

CHAPTER 8

SOILS

Soils are a natural mixture of unconsolidated minerals and organic matter that occur on the land surface. The space that soil occupies provides the setting for plant growth, serves as a natural water storage source, and is habitat for many organisms. Soils also regulate water, filter potential pollutants, cycle nutrients and provide stable support for man-made structures. Healthy soils allow for clean air and water, productive croplands and rangelands, lush forests and diverse habitat.

SOIL SEPARATES AND TEXTURE

Sand, silt and clay are the three mineral particle types, known as “separates,” that make up the soil. These types are defined and categorized by size. **Sand** particles are the largest—ranging from larger, coarse grains (2.0 mm) to smaller, fine grains (0.05 mm). The varying sizes of sand directly impacts soil porosity, which influences other physical properties, such as water movement, available water capacity, intake rates, aeration and compressibility. Sand generally drains water very easily and does not retain moisture well. As a result, there is little chemical activity in sand and minimal nutrient bonding.

Silt is a dust-like soil particle of an intermediate size (0.05 to 0.002 mm) between very fine sand and clay. It is easily transported by water, ice and wind. Both sand and silt are created from eroded rock. Silty soils possess inherent softness and cohesiveness, absorb and retain water, circulate air and are naturally more fertile than other soil types. If compacted, the permeability of silt may become compromised. Silt frequently washes into waterways via agricultural and/or industrial runoff, which can negatively affect the Lake Erie ecosystem, commercial shipping and recreation. Waterborne sediments are often contaminated with fertilizers and/or chemicals from cargo freighters. Such pollutants bring about many environmental concerns in Lake Erie, including harmful algal blooms, drinking water contamination and aquatic habitat degradation. More than 1.5 million cubic yards of accumulated material is dredged annually from Ohio’s Lake Erie commercial harbors (see maps on pages 92 and 98), including 850,000 cubic yards at Toledo (U.S. Army Corps of Engineers, 2016).

Clay particles are the smallest separates in size (less than 0.002 mm) and are also the most chemically and physically-active part of mineral soil. High density and small particle size allows clay to retain greater amounts of water and nutrients. Water permeates clay very slowly, which results in longer periods of saturation and ponding. Clay becomes soft and malleable when wet, and hard and brittle when dry. The type and amount of clay can indirectly impact plant growth by affecting the available water capacity, intake rate, water movement, aeration, erodibility and workability. An appropriate amount of clay in the subsoil layer (see “Soil Horizons” section) can help slow the water movement rate and balance the amount of water and nutrients

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needed for plant growth. However, too much clay can impede water and air movement, restrict root penetration (limit plant growth), increase runoff and increase erosion on sloped terrain. Clay also serves as strong foundation material for engineering and construction projects.

Soil texture is based on the proportion, by weight, of sand, silt and clay in the soil. “Loam” is a soil classification that contains relatively balanced quantities of sand, silt and clay (approximately 40 percent sand, 40 percent silt and 20 percent clay). Loam is ideal for gardening and agricultural purposes because of its ability to sufficiently retain water and nutrients, while also allowing for drainage and aeration. The U.S. Department of Agriculture recognizes 12 major soil texture classifications. These are based on variable separate percentages and include: (1) sand; (2) silt; (3) clay; (4) loam; (5) sandy loam; (6) loamy sand; (7) silt loam; (8) sandy clay loam; (9) sandy clay; (10) clay loam; (11); silty clay loam, and; (12) silty clay.

SOIL HORIZONS

The formation of soil is influenced by climate, topography, living organisms, parent materials and time. Natural processes, such as weathering, erosion, precipitation and flooding, among others, contribute to continual soil development. Through the formation process, soil materials are naturally organized into four distinctively visible, chemical and/or physical layers known as “**horizons**.” The layers include, from nearest to the surface to farthest below the surface, Horizon O, Horizon A, Horizon B and Horizon C. Soil horizons are generally parallel to the surface of the soil.

Horizon O is the thin layer of surficial organic matter present above the surface soils (Horizon A). The surface soil that comprises **Horizon A** contains a mix of organic matter and mineral materials. It is often referred to as topsoil. A-horizons hold the highest concentration of organic matter (decomposing plant and animal remains) and living organisms, such as earthworms and fungi, among others. It is the most biologically active horizon. A higher organic matter content gives the A-horizon a darker color, which distinguishes it from other layers. Since clays and other compounds are easily leached out, the materials in this layer are typically coarser than lower horizons.

Below the surface soil layer is **Horizon B**, the subsoil layer. B-horizons are composed of finer soil materials such as fine sand, silt and/or clay, and lack organic matter. The subsoil layer is known as the “zone of accumulation” because it accumulates high amounts of filtered clay, iron and aluminum oxides from the overlying layers through a process called, “illuviation.” This process increases the density of Horizon B. Few plant roots are able to penetrate this layer.

Below the subsoil layer is **Horizon C**, the substratum layer. The C-horizon represents the parent material and is composed of older sedimentary deposits and large unbroken rocks from weathered bedrock. The overlying horizons (A and B) typically originate from Horizon C. The underlying bedrock—located below the substratum layer—is often referred to as “Horizon R.”

SOIL SERIES AND SOIL REGIONS OF OHIO

The U.S. Department of Agriculture’s soil classification system aims to comprehensively group soils that exhibit similar characteristics. Soils can be classified by regional formation factors, such as parent material type, prevalent vegetation, climate and/or topography. Soils can also be classified by physical appearances, such as color, texture and/or horizon thickness. Soil taxonomy consists of a six-level hierarchical scheme. The levels, in order from most general to most specific, include: order, suborder, great group, subgroup, family and series. This system provides a basis for understanding the general utility of certain soil groups, including agricultural, residential and urban usages, or plant production, waste management and construction (see map on page 188).



Grain harvesting, Erie County



Low bluff at Geneva State Park, Geneva-on-the-Lake, Ashtabula County



Vineyard, South Bass Island, Ottawa County

Soils classified in the same series feature various physical commonalities, including water movement, color, pH levels and horizon characteristics, such as arrangement and thickness. There are around 150 soil series in Ohio's coastal county region. Soil series are generally named after the cities or towns where they were first studied or mapped.

Soil scientists, or pedologists, first conducted soil surveys in Ohio in 1899. The first survey effort near the Lake Erie coast was conducted in 1902 in the Toledo area. The most common soils in northern Ohio (including the entire Lake Erie Watershed) were formed from glacial deposits. Soils in the western part of Ohio (from roughly Sandusky and west), where limestone, dolomite and limy shales comprise the most prevalent bedrock material, have relatively high lime content in the substratum layer. Glacially-deposited soils in eastern Ohio have lower lime content.

The most common soils found in the regions directly adjacent to Lake Erie (and to the west of Lake Erie) are lakebed soils that were deposited as the lake took shape and glacial till soils. The western portion of this region contains the Hoytville, Nappanee, Paulding and Toledo series, which are characterized by agricultural fields with minimal slope and drainage ditches. The eastern portion of this region contains coarser materials, including Conotton, Conneaut and Allis series soils. These soils tend to be increasingly sloping, or very steep, and are affected by urbanization.

In the upper reaches of the Maumee River and Sandusky River watersheds, in the southwestern portion of the Lake Erie Basin, the most common soils are glacially-deposited till materials and lakebed soils. The very-poorly drained Pewamo series is common in depressions below broader areas of the somewhat-poorly drained Blount soil. These soils are typically fine-to-fine-loamy till and very deep. In the central part of the Lake Erie Watershed, glacial till soils with medium or low lime content and fine-to-fine-loamy separates dominate the landscape from eastern Huron and Erie counties to areas in northern Geauga County, northwestern Portage County and western Trumbull County. The somewhat-poorly drained Mahoning soil is extensive on gently sloping and flatter landscapes, and the moderately well-drained Ellsworth soil is common on gently sloping and steeper areas. Finer, loamy till is common in the eastern coastal counties, especially Ashtabula County. These soils generally have less clay in the subsoil than soils formed in fine or fine-loamy till. The poorly-drained Mill soil is extensive on flatter landscapes and the somewhat-poorly drained Darien and Platea soils are common on nearly-level and sloping areas. For more information, see the Drainage Class map on page 196.

SOIL SURVEY GEOGRAPHIC DATABASE

Soil surveys describe the types of soils that exist in a region. There are many geographic and physical traits that help classify and delineate soil units, including, but not limited to, geographic location, relationships to nearby soils, profile characteristics, suitability for various uses and management needs. The soils information presented in this chapter is derived from data available in the Natural Resources Conservation Service's (NRCS) Soil Survey Geographic Database (SSURGO). SSURGO is the most detailed collection of digital soils data available from the NRCS. It consists of high-resolution map data and comprehensive attribute information, and is based on over 100 years of recorded field observations. The database was developed for natural resource and land use planning and management at the property, township and county levels.

For mapping purposes, surveyed soils are grouped into "soil map units." A soil map unit is the basic geographic unit of the Soil Survey Geographic Database. It is a collection of areas defined and named similarly based on shared soil components, dominant taxonomic soil type(s) and miscellaneous attributes, such as productivity and other distinct properties and/or interpretations. A map unit may include two or more primary soil types. Each soil map unit differs in some respect from all other units in a surveyed area (i.e. physical or chemical differences or variable nutrient and moisture properties) and each is assigned a unique identification symbol. Comparable soil map units are often associated with landforms, vegetation types, slope gradient, slope orientation and/or geomorphology, among other physical and observable features.

There are many beneficial applications to grouping different soil types, including, but not limited to: illustrating soil patterns in the landscape; determining agricultural productivity and flooding frequency; identifying highly erodible areas and potential wetland areas; assessing native plant and animal distribution, and; conducting land use and watershed assessments. The effects of climate and topography on certain soil types can affect engineering plans, agricultural suitability, biological productivity and the natural distribution of plants and animals.

Note: Soils data were collected over the course of many decades and on a county-by-county basis. Due to different and advancing methods of data collection and interpretation, feature contiguousness across county lines may not exist. As a result, the assigned color values for some features may not match precisely with adjacent data in adjacent counties and in some instances create a noticeable patchwork effect. Additionally, since soil surveys were conducted at a more detailed scale and for different purposes than geologic maps, apparent conflicts between soils maps and geologic maps should not be considered contradictory.



Corn field, Ottawa County

Additional information about soils in the Lake Erie Watershed are presented throughout this chapter. Topics include: (1) Dominant Soil Order; (2) Prime Farmland; (3) Highly Erodible Land; (4) Depth to Water Table; (5) Drainage Class; (6) Hydric Classification; (7) Soils by Parent Materials, and; (8) Hydrologic Soil Groups.

Learn more about the information presented in this chapter:

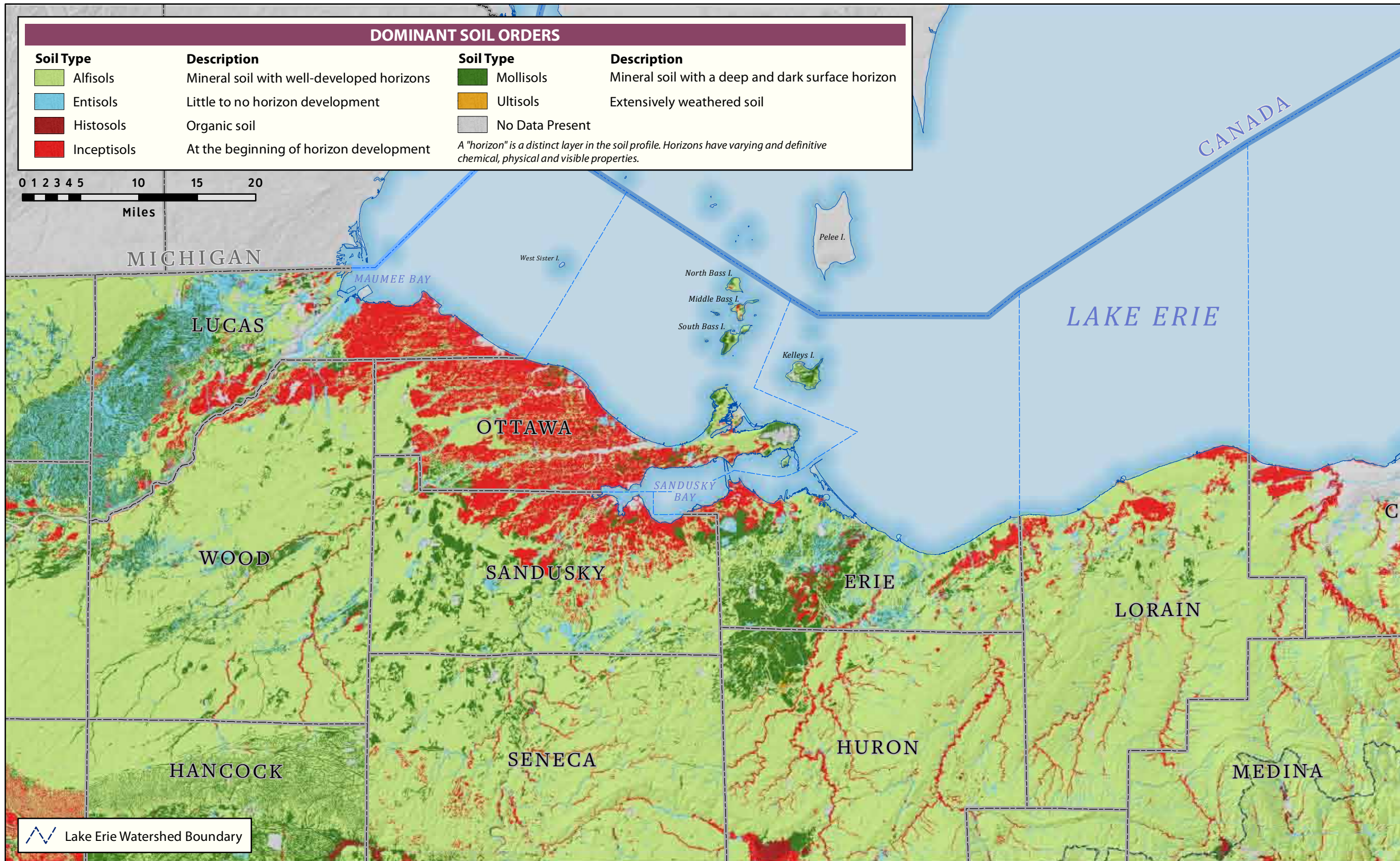
Ohio Department of Agriculture, Division of Soil and Water Conservation
www.agri.ohio.gov

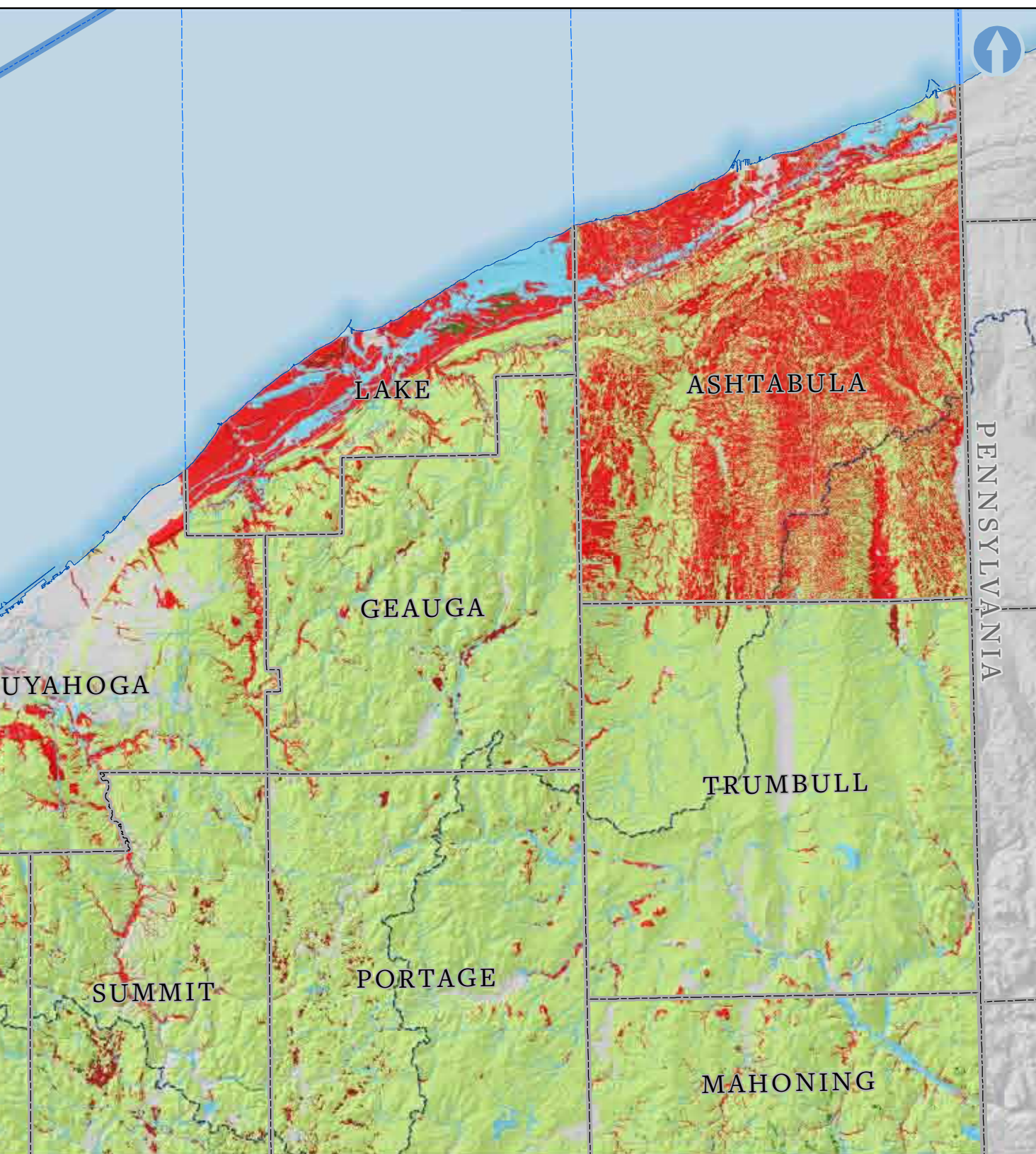
Ohio Department of Natural Resources, Division of Water Resources
water.ohiodnr.gov

U.S. Department of Agriculture, Natural Resources Conservation Service
nrcs.usda.gov

A complete list of chapter sources is found in the Appendix.

DOMINANT SOIL ORDER





The U.S. Department of Agriculture's soil classification system comprehensively groups soils that exhibit similar characteristics. Soils can be classified by regional formation factors, such as parent material type, prevalent vegetation, climate and/or topography. Soils can also be classified by physical appearances, such as color, texture and/or horizon (soil layer) thickness.

The taxonomic classification of soils identifies the dominant factors active during soil formation at a particular location. Soil taxonomy consists of a six-level hierarchical scheme. The levels, in order from most general to most specific, include: order, suborder, great group, subgroup, family and series. This system provides a basis for understanding the general utility of certain soil groups, including agricultural, residential and urban usages, or plant production, waste management and construction.

This map shows the most general taxonomic level, soil order. There are 12 soil orders recognized worldwide. Soil orders can typically be defined by a single dominant characteristic, such as prevalent vegetation, type of parent material, climate variable or amount of weathering. The area of Ohio illustrated in this map includes six soil orders: Alfisols, Entisols, Histosols, Inceptisols, Mollisols and Ultisols.

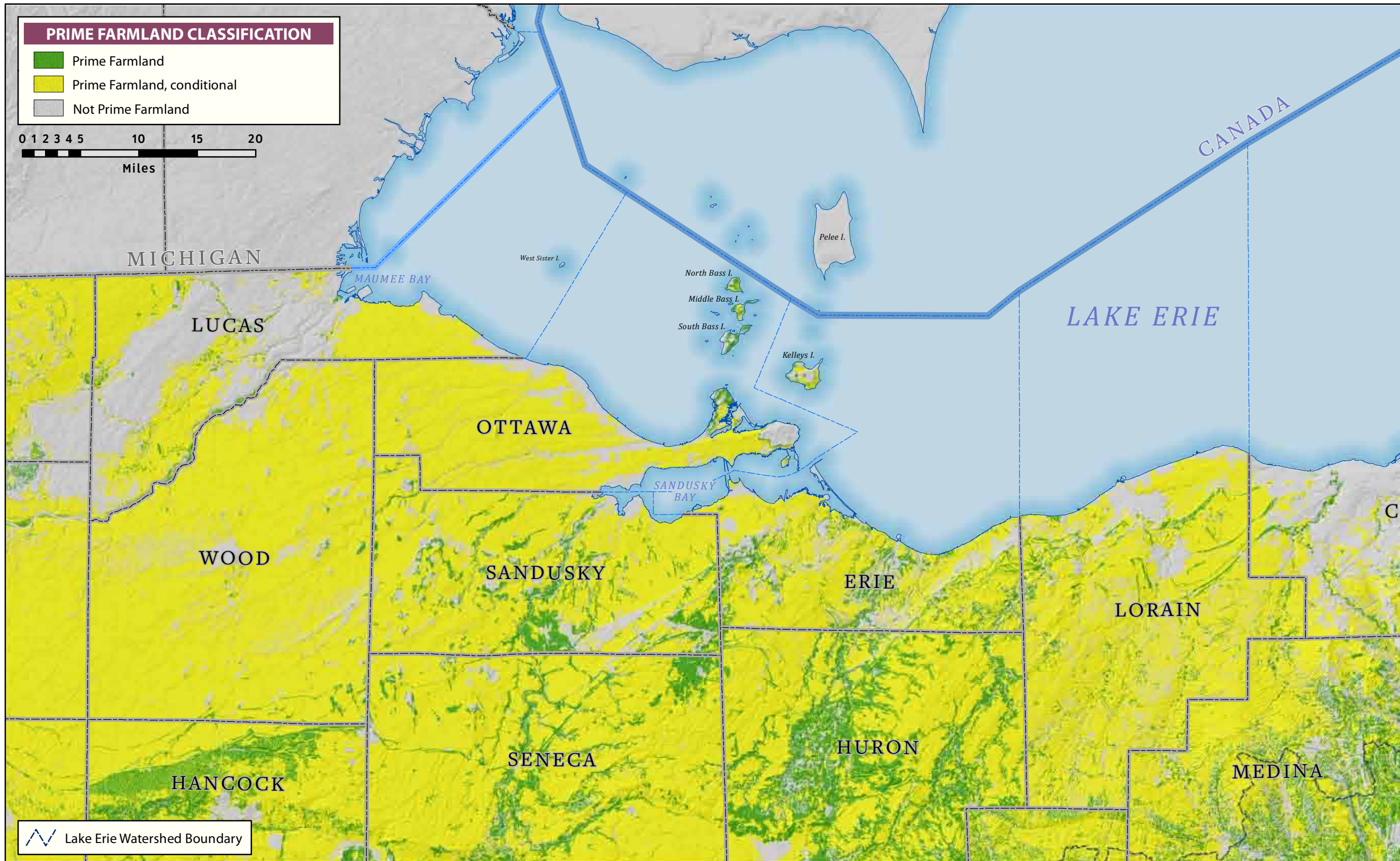
Extensive areas of Alfisols are found on this map. Alfisols are formed mostly under forest vegetation and also under grass savanna. They have high concentrations of nutrients, are well-saturated and are generally fertile and productive soils.

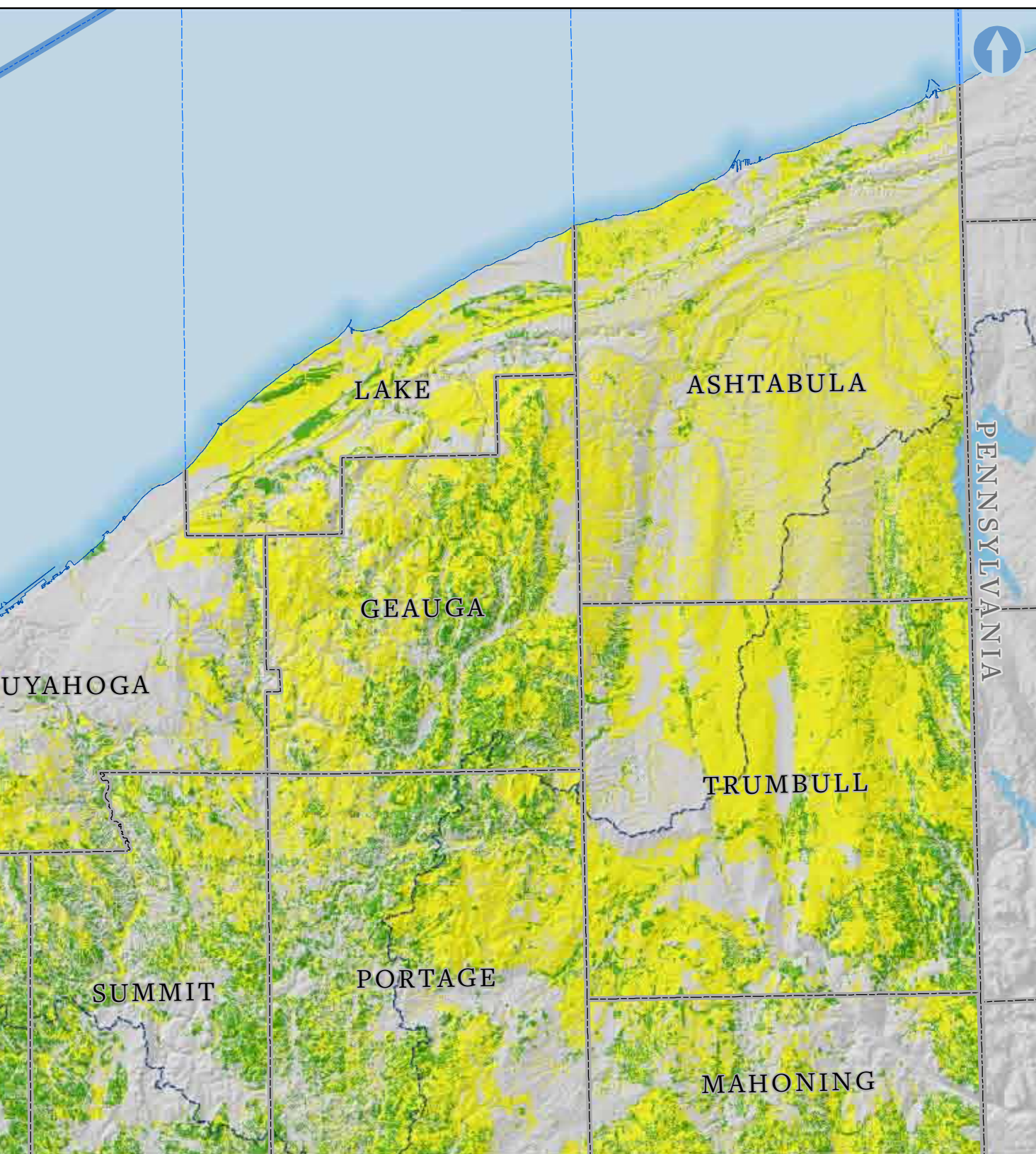
Inceptisols are found throughout the coastal region, primarily in the low-lying and marshy areas of Lucas, Ottawa and Sandusky counties, and also within the lake plain areas of Lake and Ashtabula counties. These soils are in the beginning stages of soil profile development and form quickly through the alteration of parent materials. The most prevalent suborder of the Inceptisols order found in the coastal region is Aquepts (not identified on map). Soils of this suborder are wet soils with high groundwater tables and poor natural drainage. Aquepts are frequently artificially drained and yield excellent cropland and pasture land.

The Oak Openings region in Lucas, Fulton and Henry counties is comprised of Entisols and Mollisols. Entisols are shallow, sandy soils derived from windblown and lake-deposited sands, while Mollisols are deep, finer textured grassland soils that are high in organic matter.

Histosols and Ultisols are sparser in this map. Soils of the Histosols order are dominantly organic, comprised of peats and mucks and found within bogs or fens. A speckling of small bogs and fens, some of which are protected natural areas, are found in Geauga, Portage and Summit counties. A larger concentration of Histosols are found near the town of Celeryville in southwest Huron County. This area once supported a 5,000-acre swamp known as the Willard Marsh (artificially drained in the 1890s). The soils in this area are rich with fertile peat suitable for celery, radish and lettuce farming. Ultisols, found in northwest Huron County, are strongly weathered mineral soils.

PRIME FARMLAND





Prime farmland is land that exhibits ideal physical and chemical characteristics for producing economically sustainable yields of food, feed, forage, fiber and oilseed crops. Characteristics generally include the presence of a sufficient and dependable water supply (through precipitation and irrigation), favorable temperatures, optimal growing season, acceptable pH levels, acceptable salt and sodium content and high soil quality with few or no rocks. High crop yields can be attained through efficient farming practices, including water management. Prime farmland soils are permeable to water (and air) and are not excessively saturated for long durations. The threat of flooding is either nonexistent or soils are adequately protected from flooding. Prime farmland soils are not excessively erodible. This map includes three categories that classify prime farmland: "Prime Farmland," "Prime Farmland, conditional" and "Not Prime Farmland."

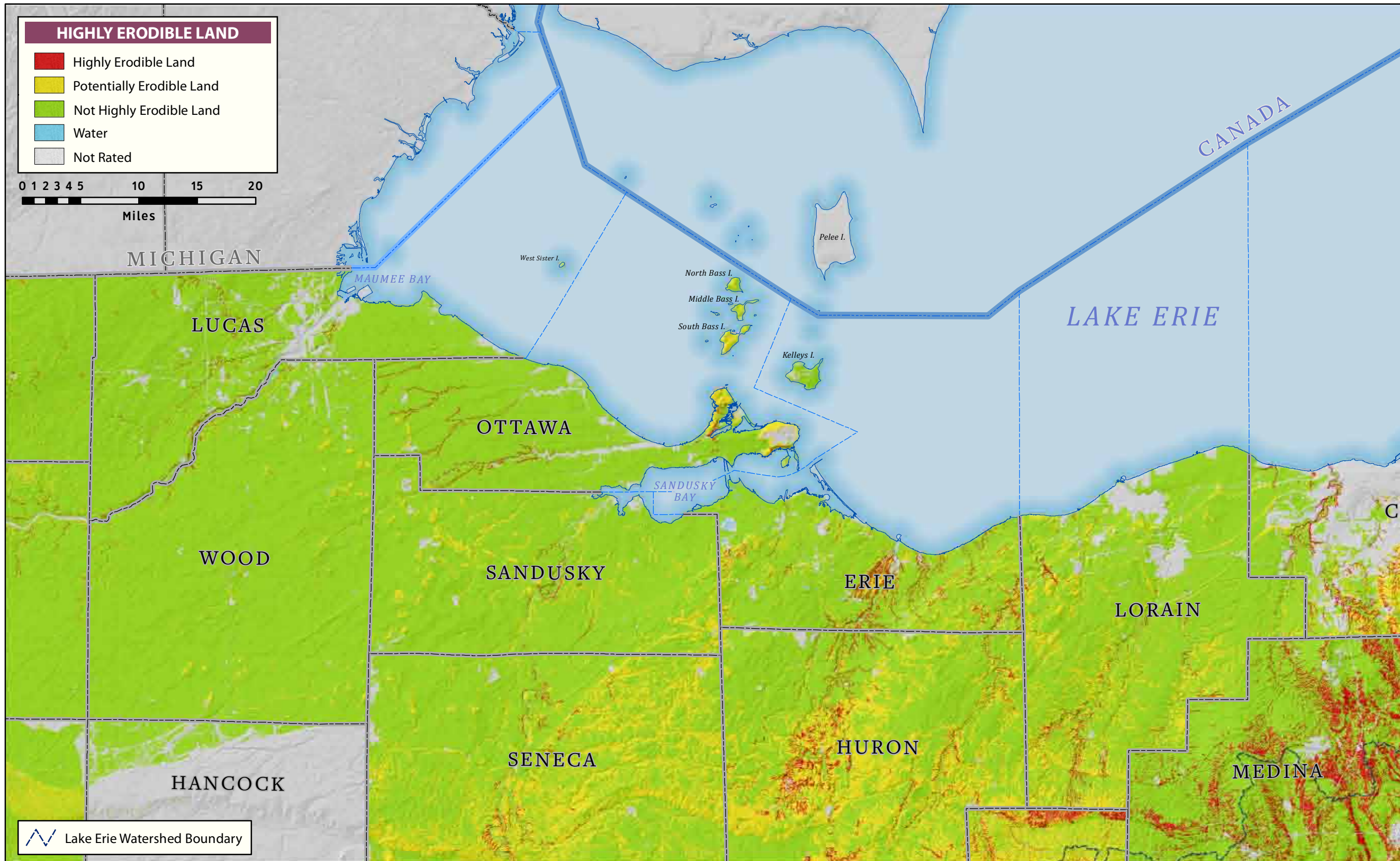
Prime Farmland: This category includes soil units that exhibit prime farmland. The natural conditions of these soil units do not require the implementation of various management practices, such as drainage or irrigation, to meet the criteria for prime farmland. This category also includes "farmland of unique importance" and "farmland of statewide importance."

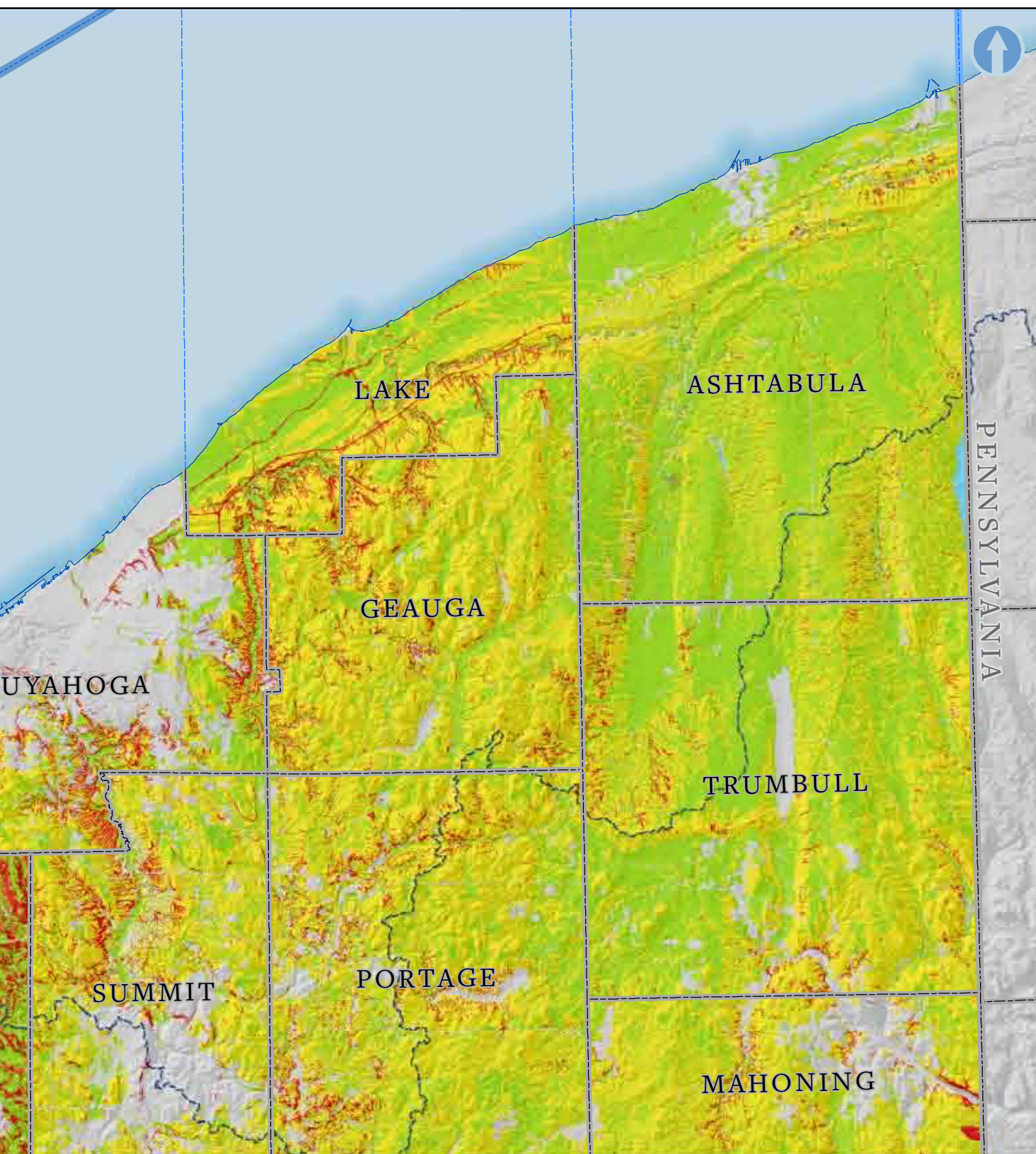
"Unique farmland" is land, other than prime farmland, that exhibits ideal conditions for producing economically sustainable yields of specialty crops, such as citrus, fruits, nuts and vegetables, when properly managed. The presence of a regional microclimate is a common determination for unique farmland classification. A microclimate is a distinctively smaller and locally-influenced climate region within a general climate zone. Lake Erie plays a significant role with the existence of a regional microclimate by prolonging seasonal temperature changes. A lake-influenced microclimate lengthens the growing season for many specialty crops, such as apples, grapes and peaches, and allows for productive wine-producing regions in northern Ohio (Lake Erie Islands and the Grand River Valley). Farmland that does not meet the criteria for "prime" or "unique" may be considered "farmland of statewide importance" by a state agency due to its high crop production (when implementing acceptable farming practices under favorable conditions).

Prime Farmland, conditional: This category includes soil units that exhibit prime farmland conditions if drained, irrigated and/or are either protected from flooding or do not frequently flood during the growing season. Most areas in the western mapped counties, where soil components are mostly or partially hydric (see map on page 198), meet criteria for prime farmland as long as subsurface drainage or surface drainage has been provided.

Not Prime Farmland: This category includes soil units that do not exhibit prime farmland conditions. These soils are common in urban and developed areas, such as Lucas and Cuyahoga counties. Soils that cannot efficiently drain water, soils with insufficient moisture holding capacity and soils with more than six percent slope also do not meet prime farmland criteria.

HIGHLY ERODIBLE LAND





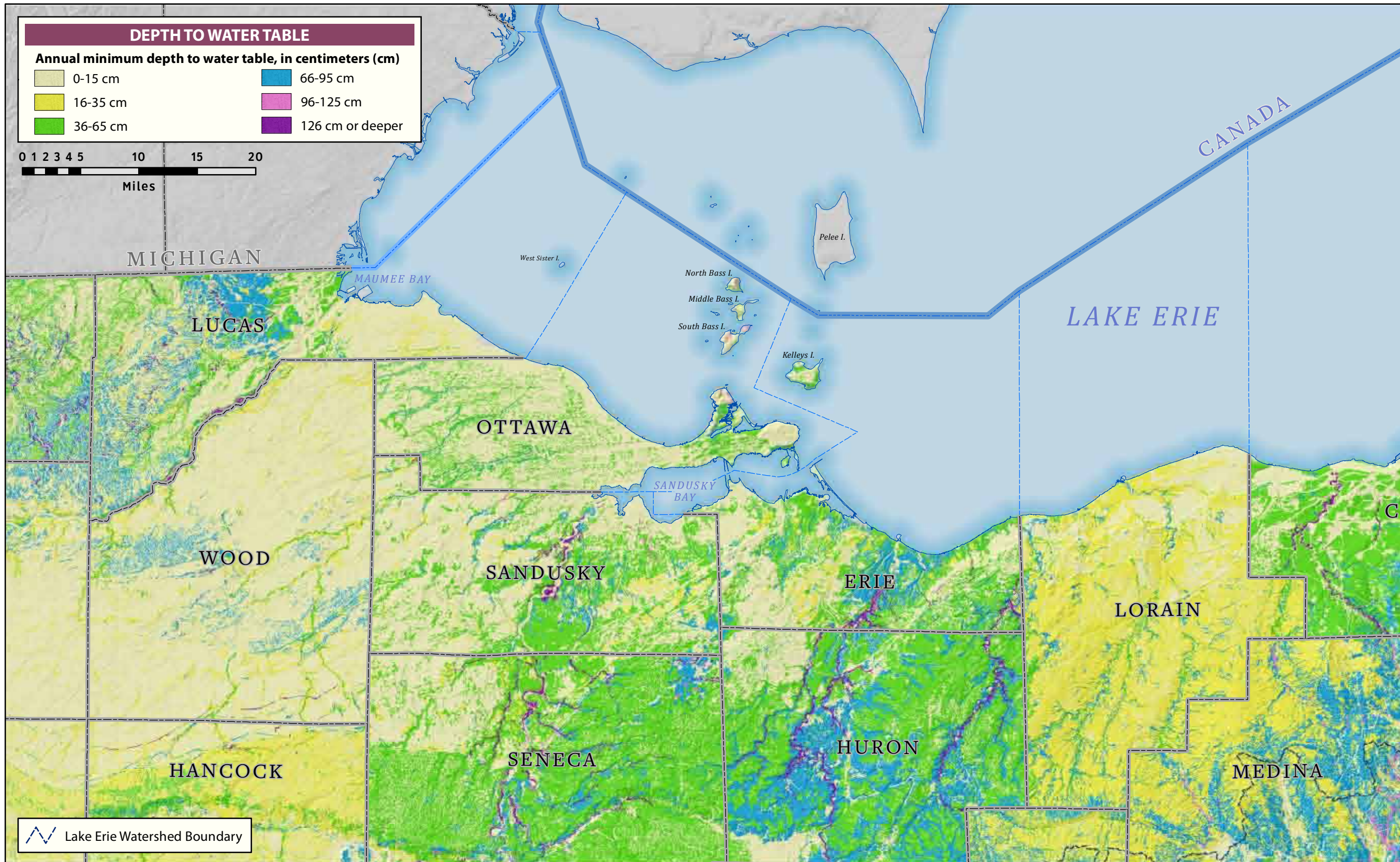
Soil erosion is a naturally occurring form of soil degradation that affects all landforms. Natural physical forces that contribute to annual soil loss and soil erosion include water and wind. Farming activities, such as tilling and cropping, can accelerate soil degradation.

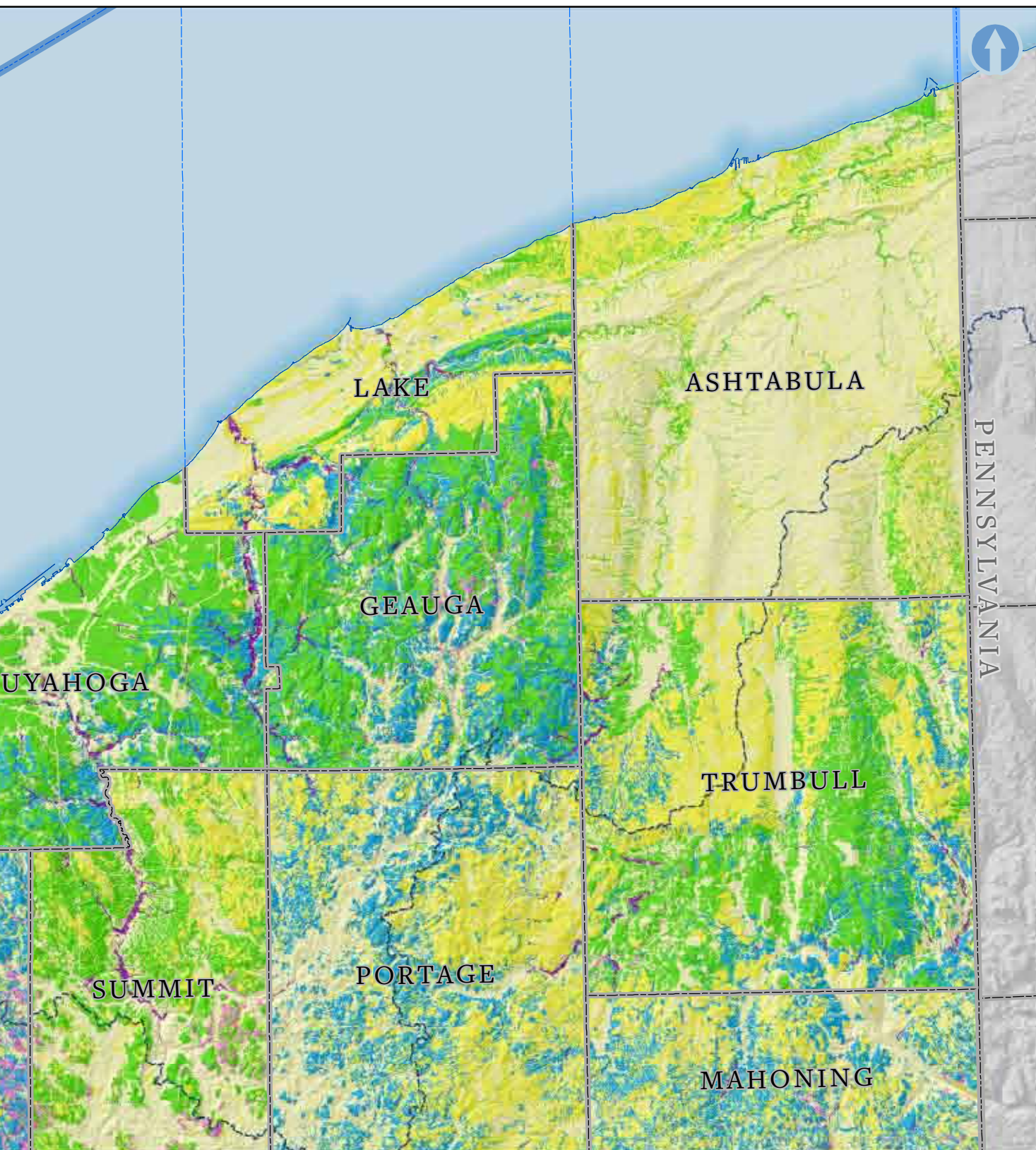
There are four main forms of soil erosion caused by rainfall and subsequent surface water runoff: splash erosion, sheet erosion, rill erosion and gully erosion. **Splash erosion** (least severe) occurs as raindrops hit the soil. The energy of falling raindrops can break down and separate the aggregate materials that make up the soil. If the soil becomes overly saturated due to high rates of precipitation, surface runoff occurs. As a result, lighter aggregate materials, such as very fine sand, silt, clay and organic matter, are easily removed through **sheet erosion**. Transport of loosened soil material is potentially increased where runoff flows and slope gradients are greater. Soils lacking vegetation (or crops) are more susceptible to sheet erosion. **Rill erosion** occurs when concentrated surface runoff transports loosened soil material through shallow ephemeral drainage channels, called rills. Farm equipment can be used to remove rills. **Gully erosion** (most severe) occurs when surface runoff rapidly transports loosened soil material through drainage channels that are much deeper than rills. Substantial flow rates will gradually increase the size of the gully if restoration or stabilization measures are not applied.

There are three types of soil erosion caused by wind: suspension, saltation and creep. **Suspension** occurs when very fine soil particles are lifted high into the air and transported over long distances. **Saltation** occurs when fine-to-medium sized soil particles are briefly lifted into the air, carried a short distance and dropped back to the soil surface. **Creep**, or surface creep, occurs when larger soil particles—too heavy to be lifted into the air—roll across the soil surface. Wind-distributed particles disperse unevenly across the landscape and can wear away at the soil surface, which increases erodibility. The loss of topsoil due to wind reduces rooting depth and can affect crop yield. Wind mainly disturbs sandy soils and organic soils; however its threat can be widespread during a drought.

Highly erodible land (HEL) is land that can erode at excessive rates and where erosion control efforts should be concentrated (especially in agricultural lands). Highly erodible soil units have a maximum potential for erosion that equals, or exceeds, eight times the tolerable rate, or “T value,” per the erodibility index. The erodibility index is based by factoring the effects of slope and soil type, rainfall intensity and land use. This map shows soil units that meet, potentially meet, and do not meet HEL criteria. The highly erodible land designation does not account for outside influences that contribute to erosion in coastal environments (i.e. along the Lake Erie shore), such as waves and water level fluctuations.

DEPTH TO WATER TABLE





The water below the surface of the land that permeates the pores between soils and sediments and within fractures of underlying rock is called **groundwater**. The space that groundwater saturates is called the “phreatic zone,” or “zone of saturation.” The unsaturated space between the surface of the land and the zone of saturation is called the “vadose zone.” The **water table** marks the upper limit of the zone of saturation and the lower limit of the vadose zone. Within the zone of saturation, layers of unconsolidated glacial material and permeable rock that yield groundwater are called “**aquifers**” (see Chapter 10: Water Resources, page 222).

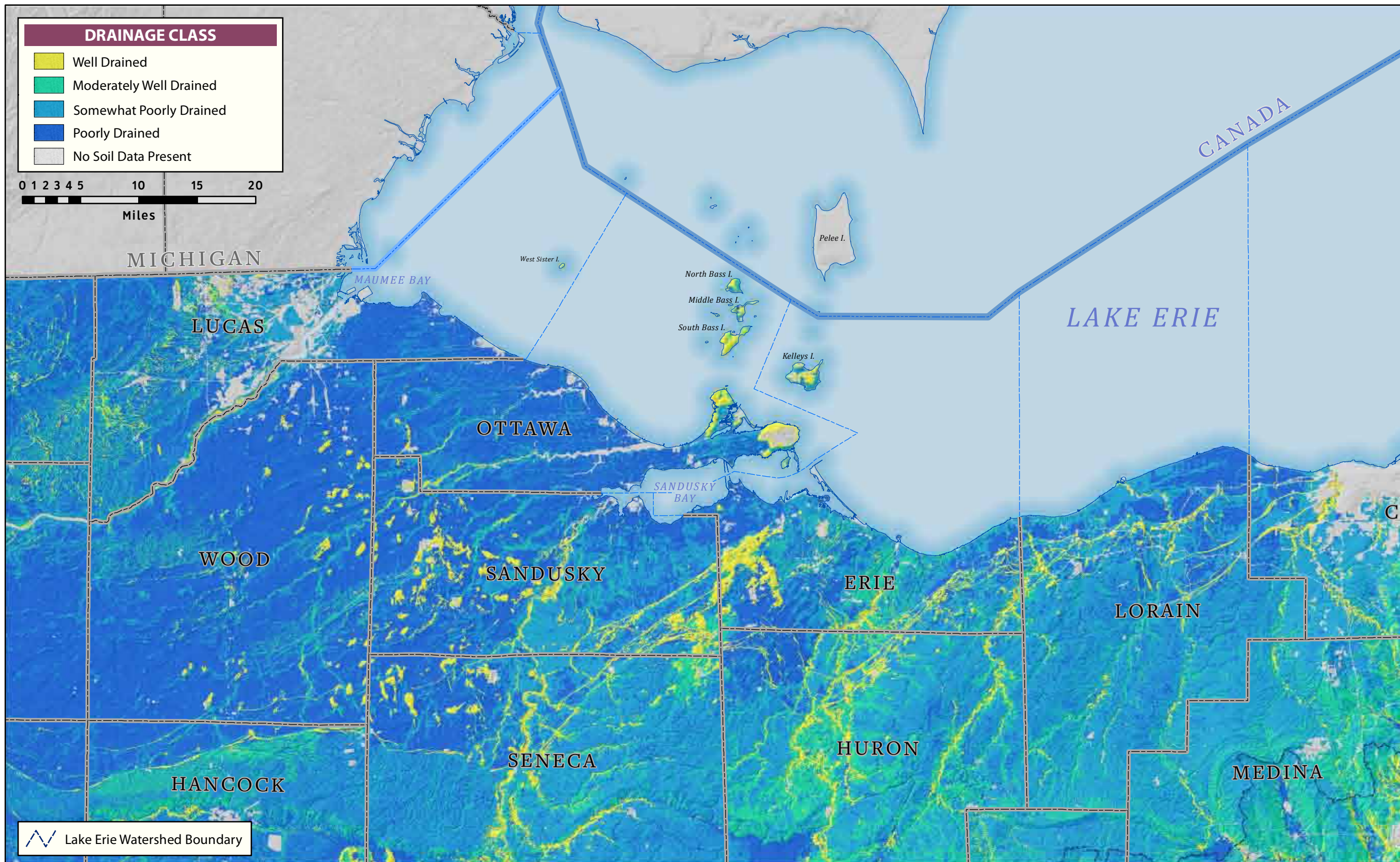
This map illustrates the annual minimum depth to the water table (in centimeters below the surface), or the shallowest depth (of the vadose zone) to a wet soil layer at any time during the year. Water tables are not perfectly flat or horizontal, but rather, in most cases, follow the general profile of the surface topography. Depth to the water table fluctuates depending on the time of year. In Ohio, the water table may fluctuate a few feet between wet and dry seasons. Water that infiltrates the ground from melting snow in late winter and from spring precipitation causes the water table to rise. The water table drops during summer months due to evapotranspiration, which is the cumulative result of evaporation caused by hotter and drier weather conditions and plant transpiration (the movement of water into the atmosphere through water-dependent vegetation).

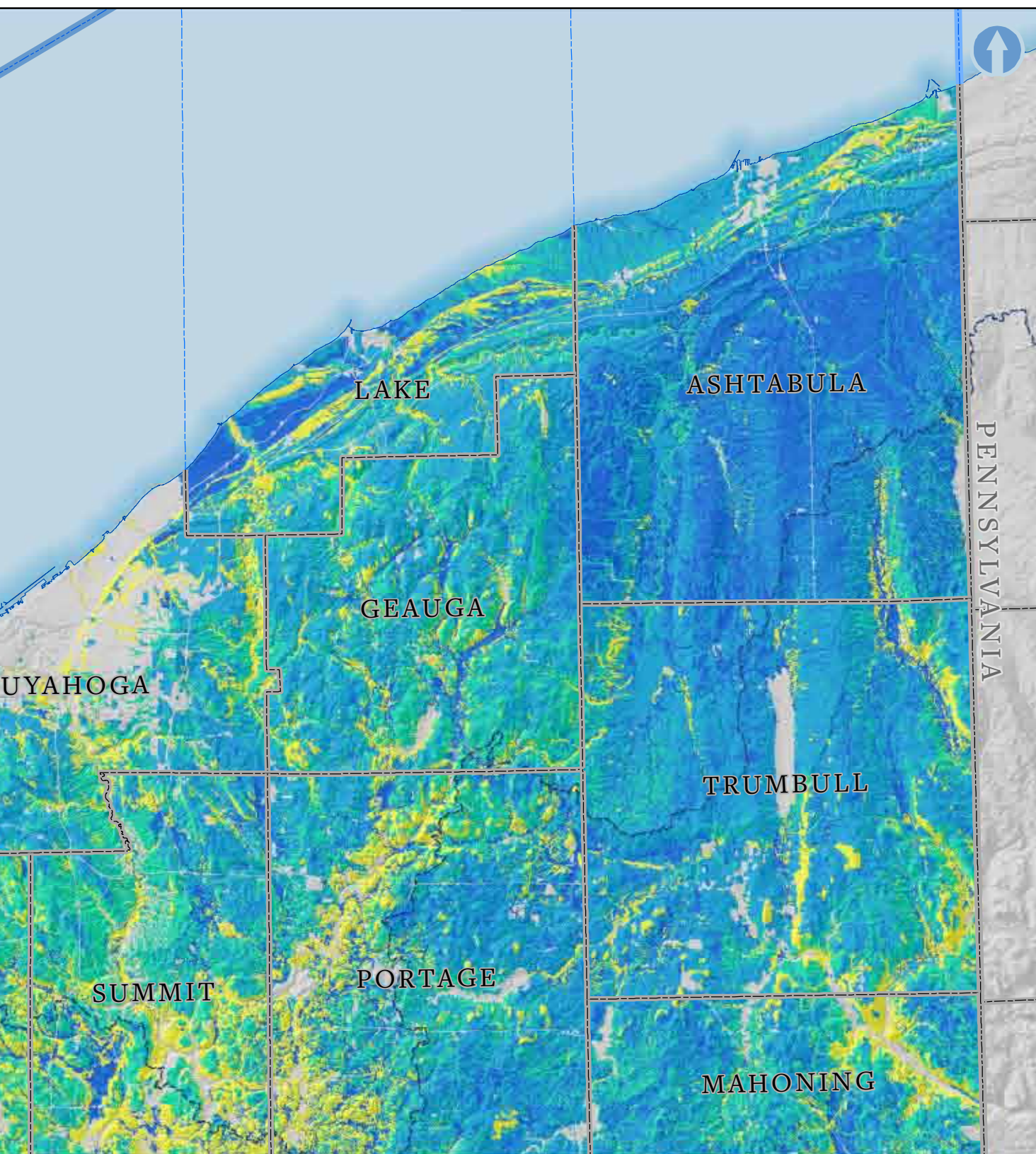
Groundwater is an important resource that provides drinking water and water for agricultural purposes. Excessive pumping can lower the water table and lead to groundwater depletion. As the zone of saturation lowers, property owners may need to deepen wells or drill new wells. Groundwater that is not lost to evapotranspiration or excessive pumping may also discharge into bodies of surface water, such as streams and lakes. Springs may occur where the water table intersects the surface or steeper terrains.

In general, soils that are poorly drained have very high water tables and are frequently ponded. While a high water table is important for wetland productivity, its presence may limit agricultural practices and address the need for artificial drainage. Depth and duration of the water table are important variables for nutrient and crop management. A high water table is not suitable for basement or underground installations. The presence of impervious surfaces, such as parking lots, can negatively affect and lower the water table, as surface water is directed away from the zone of saturation.

Depth to water table is one of seven factors for evaluating groundwater pollution potential (see map on page 240). Potentiometric surface maps show the direction and gradient of groundwater flow (see map on page 238).

DRAINAGE CLASS





Natural drainage class specifies the frequency and duration of soil wetness and degree of saturation under natural, undisturbed conditions similar to before the soil was developed. Soil drainage is an important variable for identifying groundwater aquifers and recharge areas. It can be based on soil color patterns, soil textures and the presence or absence of a high water table. Understanding natural soil drainage is useful for determining areas suitable for agriculture, conservation or development. The Natural Resources Conservation Service identifies seven natural drainage class mapping categories: excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained and very poorly drained. Since soil map units are not homogenous, drainage class categories indicate dominant drainage characteristics. For simplification purposes, drainage classifications in this map are grouped into four categories: well drained, moderately well drained, somewhat poorly drained and poorly drained.

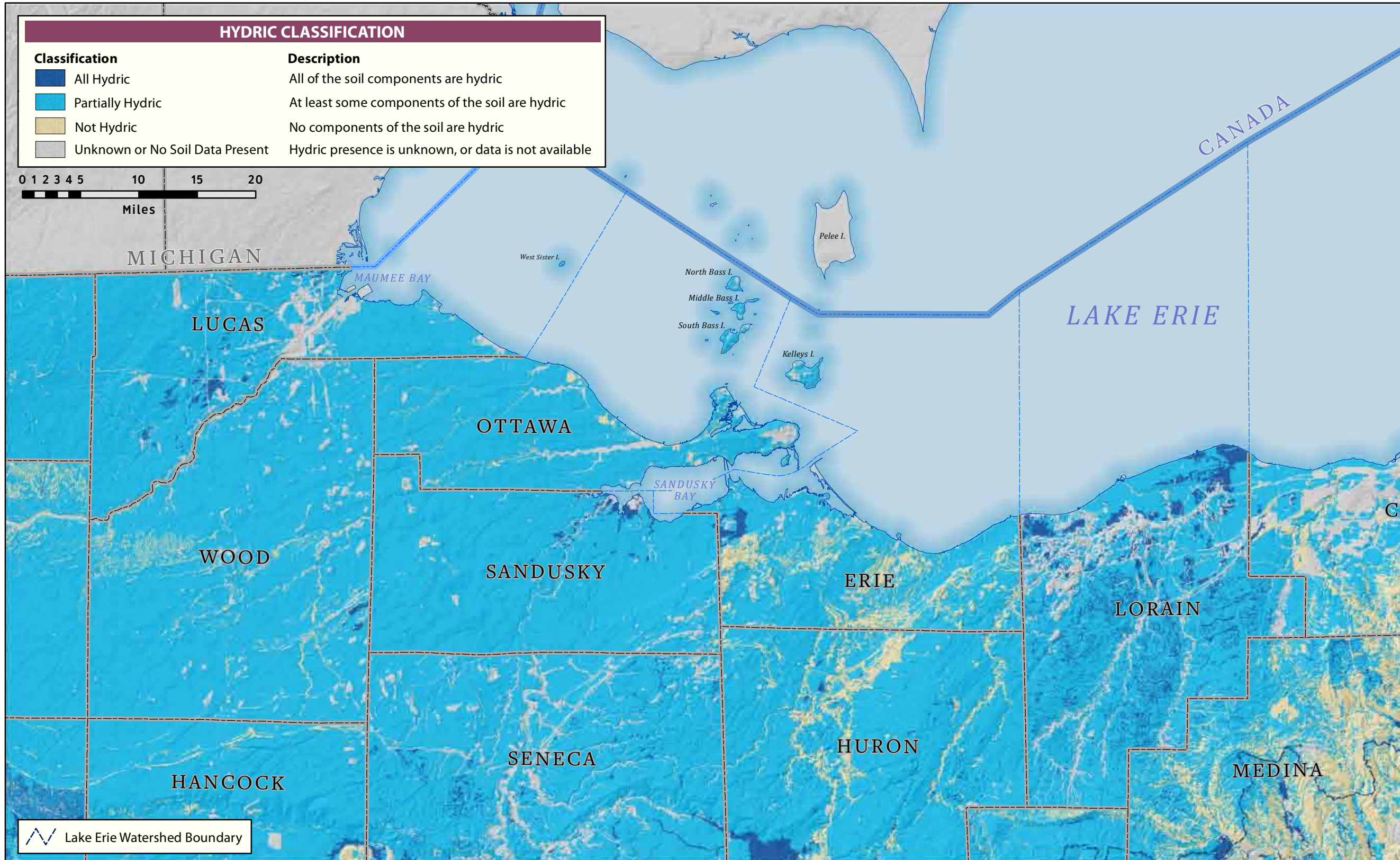
Well Drained: This category includes excessively drained, somewhat excessively drained and well-drained soils. Drainage in this group ranges from readily to rapidly. The occurrence of internal free water is deep to very deep and very rare if soils are somewhat excessively drained or excessively drained. Water is available to plant life for most of the growing season, but the wetness of well-drained soils does not significantly inhibit the growth of root systems. Somewhat excessively drained and excessively drained soils are commonly coarse-textured, sandy, rocky or shallow and are very permeable. These soils are often found in steep terrains, such as river valleys and beach ridges.

Moderately Well Drained: Water is drained from the soil somewhat slowly during parts of the year. The occurrence of internal free water is moderately deep and can range from temporary to permanent. Moderately well-drained soils are wet for only short periods of time during the growing season, but can still provide adequate amounts of water to most mesophytic crop plants, such as corn and wheat.

Somewhat Poorly Drained: Water is drained from the soil slowly, resulting in significantly wet soil at shallow depths during much of the growing season. Substantial soil wetness limits mesophytic crop growth unless artificially drained. The occurrence of internal free water is shallow to moderately deep and can range from temporary to permanent. Somewhat poorly drained soils often have slowly permeable limiting layers and/or a high water table.

Poorly Drained: This category includes poorly drained and very poorly drained soil. Drainage in this group occurs at such a slow rate that free water remains at or above the ground surface during much of the growing season. The occurrence of internal free water is very shallow and persistent or permanent. Extensive soil wetness greatly limits most mesophytic crop growth unless artificially drained. Heavily saturated poorly drained soil conditions occur when significant or nearly-continuous rainfall and/or additions of water from nearby areas equal or exceed its removal.

HYDRIC CLASSIFICATION





Hydric soils form under conditions of saturation, flooding or ponding for periods long enough during the growing season that anaerobic conditions develop in the upper part of the soil. Most soils are aerobic, meaning they consume oxygen and carbohydrates while releasing carbon dioxide. When fully saturated, all pores in the soil are filled with water and lack air. Anaerobic soils do not have the ability to consume oxygen. Under natural conditions, these soils can support the growth and reproduction of wetland vegetation. Plants with the ability to adapt to saturated, anaerobic soils are called “hydrophytes.”

Hydric soils are poorly to very-poorly drained. In locations where artificial protection structures (e.g. dikes or levees) or drainage systems have been installed, soils that were developed under hydric and anaerobic conditions in the upper part may no longer experience similar wet conditions. Regardless of such alterations, drained soils are still considered hydric.

There are three classifications of hydric soils illustrated on the map—“All Hydric,” “Partially Hydric” and “Not Hydric.”

All Hydric: All soil components are hydric.

Partially Hydric: At least some components of the soil are hydric.

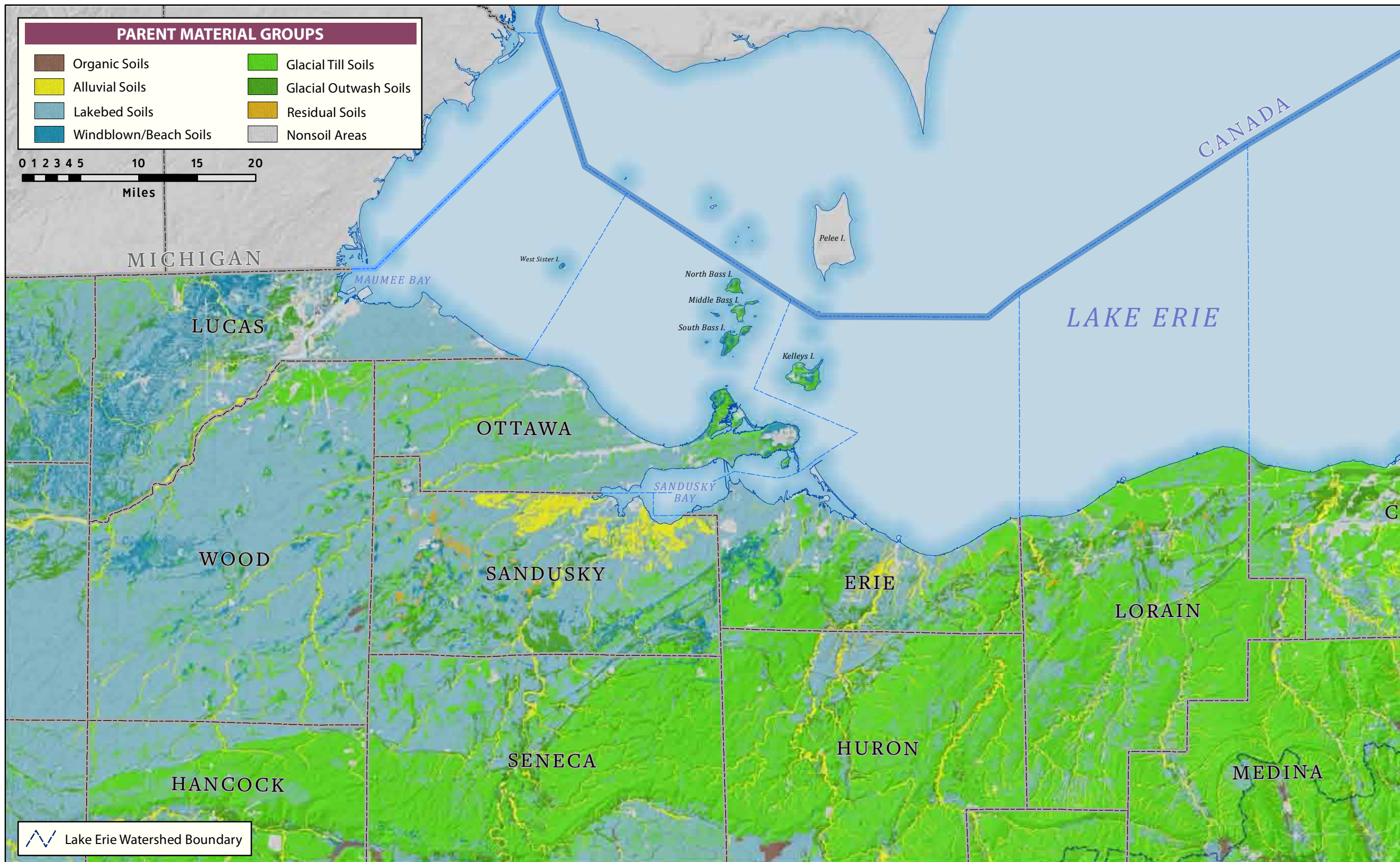
Not Hydric: No components of the soil are hydric.

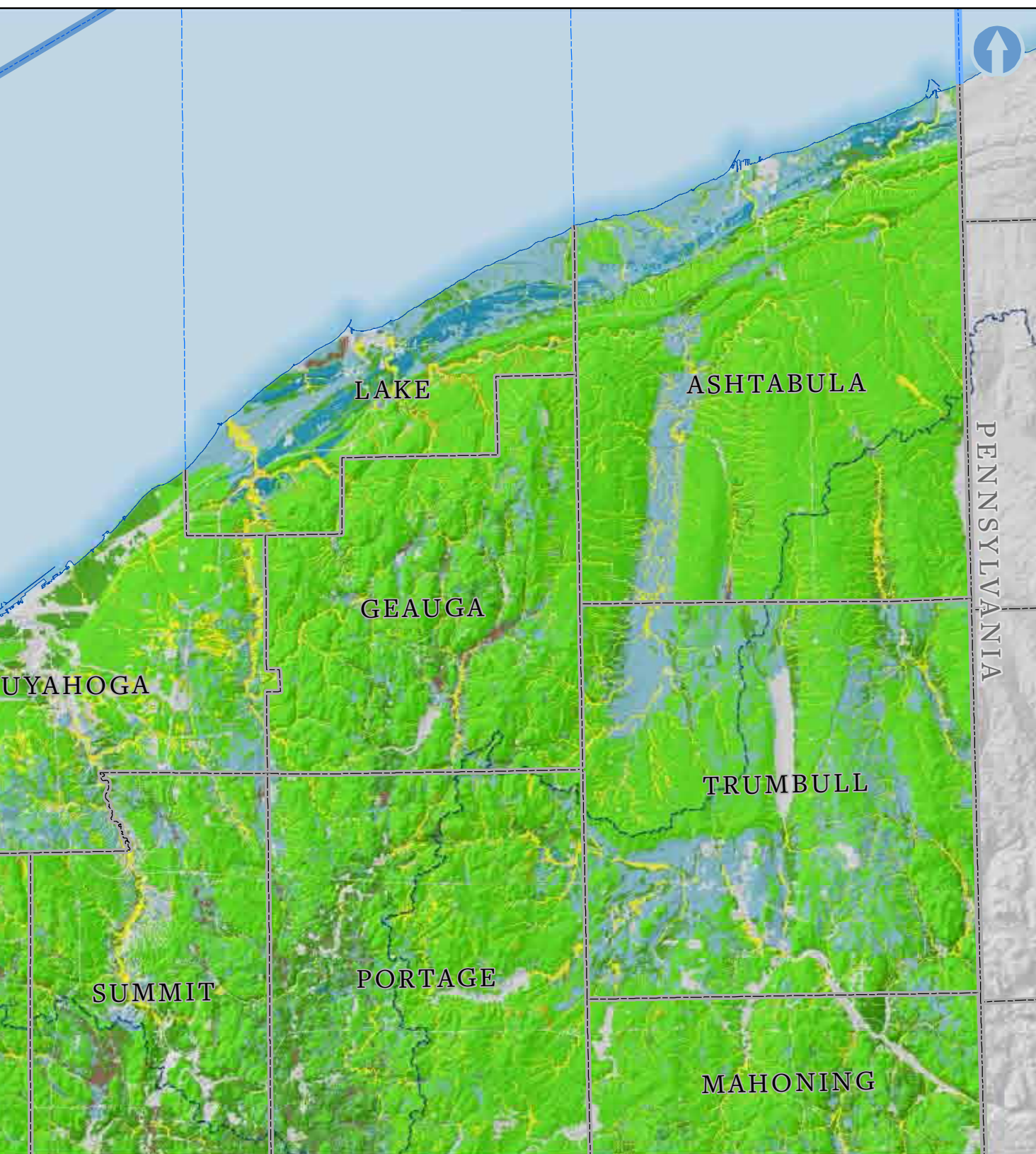
A fourth category, “Unknown,” is also displayed on the map. This category shows where hydric soil conditions are unidentifiable or where soil data are not present.

Areas that have a high water table or are prone to flooding or ponding are more likely to have saturated and potentially hydric soils. Flood plains, seeps and the coastal plain are all landscapes that may contain hydric soils. This map shows that a high percentage of areas in the Lake Erie Watershed, particularly within several miles of the coast, meet hydric criteria. The distribution of hydric soils in Ohio’s coastal region often indicates former wetland areas at the time of European settlement (see map on page 68). The percentage of hydric soils is less common in urban areas where poorly-drained and very poorly-drained soils have been paved over or built on. Soils that are not hydric are found in well-drained and moderately well-drained areas with steep terrain, like river valleys, and in areas with undulating terrain.

There are numerous agricultural and nonagricultural applications for hydric soils, including land use and conservation planning, and assessing areas suitable for on-site waste disposal systems and potential wildlife habitat. While the presence of a high, long-lasting water table may produce soils that are too saturated for farming, appropriate alterations such as drainage ditches or tiles can make hydric soils very favorable for agricultural practices. This is especially the case in Ottawa, Sandusky, Wood and eastern Lucas counties and in other areas of northwest Ohio that were once inundated by the Great Black Swamp (see map on page 70).

SOILS BY PARENT MATERIAL





Parent material is the underlying material, mineral or organic, from which soil forms. Many soil properties relate to parent material, including density, chemical content, structure and the proportioning of sand, silt and clay. Parent material is categorized by how it was transported to its current location. Means of sediment transport include ice (*), water (♣), wind (W) and gravity (none mapped).

(*) **Glacial till soils** are unsorted (vary in size) materials that were mixed, crushed, compressed and transported by the movement of glaciers. Till ranges in texture and can be slowly permeable below the surface. If properly drained, glacial till is generally well-suited for row crops. Till soils are extremely prominent in the Lake Erie Watershed.

(♣) **Glacial outwash** is a broad term for water-deposited materials that were transported by glacial meltwater. Outwash may occur in large plains, within valleys or in proglacial deltas.

(♣) **Alluvial soils**, or “**alluvium**,” are fine-grained materials (sand, gravel, silt or clay) that have been eroded and redeposited by flowing water. Alluvial deposits are most common over flood plains, near streams or in river beds. These soils have many limitations due to flooding frequency, however if properly drained and managed are typically productive for farming.

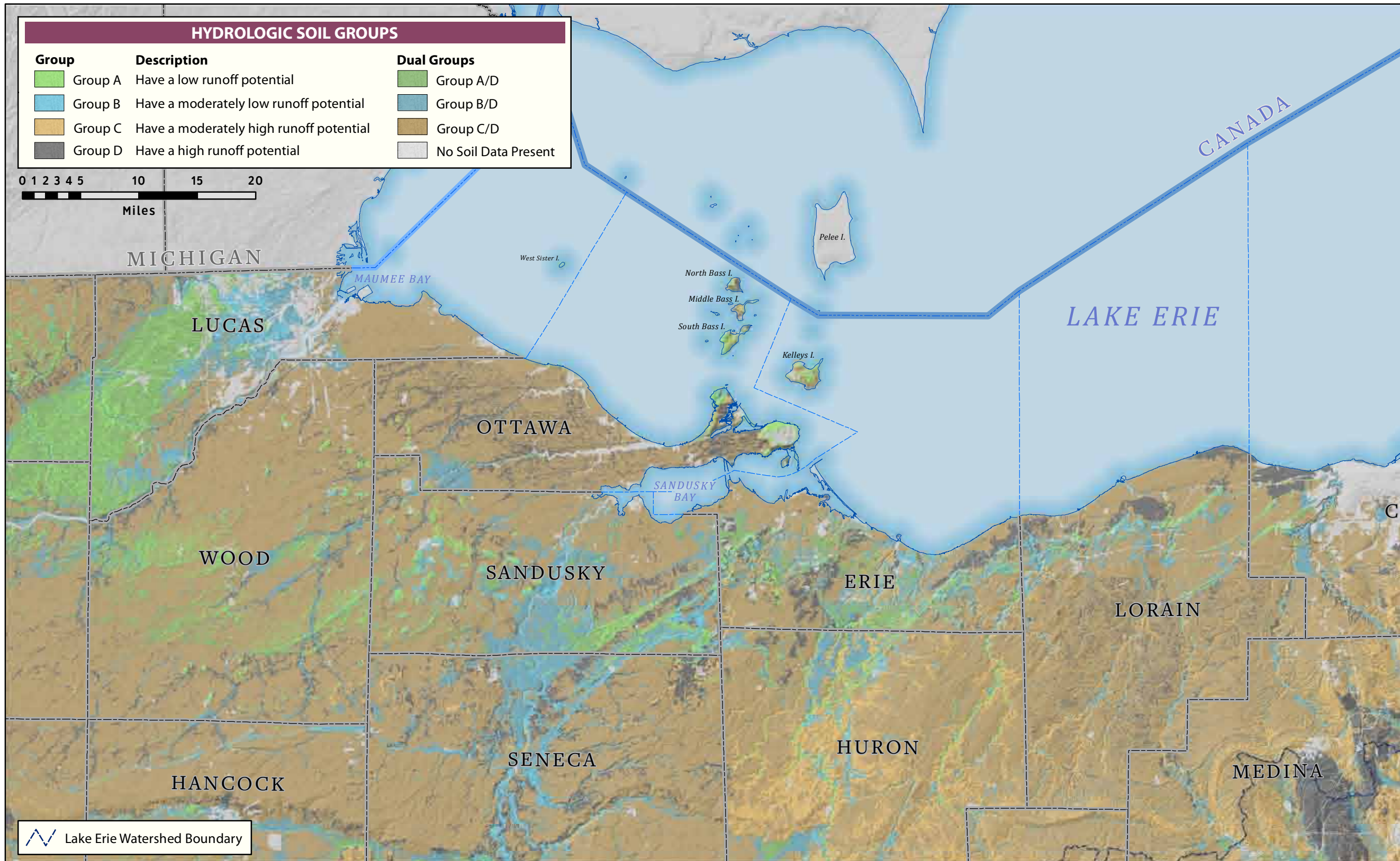
(♣) **Lakebed soils**, or “**lacustrine**” soils, are relatively uniform-textured materials that were established in lake bottoms. Lakebed sediments are prevalent in Ohio’s flat western landscapes and also in northeast Ohio’s low-lying lake plain. These soils were deposited during the prehistoric stages of Lake Erie’s formation. Most soils in this group, if properly managed and drained, are very productive for farming.

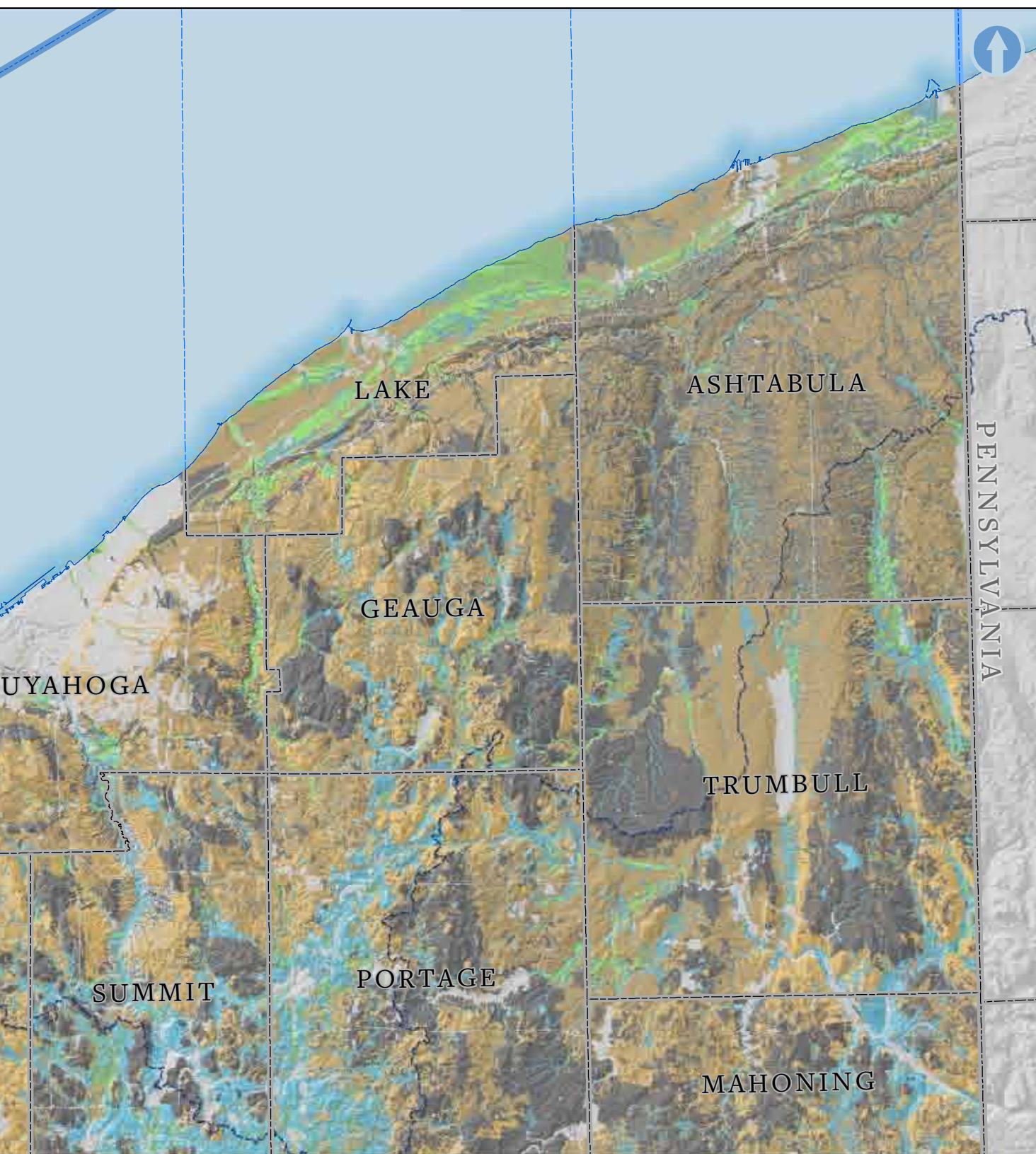
(W) Windblown materials, or “**eolian**” deposits, consist primarily of sand or silt-sized particles. Sand deposits are typically uniform in size. Sand dunes often form as eolian deposits accumulate (e.g. the Oak Openings region in western Lucas County and in adjacent counties). Wind-transported beach deposits in the Lake Erie Watershed are also prevalent and mark the former shorelines of Lake Erie’s proglacial stages.

The organic matter component of soil consists of decomposing plant and animal remains. Organic soil matter is rare but significant. It can influence plant growth through physical and chemical impacts on soil properties. As organic matter increases in soil, so does the availability of water, tilth (the physical condition of soil in relation to its suitability for planting crops), water movement and nutrients. Organic matter also increases the soil’s ability to filter pollutants and resist erosion.

Residual soils, or “**residuum**,” are formed due to the weathering of bedrock material, e.g. sandstone or shale, and are sparsely distributed in the coastal region. “Nonsoil areas” include areas where soils have been disturbed (urban development, industrial activity, highway construction, etc.) or are permanently submerged.

HYDROLOGIC SOIL GROUPS





The Natural Resources Conservation Service classifies hydrologic soil groups based on estimates of runoff potential. Runoff is the draining away of water from the surface of the ground. Soils in the United States are assigned to one of four hydrologic groups: Group A, Group B, Group C and Group D; where Group A soils commonly have the lowest runoff potential and Group D soils have the greatest runoff potential. Factors used to determine hydrologic soil groupings include, the water infiltration rate (rate at which water permeates the ground) when soils are not protected by vegetation, period of saturation and amount of water received from long-duration storms.

Group A: These soils consist of deep, well-drained to excessively drained sands, gravelly sands, loamy sands and sandy loams. Group A soils have the lowest runoff potential and highest infiltration rates when thoroughly saturated. These soils have a high rate of transmission (the rate at which water moves through the soil).

Group B: These soils consist of moderately-deep to deep silt loams or loams that are moderately-fine to moderately-coarse in texture. Group B soils are generally well-drained, have a moderately low runoff potential and have moderate infiltration (when thoroughly saturated) and transmission rates.

Group C: This group consists primarily of soils with a layer that impedes the downward movement of water and/or soils that are moderately-fine to fine in texture. These include sandy clay loams. Group C soils have a slow infiltration rate when thoroughly saturated as well as a slow transmission rate. They also have a moderately high runoff potential.

Group D: This group consists of clayey soils with high shrink-swell potential (soil expansion when wet, soil retraction when dry), soils with a high water table, soils with a claypan or clay layer at or near the surface and shallow soils over a nearly impervious material. These include clay loams, silty clay loams, sandy clays, silty clays and clays. Group D soils have the highest runoff potential and lowest infiltration rates when thoroughly saturated. These soils have a very slow rate of water transmission.

There are also three dual hydrologic soil groups: Group A/D, Group B/D and Group C/D. With these classifications, the first letter, A, B or C, represents the drained areas and the second letter, D, represents the undrained areas. Dual hydrologic groups occur when soils are assigned to Group D based on the presence of a high water table, but water transmission rates are high.

Hydrologic soil groups are no longer applicable in highly urbanized or quarried areas where the soil profile has been significantly altered.