

- 6-H-15 Sinkhole and Karst Features
- 6-H-15-a Purpose and Intent
(2/17/04) This section is to establish review procedures, use limitations, design standards, and performance standards applicable to land development activities that encompass or affect sinkholes or other karst features. The intent of this section is to protect the public health, safety and welfare by requiring the development and use of karst areas to proceed in a manner that promotes safe and appropriate construction and storm water management.
- 6-H-15-b Definitions
1. Geotechnical Engineer (GE): a Virginia Registered Professional Engineer engaged in the practice of geotechnical engineering or a Virginia-Registered Professional Geologist who is engaged in the practice of engineering geology.
 2. Karst Feature: Karst topography is a landscape created by groundwater dissolving sedimentary rock such as limestone. Karst features include sinkholes, fissures enlarged by dissolution, and caves.
- 6-H-15-c Site Review:
Investigation by Geotechnical Engineer
- Whenever an application is filed for development, the applicant will hire a Geotechnical Engineer (GE) to undertake an inspection of the subject area. The GE shall review available geologic and engineering data and air-photographs relevant to the site and shall make on-site observations, photographs, and measurements as appropriate. The GE shall provide written summary of the initial findings along with a recommendation to perform Fracture Trace Analysis, Electrical Resistivity, Cone Sounding, Core Samples, Microgravity, and/or other geophysical or intrusive studies as appropriate to determine if the action requested may have a negative impact. The examination for karst features by the engineer shall take place prior to any public hearing process applicable to the parcel in question. The engineer will report to the zoning administrator any findings as to whether there may be significant karst features that apply to the site.
3. No Evidence of Karst Features
If the engineer finds that the site has no evidence of karst features, they shall so indicate in a written report provided to the reviewing body.
 4. Evidence of Karst Features
In cases where the engineer finds evidence that karst features do exist, and which would be impacted by development, electrical resistivity testing, core drilling or microgravity tests, shall be required within a 100 foot radius for all locations on the property where karst features were identified and along any linear trend of at least three or more features. For sinkholes the 100 foot radius shall be measured from the discernable edge. At the conclusion of the tests the applicant shall submit a karst review plan to the Zoning Administrator and follow specific development procedures.
 5. The presence of karst features on the site that are not impacted.
At the discretion of the Zoning Administrator, the karst plan may be simplified if the environmental constraint found to be present on the site is not impacted by the proposed site development.
- 6-H-15-d Karst Plan
- A karst plan shall be developed for the property identified as having evidence of karst features (i.e., sites upon which sinkholes are fully or partially located and/or which drain to sinkholes). The burden of proof for establishing that there will be no significant impacts shall rest with the applicant. A karst plan shall include the following:

6. An engineering audit that identifies and maps karst features and the limitations that such features impose on site development. The audit shall include:
 - a. The physical location and limits of the area of the sinkhole depression as determined by field survey, the "Soil Survey of Clarke County" (1982), or the "Map of Selected Hydrogeologic Components of Clarke County, Virginia" (1990), or other reliable sources as may be approved by the Administrator;
 - b. locations of other karst features (fissures enlarged by dissolution and caves);
 - c. topographic contours at maximum intervals of two feet, and spot elevations sufficient to determine low points and discernable edges; and
 - d. setback distances of 25 feet and 100 feet from the discernable edge of each feature.
7. For structures proposed between 25 and 100 feet of the discernable edge of sinkholes or other karst features, engineering that ensures structural stability.

6-H-15-e
(8/17/10)

Requirements and Restrictions

8. As identified in Section 6-H-14-d, no construction or land disturbance shall occur within a minimum buffer distance of 25 feet from the discernable edge of a sinkhole or other karst feature. Vegetation in the buffer area shall not be altered from predevelopment conditions. While vegetation should not be removed so as to disturb the soil, invasive species identified by the Virginia Department of Conservation and Recreation or dead plant material may be removed with the approval of the Zoning Administrator. Fertilizers, herbicides, and pesticides shall not be applied within the buffer area.
9. No construction shall take place between 25 and 100 feet of the discernable edge of a sinkhole or other karst feature unless a geological and geophysical survey (as described in Section 6-H-14-d) indicates that such construction or earth disturbance is appropriate.
10. Sinkholes or karst features identified during construction shall be mitigated as described in the Virginia Department of Transportation's Location and Design Division Instructional and Informational Memorandum 228 (IIM-LD- 228), or other applicable standard as recommended by a GE.
11. Stormwater runoff shall be addressed as outlined in the Chesapeake Stormwater Network (CSN) Technical Bulletin No.1 "Stormwater Design Guidelines for Karst Terrain in the Chesapeake Bay Watershed" Version 2.
12. Underground utilities located within 100 feet of karst features shall be laid out so that they do not intersect those features. Along all such underground utilities, a dike of clay or other suitable material shall be constructed across the trench of the transmission lines and pipelines at intervals of 20 feet or less, or as directed by a GE.
13. For any tests requiring boreholes, such as air track drilling, the boreholes must be grouted upon completion. Grouting should be done with a mixture of 50% bentonite and 50% portland cement.
14. If air track drilling is used to determine the depth of overburden and continuity of bedrock, then these operations must be monitored full time by a GE to confirm the findings of the driller.
15. Geotechnical studies shall be conducted at each proposed structure site before issuance of a building permit to determine the existence of karst features. If karst features are found, remediation shall be done to protect the healthy, safety, and welfare of occupants of the structure.
16. Storage tanks shall have impervious secondary containment. Underground fuel storage tanks shall have interstitial monitoring of tanks and piping systems.
17. Where applicable, the following Consumer Disclosure Statement that provides

information on what review occurred and what was discovered shall be included in the Deed of Dedication:

This property is located in an area identified as having karst features. Karst features are created by groundwater dissolving sedimentary rock such as limestone. Features include sinkholes, fissures enlarged by dissolution, and caves. Geologic tests were conducted and one or more of these features were identified on this property. Karst features are unstable and collapse may occur. Measures have been taken to ensure structural stability in this area; however, karst areas are dynamic and geologic changes may cause future structural instability. Fertilizers, herbicides, and pesticides shall not be applied within designated buffer areas.

18. Measures to permanently protect karst features shall be identified on the site plan. These measures may include fencing and/or signage.