

What factors contribute to the development of a sinkhole?

- Manmade alterations of natural filtration of water into the ground
- Ground water withdrawals
- Vibration inducing activities (drilling, mining, artillery shelling, heavy traffic)
- Weight of overlying material down along the walls of the void (road traffic, structures, retention ponds, etc.)

What factors contribute to the development of other types of sinkholes?

- Burying cut tree stumps rather than pulling and filling
- Leaking or damaged culverts
- Improper disposal of building materials by burial on property
- Improperly sealed wells (drinking water or irrigation wells)
- Improperly functioning drainage system

How are sinkholes related to groundwater quality?

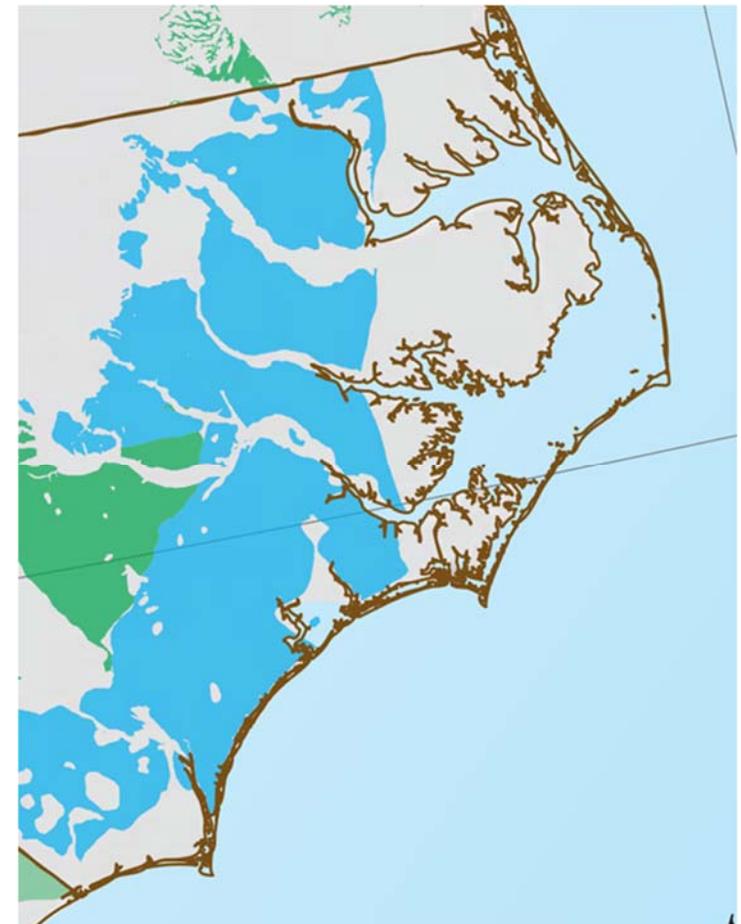
Water is naturally purified when it passes through soil. Where soil cover is thin, groundwater may not be filtered sufficiently to remove surface contaminants (e.g., disease causing organisms, pollutants, carcinogens, etc.). Surface water that enters a sinkhole passes directly into the groundwater without any filtration. In addition, contaminants that enter a sinkhole are transported at a very high rate of speed, meaning that they enter the groundwater quickly.

What can I do about sinkholes and what preventative measures can I take?

- To prevent contamination, properly seal unused wells. Test wells annually for nitrate and bacteria.
- Properly store and dispose of fuels, fertilizers, chemicals, trash, junk, and waste material. Don't put any of these into a sinkhole!!! You might contaminate the ground water and nearby waterways.
- Sinkhole insurance can be purchased for geologic sinkholes, but not those caused by drainage issues or buried material decay.



Sinkholes in Eastern North Carolina



Carbonate rocks at or near the land surface

Source: US Geological Society: Karst in the United States: A digital map compilation and database

What is a sinkhole?

A sinkhole is a natural depression or hole in the surface caused by the removal of soil or bedrock. Sinkholes may vary in size, form, and depth and they may be formed gradually or suddenly.

What is Karst geology?

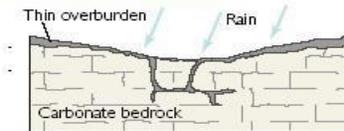
Karst is an area where bedrock such as limestone or dolomite is easily dissolved by water. Karst regions are large geographic areas where cracks and layers between the bedrock easily transport water and pollutants to the groundwater. Sinkholes, shallow soils, sinking streams and springs are found in areas of Karst bedrock. Onslow County does have areas of Karst geology (see map on cover).

What are the types of sinkholes?

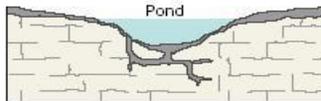
Dissolution Sinkhole

Occur when rainfall and surface water percolate through joints in limestone. The dissolved material is carried away from the surface and a depression gradually forms. Cavities may be formed beneath the surface.

Dissolution sinkholes



Rainfall and surface water percolate through joints in the limestone. Dissolved carbonate rock is carried away from the surface and a small depression gradually forms.

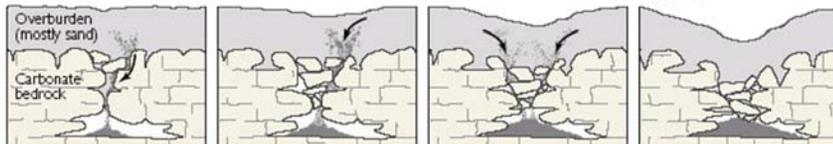


On exposed carbonate surfaces, a depression may focus surface drainage, accelerating the dissolution process. Debris carried into the developing sinkhole may plug the outflow, ponding water and creating wetlands.

Cover-Subsidence Sinkhole

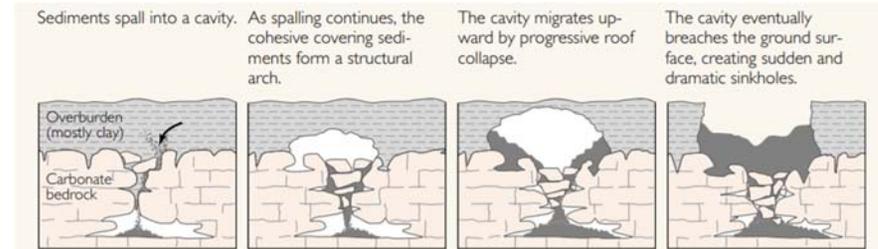
Develop gradually when the covering sediment is permeable and contains sand. The small sediment and sand will drain into the underlying bedrock creating a vacated space allowing overlying sediment to settle. As the dissolution and infilling continue a noticeable depression will form. The slow downward erosion eventually forms a small surface depression.

Granular sediments spill into secondary openings in the underlying carbonate rocks. A column of overlying sediments settles into the vacated spaces (a process termed "piping"). Dissolution and infilling continue, forming a noticeable depression in the land surface. The slow downward erosion eventually forms small surface depressions 1 inch to several feet in depth and diameter.



Cover-Collapse Sinkhole

Develop gradually when the covering sediment is permeable and contains sand. The small sediment and sand will drain into the underlying bedrock creating a vacated space allowing overlying sediment to settle. As the dissolution and infilling continue a noticeable depression will form. The slow downward erosion eventually forms a small surface depression.



Other Causes

Sinkholes can also be created by poor land-use practices resulting from groundwater pumping and construction and development practices. Development increases water usage, alters drainage pathways, overloads the ground surface, and redistributes soil. Common causes of other types of sinkholes include collapsed drain pipes, washouts from poor drainage, and decaying organic matter such as covered tree stumps and roots. These types of sinkholes tend to be noticed while still small but their size will be determined by what is causing them.

Where can I get more information on sinkholes?

- **NC Geological Survey:**
<https://deq.nc.gov/about/divisions/energy-mineral-and-land-resources/north-carolina-geological-survey/geologic-hazards/ground-collapse-old-mines-and-prospects-and-sinkholes>
- **NC Division of Water Resources:**
http://www.ncwater.org/Education_and_Technical_Assistance/Ground_Water/Sinkholes/
- **US Geological Society:**
<https://www.usgs.gov/special-topics/water-science-school/science/sinkholes>