GEI Consultants

Consulting Engineers and Scientists

September 15, 2016
Project 1404273

Ms. Johanna Schneider, Chair
Zoning Board of Appeals
Town of Brookline
333 Washington Street
Brookline, MA 02445

Dear Ms. Schneider:

Re: Groundwater Flow
1180 Boylston Development
1180 Boylston Street
Brookline, Massachusetts

GEI Consultants, Inc. has prepared this letter is to summarize the degree of potential impacts of the proposed 1180 Boylston Street Development on groundwater flow. Specifically, a question was asked at the public meeting on August 17, 2016 whether construction of an underground parking garage would affect groundwater flow such that it would contribute to flooding occasionally observed in Boylston Street.

Summary

We reviewed groundwater elevation measurements relative to ground and bedrock surface elevations and to the dimensions of the proposed parking garage and prepared a three-dimensional groundwater computer flow model, representing estimated hydrogeologic conditions at the Development site. Based on the analysis, we concluded that it is extremely unlikely that the proposed garage would affect groundwater flow to a degree that would exacerbate flooding in the vicinity.

Background

The Development is located at the corner of Boylston Street and Hammond Street in Brookline (Fig. 1). The planned development consists of a 6-story, approximately 48,000 sf, mixed-use retail and residential development. It will have one level of below ground parking, retail shops at street level, and 5-stories of over-55 housing units above the street.

The Development is located in a sand and gravel aquifer over shallow bedrock (2 to 13 feet deep). Based on our review of the Massachusetts Department of Environmental Protection (MassDEP) Geographic Information System (GIS) maps, the Development is not located within any public water supply protection areas and there are no public water supply wells within 1-mile of the Property. There are no wetlands, Natural Heritage and Endangered Species Program Priority or Estimated Habitats of Rare Wildlife, Vernal Pools, Certified Vernal Pools, or Areas of Critical Environmental Concern (ACEC) within 500 feet of the Property. Based on extensive site investigations, groundwater at the Development is known to flow west-northwest toward Boylston Street.

GEI Consultants, Inc.
400 Unicorn Park Drive, Woburn, MA 01801
781.721.4000 fax: 781.721.4073

Groundwater Flow Analysis

GEI prepared a simplified three-dimensional groundwater computer flow model, representing estimated hydrogeologic conditions at the Development site. The simplified model represents the site and surrounding area to a depth of 100 feet.

Model predictions indicate:

- The groundwater table on the upgradient (east) side of the development is predicted to rise by up to 0.4 feet above existing levels. Predicted mounding results from natural horizontal groundwater flow backing up of against the building foundation. Groundwater at the site has been measured at depths ranging from approximately 6 to 18 feet below ground surface. The predicted mounding is not significant compared to the available thickness of unsaturated soil between the water table and ground surface and therefore we do not expect an increase in flooding potential. Contours showing predicted changes in groundwater elevations are shown on Figure 1.
- Groundwater in fractured bedrock is predicted to flow both around and beneath the underground parking structure.

For the model it was assumed:

- Groundwater flows naturally from east to west (toward Hammond Brook) at a gradient of 0.0155 ft/ft. This assumes the groundwater gradient generally mimics the surrounding topography, matching the slope of Boylston Street between Dunster and Holly Streets (19 ft. elevation difference over 1,225 feet length = 0.015 ft/ft). Greater mounding would be predicted with a higher natural gradient; however, there is no indication that a higher gradient is present, such as higher infiltration to the east, or pumping withdrawals to the west.
- No net change in infiltration outside the proposed building footprint is assumed. The 1180 Boylston Street parcel is presently largely paved and the proposed footprint will similarly cover most of the parcel. Therefore, vertical surface infiltration was not included in the computation, because runoff contributions to the water table are assumed to be the same before and after development. Actual infiltration would likely decrease on-site after development, potentially resulting in a lowering of the water table and offsetting any mounding that does occur.
- Hydraulic conductivity of the bedrock was assumed to be 0.01 ft/day. Hydraulic conductivity is a measure of the ease at which water flows through the material. The value used for bedrock (0.1 ft/day) is very low, similar to values used for silt and clay with fine sand. At lower hydraulic conductivities, the tendency for greater mounding (due to greater flow resistance) would be offset by a lower natural flow rate in bedrock.
- Bedrock surface was held at constant elevation throughout the model (elev. 174). Natural dips and undulations in bedrock surface would not affect model predictions significantly, because the proposed underground structure will penetrate a bedrock thickness on a larger scale.
- Soil above the bedrock was assigned a hydraulic conductivity of 5 ft/day, a typical value for fine to medium sand with silt.

The model described above was built and run using Visual MODFLOW.

This is considered a generic model, although assigned elevations and the base map provide a frame of reference. A more comprehensive site-specific model would be calibrated to measured site-specific groundwater elevations, and result in refinements in the above input parameters. Predicted mounding values might change, but we do not expect that the predicted groundwater table would be significantly closer to ground surface so as to increase flooding potential.

Limitations

The findings provided by GEI in this report are based solely on the information reported in this document. Future investigations or information that was not available to GEI at the time of this report may result in modification of these findings. This report has been prepared in accordance with generally accepted engineering and geohydrological practices. No warranty, expressed or implied, is made.

If you have any questions or concerns regarding the environmental conditions at this proposed development site, please do not hesitate to call.

If you have any questions, please contact me at cjohnson@geiconsultants.com or (781) 721-4093.

Sincerely,

GEI CONSULTANTS, INC.

Andrew M. Adinolfi, P.E.
Senior Environmental Engineer

Catherine G. Johnson, P.G., LSP
Project Manager

CGJ/ISG:jam
Enclosure
c: Rachna Dhanda, Mason & Murphy, Inc.
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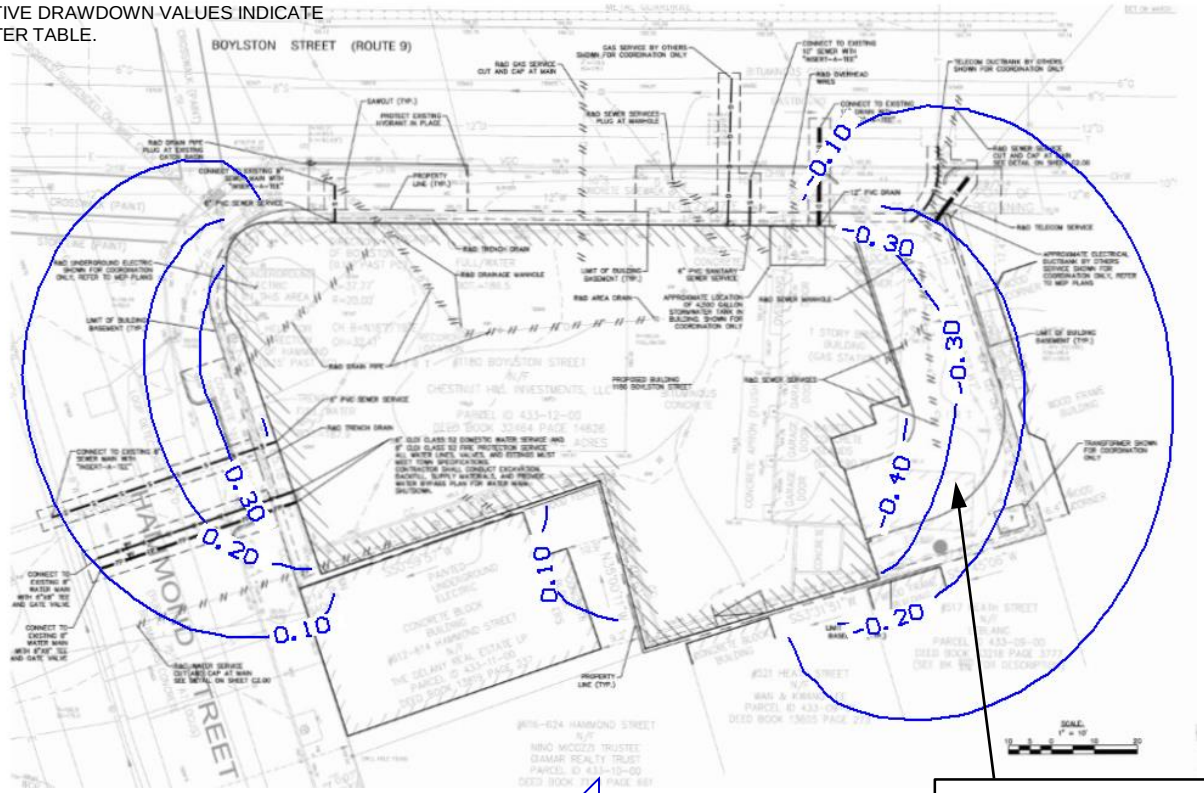
DRAFT - PRELIMINARY

LEGEND

COMPUTED GROUNDWATER DRAWDOWN CONTOUR IN FEET (PRESENT CONDITIONS MINUS PREDICTED POST-CONSTRUCTION). NEGATIVE DRAWDOWN VALUES INDICATE MOUNDING (RISE) IN WATER TABLE.



NEGATIVE COMPUTED VALUES INDICATE PREDICTED MOUNDING TO 0.40 FT. ABOVE EXISTING CONDITIONS WATER TABLE.

SIMPLIFIED GROUNDWATER FLOW DIRECTION
NATURAL GRADIENT = 0.0155 FT./FT.)

NOTE: RESULT SHOWN IS BASED ON A SIMPLIFIED 3-D GROUNDWATER MODEL TO SHOW IMPACT OF IMPERVIOUS STRUCTURE ON GROUDWATER ELEVATIONS. SIMPLIFICATIONS INCLUDE FLAT BEDROCK AND GROUND SURFACE, AND GROUNDWATER FLOW IN BEDROCK PARALLEL TO BOYLSTON STREET AT ASSUMED NATURAL GRADIENT OF 0.0155 FT./FT.

BASE PLAN SOURCE: NITSCH ENGINEERING, SITE UTILITY PLAN, 1180 BOYLSTON STREET, PLAN UPDATE 5/26/16

1180 BOYLSTON DEVELOPMENT 1180 BOYLSTON STREET BROOKLINE, MASSACHUSETTS	GEI Consultants	**SIMPLIFIED FLOW MODEL - PREDICTED WATER TABLE RISE**
MASON & MURPHY BROOKLINE, MASSACHUSETTS	Project 1404273	September 2016 Figure 1

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