

## Chapter 55

### CARBONATE ROCK DISTRICT

#### GENERAL REFERENCES

Development regulations — See Ch. 64.

Zoning — See Ch. 123.

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#### **§ 55-1. Purpose.**

- A. The Musconetcong and Pohatcong Valley areas of Washington Township are underlain by carbonate bedrock formations of limestone and dolomite. Solutioning of the bedrock by acidic groundwater in the past has resulted in surface depressions, filled or partially filled channels in the bedrock and the development of irregular, subsurface rock topography known as karst. Such areas are unstable and may be susceptible to subsidence and surface collapse. The alteration of drainage patterns in these areas by the placement of impervious coverage, grade changes or increased loads from site improvements can enhance instability and lead to land subsidence and sinkholes.
- B. Carbonate aquifers are the source of potable water for Washington Township and Washington Borough. Solutioning and fractures in the limestone bedrock may lead to public or private water supply sources in the carbonate aquifer, making those sources susceptible to groundwater contamination. Contamination of water sources can occur from solid and liquid wastes, contaminated surface water, septic tank effluent or other hazardous substances moving through openings within the rock.
- C. The purposes of this chapter are to protect the valuable potable groundwater resource of the carbonate aquifer and to reduce the frequency of structural damage to public and private improvements by sinkhole collapse or subsidence in areas of limestone geology, thus protecting the public health, safety and welfare of the citizens of Washington Township.

#### **§ 55-2. Definitions.**

For the purposes of this chapter, the following definitions shall apply:

**APPROVING AUTHORITY** — The Board constituted pursuant to the Municipal Land Use Law, N.J.S.A. 40:55D-1 et seq., which, for applications involving site plan or subdivision approval, is the Planning Board or Zoning Board of Adjustment of this township.

**APPLICABLE DEVELOPMENT ACTIVITY or ACTIVITIES** — Development (as defined in the Municipal Land Use Law) in the Carbonate Rock District which requires major subdivision or major site plan approval under Chapter 64, Development Regulations, of this Code.

**BEDDING** — The arrangement of a sedimentary rock in layers of varying thickness and character.

**BEDROCK** — A general term for the rock that underlies soil or other unconsolidated material.

**CARBONATE ROCK** — Rock consisting chiefly of calcium and magnesium carbonates.

**CARBONATE ROCK DISTRICT** — Those land areas underlain by carbonate rock formation, as shown on the Washington Township Carbonate Rock District Map, annexed to this chapter as an appendix.<sup>1</sup> (Additional information regarding land areas underlain by carbonate rock, as an aid to interpreting the map, can be gained from the New Jersey Geological Survey's Warren County Geology Map, found in a publication entitled "Environmental Geology of Warren County, New Jersey," by G.C. Herman et al [Open File Map 15B, NJGS, 1994]).

**CLOSED DEPRESSION** — A shallow, dish-shaped hollow on the land surface which, in area of limestone geology, may be indicative of old sinkholes or incipient collapse.

**DISAPPEARING STREAM** — A stream that enters the subsurface through a sinkhole or other surface entrance.

**DOLOMITE** — A carbonate rock that contains more than 15% magnesium carbonate.

**FAULT** — A surface or zone of rock fracture along which there has been noticeable differential movement.

**GEOTECHNICAL INVESTIGATION PROGRAM** — A program which identifies the geologic nature of the bedrock materials underlying a site and provides solutions directed at preserving the water quality and assuring the safety of any planned facility or improvement built over carbonate rocks.

**JOINT** — A fracture in rock, generally more or less vertical or transverse to bedding, along which no appreciable movement has occurred.

**KARST** — A type of topography that is formed over limestone or dolomite by dissolving or solutioning of the carbonate rocks, characterized by sinkholes, closed depressions, caves, solution channels, internal drainage and irregular bedrock surfaces.

**LIMESTONE** — A carbonate sedimentary rock consisting chiefly of calcium carbonate. Limestone is commonly used as a general term for that class of rocks which consists of at least 80% calcium or magnesium carbonate. In this chapter, the term "limestone" shall be used generically to refer to carbonate rocks, limestone formations and Precambrian marbles.

**SINKHOLE (DOLINE)** — A localized land subsidence, generally a funnel-shaped or steep-sided depression, caused by the dissolution of underlying carbonate rocks or the subsidence of the land surface into a subterranean

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1. **Editor's Note: The Carbonate Rock District Map is included at the end of this chapter.**

passage, cavity or cave. Sinkholes are formed by the underground removal of soil and rock material.

**SOLUTION CHANNELS** — Tubular or planar channels formed by solution in carbonate rock terrains, usually along joints and bedding planes. These openings are the main water carrier in carbonate rocks.

**VOID** — Opening in the soil or rock materials.

### **§ 55-3. Applicability.**

The provisions of this chapter shall pertain to applicable development activities in the Carbonate Rock District.

### **§ 55-4. District identification - Carbonate Rock District (CRD).**

The Carbonate Rock District (CRD) is hereby created and shall be the area identified as such upon the Washington Township Carbonate Rock District map, which is annexed to this chapter as an appendix. In this district, special submissions to the approving authority and special design features and remediation measures are required in an application involving, and as a condition of approval of, applicable development activities, as the same are important to protect the public safety and welfare, due to difficulties imposed to development arising from limestone geology. These requirements for the CRD shall be in addition to the requirements of Chapter 64, Development Regulations, regarding applications for development and in addition to zoning requirements for the applicable zoning district.

### **§ 55-5. Requirements for applicable development activities.**

The following requirements shall apply to applicable development activities proposed in the Carbonate Rock District (CRD).

#### **A. General requirements.**

- (1) For all applicable development activities in the CRD, a comprehensive site geotechnical investigation program shall be conducted by the applicant to provide the approving authority with sufficient data to define the nature of existing geologic conditions that may limit construction and development activities on the site. The investigation program shall be designed to produce information and provide recommendations for site planning, engineering design and construction techniques to minimize any adverse environmental and safety related impacts caused by the development proposal. The location of all sinkholes, disappearing streams or other karst features identified during the geotechnical investigation program shall be shown on all preliminary and final subdivision and site plans. The plans shall also detail any site remediation techniques or preventative measures proposed to stabilize or reduce the incidence of occurrence of any karst features.

- (2) The geotechnical investigation program shall be prepared by an individual retained by the applicant who is a New Jersey-licensed professional engineer or qualified geologist with experience in karst terrains. The township may retain, with respect to the application involved, a geotechnical consultant (GTC) who shall have one or more of the same qualifications to review all projects submitted.

B. Specific requirements.

(1) Checklist submissions.

- (a) An investigation program shall be commenced by completing the Carbonate Rock District Phase I and Phase II Checklists (or requesting a waiver, at the time of filing the application, from the Phase II Checklist requirements). Said checklists<sup>2</sup> (copies of which are attached to and made part of this chapter) shall be submitted to the approving authority secretary by the applicant as part of the application for an applicable development activity. If any waiver of the Phase II checklist requirements is requested, the checklist then shall be reviewed by the GTC within 14 days of receipt by the approving authority secretary. The GTC shall recommend that a waiver of the Phase II Checklist be granted or that it not be granted. If a Phase II Checklist waiver is not granted, the approving authority, or its authorized review committee, shall act to require the applicant to provide the Phase II Checklist and its information or otherwise rule the application incomplete. The Phase I and Phase II Checklists shall be reviewed by the GTC and a report shall promptly be made to the approving authority advising whether the checklists are complete. The approving authority shall rule on the completeness of the checklist(s) within 45 days of the date of their submission.
- (b) After Phase I and Phase II Checklists have been deemed complete by the approving authority, and, if the application for development has been determined by the approving authority to be otherwise complete, a permit shall be issued to the applicant authorizing the commencement of the testing procedure, the results of which shall be part of the material required and to be considered by the approving authority as part of the application for preliminary subdivision or site plan approval (as the case may be).

(2) Field investigations and findings.

- (a) Any on-site investigations and tests shall not begin until the applicant has received approval of his investigative plan and a permit has been issued. Additionally, notification shall be given

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2. Editor's Note: The checklists are included at the end of this chapter.

at least 15 days in advance of the commencement of testing, in writing, by certified mail, return receipt requested, or personal service of said notice on the Township Clerk.

- (b) The applicant shall arrange to have the proposed development site available for on-site inspection by the GTC or designated township inspectors at all times while the filed investigation program is in progress, and testing data and results shall be made available to township officials and township inspectors on demand, but at no less frequent intervals than bimonthly.
- (c) At the completion of the field investigation, a formal written report including the following shall be submitted to the approving authority: a description of the project; a general plan, to scale, of the entire project, showing the location of the project with respect to surface water, existing wells (within 1/2 mile) and adjacent property owners; logs of all borings, test pits and probes, including evidence of incipient cavity formations, loss of circulation during drilling, voids encountered, type of drilling or excavation techniques employed; drawings of monitoring or observation wells as installed; time and dates of explorations and tests; reports of chemical analyses of on-site surface and ground water; names of individuals conducting tests if other than the professional engineer referred to in the checklist; analytical methods used on soils, water samples and rock samples; a one inch to 100 feet scale topographic map of the site (at a contour interval of two feet) locating all test pits, borings, wells, seismic or electromagnetic conductivity or other geophysical surveys, as well as the location of all sinkholes, disappearing streams or other karst features identified during the field investigation; an analysis of the groundwater regime with rate and direction of flow; a geologic interpretation of the observed subsurface conditions, including soil and rock type, jointing (size and spacing), faulting, voids, fracturing, grain size and sinkhole formation.
- (d) The site investigation report should define the extent of geotechnical concerns at the site in relation to the planned development or land use. The proposed engineering solutions to minimize environmental impact as a result of the project, both during construction and in the foreseeable future, must be clearly detailed, together with the basis for the conclusions reached. Special consideration should be given in the report to innovative control of surface water flows, as well as protection and replenishment of groundwater.
- (e) All samples taken shall be preserved and shall be available for examination by the township upon request until final action is taken by the approving authority on the application.

- (3) Review and approval.
- (a) Geotechnical investigation program. The GTC shall review the findings of the field investigation program and shall consider the data, formal reports, maps, drawings and related submission materials and shall advise the approving authority of his/her findings. If the geotechnical investigation program undertaken as required by this chapter is inadequate to make an informed decision as to whether the requirements of this chapter for approval of the application for development have been met, the approving authority, upon the recommendation of the GTC, may require additional investigation or evaluation. The precise nature and extent of such additional investigation and the reasons therefor shall be identified in the approving authority determination. At the request of the applicant, the approving authority shall rule on the adequacy of the geotechnical investigation program within 45 days of receipt of the report from the GTC.
- (b) Major subdivision and site plan approval. The approving authority shall review and consider the findings of the geotechnical investigation program in its deliberations with respect to the granting of major subdivision and site plan approval and apply the following standards in its determination as to whether the requirements of this chapter have been met and whether the application for development approval should be granted:
- [1] Within the CRD, no residential or nonresidential development shall be permitted which involves the discharge of any liquid (including septic wastewater) into or on the soils unless there is a positive demonstration by the applicant that such discharge will not chemically react with the underlying geology so as to increase significantly the likelihood that solution cavities or sinkholes will result.
- [2] The major subdivision or site plan for any development to which this chapter applies shall address and respond in a satisfactory manner to those problems which have been identified in the geotechnical investigation program, and, as a minimum, shall address and so respond to Subsection B(3)(b)[2][a] through B(3)(b)[2][m] below. Approvals of major subdivisions or site plans shall be contingent upon the positive demonstration by the applicant that the following issues, Subsection B(3)(b)[2][a] through B(3)(b)[2][m], have been appropriately addressed and satisfactorily responded to:
- [a] Site selection, facility layout and structural design shall be performed in a manner that will minimize any adverse effects on the quality of surface or subsurface

water and will not alter the flow of surface and subsurface water in any detrimental manner.

- [b] Adequate support is provided for structures, roads and subsurface utility lines to span soft soils or sinkholes.
- [c] Stormwater and sanitary sewer lines are designed and constructed with watertight joints.
- [d] All pipe for storm drainage installations shall be reinforced concrete culvert pipe with rubber gaskets in sizes 12 inches and above. For smaller pipe, to be used for roof drains, underground stormwater management or other uses, pipe shall be PVC pipe with glued joints to form a watertight seal.
- [e] A trench backfill detail for storm drain, sanitary sewer and all utilities shall be provided on the plan indicating a relatively impermeable soil for pipe bedding and backfill of the trench. Imported backfill material (from the quarry) and excavated material from the site may be used for trench backfill with the approval of the Township Engineer if it meets the following minimum requirements:
  - [f] The backfill material to be used one foot above, below and around the pipe or utility shall be free of stone two inches in size or larger.
  - [g] The backfill material to be used one foot above the pipe or utility shall be free of stones six inches or larger.
  - [h] backfill material shall be installed and compacted in six-inch to eight-inch lifts. Moisture content shall be controlled and maintained with the optimum limits to obtain 95% compaction based upon testing of the material.
  - [i] Reports of testing of material to be used for backfill shall be provided for review and approval of the Township Engineer, indicating that the material is suitably impermeable for the intended use.
  - [j] Typical details for repair of sinkholes found on the site before and during construction shall be provided on the plans. These details shall be approved by the Township Engineer.
- [k] Stormwater management impoundment facilities (detention ponding, etc.) shall be constructed with an

impermeable liner (man-made or impermeable soil). If a soil liner is used, it shall be at least 12 inches thick. All liners shall line the bottom and side slopes of the facility.

- [l] All stormwater improvement facilities shall contain an impervious low-flow channel from all pipes outletting onto the facility to the outlet structure. This shall be either a concrete channel with an impervious soil liner underneath or other impervious low-flow channel approved by the Township Engineer.
  - [m] Where pavement is to be placed within six inches of exposed or excavated limestone bedrock, then a bed of at least six-inch thick (compacted) dense-graded aggregate shall be placed over the rock prior to paving.
  - [n] Water supply and other pressurized utility lines intended to transport liquids beneath the ground surface are equipped with flow alarms or automatic shutdown mechanisms to detect breaks which would allow water or other liquids to escape.
  - [o] Site grading and blasting has been minimized insofar as is reasonably practicable.
  - [p] Specific details have been shown, describing the design concepts as well as the construction and operational procedures that will be used to protect the surface and subsurface water from potential contamination, as well as a specific timetable schedule and sequence of construction for the development, as these items relate to the method to minimize or eliminate the occurrence of sinkholes, has been submitted.
  - [q] Specific details have been shown describing the construction inspection procedures intended to disclose potential hazards as well as the possible means for remediating any potential karst-related hazard that might be encountered during construction.
- (c) Notification to lot owner. The approving authority shall require, as a condition of final major subdivision or site plan approval for any development to which this chapter applies, that there be stated on the final plat and included in a deed (to be recorded) for each involved lot the following statement:

"In accordance with the Carbonate Rock District Development Regulations of the Township of Washington, the owner of this lot is advised that geologic mapping shows all or part of this lot to be underlain by formations of limestone or dolomite. Areas underlain by these geologic formations may be unstable and may be susceptible to subsidence and surface collapse. This instability may be enhanced by the alteration of drainage patterns through development activities. The exact kinds or locations of sinkholes and/or subsidence which may occur are not always predictable; therefore compliance with any measures required by the Carbonate Rock District Regulations represents no warranty or assurance that a sinkhole and/or subsidence will not occur, and the Township assumes no liability in this regard. The lot owner should always make independent investigations of these matters prior to using the lot for construction or any activity which alters drainage patterns or the soil and bedrock materials."

**§ 55-6. Reevaluation after approval.**

- A. In certain situations, a specific geologic hazard may not be identified while the geologic investigation program is underway and may be discovered during or after construction. In such cases the applicant shall:
- (1) Halt construction activities which would impact the geologic hazard and divert any stormwater away from the hazard area.
  - (2) Report the occurrence of the hazard to the Township Clerk within 24 hours of discovery.
  - (3) Prepare a report on the geologic hazard which analyzes the impact of the hazard and details a remediation plan for review and approval by the GTC.
  - (4) After obtaining approval from the township, perform necessary remediation of the hazard to prevent or minimize damage to buildings, structures, utilities, driveways, parking areas, roadways and other site improvements and to minimize pollution of the groundwater.
  - (5) Repair any damage to improvements and restore ground cover and landscaping.
- B. In those cases where the hazard cannot be repaired without adversely affecting the site plan or subdivision, or without requiring a change or modification of the approved site plan or subdivision, the applicant shall file an amended application for a site plan or subdivision approval in compliance with the provisions of this chapter and other applicable provisions of this Code.

**§ 55-7. Exemptions and enforcement.**

- A. The approving authority when acting upon applications involving applicable development activity, shall have the power to grant exceptions from the design and performance standards of this chapter in the same manner and under the same standards as exceptions may be granted from the design and performance standards in Article IV, Design and Performance Standards, of Chapter 64, Development Regulations, of this Code, pursuant to § 64-10 of this Code.
- B. If during construction of the development, the developer fails to comply with any of the design and performance standards of this chapter which are applicable to the involved development, the township may issue a stop-work order and may withhold certificates of occupancy and refuse to issue additional construction permits for the development until there is compliance. Remedial and corrective measures may be mandated by the Township Engineer and/or GTC if the appropriate construction and site planning techniques, as outlined in the applicant's approved geotechnical report, are not followed and result in actions which adversely impact karst features.