

SECTION 18 - HYDROGEOLOGIC TESTING
(Amended by the BOS on July 12, 2018)

18-1 PURPOSE

Currently, all public and private water supplies in Fauquier County are provided by groundwater wells. To ensure the continued quantity and quality of groundwater resources within the County, testing and monitoring of the groundwater supply, and the documentation of the testing results in the form of a Hydrogeologic Report, are required under certain circumstances.

18-2 APPLICABILITY *(Amended by the Board of Supervisors on October 11, 2018.)*

A Hydrogeologic Report is a detailed technical report assessing groundwater quantity and quality that is developed to detail the results of Hydrogeologic testing. Prior to submission of a Hydrogeologic Report, an Exploratory Drilling Proposal for Central Water Systems or Drilling and Testing Proposal for Private Individual Wells must be submitted for approval by the County. After drilling of wells, a Pumping Test Proposal for Central Water Systems must also be submitted for approval by the County. Upon completion of well drilling and pumping test(s), the Hydrogeologic Report is submitted for the County's review. As part of this submittal process, if the WSA has established an integrated Water Supply Management Plan, the applicant shall demonstrate that the development of a water supply within a given Service District is consistent with that Plan. The Exploratory Drilling Proposal, Production Well Drilling and Pumping Test Proposal, and Hydrogeologic Report (Report) shall be prepared by a Virginia Certified Professional Geologist (PG) who has demonstrated expertise in hydrogeology.

When required by Section 18-3.A and Section 18-4.A, below, the Hydrogeologic Report shall be submitted and reviewed by the Virginia Department of Health (VDH) and the Department of Community Development prior to submission of any accompanying Category 31 Special Exception, Preliminary Plat, Construction Plan, or any other residential subdivision as regulated by Section 3 of this Ordinance, with the exception of family (up to two on any property), administrative and large lot subdivisions, which are completely exempt from this Section.

18-3 CENTRAL WATER SUPPLIES

A. Requirement for Hydrogeologic Testing

Hydrogeologic testing is required under the following circumstances when a Central Water system is proposed:

1. In residential developments meeting the following criteria:
 - a. Any new residential subdivision consisting of lots less than one (1) acre in size in all zoning districts, regardless of the number of lots or residences; and
 - b. New residential subdivisions that have seven (7) or more lots, regardless of lot size, in rural and residential districts, and villages.

2. Any commercial or industrial subdivision that will extract more than 10,000 gallons/day.
3. Any proposed development that will extract more than 10,000 gpd in a designated County Service District.

B. Exploratory Drilling Proposal

Prior to the submission of a Hydrogeologic Report or conducting any well drilling or pumping test(s), the developer must submit an Exploratory Drilling Proposal to the Department of Community Development for review, comment and approval. This should be prepared based on the requirements for subsections D, E, and F below, including the following minimum information:

1. The location of all exploratory wells (some of which may become production wells and others that may become observation wells) must be approved by the Department of Community Development, in addition to any approvals required by the Virginia Department of Health Office of Drinking Water (VDH-ODW). The well locations shall be approved prior to well construction.
2. The Proposal shall include a map at a scale of not greater than 1:6,000 (1"=500') showing the National Watershed Boundary Dataset (NWBD) watershed units that are the subject of the hydrogeologic test and Report. This map shall include planimetric features, topography, geological contacts, and major structural features. The map shall show proposed exploratory well locations, subdivision layout and sources of potential contamination within 1,000 feet of the subdivision boundary, to include, but not be limited to, existing or abandoned wells, septic drainfields, underground storage tanks, and houses. The map shall also show land use/land cover, springs, NWBD watershed boundaries, and estimated groundwater flow direction(s). Groundwater flow directions may be estimated in the Proposal in the absence of site-specific groundwater elevations based on topography and surface water bodies. All information is to be gathered from existing records and actual field observations. Information concerning existing wells and septic drainfields is available from the local health department, the VDH-ODW Source Water Assessment Program (SWAP), and the Virginia Geographic Information Network (VGIN). Potential Sources of Contamination (PSCs) within 1-mile of the subdivision boundary must be identified in the Proposal. For public water supplies, this information may be provided by VDH-ODW as part of the site approval process. For non-public water supplies, PSC information is to be gathered from the SWAP, the Virginia Department of Environmental Quality (DEQ), or a commercial environmental database search. The developer must identify the source(s) of all data presented.
3. The Proposal shall include a water discharge plan to control the outflow of drilling discharge.
4. The Proposal shall include a plan for testing water quality from each proposed production well. The water quality testing plan shall include potential contaminants associated with PSCs identified in the area. The developer shall collect one water quality sample per well drilled. At a

minimum, water quality tests shall include a screening of metals and inorganic chemicals (including nitrate).

After submission of an Exploratory Drilling Proposal, the developer shall meet with representatives of the Department of Community Development to review the Proposal. The meeting may be accomplished via a conference call. The Department of Community Development may request changes to the Exploratory Drilling Proposal as appropriate. This review shall take no more than 30 days from the Proposal's submission date. No work shall be performed until the County grants approval of Proposal in writing.

C. Production Well Drilling and Pumping Test Proposal for assessing Adequacy of Water Supply

Following approval of the Exploratory Drilling Proposal and completion of the exploratory well drilling, a Production Well Drilling and Pumping Test Proposal shall be submitted to the County for review, comment, and approval. The Pumping Test Proposal and subsequent pumping test(s) shall meet the following minimum requirements:

1. Production Well(s):
 - a. All wells shall be placed and drilled in accordance with all State, and County requirements. A Virginia PG shall complete geologic logs to be submitted to the County. The drilling contractor shall prepare the Virginia Uniform Water Well Completion Report (Form GW2) to be registered with VDH. A geologist shall supervise drilling and prepare a detailed log of the entire length of the well.
 - b. Prior to any pumping test, the well must be developed. Development shall include airlifting or continuous pumping of the well until the discharge is visibly free of cuttings and sediment.
 - c. Prior to any pumping test, the well must be constructed, including installation and grouting of casing.
 - d. The test pump intake should be set at an appropriate depth to ensure that major water-bearing zone(s) are kept submerged during testing.
 - e. A step drawdown test shall be performed, prior to the standard constant rate aquifer test, to estimate the maximum practical pumping rate, yield and drawdown rate. The test shall include at least three (3) successively greater pumping rates. The duration of pumping shall be the same for each pumping rate. After the step drawdown test, the production wells must be allowed to recover for a minimum of 12 hours or until water levels recover fully, whichever is sooner, before starting the continuous rate aquifer test.
 - f. A constant rate pumping test shall be performed on all production wells to provide evidence that the well(s) and the aquifer are capable of furnishing the needs of the full build-out of the proposed development. If more than one production well is proposed to be in operation at the same time, the wells should be pumped simultaneously. However, the start of pumping

for each pumping well should be staggered for up to 24 hours. The exact startup of the pumping tests can be determined by the PG performing or supervising the work. However, the conclusion of the simultaneous pumping tests should be done on the same hour to evaluate recovery rates. The duration of the constant rate pumping tests shall not be less than 48 hours and up to 72 hours including a minimum of 12 hours of predictable drawdown rates. Predictable drawdown is defined herein as:

- i. A water level that has not fluctuated by more than plus or minus 0.5 feet for each 100 feet of water in the well (i.e., static water level to bottom of well) over at least a 12-hour period of constant pumping rate, or
 - ii. Plotted measurements have shown that the trend of decreasing water levels will not exceed the level of the highest yielding bedrock fracture zone after 180 days of pumping.
- g. The pump discharge rate shall be monitored on a regular basis during the test to ensure a constant pumping rate. The pump discharge rate should not vary by more than +/- 3% for the last 12 hours of the test. The frequency of monitoring shall be established in the Pumping Test Proposal.
- h. Minimum well yields must meet the following:
- i. Within any existing Service District, well yields must meet WSA requirements for the well to be accepted as a public water supply well (i.e., 400 gpd per equivalent residential connection), to be demonstrated by the hydrogeologic testing.
 - ii. Outside any existing Service District, the developer must demonstrate through the hydrogeologic testing that the proposed Central Water System's wells are capable of providing at least 600 gallons per day per equivalent residential connection.

2. Observation Wells:

- a. A minimum of two (2) observation wells will be provided for each potential production well. Existing wells (including exploratory wells) may be substituted for new observation wells provided the depth and well construction information are known and documented in the Pumping Test Proposal. Relative to a production well, attempts should be made to locate one observation well parallel to bedrock strike and one observation well perpendicular to bedrock strike.
- b. Certain development projects may require the developer to dedicate a location and easements for the County to establish a long-term observation well or wells. The developer shall identify in the Hydrogeologic Report which observation well or wells will be best suited for long-term monitoring purposes. Upon acceptance, the County or WSA shall assume responsibility for all monitoring activities.
- c. Available data on the observation wells shall be provided. The data shall include location, well depth, casing material, size and depth, static water

level, water bearing zones, proposed and current usage information, and lithologic descriptions.

- d. Where new observation wells are to be drilled, observation wells shall be constructed to observe drawdown in response to pumping. New observation wells shall be drilled to an appropriate depth within the bedrock as determined by the consulting PG. All new observation wells must be constructed with a locking steel riser cover or similar means to prevent unauthorized access.
- e. Observation wells installed for use in hydrogeologic testing and not maintained by the developer or the County for continued use for water level monitoring must be abandoned in accordance with 12VAC5-630-420 and 12VAC5-630-450. The developer must provide the County at least 30 days written notice of intent to abandon an observation well.
- f. Water levels measured to 1/100th of a foot (0.01 feet) are to be monitored for drawdown effects continually in the pumping well(s) and observation wells at least 24 hours prior to pumping (background phase), during the drawdown (pumping phase), and recovery (post-pumping phase) of the test. If datalogging pressure transducers are used, manual water level measurements shall be collected at least two times per day to confirm transducer readings.
- g. Recovery of water levels in the pumping well(s) and observation wells shall be recorded until at least 90% recovery of total test drawdown is reached, or for at least 24 hours.
- h. Water levels in the pumping well and observation wells shall be monitored at least once per hour during the background phase to evaluate potential off-site pumping effects. Barometric pressure at the test site shall be monitored at least once per hour during the background phase to monitor for potential barometric effects on water levels.
- i. Water levels in the pumping well and observation wells located within 1,000 feet of the pumping well and barometric pressure at the test site shall be monitored at the following minimum frequencies during the drawdown and recovery phases:

Time Since Pumping Started (or Stopped) in Minutes	Minimum Time Intervals Between Measurements in Minutes
0-10	1
10-30	2
30-60	5
60-180	15
180-termination of test	30

Water levels in observation wells located greater than 1,000 feet of the pumping well shall be monitored at a minimum frequency of every 15 minutes during the drawdown and recovery phases.

D. Field Testing for Water Quality

Water quality shall be monitored during the aquifer test, including pH, conductivity, oxidation-reduction potential, temperature and dissolved oxygen with a handheld multi-parameter meter or equivalent device. Measurements shall be recorded at least once per day during the pumping test and at least one time during the last four hours of the test.

E. Laboratory Testing for Drinking Water Requirements

All central water supplies shall conform to minimum drinking water quality standards contained in VDH's Waterworks Regulations, 12 VAC5-590, whether or not the proposed central water system will be regulated by VDH as a Waterworks. The required samples shall be specified by VDH in the site approval document if applicable. Samples must be collected in accordance with the approved Pumping Test Proposal. The plan shall comply with the VDH standards.

Bacteriological Sampling. A series of 20 bacteriological samples must be collected during the latter part of the yield and drawdown test. If the well was disinfected with chlorine, the well must be pumped to waste until all of the chlorine residual has been removed from the well before collecting the bacteriological or any other water quality samples. The 20 samples must be analyzed by a Most Probable Number (MPN) method for total coliform bacteria and *E. coli*. The MPN samples should be collected at appropriate intervals during the latter part of the pumping test as directed by VDH. Hygienic sampling procedures must be followed during the collection of these samples to avoid accidentally contaminating the samples.

Chemical, Physical, and Radiological Sampling. In addition to monitoring the microbial characteristics of the well source, a variety of chemical, radiological, and physical parameters must be checked during well development in order to ensure adequate water quality. The specific parameters required for testing and the number of samples will be based on requirements in the Waterworks Regulations if the central water system will be classified as a Waterworks under VDH Regulations (12VAC5-590). If the central water system is not classified as a Waterworks by VDH, the specific water quality testing parameters will be determined based on the PSC search and shall be approved by the Department of Community Development as part of the Pumping Test Proposal review. The chemical and radiological sample or samples shall be collected near the end of the aquifer test, prior to the recovery period.

After submission of a Pumping Test Proposal, the developer shall meet with representatives of the Department of Community Development to review the Testing Proposal. The meeting may be accomplished via a conference call. The Department of Community Development may direct changes to the Production Well Drilling and Pumping Test Proposal as appropriate. This review shall take no more than 30 days from the Proposal's submission date. No work is to be performed until approval of the Proposal is granted in writing by the County.

18-4 PRIVATE INDIVIDUAL WELLS

A. Requirement for Hydrogeologic Testing

Hydrogeologic testing shall be conducted on any new residential subdivision consisting of seven (7) or more lots with any lot(s) less than ten (10) acres in size where individual wells are proposed except where a Limited Hydrogeologic Assessment is allowed as described below.

A Limited Hydrogeologic Assessment may be performed demonstrating the proposed individual wells should not adversely impact present or future water supplies in lieu of hydrogeologic testing for resubdivisions described below. Where the Limited Hydrogeologic Assessment shows adverse impacts are likely, full Hydrogeologic Testing shall be required. Where the Limited Hydrogeologic Assessment shows no adverse impacts are likely, proposed residential lots for resubdivisions described below may use individual wells in place of a central water supply system with Administrative approval as part of the subdivision application.

1. Resubdivisions:

a. Subdivisions recorded after June 4, 1991 and prior to July 12, 2018:

Where an existing residential subdivision with any lot(s) less than 10 acres in size served by individual wells is resubdivided, and the cumulative total of existing and proposed lots served by individual wells is less than ten (10) lots.

b. Subdivisions recorded before or on June 4, 1991:

Where an existing residential subdivision with any lot(s) less than 10 acres in size served by individual wells is resubdivided, provided that no more than three (3) new lots are proposed and the cumulative number of existing and proposed lots is no more than twenty-five (25).

B. Limited Hydrogeologic Assessment

The purpose of the Limited Hydrogeologic Assessment (Assessment) is to provide an abbreviated evaluation of the sustainability of the groundwater supply in defined circumstances and to determine whether or not comprehensive hydrogeologic testing as detailed in this Section shall be required.

1. The Assessment shall include a map at a scale of not greater than 1:6,000 (1"=500') showing the subdivision layout and proposed well sites for each building lot, planimetric features, topography, geological contacts, and major structural features. The map shall show PSCs within 1,000 feet of the subdivision boundary, to include, but not be limited to, existing or abandoned wells, springs, septic drainfields, underground storage tanks, and houses. All information is to be gathered from existing records and actual field conditions. Information concerning existing wells and septic drainfields is available from the local Health Department. Data may be gathered from VDH-ODW, VGIN,

- DEQ, a commercial environmental database, or other sources. The developer must identify the source(s) of all data used.
2. The developer shall query available well records (GW-2 forms) within a minimum 1,000 feet of the subdivision boundary to determine average depth to bedrock, casing depth, depth of water bearing zones, and yield. The developer may need to expand the search radius if relevant information is not available within 1,000 feet of the site.
 3. The developer shall develop an estimate of normal groundwater recharge in inches per year for the subdivision area to reflect normal (non-drought year) climatic conditions. The developer shall submit a recharge estimate based on the most recent recharge estimates developed for Fauquier County by the U.S. Geological Survey or other published study for the specific subdivision/development area.
 4. The developer shall provide estimates of pervious land cover percentage for the entire subdivision and illustrate these areas on the map. The following percentages shall apply:
 - a. Areas covered by buildings or concrete/asphalt pavement: 0%
 - b. Areas covered by gravel (e.g., driveways and parking lots): 0%
 - c. Areas mapped as wetlands by the National Wetlands Inventory (NWI) or other entity are considered areas of groundwater discharge: 0%
 - d. Areas covered by vegetation (grasses, trees, and agricultural crops): 100%
 - e. Areas underlain by stormwater best management practices (BMPs) designed to allow infiltration into the subsurface: 100%
 - f. The developer may elect to specify the % pervious area for portions of the subdivision based on civil design specifications, landscape architecture, and stormwater runoff calculations prepared by a professional with expertise in these disciplines.
 5. The developer shall calculate the total area open to groundwater recharge within the footprint of the subdivision using the above pervious land cover percentage estimates.
 6. The developer shall calculate the volumetric groundwater recharge in gallons per day (gpd) to the subdivision footprint using the total area open to recharge developed in #4 above and the estimate of recharge developed above.
 - a. Groundwater recharge under normal climatic conditions will be specified as 100% of the estimated recharge.
 - b. Groundwater recharge under drought conditions will be specified as 65% of the estimated recharge under normal climatic conditions.
 7. The developer shall estimate groundwater usage for the subdivision in gallons per day (gpd) using an estimate of 400 gpd per household.
 8. The developer shall compare the groundwater usage estimate to the groundwater recharge estimates for normal and drought conditions.
 - a. If the estimated groundwater usage is less than 100% of estimated groundwater recharge under both normal and drought conditions, hydrogeologic testing may not be required.

- b. If the estimated groundwater usage exceeds 100% of estimated groundwater recharge under normal and/or drought conditions, the developer must conduct comprehensive hydrogeologic testing.
 - c. The PG preparing the Assessment shall make recommendations for water conservation measures (e.g., low-flow plumbing fixtures and limiting of non-essential water uses). Alternatively, the PG preparing the Assessment may recommend to the County that comprehensive hydrogeologic testing be conducted, based on their professional judgment of the specific hydrogeologic setting of the project site.
9. Upon completion, the developer shall submit a report on the Limited Hydrogeologic Assessment. The Assessment report shall be prepared by a PG licensed to practice in Virginia who has demonstrated expertise in hydrogeology. A minimum of two (2) printed and bound copies of the Assessment report must be submitted to the County, as well as a pdf copy. All raw data must be included as a part of the Assessment, and be additionally submitted in a machine-readable digital format.

C. Drilling and Testing Proposal

Prior to the submission of a Hydrogeologic Report or conducting any well drilling or pumping test(s), the developer must submit a Drilling and Testing Proposal to the County for review, comment and approval, that is prepared based on the requirements from subsections D. and E. below, that includes the following minimum information:

1. The Proposal shall include a map at a scale of not greater than 1:6,000 (1"=500') showing the NWBD units that are the subject of the hydrogeologic testing and Report. This map shall include the subdivision layout and proposed well sites for each building lot, planimetric features, topography, geological contacts, and major structural features. The map shall show PSCs within 1,000 feet of the subdivision boundary, to include, but not be limited to, existing or abandoned wells, springs, septic drainfields, underground storage tanks, and houses. The map shall also show land use/land cover, springs, NWBD watershed boundaries, and estimated groundwater flow direction(s). Groundwater flow directions may be estimated in the Proposal in the absence of site-specific groundwater elevations based on topography and surface water bodies. All information is to be gathered from existing records and actual field conditions. PSC information can be gathered from the VDH SWAP, VGIN, DEQ, or commercial environmental databases. The developer must identify the sources of all data used.
2. The Proposal shall include a management plan to control potential erosion and sedimentation caused by the drilling discharge water as needed.
3. The Proposal shall include a plan for testing drinking water quality from each proposed well. The plan shall include the minimum testing requirements of the Virginia Private Well Regulations as well as potential contaminants associated with PSCs identified in the area. Developers must clearly identify any proposed deviations from the testing requirements detailed in subsections

D. and E. below and provide a detailed technical explanation for the proposed deviations.

After submission of a Drilling and Testing Proposal, the developer shall meet with representatives of the Department of Community Development to review the Proposal. The meeting may be accomplished via a conference call. The County will review each well location in order to ensure that unique combinations of topographic setting and geologic units are tested within the proposed subdivision. The County may recommend changes in the proposed location of wells, and other changes as appropriate. This review shall take no more than 30 days from the Proposal's submission date. No work is to be performed until approval of the Drilling and Testing Proposal is granted in writing by the County.

D. Pumping Tests for Adequacy of Supply

Following approval of the Drilling and Testing Proposal, field-testing shall be conducted per the following requirements:

1. The developer shall drill a minimum of three (3) test wells or 30% of the total number of lots proposed, whichever is greater. Each test well location should be a site approved by the local Health Department, in conjunction with the Department of Community Development.
2. All wells shall be placed and drilled in accordance with all State and local ordinances. The drilling contractor shall prepare the Uniform Water Well Completion Report (Form GW2) to be registered with VDH for the production well(s). A geologist shall prepare a detailed geologic log of the entire length of the well, and submit such log to the County.
3. Prior to any pumping test, the well must be fully developed, including installation and grouting of casing.
4. Full development shall include airlifting or continuous pumping of the well until the discharge is visibly free of cuttings and sediment.
5. A constant-rate aquifer test shall be performed on each well to provide assurance that the proposed wells will be capable of meeting sustained long-term water use demands.
6. The test pump intake should be set at an appropriate depth to ensure that major water-bearing zone(s) are kept submerged during testing.
7. Water levels shall be monitored in the pumping and observation wells for a period of at least 24 hours prior to starting the test to determine background effects. Barometric pressure shall be monitored at the test site during this background monitoring period to determine if barometric effects are present in the water level data that would require corrections for test interpretation. If barometric effects are present, barometric pressure shall be monitored at the same frequency as the pumping and observation wells during each constant rate test.
8. Each well shall be pumped at a constant rate for a minimum of eight (8) continuous hours. The constant pumping rate should not be in excess of 10 gallons/minute. The pump discharge rate shall not vary by more than +/- 10%

for the duration of the test. Well yields must be capable of providing not less than one (1) gallon/minute at a drawdown that varies by 10% or less for the last two (2) hours of the test.

9. The two closest wells should be used as observation wells during the pumping test. To the extent practicable, one observation well should be located parallel to bedrock strike and one perpendicular to strike. Existing water wells in the area may be used as observation wells with County approval in the Drilling and Testing Proposal. Water levels in the observation wells shall be measured throughout the entire pumping test for drawdown effects. Data on the observation wells shall be provided. The data shall include location, well depth, casing material, size and depth, static water level, water bearing zones, usage information, and lithologic descriptions. New observation wells must be constructed to observe drawdown response to pumping. All new observation wells must be constructed with a locking steel riser cover or similar means to prevent unauthorized access. Observation wells installed for use in hydrogeologic testing and not maintained by the developer, the County or WSA for continued use for water level monitoring must be abandoned in accordance with 12VAC5-630-420 and 12VAC5-630-450. The developer must provide the County at least 30 days written notice of intent to abandon an observation well.
10. Water levels accurate to 1/100th of a foot (0.01 feet) are to be monitored for drawdown effects continually in the pumping well and observation wells at least 24 hours prior to pumping (background phase), during the drawdown (pumping phase), and recovery (post-pumping phase) of the test. If datalogging pressure transducers are used, manual water level measurements shall be collected at least 2 times per day to confirm transducer readings. Transducer readings shall be corrected for instrument drift, if applicable.
11. Recovery of water levels in the pumping well and observation wells shall be recorded until at least 90% recovery of total drawdown is reached (minimum of 24 hours).
12. Water levels in the pumping well and observation wells shall be monitored at least once per hour during the background phase to evaluate potential off-site pumping effects. Barometric pressure at the test site shall be monitored at least once per hour during the background phase to monitor for potential barometric effects on water levels.
13. Water levels in the pumping and observation wells shall be monitored at the following minimum frequency during the drawdown and recovery phases:

Time Since Pumping Started (or Stopped) in Minutes	Minimum Time Intervals Between Measurements in Minutes
0-10	1
10-30	2
30-60	5
60-180	15
180-termination of test	30

- E. Laboratory Testing for Drinking Water Quality
Sampling shall be performed in accordance with the current version of the Virginia Private Well Regulations. Additionally, laboratory testing shall consist of potential contaminants associated with PSCs in the project area identified in the drilling and testing proposals/plans.

18-5 HYDROGEOLOGIC REPORT

A. Applicability

Requirements of this Section apply to Private Individual Wells as indicated by (P) and to Central Water Supplies as indicated by (C).

B. Minimum Submission Requirements

A Hydrogeologic Report shall be prepared to document and detail the results of the hydrogeologic testing. All raw data must be included as a part of the Report, and be additionally submitted in a machine-readable digital format.

The Report must contain the following minimum information:

1. Lithology encountered in each borehole, physiographic province, geologic formation or unit, watershed unit, hydrogeologic unit, topographical setting, groundwater quality and quantity data from the site, and an estimated cone of depression based on the cumulative groundwater withdrawals of all wells operating at normal average production rates. (P and C)
2. A map or set of maps at a scale of not greater than 1:6,000 (1"=500'), which must fully cover the area of the proposed development. This map shall contain all existing planimetric features, topography with 5' contour intervals, Virginia planar grid coordinates, all proposed roads, proposed lot lines, proposed house sites, proposed septic drainfields, and surface water features, including springs. A flow net (i.e., groundwater contours and interpreted direction(s) of groundwater flow) shall be estimated and illustrated. The Report shall contain one or more cross-sections, at true horizontal scale and vertical scale (exaggerated as required), with location clearly shown and labeled on the plan view map, which depict at a minimum the following information on the cross-sections:
 - a. Drill log data; (P and C)
 - b. Well site locations; (P and C)
 - c. Respective elevations of top-of-bedrock and static (pre-pumping) groundwater elevation surfaces; (P and C)
 - d. Groundwater elevation surface under pumping conditions (specify pumping rate(s)); (P and C) and
 - e. Depths of all significant water bearing zones, if well is proposed to be used as part of a central water system. (C only)
3. The length of time between the step drawdown test and the continuous rate drawdown test; the Report shall discuss the recovery response of the

production well(s) after the step-drawdown test, the pumping rate and duration of each step during the step-drawdown test, and identify any excessive pumping rate that could not be sustained during the step-drawdown test. (C only).

4. Groundwater balance and recharge estimates for the study area; the Report must include a discussion of the following information, including appropriate supporting calculations and diagrams:
 - a. Discussion of the spatial extent of recharge (e.g., aerially distributed and/or concentrated along losing streams) and the source(s) of recharge (e.g., natural infiltration of precipitation, stormwater BMPs, septic systems, etc.); (P and C)
 - b. The average recharge for the subdivision in normal climatic years and in drought years as based on the most recent recharge estimates developed for Fauquier County by the U.S. Geological Survey or other published study for the specific subdivision/development area. (P and C)
 - c. The net daily water consumption of the subdivision. This may take into account any water returned to the aquifer by means of on-site septic systems or irrigation; (P and C)
 - d. Plans for addressing wells of inadequate yield on individual lots (P only)
 - e. The transmissivity and storage coefficient of the various materials estimated from interpretation of the aquifer test(s) using professionally-accepted methods; (P and C)
 - f. The specific capacity of each pumped well for all tested pumping rates; (P and C)
 - g. Table showing surveyed locations and estimated casing/land surface elevations for each well; (P and C)
 - h. Results of the laboratory testing for water quality; (P and C) and
 - i. A recommended operation plan for the well(s) being utilized, to include:
 - i. A recommended "setting depth" for the installation of final production pumps to maximize efficiency and minimize loss of well performance; (C only)
 - ii. The most desirable pumping rate for each well to maximize efficiency and minimize loss of well performance; (C only)
 - iii. The calculated effects on the piezometric surface of all wells pumping. Calculations must include reasonable assumptions and input parameters when empirical field data is not available. (P and C) Calculations for central water supplies shall also include:
 - a. 180-day projection of drought recharge conditions and normal water demand (normal pumping rates); (C only) and
 - b. The County may recommend additional calculations on a case-by-case basis to support whether the groundwater demands of the proposed development are sustainable. (P and C)

- iv. A calculated Area of Impact (AOI) shall be estimated and defined by both the 5-foot and 1-foot drawdown contour of all wells pumping at normal demand under a 180-day projection. The baseline (static) for drawdown calculation shall be the piezometric surface under pre-pumping conditions. The dynamic for drawdown shall be the piezometric surface under pumping conditions projected out a minimum of 180 days. If the predicted AOI 5 foot impact contour extends beyond the footprint of the proposed subdivision or development, the developer must also submit a Mitigation Plan. (P and C)
 - v. The Report shall acknowledge the unique challenges in determining safe yield of wells in fractured rock terrain particularly in Service Districts or other locations of limited areal extent with unknown recharge areas and vulnerabilities to sources of contamination. The Report will include a section therefore that addresses the unique uncertainties in interpretations of pumping test results, projections of sustainable/safe yield, mapping of measured and projected potentiometric surfaces, and water quality data. The assumptions of all calculations must be identified in the Report. (P and C)
 - vi. A pumping plan and schedule to meet the subdivision water demands while minimizing potential impacts to existing wells should be prepared; (C only) and
 - vii. If the calculated 5 foot AOI extends beyond the footprint of the proposed subdivision or development and a Mitigation Plan is required, the developer shall also be asked to submit a plan to monitor water levels in wells (e.g., observation wells) to characterize needs for future adjustments in the pumping plan and schedule. The developer may consider using existing observation wells or production wells as long-term observation wells. (C only)
 - viii. A plan and schedule for how observation well(s) will be dedicated to the WSA or County should be included for long-term monitoring, including associated easements. (P and C)
5. A comparison of water quality parameters to VDH and federal Safe Drinking Water Act Maximum Contaminant Levels (MCLs) and Secondary Maximum Contaminant Levels (SMCLs) shall be made. A description of possible appropriate treatment measures if any parameters exceed MCLs or SMCLs shall be included. An evaluation of whether the proposed central water system or individual wells serving the proposed subdivision could encounter water quality problems in the future (e.g., capture of surface water or existing contaminant plumes) shall be included. (P and C)
6. Results of any discharge water quality testing conducted. (C)

7. Description and analysis of mitigation measures for any off-site impacts. This may include a Water Conservation and Management Plan for limiting the amount of groundwater used, alternative pumping plans and schedules, plans for restricting non-essential water usage during water shortage emergencies (e.g., droughts), or other strategies proposed by the developer. If the calculated 5-foot AOI extends beyond the footprint of the proposed subdivision or development, the developer shall submit a Mitigation Plan. (P and C)
8. A clear discussion shall be given if maximum pumping volumes exceed the average and drought recharge volumes, and, based on the hydrogeologic testing and calculations, how the proposed subdivision or development could affect groundwater levels and local groundwater availability. (P and C)

C. Review and Approval Process

1. *Official submission*

Developers must clearly identify any deviations from their approved drilling and testing proposals and provide a detailed technical explanation for the deviations. The application shall be considered officially submitted once determined complete by the Department of Community Development in accordance with Section 18-5.C.3 of this Ordinance. Four (4) printed copies of the Report shall be submitted to the County for distribution as well as a machine-readable digital format; the County shall retain one copy for public view.

2. *Completeness review timing*

The County shall have fifteen (15) days to review the Report in order to determine that the minimum submission and content requirements have been met in accordance with the submitted drilling and testing proposals/plans. Failure of the County to notify the developer within the required timeline shall result in the application being considered officially submitted.

3. *Completeness determination*

An application failing to provide the minimum required information shall be deemed incomplete and shall not be accepted for official submission by the County. The County shall notify the developer in writing of the reasons for disapproving the application, citing the applicable section of this Ordinance or other law, and what corrections are necessary for acceptance. Once the Report is accepted based on consistency with the approved drilling and testing proposals/plans, written notification shall be sent to the developer and the Report shall be considered officially filed. If notification is not sent to the developer within fifteen (15) days after initial submission, the Report shall be considered officially submitted for review.

4. *Transmittal of application*

The County shall have thirty (30) days from the official submission date to review the Report.

5. *Comment letter*

The County may issue a formal comment letter outlining any potential deficiencies in the submitted materials to the developer or their representative;

the comment letter shall be mailed, delivered or emailed no later than thirty (30) days from the date the application was considered officially submitted. The comment letter shall pertain to the requirements of this ordinance, or other applicable ordinances, codes, or laws.

6. *Revision and resubmission*

Prior to resubmission, the developer or their representative shall revise the Report and provide additional information or documentation as necessary to address any deficiencies.

7. *Approval (Central Water Supplies)*

Once the Hydrogeologic Report is determined to meet the conditions of the ordinance and approved drilling and testing plans, approval for central water supplies shall come from the Department of Community Development and the appropriate office of VDH who can accept or deny the Hydrogeologic Report that has been submitted. The VDH shall determine the sustainability of the supply source(s) to meet the water yield demands of the proposed subdivision and whether it meets the water quality requirements set forth by the Virginia Department of Health. Upon acceptance by VDH for rated yield capacity and quality of the groundwater sources, the WSA shall begin negotiations with the developer to establish proper easements and access to on-site production wells and observation wells. The developer may be requested to provide one or more observation wells for long-term monitoring by the County or WSA.

Hydrogeologic Reports developed for subdivisions with private individual wells will be reviewed and approved by the Department of Community Development.

8. *Validity*

An approved Report shall be considered valid assuming there are no changes in water usage or land use/land cover within the recharge area or other circumstances that affect the conclusions presented in the Report.

18-6 WAIVERS

A. **Central Water Supplies**

Waivers of the Central Water Supply requirement can only be made through a Special Exception in accordance with Section 5-3100 of the Zoning Ordinance.

The hydrogeologic testing requirements of this Section may be waived by the Planning Commission in the following circumstances:

1. **Public Central Water Supplies**

Specific provisions may be waived by the Planning Commission, with recommendation from WSA as unnecessary or an undue hardship, in accordance with Section 4-27 of this Ordinance where a public system is proposed.

2. **Private Central Water Supplies**

Specific provisions may be waived by the Planning Commission, with recommendation of the WSA, based adequate hydrogeologic data, as provided

through a Limited Hydrogeologic Assessment, demonstrating that the proposed water system will not adversely affect present or future water supplies and that testing is unnecessary.

3. Within a Service District

Specific provisions for hydrogeologic testing may be waived by the Planning Commission, with recommendation from WSA, in accordance with Section 4-27 of this Ordinance on the basis that testing is unnecessary.

B. Private Wells

Certain requirements for hydrogeologic testing may be waived in accordance with the provisions of Section 4-27 based on adequate engineering data, as provided through a Limited Hydrogeologic Assessment, demonstrating that the proposed water system will not adversely affect present or future water supplies.

18-7 RELATED ORDINANCES

- A. Fauquier County Subdivision Ordinance
- B. Fauquier County Zoning Ordinance, Article 5-3100
- C. Fauquier County Water and Sewer Authority Community Water System Standards

18-8 REFERENCES

Driscoll, F.G., 1995. Groundwater and Wells, 2nd Edition.
Fetter, C.W., 2001. Applied Hydrogeology, 4th Edition.
Freeze, R.A. and Cherry, J.A., 1979. Groundwater.
Loudoun County Facilities Standard Manual, Chapter 6.000. Soils, Geotechnical, and Hydrogeologic Reviews.
New York State Department of Environmental Conservation, February 2015. Pumping Test Procedures for Water Withdrawal Permitting. Appendix 10, TOGS 3.2.1 (Water Withdrawal Supply Permit Program Application Processing).
<http://www.dec.ny.gov/lands/86950.html>
Virginia Department of Health Waterworks Regulations (12VAC5-590).
Virginia Department of Health, 2016. Handbook for Developing a Public Water Supply Well. Revised January 5, 2016.

18-9 LIST OF ABBREVIATIONS

AOI	Area of Impact
Assessment	Limited Hydrogeologic Assessment
BMP	Best Management Practice
County	Fauquier County or the Department of Community Development
CWA	Clean Water Act
DEQ	Virginia Department of Environmental Quality
ERC	Equivalent Residential Connection
MCL	Maximum Contaminant Level
MPN	Most Probable Number

NWBD	National Watershed Boundary Dataset
PDF	Portable Document Format
PE	Virginia Licensed Professional Engineer
PG	Virginia Certified Professional Geologist
PSC	Potential Source of Contamination
Report	Hydrogeologic Report
SMCL	Secondary Maximum Contaminant Level
SWAP	Source Water Assessment Program
USGS	United States Geological Survey
VDH	Virginia Department of Health
VDH-ODW	Virginia Department of Health Office of Drinking Water
VGIN	Virginia Geographic Information Network
VPDES	Virginia Pollutant Discharge Elimination System
WSA	Fauquier County Water and Sanitation Authority