Sbi Bass Islands Dol |
| <span style="background-color: #f0e68c; border: 1px solid black; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> Dol Olentangy Sh    | <span style="background-color: #90ee90; border: 1px solid black; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> Ssu Salina undiff    |
| <span style="background-color: #d8bfd8; border: 1px solid black; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> Dolpb Plum Brook Sh | <span style="background-color: #d8bfd8; border: 1px solid black; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> St Tymochtee Dol     |
| <span style="background-color: #f4a460; border: 1px solid black; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> Dd Delaware Ls      |   |





- Tiles containing karst features
- U.S. National Grid

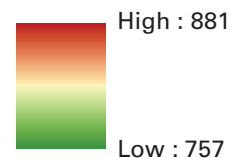


Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.

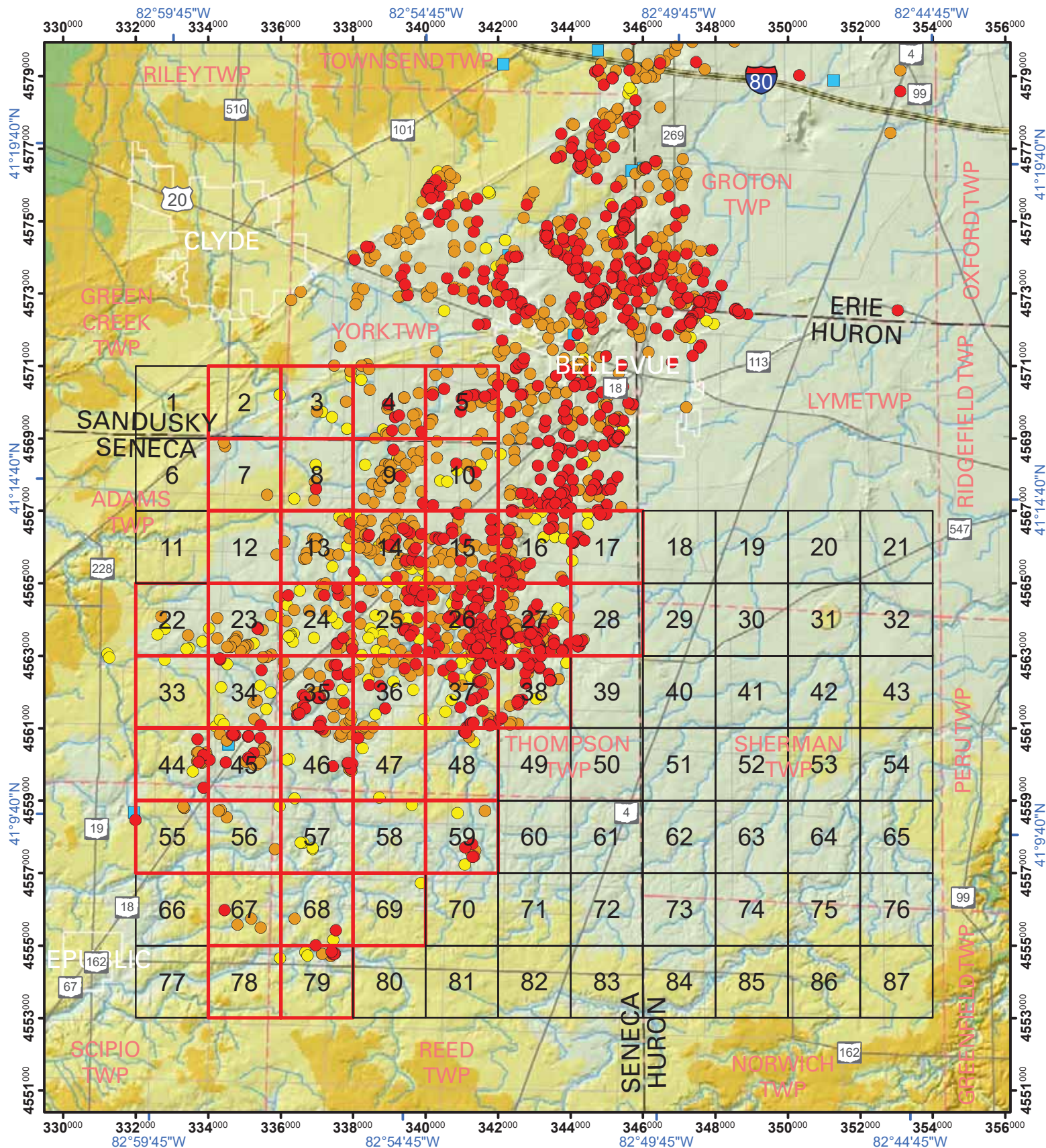
#### KARST FEATURE

- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

#### BEDROCK TOPOGRAPHY Elevation in feet







- Tiles containing karst features
- U.S. National Grid



Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.

#### KARST FEATURE

- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

#### DRIFT THICKNESS in feet

- <30
- 30—60
- 60—100
- >100



Tile Number: 2



U.S. National Grid  
100,000-m Square ID   Grid Zone Designation  
**KE**                      **17S**

0 0.5 miles

0 1 kilometers  
Scale 1:12,000

Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.



KARST FEATURE

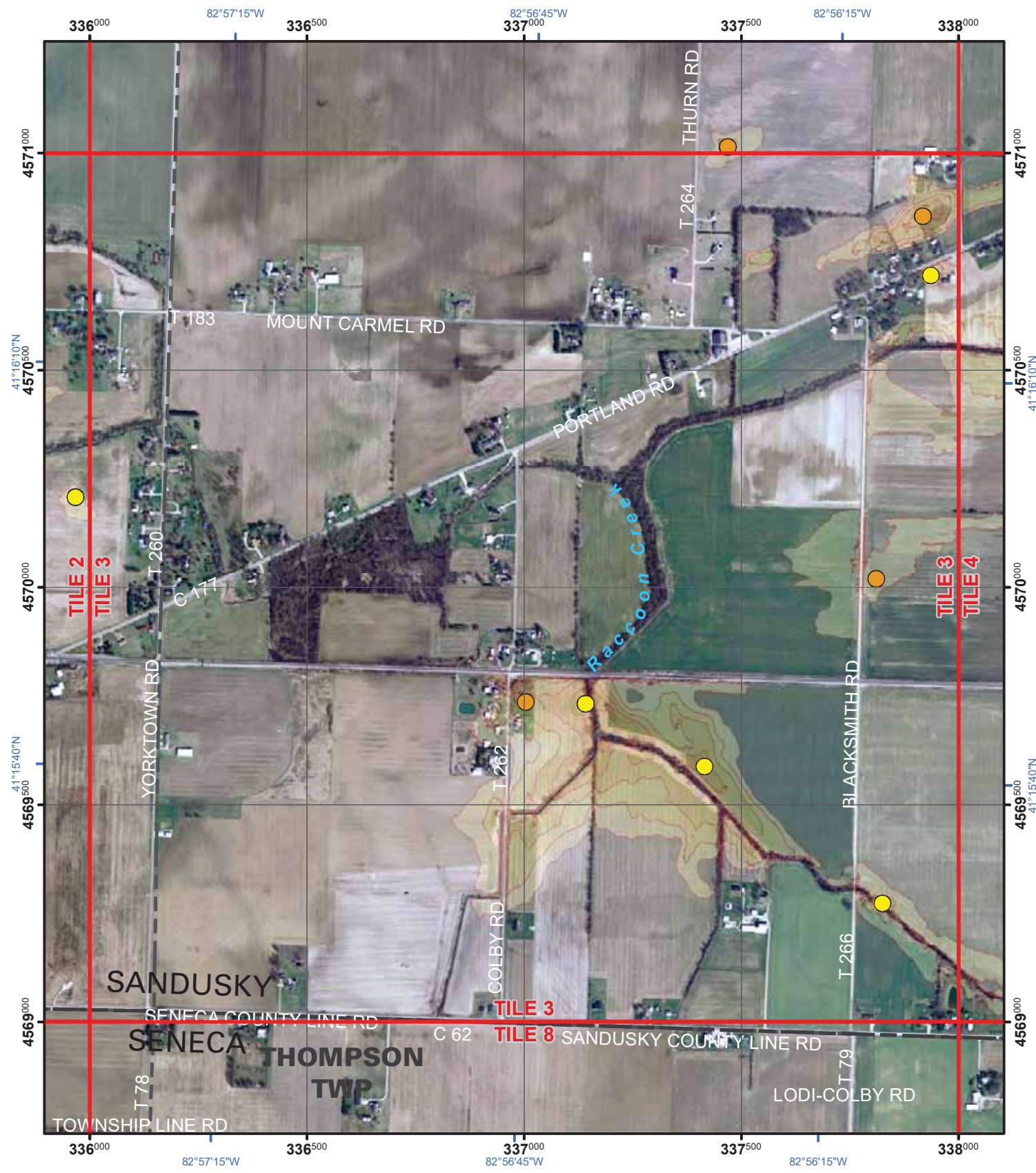
- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

DEPRESSION

Depth in feet

1	5	9
2	6	10
3	7	
4	8	





U.S. National Grid  
100,000-m Square ID Grid Zone Designation  
**KE 17S**



Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.

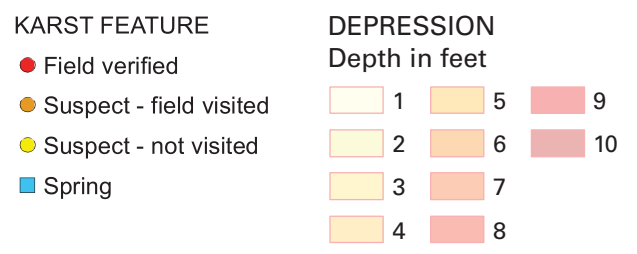
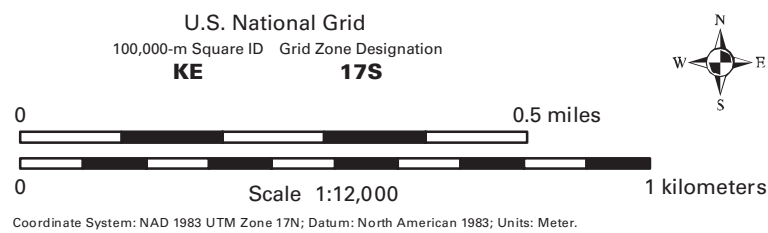
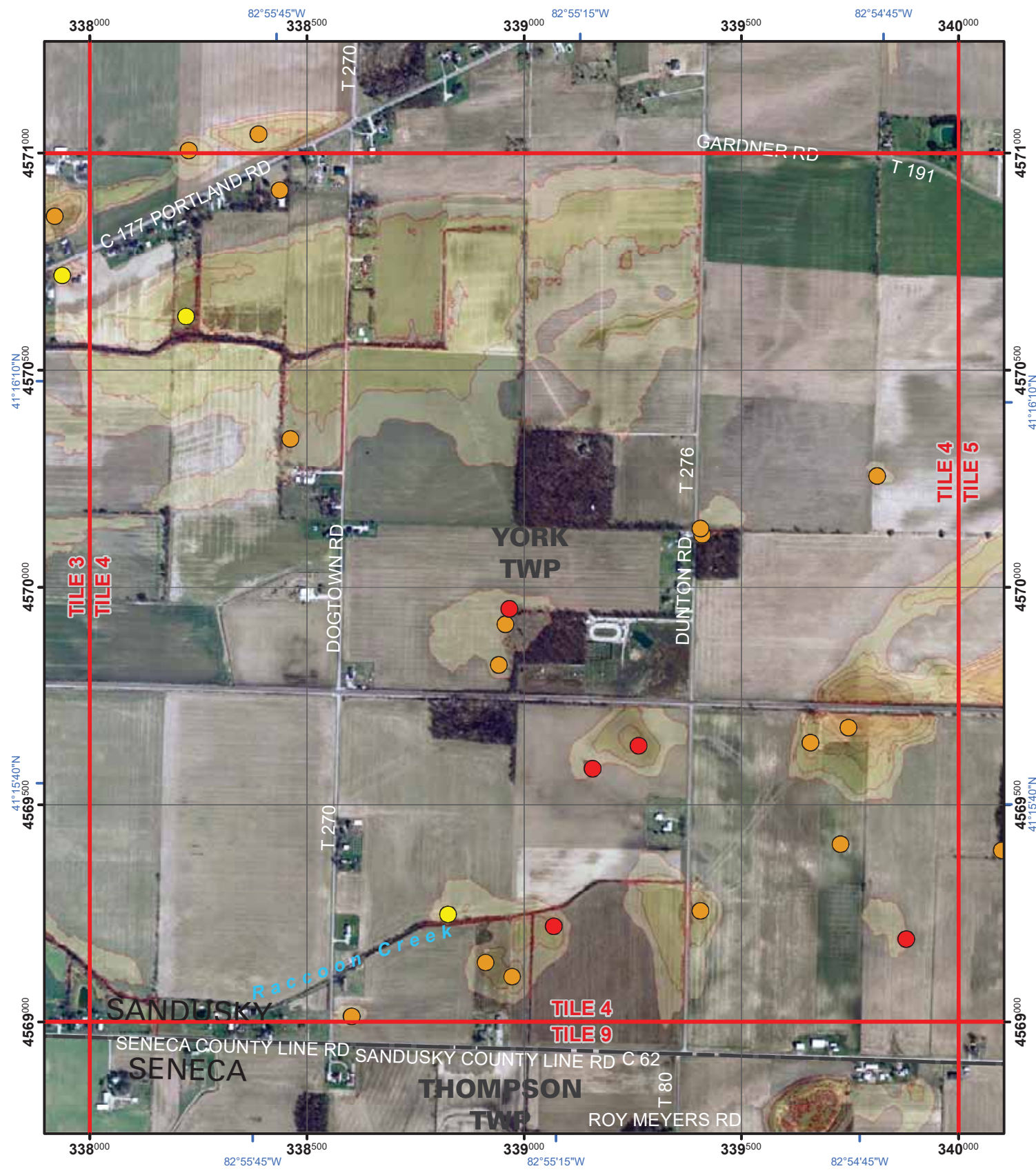


- KARST FEATURE**
- Field verified
  - Suspect - field visited
  - Suspect - not visited
  - Spring

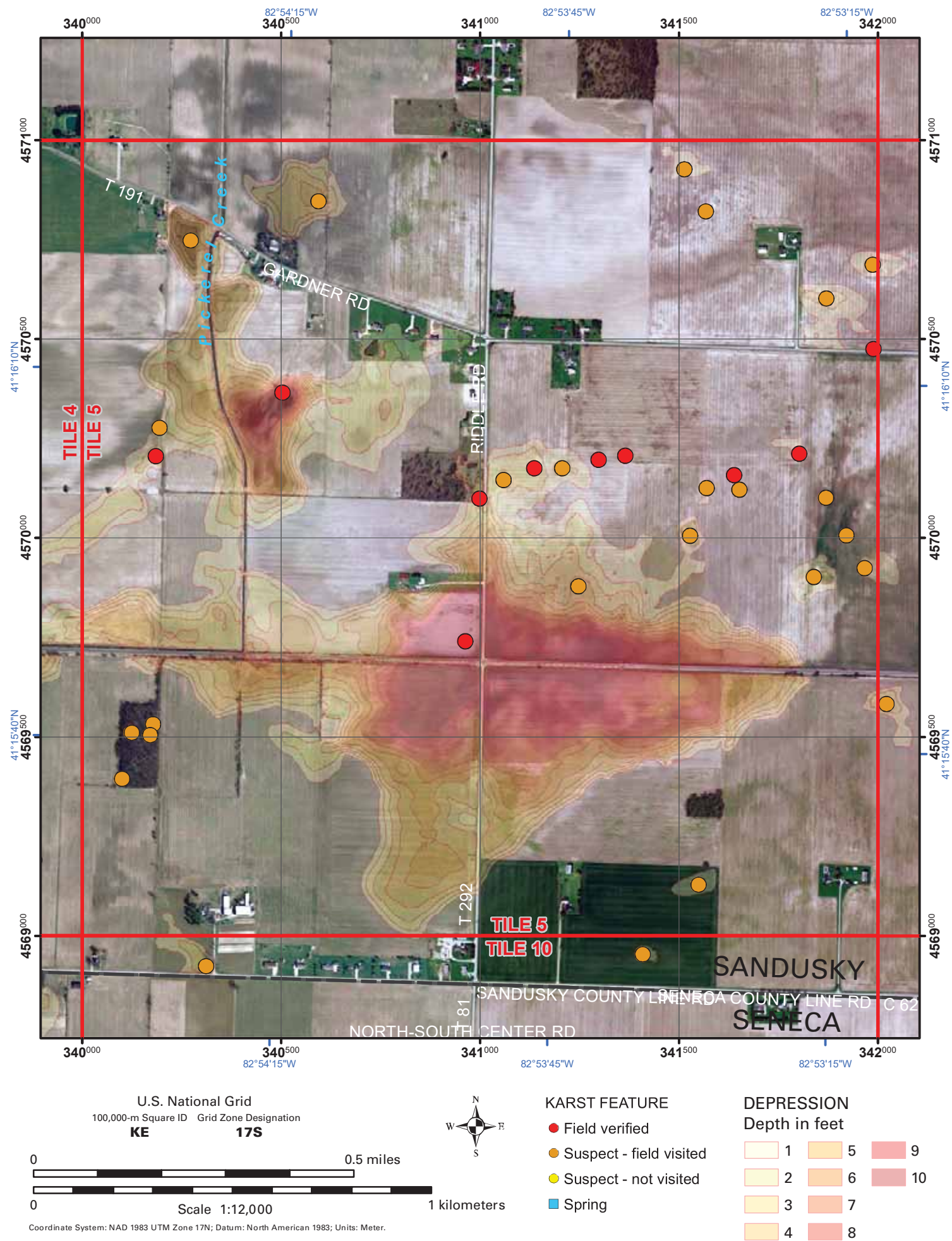
**DEPRESSION**  
Depth in feet

1	5	9
2	6	10
3	7	
4	8	



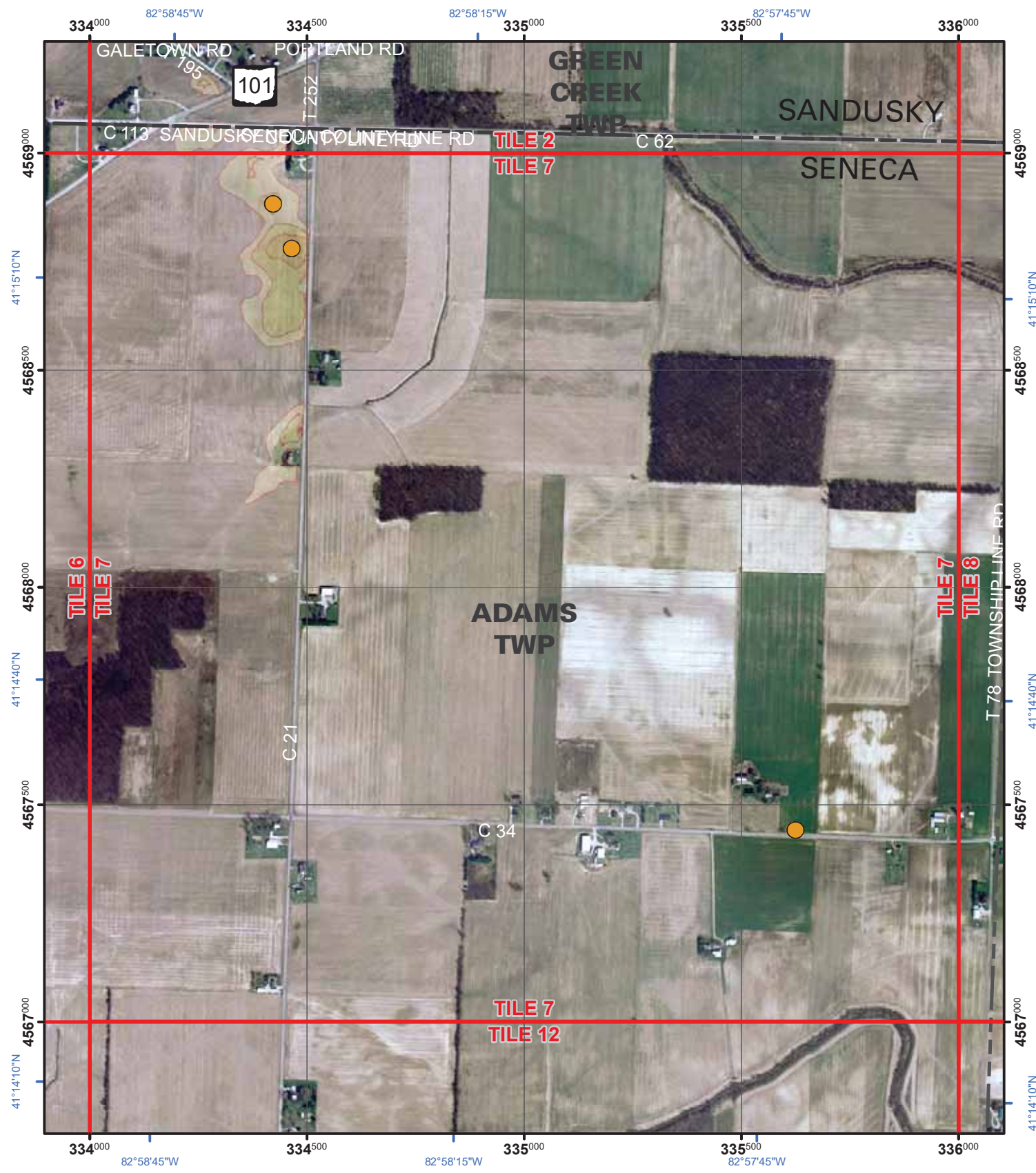








Tile Number: 7



U.S. National Grid  
100,000-m Square ID Grid Zone Designation  
**KE 17S**

0 0.5 miles

0 1 kilometers  
Scale 1:12,000

Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.



KARST FEATURE

- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

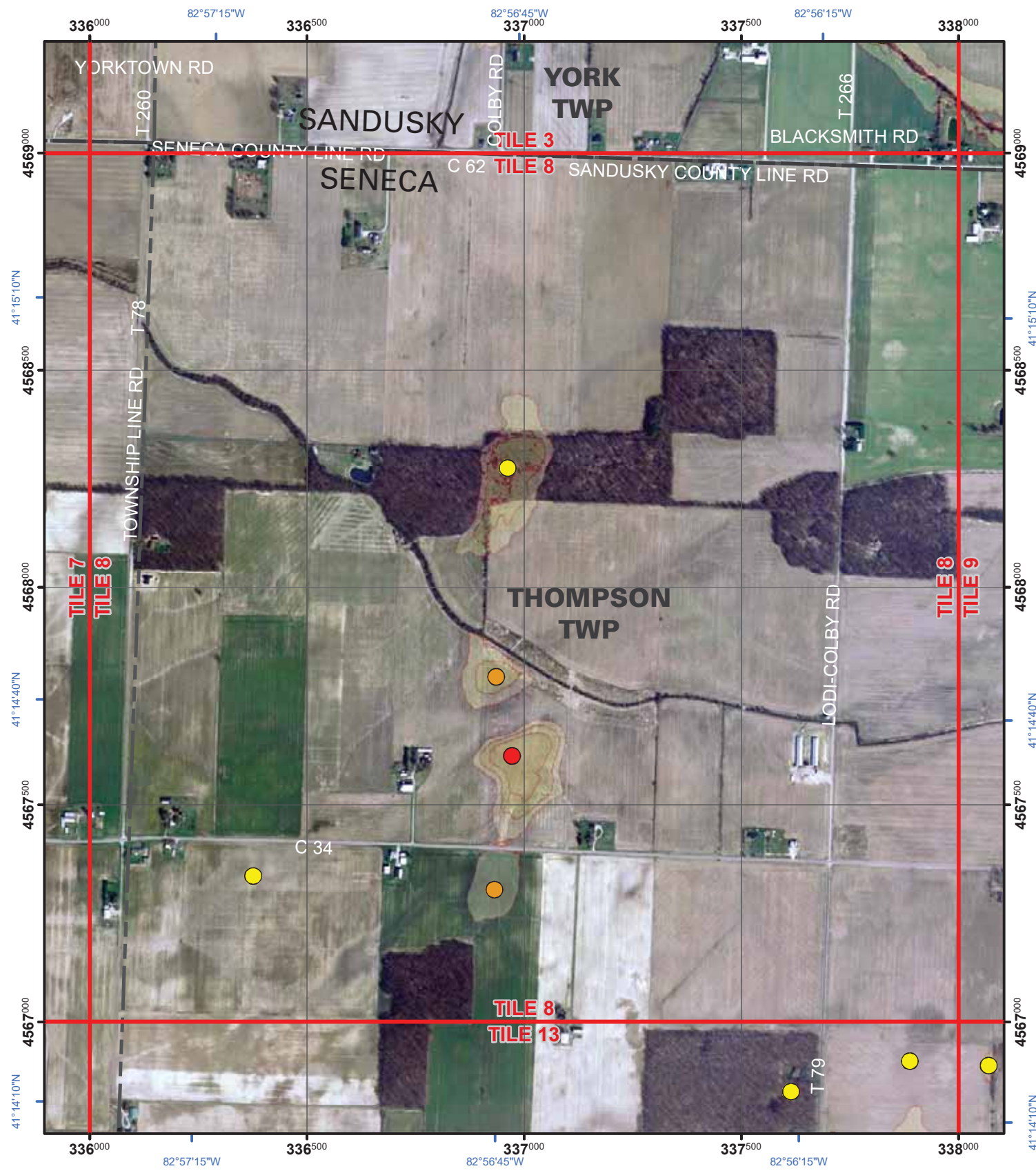
DEPRESSION

Depth in feet

1	5	9
2	6	10
3	7	
4	8	



Tile Number: 8



U.S. National Grid  
100,000-m Square ID   Grid Zone Designation  
**KE**                      **17S**

0 0.5 miles

0 1 kilometers

Scale 1:12,000



KARST FEATURE

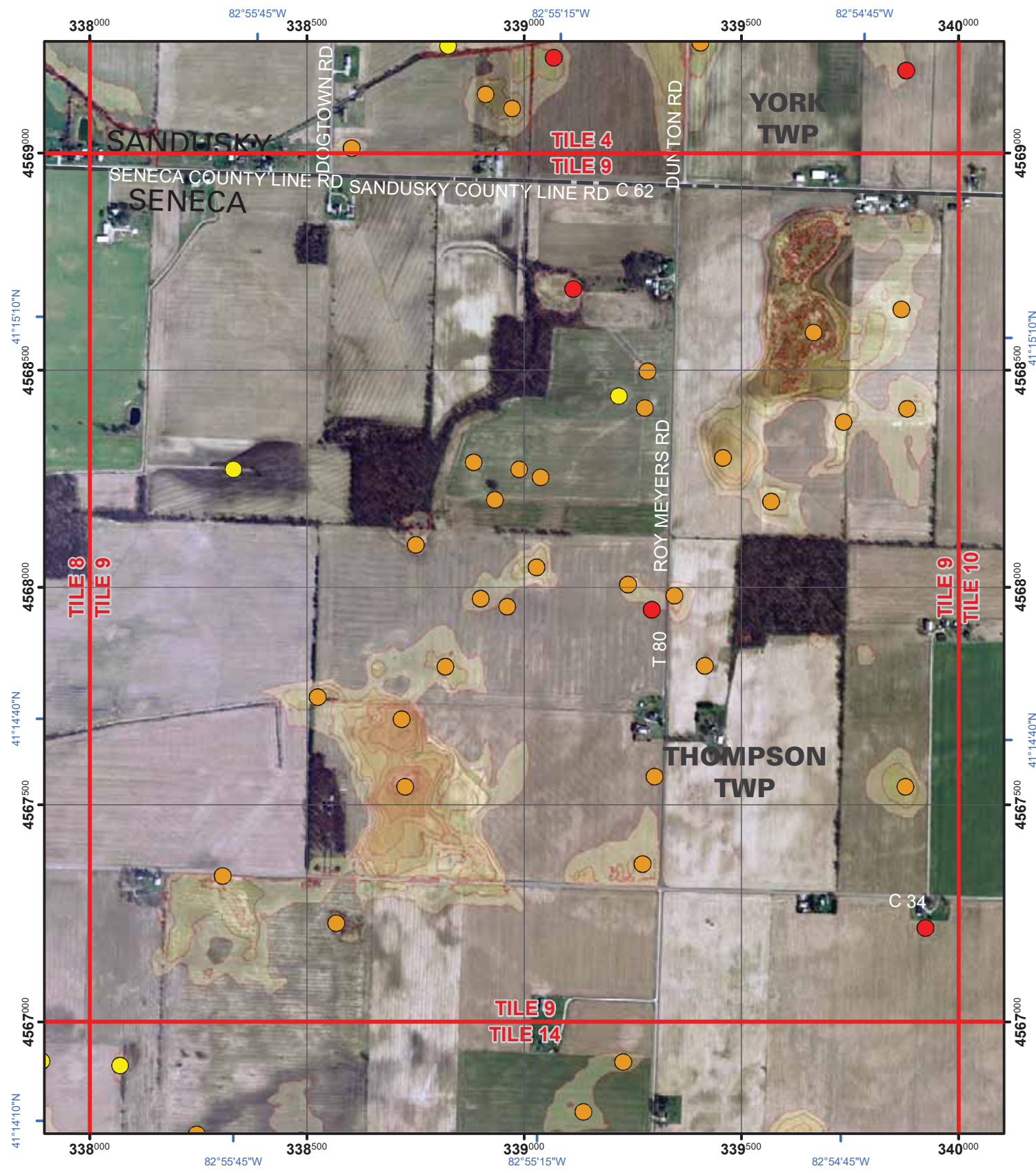
- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

DEPRESSION  
Depth in feet

1	5	9
2	6	10
3	7	
4	8	

Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.





U.S. National Grid  
100,000-m Square ID   Grid Zone Designation  
**KE**                      **17S**

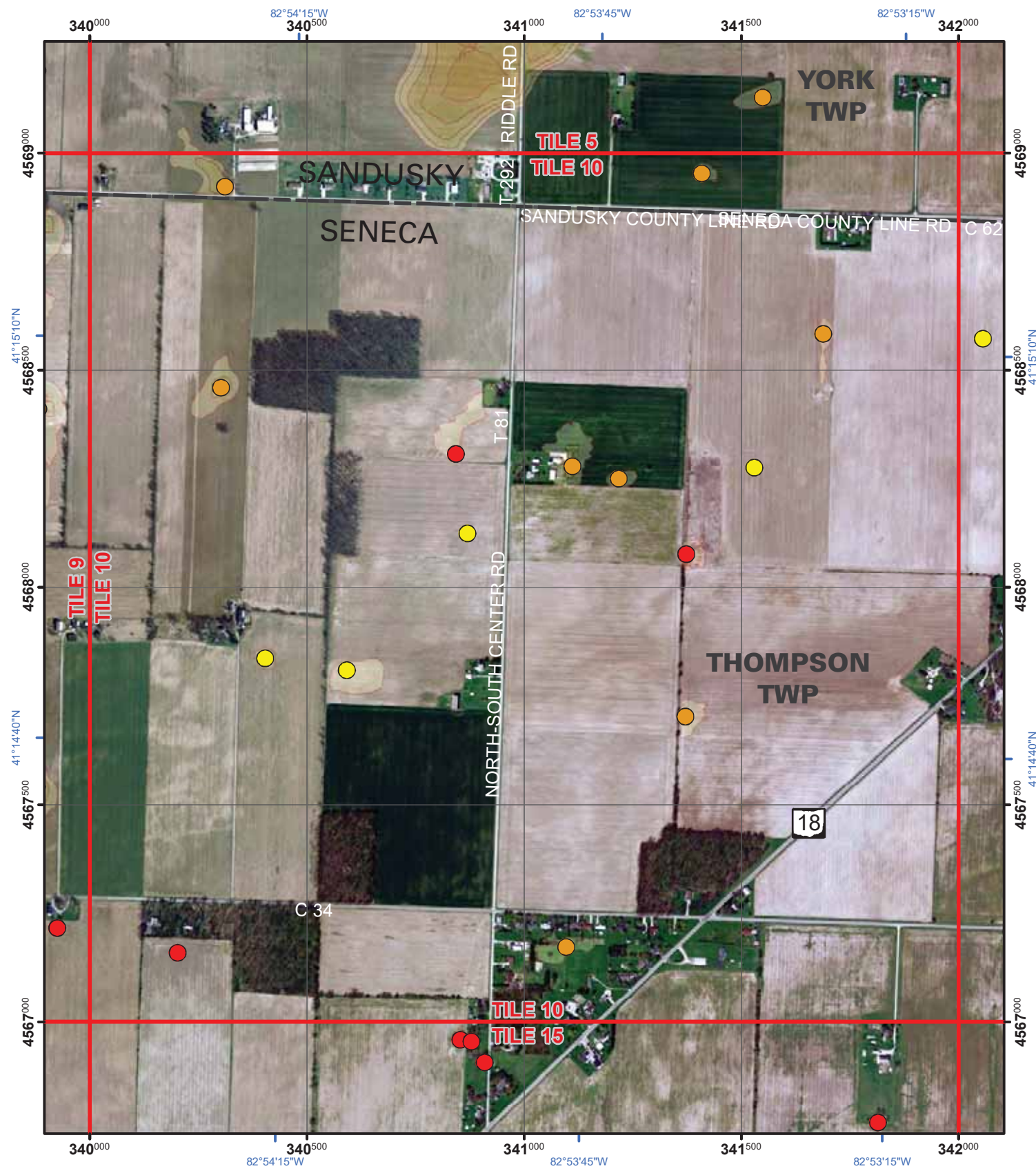


- KARST FEATURE**
- Field verified
  - Suspect - field visited
  - Suspect - not visited
  - Spring

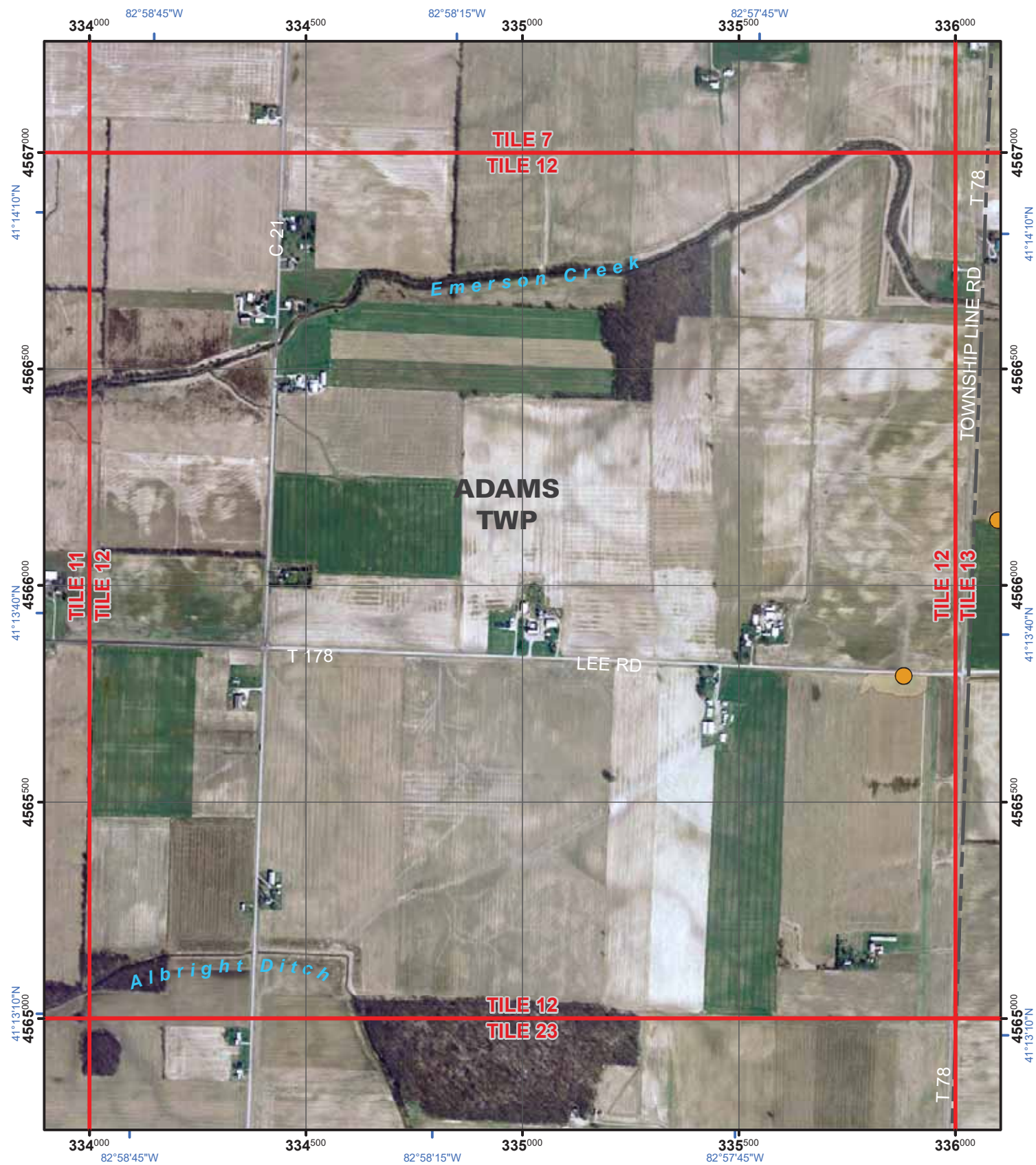
**DEPRESSION**  
Depth in feet

1	5	9
2	6	10
3	7	
4	8	





Tile Number: 12



**KARST FEATURE**

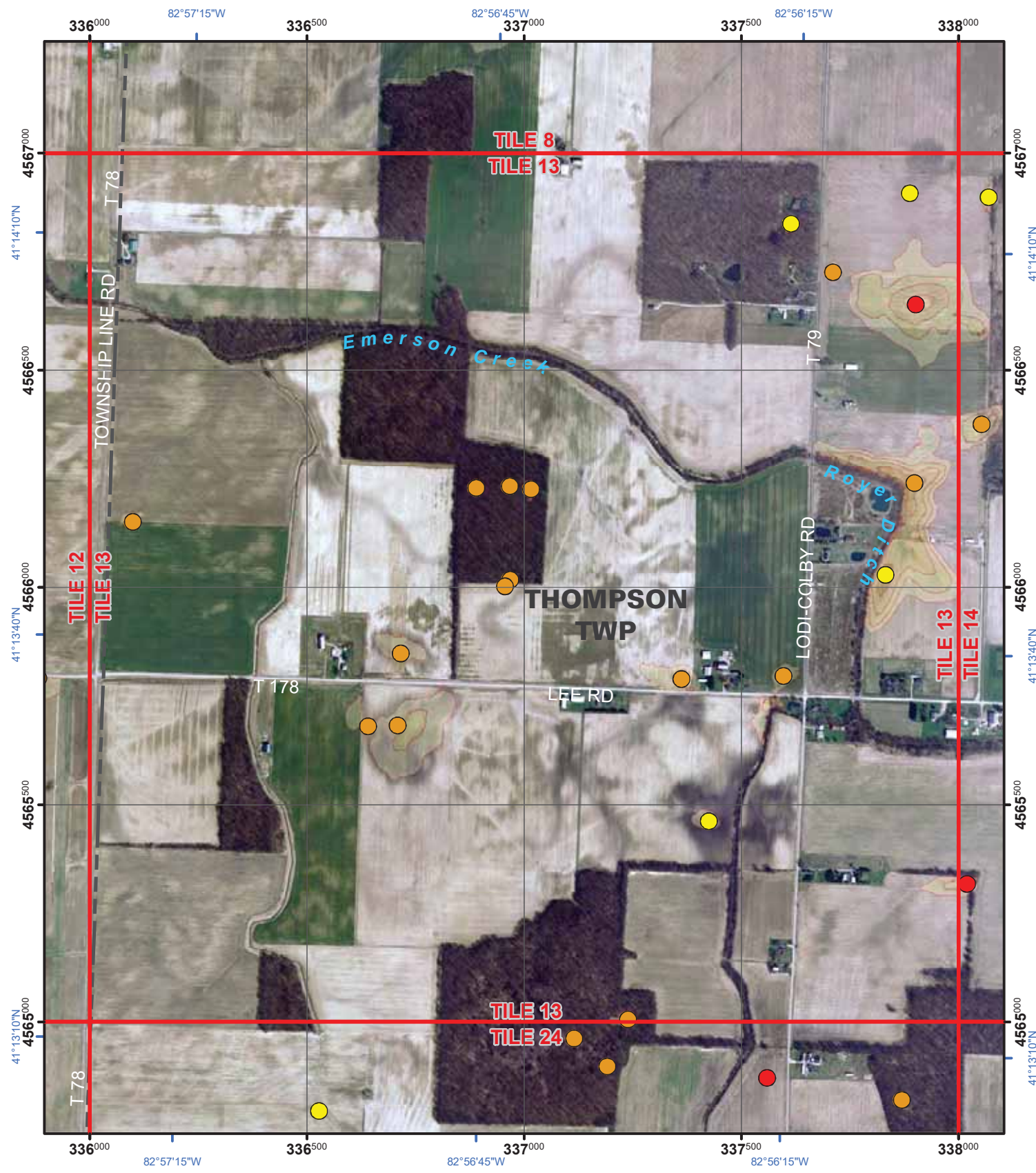
- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

**DEPRESSION**  
Depth in feet

1	5	9
2	6	10
3	7	
4	8	



Tile Number: 13



U.S. National Grid  
100,000-m Square ID    Grid Zone Designation  
**KE**                      **17S**



Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.

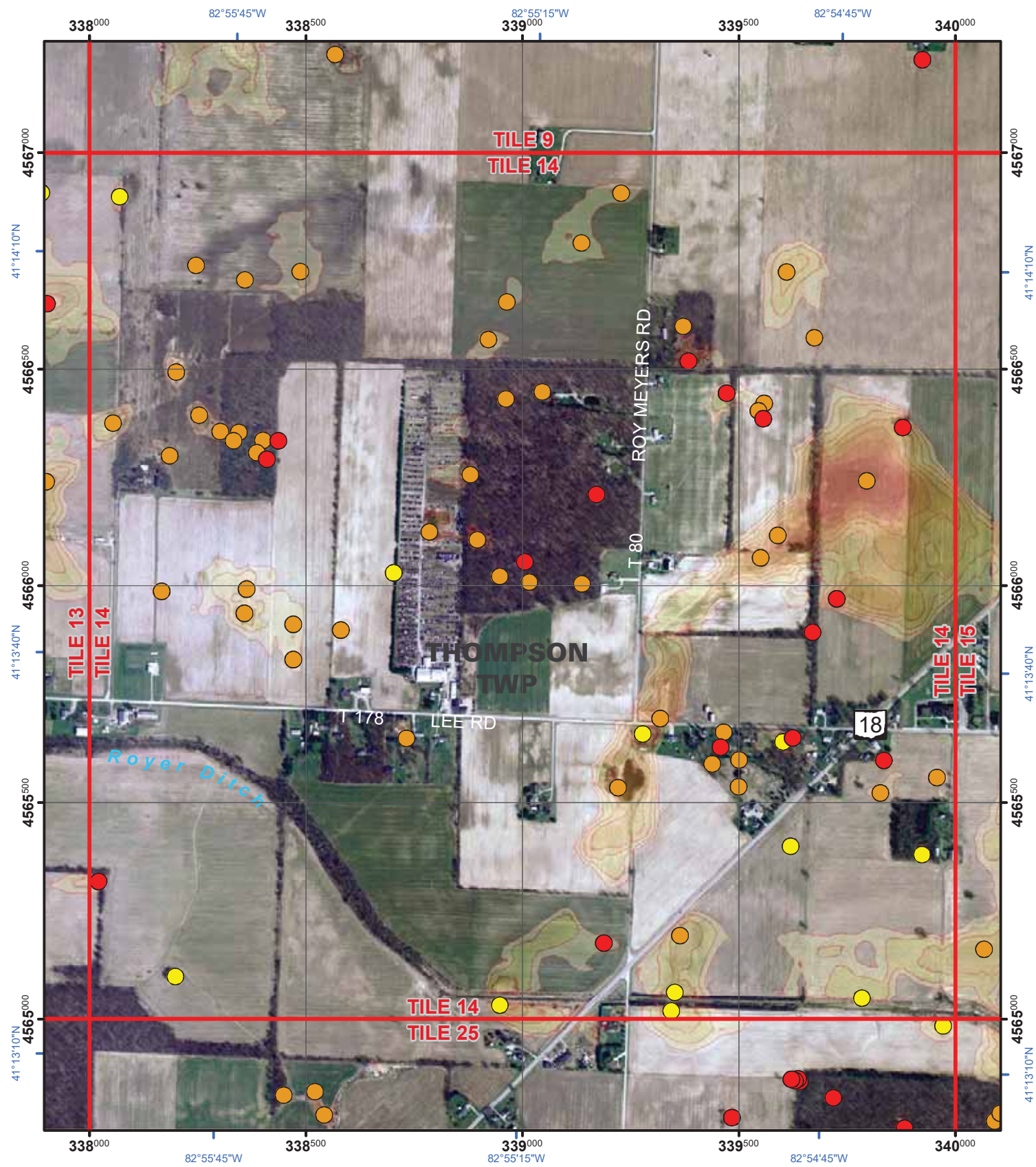
- KARST FEATURE**
- Field verified
  - Suspect - field visited
  - Suspect - not visited
  - Spring

**DEPRESSION**  
Depth in feet

1	5	9
2	6	10
3	7	
4	8	



Tile Number: 14



U.S. National Grid  
100,000-m Square ID Grid Zone Designation  
**KE 17S**

0 0.5 miles

0 1 kilometers  
Scale 1:12,000

Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.



KARST FEATURE

- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

DEPRESSION

Depth in feet		
1	5	9
2	6	10
3	7	
4	8	



Tile Number: 15



U.S. National Grid  
100,000-m Square ID   Grid Zone Designation  
**KE**                      **17S**



Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.



KARST FEATURE

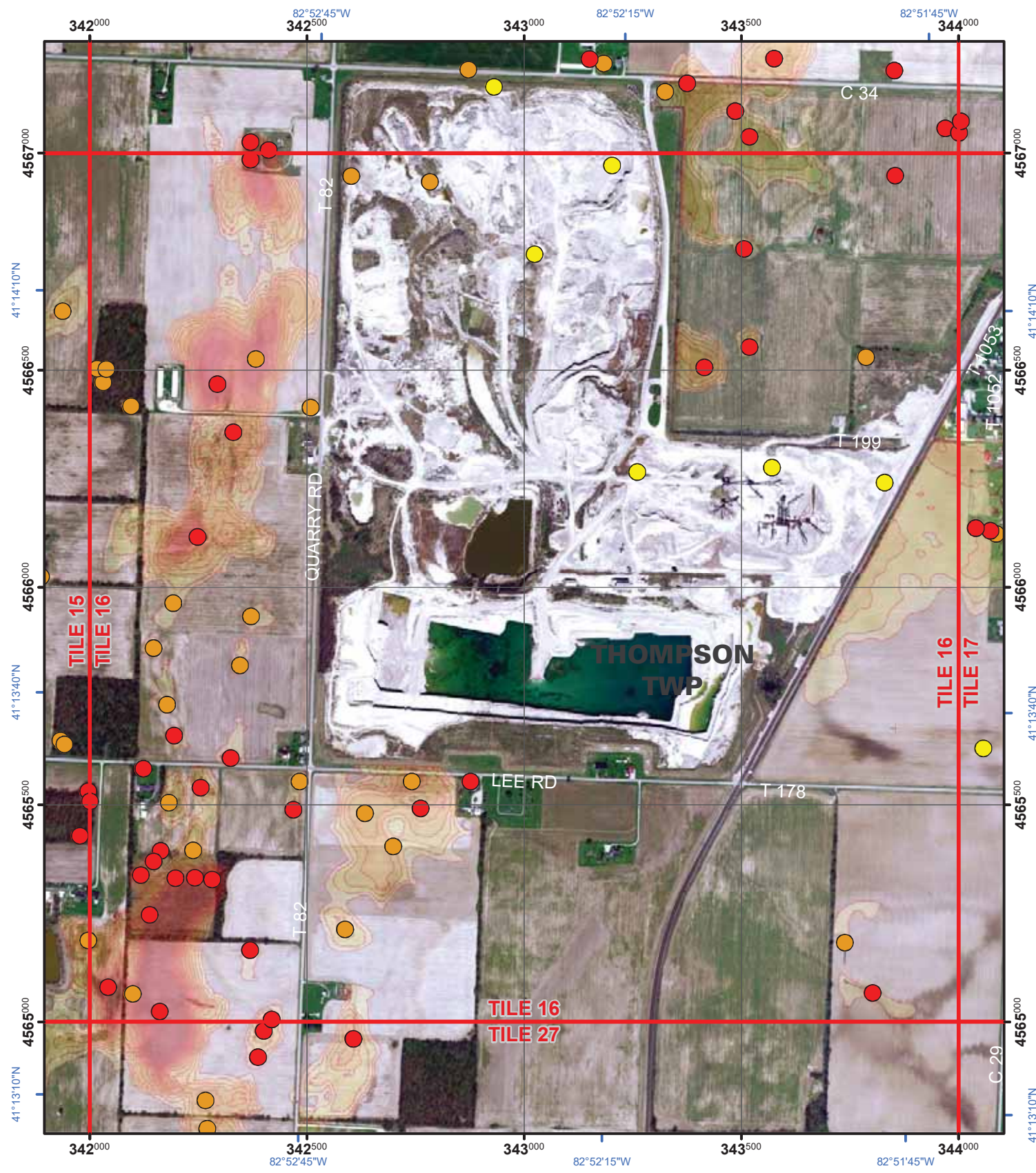
- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

DEPRESSION

Depth in feet

1	5	9
2	6	10
3	7	
4	8	





U.S. National Grid  
100,000-m Square ID    Grid Zone Designation  
**KE**                      **17S**



Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.

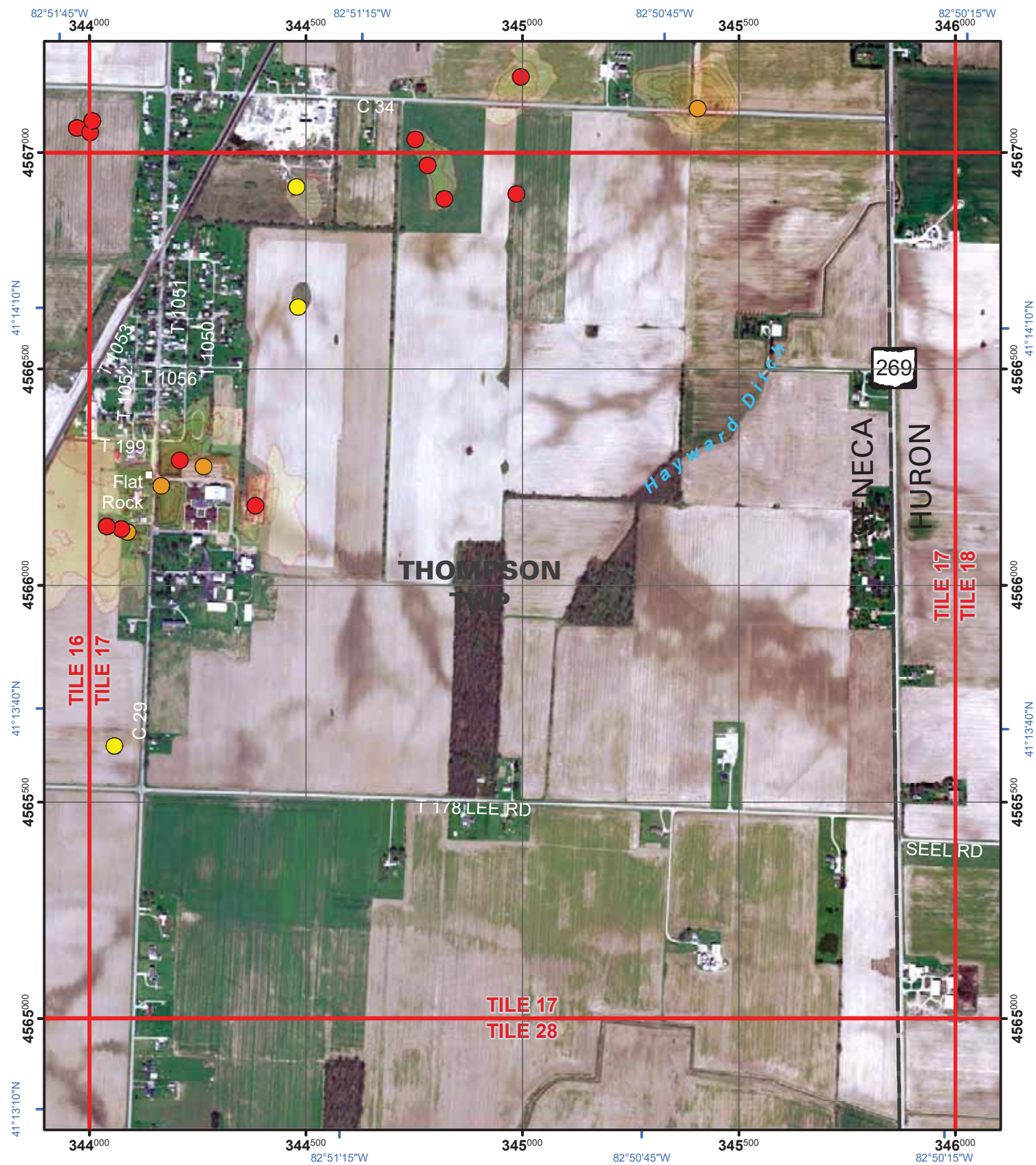
- KARST FEATURE**
- Field verified
  - Suspect - field visited
  - Suspect - not visited
  - Spring

**DEPRESSION**  
Depth in feet

1	5	9
2	6	10
3	7	
4	8	



Tile Number: 17



U.S. National Grid  
100,000-m Square ID   Grid Zone Designation  
**KE**                      **17S**



Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.



KARST FEATURE

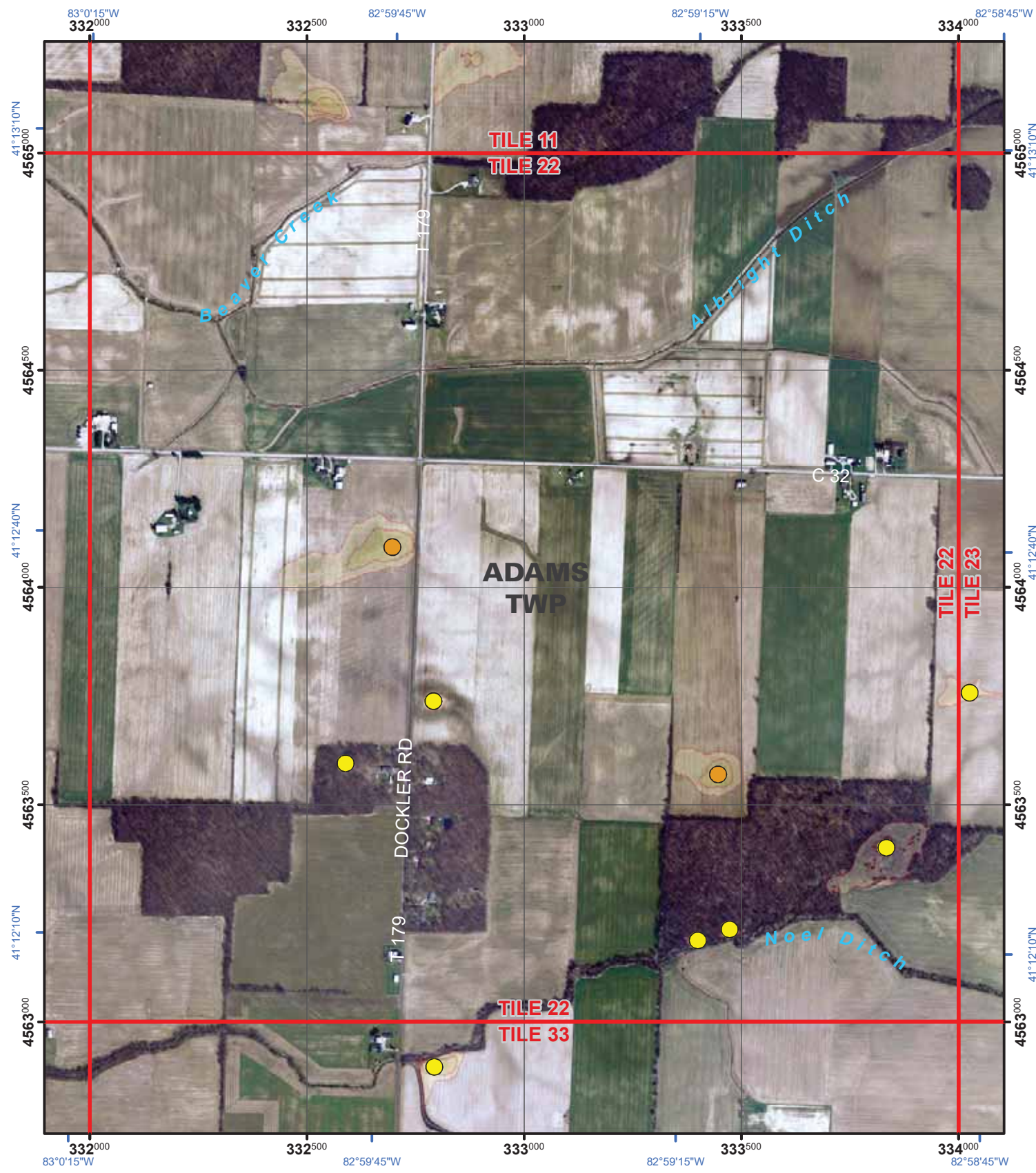
- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

DEPRESSION

Depth in feet		
1	5	9
2	6	10
3	7	
4	8	



Tile Number: 22



U.S. National Grid  
100,000-m Square ID Grid Zone Designation  
**KE 17S**



Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.



KARST FEATURE

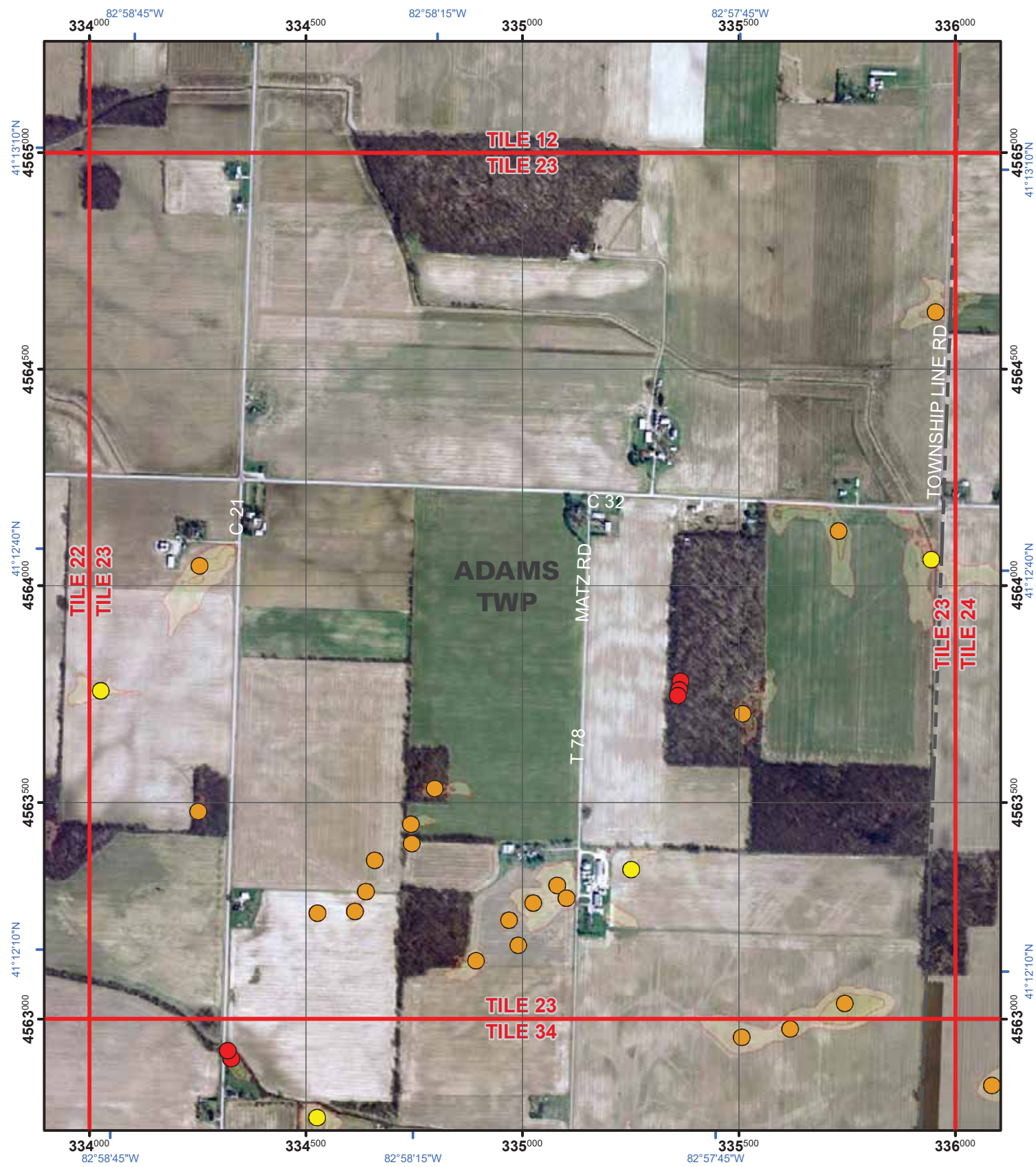
- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

DEPRESSION

Depth in feet		
1	5	9
2	6	10
3	7	
4	8	



Tile Number: 23



U.S. National Grid  
100,000-m Square ID    Grid Zone Designation  
**KE**                      **17S**

0 0.5 miles

0 1 kilometers  
Scale 1:12,000

Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.



KARST FEATURE

- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

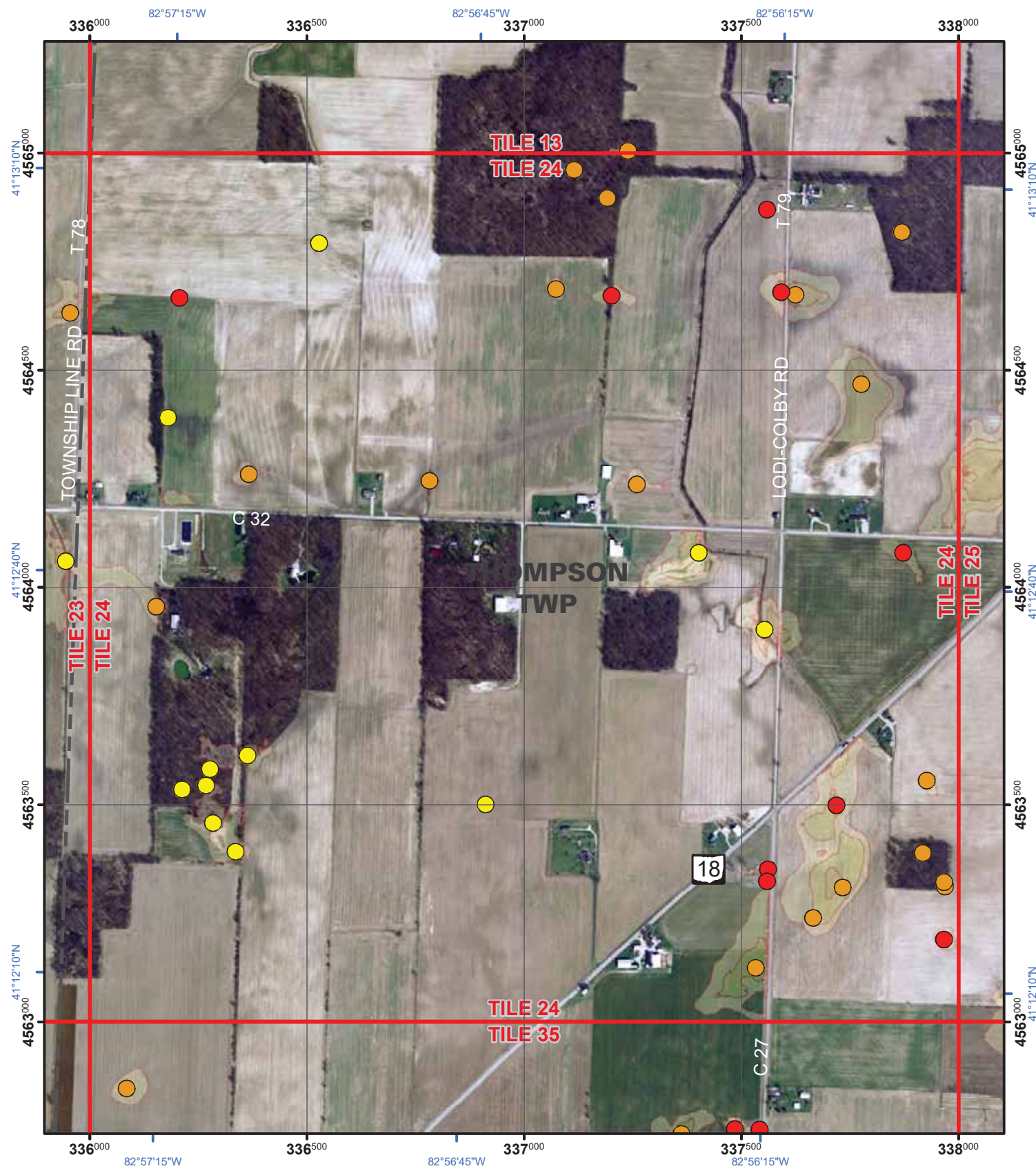
DEPRESSION

Depth in feet

- |   |   |    |
|---|---|----|
| 1 | 5 | 9  |
| 2 | 6 | 10 |
| 3 | 7 |    |
| 4 | 8 |    |



Tile Number: 24



U.S. National Grid  
100,000-m Square ID    Grid Zone Designation  
**KE**                      **17S**

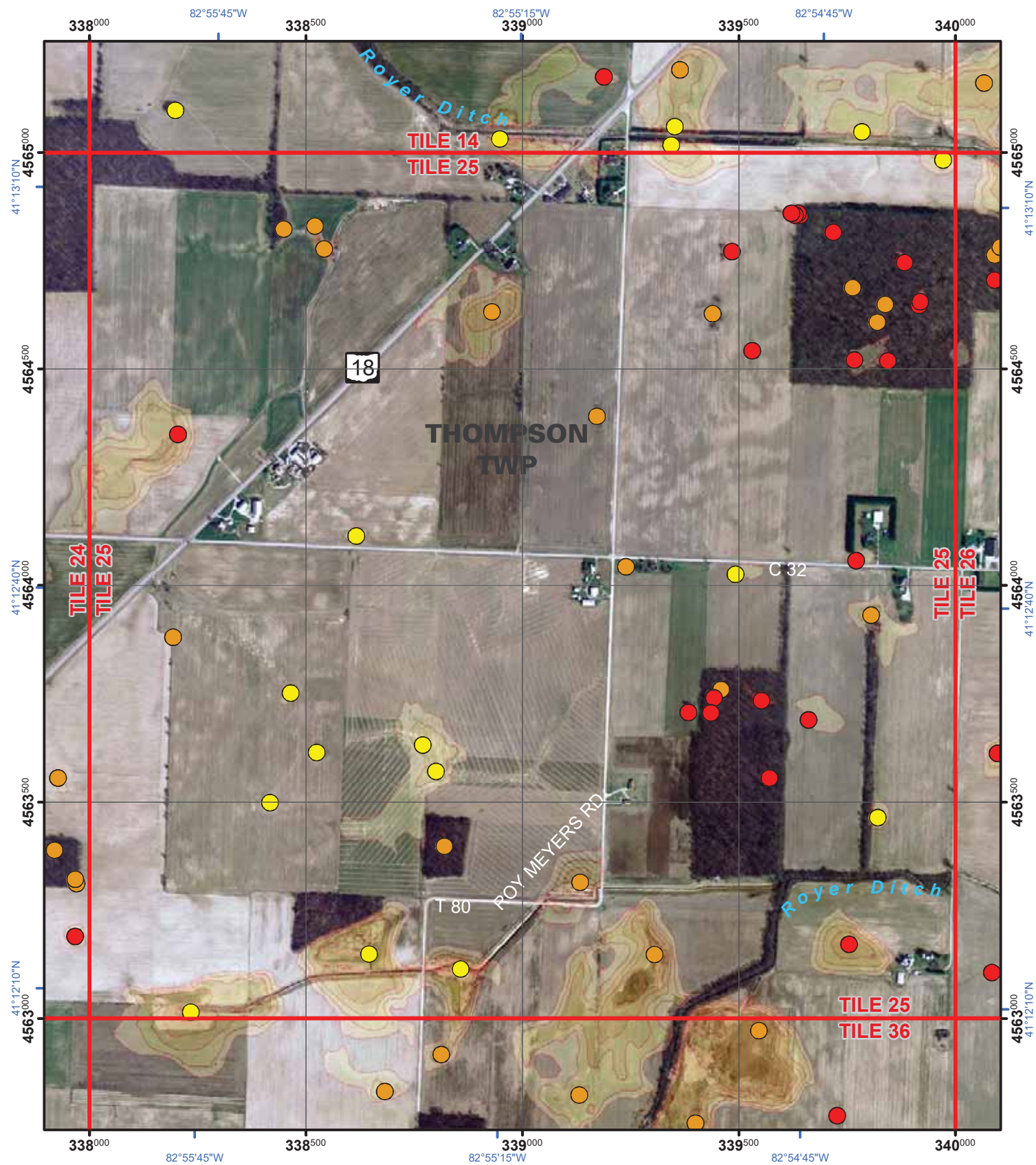


- KARST FEATURE**
- Field verified
  - Suspect - field visited
  - Suspect - not visited
  - Spring

**DEPRESSION**  
Depth in feet

1	5	9
2	6	10
3	7	
4	8	





U.S. National Grid  
100,000-m Square ID    Grid Zone Designation  
**KE**                      **17S**



Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.



**KARST FEATURE**

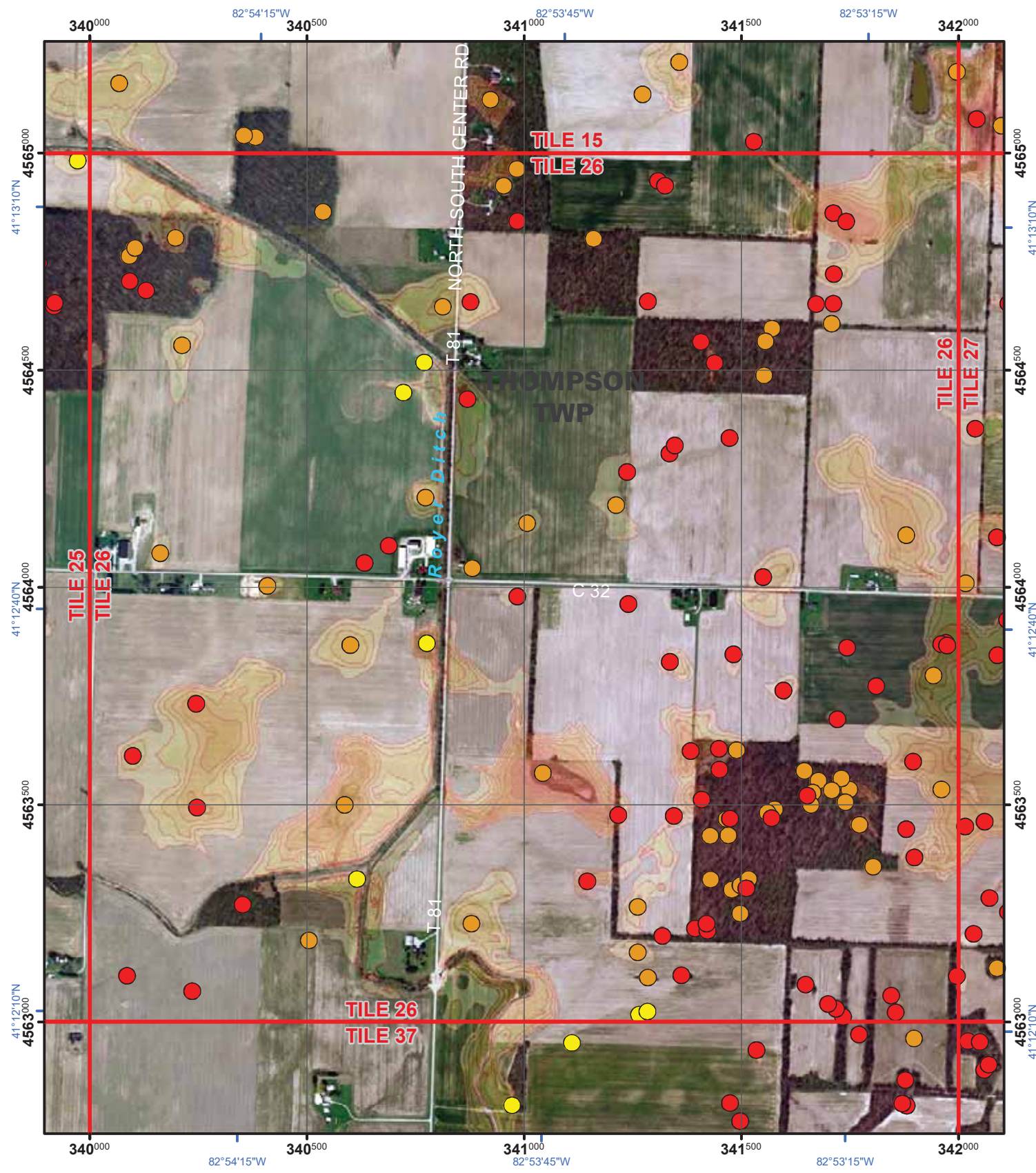
- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

**DEPRESSION**  
Depth in feet

1	5	9
2	6	10
3	7	
4	8	



Tile Number: 26

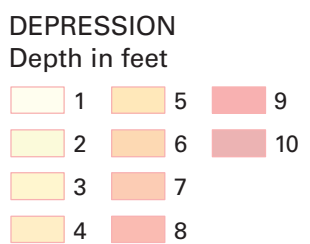


U.S. National Grid  
100,000-m Square ID   Grid Zone Designation  
**KE**                      **17S**



Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.

- KARST FEATURE**
- Field verified
  - Suspect - field visited
  - Suspect - not visited
  - Spring







U.S. National Grid  
100,000-m Square ID   Grid Zone Designation  
**KE**                      **17S**



Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.

KARST FEATURE

- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

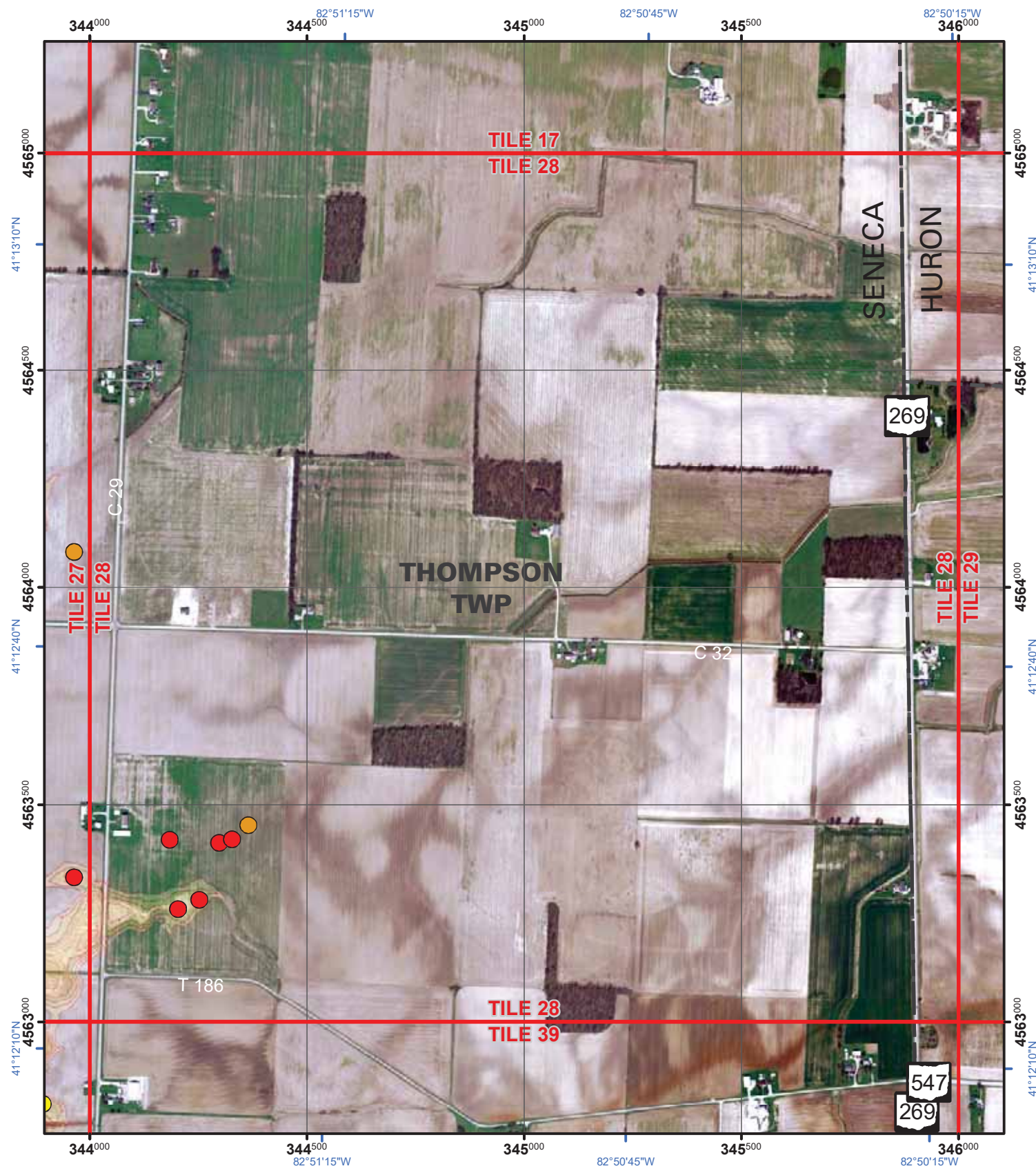
DEPRESSION

Depth in feet

1	5	9
2	6	10
3	7	
4	8	



Tile Number: 28



U.S. National Grid  
100,000-m Square ID Grid Zone Designation  
**KE 17S**

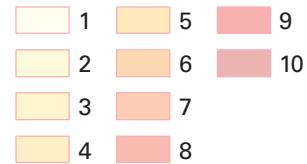


KARST FEATURE

- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

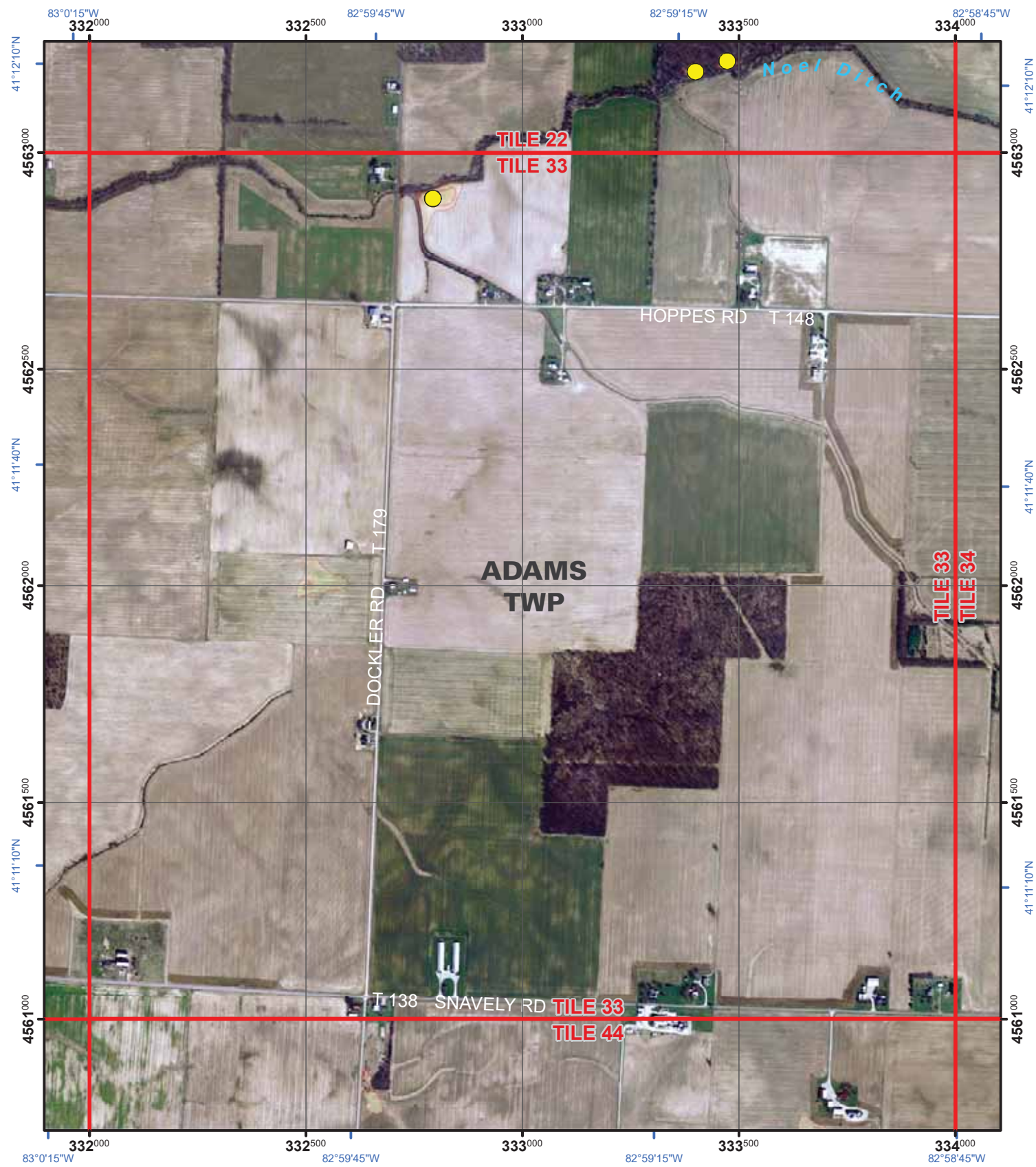
DEPRESSION

Depth in feet

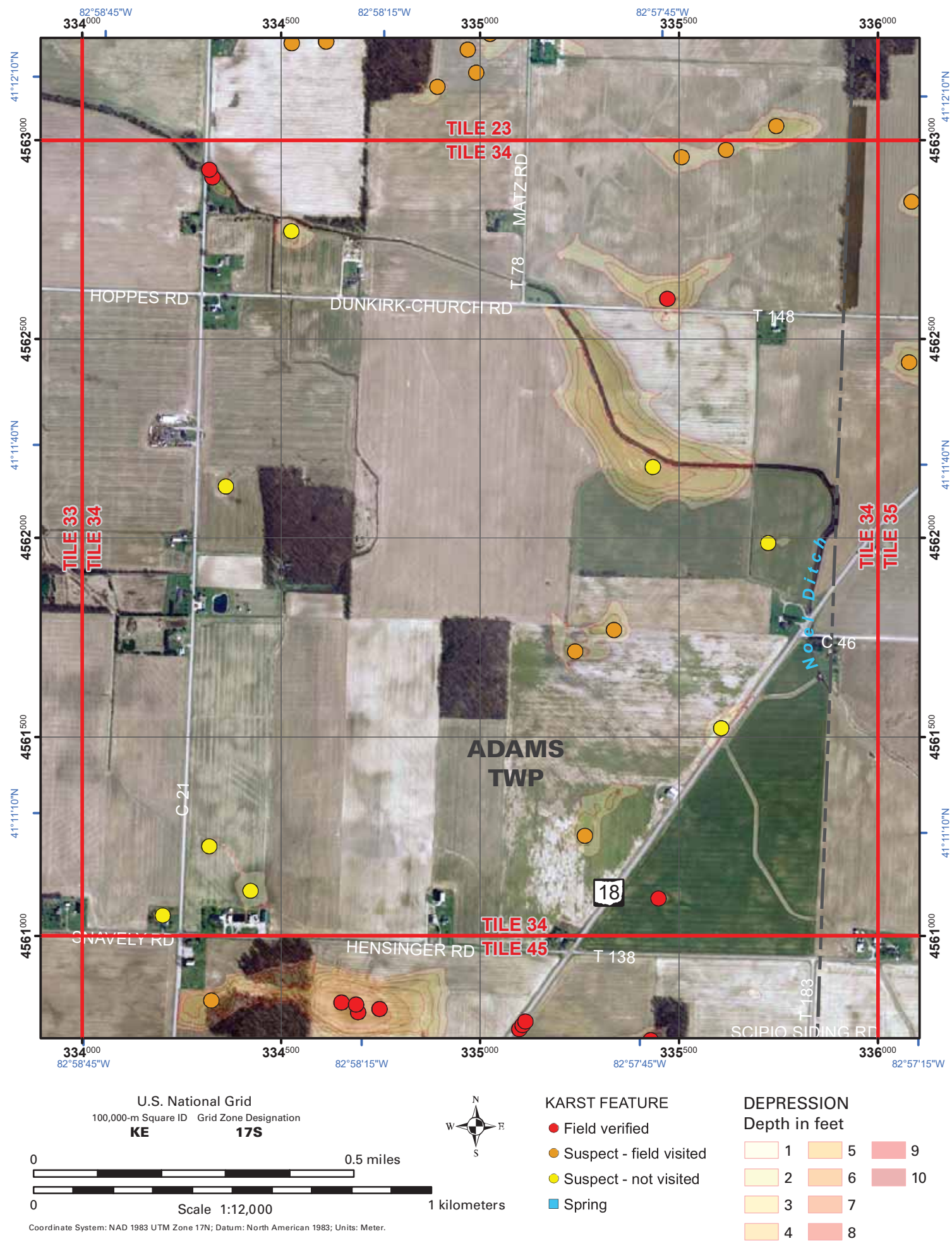




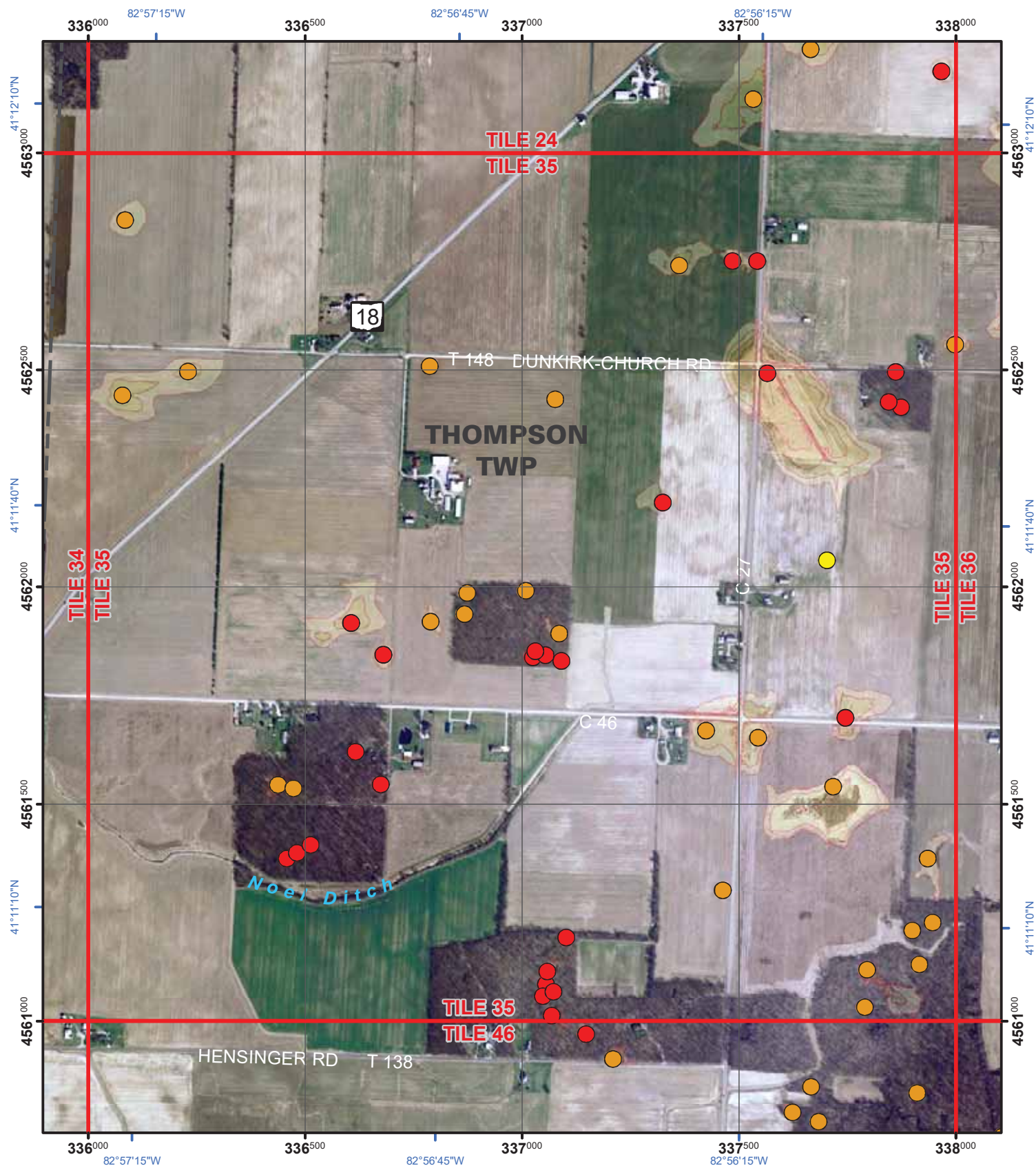
Tile Number: 33



Tile Number: 34







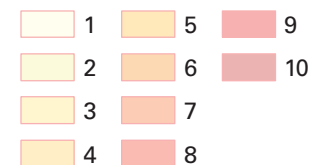
U.S. National Grid  
100,000-m Square ID    Grid Zone Designation  
**KE**                      **17S**



KARST FEATURE

- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

DEPRESSION  
Depth in feet



0 0.5 miles

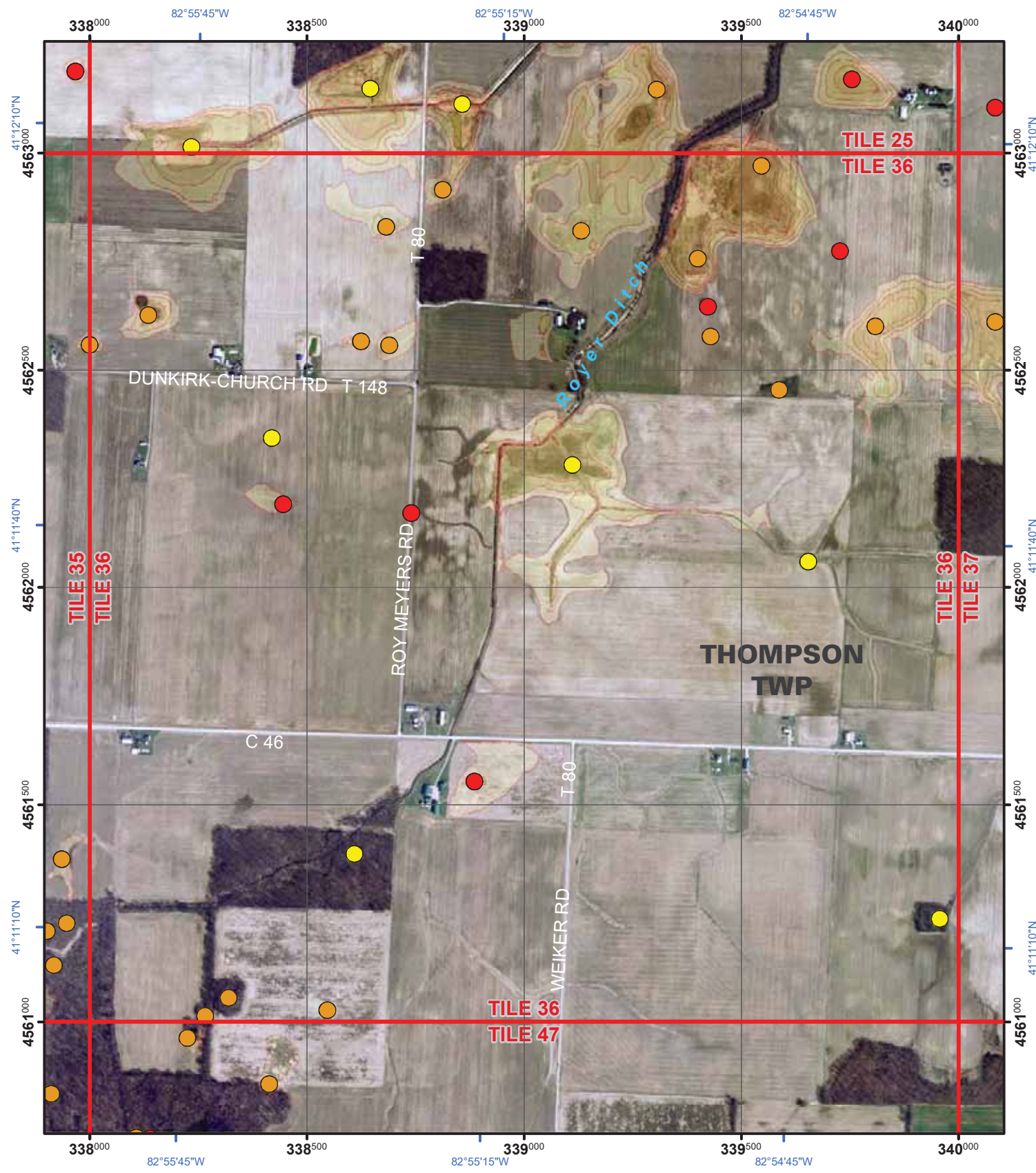
0 Scale 1:12,000

1 kilometers

Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.



Tile Number: 36



U.S. National Grid  
100,000-m Square ID    Grid Zone Designation  
**KE**                      **17S**



Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.



KARST FEATURE

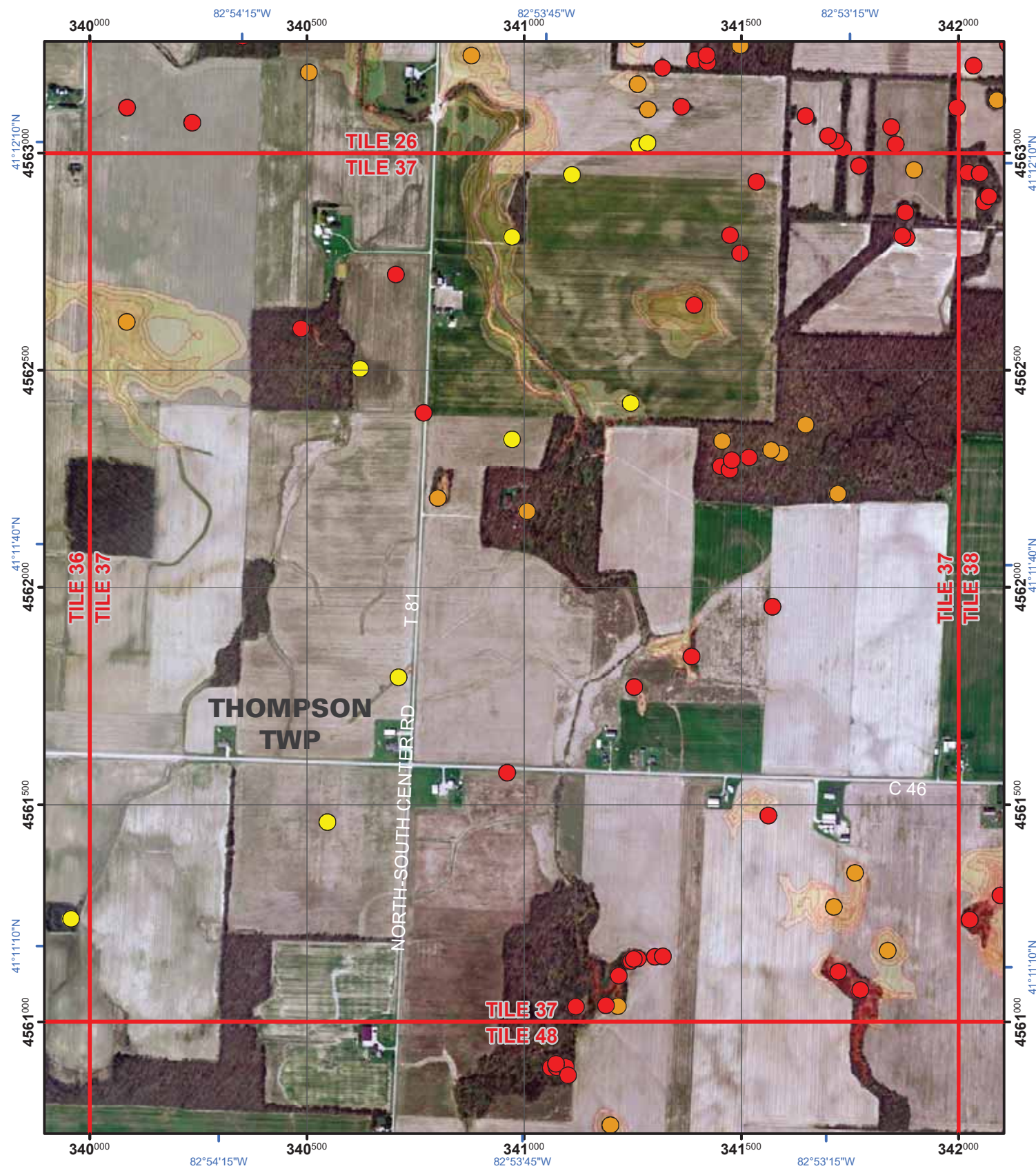
- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

DEPRESSION

Depth in feet

1	5	9
2	6	10
3	7	
4	8	





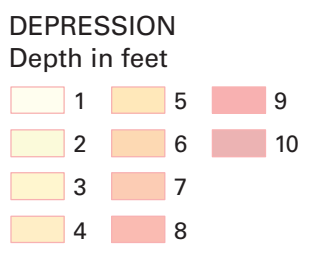
U.S. National Grid  
100,000-m Square ID    Grid Zone Designation  
**KE**                      **17S**



Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.



- KARST FEATURE**
- Field verified
  - Suspect - field visited
  - Suspect - not visited
  - Spring





Tile Number: 38



U.S. National Grid  
100,000-m Square ID Grid Zone Designation  
**KE 17S**



Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.



KARST FEATURE

- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

DEPRESSION

Depth in feet		
1	5	9
2	6	10
3	7	
4	8	



Tile Number: 44



U.S. National Grid  
100,000-m Square ID   Grid Zone Designation  
**KE**                      **17S**

0 0.5 miles

0 1 kilometers  
Scale 1:12,000

Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.



KARST FEATURE

- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

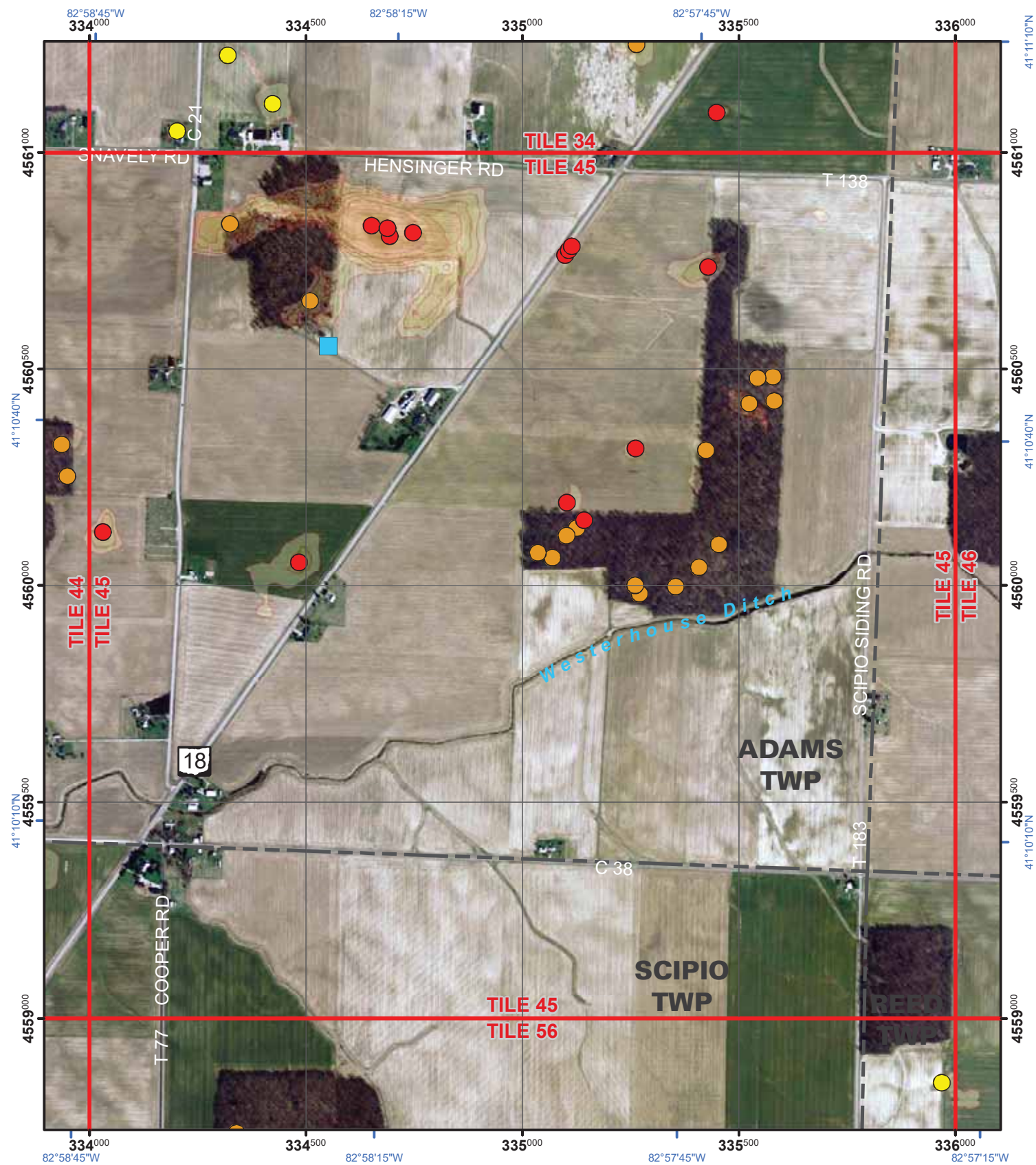
DEPRESSION

Depth in feet

1	5	9
2	6	10
3	7	
4	8	



Tile Number: 45



U.S. National Grid  
100,000-m Square ID    Grid Zone Designation  
**KE**                      **17S**



Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.



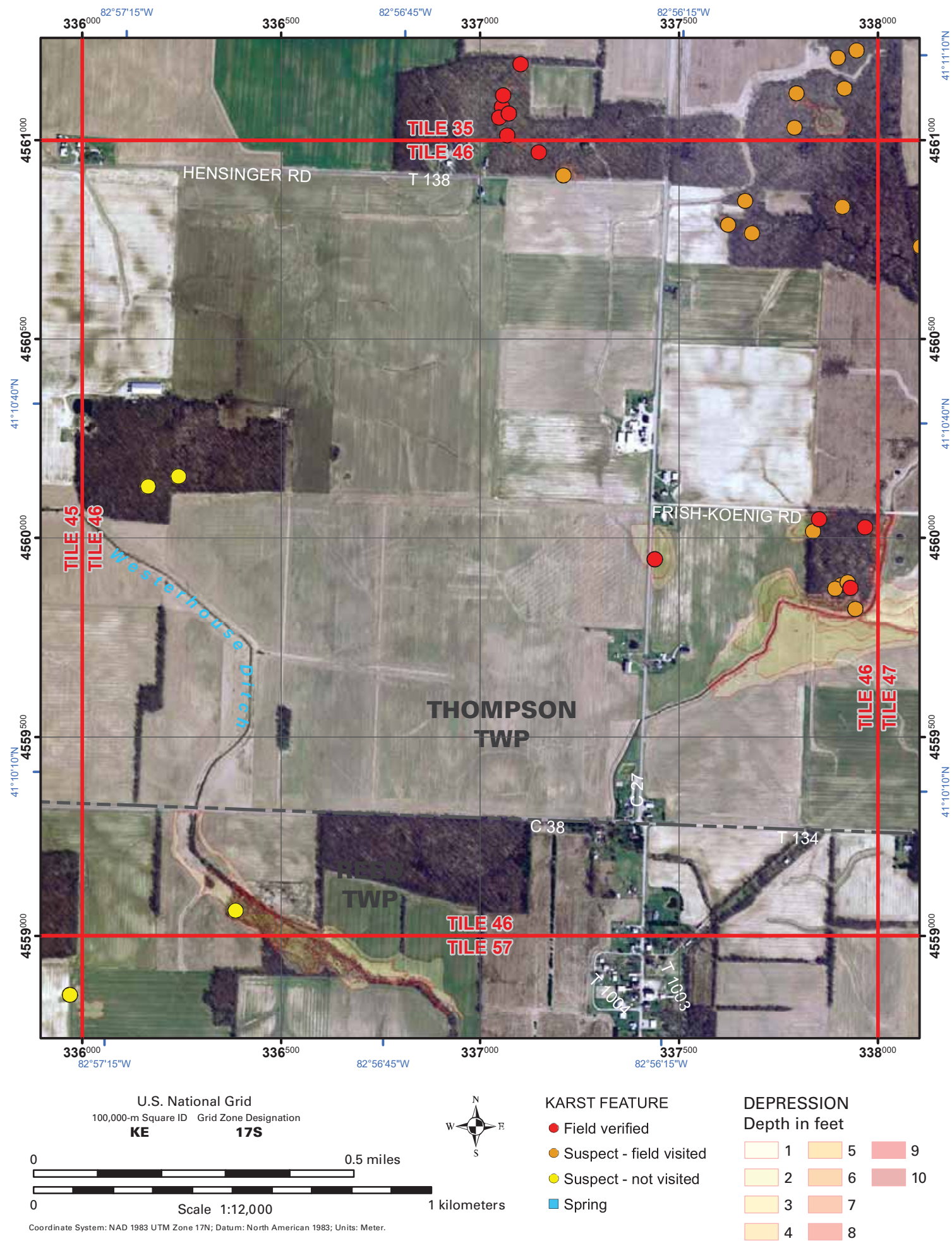
KARST FEATURE

- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

DEPRESSION  
Depth in feet

1	5	9
2	6	10
3	7	
4	8	







Tile Number: 47



U.S. National Grid  
100,000-m Square ID    Grid Zone Designation  
**KE**                      **17S**

0 0.5 miles

0 1 kilometers  
Scale 1:12,000

Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.



KARST FEATURE

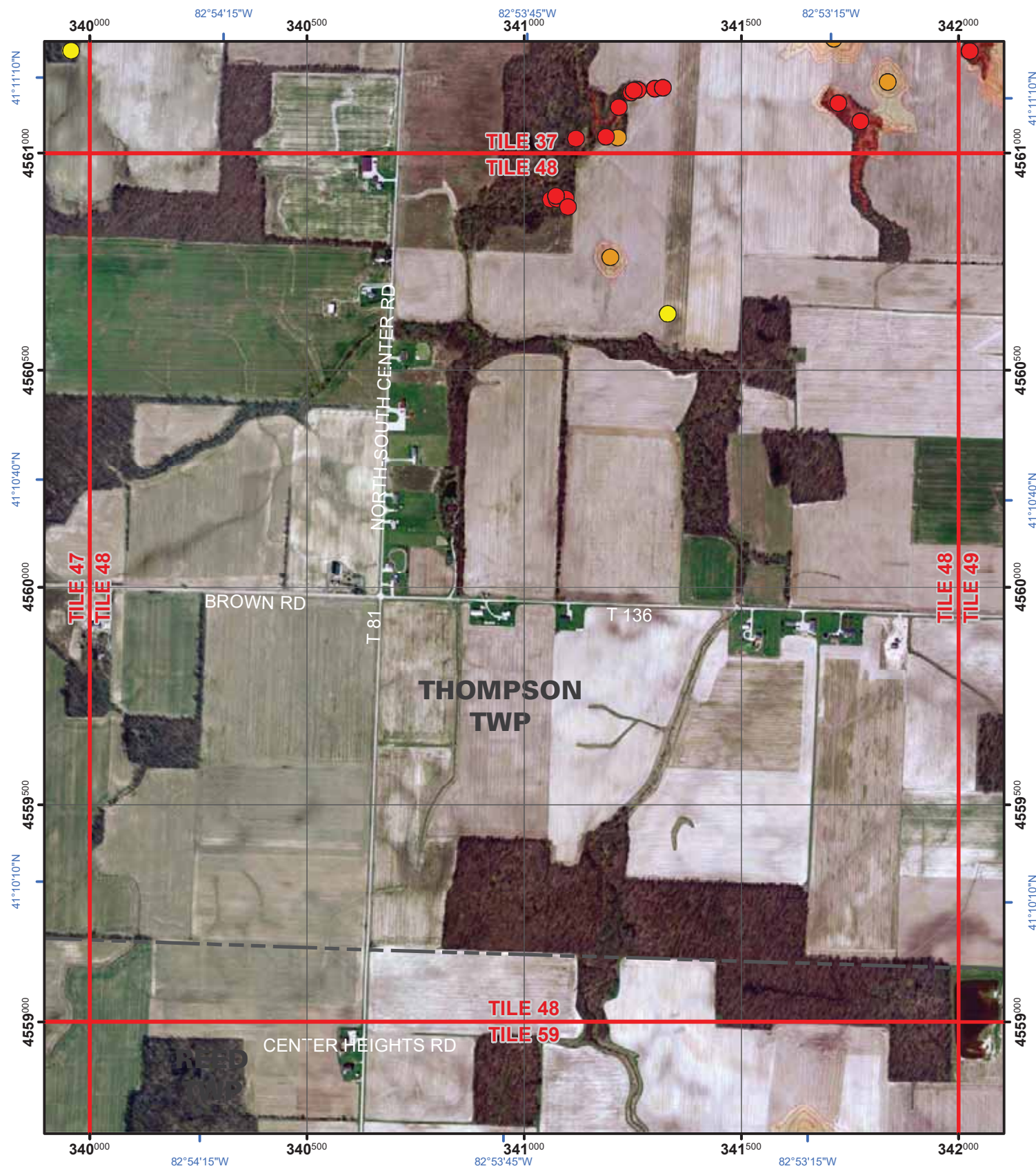
- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

DEPRESSION

Depth in feet		
1	5	9
2	6	10
3	7	
4	8	



Tile Number: 48



U.S. National Grid  
100,000-m Square ID   Grid Zone Designation  
**KE**                      **17S**



Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.



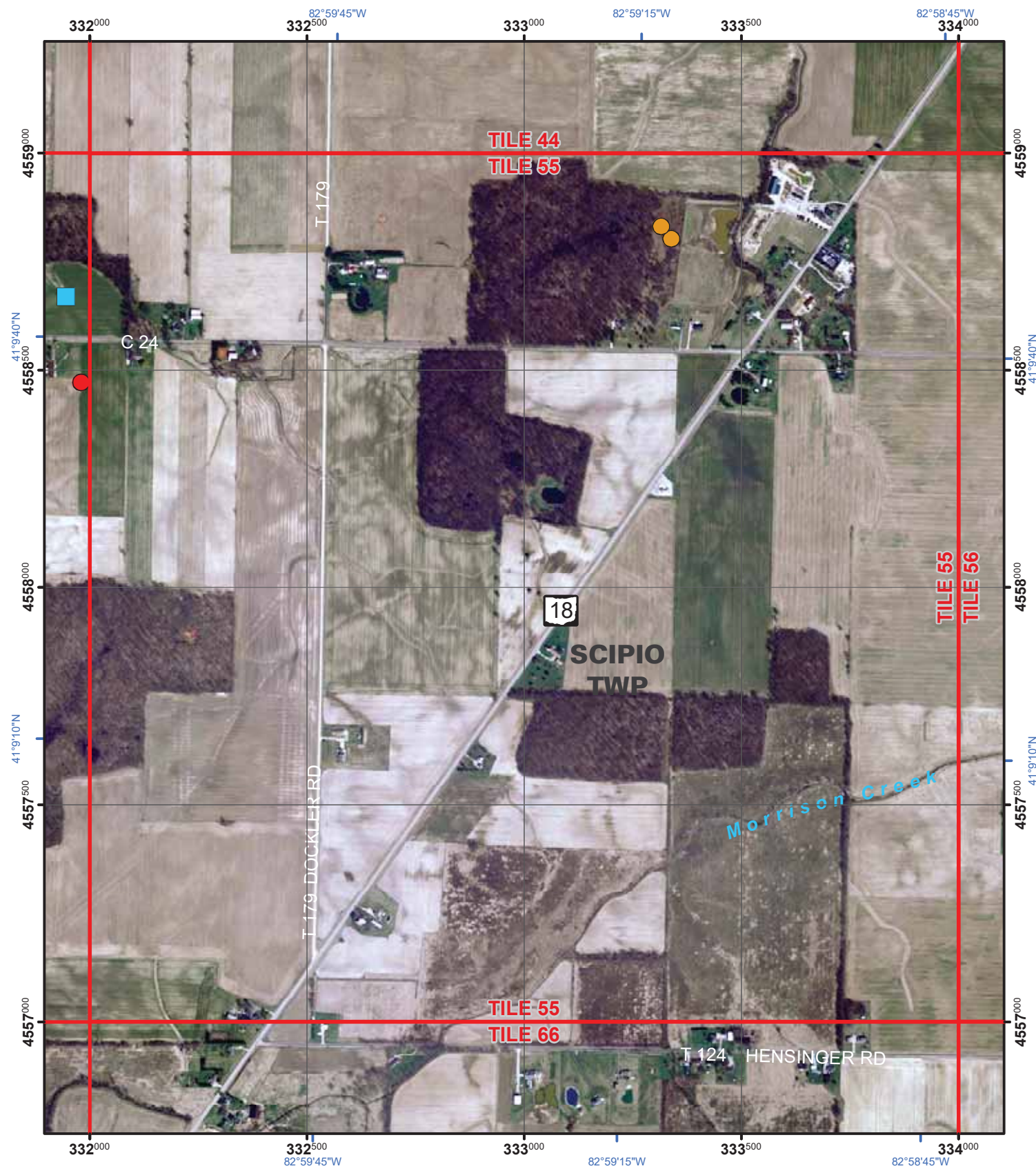
KARST FEATURE

- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

DEPRESSION

Depth in feet		
1	5	9
2	6	10
3	7	
4	8	





U.S. National Grid  
100,000-m Square ID    Grid Zone Designation  
**KE**                      **17S**



Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.

- KARST FEATURE**
- Field verified
  - Suspect - field visited
  - Suspect - not visited
  - Spring

**DEPRESSION**  
Depth in feet

1	5	9
2	6	10
3	7	
4	8	



Tile Number: 56



U.S. National Grid  
100,000-m Square ID Grid Zone Designation  
**KE 17S**

0 0.5 miles

0 1 kilometers  
Scale 1:12,000

Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.



KARST FEATURE

- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

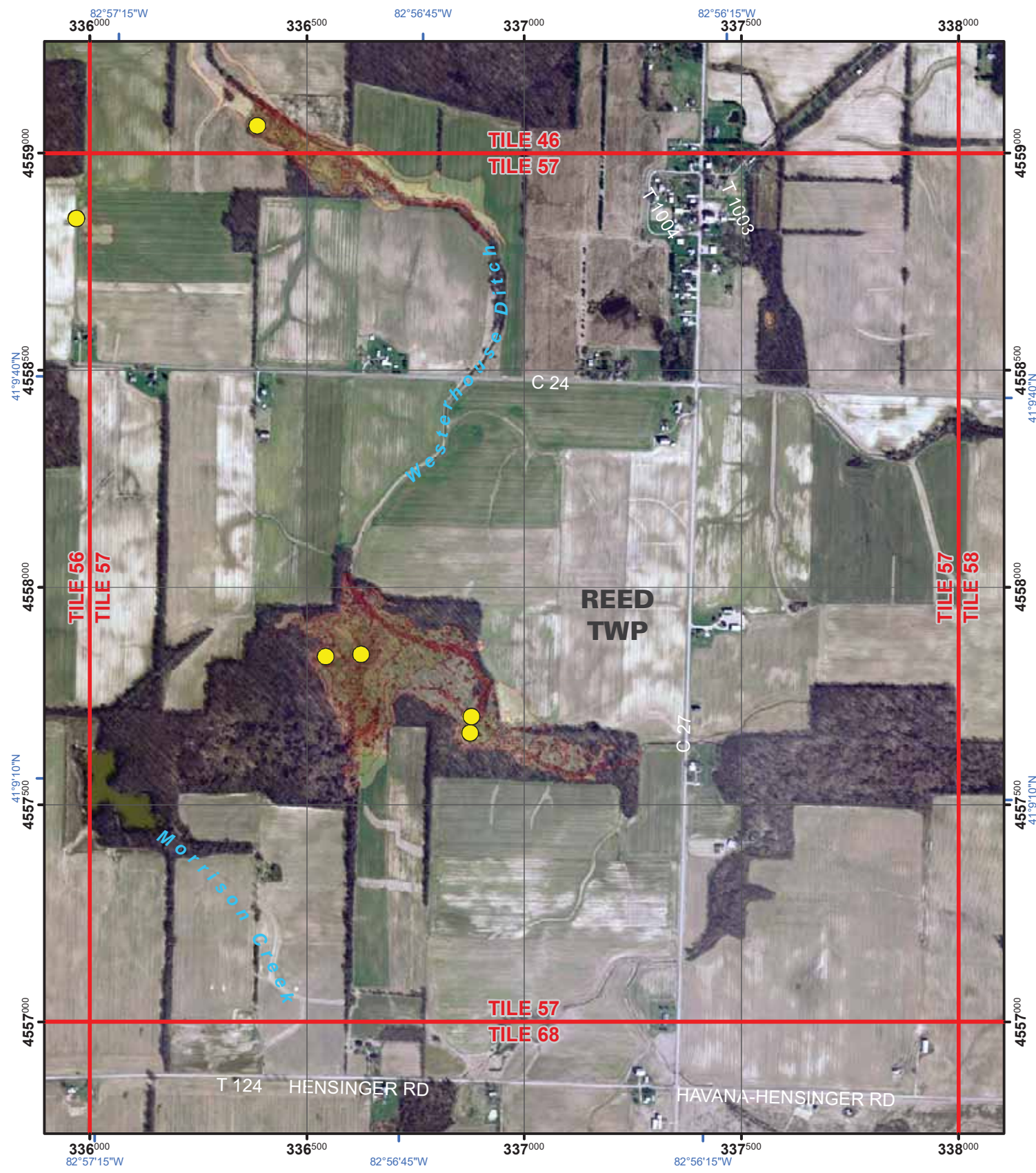
DEPRESSION

Depth in feet

1	5	9
2	6	10
3	7	
4	8	



Tile Number: 57



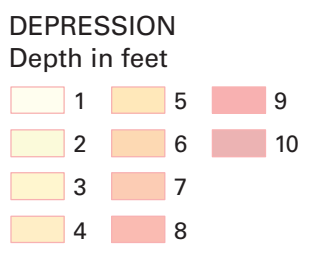
U.S. National Grid  
100,000-m Square ID    Grid Zone Designation  
**KE**                      **17S**



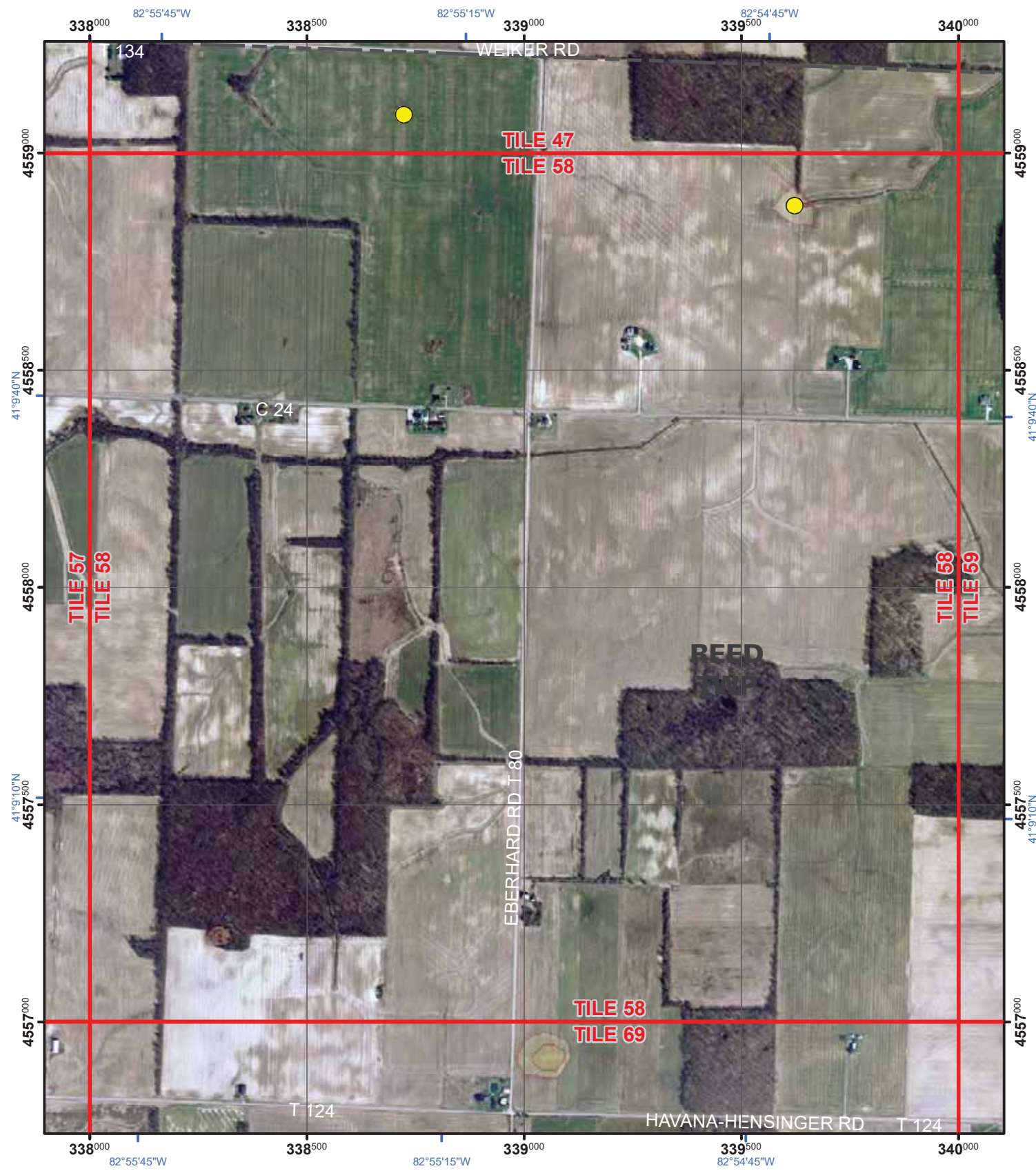
Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.



- KARST FEATURE**
- Field verified
  - Suspect - field visited
  - Suspect - not visited
  - Spring







U.S. National Grid  
100,000-m Square ID    Grid Zone Designation  
**KE**                      **17S**



Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.

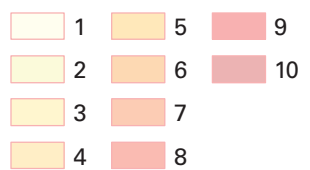


KARST FEATURE

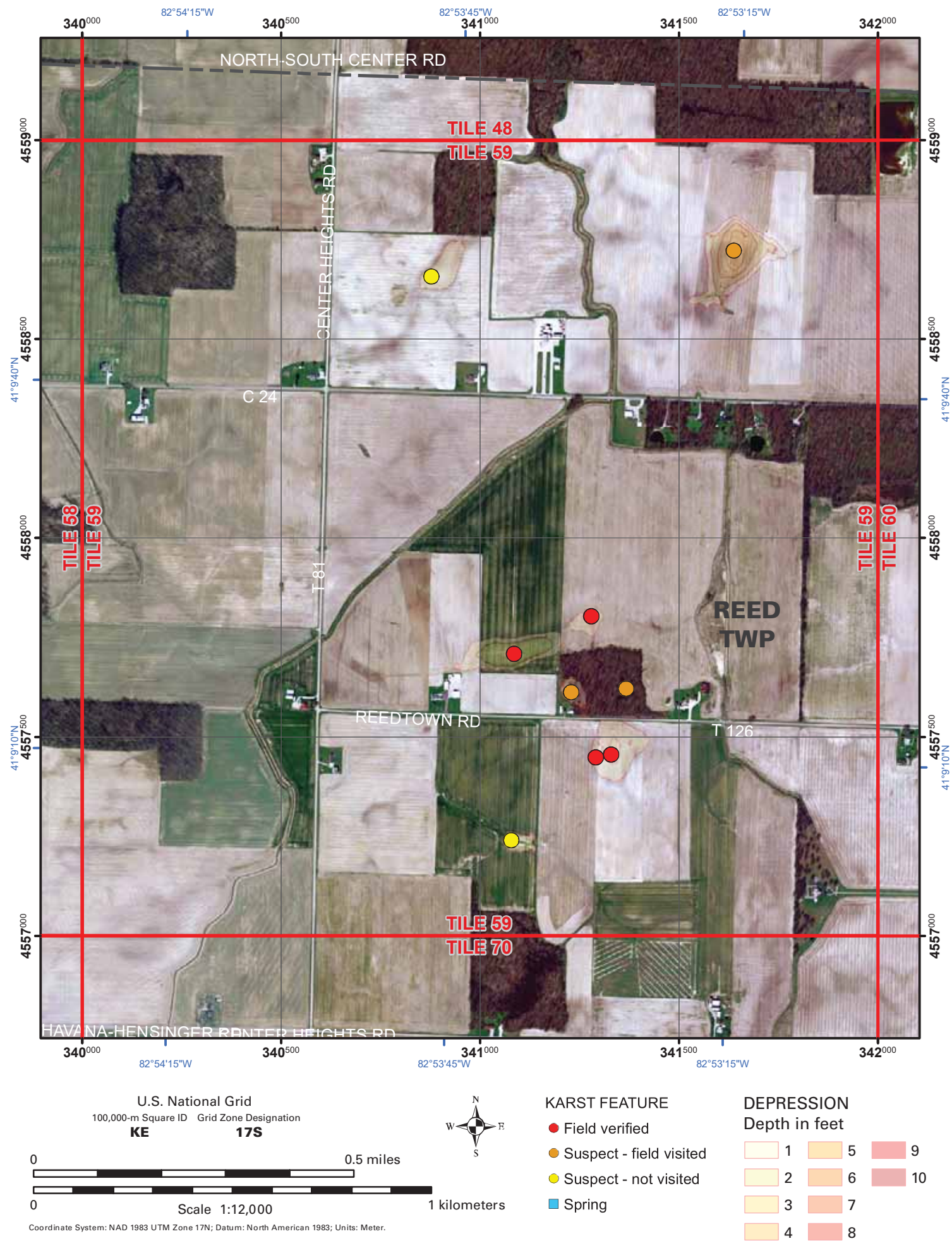
- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

DEPRESSION

Depth in feet









Tile Number: 67



U.S. National Grid  
100,000-m Square ID    Grid Zone Designation  
**KE**                      **17S**

0 0.5 miles

0 1 kilometers  
Scale 1:12,000

Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.



KARST FEATURE

- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

DEPRESSION

Depth in feet

1	5	9
2	6	10
3	7	
4	8	



Tile Number: 68



U.S. National Grid  
100,000-m Square ID    Grid Zone Designation  
**KE**                      **17S**



Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.

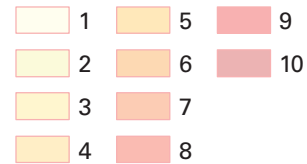


KARST FEATURE

- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

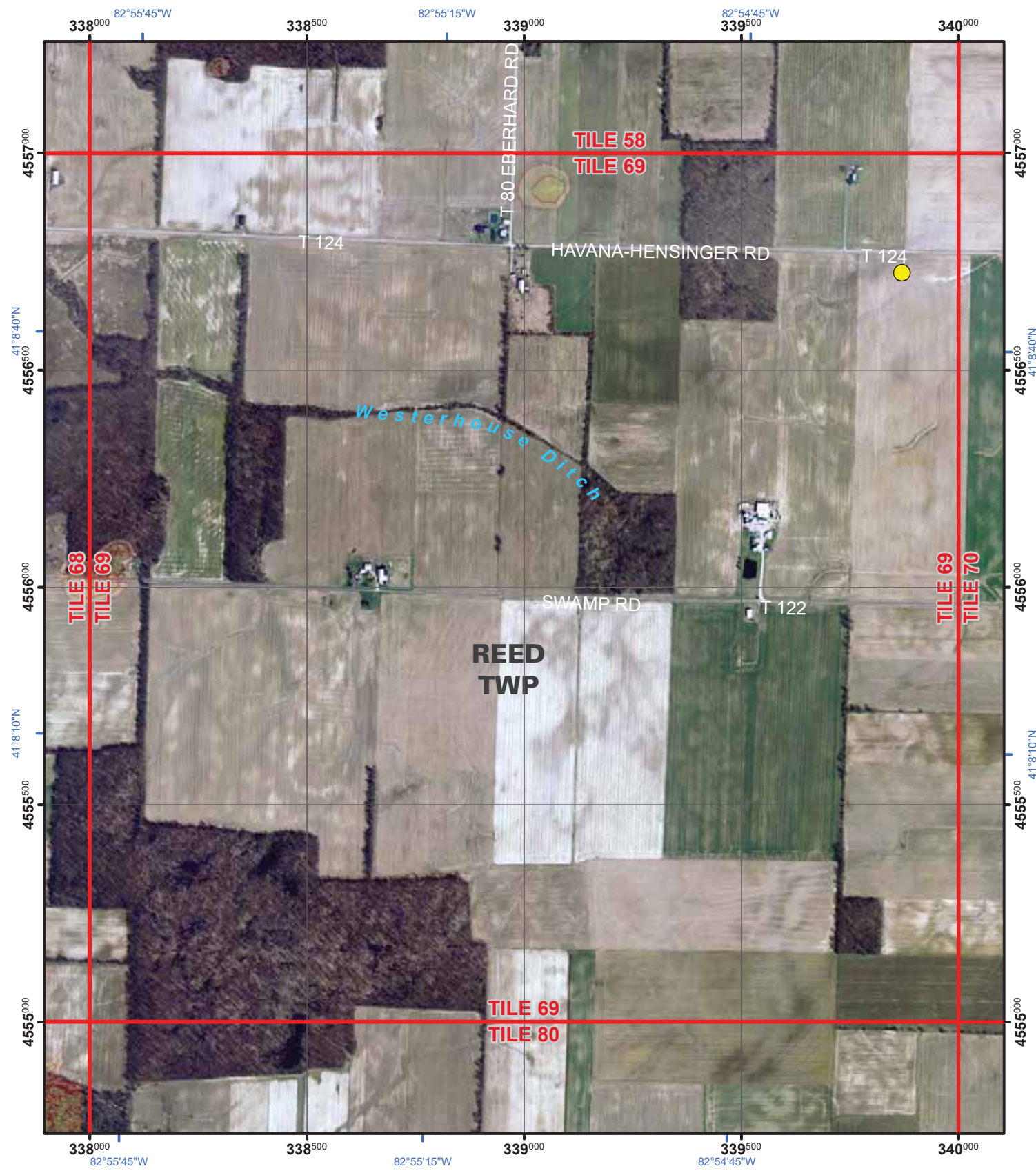
DEPRESSION

Depth in feet





Tile Number: 69



U.S. National Grid  
100,000-m Square ID    Grid Zone Designation  
**KE**                      **17S**



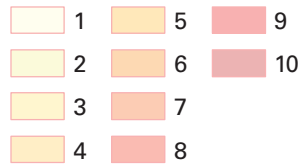
Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.

KARST FEATURE

- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

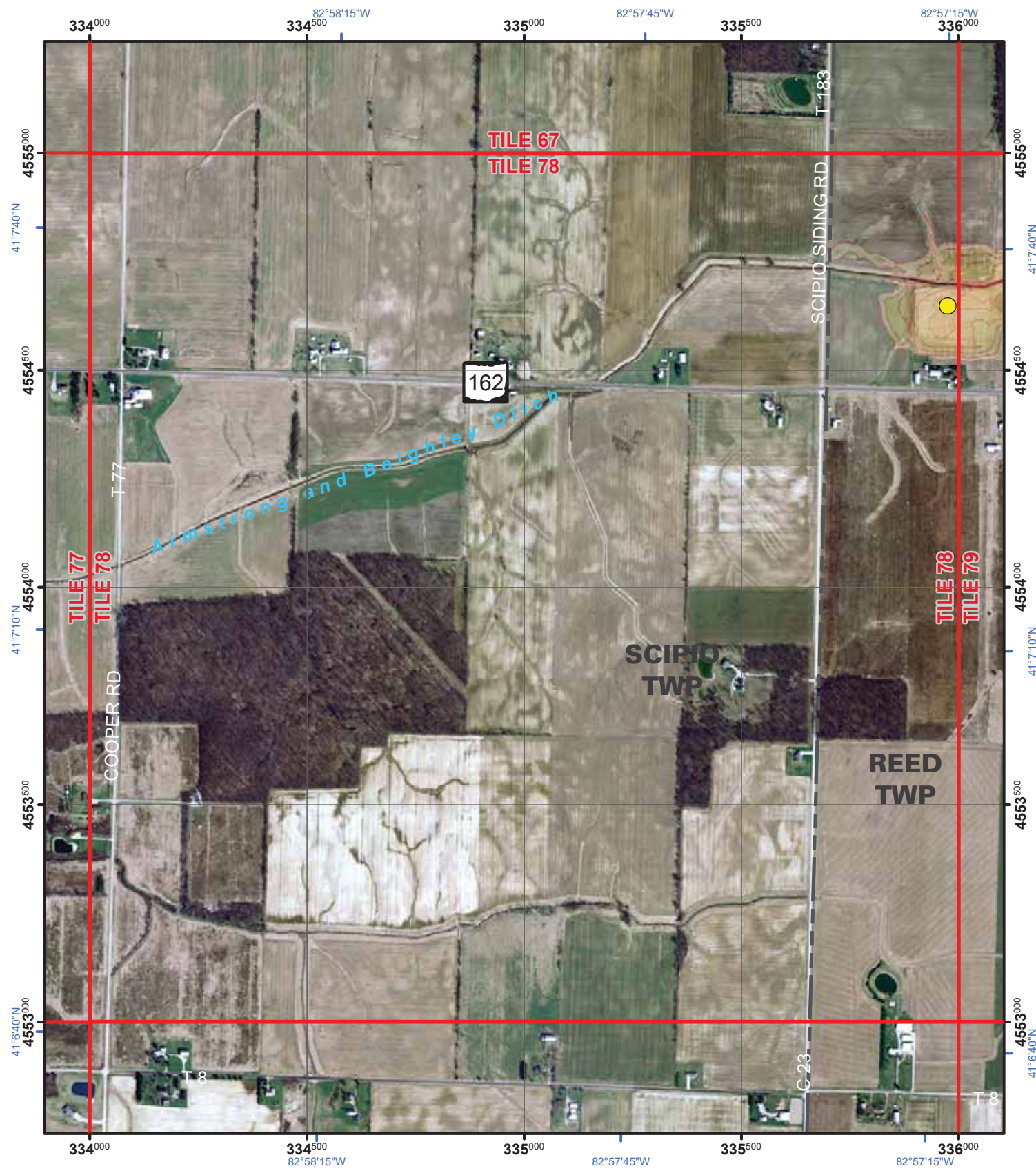
DEPRESSION

Depth in feet





Tile Number: 78



U.S. National Grid  
100,000-m Square ID    Grid Zone Designation  
**KE**                      **17S**



Coordinate System: NAD 1983 UTM Zone 17N; Datum: North American 1983; Units: Meter.

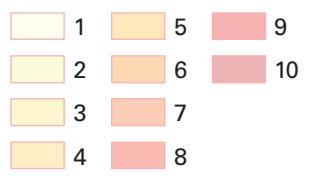


KARST FEATURE

- Field verified
- Suspect - field visited
- Suspect - not visited
- Spring

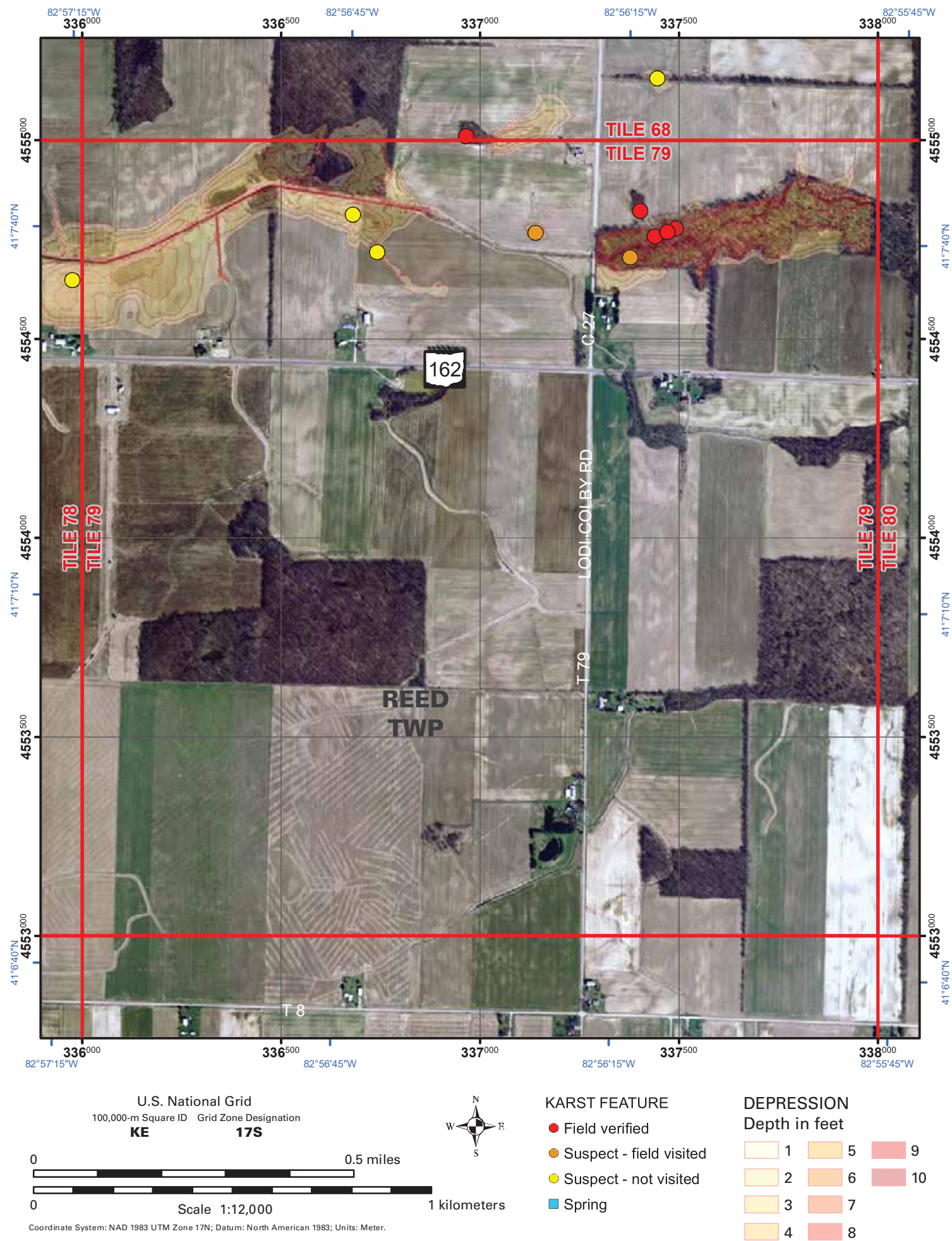
DEPRESSION

Depth in feet





Tile Number: 79



## **APPENDIX B**

Well Survey – 93 Responses

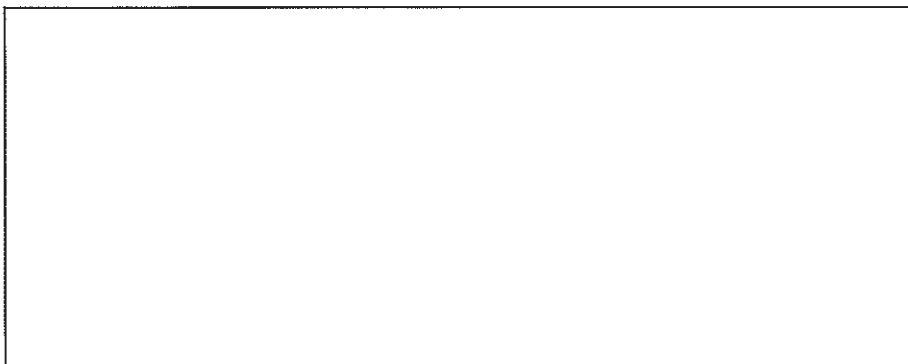


### WELL SURVEY QUESTIONNAIRE

PLEASE FILL OUT THE FOLLOWING QUESTIONNAIRE TO THE BEST OF YOUR KNOWLEDGE. IF YOU ARE NOT SURE OF THE ANSWER TO A QUESTION, PLEASE COMMENT AS "UNKNOWN". AFTER COMPLETION, PLEASE RETURN THIS QUESTIONNAIRE IN THE ENCLOSED STAMPED ENVELOPE.

1. Name and Contact Info: Sally Ebling
2. How Many Wells Do You Have On Your Property? NO
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? NO
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
NO
5. Approximate Depth of Well(s)? —
6. Diameter of Well(s)? —
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? unknown
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? —
9. Date of Installation of Well(s)? —
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? —
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? —
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? NO

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

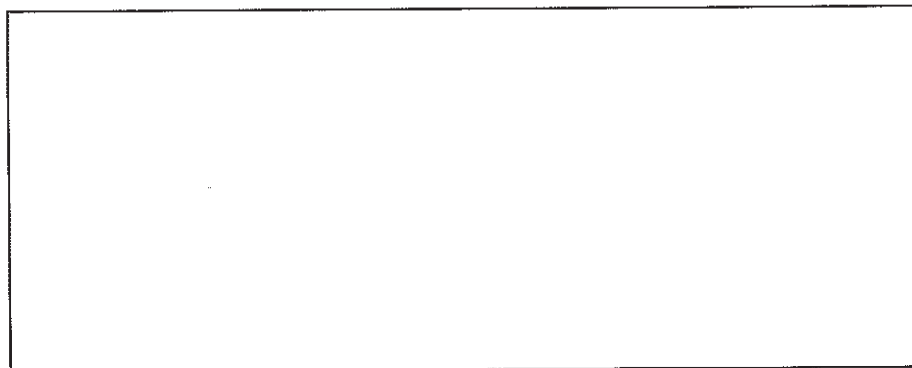


## WELL SURVEY QUESTIONNAIRE

PLEASE FILL OUT THE FOLLOWING QUESTIONNAIRE TO THE BEST OF YOUR KNOWLEDGE. IF YOU ARE NOT SURE OF THE ANSWER TO A QUESTION, PLEASE COMMENT AS "UNKNOWN". AFTER COMPLETION, PLEASE RETURN THIS QUESTIONNAIRE IN THE ENCLOSED STAMPED ENVELOPE.

1. Name and Contact Info: Harvest Adventures, Jeff Lepley 419-54-4614
2. How Many Wells Do You Have On Your Property? 0
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? Yes
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
\_\_\_\_\_  
\_\_\_\_\_
5. Approximate Depth of Well(s)? \_\_\_\_\_
6. Diameter of Well(s)? \_\_\_\_\_
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? \_\_\_\_\_
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? \_\_\_\_\_
9. Date of Installation of Well(s)? \_\_\_\_\_
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? \_\_\_\_\_
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? \_\_\_\_\_
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? \_\_\_\_\_

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



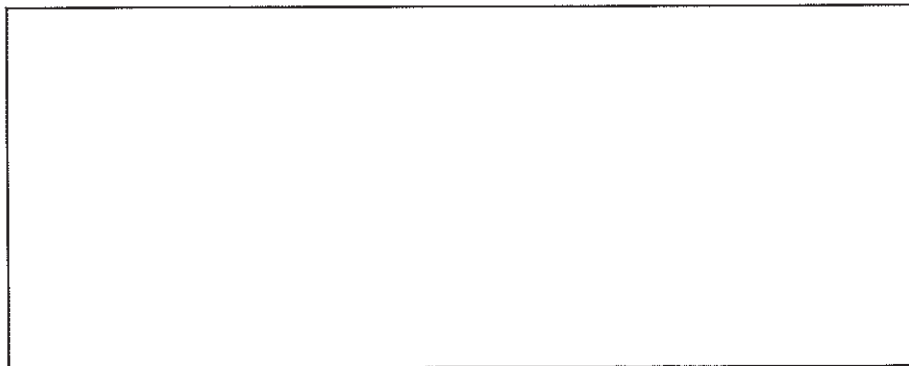


### WELL SURVEY QUESTIONNAIRE

PLEASE FILL OUT THE FOLLOWING QUESTIONNAIRE TO THE BEST OF YOUR KNOWLEDGE. IF YOU ARE NOT SURE OF THE ANSWER TO A QUESTION, PLEASE COMMENT AS "UNKNOWN". AFTER COMPLETION, PLEASE RETURN THIS QUESTIONNAIRE IN THE ENCLOSED STAMPED ENVELOPE.

1. Name and Contact Info: Vicki J. Miller 561.627.0841
2. How Many Wells Do You Have On Your Property? 0
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? NO
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
N/A
5. Approximate Depth of Well(s)? N/A
6. Diameter of Well(s)? N/A
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? N/A
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? N/A
9. Date of Installation of Well(s)? N/A
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? N/A
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? N/A
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? N/A

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings): N/A



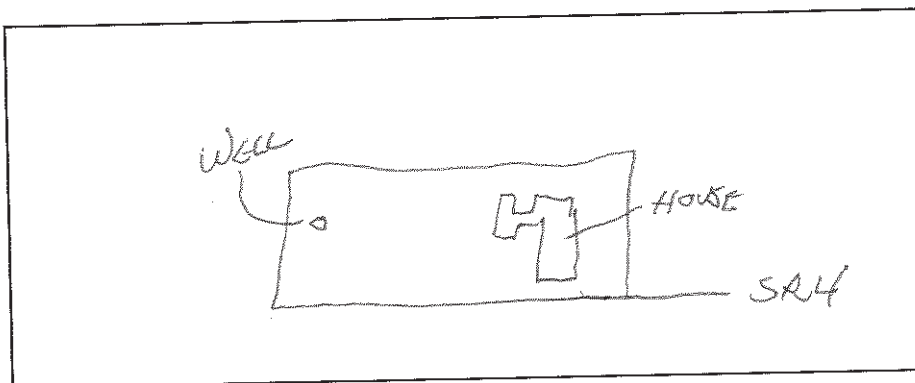
Please note this survey required more than a "few" minutes. It took 1 hour of my time plus time away from work to pick up the Certified letter. Please don't send certified in the future

## WELL SURVEY QUESTIONNAIRE

PLEASE FILL OUT THE FOLLOWING QUESTIONNAIRE TO THE BEST OF YOUR KNOWLEDGE. IF YOU ARE NOT SURE OF THE ANSWER TO A QUESTION, PLEASE COMMENT AS "UNKNOWN". AFTER COMPLETION, PLEASE RETURN THIS QUESTIONNAIRE IN THE ENCLOSED STAMPED ENVELOPE.

1. Name and Contact Info: GARY SHINGLEDECKER 419. 483-3691
2. How Many Wells Do You Have On Your Property? 1
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? YES
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes? No
5. Approximate Depth of Well(s)? 75'
6. Diameter of Well(s)? 5"
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? UNKNOWN
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? PVC
9. Date of Installation of Well(s)? UNKNOWN
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? 40'
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? UNKNOWN
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? No

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



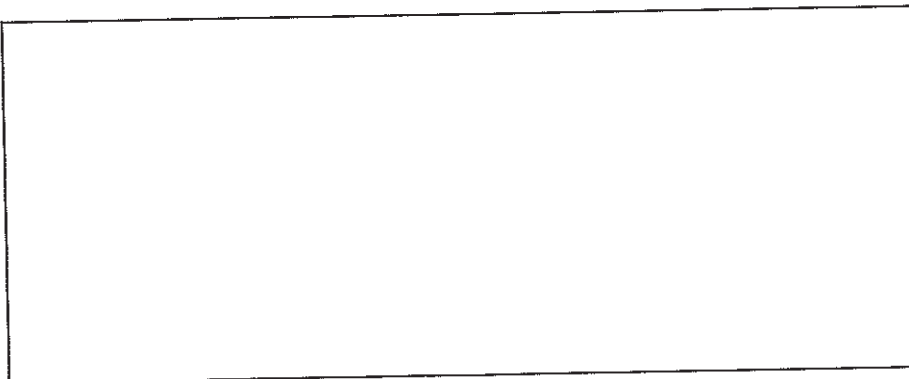


## WELL SURVEY QUESTIONNAIRE

PLEASE FILL OUT THE FOLLOWING QUESTIONNAIRE TO THE BEST OF YOUR KNOWLEDGE. IF YOU ARE NOT SURE OF THE ANSWER TO A QUESTION, PLEASE COMMENT AS "UNKNOWN". AFTER COMPLETION, PLEASE RETURN THIS QUESTIONNAIRE IN THE ENCLOSED STAMPED ENVELOPE.

1. Name and Contact Info: GARY, ROBERT & ANNA SHIMBLEDECKER 419-483-3691
2. How Many Wells Do You Have On Your Property? 0
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? YES
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
\_\_\_\_\_  
\_\_\_\_\_
5. Approximate Depth of Well(s)? \_\_\_\_\_
6. Diameter of Well(s)? \_\_\_\_\_
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? \_\_\_\_\_
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? \_\_\_\_\_
9. Date of Installation of Well(s)? \_\_\_\_\_
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? \_\_\_\_\_
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? \_\_\_\_\_
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? \_\_\_\_\_  
\_\_\_\_\_

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

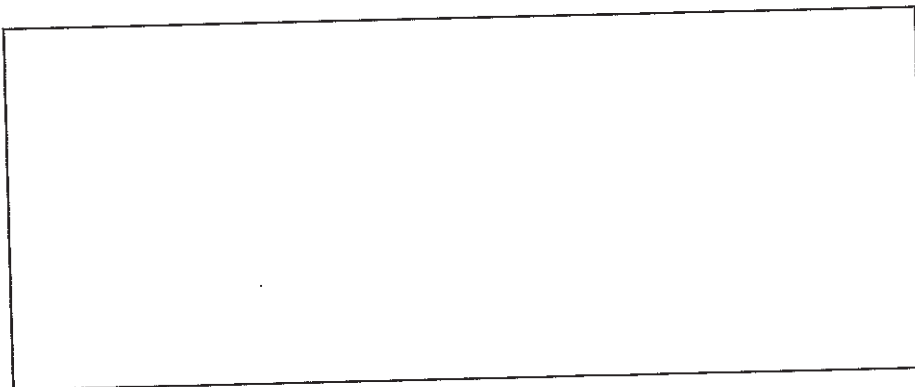


## WELL SURVEY QUESTIONNAIRE

PLEASE FILL OUT THE FOLLOWING QUESTIONNAIRE TO THE BEST OF YOUR KNOWLEDGE. IF YOU ARE NOT SURE OF THE ANSWER TO A QUESTION, PLEASE COMMENT AS "UNKNOWN". AFTER COMPLETION, PLEASE RETURN THIS QUESTIONNAIRE IN THE ENCLOSED STAMPED ENVELOPE.

1. Name and Contact Info: GARY & ROBERT SHINGLEDECKER 419-483-3691
2. How Many Wells Do You Have On Your Property? ~~2~~ 0
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? YES
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
\_\_\_\_\_  
\_\_\_\_\_
5. Approximate Depth of Well(s)? \_\_\_\_\_
6. Diameter of Well(s)? \_\_\_\_\_
7. Type of Well/Groundwater Source (i.e., Bedrock Well -- B; or Overburden/Sand-Gravel Well -- O/SG)? \_\_\_\_\_
8. Type of Well Construction (i.e., Steel Casing -- SC; PVC; brick/clay -- B/C; Other -- O)? \_\_\_\_\_
9. Date of Installation of Well(s)? \_\_\_\_\_
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? \_\_\_\_\_
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? \_\_\_\_\_
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? \_\_\_\_\_  
\_\_\_\_\_

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



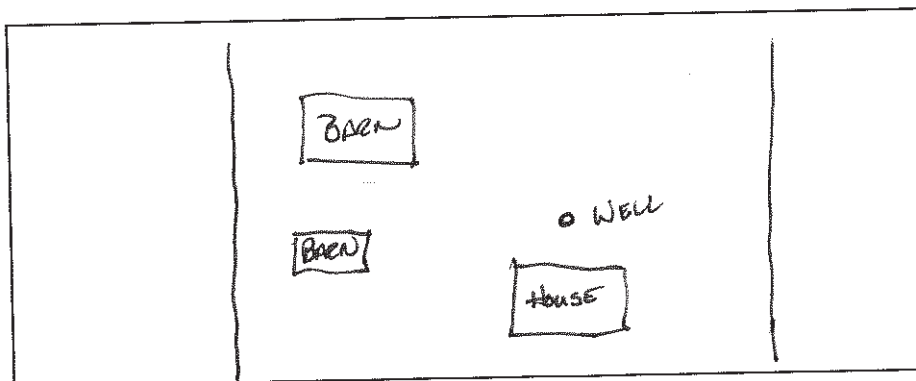


### WELL SURVEY QUESTIONNAIRE

PLEASE FILL OUT THE FOLLOWING QUESTIONNAIRE TO THE BEST OF YOUR KNOWLEDGE. IF YOU ARE NOT SURE OF THE ANSWER TO A QUESTION, PLEASE COMMENT AS "UNKNOWN". AFTER COMPLETION, PLEASE RETURN THIS QUESTIONNAIRE IN THE ENCLOSED STAMPED ENVELOPE.

1. Name and Contact Info: William Dillon
2. How Many Wells Do You Have On Your Property? 1
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? YES
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
NO
5. Approximate Depth of Well(s)? 100'
6. Diameter of Well(s)? 8" ?
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)?  
UNKNOWN
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)?  
SC
9. Date of Installation of Well(s)? 1999
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)?  
UNKNOWN
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? UNKNOWN
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? NO

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

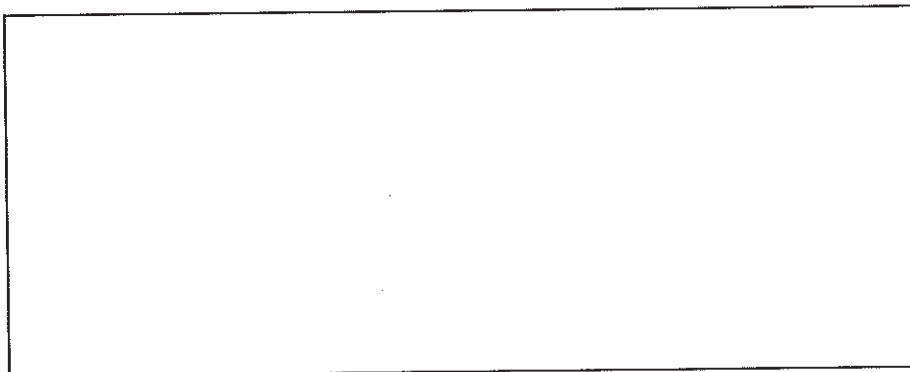


### WELL SURVEY QUESTIONNAIRE

PLEASE FILL OUT THE FOLLOWING QUESTIONNAIRE TO THE BEST OF YOUR KNOWLEDGE. IF YOU ARE NOT SURE OF THE ANSWER TO A QUESTION, PLEASE COMMENT AS "UNKNOWN". AFTER COMPLETION, PLEASE RETURN THIS QUESTIONNAIRE IN THE ENCLOSED STAMPED ENVELOPE.

1. Name and Contact Info: DOROTHY KONST
2. How Many Wells Do You Have On Your Property? 1
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? YES
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
NO
5. Approximate Depth of Well(s)? UNKNOWN
6. Diameter of Well(s)? unknown
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)?  
unknown
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)?  
unknown
9. Date of Installation of Well(s)? 1973 ?
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)?  
unknown
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? unknown
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? NO

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



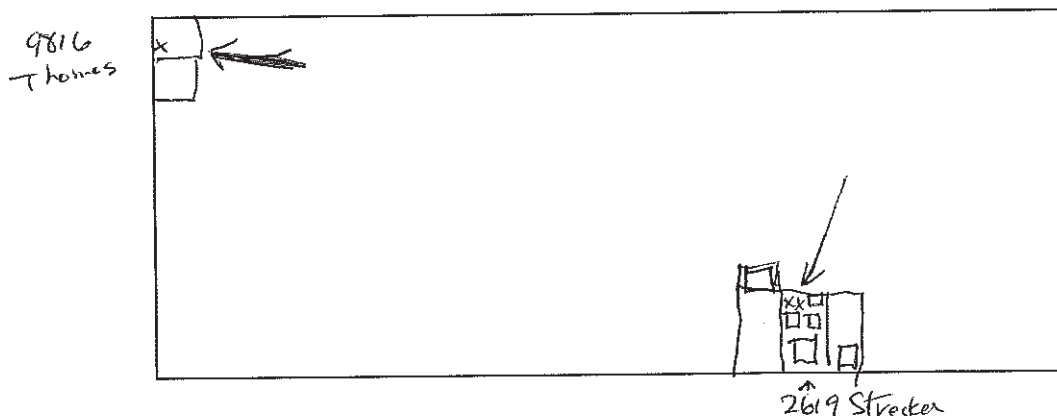


## WELL SURVEY QUESTIONNAIRE

PLEASE FILL OUT THE FOLLOWING QUESTIONNAIRE TO THE BEST OF YOUR KNOWLEDGE. IF YOU ARE NOT SURE OF THE ANSWER TO A QUESTION, PLEASE COMMENT AS "UNKNOWN". AFTER COMPLETION, PLEASE RETURN THIS QUESTIONNAIRE IN THE ENCLOSED STAMPED ENVELOPE.

- Dennis Weilman 419 499 4910  
Heath Weilman 419 706 8754
1. Name and Contact Info: \_\_\_\_\_
  2. How Many Wells Do You Have On Your Property? 2 or 3 on WLC, LLC & 1 on Heath's lot
  3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? yes
  4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
livestock and spray water for agricultural spraying and gardening
  5. Approximate Depth of Well(s)? see attached
  6. Diameter of Well(s)? see attached
  7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? sand, clay, shale
  8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? 2 or 3 steel casing 1 brick clay
  9. Date of Installation of Well(s)? dug well not known – see attached for others
  10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? see attached
  11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? see attached
  12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? drilled maybe – the two other wood wells, we only know of one site?

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

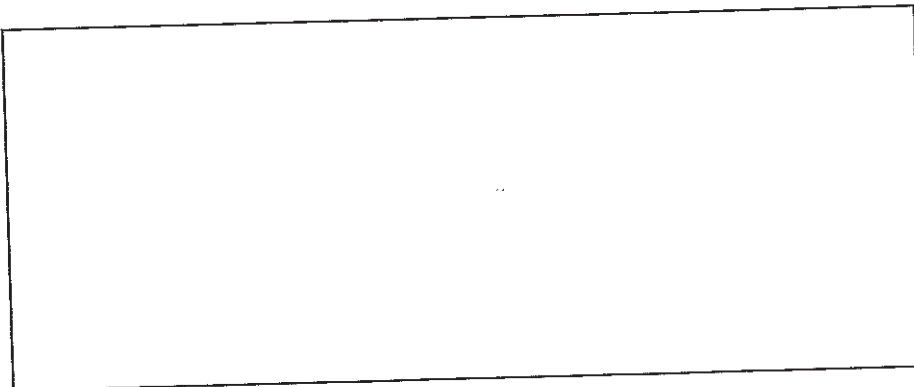


## WELL SURVEY QUESTIONNAIRE

PLEASE FILL OUT THE FOLLOWING QUESTIONNAIRE TO THE BEST OF YOUR KNOWLEDGE. IF YOU ARE NOT SURE OF THE ANSWER TO A QUESTION, PLEASE COMMENT AS "UNKNOWN". AFTER COMPLETION, PLEASE RETURN THIS QUESTIONNAIRE IN THE ENCLOSED STAMPED ENVELOPE.

1. Name and Contact Info: Sold this property in 2016
2. How Many Wells Do You Have On Your Property? unknown
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? November
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
\_\_\_\_\_  
\_\_\_\_\_
5. Approximate Depth of Well(s)? \_\_\_\_\_
6. Diameter of Well(s)? \_\_\_\_\_
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? \_\_\_\_\_
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? \_\_\_\_\_
9. Date of Installation of Well(s)? \_\_\_\_\_
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? \_\_\_\_\_
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? \_\_\_\_\_
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? \_\_\_\_\_

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



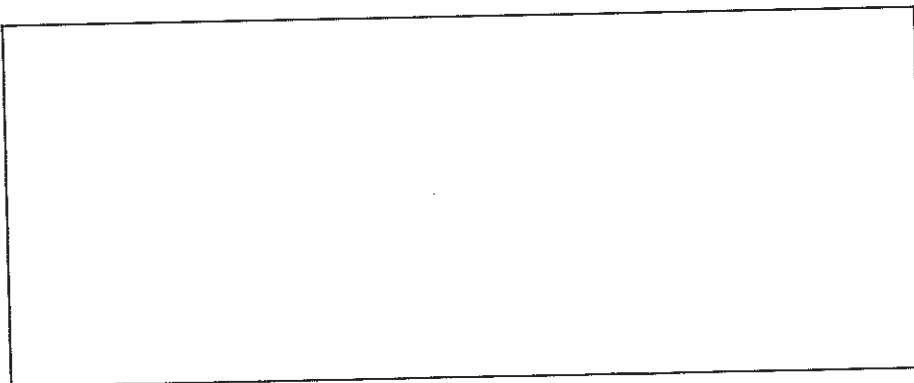


## WELL SURVEY QUESTIONNAIRE

PLEASE FILL OUT THE FOLLOWING QUESTIONNAIRE TO THE BEST OF YOUR KNOWLEDGE. IF YOU ARE NOT SURE OF THE ANSWER TO A QUESTION, PLEASE COMMENT AS "UNKNOWN". AFTER COMPLETION, PLEASE RETURN THIS QUESTIONNAIRE IN THE ENCLOSED STAMPED ENVELOPE.

1. Name and Contact Info: Ronald + Patricia Neill
2. How Many Wells Do You Have On Your Property? unknown
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? No
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
No
5. Approximate Depth of Well(s)? —
6. Diameter of Well(s)? —
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)?  
unknown
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)?  
—
9. Date of Installation of Well(s)? —
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)?  
—
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? —
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? No

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

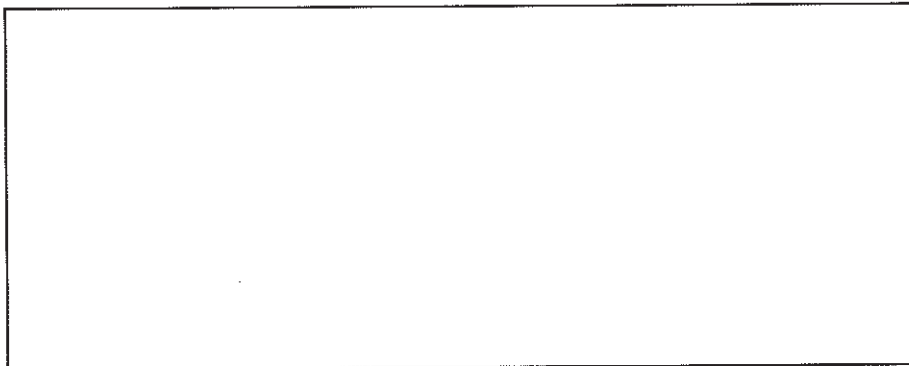


### WELL SURVEY QUESTIONNAIRE

PLEASE FILL OUT THE FOLLOWING QUESTIONNAIRE TO THE BEST OF YOUR KNOWLEDGE. IF YOU ARE NOT SURE OF THE ANSWER TO A QUESTION, PLEASE COMMENT AS "UNKNOWN". AFTER COMPLETION, PLEASE RETURN THIS QUESTIONNAIRE IN THE ENCLOSED STAMPED ENVELOPE.

1. Name and Contact Info: David P Keller
2. How Many Wells Do You Have On Your Property? 0
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? NO
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
NO WELLS
5. Approximate Depth of Well(s)? No wells
6. Diameter of Well(s)? 0
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? 0
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? 0
9. Date of Installation of Well(s)? 0
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? 0
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? 0
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? 0

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



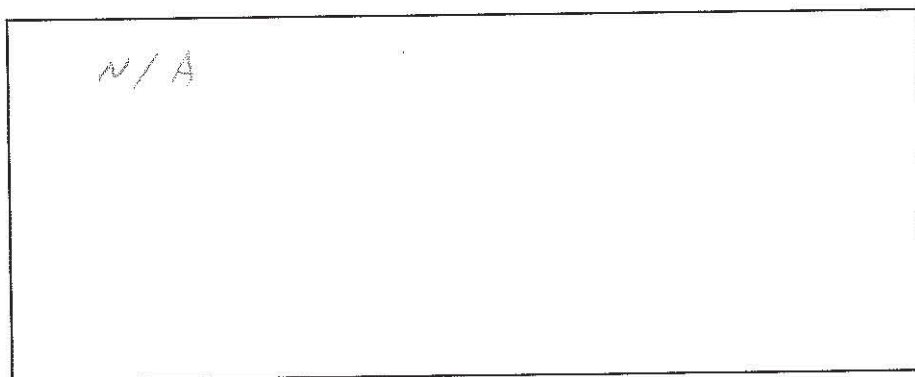


### WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: Bob Bores
2. How Many Wells Do You Have On Your Property? None
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? No
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
N/A
5. Approximate Depth of Well(s)? N/A
6. Diameter of Well(s)? N/A
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)?  
See Known
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)?  
N/A
9. Date of Installation of Well(s)? N/A
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)?  
N/A
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]?  
N/A
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? N/A

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

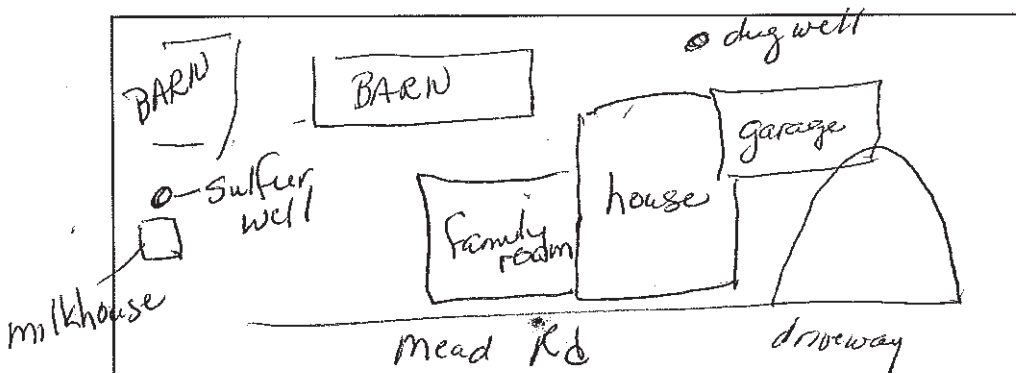


## WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: Betty Dickman betdickman@frontier.com
2. How Many Wells Do You Have On Your Property? 2
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? NO
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes? Both
5. Approximate Depth of Well(s)? 25 ft / 40 ft
6. Diameter of Well(s)? 4 ft / casing
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? Sulfur & good water
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? dug with stone lined around / steel casing
9. Date of Installation of Well(s)? before 1980
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? ?
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? ?
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? No

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



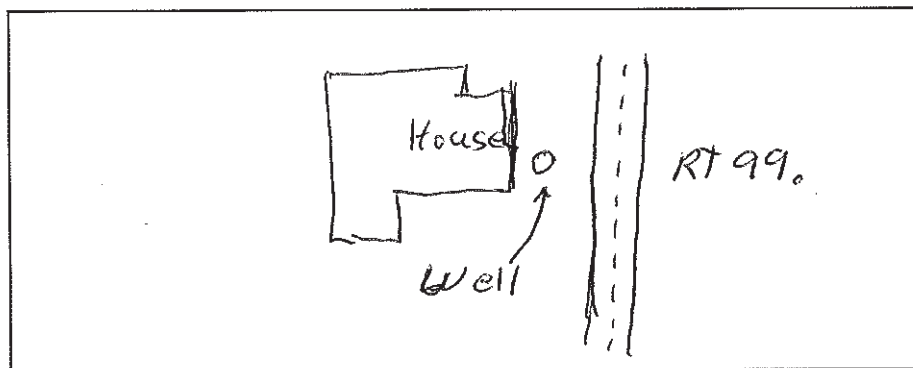


## WELL SURVEY QUESTIONNAIRE

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- Randy L Laws      email: ~~rl~~ laws01@gmail.com  
5295 ST. RT. 99 N.  
Monroeville, Ohio 44847- PH# 419-465-4145
1. Name and Contact Info: \_\_\_\_\_
  2. How Many Wells Do You Have On Your Property? 1
  3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? There is access to Rural water Line
  4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
yes
  5. Approximate Depth of Well(s)? 18 to 20 Ft
  6. Diameter of Well(s)? 3 Ft
  7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)?  
I think Bedrock
  8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? Stone hand Lay
  9. Date of Installation of Well(s)? Best of my knowledge early 1800s
  10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)?  
12 ft.
  11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? Unknown
  12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? NO

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



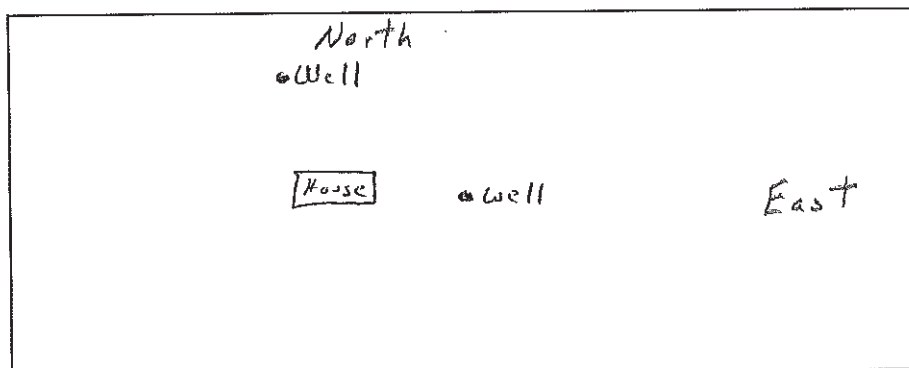
I am 3rd Generation To own this property

### WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: Gerald + Sharon Martin 4516 Williams Road Monroeville Ohio 44847
2. How Many Wells Do You Have On Your Property? 2
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? NO
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes? yes
5. Approximate Depth of Well(s)? 15 ft.
6. Diameter of Well(s)? 4 1/2 ft.
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? Sand-Gravel
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? Brick
9. Date of Installation of Well(s)? 1930's
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? 5 ft.
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? Unknown
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? NO

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



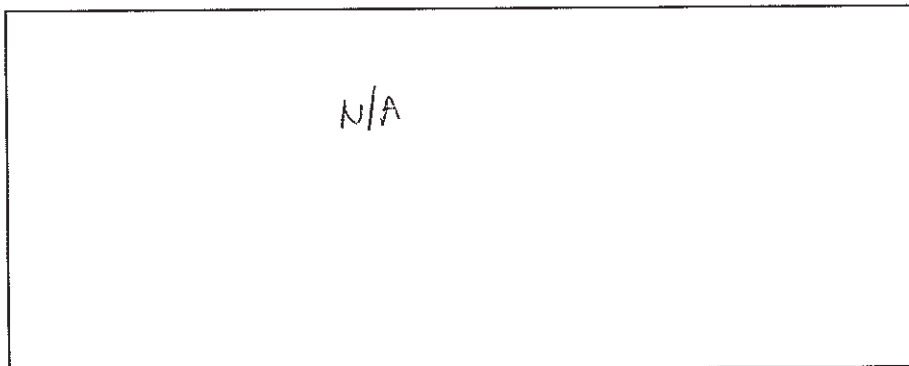


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1. Name and Contact Info: DONALD RUFFING 419-217-1165
2. How Many Wells Do You Have On Your Property? NONE
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? NORTHERN OHIO RURAL WATER
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
N/A
5. Approximate Depth of Well(s)? N/A
6. Diameter of Well(s)? N/A
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)?  
N/A
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)?  
N/A
9. Date of Installation of Well(s)? N/A
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)?  
N/A
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? N/A
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? N/A

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

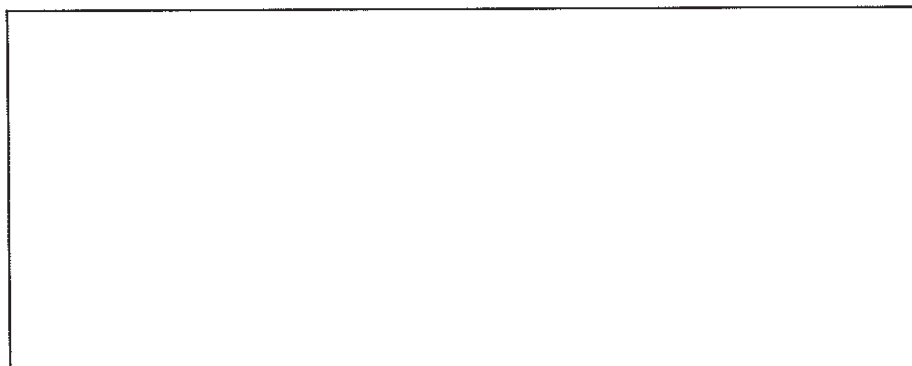


### WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: Amy J. Ferres
2. How Many Wells Do You Have On Your Property? 0
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? NO Have a cistern
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
NA
5. Approximate Depth of Well(s)? NA
6. Diameter of Well(s)? NA
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)?  
NA
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)?  
NA
9. Date of Installation of Well(s)? NA
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)?  
NA
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? NA
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? NA

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



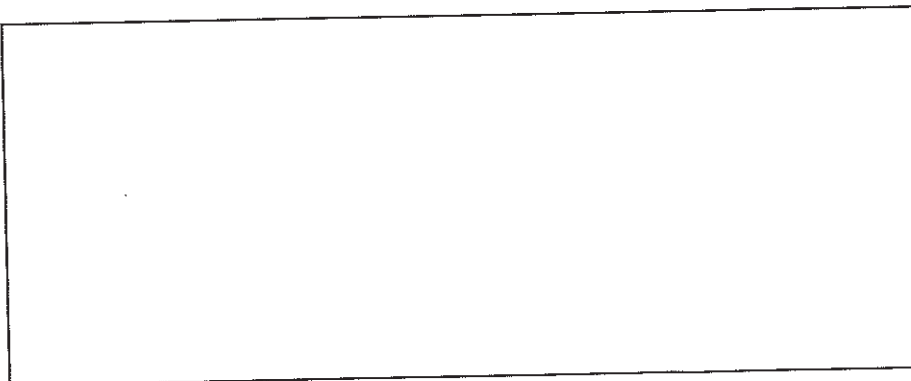


## WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: Mary Jane Maho + Margo Flickinger
2. How Many Wells Do You Have On Your Property? None
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? No
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
No
5. Approximate Depth of Well(s)? None
6. Diameter of Well(s)? None
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)?  
None
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)?  
None
9. Date of Installation of Well(s)? None
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? None
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? None
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? No

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

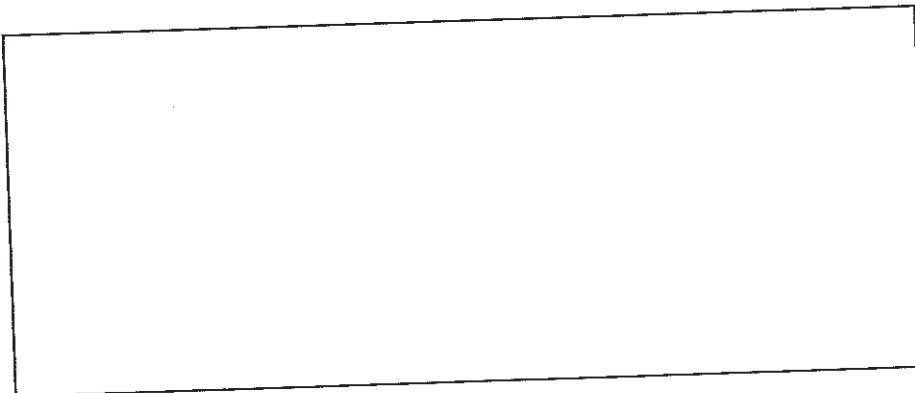


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1. Name and Contact Info: THOMAS & SYLVIA RUFFING
2. How Many Wells Do You Have On Your Property? 0
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? No
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes? No WELLS
5. Approximate Depth of Well(s)? 0
6. Diameter of Well(s)? 0
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? 0
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? 0
9. Date of Installation of Well(s)? 0
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? 0
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? 0
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? No

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



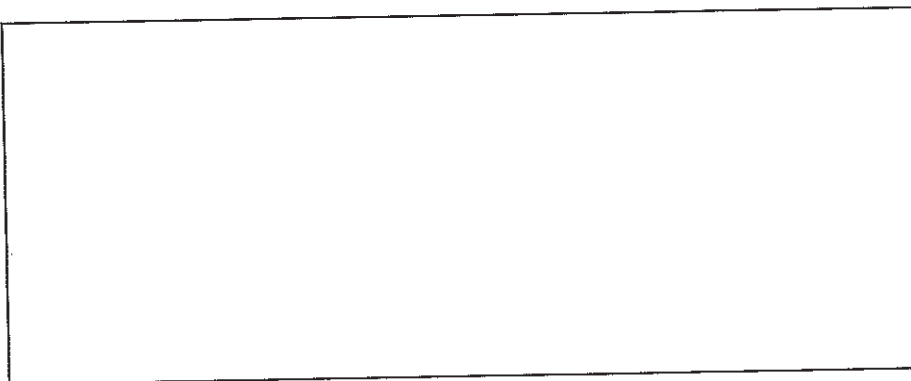


## WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: THOMAS GRUFFING
2. How Many Wells Do You Have On Your Property? 0
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? NO
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
NO WELLS
5. Approximate Depth of Well(s)? 0
6. Diameter of Well(s)? 0
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? 0
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? 0
9. Date of Installation of Well(s)? 0
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? 17
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? 0
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? NO

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

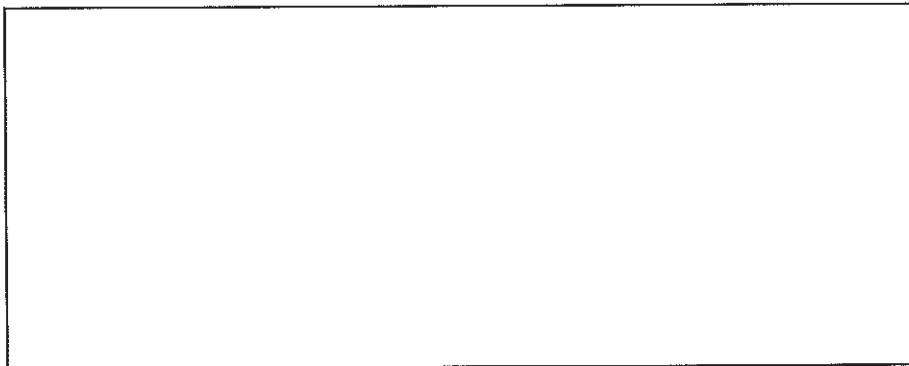


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1. Name and Contact Info: BLUE BONNET INC.
2. How Many Wells Do You Have On Your Property? 0
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? NO
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
NO WELLS
5. Approximate Depth of Well(s)? 0
6. Diameter of Well(s)? 0
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? 0
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? 0
9. Date of Installation of Well(s)? 0
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? 0
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? 0
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? NO

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



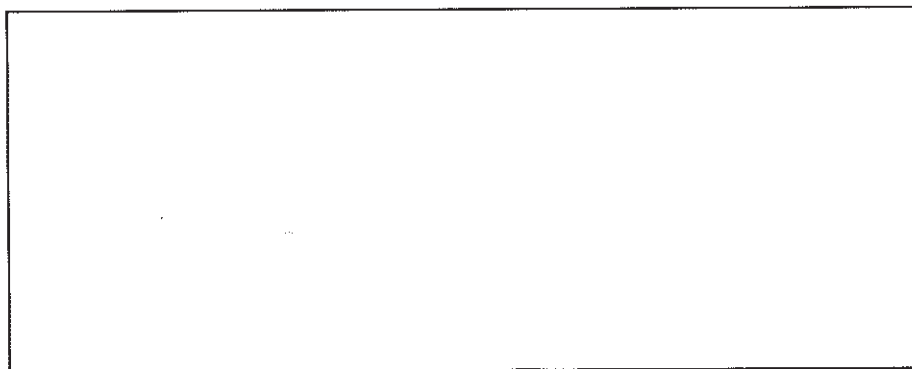


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1. Name and Contact Info: Justin Martin 419-465-4560
2. How Many Wells Do You Have On Your Property? 1
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? No
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
Yes
5. Approximate Depth of Well(s)? 18'
6. Diameter of Well(s)? 36"
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)?  
Dug well
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? PVC
9. Date of Installation of Well(s)? unknown
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? 6-8'
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? unknown
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? No

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

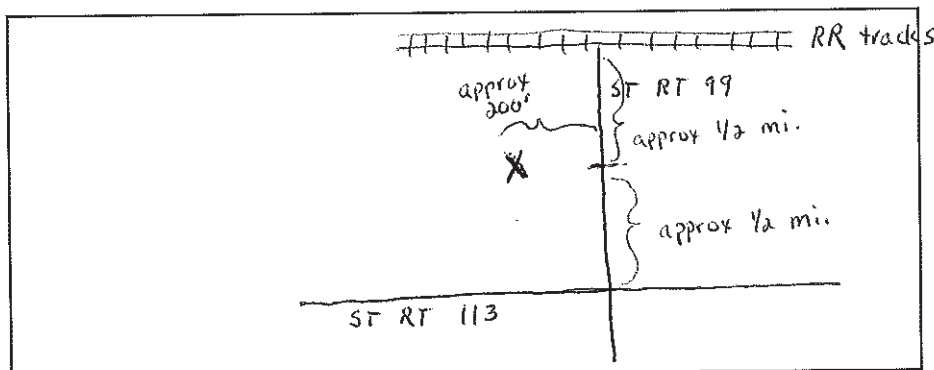


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1. Name and Contact Info: Eugene C Koch, 7403 St. Rt. 113, Bellevue, OH 44811
2. How Many Wells Do You Have On Your Property? 1
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? yes
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
Irrigation
5. Approximate Depth of Well(s)? 8'
6. Diameter of Well(s)? 5'
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? limestone
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? limestone
9. Date of Installation of Well(s)? unknown
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? unknown
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? unknown
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? NO

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



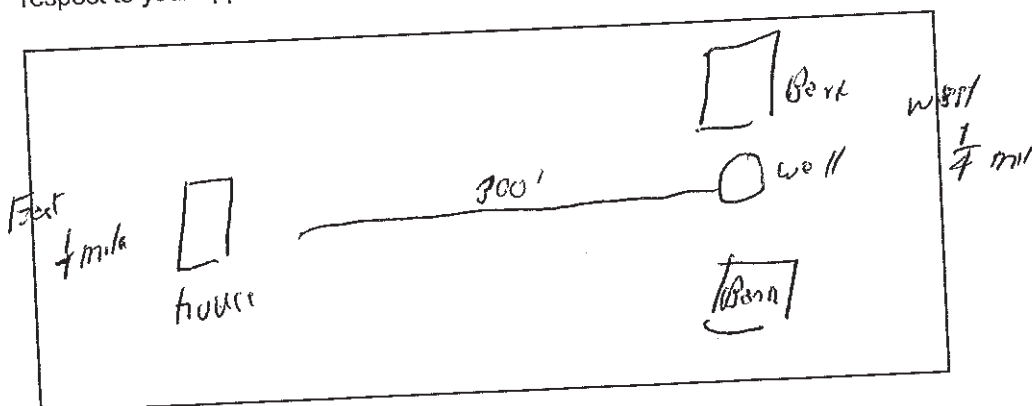


# WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: Alvin Sheller
2. How Many Wells Do You Have On Your Property? One
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? No
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes? Yes
5. Approximate Depth of Well(s)? Bag well 20'
6. Diameter of Well(s)? 4'
7. Type of Well/Groundwater Source (i.e., Bedrock Well - B; or Overburden/Sand-Gravel Well - O/SG)? O/SG
8. Type of Well Construction (i.e., Steel Casing - SC; PVC; brick/clay - B/C; Other - O)? B/C
9. Date of Installation of Well(s)? ?
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? ?
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? ?
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? No

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

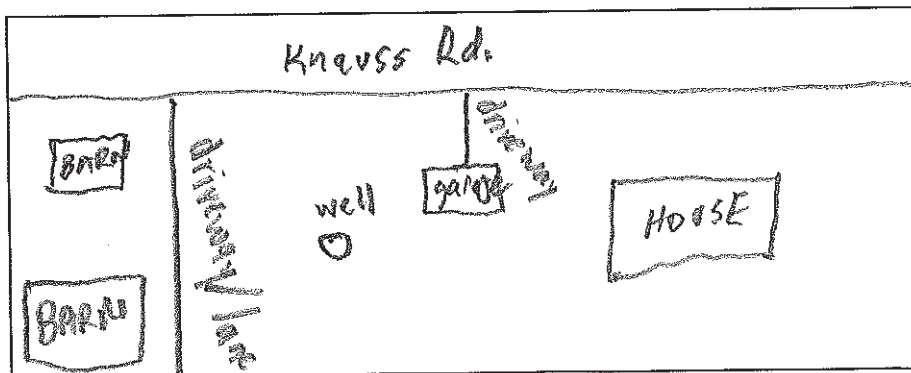


### WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: Timothy J. Moyer 419-483-0620
2. How Many Wells Do You Have On Your Property? 1
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? It is available I am not connected.
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes? Yes, we use it for drinking and for all aspects concerning the farm.
5. Approximate Depth of Well(s)? 120 ft.
6. Diameter of Well(s)? 6 inches
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? unknown
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? steel casing
9. Date of Installation of Well(s)? unknown 1950-1960 approximately
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? we installed new pump last year and hit water at about 40ft.
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? it has never gone dry
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? no

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



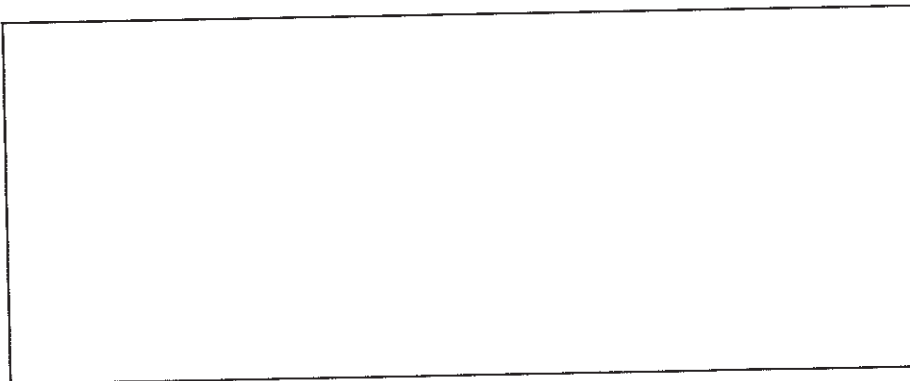


## WELL SURVEY QUESTIONNAIRE

PLEASE FILL OUT THE FOLLOWING QUESTIONNAIRE TO THE BEST OF YOUR KNOWLEDGE. IF YOU ARE NOT SURE OF THE ANSWER TO A QUESTION, PLEASE COMMENT AS "UNKNOWN". AFTER COMPLETION, PLEASE RETURN THIS QUESTIONNAIRE IN THE ENCLOSED STAMPED ENVELOPE.

1. Name and Contact Info: Chris Falter
2. How Many Wells Do You Have On Your Property? unknown
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? yes
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
no
5. Approximate Depth of Well(s)? unknown
6. Diameter of Well(s)? unknown
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)?  
unknown
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)?  
unknown
9. Date of Installation of Well(s)? n/a
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)?  
n/a
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]?  
n/a
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? no

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

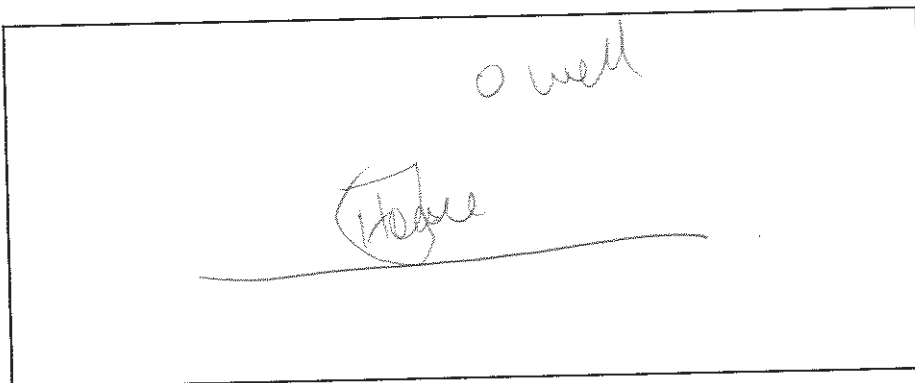


## WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: Eldise Hoer
2. How Many Wells Do You Have On Your Property? 1
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? Yes
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
Yes
5. Approximate Depth of Well(s)? 20
6. Diameter of Well(s)? 8"
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? Sand / Gravel
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? concrete
9. Date of Installation of Well(s)? Unknown
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? 1'
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? Unknown
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? no

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):





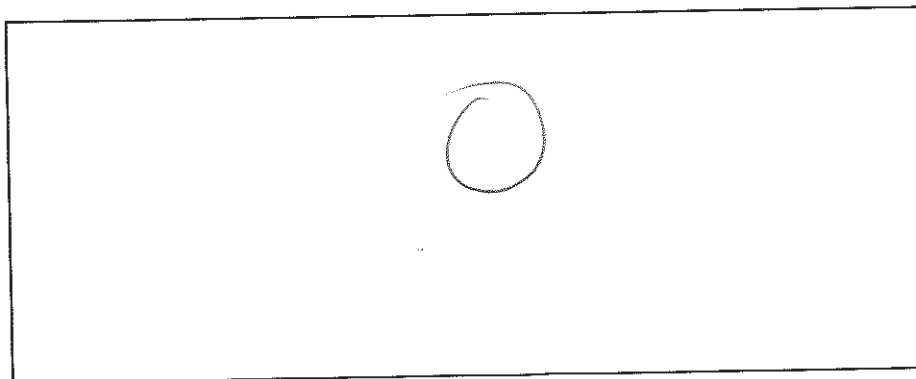
If you have questions on my moms (Elaine Horn) I filled  
Call me Scott 419-541-1810  
hers out

**WELL SURVEY QUESTIONNAIRE**

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1. Name and Contact Info: Locust Knoll Farms LLC Scott Horn
2. How Many Wells Do You Have On Your Property? 0
3. Are You Connected/Provided with Municipal-Water (i.e., water provided by town or private water supply company)? 0
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes? 0
5. Approximate Depth of Well(s)? 0
6. Diameter of Well(s)? 0
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? 0
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? 0
9. Date of Installation of Well(s)? 0
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? 0
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? 0
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? 0

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

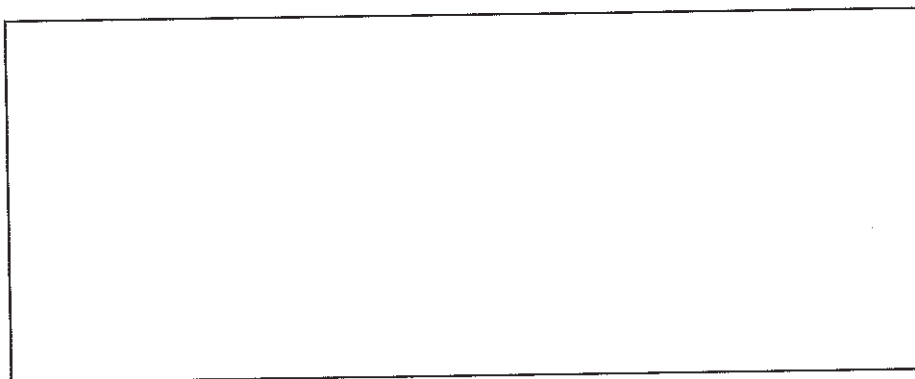


## WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: Dennis & Carol Stout (Property Owners)
2. How Many Wells Do You Have On Your Property? 0
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? Yes - CISTERN (WITH WATER HAULED)
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
N/A
5. Approximate Depth of Well(s)? N/A
6. Diameter of Well(s)? N/A
7. Type of Well/Groundwater Source (i.e., Bedrock Well - B; or Overburden/Sand-Gravel Well - O/SG)?  
N/A
8. Type of Well Construction (i.e., Steel Casing - SC; PVC; brick/clay - B/C; Other - O)? N/A
9. Date of Installation of Well(s)? N/A
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? N/A
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? N/A
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? N/A

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



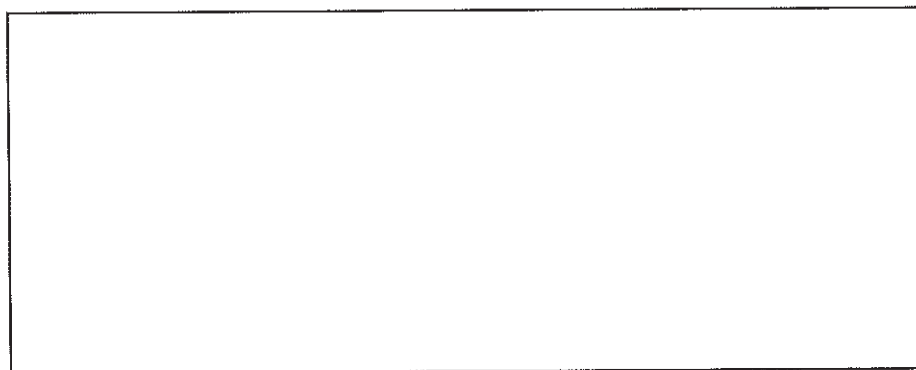


### WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: HAROLD STOCKMASTER
2. How Many Wells Do You Have On Your Property? NONE
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? CISTERN
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
NO
5. Approximate Depth of Well(s)? NONE
6. Diameter of Well(s)? NONE
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? NO
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? NO
9. Date of Installation of Well(s)? NO
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? NO
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? NO
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? NO

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

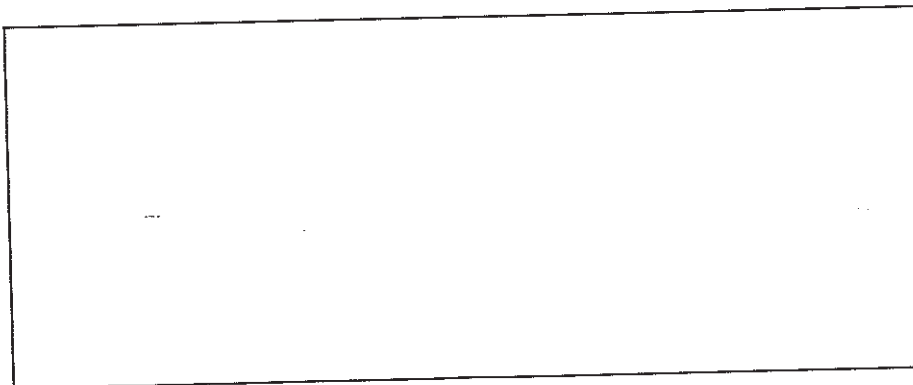


## WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: Mary Musko 419-340-1869
2. How Many Wells Do You Have On Your Property? 0
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? no
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
\_\_\_\_\_  
\_\_\_\_\_
5. Approximate Depth of Well(s)? \_\_\_\_\_
6. Diameter of Well(s)? \_\_\_\_\_
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? \_\_\_\_\_
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? \_\_\_\_\_
9. Date of Installation of Well(s)? \_\_\_\_\_
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? \_\_\_\_\_
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? \_\_\_\_\_
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? \_\_\_\_\_

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



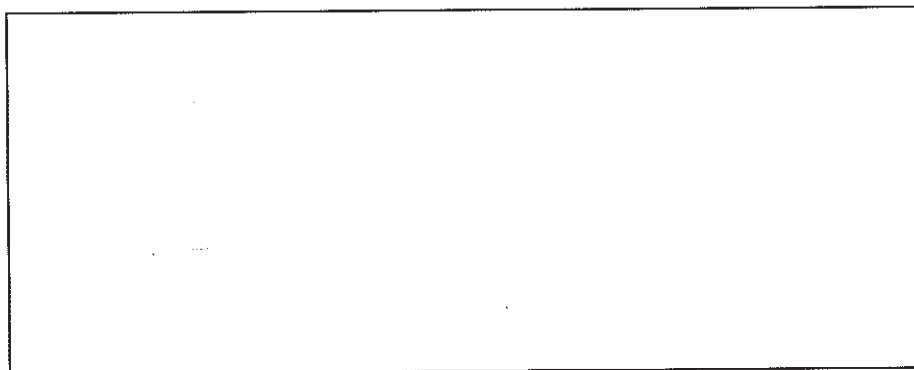


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- Kurt Heyman, Etal*
1. Name and Contact Info: *Kurt Heyman 2417 Mudbrook Rd Heron OH*  
*419-541-0544 44839*
2. How Many Wells Do You Have On Your Property? *0*
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? *no*
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
\_\_\_\_\_  
\_\_\_\_\_
5. Approximate Depth of Well(s)? \_\_\_\_\_
6. Diameter of Well(s)? \_\_\_\_\_
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? \_\_\_\_\_
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? \_\_\_\_\_
9. Date of Installation of Well(s)? \_\_\_\_\_
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? \_\_\_\_\_
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? \_\_\_\_\_
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? \_\_\_\_\_

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

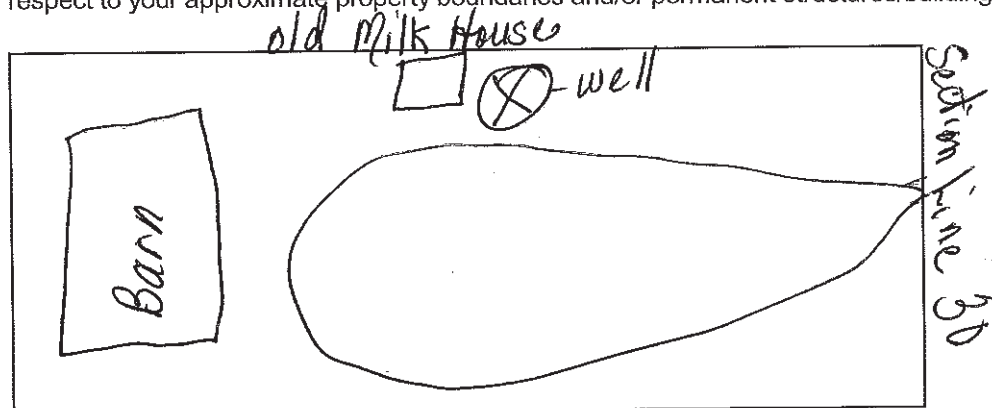


### WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: BRB Farms LLC - Richard Bores 419-212-9825
2. How Many Wells Do You Have On Your Property? 1
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? NO RW
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
Occasional irrigation
5. Approximate Depth of Well(s)? 16' Dug Well
6. Diameter of Well(s)? 6'
7. Type of Well/Groundwater Source (i.e., Bedrock Well - B; or Overburden/Sand-Gravel Well - O/SG)? Bedrock
8. Type of Well Construction (i.e., Steel Casing - SC; PVC; brick/clay - B/C; Other - O)? B/C
9. Date of Installation of Well(s)? Unknown
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? 8-10'
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? Unknown
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? No

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



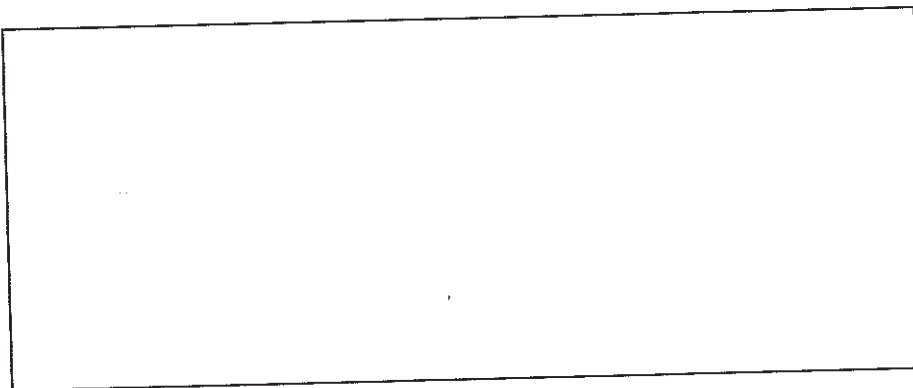


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1. Name and Contact Info: Rebecca Yingling 419-483-6555
2. How Many Wells Do You Have On Your Property? 2
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? NO
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes? NO
5. Approximate Depth of Well(s)? 16-18 feet
6. Diameter of Well(s)? unknown
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? unknown
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? B/C
9. Date of Installation of Well(s)? unknown
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? unknown
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? neither are used anymore
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? NO

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

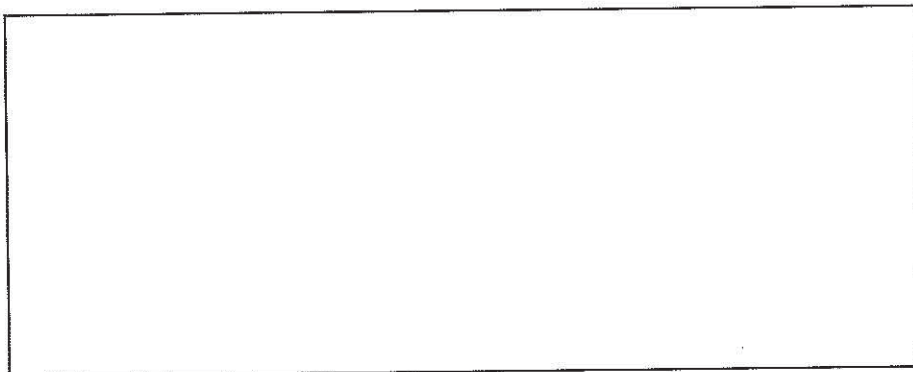


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1. Name and Contact Info: Donald Yingling 419-483-6555
2. How Many Wells Do You Have On Your Property? 2
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? NO
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
NO
5. Approximate Depth of Well(s)? 16-18 feet
6. Diameter of Well(s)? unknown
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)?  
unknown
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? B/C
9. Date of Installation of Well(s)? unknown
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)?  
unknown
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? neither are used anymore
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? NO

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



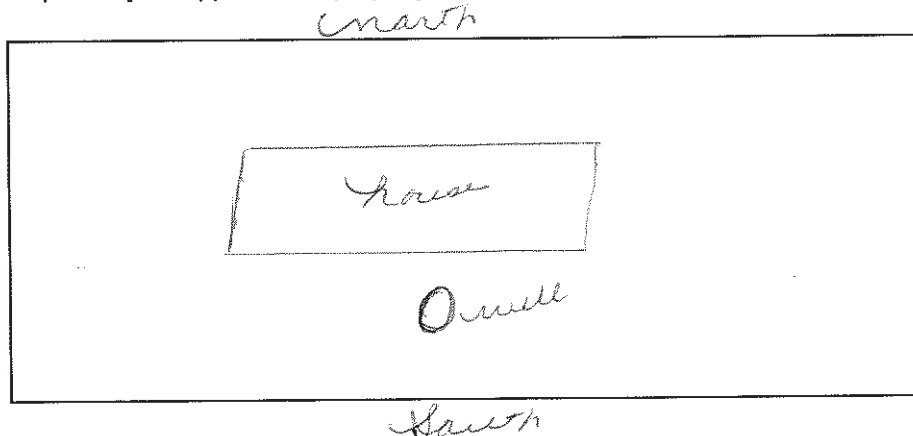


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1. Name and Contact Info: Anna Sue Kerig
2. How Many Wells Do You Have On Your Property? one
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? no
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
yes
5. Approximate Depth of Well(s)? unknown
6. Diameter of Well(s)? unknown
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)?  
unknown
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)?  
unknown
9. Date of Installation of Well(s)? unknown
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)?  
unknown
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? unknown
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? no

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

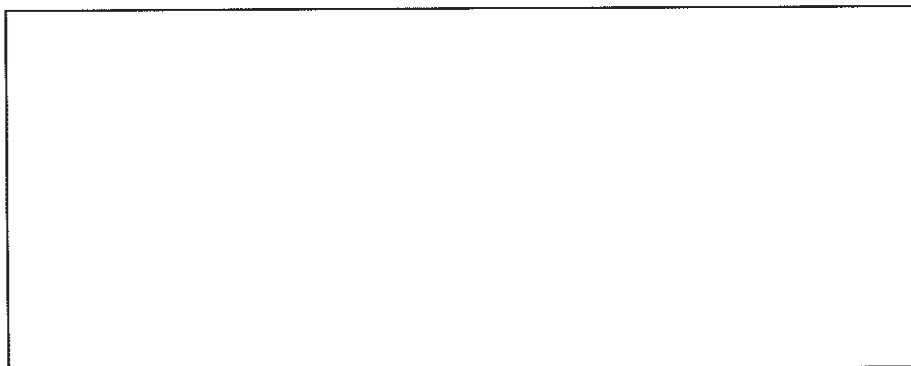


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- LF WAM LLC
1. Name and Contact Info: David E Lepley Lepley Farms, LLC  
4084 Prairie Road  
Bellevue, Ohio 44811  
419-541-3189 cell
2. How Many Wells Do You Have On Your Property? NONE
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? yes
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes? N/A
5. Approximate Depth of Well(s)? N/A
6. Diameter of Well(s)? N/A
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? N/A
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? N/A
9. Date of Installation of Well(s)? N/A
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? N/A
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? N/A
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? N/A

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):





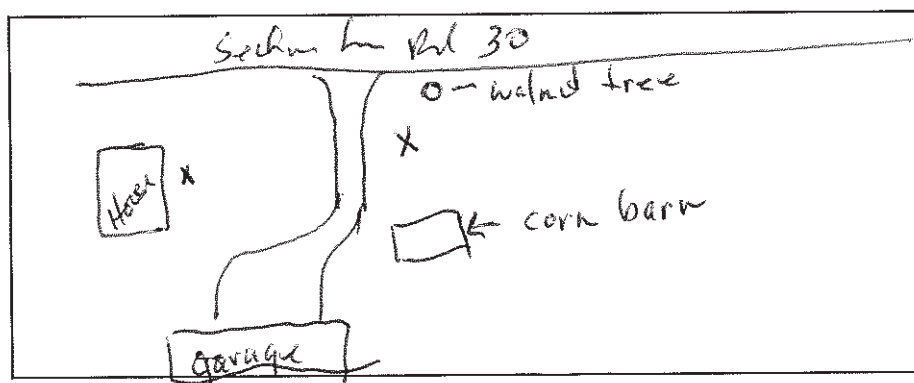
## WELL SURVEY QUESTIONNAIRE

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*Steve Bischoff will answer questions*

1. Name and Contact Info: Agnes Bischoff owner
2. How Many Wells Do You Have On Your Property? 2
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? No
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
No
5. Approximate Depth of Well(s)? 32'
6. Diameter of Well(s)? 4-6'
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? Bedrock
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? Lined up stone
9. Date of Installation of Well(s)? Before 1968
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? don't know
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? No much
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? No

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

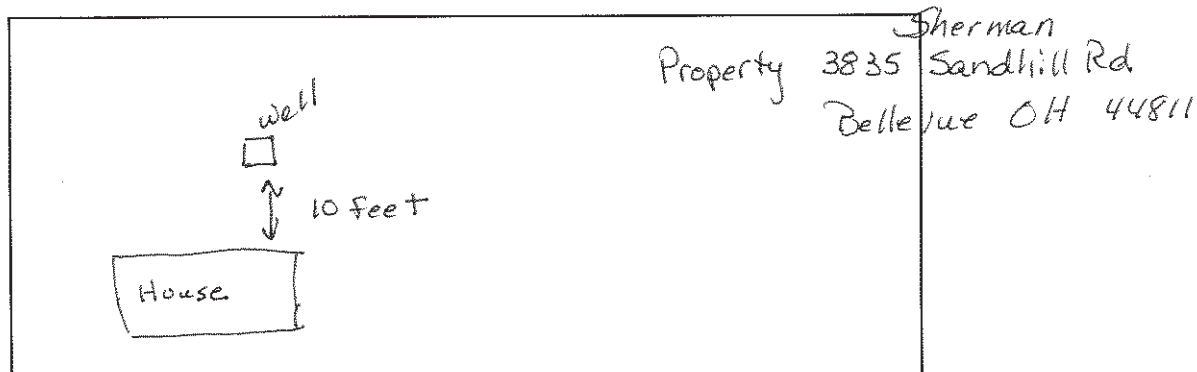


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- Georgia Orwig POA  
4209 Billings Rd  
Castalia OH 44824 419-271-1338
1. Name and Contact Info: \_\_\_\_\_
  2. How Many Wells Do You Have On Your Property? one
  3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? No
  4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
drinking & household needs - bath, washing clothes & swimming pool
  5. Approximate Depth of Well(s)? 16 feet
  6. Diameter of Well(s)? 6 feet around
  7. Type of Well/Groundwater Source (i.e., Bedrock Well - B; or Overburden/Sand-Gravel Well - O/SG)?  
"B" overburden/Sand-gravel well
  8. Type of Well Construction (i.e., Steel Casing - SC; PVC; brick/clay - B/C; Other - O)?  
other - slab rocks
  9. Date of Installation of Well(s)? 1950
  10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)?  
4 feet
  11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? 2 gallon
  12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? No

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



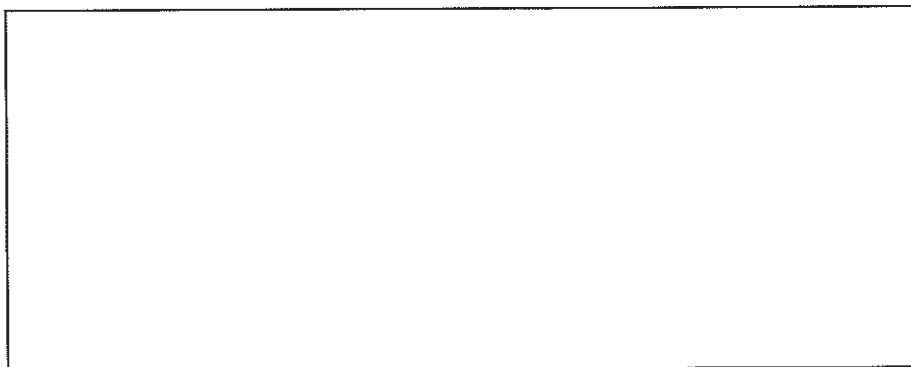


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- 419 424 4600
1. Name and Contact Info: CAS Land LLC / Curt Swartzmiller
  2. How Many Wells Do You Have On Your Property? 0
  3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? \_\_\_\_\_
  4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
\_\_\_\_\_
  5. Approximate Depth of Well(s)? \_\_\_\_\_
  6. Diameter of Well(s)? \_\_\_\_\_
  7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? \_\_\_\_\_
  8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? \_\_\_\_\_
  9. Date of Installation of Well(s)? \_\_\_\_\_
  10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? \_\_\_\_\_
  11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? \_\_\_\_\_
  12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? \_\_\_\_\_

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

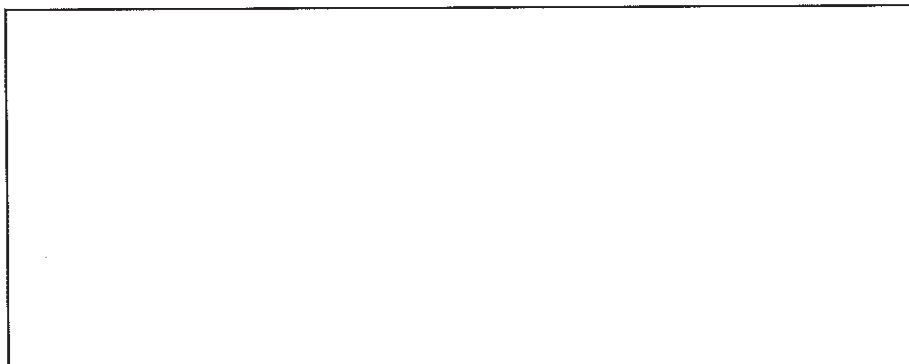


### WELL SURVEY QUESTIONNAIRE

PLEASE FILL OUT THE FOLLOWING QUESTIONNAIRE TO THE BEST OF YOUR KNOWLEDGE. IF YOU ARE NOT SURE OF THE ANSWER TO A QUESTION, PLEASE COMMENT AS "UNKNOWN". AFTER COMPLETION, PLEASE RETURN THIS QUESTIONNAIRE IN THE ENCLOSED STAMPED ENVELOPE.

1. Name and Contact Info: Mark & Patricia Bores
2. How Many Wells Do You Have On Your Property? None
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? No
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes? No
5. Approximate Depth of Well(s)?
6. Diameter of Well(s)?
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)?
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)?
9. Date of Installation of Well(s)?
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)?
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]?
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)?

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



We are Opposed to Wind Farm



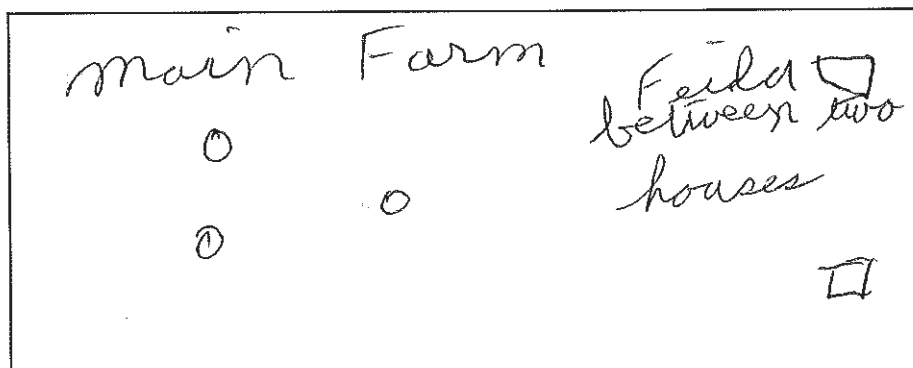
### WELL SURVEY QUESTIONNAIRE

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4196563038

1. Name and Contact Info: Roger Rowland
2. How Many Wells Do You Have On Your Property? 4
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? yes
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes? Livestock Water Drinking
5. Approximate Depth of Well(s)? 83'
6. Diameter of Well(s)? 8" casing
7. Type of Well/Groundwater Source (i.e., Bedrock Well - B; or Overburden/Sand-Gravel Well - O/SG)?
8. Type of Well Construction (i.e., Steel Casing - SC; PVC; brick/clay - B/C; Other - O)? Steel casing and PVC
9. Date of Installation of Well(s)? unknown
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? 60'
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? unknown
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? low water yield

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

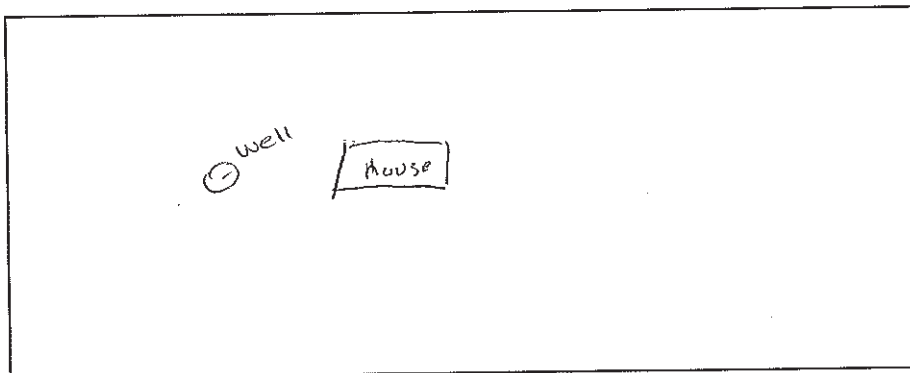


## WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: Joyce A. Pesnell
2. How Many Wells Do You Have On Your Property? 1
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? yes
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
non used
5. Approximate Depth of Well(s)? unknown
6. Diameter of Well(s)? unknown
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)?  
unknown
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)?  
unknown
9. Date of Installation of Well(s)? 1960
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)?  
unknown
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? unknown
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? No

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):





### WELL SURVEY QUESTIONNAIRE

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- Schaeffer + Sons Inc.*
1. Name and Contact Info: Kevin Schaeffer
  2. How Many Wells Do You Have On Your Property? 15 - 20 none being used at present
  3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? yes
  4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
NO
  5. Approximate Depth of Well(s)? 12 - 100 ft deep
  6. Diameter of Well(s)? 4 in to 4 ft dia
  7. Type of Well/Groundwater Source (i.e., Bedrock Well - B; or Overburden/Sand-Gravel Well - O/SG)?  
Bed rock
  8. Type of Well Construction (i.e., Steel Casing - SC; PVC; brick/clay - B/C; Other - O)?  
Steel Brick Flat + Round Stone
  9. Date of Installation of Well(s)? 1815 - 1960
  10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? ?
  11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? ?
  12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? NO

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

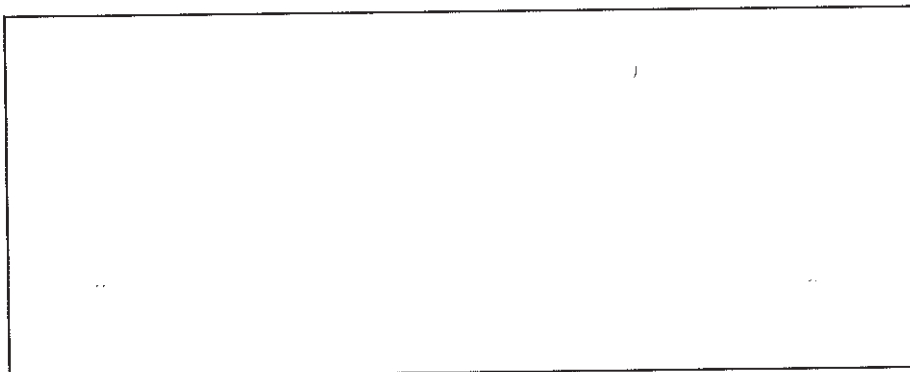
ALL over the  
present Farms around  
Existing Home Steads  
and old Home stead sites  
and Barn sites

## WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: Lean Thompson
2. How Many Wells Do You Have On Your Property? None
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? \_\_\_\_\_
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
\_\_\_\_\_  
\_\_\_\_\_
5. Approximate Depth of Well(s)? \_\_\_\_\_
6. Diameter of Well(s)? \_\_\_\_\_
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? \_\_\_\_\_
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? \_\_\_\_\_
9. Date of Installation of Well(s)? \_\_\_\_\_
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? \_\_\_\_\_
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? \_\_\_\_\_
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? \_\_\_\_\_

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



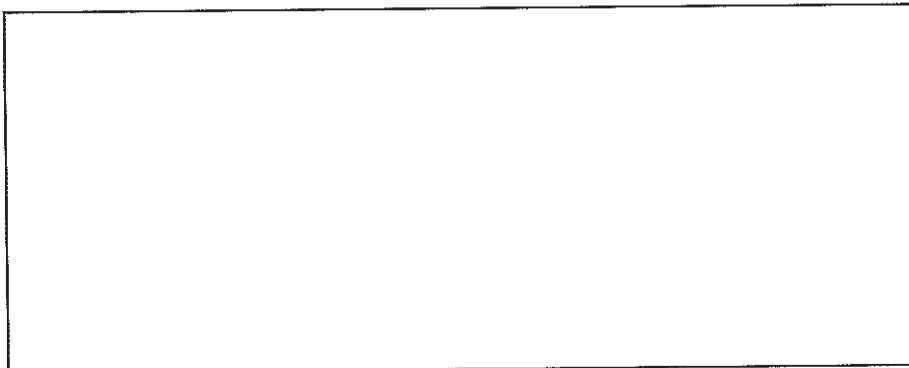


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1. Name and Contact Info: Dorothy S. Yingling
2. How Many Wells Do You Have On Your Property? None
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? \_\_\_\_\_
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
\_\_\_\_\_  
\_\_\_\_\_
5. Approximate Depth of Well(s)? \_\_\_\_\_
6. Diameter of Well(s)? \_\_\_\_\_
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? \_\_\_\_\_
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? \_\_\_\_\_
9. Date of Installation of Well(s)? \_\_\_\_\_
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? \_\_\_\_\_
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? \_\_\_\_\_
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? \_\_\_\_\_

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

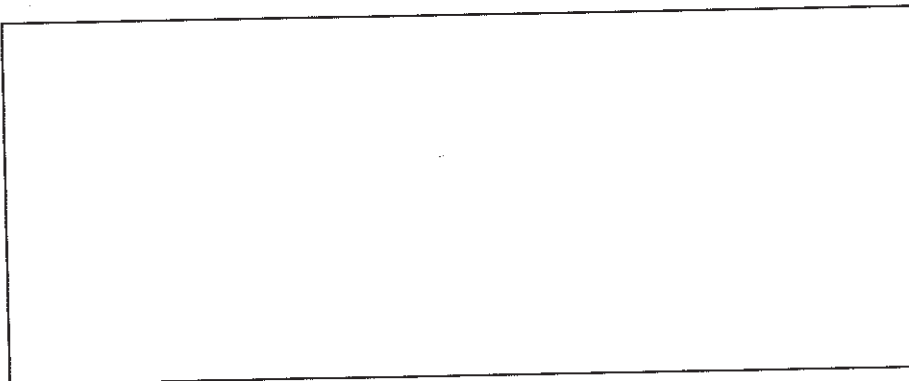


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1. Name and Contact Info: BONNIE LEE WEILNAU
2. How Many Wells Do You Have On Your Property? 1
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? YES
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
NO
5. Approximate Depth of Well(s)? 50'
6. Diameter of Well(s)? 12"
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)?  
N/A
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)?  
STEEL CASING
9. Date of Installation of Well(s)? 1950s
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)?  
UNKNOWN
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? 10 GPM
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? NO

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



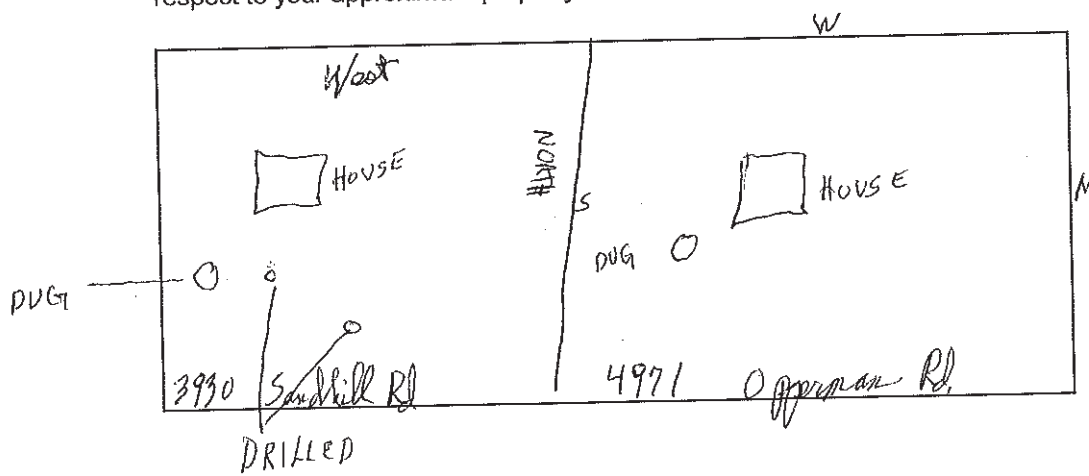


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1. Name and Contact Info: Kenton D. Sherman
2. How Many Wells Do You Have On Your Property? 4
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? no
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
Drinking
5. Approximate Depth of Well(s)? ~~dig~~ dug 15' drilled 50'-60'
6. Diameter of Well(s)? 6" + 8"
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)?  
Shale
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)?  
Steel Casing
9. Date of Installation of Well(s)? 60 + years
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)?  
unknown
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? unknown
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? no

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

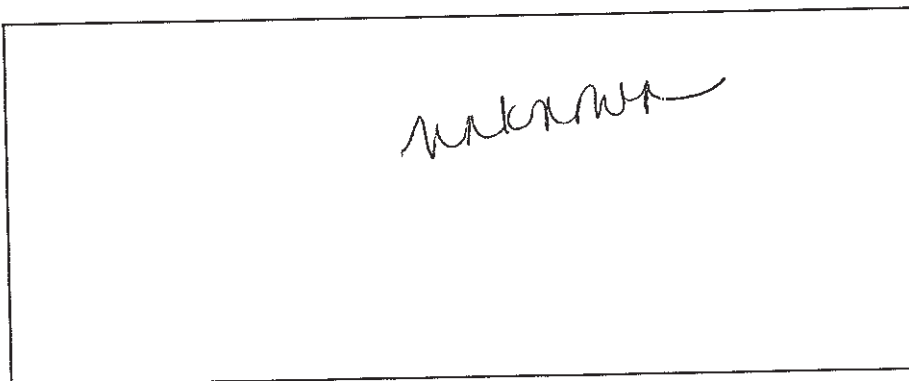


## WELL SURVEY QUESTIONNAIRE

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- 561.632.5577
1. Name and Contact Info: Vicki Miller Trustee for Betty J. Miller
  2. How Many Wells Do You Have On Your Property? 1
  3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? yes
  4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes? yes
  5. Approximate Depth of Well(s)? unknown
  6. Diameter of Well(s)? unknown
  7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? unknown
  8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? unknown
  9. Date of Installation of Well(s)? unknown
  10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? unknown
  11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? unknown
  12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? unknown

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



This information  
~~is~~ was not  
found in my  
deceased father's  
records to  
complete the  
survey

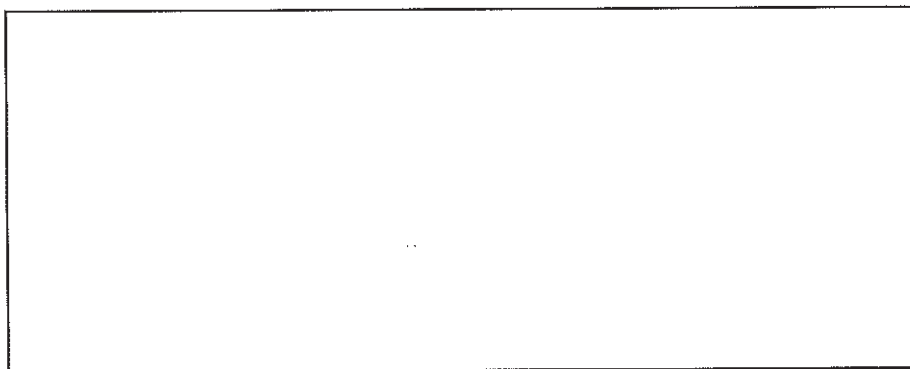


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1. Name and Contact Info: Thomas L. Aigler 414-217-9084
2. How Many Wells Do You Have On Your Property? NONE
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? NO
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
\_\_\_\_\_  
\_\_\_\_\_
5. Approximate Depth of Well(s)? \_\_\_\_\_
6. Diameter of Well(s)? \_\_\_\_\_
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? \_\_\_\_\_
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? \_\_\_\_\_
9. Date of Installation of Well(s)? \_\_\_\_\_
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? \_\_\_\_\_
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? \_\_\_\_\_
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? \_\_\_\_\_

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

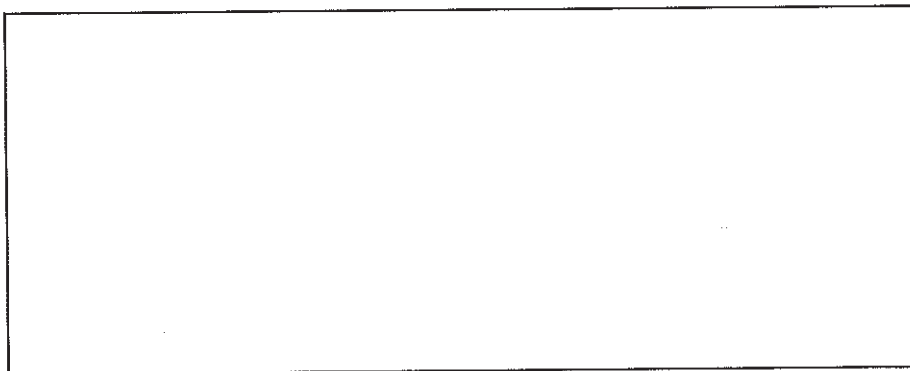


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- Das Farm LLC
1. Name and Contact Info: Kurt Heyman 419-541-0544
  2. How Many Wells Do You Have On Your Property? 0
  3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? no
  4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
\_\_\_\_\_  
\_\_\_\_\_
  5. Approximate Depth of Well(s)? \_\_\_\_\_
  6. Diameter of Well(s)? \_\_\_\_\_
  7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? \_\_\_\_\_
  8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? \_\_\_\_\_
  9. Date of Installation of Well(s)? \_\_\_\_\_
  10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? \_\_\_\_\_
  11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? \_\_\_\_\_
  12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? \_\_\_\_\_

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



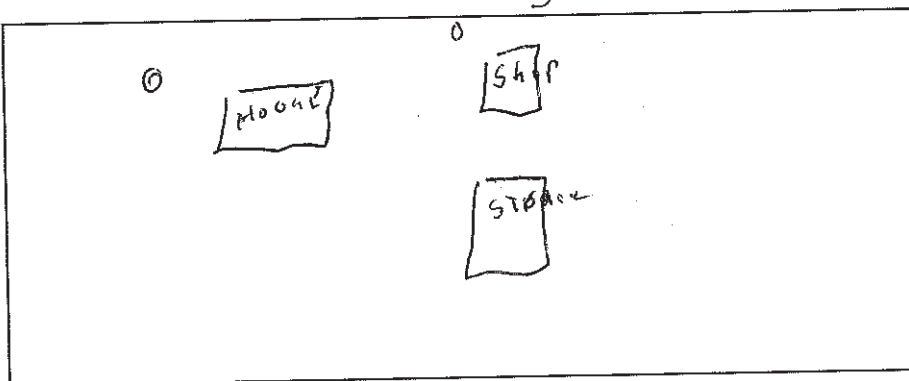


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1. Name and Contact Info: John Nixon 419 656 7453
2. How Many Wells Do You Have On Your Property? 2
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? yes
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
yes shop cleaning
5. Approximate Depth of Well(s)? 28'
6. Diameter of Well(s)? 3'
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? lime stone bed up Ground water
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? lime stone bed up
9. Date of Installation of Well(s)? 1900"
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? ?
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? 40
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? No

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

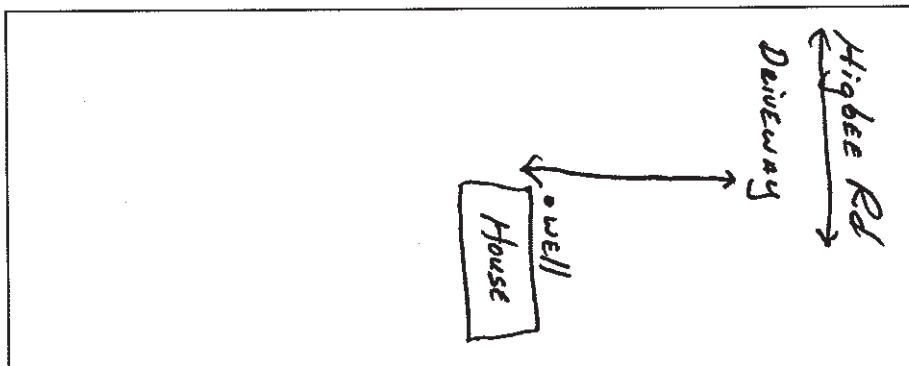


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1. Name and Contact Info:     Ron Miller
2. How Many Wells Do You Have On Your Property?     1
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)?     YES         Erie County water supply
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
    NO
5. Approximate Depth of Well(s)?     20 ft
6. Diameter of Well(s)?     3 1/2 ft.
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)?     (B)
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)?     Rock
9. Date of Installation of Well(s)?     UNKNOWN
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)?  
    UNKNOWN
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]?     UNKNOWN
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)?     NO

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



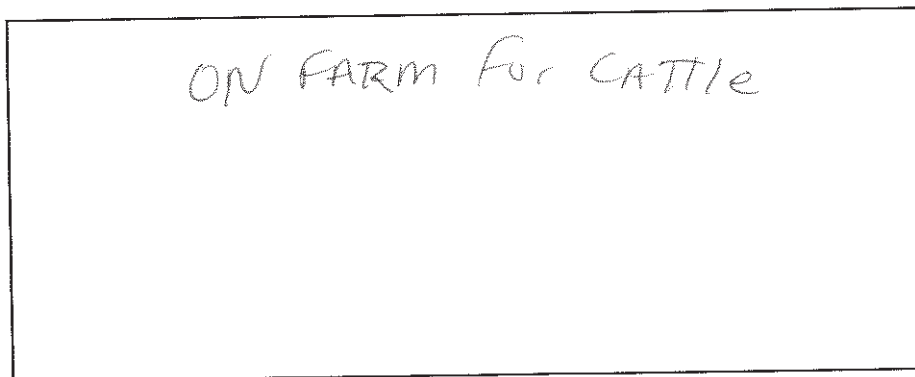


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- 419-  
541-1810
1. Name and Contact Info: Locust Knoll Farms Scott Horn
  2. How Many Wells Do You Have On Your Property? 2
  3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? Yes
  4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
Yes
  5. Approximate Depth of Well(s)? 16-20'
  6. Diameter of Well(s)? 6'
  7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)?  
SAND/GRAVEL TO STATE
  8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)?  
Concrete
  9. Date of Installation of Well(s)? Very old + 1980
  10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)?  
3-10'
  11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? UNKNOWN
  12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)?  
NO - DUG A POND

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



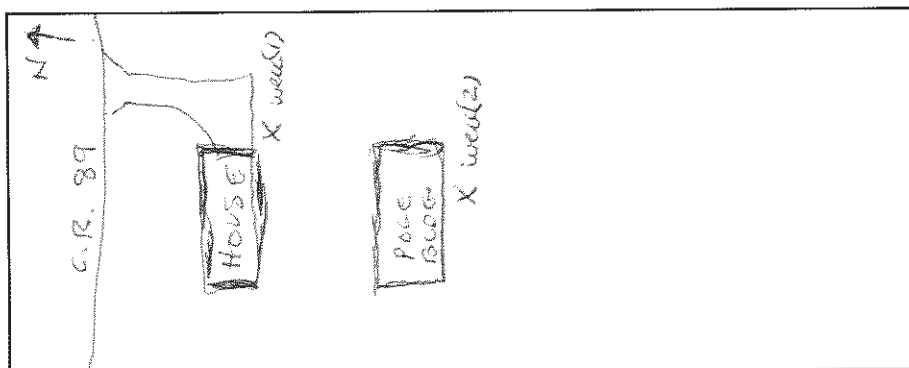
Also we have  
3 more for  
Homes

## WELL SURVEY QUESTIONNAIRE

PLEASE FILL OUT THE FOLLOWING QUESTIONNAIRE TO THE BEST OF YOUR KNOWLEDGE. IF YOU ARE NOT SURE OF THE ANSWER TO A QUESTION, PLEASE COMMENT AS "UNKNOWN". AFTER COMPLETION, PLEASE RETURN THIS QUESTIONNAIRE IN THE ENCLOSED STAMPED ENVELOPE.

1. Name and Contact Info: ROGER CROUSE 501 E C.R. 89 FREMONT, OH 43420
2. How Many Wells Do You Have On Your Property? (2) TWO
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? NO
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
DOMESTIC USE
5. Approximate Depth of Well(s)? 200 +/-
6. Diameter of Well(s)? 6"
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)?  
BED ROCK
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)?  
STEEL CASING
9. Date of Installation of Well(s)? (1) 1980 (1) 2014
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? \_\_\_\_\_
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? \_\_\_\_\_
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? NO

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



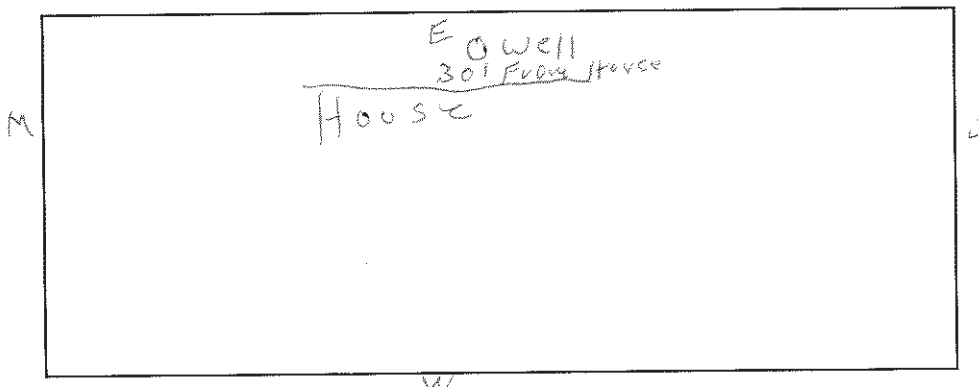


## WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: Don Bunting
2. How Many Wells Do You Have On Your Property? 1
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? Yes
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes? Irrigation
5. Approximate Depth of Well(s)? 40 FT
6. Diameter of Well(s)? 6"
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? Drilled
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? Steel Casing
9. Date of Installation of Well(s)? Before 1940
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? \_\_\_\_\_
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? \_\_\_\_\_
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? No

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

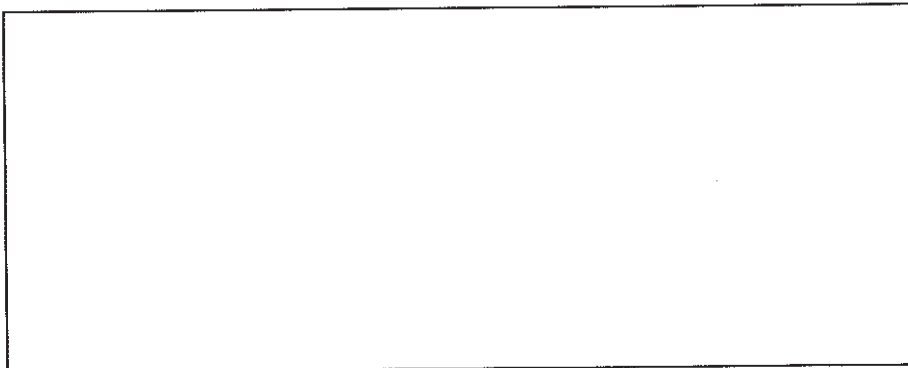


## WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: No current contract - farm sold Jean C. Myers
2. How Many Wells Do You Have On Your Property? NONE
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? \_\_\_\_\_
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
\_\_\_\_\_  
\_\_\_\_\_
5. Approximate Depth of Well(s)? \_\_\_\_\_
6. Diameter of Well(s)? \_\_\_\_\_
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? \_\_\_\_\_
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? \_\_\_\_\_
9. Date of Installation of Well(s)? \_\_\_\_\_
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? \_\_\_\_\_
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? \_\_\_\_\_
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? \_\_\_\_\_

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):





## WELL SURVEY QUESTIONNAIRE

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614-206-1331 cell

1. Name and Contact Info:

Riddle Cook LLC King MSW Amara

King a m c w a m a r a @ gmail . com

2. How Many Wells Do You Have On Your Property? None

3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? None

4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?

None

5. Approximate Depth of Well(s)? None

6. Diameter of Well(s)? None

7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? None

8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? None

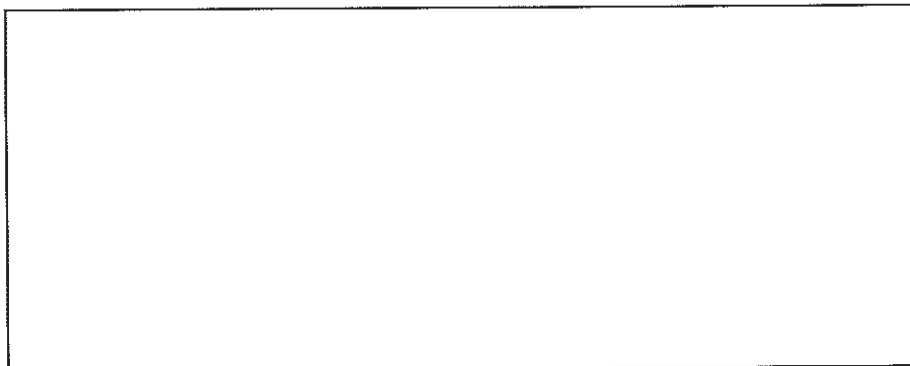
9. Date of Installation of Well(s)? None

10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? None

11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? None

12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? None

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

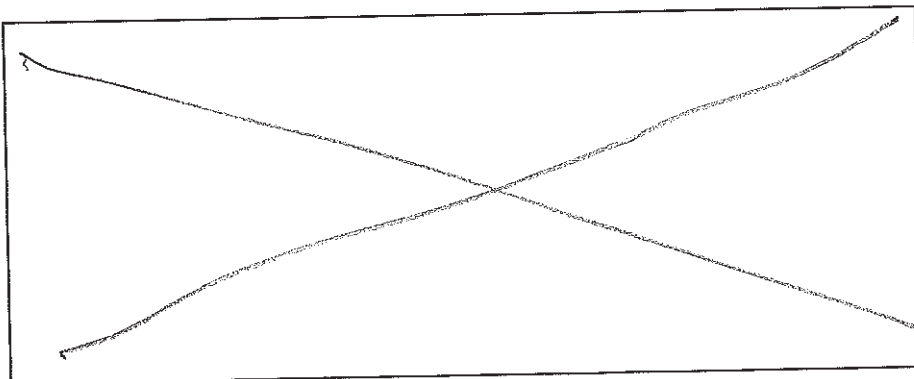


### WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: Allen H. Nixon
2. How Many Wells Do You Have On Your Property? None
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? No
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
NA
5. Approximate Depth of Well(s)? NA
6. Diameter of Well(s)? NA
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)?  
NA
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)?  
NA
9. Date of Installation of Well(s)? NA
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)?  
NA
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? NA
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? NA

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



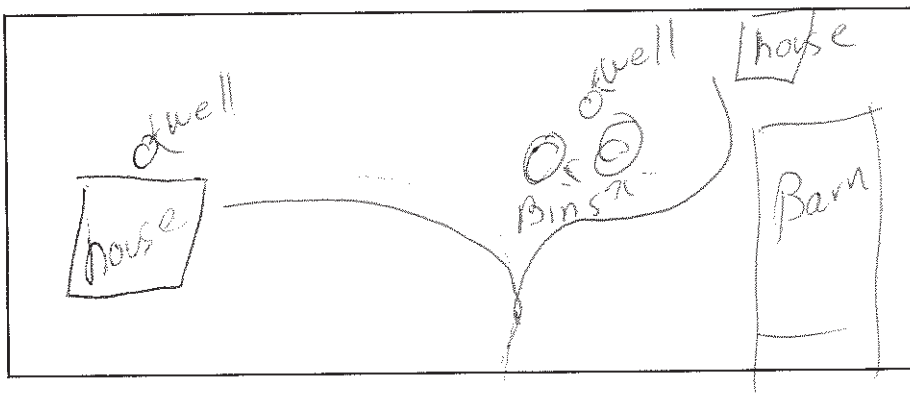


## WELL SURVEY QUESTIONNAIRE

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- 3715 Prairie Rd
1. Name and Contact Info: Charles A Werner Bellevue OH
2. How Many Wells Do You Have On Your Property? 2
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? YES
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
for farm animals
5. Approximate Depth of Well(s)? 20 - 25'
6. Diameter of Well(s)? 3'
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? \_\_\_\_\_
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? limestone
9. Date of Installation of Well(s)? \_\_\_\_\_
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? water table at time of year
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? don't know
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? NO

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

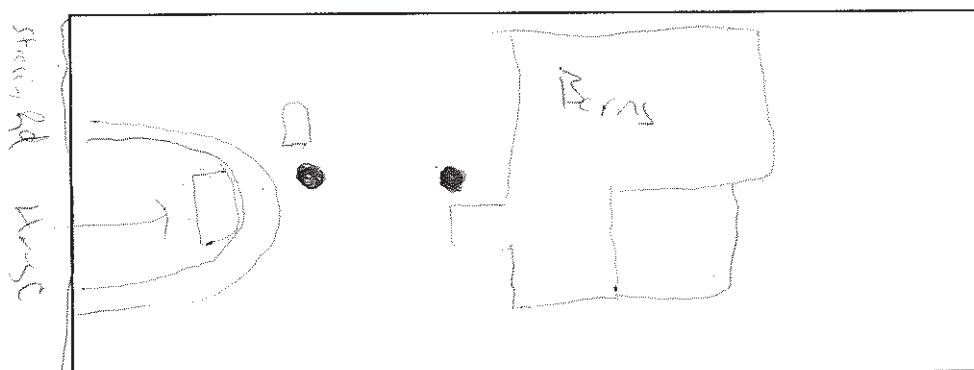


## WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: Matt Thayer 919 357 9798
2. How Many Wells Do You Have On Your Property? 2 wells
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? Yes to the milk house (Business only)
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes? Drinking water to house, water for livestock, and irrigation
5. Approximate Depth of Well(s)? unknown
6. Diameter of Well(s)? unknown
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? unknown
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? STEEL
9. Date of Installation of Well(s)? Unknown
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? Unknown
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? Unknown
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? No

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



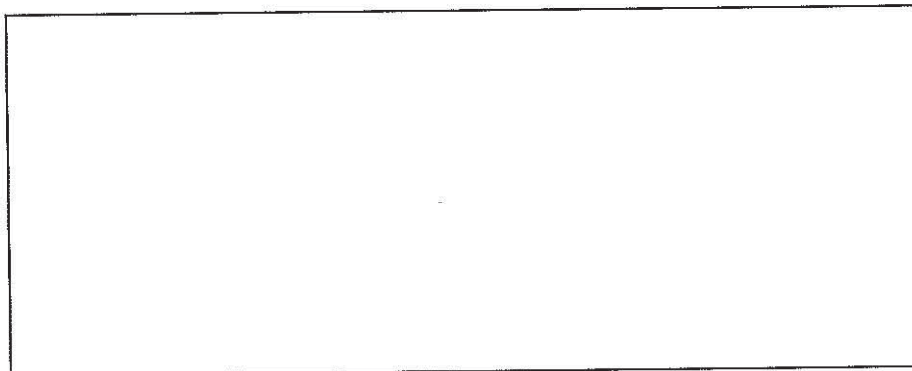


### WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: LF Enterprises LLC  
David E Lopley  
419-541-3189 cell
2. How Many Wells Do You Have On Your Property? None
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? yes
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
N/A
5. Approximate Depth of Well(s)? N/A
6. Diameter of Well(s)? N/A
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)?  
N/A
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)?  
N/A
9. Date of Installation of Well(s)? N/A
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)?  
N/A
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? N/A
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? N/A

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

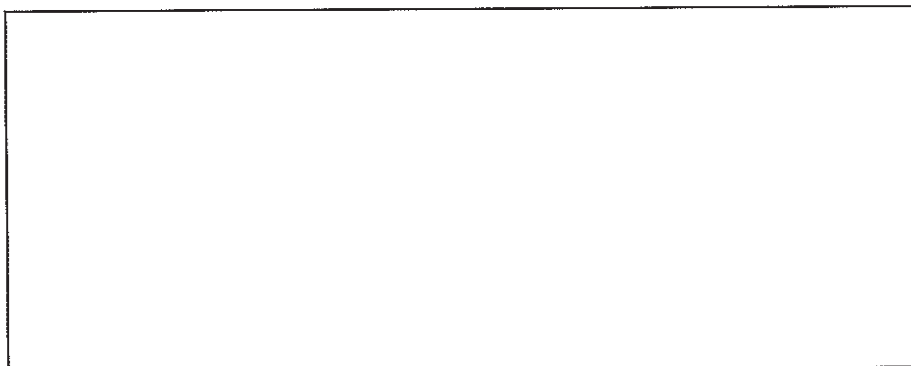


### WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: MICHAEL BOCES
2. How Many Wells Do You Have On Your Property? 0
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? NO
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
\_\_\_\_\_  
\_\_\_\_\_
5. Approximate Depth of Well(s)? \_\_\_\_\_
6. Diameter of Well(s)? \_\_\_\_\_
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? \_\_\_\_\_  
\_\_\_\_\_
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? \_\_\_\_\_  
\_\_\_\_\_
9. Date of Installation of Well(s)? \_\_\_\_\_
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? \_\_\_\_\_  
\_\_\_\_\_
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? \_\_\_\_\_  
\_\_\_\_\_
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? \_\_\_\_\_  
\_\_\_\_\_

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):





### WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: Deering Farms Inc. 9616 Ransom Rd  
Monroeville OH 44847
2. How Many Wells Do You Have On Your Property? Chickenhouse - 2, N Turnpike - 1, grain - 1
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? Kaiser - 1  
yes
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
yes
5. Approximate Depth of Well(s)? Chicken 50' 65', Turnpike - 25', grain - 25'
6. Diameter of Well(s)? Kaiser - 2  
6"
7. Type of Well/Groundwater Source (i.e., Bedrock Well - B; or Overburden/Sand-Gravel Well - O/SG)?  
Bedrock
8. Type of Well Construction (i.e., Steel Casing - SC; PVC; brick/clay - B/C; Other - O)?  
yes
9. Date of Installation of Well(s)? 1948 - 65
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)?  
4'
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? 25g+ - 10g
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? low capacity

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

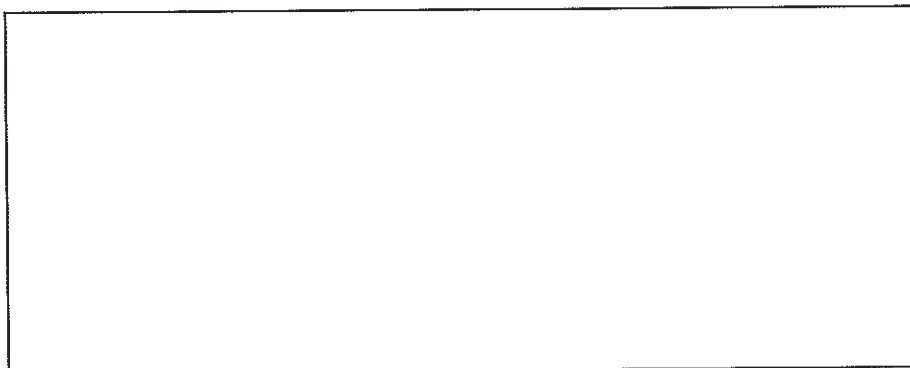
9610 Ransom Rd - 2 wells  
16518 Ransom Rd - 1  
Kaiser - 9607 Thomas Rd - 1  
9220 - Ransom Rd - 1

### WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: Keith D. Edwards 419-621-6338
2. How Many Wells Do You Have On Your Property? Unknown
3. Are You ~~Connected~~ Provided with Municipal Water (i.e., water provided by town or private water supply company)? Yes
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
No
5. Approximate Depth of Well(s)? Unknown
6. Diameter of Well(s)? Unknown
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)?  
Unknown
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)?  
Unknown
9. Date of Installation of Well(s)? Unknown
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)?  
Unknown
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? Unknown
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? No

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



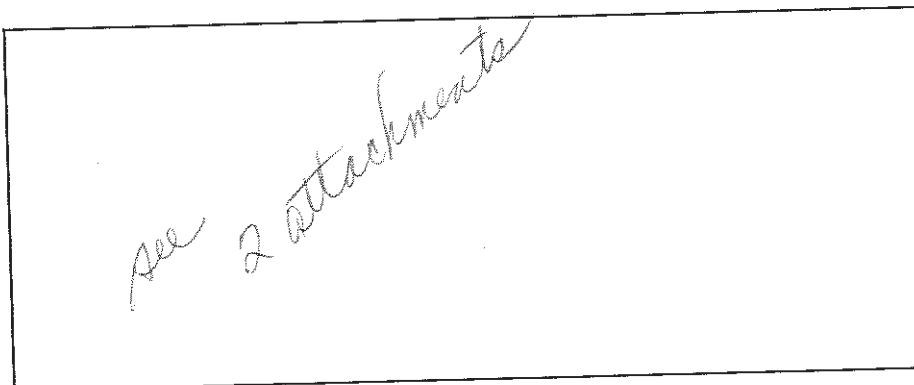


## WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: ERF FAMILY FARMS, INC KEVIN ERF 419.366.5359
2. How Many Wells Do You Have On Your Property? 2
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? YES
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
No
5. Approximate Depth of Well(s)? ① 35' - ② 18'
6. Diameter of Well(s)? 6" 4"
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)?  
unknown OSG
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)?  
SC Concrete Casing
9. Date of Installation of Well(s)? approx 1965 purchased in 2000
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)?  
approx 15' recessed in 2004 4' to 10'
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? unknown
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? no

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

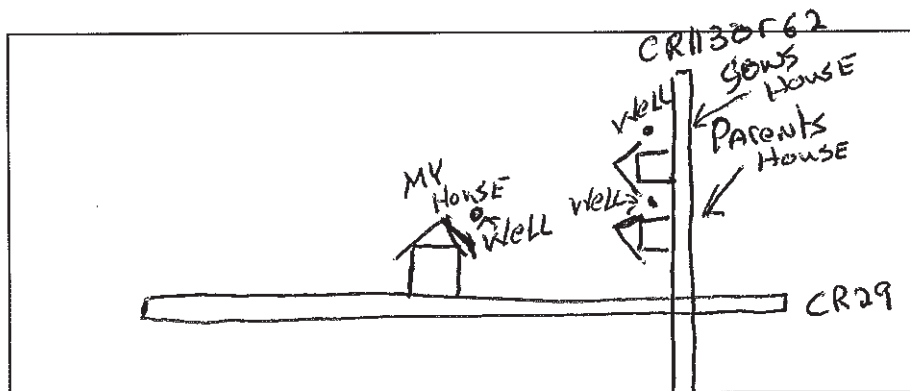


### WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: TROY L WARNER
2. How Many Wells Do You Have On Your Property? 3
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? NO
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
DRINKING
5. Approximate Depth of Well(s)? 200 ft ±
6. Diameter of Well(s)? 8"
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)?  
B
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? SC, PVC
9. Date of Installation of Well(s)? Pre 80's
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? 136'  
to 186'
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? 30-40 GPM
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? Yes Drought Year, ~~CRASHED~~ COLLAPSED

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



ALL WELLS  
WITHIN 200 FT  
OF HOUSE'S

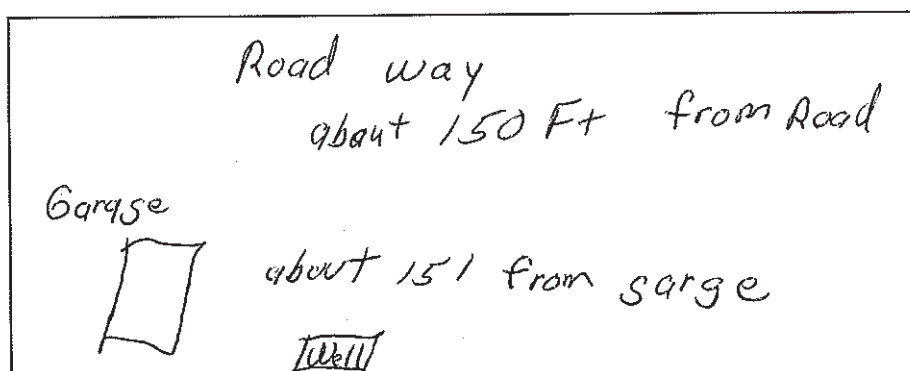


### WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: Robert Francis (419) 465-2632
2. How Many Wells Do You Have On Your Property? 1
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? No
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes? Drinking
5. Approximate Depth of Well(s)? 12 ft
6. Diameter of Well(s)? 4 ft
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? Don't know
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? Stone Wall
9. Date of Installation of Well(s)? Don't know
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? 10 Feet
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? don't know
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? No

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

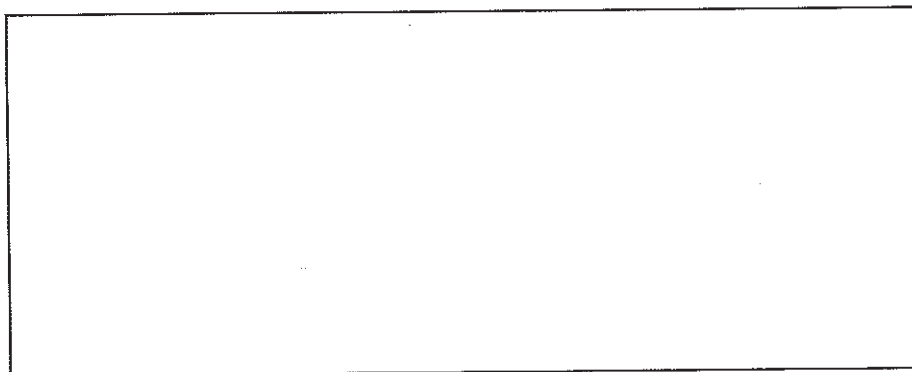


## WELL SURVEY QUESTIONNAIRE

PLEASE FILL OUT THE FOLLOWING QUESTIONNAIRE TO THE BEST OF YOUR KNOWLEDGE. IF YOU ARE NOT SURE OF THE ANSWER TO A QUESTION, PLEASE COMMENT AS "UNKNOWN". AFTER COMPLETION, PLEASE RETURN THIS QUESTIONNAIRE IN THE ENCLOSED STAMPED ENVELOPE.

1. Name and Contact Info: Charlotte (Bumb) Sriithai 3630 Bismark Rd  
Bellevue OH 44811
2. How Many Wells Do You Have On Your Property? — 0 —
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? don't know
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
\_\_\_\_\_  
\_\_\_\_\_
5. Approximate Depth of Well(s)? \_\_\_\_\_
6. Diameter of Well(s)? \_\_\_\_\_
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? \_\_\_\_\_
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? \_\_\_\_\_
9. Date of Installation of Well(s)? \_\_\_\_\_
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? \_\_\_\_\_
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? \_\_\_\_\_
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? \_\_\_\_\_

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



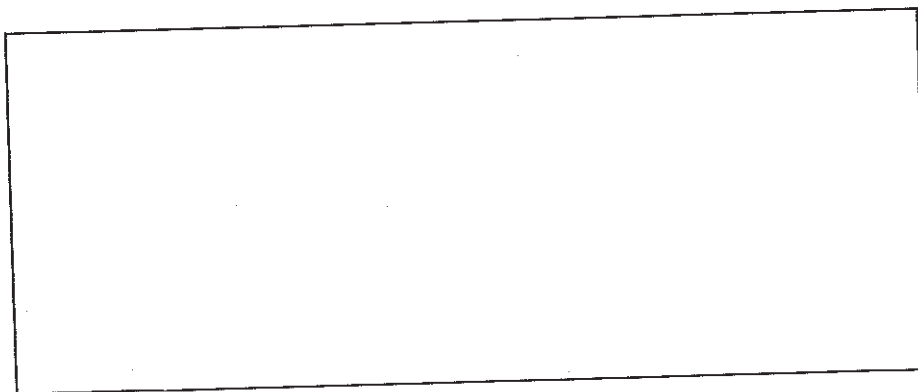


## WELL SURVEY QUESTIONNAIRE

PLEASE FILL OUT THE FOLLOWING QUESTIONNAIRE TO THE BEST OF YOUR KNOWLEDGE. IF YOU ARE NOT SURE OF THE ANSWER TO A QUESTION, PLEASE COMMENT AS "UNKNOWN". AFTER COMPLETION, PLEASE RETURN THIS QUESTIONNAIRE IN THE ENCLOSED STAMPED ENVELOPE.

1. Name and Contact Info: Bradley & Alisa Smith
2. How Many Wells Do You Have On Your Property? 0
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? No
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes? N/A
5. Approximate Depth of Well(s)? N/A
6. Diameter of Well(s)? N/A
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? N/A
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? N/A
9. Date of Installation of Well(s)? N/A
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? N/A
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? N/A
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? N/A

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

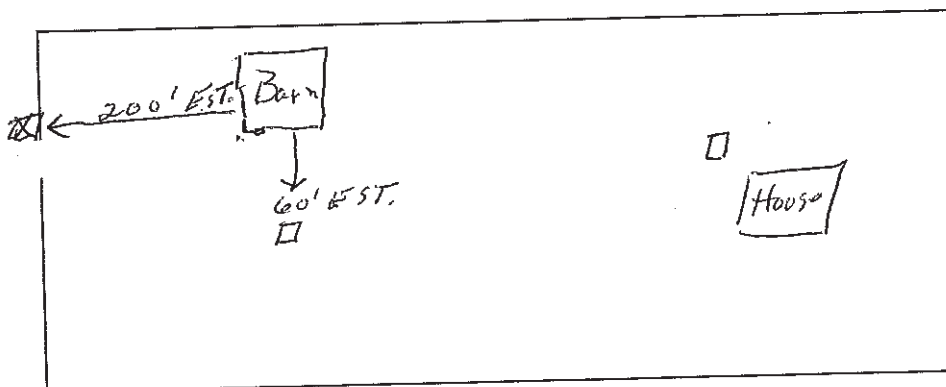


## WELL SURVEY QUESTIONNAIRE

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- Bellevue, Ohio 44811
1. Name and Contact Info: Violet Herzer 3609 Sandhill Rd.
2. How Many Wells Do You Have On Your Property? 3
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? yes
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes? No
5. Approximate Depth of Well(s)? 12-14 Feet
6. Diameter of Well(s)? 4'
7. Type of Well/Groundwater Source (i.e., Bedrock Well - B; or Overburden/Sand-Gravel Well - O/SG)? Unknown
8. Type of Well Construction (i.e., Steel Casing - SC; PVC; brick/clay - B/C; Other - O)? 1 - Brick - 2 - O
9. Date of Installation of Well(s)? Unknown
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? 8' - 9' EST.
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? Unknown
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? No

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



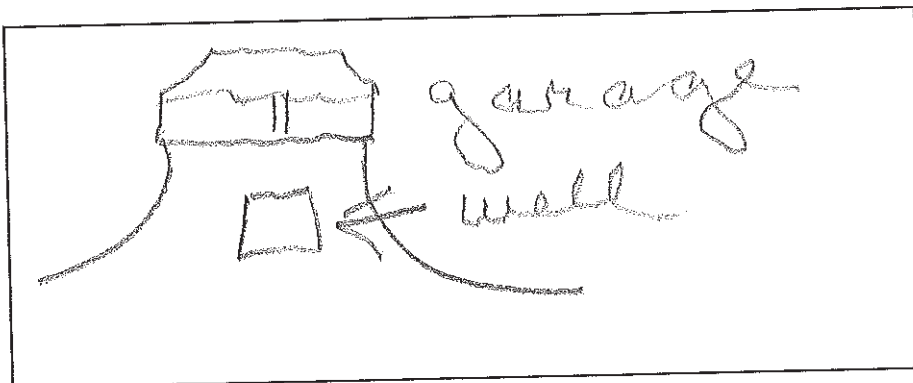


## WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: Poiv Schlessman
2. How Many Wells Do You Have On Your Property? one
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? Yes
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes? No
5. Approximate Depth of Well(s)? Unknown
6. Diameter of Well(s)? " "
7. Type of Well/Groundwater Source (i.e., Bedrock Well - B; or Overburden/Sand-Gravel Well - O/SG)? Unknown
8. Type of Well Construction (i.e., Steel Casing - SC; PVC; brick/clay - B/C; Other - O)? Not Sure
9. Date of Installation of Well(s)? Unknown
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? Unknown
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? Unknown
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? No

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

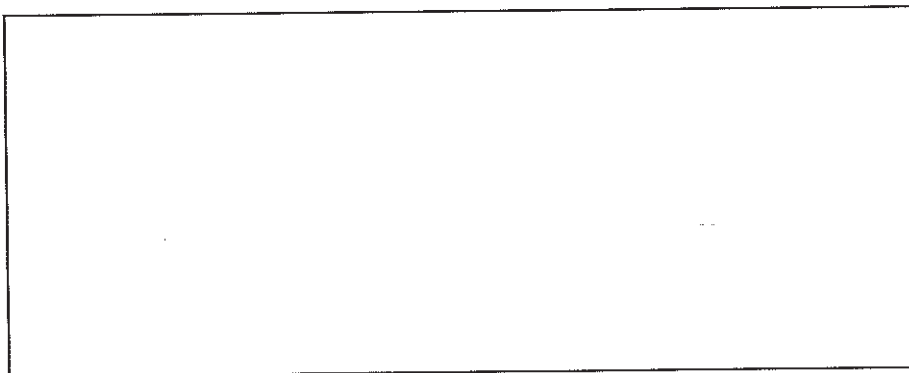


### WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: Harold Bumb 419-681-5180
2. How Many Wells Do You Have On Your Property? 0
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? Yes Rural Water
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
none
5. Approximate Depth of Well(s)? none
6. Diameter of Well(s)? none
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)?  
none
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)?  
none
9. Date of Installation of Well(s)? none
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)?  
none
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? none
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? none

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



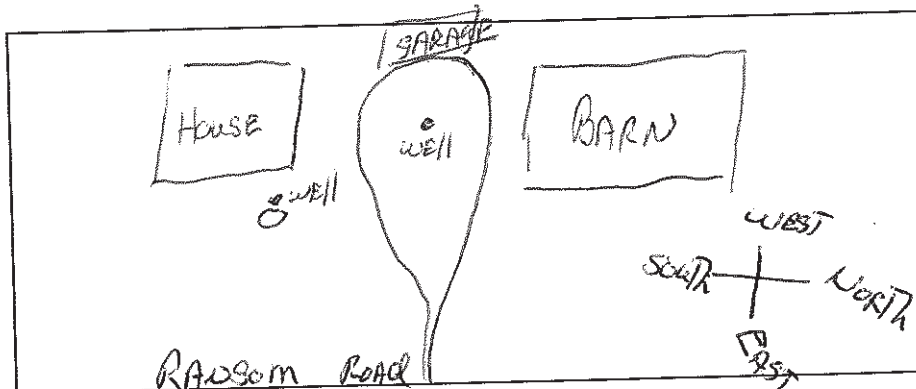


## WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: MARK DEERING 75 SEMINARY ST GREENWICH OHIO 44837
2. How Many Wells Do You Have On Your Property? 2
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? NO
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
NO
5. Approximate Depth of Well(s)? \_\_\_\_\_
6. Diameter of Well(s)? 4"
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? \_\_\_\_\_
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? \_\_\_\_\_
9. Date of Installation of Well(s)? \_\_\_\_\_
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? \_\_\_\_\_
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? \_\_\_\_\_
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? \_\_\_\_\_

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



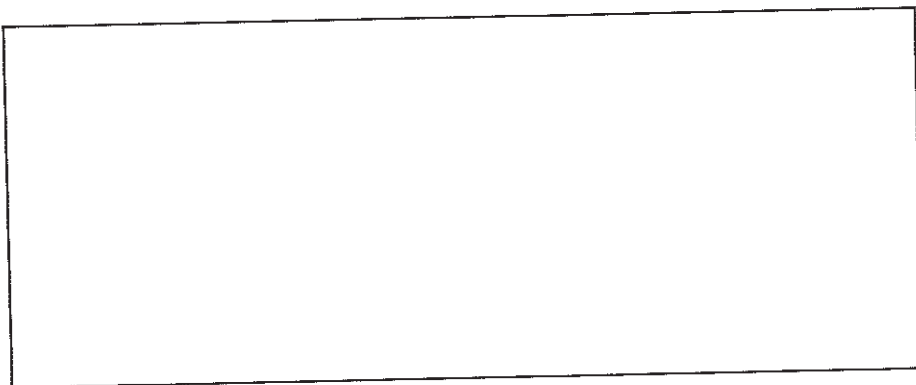
11407 RAUSOM RD  
MORROWVILLE OHIO  
ERIE COUNTY

### WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: Eric Heyman 419-706-3405
2. How Many Wells Do You Have On Your Property? 0
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? Yes Rural water
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
NA
5. Approximate Depth of Well(s)? NA
6. Diameter of Well(s)? NA
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)?  
NA
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? NA
9. Date of Installation of Well(s)? NA
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)?  
NA
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? NA
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? NA

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



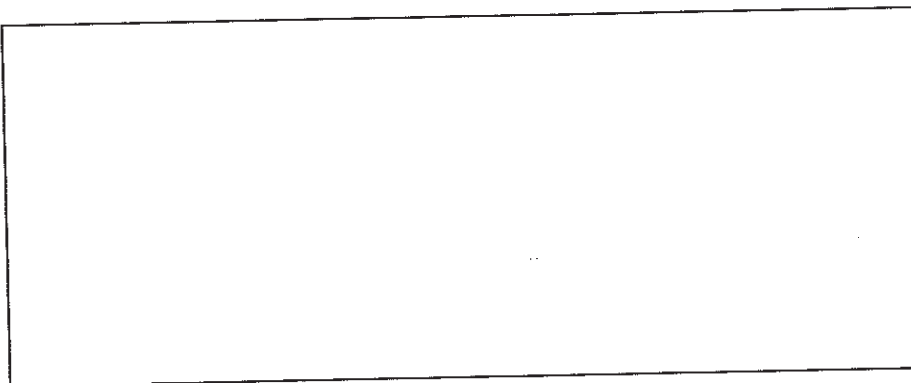


## WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: Many J. Yongling Jr.
2. How Many Wells Do You Have On Your Property? one
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? N.O. Rural ~~water~~ Water - This is @ our house
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes? Irrigation
5. Approximate Depth of Well(s)? ? unknown
6. Diameter of Well(s)? ? unknown
7. Type of Well/Groundwater Source (i.e., Bedrock Well - B; or Overburden/Sand-Gravel Well - O/SG)?
8. Type of Well Construction (i.e., Steel Casing - SC; PVC/brick/clay - B/C; Other - O)? unknown
9. Date of Installation of Well(s)? ? unknown
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? unknown
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? ? unknown
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? no

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

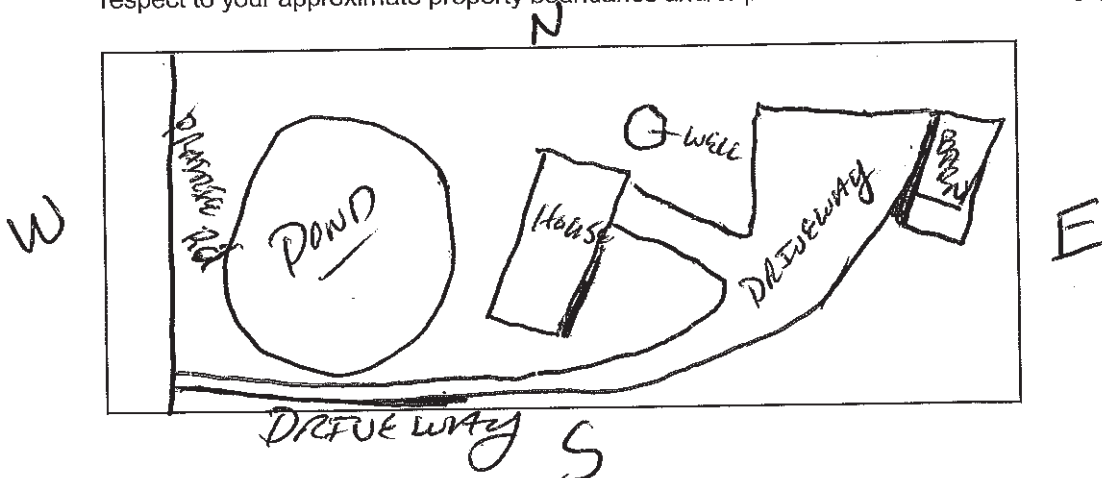


### WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: JAMES G. YENGLING 419-217-1095.
2. How Many Wells Do You Have On Your Property? 1 & SPRING FED POND.
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? NO
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes? YES WATERING PLANTS ETC.
5. Approximate Depth of Well(s)? DUG WELL APPROX 20'
6. Diameter of Well(s)? 4'
7. Type of Well/Groundwater Source (i.e., Bedrock Well - B; or Overburden/Sand-Gravel Well - O/SG)? UNKNOWN / POND SPRING FED
8. Type of Well Construction (i.e., Steel Casing - SC; PVC; brick/clay - B/C; Other - O)? Ⓢ LIMESTONE
9. Date of Installation of Well(s)? UNKNOWN / POND 1975
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? DEPENDS ON WATER TABLE APPROX AVG. 10'
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? UNKNOWN
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? NO

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):





Farm 2267 Seneca County

WELL SURVEY QUESTIONNAIRE

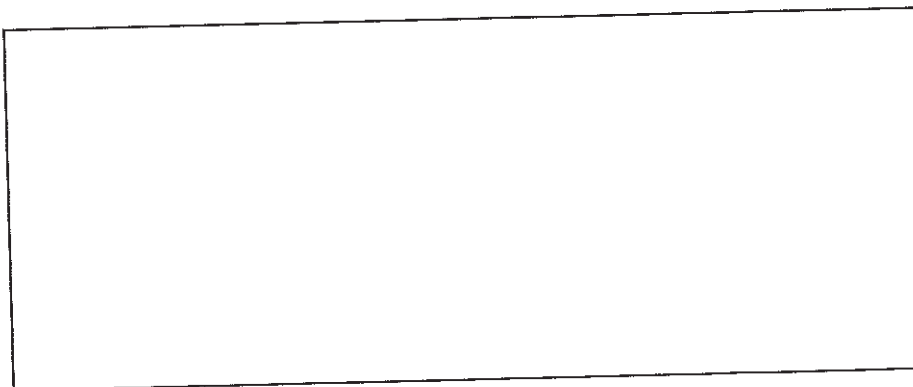
Parcel W46-00-075112-00-00

PLEASE FILL OUT THE FOLLOWING QUESTIONNAIRE TO THE BEST OF YOUR KNOWLEDGE. IF YOU ARE NOT SURE OF THE ANSWER TO A QUESTION, PLEASE COMMENT AS "UNKNOWN". AFTER COMPLETION, PLEASE RETURN THIS QUESTIONNAIRE IN THE ENCLOSED STAMPED ENVELOPE.

Property is farmed land with small area of woods  
No dwelling or wells

1. Name and Contact Info: Raymond & Patricia Misp, 119 Oakley Meadows Ln
2. How Many Wells Do You Have On Your Property? None Tiffin, Oh. 44883
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? No Phone 419 448-0178
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
No wells
5. Approximate Depth of Well(s)? —
6. Diameter of Well(s)? —
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? —
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? None
9. Date of Installation of Well(s)? —
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? —
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? —
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? —

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



Form 1822 Sandusky County

Parcel 0134000001-00

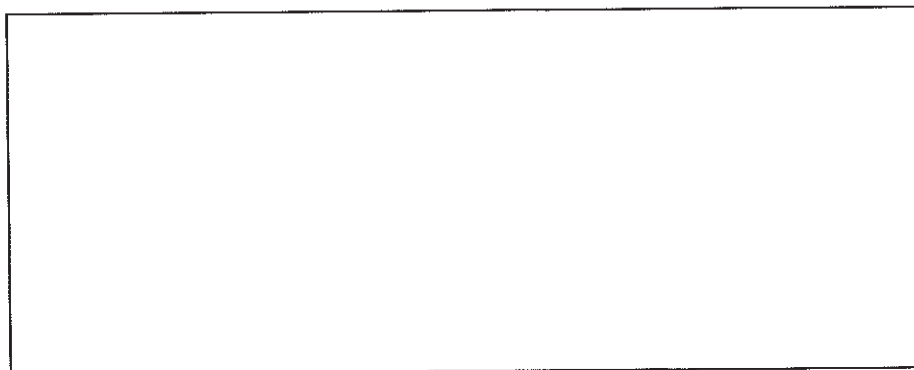
WELL SURVEY QUESTIONNAIRE

PLEASE FILL OUT THE FOLLOWING QUESTIONNAIRE TO THE BEST OF YOUR KNOWLEDGE. IF YOU ARE NOT SURE OF THE ANSWER TO A QUESTION, PLEASE COMMENT AS "UNKNOWN". AFTER COMPLETION, PLEASE RETURN THIS QUESTIONNAIRE IN THE ENCLOSED STAMPED ENVELOPE.

Property is only farmed land with a small area of woods

1. Name and Contact Info: No dwelling or wells Raymond & Patricia Wisp  
119 Oakley Meadow Ln, Tiffin, Ohio
2. How Many Wells Do You Have On Your Property? None Phone 419 448-0178
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? No
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
—
5. Approximate Depth of Well(s)? —
6. Diameter of Well(s)? —
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? —
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? —
9. Date of Installation of Well(s)? —
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? —
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? —
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? —

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



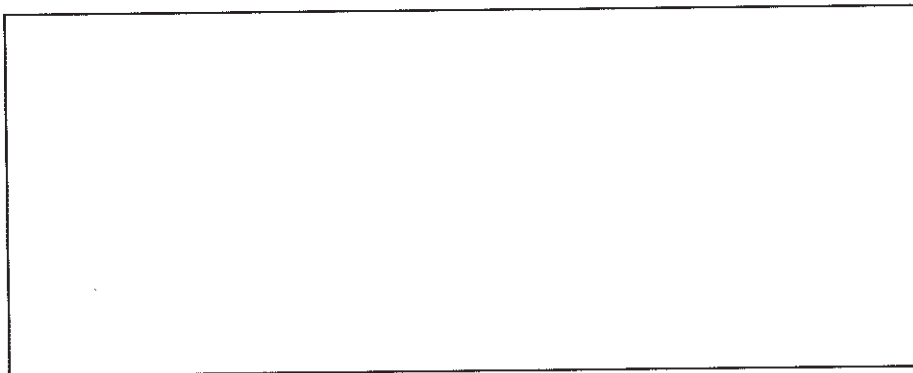


### WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: \_\_\_\_\_
2. How Many Wells Do You Have On Your Property? NONE
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? \_\_\_\_\_
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
\_\_\_\_\_  
\_\_\_\_\_
5. Approximate Depth of Well(s)? \_\_\_\_\_
6. Diameter of Well(s)? \_\_\_\_\_
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? \_\_\_\_\_
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? \_\_\_\_\_
9. Date of Installation of Well(s)? \_\_\_\_\_
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? \_\_\_\_\_
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? \_\_\_\_\_
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? \_\_\_\_\_

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

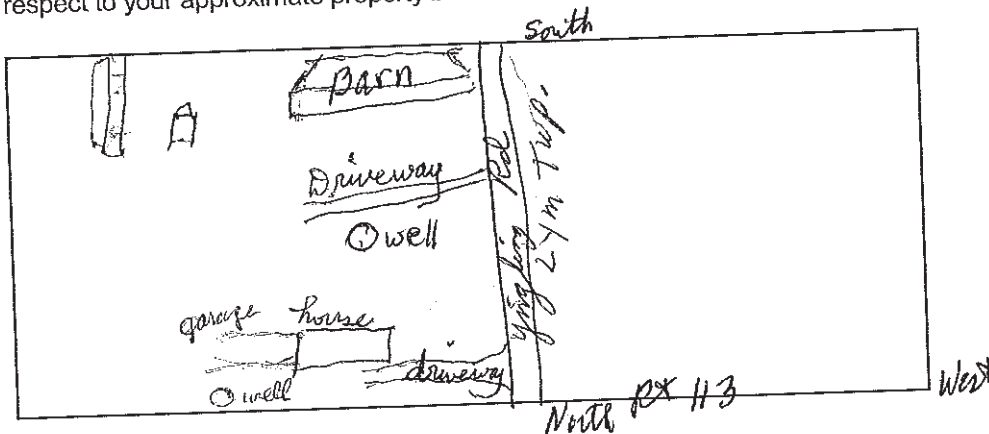


# WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: Marilyn Leher - Yingling Rd - Bellevue, ID 83401 Lyme Twp.
2. How Many Wells Do You Have On Your Property? 2
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? yes
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes? yes
5. Approximate Depth of Well(s)? unknown
6. Diameter of Well(s)? unknown
7. Type of Well/Groundwater Source (i.e., Bedrock Well - B; or Overburden/Sand-Gravel Well - O/SG)? unknown
8. Type of Well Construction (i.e., Steel Casing - SC; PVC; brick/clay - B/C; Other - O)? 1
9. Date of Installation of Well(s)? unknown
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? unknown
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? unknown
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? No

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



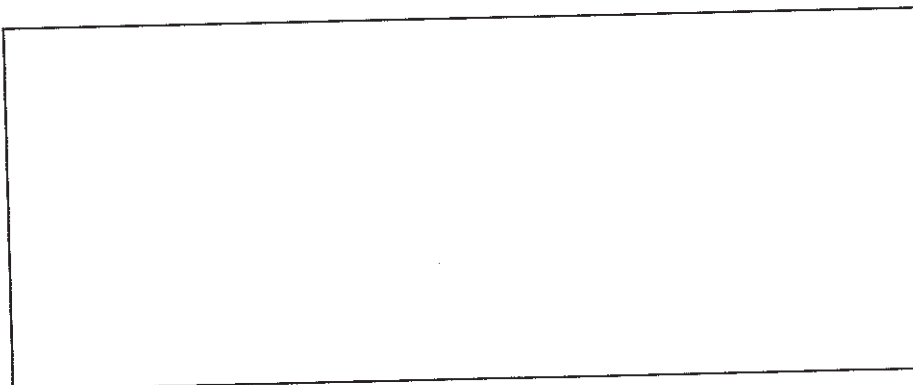


## WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: Michael S. Bunk, Trustee
2. How Many Wells Do You Have On Your Property? 0
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? NO
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
\_\_\_\_\_  
\_\_\_\_\_
5. Approximate Depth of Well(s)? \_\_\_\_\_
6. Diameter of Well(s)? \_\_\_\_\_
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? \_\_\_\_\_
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? \_\_\_\_\_
9. Date of Installation of Well(s)? \_\_\_\_\_
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? \_\_\_\_\_
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? \_\_\_\_\_
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? \_\_\_\_\_

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

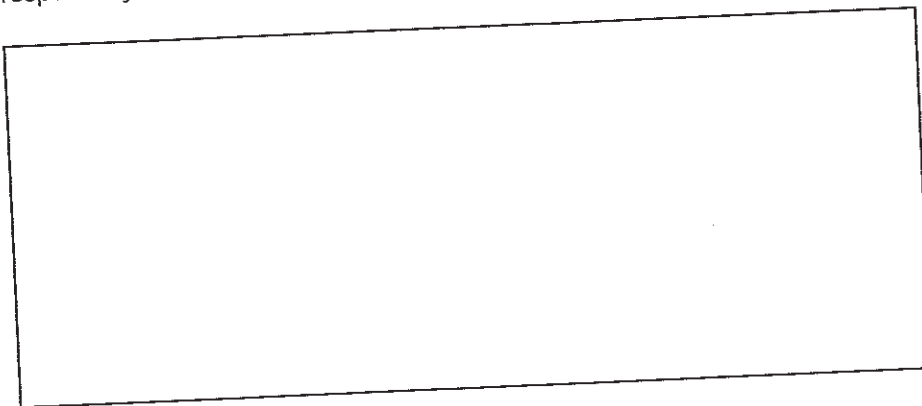


## WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: Tom Yingling 419-271-1787
2. How Many Wells Do You Have On Your Property? - 0 -
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? No
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
\_\_\_\_\_  
\_\_\_\_\_
5. Approximate Depth of Well(s)? \_\_\_\_\_
6. Diameter of Well(s)? \_\_\_\_\_
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? \_\_\_\_\_
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? \_\_\_\_\_
9. Date of Installation of Well(s)? \_\_\_\_\_
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? \_\_\_\_\_
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? \_\_\_\_\_
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? \_\_\_\_\_  
\_\_\_\_\_

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



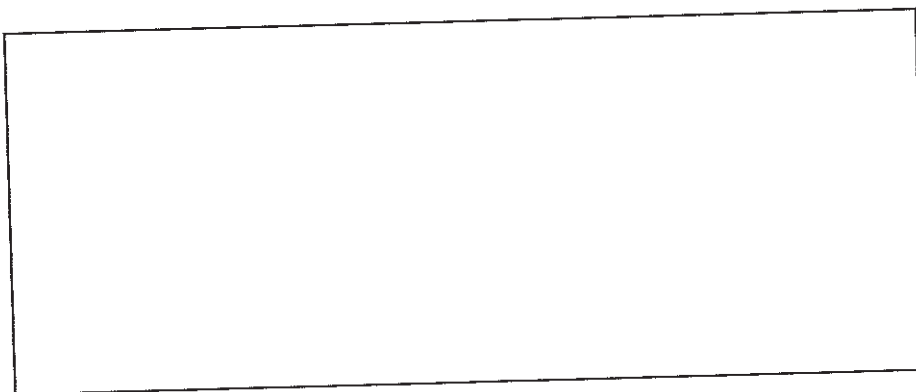


## WELL SURVEY QUESTIONNAIRE

PLEASE FILL OUT THE FOLLOWING QUESTIONNAIRE TO THE BEST OF YOUR KNOWLEDGE. IF YOU ARE NOT SURE OF THE ANSWER TO A QUESTION, PLEASE COMMENT AS "UNKNOWN". AFTER COMPLETION, PLEASE RETURN THIS QUESTIONNAIRE IN THE ENCLOSED STAMPED ENVELOPE.

1. Name and Contact Info: Tom Yingling 419-271-1787
2. How Many Wells Do You Have On Your Property? - 0 -
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? Yes NORW
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
\_\_\_\_\_  
\_\_\_\_\_
5. Approximate Depth of Well(s)? \_\_\_\_\_
6. Diameter of Well(s)? \_\_\_\_\_
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? \_\_\_\_\_
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? \_\_\_\_\_
9. Date of Installation of Well(s)? \_\_\_\_\_
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? \_\_\_\_\_
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? \_\_\_\_\_
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? \_\_\_\_\_  
\_\_\_\_\_

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

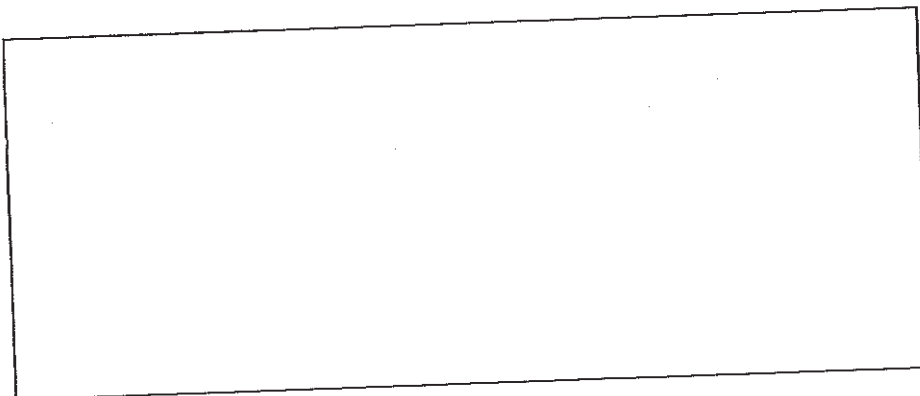


## WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: Woodside Farms, Inc.  
Tom Yingling 419-271-1787
2. How Many Wells Do You Have On Your Property? - 0 -
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? NO
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
\_\_\_\_\_  
\_\_\_\_\_
5. Approximate Depth of Well(s)? \_\_\_\_\_
6. Diameter of Well(s)? \_\_\_\_\_
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? \_\_\_\_\_
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? \_\_\_\_\_
9. Date of Installation of Well(s)? \_\_\_\_\_
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? \_\_\_\_\_
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? \_\_\_\_\_
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? \_\_\_\_\_  
\_\_\_\_\_

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



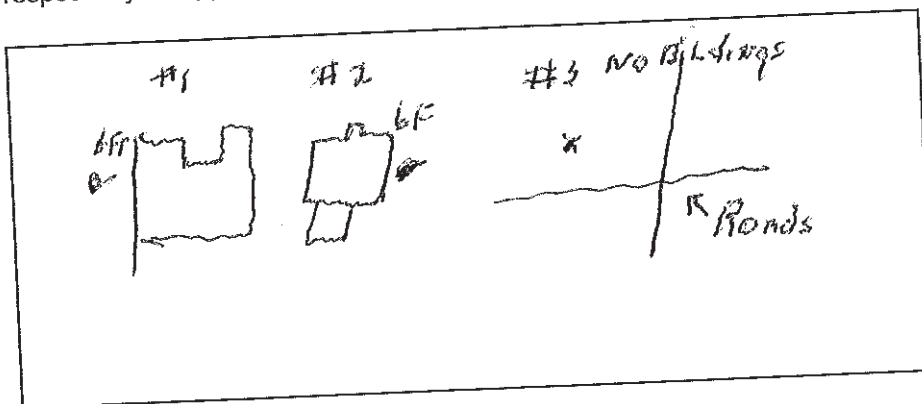


## WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: Roger & Joyce Kinney
2. How Many Wells Do You Have On Your Property? 3
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? yes
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
Domestic
5. Approximate Depth of Well(s)? #1 160 ft. #2 150 #3 hand
6. Diameter of Well(s)? 6 inches 6" 3ft
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)?  
#1 & 2 Bedrock #3 O/SG
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)?  
SC SC B/C
9. Date of Installation of Well(s)? #1 1971 #2 1955 #3 1900?
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)?  
UNKNOWN
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? #1 + 10 gpm #2 60 #3 UNKNOWN
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? no

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

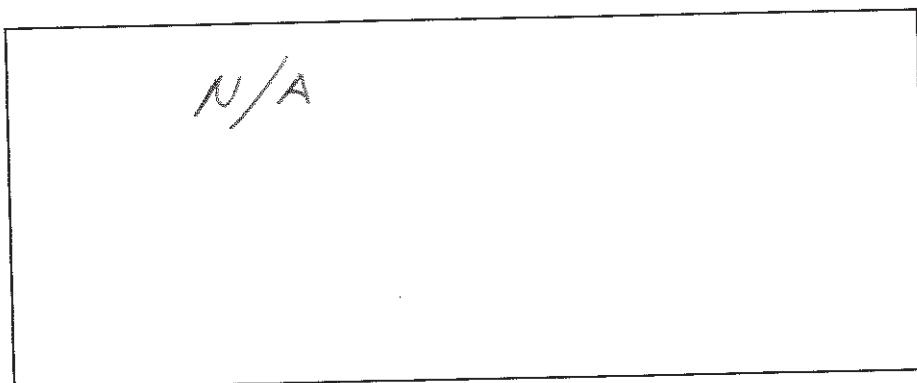


## WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: John Pingling 419-271-8571
2. How Many Wells Do You Have On Your Property? -0-
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? YES (NORW)
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
N/A
5. Approximate Depth of Well(s)? N/A
6. Diameter of Well(s)? N/A
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)?  
N/A
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? N/A
9. Date of Installation of Well(s)? N/A
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? N/A
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? N/A
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? N/A

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



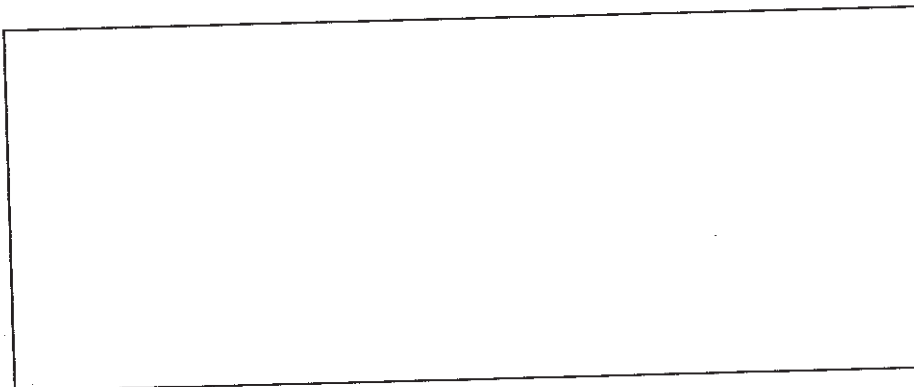


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1. Name and Contact Info: Douglas Heyman P.O. Box 448 Attica OH 44807
2. How Many Wells Do You Have On Your Property? 0
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? No
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
\_\_\_\_\_  
\_\_\_\_\_
5. Approximate Depth of Well(s)? \_\_\_\_\_
6. Diameter of Well(s)? \_\_\_\_\_
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? \_\_\_\_\_
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? \_\_\_\_\_
9. Date of Installation of Well(s)? \_\_\_\_\_
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? \_\_\_\_\_
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? \_\_\_\_\_
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? \_\_\_\_\_

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



## WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info:

3828 Sandhill Rd  
Dale Wilson Bellvue, OK 74811

2. How Many Wells Do You Have On Your Property? 2

3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? Yes

4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
No

5. Approximate Depth of Well(s)? 12' 10'

6. Diameter of Well(s)? 4' 3'

7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)?  
O/SG O/SG

8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)?  
O B/C

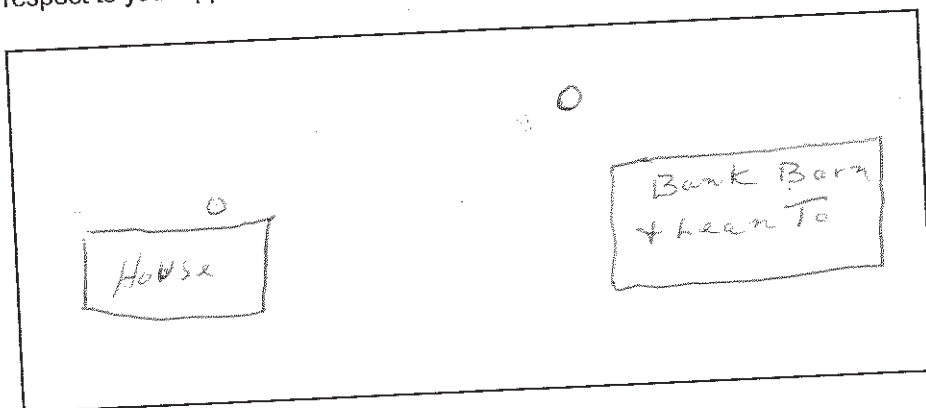
9. Date of Installation of Well(s)? Unknown

10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)?  
6' Unknown

11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]?  
8 0

12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? No

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



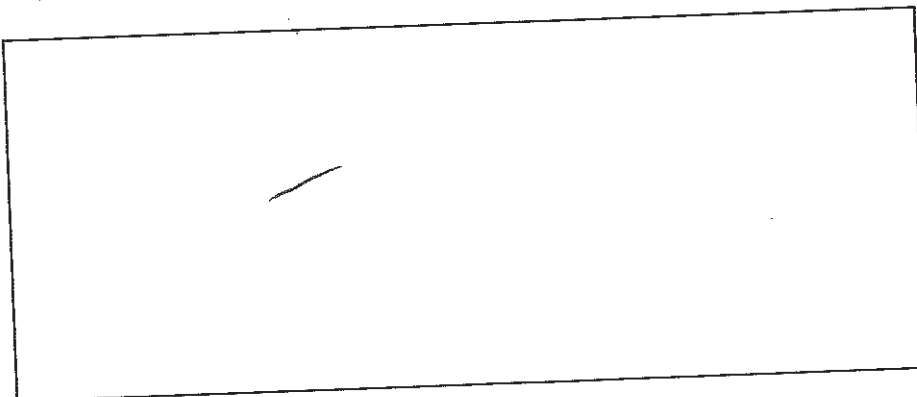


## WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: JOHN FENN - FENN FARMS LLC, BELLEVUE, OHIO
2. How Many Wells Do You Have On Your Property? 0
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? NO
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
N/A
5. Approximate Depth of Well(s)? N/A
6. Diameter of Well(s)? N/A
7. Type of Well/Groundwater Source (i.e., Bedrock Well - B; or Overburden/Sand-Gravel Well - O/SG)?  
UNKNOWN
8. Type of Well Construction (i.e., Steel Casing - SC; PVC; brick/clay - B/C; Other - O)? None
9. Date of Installation of Well(s)? N/A
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? N/A
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? N/A
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? NO

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):

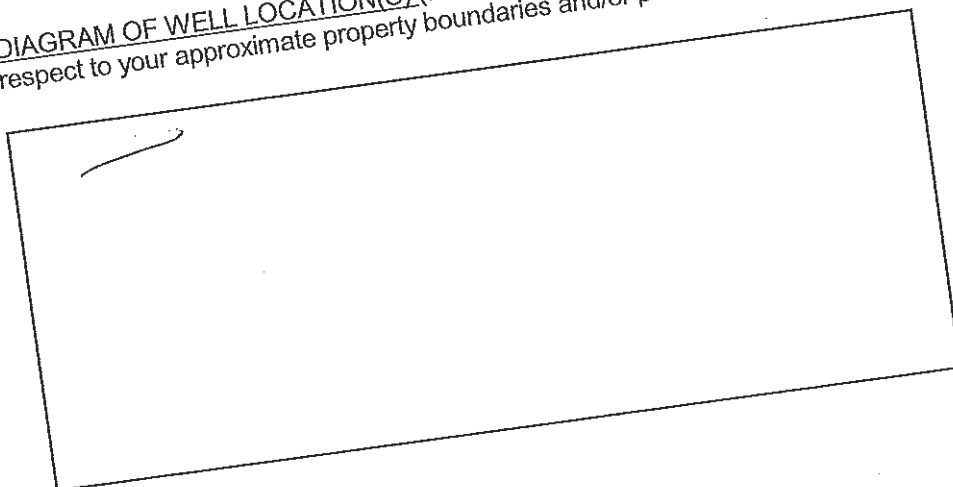


## WELL SURVEY QUESTIONNAIRE

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1. Name and Contact Info: Katherine King 419-681-0993
2. How Many Wells Do You Have On Your Property? 1 cistern only
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? No yes
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes? \_\_\_\_\_
5. Approximate Depth of Well(s)? \_\_\_\_\_
6. Diameter of Well(s)? \_\_\_\_\_
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)? \_\_\_\_\_
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)? \_\_\_\_\_
9. Date of Installation of Well(s)? \_\_\_\_\_
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)? \_\_\_\_\_
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? \_\_\_\_\_
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? \_\_\_\_\_

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):





## WELL SURVEY QUESTIONNAIRE

PLEASE FILL OUT THE FOLLOWING QUESTIONNAIRE TO THE BEST OF YOUR KNOWLEDGE. IF YOU ARE NOT SURE OF THE ANSWER TO A QUESTION, PLEASE COMMENT AS "UNKNOWN". AFTER COMPLETION, PLEASE RETURN THIS QUESTIONNAIRE IN THE ENCLOSED STAMPED ENVELOPE.

1. Name and Contact Info: Jeffrey + Beverly Lepley (Harvest Adventures, LLC)  
Phone: 419-541-3032  
email: jbdiamond1@gmail.com
2. How Many Wells Do You Have On Your Property? 1
3. Are You Connected/Provided with Municipal Water (i.e., water provided by town or private water supply company)? Northern Ohio Rural Water for shop use only
4. Are the Wells Used for Domestic Purposes (i.e., Drinking/Potable Water) and/or for Irrigation Purposes?  
Livestock Water (Neighbors within 1 mile have wells that are their only source of water for drinking, etc.)
5. Approximate Depth of Well(s)? 150 ft
6. Diameter of Well(s)? 8 inch casing
7. Type of Well/Groundwater Source (i.e., Bedrock Well – B; or Overburden/Sand-Gravel Well – O/SG)?  
B - Bedrock Shale
8. Type of Well Construction (i.e., Steel Casing – SC; PVC; brick/clay – B/C; Other – O)?  
SC
9. Date of Installation of Well(s)? 1950's
10. Depth to Water/Groundwater Within Well (or depth to water encountered during drilling of well)?  
Depth to water 20-30 feet
11. Approximate Yield of Well(s) [i.e., referenced in gallons per minute (gpm)]? 150 gpm
12. Have You Ever Had to Drill a New Well Due to Lowering of Water Table or Poor Well Yield (if yes, indicate reason)? No

DIAGRAM OF WELL LOCATION(S) (If known, please provide a rough sketch of where your well(s) are with respect to your approximate property boundaries and/or permanent structures/buildings):



Well is located approximately 120ft from the road + 12 ft. in front of the barn. This well water supply is crucial for the sustainability of our livestock operation.

Address: 3340 Ste Rte 4  
Bellevue, Oh. 44811

## **APPENDIX C**

Photographs from October 22, 2018 Site Reconnaissance





PHOTO 1: Looking east from Township Road 10 and Greenfield Section Line Road.

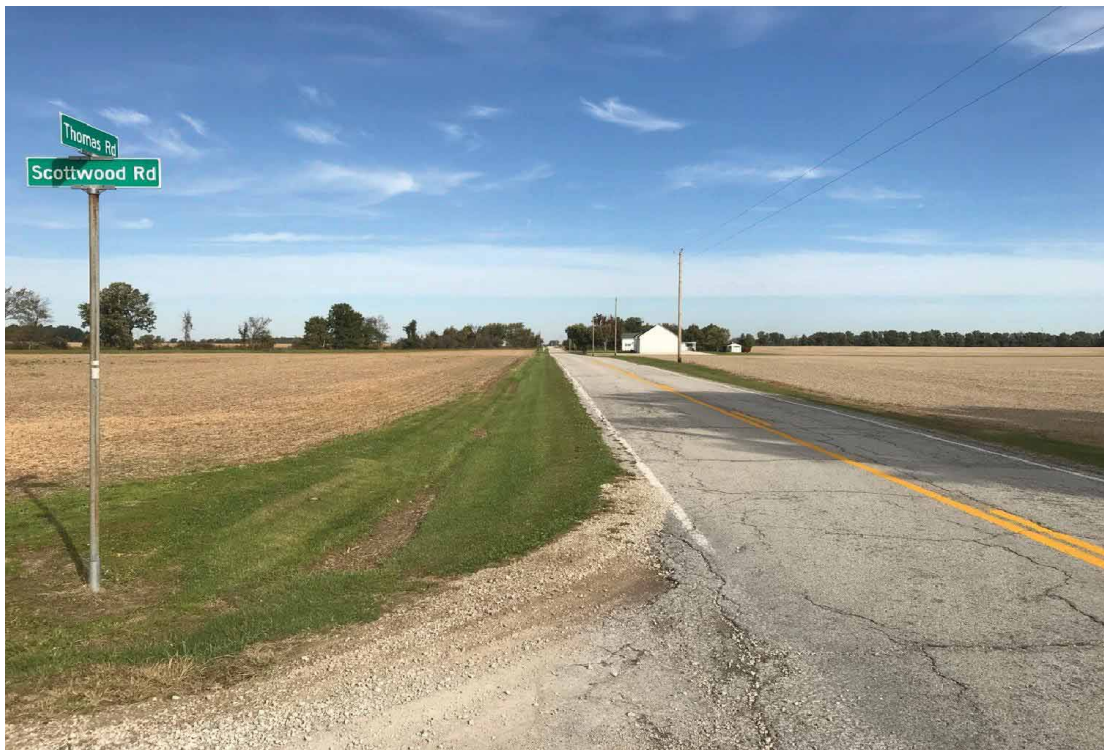


PHOTO 2: Looking north from Scottwood Road and Thomas Road.

**HULL**  
Environment / Energy / Infrastructure

6397 Emerald Pkwy Phone: (614) 793-8777  
Dublin, Ohio 43026 Fax: (614) 793-9070  
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Apex Clean Energy, Inc.  
Proposed Emerson Creek Wind Project

Site Photographs

Huron, Erie and Seneca Counties, Ohio

Date:

NOVEMBER 2018

Project Number:

ACX006.0002.xlsx

File Name:

ACX006.0002.xlsx





PHOTO 3: Looking north from Townline Road & Thomas Road.

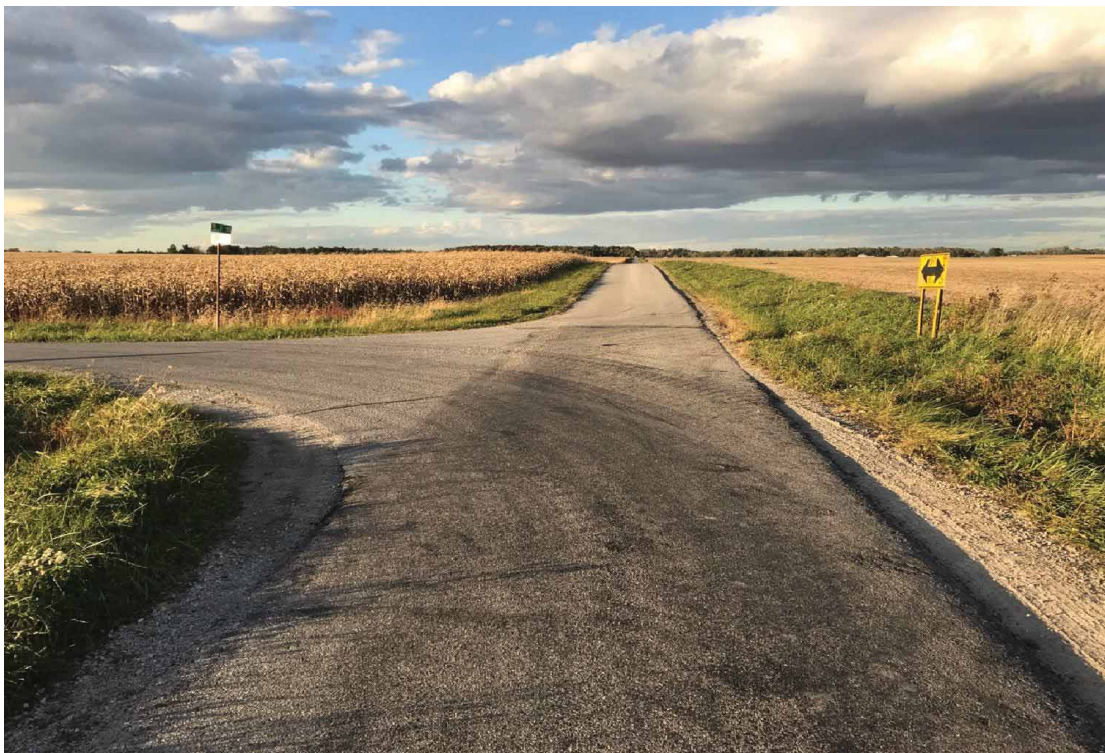


PHOTO 4: Looking North from Township Road 136.


 <p><b>Environment / Energy / Infrastructure</b></p> <p>6397 Emerald Pkwy Phone: (614) 793-8777          Dublin, Ohio 43026 Fax: (614) 793-9070          ©2018 Hull &amp; Associates, Inc. www.hullinc.com</p>	<p>Apex Clean Energy, Inc.          Proposed Emerson Creek Wind Project</p> <p>Site Photographs</p> <p>Huron, Erie and Seneca Counties, Ohio</p>	<p>Date:</p> <p>NOVEMBER 2018</p>
		<p>Project Number:</p> <p>ACX006.0002.xlsx</p> <p>File Name:</p> <p>ACX006.0002.xlsx</p>





PHOTO 5: Looking South from State Route 4 and Young Road.



PHOTO 6: Looking west from Willoughby Road and Willard West Road.

**HULL**  
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Dublin, Ohio 43026

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Fax: (614) 793-9070

www.hullinc.com

Apex Clean Energy, Inc.  
Proposed Emerson Creek Wind Project

Site Photographs

Huron, Erie and Seneca Counties, Ohio

Date:

NOVEMBER 2018

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ACX006.0002.xlsx

File Name:

ACX006.0002.xlsx

## **APPENDIX D**

### **General Earthwork Recommendations**



## **APPENDIX D**

### **GENERAL EARTHWORK RECOMMENDATIONS**

Earthwork is most efficiently accomplished using large, heavy-duty equipment, unimpeded by obstacles. Consequently, it is preferable to complete as much of this work as is possible prior to initiating other phases of construction, such as footing excavation and installation of underground utilities. The following are general recommendations concerning earthwork construction and may not be applicable to site-specific conditions. Furthermore, the contractor is responsible in selecting and implementing the most appropriate construction techniques (e.g., construction means, methods, sequences or procedures, or for safety precautions or programs) for each site-specific condition(s).

#### **1. Stripping, clearing and grubbing**

In areas where fill is to be placed to support structures, drive and parking areas, the following is proposed:

Strip and remove all sod, topsoil, and organic contaminated soils.

Remove all trees and shrubs, designated to be cleared, inclusive of grubbing roots of larger trees.

Remove all trash, debris, rubble, existing random fill, soil softened by standing water, and any other soft soil as determined necessary by the geotechnical engineer. The fill placement should begin on firm, relatively unyielding foundation material.

The fill foundation should be stripped and cleared beyond the limits of the structure by a distance equal to not less than the thickness of the fill below the structure foundation plus 10 feet. For drives and parking areas, the fill foundation should be stripped and cleared for a distance of at least 5 feet beyond the limits of the pavement.

#### **2. Fill Material – Composition**

Material satisfactory for use as fill includes clayey silt and silty (lean) clay soils or sand and gravel, free of topsoil, organic or other decomposable matter, rocks having a major dimension greater than 6 inches, or frozen soil.

Soils having a maximum dry density of less than 90 pounds per cubic foot as determined by the moisture-density relationship are not considered suitable for use as fill.

Soils described as SILT (USCS ML, MH or ODOT A-4B) are considered questionably suitable for use as fill material because the stability of these materials is very sensitive to increases in moisture. These soils should not be placed within three feet of the top of the subgrade.

#### **3. Fill Material – Moisture**

Predominately fine grained fill materials (lean clayey soils) are recommended to contain moisture contents within 3 percent (above or below) the optimum moisture as determined by the moisture-density relationship (ASTM International D698), or less if found to be needed to obtain stability below the compaction equipment. This provides the best assurance of establishing not only adequate density for ultimate support of construction but also provides stability of the compacted soil under the dynamic loading induced by the heavyweight construction equipment during placement.

Sand and gravel fill material is not as sensitive to moisture content with regards to stability. Therefore, we recommend no specified limitation, as long as specified density and stability can be established.

#### **4. Moisture Adjustment**

If the moisture content of the material from the fill source or native subgrade is not appropriate to establish density, moisture adjustment of the material will be required.

If the moisture content of the fill being placed or the native subgrade is too high, appropriate adjustment entails spreading and exposing to the sun and wind for drying and using equipment such as a disc and/or a grader. This may not be feasible during wet seasonal conditions. Wet soils will pump and may cause excessive rutting under heavy equipment traffic. Therefore, improvements to the subgrade may be achieved by undercutting and replacing with suitable fill (possibly in combination with a non-woven geotextile or biaxial geogrid) or stabilization with lime or cement. The most appropriate subgrade improvement technique should be determined at the time of construction.

If the moisture content of the fill is too low, a water truck with a sprinkler bar may be required. After sprinkling, the soil should be thoroughly mixed with a disc and/or a grader.

#### **5. Equipment**

Equipment to compact the fill should be heavy duty with a steel drum roller having a minimum effective unit weight of 10 tons. For example:

Fine-grained materials (clayey silts and lean clays) may be efficiently compacted using a sheepfoot roller comparable to a Caterpillar 815 self-propelled roller.

Coarse-grained materials (sand and gravel) having little or no silt and clay sizes may be efficiently compacted using a heavy, self-propelled, vibratory smooth wheel roller.

Coarse-grained materials having about 10% or more silt and clay sizes may be efficiently compacted using a sheepfoot roller comparable to a Caterpillar 815 self-propelled sheepfoot roller.

#### **6. Lift Thickness**

Fill should be placed in horizontal layers, 8-inch loose thickness, compacted uniformly to approximately 6-inch thickness.

If equipment is used which is lighter weight than recommended above, lift thickness should be appropriately thinner.

#### **7. Fill Density**

In areas to support access roads and within the pad, the fill and backfill should be compacted to the density requirements as recommended in the main body of the report

#### **8. Season of Earthwork**

Weather conditions are very important to efficiency in working soils. Generally, earthwork is accomplished most efficiently between May and November. Cold periods may hamper moisture adjustment. If the temperature is below 32 degrees Fahrenheit (°F) for prolonged periods, frozen



material on the fill surface must be removed before subsequent lifts may be placed. Also, densification of fill is more difficult when air temperatures are below freezing. Granular material, such as bank run sand and gravel is somewhat less sensitive to weather conditions but is not immune from difficulties that may be presented by precipitation and low temperatures.

#### **9. Trench Backfill**

Trench backfill should be controlled compacted fill, placed in accordance with recommendations presented above and as engineered for thermal properties in collection systems

It is recommended that suitable granular material be used to backfill trenches that traverse beneath buildings, drives, or parking areas.

#### **10. Proof Rolling**

Upon completion of stripping, clearing, and grubbing; the areas planned to support pavement or building floor slab shall be proof rolled in accordance with ODOT Item 204 to identify any soft, weak, loose, or excessively wet subgrade conditions. At a minimum, the proof rolling should be completed with a minimum 20-ton loaded tandem axle dump truck. The vehicle should pass in each of two perpendicular directions covering the proposed work area. Any observed unsuitable materials should be undercut and replaced with suitable fill as directed by the geotechnical engineer.

#### **11. General**

All fill should be placed and compacted under continuous observation and testing by a soils technician under the general guidance of the geotechnical engineer.

## **APPENDIX E**

### Generalized Geotechnical Exploration Work Plan



## **APPENDIX E**

### **GENERALIZED GEOTECHNICAL EXPLORATION WORK PLAN**

A geotechnical engineer shall prepare a proposal for a geotechnical site exploration in general accordance with the suggested scope of work provided below. The geotechnical engineer shall be qualified in geotechnical investigations. The geotechnical exploration program suggested below (e.g., boring frequency, location and depth) should be adjusted by the geotechnical engineer based on their experience and to allow for specific geological, topographic, and drainage conditions of the site.

#### **PROJECT DESCRIPTION**

A geotechnical exploration will be performed at the proposed Project Boundary in Erie, Huron, and Seneca Counties, Ohio. The project involves planned construction of wind turbine generators at various locations (Sites) for the Republic Wind Farm Project. Upon completion of the geotechnical exploration suitable foundation systems will be reviewed that will work with the Site conditions as determined by the geotechnical exploration and design preferences provided by the Client. The foundation types that will be considered include spread footings, ring foundation, P&H foundations, and pile supported foundations.

The purpose of the geotechnical exploration is to obtain geologic information and to determine relevant engineering properties of the Site soils. A review of generalized geologic references, including ODNR Well Logs and ODNR Groundwater Resource Maps, suggest the Project Boundary is underlain by lacustrine and ground moraine deposits with dolomite, limestone, and shale bedrock depths ranging from less than 10 feet in the eastern portion of the site and approximately 150 feet below existing ground surface in the western portion of the Project Area.

#### **PROPOSED SCOPE OF WORK**

##### **Reconnaissance, Planning and Boring Layout**

The following will be conducted as part of this task:

1. A review of pertinent, readily available subsurface geotechnical information for the Site that is provided to the Geotechnical Engineer will be performed.
2. A site visit will be performed to lay out the borings and clear underground utilities at the boring locations. The landowner will be consulted to provide the geotechnical engineer with information and the locations of all private utilities at the site. The geotechnical engineer will be responsible for locating the boring, which should be surveyed and staked on the site prior to drilling.
3. The Ohio Utility Protection Service (OUPS) and Ohio Oil & Gas Producers Underground Protection Service (OGPUPS) will be notified a minimum of 48-hours prior to the commencement of drilling services.

##### **Drilling and Sampling**

After the geotechnical engineer has reviewed all available desktop information, they will determine the number of borings to be drilled at turbine locations. The borings will extend to the minimum of 50 feet or competent bedrock, whichever is encountered first.

For all borings, the following will be performed:

1. Split-barrel sampling of soil will be performed in accordance with ASTM International D 1586 for each boring in increments of 2.5 feet to the depth of 10 feet and at five-foot intervals below 10 feet to the depth of the borings (i.e., 50). In all the borings, Standard Penetration Test (SPT) data will be developed and representative samples preserved.
2. It is anticipated that the drilling will be accessible with and performed by a truck-mounted drilling rig. Provisions shall be made by the Geotechnical Engineer based on the time of year the fieldwork will occur in using an ATV drill rig if the borings cannot be accessed with a truck-mounted drilling rig.
3. Water observations in the boreholes will be recorded during and at the completion of drilling.
4. All borings will be backfilled at the completion of drilling with bentonite chips and drill cuttings.

#### **Geotechnical Laboratory Testing**

A laboratory testing program will be established by the geotechnical engineer based on the observations made during the drilling activities and experience. The following laboratory tests shall be performed on samples retained during the drilling activities:

1. All samples will be classified in the laboratory based on the visual-manual examination (ASTM International D 2488) Soil Classification System and the laboratory test results. Formal boring logs will be prepared using the field logs and the laboratory classifications.
2. Laboratory testing will include moisture content, particle-size analyses, and Atterberg limits of a limited number of samples considered to be representative of the foundation materials encountered by the borings. Unconfined compression and consolidation tests will be performed if low strength and/or highly compressible cohesive soils are encountered as deemed necessary by the geotechnical engineer.
3. All laboratory testing will be performed in accordance with ASTM International or other specified standards.

#### **Geotechnical Exploration Report**

The geotechnical engineer will prepare a Geotechnical Exploration Report that will include the findings, conclusions and recommendations concerning proposed geotechnical related design-construction considerations and foundation design recommendations. The report shall also include an Appendix, which will include a boring location plan, a legend of the boring log terminology, the boring logs, and the results of any laboratory tests. Three (3) copies of the report will be presented by the Geotechnical Engineer.



## **Exhibit F**

# **Socioeconomic Report**

**CONFIDENTIAL**  
**PORTIONS FILED UNDER SEAL**

Firelands Wind, LLC has requested confidential treatment of portions of pages 22, 25, and 27 in this document in accordance with OAC Rule 4906-2-21.

This document contains sensitive financial information and, as such, is entitled to confidential treatment under state and/or federal statutes and regulations.

An unredacted version of the following document has been submitted to the Docketing Division of the OPSB in accordance with OAC Rule 4906-2-21(D)(2).

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*Attorneys for Firelands Wind, LLC*

# Socioeconomic Report (REDACTED)

## Emerson Creek Wind

Lyme, Ridgefield, Sherman, Norwich, and Richmond Townships (Huron County)  
Groton and Oxford Townships (Erie County)

Prepared for:



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**January 2019**



# TABLE OF CONTENTS

<b>LIST OF TABLES .....</b>	<b>iii</b>
<b>LIST OF FIGURES .....</b>	<b>iii</b>
<b>EXECUTIVE SUMMARY .....</b>	<b>1</b>
<b>Part I: Introduction .....</b>	<b>2</b>
<b>Part II: Socioeconomic Profile .....</b>	<b>4</b>
1. Population trends .....	4
2. Employment statistics .....	6
<b>Part III: Regional Development Impacts .....</b>	<b>13</b>
1. Housing .....	13
2. Commercial and Industrial Development .....	15
3. Transportation .....	15
4. Local and Regional Plan Compatibility .....	16
5. Concurrent or Secondary Uses .....	19
<b>Part IV: Assessing Job and Economic Development Impacts .....</b>	<b>19</b>
1. Jobs and Economic Development Impact (JEDI) Model .....	19
2. Methodology .....	21
<b>Part V: Job and Economic Development Impacts on the Statewide Economy .....</b>	<b>23</b>
1. Statewide Job and Economic Impact: Construction .....	23
2. Statewide Economic Impact: Operations and Management .....	24
3. Land Lease Payments .....	25
<b>Part VI: Local Tax Revenues .....</b>	<b>25</b>
1. Legislative Context .....	25
2. Estimated Payments In Lieu Of Taxes .....	26
<b>Part VII: Conclusion .....</b>	<b>27</b>
<b>Part VIII: References .....</b>	<b>28</b>

## LIST OF TABLES

Table 1: County Population Trends and Densities .....	4
Table 2: Municipal Population Trends and Densities .....	5
Table 3: Local Labor Force and Unemployment .....	6
Table 4a: Employment and Payroll by NAICS Sector in the State of Ohio.....	7
Table 4b: Employment and Payroll by NAICS Sector in Crawford County.....	8
Table 4c: Employment and Payroll by NAICS Sector in Erie County.....	9
Table 4d: Employment and Payroll by NAICS Sector in Huron County .....	10
Table 4e: Employment and Payroll by NAICS Sector in Sandusky County .....	11
Table 4f: Employment and Payroll by NAICS Sector in Seneca County.....	12
Table 5: Study Area Housing Characteristics.....	14
Table 6: Adjustments Made to JEDI Model Cost.....	22
Table 7: Summary Results of Jobs and Economic Impact Analysis .....	23
Table 8: Service Payment per Megawatt Schedule .....	26
Table 9: Estimated Total PILOT Revenue .....	26

## LIST OF FIGURES

Figure 1: Study Area Map



## EXECUTIVE SUMMARY

This socioeconomic report is prepared in support of the proposed Emerson Creek Wind (“the Facility”). The Project Area is defined as an area encompassing all Facility-related development and associated setbacks. It consists of approximately 41,000 acres of private land in Groton and Oxford Townships (Erie County); Lyme, Ridgefield, Sherman, Norwich, and Richmond Townships (Huron County); and Reed and Venice Townships (Seneca County) (Figure 1). The proposed Facility is located entirely within Erie and Huron Counties. The Facility presented herein consists of up to 66 wind turbine generators, each with a nameplate capacity rating of 4.2 to 4.5 megawatts (MW), depending on the final turbine model selected. In addition to the turbines, the Facility will include access roads, buried 34.5 kV electrical collection cable, a collection substation, a temporary laydown yard for construction staging, an O&M building, up to three permanent meteorological towers, and all other associated equipment. The energy generated at the Facility will deliver power to a single point of interconnection (POI) on the existing Beaver – Davis Besse 345 kilovolt (kV) transmission line. The Facility will have an installed capacity of up to 297.66 megawatts (MW) and will deliver approximately 849,000 - 953,000 megawatt-hours (MWh) of electrical power annually to the regional power grid. Construction is scheduled for 2020.

The focus of this report is to assess the potential socioeconomic impacts of this Facility on local municipalities within a 5-mile radius from the Facility (“the Study Area”; see Figure 1), as well as across the State of Ohio. This involves a review of the past and current demographic and economic characteristics and trends in the Study Area, which includes 30 municipalities and (where applicable) those of the greater region. The regional economy surrounding the Study Area is shaped in large part by the agricultural industries of Crawford, Erie, Huron, Sandusky, and Seneca Counties as well as the metropolitan areas in northern Ohio and further afield. Potential impacts including those to employment, earnings, and overall economic output resulting from Facility construction and operation are assessed considering socioeconomic conditions within the State of Ohio and the Study Area.

In short, the Emerson Creek Wind is expected to produce a positive economic impact throughout the state and on the communities within the Study Area. Through lease payments to private landowners, short- and long-term job creation, and tax payments to each participating taxing jurisdiction, the Facility will supply a revenue stream to each of these jurisdictions without requiring significant services or expenditures on their behalf.

## Part I: Introduction

This socioeconomic report is prepared in support of the proposed Emerson Creek Wind (“the Facility”). The Project Area is defined as an area encompassing all Facility-related development and associated setbacks. It consists of approximately 41,000 acres of private land in Groton and Oxford Townships (Erie County); Lyme, Ridgefield, Sherman, Norwich, and Richmond Townships (Huron County); and Reed and Venice Townships (Seneca County) (Figure 1). The proposed Facility is located entirely within Erie and Huron Counties. The Facility presented herein consists of up to 66 wind turbine generators, each with a nameplate capacity rating of 4.2 to 4.5 megawatts (MW), depending on the final turbine model selected. In addition to the turbines, the Facility will include access roads, buried 34.5 kV electrical collection cable, a collection substation, a temporary laydown yard for construction staging, an O&M building, up to three permanent meteorological towers, and all other associated equipment. The energy generated at the Facility will deliver power to a single point of interconnection (POI) on the existing Beaver – Davis Besse 345 kilovolt (kV) transmission line. The Facility will have an installed capacity of up to 297.66 megawatts (MW) and will deliver approximately 849,000 - 953,000 megawatt-hours (MWh) of electrical power annually to the regional power grid. Construction is scheduled for 2020.

This analysis examines estimated impacts to the state and local economy generated from the construction and operation of the Facility. It includes a review of existing demographic and economic characteristics in the area, as well as several trends affecting both. When such comparison is informative, state and federal demographic and economic data are also included. Unless noted otherwise, the Study Area for this report includes the following 30 municipalities in Crawford, Erie, Huron, Sandusky, and Seneca Counties; all of which are found wholly or partially within a 5-mile radius of the Facility (the Study Area; see Figure 1):

- City of Bellevue
- City of Norwalk
- City of Willard
- Auburn Township
- Cranberry Township
- Chatfield Township
- Greenfield Township
- Groton Township
- Huron Township
- Lyme Township
- Margaretta Township
- Milan Township
- New Haven Township
- Norwalk Township
- Norwich Township
- Oxford Township
- Perkins Township
- Peru Township
- Reed Township
- Richmond Township
- Ridgefield Township
- Sherman Township



- Thompson Township
- Townsend Township
- Venice Township
- York Township
- Village of Attica
- Village of Castalia
- Village of Milan
- Village of Monroeville

Part II of this report provides an examination of population trends within the State of Ohio and the Study Area, from 2010 through 2017, including projected population growth through 2030. In addition, Part II provides data regarding the civilian labor force for 2016 by state and county (latest data available). Part III reviews the types of potential impacts that could be experienced throughout the region, including those regarding housing demand, commercial and industrial employment, and transportation networks. Part IV describes the methods of analysis of potential economic benefits provided within this report, including an overview of the Job and Economic Development Impact (JEDI) Wind Model. This model was created by MRG & Associates, under contract with the National Renewable Energy Laboratory and is an industry standard for economic impact investigation. This is followed by the JEDI results (Part V), which describes the jobs created by the construction and operation of the Facility, as well as a summary of payments to landowners as a result of land leases for turbines. Part VI reviews potential impacts of the Facility from the perspective of local taxing jurisdictions. The findings of this report are summarized in Part VII, which is followed by a bibliography of cited sources in Part VIII.

## Part II: Socioeconomic Profile

### 1. Population trends

Census data reveals that these communities have experienced histories of small population growth and decline over the past two decades. The 2017 population for the State of Ohio and Crawford, Erie, Huron, Sandusky, and Seneca Counties is shown in Table 1 below. Ohio showed an increase in population between 2000 and 2017, however, the counties in the study area each experienced an overall decrease of equal or higher magnitude between the same duration. Huron County experienced the smallest annual rate of population decrease (-0.1%) while Crawford County experienced the greatest overall decrease in population, at an annual rate of 0.7%. Population within the cities, townships, and village also generally decreased from 2000 to 2017. Of the 30 municipalities within a 5-mile radius of the proposed turbines, Auburn Township has experienced the greatest decline in population (-0.9%) from 2000-2017 (Table 2). The Village of Attica and Oxford Township were two areas of notable growth however, each experiencing an annual rate of population increase at 0.5% over the same time span.

**Table 1: County Population Trends and Densities**

County	2000 Population	2010 Population	2017 Population	% Annual Change 2000-2017	Est. 2030 Pop.	% Change 2017-2030	2017 Population Density (people per square mile)
Crawford County	46,966	43,784	41,746	-0.7%	38,334	-8.2%	105.7
Erie County	79,551	77,079	74,817	-0.4%	71,483	-4.5%	297.5
Huron County	59,487	59,626	58,494	-0.1%	57,752	-1.3%	119.4
Sandusky County	61,792	60,944	59,195	-0.2%	57,320	-3.2%	251.5
Seneca County	58,683	56,745	55,243	-0.3%	52,817	-4.4%	101.1
State of Ohio	11,353,140	11,536,504	11,658,609	0.2%	11,900,779	2.1%	282.3

Source: U.S. Census Bureau, 2000 and 2010 Decennial Census, Census Reporter, and 2017 American Community Survey 5-Year Estimates (2012-2017). Projections derived from each jurisdiction's constant annual growth rates between 2000-2017. Population Densities from CensusReporter.org. Totals calculated by formula, may reflect rounding errors

For the purposes of this report, the trends experienced by each community from 2000 to 2017 are expected to continue regardless of whether the proposed Facility is built. Over the next decade, the total population within the Study Area is projected to decrease by -2.8% from 2017 to 2030; compared to the projected statewide increase of 2.1% during the same time span. Meanwhile, county population projections are expected to decline between the same time span. Crawford County is projected to experience the greatest decrease in population (-0.7%) from 2010-2017, while Huron County is projected to experience only a -0.1% decline in population during the same time span (see Table 1).



**Table 2: Municipal Population Trends and Densities**

Jurisdiction within 5-Miles Radius of Facility	2000 Pop.	2010 Pop.	2017 Pop.	% Change 2000-2017	Est. 2030 Pop.	% Change 2017-2030	Population Density (people per square mile)
City of Bellevue	8,193	8,202	7,966	-0.2%	7,799	-2.1%	1,335.3
City of Norwalk	16,238	17,012	16,824	0.2%	17,294	2.8%	1,902.5
City of Willard	6,806	6,382	6,047	-0.7%	5551	-8.2%	1,705.1
Auburn Township	897	795	757	-0.9%	671	-11.3%	215.4
Cranberry Township	1,674	1,579	1,503	-0.6%	1,390	-7.5%	52.5
Chatfield Township	776	724	687	-0.7%	629	-8.4%	21.5
Greenfield Township	1,442	1,374	1,438	0.0%	1,435	-0.2%	49.9
Groton Township	1,384	1,427	1,344	-0.2%	1,315	-2.2%	51.1
Huron Township	10,530	10,697	10,517	0.0%	10,507	-0.1%	459.5
Lyme Township	968	853	842	-0.8%	762	-9.5%	35.6
Margaretta Township	6,289	5,981	5,843	-0.4%	5,534	-5.3%	180.5
Milan Township	3,686	3,606	3,538	-0.2%	3,431	-3.0%	139
New Haven Township	2,860	2,670	2,556	-0.6%	2,356	-7.8%	110.5
Norwalk Township	3,685	3,591	3,490	-0.3%	3,351	-4.0%	199.0
Norwich Township	1,072	1,070	1,055	-0.1%	1,042	-1.2%	35.8
Oxford Township	1,096	1,201	1,182	0.5%	1,255	6.2%	47.8
Perkins Township	12,578	12,202	11,746	-0.4%	11,166	-4.9%	461.6
Peru Township	1,043	1,105	1,067	0.1%	1,086	1.8%	50.7
Reed Township	949	848	814	-0.8%	730	-10.3%	20.7
Richmond Township	501	510	501	0.0%	501	0.0%	41.8
Ridgefield Township	2,390	2,329	2,298	-0.2%	2,231	-2.9%	88
Sherman Township	501	510	501	0.0%	501	0.0%	13.9
Thompson Township	1,422	1,443	1,390	-0.1%	1,366	-1.7%	37.2
Townsend Township	1,670	1,623	1,559	-0.4%	1,482	-5.0%	40.8
Venice Township	1,871	1,716	1,688	-0.6%	1,566	-7.2%	43.6
York Township	955	899	1,033	-0.2%	2,353	-2.8%	76.2
Village of Attica	935	852	808	0.5%	1,099	6.4%	1,526.4
Village of Castalia	1,670	1,623	1,559	-0.8%	728	-9.9%	816.8
Village of Milan	1,445	1,367	1,317	-0.5%	1,231	-6.6%	925.9
Village of Monroeville	1,433	1,400	1,382	-0.2%	1,345	-2.7%	93
<b>Total<sup>1</sup></b>	<b>97,801</b>	<b>96,500</b>	<b>94,113</b>	<b>-0.2%</b>	<b>91,435</b>	<b>-2.8%</b>	<b>N/A</b>

Source: U.S. Census Bureau, 2000 and 2010 Decennial Census and American Community Survey 2017 Population Estimates; Projections derived from each jurisdiction's constant annual growth rates between 2000-2017; Population Densities from CensusReporter.org. Totals calculated by formula, may reflect rounding errors

<sup>1</sup> Totals calculated by formula; may reflect rounding errors

Although construction employment related to the construction of the Facility will be substantial, this employment is relatively short term and is not expected to result in the permanent relocation of construction workers to the area; therefore, the Facility is not anticipated to generate significant population growth within the Study Area. The number of potential short- and long-term employment opportunities associated with the construction and operation of the Facility is discussed in further detail below.

## 2. Employment statistics

Table 3 illustrates the size of the local labor force and level of unemployment in counties located either wholly or partially within 5 miles of the proposed Facility, as well as across Ohio. Annual average unemployment has decreased both statewide and countywide from 2015-2017. Annual unemployment for Sandusky and Seneca Counties has been relatively consistent with that of the state over the last two years; while, the annual unemployment rate for Crawford, Erie, and Huron Counties has been relatively higher compared to that of Ohio statewide levels. Table 4a through Table 4f illustrates employment in the State of Ohio and Crawford, Erie, Huron, Sandusky, and Seneca Counties broken down by industrial sector for 2016 (most current available data).

**Table 3: Local Labor Force and Unemployment**

Place	Labor Force	Employed	Unemployed	2015 Annual Unemployment Rate	2016 Annual Unemployment Rate	2017 Annual Unemployment Rate
Crawford County	19,020	17,927	1,093	5.8%	6.0%	5.7%
Erie County	37,920	35,571	2,349	5.5%	5.5%	6.2%
Huron County	28,075	26,259	1,816	6.6%	6.5%	6.5%
Sandusky County	31,354	29,866	1,488	4.8%	4.7%	4.7%
Seneca County	27,323	26,020	1,303	4.8%	4.8%	4.8%
State of Ohio	5,780,912	5,528,810	252,102	4.9%	4.9%	4.4%

Note: Not Seasonally Adjusted; Source: U.S. Bureau of Labor Statistics, 2017



**Table 4a: Employment and Payroll by NAICS Sector in the State of Ohio**

NAICS code description	Paid employees for pay period including March 12, 2016	First-quarter payroll (\$1,000)	Annual payroll (\$1,000)	Total establishments
Total for all sectors	4,790,178	53,695,191	218,466,744	252,201
Agriculture, forestry, fishing and hunting	1,207	8,515	40,091	279
Mining, quarrying, and oil and gas extraction	10,575	160,513	670,009	721
Utilities	23,839	795,921	2,289,648	647
Construction	188,864	2,359,686	11,116,285	19,727
Manufacturing	662,428	9,074,716	36,621,708	14,000
Wholesale trade	232,886	3,510,084	14,256,812	13,856
Retail trade	573,837	3,517,657	14,781,616	36,020
Transportation and warehousing	176,312	1,978,269	8,372,644	7,497
Information	84,760	1,519,804	6,104,025	4,035
Finance and insurance	255,131	5,582,064	19,152,621	17,335
Real estate and rental and leasing	66,391	857,733	3,253,606	10,361
Professional, scientific, and technical services	250,766	4,062,533	17,052,928	23,929
Management of companies and enterprises	150,837	4,172,043	14,989,563	2,265
Administrative and support and waste management and remediation services	397,162	2,977,683	13,170,501	13,576
Educational services	121,226	847,072	3,485,175	3,054
Health care and social assistance	840,716	8,778,022	37,675,991	29,225
Arts, entertainment, and recreation	68,762	482,221	2,506,674	3,817
Accommodation and food services	481,956	1,685,389	7,358,502	24,115
Other services (except public administration)	202,431	1,323,427	5,559,716	27,395
Industries not classified	443	1,839	8,629	347

Source: U.S. Census Bureau, 2016

**Table 4b: Employment and Payroll by NAICS Sector in Crawford County**

NAICS code description	Paid employees for pay period including March 12, 2016	First-quarter payroll (\$1,000)	Annual payroll (\$1,000)	Total establishments
Total for all sectors	12,389	103,281	426,639	802
Agriculture, forestry, fishing and hunting	-	-	-	-
Mining, quarrying, and oil and gas extraction	a	D	D	1
Utilities	1	D	D	1
Construction	307	2,609	13,968	62
Manufacturing	3,550	36,355	147,293	72
Wholesale trade	447	4,644	17,988	33
Retail trade	1,387	7,828	32,994	123
Transportation and warehousing	234	1,385	6,191	23
Information	99	750	3,158	11
Finance and insurance	599	9,803	33,666	67
Real estate and rental and leasing	119	514	2,110	25
Professional, scientific, and technical services	530	2,789	13,366	46
Management of companies and enterprises	55	317	1,402	4
Administrative and support and waste management and remediation services	475	2,925	13,737	36
Educational services	-	-	-	-
Health care and social assistance	2,694	27,330	113,698	80
Arts, entertainment, and recreation	135	269	1,540	15
Accommodation and food services	1,100	2,702	12,655	78
Other services (except public administration)	631	2,406	9,976	123
Industries not classified	a	D	D	2

a: 0-19 employees

b: 20-99 employees

D: Withheld to avoid disclosing data for individual companies; data are included in higher level totals.

Source: U.S. Census Bureau, 2016



**Table 4c: Employment and Payroll by NAICS Sector in Erie County**

NAICS code description	Paid employees for pay period including March 12, 2016	First-quarter payroll (\$1,000)	Annual payroll (\$1,000)	Total establishments
Total for all sectors	31,553	273,849	1,178,848	1,851
Agriculture, forestry, fishing and hunting	a	D	D	2
Mining, quarrying, and oil and gas extraction	116	502	2,770	5
Utilities	b	D	D	4
Construction	908	10,454	49,386	129
Manufacturing	6,923	82,287	334,956	97
Wholesale trade	1,219	14,221	62,000	64
Retail trade	5,226	26,612	118,809	310
Transportation and warehousing	575	6,007	27,929	44
Information	294	3,905	18,102	22
Finance and insurance	633	10,157	38,907	114
Real estate and rental and leasing	294	2,294	10,850	64
Professional, scientific, and technical services	679	9,210	36,988	109
Management of companies and enterprises	211	2,848	11,166	14
Administrative and support and waste management and remediation services	614	5,026	22,589	80
Educational services	353	2,111	9,194	26
Health care and social assistance	4,841	48,597	210,889	221
Arts, entertainment, and recreation	1,358	22,364	93,642	67
Accommodation and food services	6,017	20,534	102,053	279
Other services (except public administration)	1,056	5,090	22,675	200
Industries not classified	-	-	-	-

a: 0-19 employees

b: 20-99 employees

D: Withheld to avoid disclosing data for individual companies; data are included in higher level totals.

Source: U.S. Census Bureau, 2016

**Table 4d: Employment and Payroll by NAICS Sector in Huron County**

NAICS code description	Paid employees for pay period including March 12, 2016	First-quarter payroll (\$1,000)	Annual payroll (\$1,000)	Total establishments
Total for all sectors	17,302	153,113	687,283	1,131
Agriculture, forestry, fishing and hunting	a	D	D	2
Mining, quarrying, and oil and gas extraction	-	-	-	-
Utilities	b	D	D	3
Construction	1,236	14,652	97,249	125
Manufacturing	5,018	56,018	236,059	83
Wholesale trade	609	6,668	31,352	42
Retail trade	2,240	12,386	51,332	170
Transportation and warehousing	891	8,885	40,534	35
Information	154	1,726	7,781	19
Finance and insurance	421	4,857	19,116	72
Real estate and rental and leasing	137	968	4,305	45
Professional, scientific, and technical services	411	3,347	14,730	77
Management of companies and enterprises	b	D	D	3
Administrative and support and waste management and remediation services	467	2,365	10,238	44
Educational services	95	355	1,526	9
Health care and social assistance	2,785	29,751	122,970	102
Arts, entertainment, and recreation	117	756	3,593	14
Accommodation and food services	1,620	4,133	18,633	122
Other services (except public administration)	1,000	4,896	20,214	163
Industries not classified	a	D	D	1

a: 0-19 employees

b: 20-99 employees

D: Withheld to avoid disclosing data for individual companies; data are included in higher level totals.

Source: U.S. Census Bureau, 2016

**Table 4e: Employment and Payroll by NAICS Sector in Sandusky County**

NAICS code description	Paid employees for pay period including March 12, 2016	First-quarter payroll (\$1,000)	Annual payroll (\$1,000)	Total establishments
Total for all sectors	23,452	201,341	860,592	1,307
Agriculture, forestry, fishing and hunting	3	32	744	4
Mining, quarrying, and oil and gas extraction	c	D	D	3
Utilities	38	1,024	3,458	4
Construction	984	10,353	50,642	139
Manufacturing	9,673	100,470	429,883	108
Wholesale trade	619	6,470	27,912	53
Retail trade	2,575	15,414	62,469	199
Transportation and warehousing	715	7,548	33,135	49
Information	131	1,234	5,142	11
Finance and insurance	460	5,579	21,732	76
Real estate and rental and leasing	173	1,317	5,322	39
Professional, scientific, and technical services	432	3,683	15,249	82
Management of companies and enterprises	210	3,941	13,911	7
Administrative and support and waste management and remediation services	808	5,081	22,325	59
Educational services	61	291	1,171	7
Health care and social assistance	3,146	24,169	104,307	184
Arts, entertainment, and recreation	251	921	4,374	22
Accommodation and food services	2,008	5,703	24,867	118
Other services (except public administration)	995	5,244	21,688	144
Industries not classified	-	-	-	-

a: 0-19 employees

c: 100-249 employees

D: Withheld to avoid disclosing data for individual companies; data are included in higher level totals.

Source: U.S. Census Bureau, 2016



**Table 4f: Employment and Payroll by NAICS Sector in Seneca County**

NAICS code description	Paid employees for pay period including March 12, 2016	First-quarter payroll (\$1,000)	Annual payroll (\$1,000)	Total establishments
Total for all sectors	17,058	135,778	576,653	1,106
Agriculture, forestry, fishing and hunting	b	D	D	2
Mining, quarrying, and oil and gas extraction	58	616	3,290	5
Utilities	96	2,058	7,200	5
Construction	801	8,218	43,254	113
Manufacturing	4,192	49,560	202,517	73
Wholesale trade	791	8,475	35,229	47
Retail trade	2,200	13,806	57,076	163
Transportation and warehousing	601	5,550	24,032	50
Information	132	1,044	4,226	13
Finance and insurance	401	5,667	21,574	68
Real estate and rental and leasing	73	415	1,816	27
Professional, scientific, and technical services	360	2,960	11,954	61
Management of companies and enterprises	68	1,328	6,247	7
Administrative and support and waste management and remediation services	439	2,840	13,125	40
Educational services	1,945	9,848	40,468	12
Health care and social assistance	2,402	15,290	68,401	135
Arts, entertainment, and recreation	201	406	2,122	16
Accommodation and food services	1,443	3,820	17,335	108
Other services (except public administration)	828	3,644	15,667	159
Industries not classified	a	D	D	2

b: 20-99 employees

D: Withheld to avoid disclosing data for individual companies; data are included in higher level totals.

Source: U.S. Census Bureau, 2016

## Part III: Regional Development Impacts

The Study Area is primarily agricultural, and while it is predominantly rural, the City of Toledo (west of the Study Area) and the City of Cleveland (east of the Study Area) are significant metropolitan regions and in relative proximity to the Study Area (see Figure 1). The study area, which includes portions of Crawford, Erie, Huron, Sandusky, and Seneca Counties, is primarily agricultural in nature. The regional context for the development of this Facility is discussed in further detail below, concentrating on three primary components: housing, commercial and industrial development, and transportation. In addition, the compatibility of the proposed Facility with regional developmental goals and plans is reviewed.

### 1. Housing

As with all sectors of the economy, the housing market throughout the region and within the Study area has felt the impact of population loss. Owner-occupied vacancy rates in Erie, and Seneca Counties, 3.0% and 1.8% are slightly higher than the statewide average of 1.7%, while the owner-occupied vacancy rate for Sandusky County (1.6%) is slightly lower than the statewide average. Owner-occupied vacancy rates in Crawford and Huron Counties, 1.4% are both noticeably lower than the statewide average. The rental vacancy rate in Sandusky County (9.3. %), Seneca County (8.9%), Huron County (7.9%), and Erie County (7.1%) is substantially higher than the statewide average of 5.8%, while the rental vacancy rate in Crawford County is only 4.0% lower than the statewide average.

Crawford, Erie, Huron, Sandusky, and Seneca Counties feature a median monthly gross rent level of \$637, \$716, \$650, \$507 and \$672, respectively, all of which is below the statewide average of \$764/month. Each county has a lower than statewide percentage of households whose rent accounts for more than 35% of their household income. In addition, Crawford, Erie, Huron, Sandusky, and Seneca Counties features a median housing values of \$85,600, \$132,400, \$118,900, \$111,300, and \$98,600, respectively, all of which are below the statewide average of \$135,100.

It is estimated that 16,093 housing units within Crawford, Erie, Huron, Sandusky, and Seneca Counties are currently vacant. Given these figures, in addition to the population projections discussed in Part II of this report, it is not expected that the development of the Facility will have a significant impact on the regional housing market. While the Facility development may not represent a widespread boom for rental property owners, it is worth noting that the availability of vacant rental housing also indicates that the Facility should not have a destabilizing effect on current renters.

**Table 5: Study Area Housing Characteristics**

Municipality/County/ State	Total housing units	Occupied units	Vacant units	Vacancy rate		Median housing value of owner- occupied units	Median gross rent (monthly)	% of household s with gross rent > 35% of household income
				Home- owner	Rental			
Ohio Statewide	5,174,838	4,633,145	541,693	1.7%	5.8%	\$135,100	\$764	38.1%
Crawford County	20,084	17,833	2,251	1.4%	5.4%	\$85,600	\$637	30.3%
Erie County	37,827	31,577	6,250	3.0%	7.1%	\$132,400	\$716	33.9%
Huron County	25,259	22,876	2,383	1.4%	7.9%	\$118,900	\$650	32.7%
Sandusky County	26,332	23,721	2,611	1.6%	9.3%	\$111,300	\$507	33.5%
Seneca County	24,105	21,507	2,598	1.8%	8.9%	\$98,600	\$672	33.7%
City of Bellevue	3,555	3,184	371	2.3%	11.9%	\$94,900	\$639	15.9%
City of Norwalk	7,306	6,778	528	0.0%	6.3%	\$118,500	\$632	37.9%
City of Willard	2,583	2,329	254	0.0%	9.7%	\$85,100	\$598	32.3%
Auburn Township	256	206	50	6.0%	0.0%	\$82,500	\$694	78.9%
Chatfield Township	301	266	35	0.0%	0.0%	\$84,500	\$571	68.4%
Cranberry Township	684	604	80	0.0%	4.0%	\$94,600	\$663	24.3%
Greenfield Township	732	533	199	0.0%	11.0%	\$135,200	\$601	69.1%
Groton Township	428	411	17	0.0%	0.0%	\$136,700	(x)	0.0%
Huron Township	5,437	4,639	798	4.9%	0.0%	\$176,900	\$817	21.2%
Lyme Township	395	363	32	0.0%	0.0%	\$146,800	\$524	0.0%
Margaretta Township	2,632	2,393	239	2.6%	0.6%	\$142,900	\$645	33.6%
Milan Township	1,389	1,238	151	1.5%	2.0%	\$158,700	\$789	5.6%
New Haven Township	967	818	149	5.5%	13.4%	\$106,700	\$677	21.9%
Norwalk Township	1,480	1,337	143	4.5%	0.0%	\$148,600	\$813	15.3%
Norwich Township	425	400	25	0.0%	23.6%	\$113,900	\$815	87.3%
Oxford Township	506	461	45	0.0%	(x)	\$158,500	(x)	0.0%
Perkins Township	5,166	4,767	399	2.8%	4.3%	\$147,200	\$787	30.1%
Peru Township	473	473	0	0.0%	0.0%	\$167,600	(x)	77.8%
Reed Township	304	304	0	0.0%	0.0%	\$92,100	\$1,025	16.7%
Richmond Township	448	420	28	0.0%	0.0%	\$123,600	\$843	44.3%
Ridgefield Township	1,012	910	102	3.5%	7.7%	\$129,700	\$679	25.5%
Sherman Township	181	142	39	14.7%	0.0%	\$132,800	(x)	0.0%
Thompson Township	594	507	87	0.0%	0.0%	\$153,800	\$748	0.0%
Townsend Township	647	448	199	0.0%	23.2%	\$127,800	\$625	0.0%
Venice Township	787	641	146	8.4%	22.4%	\$94,200	\$596	29.3%
York Township	1,083	984	99	0.0%	0.0%	\$151,700	\$694	31.9%
Village of Attica	485	415	70	2.4%	9.3%	\$83,200	\$585	32.8%
Village of Castalia	364	324	36	5.1%	0.0%	\$125,000	\$675	28.3%
Village of Milan	502	457	45	2.8%	5.0%	\$136,900	\$767	12.7%
Village of Monroeville	598	512	86	7.7%	10.0%	\$95,500	\$728	11.6%

Source: U.S. Census Bureau, American Community Survey 5-Year Estimates 2013-2017. (x) = No sample observations or too few sample observations were available to compute an estimate.



## 2. Commercial and Industrial Development

The Environmental Law & Policy Center estimated that the State of Ohio is currently home to 106 wind power supply chain businesses, providing 1,000 to 2,000 jobs throughout the state (ELPC, 2011). Wind energy technology manufacturing opportunities include rotors, controls, drive trains, generators, and towers. Several of these manufacturers and other wind power-related businesses are in the northern Ohio region (AWEA, 2017).

The diversification of Ohio's energy portfolio will have significant and positive economic impacts. The Environment Ohio Research & Policy Center estimated that if the State of Ohio increased wind power production to 20% of the state's total energy portfolio by 2020, such development would create 3,100 permanent, full-time positions within the state, and result in cumulative wages totaling \$3.7 billion. This same analysis estimated that such a commitment would result in an increase in gross state product of approximately \$8.2 billion by 2020 (Environment Ohio, 2007).

The State of Ohio is uniquely positioned to take advantage of continued growth in advanced manufacturing opportunities for the development and distribution of wind power technology, according to the Renewable Energy Policy Project's (2004) report, "Wind Turbine Development: Location of Manufacturing Activity." This analysis estimates that if the United States were to invest \$50 billion into 50,000 MW of new wind power production, Ohio manufacturers could create 11,688 jobs in wind turbine and related manufacturing. More recently, the American Wind Energy Association (AWEA) assessed the State of Ohio's wind capacity and estimated that the Ohio has enough wind resources to generate nearly 110,439 MW at 110m hub height of onshore wind energy, indicating the capacity to further increase number of potential manufacturing jobs for Ohio workers (AWEA, 2017). As of 2017, AWEA reported that the wind industry in the State of Ohio supported 2,000 to 3,000 direct and indirect jobs throughout the state. By developing more of these resources, new economic development is expected to be created and the manufacturing sector will be allowed to attract larger investments.

Specific short- and long-term economic impacts of this Facility on commercial and industrial development throughout the region are described in further detail in Part V of this report.

## 3. Transportation

The region surrounding the Facility features numerous Interstates, U.S, and State highways, as well as county and local roadway networks, in addition to freight rail lines and small airports. The main transportation route to the Facility is I-80/90 (Ohio Turnpike), which runs just north of the 5-mile Study Area. U.S. Route 250 (east) State Route 2 (north), and State Route 18 (west) run adjacent to the Project Area. U.S. Route 20 and State Route 4 provide direct access into the Project Area. These and other primary routes facilitate transportation between the Facility and the surrounding metropolitan areas.

Workers coming to and from the site will most likely enter via County Route 4 from I-80/90, and then traveling along other county roads (CR-547, CR-99, and CR-162). The proposed Facility is not expected to cause any substantial disruption to major transportation corridors serving the Study Area.

Freight rail lines connect several of the municipalities throughout the Study Area. CSX and Norfolk Southern operate the majority of Ohio's freight rail system. Study Area municipalities connected to freight rail lines include the Cities of Bellevue Norwalk and Willard; the Townships of Groton, Huron, Lyme, Margaretta, Perkins, Milan, Norwalk, Oxford, Perkins, Reed, Ridgefield, Thompson, Townsend, and York; and the Villages of Attica, Milan, and Monroeville. The rail system may be used for the transportation of a very small number of turbine component and equipment suppliers, but the Applicant does not anticipate making any modifications to the system.

The Study Area is also in proximity to the Port-Bucyrus-Crawford County Airport, Huron County Airport, the Sandusky County Regional Airport, the Seneca County Airport, the Bandit Field Airport, the Carl R. Keller Field Airport, the Fremont Airport, the Griffing-Sandusky Airport, the Hinde Airport, the Wakeman Airport, the Weiker Airport, and the Willard Airport. Construction and operation of the Facility will be designed according to Federal Aviation Administration (FAA) standards and are not expected to result in any adverse impacts to the regional air transportation network. The Applicant will file a notice of proposed construction or alteration (Form 7460-1) with the FAA to confirm the structure will not result in a substantial adverse impact.

#### 4. Local and Regional Plan Compatibility

The current land use of the Study Area is predominately agricultural. The Facility will be compatible with the existing agricultural land use. Only a select number of the municipalities within the five-mile Study Area have adopted comprehensive land use plans, strategic downtown plans, and/or economic development plans. Each of these are summarized as follows:

- City of Bellevue Vision 2025 Comprehensive Master Plan

This plan, adopted in 2005 by the Bellevue City Council, identifies the need for a 20-year vision, in which the issues, concerns, goals and priorities of the community are addressed through civic engagement. High-paying job creation in the manufacturing sector, as well as the retention of existing jobs and the preservation of existing farming operations are goals and issues presented in the plan. In terms of economic development, the Facility offers an opportunity for the use of local goods and services, including but not limited to labor, equipment, and maintenance. In addition, the payments associated with land leases provide additional income for landowners, including agricultural producers, and in doing so, improves the economic conditions for existing farming practices. The Facility is compatible with the Plan's economic goals.

- 2006 City of Norwalk Comprehensive Plan

This plan serves as an updated City of Norwalk's blueprint for the future through its vision to preserve natural resources and strong neighborhoods while promoting business growth and intergenerational opportunities and responding to both local and global challenges. To achieve this vision, the plan outlines goals relating to community character, community facilities, economic and business development, education, government, housing, land use, natural environment and resources, population growth and demographics, quality of life, services, transportation, and utilities and infrastructure. These categories consist of an array of high-priority goals that are compatible to the construction of the proposed Facility: retaining and attracting new industry, reflecting good stewardship of the environment, and preserving a balance between emerging residential uses and commercial needs. An additional goal is the protection of existing views of Norwalk Creek and its environs, as well as views of and from other scenic/attractive natural areas. According to the Emerson Creek Wind Visual Impact Assessment (VIA), views of the proposed Facility along the highly vegetated Norwalk Creek will be in the limited areas of shoreline that are non-vegetated. Portions of the Facility are also expected to be visible from locations within the Memorial Lake Park. The areas of visibility according to the viewshed analysis are limited to the eastern side of Memorial Reservoir and the pedestrian bridge that straddles the Memorial Reservoir and Upper Reservoir. The VIA includes a simulation of the visibility from the pedestrian bridge, showing that visibility is limited to the blade tips of three individual turbines. Also included in the VIA is a wireframe rendering of the southwest view from the Memorial Reservoir that shows there is no visibility of the Facility due to intervening vegetation and structures. A comprehensive analysis of these sensitive resources can be found in the VIA. Whether or not a wind facility negatively impacts local character is subjective, to some extent. Some people may feel the Facility will impact local character if visible from these areas, which would represent an inconsistency.

- 1995 Erie County Comprehensive Development Plan

This plan "determines the immediate and future needs of the community and provides ways to allow the County to guide appropriate land uses to the most suited areas for that kind of development" (Erie County, 1995). Based on an analysis of the existing conditions and growth trends of the County, along with issues facing the region, the plan identifies goals for future land use and policy making. The Facility is compatible with the Plan's goal to "promote community development through the improvement of infrastructure that meets development demands".

- 2017 Huron County Comprehensive Land Use Plan

Originally developed in 2007 and updated in 2017, the Huron County Commissioners, the Huron County Comprehensive plan aims to manage future growth within the County to guide development patterns over the next thirty years. A key goal is to promote Huron County as a development destination and to retain and expand existing businesses. The Facility is compatible with this goal due to the positive impacts it will create



for the local economy. Recently, the County approved a resolution to support Emerson Creek Wind Facility in the county as a Qualified Energy Project, making it eligible for state tax incentives.

- 2013 Sandusky County Comprehensive Plan

This plan is an update to the 2003 Comprehensive Plan and is intended to be long-range plan used to guide growth and development using current existing condition, along with updated trends and priority project. A major goal of the plan is to facilitate the economic health and growth of the County and its municipalities by expanding on the tax and employment base. Furthermore, the plan “promotes and facilitates the proper placement and provision of energy infrastructure components throughout the County, including but not limited to wind farms and solar arrays” (Sandusky County, 2013). The Facility is compatible with these goals, specifically the placement and provision of alternative energy infrastructure.

- 2011 Seneca County Comprehensive Economic Development Strategy

The plan is intended to position Seneca County as a “redevelopment area,” as defined by the EDA, and thus to make its political subdivisions eligible to apply from the EDA Public Works and other programs. As specified by the plan, “the assumptions, goals, and strategies laid out in the plan create a blueprint for the County’s overall economic development and a summary of what is considered the most effective and proactive, targeted strategy to improve the economic position and climate of Seneca County” (Seneca County, 2011). The Facility is compatible with the plan’s priority action to improve the local economy and implement alternative energy. Recently, the County approved a resolution to make Seneca County an “Alternative Energy Zone”, making it eligible for state tax incentives.

- 2005 Perkins Township Comprehensive Development Plan

The 2005 Comprehensive Plan presents a vision for the community through a series of issues and action steps for various components of the community: economic/industrial development, commercial enhancement, land use, housing, infrastructure and utilities, parks and recreation, and transportation. Regarding economic and industrial development, the plan aims to retain existing and attract new industry and business to the Perkins Township area in order to add to the tax base, provide high paying jobs for the residents and enhance the financial stability of the region. Regarding land use, the plan aims to develop a long-range Master Growth Plan that would result in retaining the township atmosphere while encouraging sustainable development and discouraging land-use conflicts. An action step of this plan to encourage a balance of farmland preservation and land use development. To the extent that this facility adds to the tax base, provides high-paying jobs, and facilitates additional revenues for operational agriculturalists, this proposed facility is compatible with both the economic and land use goals of the Perkins Township Comprehensive Plan.

The Facility is in an area that is largely rural in nature with most impacts from the Facility construction and operation occurring on land used for agriculture. The economic benefits of the turbines for local agriculturalists, as well as their

overall compatibility with farming practices, will support and aid in the preservation of local farming operations. Furthermore, the jobs and economic development created by Facility may help to create and retain existing local employment opportunities. Therefore, the development of this Facility is compatible with the goals and strategies of existing local and regional plans.

#### 5. Concurrent or Secondary Uses

Facility components will be located on portions of leased land with existing rural residential or agricultural uses. These existing uses are expected to continue throughout the lifetime of the Facility.

## Part IV: Assessing Job and Economic Development Impacts

### 1. Jobs and Economic Development Impact (JEDI) Model

The proposed Emerson Creek Wind Farm is anticipated to have local and statewide economic benefits. Wind power development, like other commercial development projects, can expand the local, regional, and statewide economies through both direct and indirect means. Income generated from direct employment during the construction and operation phases of the wind farm is used to purchase local goods and services, creating a ripple effect throughout the state. The Job and Economic Development Impact (JEDI) Wind model allows users to estimate exactly that; the jobs and the economic development impacts from wind power generation projects for both the construction and operation phases of the proposed Facility (NREL 2017). These economic development impacts, categorized by the levels of impact and indicators described above, include onsite jobs and earnings, economic output from these onsite earnings, local revenue/supply chain jobs and earnings, economic output from these local revenue/supply chain earnings, induced jobs and earnings, and economic output from these induced jobs and earnings. The JEDI model was created by the National Renewable Energy Laboratory (NREL), a national laboratory of the United States Department of Energy. It then calculates the aforementioned indicators for each level of impact using project-specific data provided by the Applicant and geographically-defined multipliers. These multipliers are produced by IMPLAN Group, LLC using a software/database system called IMPLAN (Impact analysis for PLANing), a widely-used and widely-accepted general input-output modeling software and data system that tracks every unique industry group in every level of the regional data (IMPLAN Group, 2018).

Using the JEDI wind model, this report analyzes three levels of impact that the proposed Facility may have on the economy:

**On-site labor impacts:** These are the direct impacts experienced by the companies/individuals residing in the State of Ohio engaged in the onsite construction and operation of the Facility. These values represent

expenditure of dollars on labor (wages, salaries and associated expenses) by Facility onsite construction personnel as well as operation and maintenance (O&M) personnel. On-site labor impacts do not reflect material expenditures. Most other input-output models consider this level as “direct impacts”, referring to changes in jobs, economic activity and earnings associated with the immediate impacts created by the investment, which would include the equipment installed onsite, the concrete used onsite, etc. However, the immediate economic impacts of the physical items used onsite, normally included in direct impacts, typically occur at some geographic distance from the project itself. Because of JEDI's focus on the local impacts of a Facility, only the labor associated with the on-site location of the Facility (Construction and Construction-Related Services) is counted at this level.

**Local revenue and supply chain impacts:** These impacts measure the estimated increase in demand for goods and services in industry sectors that supply or otherwise support the companies engaged in construction and operation (also known as “backward-linked” industries). These measures account for the demand for goods and services such as turbine components, project analysis, legal services, financing, insurance, etc. Most other input-output models consider this level as “indirect impacts”, referring to economic impacts associated with linked sectors in the economy that are upstream of the direct impacts, such as suppliers of hardware used to make the equipment installed onsite or the concrete used onsite. However, because of JEDI's focus on the local impacts of the Facility, labor for components of this Facility (e.g. turbine manufacturers) occurring at off-site locations is also counted in this level as a local revenue and supply chain impact.

**Induced impacts:** Induced impacts measure the estimated effect of increased household income resulting from the project. Induced impacts reflect the reinvestment of earned wages, as measured throughout the first two levels of economic impact. This reinvestment can occur anywhere within the local, regional, or state economy, on household goods, entertainment, food, clothing, transportation, etc.

Each of these three levels of impact can be measured in terms of three indicators: jobs (as expressed through the increase in employment demand), the amount of money earned through those jobs, and the overall economic output associated with each level of economic impact. These indicators are described in further detail:

**Jobs:** Jobs refer to the increase in employment demand because of Facility development. These positions are measured across each level of impact, so that they capture the estimated number of jobs on site, in supporting industries, and in the businesses, that benefit from household spending. For the purposes of this analysis, this term refers to the total number of year-long full-time equivalent (FTE) positions created by the Facility. Persons employed for less than full time or less than a full year are included in this total, each representing a fraction of a FTE position (e.g. a half-time, year-round position is 0.5 FTE).

**Earnings:** This measures the wages and salary compensation paid to the employees described above.



**Output:** Output refers to the value of industry production in the state economy, across all appropriate sectors, associated with each level of impact. For the manufacturing sector, output is calculated by total sales plus or minus changes in inventory. For the retail sector, output is equal to gross profit margin. For the service sector, it is equal to sales volume. For example, output would include the profits incurred by those businesses that sell electrical transmission line, concrete, or motor vehicle fuel to the Applicant.

## 2. Methodology

Calculating the number of jobs and economic output from a proposed Facility using the JEDI Model is a two-step process. The first step requires Facility-specific data inputs (such as year of construction, size of Facility, turbine size and location). These facility-specific data were used to provide a baseline set of assumptions that would produce a conservative estimate of the total positive jobs and economic impacts produced by this Facility. Note that the Applicant presents a turbine layout of 87 turbines for permitting purposes; with the exception of the economic analysis for the socioeconomic report, this 87-turbine layout is presented and analyzed throughout the rest of the Ohio Power Siting Board (OPSB) Application. The socioeconomic report, however, analyzes the total number of positive jobs and economic impacts produced by the Facility based on a 66-turbine layout to avoid overestimating the Facility's economic benefits.

- Location: Ohio
- Year of Construction: 2020
- Total Project Nameplate Capacity: 297.66 MW
- Number of Turbines: 66
- Average Turbine Capacity: 4.518 MW

Using this Facility-specific data, the JEDI model then creates a list of default values, which include project cost values, default financial parameter values, default tax values, default lease payment values, and default local share of spending values. These default values are derived from 10 years of research by NREL, and stem from various sources, including interviews and surveys from leading project owners, developers, engineering and design firms, and construction firms active in the wind energy sector. The version of the model (W9.14.18) used for the job and economic impact analysis presented here used the most currently available (2016) multiplier data specific to Ohio to estimate potential impacts on a statewide basis.

The second step of the JEDI model methodology requires the review, and if warranted, the customization of default project cost values and financial parameter values to more reasonable estimates. The Applicant reviewed the default project cost values subtotaled by each of the following categories in the JEDI model: Equipment during Construction, Balance of Plant Construction, Labor during Operation & Maintenance, Materials and Services during Operation &

Maintenance, Financial Parameters, Tax Parameters, Land Lease Parameters and Payroll Parameters. The Applicant reviewed these default values in November 2018 and determined whether they were appropriate for the project under review. As a result of that review, adjustments were made to specific default values (see Table 6). The remaining JEDI default values were reviewed and determined to be reasonable estimates based on the Applicant's previous experience in wind energy development.

**Table 6: Adjustments Made to JEDI Model Cost**

<b>JEDI Cost Items (Annual Estimates)</b>	<b>Default Value</b>	<b>Adjusted Value</b>	<b>Change</b>
Construction Equipment Costs	\$360,811,713	\$ [REDACTED]	[REDACTED]
Construction Materials Costs	\$75,607,608	\$ [REDACTED]	[REDACTED]
Construction Labor Total Costs	\$30,125,350	\$ [REDACTED]	[REDACTED]
Construction Foundation Hourly Wage	\$17.12/hour	\$ [REDACTED]	[REDACTED]
Construction Erection Labor Hourly Wage	\$19.39/hour	\$ [REDACTED]	[REDACTED]
Construction Management/Supervision Hourly Wage	\$34.93/hour	\$ [REDACTED]	[REDACTED]
Construction Electrical Hourly Wage	\$25.69/hour	\$ [REDACTED]	[REDACTED]
Employer Payroll Overhead for Foundation, Erection, Electrical, and Management Construction Labor	37.6%	[REDACTED]	[REDACTED]
Development Costs	\$13,457,302	\$ [REDACTED]	[REDACTED]
Sales Tax for Construction Materials and Equipment	\$22,874,217	\$ [REDACTED]	[REDACTED]
Operating/Maintenance Labor Costs	\$913,643	\$ [REDACTED]	[REDACTED]
Operating Field Salaries Hourly Wage	\$23.37/hour	\$ [REDACTED]	[REDACTED]
Operating Administrative Hourly Wage	\$14.95/hour	\$ [REDACTED]	[REDACTED]
Operating Management/Supervision Hourly Wage	\$37.38/hour	\$ [REDACTED]	[REDACTED]
Employer Payroll Overhead for Field, Administrative, and Management O&M Labor	37.6%	[REDACTED]	[REDACTED]
Operating/Maintenance Materials and Services	\$7,435,957	\$ [REDACTED]	[REDACTED]
Sales Tax for Operating/Maintenance Materials and Equipment	\$314,523	\$ [REDACTED]	[REDACTED]
Other Taxes/Payments During O&M	\$0	\$ [REDACTED]	[REDACTED]
Debt Repayment Period	10 years	[REDACTED]	[REDACTED]
Land Lease Costs	\$894,600	\$ [REDACTED]	[REDACTED]

## Part V: Job and Economic Development Impacts on the Statewide Economy

An economic impact analysis was performed for the Emerson Creek Wind (the Facility) to be constructed in 2020 with a rated capacity of up to 300 MW and an assumed 66 turbines, sized at 4.518 MW. The results of this analysis, estimated for both the construction and operation phases of the proposed Facility, are illustrated in Table 7 and summarized in the narrative that follows.

**Table 7: Summary Results of Jobs and Economic Impact Analysis**

	<b>Jobs</b>	<b>Earnings (Millions)</b>	<b>Output (Millions)</b>
<b>Construction</b>			
Project Development and Onsite Labor	296	\$19.0	\$19.5
Construction & Interconnection Labor	289	\$18.5	-
Construction Related Services	6	\$0.5	-
Turbine & Supply Chain Impacts	553	\$31.8	\$113.1
Induced Impacts	247	\$12.1	\$37.7
<b>Total Impacts</b>	<b>1,096</b>	<b>\$62.9</b>	<b>\$170.4</b>
<b>Annual Operation</b>			
Onsite Labor Impacts	9	\$0.8	\$0.8
Local Revenue and Supply Chain Impacts	25	\$1.3	\$6.6
Induced Impacts	19	\$1.0	\$3.2
<b>Total Impacts</b>	<b>53</b>	<b>\$3.1</b>	<b>\$10.6</b>

Source: NREL JEDI Model (version W9.14.18) (USDOE NREL, 2018)

Notes: Earnings and Output values are millions of dollars in 2018 dollars. Totals may not add up due to independent rounding. Results are based on model default values.

Demand for new jobs associated with the Facility will be created during both the initial construction period and the years following construction, in which the Facility is in operation. The money injected into the statewide economy through the creation of these jobs will have long-term, positive impacts on individuals and businesses in Ohio as it ripples through the economy.

### 1. Statewide Job and Economic Impact: Construction

Based upon JEDI model computations, it is anticipated that construction of the proposed Facility will directly generate employment of an estimated 296 FTE on-site construction and project development positions for Ohio residents, which will be for Construction and Interconnection Labor and Construction Related Services. The JEDI model estimates in a total of \$19.0 million for annual earnings for these positions. Turbine manufacturing and supply chain industries could in turn generate an additional 553 jobs across the State of Ohio over the course of Facility construction. In addition, Facility construction could induce demand for 247 jobs statewide through the spending of additional household income.



Based on the results of the model, the total impact of potentially 1,096 new jobs could result in up to \$62.9 million of earnings, assuming a 2020 construction schedule and wage rates consistent with statewide averages. Facility construction labor wages for similar construction positions within the North Northeastern Ohio nonmetropolitan area, which average from approximately \$22 for Construction Laborers, \$23 per hour for Electricians, and around \$50 per hour for Construction Management occupations (Bureau of Labor Statistics, 2017). Local, regional, and statewide employment during the construction phase will primarily benefit those in the construction trades, including equipment operators, truck drivers, laborers, and electricians. Facility construction will also require workers with specialized skills, such as crane operators, turbine assemblers, specialized excavators, and high voltage electrical workers. It is anticipated that many of the highly-specialized workers will come from outside the area and will remain only for the duration of construction.

In addition to jobs and earnings, the construction of the Facility is expected to have a positive impact on statewide economic output, a measurement of the value of goods and services produced and sold by backward-linked industries. As described in the definition above, output provides a general measurement of the amount of profit earned by manufacturers, retailers, and service providers connected to a given project. Based on the results of the model, the value of economic output associated with Facility construction is estimated to be \$170.4 million. Between workers' additional household income and industries' increased production, the impacts associated with the Facility are likely to be experienced throughout many different sectors of the statewide economy. Pursuant to Section 5727.75 of the Ohio Revised Code (ORC), the Facility may qualify for tax incentives based on the degree to which it employs in-state construction labor (see Part VI). At the time of the publication of this report, it is not yet known what portion of construction labor will be Ohio-domiciled.

## 2. Statewide Economic Impact: Operations and Management

Based upon JEDI model computations, the operation and maintenance of the proposed Facility is estimated to generate 9 full-time equivalent jobs with combined estimated annual earnings of approximately \$0.8 million. These 9 jobs are anticipated to be comprised of Project Manager, Wind Technician, and Administrative personnel. Projected wage rates are projected to be consistent with averages within the North Northeastern Ohio nonmetropolitan area, which are estimated to be \$18 per hour for Payroll and Timekeeping Clerks, \$23 per hour for Mechanical Engineering Technicians, and \$48 for General and Operations Managers (Bureau of Labor Statistics, 2017). These 9 full-time local jobs generated by the wind energy facility comprise the Facility's direct long-term employment impact.

Operations and maintenance should also generate new jobs in other sectors of the economy through supply chain impacts and the expenditure of new and/or increased household earnings. Increased employment demand throughout the supply chain is estimated to result in approximately 25 jobs with annual earnings of around \$1.3 million. In addition,

it is estimated that 19 jobs with associated annual earnings of \$1.0 million will be induced through the increased household spending associated with Facility operations. In total, while in operation, this Facility is estimated to generate demand for 53 jobs with annual earnings of approximately \$3.1 million. Total economic output could also increase by an estimated \$10.6 million as a result of Facility operations and maintenance.

### 3. Land Lease Payments

Operation of the Project will result in payment to local landowners in association with the lease agreements executed to host Facility components. These annual lease and easement payments will offer direct benefits to participating landowners, which will be in addition to any income generated from the surrounding land use (e.g. agricultural production). The Applicant estimates that these payments will total approximately \$[REDACTED] on an annual basis each year the Project is in operation, although this value is contingent upon project details still in development (e.g., turbine choice and layout). The Facility will also generate lease payments during the construction phase; while the value is currently unknown, the lease payments will have a beneficial impact on the local economy during construction. These lease payments will have a positive impact on the region, to the extent that landowners will spend their revenue locally.

## Part VI: Local Tax Revenues

### 1. Legislative Context

Wind energy projects in the State of Ohio can be exempted from tangible personal property and real property tax payments if they meet certain conditions. These conditions are enumerated in Section 5727.75 of the ORC. Operators of these exempted projects, known as qualified energy projects (QEP), are instead required to make annual payments in lieu of taxes (PILOT). In order to be certified as a QEP by the state, a project must meet all of the following criteria:

- an application for certification of the energy project as a QEP that complies with the requirements under Section 5727.75 of the ORC and Chapter 122:23-1 of the OAC must be submitted to the director of the Ohio Development Services Agency (ODSA) on or before December 31, 2020;
- an application under Section 4906.20 of the ORC must be submitted to the Ohio Power Siting Board (OPSB) on or before December 31, 2020;
- the county commissioners of a county in which property of the project is located must have adopted a resolution approving the application submitted to ODSA or the county commissioners must pass a resolution declaring the county an alternative energy zone (AEZ);
- at least 50% of the full-time equivalent construction and installation employees, as defined in Section 5727.75 of the ORC, must be Ohio-domiciled; and
- construction must begin by January 1, 2021.

If an applicant is granted exemption from taxation for any of the tax years 2011 through 2021, the QEP will be exempt from taxation for tax year 2022 and all ensuing years if the property was placed into service before January 1, 2022. The amount of PILOT to be paid annually to the county treasurer, ranging from \$6,000 and \$8,000, is assessed per megawatt (MW) of nameplate capacity, with the rate dependent on the percentage of construction/installation employees who are domiciled in Ohio. The PILOT would be: \$6,000 per MW, if during construction the project employs 75% or more Ohio-domiciled employees; \$7,000 per MW, if during construction the project employs 60% or more Ohio-domiciled employees; and \$8,000 per MW, if during construction the project employs the minimum requirement of 50% or more Ohio-domiciled employees (Table 8). County commissioners may require an additional service payment, as long as the total of the additional payment and the PILOT do not exceed \$9,000 per MW.

**Table 8: Service Payment per Megawatt Schedule**

<b>Annual Service Payment per Megawatt of Nameplate Capacity</b>	<b>Ratio of Ohio-Domiciled Full-Time Equivalent Employees</b>
\$6,000	75% or More
\$7,000	60% to 74%
\$8,000	50% to 59%

## 2. Estimated Payments In Lieu Of Taxes

Turbines for the Emerson Creek Wind are anticipated<sup>2</sup> to be in a total of nine municipalities (Groton and Oxford Townships in Erie County; and Lyme, Ridgefield, Sherman, Norwich, and Richmond Townships in Huron County), along with seven school districts (Bellevue City School District, Berlin-Milan Local School District, Margareta Local School District, Monroeville Local School District, Perkins Local School District, Seneca East Local School District, and Willard City School District). Table 9 displays the total estimated PILOT revenues to be distributed throughout all taxing jurisdictions under the four scenarios identified in the payment schedule in Section 5727.75 of the ORC.

**Table 9: Estimated Total PILOT Revenue**

<b>Total Facility capacity (MW)</b>	<b>PILOT at \$6,000/MW</b>	<b>PILOT at \$7,000/MW</b>	<b>PILOT at \$8,000/MW</b>	<b>PILOT at \$9,000/MW</b>
297.66	\$1,785,960	\$2,083,620	\$2,381,280	\$2,678,940

<sup>2</sup> As of mid-January 2018, the Erie County PILOT resolution has not been finalized, however it is anticipated. If the resolution is not adopted, actual tax payments could differ from those presented here.



## Part VII: Conclusion

The socioeconomic effects of the Emerson Creek Wind, when assessed in light of regional and local economic trends, will have a positive impact on the communities within the Study Area and across the State of Ohio. Lease payments, short- and long-term job creation, and PILOT revenues will benefit private landowners, businesses, and taxing jurisdictions. The Facility is not expected to generate significant expenditures on behalf of these beneficiaries; therefore, it will have a positive impact on the social and economic conditions of these communities and across Ohio.

### 1. Total Statewide Economic Benefit

The construction of the Emerson Creek Wind is expected to produce \$62.9 million in employment earnings and \$170.4 million in total economic output statewide. Subsequently, each year the Facility is operational it is expected to generate approximately \$3.1 million in earnings and \$10.6 million in total economic output statewide.

### 2. Statewide Employment Benefits

During the construction period, the Facility is expected to support demand for a total of 1,096 onsite, supply chain, and induced employment positions statewide. It is expected to support a total of 53 positions statewide during each year of its operation.

### 3. Land Lease Revenues

The development of the Facility will result in \$[REDACTED] in annual lease payments made to participating landowners.

### 4. Property Tax Revenues

Construction of the proposed Emerson Creek Wind will increase local government revenues through payments in lieu of taxes (PILOTs). Though the agreements outlining these payments are not yet finalized, it is estimated that annual PILOT revenues could amount to approximately \$1.8 million to \$2.7 million to be distributed for the benefit of the counties and the local taxing jurisdictions.

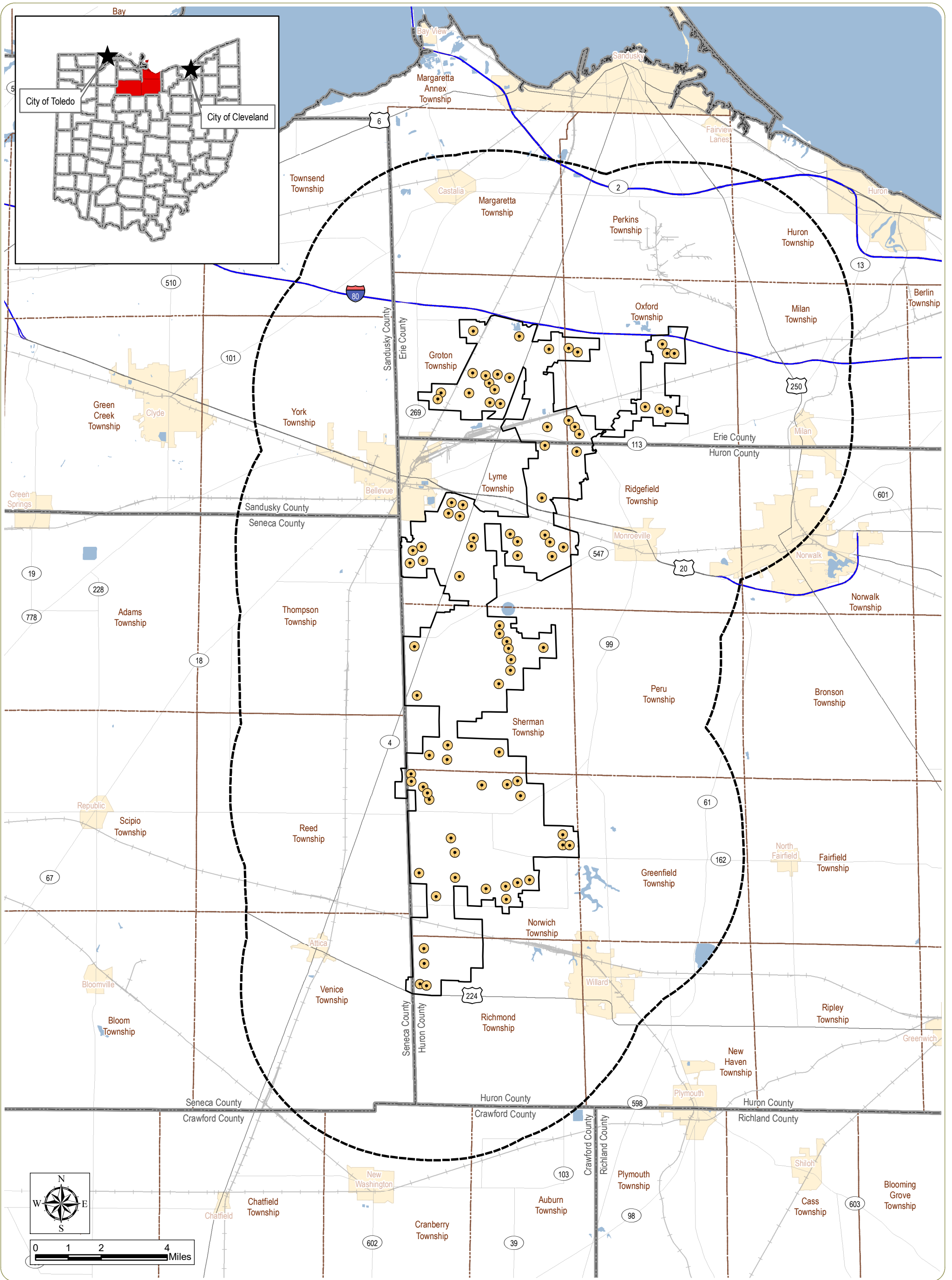
## Part VIII: References

- American Wind Energy Association (AWEA). 2017. Ohio State Fact Sheet. Available at: <http://awea.files.cms-plus.com/FileDownloads/pdfs/ohio.pdf> (Accessed August 2017).
- City of Bellevue. 2005. City of Bellevue Vision 2025 Comprehensive Master Plan. Available at <http://www.cityofbellevue.com/Bellevue/city-master-plan-2025/> (Accessed June 2017).
- City of Norwalk. 2006. City of Norwalk 2006 Comprehensive Plan. Available at [https://www.egovlink.com/public\\_documents300/norwalk/published\\_documents/City%20Information/2006%20Comprehensive%20Plan.pdf](https://www.egovlink.com/public_documents300/norwalk/published_documents/City%20Information/2006%20Comprehensive%20Plan.pdf) (Accessed October 2017).
- City of Tiffin. 2010. City of Tiffin Downtown Strategic Plan. Available at <https://senecasuccess.files.wordpress.com/2014/11/downtown-plan-2010.pdf> (Accessed June 2017).
- City of Tiffin. 2016. City of Tiffin Downtown Strategic Growth and Development Plan. Available at <https://senecasuccess.wordpress.com/tag/downtown-strategic-growth-and-development-plan/> (Accessed June 2017).
- Environmental Law & Policy Center (ELPC). 2011. The Solar and Wind Energy Supply Chain of Ohio. Available at: <http://elpc.org/newsroom/publications/> (Accessed August 2017).
- Environment Ohio Research & Policy Center (Environment Ohio). 2007. Energizing Ohio's Economy: Creating Jobs and Reducing Pollution with Wind Power. Published by Environment Ohio and the Frontier Group. Available at: <http://www.frontiergroup.org/reports/fq/energizing-ohio%E2%80%99s-economy> (Accessed August 2017).
- Erie County. 1995. Erie County Comprehensive Development Plan. Available at <http://www.eriecounty.oh.gov/departments-and-agencies/economic-development/erie-regional-planning-commission/downloadable-documents/> (Accessed June 2017).
- Huron County. 2017. Huron County Comprehensive Land Use Plan. Available at [http://www.huronswcd.com/uploads/2/7/9/7/27972647/2017\\_comp\\_land\\_use\\_plan\\_for\\_website.pdf](http://www.huronswcd.com/uploads/2/7/9/7/27972647/2017_comp_land_use_plan_for_website.pdf) (Accessed June 2017).
- Sandusky County. 2013. The Sandusky County Comprehensive Plan. Available at <https://www.sanduskycountyedc.net/site-selection/sc-comprehensive-plan/> (Accessed June 2017).
- Seneca County. 2011. Seneca County Comprehensive Economic Development Strategy. Available at <https://senecasuccess.files.wordpress.com/2014/11/economic-plan-ceds-2011.pdf> (Accessed June 2017).
- State of Ohio. 2012. Section 5727. Ohio Revised Code. Available at: <http://codes.ohio.gov/orc/5727> (Accessed August 2017).
- U.S. Census Bureau. 2017. American Community Survey 5-year estimates. Retrieved from Census Reporter Profile page for York township, Sandusky County, OH. <https://censusreporter.org/profiles/06000US3914387080-york-township-sandusky-county-oh/> (Accessed December 2018).

- U.S. Census Bureau. 2017 American Community Survey County – Household, Population and NAICS Characteristics (web database portal). Available at: <http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml> (Accessed June 2017).
- U.S. Census Bureau. 2017. American Community Survey 1-year estimates. Retrieved from Census Reporter Profile page for Erie County, OH <https://censusreporter.org/profiles/05000US39043-erie-county-oh/> (Accessed December 2018).
- U.S. Department of Energy (USDOE) National Renewable Energy Laboratory (NREL). 2017. Jobs and Economic Development Impact (JEDI) model release W12.23.16. Available at: <http://www.nrel.gov/analysis/jedi/download.html> (Accessed August 2017).
- U.S. Department of Labor (USDOL) Bureau of Labor Statistics. 2015-2017. Local Area Unemployment Statistics. Available at: <http://www.bls.gov/lau/data.html> (Accessed December 2018).
- U.S. Department of Labor (USDOL) Bureau of Labor Statistics. 2017. Metropolitan Area Occupational Employment and Wage Estimates for North Northeastern Ohio Nonmetropolitan Area. Available at [https://www.bls.gov/oes/current/msa\\_def.htm#17460](https://www.bls.gov/oes/current/msa_def.htm#17460) (Accessed November 2018).



## Figure



**Emerson Creek Wind**  
Erie, Huron, and Seneca Counties, Ohio

**Figure 1: Study Area Map**

**Notes:** 1. Basemap:ESRI StreetMap North America, 2012. 2. This map was generated in ArcMap on January 10, 2019. 3. This is a color graphic. Reproduction in grayscale may misrepresent the data.

- Wind Turbine
- Project Area
- 5-Mile Study Area
- City Boundary
- Township Boundary
- County Boundary

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Summary: Application - 5 of 17 electronically filed by Christine M.T. Pirik on behalf of Firelands Wind, LLC