CARBONATE AREA DISTRICT
MODEL ORDINANCE

Section 100.0 PURPOSE:

Areas within the municipality are underlain by carbonate bedrock such as limestone and dolomite. The solution of this bedrock causes surface depressions, open drainage passages, and the development of irregular, sub-surface rock topography known as karst. These conditions make such areas unstable and susceptible to subsidence and surface collapse. As a result, the alteration of drainage patterns in these areas by the placement of impervious coverage, grade changes, or increased loads from site improvements can lead to land subsidence and sinkholes.

Fractures or solution openings and fissures in the limestone rock may lead to public or private water supplies, making those sources especially 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 fractures or solution openings and fissures within the rock.

Carbonate aquifers are an important source of groundwater in the municipality. (Name of municipality) relies on a clean supply of subsurface water to foster and promote human health, welfare and economic and social development. Therefore, the purposes of enacting this chapter are to protect, preserve and enhance a sensitive and valuable potable groundwater resource area 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 and insuring orderly development within the municipality.

COMMENTS

The purpose of this section is to establish the basic rationale and legal basis for adopting the chapter. The problems of carbonate-related groundwater pollution and structural failures are explicitly recognized and are directly related to the health, safety, welfare and orderly development of (name of the municipality).

The statutory authorization for enacting this chapter appears at N. J. S. A. 40:55D-2(a), (b), (d), (f) , (j), and (m). In conjunction with the adoption of land use regulations, municipalities should also revise their master plan to acknowledge and discuss the environmental and safety issues related to development in limestone areas.

Section 101.0 DEFINITIONS:

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

Agricultural Use - The production, keeping or maintenance of plants or animals for sale, lease or personal use.

Approval Authority - (1) The local land use board constituted pursuant to 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. (2) For projects not requiring approval by either the planning board or zoning board of adjustment, but requiring the issuance of a building or zoning permit, the approval authority shall be the zoning officer. (3) For activities requiring only approval or permits from the board of health (e.g. well and septic system installation and repairs), the approval authority shall be the board of health or its approved licensed sanitarian.

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 Area District - The Carbonate Area District is comprised of the Carbonate Rock District and the Carbonate Drainage Area.

Carbonate Drainage Area - Watershed areas which directly drain into the Carbonate Rock District.

Carbonate Rock - Rock consisting chiefly of calcium and magnesium carbonates.

Carbonate Rock District - Those land areas underlain by carbonate rock formations.

Cave - A natural opening of a size permitting human exploration and extending into a region of sharply reduced or no light.

Closed Depression - A shallow, dish-shaped hollow on the land surface which, in areas of limestone geology, may be indicative of old sinkholes or incipient collapse.

Collapse Sinkhole - A sinkhole caused by the collapse of the roof of a bedrock cavern.

Development - Any improvements in the Carbonate Area District requiring, pursuant to existing land use statutes or ordinances, subdivision or site plan approval, building permits, zoning permits, septic systems and wastewater disposal systems requiring state permits or treatment works approvals; this chapter shall also be applicable to the installation of wells, site improvements, pond construction (except for agricultural purposes), filling of any sinkhole, or any other activity which could be affected by the presence of limestone geology on or near the site.

Disappearing Stream - A stream that enters the subsurface through a sinkhole or other entrance.

Dissolution - A space or cavity in or between rocks, formed by the solution of part of the rock material.

Doline - See sinkhole.

Dolomite - A carbonate rock that contains more than 15% magnesium carbonate.

Drainage - The process by which water moves from an area by stream or overland sheet flow and/or the removal of excess surface water from soil by downward flow through the soil profile.

Fault - A surface or zone of rock fracture along which there has been noticeable differential movement.

Fissure - An extensive crack, break, or fracture in the rock.

Geotechnical investigation program - A program which identifies the geologic nature of the bedrock materials underlying the 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 solution 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.

Lineation - Any straight line or alignment of natural features seen on an aerial photograph or any geographically- referenced source. Although some lineations may be geologically controlled, ground-based geologic investigations are necessary to define their existence and significance.

Marble - A metamorphic rock consisting chiefly of crystalized limestone or dolomite.

Outcrop - An exposure of bedrock projecting through the ground surface.

Pinnacle - An irregular rock projection often buried beneath the ground surface.

Shear Zone - A zone in which shearing has occurred on a large scale so that the rock is crushed and brecciated (broken).

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

Soil - The material found in the surface layer of the earth's crust which may be moved by a spade or shovel.

Solutioned Carbonates - Carbonate rocks that have had cavities formed, fractures widened, and passages in the rock created through the dissolution of the rock by the passage of surface water.

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.

Solution Sinkhole - A depression formed from the slow dissolution of bedrock.

Spring - A place where water naturally flows from rock or soil upon the land or body of surface water.

Subsidence Sinkholes - Sinkholes formed by the downward settlement of unconsolidated overburden into openings in the underlying, soluble bedrock.

Surface Runoff - The part of the precipitation that passes over the surface of the soil.

Void - Opening in the soil or rock materials.

Section 102.0 APPLICABILITY

The provisions of this chapter shall be applicable to development activities in the Carbonate Area District requiring, pursuant to existing land use statutes or ordinances, subdivision or site plan approval, building permits, zoning permits, septic systems and wastewater disposal systems requiring state permits or treatment works approvals; this chapter shall also be applicable to the installation of wells, site improvements, pond construction (except for agricultural purposes), filling of any sinkhole, or any other activity which could be affected by the presence of limestone geology on or near the site.

COMMENTS

The purpose of this section is to make clear that no development of any type is to take place in the Carbonate Area District except in compliance with the provisions of this chapter. This ordinance format is probably the most restrictive a community should consider. Some communities with limestone ordinances only choose to regulate new site plan or subdivision applications so as to reduce the impact on the local community. While this would assure proper resource management occurs with new development, it would not address such activities as well drilling, septic system repairs, wastewater disposal system repairs, additions to residential buildings, or sinkhole remediation.

Section 103.0 DISTRICT IDENTIFICATION

Section 103.1 CARBONATE AREA DISTRICT (CAD)

The Carbonate Area District is hereby created and shall be any area identified as such upon the (name of the municipality) zoning map. The district shall be constituted as secondary, or as an "overlay," to the zoning districts heretofore established by the zoning map and may encompass all or portions of more than one existing zoning district. Regulation of the CAD shall be in addition to those requirements governing the existing zoning district.

The Carbonate Area District shall contain two areas which shall be known as the Carbonate Rock District and the Carbonate Drainage Area.

Section 103.1(a) CARBONATE ROCK DISTRICT (CRD)

The Carbonate Rock District is composed of those areas of the municipality underlain by limestone or carbonate rocks. The geologic mapping utilized to prepare the CRD overlay boundary is derived from New Jersey Geologic Survey and United States Geological Survey maps. These maps are interpretations developed from available field observations and subsurface data; additional unmapped areas of limestone rocks may exist in (name of municipality). Therefore, the provisions of this chapter may be applied to any development which, in the opinion of (name of the municipality), is located in an area underlain by limestone. The CRD map shall be updated as information is developed through the application of this chapter.

Section 103.1(b) CARBONATE DRAINAGE AREA (CDA)

The Carbonate Drainage Area shall consist of all lands which drain surface water into the Carbonate Rock District. Changes in the quantity, quality and rate of discharge of surface water runoff from lands upslope of the Carbonate Rock District can adversely affect the CRD. Therefore, development activities in the CDA which may alter the surface drainage patterns or affect the water quality or increase runoff into the CRD shall be subject to the requirements of this chapter.

COMMENTS

The purpose of this section is to specify the components of the Carbonate Area District and to indicate that the CAD requirements are in addition to existing zoning requirements.

The Carbonate Rock District should be drawn on the zoning map by identifying the marble, limestone and carbonate geologic formations as mapped by the NJ Geological Survey, US Geological Survey, or other recognized source. Table A lists all geologic formations which should be included in the Carbonate Rock District.

The mapping of the CDA should be developed using topographic maps, such as the U.S.G.S. topographic maps. The drainage area is defined as all lands contributing surface water drainage into carbonate rock areas. Regulation of development activities in the CDA that change the type and amount of runoff entering the carbonate rock district is required to prevent the formation or enlargement of sinkholes, the introduction of contaminated surface water into groundwater aquifers via sinkholes or cavities, and the lowering of the water table. These activities can have a negative impact on downstream groundwater quality and on the stability of limestone land areas. Applicants seeking approval of development activities in the CDA shall be required to complete information under Phase I Checklist.

Section 105.0 PERFORMANCE STANDARDS FOR CRD:

The following performance standards shall be applicable to development activities occurring in the Carbonate Rock District:

A. The location of all sinkholes, disappearing streams, or other karst features identified during the geotechnical investigation program and shown on documents submitted under the Phase I and/or Phase II Checklist shall be drawn

on all final plats. The plats shall also note any site remediation techniques utilized to stabilize any solution channels or subsidence karst features. All final subdivision deeds shall contain the following wording:
Block ___ Lot ___ is underlain by limestone formations. Limestone formations are susceptible to surface collapse (or sinkholes) and subsidence caused by the physical erosion and chemical alteration of the soil and bedrock.

COMMENTS
It is unlikely that future property owners will be informed of the presence of limestone during the course of a realty transaction. By showing the location and method of site remediation utilized on the subject property and including this note in the deed, new property owners are at least made aware of the limestone features. If possible, the occurrence of new sinkholes or closed depressions should be reported and a follow-up risk evaluation conducted by the municipality.

B. The design and construction of the improvements listed in Table 1 shall be accomplished so as to minimize, to the greatest extent practical, the development of future sinkholes or other karst hazards and the pollution of surface and groundwater resources.

Carbonate formations present complex design and engineering challenges. For example, design and engineering solutions which may be appropriate for a single family home may not work for a high rise office building.

As a result, the provisions of Table 1 were developed to provide an outline of design concerns which apply to different construction activities. Table 1 also provides rudimentary suggestions as to current engineering and geotechnical procedures, and minimum standards that might be useful to those using this ordinance. None of the items is intended to preclude the application of judgment, innovation and experience. Table 1 represents the best technical judgment available at this time. As a municipality gains experience with the carbonate chapter and the local geologic conditions, both the level of review and the scope of
Table 1 should be evaluated.

A number of "testing" procedures are presented in
Table 1. These include direct methods, such as site reconnaissance, test pits, test probes and test borings. These direct methods are essentially those procedures which allow the investigator to physically see or sample some of the geotechnical parameters of the site. Direct methods can provide an accurate picture of known site locations. It is then necessary to extrapolate these known data points to the entire site.

Indirect methods include the use of such items as aerial photography, satellite imagery and geophysical procedures. With geophysical procedures one records some earth properties and attempts to correlate each property with more specific site characteristics, such as rock properties or depths. Indirect methods must be used with great care because of the complex nature of karst sites. Indirect methods may not detect small variations in the carbonate bedrock features which may be of great significance to the project design.

For purposes of better understanding Table 1, a number of specific items are discussed herein.

Direct Methods

A. Site Reconnaissance. An on-site reconnaissance, by a person with knowledge of local geology, is important to develop an understanding of the site

constraints. Prior to conducting reconnaissance on-site, field personnel should review aerial photography to look for the presence of such features as photo lineaments, vegetation changes and depression areas. Black and white aerial photographs, when viewed in a stereo image, can reveal such features as sinkholes, closed surface depressions, lineaments and bedrock pinnacles. Older aerial photographs are a valuable resource to document changes in the land forms or karst features which have occurred on the site over time.

B. Test Pits. As described in Checklist II , test pits are a simple, inexpensive way to view the overburden materials and the condition and variability of the carbonate rock surface. Test pits are backhoe excavations generally to the depth of the bedrock or limitation of backhoe.

C. Test Probes. These generally consist of advancing a steel bit into the ground by an air-percussion machine. Essentially a large, mobile "jack-hammer" is used. Depth of normal penetration is usually less than 50 feet. The "cuttings" are blown out of the hole and examined. Although quite disturbed, these cuttings yield a sample of the materials penetrated. The amount of air injected and return of cuttings at the surface can indicate the presence of fractures and cavities. The rate of speed of the advance of the probe provides a qualitative estimate of the competency of the material encountered. Back-filling with a fluid cement grout and recording the volume of materials placed in the drill hole (of known dimension) can also yield a measure of the size of openings encountered in the subsurface during the downward progress of the probe.

D. Test Borings. As discussed in Checklist II, test borings can yield virtually complete and undisturbed soil and rock samples. These provide visual evidence of fractures, weathering, fracture fillings and even the vertical dimensions of cavities. A measure of the drilling fluid losses can also indicate the volume and nature of any soil or rock cavities encountered. Back-filling with a fluid cement grout and recording the volume of materials placed in the drill hole (of known dimension) can also yield a measure of the size of openings encountered in the subsurface during the downward progress of the probe.

Indirect Methods

A. Aerial Photography. This is the simplest indirect technique, particularly when photos taken over a long time period are analyzed. Open depressions, bedrock exposures, vegetation and moisture changes over time can be detected on either black and white or color photographs. Piles of rock or small groups of brush or trees in otherwise open fields can indicate active sinkholes or rock pinnacles breaking the ground surface. Images defined at wave lengths other than visible light can be as useful as, or even more useful than, conventional aerial photographs. These images are generally available from satellite mapping work.

B. Geophysical Procedures. Various geophysical investigation techniques which can be used in karst terrains include: ground penetrating radar, electrical conductivity, electrical resistivity, magnetic field, very low frequency measurement (ELF), gravity field recording and seismic velocity measurements. In general, none of these methods has the ability to discriminate all fractures and small cavities. The data provides information on the variation in underground conditions which should be interpreted by a person trained in geophysics.

These procedures are used to identify zones of variation across a site. Areas showing variation are then targeted for additional direct testing

procedures. Geophysical procedures should not be used as the only method of verifying underground conditions. Information gathered with geophysical procedures is useful when extrapolating directly measured data.

The variability in physical properties and the solutioned nature of most carbonate rock sites require an increase in the number of sites analyzed and the use of several investigation methods to provide a reliable interpretation of the subsurface conditions.

Section 106.0 PROCEDURES AND SUBMISSION REQUIREMENTS FOR THE CARBONATE AREA DISTRICT:

106.1 GENERAL REQUIREMENTS

A. All applicants filing for site plan or subdivision approval, building permits, zoning permits, land grading permits, conditional use approval, septic system certification, well installation, pond construction (except for agricultural uses), or undertaking any other activity affected by the presence of limestone on or near the project site, shall undertake a geotechnical investigation program. Projects located in the Carbonate Drainage Area shall complete the Phase I Checklist. Projects located in the Carbonate Rock District shall first complete the Phase I Checklist. Submission of the Phase II Checklist shall be based on the recommendation of the municipal geotechnical consultant as per Section 106.1 F.

B. The geotechnical investigation program shall be prepared by a professional engineer or geologist with experience in karst terrains. The municipality's geotechnical consultant (GTC) shall be similarly qualified to review all projects submitted.

C. The geotechnical investigation program shall identify the geologic nature of the materials underlying the site.

D. The Geologic Investigation Report shall evaluate site information gathered during the geotechnical investigation, and provide recommendations for the planning, engineering design, and construction techniques to be utilized. All design recommendations shall minimize, to the greatest extent practical, impacts upon water quality and structural hazards associated with limestone formations.

COMMENTS

The geologic and engineering studies are not performed merely for the sake of providing data. Study data are to be interpreted in light of the proposed activity and the results directed toward protecting the public and the environment.

The many variations in subsurface conditions in areas underlain by limestone rocks require the designer/builder to perform a geologic and engineering investigation and evaluation program and to utilize the results in the planning, design, and construction process.

E. In the case of applications for site plans or subdivisions, the geologic investigation program may be completed and filed prior to a formal application for preliminary approval.

COMMENTS

The opportunity for early completion of the geologic investigation program is offered in an attempt to encourage proper site design based on known geologic conditions. Proper site evaluation sequencing by the applicant can minimize project expenses. Data derived during the completion of the Phase I Checklist can give an early indication of the project viability. In the past extensive costs were incurred by the project developers for preliminary site design and engineering before the issue of limestone hazards were investigated. Improper sequencing of the project design can lead to expensive re-design and site testing costs for the applicant.

F. After the submission of the information required in the Phase I Checklist, the authorized approval authority may grant a waiver from the requirement of part or all of the geotechnical investigation and report requirements under Sections 106.4 and 106.5 below, upon recommendation of the municipal geotechnical consultant.

COMMENTS

The opportunity to waive some or all of the geotechnical investigation requirements after the submission of the Phase I Checklist is permitted in order that the amount of information required is commensurate with the intensity of the proposed project. For example, a homeowner proposing to construct an addition would not be required to undertake the same investigation program as the developer of a new commercial site. The ability to waive the chapter requirements should only be exercised when the approval authority has received advice from the municipality's geotechnical consultant. Applicants seeking approval of development activities in the CDA are only required to complete the Phase I Checklist to evaluate the project impacts on the Carbonate Rock District.

Section 106.2 GEOTECHNICAL INVESTIGATION PROGRAM PROCESS

For all properties located in the CAD a comprehensive geologic investigation program shall be conducted by the applicant. The purpose of this program is to provide the approval authority with sufficient data to define the nature of all existing geologic conditions that may affect construction and land use activities on the site. Specifically, the investigations shall yield information which shall demonstrate that the proposed development will identify any existing geologic conditions for which appropriate site design and/or engineering solutions may be necessary to minimize any adverse environmental impacts caused by the project. A geotechnical investigation program involves the following:

A. Phase I - completion of the Phase I Checklist by applicant and review by the municipal GTC, action on completeness by approval authority.

B. Phase II - completion of the Phase II Checklist and proposed Geotechnical Investigation Program by applicant, review by the municipal GTC and action on completeness by approval authority; issuance of permit to undertake on-site testing.

C. Applicant undertakes on-site geotechnical investigation program, with observation by municipal GTC.

D. Submission of a Geologic Investigation Report and site recommendation by applicant.

E. Municipality GTC review, report and final recommendation forwarded to approval authority.

F. Approval authority acts on the geotechnical aspects of the proposed project.

Section 106.3 GEOTECHNICAL INVESTIGATION PROGRAM TIME LIMITS

A. An investigation program shall be commenced by completing the Phase I Checklist. The Phase I Checklist shall be submitted to the approval authority and shall be reviewed by the municipal geotechnical consultant. A report from the GTC shall be rendered to the approval authority within 30 days of the submission by applicant of the Phase I Checklist. The approval authority shall rule on the completeness of the Checklist within 30 days of the receipt of the GTC completeness report. The GTC's report shall either recommend that the Phase II Checklist be prepared and submitted or, in the alternative, that portions or all of the requirements of the Phase II Checklist be waived.

B. If the Phase II Checklist is required, it shall be submitted to the approval authority and be reviewed by the GTC for completeness. A completeness report shall be made to the approval authority within 30 days of the submission by applicant of the Phase II Checklist. The approval authority shall rule on the completeness of the checklist within 30 days of the receipt of the GTC's completeness report. The GTC's completeness report shall also advise the applicant as to whether any proposed testing methodology is prohibited because of the potential danger the methodology may pose to the integrity of the site or the health, safety and welfare of the community. If the geotechnical consultant recommends the disapproval of the testing program, the recommendation shall include suggestions on alternate methodology which would provide the requisite data. The geotechnical consultant may also recommend waiver of some or all of the required investigations in appropriate cases pursuant to Section 106.1 F.

C. At the applicant's option, both the Phase I and or the Phase II Checklist may be submitted simultaneously, in which case the GTC shall submit a completeness report to the approval authority within 30 days of submission of the checklist(s) by applicant. The approval authority shall act on the completeness report within 30 days of submission of the GTC's report.

D. After the Phase I and Phase II Checklists have been deemed complete by the approval authority and the GTC has advised that the testing methodology poses no danger to the integrity of the site or to the health, safety and welfare of the community, a permit shall be issued to the applicant authorizing the commencement of the testing procedure.

COMMENTS

The submission checklist for major and minor subdivisions and major and minor site plans should require the applicant to have completed the Phase I and Phase II Checklists and completed the testing program as a condition of completeness.

Section 106.4 ON-SITE INVESTIGATION PROTOCOL

A. Any on-site investigations and tests undertaken pursuant to this chapter shall not begin until the applicant has received a permit pursuant to Section 106.3 D. Applicant shall also be responsible for providing, at least fifteen (15) days prior to commencement of any testing procedures, written notice of same to the municipal clerk, which notice shall be transmitted by certified mail, returned receipt requested or served personally. All site investigations shall be properly closed in accordance with N.J.A.C. 7:9-9.1 et seq.

B. The proposed development site shall be subject to inspection by the GTC or designated municipal inspectors at any time. All testing data and results shall be made available to municipal officials and inspectors on demand.

C. All samples taken shall be properly preserved and shall be available for examination by the municipality upon request until final action is taken by the approval authority on the application.

Section 106.5 GEOTECHNICAL INVESTIGATION REPORT REQUIREMENTS

A. At the completion of the field investigation a formal site investigation report shall be submitted and include any of the following required information gathered during the testing protocol: logs of all borings, test pits, and probes including evidence of cavities, loss of drilling fluid circulation during drilling, voids encountered and similar cavities, type of drilling or excavation technique 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 1" = 100' 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 and analysis of the ground water including any potentiometric maps constructed from site data or aquifer tests 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.

B. The report shall define the extent of geotechnical findings at the site in relation to the planned development or land use. The engineering solutions proposed to minimize environmental and structural impacts for the useful life of the project, as well as during construction, must be clearly detailed.

COMMENTS

The Geotechnical Investigation Program was developed to allow for the phased evaluation of a project site. After each submission of information both the municipality's geotechnical consultant and the approval authority are given time to review and act on the information.

Information required for the Geotechnical Information Report is explicitly listed in the chapter so that applicants understand what information is necessary.

Section 106.6 MUNICIPAL REVIEW OF GEOTECHNICAL INVESTIGATION REPORT

A. Within forty-five (45) days of submission of the Geotechnical Investigation Report by the applicant the GTC shall review and prepare a completeness report for submission to the approval authority. During the GTC's review of the Geotechnical Investigation Report for proposed development in the CRD the GTC shall consider the data, formal reports, maps, drawings and related submission materials and shall advise the approval authority whether or not the applicant has provided the municipality with:

1. Sufficient design, construction and operational information to insure that the proposed development of the tract will not adversely impact on the health, safety and welfare of the community;

2. Proof that the proposed method of development of the tract will minimize any adverse effects on the quality of surface or subsurface water, and will not alter the character of surface and/or subsurface water flow in a manner detrimental to known on-site or off-site conditions;

3. Specific details insuring that design concepts and construction and operational procedures intended to protect surface and subsurface waters will be properly implemented;

4. Specific details on inspection procedures to be followed during construction and after project completion.

B. The approval authority shall, within forty-five (45) days of the receipt of the report from the geotechnical consultant, approve or disapprove the proposed geotechnical aspects of the development plan and associated construction techniques. In the event the approval authority denies the proposed development plan and associated construction procedures the approval authority shall state in the resolution its reasons for disapproval.

COMMENTS

The value of the on-site investigation process depends upon how well the applicant's consultants have incorporated the site conditions into the project design. Site designs should recognize the carbonate formation limitations while accommodating the project design.

Section 107.0 RE-EVALUATION

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. Report the occurrence of the hazard to the municipal clerk within twenty-four (24) hours of discovery;

2. Halt construction activities which would impact the geologic hazard;

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 municipal geotechnical consultant;

4. After obtaining approval from the municipality, 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;

6. In those cases where the hazard cannot be repaired without adversely affecting the 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.

COMMENTS

Even with the best investigation program and site design unrecognized hazards may become evident once construction commences. In some instances problems occur after the project is complete. In both instances the chapter requires remediation to occur based on the technical advice of the geotechnical consultant. The municipality may also want to evaluate the amount of the performance bond in light of the additional development costs associated with development in carbonate areas.

Section 108.0 COMPLIANCE AND ENFORCEMENT

A. Compliance with this chapter is required prior to the granting of municipal subdivision or site plan approval, the granting of zoning or building permits, or the municipal endorsement of State permits and treatment works approvals, unless the applicant is exempted from the provisions of this chapter or the requirements in this chapter have been waived. The enforcement officials for any application requiring the approval of the planning board or board of adjustment and subject to this chapter shall be the municipal engineer and the municipal GTC. The enforcement official for zoning or building permit applications that are subject to this chapter shall be the zoning officer or construction code official. For well and septic system installation, the municipality's sanitarian shall serve as the enforcement officer. The municipal GTC, engineer, or sanitarian shall serve as the enforcement officials for wastewater systems requiring NJDEPE permits or Treatment Works Approvals.

B. Failure to comply with any of the conditions in this chapter may result in the issuance of a stop-work order, revocation of building permits, or denial of certificates of occupancy. Remedial and corrective measures may be mandated 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.

COMMENTS

The ability to issue stop-work orders or impose other punitive measures is needed for those rare occasions when the provisions of this chapter are violated. If compliance problems occur the municipality may wish to include a provision for daily fines similar to those imposed for the non-compliance with the Soil Erosion and Sediment Control Act, N.J.S.A. 4:24-29, et seq.

Section 109.0 CARBONATE AREA DISTRICT DATA DISTRIBUTION

On-site geologic information collected through the provisions of this chapter represents important resource data. Copies of the final geologic investigation report and all maps and accompanying data shall be submitted to the municipal board of health, the municipal clerk, and a copy filed with the planning board secretary.

The municipality shall develop a catalogue system of all available municipally-generated geologic reports. This file shall be accessible to the public during normal working hours.

COMMENTS

The development of site specific geologic reports and remediation plans represents a significant data resource that should be available to both the public and their consultants. It is suggested that the submissions to the board of health, planning board, and municipal clerk be made to assure the long-term availability of this information separate from the full files maintained on the project. The municipality should consider updating the CAD base map periodically as more site-specific information is generated. It would also be beneficial for copies of the geologic investigation reports, maps, and supporting data to be submitted to the NJDEPE Geological Survey.

Section 110.0 APPLICATION AND ESCROW REVIEW FEES

For any project in the CAD requiring a submission, there shall be an application fee of _____.
Additionally, there shall be posted with the municipality a review escrow as follows:

A. Escrow for the Phase I Checklist: $_____ plus $_____ per acre for each acre of the project site in the Carbonate Rock Area, plus $_____ per acre of land in the Carbonate Drainage Area;

B. Escrow for the Phase II Checklist: $_____ plus $_____ per acre of land being developed in the
Carbonate Rock Area.

COMMENTS

The strength of the chapter depends on the municipality's ability to hire experts competent in limestone geology and knowledgeable about the proper engineering solutions to protect the water quality and prevent structural hazard issues. The escrow is broken down by Phase I and II Checklist to allow the applicant to furnish the smallest amount of escrow possible for the initial review of the project.

The fixed amount and the per-acre review fees are included to allow the charging of review fees which are commensurate with the type of project. More review time is required for projects in the CRD than in the CDA. Also, the escrow is split for the Phase I and Phase II Checklist to allow those projects which do not require or proceed to the Phase II Checklist to provide the smallest amount of up-front escrow fees. An application fee is included to cover municipal costs incurred in the processing of the application.