Board of Health

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MEMORANDUM

TO: **Sherborn Zoning Board of Appeals, ZBA**

FROM: **Daryl Beardsley and Mark Oram, Sherborn Board of Health (BoH)**

DATE: **May 7, 2024**

RE: **Farm Road Homes 40B – Current Status of BoH Comments and Recommendations on Septic System Issues**

The following constitutes an update regarding the status of several key septic issues pertaining to the Farm Road Homes 40B project. Please note that final Peer Reviewer comments regarding the mounding and nitrogen loading analyses have not yet been received. The BoH recently confirmed with the Peer Reviewer that the mounding issues must be resolved before the review of the nitrogen loading calculations can take place since the latter depends in part on the results of the former.

1. ***Provisional Use Approval has not yet been issued by MassDEP for the SeptiTech STAAR 13.5 engineered system.***

   The septic plans indicate that this innovative, alternative (I/A) system is proposed in order to meet Title 5 requirements for nitrogen sensitive areas (i.e., areas such as Sherborn where local groundwater resources are used for potable water supplies). Specifically, a nitrogen-reduction system is necessary to achieve the bedroom density for the project as proposed.

   The system as currently designed cannot be permitted until the STAAR 13.5 system is approved. If and when MassDEP's approval is issued, it will be important to review the conditions associated with such an approval because they may have significant technical, financial, and/or operational implications for the future owners of the septic system, as is the case with other I/A systems' Provisional Use Approvals. It is then a decision of the local approving authority as to whether to accept its use for the individual application.

   A principal purpose of Provisional Use Approvals is the acquisition of data about how these systems --with limited application in Massachusetts-- perform. Provisional Use Approvals for other versions of the SeptiTech STAAR technology include a condition for routine monitoring of effluent quality. Not only does this help MassDEP decide whether the systems can eventually be classified for general use but it also may alert the owners and the municipality about potential underperformance of an I/A system, which could result in unintended public health consequences if not addressed.

2. Nitrogen loading analyses must use the proper value for post-treatment septic effluent total nitrogen (TN) concentration.

For the purposes of nitrogen loading analyses, it is unlikely that the septic application's existing assumption about TN in the post-treatment effluent being 19 mg/l will be the value designated by MassDEP for use in calculations. Only some STAAR systems with design flows less than 2,000 gallons per day have been allowed to use 19 mg/l as the TN concentration in effluent for compliance calculations. The proposed system is an expansion upon the STAAR 9.0 engineered system, which is allowed a TN concentration assumption of 25 mg/l by the Provisional Use Approval tailored to STAAR 9.0, not as part of an approval for all similarly engineered systems. If and when the TN level is established in a Provisional Use Approval for STAAR 13.5, the nitrogen loading calculations will need to be adjusted accordingly.

3. Adequate monitoring of the I/A technology's performance is recommended.

If the STAAR 13.5 system receives MassDEP approval, conditions associated with the approval should be scrutinized. Although we cannot know what the conditions may be, an example condition typical for Provisional Use I/A systems is that a monitoring program (i.e., effluent sample collection and analysis) be implemented. For other, smaller STAAR systems, 3 years of monthly monitoring is required, switching to quarterly monitoring thereafter.

The purpose of the monitoring is to evaluate the performance of the new technology. For a project of this size, full build-out and occupancy might not take place until well into the 3 year period. Thus, performance evaluation of the system under full load would not gather 3 full years of data before being allowed by MassDEP to reduce testing (MassDEP's timing begins when installation of the system is completed).

An option for the local approving authority is to extend the monthly monitoring requirement to 3 years past the date when full occupancy has been reached.

4. 2 sieve analyses of soils do not substitute for 7+ deep hole observations.

The BoH did not request that the sieve analyses be performed for confirmation of soil types at the site because the Health Agent noted:

- significant alignment between the engineer's Form 11 (a state form used to report soil types identified in deep observation holes) and his field notes made during observation of the same holes at the same time in the SAS area, and
- he thought the few discrepancies could be resolved because this is the first recalled instance (in 30+ years) whereby an engineer was proposing to use different soil assessments than those recorded in the Health Agent's field log during joint observations.

Although laboratory testing can be a reliable analytical method, 2 samples are ***not*** a reasonable substitute for the more numerous and spatially distributed deep hole test pit observations listed in the Table under Item #5.

According to the Health Agent, at the December 20, 2024 meeting in Town Hall with CLAWE and TetraTech, the Peer Reviewer recommended further study by CLAWE to address hydraulic conductivity and hence mounding analysis concerns raised by various attendees at ZBA hearings; it is believed that the two soil samples were collected for sieve analyses pursuant to that suggestion. In his e-mailed summary of the meeting, Mr. Wang notes: "We will take two soil samples in the area to do sieve analysis to confirm the soil texture and verify the hydraulic conductivity value."

Although the Health Agent was on site as soils for sieve analysis were collected, he was not focused on how many samples were collected, whether they were composited, and which were ultimately sent to the laboratory for sieve analysis because the action was not a BoH request. He did observe the engineer collecting two types of soil onto one shovel that the engineer indicated would be taken to a laboratory.

5. Accurate identification of soil types in the soil absorption system (SAS) area is important to adequate system design.

CLAWE's Soil Evaluation Report for the project site (last updated January 20 2022) included copies of State Form 11, "Soil Suitability Assessment for On-Site Sewage Disposal". The data reported on those forms for deep observation holes in the SAS area, as witnessed by the BoH Health Agent during subsurface investigation field work of April 20-21, 2021, most closely reflects the Health Agent's field notes for the A and B layers and for all but 2 of the 7 observed C layers.

When a range of relevant soil types is identified in an SAS area, MassDEP recommends that the more conservative (i.e., precautionary) soil type be applied to the SAS design calculations. A similar situation was encountered at another recent project site (Greenwood Street Homes) and the recommended conservative approach was applied to those SAS designs. At the April 24, 2024 Zoning Board of Appeals hearing, Mr. Wang indicated that:

- He agreed to the selection of the conservative soil types for Greenwood Homes SASs because they were "just typical conventional systems" and "to make it a little bigger is better".
- Reasons why he is not choosing the conservative soil types for Farm Road Homes include that the system would be pressure dosed and the "nitrogen level is treated much much better than Greenwood". [1]

In order for this project to be able to discharge ~550 gallons of septic effluent per acre (beyond the standard limit of 440 gallons/acre), a nitrogen-reducing treatment technology is required by Title 5. The proposed STAAR 13.5 technology is meant to alleviate some impacts from the 25% increase in effluent discharges into a nitrogen sensitive area, thus compensating for development density. Also applying that compensation to additional design concessions is questionable, especially when it is not only nitrogen in effluent that poses a public health threat.

[1] Conventional septic systems result in effluent with TN concentrations of ~35 ppm (per MassDEP). A target for STAAR systems with flows > 2,000 GPD is 25 ppm, a further reduction of ~28% (hence the permitted 25% increase in effluent volume). Title 5 requires pressure dosing to properly implement many I/A nitrogen reduction systems.

The following table summarizes information gathered from the deep hole test pits at the project site, both in the SAS area and elsewhere on the property.[2] Soil types and percolation rates are considered in concert for project evaluations.[3]

Farm Road Homes 40B -- 55 and 65 Farm Road (Lots 2, 3, 4, 5, 6)

Comparison of Soil Types Identified

Deep Hole Test Pits at the Site	CLAWE's Soil Evaluation Report (first report for site; last updated 1-20-2022) *Data for each Deep Observation Hole as reported on State Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal*				Health Agent Field Notes (April 20-21, 2021)	Comments
Identification	A layer	B layer	C layer	Depth* (inches) to ledge/refusal	same as CLAWE's Form 11 unless otherwise noted	
DHTP 55-10	S.L.	S.L.	L.S.	135	C layer, L.S.-S.L.	SAS 1/2 area; septic plan refusal depth difffers from Form 11
DHTP 55-10An	S.L.	S.L.	L.S.-S.L.	174		SAS 1/2 area
DHTP 55-11	S.L.	S.L.	L.S.-S.L.	> 192		SAS 1/2 area; septic plan C layer differs from Form 11; perc = 4 mpi
DHTP 55-11An	S.L.	S.L.	L.S.	> 216	C layer, L.S.-S.L.	northern end of SAS #3
DHTP 55-11B	S.L.	S.L.	L.S.	> 120	*not observed for soil types*	noted as for ledge location
DHTP 5-1	S.L.	S.L.	Co.M.L.S.	> 168		southern half of SAS #3
DHTP 5-2	S.L.	S.L.	Co.L.S.	> 180		so. half of SAS #3; perc = 6 mpi
DHTP 5-3	S.L.	S.L.	M.S./Co.M.L.S.	> 180		so. half of SAS #3; perc = 3 mpi
DHTP 65-10					*not observed*	*not in proposed SAS area*
DHTP 65-10A	S.L.	S.L.	M.L.S.	150	C layer, L.S.-S.L. ; GW at 120"	*not in proposed SAS area*
DHTP 65-10B					C layer, L.S.-S.L.	*not in proposed SAS area*
DHTP 65-10C	S.L.	S.L.	L.S.	> 168	C layer, L.S.-S.L.	*not in proposed SAS area*
DHTP 65-10D	S.L.	S.L.	L.S.	> 168	C layer, L.S.-S.L.	*not in proposed SAS area*
DHTP 65-10E	S.L.	S.L.	L.S.	96	C layer, L.S.-S.L.	*not in proposed SAS area*
DHTP 4-1	S.L.	S.L.-L.S.	S.L.-L.S.	> 120	B layer, S.L.	*not in proposed SAS area*
DHTP 4-2	S.L.	S.L.-L.S.	S.L.-L.S.	144	B layer, S.L.	*not in proposed SAS area*
DHTP 55-4	S.L.	S.L.	S.L.	> 216	*not observed*	

NOTES

*	if ledge or refusal is not encountered, it is indicated as > the depth to the bottom of the pit		
Co.L.S.	Coarse Loamy Sand	M.L.S.	Medium Loamy Sand
Co.M.L.S.	Coarse Medium Loamy Sand	M.S.	Medium Sand
L.S.	Loamy Sand	S.L.	Sandy Loam

Note that 2 of the percolation rates were determined in the southern half of SAS area #3, which represents approximately 1/6th to 1/5th of the total SAS area. The C-layer soils were also different than the C-layer soils in other portions of the overall SAS area.

[2] The table provides details behind simplified comments shared by D. Beardsley at a ZBA hearing.

[3] For background, larger grain soils tend to have faster percolation (a.k.a. perc) rates than do finer grained soils. The lower the number of minutes per inch (mpi) it takes for water to move through soil, the faster is the percolation rate (e.g., 5 mpi for a sandy soil versus 40 mpi for a clayey soil).

Results of percolation tests depend on a variety of factors: soil type, compaction, shape of the test hole, pre-saturation effectiveness, etc. For example, in the table above, the percolation rate for coarse loamy sand is more typically 2+ times as fast as that of loamy sand to sandy loam, yet it was slower.

At the technical meeting of April 29, 2024 (attended by Bob Murchison, Desheng Wang, Peter Dillon, Mark Oram, and Jeremy Marsette), it was noted that Mr. Murchison stated the project would not be feasible if the conservative soil type was applied to the SAS design. To help understand that statement, Agent Oram calculated the increase in the SAS's size that would result from changing the soil type used by the calculations and estimated it would require that the SAS be approximately 20% larger in area than currently designed. This does not preclude an SAS of the same size as is now proposed from being built, but it would serve fewer bedrooms.

6. Nitrogen loading analysis is an essential evaluation to perform on behalf of public health for the future residents of the project and for surrounding residences.

This is an atypically large Title 5-based septic system, resulting in the discharge of a flow equal to that from almost 18 4-bedroom homes into a concentrated area. Dilution may not be the best "solution to pollution" but it is a dynamic that plays a role in mitigating septic effluent impacts, as acknowledged by Title 5's nitrogen loading analysis requirement covering a subset of Title 5 systems with design flows over 2,000 gallons per day. Sherborn's Environmental Health Impact Report requirement was prompted by the same drinking water quality concerns associated with larger volume, concentrated discharges in the vicinity of supply wells.

In an email of December 20, 2024, Mr. Wang notes: "As all wells on site and off site are located upgradient of or cross gradient of the SAS, we agreed that the nitrogen analysis would not be considered mandatory for this site setting. This analysis is to provide more assurance to all concerning parties."

The BoH does not agree that there is sufficient hydrologic information to ascertain whether existing and proposed bedrock wells in the vicinity of the SAS are upgradient of or cross-gradient from the SAS' effluent plume. Such terminology is better applied to overburden wells. Effluent discharged to the overburden aquifer may reach fractures at the overburden-bedrock interface and, from there, the relative levels of water and their direction of flow in the bedrock fractures is not known. Also, well pumping may cause flow directions in fractures to vary, particularly in the case of the larger draws expected for the Farm Road Homes' wells that will each serve multiple households.