

**NATURAL RESOURCES CONSERVATION SERVICE**  
**CONSERVATION PRACTICE STANDARD**

**SINKHOLE AND SINKHOLE AREA TREATMENT**

(No.)

**CODE 527**

**DEFINITION**

The treatment of sinkholes and/or sinkhole areas to reduce contamination of ground water resources, and/or improve farm safety.

**PURPOSE**

This practice may be applied as part of a conservation management system to support one or more of the following purposes:

- Improve water quality.
- Improve farm safety.

**CONDITIONS WHERE PRACTICE APPLIES**

On any land surface or existing practice where the soils and geologic conditions have led to the development of sinkholes.

**CRITERIA**

**General Criteria Applicable to all Purposes**

The installation and operation of sinkhole treatment(s) will comply with all federal, state, and local laws, rules, and regulations.

A geologic investigation of the potential impact of the treatment on ground water, surface water, and the karst features will be conducted by a qualified geologist.

Trash and other material will be removed from the sinkhole and disposed of in an environmentally sound manner.

Excess surface water caused by construction activities will be diverted from the sinkhole area.

Nutrient and pest management plans will be developed for the drainage area of the sinkhole controlled by the landowner.

**Vegetative Treatment.** All sinkholes treated will have a vegetated buffer a minimum of 25 feet wide measured from the rim of the sinkhole. The buffer area may be extended to control concentrated flow channels entering the sinkhole. The width of the vegetated buffer will be established and maintained in accordance with the type of buffer chosen. The sinkhole and surrounding buffer will be fenced. Virginia Conservation Standards Riparian Forest Buffer (Code 391), *Riparian Herbaceous Cover* (Code 390), or *Filter Strip* (Code 393) may be used for buffer establishment. Virginia Conservation Standard *Fence* (Code 382) shall be used.

Livestock will be excluded from the vegetative buffer except where applicable for maintenance purposes.

Nutrients, herbicides, pesticides, and animal waste will not be applied within an established buffer. Only mechanical treatments shall be used for weed control.

Appropriate erosion and sediment control measures will be used to reduce the amount of sediment entering sinkhole openings during the establishment of the vegetative buffer.

**Surface Water Control.** Changes to the volume of surface water that enters a sinkhole may disturb the underground hydrology. To the extent possible, the surface water flow should be maintained at historic (or predevelopment) volumes.

Pre-existing concentrated flow channels will be stabilized but should not otherwise be altered. If a plug or inverted filter is used, the area to be protected will be characterized by a qualified geologist. Concentrated flow caused by the construction activities will be dispersed with a suitable spreading structure.

**Sinkhole Treatment/Closing.** Adequate protection of most sinkhole and sinkhole areas can be achieved by the use of vegetative buffers and livestock exclusion. However, if an open sinkhole is a safety hazard, it may be treated with a rock filter, gabions, or other methods approved by the State Conservation Engineer. Concurrence from the Virginia Department of Conservation and Recreation, Division of Natural Heritage, Karst Program Office is required. The location of a closed sinkhole must be marked with a permanent marker indicating the nature of the feature.

Sinkholes that open into caves shall not be filled under any circumstances. Gated openings may be used for safety reasons. Coordination with the Virginia Cave Board or the Karst Program Office is required.

### CONSIDERATIONS

The practice should work in conjunction with conservation cropping systems, pest and nutrient management, and practices that control sheet, rill and gully erosion.

Current and planned land use should be considered. In particular, structures, septic fields, wells, feedlots, ponds, and animal waste storage systems should not be located over a sinkhole site or within the impact area.

For a sinkhole receiving contaminated overland flow, every effort should be made to first treat the source of the contamination. Although it is important to maintain the hydrology of the karst system, it may be more beneficial to the ground water quality to divert the contaminated water away from the sinkhole. In some cases, it may be necessary to completely plug a sinkhole with sealing materials rather than treat it with a filter. Acceptable sealing materials are provided in ASTM D 5299, part 6.4. An example of this would be a sinkhole in a feedlot or a site that is difficult to protect by any other method.

The sinkhole treatment should not result in excessive surface water ponding or high soil moisture conditions over an extended period.

Treatment of one sinkhole may have an effect on other sinkholes or solution features in the vicinity.

The use of a Conservation Easement for the buffer and sinkhole should be considered.

### PLANS AND SPECIFICATIONS

Plans and specifications for Sinkhole and Sinkhole Area Treatment will be in keeping with this standard and will describe the requirements for applying the practice to achieve its intended purpose.

Record all required information in an engineer field book, on a plan sheet or design computation sheet, or in another appropriate location.

### DESIGN DATA

1. Completed Environmental Evaluation (Form VA-EE-1) and subsequent requirements.
2. Soils investigation.
3. Geologic investigation, including a study of potential impacts on the karst resource.
4. Survey and plot data: profile, cross-sections, topography, as needed.
5. Design computations, including purpose of practice and references used.
  - a. Planned treatment measures, including control of surface water. Note availability of safe outlet for surface water, if applicable.
  - b. Delineate the drainage area of sinkhole on a topographic map.
6. Plan view of site with existing and planned features, including dimensions, distances, etc. Include topographic information and photographs.
7. Standard Cover Sheet (VA-SO-100A).
8. Materials and quantities needed. Identify borrow material and/or spoil area, as needed.
9. Vegetation and/or ground cover requirements.
10. Identification of needed Erosion & Sediment Control measures.
11. Special safety requirements.
12. Supplemental practices required.
13. Virginia Conservation Practice Specifications (700 Series).
14. Operation and Maintenance Plan.

15. Documentation of contact with the Virginia Department of Conservation and Recreation, Division of Natural Heritage, Karst Program Office, if needed.
16. Approval from State Conservation Engineer, if needed.

#### CHECK DATA

1. As-built survey.
2. As-built plans including dimensions, types and quantities of materials installed, and variations from design. Include justification for variations.
3. Locations of appurtenant practices.
4. Adequacy of vegetation and/or ground cover.
5. Complete as-built section of Cover Sheet.

#### OPERATION AND MAINTENANCE

An operation and maintenance (O&M) plan will provide specific instructions for maintaining the sinkhole and sinkhole area treatment, including reference to periodic inspections and the prompt repair and/or replacement of damaged components.

#### REFERENCES

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Living on Karst – A Reference Guide of Landowners in Limestone Regions. 1997. Cave Conservancy of the Virginias.

National Crushed Stone Association. Graded Riprap Stone, Quarried Stone for Erosion and Sediment Control, June 1978.

USDA-Natural Resources Conservation Service. Electronic Field Office Technical Guide (eFOTG), Section IV [Online]. Available at <http://www.nrcs.usda.gov/technical/eFOTG>.

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