3745-9-09 **Well development and pumping test.**

(A) A public water system well shall be developed upon completion to remove the native silts and clays, drilling mud or finer fraction of the filter pack until turbidity or sand content in the well is minimal.

(1) Mechanical development shall be performed so as not to cause damage to the components of the well. Mechanical development techniques include: mechanical surging; air surging or air lifting; overpumping and backwashing; high velocity jetting; bailing; and hydrofracturing.

(2) With prior consultation with the district office, chemical development procedures may be used in conjunction with mechanical procedures. Chemical development techniques include use of an acid or dispersant that has standard ANSI/NSF 60 certification. The director may require submission of chemical development procedures with specifications for the method, equipment, chemicals, and testing for residual chemicals.

(a) Dispersants that contain phosphorous compounds shall not be used during the development of a well.

(b) Dispersant may be used to disaggregate clay particles to enhance removal. Dispersant shall be immediately flushed from the well and aquifer to prevent bacterial growth in the aquifer.

(c) Dispersant shall be premixed and used according to the manufacturer's recommendations.

(d) Acid shall be used according to the manufacturer's recommendations. Proper pH shall be maintained in the borehole to ensure the effective action of the acid.

(B) A pumping test shall be conducted upon completion of development of the public water system well and conform to the following:

(1) Be used to estimate the specific capacity of the well at the anticipated permanent design pumping rate.

(2) Be used to demonstrate that the well can supply water at the anticipated permanent design pumping rate while at a minimum maintaining the operational capacity of the well field and without degrading the water quality of any well in the well field.

(3) The determination of a permanent design pumping rate for a new public water system well shall include analysis of the effects of interference drawdown from other wells owned by the public water system as well as other high capacity wells not owned by the public water system. Operational practices and the potential to cause degradation of water quality at the well field should

also be considered when establishing a permanent design pumping rate for a new public water system well.

(4) The pumping test classification is determined from the estimated average daily water demand of the well and type of water system, as illustrated in the following table. Estimated average daily water demand may be determined by the director from the design pumping rate of the well. With prior consultation, the director may accept an alternative constant rate pumping test that is conducted under the supervision of a qualified ground water professional or person with demonstrated competency in performing pumping or aquifer tests.

Pumping Test Classification	Estimated Average Daily Demand of the Well (gallons per day)
Low use	0 to 10000
Medium use	10001 to 100000
High use	greater than 100000

Acceptable pumping tests for low, medium and high use classifications are as follows:

(a) For low or medium use wells, the pumping test shall be conducted at a constant rate for a period of at least normal operation either at the peak hourly demand, or at least 1.5 times the anticipated permanent design pumping rate if the well cannot sustain peak hourly flow. For a community water system well, the duration of the constant rate pumping test shall be no less than twenty-four hours.

(b) For all high use wells, a step-drawdown test shall be conducted, followed by a constant rate pumping test.

(i) The step-drawdown test shall be used to obtain sufficient hydrogeologic information to design an appropriate constant rate pumping test for the well. The step-drawdown test shall, at a minimum conform to the following:

(a) Consist of three or more steps of progressively increasing pumping rates.

(b) Each step shall be of approximately equal duration.

(c) Each step shall be run at a constant pumping rate for no less than forty-five minutes.

(ii) The constant rate pumping test shall be conducted for at least twenty-four hours at a pumping rate of at least 1.5 times the anticipated permanent design pumping rate. The constant rate pumping test shall not commence until the water level has recovered to at least ninety per cent of the drawdown caused by the step-drawdown test or twenty-four hours after the completion of the step-drawdown test, whichever comes first.

(c) The public water system shall consult with the Ohio environmental protection agency to determine if the constant rate pumping test will need to extend beyond twenty-four hours if any of the following conditions exist at the time a new well site is proposed or can be expected to result from the well's operation:

(i) Pumping at the new well may cause interference with existing wells.

(ii) Prolonged pumping at the new well may cause changes in water quality.

(iii) The well will have special design criteria such as a radial collector well.

(iv) Information about the aquifer's response to pumping is needed for ground water modeling.

[Comment: If any of these conditions exist, the public water system should consult with a qualified ground water professional to design and implement a pumping test or tests which will address the noted condition.]

(d) For low, medium or high use wells, the constant rate pumping test may be conducted at a lower pumping rate if there is concern that pumping the well at 1.5 times the anticipated permanent pump design rate will be overly excessive, will not be possible, or will have adverse effects on the long-term performance of the well or aquifer. The test may be conducted at a lower pumping rate if the following criteria are met:

(i) The constant rate pumping test is conducted at no less than 1.2 times the pump design rate.

(ii) A demonstration is provided that supports the reasoning for a lower pumping rate that even under adverse conditions, including but not limited to severe drought, the well will likely be able to supply water at the anticipated permanent design pumping rate over the anticipated functional life of the well.

[Comment: If the permanent pump design rate will not be known until after the constant rate test, then the maximum permanent pump design rate will be based on back-calculation of the pumping rate used for the constant rate test. For example, if the constant rate test is performed at three hundred gallons per minute, the maximum permanent pump design rate will then be two hundred gallons per minute if the 1.5 times factor is used or two hundred and fifty gallons per minute if the 1.2 times factor is used.]

(5) The pumping test shall include the following:

(a) The flow rate shall be measured using an orifice weir with manometer, or equivalent method acceptable to the director.

(b) During a step-drawdown or constant rate pumping test, water level measurements shall be taken from the well starting with the static water level and continuing during drawdown to the nearest 0.1 foot, as measured from an identified datum.

(i) Water level measurements shall be at the following time intervals:

Time After Test Started (minutes)	Time Interval Between Measurements (minutes)
0 - 15	1
16 - 60	5
61 - 120	10
121 - 180	20
181 - 300	30
Greater than 300	60

(ii) Recovery water level measurements shall be taken immediately after termination of the constant rate pumping test at time intervals of five minutes for the first hour and every thirty minutes thereafter until the water level has recovered to at least ninety per cent of the drawdown caused by the pumping test or twenty-four hours after the completion of the pumping test, whichever comes first.

(iii) For high use wells, all pumping tests shall include water level

measurements from observation or surrounding wells. An observation well shall be selected or sited such that the water level measurements obtained before, during and after the pumping test will, upon analysis, provide information about the aquifer's response to pumping. The selection or siting process shall consider the distance between the observation well and the pumping well, the type of aquifer from which water is being withdrawn, the hydraulic gradient and other aquifer characteristics.

(6) The well owner shall submit a report of the pumping tests with their results, interpretations and conclusions.

(a) The pumping test report shall include the following:

(i) The date and times of starting through ending the pumping test.

(ii) A data table for each well used to observe the drawdown and recovery water level measurements, as required by paragraph (B)(5)(b) of this rule, showing the time after the pump test started and the corresponding water level measurements to the nearest 0.1 foot.

(iii) The height above ground (in feet) of the water level measurement reference point.

(iv) The pumping rate and depth at which the pump used for the test was set.

(v) The anticipated permanent pump setting depth (in feet below ground).

(vi) The specific capacity of the well at the tested pumping rates.

(vii) The specific capacity of the well at the anticipated permanent design pumping rate when drawdown is stabilized.

(b) In addition to paragraph (B)(6)(a) of this rule, the report for a high use well pumping test report shall include the following:

(i) A map showing the location of the pumping wells and the location of other wells used to observe drawdown. The map shall, at a minimum, include the names of the wells as used in the report and the distance between the pumping well and other wells used to observe drawdown.

(ii) Graphs plotted on semi-logarithmic graph paper showing the

drawdown measurements on the arithmetic scale and time on the logarithmic scale.

Graphs must be submitted for the pumping well and any other wells used to observe drawdown and recovery during the pumping test.

(iii) Graphs plotted on semi-logarithmic graph paper showing the recovery measurements on the arithmetic scale and time on the logarithmic scale.

Graphs must be submitted for the pumping well and any other wells used to observe drawdown and recovery during the pumping test.

(iv) Arithmetic graphs showing all water-level data collected during the pumping test and recovery period from the pumping well and all observation wells.

(c) In addition to paragraph (B)(6)(b) of this rule, when a high use community water system well is part of a multiple-well system the report shall include documentation that the well meets the demonstration requirements in paragraphs (B)(2) and (B)(3) of this rule.

(C) Samples shall be collected and analyzed from a public water system well for contaminants at the conclusion of the pumping test performed in accordance with paragraph (B) of this rule.

(1) A community water system well shall be sampled and analyzed for the contaminants that are listed in appendix A of this rule, "Required Analyses for Wells Utilized by Community Public Water Systems."

(2) A nontransient noncommunity water system well shall be sampled and analyzed for the contaminants that are listed in appendix B of this rule, "Required Analyses for Wells Utilized by Nontransient Noncommunity Public Water Systems."

(3) A transient noncommunity water system well shall be sampled and analyzed for the contaminants that are listed in appendix C of this rule, "Required Analyses for Wells Utilized by Transient Noncommunity Public Water Systems."

(4) The director may reduce or add to the contaminants that are listed in the appendices to this rule because of well siting, well construction, treatment, promulgated drinking water standards, or other criteria to assess if the ground water is acceptable for human consumption.

(5) Samples that are collected from a public water system well in accordance to this rule shall be analyzed in a laboratory certified to analyze drinking water for contaminants in accordance with Chapter 3745-89 of the Administrative Code. The analytical methods shall be the same as required by the entry point to the distribution system monitoring in accordance with rule 3745-81-27 of the Administrative Code and shall include all the volatile organic and synthetic organic analytes that are quantified by the laboratory for the organic analytical method.

[Comment: "Standard ANSI/NSF 60, Drinking Water Treatment Chemicals - Health Effects, December 11, 2009, Document Number NSF/ANSI 60-2009a." This rule incorporates this standard or specification by reference. A copy may be obtained from "NSF International, 789 N. Dixboro Road, P.O. Box 130140, Ann Arbor, MI 48105," (734) 769-8010, www.nsf.org. This standard is available for review at "Ohio EPA, Lazarus Government Center, 50 West Town Street, Suite 700, Columbus, OH, 43215."]

Replaces: 3745-9-09

Effective:

Five Year Review (FYR) Dates:

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Certification

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Date

Promulgated Under:	119.03
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Rule Amplifies:	6109.04
Prior Effective Dates:	05/01/03, 09/01/09, 04/19/12

Appendix A 3745-9-09

Required Analyses for Wells Utilized by Community Public Water Systems

Inorganic

Alkalinity, total (as CaCO3)	Cyanide	Nitrite-(as N)
Antimony, total	Fluoride, total	pH
Arsenic, total	Iron, total	Selenium, total
Barium, total	Lead, total	Silver, total
Beryllium, total	Magnesium, total	Sodium, total
Cadmium, total	Manganese, total	Sulfate
Calcium, total	Mercury, total	Thallium, total
Chloride	Nickel, total	Total Dissolved Solids
Chromium, total	Nitrate-(as N)	Zinc, total
Copper, total	Nitrate-Nitrite-(as N)	

Radiological

Gross Alpha	
Gross Beta	
Radium-228	
Radium-226	(if either gross alpha analysis exceeds 5pCi/L or radium-228 analysis exceeds 1 pCi/L)
Uranium	(if gross alpha analysis exceeds 15 pCi/L)

Synthetic Organic Chemicals (SOC)

Alachlor
Atrazine
Simazine

Bacteria Standards

Total Coliform (2 samples collected at least 30 min. apart)	1 Positive = Standard Exceeded

Volatile Organic Chemicals (VOC)

Benzene	Ethylbenzene	trans-1,2-Dichloroethene (or –ethylene)
Carbon Tetrachloride (tetrachloromethane)	Monochlorobenzene (chlorobenzene)	Trichloroethene (or –ethylene)
cis-1,2-Dichloroethene (or –ethylene)	ortho-Dichlorobenzene (1,2-Dichlorobenzene)	1,1,1-Trichloroethane (methyl chloroform)
Dichloromethane (methylene chloride)	para-Dichlorobenzene 1,4-Dichlorobenzene	1,2,4-Trichlorobenzene
1,1-Dichloroethene (or –ethylene, 1,1-DCE)	Styrene	1,1,2-Trichloroethane
1,2-Dichloroethane	Tetrachloroethene (or –ethylene, perchloroethylene)	Vinyl Chloride
1,2-Dichloropropane	Toluene	Xylenes, total

Appendix B 3745-9-09

Required Analyses for Wells Utilized by Nontransient Noncommunity Public Water Systems

Inorganic

Alkalinity, total (as CaCO3)	Cyanide	Nitrite-(as N)
Antimony, total	Fluoride, total	pH
Arsenic, total	Iron, total	Selenium, total
Barium, total	Lead, total	Silver, total
Beryllium, total	Magnesium, total	Sodium, total
Cadmium, total	Manganese, total	Sulfate
Calcium, total	Mercury, total	Thallium, total
Chloride	Nickel, total	Total Dissolved Solids
Chromium, total	Nitrate-(as N)	Zinc, total
Copper, total	Nitrate-Nitrite-(as N)	

Radiological

Gross Alpha
Gross Beta

Synthetic Organic Chemicals (SOC)

Alachlor
Atrazine
Simazine

Bacteria Standards

Total Coliform (2 samples collected at least 30 min. apart)	1 Positive = Standard Exceeded

Volatile Organic Chemicals (VOC)

Benzene	Ethylbenzene	trans-1,2-Dichloroethene (or –ethylene)
Carbon Tetrachloride (tetrachloromethane)	Monochlorobenzene (chlorobenzene)	Trichloroethene (or –ethylene)
cis-1,2-Dichloroethene (or –ethylene)	ortho-Dichlorobenzene (1,2-Dichlorobenzene)	1,1,1-Trichloroethane (methyl chloroform)
Dichloromethane (methylene chloride)	para-Dichlorobenzene 1,4-Dichlorobenzene	1,2,4-Trichlorobenzene
1,1-Dichloroethene (or –ethylene, 1,1-DCE)	Styrene	1,1,2-Trichloroethane
1,2-Dichloroethane	Tetrachloroethene (or –ethylene, perchloroethylene)	Vinyl Chloride
1,2-Dichloropropane	Toluene	Xylenes, total

Appendix C 3745-9-09

Required Analyses for Wells Utilized by Transient Noncommunity Public Water Systems

Inorganic

Alkalinity, total (as CaCO3)	Fluoride, total	Nitrate-Nitrite-(as N)
Arsenic, total	Iron, total	Nitrite-(as N)
Barium, total	Lead, total	pH
Calcium, total	Magnesium, total	Sodium, total
Chloride	Manganese, total	Sulfate
Copper, total	Nitrate-(as N)	Total Dissolved Solids

Radiological

Gross Alpha
Gross Beta

Bacteria Standards

Total Coliform (2 samples collected at least 30 min. apart)	1 Positive = Standard Exceeded