

**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

May 20, 2011

PROPOSED FINDINGS OF FACT
BY FAIRWINDCT, INC., STELLA AND MICHAEL SOMERS AND SUSAN WAGNER

Pursuant to the Council’s invitation to the parties and intervenors to submit briefs and findings of fact by May 20, 2011, FairwindCT, Inc., Stella and Michael Somers and Susan Wagner hereby submit these proposed findings of fact regarding the petition for declaratory ruling filed by BNE Energy Inc. on December 6, 2011.

I. Introduction

1. BNE Energy Inc. (“BNE”) filed a petition for a declaratory ruling that no certificate of environmental compatibility of public need is required for the proposed construction, maintenance, and operation of a 4.8 megawatt wind renewal generating project on Flagg Hill Road in Colebrook that was received by the Council on December 6, 2010. The proposed project is known as Wind Colebrook South. (Petition, page 1.)
2. BNE is a Delaware corporation headquartered at 29 South Main Street, Suite 200, West Hartford, Connecticut. The petition states that BNE was founded in 2006, though the Secretary of State’s records indicate that BNE was incorporated in 2007. According to the petition, BNE was founded 2006 for the purpose of constructing and operating commercial wind generation projects in Connecticut, New England and beyond. (Petition, page 2.) BNE has not yet constructed or operated a wind generation project, commercial or otherwise.
3. BNE claims that its proposed project is eligible for approval by declaratory ruling because it is a grid-side distributed resources facility under 65 MW that complies with the air and water quality standards of the Connecticut Department of Environmental Protection (“DEP”). (Petition, page 1.) BNE also claims that its proposed project will not have a substantial adverse environmental effect. (Petition, page 2.)

4. The parties to this proceedings include the petitioner, the Town of Colebrook, FairwindCT, Inc. ("FairwindCT"), Stella and Michael Somers, Susan Wagner, Robin Hirtle, Kristin and Benjamin Mow, Eva Villanova, David Lawrence and Jeannie Lemelin and Walter Zima and Brandy Grant. The Connecticut Light and Power Company is an intervenor.
5. Although not required to do so by statute, the Council chose to hold public hearings on this proceeding. Public notice of the hearings was published in the Hartford Courant on February 11, 2011. (3/22/11 Tr. 6:20-22.)
6. The public hearings were held on March 22 and 23, 2011 at the Northwestern Regional 7 High School, Battistoni Drive, Winsted, Connecticut. The public hearings began at 6:30 p.m. and continued until 8:30 p.m. and 8:40 p.m., respectively. (3/22/11 Tr. 79:14-15; 3/23/11 Tr. 82:12.)
7. The Council and its staff conducted a field review of the proposed site on March 22, 2011, beginning at 2 p.m. The petitioner did not fly a balloon at the site. (3/22/11 Tr. 30:10-12.) The proposed turbine locations were marked with signs at ground level.
8. The evidentiary hearing on Petition No. 983 began on March 23, 2011 at 3 p.m. at the Northwestern Regional 7 High School, Battistoni Drive, Winsted, Connecticut. The evidentiary hearing was continued on April 14, April 21 and April 26 at the office of the Connecticut Siting Council, 10 Franklin Square, New Britain, Connecticut. (3/23/11 Tr. 82:2-5; 4/14/11 Tr. 3:13-23, 229:7-9; 4/21/11 Tr. 3:19-4:5; 4/26/11 Tr. 3:20-4:7.)
9. Although the petitioner claims it was not legally required to provide notice of its filing, BNE published a legal notice of its intent to file the petition with the Council in the Litchfield County Times on or about December 3, 2010. (Petition page 33 & Ex. D; BNE Responses to Council's First Set of Interrogatories, dated Feb. 23, 2011, Answer 2 & Ex. 2; 3/22/11 Tr. 6:18-20.)
10. Although the petitioner claims it was not legally required to provide notice of its filing, BNE sent notice of its intent to file the petition with the Council by certified mailing on or about November 28, 2010 to abutting property owners of record listed in its petition. BNE received return receipts from all but one property owner, Nature Conservancy of Connecticut, Inc. A second notice was sent to Nature Conservancy of Connecticut, Inc. via regular mail. (BNE Responses to Council's First Set of Interrogatories, dated Feb. 23, 2011, Answer 1 & Ex. 1; 4/14/11 Tr. 33:3-11.)
11. Although the petitioner claims it was not legally required to provide notice of its filing, BNE also sent copies of its petition to the state and local officials listed in its petition by Federal Express on December 6, 2010. (Petition page 32 & Ex. E.)

12. BNE posted a sign giving public notice of its pending petition at 17 Flagg Hill Road, the proposed entrance to the site. The sign included the date of the scheduled public hearings and field review and contact information for the Council. (3/22/11 Tr. 31:5-12.)

II. State Agency Comment

13. On February 7, 2011 and again on April 27, 2011, the Council solicited comments on BNE's petition from the following state agencies: Department of Agriculture, Department of Environmental Protection ("DEP"), Department of Public Health ("DPH"), Council on Environmental Quality, Department of Public Utility Control ("DPUC"), Office of Policy and Management, Department of Economic and Community Development, Department of Transportation ("DOT") and Department of Emergency Management and Homeland Security. (Council Hearing Package, dated Feb. 7, 2011; Council Letters to State Agency Department Heads, dated Apr. 27, 2011.)
14. On March 23, 2011, a DOT representative answered on behalf of that agency, indicating that DOT had no comments on the petition. (DOT Letter, dated Mar. 23, 2011.)
15. On April 6, 2011, a DEP representative responded on behalf of that agency. DEP expressed concerns regarding the timing and duration of BNE's breeding bird surveys, which took place in June and July, and which were conducted in only five-minute intervals. DEP also demonstrated concern over BNE's acoustic bat studies and further noted that "[i]t is not possible to provide accurate conclusions on the acoustic bat survey without the final report and additional survey data that spans the migratory period." No survey data that spans the migratory period has been submitted. (DEP Letter, dated Apr. 6, 2011.) Additional information related to DEP comments is provided in the findings regarding Environmental Impact.

III. Municipal and Other Consultation

16. On December 8, 2010, the Council notified the Towns of Colebrook and Norfolk of the petition. On December 13, 2010, the Council notified the Town of Winchester of the petition. (Council Letters, dated Dec. 8 and 13, 2010.)
17. On December 16, 2010, the Colebrook Planning and Zoning Commission ("PZC") submitted a letter opposing the project to the Council, noting that the petition "presents not only several potential violations of the town's zoning regulations, but also contradicts both the spirit and intent of the state-mandated Town Plan of Conservation and Development, as approved in 2006." The PZC requested local hearings on the petition and further requested that the Council adopt a moratorium on the siting of the turbines subject to the petition pending the adoption of appropriate regulations. (PZC Letter, dated Dec. 16, 2010.) The PZC letter was forwarded by the Council to all parties and intervenors on the service list. (Council Letter regarding PZC Comments, dated Dec. 20, 2010.)

18. By letter dated December 16, 2010, the Colebrook Board of Selectmen asked the Council to conduct a local hearing on the petition prior to rendering a decision. (Board of Selectmen Letter, dated Dec. 16, 2010.) The letter was forwarded by the Council to all parties and intervenors on the service list. (Council Letter regarding Board of Selectmen Comments, dated Dec. 20, 2010.)
19. Thomas D. McKeon, First Selectman of the Town of Colebrook, subsequently testified regarding the Town's concerns if the petition were to be granted, including, among others, issues related to decommissioning the proposed turbines when and if necessary, necessary upgrades and repairs to local roads, the potential that the project would become tax exempt, the need for BNE to be responsive to concerns of neighbors if the project is built, and the additional expenses the town may incur in reviewing site plans and environmental issues if the project is approved (4/21/11 Tr. 24:18-25:7 (McKeon).)
20. During the hearing, BNE stated that it would enter into a Host Community Agreement with the town to address many of those concerns. No agreement has been reached, though Mr. Corey did make certain commitments on behalf of BNE while sworn as a witness in this proceeding. (4/26/11 Tr. 105:19-123:18 (Corey).)
21. On December 20, 2010, the Colebrook Conservation Commission submitted a letter to the Council expressing its opposition to the project based on concerns that issues related to effects on environmental and historic resources had not been adequately addressed by the petition. The Commission urged the Council to hold a public hearing on the petition and to impose a moratorium on the project pending adoption of applicable regulations. (Conservation Commission Letter, dated Dec. 20, 2010.) The letter was forwarded by the Council to all parties and intervenors on the service list. (Council Letter regarding Board of Selectmen Comments, dated Dec. 29, 2010.)
22. On March 8, 2011, Congressman John B. Larson wrote a letter to the Council expressing his opposition to the proposed project. Congressman Larson noted the fact that Connecticut consistently ranks poorly with respect to wind power capacity and the possible adverse effects on Colebrook and its residents, ultimately concluding that "the proposed construction of wind turbines in Colebrook seems to unjustly impact the community for the potential of energy generation." (Congressman Larson Letter, dated Mar. 8, 2011.)
23. On January 11, 2011, Senators Joan Hartley and Kevin Witkos, and Representatives Vickie Nardello and John Rigby, state legislators from Prospect and Colebrook, wrote a letter to the Council urging the Council to decline to consider the proposed project and to initiate regulation-making proceedings that would allow for data collection and which would ensure that public safety and environmental concerns related to the project were adequately addressed. (Legislators Letter, dated Jan. 11, 2011.)

IV. Other Permits

24. If this project is approved, BNE plans to file with DEP a General Permit for the Discharge of Stormwater and Dewatering Wastewaters Associated with Construction Activities. (Petition, page 31.)
25. Two of FairwindCT's witnesses, Michael Klein and William Carboni, testified that BNE's plans do not conform to the requirements of the General Permit. (Klein Pre-Filed Testimony, pages 8-9; Carboni Pre-Filed Testimony, pages 3, 7-9.)
26. After the close of the evidentiary hearing in this matter, the U.S. Department of the Army Corps of Engineers informed BNE that based on the Corps' review, at a minimum the site will need to be evaluated under Category 2 of the General Permit. (FairwindCT, Inc.'s Late-Filed Request for Administrative Notice, dated May 16, 2011 (pending).)
27. BNE does not have a Department of the Army permit, and the Corps of Engineers has determined that one is required. (FairwindCT, Inc.'s Late-Filed Request for Administrative Notice, dated May 16, 2011 (pending).)
28. BNE has from the Federal Aviation Administration a December 2009 Determination of No Hazard to Air Navigation for one turbine with a 100-meter hub and 100-meter blades on the site. (Petition, page 32 & Ex. C.)
29. On October 24, 2010, BNE filed for a Determination from the FAA for all three proposed turbines. (Petition, page 32.)
30. BNE stated in response to interrogatories that it has received a Determination for all three turbines, but the three letters provided in response to those interrogatories all refer to Wind Colebrook North Turbine 3. (BNE Responses to FairwindCT's First Set of Interrogatories, Answer 47 & Ex. 2.) BNE has not provided copies of Determination letters for the three turbines at Colebrook South.
31. The FAA's initial Determination is conditional on affixing flashing white or red lights to the nacelle of the turbine so it will be visible from 360 degrees. BNE anticipates using red lights, which it states the FAA has determined to be the most effective. (Petition, page 32.) However, BNE apparently plans to use red lights for only two of its three proposed wind turbines. (Rinebold Pre-Filed Testimony, page 18.)
32. If this project is approved, BNE must notify the FAA within 5 days after construction reaches its greatest height. (Petition, page 33.)

V. Site Description

33. The proposed project site consists of two adjacent parcels of land. BNE's principals co-own the property at 29 Flagg Hill Road and the adjacent property at 17 Flagg Hill Road. Together, the properties total 79.44 acres. (Petition, pages 4, 7, 13.)
34. The project site is located in the southeastern corner of Colebrook, along the Norfolk town line and approximately 600 feet from the Winsted/Winchester town line. (Petition, pages 4, 7.)
35. The parcel at 29 Flagg Hill Road is presently undeveloped, with the exception of the meteorological tower. (Petition, page 7.) The parcel at 17 Flagg Hill Road contains a residence and driveway. BNE proposes to build the access road for its project where that driveway is presently located. (Petition, page 8.)
36. Because BNE owns the residence at 17 Flagg Hill Road, it is a participating property/residence. Unless expressly stated otherwise herein, all findings regarding the potential impacts of Wind Colebrook South will be limited to impacts on non-participating properties.
37. The site as a whole is generally characterized by second growth, northern hardwood forest, but also includes a hilltop clearing where the met tower is located and a large wetland complex that includes a ±6.70-acre beaver pond that is centrally located within the site. An unnamed perennial watercourse outlets from the pond in the vicinity of the southern site boundary, flowing south. (Petition, page 7 & Ex. I, page 2.)
38. The project site is abutted by undeveloped land owned by the Nature Conservancy to the west. The Nature Conservancy property is also known as the Wolcott Preserve and was the first Nature Conservancy preserve in the state. The Wolcott Preserve consists of approximately 198 acres of undeveloped land and contains the Beckley Bog, a National Natural Landmark. The Beckley Bog is the most southerly sphagnum-heath-black spruce bog in New England and is a relic of the early post-Pleistocene. (Petition, Ex. I, page 18; FairwindCT Admin. Notice Item No. 70.)
39. The project site's northern boundary abuts land owned by the Northwestern Connecticut Sportsmen's Association Inc., which operates a gun club on part of its property. (Petition, page 7 & Ex. F, Sheet C-001.)
40. To the east and south, the project site is abutted by several residential lots. (Petition, page 7 & Ex. F, Sheet C-001.)
41. A portion of the Algonquin State Forest is situated to the east of the project site, on the opposite side of Flagg Hill Road. (Petition, Ex. F, Sheet C-001; Petition, Bulk Filing, Zoning Map.)

42. Both parcels of land included in the project site are zoned residential. (Petition, page 7.)
43. The site slopes steeply towards Flag Hill Road and several residences along its western boundary. (Petition, Ex. F; Cline Pre-Filed Testimony, Ex. 1; 4/21/11 Tr. 107:28-108:23 (Klein).)
44. There are 29 residential homes within 2,000 feet of the site boundary. (BNE Responses to Council's First Set of Interrogatories, dated Feb. 24, 2011, Answer 4.) Thirty-five homes are located within 1 mile of each turbine location. (4/14/11 Tr. 43:8-9.)
45. Flag Hill Road is exclusively residential. (Petition, Bulk Filing, Zoning Map; 4/21/11 Tr. 39:6-13 (Garrels).) There are 174 structures within 1.25 miles of any of the six turbines proposed by BNE for Wind Colebrook North and South. (Franson Supp. Pre-Filed Testimony, page 3.)
46. Colebrook is almost exclusively residential. The town does not have a gas station, a bank, a grocery store or a traffic light. (Petition, Bulk Filing, Zoning Map; 4/21/11 Tr. 51:13-23 (Garrels).)
47. There are no industrial zones in Colebrook and no industry in Colebrook. (Petition, Bulk Filing, Zoning Map; 4/21/11 Tr. 39:15-20 (Garrels).) If this petition is approved, the project site would remain zoned residential, but the zone would be corrupted. (4/21/11 Tr. 40:2-5 (Garrels).)
48. Two commercial "general business zones" exist in Colebrook along a narrow band of Route 44 (Winsted-Norfolk Road) running east to west and along a narrow band of Route 8 (Colebrook River Road) running north and south. These narrow bands extend about 100 yards on either side of the roads. (Petition, Bulk Filing, Zoning Map; 4/21/11 Tr. 38:23-40:5 (Garrels).)

VI. Power Plant Description

49. Wind Colebrook South consists of the installation of three GE 1.6 MW wind turbines and associated ground equipment, an ancillary building, upgrading and installation of an access road and an electrical interconnection. The ancillary building would provide storage, office space and an educational area. (Petition, page 7.)
50. BNE proposes installing three 100-meter tall turbines, each with blade lengths of up to 50 meters. Although BNE has stated that it intends to utilize 40.3 meter blades at the site, and certain of the evidence provided by BNE reflects blades of that length, BNE is seeking approval for blades of up to 50 meters in length. (Petition, pages 7-8.)
51. The turbine hubs (towers) will stand approximately 328 feet high. The equipment used to operate the turbines is contained within the nacelle, including the gearbox, a magnet generator and an automatic lubrication system. (Petition, page 7.)

52. In order to access the project, BNE proposes constructing a new driveway over property it owns at 17 Flagg Hill Road to connect the site to Flagg Hill Road. (Petition, page 8.) BNE to this point has not evaluated Flagg Hill Road to assess potential impacts to the road. (4/14/11 Tr. 43:19-20 (Cline).)
53. BNE proposes to construct an electrical collector yard on the site, as well as additional equipment to monitor circuit voltage and to disconnect the facility from the grid as needed to protect the system during system outage. (Petition, page 8.)
54. Interconnection would be made to CL&P's 13.8-kV distribution system at Winsted-Norfolk Road (Route 44). BNE has not yet completed a System Impact Study or a Transmission Study with CL&P, nor has BNE executed an Interconnection Agreement with CL&P. (Petition, page 9.)
55. The turbines can be controlled automatically or manually from either an interface located inside the nacelle or from a control box at the bottom of the tower. They can also be controlled remotely. Each turbine has emergency stop buttons located in the base of the hub and in the nacelle. (Petition, page 10.)
56. The turbine blades are controlled by a rotor that can adjust blade pitch angles during operation and brake or otherwise regulate the blade speed. A controller within the nacelle aligns the nacelle and blades to the average wind direction based on a wind vane sensor mounted on the nacelle. (Petition, page 10.)
57. BNE states that Wind Colebrook South will meet all applicable safety requirements for construction, operation and electrical interconnection and will follow all applicable GE guidelines and requirements. (Petition, page 14.)
58. The rotor blades of the turbines are equipped with lightning receptors mounted in the blade and the turbines are grounded and shielded to protect against lightning. The turbines are also built to handle seismic loads. (Petition, page 15.)
59. BNE expects to enter into an operations and maintenance agreement with GE to remotely monitor and maintain the turbines. BNE operations and maintenance personnel will also be located on-site to supplement the services provided by GE. (Petition, page 15.)
60. BNE did not provide details regarding the BNE on-site personnel in its petition. During the course of this proceeding, BNE testified that BNE plans to hire three to five employees who will rotate between the site and BNE's other proposed sites in Colebrook and Prospect. BNE anticipates that personnel will be located on site in the proposed ancillary building during daylight hours. (3/23/11 Tr. 60:6-62:2 (Corey).)
61. The proposed ancillary building would provide storage, office space for BNE operations and maintenance personnel and an area for education and tours by appointment for schools, organizations or members of the public. The ancillary building would contain

restroom facilities and utilize an on-site well to meet sanitary and drinking needs. BNE proposes disposing of wastewater to an on-site septic system, but has not provided plans for the system. (Petition, page 8.)

62. BNE concedes that wind turbines are by definition intermittent electric energy generation facilities that operate only when there is sufficient wind to turn the rotor and produce electricity from the electric generator. (Petition, page 12.) The GE 1.6 MW turbines generate power when the wind speeds are at or above 3.5 m/s (approximately 7.8 miles per hour) and below 25 m/s (approximately 56 miles per hour). (Heraud Pre-Filed Testimony, Ex. 2, page 2.)
63. BNE claims that the GE turbines it has selected will be “available” to produce electricity 98 percent of the time and have an expected capacity factor of approximately 30 percent. Based on output from three 1.6 MW turbines, BNE states that Wind Colebrook South would produce approximately 12,614 MWh of Class I renewable energy each year. (Petition, pages 9, 11.)
64. David Pressman testified that wind’s capacity factor is highly variable but typically ranges from 20 to 32 percent, and noted that BNE did not provide any details on how it reached this assumed capacity factor. (Pressman Pre-Filed Testimony, page 10.) BNE’s Wind Assessment reports calculated capacity factors of 21 to 36 percent at an 80-meter hub height based on 13.4 months of wind data. (Petition, Ex. M, Wind Assessment, page 2.) In 2009, Northeast wind projects had an average capacity factor of 26.8%, and many of these projects face more favorable wind conditions than Wind Colebrook South. (Pressman Pre-Filed Testimony, page 13.)
65. Wind Colebrook is unlikely to achieve 30 percent capacity. Based on Colebrook’s wind resources, wind turbulence, and potential icing, a capacity of 22 to 26 percent is more likely, which would significantly lower the estimated energy to be produced annually by this proposed project. (Pressman Pre-Filed Testimony, page 13.)
66. The proposed turbines will be built for a 20-year life, though industry looks to a lifespan of 25 to 30 years. (4/14/11 Tr. 46:25-47:1 (Corey).)
67. As a general rule, the industry standard is that 60 acres of land is needed for each industrial-size turbine. (BNE Responses to Council’s First Set of Interrogatories, dated Feb. 24, 2011, Answer 14.) BNE proposes to site three turbines on less than 80 acres of land.

VII. Cultural Resources

68. At BNE’s request, on November 29, 2010, the Historic Preservation and Museum Division of the Connecticut Commission on Culture and Tourism, also known as the State Historic Preservation Office (“SHPO”), issued a “no effect” letter for this project. (Petition, Ex. B.)

69. On March 21, 2011, the SHPO rescinded its prior finding of “no effect” following BNE’s failure to provide additional information the SHPO had requested about the potential adverse effect on Rock Hall, a property listed on the National Register of Historic Places. (FairwindCT Admin. Notice Item No. 72.)
70. Rock Hall, located at 19 Rock Hall Road and listed on the National Register of Historic Places, was designed and built in 1911 and 1912 as a private residence by Addison Mizner, who is known as “The Architect of Palm Beach.” The nearly 23-acre estate contains landscaping features from the original design and is home to a 10,000-square foot manor house in Mizner’s signature Spanish Mediterranean Revival style. Today, Rock Hall is the only surviving Mizner residence north of the Mason-Dixon line. (Somers Pre-Filed Testimony, pages 1-2.)
71. Because of its cultural and historic significance, Rock Hall was listed on the National Register of Historic Places in June 2010. (Somers Pre-Filed Testimony, page 1.)
72. The National Register of Historic Places was created by the National Historic Preservation Act of 1969 (“NHPA”) in order to protect districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, engineering, and culture. In passing the NHPA, Congress recognized “the spirit and direction of the Nation are founded upon and reflected in its historic heritage,” that “[t]he historical and cultural foundations of the Nation should be preserved as a living part of our community life and development in order to give a sense of orientation to the American people,” and that “[t]he preservation of this irreplaceable heritage is in the public interest so that its vital legacy of cultural, educational, aesthetic, inspirational, economic and energy benefits will be maintained and enriched for future generations of Americans.” (Faude Pre-Filed Testimony, page 5; FairwindCT Admin. Notice Item No. 28.)
73. Under the NHPA, the government agencies must consider the potential adverse effects of their activities on historic properties. In order to expedite that review process, the Federal Communications Commission has established an area of potential effect of 1.5 miles for the stationary communication towers within its jurisdiction that are 400 feet or higher. If a historic property is located within the area of potential effect, adverse effect is presumed. (FairwindCT Admin. Notice Item No. 6.)
74. The types of towers with which the FCC is concerned are stationary and therefore will have less significant impacts on nearby historical and cultural resources than BNE’s proposed turbines. (Faude Pre-Filed Testimony, page 4.)
75. Rock Hall is within the 1.5-mile area of potential effect of the project. (Faude Pre-Filed Testimony, page 4.)
76. Aside from Rock Hall, there are at least 47 sites and districts located on the National Register of Historic Places within a 5-mile radius of the project, including the Norfolk

Historic District, the Phelps Farms Historic District, and the Colebrook Center Historic District. (Faude Pre-Filed Testimony, Ex. 2.)

77. BNE states that its proposed project is not anticipated to have any impact on scenic or recreational values in the area. However, BNE's photosimulations indicate that Wind Colebrook South will be visible year-round from the grounds of Rock Hall. (Petition, Ex. J, Figure 3.) Simulations submitted by Glenn Chalder on behalf of FairwindCT, the Somers and Susan Wagner indicate more visibility of the turbines. (Chalder Pre-Filed Testimony, Ex. 2, Figure 3.)
78. BNE also acknowledges that there is a "small area of spotty visibility" from Winchester Road in Norfolk, which is locally designated as a scenic road. (Petition, page 21.)
79. Beckley Bog, one of only eight designated National Natural Landmarks in Connecticut, is located 3,668 feet from nearest turbine associated with this project (FairwindCT Admin. Notice Item No. 70; Franson Supp. Pre-Filed Testimony, Ex. 6.) A large portion of Beckley Bog will be subject to at least 10 or fewer hours of probable shadow flicker each year, and a smaller portion will be subject to at least 10 to 20 hours of probable shadow flicker per year. (Libertine Supp. Pre-Filed Testimony, Ex. 3.)
80. As "[t]he most southerly sphagnum-heath-black spruce bog in New England, Beckley Bog possesses all principal elements of a boreal bog. It is a rare relic of the early post-Pleistocene." It was designated as a National Natural Landmark in 1977. (FairwindCT Admin. Notice Item No. 70.)
81. The National Natural Landmarks Program was established by the Secretary of the Interior in 1962, under authority of the Historic Sites Act of 1935 (16 U.S.C. 461 et seq.) to identify and encourage the preservation of the full range of geological and biological features that are determined to represent nationally significant examples of the Nation's natural heritage. Potential sites are evaluated by qualified scientists and, if determined nationally significant, recommended to the Secretary of the Interior for designation. Once a landmark is designated it is included on the National Registry of Natural Landmarks, which currently lists 586 National Natural Landmarks nationwide. (FairwindCT Admin. Notice Item No. 70.)
82. In supplemental filings, a BNE witness testified that the project is likely to be visible from other "points of interest" up to 17.5 miles away, including the Haystack Mountain observation tower, Winsted Soldiers Memorial, and Peoples State Forest. (Libertine Supp. Pre-Filed Testimony, pages 2-3.)
83. At present, Colebrook presents a pristine natural landscape, essentially untouched by any significant development. (3/23/11 Tr. 72:19-73:6 (Bernstein); 4/21/11 Tr. 51:13-51:23 (Garrels); Faude Pre-Filed Testimony, page 19.) The proposed project would alter the nature and character of the surrounding area and would thereby have an adverse impact

on nearby historic and cultural resources, including Rock Hall. (Faude Pre-Filed Testimony, page 3.)

VIII. Environmental Considerations

A. Site Clearing

84. In its petition, BNE stated that the area to be cleared would be approximately 11.32 acres (493,277 square feet). (Petition, Ex. F, Sheet C-002.)
85. Since that petition, BNE has revised its plans. The revision increased the area to be by approximately 3 acres, to a total clearing of 14.30 acres (622,711 square feet). (Cline Pre-Filed Testimony, Ex. 1, Sheet C-002.)

B. Wetlands

86. There are three wetland systems located on the site and two more immediately off site. (Petition, page 28.)
87. Wetland 1 is a large wetland complex that is dominated by a beaver pond. Forested wetland lobes extend to the north and west of the beaver pond and drain into this system. Within the western lobe, an intermittent watercourse generally having a diffuse meandering flow pattern drains into the beaver pond from the west property boundary. While soil characteristics within this wetland complex are consistent throughout with the aforementioned soil catena, the vegetation and hydrology vary. Open water areas are permanently inundated and generally unvegetated. The forested wetland lobe extending to the north of the pond is seasonally saturated and dominated by hardwood tree species such as red maple, yellow birch and American beech. The wetland lobe extending to the west of the pond is a seasonally saturated hemlock wetland. (Petition, pages 28-29.)
88. Wetland 2 is a small wetland finger extending onto the site from a wetland on the adjacent property to the north. While the narrow interior is generally void of woody vegetation, the fringes are dominated by American beech and eastern hemlock. (Petition, page 29.)
89. Wetland 3 is a seasonally saturated forested wetland located immediately south of the southern property boundary (off-site). It is a portion of a larger wetland extending in a southeasterly direction. This wetland drains towards the east. (Petition, page 29.)
90. Wetland 4 is a seasonally saturated forested wetland located to the south of the southern property boundary (off-site). It is a portion of a larger wetland draining southwesterly to an unnamed perennial watercourse. (Petition, page 29.)
91. Wetland 5 is a forested hillside seep wetland draining northeast along the east property boundary. An intermittent watercourse feature, having diffuse flows and intermittent

channel, flows within the wetland interior. Flows are conveyed beneath an existing gravel driveway with a 36-inch corrugated metal pipe. An additional intermittent watercourse feature was delineated along the west side of the existing driveway. This feature is characterized as a dug drainage ditch that intercepts groundwater (has base flow). It drains into Wetland 5 north of the existing driveway. (Petition, page 29.)

92. BNE stated in its petition and during the hearing that it worked to avoid direct impacts to wetland resources on the site. (Petition, page 29.) However, BNE concedes that there will be significant temporary and permanent direct wetland impacts and disturbance of areas in close proximity to wetland resources on the site. (Petition, page 30.)
93. In its petition, BNE stated that the construction of a gravel access road over Wetland 1 would require permanent direct impact to 4,702 square feet of wetlands. (Petition, page 30 & Ex. F, Sheet C-002.) Further, approximately 213 square feet of Wetland 1 would be temporarily impacted. (Petition, page 30.) The total direct wetland impact in the petition is therefore at least 4,913 square feet.
94. Indirect wetland impact (i.e., clearing of, and building in, the area within 100 feet of wetlands) was identified in BNE's petition as 0.89 acres (39,000 square feet). (Petition, Ex. F, Sheet C-002.)
95. BNE's revised plans show an increase in the area of direct wetland impact to 4,722 square feet and an increase in the area of indirect wetland impact to 1.55 acres (66,853 square feet). (Cline Pre-Filed Testimony, Ex. 1, Sheet C-002.)
96. FairwindCT presented a witness who testified that BNE's inadequate erosion control measures are likely to result in erosion and deposits of sediment into wetlands, having an adverse effect on wetlands not contemplated by BNE. (Carboni Pre-Filed Testimony, pages 6-7.) The same witness also testified that the modifications necessary to resolve BNE's plans failures to meet 2002 Connecticut Guidelines for Soil Erosion and Sediment Control would result in a greater direct impact to wetlands than shown in the plans. (Carboni Pre-Filed Testimony, pages 6, 7, 17 & 23.)
97. In response to interrogatories questioning whether the wetland crossing is designed to support the proposed loads required during construction of the project, BNE stated that the wetland crossing will be designed to meet specifications after the project is approved. BNE also stated that the underground utility trenching design and location will be completed after approval of the project. (BNE's Responses to FWCT's Second Set of Interrogatories, Answers 136 & 137.)
98. At the hearing, Mr. Cline and Mr. Matthew Davison, both witnesses for BNE, confirmed that BNE's proposed wetland crossing engineering is not yet designed to bear the load of the crane and associated equipment, and will not be so designed until geotechnical investigations are completed. (4/26.11 Tr. 144:9-146:3 (M. Davison, Cline).)

Mr. Davison suggested that a temporary crossing may need to be put in place during construction to bear the loads. (4/26.11 Tr. 144:9-144:19 (M. Davison).)

99. Based on that evidence, BNE's calculations of the wetland areas that may suffer direct and indirect temporary and permanent impacts are not accurate.

C. Natural Diversity Database

100. BNE's consultant, VHB, reviewed the DEP's Natural Diversity Database map for endangered or threatened species or designated critical habitats in proximity to the site. (Petition, Ex. I, page 12.)
101. DEP's Bureau of Natural Resources informed VHB that Great St. John's-wort (*Hypericum ascyron*), a state species of special concern plant, occurs in a wetland to the east of the site. (Petition, Ex. I, page 12.)
102. VHB informed the DEP that it was not proposing work in that area. VHB also informed the DEP that because the Great St. John's Wort prefers stream banks, wet meadows and thickets, and because direct wetland impacts are not associated with a watercourse, BNE's activities are not likely to affect the species. (Petition, Ex. I, pages 12, 17-18, 21 & Attachment C.)
103. BNE did not conduct an on-site survey to determine whether Great St. John's Wort in fact exists on the site. (Petition, Ex. I; 4/21/11 Tr. 222:1-8.) The only site-specific vegetative data was collected incidental to VHB's wetland evaluation and covers at best approximately 25% of the site. (Klein Pre-Filed Testimony, page 3.)
104. An on-site survey for the Great St. John's Wort must be completed in mid-summer. (Klein Supp. Pre-Filed Testimony, page 3.)

D. Wildlife

105. With its petition, BNE submitted an interim bat acoustic survey, a breeding bird survey and a terrestrial wildlife habitat and wetland impact analysis. (Petition, Exs. I, K, L.)

1. Terrestrial Wildlife

106. BNE conducted a desktop wildlife evaluation that identified potential mammal, reptile and amphibian species that may exist on the site. (Petition, Ex. I, pages 8, 9.)
107. BNE's petition stated that the site does not contain vernal pools; however, that statement was based in large part on a wetlands delineation that took place with snow cover on the ground. (Petition, Ex. I, pages 4, 11.)
108. During BNE's breeding bird survey on the site, an incidental observation of the wood frog was recorded. (Petition, Ex. L, page 13.) The wood frog is a vernal pool obligate

species. Its presence on the site indicates that vernal pools may exist on the site. (Klein Pre-Filed Testimony, page 4.)

109. BNE did not conduct an amphibian survey or an in-season vernal pool survey on the site prior to filing its petition, despite the petitioner's incidental observation of a state-listed species (Northern Leopard Frog, *Rana pipiens*). (Petition, Ex. I & Ex. L, page 13; Klein Pre-Filed Testimony, page 3.)

2. Amphibians and Reptiles

110. BNE did not conduct an amphibian survey or an in-season vernal pool survey on the site prior to submitting its petition. (Petition, Ex. I.) Instead, BNE opined that no vernal pools existed on the site based on field surveys conducted with several inches of snow on the ground. (Petition, Ex. I, pages 4, 11; Klein Pre-Filed Testimony, pages 3-4.)
111. Vernal pool obligate amphibians contribute significantly to the food chain and nutrient cycling of the forest ecosystem and require extensive areas of forested habitat surrounding their breeding sites. (Klemens Herpetological Assessment, page 1.)
112. On March 15, 2011, Michael Klein testified that this omission was significant, particularly because BNE's consultants recorded an "incidental observation" of a wood frog, which is a vernal pool obligate species. BNE's wetlands scientist also included descriptions from field surveys that were possibly indicative of vernal pools. (Klein Pre-Filed Testimony, pages 3-4.)
113. In response to interrogatories dated March 15, 2011, BNE revealed that it had retained the services of Michael Klemens to determine if any on-site wetland resources provide breeding habitat for obligate vernal pool amphibians. (BNE Responses to FairwindCT's Second Set of Interrogatories, Answer 77.)
114. Dr. Klemens' report was filed on April 20, 2011, the afternoon before the last opportunity for all parties and intervenors to cross examine him on his findings. Dr. Klemens was not available to be present for cross-examination on April 26, 2011, the last day of the evidentiary hearing in these proceedings. (Klemens Herpetological Assessment, page 1; 4/21/11 Tr. 10:9-18, 205:18-20; 4/26/11 Tr. 100:15-23.)
115. Dr. Klemens conducted on-site surveys on April 4, 5 and 17, 2011. The goals of his study were to determine the suitability of the wetlands on and immediately off site to support vernal pool obligate amphibians and to assess the suitability of the site for state-listed species, including the Jefferson salamander, the spring salamander and the smooth green snake. (Klemens Herpetological Assessment, page 1.)
116. Based on their desktop wildlife analysis, BNE's consultants had determined that no vernal pools existed on site and that no state-listed amphibians or reptiles were likely to exist on the site. (Petition, Ex. I, pages 4, 11, 21 & Attachment D.)

117. Dr. Klemens' on-site survey revealed that in fact, Wetland 1 encompasses four areas that could be defined as cryptic vernal pools, which are vernal pools embedded within a larger wetland complex. (Klemens Herpetological Assessment, page 1.)
118. Two of those four cryptic vernal pools are Tier One pools, which are the most valuable vernal pools and are worthy of conservation planning. Tier One vernal pools are characterized by the presence of two or more vernal pool obligate species confirmed breeding in those areas, 25 or more egg masses, an intact vernal pool envelope and an intact critical upland habitat area. (Klemens Herpetological Assessment, page 2.)
119. Dr. Klemens identified several species of amphibians and reptiles on site that were not included in VHB's wildlife assessment, namely dusky salamanders, wood frogs and spotted salamanders. (Klemens Herpetological Assessment, pages 1-3; Petition, Ex. I, pages 11, 13.)
120. Dr. Klemens also concluded that habitat on the site is likely to support three state-listed species: the spring salamander, the smooth green snake and the eastern ribbon snake. (Klemens Herpetological Assessment, pages 3-4; 4/21/11 Tr. 216:25-219:3.)
121. VHB's report does not list the eastern ribbon snake or the spring salamander as likely to be on site, and VHB has stated that the site does not contain habitat suitable for the smooth green snake. (Petition, Ex. I, pages 11, 13; BNE's Responses to FairwindCT's Second Set of Interrogatories, Answer 86; 4/21/11 Tr. 122:20-24.)
122. The presence of dusky salamanders is significant because the species is an indicator of streams able to support spring salamanders, as well as serving as a major food source for the spring salamander. Based on the dusky salamander's presence and an assessment of the perennial seepage-fed watercourses on site, Dr. Klemens concluded that the spring salamander is likely to be on the site in the stream corridor of Wetland 1. (Klemens Herpetological Assessment, page 3.)
123. Dr. Klemens concluded that a wide, intact forested buffer should be left around this stream corridor to prevent thermal alterations, that all construction activities near to or draining into the stream should pay special attention to the adverse affects of siltation to this delicate system and to the spring salamander, and that there should not be any crossings of the stream corridor. (Klemens Herpetological Assessment, page 3.)
124. BNE's proposed project as presented to the Council does not cross the stream corridor. The proposed project does include activities within the critical upland habitat zone (defined as 100-750 feet) of the two Tier One vernal pools, but Dr. Klemens testified that the proposed project complies with the best development practices manual regarding vernal pool conservation. (Klemens Herpetological Assessment, page 2; 4/21/11 Tr. 225:4-19.)

125. The best development practices manual dictates that no more than 25% of the critical upland habitat zone may be cleared. BNE proposes to clear approximately 21% of the zone around one Tier One vernal pool and 5% of the zone around the other Tier One vernal pool on site. (Klemens Herpetological Assessment, page 2; 4/21/11 Tr. 225:4-19.)
126. The location of the proposed wetland crossing crosses Wetland 1, which is the highest value wetland on the site. The wetland crossing is approximately 350 feet north of the larger of the two Tier One cryptic vernal pools on the site. (Klemens Herpetological Assessment, page 6 (figure).)
127. Dr. Klemens testified that additional clearing on the site is not likely to harm the smooth green snake, and in fact may be a benefit to both the smooth green snake and the eastern ribbon snake by enhancing habitat, particularly if BNE annually mows the meadow it created with the installation of its meteorological tower. (Klemens Herpetological Assessment, pages 3-4.)

3. Bats

128. BNE's consultant, Western Ecosystems Technology, Inc. ("WEST"), conducted an acoustic bat study. The petition contains an interim report on that study. The final acoustic bat study was filed more than three months later. The purpose of the study was to characterize seasonal and spatial activity by bats during the summer maternity and fall migration seasons, and provide species identification of calls recorded to document presence of bat species. (Petition, Ex. K; Tidhar Pre-Filed Testimony, Ex. 2, page i.)
129. Data collected over the last several years has shown that the migratory bats (hoary bats, red bats, silver-haired bats) are more susceptible to wind turbine mortality than are hibernating bats (the Myotis bats and big brown bat). Specifically, the hoary bats, red bats, and silver-haired bats usually account for over 80% of all bat mortalities. (Reynolds Pre-Filed Testimony, page 5.)
130. Connecticut does not have guidelines regarding pre-construction monitoring for bat activity at proposed wind turbine sites. Several states, including Pennsylvania, New Jersey and New York, do have such guidelines. (Reynolds Pre-Filed Testimony, page 21; FairwindCT Admin. Notice Item Nos. 21-23.) The U.S. Fish and Wildlife Service ("USFWS") also has guidelines for such monitoring. (BNE Admin. Notice Item No. 8.) WEST testified that it followed the USFWS guidelines. (Tidhar Pre-Filed Testimony, page 2.)
131. Most acoustic bat studies encompass the entire active season for bats, which typically stretches from early to mid-April through late October. (Reynolds Pre-Filed Testimony, page 15.) The USFWS guidelines recommend acoustic monitoring for a full year, collected concurrently with environmental variables such as temperature and wind speed. (Reynolds Pre-Filed Testimony, page 20.) WEST did not monitor for a full year.

132. WEST stated that its bat study took place during the “estimated summer maternity season.” (Tidhar Pre-Filed Testimony, Ex. 2, page 11.) However, the maternity season for bats typically begins in mid-May. For the Indiana myotis, the USFWS characterizes the maternity season as May 15 through August 15. (Reynolds Pre-Filed Testimony, page 15.) WEST did not start sampling until late June. (Tidhar Pre-Filed Testimony, Ex. 2, page 11.) The WEST survey therefore missed 41 days (44%) of this summer maternity sampling period. (Reynolds Pre-Filed Testimony, page 15.)
133. WEST’s bat study was conducted with two Anabat detectors placed at two fixed locations on the site between June 25 and November 1, 2010. WEST also used a Wildlife Acoustic SM2Bat Unit ultrasonic detector for 7 nights June 25 and August 15 and for 36 nights between August 16 and November 1. WEST used the SM2Bat Unit to identify the bat species using the study are and estimate the relative levels of activity by different species within the site. (Tidhar Pre-Filed Testimony, Ex. 2, page i.)
134. The Anabat detectors were placed near the ground. One detector was placed along an abandoned forest track in deciduous forest at one of the proposed turbine locations near the center of the site. The other was located along an abandoned forest track at a proposed turbine location in the northwest corner of the site, also in deciduous forest. The SM2Bat unit was placed at the edge of a beaver pond and wetland complex between the two Anabat stations. (Tidhar Pre-Filed Testimony, Ex. 2, page 3.)
135. Ideally, an acoustic monitoring survey will use both ground and elevated detectors. (Reynolds Pre-Filed Testimony, pages 13-15; DEP comment letter, page 4.) The DEP noted that using elevated detectors may have increased the quality and detection rate, particularly of the hoary bats, which forage at the top of the tree canopy and is the species most often negatively impacted by turbines. (DEP comment letter, page 4.)
136. Elevated detectors allows for sampling to take place within the anticipated rotor-swept area of the turbines. Elevated detectors are generally placed on met towers where available. (Reynolds Pre-Filed Testimony, pages 13-15.)
137. The USFWS guidelines recommend placing acoustic detectors on existing met towers, approximately every two kilometers across the site where turbines are expected to be sited and state that acoustic detectors “should be placed at high positions” and “near the rotor swept zone.” (Reynolds Supp. Pre-Filed Testimony, page 20 (citing USFWS guidelines, page 37).) WEST did not follow these recommendations.
138. BNE has a met tower on the site. Dr. Reynolds opined that placing ground-based monitors next to a met tower is unjustifiable. (Reynolds Pre-Filed Testimony, page 14.) BNE claimed that no elevated monitoring was done because placing a detector on the met tower would have required lowering the tower to the ground, which may have resulted in damage to the instrumentation and study delay. (BNE Response to FairwindCT’s Second Set of Interrogatories, dated Mar. 8, 2011, Answer 61.)

139. Lowering met towers to service the meteorological equipment and to attach bat acoustic detectors is a standard industry practice. Dr. Reynolds testified that he has been involved in the lowering of more than 100 met towers throughout his career and has never seen damage to a tower or piece of meteorological equipment. (Reynolds Supp. Pre-Filed Testimony, page 12.)
140. Experts and pre-construction monitoring guidelines recommend using elevated acoustic monitoring because stationary ground-based monitoring fails to capture special heterogeneity and the vertical variation in bat activity of a project site, both of which are indicative of collision risk with wind turbines. (Reynolds Pre-Filed Testimony, page 14.)
141. BNE concluded that the project is not in the vicinity of any known bat colonies or features likely to attract large numbers of bats. (Petition, page 23.) However, bats are attracted to permanent water features such as the beaver pond and forested wetlands on the site. (Reynolds Pre-Filed Testimony, page 10.) Moreover, the DEP noted that the project site is not far from several known large hibernacula locations. (DEP comment letter, page 4.)
142. WEST drew many conclusions from its studies regarding the species of bats likely to occur on or near the site based on the frequency of the bat calls recorded. One conclusion was that eight different species of bats have the potential to occur on the site, all of which have been recorded as casualties at wind-energy facilities. (Tidhar Pre-Filed Testimony, Ex. 2, page 24.)
143. WEST concluded that the proposed project site contains forestlands and some forested wetlands, which likely support tree-roosting bat species common to the region. (Tidhar Pre-Filed Testimony, Ex. 2, page 24.)
144. WEST did not gather data on the potential for bat roosting habitat on the project site. (Petition, Ex. K.)
145. BNE hired WEST to conduct additional acoustic bat monitoring during the spring 2011 season. (Tidhar Rebuttal Testimony, page 3.) The results of that study will not be available to the Council before its statutory deadline for deciding this petition.
146. If this project is approved, BNE will conduct post-construction bat fatality monitoring for two years at the site, between May and October each year. (Tidhar Rebuttal Testimony, page 2; 4/14/11 Tr. 122:8-11.)

4. Birds

147. WEST also conducted breeding bird surveys. The purpose of the surveys were to provide site-specific bird resource and use data that would be useful in evaluating potential impacts from the proposed wind energy facility, provide information that could be used in project planning and design of the facility to minimize the impacts to birds and

recommend further studies or potential mitigation measures, if needed. (Petition, Ex. L, page i.)

148. Based on the results of these surveys, WEST concluded that the proposed project will not have undue impacts to the breeding bird populations in the Colebrook area because the breeding birds identified at the site are regionally common and no high value bird habitats are located within the Wind Colebrook development area. (Tidhar Pre-Filed Testimony, page 4.)
149. WEST identified 461 individuals representing 39 unique bird species. Three species comprised nearly one-third of the individual observations: unidentified passerines, red-eyed vireo and ovenbird. (Petition, Ex. L, pages i, 6-8.)
150. Thirty-one bird species, totaling 86 individuals, were recorded incidentally. (Petition, Ex. L, pages i, 11-12.)
151. WEST's report concludes that direct results to individuals may result from operation of the proposed project. WEST further concludes that currently, there is no evidence that observed impacts to individuals resulting from collisions at other wind turbine sites have an effect on populations. Finally, WEST concludes that the breeding bird habitats at the site are regionally common and no high value bird habitats such as wetlands are located within the proposed development areas. (Petition, Ex. L, page 13.)
152. Connecticut does not have guidelines regarding pre-construction monitoring for bird activity at proposed wind turbine sites. Several states, including New Jersey and New York, do have such guidelines. (E. Davison Pre-Filed Testimony, page 3.) The U.S. Fish and Wildlife Service ("USFWS") also has guidelines for such monitoring. (BNE Admin. Notice Item No. 8.) WEST testified that it followed the USFWS guidelines. (Tidhar Pre-Filed Testimony, page 2.)
153. The New York and New Jersey guidelines both recommend that pre-construction bird surveys be conducted for a minimum of one year and should include inventory of spring and fall migrants, migratory raptors and breeding birds. These guidelines recommend that surveys be conducted from approximately March through November (spring through fall). (E. Davison Pre-Filed Testimony, page 3.)
154. WEST's bird surveys took place on three different days between June 29 and July 15, 2010. (Petition, Ex. L, page i.) BNE claims that the late June to mid-July dates were selected to maximize coverage of the peak breeding season because they occurred when the most number and the greatest species richness of breeding birds would be expected to occur. (BNE Responses to FairwindCT's Second Set of Interrogatories, Answer 30.)
155. WEST's surveys took place outside of the ideal breeding bird survey period in Connecticut. (DEP comment letter, page 4.) At the time WEST's surveys were conducted, the peak song period for most male birds had ended. (E. Davison Pre-Filed

Testimony, page 6.) DEP noted that by these dates, many nesting species are calling for greatly limited time periods or using only call and chirp notes, making accurate identification extremely challenging. (DEP comment letter, page 4.)

156. In this state, breeding bird surveys should begin in late May and end in mid- to late June. The peak period for singing by territorial males is between June 1 and June 15 each year, making that two-week period especially important for breeding bird surveys. (E. Davison Pre-Filed Testimony, page 6; FairwindCT Admin. Notice Item No. 10 (Description of the Forest Interior Bird Survey Program).)
157. WEST used a total of 12 data points for its surveys. A WEST biologist was stationed at each point for a total of 5 minutes. This method provided a total of 3 hours of collected data for the site. (Petition, Ex. L, pages 3-4.)
158. DEP staff stated that the 5-minute survey period at each data point was too short to adjust for the reduced level of calling activity of birds during the late-season time period of the surveys. (DEP comment letter, page 4.)
159. Eric Davison testified that this number of data points was small for an 80-acre site. He also testified that using the 5-minute, 50-meter radius survey protocol, an observer typically can collect data at 20 to 30 points in a morning sampling period, i.e., between 5 and 9 a.m. (E. Davison Pre-Filed Testimony, page 5.)
160. Collection of data at additional points would have provided a more robust dataset for statistical analysis. (E. Davison Pre-Filed Testimony, page 5.)
161. No data points were located in the vicinity of the beaver pond/emergent marsh portions of Wetland 1. (Petition, Ex. L, page 4.)
162. The beaver pond is an uncommon habitat type in Connecticut capable of supporting rare species including the state-listed Northern Saw-whet Owl (*Aegolius acadicus*) American Bittern (*Botaurus lentiginosus*). (E. Davison Pre-Filed Testimony, pages 5-6.)
163. In his on-site survey for amphibians and reptiles in April 2011, Dr. Klemens discovered a small great blue heron (*Ardea herodias*) rookery present on the south end of the beaver pond. On April 17, he counted at least four nests in that area, and at least one (possibly two) were active with pairs of great blue herons presumably in the process of laying and/or incubating eggs. (Klemens Herpetological Assessment, page 4.) WEST's breeding bird survey reported sighting only one great blue heron in its three hours spent surveying the site. (Petition, Ex. L, page 12.)
164. Dr. Klemens also observed pileated woodpeckers (*Dryocopus pileatus*) actively foraging and calling on two separate days in April 2011 in the area immediately above Wetland 5. (Klemens Herpetological Assessment, page 4.) WEST's breeding bird survey reported

sighting only one pileated woodpecker in its three hours spent surveying the site. (Petition, Ex. L, page 8.)

165. The high number of unidentified passerines noted in the breeding bird survey confirm that identification was challenging, as predicted by DEP and Eric Davison. A total of 46 unidentified passerines were observed during the 3 hours of observation. (Petition, Ex. L, pages i, 6; E. Davison Pre-Filed Testimony, page 8; DEP comment letter, page 4.)
166. The high number of unidentified passerines equates to 10 percent of total observations within the 3-hour period, which is a significant data gap that affects any conclusions regarding species richness and species diversity that may be drawn from the survey results. (E. Davison Pre-Filed Testimony, page 9.)
167. DEP staff noted that WEST's report indicates that no sensitive species were recorded, yet due to the late survey period, species of regional conservation interest could occur in the vicinity of the project and may not have been documented. (DEP comment letter, pages 4-5.)
168. Fourteen of the species observed on the site are considered to be species of conservation concern by the DEP and national conservation organizations due to declining populations. These species include Eastern Towhee, Indigo Bunting, Eastern Kingbird, Scarlet Tanager, Wood Thrush, Black-Throated Green Warbler, Chestnut-Sided Warbler, Ovenbird, Baltimore Oriole, Black-Throated Blue Warbler, Ruffed Grouse, Pileated Woodpecker, Hairy Woodpecker and Black-billed Cuckoo. Several of these species, including the Indigo Bunting, Eastern Kingbird, Wood Thrush, Black-Throated Green Warbler, Black-Throated Blue Warbler, Ruffed Grouse, Pileated Woodpecker, Chestnut-Sided Warbler and Ovenbird are species listed at Greatest Conservation Need. (E. Davison Pre-Filed Testimony, pages 10-11.)
169. WEST did not provide an analysis of impact for these fourteen species of conservation concern in its petition. (Petition, Ex. L.)
170. BNE did not conduct spring or summer nighttime call-back surveys to inventory nocturnal species, such as owls and nightjars. Several species of owls in Connecticut are state-listed and are known to occur in mixed and/or coniferous woods near large wetlands as are present on the site. (E. Davison Pre-Filed Testimony, pages 6-7.)
171. BNE did not conduct spring or fall migration studies. (E. Davison Pre-Filed Testimony, page 4.) WEST's breeding bird survey report states that two-thirds of bird fatalities documented during post-construction mortality monitoring were assumed to be migrants. (Petition, Ex. L, page 13.)
172. BNE plans to conduct a spring migratory bird study on the site during the spring and fall migration periods of 2011. (BNE Responses to FairwindCT's Second Set of Interrogatories, Answer 31; 4/14/11 Tr. 121:1-17.) The results of that study will not be

available to the Council before its statutory deadline for deciding this petition. (4/14/11 Tr. 122:3-6.)

IX. Noise

173. Noise is unwanted or excessive sound. Sound becomes unwanted when it interferes with normal activities such as sleep, work or recreation. (Petition, Ex. M, page 1).
174. Sound levels are most often measured on a logarithmic scale of decibels (“dB”). Because sound levels are measured in dB, the addition of two sound levels is not linear. Adding two equal sound levels creates a 3 dB increase in the overall sound level. (Petition, Ex. M, page 1).
175. A three dB increase is a doubling of acoustical energy and is the threshold of perceptibility of the average person. (Petition, Ex. M, page 1).
176. A 10 dB increase is a tenfold increase in acoustic energy but is perceived as a doubling in loudness to the average person. (Petition, Ex. M, page 1).
177. BNE’s noise evaluation assumed that the Emitter Zone for the proposed wind turbines is a Class C (Industrial) and that the Receptor Noise Zone for the receptor location is Class A (Residential). (Petition, Ex. M, page 4).
178. The zoning classification for the property at 17 and 29 Flagg Hill Road, Colebrook Connecticut is R-2, Residential. (Petition, Bulk Filing, zoning map; Petition, page 17.)
179. No application has been made to the Town of Colebrook Planning and Zoning Commission for a zone change. (4/21/2011 Tr. 39:21-40:18 (Garrels).)
180. Thomas Wholley, BNE’s noise consultant, had noise monitoring conducted using a Larson Davis 824 Type I sound level analyzer to determine background noise levels. (Petition, Ex. M, page 6).
181. BNE’s monitoring was done on Flagg Hill Road starting at 2:55 p.m. on April 1, 2010 and took a total of 20 minutes. (Petition, Ex. M, App’x (Noise Monitoring Summary).)
182. BNE’s monitoring was done on Beckley Road starting at 12:45 a.m. on April 2, 2010 and for a total of 15 minutes. (Petition, Ex. M, App’x (Noise Monitoring Summary, unnumbered page 3).)
183. BNE did additional monitoring on Flagg Hill Road starting at 1:15 a.m. on April 2, 2010 for a total of 15 minutes. (Petition, Ex. M, App’x (Noise Monitoring Summary, unnumbered page 5).)

184. Mr. Wholley interpreted the results to establishing existing sound levels at the L₉₀ decibel level as follows:

| Monitoring Location | Daytime Sound Level | Nighttime Sound Level |
|----------------------------|----------------------------|------------------------------|
| Flagg Hill Road | 37 | 38 |
| Beckley Road | 37 | 37 |

(Petition, Ex. M, page 4.)

185. Mr. Wholley then used the noise level of 106 dB as maximum noise level for the operation of three 1.6 MW wind turbines and then calculated projected sound levels at various receptor locations. (Petition, Ex. M, pages 7-9).
186. Mr. Wholley selected receptor locations where people sleep, rather than receptor locations at the site's property lines. (4/14/2011 Tr. 40:4-16 (Wholley).)
187. State regulations provide: "General Prohibition. No person shall cause or allow the emission of excessive noise beyond the boundaries of his/her Noise Zone so as to violate any provision of these Regulations." RCSA § 22a-69-3.1.
188. FairwindCT offered Michael Bahtiarian, INCE Bd. Cert., Vice President at Noise Control Engineering, Inc., as its expert witness with respect to noise and acoustical matters. He has a Masters of Science in mechanical engineering from Rensselaer Polytechnic Institute and a Bachelor of Science in mechanical engineering from Pennsylvania State University and has reviewed wind turbine noise studies in the towns of Falmouth, Wareham, Bourne and Brewster, Massachusetts. (Bahtiarian Pre-Filed Testimony, dated Mar. 15, 2011, pages 1-2.)
189. Mr. Bahtiarian is a Board Certified Member of the Institute of Noise Control Engineering. The certification is the equivalent to a Professional Engineering license for the field of noise and vibration. The requirements for receiving the certification are more than four years of experience, recommendations from colleagues and the passing of a rigorous 8-hour written examination. (Bahtiarian Pre-Filed Testimony, dated Mar. 15, 2011, pages 1-2.)
190. Mr. Bahtiarian undertook a peer review of the noise evaluation performed by VHB of the Wind Colebrook South wind turbine project. (Bahtiarian Pre-Filed Testimony, dated Mar. 15, 2011, page 2.)
191. Mr. Bahtiarian reviewed the VHB report and found unsubstantiated claims, incorrect use of noise regulations, questionable computation methods and only a token study of existing conditions. Based on his own computations of expected noise levels from the project, he concluded that sound levels will exceed the DEP noise regulations. (Bahtiarian Pre-Filed Testimony, dated Mar. 15, 2011, page 2.)

192. Mr. Bahtiarian found a violation of the Connecticut nighttime noise limit. He also testified that wind turbines have other acoustical characteristics such as low-frequency sound, amplitude modulation and wind turbine sound directionality. (Bahtiarian Pre-Filed Testimony, dated Mar. 15, 2011, page 9.)
193. Amplitude modulation as it relates to wind turbines is sound pressure from aerodynamic action of the turbine blades. This sound is sometimes distinguished as a “swishing noise” or “thumping.” Amplitude modulated noise is characterized by a fluctuation sound amplitude having a period equivalent to the blade passage frequency (rotational speed of the hub multiplied by the number of blades). (Bahtiarian Pre-Filed Testimony, dated Mar. 15, 2011, page 10.)
194. Mr. Bahtiarian testified that the turbine manufacturer had not provided sufficient data to evaluate infrasound and pure tones from the wind turbines. (Bahtiarian Pre-Filed Testimony, dated Mar. 15, 2011, page 10.)
195. Directionality is important as sound emitted from a source is often not equal in magnitude in all directions. For example, a stereo speaker has much higher sound output from the front of the speaker than the rear of the speaker. Mr. Bahtiarian criticized the VHB noise evaluation for assuming that directionality was uniform in all directions. (Bahtiarian Pre-Filed Testimony, dated Mar. 15, 2011, page 10.)
196. Directionality plays a role in this analysis because wind turbines constantly change direction in response to the wind. Thus, at any single location, the levels of sound will vary with changes in both wind speed and wind direction. (Bahtiarian Pre-Filed Testimony, dated Mar. 15, 2011, page 11.) This is an important factor in annoyance as it is just not sound amplitude but sound variability that creates annoyance. (Bahtiarian Pre-Filed Testimony, dated Mar. 15, 2011, page 11.)
197. Mr. Bahtiarian opined that this is a very significant issue, especially for homes located between the Wind Colebrook South and BNE’s concurrently proposed project located approximately half a mile north, known as Wind Colebrook North. Mr. Bahtiarian testified that the large number of homes located between the Colebrook South and Colebrook North projects will be impacted nearly all of the time from at least one of the projects. Having homes surrounded by wind turbines is an atypical situation, which may result in higher levels of impact (stress, sleep loss, and annoyance) than observed at other sites. (Bahtiarian Pre-Filed Testimony, dated Mar. 15, 2011, page 11.)
198. There are no noise control treatments such as barriers, silencers or acoustic cladding that can be added after the wind turbine is installed to reduce the noise. The only method of minimizing noise after the fact is to shut the turbine down during windy conditions. (Bahtiarian Pre-Filed Testimony, dated Mar. 15, 2011, page 11.)
199. In addition to conducting a peer review of BNE’s noise evaluation, Mr. Bahtiarian did his own analyses of the proposed project. First, he measured the distance from each turbine

to the surrounding property lines by using BNE's site plans to establish the approximate distance to each property line receptor. (See Petition, Ex. F, Sheet C-003.) Then, using a hub height of 328 feet, a sound power level of $L_w=106$ decibels and an absorption coefficient of $a=0.005$ dB/m (the same inputs used by BNE), he modeled the nighttime conditions to obtain the following results:

| | PL-S1 | PL-S2 | PL-S3 |
|-------------------------------|-----------|-----------|-----------|
| Total SPL, dB(A) | 53 | 54 | 51 |
| Residence-to-Residence limit | 45 | 45 | 45 |
| Excess above limit | 8 | 9 | 6 |
| Industrial-to-Residence limit | 51 | 51 | 51 |
| Excess above limit | 2 | 3 | 0 |

(Bahtiarian Supp. Pre-Filed Testimony, dated Apr. 4, 2011, Ex. 6.)

200. The results above show that even using the industrial-to-residence limit, as BNE proposes, two of the three turbines included in the proposed project will violate DEP noise regulations.
201. Mr. Bahtiarian also undertook his own background noise monitoring program in Colebrook. The equipment was installed on the afternoon of Friday, March 25, 2011 and was removed on the afternoon of Monday, April 4, 2011. (Bahtiarian Second Supp. Pre-Filed Testimony, dated Apr. 14, 2011, pages 1-2.)
202. One device was located at the end of Flagg Hill Road in the vicinity of VHB's monitoring location M1. (Bahtiarian Second Supp. Pre-Filed Testimony, dated Apr. 14, 2011, page 2.)
203. The results showed at that location showed that the average background noise level was 30 dB(A), not the 37 dB(A) reported by BNE. The background noise level dropped to as low as 22 dB(A) for three of the seven nights and 28 dB(A) for the four remaining nights. (Bahtiarian Second Supp. Pre-Filed Testimony, dated Apr. 14, 2011, page 2.)
204. Mr. Bahtiarian concluded that Colebrook location M1 is extremely quiet, much quieter than indicated by the brief sampling done by the BNE. (Bahtiarian Second Supp. Pre-Filed Testimony, dated Apr. 14, 2011, page 3.)
205. The significance of these measurements is that the proposed wind turbine operation will raise noise levels approximately 20 dB higher than the background. A 10 dB increase is perceived as a doubling of loudness. A 20 dB increase will be a quadrupling in loudness. This is extreme. (Bahtiarian Second Supp. Pre-Filed Testimony, dated Apr. 14, 2011, page 2.)

206. Dr. Bronzaft testified concerning the psychological effects of noise on people. (Bronzaft Pre-Filed Testimony; 4/21/2011 Tr. 151:18-160:13 (Bronzaft).)
207. Dr. Bronzaft has a PhD and MA from Columbia University, has been a consultant on noise abatement to the New York City Transit Authority and has written chapters in eight books mostly on noise and its effects on people. She has been an invited speaker at several conferences. (Bronzaft Pre-Filed Testimony, Ex.1.)
208. Based upon her review of the noise reports in this matter, her review of the literature linking noise to adverse mental and physical health and well-being and her many years of experience in the noise field, Dr. Bronzaft testified that residents in the area of the proposed wind turbine project may very well suffer ill effects from the noise generated by the turbines, including physiological health impacts, stress and a diminished quality of life. (Bronzaft Pre-Filed Testimony, page 3.)
209. In addition to documented physiological health impacts, noise may dramatically affect an individual's quality of life. Individuals living near a constant noise source may not yet have measurable physiological symptoms, but their quality of life may be substantially diminished. (Bronzaft Pre-Filed Testimony, page 7.)
210. In a study by Dr. Bronzaft on the effects of noise on people living in a flight pattern community, those identified as being bothered by the noise reported having sleep difficulty. While night flights are of special concern in the area of sleep deprivation, the young, the old and the infirm often tend to sleep during the day, and thus day flights may prove intrusive to these individuals. Sleep difficulties as experienced by the subjects in a study done by Dr. Bronzaft show that these individuals may have long-term health consequences. (Bronzaft Pre-Filed Testimony, pages 7-8.)
211. Dr. Bronzaft cited a study from 1997 that suggested that psychological disorders of residents living around Kadena Air Base were due to noise exposure. In a paper published in the year 2000, Dr. Bronzaft noted that individuals identified six emotional responses to noise with annoyance ranking first and anger second. (Bronzaft Pre-Filed Testimony, pages 9-10.)
212. Dr. Bronzaft opined that nearly doubling of nighttime noise will prove intrusive and lead to sleep disturbance. Sleep is essential to good health. (Bronzaft Pre-Filed Testimony, page 14.)
213. In BNE's petition to site turbines in Prospect, known as Wind Prospect (Petition No. 980), several fact witnesses who live near 1.5 MW or 1.65 MW wind turbines testified as to the noise created by the wind turbines that result in sleep disturbance and headaches and other health effects suffered by each of those witnesses. This testimony was administratively noticed in this record. (See Andersen Pre-Filed Testimony, FairwindCT Admin. Notice Item No. 50; A. Cool Pre-Filed Testimony, FairwindCT Admin. Notice Item No. 53; M. Cool Pre-Filed Testimony, FairwindCT Admin. Notice

Item No. 54; Ford Pre-Filed Testimony, FairwindCT Admin. Notice Item No. 55; Hobart Pre-Filed Testimony, FairwindCT Admin. Notice Item No. 56; Hobart Amended and Supplemental Pre-Filed Testimony, FairwindCT Admin. Notice Item No. 57; Lindgren Pre-Filed Testimony, FairwindCT Admin. Notice Item No. 58; Meyer Pre-Filed Testimony, FairwindCT Admin. Notice Item No. 59.)

214. These witnesses live within the following distances to the nearest wind turbines:

| Name | Town | Wind Turbine | Distance in feet |
|-----------------|-----------------|---------------------|-------------------------|
| Neil Anderson | Falmouth, MA | 1.65 MW | 1320 |
| Annie Hart Cool | Falmouth, MA | 1.65 MW | 1620 |
| Michael Cool | Falmouth, MA | 1.65 MW | 1620 |
| John J. Ford | Falmouth, MA | 1.65 MW(1) | 3485 |
| | | 1.65 MW(2) | 2745 |
| | | 1.65 MW(3) | 4065 |
| Sue Hobart | Falmouth, MA | 1.65 MW | 1620 |
| Cheryl Lindgren | Vinalhaven, ME | 1.65 MW | 2440 |
| Gerry R. Meyer | Brownsville, WI | 1.5 MW(1) | 1560 |
| | | 1.5 MW(2) | 3200 |
| | | 1.5 MW(3) | 3300 |
| | | 1.5 MW(4) | 2480 |
| | | 1.5 MW(5) | 3200 |

(See Andersen Pre-Filed Testimony, FairwindCT Admin. Notice Item No. 50; A. Cool Pre-Filed Testimony, FairwindCT Admin. Notice Item No. 53; M. Cool Pre-Filed Testimony, FairwindCT Admin. Notice Item No. 54; Ford Pre-Filed Testimony, FairwindCT Admin. Notice Item No. 55; Hobart Pre-Filed Testimony, FairwindCT Admin. Notice Item No. 56; Hobart Amended and Supplemental Pre-Filed Testimony, FairwindCT Admin. Notice Item No. 57; Lindgren Pre-Filed Testimony, FairwindCT Admin. Notice Item No. 58; Meyer Pre-Filed Testimony, FairwindCT Admin. Notice Item No. 59.)

215. Gerry R. Meyer provided his wind turbine diary as Schedule 2 to his Pre-Filed Testimony. A portion of that diary is reproduced below.

July 7 - 5:10 AM Wind S. Fairly quiet yet annoying. 9:00 AM Wind S. Similar sound as earlier. 5:20 PM Jet sound. 9:50 PM It is raining. Wind S. Sound is audible. 12:50 AM Wind S Turbines 4, 6, 73 and 74a are giving off the loud jet sound ripping the sky apart. I can hear 73 & 74a from the computer room. From our family room I can hear turbines 6 & 4.

July 8 - 6:15 AM The first words from my wife's mouth were "I'm going to go back to sleep"; "I didn't sleep half the night and was up at 2:00 AM". That is not a surprise considering when we went to bed we could hear the industrial wind turbines in all parts of our house. 5:15 PM Wind SW Jet sound from turbine 4. 11:15 PM wind NW. It is loud again tonight. Turbines 6 & 4 are a very loud jet sound with thumping sound from # 6. And .. how exciting (not really) that tonight I can hear an additional turbine #75a which is also $\frac{3}{4}$ of a mile from our house. If you have been paying attention you have figured out we have turbines almost in a 360 degree circumference of our house. It is getting worse. Not better.

July 9 - 5:15 AM Our 13 year old son is up. He should be in bed sound asleep at this time. He said he has been up since 2:00 AM. He said he was woke up by the wind turbines. That is not a surprise considering how loud they were last night. 5:40 AM. I can hear # 4 & 6. 8:55 AM Wind NW. I can hear #4 whooshing and humming. The wind is not strong. 4:00 PM. Our son and I are leaving chess camp in Shorewood. Robert got sick. It was very unusual. He was very anxious and worried about his pulse, heart, blood clots, blood not moving in his body, he was sweating and thirsty, kept checking his stomach by pulling up his shirt. Remember in the beginning of this diary I commented that especially my wife was concerned as soon as she heard about turbines coming to our area the health effects it may have on our son due to the trauma he experienced before social services entered his life? I believe today is a direct result of the wind turbines affecting his life due to headaches, lack of sleep and just plain stress and anxiety created by the constant sound. Part of this sound is rarely mentioned which is the low vibration sound we may not even feel. 9:05 PM. Most of the 86 turbines are moving slow or are stopped. There is almost no wind from the W. My wife and I discussed where the wind is operating the turbines or are they being back fed with electricity to make them appear they are producing? 10:40 PM. There is no wind on the ground.

July 10 - 6:30 AM Almost no breeze. Turbines tuning slow. 11:40 AM I can hear #'s 4 & 73 at my computer. We got home 30 minutes ago and I thought the turbines were fairly quiet. Now I hear both IN THE HOUSE. 1:15 AM It's disgusting and very aggravating. I can hear turbines 4, 6, 73 and 74a inside the

house and outside and is like being at O'Hare airport listening to the jet sounds. Very loud.

July 11 - 6:30 AM Turbine 4 not turning. 7:10 AM Wind S quiet. Turbine # 4 turning, but slow with only a hum, but easily heard from 1560' away. 10:15 AM I can hear # 4 in our dining room. 5:15 to 7:15 PM While changing oil in the cars I could hear #'s 4 and 73 the whole time. 9: 1 0 PM Wind SE. I can hear # 4. 10:05 PM Turbines 4 and 73 loud jet sound. 12:10 AM I am hearing a vibration, thumping vibration, thumping sound from turbines 4,6 & 73 in all parts of our house. Very, very sad and aggravating.

(Meyer Pre-Filed Testimony, FairwindCT Admin. Notice Item No. 59, Schedule 2, pages 13-14.)

216. The testimony of these witnesses demonstrates that wind turbine noise adversely affects residents living within at least 3300 feet of turbines.
217. Mark A. Franson provided testimony in which he provided distances to all six of the proposed wind turbines originally proposed in Petition Nos. 983 and 984. Mr. Franson identified a total of 174 structures within 1.25 miles of any the six proposed wind turbines. (Franson Supp. Pre-Filed Testimony, page 3.)
218. Charter Oak Exhibit 6, attached to Franson's supplemental Pre-Filed Testimony, includes a table of distances from BNE's proposed turbines to various houses and other structures found in Colebrook and Norfolk, Connecticut. Part of the table is reproduced below.

| Address | Turbine | Direction | Distance in Feet |
|---------------------|----------------|------------------|-------------------------|
| 48 Flagg Hill Road | CS-1 | W | 1698 |
| 47 Flagg Hill Road | CS-1 | W | 1458 |
| 44 Flagg Hill Road | CS-1 | W | 1677 |
| 42 Flagg Hill Road | CS-1 | W | 1759 |
| 29A Flagg Hill Road | CS-1 | W | 1010 |
| 43 Flagg Hill Road | CS-1 | W | 1390 |
| 45 Flagg Hill Road | CS-2 | W | 1564 |
| 40 Flagg Hill Road | CS-2 | WNW | 1673 |
| 36 Flagg Hill Road | CS-3 | WNW | 1646 |
| 30 Flagg Hill Road | CS-3 | WNW | 1554 |
| 33 Flagg Hill Road | CS-2 | WNW | 1174 |
| 28 Flagg Hill Road | CS-2 | WNW | 1397 |

| Address | Turbine | Direction | Distance in Feet |
|--------------------------|----------------|------------------|----------------------------|
| 17 Flagg Hill Road | CS-2 | WSW | 685 (participating parcel) |
| 8 Flagg Hill Road | CS-2 | SW | 1270 |
| 110 Winsted Norfolk Road | CS-2 | SW | 1790 |
| 114 Winsted Norfolk Road | CS-2 | SW | 1748 |
| 120 Winsted Norfolk Road | CS-2 | SW | 1734 |
| 32 Greenwood Tpke | CS-2 | NNE | 2389 |
| 25 Greenwood Tpke | CS-2 | NNE | 2212 |
| 123 Beckley Road | CS-3 | SE | 3264 |
| 131 Beckley Road | CS-1 | NNE | 3063 |
| 324 Beckley Road | CS-1 | NE | 2755 |
| 319 Beckley Road | CS-1 | NE | 2162 |
| 135 Skinner Road | CS-1 | NNW | 3115 |
| 129 Skinner Road | CS-1 | NW | 3363 |
| 133 Skinner Road | CS-1 | NNW | 3382 |

(Franson Supp. Pre-Filed Testimony, Ex. 3.)

X. Air Quality

219. If constructed, the project will comply with air quality standards because it will have no air emissions. (Petition, pages 1, 11, 34.)

XI. Water Quality

220. DEP water quality standards are contained in several publications, the most expansive of which are the 2004 Connecticut Stormwater Quality Manual and the 2002 Connecticut Guidelines for Soil Erosion and Sediment Control. (Council Admin Notice Item Nos. 9 (“2002 Guidelines”), 25 (“2004 Manual”).)
221. The goals of these water quality standards are to provide guidance on methods and techniques for minimizing erosion and sedimentation, and to protect the waters of the State of Connecticut from the adverse effects of post-construction stormwater runoff, thereby preventing pollution to the waters of the State. (2004 Manual at 1-2; 2002 Guidelines at 1-1.)

222. If a project complies with the 2004 Connecticut Stormwater Quality Manual and the 2002 Connecticut Guidelines for Soil Erosion and Sediment Control, it is unlikely to have adverse effects on the waters of the State. (2004 Manual at 1-2; 2002 Guidelines at 1-1.)
223. BNE has revised its original site plans during the course of this proceeding. BNE has also revised the accompanying stormwater management plan with stormwater pollution prevention plan (SMP) and erosion and sediment control plan (ECP). (Petition, Exs. F-H; Cline Pre-Filed Testimony, Exs. 1-3.)
224. BNE stated in its petition that its project, then including the original site plans, SMP and ECP, met DEP water quality standards. (Petition, page 1-2, 30-31, 34-35.) Those original plans, submitted with its petition, were conceptual 15% construction drawings. (4/14/11 Tr. 1147:13-148:3 (Cline).) Mr. Cline testified that the original plans met water quality standards to the extent possible with 15% construction drawings that were not complete. (4/14/11 Tr. 1147:13-148:3 (Cline).)
225. Mr. Carboni testified that the original plans did not comply with the water quality standards, including but not limited to the 2002 Guidelines, the 2004 Manual and the General Permit. (Carboni Pre-Filed Testimony, pages 3-10, 15, 23.)
226. Mr. Carboni's most significant concern regarding the original plans concerned the lack of sedimentation and outlet protection facilities. BNE's plans provided for only silt fences to prevent sedimentation at discharge points on the site. Mr. Carboni testified that at least six sediment traps and two sediment basins would be required under the 2002 Guidelines. The silt fences would not prevent sedimentation and would result in pollution of the waters of the state. (Carboni Pre-Filed Testimony, pages 3-5.)
227. Mr. Carboni also expressed concern about two discharge areas on the site: the intersection of the proposed access road with Flagg Hill Road and the proposed wetlands crossing. According to Mr. Carboni's calculations, the physical constraints of the site likely will not permit the construction of an appropriately sized sediment basin at the intersection with Flagg Hill Road, which could result in Flagg Hill Road washing out. At the proposed wetlands crossing, the lack of sedimentation facilities would result in sedimentation of the wetlands; adding appropriate facilities would increase the direct wetlands impact. (Carboni Pre-Filed Testimony, pages 5-9.)
228. Mr. Carboni also expressed concerns about slope stabilization. BNE used 1:1 slopes extensively throughout the site in its original plans and the first revised plans. (Carboni Pre-Filed Testimony, pages 9-11.) The 2002 Guidelines require slopes of 2:1 or shallower in the absence of geotechnical analysis that shows steeper slopes will be stable with engineered design features. (2002 Guidelines, 5-2-5.) BNE had not done any geotechnical analysis at the time the original plans were prepared. (4/14/11 Tr. 148:15-149:7 (Cline).)

229. Mr. Carboni also expressed concerns regarding structural fabrication, road section, water quality swale, hydrology, water quality and stormwater quantity. (Carboni Pre-Filed Testimony, pages 11-21.)
230. BNE then revised its original plans. Mr. Cline testified that the revised plans met DEP water quality standards. (Cline Pre-Filed Testimony, pages 6-7.) He later qualified his testimony to note that the plans were conceptual in nature and therefore complied with water quality standards to the extent possible to the extent possible with 15% construction drawings that were not complete. (4/14/11 Tr. 1147:13-148:3 (Cline).)
231. Changes made in the revised plans included decreasing the width of the crane and access roads, changing 1:1 slopes to 2:1 and 3:1 slopes, including sediment traps and conveyance swales and providing for post-construction bioretention ponds to treat stormwater. (Cline Supp. Pre-Filed Testimony, pages 3-6.)
232. Mr. Carboni testified that the revised plans, although an improvement, still failed to comply with the 2002 Guidelines and the 2004 Manual. (Carboni Supp. Pre-Filed Testimony, pages 1-2.) He also testified that many of his concerns about the first set of plans had not been alleviated. (Carboni Supp. Pre-Filed Testimony, page 2.)
233. Mr. Carboni's most significant concerns regarding the revised plans relate to slope stabilization, due to BNE's continued use of slopes steeper than 2:1 in the absence of geotechnical analysis and engineered design features – despite Mr. Cline's claim that the revised plans eliminated 1:1 slopes. (Carboni Supp. Pre-Filed Testimony, pages 2-3.)
234. Mr. Carboni also testified that when errors in grading contained in the revised plans are corrected, the grading will extend in some areas beyond the boundaries of the project site. Two example analyses by Mr. Carboni shows that the corrected grading at two locations and related outlet protection facilities on the lower access road will extend beyond the boundary of the driveway and utility easement over BNE's property in favor of the property owner at 29A Flagg Hill Road. (Carboni Supp. Pre-Filed Testimony, pages 2-4.)
235. Mr. Carboni also testified that the sedimentation facilities remain undersized in the revised plans, and commented on apparent errors in design of road culverts and bioretention ponds. Mr. Carboni testified that once the bioretention ponds were properly graded in conformance with the 2004 Manual, several of the ponds would not actually fit on the site. (Carboni Supp. Pre-Filed Testimony, pages 9-10.)
236. Mr. Cline testified that revised plans most closely meets DEP water quality standards and is most protective of the waters of the State. (4/14/11 Tr. 169:1-8 (Cline).)
237. Mr. Carboni testified that he does not believe that the proposed project can be built on the site in compliance with state regulations. (4/21/11 Tr. 114:24-118:6 (Carboni).) Mr. Klein testified that the site constraints are too significant in terms of the locations of the access

points in relationship to the wetlands on the site for the project to be built. (4/14/11 Tr. 118:17-120:14 (Klein).)

- 238. BNE has not done a geotechnical investigation of the site, collected test pit or infiltration data or determined the depth of the season-high groundwater on the site. BNE cannot design the bioretention ponds until that data is collected. (4/14/11 Tr. 158:4-19 (Cline).)
- 239. Mr. Carboni testified that both sets of plans will result in a project that will, within a reasonable degree of engineering certainty, lead to pollution of the waters of the State. (Carboni Pre-Filed Testimony, page 23; Carboni Supp. Pre-Filed Testimony, page 11.)

XII. Visibility

- 240. A total of 254 acres will have visibility of the turbine hubs above the tree canopy during leaf-on conditions. At their apexes, turbine blades will be visible from 457 acres. (Libertine Pre-Filed Testimony, page 2.) Approximately 1,255 acres of land will have visibility of the proposed turbine hubs during leaf-off conditions.
- 241. Approximately 163 residential properties may have at least partial views of the turbine hub during leaf-on conditions. (Libertine Pre-Filed Testimony, Ex. 2.)
- 242. Residential visibility is further demonstrated in the following chart, which lists BNE’s reported numbers of residential properties within 1 mile of the project:

| | Year-round Visibility | Leaf-off Visibility |
|---|------------------------------|----------------------------|
| Hub height | 35 | 80 |
| Hub plus 100-meter diameter blades | 28 | N/A |
| Hub plus 82.5-meter blades | 51 | N/A |

(Petition, Ex. J, page 6; Libertine Pre-Filed Testimony, Ex. 2, page 6.)

- 243. The dynamic nature of the turbines’ moving blades causes a more significant visual impact than projects that are static. (3/23/11 Tr. 50:21-51:24 (Libertine).)
- 244. At least two residential properties – located at 12A and 12B Greenwoods Turnpike – will be subject to year-round views of six wind turbines, based on the location of those residences in between Wind Colebrook South and that proposed in Petition 984, known as Wind Colebrook North. (Mow Pre-Filed Testimony, page 1; Grant Pre-Filed Testimony, page 1; Chalder Pre-Filed Testimony, Ex. 3, Figures 9 & 10; 4/21/11 Tr. 167:21-168:12 (Chalder).) Additional residential properties are likely to be subjected to similar visibility, including residential properties on Pinney Street and several other residential properties along Greenwoods Turnpike. (Chalder Pre-Filed Testimony, Ex. 3, Figures 11 & 12; 4/21/11 Tr. 168:4-15 (Chalder); 4/21/11 Tr. 200:19-205:1 (Libertine).)

XIII. Public Health and Safety Issues

A. Setbacks

245. Some states have setback standards for the siting of industrial wind turbines. (Supplemental Pre-Filed Testimony of Joel Rinebold dated Mar. 24, 2011, pages 15-17.)
246. In Dixmont, Maine, each wind turbine must be set back at least 2,500 feet from the property line of any non-participating property (unless waived by the property owner in writing) and at least 1,500 feet from any public way. (FairwindCT Admin. Notice Item No. 61 (Town of Dixmont, Maine, Wind Energy Facility Ordinance).)
247. In Jackson, Maine, each wind turbine greater than or equal to 1 MW, or a turbine height greater than or equal to 300 feet must be set back from the property line of any nonparticipating landowner a distance of no less than 13 times the turbine height (unless waived by the property owner in writing) and set back from any public road a distance no less than 4 times the turbine height. (FairwindCT Admin. Notice Item No. 62 (Town of Jackson, Maine, Wind Turbine Ordinance (Amended), Feb. 25, 2010).)
248. In Thorndike, Maine, each wind turbine must be set back at least 1,800 feet from the property line of any non-participating property (unless waived by the property owner in writing) and at least 1,500 from any public way. (FairwindCT Admin. Notice Item No. 64 (Thorndike, Maine, Wind Energy Facility Ordinance).)
249. The Montville (Maine) Wind Turbine Generator Ordinance states that “[s]etbacks to property lines are a minimum buffer of one mile from the Project Boundary. This is assuming a 1.5 MW industrial wind turbine, which has a Turbine Height of approximately 400 feet. However, larger wind turbines are louder, so a varying setback basis is required. A one mile setback is approximately equal to 13 times the turbine height for a 400 foot turbine. Therefore, the Setback Distance is defined as the larger of one mile or 13 times the Turbine Height, measured horizontally from the Project Boundary to the nearest property line.” Furthermore, wind turbines must be “set back from any public road a distance no less than 4 times the turbine height, measured horizontally.” (FairwindCT Admin. Notice Item No. 65 (Montville, Maine, Wind Turbine Generator Ordinance).)
250. In February 2010, House Bill 677, “An act relating to wind energy plants” was introduced in the Vermont legislature. The bill proposes minimum setback requirements for wind energy plants that exceed 0.49 megawatts. The setbacks proposed in the bill include (1) one and one-quarter miles (6,600 feet) from an occupied building if the elevation change between the wind turbine and the occupied building is equal to or less than 500 feet, (2) two miles (10,560 feet) from an occupied building, if the elevation change between wind turbine and the occupied building exceeds 500 feet, (3) one-half mile (2,640 feet) from the closest boundary of the parcel on which the wind turbine will be located, and (4) one-third of a mile (1,759 feet) from any public highway or right-of-

way and from any above-ground utility line or facility. Under this bill, a property owner may waive one or more of the setback requirements by signing a written waiver of rights. (FairwindCT Admin. Notice Item No. 66 (Vermont House Bill 677 as Introduced (2010)).)

251. In November 2010, Senate Bill 2374, “An act concerning wind energy and supplementing Titles 13 and 40 of the Revised Statutes” was introduced in the New Jersey legislature. The bill states that no state “entity may approve any plan, proposal, or permit application for a wind energy structure if that wind energy structure will be erected or installed at a site that is closer than 2,000 feet from any residence or residentially zoned property.” (FairwindCT Admin. Notice Item No. 67 (New Jersey Senate Bill 2374 (2010)).)
252. Appropriate setbacks can reduce the risk to people and property. (4/14/11 Tr. 82:4-6 (Heraud).)
253. An ice fragment can be thrown an estimated 285 meters (935 feet) or more from the GE 1.6-100 and 265 meters (869 feet) or more from the GE 1.6-82.5. (Heraud Pre-Filed Testimony, page 3.)
254. At the property boundary of the site, modeled noise conditions demonstrate that the proposed wind turbines will be in excess of 6 to 10 dB above the permitted residential-to-residential limits at night pursuant to the DEP noise regulations. (Bahtiarian Supp. Pre-Filed Testimony Apr. 4, 2011, page 3 & Ex. 6.)
255. If icing is likely at the wind turbine site, GE Energy recommends a setback distance of $1.5 \times (\text{Hub Height} + \text{Rotator Diameter})$. (FairwindCT Admin. Notice Item No. 16 (GE Energy, Ice Shedding and Ice Throw – Risk and Mitigation).) This calculates to 273.75 meters (approximately 898 feet) for the 82.5-meter blade diameter and 300 meters (approximately 984 feet) for the 100-meter blade diameter.
256. One of BNE’s witnesses testified that 984 feet to the nearest residential dwelling is an adequate buffer to protect public health and safety, and noted that this buffer would also meet a setback equal to 1.5 times the maximum height of the tower plus the diameter of the blade with either an 82.5-meter diameter blade or a 100-meter diameter blade. (Rinebold Pre-Filed Testimony, page 13.)

257. Seven property lines, including four residential property lines, are within 984 feet of one or more of the proposed turbines, as shown in the table below.

| Address | Property Owner | Distance from Turbine to Abutting Property Line | | |
|--------------------|---|---|----------------|----------------|
| | | S Turbine (1) | NE Turbine (2) | NW Turbine (3) |
| 8 Flagg Hill Rd | Bank of America | | 940 ft | |
| Winsted-Norfolk Rd | State of Connecticut | | 895 ft | |
| 33 Flagg Hill Rd | Carole Marchetti | 875 ft | 675 ft | |
| 29A Flagg Hill Rd | Robin L. Dziejdzic (Hirtle) | 740 ft | 895 ft | |
| Flagg Hill Rd | Northwestern CT Sportsman's Association | | 435 ft | 265 ft |
| 45 Flagg Hill Rd | Mark & Mary Matarainen | 140 ft | | |
| Beckley Rd | Nature Conservancy of Conn. Inc. | | | 235 ft |

(BNE Responses to FairwindCT's First Set of Interrogatories, Answer 41 & Ex. 1.)

258. Flagg Hill Road, a conservation easement and a private residential driveway are also within 984 feet of one or more of the proposed turbine locations. (BNE Responses to FairwindCT's First Set of Interrogatories, Answer 42; Heraud Pre-Filed Testimony, Ex. 2, Figure 5-6; Petition, Ex. F, Sheet C-001; 4/14/11 Tr. 90:18-91:14.)

B. Ice Throw

259. Ice can be and has been thrown from wind turbines. Ice throw is a safety issue with wind turbine projects. (4/14/11 Tr. 81:21-24 (Heraud).) Proposed turbine locations have been moved due to ice throw risk. (See 4/14/11 Tr. 77:25-78:13 (Heraud).)
260. Connecticut has weather conditions that will result in ice buildup on the proposed wind turbines if they are built. (4/14/11 Tr. 81:25-82:3 (Heraud).) Both glaze ice and rime ice are safety concerns. (4/14/11 Tr. 49:24-50:5 (Heraud).)
261. With appropriate setbacks and mitigation measures, the risk of injury to people and property due to ice throw can be reduced to zero. (4/14/11 Tr. 82:4-8 (Heraud).)
262. BNE submitted ice throw reports for both the 82.5-meter and 100-meter blade diameter. (Heraud Pre-Filed Testimony, Exs. 2 & 3) Those reports calculated the probability that ice would drop or throw and hit a one square meter "receptor." If the reports had used a "receptor" area larger than one square meter, the risk levels reported would be higher. (3/23/11 Tr. 49:3-13 (Heraud).)

263. Dr. Heraud, BNE's witness, determined the probability of ice throw and ice drop based on a two-step process. The first step involved a Monte Carlo analysis, in which inputs, or assumptions, regarding the size and shape of the possible ice throw were used. This analysis was conducted using internal software developed by Dr. Heraud's employer, rather than publicly available software programs such as WindPRO and WindFarmer. (Heraud Pre-Filed Testimony, Ex. 2 & Ex. 3; 4/14/11 Tr. 78:24-79:16 (Heraud).)
264. The Monte Carlo analysis assumed that ice would throw or drop in 1 and 2 kilogram chunks. (3/23/11 Tr. 48:12-49:2.) The analysis also assumes no lift. (Heraud Pre-Filed Testimony, Ex. 2, page 7 & Ex. 3, page 7.)
265. In the second step of Dr. Heraud's analysis, he looked at climate data obtained from the met tower data from one winter season at the site. Based on the total amount of corrupted data from the met tower, which was provided to him by another of BNE's consultants, Dr. Heraud assumed a total of 12 icing days per year at the site. (4/14/11 Tr. 91:22-92:11, 93:16-94:5, 94:18-95:4 (Heraud).)
266. Dr. Heraud has done ice throw assessments elsewhere in New England, including an assessment related to the Kingdom Community Wind Power Project in Vermont. (4/14/11 Tr. 78:19-23 (Heraud).)
267. Dr. Heraud testified that 20 or 25 icing days could be used in an ice throw analysis. Using a larger number of icing days in the analysis would proportionately increase the probability of the risk of ice throw injury. (4/21/11 Tr. 184:24-185:11:11 (Heraud).)
268. The maximum distance ice could drop with the 100-meter diameter blades is 104 meters, or approximately 341 feet. (Heraud Pre-Filed Testimony, Ex. 2, page 10.) There are three property lines located within that distance from proposed turbine locations. (BNE Responses to FairwindCT's First Set of Interrogatories, Answer 41 & Ex. 1.)
269. Turbine 1 is just 140 feet from a residential property line to the south of the site, located at 45 Flagg Hill Road, and Turbine 3 is 235 feet from the Nature Conservancy's property line to the west of the site and is 265 feet from the gun club's property to the north of the site. (BNE Responses to FairwindCT's First Set of Interrogatories, Answer 41 & Ex. 1.) Ice could therefore drop beyond the boundaries of the site onto three different properties, one of which is residential.
270. The "typical range" for ice throw from the 100-meter diameter blades is up to 160 meters, or about 525 feet. (Heraud Pre-Filed Testimony, Ex. 2, page 10.) There are four property lines located within that distance from proposed turbine locations. (BNE Responses to FairwindCT's First Set of Interrogatories, Answer 41 & Ex. 1.)
271. In addition to the properties listed above, the gun club's property is also 435 feet from Turbine 2, which means ice thrown from Turbines 2 and 3 could strike the gun club's property. (BNE Responses to FairwindCT's First Set of Interrogatories, Answer 41 &

- Ex. 1.) Ice could therefore be typically thrown beyond the boundaries of the site onto four different properties, one of which is residential.
272. The maximum distance ice could be thrown with the 100-meter diameter blades is 285 meters, or approximately 935 feet. (Heraud Pre-Filed Testimony, Ex. 2, page 10.) There are six property lines located within that distance from proposed turbine locations. (BNE Responses to FairwindCT's First Set of Interrogatories, Answer 41 & Ex. 1.)
273. In addition to the properties listed above, two additional residential property lines are within that distance from the proposed turbine locations, as is the Algonquin State Forest. Turbine 2 is 895 feet from the state forest. Turbine 1 is 875 feet from the property line at 33 Flagg Hill Road and Turbine 3 is 675 feet from the same residential property. Turbine 1 is 740 feet from the property line at 29A Flagg Hill Road and Turbine 2 is 895 feet from the same residential property. Ice in the maximum range for ice throw could therefore cross the boundaries of the project site if thrown from any of the three turbines. In this scenario, ice could cross six property lines, including three residential property lines. (BNE Responses to FairwindCT's First Set of Interrogatories, Answer 41 & Ex. 1.)
274. A fourth residential property line is just 5 feet outside of BNE's calculated maximum ice throw range for the 100-meter diameter blades. (BNE Responses to FairwindCT's First Set of Interrogatories, Answer 41 & Ex. 1.)
275. Nearly all of a private driveway used to access the residence at 29A Flagg Hill Road is within the maximum ice throw range for the 100-meter diameter blades. A conservation easement is also within the maximum ice throw range for the 100-meter diameter blades. (Heraud Pre-Filed Testimony, Ex. 2, Figure 5-6; Petition, Ex. F, Sheet C-001; 4/14/11 Tr. 90:18-91:14.)
276. Flagg Hill Road is within the maximum ice throw range because it is located 920 feet from Turbine 2. (BNE Responses to FairwindCT's First Set of Interrogatories, Answer 42.)
277. The maximum distance ice could drop with the 82.5-meter diameter blades is 98 meters, or approximately 322 feet. (Heraud Pre-Filed Testimony, Ex. 3, page 10.) There are three property lines located within that distance from proposed turbine locations, including one residential property, listed above. (BNE Responses to FairwindCT's First Set of Interrogatories, Answer 41 & Ex. 1.) Ice could therefore drop beyond the boundaries of the site onto three different properties, one of which is residential.
278. The "typical range" for ice throw from the 82.5-meter diameter blades is up to 140 meters, or about 459 feet. (Heraud Pre-Filed Testimony, Ex. 2, page 10.) There are three property lines located within that distance from proposed turbine locations, including one residential property, listed above. (BNE Responses to FairwindCT's First Set of Interrogatories, Answer 41 & Ex. 1.) Ice in the "typical range" for ice throw could

therefore cross the boundaries of the project site onto three different properties, one of which is residential.

279. The maximum distance ice could be thrown with the 82.5-meter diameter blades is 265 meters, or approximately 869 feet. (Heraud Pre-Filed Testimony, Ex. 3, page 10.) There are five property lines located within that distance from proposed turbine locations, including three residential property, listed above. (BNE Responses to FairwindCT's First Set of Interrogatories, Answer 41 & Ex. 1.) Ice in the maximum range for ice throw could therefore cross the boundaries of the project site onto five different properties, three of which are residential.
280. Approximately two-thirds of a private driveway used to access the residence at 29A Flagg Hill Road is within the maximum ice throw range for the 82.5-meter diameter blades. A conservation easement is also within the maximum ice throw range for the 82.5-meter diameter blades. (Heraud Pre-Filed Testimony, Ex. 3, Figure 5-6; Petition, Ex. F, Sheet C-001; 4/14/11 Tr. 90:18-91:14.)

C. Blade Throw

281. Blades can be thrown and have been thrown from wind turbines. (FairwindCT Admin. Notice Item No. 60, pages 35-37.)
282. BNE did not submit a blade throw analysis. (4/14/11 Tr. 81:13-16.) Nor did it respond to the Council's interrogatory asking for the approximate distance that parts of the blades could be thrown from a turbine. (BNE Response to Council's Interrogatories, Set One, Answer 25.)
283. Blades have been thrown distances beyond the wind-industry recommended setback of 1.5 times total hub and blade height. (FairwindCT Admin. Notice Item No. 60, pages 37.)

D. Shadow Flicker

284. "Shadow flicker," an annoyance unique to wind turbines, is defined as the effect of alternating changes in light intensity of the sun caused by the rotating blades of the turbine casting a moving shadow to a nearby area. (Libertine Pre-Filed Testimony, Ex. 3, pages 1-2.)
285. Michael Libertine, LEP, did the shadow flicker analyses for BNE. The collection of shadow flicker analyses done for BNE are the first shadow flicker studies ever undertaken by Mr. Libertine.
286. Under certain circumstances, shadow flicker can be cast through an unobstructed window of a home, so that a room could experience repetitive changes in brightness. Shadow flicker can also occur outside by casting alternating shadows. (Libertine Pre-Filed Testimony, Ex. 3, page 2.)

287. The frequency of shadow flicker is determined by a rotor's speed and the number of blades on the rotor. The frequency is measured in Hertz (Hz), with 1 Hz being equivalent to one flicker per second. (Libertine Pre-Filed Testimony, Ex. 3, page 3.)
288. Initially, Mr. Libertine did a shadow flicker analysis for the blade diameter of 100 meters. (BNE's Amended Responses to Council's Interrogatories, Set One, Answer 17 & Ex. 3.) Several weeks later, BNE submitted a shadow flicker analysis for the 82.5-meter diameter blades. (Libertine Pre-Filed Testimony, Ex. 3.)
289. Mr. Libertine did the BNE shadow flicker analysis for the blade diameter of 82.5 meters using a nominal speed range of 9.75 to 16.18 revolutions per minute. (Libertine Pre-Filed Testimony, Ex. 3, page 3.)
290. Mr. Libertine did the BNE shadow flicker analysis for the blade diameter of 82.5 meters using a nominal speed range of 9.75 to 16.18 revolutions per minute. (Libertine Pre-Filed Testimony, Ex. 3, page 3.)
291. That rotation speed corresponds to 29.2 to 48.5 shadows per minute, or 0.49 to 0.81 Hz. (Libertine Pre-Filed Testimony, Ex. 3, page 3; 4/26/11 Tr. 26:19-27:4 (Libertine).)
292. Flicker frequencies within this range may be considered an annoyance under certain circumstances. (Libertine Pre-Filed Testimony, Ex. 3, page 3.)
293. An analysis of potential shadow flicker occurrences in the surrounding area resulting from the proposed project was conducted using the SHADOW module of WindPRO software. WindPRO is a modular-based software package developed by EMD International that was designed for the wind industry for the planning and evaluation of wind power projects. The software model claims that it can determine the duration of shadow flicker experienced at a specific viewing location, by using a geometric analysis which accounts for the relative positions of the sun (throughout the time of year and day), the locations of the wind turbines, and the viewing location. The SHADOW module calculates the duration of time that shadow flicker could occur at receptor locations within the program's default distance of 2,000 meters (6,561 feet) from the wind turbine locations. The 2,000-meter distance was used in Mr. Libertine's analysis as the "Study Area." (Libertine Pre-Filed Testimony, Ex. 3, page 3.)
294. The WindPRO analysis purports to calculate predicted shadow flicker occurrences for specific receptor locations. A "receptor" is defined as an occupied structure within the 2,000 meter (6,561 feet) radius study area. The receptors were located using a combination of aerial photography, online assessor information and selective field verification. Each receptor was modeled using the WindPRO SHADOW module's "greenhouse" mode. The greenhouse mode sensors can "see" in all directions, as if the receptor were an entirely glass structure (similar to a greenhouse), with no obstructions to block incoming light (or shadows). (Libertine Pre-Filed Testimony, Ex. 3, page 3.)

295. A total of 75 receptors were identified within the 2,000 meter radius study area for both the 82.5 meter and the 100 meter blade shadow flicker analyses. (Libertine Pre-Filed Testimony, Ex. 3, page 3; BNE's Amended Responses to Council's Interrogatories, Set One, Ex. 3, page 8.)
296. Mr. Libertine claims the modeling offered by BNE assumes that at distances greater than a 2,000 meter (6,561 feet) radius from the turbines, the frequency of shadow flicker occurrence is low enough and its intensity faint enough to not be a distraction to human activities. (Libertine Pre-Filed Testimony, Ex. 3, page 4.) He offered no evidence to verify the adequacy of the 2,000 meter default radius.
297. Mr. Libertine did not do a shadow flicker analysis using either a 3,000-meter or a 5,000-meter radius. (4/26/2011 Tr. 130:5-16.)
298. Both analyses report that Turbine 3 has no shadow. Mr. Libertine explained that the determination of hours of shadow flicker is from calculations that are generated through data inputs and the computer model did not pick up any shadow being thrown on the 75 selected receptor locations by Turbine 3. He would not represent that there is no flicker from Turbine 3. (Libertine Pre-Filed Testimony, Ex. 3, page 8; BNE's Amended Responses to Council's Interrogatories, Set One, Ex. 3, page 9; 4/26/2011 Tr. 129:2-21.)
299. Mr. Libertine viewed the WindPRO software as a "worst-case scenario" and then did a modified analysis using a 50% reduction factor to produce what he labeled a "probable case scenario." Mr. Libertine testified that the 50% reduction factor was reasonable given historic weather statistics and accounting for periodic operational limitations. (Libertine Pre-Filed Testimony, Ex. 3, page 5.) He cited no historic weather statistics in evidence to verify this claim.
300. The 50% reduction factor was not based on any specific formula, even though partly cloudy days occur 20% to 25% annually in Colebrook (according to Mr. Libertine). (Libertine Pre-Filed Testimony, Ex. 3, page 6.)
301. There are no federal or State of Connecticut standards for exposure to shadow flicker. (Libertine Pre-Filed Testimony, Ex. 3, page 6.)
302. According to Mr. Libertine, some other countries have adopted standards that limit shadow flicker to amounts ranging from 8 hours per year to 30 hours per year at an occupied structure. (Libertine Pre-Filed Testimony, Ex. 3, pages 6-7.)
303. The 30-hour per year standard relied upon by Mr. Libertine, however, comes with an additional limitation that no one receptor may be subjected to more than 30 minutes per day of shadow flicker. Denmark has an unofficial guideline of 10 hours per year and Sweden uses 8 hours per year. (4/26/2011 Tr. 126:11-9 (Libertine).)

304. The map showing “Probable Case Shadow Flicker” for the 82.5-meter diameter blades was not created using the values found in Table 4 Shadow Flicker Results-Receptor Locations, but was “... developed using a raster image created from the WindPRO software calculations. The WindPRO raster image of shadow flicker is a 10 m x 10 m grid cell dataset that contains the values based on the tabulator report values. Due to the 10 m resolution of the grid cells, the resulting raster image is not as accurate as it tabulated values, and thus has been incorporated into Figure 1 to depict the generalization of the shadow flicker results.” (Libertine Pre-Filed Testimony, Ex. 3, page 6.)
305. The Project was analyzed to determine the potential for shadow flicker impacts at the 75 receptors located within the Study Area using a combination of worst-case scenario modeling and incorporating a probable-case scenario. A total of seven receptors are predicted to experience shadow flicker at some time during the year, with annual durations ranging from nearly 10 hours to over 48 hours. One receptor is predicted to experience more than 30 hours per year; three receptors are predicted to experience between 20 and 30 hours; and three receptors between approximately 10 and 17 hours annually. (Libertine Pre-Filed Testimony, Ex. 3, page 7.)
306. Mr. Libertine’s probable case scenario for the 82.5-meter diameter blades evaluated 75 dwellings, including 74 non-participating residences. Six of the non-participating residences are expected to experience between nearly 10 and up to 27.5 hours of shadow flicker per year. Under the worst-case scenario, the same properties would experience between nearly 20 hours and up to 55 hours of shadow flicker a year, ranging from 45 to 77 minutes per day during certain times of the year. (Libertine Pre-Filed Testimony, Ex. 3, Table 4.)
307. Other properties that are within the Study Area are not included in Table 4. According the raster image map, receptor AO is the grounds, not the dwelling, at 117 Pinney Street. Under the probable case scenario for the 82.5-meter diameter blades, that property will be assaulted with less than 10 hours of shadow flicker each year. (Libertine Pre-Filed Testimony, Ex. 3, Figure 1; 4/26/2011 Tr. 133:12-135:12 (Libertine).)
308. Other areas will experience 10 to 20 hours of shadow flicker each year, including portions of Route 44. BNE did not calculate the times of year during which that flicker will be experienced, so one cannot draw a conclusion as to the effects on traffic. (Libertine Pre-Filed Testimony, Ex. 3, Figure 1; 4/26/2011 Tr. 131:23-132:7 (Libertine).)
309. Beckley Bog will experience, probable case, less than 10 hours of shadow flicker each year. The amount of worst-case shadow flicker was not provided by BNE. (Libertine Pre-Filed Testimony, Ex. 3, Figure 1; 4/26/2011 Tr. 131:12-22 (Libertine).)
310. The effect of shadow flicker on wildlife in Beckley Bog is unknown. Mr. Tidhar did not do any analysis of the habitat of Beckley Bog in conjunction with Wind Colebrook South; shadow flicker effects on wildlife is not part of his expertise. Mr. Tidhar was unfamiliar with both Beckley Bog and the National Natural Landmark program.

(4/14/2011 Tr. 114:14-115:1 (Tidhar).) No other BNE witness offered testimony regarding the impacts of Wind Colebrook South on Beckley Bog.

311. If BNE constructs Wind Colebrook South using the 82.5-meter diameter blades, Robin Hirtle, the owner of 29A Flagg Hill Road, can expect to have worst-case shadow flicker every evening between March 24 and April 30. Depending on the day, Ms. Hirtle may experience between 12 minutes and 55 minutes of shadow flicker every evening during this period. Shadow flicker will return to her house every evening between August 12 and September 19, during which time Ms. Hirtle can expect flicker of a duration between 7 minutes and 55 minutes a day. (Libertine Pre-Filed Testimony, Ex. 3, App'x B (receptor B).)
312. BNE's shadow flicker analysis for the 82.5-meter diameter blades contains other values for other receptors and does not show cumulative values for Wind Colebrook South and Wind Colebrook North. Worst-case impacts for each of the non-participating properties are listed below. Note that in Table 4 of his report, Mr. Libertine reports the Shadow Number of Days Per Year from his SHADOW-Main Result report as the maximum minutes of flicker per day. The table below corrects the report and supplies values from Mr. Libertine's Appendix B, SHADOW-Calendar reports for each receptor, to report values for the maximum minutes of flicker per day.

| ID | Site Address | Worst-Case Hours Per Year | Worst-Case Max Minutes Per Day (corrected) | Max Days of Flicker Per Year | >30 Hours Per Year and 30 Minutes Per Day Limit |
|-----------|------------------------|----------------------------------|---|-------------------------------------|---|
| B | 29A Flagg Hill Rd | 55:04:00 | 55 | 77 | Yes |
| L | 8 Flagg Hill Rd | 42:54:00 | 44 | 93 | Yes |
| M | 8 Flagg Hill Rd | 40:04:00 | 46 | 67 | Yes |
| P | 120 Winsted-Norfolk Rd | 33:42:00 | 37 | 72 | Yes |
| N | 114 Winsted-Norfolk Rd | 23:29:00 | 36 | 51 | No |
| O | 110 Winsted-Norfolk Rd | 19:55:00 | 34 | 45 | No |

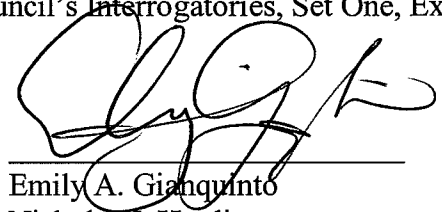
(Libertine Pre-Filed Testimony, Ex. 3, Table 4 & App'x B.)

313. BNE's shadow flicker analysis for the 100-meter diameter blades contains other values for other receptors and does not show cumulative values for Wind Colebrook South and Wind Colebrook North. Worst-case impacts for each of the non-participating properties are listed below.

| ID | Site Address | Worst-Case Hours Per Year | Worst-Case Max Minutes Per Day | Max Days of Flicker Per Year | >30 Hours Per Year and 30 Minutes Per Day Limit |
|-----------|------------------------|----------------------------------|---------------------------------------|-------------------------------------|---|
| B | 29A Flagg Hill | 58:11:00 | 57 | 80 | Yes |
| L | 8 Flagg Hill | 42:54:00 | 44 | 93 | Yes |
| M | 8 Flagg Hill | 40:04:00 | 46 | 67 | Yes |
| P | 120 Winsted-Norfolk Rd | 33:42:00 | 37 | 72 | Yes |
| N | 114 Winsted-Norfolk Rd | 23:29:00 | 36 | 51 | No |
| O | 110 Winsted-Norfolk Rd | 19:55:00 | 34 | 45 | No |

(BNE's Amended Responses to Council's Interrogatories, Set One, Ex. 3, Table 4, App'x A & B.)

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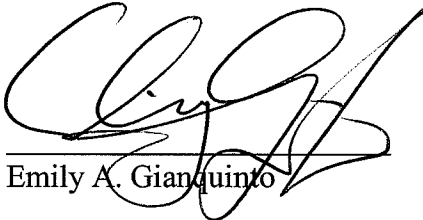
CERTIFICATION

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 20th day of May, 2011:

Lee D. Hoffman
Bonnie L. Heiple
Paul Corey
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 A. Gianquinto