

15A NCAC 13B .1623 GEOLOGIC AND HYDROGEOLOGIC INVESTIGATIONS FOR MSWLF FACILITIES

(a) Site Hydrogeologic Report. An investigation is required to assess the geologic and hydrogeologic characteristics of the proposed site to determine: the suitability of the site for solid waste management activities; which areas of the site are most suitable for MSWLF units; and the general ground-water flow paths and rates for the uppermost aquifer. The report shall provide an understanding of the relationship of the site ground-water flow regime to local and regional hydrogeologic features, with special emphasis on the relationship of MSWLF units to ground-water receptors (especially drinking water wells) and to ground-water discharge features. Additionally, the scope of the investigation shall include the general geologic information necessary to address compliance with the pertinent location restrictions described in Rule .1622 of this Section. The Site Hydrogeologic Report shall provide, at a minimum, the following information:

- (1) A report on local and regional geology and hydrogeology based on research of available literature for the area. This information is to be used in planning the field investigation. For sites located in piedmont or mountain regions, this report shall include a fracture trace analysis and Rose Diagram, based at a minimum on an evaluation of structurally controlled features identified on a topographic map of the area.
- (2) A report on field observations of the site that includes information on the following:
 - (A) Topographic setting, springs, streams, drainage features, existing or abandoned wells, rock outcrops, (including trends in strike and dip), and other features that may affect site suitability or the ability to effectively monitor the site; and
 - (B) Ground-water discharge features. A more extensive hydrogeologic investigation may be required for a proposed site where the owner or operator does not control the property from any landfill unit boundary to the controlling, downgradient, ground-water discharge feature(s).
- (3) Borings for which the numbers, locations, and depths are sufficient to provide an adequate understanding of the subsurface conditions and ground-water flow regime of the uppermost aquifer at the site. The number and depths of borings required will depend on the hydrogeologic characteristics of the site. At a minimum, there shall be an average of one boring for each ten acres of the proposed landfill facility, unless otherwise authorized by the Division. All borings intersecting the water table shall be converted to piezometers or monitoring wells.
- (4) A testing program for the borings which describes the frequency, distribution, and type of samples taken and the methods of analysis (standard ASTM test methods or methods approved by the Division) used to obtain, at a minimum, the following information:
 - (A) Standard penetration - resistance;
 - (B) Particle size analysis;
 - (C) Soil classification: Unified Soil Classification System;
 - (D) Formation descriptions; and
 - (E) Saturated hydraulic conductivity, porosity, and effective porosity for each lithologic unit of the uppermost aquifer.
- (5) In addition to borings, other techniques may be used to investigate the subsurface conditions at the site, including but not limited to: geophysical well logs, surface geophysical surveys, and tracer studies.
- (6) Stratigraphic cross-sections identifying hydrogeologic and lithologic units, and stabilized water table elevations.
- (7) Water table information, including:
 - (A) Tabulations of water table elevations measured at the time of boring, 24 hours, and stabilized readings for all borings (measured within a period of time short enough to avoid temporal variations in ground-water flow which could preclude accurate determination of ground-water flow direction and rate);
 - (B) Tabulations of stabilized water table elevations over time in order to develop an understanding of seasonal fluctuations in the water table;
 - (C) An estimation of the long-term seasonal high water table based on stabilized water table readings, hydrographs of wells in the area, meteorological and climatological data, and any other information available; and
 - (D) A discussion of any natural or man-made activities that have the potential for causing water table fluctuations, including tidal variations, river stage changes, flood pool changes of reservoirs, high volume production wells, injection wells, etc.
- (8) The horizontal and vertical dimensions of ground-water flow, including flow directions, rates, and gradients.

- (9) Ground-water contour map(s) to show the occurrence and direction of ground-water flow in the uppermost aquifer, and any other aquifers identified in the hydrogeologic investigation. The ground-water contours shall be superimposed on a topographic map. The location of all borings and rock cores, and the water table elevations or potentiometric data at each location used to generate the ground-water contours shall be shown on the ground-water contour map(s).
 - (10) A topographic map of the site locating soil borings with accurate horizontal and vertical control which are tied to a permanent onsite bench mark.
 - (11) Boring logs, field logs and notes, well construction records, and piezometer construction records.
 - (12) Identification of other geologic and hydrologic considerations, including but not limited to: slopes, streams, springs, gullies, trenches, solution features, karst terranes, sinkholes, dikes, sills, faults, mines, ground-water discharge features, and ground-water recharge/discharge areas.
 - (13) A report summarizing the geological and hydrogeological evaluation of the site that includes the following:
 - (A) A description of the relationship between the uppermost aquifer of the site to local and regional geologic and hydrogeologic features.
 - (B) A discussion of the ground-water flow regime of the site focussing on the relationship of MSWLF units to ground-water receptors and to ground-water discharge features.
 - (C) A discussion of the overall suitability of the proposed site for solid waste management activities and which areas of the site are most suitable for MSWLF units.
 - (D) A discussion of the ground-water flow regime of the uppermost aquifer at the site and the ability to effectively monitor the MSWLF units in order to ensure early detection of any release of hazardous constituents to the uppermost aquifer.
- (b) Design Hydrogeologic Report.
- (1) A geological and hydrogeological report shall be submitted in the application for the Permit to Construct. This report shall contain the information required by Subparagraphs (2) and (3) of this Paragraph. The number and depths of borings required shall be based on the geologic and hydrogeologic characteristics of the landfill facility. At a minimum, there shall be an average of one boring for each acre of the area of investigation, unless otherwise authorized by the Division, where the area of investigation shall be defined by the Division's review of the Site Study and by the scope and purpose of the investigation as follows:
 - (A) The investigation shall provide adequate information to demonstrate compliance with the vertical separation and foundation standards set forth in Subparagraphs (b)(4) and (b)(7) of Rule .1624 of this Section, and Paragraph (e) of Rule .1680 of this Section.
 - (B) The report shall include an investigation of the hydrogeologic characteristics of the uppermost aquifer for the proposed phase of landfill development and any leachate surface impoundment or leachate disposal facility. The purpose of this investigation is to provide more detailed and localized data on the hydrogeologic regime for this area in order to design an effective water quality monitoring system.
 - (2) The Design Hydrogeologic Report shall provide, at a minimum, the following information:
 - (A) The information required in Subparagraphs (a)(4) through (a)(12) of this Rule.
 - (B) All technical information necessary to determine the design of the monitoring system as required by Rule .1631(c) of this Section.
 - (C) All technical information necessary to determine the relevant point of compliance as required by Rule .1631(a)(2)(B) of this Section.
 - (D) Rock corings (for sites located in the piedmont or mountain regions) for which the numbers, locations, and depths are adequate to provide an understanding of the fractured bedrock conditions and ground-water flow characteristics of at least the upper 10 feet of the bedrock. Testing for the corings shall provide, at a minimum, the following information:
 - (i) Rock types;
 - (ii) Recovery values;
 - (iii) Rock Quality Designation (RQD) values;
 - (iv) Saturated hydraulic conductivity and secondary porosity values; and
 - (v) Rock descriptions, including fracturing and jointing patterns, etc.
 - (E) A ground-water contour map based on the estimated long-term seasonal high water table that is superimposed on a topographic map and includes the location of all borings and rock cores and the water table elevations or potentiometric data at each location used to generate the ground-water contours.

- (F) A bedrock contour map (for sites located in piedmont or mountain regions) illustrating the contours of the upper surface of the bedrock that is superimposed on a topographic map and includes the location of all borings and rock cores and the top of rock elevations used to generate the upper surface of bedrock contours.
- (G) A three dimensional ground-water flow net or several hydrogeologic cross-sections that characterize the vertical ground-water flow regime for this area.
- (H) A report on the ground-water flow regime for the area including ground-water flow paths for both horizontal and vertical components of ground-water flow, horizontal and vertical gradients, flow rates, ground-water recharge areas and discharge areas, etc.
- (I) A certification by a Licensed Geologist that all borings at the site that have not been converted to permanent monitoring wells will be properly abandoned in accordance with the procedures for permanent abandonment of wells, as delineated in 15A NCAC 2C Rule .0113(a)(2).
- (3) A Water Quality Monitoring Plan shall be submitted that contains the following information.
 - (A) A ground-water monitoring plan including information on the proposed ground-water monitoring system(s), sampling and analysis requirements, and detection monitoring requirements that fulfills the requirements of Rules .1630 through .1637 of this Section.
 - (i) The Division may require the use of alternative monitoring systems in addition to ground-water monitoring wells at sites:
 - (I) Where the owner or operator does not control the property from any landfill unit to the ground-water discharge feature(s); or
 - (II) Sites with hydrogeologic conditions favorable to detection monitoring by alternative methods.
 - (ii) The ground-water monitoring plan shall provide a detailed discussion of the geologic and hydrogeologic criteria used to determine the number, spacing, location, and screen depths of proposed monitoring wells.
 - (B) A surface water monitoring plan in accordance with Rule .0602 of Section .0600.
 - (C) The final water quality monitoring plan shall be certified by a Licensed Geologist to be effective in providing early detection of any release of hazardous constituents (from any point in a MSWLF unit or leachate surface impoundment) to the uppermost aquifer, so as to be protective of public health and the environment.

*History Note: Authority G.S. 130A-294;
Eff. October 9, 1993.*