

DRAFT OAC Chapter 3745-510 Multi-Program Site Investigation Rules - Table of Contents

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3745-510-01 Site investigation - applicability.

(A) The rules in this multi-program chapter shall apply when referenced in either of the following:

(1) A rule in a program chapter.

(2) A rule in another multi-program chapter that was made applicable by a rule in a program chapter.

Program chapters are Chapters 3745-520 to 3745-599 of the Administrative Code.

(B) The applicant, owner, or operator shall conduct a site investigation and prepare a site investigation report as required by this chapter.

(C) Any exception to paragraph (B) of this rule will be described by the individual program chapter.

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3745-510-02 Site investigation - definitions.

If a term used in this chapter is defined in rule 3745-500-02 of the Administrative Code, that definition used in rule 3745-500-02 of the Administrative Code is applicable to this chapter.

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3745-510-100 Site investigation report.

(A) The applicant, owner, or operator of a facility shall provide a site investigation report. The site investigation report shall consist of the following:

(1) A report on the hydrogeologic investigation meeting the format and standards specified in rules 3745-510-210 to 3745-510-232 and 3745-510-240 of the Administrative Code. For a facility requiring a gas migration monitoring system, the report on the hydrogeologic investigations shall include a section on the gas sources and migration pathways investigation meeting the format and standards specified in rule 3745-510-235 of the Administrative Code.

(2) A report on the geotechnical investigation meeting the format and standards specified in rules 3745-510-310 to 3745-510-350 of the Administrative Code.

(B) The site investigation report shall be in an easily understandable format and shall contain all information necessary to allow the permitting authority to determine if the applicant, owner, or operator has satisfied, as appropriate, the following:

(1) Located ground water monitoring wells to conform to Chapter 3745-506 of the Administrative Code.

(2) Demonstrated compliance with applicable stability standards.

(3) Demonstrated compliance with applicable hydrogeologic siting criteria.

(4) Designed the gas migration monitoring system to meet applicable requirements.

(C) All plan drawings in the site investigation report shall show the facility boundary, the disposal limits, and access roads. Plan drawings shall use a scale of one inch equals not more than two hundred feet. Plan drawings shall be referenced to the facility grid system if one was established.

(D) All cross sections shall show the facility boundary, the limits of excavation, the disposal limits, the horizontal scale of the cross section, and the vertical scale of the cross section. The cross section shall include an insert showing a plan view of the facility identifying the location of the cross section.

(E) The site investigation report shall contain a certification statement and signature of the applicant, owner, or operator in accordance with rule 3745-500-50 of the Administrative Code.

(F) The report on the hydrogeologic investigation shall be signed by a qualified ground water scientist and shall contain a certification statement from the qualified ground water scientist that to the best of the knowledge of the qualified ground water

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scientist the hydrogeologic information contained in the report is a true and accurate representation of the hydrogeology of the facility.

(G) The report on the geotechnical investigation shall be signed and, if appropriate, sealed by such other professionals skilled in the appropriate disciplines as is necessary to comply with Ohio laws and rules.

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3745-510-210 **Hydrogeologic investigation cover page.**

The report on the hydrogeologic investigation identified in rule 3745-510-100 of the Administrative Code shall include a cover page that includes the following:

(A) Title of the report.

(B) Name and location of the facility.

(C) Names, addresses, and telephone numbers of the applicant, owner, and the preparer of the hydrogeologic investigation report.

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3745-510-220

Hydrogeologic investigation summary and conclusions.

The report on the hydrogeologic investigation identified in rule 3745-510-100 of the Administrative Code shall include clearly labeled and tabbed pages for the section titled "Summary and Conclusions," and shall include the following:

(A) A description of the following:

(1) The uppermost aquifer system.

(2) All significant zones of saturation above the uppermost aquifer system.

(3) Presence or absence of any unconsolidated aquifer system capable of sustaining a yield of one hundred gallons per minute for a twenty-four-hour period.

(4) A description of all potential gas sources and migration pathways, if applicable.

(B) Summary tables of compiled measurements and test results from the site investigation. The tables shall clearly identify the sample locations, logs, and units of measurement associated with each measurement and test result. The results from all field measurements, field tests, laboratory measurements, and laboratory tests shall be included in the summary tables. The summary tables shall also clearly identify the measurements and test results that are associated with the uppermost aquifer system, and the significant zones of saturation above the uppermost aquifer.

(C) Any figures, drawings, or references needed to provide a clear understanding of the summary information contained in the report of the hydrogeologic investigation.

(D) A map that identifies the location of each cross section included in the hydrogeologic investigation report.

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3745-510-231

Uppermost aquifer system and significant zones of saturation.

The report on the hydrogeologic investigation identified in rule 3745-510-100 of the Administrative Code shall include clearly labeled and tabbed pages for the section titled "Uppermost Aquifer System and Significant Zones of Saturation," and shall include the following:

(A) A report on the regional aquifer including the following:

- (1) A description of the regional aquifer based on publicly available information including the following:
 - (a) The identification and average yield.
 - (b) The direction of ground water flow.
 - (c) The identification of recharge and discharge areas.
 - (d) The identification of the regional stratigraphy, including any regional stratigraphic or structural features (such as bedrock surface, bedrock dip, or joint systems), that may influence the ground water flow system.
 - (e) A description of the regional and local geomorphology including but not limited to the location of surface water, floodplains, and all topographic features that may influence the ground water flow system at the facility.
- (2) The Ohio department of natural resources, division of soil and water, ground water resource maps or other appropriate regional hydrogeologic data.
- (3) A map showing the location of the facility with respect to the limits of any drinking water source protection area for a public water system using ground water including the area surrounding a public water supply well that will provide water from an aquifer to the well as delineated or endorsed by Ohio EPA under Ohio's wellhead protection or source water assessment and protection programs. If the limits of any subject drinking water source protection area for a public water system are not in the vicinity of the facility, a statement to that fact will be sufficient.
- (4) A map showing the location of the facility and all water supply wells within one mile of the facility. The public and private wells shall be denoted differently.
- (5) A description of the uppermost aquifer system and any significant zone of saturation above the uppermost aquifer system at the facility, including the following:

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- (a) The depth and lateral and vertical extents of the uppermost aquifer system and all significant zones of saturation above the uppermost aquifer system.
- (b) Temporal fluctuations in ground water levels for a period of at least one year on a quarterly basis to determine the seasonal effects on ground water flow directions.
- (c) An interpretation of the ground water flow system, including hydraulic conductivity, rate of flow, average yield, direction of flow, vertical and lateral components of flow including hydraulic gradient, and interconnections between and within the uppermost aquifer system and any significant zone of saturation above the uppermost aquifer system. This interpretation shall be described in both narrative and map form.
- (d) Identification and characterization of recharge and discharge areas within the boundaries of the facility. This shall include all relationships of ground water with seeps, springs, streams, or other surface water features.
- (e) Yield of the uppermost aquifer system and all significant zones of saturation above the uppermost aquifer system.
- (f) The results of sampling and analyzing the quality of the ground water in the uppermost aquifer system and all significant zones of saturation above the uppermost aquifer system.
- (6) A description of the site investigation activities, including field testing and laboratory testing, directly related to identifying, locating, and characterizing the uppermost aquifer system and all significant zones of saturation above the uppermost aquifer system.
- (7) Cross sections that clearly show the identification, extent, and characteristics of the following:
 - (a) Consolidated stratigraphic units.
 - (b) Unconsolidated stratigraphic units.
 - (c) Uppermost aquifer system.
 - (d) Significant zones of saturation above the uppermost aquifer system.
 - (e) At least one cross section shall depict the deepest excavation or proposed excavation.

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(8) Summary logs and drawings to identify, locate, and characterize the uppermost aquifer system and all significant zones of saturation above the uppermost aquifer system.

(9) Summary of results from field tests and laboratory tests used to identify, locate, and characterize the uppermost aquifer system and all significant zones of saturation above the uppermost aquifer system. If a field or laboratory test result was not used, include reasoning for excluding the result from consideration.

(B) Results from the site investigation including the following:

(1) A brief description of each field test method and each laboratory test method used to characterize the geologic and hydrogeologic properties for the purpose of investigating the uppermost aquifer system and all significant zones of saturation above the uppermost aquifer system.

(2) Information and results from each field test that was conducted, including completed, failed, or incomplete results. An explanation shall be provided for any test results that were not used. The results shall include the following information:

(a) Quality assurance and quality control testing conducted to verify the accuracy and precision of testing methods and equipment.

(b) The results of data validation.

(c) The characterization of each specimen used in each test.

(d) Intermediate data produced during testing.

(e) The final results of each test.

(3) All figures, drawings, or references used and marked to show how they relate to the characterization of the geologic and hydrogeologic properties.

(4) Logs, including field notes and other pertinent information, from sites investigated to obtain information, data, or samples used to identify, locate, and characterize the uppermost aquifer system and all significant zones of saturation above the uppermost aquifer system. As appropriate for the method, logs shall include the following:

(a) A description of where information, data, or samples were obtained, including, as appropriate, the following:

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- (i) The location of each site with northings and eastings referenced to the facility grid system or referenced to the following if a facility grid system was not established:
 - (a) Horizontally to the "1927 North American Datum," "1983 North American Datum," or "State Plane Coordinate System."
 - (b) Vertically to the "1929 or 1988 North American Vertical Sea Level Datum" as identified on the USGS 7.5 minute (topographic) map.
- (ii) The surface elevation of each site to the nearest tenth of a foot.
- (iii) The depth interval of all samples collected, including those submitted for laboratory testing.
- (b) Information related to the subsurface investigatory method, including, as appropriate, the following:
 - (i) The diameter, or width and length at the surface, of the boring.
 - (ii) The total depth of the boring.
 - (iii) The total depth of the well.
 - (iv) The inside diameter of the well casing.
 - (v) The top-of-casing elevation used for water level measurement reference surveyed to the nearest hundredth foot.
 - (vi) The screened interval depth and elevation, the screen slot size, and the inside diameter of the screen.
 - (vii) A description of construction materials and the elevations at which all construction materials were placed including at a minimum the following:
 - (a) Sand pack.
 - (b) Grout.
 - (c) Well seal.
- (c) The top and bottom elevations for each consolidated and unconsolidated stratigraphic unit.

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(d) Information or data on the characteristics, composition, and features for each consolidated and unconsolidated stratigraphic unit including the following:

(i) For unconsolidated stratigraphic units, the textural classification using the Unified Soil Classification System (USCS), as described in ASTM D2487 as described in rule 3745-500-03 of the Administrative Code.

(ii) For consolidated stratigraphic units, the rock type (such as limestone, dolomite, coal, shale, siltstone, or sandstone).

(iii) Color.

(iv) Moisture content.

(v) Stratigraphic features (such as layering, interbedding, and weathering).

(vi) Fracturing, jointing, and other types of secondary porosity.

(vii) Any visible accessory minerals (such as pyrite, calcite, or gypsum).

(viii) Lateral extent.

(ix) The depth to saturation.

(x) The depth to the static water level in the boring.

(e) Information or data on the hydraulic conductivity according to the following:

(i) For each saturated unconsolidated stratigraphic unit, two field measurements of hydraulic conductivity or at least one measurement per saturated unconsolidated stratigraphic unit for each twenty acres, whichever is more.

(ii) For each unconsolidated stratigraphic unit from which an undisturbed sample can be collected, two laboratory measurements of vertical hydraulic conductivity or at least one measurement per unconsolidated stratigraphic unit for each twenty acres, whichever is more.

(iii) For each saturated consolidated stratigraphic unit, two field measurements of hydraulic conductivity or at least one measurement per saturated consolidated stratigraphic unit for each twenty acres, whichever is more.

(iv) When laboratory measurements of vertical hydraulic conductivity are obtained for unconsolidated stratigraphic units that are wholly or partially saturated, the vertical hydraulic conductivity shall be

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compared to the field hydraulic conductivity to evaluate the extent to which near-vertical fractures may be contributing to ground water flow through the unit.

- (v) Hydraulic conductivity data shall be interpreted with respect to the primary and secondary porosity features and the stratigraphic and structural features of the investigated units that are observed or are reasonably expected to occur in the investigated units.
- (f) Variations in texture, saturation, stratigraphy, structure, or mineralogy exhibited by each stratigraphic unit that could influence ground water flow or quality in the uppermost aquifer system or any significant zone of saturation above the uppermost aquifer.
- (g) The geomorphology at the facility including but not limited to surface water or topographic features that may influence ground water flow in the uppermost aquifer system or any significant zone of saturation above the uppermost aquifer.
- (h) All structural geologic features beneath the facility that may influence ground water flow in the uppermost aquifer system or in any significant zone of saturation above the uppermost aquifer system.
- (5) Results of sampling and analyzing the ground water from the uppermost aquifer system and all significant zones of saturation above the uppermost aquifer system.
- (6) All well logs and, where applicable, the decommissioning records for public water supply wells and private water supply wells within one mile of the facility.

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3745-510-232

One hundred gallon per minute unconsolidated aquifer system.

The report on the hydrogeologic investigation identified in rule 3745-510-100 of the Administrative Code shall include clearly labeled and tabbed pages for the section titled "One Hundred Gallon per Minute Unconsolidated Aquifer System," and shall include the following:

(A) A report of the following:

(1) A determination, based on publicly available information, of whether an unconsolidated aquifer system capable of sustaining a yield of at least one hundred gallons per minute for a twenty-four-hour period is present or absent at the facility.

(2) If the applicant, owner, or operator chooses to refute the determination made pursuant to paragraph (A)(1) of this rule, the following:

(a) A description of the site investigation activities, including field testing and laboratory testing, directly related to determining whether and where an unconsolidated aquifer system capable of sustaining a yield of at least one hundred gallons per minute for a twenty-four-hour period exists at the facility.

(b) Summary logs and drawings appropriate for the subsurface investigatory method used to identify, locate, and characterize the subject unconsolidated aquifer system. The applicant, owner, or operator shall also include the yield of any aquifer system between the uppermost aquifer system and the subject unconsolidated aquifer system.

(c) A summary of results from field test and laboratory tests used to identify, locate, and characterize the unconsolidated aquifer system capable of sustaining a yield of at least one hundred gallons per minute for a twenty-four-hour period. If a field or laboratory test result was not used, include reasoning for excluding the result from consideration.

(B) If the applicant, owner, or operator chooses to refute the determination made pursuant to paragraph (A)(1) of this rule, results from the site investigation shall include the following:

(1) A brief description of each field test method and each laboratory test method used to characterize the geologic and hydrogeologic properties of the unconsolidated aquifer system.

(2) Information and results from each field test that was conducted, including completed, failed, or incomplete results. An explanation shall be provided for

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any test result that was not used. The results shall include the following information:

- (a) Quality assurance and quality control testing conducted by the laboratory to verify the accuracy and precision of testing methods and equipment.
 - (b) The results of data validation.
 - (c) The characterization of each specimen used in each test.
 - (d) Intermediate data produced during testing.
 - (e) The final results of each test.
- (3) All figures, drawings, or references used and marked to show how they relate to the characterization of the geologic and hydrogeologic properties.
- (4) Logs, including field notes and other pertinent information, from each subsurface investigatory site used to obtain information, data, or samples utilized to identify, locate, and characterize the subject unconsolidated aquifer system, the uppermost aquifer system, and all significant zones of saturation above the uppermost aquifer system. As appropriate for the method, logs shall include the following:
- (a) A description of where information, data, or samples were obtained, including, as appropriate, the following:
 - (i) The location of each site with northings and eastings referenced to the facility grid system or referenced to the following if a facility grid system was not established:
 - (a) Horizontally to the "1927 North American Datum," "1983 North American Datum," or "State Plane Coordinate System."
 - (b) Vertically to the "1929 or 1988 North American Vertical Sea Level Datum" as identified on the USGS 7.5 minute (topographic) map.
 - (ii) The surface elevation of each site to the nearest tenth of a foot.
 - (iii) The depth interval of all samples collected, including those samples submitted for laboratory testing.
 - (b) Information related to the subsurface investigatory method, including, as appropriate, the following:
 - (i) The diameter, or width and length at the surface, of the boring.

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- (ii) The total depth of the boring.
- (iii) The total depth of the well.
- (iv) The inside diameter of the well casing.
- (v) The top-of-casing elevation used for water level measurement reference, which shall be surveyed to the nearest hundredth of a foot.
- (vi) The screened interval depth and elevation, the screen slot size, and the inside diameter of the screen.
- (vii) The description of all construction materials and the elevations at which all construction materials were placed including at a minimum a description and depth of the following:
 - (a) Sand pack.
 - (b) Grout.
 - (c) Well seal.
- (c) The top and bottom elevations for each consolidated and unconsolidated stratigraphic unit.
- (d) Information or data on the characteristics, composition, and features for each consolidated and unconsolidated stratigraphic unit including the following:
 - (i) For unconsolidated stratigraphic units, the textural classification using the Unified Soil Classification System (USCS), as described in ASTM D2487 as described in rule 3745-500-03 of the Administrative Code.
 - (ii) For consolidated stratigraphic units, the rock type (such as limestone, dolomite, coal, shale, siltstone, or sandstone).
 - (iii) Color.
 - (iv) Moisture content.
 - (v) Stratigraphic features (such as layering, interbedding, and weathering).
 - (vi) Fracturing, jointing, and other types of secondary porosity, and any visible accessory minerals (such as pyrite, calcite, or gypsum).
 - (vii) Lateral extent.

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(viii) The depth to saturation.

(ix) The depth to the static water level in the boring.

(e) Information or data on the hydraulic conductivity according to the following:

(i) For each saturated unconsolidated stratigraphic unit, two field measurements of hydraulic conductivity or at least one measurement per saturated unconsolidated stratigraphic unit for each twenty acres, whichever is more.

(ii) For each unconsolidated stratigraphic unit from which an undisturbed sample can be collected, two laboratory measurements of vertical hydraulic conductivity or at least one measurement per unconsolidated stratigraphic unit for each twenty acres, whichever is more.

(iii) For each saturated consolidated stratigraphic unit, two field measurements of hydraulic conductivity or at least one measurement per saturated consolidated stratigraphic unit for each twenty acres, whichever is more.

(iv) When laboratory measurements of vertical hydraulic conductivity are obtained for unconsolidated stratigraphic units that are wholly or partially saturated, the vertical hydraulic conductivity shall be compared to the field hydraulic conductivity to evaluate the extent to which near-vertical fractures may be contributing to ground water flow through the unit.

(v) Hydraulic conductivity data shall be interpreted with respect to the primary and secondary porosity features that are observed or are reasonably expected to occur in the investigated units as well as the stratigraphic and structural features of the investigated units.

(f) All structural geologic features beneath the facility that may influence ground water flow in the subject unconsolidated aquifer system or in any significant zone of saturation above the uppermost aquifer system.

(5) Results of sampling and analyzing the ground water from the subject unconsolidated aquifer system.

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3745-510-235

Gas sources and gas migration pathways.

The report on the hydrogeologic investigation identified in rule 3745-510-100 of the Administrative Code shall include clearly labeled and tabbed pages for the section titled "Gas Sources and Gas Migration Pathways," and shall include the following:

(A) A report of the following:

(1) A description of naturally occurring gas sources and potential gas migration pathways at the facility, including the following:

(a) All naturally occurring sources of explosive gas.

(b) All naturally occurring sources of hydrogen sulfide.

(c) All naturally occurring potential pathways at the facility for gas migration and interconnections between pathways. This description shall be in both narrative and map form.

(2) A description, based on publicly available information and any encounters during the site investigation, of gas sources and potential gas migration pathways built by humans within one thousand feet of the facility, including the following:

(a) Oil wells, gas wells, and landfills.

(b) Roads, railroads, underground utilities, mines, field tiles, storm sewers, water lines, electric cables, and pipelines.

(3) A description of the site investigation activities, including field testing and laboratory testing, directly related to identifying, locating, and characterizing the naturally occurring gas sources and potential gas migration pathways.

(4) Summary logs and drawings appropriate for the subsurface investigatory method used to identify, locate, and characterize the naturally occurring gas sources and potential gas migration pathways.

(5) Cross sections that clearly show the identification, extent, and characteristics of the following:

(a) Consolidated stratigraphic units.

(b) Unconsolidated stratigraphic units.

(c) The phreatic surface.

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(6) A cross section of the property boundary identifying the potential gas migration pathways that are naturally occurring and the potential gas migration pathways that are built by humans.

(7) Summary of results from field tests and laboratory tests used to identify, locate, and characterize the naturally occurring gas sources and potential gas migration pathways. If a field or laboratory test result was not used, include reasoning for excluding the result from consideration.

(B) Results from the site investigation including the following:

(1) A brief description of each field test method and each laboratory test method used to characterize the geologic and hydrogeologic properties for the purpose of investigating the naturally occurring gas sources and potential gas migration pathways.

(2) Information and results from each field test that was conducted, including completed, failed, or incomplete results. An explanation shall be provided for any test result that was not used. The results shall include the following information:

(a) Quality assurance and quality control testing conducted by the laboratory to verify the accuracy and precision of testing methods and equipment.

(b) The results of data validation.

(c) The characterization of each specimen used in each test.

(d) Intermediate data produced during testing.

(e) The final results of each test.

(3) All figures, drawings, or references used and marked to show how they relate to the characterization of the geologic and hydrogeologic properties.

(4) Logs, including field notes and other pertinent information, from each subsurface investigatory site used to obtain information, data, or samples utilized to identify, locate, and characterize the naturally occurring gas sources and potential gas migration pathways. As appropriate for the method, logs shall include the following:

(a) A description of where information, data, or samples were obtained, including, as appropriate, the following:

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- (i) The location of each site with northings and eastings referenced to the facility grid system or referenced to the following if a facility grid system was not established:

 - (a) Horizontally to the "1927 North American Datum," "1983 North American Datum," or "State Plane Coordinate System."
 - (b) Vertically to the "1929 or 1988 North American Vertical Sea Level Datum" as identified on the USGS 7.5 minute (topographic) map.
- (ii) The surface elevation of each site to the nearest tenth of a foot.
- (iii) The depth interval of all samples collected including those submitted for laboratory testing.
- (b) Information related to the subsurface investigatory method, including, as appropriate, the following:

 - (i) The diameter, or width and length at the surface, of the boring.
 - (ii) The total depth of the boring.
 - (iii) The total depth of the well.
 - (iv) The top-of-casing elevation used for water level measurement reference surveyed to the nearest hundredth of a foot.
 - (v) The screened interval depth and elevation.
 - (vi) A description of all construction materials and the elevations at which all construction materials were placed including at a minimum the following:

 - (a) Sand pack.
 - (b) Grout.
 - (c) Well seal.
- (c) The top and bottom elevations for each consolidated and unconsolidated stratigraphic unit.
- (d) Information or data on the characteristics, composition, and features for each consolidated and unconsolidated stratigraphic unit including the following:

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- (i) For unconsolidated stratigraphic units, the textural classification using the Unified Soil Classification System (USCS), as described in ASTM D2487 as described in rule 3745-500-03 of the Administrative Code.
 - (ii) For consolidated stratigraphic units, the rock type (such as limestone, dolomite, coal, shale, siltstone, or sandstone).
 - (iii) Color.
 - (iv) Moisture content.
 - (v) Stratigraphic features (such as layering, interbedding, and weathering).
 - (vi) Fracturing, jointing, and other types of secondary porosity, and any visible accessory minerals (such as pyrite, calcite, or gypsum).
 - (vii) Lateral extent.
 - (viii) The depth to saturation.
 - (ix) The depth to the static water level in the boring.
- (e) A notation if any gas or odors were encountered.

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3745-510-240 **Hydrogeologic investigation procedures, equipment, and methodologies.**

The report on the hydrogeologic investigation identified in rule 3745-510-100 of the Administrative Code shall include clearly labeled and tabbed pages for the section titled "Hydrogeologic Investigation Procedures, Equipment, and Methodologies," and shall include the following:

(A) A description and an explanation of why a particular subsurface investigatory method and sampling method were chosen to characterize the geomorphologic, geologic, and hydrogeologic properties for the purpose of preparing the topic reports specified in rules 3745-510-231 to 3745-510-235 of the Administrative Code. The procedures, methodologies, and equipment used to sample and analyze ground water from the uppermost aquifer and all significant zones of saturation above the uppermost aquifer system shall be the same as those required for the ground water sampling plan in accordance with rule 3745-506-200 of the Administrative Code. The description and explanation shall include the following:

(1) Appropriate subsurface investigatory methods used to collect data including but not limited to geophysical surveys, soil gas surveys, and borings (such as piezometers, monitoring wells, and test pits).

(2) Depth of site characterization, which shall extend from the ground surface to the bottom of the uppermost aquifer system, with the following exceptions:

(a) The applicant, owner, or operator may limit the maximum depth of the site investigation to one hundred fifty feet below the basal elevations of the disposal limits, unless paragraph (A)(2)(c) of this rule applies.

(b) If the uppermost aquifer system is a consolidated stratigraphic unit, the applicant, owner, or operator may limit the investigation of the uppermost aquifer system to the upper twenty-five feet of the saturated portion of the uppermost aquifer system.

(c) If publicly available information on the regional aquifer indicates that an unconsolidated aquifer system capable of sustaining a yield of at least one hundred gallons per minute for a twenty-four-hour period may exist beneath the facility, and the applicant, owner, or operator proposes to assign a yield of less than one hundred gallons per minute for a twenty-four-hour period, the applicant, owner, or operator shall extend the depth of the site investigation to obtain adequate site-specific information about the aquifer system to justify the assignment of lower yield.

(d) If it is necessary to evaluate below the limits established in paragraphs (A)(2)(a) or (A)(2)(b) or this rule to demonstrate the facility meets siting

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criteria, the applicant, owner, or operator may extend the subsurface investigation beyond those limits.

(B) The procedures used to protect samples from damage and adverse effects during transportation of the samples to the place of testing.

(C) The analytical procedures and methodology used to characterize the unconsolidated and consolidated materials obtained from borings including but not limited to test pits, drilling, and other investigation methods.

(D) The methodology, equipment, and procedures used to define the uppermost aquifer system and all significant zones of saturation above the uppermost aquifer system, including the following:

(1) Well and piezometer construction specifications.

(2) Water level measurement procedures.

(3) The methodologies, equipment, and procedures used to determine the ground water quality and any contamination in the uppermost aquifer system and the significant zones of saturation above the uppermost aquifer system. The methodologies, equipment, and procedures shall be the same as those required for the ground water sampling and analysis plan in accordance with rule 3745-506-200 of the Administrative Code.

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3745-510-310 **Geotechnical investigation cover page.**

The report on the geotechnical investigation identified in rule 3745-510-100 of the Administrative Code shall include a cover page that includes the following:

(A) Title of the report.

(B) Name and location of the facility.

(C) Names, addresses, and telephone numbers of the applicant, owner, and the preparer of the geotechnical investigation report.

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3745-510-320

Geotechnical investigation summary and conclusions.

The report on the geotechnical investigation identified in rule 3745-510-100 of the Administrative Code shall include the following clearly labeled and tabbed pages for the section titled "Summary and Conclusions" and shall include the following:

(A) A description of the following:

- (1) Critical layers due to shear strength.
- (2) Critical layers due to liquefaction potential.
- (3) Compressible layers.
- (4) Highest temporal phreatic surface as determined through the hydrogeologic investigation.
- (5) Highest temporal piezometric surface as determined through the hydrogeologic investigation.
- (6) All piezometric surfaces associated with bedrock as determined through the hydrogeologic investigation that may affect the facility during excavation or construction.
- (7) The vertical hydraulic conductivity of each unsaturated unconsolidated stratigraphic unit as determined through the hydrogeologic investigation.
- (8) Unstable areas.

(B) Summary tables of measurements and test results from the site investigation. The tables shall clearly identify the sample locations, logs, and units of measurement associated with each measurement and test result. The results from all field measurements, field tests, laboratory measurements, and laboratory tests shall be included in the summary tables. The summary tables shall also clearly identify the measurements and test results that are associated with each critical layer and compressible layer.

(C) Any figures, drawings, or references necessary to provide a clear understanding of the summary information contained in the report on the geotechnical investigation.

(D) A map that identifies the location of each cross section included in the report.

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3745-510-331 Critical layers due to shear strength.

The report on the geotechnical investigation identified in rule 3745-510-100 of the Administrative Code shall include labeled and tabbed pages for the section titled "Critical Layers due to Shear Strength," and shall include the following:

- (A) A description of the critical layers due to shear strength.
- (B) An explanation of the criteria used to identify the critical layers due to shear strength.
- (C) A description of the site investigation activities directly related to identifying, locating, and characterizing the critical layers due to shear strength, including the subsurface investigatory method, field testing, and laboratory testing.
- (D) A summary of the results of site investigation activities directly related to identifying, locating, and characterizing the critical layers due to shear strength.
- (E) Any other sources of information used to determine the critical layers due to shear strength.
- (F) Cross sections that clearly show the identification, extent, and characteristics of the following:
 - (1) Consolidated stratigraphic units.
 - (2) Unconsolidated stratigraphic units.
 - (3) Critical layers due to shear strength.
 - (4) Highest temporal phreatic surfaces.
 - (5) Highest temporal piezometric surfaces.
 - (6) Basal elevations of the disposal limits.
 - (7) Basal elevations of existing and proposed excavations. At least one cross section shall depict the deepest excavation or deepest proposed excavation.

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3745-510-332

Critical layers due to liquefaction potential.

The report on the geotechnical investigation identified in rule 3745-510-100 of the Administrative Code shall include labeled and tabbed pages for the section titled "Critical Layers due to Liquefaction Potential," and shall include the following:

- (A) A description of the critical layers due to liquefaction potential.
- (B) An explanation of the criteria used to identify the critical layers due to liquefaction potential.
- (C) A description of the site investigation activities directly related to identifying, locating, and characterizing the critical layers due to liquefaction potential, including the subsurface investigatory method, field testing, and laboratory testing.
- (D) A summary of the results of site investigation activities directly related to identifying, locating, and characterizing the critical layers due to liquefaction potential.
- (E) Any other sources of information used to determine the critical layers due to liquefaction potential.
- (F) Cross sections that clearly show the identification, extent, and characteristics of the following:
 - (1) Consolidated stratigraphic units.
 - (2) Unconsolidated stratigraphic units.
 - (3) Critical layers due to liquefaction potential.
 - (4) Highest temporal phreatic surfaces.
 - (5) Highest temporal piezometric surfaces.
 - (6) Basal elevations of the disposal limits.
 - (7) Basal elevations of existing and proposed excavations. At least one cross section shall depict the deepest existing or proposed excavation.

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3745-510-333

Compressible layers.

The report on the geotechnical investigation identified in rule 3745-510-100 of the Administrative Code shall include labeled and tabbed pages for the section titled "Compressible Layers," and shall include the following:

- (A) A description of the compressible layers.
- (B) An explanation of the criteria used to identify the compressible layers.
- (C) A description of the site investigation activities directly related to identifying, locating, and characterizing the compressible layers, including the subsurface investigatory method, field testing, and laboratory testing.
- (D) A summary of the results of site investigation activities directly related to identifying, locating, and characterizing the compressible layers.
- (E) Any other sources of information used to determine the compressible layers.
- (F) Cross sections that clearly show the identification, extent, and characteristics of the following:
 - (1) Consolidated stratigraphic units.
 - (2) Unconsolidated stratigraphic units.
 - (3) Compressible layers.
 - (4) Highest temporal phreatic surfaces.
 - (5) Highest temporal piezometric surfaces.
 - (6) Basal elevations of the disposal limits.
 - (7) Basal elevations of existing and proposed excavations. At least one cross section shall depict the deepest excavation or deepest proposed excavation.

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3745-510-335 Unstable areas.

The report on the geotechnical investigation identified in rule 3745-510-100 of the Administrative Code shall include labeled and tabbed pages for the section titled "Unstable Areas," and shall include the following:

(A) Identification and description, based on publicly available information, of the following within one mile of the facility boundary:

(1) Areas with poor foundation conditions including the following:

(a) Presence of peat.

(b) Presence of loess.

(c) Presence of liquefiable soils.

(d) Soil conditions conducive to significant differential settlement.

(2) Areas susceptible to mass movement including the following:

(a) Coastal or river erosion.

(b) Landslides and rock falls, including the presence of following:

(i) Bedford shale, Kope formation, and Miamitown shale.

(ii) Weathered shales and mudstones of the Conemaugh, Monongahela, and Dunkard groups.

(iii) Lake deposits.

(iv) Cliffs of thick, massive sandstone.

(c) Presence of surface mines.

(d) Presence of underground mines.

(3) Areas with karst terrain.

(B) If publicly available information indicates the presence of underground mines, the following information shall be included in this section:

(1) The location of each mine.

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- (2) A description of the mining method used for each mine.
- (3) The properties of the consolidated and unconsolidated stratigraphic units above each underground mine based on the findings of the site investigation.
- (4) A description of the height and width of the mine voids for each underground mine.
- (5) A letter from the Ohio department of natural resources, division of mineral resources management or other appropriate agency verifying the type of mine, mining method, location, depth, and status of each underground mine.

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3745-510-340 Geotechnical investigation procedures, equipment, and methodologies.

The report on the geotechnical investigation identified in rule 3745-510-100 of the Administrative Code shall include labeled and tabbed pages for the section titled "Geotechnical Investigation Procedures, Equipment, and Methodologies," and shall include the following:

(A) A description and an explanation of why a particular subsurface investigatory method and sampling method were chosen to characterize the geotechnical properties for the purpose of preparing the sections specified in rules 3745-510-331 to 3745-510-335 of the Administrative Code, including the following:

(1) Appropriate subsurface investigatory methods used to collect data including but not limited to tensiometers, geophysical surveys, and borings (such as piezometers, dutch cone penetrometers, and test pits).

(2) Depth of site characterization. The applicant, owner, or operator may limit the maximum depth of the geotechnical site investigation to unconsolidated stratigraphic units that are within fifty feet of the basal elevations of the deepest excavation at the facility if there is no information that indicates that an unconsolidated stratigraphic unit may exist deeper that could be a critical layer or compressible layer.

(3) Number of borings. The applicant, owner, or operator shall install exploratory borings for the purpose of continuous logging of the subsurface characteristics and properties at a frequency of one boring for every four acres within the facility boundary. Spacing shall be on a uniform grid system. Borings may be moved laterally from the grid to accommodate site topography and features. Additional borings shall be installed where engineered components will be placed above a critical layer or compressible layer or in an unstable area.

(B) The applicant, owner, or operator shall collect, analyze, and log in accordance with paragraph (D) of rule 3745-510-350 of the Administrative Code, the following number of undisturbed samples:

(1) The greater of the following:

(a) Ten per cent of the borings that extend to or through each unconsolidated stratigraphic unit that is a critical layer.

(b) Three samples from each unconsolidated stratigraphic unit that is a critical layer.

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(2) One sample from each unconsolidated stratigraphic unit that is a compressible layer

(C) The procedures used to protect samples from damage and from adverse effects during transportation of the samples to the place of testing.

(D) The analytical procedures and methodology used to characterize the unconsolidated and consolidated materials obtained from borings including but not limited to test pits, drilling, and other investigation methods.

(E) The methodology, equipment, and procedures used to define the critical layers, compressible layers, highest temporal phreatic surfaces, and highest temporal piezometric surfaces.

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3745-510-350

Geotechnical investigation data and results.

[Comment: For dates of non-regulatory government publications, publications of recognized organizations and associations, test methods, federal rules, and federal statutory provisions referenced in this rule, see rule 3745-500-03 of the Administrative Code titled "Incorporation by reference."]

The report on the geotechnical investigation identified in rule 3745-510-100 of the Administrative Code shall include labeled and tabbed pages for the section titled "Geotechnical Investigation Data and Results," and shall include the following:

- (A) A brief description of each field test method and each laboratory test method used to characterize the geotechnical properties for the purpose of preparing the sections specified in rules 3745-510-331 to 3745-510-335 of the Administrative Code.
- (B) Information and results from each field test, laboratory test, or screening activity that was conducted, including completed, failed, or incomplete results. An explanation shall be provided for any test result that was not used. The results shall include the following information:
 - (1) Quality assurance and quality control testing conducted by the laboratory to verify the accuracy and precision of testing methods and equipment.
 - (2) The results of data validation.
 - (3) The characterization of each specimen used in each test.
 - (4) Intermediate data produced during testing.
 - (5) The final results of each test.
- (C) All figures, drawings, or references used and marked to show how they relate to the characterization of the geotechnical properties.
- (D) Logs, including field notes and other pertinent information, from each subsurface investigatory site used to obtain information, data, or samples for the site investigation. As appropriate for the method, logs shall include the following:
 - (1) Information on the site where information, data, or samples were obtained, including, as appropriate, the following:
 - (a) The location of each site with northings and eastings referenced to the facility grid system or referenced to the following if a facility grid system was not established:

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- (i) Horizontally to the "1927 North American Datum," "1983 North American Datum," or "State Plane Coordinate System."
 - (ii) Vertically to the "1929 or 1988 North American Vertical Sea Level Datum" as identified on the USGS 7.5 minute (topographic) map.
- (b) The surface elevation of each site to the nearest tenth of a foot.
- (c) The depth interval of all samples collected including those submitted for laboratory testing.
- (2) Information related to the subsurface investigatory method, including, as appropriate, the following:
 - (a) The diameter, or the width and length at the surface, of the boring.
 - (b) The total depth of the boring.
 - (c) The type of hammer.
 - (d) Method of advancing and cleaning the boring.
 - (e) Method of keeping the boring open.
 - (f) Size of casing and depth of the cased portion of boring.
 - (g) Equipment and method of driving the sampler.
 - (h) Type of sampler, length and inside diameter of barrel, and if liners were used.
 - (i) Size, type, and section length of sampling rods.
 - (j) Description of cone penetrometer, including, as appropriate, the penetrometer tip, friction sleeve, pressure transducer, and inclinometer.
 - (k) Type of thrust machine.
 - (l) Tip and thrust calibration information.
 - (m) Any occurrence of zero-drift.
 - (n) Condition of the rods and tip after withdrawal.
 - (o) Whether a friction reducer was used.

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- (p) Proximity of any existing borehole that is unbackfilled and uncased.
- (3) The top and bottom elevations for each consolidated and unconsolidated stratigraphic unit.
- (4) Information or data on the characteristics, composition, and features for each consolidated and unconsolidated stratigraphic unit, including the following:

 - (a) Variations in texture, saturation, stratigraphy, structure, or mineralogy within each stratigraphic unit that could influence the strength or compressibility of the material.
 - (b) For unconsolidated stratigraphic units, the textural classification using the Unified Soil Classification System (USCS), as described in ASTM D2487.
 - (c) For fine-grained unconsolidated stratigraphic units (e.g., silts and clays), field descriptions of consistency, plasticity, and dilatancy.
 - (d) For consolidated stratigraphic units, the rock type (such as limestone, dolomite, coal, shale, siltstone, or sandstone).
 - (e) Color.
 - (f) Moisture content.
 - (g) Lateral extent.
 - (h) The results from continuous penetration sampling following ASTM D1586 and the corrected and normalized standard penetration number, or results from continuous mechanical cone penetration testing following ASTM D3441.
 - (i) Atterberg limits.
 - (j) In situ unit weight.
 - (k) Dry unit weight.
- (E) The following information on each unconsolidated stratigraphic unit:

 - (1) For unconsolidated stratigraphic units susceptible to bearing capacity failure, the effective drained or undrained peak shear strength parameters, as appropriate, shall be provided on three representative samples using ASTM D3080 (direct shear), ASTM D2850 (unconsolidated undrained compression), or ASTM D4767 (consolidated undrained triaxial compression).

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- (2) For unconsolidated stratigraphic units susceptible to failure under static conditions or failure under seismic conditions, the effective shear strength shall be provided on three representative samples using ASTM D3080 (direct shear), ASTM D4767 (consolidated undrained triaxial compression), or ASTM D6467 (torsional ring shear).
- (3) For saturated unconsolidated stratigraphic units susceptible to failure under static conditions or failure under seismic conditions, the undrained shear strength using fully saturated samples shall be provided on three representative samples using ASTM D2850 (unconsolidated-undrained triaxial compression).
- (4) For all unconsolidated stratigraphic units consisting of fine-grained soils, all of the inputs, intermediate results, outputs, calculations, and parameters resulting from testing samples using ASTM D2435 (one-dimensional consolidation) on one representative sample.