

SINKHOLES

Sinkholes are a natural part of Pennsylvania's landscape but are a geologic hazard, particularly in the central and eastern parts of the state. Subsidence and collapsed sinkholes are found in limestone or dolomite bedrock, which is prone to dissolve over time. Open spaces within the rock allow water and soil to travel downward from the surface. Sinkholes can be a source of groundwater pollution and can become a large expense for property owners and businesses.

What is a sinkhole?

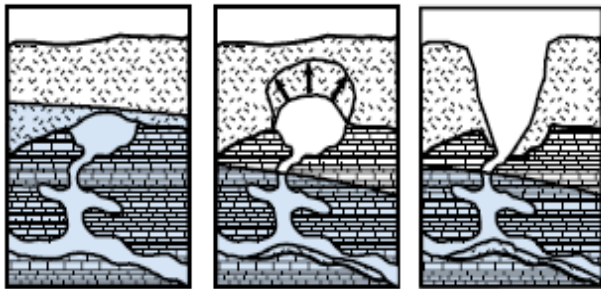
A sinkhole is generally a circular hole or depression in the ground that serves as a drain for water and surface material. It can result from either gradual subsidence to form a depression in the landscape or by collapse to form an abrupt break in the soil. Sinkholes range in size from one to 30 feet in width and depth. Sinkholes in Pennsylvania are common where there are voids present in the rock below the soil. The voids were formed over thousands of years when the rock was dissolved away by rain or groundwater passing through small openings and making them larger.

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 gradually, maybe over decades, but can be hastened by human activities. The timing, location, and extent of a collapse usually have many influencing factors.

Geology: Sinkholes in Pennsylvania mostly occur in areas of limestone and dolomite bedrock. These types of rock are prone to dissolving and forming enlarged round or elongated internal cavities and pathways. The soil above is lost downward into these openings, causing a sinkhole at the surface. Fractured and faulted rock may be extensively weathered, causing voids in the rock. In some places, sinkholes form in a line or in clusters on the surface related to a central drain under the surface.



Formation of Sinkhole as water table drops
(From USGS Open File Report OF-01-0484)

Surface-Water Interaction: Water is a key to sinkhole collapses. Taking water away from where it was or putting a new, concentrated source of water where it was not 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 in karst terrain must be carefully designed to prevent a sudden drainage out of the bottom and into the groundwater. Leaking water and sewer pipes can cause the soil underneath to wash away and trigger sinkholes. However, an existing sinkhole under a pipe can also cause the initial leak. Greater volumes of water moving fast into the karst system causes more soft

material to be washed from the voids. Weather events can also trigger sinkholes. Sinkholes can "pop" when a heavy rain event comes after a prolonged drought.

Lowered Groundwater: 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, soft material is especially prone to movement into the voids in the rock below. Clay can temporarily stick, spanning the void; but it may then fall in clumps or get 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.

Other Causes: 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 typically reactivate and collapse repeatedly if the drain into the bedrock is not satisfactorily sealed off. A new sinkhole can appear next to one just repaired, utilizing the same bedrock drain.

Sinkhole-like Subsidence: “False” sinkholes can appear for several reasons: mine subsidences; decaying, buried organic material such as tree roots or trash; collapse of buried relict structures; and wash-out of fill around pipes, especially due to a water main break. These often appear in relation to high rainfall events.

Dangers of Sinkholes

Safety: Sinkholes are considered a serious geologic hazard in Pennsylvania. They can appear suddenly and may continue to grow after the initial collapse, making the surrounding ground unstable.

Structural damage: Sinkhole collapse or gradual subsidence can cause structural damage and instability in buildings, roads, and bridges. Repairing structures after the subsidence is difficult and expensive, and it requires specialized knowledge by the engineer and contractor doing the work. Even if a repair appears to be successful, it may not be permanent if the underlying cause of the hole remains.

Groundwater contamination: 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 a large hole without help.
6. Do not put trash or potential pollutants into a sinkhole.

Who to contact: If you suspect that a sinkhole may be related to a Department of Environmental Protection (DEP) regulated activity, call the DEP [District Mining Office](#) or [Regional Office](#) serving your county. If no regulated activity is suspected, you can report sinkholes to the Pennsylvania Geological Survey at 717-702-2047. A sinkhole noticed in a publicly-travelled area should be reported to local officials.

Limits of DEP involvement: DEP is making an effort to prevent sinkholes resulting from permitted activities. If a sinkhole is not the result of DEP-regulated activity, DEP has no legal recourse to help the landowner. There are no special organizations or funding that provide aid to those with a high sinkhole repair bill. DEP personnel will advise you to consult a geologic and/or engineering professional to assess the problem. Ultimately, landowners are financially responsible for sinkhole repairs on their property.

Living with Sinkholes

Sinkhole occurrences will likely become more frequent as development continues in karst areas. Land-use planning and engineering precautions can help alleviate some sinkhole hazards. Some municipalities have local ordinances in place to address karst, but many do not. Homeowner's insurance companies may provide low-cost sinkhole coverage to compensate for structures, but not land repairs.

To determine if you are in a sinkhole-prone area, access the maps available through the Pennsylvania Geological Survey at <https://www.dcnr.pa.gov/Geology/GeologicHazards/Sinkholes/Pages/default.aspx>, or call 717-702-2047.

For more information, visit www.dep.pa.gov and enter search term: Sinkholes.