

Sinkhole Treatment

Code 725

Natural Resources Conservation Service
Conservation Practice Standard

I. Definition

An excavation, cleanout, filter treatment, sealing, and refilling of a sinkhole to reduce erosion, prevent expansion of the hole, and reduce pollution of water resources.

II. Purposes

Sinkhole treatment measures are installed to prevent or reduce direct ground water pollution from chemicals, animal wastes, or sediment by diverting or controlling surface water inflow to open sinkholes or depressions where geologic formations are subject to sinkhole development.

III. Conditions where practice applies

This practice applies to areas where geologic conditions are conducive to sinkhole development and subsidence and where one or more of the following discharges occur into sinkholes:

1. Surface water runoff from eroding areas.
2. Surface water runoff from impervious areas such as parking lots, streets, or other commercial developments.
3. Surface water runoff from feedlots or water that traverses feedlots contains excessive amounts of nutrients or organic matter.
4. Surface water runoff from areas on which chemicals, fertilizers, or animal wastes have been applied.

This practice does not apply to sinkholes caused by mine collapses.

IV. Federal, state, and local laws

Sinkhole treatment or component practices shall comply with all federal, state, and local laws, rules and regulations. The owner or operator is responsible for securing any required permits. This standard does

not contain the text of any federal, state, or local laws governing sinkhole treatment.

V. Criteria

A. General Criteria

1. Sinkhole treatment methods are site specific depending on:
 - a. Location of sinkhole.
 - b. Size of the drainage area to the sinkhole.
 - c. Land use within the drainage area to the sinkhole.
 - d. Size of sinkhole.
 - e. Ground water contamination potential due to continued inflow to the sinkhole.
 - f. Effects of sealing the sinkhole and diverting runoff.
 - g. Condition of bedrock.
2. Subsurface and geologic investigations of the site will be performed prior to design to determine treatment methods and extent.
3. Where backfilling and grading is not practical, fencing shall be provided as needed for the safety of humans and livestock.
4. Emphasis in sinkhole treatment shall be given to preventing the direct entry of contaminant laden runoff into the bedrock and ground water and to preventing sinkhole reformation. Treatment can be divided into two types depending on how the runoff into the sinkhole is handled.
 - a. Diversion of surface runoff and sinkhole sealing.
 - b. Continued inflow of surface water into sinkhole and sinkhole backfilling with a reverse filter.

5. Criteria for other practices used in conjunction with this standard shall be in accordance with standards contained in the Wisconsin Field Office Technical Guide.
6. An adequate protective cover of vegetation shall be established on treated areas where necessary for protection from erosion.
7. An operation and maintenance plan shall be developed that is consistent with the purposes of this practice, intended life of the components, safety requirements, and the criteria for design.

B. Specific Criteria

1. Diversion of Surface Runoff and Sinkhole Sealing.

The minimum procedure for runoff diversion and sealing shall include:

- a. Diversion of surface runoff to the maximum extent practicable.
- b. Removing any debris and excavating the overburden from the underlying fractured rock structure. The excavation shall expose the crevice and enlarge the surface area to sound bedrock for treatment.
- c. Placement of rock material to bridge the bedrock void. The rock shall be of sufficient size that it will not be able to migrate into the void. Concrete or a geotextile may be used by itself or in conjunction with the rock materials to bridge the void.
- d. Sealing the sinkhole to prevent or retard the seepage of water into the bedrock at the location of the existing sinkhole. Backfill shall be fine, relatively impervious soils placed in layers suitably graded and combined, as needed, with geotextile so as not to allow migration of soil into lower layers. Compaction of the backfill shall be in accordance with Wisconsin Specification 3, Earthfill.

- e. Crowning the backfill a minimum of 6 inches above the ground surface elevation to allow for settlement and provide surface water drainage.
- f. A final top layer of suitable soils for establishing vegetation if necessary.

2. Continued Inflow of Surface Water Into Sinkholes and Sinkhole Backfilling With a Reverse Filter.

The minimum procedure for runoff inflow and reverse filter backfilling shall include:

- a. The drainage area of the sinkhole shall be treated to reduce sediment and contaminant inflow to the maximum extent practicable.
- b. Removing any debris and excavating the overburden from the underlying fractured rock structure. The excavation shall expose the crevice and enlarge the surface area to sound bedrock for treatment.
- c. Placement of rock material to bridge the bedrock void. The rock shall be of sufficient size that it will not be able to migrate into the void. A geotextile may be used by itself or in conjunction with rock materials to bridge the void.
- d. Placement of backfill above the void to allow continued inflow of water. The backfill shall be a graded granular material that consists of a coarse material nearest the void and is a progressively finer material as the ground surface is approached.

VI. Considerations

Additional recommendations relating to design which may enhance the use of, or avoid problems with, this practice but are not required to ensure its basic conservation function are as follows:

1. Limiting water contact with the bedrock may lessen the possibility of sinkhole reformation.
2. Providing a vegetated buffer around the sinkhole.

VII. Plans and Specifications

Plans and specifications shall be prepared in accordance with the criteria of this standard and shall describe the requirements for applying this practice to achieve its intended use. A construction plan and inspection plan are required.

VIII. References

United States Department of Agriculture, Natural Resources Conservation Service, Soil Mechanics Note No. 1, "Guide for Determining the Gradation of Sand and Gravel Filters."