McDonald Morrissey ASSOCIATES, LLC
GROUND WATER HYDROLOGISTS
280 Pleasant Street, Concord, NH 03301
Phone: (603) 228-2280 Fax: (603) 228-2112
www.mcdonaldmorrissey.com

August 24, 2021

Ms. Jane Fisher Carlson, Chair
Weston Town Hall
PO Box 378
Weston, MA 02493

RE: Proposed 40B Development Located at 518 South Avenue
Preliminary Comments – Revised Groundwater Mounding Analysis

Dear Board Members,

In response to a request by Hill Law acting on behalf of abutters to the proposed project, McDonald Morrissey Associates, LLC (MMA) is providing this letter to convey two preliminary comments on the revised groundwater mounding analysis presented by Sanborn, Head and Associates, Inc. (SHA) within the document titled *Groundwater Model Report, Hanover Weston, Weston, Massachusetts*, dated August 3, 2021 (referred to herein as the Revised Modeling Report). These comments are as follows:

Preliminary Comment 1: The transient MODFLOW simulations representing potential groundwater mounding scenarios rely on erroneous input values.

MODFLOW models require many inputs, some of which represent hydraulic properties of the aquifer system being modeled (i.e., often referred to as parameters). These parameter values are often informed by field data or are estimated using published ranges for similar material types. For certain parameters, value assignments may be refined and/or supported through model calibration and/or so-called "verification".

While the Revised Modeling Report describes calibration and "verification" of a steady-state version of a revised MODFLOW model, the actual mounding estimates are produced using a series of transient, time-varying simulations. These transient simulations require certain additional inputs that were not constrained by the calibration and/or verification processes – namely values representative of the "storativity" of the simulated aquifer materials.

Storativity can be thought of as the volume of groundwater released or retained as a function of hydraulic changes (e.g., mounding) within the aquifer. It is common groundwater modeling practice to represent storativity within unconfined portions of a given aquifer system using a parameter called "specific yield", which is the drainable porosity of an aquifer. In confined portions of an aquifer, by contrast, storativity is

represented by the product of parameter called "specific storage" and the thickness of the confined unit. Unconfined aquifer conditions where drainable porosity is available (specific yield) differ from confined conditions in that, in the latter case, storage capacity is limited to compressibility of the aquifer and water itself (specific storage).

The Revised Modeling Report provides no description of either specific yield or specific storage, but review of the electronic files provided by SHA indicates selected values are well outside generally accepted ranges. For specific yield, all transient simulations relied on an erroneously low value of 0.001 or 0.1%, where the generally recognized range is exponentially greater at 10% to 35% by volume.[1] For specific storage all transient simulations relied on an erroneously high value of 0.25, where the generally accepted values on a per unit thickness basis are exponentially lower at less than 0.0001.[1]

These input errors in specific yield and specific storage are orders of magnitude outside commonly accepted parameter ranges and cause the transient mounding simulations to unrealistically overstate bulk aquifer storativity. As a result, rather than responding like a natural porous medium should to simulated infiltration of wastewater and stormwater, the modeled system acts like an enormous sponge that underestimates hydraulic mounding responses. The specific yield and specific storage inputs should be revisited, and in recognition of applicable uncertainty, conservative values should be selected based on representative ranges associated with the material types encountered during site investigation activities.

Preliminary Comment 2: The analysis relies on an inadequately low estimated seasonal high groundwater condition that is inconsistent with previously collected data and does not meet Title 5 requirements.

Within Title 5 Subpart B: *Siting of Systems*, 310 CMR 15.103(3) specifies the methods by which the "High Groundwater Elevation" shall be determined as follows:

[1] Fetter, C.W. (2001) Applied Hydrogeology. 4th Edition, Prentice Hall, Upper Saddle River.

310 CMR: DEPARTMENT OF ENVIRONMENTAL PROTECTION

15.103: continued

(3) High ground-water elevation shall be determined by:

(a) soil color using the Munsell system, the abundance, size and contrast of redoximorphic features, if present;

(b) one or more of the following methods may be used to supplement the method in 310 CMR 15.103(3)(a) and shall be used when no redoximorphic features are present:

1. observation of actual water table during times of annual high water table;
2. the use of USGS wells for correlating comparisons in water tables during times when the water table is not at the annual high range;
3. a Department-approved method for determining inland high ground-water elevation as contained in Frimpter, M.H. "Probable High Groundwater Levels in Massachusetts," Open File Report 80-1205, USGS or Frimpter, M.H. and G.C. Belfit, 1992, "Estimating highest ground-water levels for construction and land use planning, Cape Cod, Massachusetts," updated, Barnstable, MA Cape Cod Commission Technical Bulletin 92-001"; or
4. a Department-approved method for determining coastal high groundwater elevation which incorporates tidal fluctuation information into the use of historical high groundwater data as contained in Frimpter, M.H. and G.C. Belfit, 1992, "Estimating highest ground-water levels for construction and land use planning, Cape Cod, Massachusetts," updated, Barnstable, MA, Cape Cod Commission Technical Bulletin 92-001 or, if the location of the system is affected by tidal cycle typically within 300 feet of mean high water of the ocean, monitoring the high groundwater elevation over a tidal cycle during a full moon high tide.

(4) The Soil Evaluator shall indicate on the soil log whether four feet of naturally occurring pervious materials exist in all areas observed throughout the area proposed for the soil absorption system.

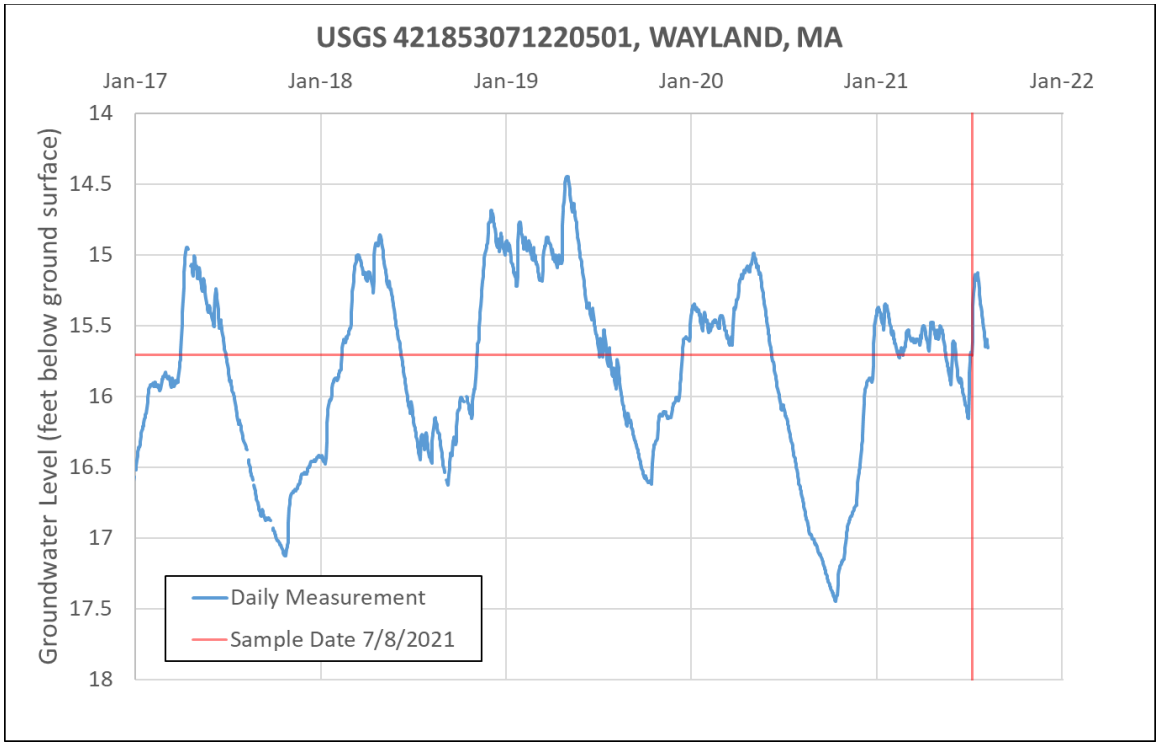
Section 3.3 of the Revised Modeling Report describes SHA's methodology for selecting what they refer to as the "seasonal high groundwater elevation" as follows: "*It is our opinion that the groundwater levels measured on July 8, 2021 are reasonably representative of the estimated seasonal high groundwater elevation (see Table 1 and Figure 5). These water levels were measured after an extended period of rainfall and water levels in three of the four wells located in the primary disposal area are at their maximum level observed over a two-year monitoring period.*" (8/3/21 SHA Revised Modeling Report, p. 4)

However, the following observations suggest the July 8, 2021 condition is not appropriately representative of the high groundwater elevation detailed under applicable regulations, 310 CMR 15.103(3).

First, Appendix C of the Revised Modeling Report presents soil testing results generated by Metrowest Engineering, Inc. (Metrowest) that are inconsistent with the seasonal high groundwater elevations used in the Revised Modeling Report. According to Metrowest, Redoximorphic features (i.e., "mottling") were identified in discrete vertical intervals within seven of the nine test pits, including the two located in the

general vicinity of the proposed primary wastewater infiltration area. Metrowest reports the interpreted elevations at which these features occur as being representative of the "Design Water Table", which is generally consistent with the methodology described by 310 CMR 15.103(3)(a). But near the proposed primary wastewater infiltration area where the Metrowest observations suggests high water table conditions reside around approximately 214 feet, NAVD88[2], comparable groundwater elevations reported by SHA for July 8, 2021 occur approximately two (2) feet lower (i.e., SH-208W measured at 211.93 feet, NAVD88 and SH-103 measured at 211.9 feet, NAVD88).

Second, data obtained from the nearest USGS well do not support the selection of July 8, 2021 as being representative of a high groundwater condition. Under the technique described by 310 CMR 15.103(3)(b)(2), water level measurements collected by the USGS can be used to assess local site conditions on a given date. The monitoring well located in Wayland – approximately 3.5 miles west of the site – provides data to support such an assessment. But as evidenced by the following plot comparing measurements at the Wayland well to the July 8, 2021 measurement, groundwater levels are unlikely to have peaked at an appropriately representative level, as suggested within the Revised Modeling Report.



[2] Note that a vertical datum is not reported by Metrowest. Comparisons between reported ground surface elevations and available LiDAR elevation data referenced to the NAVD88 vertical datum showed general consistency; therefore, the elevations reported by Metrowest have been assumed to be relative to this datum.

Applying appropriate methodology to estimate the high groundwater elevation condition is critical to the proposed design because this level serves as the starting point upon which estimated mounding effects and the required buffer are added to determine the appropriate base elevation for the proposed wastewater infiltration infrastructure. Thus, if the starting point is not accurate, the base elevations may be set too low, and the systems would be more prone to failure. For this reason, the high groundwater condition should be revisited using more appropriate methodology that is consistent with observed data from Metrowest and the options presented in 310 CMR 15.103(3)(b). Under the regulations, the so-called "Frimpter" method described under 310 CMR 15.103(3)(b)(3) should be considered for scaling water levels measured at the site in consideration of variability captured by long-term monitoring performed by the USGS.

I appreciate the Board's continued attention to groundwater-related issues associated with the proposed development. It is my hope the Board will consider these preliminary comments and request specific attention be paid to these matters by the Applicant in anticipated additional revisions to their groundwater mounding analysis. Please note that I view the comments presented above as preliminary based on information provided by the Applicant to-date. Further comments may be warranted based on review(s) of additional submitted materials.

Sincerely,

Michael Mobile, Ph.D.
Managing Partner, McDonald Morrissey Associates, LLC

MAM
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