



DEFINITION

Karst Sinkhole Treatment involves the treatment of sinkholes in karst areas to reduce contamination of groundwater resources, and/or to improve farm safety.

PURPOSE

This practice may be applied as part of a conservation management system in karst topography, which is an area underlain by solutioned carbonate bedrock with sinkholes and caverns. The practice supports one or more of the following purposes:

- Improve water quality
- Improve farm safety

This practice does not apply to erosional or collapse features caused by failure or leakage of underground pipes or constructed surface drainage features (e.g., canals), or due to piping of unstable soil materials, or due to poorly compacted or poorly constructed features.

This practice does not apply to sinkholes that may appear in or beneath structures or in flowing streams. Treatment of sinkholes in these areas will be determined through engineering investigations and structural design solutions.

PRACTICE INFORMATION

Sinkholes are a natural part of northern Arkansas' landscape, but can become a geologic hazard. Subsidence and collapse sinkholes are found in limestone or dolomite bedrock that is prone to dissolve over time. Open spaces within the rock allow water and soil to travel downwards from the surface. Sinkholes cause problems for homeowners, builders, farmers, motorists and fishermen as well as the unsuspecting public who might encounter them. They also can be a source of groundwater pollution and become a large expense for property owners and businesses.

What is a sinkhole?

A sinkhole is a generally circular hole or depression in the ground that serves as a drain for water and surface material into the subsurface. It can result from either gradual subsidence to form a depression in the landscape or by collapse to form an abrupt break in the soil. Sinkholes range in size from 1-30 feet across and deep. Sinkholes in Arkansas happen where there are voids present in the limestone or dolomite rock below the soil. The voids were formed over a long period of time (thousands of years) when the rock was dissolved away by rain or groundwater passing through small openings and making them larger. Some spaces in the rock are filled with the leftover material from the rock or soil that has traveled in from above.

Karst is the name of the landscape type characterized by sinkholes, caves and underground drainage of water. Other features of a karst landscape include rock pinnacles, uneven bedrock surface, rolling terrain, swallets (swallow holes in a stream), springs, and surface depressions.

What causes a sinkhole?

A "true" sinkhole is caused when the surface material collapses into a void space beneath the surface. Under natural conditions, this process occurs very gradually but can be hastened by human activities. The timing, location and extent of a collapse usually have many influencing factors.

Sinkholes in Arkansas occur in areas of limestone and dolomite bedrock. These types of rock are prone to dissolving and forming enlarged round or elongated cavities and pathways through the rock. The soil above can be lost downward into these openings causing a sinkhole. In some places, sinkholes form in a line on the surface related to a central drain under the surface. Areas where the rock has been fractured and faulted may have extensive weathering that caused voids in the rock. Some rock may not dissolve much at all and has few sinkhole collapses.

Water is a key to sinkhole collapses. Taking water away from where it was or putting a new, concentrated source of water where it wasn't before can speed the development of sinkholes. Examples of new sources of water could be drainage from rain gutters, pavement, collection ditches and ponds. Treatment basins or lagoons must be diligently lined in karst to prevent a sudden drainage out of the bottom and into the groundwater. Leaky water and sewer pipes can cause the soil underneath to wash away and are often the trigger for sinkholes. However, an existing sinkhole under a pipe can cause the initial leak. The greater the volume of water and the faster it moves into the karst system, the more soft material is washed from the voids. Weather events can also trigger sinkholes. In Arkansas, sinkholes can “pop” when a heavy rain event comes after a prolonged drought.

Natural or artificial lowering of the groundwater table can cause sinkholes to collapse. When the groundwater level goes down, the upper zone loses its support and can sink. When the water is lowered below the boundary between soil and bedrock, the soft material, often clay, is especially prone to movement into the voids in the rock below. The clay can temporarily stick together spanning the void but then falls in clumps or gets washed out by surface water resulting in a sudden, unexpected collapse. A change in surface drainage can often trigger sinkholes “primed” by changes in the groundwater table. Groundwater levels can be lowered by drought or pumping from quarries or wells.

Any action that disrupts the karst system at or below the surface can accelerate the formation of sinkholes. Disrupting the surface layers by digging or construction can significantly change the waterproofing over a bedrock drain. Unsealed drill holes also allow water to enter the subsurface, possibly causing a later subsidence. Only very rarely is a sinkhole the result of a collapsed cave roof.

Repaired sinkholes can reactivate and collapse repeatedly. A new sinkhole can appear next to one just repaired, utilizing the same bedrock drain.

A “false” sinkhole can appear due to decay of buried organic material such as tree roots or trash. An abandoned septic treatment area may also collapse.

Dangers of Sinkholes

Sinkholes are considered a serious geologic hazard in northern Arkansas. They can appear very suddenly and without warning and may continue to grow after the initial collapse making the surrounding ground unstable for curious onlookers. Sinkholes in roadways are a danger to drivers. Sinkholes around gas lines can result in leaks and explosions if left undetected.

Sinkhole collapse or gradual subsidence can cause structural damage and instability in houses, commercial buildings, roads, and bridges. Repairing structures after the subsidence is difficult and expensive, and requires specialized knowledge from the engineer and contractor doing the work. Even if a repair appears successful, it may not be permanent.

Groundwater can travel very rapidly through an open karst system. Therefore, unfiltered or polluted water entering karst can affect groundwater throughout a large area in a short time. Historically, sinkholes have been used as trash dumps through which undesirable materials can easily enter the groundwater.

What to do if you have a sinkhole

Here are some basic guidelines to follow if you have a sinkhole on or near your property:

1. Restrict access to the hole.
2. Contact local police or emergency responders. Advise them if the hole is near utility lines or in a roadway.
3. Take photographs for documentation but do not get too close to the edges of a sinkhole.
4. Do not allow unauthorized or inexperienced persons to investigate the sinkhole.
5. Never go down into a sinkhole or attempt to fill the hole yourself.

ADDITIONAL ASSISTANCE

Additional information including design criteria and specifications can be found in the Arkansas NRCS Electronic Field Office Technical Guide (eFOTG). Technical assistance is available through your local Field Service Center of the USDA Natural Resources Conservation Service (<http://www.ar.nrcs.usda.gov/>), and the Arkansas Geological Survey, (501) 296-1877 or online at <http://www.geology.ar.gov/home/index.htm>