● Soil & Wetland Studies
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January 25, 2021

VIA EMAIL

Town of North Haven
Inland Wetlands Commission
Memorial Town Hall, 18 Church Street
North Haven, CT 06473

RE: **PRELIMINARY APPLICATION REVIEW**
The Slate Upper School, 5100 Ridge Road
IWC Application No.: 120-06

REMA Job #: 20-2352-NHA12

Dear Chairman Bumsted and Commissioners:

At the request of adjacent property owners, REMA ECOLOGICAL SERVICES ("REMA") has been asked to review the application for the above-referenced development proposal, for completeness and consistency with the Town's Inland Wetlands and Watercourses Regulations, based on Sections 22a-36 to 45 of the Connecticut General Statutes.

The original application materials were reviewed, including the *Wetland and Watercourse Delineation Report* by Milone & MacBroom, Inc. (MMI), dated October 26th, 2020, as well as the more recently revised plans by MMI (15 sheets), and the MMI *Drainage Report*, both revised through December 10th, 2020. REMA also reviewed secondary-source information, mostly available on-line, such as from Town of North Haven GIS, and the Connecticut Environmental Conditions Online (CTECO), and both archival and recent aerial photographs (e.g., UConn MAGIC, CT State Library, Google Earth, etc.).

A REMA soil and wetland scientist conducted a site visit on January 10th, 2021, documenting conditions at the off-site wetland and watercourse corridor, and viewing the subject property

from its perimeter. Several illustrative figures (i.e., Figures A to D) and a few annotated photographs taken during the field visit are attached to this report (i.e., Photos 1 to 7).

It should be noted that this application review is preliminary in nature, since in our professional opinion the application is deficient in many respects. Should the applicant attempt correct such deficiencies and revise the submitted plans, REMA will provide its final review.

Following are comments and concerns regarding the application as currently presented in the record:

1. Wetland Delineations: A MMI wetland/soil scientist delineated wetlands off-site and to the north, on a neighboring property. Setting aside at this juncture the fact that permission had not been granted for wetland delineations or for survey by the property owner, REMA reviewed the wetland boundary and found it wanting is several areas.

   Each of the wetland boundary flags were evaluated in the field. To those flags that were found to be substantially correct a green survey ribbon was added (see attached photo). Additional pink and/or pink & blue survey flags were added upgradient at those locations where the wetland delineation was incorrect.

   With one notable exception only a handful of flags were found to be incorrect and additional wetland boundary markers were added, typically 6-8 feet or more above the existing wetland boundary markers. However, in the segment bracketed by wetland boundary markers "wl13a" to "wl16a," the actual wetland boundary is up to 24 feet further upgradient, and may even extend onto the property that is the subject of the application (see Figure A, attached). This would substantially change the activities within the 50-foot wide upland review area (URA).

   We recommend that MMI's soil scientist(s) should inspect the wetland boundary with REMA's soil scientist(s) and jointly perform the wetland delineations at the off-site property. Moreover, we would suggest that any new wetland boundary markers, as well as the old wetland boundary markers that do not change, be resurveyed using conventional survey. According the property owner on whose parcel wetlands were delineated, a resurvey by a licensed surveyor hired by him showed that the actual points did not coincide with those surveyed by MMI.

2. Wetland Characterizations/Inventory: While a *Wetland and Watercourse Delineation Report* was produced by MMI, a report that would characterize the wetlands and watercourses or provide an inventory of at least flora if not also fauna is missing from the record. Also, a wetland functions & values analysis is absent as well as an analysis of potential short-term and long-term impacts to the regulated resources. Such data and analysis is of paramount importance in analyzing the potential for adverse and or significant impacts to these resources.

   At first glance the wetland corridor and its intermittent watercourse immediately adjacent to the site may not seem highly functioning or comprised by diverse wetland communities. However, just the fact that these resources are situated in an area dominated and influenced by the underlying bedrock geology (i.e., New Haven arkose) changes this initial assumption. It is widely understood that wetlands and uplands influenced by red Triassic age materials are more likely to harbor rare and uncommon flora and fauna, leading high functionality.

   Moreover, the forested wetland complex immediately downgradient of the subject property is relatively large, diverse, and is headwaters to a perennial stream, tributary to the Mill River.

3. Aquifer Protection Zone: The subject property, as well as its associated wetlands and watercourse are found within a Class AA watershed, and with a Class GAA groundwater classification (see Figures B and C, attached). In fact, the property is within a Level A, Aquifer Protection Area (APA). The State has an "antidegradation policy" (see CGS Section 22a426-8) that gives the highest priority to protecting Class AA and GAA, surface and groundwaters, respectively. While the location of the subject site within an APA is mentioned in the *Wetland and Watercourse Delineation Report* and in the *Drainage Report*, discussion of how the water quality of the receiving waters will be maintained and not degraded in view of that fact, is not put forth with any clarity. As will be explained below, degradation of surface and groundwaters *will* take place, given the current design of the proposed school.

4. Soil Erodibility: The soils associated with the site are classified as being highly erodible (see Figure D, attached). The primary upland soil mapping unit, as seen on the State of Connecticut Soil Survey, is the Yalesville (69) fine sandy loam, on 8 to 15 percent

slopes. Many of the soil test pits documented on the site appear to verify the Yalesville soils series, with even finer substrata (i.e., fine silty loam), as well as a "hardpan" which refers to the typical massive to firm restrictive layer associated with these soils. It should be noted that Yalesville soils, within 30 inches of the surface have a typical silt content of 36% and a clay content of 9.7%. The size range of silt particles is 2 to 50 microns, while for clay particles it is less than 2 microns. The majority of these particles will pass through a standard silt fence and haybale combination.

The combination of slope (8 to 15 percent), the magnitude of proposed earthwork, and the high erodibility of the soils, lead us to conclude that the probability of erosion and sedimentation of the receiving waters is *high*, even if additional measures were included on the plans.

5. Water Quality: The revised plans show two interconnected stormwater management systems. One system conveys and treats stormwater runoff from the parking field to a below-ground detention system, which includes an isolator row for water quality purposes. A second system treats the balance of the site's impervious surfaces by conveying runoff to an above-ground basin, with a dewatering underdrain. The discharges from both these systems are combined to final discharge point, a a rip-rap level-spreader at the far western section of the site, immediately above the off-site wetlands, that is, within 30 feet.

   First, given the overall sensitivity of the receiving surface waters (i.e., Class AA), the below-ground detention system with an isolator row is not efficient enough to protect water quality. While these systems purportedly achieve over 80% TSS (total suspended particles) removal, they are not efficient in attenuating other runoff constituents, especially the soluble forms of nitrogen, phosphorus, and heavy metals. This is the primary reason why CT DEEP's 2004 Stormwater Quality Manual ("the Manual"), does not consider underground systems as "primary treatment systems," as would be, for example, a properly designed and sized above-ground extended detention basin or stormwater wetland. They are considered "secondary systems" since they cannot achieve superior stormwater renovation.

   In addition to the less than stelar runoff renovation efficiency of the below ground detention system, which will release the majority of dissolved constituents such as

nitrogen, the final discharge is taking place at the level-spreader, which is situated just downgradient of the proposed septic system.

It is widely understood, that while septic systems are designed to attenuated nitrate-nitrogen to below 10 mg/L, per the CT Health Code, most natural streams and watercourses have nitrate-nitrogen concentrations of less than 0.5 mg/L. In addition to this, above-ground detention basins, if they are property sized and designed, which the one proposed is not as will be explained below, only take out 50 to 60 percent of nitrogen. In the case of the proposed stormwater system discharge, nitrate-nitrogen from the septic system will combine with soluble nitrogen from the below ground detention system, and with nitrogen from the detention basin discharge, and flow either as surface flow, or as shallow groundwater flow downgradient to the wetlands and watercourse. The intervening uplands soils below the discharge do not have enough denitrification capacity or uptake capacity to reduce nitrogen concentrations to background levels, resulting in pollution of the wetland, and more importantly the watercourse, *a significant and adverse impact*.

Because of the proposed underdrain in the detention basin, this basin also does not qualify as a "primary treatment system" per the CT DEEP Manual. The residence time of stormwater in this basin is not sufficient for water renovation mechanisms to work, and because of the inherent permeability of the underdrain system, stormwater will exit relatively quickly. While this design may be sufficient in reducing peak flow rates, it is not sufficient for water quality purposes.

6. Hydrologic Sizing Criteria: In Chapter 7 of the CT DEEP Manual, hydrologic criteria for stormwater practices are presented and discussed. Over the years, most practitioners have focused on the Water Quality Volume (WQV), but often do not pay much attention to other important criteria. The MMI Drainage Report presents WQV calculations but does not discuss other pertinent criteria, such as the Groundwater Recharge Volume (GRV), and the Stream Channel Protection. The GRV is described as:

> "The groundwater recharge criterion is intended to maintain pre-development annual groundwater recharge volumes by capturing and infiltrating stormwater runoff. The objective of the groundwater recharge criterion is to maintain water table levels, stream baseflow, and wetland moisture levels."

The wetland and watercourse downgradient of the proposed development is fed both by surface flows, within its drainage area, and shallow groundwater flows. The latter is rainwater that infiltrates into the ground and reaches the less permeable "hardpan" described in the soil test pit data, which is a massive and firm layer. In areas such as this one where slopes are at least moderate, the infiltrated rainwater runs along the restrictive layer and discharges to the wetlands and watercourse below. That is why the GRV should have been calculated for this site. Furthermore, as discussed below, the proposed stormwater management system will starve the wetland and watercourse from the water that currently receives.

The Stream Channel Protection criterion is described as follows in the Manual:

> "The stream channel protection criterion is intended to protect stream channels from erosion and associated sedimentation in downstream receiving waters and wetlands as a result of urbanization within a watershed. By restricting peak flows from storm events that result in bankfull flow conditions (typically the 2-year storm, which controls the form of the stream channel), damaging effects to the channel from increased runoff due to urbanization can be reduced."

As can be seen in the attached photos of the wetland immediately downgradient of the discharge, the channel is quite narrow and diffuse, as water from the stream channel in the higher gradient segment to Ridge Road spreads out over the wide and nearly flat wetland. This narrow and shallow channel within the wetland is very susceptible to the increased volumes of water that it will receive from the proposed stormwater management system. One of the two methods prescribed in Manual for protecting against bank erosion and sedimentation states: *"control the 2-year, 24-hour, post-development peak flow rate to 50 percent of the 2 year, 24-hour pre-development level."*

Based on the MMI *Drainage Report*, the 2-year, post-development peak flow rate is 4.5 cfs (cubic feet per second), while the 2-year, pre-development peak flow rate is 4.7 cfs. Therefore, in order to meet this criterion, the peak flow rate during a 2-year, post-development peak flow must not be higher than 2.35 cfs. If this is not achieved, then there will be *a significant and adverse impact* upon the downgradient regulated resources.

7. Impacts to Wetland Hydrology: Under existing conditions the hydrology of the off-site wetland and watercourse are supported in part by both surface flows and shallow groundwater flows associated with the subject site. This especially true of the wetland fringe along the watercourse, but the ecology of the watercourse itself is supported by discharge from the wetland, during the early portion of the growing season and also during low flow conditions. Under the proposed conditions the portion of the wetland associated with the watercourse upstream of the proposed level spreader, a distance of approximately 220 feet, is in the "shadow" or influence of the proposed detention basin.

   It is estimated that the watershed (and ground-shed) to the wetland under proposed conditions and "upstream" of the level-spreader is at least 2.85 acres, but the great majority of this will be intercepted by the detention basin and its underdrain, and shunted to the level-spreader, thus by-passing the wetland. Even rainwater that would infiltrate into the ground above and to the east of the detention basin, will be intercepted by the underdrain which is well into the ground. The underdrain is at elevation of 153.0 feet, while the existing surface elevation is between roughly 161.0 and 164.0 feet. This will result in dewatering of the wetland fringe, *a significant adverse impact*.

To summarize, based on the review of the submitted revised plans and supporting documentation, and also supported by our inf-field view of the wetlands and watercourses, it is our professional opinion that the proposed development will result in significant adverse impacts to these regulated watercourses.

The primary categories of the significant, adverse, "physical" impacts to wetlands and watercourses are as follows:

A. ***Impacts to the water quality of wetlands and watercourses***, through the design of an ineffective stormwater management system, which does comply with CT DEEP's guidelines found in the Connecticut Stormwater Quality Manual (2004). Impacts are exacerbated by the "stacking" of the septic system above the stormwater management system's discharge.

B. ***Impacts from erosion and sedimentation***, through the discharge of additional volumes of water, generated on impervious surfaces, which will result in the erosion of the

downgradient stream through bankfull events, and subsequent sedimentation of wetlands and downgradient aquatic habitats (i.e., stream habitat).

C. ***Impacts to wetland hydrology***, through the diversion of both surface and shallow groundwater flows to off-site wetlands.

Finally, we should note that the above described adverse impacts to regulated wetlands and watercourses, will occur both in the Town of North Haven (hydrology impacts) and in the Town of Hamden (water quality and erosion/sedimentation impacts). The Town of Hamden Inland Wetlands Commission (IWC), in a letter to the North Haven Inland Wetlands Commission, dated December 11th, 2020, has asked the North Haven IWC to consider a non-disturbance buffer zone to wetlands of 100-feet. The letter cites The Town of Hamden Inland Wetlands & Watercourses Regulations (i.e., 10.2.k), in which factors to be considered in the determination of a sufficient buffer include, but are not limited to, "intensity of adjacent land use" and "soil erodibility." We concur with Hamden IWC's request and would recommend a minimum non-disturbance buffer of eighty (80) feet.

Respectfully submitted,

REMA ECOLOGICAL SERVICES, LLC

George T. Logan, MS, PWS, CSE
Professional Wetland Scientist, Registered Soil Scientist
Certified Senior Ecologist (ESA)

Attachments: Figures A through D; Photos 1 to 7

cc: Joan F. Lakin, Chair, Hamden Inland Wetlands Commission