

**POLICY ON HYDROGEOLOGICAL ASSESSMENT FOR RESIDENTIAL
DEVELOPMENT WITH PRIVATE DRINKING WATER WELLS**

8/22/17

**APPLICATION AND SUBMISSION REQUIREMENTS
FOR
HYDROGEOLOGICAL ASSESSMENT**

Initial Requirements:

The Developer of a Development meeting any of the Trigger Criteria requiring a Pre-Development Hydrogeological Assessment shall submit an application for an assessment and approval on a form prescribed by the Board. The Developer of the Development shall retain, at Developer's expense, a qualified hydrogeologist, as defined in the Board of Health Regulations, to prepare and complete, as part of any such application, an assessment report (the "Assessment Report") detailing the quantity and quality of water at the Development, current and future, and any impacts to water sources in the vicinity.

Assessment Report:

Existing Conditions:

The Assessment Report shall be based on a records review, site visit(s), field work, test well installation, pumping tests, water quality sampling, and such further testing and investigation as is necessary to characterize the local hydrology, surface water features and land use in the vicinity of the proposed Development, and shall include, without limitation:

1. a compilation of records of wells in the area of the proposed Development;
2. a compilation of local pumping test results for the proposed aquifer source.
3. water quality analyses for the proposed aquifer source.

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4. groundwater studies and/or literature on the area of the Development; a review geological maps and reports.
5. assessment of local bedrock and surficial geology, including types of soils and locations of same, stratigraphy, depth, thickness, composition, texture, known relevant weathering/alteration/structural features (i.e., joints, fractures, faults, or bedding planes), water bearing potential and lateral continuity; identification of connections between groundwater in the overburden and bedrock aquifers, and assessment of possible connections between sub-surface sewage disposal areas for each lot and bedrock fractures and aquifers.
6. watershed information, including identification of primary, secondary and tertiary sub-watersheds of the proposed Development site, and assessment of surface water features within 1500 feet of the Development boundaries, including the types of surface water features and the location of the surface water features relative to the Development site; surface water features should also be assessed for water levels, flow rates, seasonal variation, surface water quality, drainage patterns, flood risk and annual precipitation rates, including expected loads, 100-year rainfall events and others that could cause adverse risk to the potable water resources at depth.
7. review of any Stormwater Management Plan as to the Development with respect to the potential for water quality impacts to local aquifers.
8. description of surrounding land use, with a determination of whether there are current or historical land uses that may cause or have caused groundwater contamination (e.g., landfill or dump, commercial facilities, agricultural or

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recreational uses of pesticides, herbicides, etc.); identification of existing water users, with a description of how many wells are located within 1500 feet of the Development site, whether they are bedrock wells or overburden wells, and what they are used for (e.g., domestic, commercial, industrial, municipal, governmental, agricultural, open-loop groundwater heat pumps); a review and discussion of known water quality and quantity concerns as to the Development site and vicinity (e.g., water shortages, low well yields, high arsenic levels, etc.).

9. description of the hydrogeology, geology and surface water features including: geological mapping, pumping test results, water quality results, and surface water/watershed characteristics.

Proposed Development:

The Assessment Report shall provide a description of the Development site, including (without limitation)

1. the site location,
2. existing conditions,
3. the details of the proposed Development (e.g., number of lots, location and size of proposed lots, water well locations and leaching field locations and reserve areas).

Analysis of Proposed Development on Existing Conditions

The Assessment Report shall contain a full analysis of the following:

1. analysis and discussion of potential well interference effects that the proposed Development wells may have on each other and the effects they may have on

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existing off-site wells, with a discussion of the potential effects that the proposed Development wells may have on surface water and the environment.

2. analysis and discussion of the risk that on-site sewage disposal systems may pose to individual wells.

Testing Used in Performing Analysis and Results

The Assessment Report shall contain a description of all tests and results performed, including:

1. description of the test well drilling program;
2. description of the pumping test program and presentation of the interpretation and results;
3. description of the water quality sampling program (including sampling protocols) and results.
4. the field program for the installation of test wells that will be used for pumping tests and water quality sampling.
5. a well survey, if required (at the discretion of the Board if there is potential for the proposed Development to interfere with existing off-site water wells, particularly if there are off-site wells located within 1500 feet of the Development's boundaries or if there is a history of well interference problems in the area);

Well Survey Test Requirements:

A well survey shall include water level measurements in at least 10 of the nearest off-site water wells and documentation of the location and well construction details of these wells along with their estimated production capacity upon installation or

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upgrading; this information shall be used to assess the potential for the proposed Development to interfere with existing wells, or vice versa.

The objective of the test well installation program is to locate and construct test wells for aquifer testing, including pumping tests and water quality sampling. Test wells shall be drilled wells. The minimum number of test wells is: (a) 3 if less than 25 lots, (b) 4 if 25 to 50 lots, plus one additional test for every 25 lots (or portion thereof) above 50. The test wells should be located such that the hydrogeological conditions across the Development site are adequately represented. Additional test wells may be required depending on the site-specific conditions, such as lack of detail on the target aquifer(s), evidence of historical groundwater contamination in the area, a large number of off-site wells within 1500 feet of the proposed Development boundaries, the presence of sensitive features such as wetlands or streams that may be impacted by development, and evidence of significant hydrogeological variability across the site, particularly but not exclusively, as affecting drainage of effluent from septic systems. The test wells should be located and constructed in a way that permits the prediction of the quality and quantity of groundwater supplies in the proposed Development.

If past or present land uses on or adjacent to the Development are a concern, the test wells should be located in a manner that permits a proper assessment of potential land-use impacts. At least two of the test wells should be located within 450 feet of each other to facilitate observation well requirements during the pumping test and to permit the calculation of aquifer properties. All test wells must be constructed in accordance with Massachusetts and the Board's well construction regulations by a person who is licensed to construct wells in Massachusetts.

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Particular attention must be paid to ensuring that the discharge of water from each well test is located sufficiently far from the well(s) under test so as to preclude biased results. Test well installation should be supervised by a qualified hydrologist and detailed information on the site geology should be collected and recorded during the test well installation program.

After the groundwater assessment is completed, the test wells may be used as water supply wells on the individual lots on which they are sited, if practical and feasible. Test wells that are not intended to be used as water supply wells or long-term monitoring wells must be decommissioned in accordance with applicable regulations. Test wells should be used to determine: groundwater flow direction in the alluvium and the bedrock, which may not be the same; whether the groundwater in the alluvium recharges the bedrock, i.e., what are the vertical gradients between the alluvium and the bedrock; if there are downward gradients between the alluvium and the bedrock, analyze the possibility that septic effluent may eventually migrate to the bedrock wells. Pumping tests should be carried out at all of the test wells.

Prior to performing the pumping tests, the test wells should be developed until they are free of sand, drifting mud and rock fines. Initial step drawdown pumping tests appropriate for the proposed use should be performed in all test wells to estimate well yields, assess well efficiency, and to determine the optimum rate for a constant rate pumping test. The step drawdown pumping tests should include a minimum of four pumping intervals consisting of a minimum period of 30 minutes each. The constant rate pumping tests should begin with a static water level and should be performed at a fixed pumping rate (plus or minus 5%) for a minimum of forty (40) hours; five (5) eight-

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hour (8) days, each eight (8) hour day to consist of continuous pumping (no stoppages). Longer duration pumping tests may be required in some cases depending on the proposed well use, specific site conditions and nearby existing supply wells. The pumping rate used during the constant-rate pumping tests should be based on the results of the step drawdown pumping tests.

The test wells should be fully recovered prior to proceeding with the constant rate pumping test. When a constant rate pumping test is being carried out at one well, the other test wells should be used as observation wells, and the time history of drawdown and recovery appropriately recorded. The pumping tests should include regular water level measurements during and after pumping until 95% recovery occurs, or until sufficient data has been collected to establish a recovery curve. Water levels should be continuously monitored at an appropriate frequency in pumping wells and observation wells. The recommended frequency for water level measurements during pumping tests is shown in the following Water Level Measurement Frequency for Pumping Tests Table. Surface water bodies within 180 feet of the pumping wells should also be monitored during the pumping tests in order to assess groundwater-surface water interaction (e.g., stream level measurements relative to a fixed datum, any evidence of disturbance to streamflow, etc.).

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Table: Water Level Measurement Frequency for Pumping Tests

(Provisional recommendations for planning purposes, which may need to be adjusted to meet
field conditions)

<u>Pumping Well</u>		<u>Observation Wells</u>	
<u>Time Since Pumping Began or Stopped (min)</u>	<u>Time Intervals Between Measurements (min)</u>	<u>Time Since Pumping Began or Stopped (min)</u>	<u>Time Intervals Between Measurements (min)</u>
0-10	0.5-1	0-60 (1 hr)	2
10-15	1	60-100 (2 hr)	5
15-60 (1 hr)	5	120-240 (4 hr)	10
60-360 (6 hr)	30	240-360 (6 hr)	30
360-1440 (24 hr)	60	360-1440 (24 hr)	60

During the pumping tests, the discharge should be diverted an appropriate distance and direction away from the wellhead to prevent artificial recharge. The appropriate discharge location will be site-specific and will depend on the local hydrogeology, pumping test rate and pumping test duration. At a minimum, it is recommended this be achieved by conveying the water to a down-gradient location at a distance from the monitoring well which is at least five (5) times greater than the depth of said well, or farther, depending on the location of other monitoring wells. This is likely to be adequate for the low-flow, short-duration pumping tests discussed herein, however, the pumping test results should be inspected to confirm that artificial recharge did not occur, and if such local recharge occurred, a proper design adopted. The water

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should be discharged at a location that will not harm aquatic habitat or cause environmental or property damage.

Pumping test data must be plotted, interpreted and analyzed, including a description of the analysis method and the resulting aquifer properties (well yield, specific capacity, transmissivity, storativity). It is not acceptable to provide raw pumping test data without analysis and interpretation.

Before starting the pumping test, the discharge line should be filled with water to prevent unnecessary fluctuations in the discharge rate at the beginning of the test. The discharge water should be checked periodically for sediment: excessive sediment in the discharge, which could damage the pump, indicates that the well needs additional development. Water level measurements should be measured in feet and hundredths of a foot. Water levels should be monitored in any test wells or supply wells that could potentially be influenced by the well being tested.

Water quality sampling.

Water samples should be collected from all test wells. Water quality testing, utilizing the applicable US EPA approved method for drinking water testing, shall be conducted by a Massachusetts certified laboratory. Samples should be collected at the end of the step drawdown or constant rate pumping test (last hour of pumping test), and analyzed for the following parameters and such others as may be requested by the

Board:

Arsenic	Hardness	pH
Chloride	Iron	Sodium
Conductivity	Lead	Total Coliform bacteria
Copper	Manganese	E. coli bacteria
Fluoride	Mercury	Nitrate/Nitrite

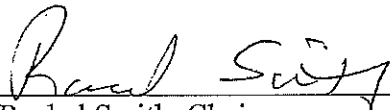
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VOCs

In wells drilled into bedrock, in addition to the parameters listed above, a Gross Alpha Screen and Radon test shall be performed. If the Gross Alpha Screen detects radiation of 15 pci/l or more, then the water must be analyzed for Radium and Uranium concentrations. In addition, water from the test wells must meet all current Massachusetts Primary and Secondary Drinking Water Standards and Guidelines adopted by the MassDEP Office of Research and Standards (ORS).

Adopted August 22, 2017



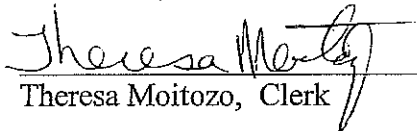
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