Board of Health

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MEMORANDUM

TO: **Sherborn Zoning Board of Appeals, ZBA**
FROM: **Sherborn Board of Health, BoH**
DATE: **February 15, 2024**
RE: **Farm Road Homes 40B – Preliminary BoH Questions and Comments Regarding Septic Effluent Impact Analyses (per CLAWE 2-2-2024 update)**

Introduction

After review of the materials submitted by the applicant for the Farm Road Homes project, including the latest updates/revisions of February 2, 2024, the Board of Health has identified a number of questions and concerns regarding aspects of the ***septic effluent impact analyses***, which may include:

- evaluation of groundwater mounding beneath the soil absorption system,
- fate and transport of septic effluent constituents,
- water balance of the site,
- etc.

For simplicity and in the spirit of addressing fundamental issues first since they may resolve other issues identified by the BoH, this preliminary memorandum will focus on basic issues of:

- data sufficiency and appropriateness; and
- methodologies applied and/or needed.

Following the Peer Reviewer's and/or applicant's responses to these concerns, the BoH will share other issues it has identified, if they remain pertinent.

Note that the BoH's identification of questions and comments about septic effluent impact evaluations has significant overlap with the February 6, 2024 "Review of Predicted K Values" provided by Andrea Stiller of the Groundwater Protection Committee. Those issues are not reiterated in full here so as to not duplicate information. However, ***if Ms. Stiller's comments are not being formally reviewed by the Peer Reviewer***, please indicate that to us and the BoH will include additional commentary in its next memorandum.

These are critical analyses about how an atypically dense and large project may impact groundwater quality, in particular. The BoH has a responsibility to ensure that the analyses are robust so that, if health risks are identified, those risks are appropriately abated per MassHousing's instruction in its Project Eligibility/Site Approval letter of November 2, 2022:

> *"The Applicant should be prepared to discuss the impact of the Project on water resources and private wells in the area and respond to reasonable request for mitigation."*

Data Sufficiency / Accuracy / Appropriateness

Analytical projections of impacts are sensitive to not only the methods selected but also to the input data used. Proper selection of data is a concern.

A. ***Soil type identification*** has been oversimplified and is not consistent with Health Agent observations in the field. Photographs and field notes taken by the Health Agent support alternative interpretations.

B. Various data provided by CLAWE (12-11-2023) provide useful background information (e.g., Figures 2-5). However, their broad and approximate quality lacks the precision and detail needed for the effluent impact analyses and thus are not substitutes for ***site-specific data*** collection.

C. Given the variability in soil/bedrock conditions on the subject property alone ("the site in general has mixed ledge outcrops in the upper hill area and very permeable soil in the lower western part of the land" CLAWE, 2-2-2024), reliance on ***well drilling logs from neighboring properties*** is speculative.

D. Two ***soil samples*** were collected from shallow depths for lab analysis pursuant to establishing hydraulic conductivity. At this site, effluent from the soil absorption system will be migrating through to deeper soils that are different and less permeable (e.g., glacial till, as observed in test pits). Lab analysis of soil samples is not sufficient unless the subsurface is fairly homogeneous, such as the sandy, stratified drift deposits at The Fields at Sherborn.

E. What on-site soil evaluation confirmed that soils in the proposed SAS area have a ***soil depth*** up to 50 feet? This leads to a claim that an estimate of 25 feet to the aquifer base is conservative. (CLAWE, 12-11-2023)

F. ***High groundwater*** is claimed to be based on "the dry test pit bottom" or "the observed water tables in the two wet wells". High groundwater means the historic high and thus shall be based either on redoximorphic evidence (i.e., mottles, which are the primary determinant if present) or observed groundwater adjusted using the Frimpter method and long-term data from comparison USGS wells. References to individual or short-term observations are inappropriate for establishing expectations of high groundwater conditions.

Methodologies

Associated with several of the items below are comparisons with The Fields at Sherborn's effluent impact analyses. This is because it was a key prior project in Sherborn for which these sorts of analyses were performed. Overall, those analyses were more detailed and were vetted extensively across a range of participating technical representatives: consultants acting on behalf of the project applicant (CLAWE and Hydrogeocycle); staff from the peer reviewing firm Beta

Groups; Sherborn's hydrogeology advisors (Nobis); and Sherborn authorities. Furthermore, Farm Road Homes shares some characteristics of that earlier project.

G. Groundwater mounding analyses are sensitive to not only soil types but also their distribution in the soil column. ***Bore hole permeability testing*** is considered a more accurate technique for measuring hydraulic conductivity for a heterogeneous soil profile, such as is found in the area of the soil absorption system. Appendix C (CLAWE 12-11-2023) mentions this method but it does not seem to have been applied.

H. How was ***groundwater slope (flow direction)*** determined? Did the evaluations distinguish between wet and dry seasons?

I. For comparison, groundwater contour studies for The Fields at Sherborn involved at least a dozen ***monitoring points***. What accounts for the different level of technical input for this similarly scaled project?

J. Groundwater ***mounding*** results obtained using the Hantush method are "considered by experts to be a simplified version of the actual site conditions. The Hantush method can be limited by its assumptions … A common numerical method is to model site conditions using computer simulations. MODFLOW is the most widely used among the many programs that exist. While numerical modeling can provide a more accurate representation of site conditions, it also requires the user to have considerable training in order to develop the model and run simulations and interpret the results." (Minnesota Stormwater Manual)

K. The Hazen method for estimating ***hydraulic conductivity*** is not typically used. Additionally, is Wang's method for estimating permeability from percolation rates suitable to determining mounding? Percolation rate testing focuses on the immediate movement of effluent from the bottom of the soil absorption system into adjacent soils, whereas mounding is about the potential raising of the groundwater table beneath the soil absorption system, which is a deeper condition and one to be viewed over the long-term.

L. ***Mounding*** beneath The Fields at Sherborn soil absorption system was predicted to have a maximum height of 0.81 feet (CLAWE), with relatively homogeneous sandy soils over the depth. Maximum mounding heights beneath Farm Road Homes soil adsorption system are predicted to be 0.91 feet for L1 and L2, and 0.81 feet for L3 (CLAWE). Might these values change significantly with bore hole testing and/or adjustments for the heterogeneous soil profile?

M. How has the ***water budget*** for the site been determined?

N. Once good hydraulic conductivity values are established, ***dispersion analysis*** can be performed to evaluate subsurface movement of septic effluent contaminants. For The Fields at Sherborn, Nobis used Domenico dispersion equations and also sought/tested 3-dimensional versions of Domenico. Nobis identified several, including those:

- as used for EPA's Raymark Superfund Site (Remedial Investigation Report [TtNUS #N4106], Tetra Tech NUS, Inc., 2005);
- in guidance from the State of California; and
- developed by Guyonnet and Neville (2004).

How does the method used for Farm Road Homes compare with those applied by CLAWE, Hydrogeocycle, Beta Groups, and Nobis for The Fields at Sherborn project? Given similarities in septic system size, soils, and climate, what accounts for the significant differences in ***projected nitrogen levels*** at identified receptors? Note the following site-specific distances from the downgradient edge of the soil absorption systems to the primary/nearest identified receptor of effluent plumes:

- for The Fields at Sherborn, approximately 600 feet to the northern edge of Dirty Meadow Swamp, reached by predicted nitrogen concentrations of 23 to 26 mg/l; and
- for Farm Road Homes, approximately 150 feet to the property line to the west[1], reached by predicted nitrogen concentrations of 4 to 7 mg/l.

Other

Does the Peer Reviewer have access to the functioning versions of the nitrogen loading analysis, water budget, and downgradient receptor spreadsheets (e.g., not just printouts of Appendix G's tables) to be able to review the accuracy of underlying calculations, assumptions, raw data input, etc.?

[1] The location of the downgradient receptor is not clear; for now it is assumed to be the property line to the west of the soil absorption system.