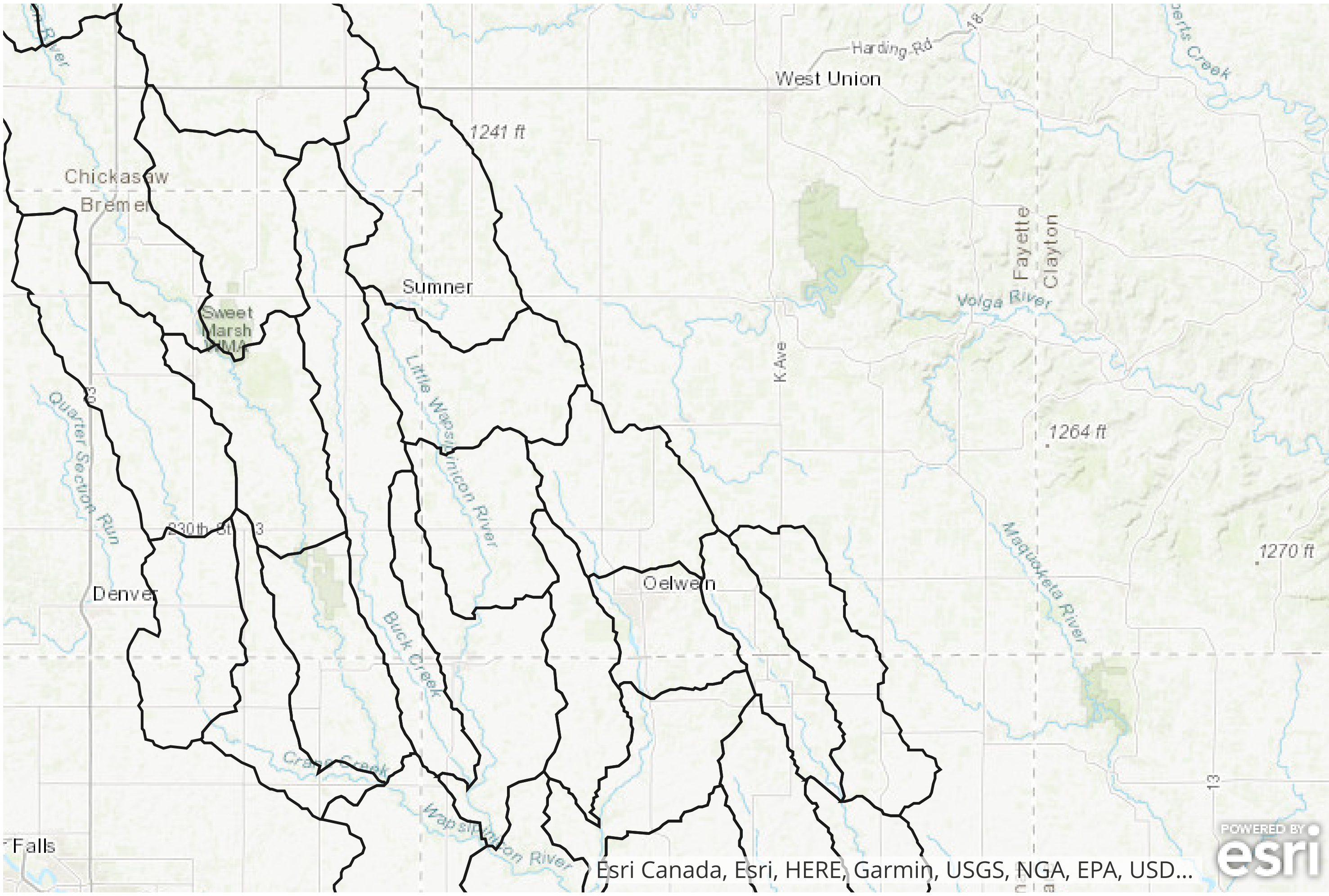
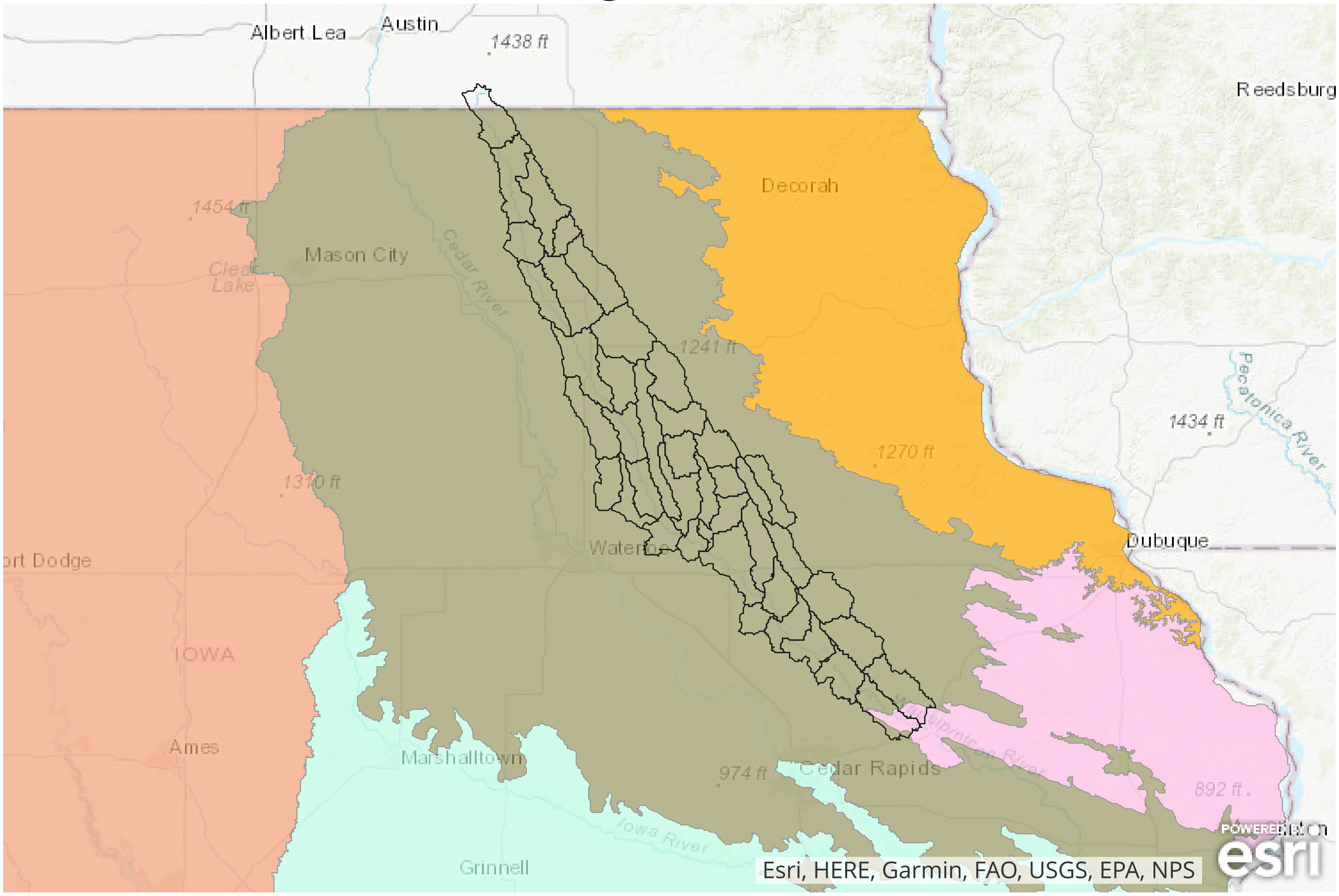
Geography and Geology

This story was made with [Esri's Story Map Journal](#).
Read the interactive version on the web at https://arcg.is/1TuC4f.



Geology, land forms and land features are extremely important components of any watershed. They influence everything from soils, land use, surface and subsurface stormwater flow and infiltration, to water quality, hydrology, flooding, and watershed resiliency. They also create and influence critical areas where water interacts with and mobilizes contaminants, including non-point and point source contributions to surface water bodies. As a result, where and how nutrients, bacteria and/or pesticides are mobilized to reach surface water can be better understood through a careful study of subsurface hydrology, or hydro-geology, which, according to the Iowa Geological and Water Survey Bureau, *"allows better identification for sources, pathways and delivery points for groundwater and contaminants transported through the watershed's subsurface geological plumbing system."*

Iowan Surface Landform Region



HUC12_lookup

Upper Wapsipinicon

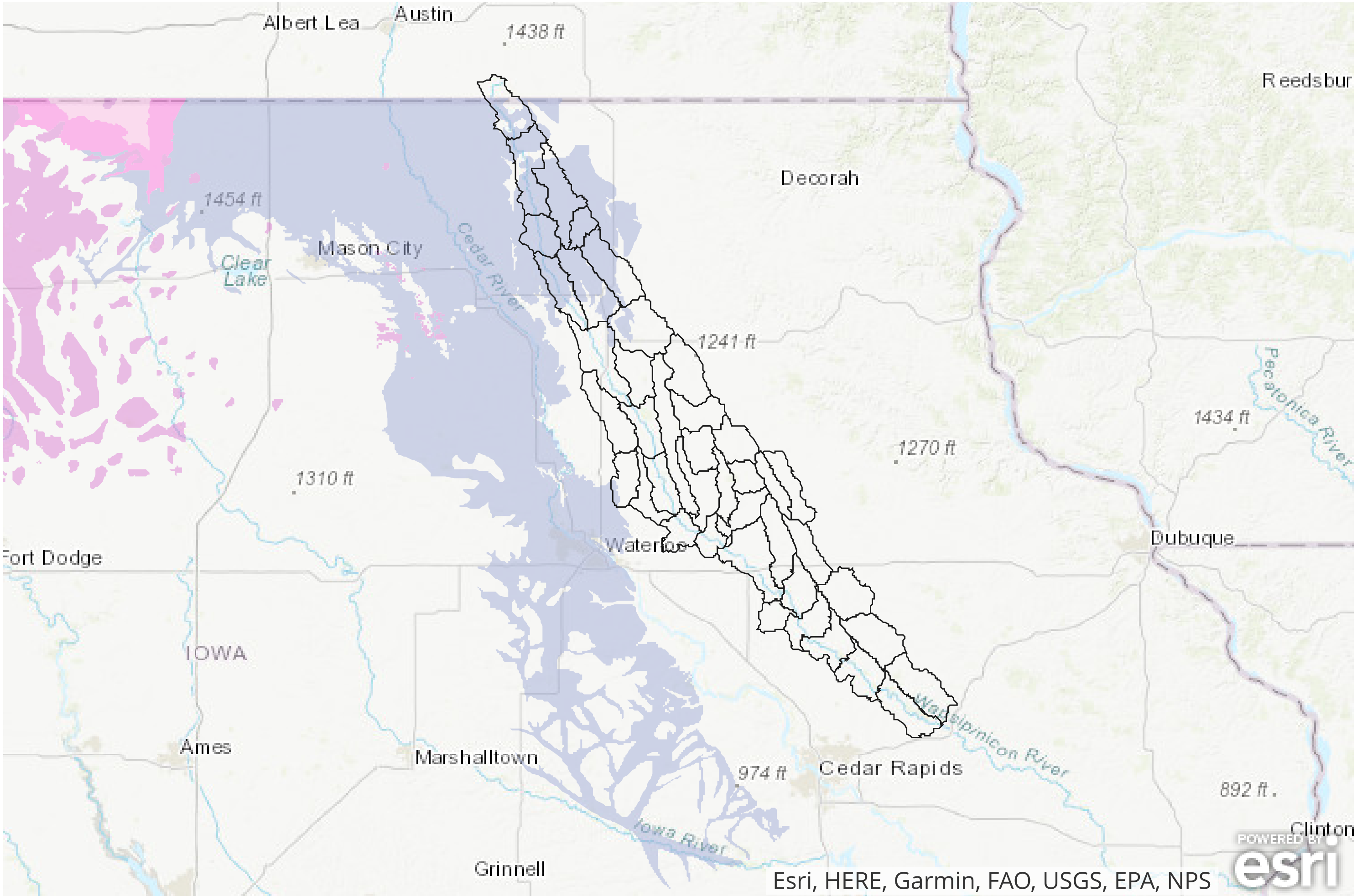
Iowa_Landforms

- Des Moines Lobe
- East-Central Iowa Drift Plain
- Iowa-Cedar Lowland
- Iowan Surface
- Loess Hills
- Mississippi River Alluvial Plain
- Missouri River Alluvial Plain
- Northwest Iowa Plains
- Paleozoic Plateau
- Southern Iowa Drift Plain

The UWR Watershed is located within the Iowan Surface Landform region. Some of the more prominent characteristics of this landform region are listed below. They and others are described in more detail by the Iowa Geologic Survey.

- The land surface has a slight inclined, with gently rolling, long slopes, low relief, and open views to the horizon.
- Drainage networks are well established, though stream gradients are usually low.
- There are some scattered areas of poor drainage where wetlands historically occurred.
- The last glaciation in this region occurred in Pre-Illinoian time and since then it has lain exposed to various episodes of weathering and soil development, erosion, and loess deposition.
- Erosion on a large scale is the key to the geological origins of the Iowan Surface.
- Fossil remains of arctic and subarctic species have been recovered from organic-rich sediment in glacial deposits.
- Loess could not accumulate on the rapidly evolving landscape in the face of the extensive corrosive erosion activity.
- More resistant pebbles and cobbles are a commonly observed stratigraphic feature where road cuts or quarries expose cross-sectional views of the eroded drift surface and the thin loess or loamy sediment that may cover it.
- Fieldstones, also known as glacial erratics, are common.
- Smaller erratics continue to work upward to the land surface during seasonal freezes and thaws. Farmers in some areas of the watershed haul them to unused field corners or pile them along fence lines.
- Some pastures in Chickasaw, Bremer, Butler, Buchanan, and Black Hawk counties exhibit an undisturbed boulder-strewn landscapes.
- There are 11 mapped pahas in the UWR Watershed.

Groups and Formations



HUC12_lookup

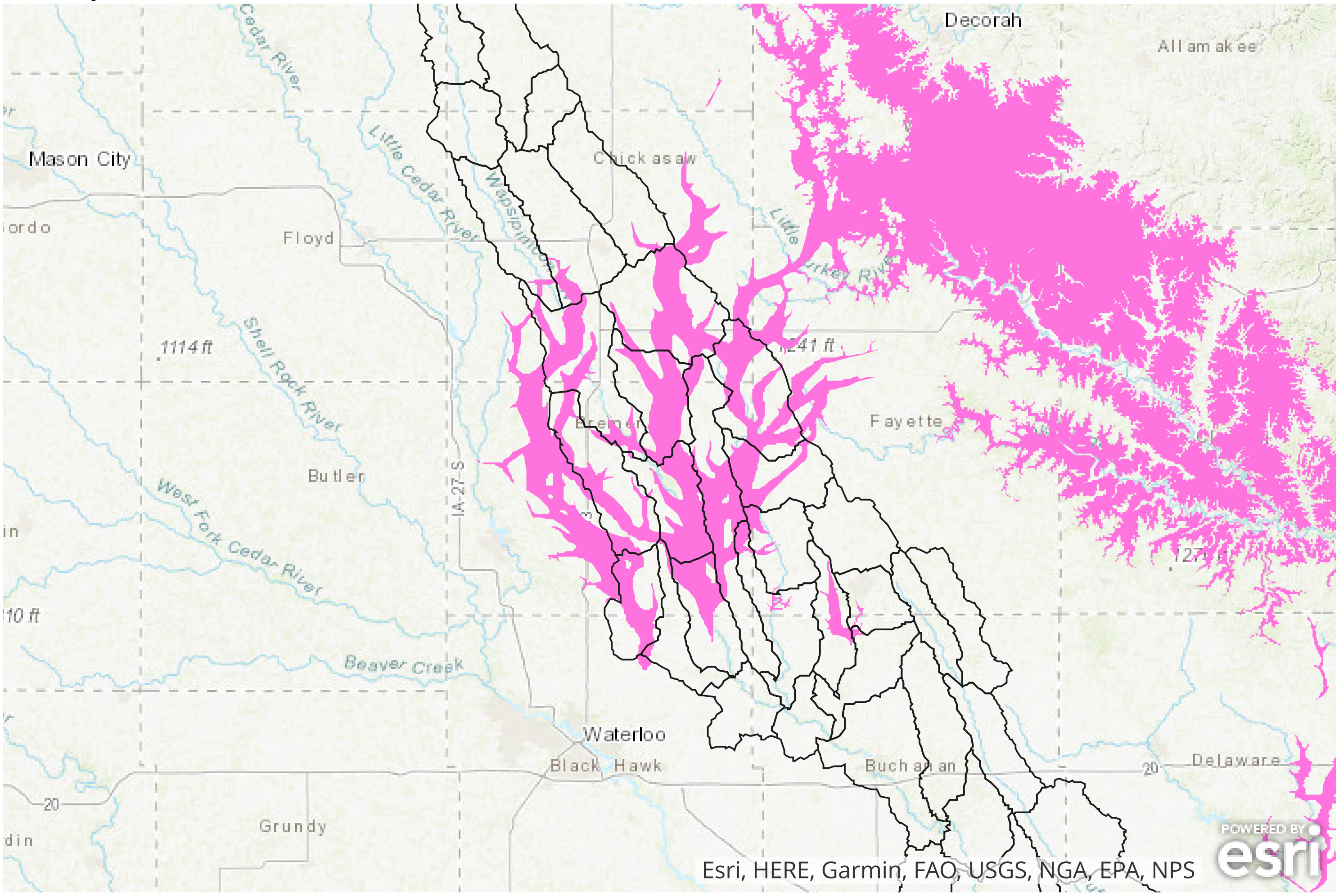
- Upper Wapsipinicon

Bedrock Formation Unit Name

- lower Cherokee Group
- Scotch Grove Formation
- Cedar Valley Group
- Dakota, Windrow
- Wapsipinicon Group
- Gower Formation
- Maquoketa Formation
- Galena Group and Platteville Formation
- Hopkinton, Blanding, Tete des Morts, Mosalem
- LaPorte City Formation
- Waucoma Formation
- Other

Although the UWR Watershed is within the Iowan Surface Landform Region, there are additional considerations regarding specific geologic “groups” and “formations” associated with the UWR Watershed. The International Commission on Stratigraphy (ICS) has established a set of conventions for grouping, describing, and naming sedimentary rock units. They note that a “formation” is a series of beds that are distinct from others that are below and above it and the thickness of a formation may range from less than a meter to several thousands meters. A series of formations can be classified together to define a “group”, which could be a few thousands meters thick. More information about these definitions can be found here. The characteristics of the groups and formations in the UWR Watershed are briefly described below.

Maquoketa Formation



HUC12_lookup

Upper Wapsipinicon

Maquoketa Formation

- lower Cherokee Group
- Scotch Grove Formation
- Cedar Valley Group
- Dakota, Windrow
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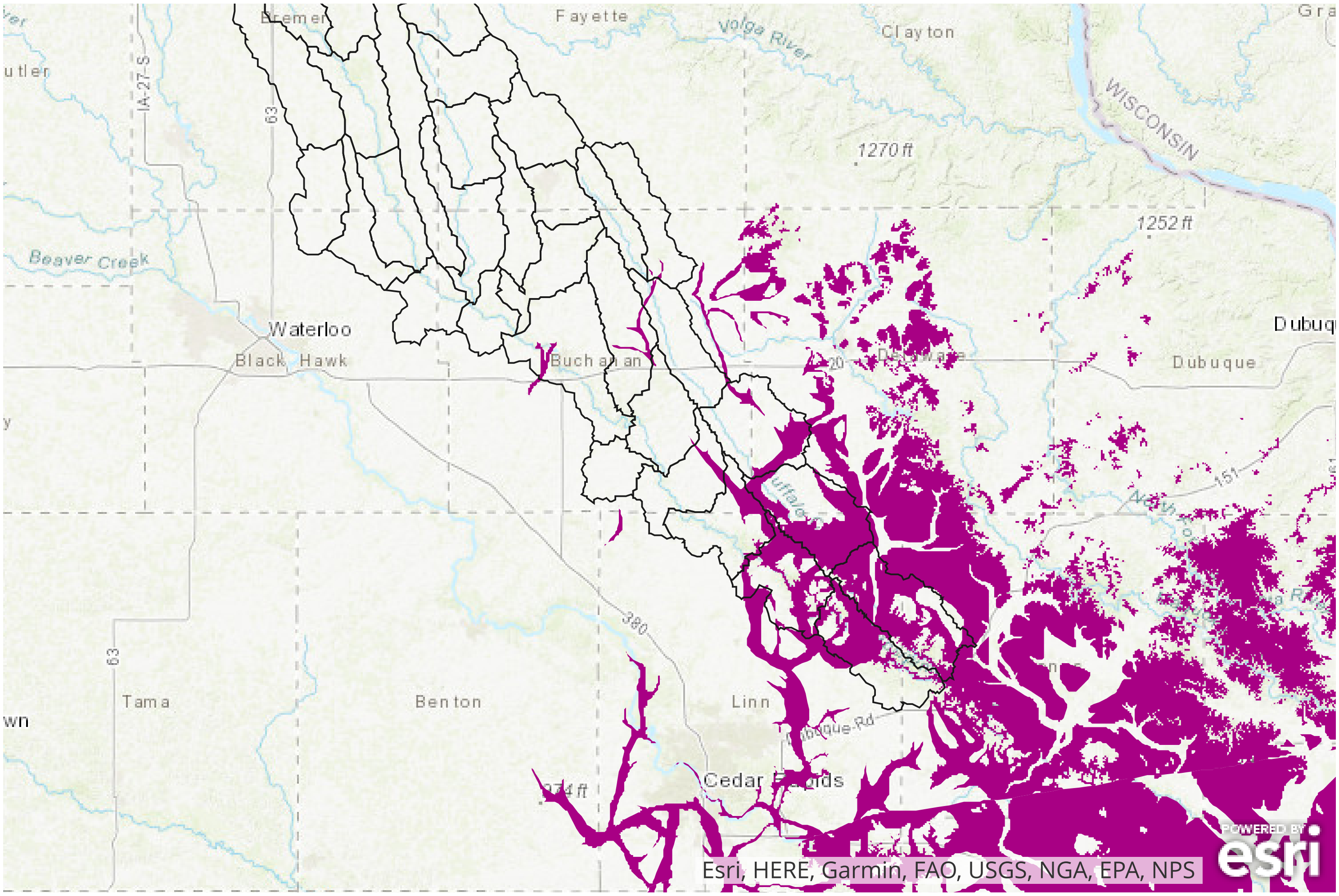
- Maquoketa Formation
- Galena Group and Platteville Formation
- Hopkinton, Blanding, Tete des Morts, Mosalem
- LaPorte City Formation
- Waucoma Formation
- Other

The Maquoketa Formation is a 190-foot formation that the Iowa Geologic Survey notes has sinkholes and is susceptible to karst formation in the lower limestone portions of the formation. The Iowa Geologic Survey and the IDNR has also provided a GIS layer that identifies different groupings of bedrock formations, each identified by different rock groupings. Both these GIS maps and GIS layers are useful for, and should be carefully considered by conservation professionals and watershed residents striving to implement specific practices and strategies that could accelerate karst formation in the UWR Watershed.

Scotch Grove Formation



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- Upper Wapsipinicon

Scotch Grove Formation

- lower Cherokee Group
- Scotch Grove Formation
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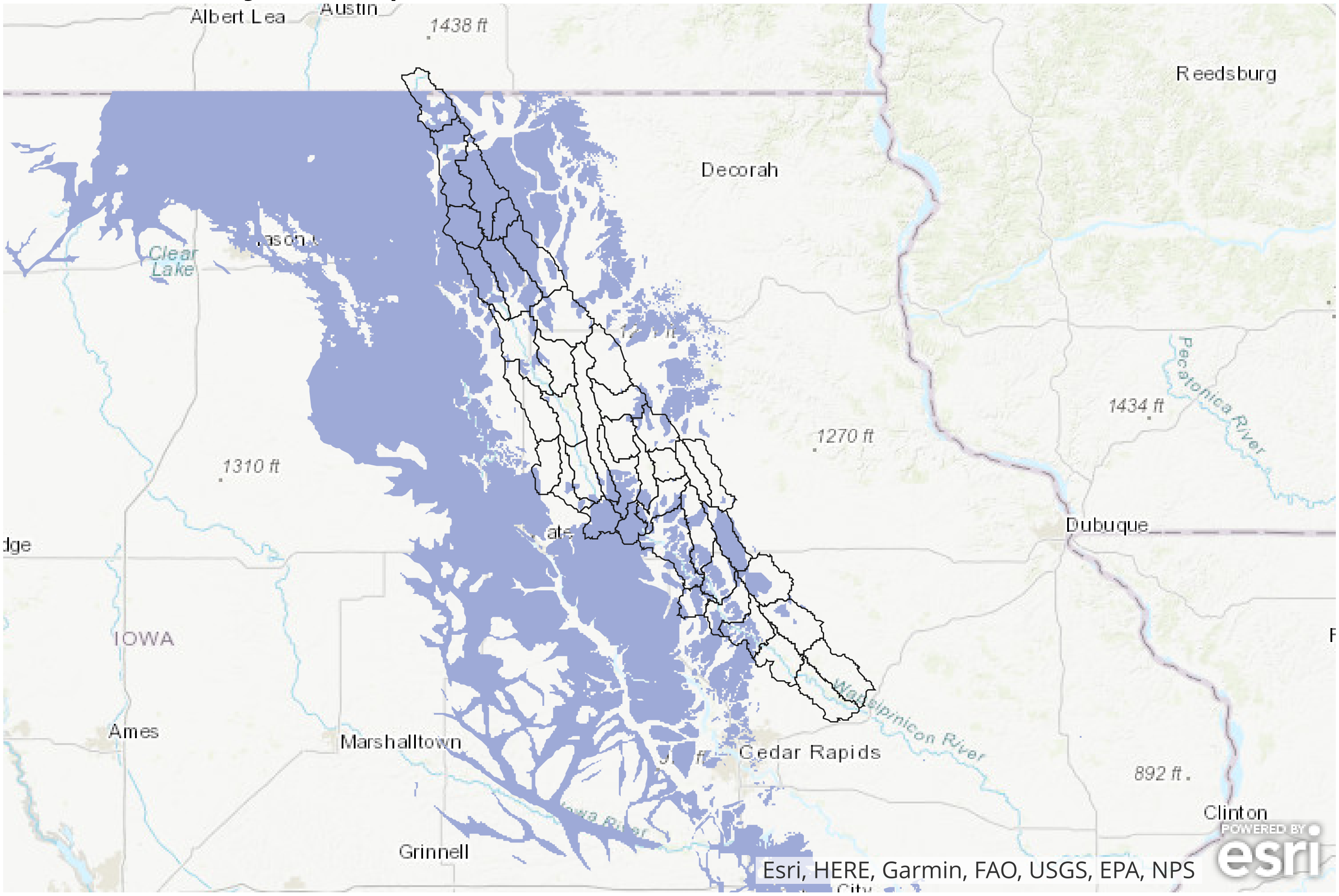
- LaPorte City Formation
- Waucoma Formation
- Other

The Scotch Grove Bedrock FormationIn is located in the southern portion of the UWR Watershed. Known for its coral reef fossils, surface exposures of this formation are most prominence in Jones County in Maquoketa Caves.

Cedar Valley Group



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Upper Wapsipinicon

Cedar Valley Group

- lower Cherokee Group
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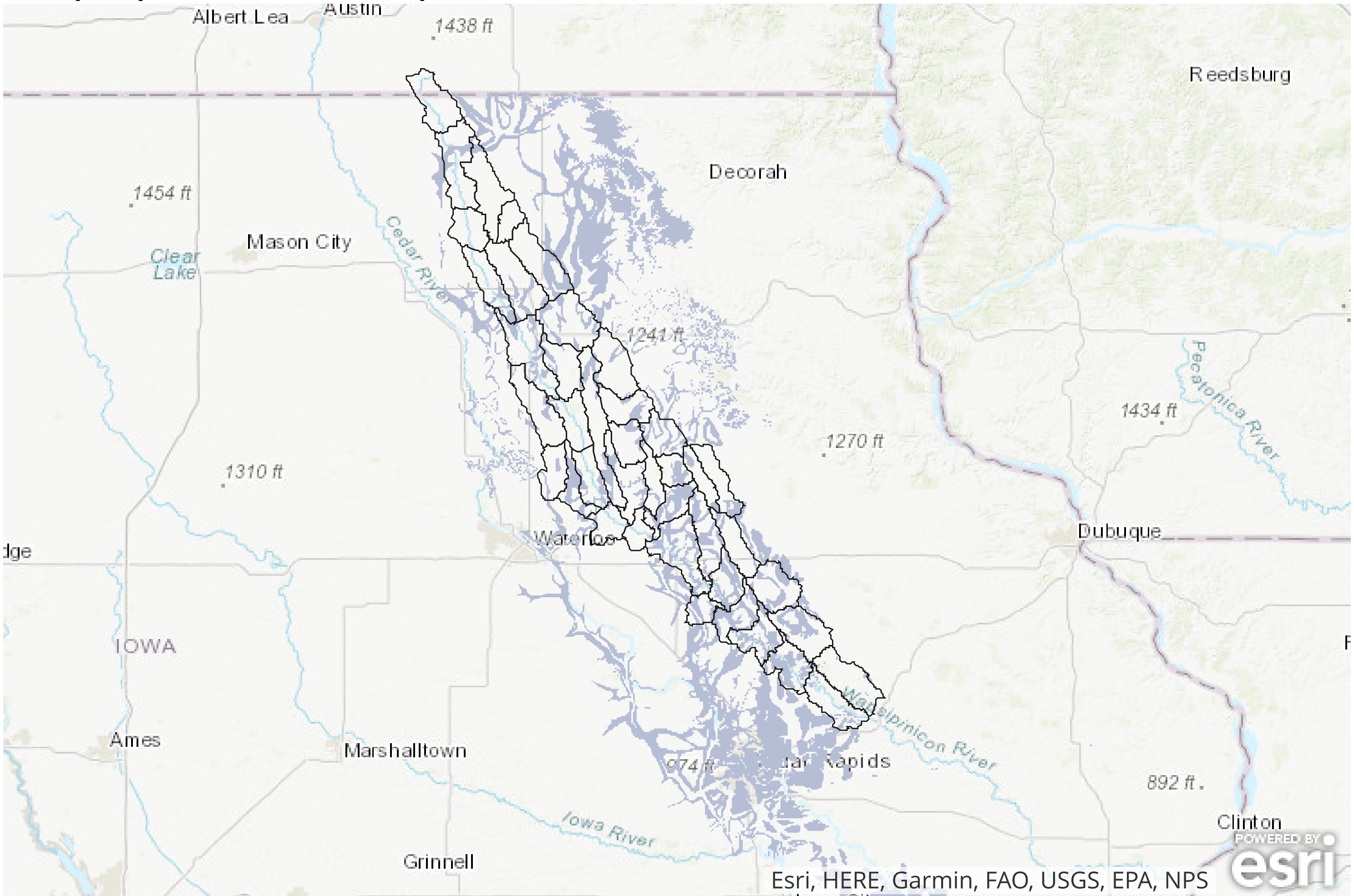
- LaPorte City Formation
- Waucoma Formation
- Other

According to the Iowa Geologic Survey, the Cedar Valley Group, which is throughout the entire UWR Watershed, hosts an abundance of karst and sinkholes, and is considered to be highly karst-susceptible. This high susceptibility to karst formation should be carefully considered by conservation professionals and watershed residents striving to implement specific practices and strategies that could accelerate karst formation Upper Wapsipinicon River Subwatersheds.

Wapsipinicon Group



HUC12_lookup

- Upper Wapsipinicon

Wapsipinicon Group

- lower Cherokee Group
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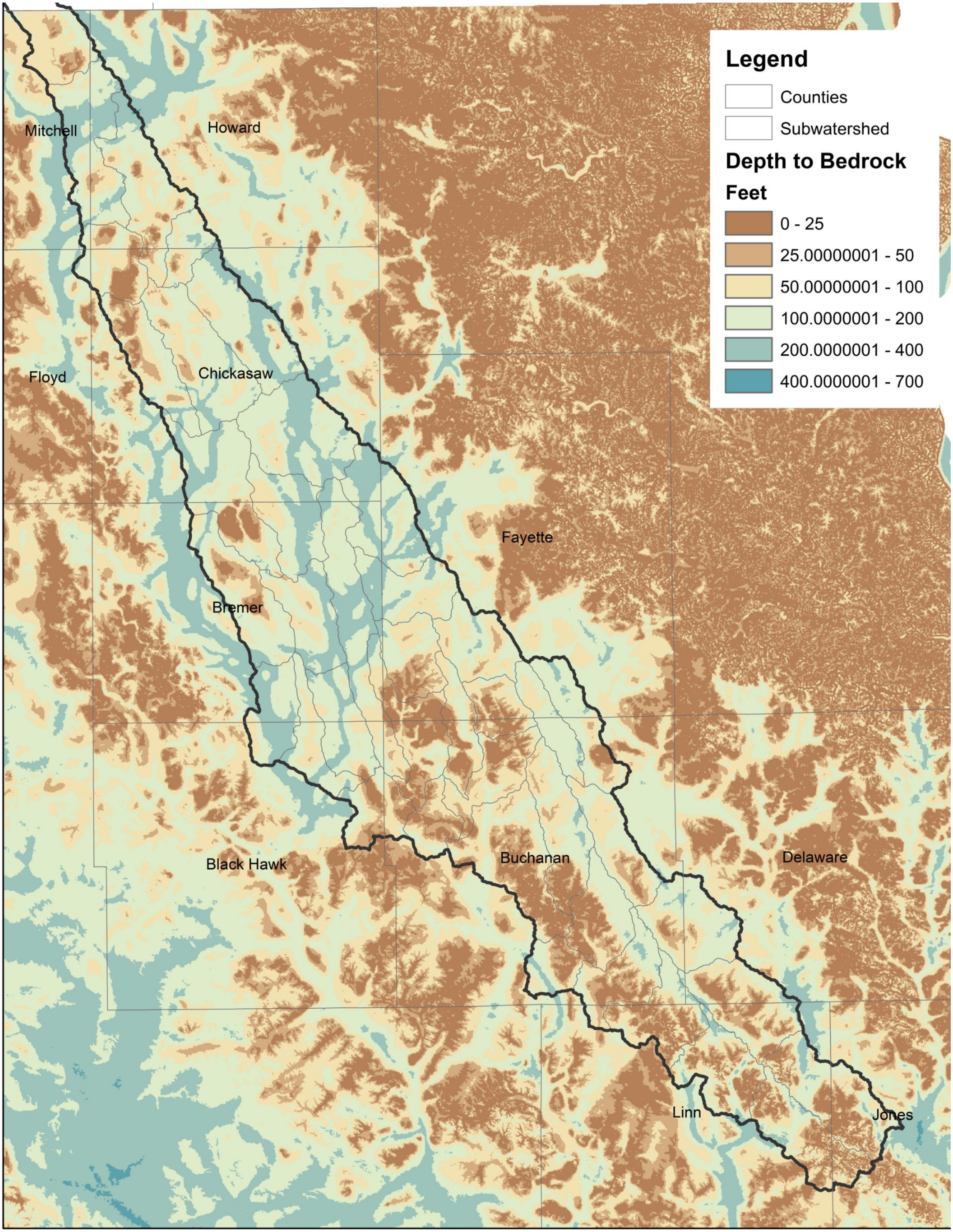
- LaPorte City Formation
- Waucoma Formation
- Other

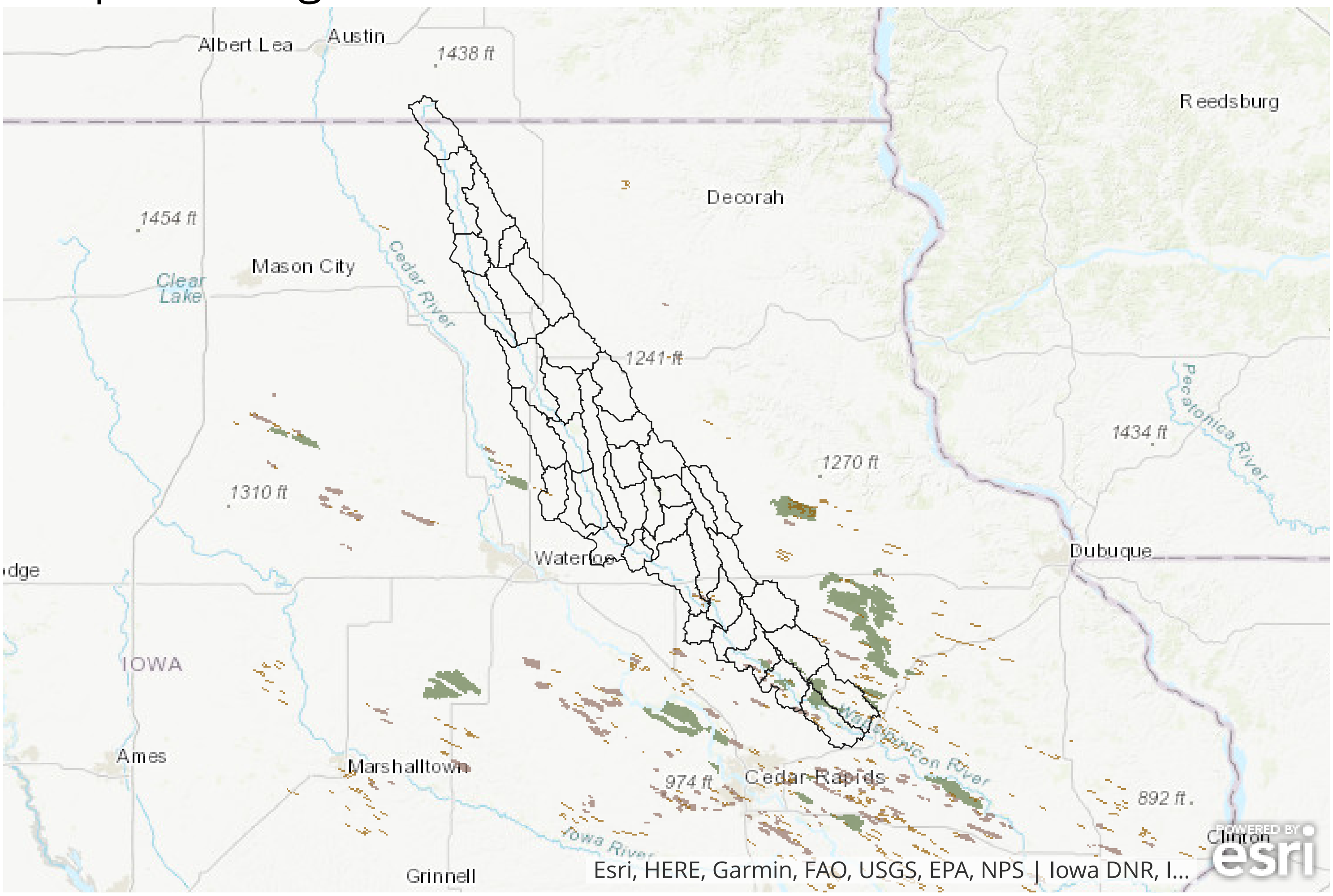
The Wapsipinicon Group is a 90-100 foot formation found in the UWR Watershed. It is considered to be karst-susceptible, and where this group is near the land surface, rainfall infiltrates rapidly. The Wapsipinicon Group formation is also shown in the Iowa Geologic Survey and IDNR bedrock formations layer shown in the map. The presence of springs and seeps as well as the infiltration rates are both important considerations for conservation professionals and watershed residents striving to implement specific practices and strategies in Upper Wapsipinicon River Subwatersheds.

Sediment


Legend
Counties
Subwatershed
Depth to Bedrock
Feet
0 - 25
25.00000001 - 50
50.00000001 - 100
100.0000001 - 200
200.0000001 - 400
400.0000001 - 700
Mitchell
Howard
Floyd
Chickasaw
Fayette
Bremer
Black Hawk
Buchanan
Delaware
Linn
Jones

Overlaying the bedrock formations of the UWR Watershed is a variable thickness of loose sediments containing different mixtures of clay, sand and silt. This layer is typically thicker in the north central areas of the watershed. The layer of loose sediments works as an infiltration system for surface water pulling out contaminants and nutrients as water works its way into the bedrock aquifers below. This layer is very important and influential to the water quality in an area.

Unique Geologic Features



HUC12_lookup

Upper Wapsipinicon

Iowa_Landforms

Lineated Ridges

Lineated Inlier

Paha Ridges

Paha Ridges

One of the most unique features of the Iowan Surface Landform Region is elongated ridges and isolated oblong hills known as paha ridges or pahas. Pahas rise 30 to 100 feet above the surrounding landscape. They are mantled with silt and sand and stand out from the surrounding landscape because they are distinctly oriented in a northwest-to-southeast direction. There are 11 mapped pahas in the UWR Watershed (Iowa DNR). All located in the southern quarter of the watershed. Their distribution and alignment parallel to (and often very near) river valleys strongly suggest that pahas are actually wind-aligned dunes that accumulated in response to the strong, prevailing northwest winds that historically scoured the Iowan Surface during glacial times. The pahas are believed to have formed close to valleys that supplied abundant amounts of loose sand and silt. Soils indicate the subsequent native vegetation of these elevated sites was forest rather than prairie. It is significant to note that larger paha exhibit differences in permeability between the more porous loess and sand and the underlying clay-rich soil horizon and glacial till and the hydrologic conditions produce occasional hillside seeps. (**Iowa Geologic Survey, Iowan Surface**)

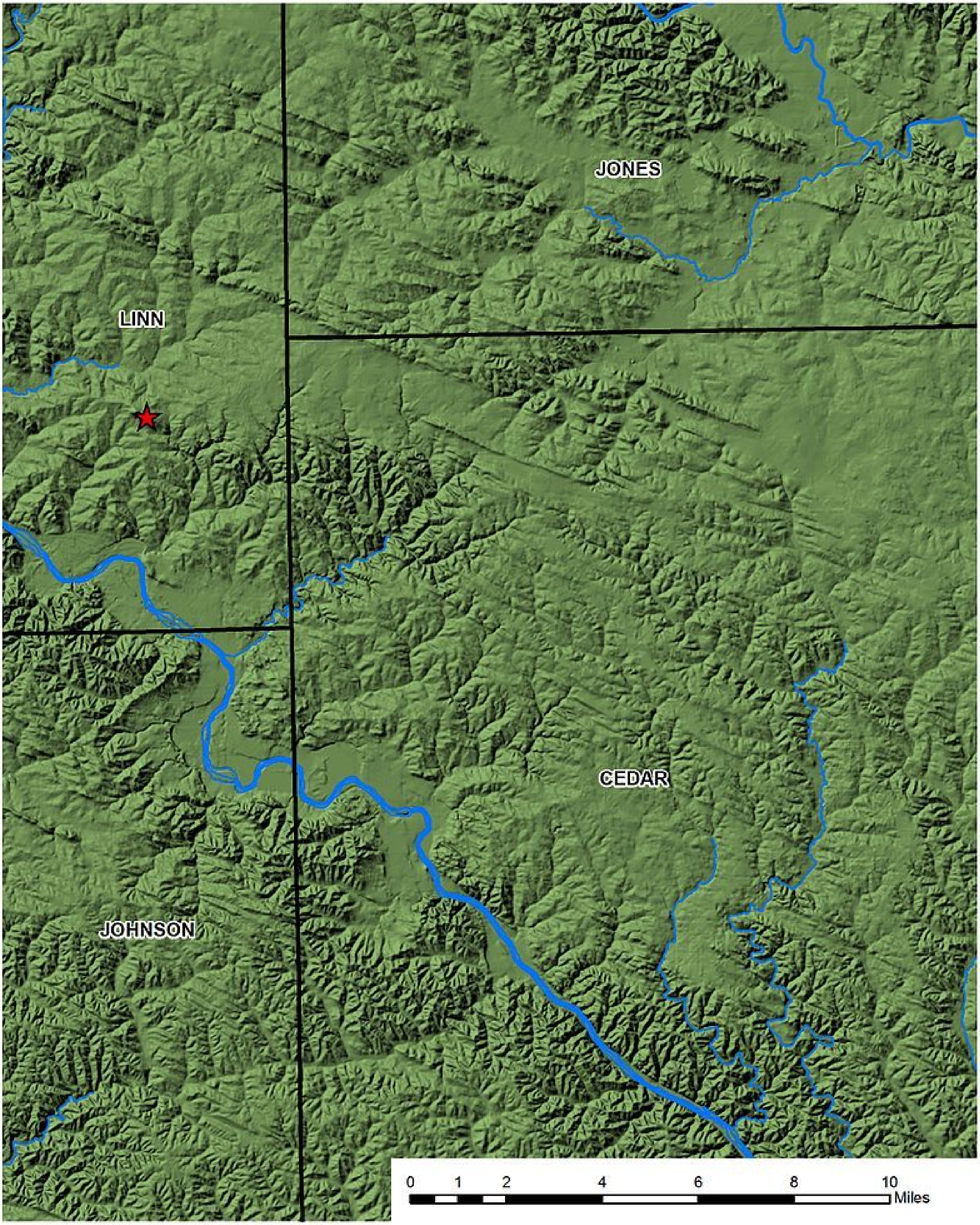


Photo courtesy of US Geologic Survey

Sinkholes

In the northern half of the watershed, remaining glacial deposits of this area are quite thin, and the influence of shallow limestone bedrock is seen on the land surface in the formation of karst features, such as caves, sinkholes and springs. Sinkholes are formed when specific types of underlying bedrock are gradually dissolved, creating voids in the subsurface. When soils and other materials above these voids can no longer bridge the gap created in the bedrock, a collapse occurs. According to GIS data provided by the Iowa DNR, the UWR Watershed has approximately 50 known sinkholes in the Iowa portion of the watershed. Sinkhole development is an active process so this number changes over time as some are filled in through natural or human processes and others are formed.

According to the Iowa Geologic Survey, sinkholes are often connected to underground bedrock fractures and conduits, from minor fissures to enlarged caverns, which allow for rapid movement of water from sinkholes vertically and laterally through the subsurface. Therefore, sinkholes provide a direct conduit for surface water to enter underground aquifers without the benefit of the filtration that would normally occur through soil layers. As a result, following rainfall or snow melt, sediment, nutrients like phosphorus and nitrate, herbicides, and bacteria can be quickly carried into groundwater aquifers. Sinkholes are important to groundwater recharge and, in some cases, they connect to springs via what the Iowa Geologic Survey calls transmissive conduit zones that function as drains that feed springs.
Zoom into the map on the right to vies sinkhole locations in the UWR Watershed.

Springs and Waterfalls

While sinkholes are infiltration points for rainfall and surface water to recharge groundwater, springs and seeps are the locations on the landscape where the water table intersects with the land surface and groundwater flows or seeps out, usually in stream valleys but also on hillsides. Although not all are recorded, their presence can be predicted through a careful examination of the geology and topography of the watershed.

One such instance in the UWR Watershed can be found along Woodpecker Hill Trail in the Pinicon Ridge County Park in Linn County. According to the Linn County Conservation Board, *"The trail features a unique limestone outcropping located in the valley of the forest and a small water cascade known locally as Horseshoe Falls."*

Caves

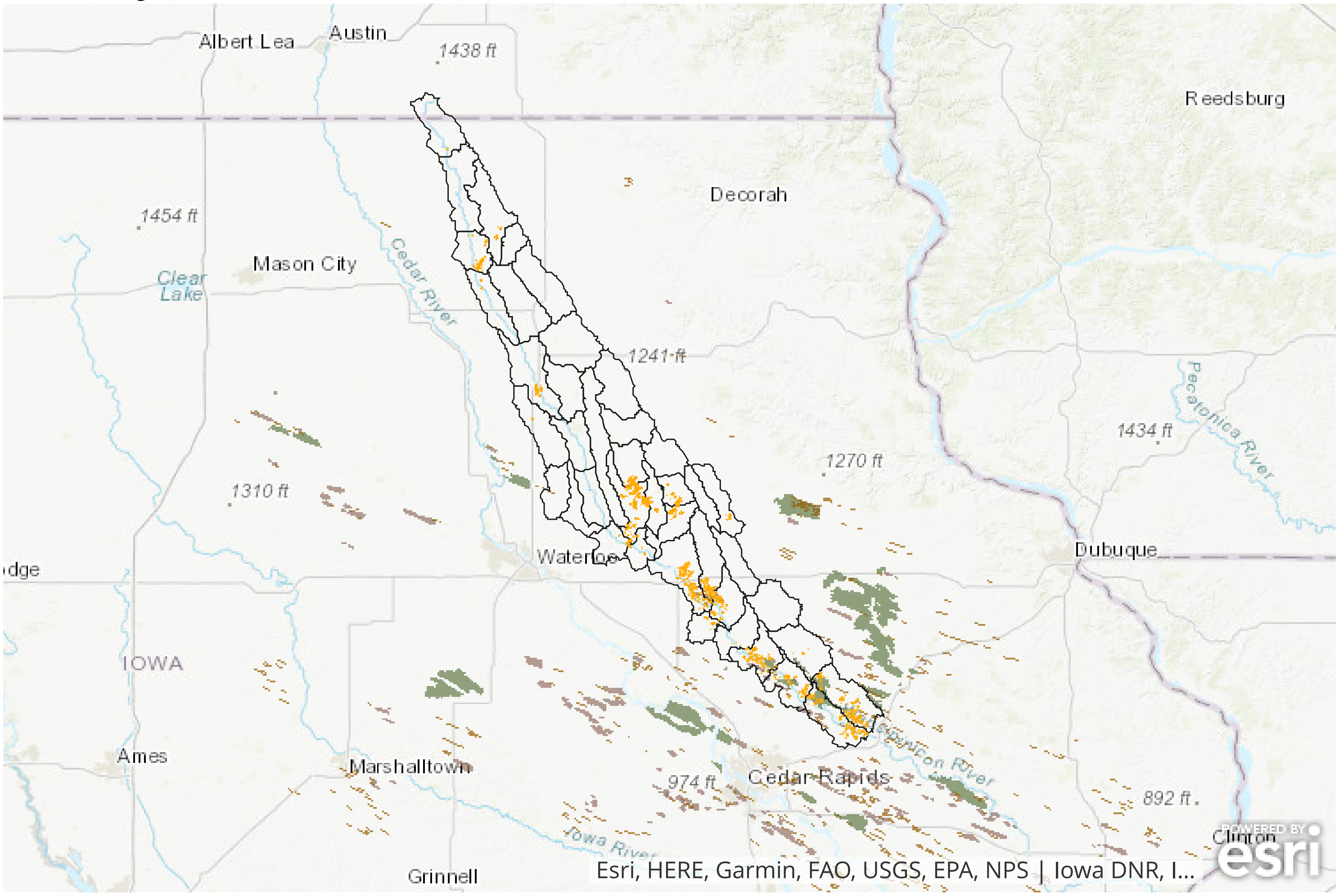
Active cave formation is ongoing as underground rivers and streams carve new openings and bedrock collapses redirect underground water flow and subsequent erosion. Some caves in the watershed were originally located and explored because they were associated with other karst features such as springs, losing streams, and/or sinkholes. Spelunkers would enter the caves through the spring or sinkhole opening and in some cases identify alternative entrances and or created new man-made entrances.

The most publicly accessible caves in the UWR Watershed are Horse Thief Cave and Ice Cave, which are located in the Wapsipinicon State Park. Legend is, Horse Thief Cave was named after two horse thieves who used the cave for their camp. Prior to the horse thieves, the cave was used as a shelter by prehistoric American Indian cultures. According to the Iowa DNR, *" While improving the entrance in 1923, workers found the remains of nine human skeletons dating to the Archaic Period 4,000 years ago."* Travel Iowa ranks the caves at the **Wapsipinicon State Park** as one of the top **"5 Must See Iowa Caves"**. The caves are open to the public year round.

Photo courtesy of Doug Schutjer, Sweet Light Studio

Although karst feature development in the UWR Watershed is not as extensive as it is in watersheds to the north and east, sinkholes and depressions in the landscape where karst conditions are just beginning to show above shallow fractured limestone make this intensively cultivated region especially vulnerable to groundwater contamination.

GIS Layers of Bedrock Formations



HUC12_lookup

Upper Wapsipinicon

Bedrock Exposures - Areas

PolyStyle00

Iowa_Landforms

Lineated Ridges

Lineated Inlier

Paha Ridges

GIS layers of bedrock formations in the UWR Watershed are very useful to the UWR WMA Board and their partners, particularly for targeted use of specific strategies and actions. Research by the Northeast Iowa RC&D Watershed Planning Team identified the most transmissive bedrock units in the northern parts of the watershed. These units are the most prone to the development of karst and as a result the land surface activities above these bedrock units can readily result in groundwater contamination of specified aquifers. Landscape information about karst development and groundwater discharge to the surface is particularly useful for private and public partners working to install conservation structures. Watershed resiliency strategies and practices utilized in sensitive areas may require different specifications, considerations and precautions, to prevent failure and/or groundwater contamination. Partners working in other parts of the watershed will also find the information related to the susceptibility of important aquifers very useful.