13-0328-024
July 29, 2020

Mr. Eric Joosten
Chairman
Environmental Protection Commission
Town of Darien
2 Renshaw Road
Darien, Connecticut 06820

Re: **49 Sunswyck Road**
EPC 5-2020

Dear Mr. Joosten and Commissioners:

We have been asked by the Darien Environmental Protection Commission, in our capacity as consultant to the Commission, to review the information presented by engineers retained by the applicant and area property owners. Immediately before the July 1, 2020 hearing, a letter from Steven Trinkaus, PE, of Trinkaus Engineering, LLC, representing area property owners was submitted to the Commission with a focus on Lot 1. The letter discussed concerns that Mr. Trinkaus had identified in the course of his review. In response, the applicant's engineer, Douglas DiVesta, PE, of DiVesta Civil Engineering Associates, Inc., provided a written response on July 14, 2020.

The documents submitted for review include:

1. "Proposed Site Development Plan, Palladian Builders, 49 Sunswyck Road, Darien, Connecticut," Drawing 1 of 3, prepared by DiVesta Civil Engineering Associates, dated February 26, 2020, revised July 14, 2020.

2. "Details, Palladian Builders, 49 Sunswyck Road, Darien, Connecticut," Drawing 2 of 3, prepared by DiVesta Civil Engineering Associates, dated February 26, 2020, revised July 14, 2020.

3. "Notes, Palladian Builders, 49 Sunswyck Road, Darien, Connecticut," Drawing 3 of 3, prepared by DiVesta Civil Engineering Associates, dated February 26, 2020, revised July 14, 2020.

4. Water Quality Volume Calculations, Palladian Builders, 49 Sunswyck Road, Darien, Connecticut, prepared by DiVesta Civil Engineering Associates, revised July 9, 2020.

5. HydroCAD Report, prepared by DiVesta Civil Engineering Associates, revised July 13, 2020.

6. Groundwater Quality Volume Calculations, Palladian Builders, 49 Sunswyck Road, Darien, Connecticut, prepared by DiVesta Civil Engineering Associates, revised July 6, 2020.

7. Letter to Eric Joosten, Chairman, Environmental Protection Commission from Douglas DiVesta, PE, DiVesta Civil Engineering Associates, Inc., dated July 14, 2020, Re: Palladian Builders, LLC Subdivision – 49 Sunswyck Road, Darien, CT.

8. Letter to Eric Joosten, Chairman, Environmental Protection Commission from Steven Trinkaus, PE, Trinkaus Engineering, LLC, dated July 1, 2020, Re: Palladian Builders, LLC Subdivision – 49 Sunswyck Road, Darien, CT.

The comments offered by Mr. Trinkaus fall into two broad categories, Sewage Disposal Systems and Stormwater Management. Mr. Trinkaus makes several references to the 2004 Connecticut Stormwater Quality Manual. While the 2004 Connecticut Stormwater Quality Manual provides useful design guidance, the design document reference in Section 880a of the Darien Zoning Regulations is the Darien Stormwater Management and Drainage Manual, the most current version is 2003. Therefore, the standard of compliance with the stormwater management regulations should be based on the manual cited in the Zoning Regulations. In general, we concur with some of his observations and conclusions and disagree with others.

Where additional information will be required by the applicant, we have noted those as "Action Item for Applicant" to help clarify additional information that will be needed.

Septic System Comments

In his letter, Mr. Trinkaus had three comments related to the sewage disposal system design.

Acceptability of Soils. In Comment 1, Mr. Trinkaus notes: "The soils for the proposed sewage disposal system for proposed Lot #1 are marginal at best for a new sewage disposal system. Ledge was encountered around 30" or so (on average) within the area, so a significant amount of select fill must be brought to the site to provide the required 48" vertical separation to ledge from the bottom of the sewage disposal system."

The 48-inch separation vertical separation from ledge stems from Section 19-13-B103e(a)(3) of the State Public Health Code, which states:

> *"For any new subsurface sewage disposal system where the soil conditions in the area of the leaching system are unsuitable for sewage disposal purposes at the time of the site investigation made pursuant to this section. Unsuitable conditions occur where the existing soil is impervious, or where there is less than four feet depth of suitable existing soil over ledge rock, two feet of which is naturally occurring soil, or where there is less than 18 inches depth of suitable existing soil over impervious soil, or where the groundwater level is less than 18 inches below the surface of the ground for a duration of one month or longer during the wettest season of the year;"*

The project plans, Drawing 1 of 3, show Deep Test Holes 1 and 3 over the proposed leaching system for Lot 1, and Deep Test Holes 29, 30 and 110 directly over the proposed leaching system for Lot 2. Sheet 3 of 3 has cross sections of both proposed systems, which show the top of the proposed systems will be placed in select fill. On Lot 1, Deep Test Hole #3 was the most restrictive showing a depth to ledge of 37 inches. Since the existing grade is 43.2 at Test Hole #3, the elevation of the restrictive layer is 40.1 The proposed bottom of the system is elevation 44.6, which is 4.5 feet higher than the restrictive layer, meeting the four foot depth requirement established in Section 19-13-B103e(a)(3). The depth between natural grade (Elevation 43.2) under existing conditions and the restrictive layer (Elevation 40.1) is 3.1 feet, exceeding the minimum requirement of two feet of naturally occurring soil. The test holes indicate no groundwater was present.

Similarly, at Lot 2, Deep Test Hole #29 was most restrictive, with a depth to ledge of 24 inches. The existing grade is approximately 45.2 at Test Hole #29, therefore, the depth of ledge rock is elevation 43.2. The proposed bottom of system is at elevation 48.7, which is 5.5 feet above the restrictive layer, meeting the requirement of four feet of separation.

Additionally, the requirement of two feet of natural soil is also met, since the separation between natural grade and bedrock is two feet. This system meets the absolute minimum requirements at this particular point, however, we note that the depth of naturally occurring soil increase if the other two test holes are evaluated. The test holes indicate no groundwater was present.

Therefore, we believe the system meets the requirements of the State Public Health Code. The provisions of the Health Code were developed for the purposes of protecting public and environmental health, and our opinion is that compliance with Public Health Code is sufficient to demonstrate that there would be no unreasonable harm or pollution of the wetlands.

Use of Proprietary Leaching System. Mr. Trinkaus notes that the applicant proposes a proprietary system for the leaching system. Mr. Trinkaus is correct that these systems are proposed where area or depths are limited. Section VIII.E of the "Connecticut Public Health Code On-Site Sewage Disposal Regulations and Technical Standards for Subsurface Sewage Disposal Systems"[1], effective January 1, 2018, lists systems approved by CTDPH, which includes the Geomatrix and Green Leach systems proposed by the applicant's engineer on page 41 of the document. Since the use of these systems is approved by CTDPH, we believe that they are acceptable for this property, and will not adversely impact the wetlands, provided they are installed and maintained in accordance with manufacturer and health code requirements.

Requirement for Nutrient Analysis. Mr. Trinkaus states that since the proposed sewage disposal system is 25 feet from the downgradient property line and the native soils are marginal, a renovation analysis in accordance with the CTDEEP design manual needs to be performed to ensure that the 21-day travel time for bacteria and viruses is met and that there is adequate dilution of nitrogen to 10 mg/L or less at the downgradient property line.

Mr. Trinkaus would be absolutely correct if this were a larger community development or a development with flow exceeding 7,500 gallons per day. The proposed flow for the proposed residences is 525 gpd each. Larger systems in excess of 7,500 gpd are regulated by the Connecticut Department of Energy and Environmental Protection (CTDEEP) as opposed to smaller systems, which are regulated by the local health district and/or CTDPH. Systems permitted by CTDEEP are required to perform the renovation analysis, systems permitted by CTDPH and/or the local health district are not required to perform the analysis.

The CTDPH's "Design Manual - Subsurface Sewage Disposal Systems for Households and Small Commercial Buildings", July 1998[2], states on Page 3: "There are many other nitrogen sources in the environment which also will contribute nitrates to the ground water, such as fertilizers, rotting vegetation and the atmosphere itself. For this reason, it is usually not practical or necessary to try to design small subsurface sewage disposal systems for nitrate removal. An exception to this might be in heavy developed lakeside property where nitrates from subsurface sewage disposal systems could be a significant source of nitrate fertilization of the lake water, which would cause undesirable algae blooms." The proposed application is not a heavily developed lakeside property.

Similarly, the CTDPH Design Manual notes that phosphates in sewage combine readily with minerals normally present in soils to form insoluble deposits that are removed by only a foot

[1] https://portal.ct.gov/-/media/Departments-and-Agencies/DPH/dph/environmental_health/environmental_engineering/2018-Uploads/Technical-Standards-2018-Master-011918.pdf?la=en

[2] https://portal.ct.gov/-/media/Departments-and-Agencies/DPH/dph/environmental_health/environmental_engineering/pdf/DESIGNMANUALPart1pdf.pdf?la=en

or two of soil, concluding "it is unlikely that properly designed subsurface sewage disposal systems would be a significant source of phosphate pollution".

The Design Manual also notes that the separation distance prescribed in the manual are very conservative for coliform bacteria, but are based on the possibility of disease transmission by viruses in contaminated groundwater. The proposed project meets the prescribed separation distances.

Since the CTDPH criteria for small systems accounts for environmental as well as public health, it is our professional opinion that the proposed subsurface sewage disposal system, since it is designed in accordance with CTDPH criteria, will not cause undue pollution or harm to the wetlands provided the system is maintained appropriately.

Stormwater Management

Mr. Trinkaus's letter makes several observations regarding the stormwater management system.

Operations and Maintenance Plans. Mr. Trinkaus notes that there are no provisions for inspecting and maintaining the underground Cultec systems or level spreader. We agree with Mr. Trinkaus.

Action item for applicant: Expand the Operation and Maintenance plan to include inspection and maintenance activities for the Cultec systems and level spreader. Keep in mind that the homeowner will ultimately be responsible for system maintenance and the schedule should be presented so that it is as easy to follow as possible. It may be helpful, but not required to list the maintenance activities in tabular format, with frequency in one column and the corresponding action in the next column.

Cultec Inspection Access. Mr. Trinkaus observed that there is no access to inspect or maintain the Cultec systems. We agree that there should be maintenance access to each system. The current Site Plan, Drawing 1 of 3, revised July 14, 2020, shows each Cultec row having at least one inspection port for access.

Action item for applicant: The proposed overflow grates are shown to be set to grade. We suggest setting the overflow grates a little above the surrounding grade so that sediment from adjacent grade does not migrate into the grates. The elevated grates should have a concrete collar around them to protect them to avoid damage that may occur during lawn maintenance.

Pre-treatment of Flow. Mr. Trinkaus expressed concerns with the pretreatment of runoff directed to the proposed Cultec systems. Pretreatment typically consists of another, typically smaller, stormwater treatment practice that serves to capture sediment, trash, and debris to maximize the efficiency and reduce the maintenance needed on downstream systems. We agree with Mr. Trinkaus on the importance of pretreatment.

The 2003 Darien Stormwater Management Manual (page 3-3) states that rooftop runoff may be infiltrated into the ground without pretreatment. The larger system on Lot 1 exclusively serves rooftop runoff, therefore, no pretreatment is required.

Table 9.1 of the Manual identifies categories and corresponding applicability of practices. Deep sump catch basins are identified as acceptable for pre-treatment. Therefore, the use of deep sump catch basins is allowed by the regulations. Our review of the catch basin details on Drawing 2 of 3 indicates that the depth of the sumps needs to be increased to meet the definition of a deep sump catch basin.

Action item for applicant: Increase the depth on all catch basin sumps and junction boxes contributing to the Cultec systems from two to four feet.

Water Quality Volume. Mr. Trinkaus commented on the Water Quality Volume (WQV) for Lot #1, but indicated that no computation had been provided that the WQV was met. Water Quality Volume is the storage needed to capture and treat 90% of the average annual stormwater runoff volume. The concept is that 90 percent of rainfall events are one inch or less, and therefore treating the first inch of runoff would achieve the treatment goal. The first inch of runoff is the "dirtiest" part of the runoff, since it represents the initial "first flush" of sediment from surfaces.

Mr. DiVesta's response of July 14, 2020 included computations. On Lot #1, Mr. DiVesta computed a WQV of 98 cubic feet for the smaller system in the rear and 234 cubic feet for the system in the front. On Lot #2 he computed a required WQV of 331 cubic feet.

In his letter of July 14, 2020, Mr. DiVesta provided an explanation, though it appears as if there is a disconnect between the volumes of particular systems and how they are labeled. For example, in the letter, which deals directly with Lot #1, Mr. DiVesta states that the required WQV is 331 cubic feet for the larger system, but his calculations show that the 331 cubic feet applies to Lot #2.

In general, we agree with the concept that the storage below the lowest invert outlet should be considered to be water quality treatment, and although the water quality volume appears to have been met, more clarity needs to be shown as to how the provided water quality volume was computed. On the rear system in Lot 1 (Pond 1), the calculation is straightforward since the invert and top of stone elevation are the same, meaning the entire water quality volume is in the stone. (15' x 71' x 6 inches x 40% void space = 213 cubic feet, aligning with the calculations presented by the applicant's engineer.) However, where the outlet is above the stone, more clarification is needed to determine how the volume was computed since no detailed computations were provided.

Action item for applicant: Provide additional detail in the computation as to how the provided water quality volumes were obtained.

Groundwater Recharge Volume Computations. Mr. Trinkaus requested, and Mr. DiVesta provided Groundwater Recharge Volume (GRV) computations. The concept is that as natural surfaces are covered with impervious cover, rainfall is not absorbed into the ground, and instead runs off into storm drains. The intent is to try to recapture rainfall volume that would otherwise would have been lost. The Town has two mechanisms for this, (1) the "Fresh Meadow" approach, and infiltration of the GRV. The GRV is the post-development design recharge volume (i.e., on a storm event basis) required to minimize the loss of annual pre-development groundwater recharge. It is based on the depth of runoff multiplied by the area and impervious coverage percentage. The depth of runoff varies by the Hydrologic Soils Group assigned by the USDA's Natural Resources Soil Conservation Service, recognizing that some soils are more permeable than others, therefore absorbing more runoff. For example, gravels and sands are more permeable than clay, and therefore would be assigned to different Hydrologic Soils Groups. Based on the NRCS Web Soil Survey, the soils are Hydrologic Soil Group D, which has a 0.0 inch recharge requirement. Therefore, there is no GRV requirement for this application.

We note that Mr. DiVesta used a 0.1 inch recharge depth, exceeding the requirement. The ground water recharge volume is a subset of the water quality volume, and not an addition to it. Since the entire water quality volume is presumably infiltrated subject to the computation clarifications requested above, the ground water recharge volume would also be

met. This is not the case on all projects, such as where wet detention ponds are used to provide water quality volume treatment and infiltration is provided by other practices.

Determination of Infiltration Rates. Mr. Trinkaus's Comments 6, 7, 8, 16, and 17 discuss the methodology used by the applicant's engineer to establish infiltration rates, and how it could affect the hydrologic analysis.

In Comment 6, Mr. Trinkaus notes that the applicant used a percolation test conducted at a depth of 19 inches, while the bottom of the Cultec system is at 27 inches below grade and doesn't represent the infiltrative capacity of the soil. We agree with Mr. Trinkaus's observation. Mr. DiVesta conducted new percolation tests over the proposed systems. In reviewing the natural grade, depth of test, and proposed system bottom, we believe that two of the tests are now at sufficient depth, while another needs to be extended deeper.

Lot	Location	Natural Grade Elevation	Test Depth	Bottom of Test Elevation	Bottom of System Elevation
1	Front	51.5	23 inches	49.6	47.1
	Rear	47.5	28 inches	45.16	46.25
2	Rear	47.6	32 inches	44.90	45.5

Mr. Trinkaus also states that percolation tests over-estimate vertical infiltrative capacity of the soil, and a double ring infiltration test would be more appropriate. Mr. DiVesta noted that the Commission historically has accepted percolation tests for stormwater systems. A percolation test is conducted by excavating a hole with a post hole digger, filling it with water, and measuring the drop in depth from a fixed point over time. A double ring infiltrometer is done with a device specifically created for measuring infiltration rates, featuring concentric rings. Both rings are filled with water, and measurements in depth are taken from a fixed point over time. The outer ring promotes one-dimensional, vertical flow beneath the inner ring.

The 2003 Darien Stormwater Management Manual allows percolation tests, as evidenced by references throughout Chapter 9.

The 2004 Connecticut Stormwater Quality Manual defines infiltration rate as a soil characteristic determining or describing the maximum rate at which water can enter the soil under specific conditions. It does not specify a specific methodology. However, we note that the neighboring City of Stamford just adopted requirements to use a double ring infiltrometer.

We examined the potential difference in results. The State of Michigan's Low Impact Design Manual offers a conversion for percolation testing to remove lateral flow that is based upon the initial and final depth of water readings and the diameter of the test hole. We computed converted infiltration rates that were slightly faster than the design infiltration rates used.

We note that the applicant's HydroCAD analysis specified exfiltration from the Cultec chambers based on surface area. HydroCAD allows exfiltration based on the surface area or the wetted area. Restricting exfiltration to the surface area is more conservative, and limits flow to downward movement. If it were set to wetted area, it would allow exfiltration out of vertical surfaces as well.

The applicant can be encouraged to use a double ring infiltrometer, but the applicant can only be held to standards that have been established in the regulations, which accept percolation tests.

Action item for applicant: Extend test for Lot 1, Front Cultec system, to bottom of system.

Separation distance for stormwater systems. Mr. Trinkaus's Comments 9 through 11 discuss the separation of the bottom of the proposed Cultec systems to mottling or other restrictive layer. The 2004 Connecticut Stormwater Quality Manual, Page 11-P3-3, states that the bottom of infiltrative practices should be located at least three feet above seasonal high groundwater table.

The 2003 Darien Stormwater Management Manual specifies a 24 inch minimum separation distance for aquifer protection areas and along beaches. The subject site is not within an aquifer protection area. Historically, 12 inches has been used as separation because of the relatively high groundwater tables.

Location of proposed pool. We agree with Mr. Trinkaus's Comment 12 that the proposed pool as shown on Lot 1 is too close to the proposed Cultec system to allow it to be constructed as shown. As discussed at the July 1, 2020 hearing, the pool is not proposed at this time, and is a place holder until a final pool design is completed.

Action item for applicant: Revise the location of the pool to provide separation from the Cultec system. If the Commission chooses, the revised pool location can be noted within the patio area as a potential condition of approval. The final location of the pool will need to be approved by Planning and Zoning.

Sump Pump and Footing Drains. Mr. Trinkaus's Comment 13 discusses the discharge of sump pump discharge to the proposed Cultec systems for Lots 1 and 2. Mr. Trinkaus states that the volume will fluctuate greatly throughout the year, and snow melt will contribute additional volume. We agree with Mr. Trinkaus's statement. The amount of water to be pumped will be highly variable, dependent on how high the water table is, how much water infiltrates into the basin, the size and depth of the interior sump and the pumping capacity of the sump pump. A typical sump could receive up to 20 gallons per minute, and with a recommended 1.5 factor of safety, would pump 30 gallons per minute. The proposed Cultec system behind Lot #1 infiltrates downward over an area of 1,065 square feet at a design rate of 1.70 inches per hour, which is 0.142 feet per hour, or 0.0023 feet per minute. Applied evenly over the infiltration area, this results in a loss of 2.52 cubic feet per minute, which is 18.85 gallons per minute. Therefore, after taking exfiltration into account, the Cultec system would fill at a rate of 11 gallons of minute.

Mr. DiVesta's computations show that there is 4,200 gallons of spare capacity in the Cultec unit behind Lot #1. If it were to fill at a rate of 11 gallons per minute, the system would fill in a little over 6 hours. This assumes that the water pumping rate maintains constant, and the pump runs continuously.

Based on the deep test holes, it is likely that the basements of both houses will be in groundwater. The amount of groundwater will vary tremendously depending on the time of year, depth of groundwater and size of the basement, and it is not possible to clearly identify the volume of groundwater that will be pumped. Basements should be made as small as possible to reduce the discharge volume and amount of rock excavation.

Level Spreader. Comment 14 in Mr. Trinkaus's letter takes exception the use of pressure treated timber as a component of the level spreader, and that the level spreader will move over time, potentially resulting in concentrated flow.

We agree with Mr. Trinkaus's observations that ground contact lumber will degrade over time and that the level spreader is subject to movement. There are many different types of level spreader materials, some are constructed of pea gravel, some of timber, and some of concrete curb. We believe that concrete would be a more durable material, but more difficult to correct/repair in the event of settlement. Mr. Trinkaus's comment underscores the importance of his initial comment regarding the inclusion of level spreaders in the Operations and Maintenance Plan.

Action item for applicant: Specify that the level of the spreader shall be checked twice a year, or immediately after any erosion is noted in the revised Operations and Maintenance Plan.

Runoff volume. Mr. Trinkaus questioned the resultant runoff volumes from the site in Comments 15 and 18 of his letter. Stormwater is most often quantified in two ways, one is peak flow, which is how much runoff is discharged over a specified time frame, and the other is volume, which is the total quantity of stormwater discharged regardless of time.

Mr. DiVesta provided computations showing that the post-development runoff volumes will be less than the pre-development runoff volumes. The documented runoff volume reduction is accomplished through two primary channels, (1) the proposed Cultec systems, and (2) the Town of Darien Zoning Regulations, Section 883a requiring that where an existing residential dwelling is proposed to be razed and replaced with a new structure, the site's undeveloped condition shall be used as the basis of existing conditions. Credit for existing impervious cover is disallowed, therefore runoff volumes and rates must be attenuated to levels matching an undeveloped site.

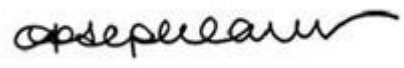
Based on the information presented, the calculations support a reduction of runoff volume.

Conclusion

Mr. Trinkaus has raised valid concerns and the applicant's engineer has addressed some of them. Conversely, some of Mr. Trinkaus's concerns do not appear to apply to the regulatory framework of the Town's Stormwater Management Regulations. We believe that some additional clarifications are necessary on the applicant's part, as highlighted throughout this letter. We look forward to presenting our findings and answering the Commission's questions when this application is heard.

Very truly yours,

TIGHE & BOND, INC.



Joseph Canas, PE, LEED AP, CFM
Principal Engineer

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