STATE OF CONNECTICUT
CONNECTICUT SITING COUNCIL

Petition of BNE Energy Inc. for a Declaratory Ruling for the Location, Construction and Operation of a 4.8 MW Wind Renewable Generating Project on Flagg Hill Road in Colebrook, Connecticut ("Wind Colebrook South")	**Petition No. 983** **March 15, 2011**

PRE-FILED TESTIMONY OF WILLIAM F. CARBONI

Q1. Please state your name for the record.

A1. My name is William Carboni. I work at Spath-Bjorklund Associates.

Q2. Please describe your involvement in this project.

A2. I was retained by Reid and Riege, PC on behalf of FairwindCT, Inc. to assess the plans and reports submitted by BNE Energy Inc. ("BNE") regarding stormwater discharge, erosion and sediment control and provide testimony on those subjects. The plans and reports were prepared for BNE by Zapata Inc. ("Zapata"). I began by conducting an initial review of the plans to determine whether they complied with Connecticut State Guidelines with regards to erosion and sedimentation, the Connecticut General Permit for the Discharge of Stormwater and Dewatering Wastewaters Associated with Construction Activities, site engineering with regards to drainage and grading, and Standards of Good Practice for this type of site development. That review led to my submission of this testimony.

Q3. What degrees do you have?

A3. I earned a B.S. in civil engineering from Worcester Polytechnic Institute in 1967.

Q4. What professional licenses do you hold?

A4. I am a licensed professional engineer in Connecticut and California.

Q5. Please describe your experience as a civil engineer.

A5. I have worked as a civil engineer with several firms and state agencies since 1967. My career began in California, where I worked for the California Department of Water Resources and later the California Division of Highways. In those positions, I completed assignments ranging from evaluating local surface and imported water projects, geologic and hydrologic water resources, ground water utilization, analysis of agricultural and urban unit water use, preparation of freeway designs, evaluation of socio-economic impacts of alternate freeway locations and incorporating freeways into city plans. In 1972, I moved into the private sector. I worked for three different corporations over the next dozen years and worked on projects including transportation systems, engineering and environmental evaluations of potential effects of industrial parks, planned residential developments and the conversion of agricultural land, expansion of a sewer plant, preparation of master water supply and waste water disposal plans and studies of noise pollution from transportation sources.

In 1984, I moved to Connecticut and started working at Spath-Bjorklund Associates, where I am still employed today. At Spath-Bjorklund, I supervise the engineering section. In that role, I have been responsible for preparing grading, street, utility and sewage disposal plans for residential and commercial projects. My work on projects has included hydrologic and hydraulic computations, designing stormwater treatment and detention and drainage calculations. I have designed, evaluated and consulted on all manner of drainage system and erosion control analysis and design. A copy of my current CV is attached to this testimony.

Q6. Have you testified in front of the Siting Council before?

A6. Yes, I submitted pre-filed testimony regarding Petition No. 980, in which BNE is seeking approval to site a similar project in Prospect, Connecticut.

Q7. What is the purpose of your testimony?

A7. This testimony details my findings regarding BNE's submission to the Siting Council.

Q8. Please summarize your findings.

A8. Generally, I found that BNE's submission contains technical and engineering errors, omits necessary information and data and does not conform with the Connecticut Public Health Code, the Connecticut General Permit for the Discharge of Stormwater and Dewatering Wastewaters Associated with Construction Activities (General Permit), the 2004 Connecticut Stormwater Quality Manual (2004 Manual), the 2002 Connecticut Guidelines for Soil Erosion and Sediment Control (2002 Guidelines), the 2004 Connecticut Department of Transportation's ("CT DOT") Standard Specifications for Roads, Bridges and Incidental Construction (Form 816) or the CT DOT 2000 Drainage Manual.

The proposed project, its plans and reports therefore do not comply with the requirements of the State of Connecticut. BNE's submission also contains statements and calculations that do not represent the site accurately and minimize the impact that this project will have on the site.

Q9. What is your most significant finding?

A9. My most significant finding concerns the lack of sedimentation facilities and outlet protection facilities. There are multiple discharge points from the proposed road and from the blade assembly areas. However, there are no temporary sedimentation basins, temporary sedimentation traps or level spreaders. The absence of these facilities violate the water quality standards of the State and will result in erosion and deposits of sediment into wetlands.

Section 5-11 of the 2002 Guidelines provides the criteria for sediment impoundments and barriers. For drainage areas less than 1 acre, geotextile silt fences or hay bale barriers are required below the disturbed area. For drainage areas of 1 to 5 acres, temporary sediment traps are required. For drainage areas larger than 5 acres, temporary sediment basins are required.

BNE's plans propose eight point discharges from the roads and three area discharges from the tower areas. The following table shows the area tributary to each of the discharges and the type of sedimentation impoundment required under the 2002 Guidelines. Under the 2002 Guidelines, these plans should provide for the installation of six temporary sediment traps, two temporary sediment basins and three geotextile silt fences or hay bale barriers. The Zapata plans do not show any temporary sediment basin or traps; instead, Zapata proposes using only silt fences at each discharge point. Those facilities violate the 2002 Guidelines and will not control erosion on the site.

Table 1. Facilities required by CT water quality standards versus facilities provided by BNE.

Discharge Point	Tributary Area (acres)	Disturbed Area (acres)	Facility Required by 2002 Guidelines	Facility Provided
Crane road Station 3+36	3.61	N/A	Sediment trap	Silt fence
Crane road Station 9+73	1.50	N/A	Sediment trap	Silt fence
Crane road Station 14+48	2.84	N/A	Sediment trap	Silt fence
Crane road Station 23+40	1.53	N/A	Sediment trap	Silt fence
Crane road Station 24+90	0.50	N/A	Silt fence	Silt fence
Access road Station 7+50	0.26	N/A	Silt fence	Silt fence
Access road Station 0+00	15.91	5.46	Sediment basin	Silt fence
Access road Station 3+20	6.92	3.08	Sediment basin	Silt fence
Northwest tower area	1.37	N/A	Sediment trap	Silt fence
Northeast tower area	0.93	N/A	Silt fence	Silt fence
South tower area	1.91	N/A	Sediment trap	Silt fence

N/A = Not applicable. The 2002 Erosion Control Guidelines criteria is based on total tributary area only.

In the Stormwater Management Plan submitted as Exhibit H to BNE's petition, Appendix K contains calculations for water quality volume, water quality flow and water quality sediment loading. The Zapata calculations are for the sediment storage only. Based on my studies, sediment storage volume is less than 5 percent of the total storage required in a temporary sediment basin. The larger portion of the volume in a basin is the residence storage volume, which is not included in Zapata's calculations. In providing the calculations, Zapata acknowledges the requirement for sediment controls. However, this requirement is not implemented in the plans.

In addition to having no sedimentation facilities, the plans have no outlet protection. Outlet protection refers to structures placed at the end of culverts, swales, ditches or other conveyance facilities to reduce the velocity of the water and to dissipate energy for the purpose of preventing erosion of the soil downstream of the discharge points. During the construction phase of this project, there will be eight point discharges. There do not appear to be any outlet protection facilities at any of the point discharges. There are no calculations provided in the reports showing compliance with 2002 Guidelines.

Q10. Are some of these discharge areas more troublesome than others?

A10. Yes. Two of the discharge areas are more significant than the others.

The first is the discharge point at the intersection of the proposed entrance road to the site and Flagg Hill Road. The 2002 Guidelines require a sediment basin at that location. BNE has provided a silt fence instead. Section 5-11 of the 2002 Guidelines states that the minimum storage volume for impoundments is 134 cubic yards per acre of drainage area. For drainage areas larger than 5 acres, the volume is adjusted based on engineering studies. Using the design methodology in the 2002 Guidelines, the basin that should have been located at the entrance road and Flagg Hill Road should contain 2394 cubic yards.

Using a 4-foot depth, this basin would have an average surface area measuring of 127 feet by 127 feet. There is not enough room to construct this required basin in the area north of the intersection of the entrance road and Flagg Hill Road. There are only 40 feet from the access road to the property line. A point 127 feet from Flagg Hill Road is 30 feet higher than the road. In order to construct a sedimentation basin in this area, it will require a 30 foot high, 60 foot wide cut into the hillside. Without an appropriately sized basin at this location, the runoff after a big storm would likely wash out Flagg Hill Road. Other temporary sediment traps and basins that are required to be on the site but are not provided for in the plans may also not be able to be constructed due to slope and other constraints, but this area is the most troublesome due to the obvious space constraints and the intersection with a town road.

The lack of outlet protection in this area is also a problem. The area west of Flagg Hill Road has a relativity uniform slope. Prior to construction, rainfall on this area will sheet flow to the road. However, after construction of the access road, the runoff will be channeled into discrete points of discharge. Each of these points will require outlet protection to prevent erosion of the road and its drainage facilities. In addition to the erosion of the road, there will be subsequent sedimentation, which will have an adverse effect on the wetlands and surrounding areas.

Q11. What other discharge area concerns you?

A11. The area surrounding to proposed wetlands crossing is also a problem.

The wetlands crossing is located on the crane road at Stations 23+40 to 24+90, heading out to Turbine 3. Here, the four road side ditches discharge directly into the wetlands. At least one of the four points should have a temporary sediment trap. Level spreaders should be located at all the other discharge points. The areas where the four ditches along the side of the crane road discharge into the wetlands should be protected with level spreaders. There are no design calculations for these facilities to show compliance with 2002 Guidelines design criteria for level spreaders. Compliance with the 2002 Guidelines by installing appropriate facilities in that area will result in additional wetlands impact.

The plans (Sheets C-100, 200, 300) state that the direct wetland impact will not exceed 4915 square feet. That statement is contradicted by the Petition, which states:

> . . . the proposed Project would require permanent direct wetland impacts associated with the construction of a gravel access road over a forested wetland (Wetland 1) totaling 4702 square feet. In addition, approximately 213 square feet of temporary direct impact related to a tree clearing to construct this crossing are necessary. Clearing and grading to construct the Blade Laydown and Assembly Areas associated Turbine One and Three will cause temporary disturbance in proximity to Wetland 1.

(Section VII. K.) Temporary disturbance is direct wetland impact. Clearly, there will be more disturbance than the 4915 square feet shown on the plans, even using BNE's current plans. Modifying the plans to comply with the water quality standards of the state will increase that disturbance area even more.

The crane road crossing of the wetlands is also of concern. BNE's plans show the crossing at a high point in the wetlands. This appears true based on the limited topography provided on the plans. The USGS topography maps of the surrounding area map indicate that the actual drainage divide may be located to the east of the site. This cannot be verified without additional detailed off-site topography or field observation of the off-site property. However, if the drainage divide is located to the east, about 13 acres of land would drain to the wetlands crossing. The runoff from this area will require culverts or other facilities to convey the water under the crossing. Without these facilities, the road will act as a dam, flooding the upstream wetlands. These facilities may increase the amount of disturbance in the wetlands.

Q12. What about the post-construction plans to control erosion on the site?

A12. The above erosion and sediment control measure pertain to the construction period. The General Permit Section 6 (b) (6) C (iii) 1) has "[a] goal of 80 percent removal of total sentiment load from the stormwater discharge shall be used in designing and installing stormwater management measures." This goal is applicable to post-construction stormwater management. In order to meet this goal, the criteria of the 2004 Manual should be followed, but that criteria have not been implemented by BNE.

The 2004 Manual Section 7.4.1 provides that "the water quality volume (WQV) is the amount of stormwater runoff from a given storm that should be captured and treated in order to remove the majority of stormwater pollutants on average annual basis." This criterion is applicable to "[a]ny development resulting in disturbance of greater than or equal to one acre of land." According to Section 7.5.1, "[t]he groundwater recharge criterion is intended to maintain pre-development annual groundwater recharge volumes by capturing and infiltrating stormwater runoff." This section provides an equation for the calculation of the Groundwater Recharge Volume (GRV). In Appendix K to BNE's Stormwater Management Plan, the WQV and the GRV are calculated. (See Petition No. 983, Ex. G, pages K-1 to K-4.) However, there is no implementation of these criteria on the plans or other places in BNE's submission.

The plans also violate several provisions of the General Permit. Section 6 (b) (6) C (I) 2), Structural Practices, provides that "All sediment traps or basins shall provide a minimum of 134 cubic yards of water storage per acre drained and shall be maintained until final stabilization of the contributing area." Section 6 (b) (6) C (iii) 2) provides that "Velocity dissipation devices shall be placed at discharge locations and along the length of any outfall channel as necessary to provide a non-erosive velocity flow . . ." The plans do not comply with these requirements.

Q13. What is your overall control about the lack of sediment facilities and outlet protection facilities?

A13. Overall, the lack of such facilities violates the 2002 Guidelines, the General Permit and the 2004 Manual. As currently proposed, erosion will occur during construction, resulting in deposits of sediment into the wetlands.

Q14. Do you have other concerns regarding the plans?

A14. Yes. Slope stability is another major concern. The Zapata plans used 1 foot horizontal to 1 foot vertical, or 1:1, slopes extensively throughout the plans for the proposed project. I have never seen 1:1 slopes used this extensively in any proposed development without being accompanied by slope protection, such as riprap, geotextile materials, retaining walls, or gabion walls to provide the required slope stability. Good engineering practice is to use slopes of 2:1 or shallower. Applying 2:1 slopes to the proposed project would significantly expand the amount of land that would be disturbed and possibly extend the grading into wetlands or adjoining property. The additional disturbance and earthwork also have serious implications for the rate and volume of runoff and erosion into wetlands on the property and onto neighboring properties.

Q15. Please describe in greater detail your findings regarding slope stability.

A15. As I stated above, good engineering practice is to use slopes of 2:1 or shallower. That practice is included in the 2002 Guidelines, which states:

> Where a slope is to be vegetated and mowed, the slope shall not be steeper than 3:1; flatter slopes are preferred because of safety factors related to the operation of equipment.
>
> Where a slope is to be vegetated but not mowed, the slope shall not be steeper than 2:1.

Instead of complying with the Guidelines, these plans make extensive use of slopes of 1:1, for both cut and fill situations. These slopes are used on the side of the road, for the graded areas for blade assembly and tower assembly and they are used for the side slopes of the roadside ditches. None of the slopes show any slope protection such as riprap or geotextile materials. The slopes will not be stable and do not conform to good engineering practice. The Soil Survey lists the soils on this site as having a moderate to very severe erosion hazard.

The Guidelines also require "engineered structural design features" to be incorporated in the design.

> For slopes steeper than 2:1, or when slopes are steeper than 3:1 and the change in elevation exceeds 15 feet without a cross slope bench . . .

Using the good engineering practice of 2:1 slopes would have many ramifications here. If the good engineering practice of using 2:1 or shallower slopes was followed by BNE, the width of the area required for the road cross-section would be significantly expanded. For example, the access road section at Station 9+00 will be expanded from the 50-foot width shown on the plans to about 85 feet. The disturbance would be increased by 70 percent.

The expansion of disturbance area would increase removal of the native vegetation. The peak rate of runoff would also increase because there would be a greater conversion of woods to meadows, so the rates and volume of runoff discharged onto the adjoining properties would increase. Also, there would be increased erosion due to the increased rates of runoff. This eroded sediment would be deposited in wetlands and watercourses. BNE's plans fail to conform to good engineering practice and to the 2002 Guidelines.

Q16. What is good engineering practice with regard to slope stability?

A16. In order to show compliance with Connecticut water quality standards and requirements, the normal engineering procedure is to grade the roads and other features to a stable condition. The 2002 Guidelines mandate that procedure, and further state:

> Exceptions: Slope limitations may be increased <u>providing detailed soil mechanics analysis calculations are performed which confirm an acceptable safety factors for the finished slope</u>.

(Chapter 5-2, Land Grading (emphasis added).) Therefore, under good engineering practices and under the requirements of the 2002 Guidelines, using steeper slopes should be considered as an alternative option only if subsequent in situ geotechnical testing shows that steeper slopes are possible. Unless and until in situ testing proves that steeper slopes are possible, the plans presented by BNE should be an alternative, not the proposed design.

On Sheet C-200 of the plans is a note stating "Maximum graded slopes are 2:1. When steeper slopes must be used plans must be sealed by a geotechnical engineer for slope stability and final surface stability." Zapata acknowledges that 2:1 slopes are the accepted engineering standard. However, they have not followed their own criteria, have not the provided additional testing nor have the plans been appropriately sealed.

If BNE has conducted any such detailed geotechnical analysis, it has not reported the results. Therefore, the only soil data available is the Soil Survey, which reports that soils in the area of the Site have a moderate to very severe erosion hazard. Stabilizing all of the 1:1 slopes proposed by BNE will require more than temporary seeding and erosion control blankets; stabilization will most likely require riprap slopes, retaining walls, gabions or any of the measures suggested in the 2002 Guidelines stabilization structures matrix. Without conducting a detailed geotechnical analysis and including stabilization structures in its plans now, BNE cannot prove that its plans meet the state's water quality standards.

Q17. What other engineering errors did you find in BNE's submission?

A17. The other engineering errors I found in my review of BNE's petition and associated reports and plans can be grouped into several categories: structural fabrication, road section, water quality swale, hydrology, water quality and stormwater quantity.

Q18. What engineering errors did you find with regard to structural fabrication?

A18. The petition states that the rotor blades are 40.3 meters (132 feet) in length. (Section III.B.1.) BNE is requesting that the rotor be approved up to 50 meters (164 feet). The blade assembly areas shown on the plans (Sheets C-101, 102 and 103) have a length from the centroid of the triangle to the furthest end of the leg of approximately 132 feet or 40.3 meters. It appears that the layout area shown on the plans is not large enough to accommodate the 40.3 meter blades and allow room for equipment to maneuver. The laydown area will not allow the assembly of the 50 meter blades. It would need to be extended 34 feet in all directions just to accommodate the blades. Presumably, another 10 feet would be necessary for equipment. The extension of 44 feet in all directions would significantly increase the disturbed areas. In the case of the northwest tower, the grading around the blade assembly area may extend into the wetlands area.

On Sheet C-102 of the BNE plans, Note 2 states "Blade assembly area shall not have flatness deviation of more than six inches over the length of blades." In the northwest tower area, two legs of the blade assembly area are level at elevation 1443. The third leg (southerly leg) has a 5:1 slope near the end.

In the northeast tower area, two legs of the blade assembly area are level at elevation 1449. However, the third leg (northerly leg) has a 1:1 slope near the center. The leg drops from elevation 1449 to 1430 in a distance of 20 feet. It continues to drop to elevation 1420 at the end of the leg area. Therefore, the ground at the tip of the blade will be 29 feet below the rotor of the blade. A significant amount of fill will be necessary to make the blade assembly area meet the flatness standard. This fill would need to be expanded about 60 feet.

In the southerly tower area, two legs of the blade assembly area are level at elevation 1450. However, the third leg (southerly leg) has a 2:1 slope near the center. The leg drops from elevation 1440 to 1430 in a distance of 20 feet. It continues to drop to elevation 1415 at the end of the leg area. Therefore, the ground at the tip of the blade will be 35 feet below the rotor of the blade. A significant amount of fill will be necessary to make the blade assembly area meet the flatness standard. This fill would need to be expanded about 70 feet. This fill will significantly impact the wetlands, which are located less than 30 feet away from the blade assembly area as shown on Sheet C-300. The extension of the fill in combination with the extension of the blade length will place the fill in the wetland area.

Q19. What engineering errors did you find with regard to the road section?

A19. Sheet C-503 shows the road cross section. There is only one road section. The section does not describe what happens with the roadside ditches when the road is in a fill section. The grading on the Plan and Profile sheets does not have a roadside ditch as show in the details. The section uses 1:1 side slope on cut and fill slopes. This is not stable, as discussed above, and will lead to erosion and potential slope failure.

The roadside ditch is shown on the plans as having 1:1 slopes. The velocity in the channels with a slope of 12 percent will be more than 7 feet per second. An analysis has not been performed to show that the shear forces on the bottom and sides of the ditch are within the acceptable limits of stability. These analyses must be in compliance with the CT DOT 2000 Drainage Manual.

The road section calls for a wearing surface of "24 inches of compacted #57 stone." The road surface does not conform to CT DOT, Form 816, "Standard Specifications for Roads, Bridges and Incidental Construction," 2004, Section M.02.03. Form 816 call for the use of Rolled Bank Gravel or Traffic Bound Gravel for travel surfaces.

BNE's plans fail to comply with the requirements of CT DOT's Form 816 and CT DOT's 2000 Drainage Manual.

Q20. What engineering errors did you find with regard to the water quality swale?

A20. Section 2.3.1 of BNE's Stormwater Management Plan states "The diversion swale constructed as part of the Erosion and Sediment Control Plan will remain in place and will be converted to a water quality swale." (Petition No. 983, Ex. G, page 2-1.) The water quality swales are shown on the plans paralleling the road. The swales shown are actually triangular-shaped ditches with side slopes of 1:1 on one side and 8:1 on the other side. The longitudinal slope of the swales is the same as the road, ranging up to 12.5 percent. The post construction grading plans do not show any channel protection or any check dams. The gravel along the channel bottom and the stone check dams shown on the erosion control plans have been removed. The area is shown as part of the restoration area that calls for grass seeding.

The 2004 Manual has the following design criteria for dry water quality swales:

1) Trapezoidal shape with a bottom width of 4 foot minimum recommended for maintenance, an 8-foot maximum, widths up to 16 feet are allowable if a dividing berm or structure is used

2) The side slopes are a 3(h):1(v) maximum; 4:1 or flatter recommended for maintenance

3) The longitudinal slope is 1% to 2% without check dams, up to 5% with check dams

4) The size of the swale shall have the length, width, depth, and slope needed to provide surface storage for the WQV

5) The underlying soil bed shall be 30 inches deep with gravel/pipe underdrain system

6) The swale will safely convey the 2-year storm with non-erosive velocity

The proposed roadside ditch converted to a water quality swale meets none of these criteria. It will not function as a water quality swale providing the water quality benefits required by the 2004 Manual.

BNE's plans fail to conform to the CT DEP's 2004 Manual. Compliance with the Manual ensures compliance with a whole host of state statutes and associated regulations regarding water quality.

Q21. What engineering errors did you find with regard to hydrology?

A21. Without the flow diagram, which is a standard part of the HydroCad computer program output data, it is hard to follow the analysis. Page 2-7 of the Stormwater Management Plan says "Hydrograph routing – See Appendix K." There is no routing diagram in Appendix K. The Plan is therefore incomplete.

Section 2.3.2 of BNE's Stormwater Management Plan makes the following statement:

> Construction within the project area is such that flooding caused by an increase in impervious area or the reconfiguration of stormwater conveyance through the drainage area is not a primary concern. The total increase in impervious area is approximately one percent. Permanent stormwater conveyance structures such as storm drains, catch basin, and the like are not planned for this development. Upon completion of the construction of the three towers, the site will be returned to pre-construction conditions.

(Petition No. 983, Ex. G, page 2-2.) These statements are not true. Impervious area is not the only cause for increase in the rate and volume of runoff. The conversion of the land from a wooded site to gravel roads and meadow will increase the runoff coefficient of the land.

As stated in Section 1.7.3 of BNE's Stormwater Management Plan, ". . . runoff migrates, typically via overland sheet flow . . ." The project proposes the use of roadside ditches in order to convey the water to discharge points, which will have the same effect as a pipe except that the ditch is subject to erosion. The ditch will concentrate the flow and greatly decrease the Time of Concentration of the runoff, which will increase the peak rate of runoff.

Furthermore, BNE does not propose to return the site to pre construction conditions. Sheets C-314 through C-318 show the Upland Meadow and Wetland Restoration Plan. The plan calls for the site to be seeded with a conservation/wildlife seed mix. Petition 983, Section VII. J. page 30 states "A Wildlife/Conservation seed mix containing native grasses and forbs will be used to stabilize expose areas post-construction." The restoration/creation plan does not call for any trees or shrubs to be planted in the disturbed area. This plan would not come close to recreating the second growth and upland hardwood forest in the pre construction conditions. The site would have a higher peak rate of runoff.

BNE's plans fail to conform to the 2004 Manual.

Q22. What engineering errors did you find with regard to stormwater quantity?

A22. The Flood Control and Peak Runoff Attenuation Management Practices study contained in BNE's Stormwater Management Plan does not accurately represent the site. The configuration of the drainage areas does not conform to the drainage patterns of the site nor do they allow the analysis of the discharge points. Due to these inadequacies, it is impossible to determine the increase in peak runoff reaching the wetlands or neighboring properties. The Plan is therefore incomplete.

There are three deficiencies in the preparation of the study. These are the CN values used to represent the site, the calculation of the Time of Concentration (Tc) and calculation of the pre- and post-development drainage areas.

Section 1.7.4 of BNE's Stormwater Management Plan makes the following statement:

> The property is generally characterized by second growth and upland hardwood forest. Forested uplands in the eastern portion of the Property are dominated by deciduous pole timber (trees 4.0 to 11.9 inches diameter at breast height [DBH]) and small sawtimber size trees (12 to 15 inches DBH). In the northwest and southwest corners of the property, vegetation is characterized as red oak-northern hardwood forest.

However, in the hydrologic analysis, the land use is classified as brush, weed, grass mix or woods/grass combination. These land use classification do not match BNE's own description of the site, nor do they match the actual conditions present on the site.

The drainage analysis uses runoff Coefficient Numbers (CN) of 65 or 67 for the existing condition. That CN is to be applied to a wood/grass combination on Hydrologic Soils Group B soils in Fair condition or brush on Hydrologic Soils Group B soils in Poor condition. However, the Stormwater Management Plan describes the site as wood in Good condition. That description indicates that BNE should have used a CN value of 55 on Hydrologic Soils Group B soils. Instead, Zapata uses a wood/grass combination value to represent the majority of the site.

Using the actual values for woods, the runoff in a 2-year storm under existing conditions is 1.86 cfs. The drainage analysis value is 10.2 cfs. Using an inappropriate CN value for the site, as was done here by Zapata and BNE, overstates the peak runoff in the existing condition, thereby reducing the percent increase in the proposed condition. Using the appropriate CN number would show that the actual increase in the peak rate of runoff is much higher and the potential for adverse impacts are much greater.

The Zapata report uses the lag/CN methodology to calculate Tc. Using this methodology results in a Tc for Drainage Area 6 of 15.2 minutes for the existing condition. For the proposed condition the Tc is 14.8 minutes, a relatively small change. Using this methodology is misleading because it does not take into account the change in land use in critical portions of the drainage area. The methodology takes advantage of the fact that a large portion of the site is not being modified. However, in Drainage Area 6, the land use in the area where the time of concentration is calculated is being changed significantly.

An alternate methodology is to use sheet flow-shallow concentrated flow values. This methodology is more appropriate for the circumstances of this site and it yields a vastly different result. Using the methodology based on sheet flow and shallow concentrated flow through a wooded area, the Tc is 73.3 minutes for the existing condition. For the Tc in the proposed condition, this methodology uses sheet flow across woods for the first 100 feet, shallow concentrated flow across gravel road areas for the next 320 feet and then shallow concentrated flow for the remaining 300 feet. The Tc for the proposed condition is reduced to 34.7 minutes. This methodology better represents the flow conditions that will occur according to BNE's submitted plans. The peak rate of flow in a 2-year storm will increase by 69 percent, not the 11 percent increase from Zapata's report. The higher peak rate of runoff should be used to design the soil erosion control facilities. Using the underestimated amount will result in undersized facilities, which will in turn result in erosion and subsequent sedimentation in the wetlands and watercourses. This analysis is summarized in the table below.

Table 2. Comparison of proposed versus existing condition calculations.

Coefficient number	Methodology	Tc existing condition	Tc proposed condition	Increase in peak rate of flow in 2-year storm
65 or 67	lag/CN	15.2 minutes	14.8 minutes	11%
55	sheet flow-shallow concentrated flow	73.3 minutes	34.7 minutes	69%

Another deficiency in the plans is the drainage analysis, which divided the site into nine drainage areas. The boundaries are apparently based on the pre-development conditions. The construction of the roads and other grading will modify these drainage patterns. However, the areas used for the post-development condition are the same as the pre-development conditions. For example, runoff from Drainage Area 1 currently flows northeasterly toward Flagg Hill Road. The crane road from Station 16+10 to about 18+60 will intercept that runoff and redirect it to the wetlands located to the west. The area of the subcatchment cannot be the same pre- and post-development. In this case, the watershed boundaries have been changed. Similarly, a large portion of Drainage Area 2 that currently sheet flows toward Flagg Hill Road will collect in the access road ditch and the runoff will be a point discharge at the road.

The petition states that "the Project will disturb 11.34 acres." (Section IX.A.) However, Appendix K of the Stormwater Management Plan shows that only 2.08 acres of disturbed areas were used to compute the post-development runoff. The other areas in the post-development condition have the same CN values as the pre development. Apparently, only the proposed roads and gravel areas were considered in the calculation. By Zapata's estimate, there another 9.26 acres of land that are presently wooded and will become grass areas. As stated above, I believe that estimate is low because the disturbed area will increase significantly when the proper 2:1 slopes are used. The CN value for woods is 55. The CN value for grassland or range in fair condition is 69. (As a point of reference, gravel roads have a CN value of 85.)

The petition states that "BNE will employ a storm water management plan that will result in no net increase in runoff to any surrounding properties." (Section VII. K.) However, the Stormwater Management Plan does not show that result. Section 2.3.2 and the Appendix K report the following increases.

Table 3. Summary of peak flows as reported in the Stormwater Management Plan (in cfs).

Drainage Area	Pre Development Conditions		Post Development Conditions	
	Q2	Q10	Q2	Q10
1	10.20	28.39	11.24	30.05
2	4.21	12.94	4.65	13.68
3	4.25	12.86	4.73	13.64
4	3.88	11.71	3.88	11.71
5	3.65	11.06	4.07	11.75
6	3.39	10.24	3.76	10.97
7	25.71	39.27	25.71	39.27
8	2.72	8.20	2.72	8.20
9	1.97	5.97	2.19	6.40
Out of pond	2.33	8.54	2.41	8.74

Drainage Areas 4, 7 and 8 are not changed by the proposed project, but Zapata's report shows an increase for every other drainage area. The increases are in 10 to 12 percent range during 2-year storms. When the above-noted deficiencies are corrected, the increases in the runoff calculated by Zapata will be significantly larger. This increase will contribute to increase erosion and sedimentation. In the case of Flagg Hill Road, the increase and concentration of runoff could cause damage to the road.

According to the 2004 Manual:

> The stream channel protection criterion is intended to protect stream channels from erosion and associative sedimentation and downstream receiving orders 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 two-year storm, which controls the form of the stream channel), damaging effects to channel from increased runoff due to urbanization can be reduced.

(Section 7.4.) The stream channel protection criterion is:

> Control the 2-year, 24-hour post-development peak flow rate to 50 percent of the two-year, 24-hour predevelopment level or
>
> Control the 2-year, 24-hour post-development peak rate of flow to the 1-year, 24-hour predevelopment level.

(Section 7.6.) Setting aside the fact that the post development peak rates of flow are under reported, the values in the report show an increase in the runoff for all storms. This does not meet the standards of the 2004 Manual, which requires that the peak rates of runoff during a 2-year storm decrease.

Q23. Did you find other errors in BNE's submission?

A23. Yes, I found some omissions and another error.

Q24. What information or data was omitted from BNE's submission?

A24. I found several omissions in my review of BNE's petition.

First, on page 8 of the petition, BNE states that the ancillary building will be used for office space and for education and tours. The building will have restroom facilities and the wastewater will need to be disposed in an on-site septic system designed in accordance with applicable standards. However, there is no information regarding the design flows for the intended uses. Therefore, I do not know if the standards referred to are the Connecticut Public Health Code Section 19-13-B103 or Section 19-13-B104. That omission violates the Public Health Code and authorizing statutes.

BNE does not provide any deep test information, percolation data or permeability data for the area in which the septic system will likely be installed. Therefore, it is impossible to know if the receiving soils are available to safely dispose of the wastes without polluting the waters of the State of Connecticut.

The ancillary building is shown on Post Construction Grading Plan, Sheet C-310 with no means of access. The building is on the north side of the crane road 10 feet above the road. The area between the road and the building has a slope of 2 feet horizontally to 1 foot vertically (2:1). The result is that there is no access to the building.

Also, there is no parking area for either the employees who will use the ancillary building or the buses bringing people for education and tours. Nor is there grading showing how the area will be able to accommodate the ancillary building or the associated parking facilities. Without information on the grading and location of the access, it is impossible to determine if the site can accommodate the building and its septic system.

Another omission is the cross country electric line is not show on the grading plan. This line will require additional tree clearing. Presumably, the conversion from woods to grass land was not included in the calculation of runoff.

Q25. What additional error is in the BNE's submission?

A25. The Zapata plans make extensive use of a drainage ditch paralleling the roads. From the grading plans and erosion control plans, these ditches are approximately 1 foot deep with 1:1 side slopes. The erosion control plans show culverts under the road to carry runoff from one side of the road to the other. The runoff is picked up on the other side of the road by another ditch or it becomes a discharge point. These culverts are not show on the road plan and profile sheets nor on the post construction grading plans. It is not known if these culverts are temporary facilities for construction or if they are part of the final stabilization plan. Without these cross culverts, the road side ditches will over flow and there will be numerous new discharge points without outlet protection.

The culverts will have to have at least 2 feet of cover in order to carry the large cranes that will be necessary to erect the towers and blade assemblies. The culverts may be 15-inch pipes (standard minimum road drainage pipes). The bottoms of the pipes will have to be 3 and a half feet below the road. This will not work with a 1 foot ditch. A ditch 3 and a half foot deep with 2:1 side slopes and a two-foot bottom width will have a top width of about 16 feet. The plans call for a top width of 4 feet. Properly sized road side ditches will increase the amount of land disturbance. This in turn will increase the rate of runoff and erosion.

Q26. What are your conclusions regarding BNE's proposed project?

A26. BNE's plans fail to conform with Connecticut water quality standards. The plans do not contain any sediment impoundment. As a minimum, the 2002 Guidelines requires the installation of six temporary sediment traps and two temporary sediment basins. Zapata's calculations and plans do not follow good engineering practice, which may result in unstable slopes, excessive erosion and inadequate sediment control. The methodologies seem to inaccurately minimize the impact that BNE's project will have on the site. BNE's project will dramatically change the character of the site, and those changes will have significant impacts on the rate of flow of runoff from the site, which in turn has significant implications for the likely rate of erosion on the site. As currently designed, this project will, within a reasonable degree of engineering certainty, lead to pollution of the waters of the state. This stormwater management plan does not meet Connecticut's water quality standards, as reflected in the 2004 Stormwater Quality Manual, the 2002 Connecticut Guidelines for Soil Erosion and Sediment Control, the General Permit, CT DOT Form 816, CT DOT 2000 Drainage Manual and the Public Health Code.

The statements above are true and accurate to the best of my knowledge.

March 15, 2011
Date

William F. Carboni
William F. Carboni, P.E., No. 22722

ATTACHMENT

Exhibit 1 CV of William F. Carboni

EXHIBIT 1

WILLIAM F. CARBONI, P.E.

1984 - Present: Spath-Bjorklund Associates; Monroe, CT

Mr. Carboni supervises the engineering section and has been responsible for the preparation of grading, street, utility and sewage disposal plans for single family, condominium, commercial and office projects. Sewage disposal systems have included municipal sewer extensions and septic systems meeting both local and State D.E.P. regulations. Many of the systems have required the design of sewage pump stations. He has prepared engineering reports detailing hydrologic and hydraulic computations, design of storm water treatment and detention, drainage system calculations and other engineering aspects of land development. Other assignments include soils testing, ground water monitoring and utilization of computer aided design for predicting groundwater flow patterns.

1980 - 1984: Consulting Engineering; Sacramento, CA

As a consulting engineer, prepared evaluations of a variety of engineering projects. Projects have included the cost evaluation of improvements to a regional transportation system, the engineering and environmental evaluations of the potential effects of industrial parks, planned residential developments, and the conversion of agricultural land. The studies were coordinated with State and local agencies to insure compliance with all engineering and environmental regulations.

1977 - 1980: The Spink Corporation; Sacramento, CA

As an Associate with the Spink Corporation, prepared the overall water system design for two major residential developments (population exceeding 10,000 persons), designed an expansion of a sewage treatment plant. He headed a design section and supervised the preparation of engineering plans. The plans included all engineering facilities required for the construction of residential, commercial and industrial developments. As head of the Environmental Section of the firm, was responsible for the preparation of environmental studies and their representation at public hearings.

1972 - 1977: Albert A. Webb Associates; Riverside, CA

Assignments included the preparation of master water supply and waste water disposal plans; estimations of existing and projected future populations, land use and agricultural activities and estimated their resultant water demand and/or waste water generation; assisted in the formulation of alternative means of improving water supply and its quality; and prepared economic analyses of these plans.

As head of the environmental analysis group of the company, assignments included preparation of environmental studies for private and public projects, preparation of specialized environmental investigations and preparation of studies of noise pollution resulting from various transportation sources.

1970 - 1972: California Division of Highways (Caltrans); Los Angeles, Ca

Assignments included the preparation of preliminary freeway designs; evaluation of the socio-economic impacts of alternate freeway locations; assessment of housing relocation needs and employment displacement; incorporation of freeways into city plans; meetings with citizens' advisory committees.

1967 - 1970: California Department of Water Resources; Los Angeles, CA

Assignments included the evaluation of local surface and imported water projects, geologic and hydrologic ground water resources, waste water reclamation, ground water utilization, potential surface water projects, desalinization of sea water, and weather modification. Assignments also included projection of population and agricultural land use, analysis of agricultural and urban unit water use, design of system for conjunctive use of surface water reservoirs, ground water and imported water and present worth analysis of cost of projects.

1966 Summer: Boston Redevelopment Authority; Boston, MA

As a student intern, conducted traffic surveys and compiled data for a traffic flow map of the city; and conducted a pedestrian survey and origin-destination studies.

Academic Background

Earned a Bachelor of Science Degree in Civil Engineering at Worcester Polytechnic Institute; Worcester, MA, in June 1967.

Professional Registration
Professional Engineer - Connecticut No. 22722, 2001
Professional Engineer - California No. 26890, 1976

CERTIFICATION

I hereby certify that a copy of the foregoing document was delivered by first-class mail and e-mail to the following service list on the 15th day of March, 2011:

Carrie L. Larson
Paul Corey
Jeffery and Mary Stauffer
Thomas D. McKeon
David M. Cusick
Richard T. Roznoy
David R. Lawrence and Jeannie Lemelin
Walter Zima and Brandy L. Grant
Eva Villanova

and sent via e-mail only to:

John R. Morissette
Christopher R. Bernard
Joaquina Borges King

Emily Gianquinto