

In Section 5.14 of the District’s Rules and Regulations, the Chelmsford Water District (CWD) has the following Groundwater Protection statement:

*If the Chelmsford Board of Health under the provisions of Chapter 201, Board of Health Article VII, “Groundwater Protection Zone” requests a review by the North, Chelmsford, and East Water District(s) of a site located in the “Groundwater Protection Zone,” then the Water District will do the following:*

1. *Review the site application, plans, and material included therewith,*
2. *Decide what, if anything, the Chelmsford Water District will require for hydrogeologic investigations before it can make its review. Upon receipt of the required study, it will send its review to the Chelmsford Board of Health.*

*The North, Chelmsford, and East Water Commission Boards reserve the right to request more information, if needed, and to waive any and all of the above requirements, so long as the water quality at the well site in its opinion will not be impaired.*

Should the District decide that further hydrogeologic investigations are required, the following is the Standard Operating Procedure the District will follow:

1. The Contractor/Developer/Owner shall conduct a Hydrogeologic Investigation in the Groundwater Protection Zone extending from the proposed site to the applicable Water District water-supply well(s).
2. The final scope of work shall be developed in consultation with the Water District and approved by the Water District in advance.
3. The Hydrogeologic Investigation shall include, at a minimum, the following features:
  - a. Installation of observation wells extending from the ground to the bedrock surface.
    - i. Soils encountered in the borings shall be logged by a qualified geologist or hydrogeologist.
    - ii. Geologic information, including depth to the water table, shall be recorded on a log acceptable to the Water District.
    - iii. Perform grain-size analysis on selected soil samples obtained during drilling.
    - iv. Observation wells shall be made of 2-inch diameter PVC pipe and well screen installed in a minimum 4.5-inch diameter borehole.
    - v. A steel guard pipe or road box shall be installed to protect the PVC observation well.
    - vi. Observation wells shall be pumped free-of-sand upon installation to ensure their proper functioning.
    - vii. The location of each observation well shall be determined to the nearest 1-foot and the elevation of the top of the PVC well pipe shall be determined to the nearest 0.01-foot and marked on the observation well. Ground surface elevation shall be determined to the nearest 0.1-foot.
    - viii. All survey work shall be performed by a Licensed Land Surveyor.
    - ix. The exact number and location of observation wells shall be determined in advance in consultation with the Water District.
4. Water levels shall be measured on three (3) separate occasions:
  - a. Upon installation.
  - b. Under non-pumping (static) conditions (i.e., when the Water District wells are not operating).
  - c. Under pumping conditions.
    - i. **Note:** *Water-level measurements shall be made at all observation wells installed by the proponent as well as pre-existing observation wells identified by the Water District.*
5. Groundwater flow patterns shall be mapped as follows:
  - a. By first converting water-level depth to water-level elevation.
  - b. Under pumping and non-pumping conditions.
  - c. Groundwater flow mapping shall be prepared at a scale that is acceptable to the Water District.
6. Groundwater Quality Testing shall be performed as follows:
  - a. Observation wells shall be pumped for an hour each at a rate of flow that exceeds 10 GPM before sampling
  - b. The exact number of observation wells to be sampled for water-quality testing shall be determined in consultation with the Water District.
  - c. Observation wells shall be sampled on one (1) occasion unless conditions call for additional sampling events.

- d. Water quality shall be tested for the following drinking water analytes:
    - i. pH
    - ii. Specific conductance
    - iii. TDS
    - iv. Turbidity
    - v. Color
    - vi. Total alkalinity
    - vii. Chloride
    - viii. Nitrate
    - ix. Nitrite
    - x. Sulfate
    - xi. Total calcium
    - xii. Total magnesium
    - xiii. Total potassium
    - xiv. Total sodium
    - xv. Total silica
    - xvi. Iron (total and dissolved)
    - xvii. Manganese (total and dissolved)
    - xviii. Total hardness
    - xix. VOCs by EPA 524.2
    - xx. PFAS6
  - e. Water-quality analyses shall be performed by an analytical laboratory certified in Massachusetts for those analytes tested. Samples to be tested for dissolved iron and manganese shall be filtered in the laboratory.
7. A Conceptual Site Model (CSM) shall be developed as follows:
- a. At least three (3) geologic cross-sections shall be constructed using newly acquired and pre-existing geologic data obtained from borings or other sources.
  - b. The lines of geologic section shall be displayed on a map that also shows the boundary between exposed glacial till/bedrock and the sand-and-gravel aquifer and other relevant features.
  - c. The Conceptual Site Model shall be presented as a brief narrative, in tabulated form or a combination of the two. Hydrogeologic information of interest includes:
    - i. Approximate range of aquifer hydraulic conductivity (based on grain-size analysis, pumping tests performed by the Water District and published values)
    - ii. Approximate aquifer storage coefficient
    - iii. Aquifer thickness
    - iv. Approximate hydraulic gradient
    - v. Generalized stratigraphy and boundary conditions (including streams and wetlands)
    - vi. Approximate annual rainfall recharge (inches or feet)
    - vii. Description of recharge areas
  - d. The CSM shall include hydrogeologic information available for the Water District well(s).
8. The North, Chelmsford, and East Water District(s) may require development of an analytical or numerical Groundwater Flow Model or modification of the Water District's existing Model: Using the CSM (combination of District's CSM and new proponent's CSM) as a starting point.
- a. Using modeling software acceptable to the District.
  - b. The model shall be calibrated to observed groundwater flow patterns under non-pumping (static) conditions.
  - c. The model shall be verified using observed groundwater flow patterns under pumping conditions.
  - d. Model simulations shall be performed to predict impacts of the proposed development on the District's wells.
  - e. Perform particle-tracking analysis and, if necessary, contaminant transport modeling.
9. A Hydrogeologic Investigation Report shall be prepared that includes the following:
- a. A brief description of the regional bedrock and surficial geology with appropriate mapping.

- b. A description of groundwater flow under pumping and non-pumping conditions with appropriate maps (see above).
- c. A summary of groundwater quality testing.
- d. A description of the CSM (see above).
- e. A description of sensitive environments, habitat, streams, and wetlands along with appropriate mapping.
- f. A description of the groundwater modeling approach, model design, model calibration, sensitivity analysis, model verification and model limitations.
- g. A brief description of the activities at the proposed site, including activities, products and uses that could affect groundwater quality.
- h. A description of proposed mitigation activities intended to prevent damage to groundwater quality.