LOW IMPACT SUSTAINABLE DEVELOPMENT
TRINKAUS ENGINEERING

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December 7, 2025

Mr. Jeffrey Kennedy, Chairman
Woodbridge Town Plan and Zoning Commission
11 Meetinghouse Lane
Woodbridge, Connecticut 06525

RE: 804 Fountain Street
Woodbridge, Connecticut

Dear Mr. Kennedy and Members of the Town Plan and Zoning Commission,

At the request of Woodbridge Land Trust, I have reviewed the most recent plans submitted by the applicant for the above-referenced project. Specifically, I reviewed the following documents and have the following comments.

Plans and documents Reviewed:

1. Response letter by Solli Engineering of 12/1/25
2. Preliminary dumpster pad relocation of 12/1/25

Response to comments made on the record by the applicant's counsel.

A. It is obvious that the applicant's counsel has not bothered to read my resume. I have over 45 years in the land development field performing work for land developers and builders. The following work included site feasibility studies, soil testing, layout of the development program, access design (roads and driveways), grading, stormwater management, erosion control and permitting.
    a. I have designed and obtained approvals for a minimum of 11 affordable housing projects containing almost 750 units.
    b. I have designed and obtained approvals for a minimum of 50 residential subdivisions containing over 350 lots.
    c. I have designed and obtained approvals for commercial/industrial space containing approximately 100,000 square feet.
    d. I have designed over 3,000 subsurface sewage disposal systems for residential, commercial and industrial uses.

B. In addition to my civil engineering practices, since July 7, 2025 I have been employed as the assistant Town Engineer for Stonington, Connecticut. My primary responsibility is performing review of all land use applications to ensure that they address water quality prior to be discharged to the environment. I am also designing stormwater retrofits or existing stormwater practices which are maintained by the town to address water quality as when these systems were approved, only peak rate control was required.

C. I have attended many engineering workshops over the years to learn about water quality issues and how to address them to minimize or eliminate environmental impacts. This has led to me being retained by municipalities and resident groups to review projects to ensure that these environmental issues are addressed.
D. In the Weed Street project, I did provide factual evidence using the applicant's own soil data and design information to show that the bottom of the proposed stormwater infiltration systems would either be below the seasonal high groundwater level or did not provide the required three foot vertical separation as stated in the CT DEP 2004 Storm Water Quality Manual. In every land use application, it is the burden of the applicant to prove with soil testing, calculations and other necessary engineering analyses that there design will work. That has not been done in the case as the applicant is relying on the CT DEEP 2024 Storm Water Quality Manual (A guidance document) which has incorrect information on it.
E. When I review plans for the Town of Stonington, other municipalities or neighborhood groups, many of my comments on stormwater all sound similar for the following reasons:
    a. Stormwater management practices are not designed in accordance with the specifications found in the CT DEEP 2024 Storm Water Quality Manual.
    b. Underground systems like the two proposed here do not have any or inadequate soil testing as required by the CT DEEP 2024 Storm Water Quality Manual for their design.
    c. There is an overreliance by design professionals on representations by manufacturers of structural drainage components regarding how these systems can reduce non-point source pollutant loads. Despite the amount of field monitoring data of real-world conditions found at either the University of New Hampshire Stormwater Center (UNHSC) or the American Society of Civil Engineers Best Management Practices Database (ASCE BMP Database), design professionals use laboratory results which are done in controlled conditions and not in the real world.
    d. Specifying a stormwater practice in a soil type which will cause the premature failure of the system. An example is the location of a Bioretention system (infiltration practice) next to a wetland which has no infiltrative capacity.
F. Counsel stated that many of the same types of system proposed here have been installed throughout Connecticut and are working. No monitoring data or other information has been provided by counsel to support this statement.

Final Comments:

1. The stormwater management system will not adequately reduce non-point source pollutant loads which will result in increased pollutant loads being discharged to the downgradient wetland system. Increased pollutant loads including suspended sediments, nitrogen, phosphorous, metals and hydrocarbons will be discharged to the off-site wetland system, where over time, these pollutant loads will adversely affect the water quality in the wetland area which is an adverse physical impact. Because of this impact, the application should be evaluated by the Inland Wetlands Commission.

2. The design of the stormwater management system does not comply with the CT DEEP 2024 Storm Water Quality Manual. As proposed, there will be no reduction in runoff volume as it has not been demonstrated that any infiltration will occur in the two underground detention systems.
3. There are many aspects of the erosion control plan that are not in compliance with the CT DEEP 2024 Guidelines for Soil Erosion and Sediment Control. Because of the inadequacy of the erosion control plan, there will be discharges of turbid runoff during the active construction period.
4. The two test holes excavated off either end of the large Retain It system were dug to a depth of 11' and according to the applicant, the machine could not dig any deeper. The problem with this response is that the bottom of the large Retain It system is between 16' and 24' below the existing ground surface and the 2024 CT DEEP Storm Water Quality Manual requires that deep test holes be dug to a depth which is a minimum of 3' below the bottom of the practice. In this case, the deep test holes would have to be dug to a minimum depth of 19' on the low end of the system and 27'on the upper end of the system. As the deep tests were not dug to the required depth, the applicant has no evidence of the soil conditions at and below the bottom of the Retain It, thus all of the assumptions made by the applicant are unsupported by any factual data.
5. The applicant used the Rawl's Rate of 0.52"/hr. (Table 10-2, page 184) of the 2024 CT DEEP Storm Water Quality Manual for a 'loam' soil. As stated in comment #4, the applicant has no idea what the soil conditions are at the bottom of the Retain It system, thus, any assumptions of the infiltrative capacity are complete speculation by the applicant.
6. The applicant did not reduce the Rawl's Rate by 50% as required by the CT DEEP 2024 Storm Water Quality Manual, thus the routing analyses for both Retain It systems are not valid.
7. As the applicant did not perform double ring infiltration testing for the central underground detention system as required by the CT DEEP 2024 Storm Water Quality Manual, infiltration from the system has not been demonstrated and thus cannot be considered a treatment practice.
8. The only water quality treatment provided for the site consists of catch basins, and online hydrodynamic separators. These systems will not provide adequate treatment of the runoff to meet the requirements found in the CT DEEP 2024 Storm Water Quality Manual. This will result in the discharge of increase non-point source pollutant loads to the off-site wetland system.
9. The following information has been reproduced from the University of New Hampshire Stormwater Center and the ASCE BMP Database for many types of stormwater management systems and is based upon field monitoring data of actual sites in the field.
    a. Catch Basins with 48" deep sumps with hooded outlets:
        i. Total Suspended Solids = 9%
        ii. Total Petroleum Hydrocarbons = 0%
        iii. Metals = 4%
        iv. Phosphorous = 0%
        v. Nitrogen = 0%
    b. Online Hydrodynamic Separators:
        i. Total Suspended Solids = 29%

ii. Total Petroleum Hydrocarbons = 42%
iii. Metals = 21%

iv. Phosphorous = 0%
v. Nitrogen = 0%

10. The following calculations are called a Pollutant Loading Analysis, which uses pollutant concentrations published data for various land uses which allow a design professional to calculate the pollutant loads (in pounds) for the water quality storm (1.3"/24 hours) or annually using the equation developed by Tom Schueler when Tom worked for the Center for Watershed Protection in Maryland. Once the pollutant loads have been calculated, the published removal rates for different types of stormwater management practices can be applied to demonstrate mathematically how much the non-point source pollutant loads will be reduced.
11. The calculations show the following reductions of non-point source pollutants:
    a. Total Suspended Solids (TSS) – 35.39% (CT DEEP requires 90%)
    b. Total Phosphorous (TP) – 0.0% (CT DEEP requires 60%)
    c. Total Nitrogen (TN) – 0.0% (CT DEEP requires 40%)
12. The design by the applicant will not provide the required pollutant load reductions required by CT DEEP.

APARTMENT PROJECT - 804 FOUNTAIN STREET - WOODBRIDGE

WATERSHED	TOTAL AREA		IMPERVIOUS AREA		RUNOFF COEFFICIENT		WATER QUALITY STORM (INCHES)	
BASIN	A(acres) =	1.32	I (%) =	79	Rv =	0.76	P =	1.3

POLLUANT LOADS DETERMINED BY SCHUELER EQUATION: L = (0.226)*(P)*(Pj)*(Rv)*(C)*(A)

HIGH DENSITY RESIDENTIAL

TSS =	60	mg/l
TP =	0.3	mg/l
TN =	1.5	mg/l
ZN =	0.07	mg/l
TPH =	2	mg/l

CALCULATED POLLUTANT LOADS - WATER QUALITY STORM (1.3"/24 HOURS)

HIGH DENSITY RESIDENTIAL

TSS	16.82229	lbs
TP	0.084111	lbs
TN	0.420557	lbs
ZN	0.019626	lbs
TPH	0.560743	lbs

STORMWATER MANAGEMENT TREATMENT SYSTEMS

Catch Basin with 48" deep sump with hood

Pollutant	Removal		Removal Percent
TSS	**1.514007**	lbs	9.00%
TP	**0**	lbs	0.00%
TN	**0**	lbs	0.00%
ZN	**0.000785**	lbs	4.00%
TPH	**0.078504**	lbs	14.00%

ONLINE HYDRODYNAMIC SEPARATOR

Pollutant	Removal		Removal Percent	Cumulative Percent
TSS	**4.439404**	lbs	29.00%	**35.39**
TP	**0**	lbs	0.00%	**0**
TN	**0**	lbs	0.00%	**0**
ZN	**0.003957**	lbs	21.00%	**24.16**
TPH	**0.20254**	lbs	42.00%	**50.12**

STORMWATER PRACTICE - REMOVAL RATES

CATCH BASIN - 48" SUMP, WITH HOOD		ONLINE HYDRODYNAMIC SEPARATOR	
TSS REMOVAL RATE	0.09	TSS REMOVAL RATE	0.29
TN REMOVAL RATE	0	TN REMOVAL RATE	0
TP REMOVAL RATE	0	TP REMOVAL RATE	0
ZN REMOVAL RATE	0.04	ZN REMOVAL RATE	0.21
TPH REMOVAL RATE	0.14	TPH REMOVAL RATE	0.42

SCHUELER'S EQUATION:

0.226	CONVERSION FACTOR
P	WATER QUALITY STORM RAINFALL
Pj	FACTOR THAT CORRECTS FOR STORMS WHICH DO NOT GENERATE RUNOFF
Rv	RUNOFF COEFFICIENT
C	POLLUTANT CONCENTRATION (mg/l)
A	WATERSHED AREA IN ACRES
L	POUNDS

10. Based upon the above calculations, it is crystal clear that the applicant's design does not meet the requirements found in the CT DEEP 2024 Storm Water Quality Manual. As far as environmental impacts, I am providing descriptions of the water quality impacts associated with the various non-point source pollutant loads based upon professional literature the impacts in Appendix A of this response.
11. The applicant claims that since they are containing the water quality volume in the stormwater system, the pollutant loads are magically reduced as the following language from the CT DEEP 2024 Storm Water Quality Manual seems to imply: ***"Achieving these minimum required load reductions for sediment and nutrients is assumed to provide adequate reductions of other stormwater pollutants including floatable materials. However, it is important to note that if the full retention goal (i.e., Required Retention Volume) is met, then it is assumed pollutant reduction is also achieved and individual pollutant calculations are not necessary."***
12. The above statement is not supported by science for the following reasons:
    a. Treatment Processes: Effective removal relies on specific physical, chemical, and biological processes occurring within the practice, such as sedimentation, filtration, adsorption, and microbial action. Holding the water simply provides the opportunity for these process to work.
    b. Design and Maintenance: The specific design of the practice (e.g., detention pond, rain garden, permeable pavement) and its ongoing maintenance are vital for ensuring these processes function correctly. Clogged systems or short-circuiting flow paths can drastically reduce efficiency, even if the total volume is captured.
    c. Pollutant Characteristics: Different pollutants behave differently. Suspended solids often settle out well, while dissolved nutrients (like nitrogen and phosphorus) or certain chemicals might require specialized treatment components or longer retention times for effective removal.
    d. Storm Dynamics: The WQV is typically designed for a specific "design storm" (e.g., the first flush or a 90% storm event) [1]. Larger or more intense storms may overwhelm the system, resulting in bypass or reduced treatment efficiency for the excess volume.
    e. Many stormwater practices found in the 2024 CT DEEP Storm Water Quality Manual are incapable of providing the high level of reduction required. As an example, a Dry Detention Basin is rated by CT DEEP to have Moderate TSS removal and low TP and TP removal, so it does not matter how much water is held in a Dry Detention Basin, the required pollutant load reductions will never be met as the system cannot provide them.
    f. Another analogy is useful here: Do you get any cleaner if you take a bath, where the tub has been filled with 12" of water instead of 6" of water? The answer is NO; you simply have more water to sit in.
13. The applicant has provided some information from the Retain It company that this system can be easily cleaned out, however the information provided does not reflect this specific design. It does not appear that the representative from Stormwater Compliance is aware of the depth of the Retain It system below grade. Their approach would likely be feasible when there is four feet or less cover over the system but is clearly not feasible at the depth of this system.

a. The bottom of the Retain It system is located between 16' and 24' below the original grade.
b. As the site over the Retain It is being filled based upon the site plan by 10', there will be 32' from the ground surface to the bottom of the Retain It system. The submitted details do not call out how safe access will be provided via a 30" manhole cover.
c. They are no specifications for the type of equipment to be used
d. There is no information as to how the material will be removed from the system.
e. There is no information as to how access for the workers and equipment will get from the ground surface to the bottom of the system.

Please contact my office if you have any questions concerning this information.

Respectfully submitted,
Trinkaus Engineering, LLC

Steven D. Trinkaus

Steven D. Trinkaus, PE

APPENDIX “A”
DISCUSSION OF WATER QUALITY IMPACTS DUE TO NON-POINT SOURCE POLLUTANTS

Total Suspended Solids (TSS)

Total Suspended Solids are fine soil particles, such as silts and clay which are dissolved in water. In excessive amounts it causes turbidity in water. The turbidity blocks light in the water column, which causes reduced photosynthesis, which in turn reduces the oxygen levels in the water. Coarse and fine sediments can clog the gravel substrate in breeding streams thus affecting the biological community’s ability to reproduce. Common sources of TSS and sediment are runoff from construction sites, winter sanding operations, airborne dust via atmospheric deposition and decomposition of organic matter, such as leaves. Turbidity is measured as nephelometric turbidity units (NTU). A range of turbidity levels are shown in Figure 5.1.2 below.

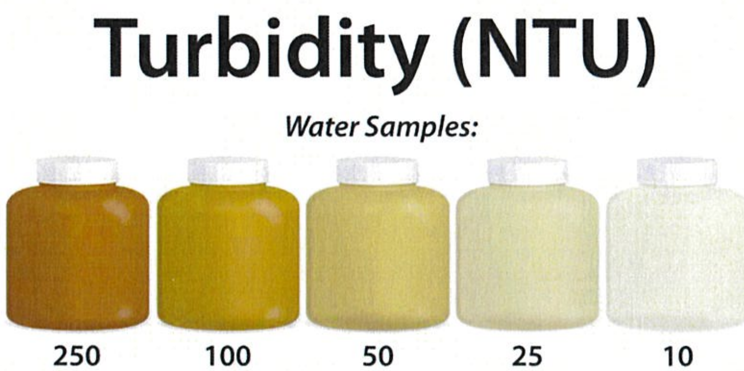

Figure 5.1.2 - Range of turbidity in water samples

Nutrients

Phosphorus and nitrogen are commonly found in non-point runoff with the primary source being lawn fertilizers. A secondary, but more important source of phosphorous and nitrogen is atmospheric deposition on impervious surfaces. It is well documented in professional literature that atmospheric deposition of nitrogen and phosphorous is a substantial amount of nutrients in post-development runoff. Atmospheric deposition is responsible for 55% of the total nitrogen, 15% of total phosphorous in post-development runoff.

Excessive levels of phosphorus in freshwater systems are a concern as this increased phosphorus, both as particulate and soluble forms are responsible for excess growth of non-native aquatic plants and algae in lakes. As a result of increased nutrient loads, toxic algae blooms are becoming more prevalent in lakes in Connecticut. These toxic algae blooms have resulted in beach closures as exposure to the algae blooms can cause adverse health issues in humans.

A further problem occurs when the non-native plants die in the water. The decomposition process of organic matter removes oxygen from the water column, thus reducing oxygen levels in the water. The reduced oxygen levels in the waterbody can result in fish dying.

Nitrogen, in its many forms, is a direct human health hazard and an indirect hazard in some areas where it leads to the release of arsenic from sediments. While not a major concern for freshwater systems, nitrate can cause environmental impacts in tidal regions, even though the source of nitrate can be far away from coastal regions. Sources of nutrients are organic and inorganic fertilizers, animal manure, biosolids and failing sewage disposal systems which result in a surface discharge of effluent.

Figure 5.1.3 - Phosphorus impacts on a freshwater pond

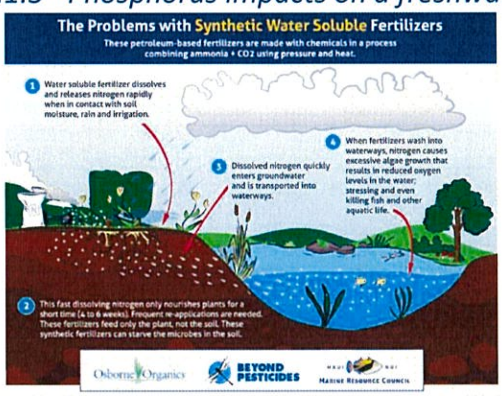

Figure 5.1.4 - Impacts of dissolved inorganic nitrogen (www.yourgreenpal.com)

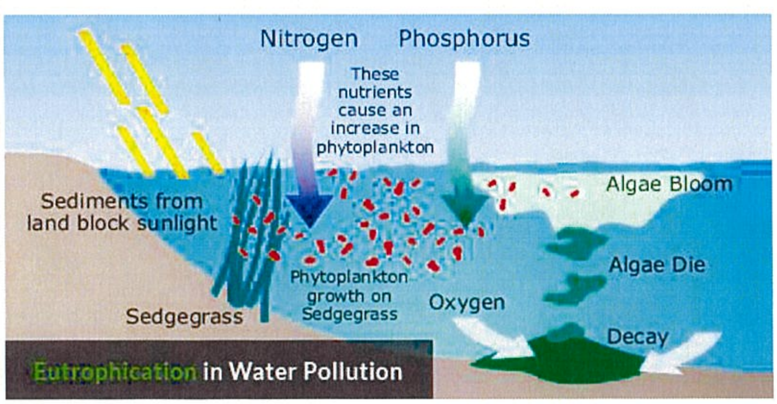

Figure 5.1.5 - Impacts of nitrogen and phosphorus on aquatic systems

Metals

Metals in non-point source runoff are very toxic to aquatic life at low concentrations. The adverse effects of metals are significant for both aquatic and human health. Many metals can bioaccumulate in the environment, which can affect higher living organisms, such as humans. This condition occurred with mercury in tuna fish in the ocean years ago. While the concentration of zinc or copper in stormwater generally is not high enough to bother humans, these same concentrations can be deadly for benthic aquatic organisms. Many microorganisms in soil are especially sensitive to low concentrations of cadmium. Zinc, Copper, and Cadmium found in non-point source runoff result from the movement and wear and tear of automobiles on our roadways. The primary sources of metals are from vehicle brake pads and tires. Components of homebuilding such as metal roofs, gutters and downspouts can also be sources of metals in stormwater.

Of the above discussed metals, zinc and copper are the two metals which are found dominantly in non-point source runoff. Metals commonly bind themselves to sediment and organic matter in stormwater and thus are transported to the receiving waters.

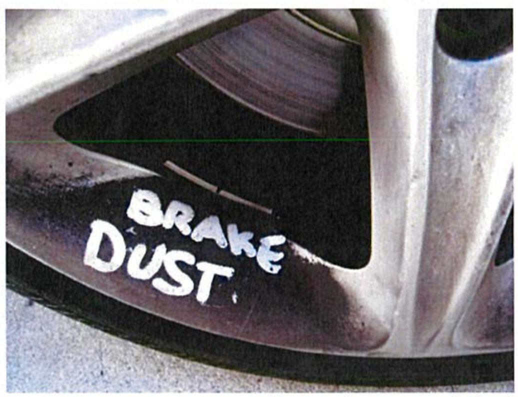

Figure 5.1.6 - Primary source of zinc (automobile brake pads)

Hydrocarbons

Total Petroleum Hydrocarbons (TPH) are highly toxic in the aquatic environment, especially to aquatic invertebrates. The primary sources of petroleum hydrocarbons are oil, grease drops from an automobile, gas spills, and vehicle exhaust. Polycyclic Aromatic Hydrocarbons (PAHs) are also toxic to aquatic life. PAHs can be discharged into the environment by using coal tar asphalt sealants, commonly used by homeowners on residential driveways. The movement of vehicles or people walking over the sealed driveway can release dust particles containing PAH, which can then be washed off with the next rainfall into the stormwater management system. PAHs are also generated by the burning of fossil fuels, and the airborne particles are then deposited by atmospheric deposition on an impervious surface, especially large flat roof areas. When it rains, the accumulations of PAHs due to atmospheric deposition are carried off in the stormwater.

Figure 5.1.7 - Petroleum Hydrocarbons in Stormwater

De-icing Agents

In the past fifteen years, it has been common for states and municipalities to use deicing agents on roads prior to a snowfall event to prevent the snow from sticking to the road surface. These de-icing agents are applied in a liquid form called brine. The brines can consist of Sodium Chloride, Calcium Chloride, Magnesium Chloride and Potassium Chloride. Sodium Chloride is the most common deicing agent due to its availability and low cost. According to the University of Minnesota Extension Group deicing agents will cause the following adverse environmental impacts:

1. Water Quality
    i. One teaspoon of salt will pollute 5 gallons of water.
    ii. Deicing agents will pollute the groundwater.
    iii. Chloride in high amounts affects the oxygen levels and natural mixing of lakes and waterways and is toxic to fish, aquatic bugs and amphibians.
    iv. Excessive use of de-icing agents can degrade concrete, asphalt, and natural stone, and will corrode metals.
2. Plants and Soils
    i. Dried up brown needles and leaves.
    ii. Loss of foliage, buds, and branches.
    iii. Premature plant death.
    iv. Sodium causes clay particles in soil to expand, increasing soil compaction, reducing water infiltration and making it harder for roots to grow.
    v. High salinity can cause root damage and dehydration in many turfgrass species which result in yellowing death.

Figure 5.1.8 - Application of deicing agents on road (www.harmonydeicing.com)

Thermal Impacts

Impervious surfaces, such as roofs and paved areas, such as residential driveways can heat up during sunny days and hold onto this heat. When rainfall occurs on these heated surfaces, the resulting runoff will have a highly elevated temperature resulting from the heat transference from the impervious surface to the runoff. As this heated runoff is discharged into receiving water, the temperature of the receiving water is raised to a level which can exceed the temperature tolerance limits for fish and invertebrates, thus lowering their survival rates. Elevated water temperatures will also contribute to reduced oxygen levels in the water. While temporary spikes in temperature in cold water stream may not have an adverse impact on fish species, frequent or prolonged spikes in water temperature will have adverse impacts on fish species.

www.shutterstock.com · 138077300

Figure 5.1.9 - Fish kills due to increased thermal levels

Pathogens

Pathogens are bacteria and viruses, which can cause disease in humans. Most pathogens are found in discharges from overflowing sanitary sewers or in combined sanitary/stormwater systems which is not applicable to the Town of Stonington. In communities such as Stonington, the primary source of pathogens in stormwater is pet waste which is not picked up by dog walkers along roadways. Dog poop which washes into a storm drain are the common source of both fecal coliform and enterococci bacteria which are used as indicators for the presence of pathogenic organisms, yet their presence does not mean a pathogen is present, just that there is a higher risk of being present.

Figure 5.1.10 - Primary source of pathogens in stormwater