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 Winstead-Norfolk Road in Colebrook, Connecticut ("Wind Colebrook North")	**Petition No. 984** **March 22, 2011**

PRE-FILED TESTIMONY OF THOMAS WHOLLEY

Q1. Please state your name and profession.

A. Thomas Wholley and I am the Director of Air Quality Services and Noise Services for Vanasse Hangen Brustlin, inc. ("VHB"). VHB's Connecticut office is located at 54 Tuttle Place in Middletown, Connecticut.

Q2. Please summarize your professional background and experience.

A. I have a B.S. from Lowell Technological Institute. I have over 37 years of experience in transportation and land development air quality and noise evaluations. My experience includes noise evaluation for local, state, and federal environmental documents. Prior to working at VHB, I also worked for 13 years at the United States Environmental Protection Agency (EPA) where I was responsible for the implementation of federal laws including the Clean Air Act and the Noise Control Act. I began working for the State of Massachusetts Highway department where I was responsible for implementing the highway air quality and noise program. Wind turbines are turbine engines fueled by wind, rather than coal, natural gas, or oil. I have worked on the air quality and noise permitting of numerous turbine engines in Connecticut, Massachusetts, Rhode Island, New York, New Hampshire, and Maine for facilities that require electricty, such as banking and internet data centers. My resume is attached hereto as Exhibit 1, which details my qualifications and experience.

Q3. What is your involvement with BNE Energy Inc.'s Wind Colebrook North project?

A. I was responsible for the preparation of the revised noise evaluation report, dated March 2011. This report is included in BNE's petition as Exhibit 2. The noise report has been revised to reflect a change in location for turbine 1.

Q4. Please summarize the findings of the noise evaluation?

A. The noise evaluation determined existing conditions using noise monitoring, calculated future build sound levels from the proposed wind turbines, and compared the results to the Connecticut Department of Environmental Protection ("DEP") noise regulations. VHB collected baseline noise data in the in the neighborhood of Flagg Hill Road, which was considered representative of the property at Winstead-Norfolk Road in Colebrook (the "Property") in order to establish existing noise conditions on the Property and the surrounding area, which could be compared to Sec. 22a-69-3.6. "High background noise areas". VHB then utilized BNE's wind data, the manufacturer's reference sound level information from GE concerning the proposed 1.6 MW turbines, and the principles of acoustical propagation of sound over distance to calculate the worst case analysis of the future build sound levels. It should be noted that the noise analysis modeled all six of the proposed Colebrook North and South wind turbines. As can be seen from the revised noise evaluation report, the maximum daytime and nighttime sound levels at the residential receptor locations will not exceed DEP noise impact criteria and results in a 2 to 5 dB(A) reduction at the residential locations that previously had the highest sound levels. In actuality, the sound levels from the proposed project will be even lower then the predicted worst case scenario much of the time due to lower wind speeds.

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

3/25/2011
Date

Thomas E Wholley
Thomas Wholley

ACTIVE/72955.3/CLARSON/2378644v1

EXHIBIT 1

Thomas F. Wholley

Director of Air Quality and Noise Services

Mr. Wholley is a Senior Air and Noise Quality Engineer experienced in all aspects of mobile source emissions and noise analyses. Prior to joining VHB, he was the Senior Environmental Engineer for the Environmental Protection Agency (EPA) Region 1 where he was responsible for implementing EPA's air quality and noise mobile source policies and coordinating mobile source issues with the public, and local, State, and Federal agencies. He developed the modeling procedure CAL3QHC for evaluating carbon monoxide impacts at intersections. This procedure is still required by the EPA as the national guideline modeling procedure.

Mr. Wholley has over 37 years of experience in all aspects of transportation and land development air quality and noise evaluations. This experience includes providing strategic assistance, conducting mobile source analyses, and development and implementation of regulatory requirements based upon his employment at the Vanasse Hangen Brustlin, Inc. (VHB), the U.S. Environmental Protection Agency (EPA), and the Massachusetts Highway Department (MassHighway). Mr. Wholley managed MassHighway's noise program.

Mr. Wholley has been involved with the development and implementation of State Implementation Plans (SIP) including the regulatory processing of SIPs, SIP revisions, and redesignations; coordinating regulatory actions with the public and with State and Federal agencies; and preparing Federal Register Notices and tracking them through the Federal Rulemaking process. Specific activities include the following:

Noise Modeling and Policy

Mr. Wholley is responsible for the preparation and review of noise analyses related to highway, rail, and land development projects for Environmental Impact Statements (EISs), state and local environmental documents, and special studies. He has extensive experience in the Federal Highway Administration's Traffic Noise Model (TNM) and monitoring procedures. He is also familiar with the Federal Transit Administration's transit noise analysis and evaluation procedures for rail projects. He is a member of the Transportation Research Board's Committee on Transportation Related Noise and Vibration (A1F04).

While at the Environmental Protection Agency, Mr. Wholley was responsible for the review of all New England projects under the National Environmental Policy Act (NEPA), including land development, highway and transit projects. In addition, he assisted the public, state, and local government agencies on the implementation of noise regulations. He was responsible for reviewing and approving the noise modeling procedures including study areas, receptor locations, and noise abatement procedures.

Mr. Wholley is the Technical Task Manager for MassHighway's On-Call noise contract. Among the activities included in this assignment are noise measurements, acoustical studies, noise barrier design, noise public meetings, and assisting MassHighway in the development and implementation of Type I and Type II noise policies.

Air Quality Modeling and Policy

Mr. Wholley is responsible for the preparation and review of air quality and noise modeling related to mobile source emissions for EISs, SIPs, and special studies. While working at the EPA, Mr. Wholley was responsible for implementing the mobile source modeling aspects of the Clean Air Act Amendments and Noise Control Act for New England. In addition, he often advised other EPA Regional offices on mobile source issues including conducting workshops on modeling policies and procedures.

Mr. Wholley developed the mobile source modeling procedure, CAL3QHC, which is required by the EPA to be used in evaluating carbon monoxide (CO) impacts at congested locations, typically intersections. At VHB, he led the development of graphical AutoCAD version of CAL3QHC greatly improving the task of modeling intersections with complex geometry, facilitating the development of input files, helping identify output modeling errors, enhancing the identification and evaluation of mitigation measures, and providing for a graphical display of the modeled results.

Mr. Wholley has assisted the Departments of Transportation in Connecticut, Delaware, Massachusetts, and Rhode Island in preparing mobile source analyses for their SIPs and Transportation Conformity submissions. These analyses included 1990 Base Year Emission Inventories, Adjusted Base Year Emission Inventories, 1993 Periodic Emission Inventories, 1996 Rate of Progress Plans, Future Emission Inventories, SIP strategy analyses, Conformity submissions for Transportation Plans, Programs, and Projects, Inspection and Maintenance Programs, and National Environmental Policy Act (NEPA) submissions.

Project Experience

Mr. Wholley has been responsible for the preparation of air quality and noise analyses of transportation projects, including highway, rail, and aircraft projects, for Major Investment Studies, EISs, Environmental Assessments, and various state and local environmental documents.

He has been the Project or Task Manager for numerous transportation projects. His duties have included evaluating all relevant traffic, air quality, and noise data for the study area; preparing a modeling protocol that defines the modeling approach, modeling assumptions, and review criteria; coordinating with EPA and State Environmental Agencies; preparing traffic data for air quality and noise analyses, preparing input files for EPA's MOBILE 5 and MOBILE 6 emission factor models, running EPA's CAL3QHC model to predict 1 and 8-hour CO concentrations for the future year (No-Build and Build) alternatives, developing mitigation measures to reduce high CO values, preparing input files for FHWA's Traffic Noise Model (TNM) noise model, conducting noise monitoring, evaluating noise impacts, development of noise mitigation, conducting noise barrier design, and the preparation of appropriate technical documentation for environmental documents. Mr. Wholley was responsible for the following projects where air quality and noise analyses were prepared:

Environmental Assessments of Environmental Impact Statements (Noise and Air Quality)

- I-93 Interchange and Transportation Center Project in Woburn, Massachusetts.
- Restoration of Transit Service for Fall River and New Bedford, Massachusetts.
- Spaulding Turnpike in Portsmouth, New Hampshire.
- I-93 Widening for 17 miles in Salem, New Hampshire.
- Route 7 in Milford, Connecticut
- I-84 Widening for 14 miles in Waterbury, Connecticut.
- Evaluation of Intelligent Transportation Systems on I-95 in Bridgeport, Connecticut
- Route 99 Extension in Woonsocket, Rhode Island.
- Route 100 By-Pass in Wilmington, Vermont.
- Restoration of Transit Service from Boston to Portland, Maine.
- Extension of Transit Service from Portland to Brunswick, Maine
- I-66 Widening in Northern Virginia.

FHWA Noise Services – Development and Implementation of Noise Mitigation

Mr. Wholley is the Project Manager for **On-Call Noise Services for MassHighway**. VHB has prepared highway noise analyses for several Type II (Addressing noise issues along existing highways) locations to determine if these areas meet MassHighway's and FHWA's noise guidelines. This work has included conducting noise monitoring, noise analyses (TNM), noise barrier design, and public meetings to involve the citizens in the design process. VHB has prepared special noise reports to assist MassHighway in responding to highway noise complaints from the public. VHB is currently preparing a reference document that will provide a layperson's discussion of noise principles, a description of MassHighway's Type I and II noise policy, a list of common noise questions and answers, a key map for existing noise barrier locations, and an updated Type II list of the locations in the *Massachusetts Type II Noise Study*.

I-81 – Corridor Improvement Study

Project Manager for **Air Quality Services**. VHB prepared a corridor mesoscale analysis the calculated the regional emissions of the Ozone to respond to the Transportation Conformity requirements. The mesoscale analysis evaluated the change on regional emissions based upon changes in VMT and vehicle operational characteristics and the changes in Rail services. Mr. Wholley also assisted in the preparation of the noise analysis, including the development of traffic data for the noise modeling and development the rail parameters to calculate rail sound levels.

CAAA – Transportation Conformity and State Implementation Plan Submissions

Mr. Wholley is the Project Manager for **On-Call Transportation and Air Quality Services for Delaware's Department of Transportation**. VHB has prepared CAAA and SIP submissions including, the 1990 emission inventory, the adjusted 1990 emission inventory, the future projected emission inventories, and the development of emission reduction strategies. VHB has assisted DelDOT in the preparation of traffic and air quality data evaluating Transportation Improvement Programs and Plans. VHB has provided coordination between DelDOT and DNREC and EPA on SIP issues. VHB has assisted in the development of the transportation portion of the SIP and in the development and review of Delaware's conformity procedures.

Mr. Wholley is the Project Manager for **On-Call Transportation and Air Quality Services for Rhode Island's Department of Transportation**. VHB has assisted RIDOT in the development of a statewide Travel Demand Model; providing air quality analysis of transportation control measures (TCMs), congestion management air quality (CMAQ), and SIP related proposals, and training RIDOT in state-of-the-art air quality modeling procedures needed for conformity analyses. VHB has assisted in the development of the transportation portion of the SIP; assisting RIDOT in CO microscale modeling for NEPA compliance; assisting in the development of air quality protocols, and meeting with RIDOT personnel to train them on the application of these procedures.

In addition to public sector projects, Mr. Wholley conducts **air quality and noise analyses for private development projects**. Projects have included numerous land development projects in Massachusetts, the reuse of the Pease Air Force base in New Hampshire, the development of the Providence Place Mall in Rhode Island, and the development of the Patriot Place in Massachusetts. Mr. Wholley focuses on developing solutions, which address improving transportation efficiency while also increasing air quality benefits from these projects. While at EPA, he directed consultants in the evaluation and preparation of EISs including for the Central Artery/Third Harbor Tunnel project in Massachusetts.

Activities

Mr. Wholley's background and experience enables him to facilitate coordination between DOTs and state air agencies on CAAA and SIP issues. He has provided **training to state agencies on traffic demand modeling for air quality, emission factors, and air quality and noise modeling needed for SIP, NEPA, and Transportation Conformity analyses.**

Mr. Wholley is currently a member of the American Society of Civil Engineers' (ASCE) National Transportation Policy Committee. Recently, he served on the Transportation and Development Institute (T&DI) Board of Governors. Mr. Wholley was Chair of the ASCE Executive Committee for Urban Transport Institute. He has also Co-Chair for the Committee on Energy and Environment. In 1991, he helped organize the first ASCE specialty conference on Transportation Planning and Air Quality, which was held in Santa Barbara, California. In 1993, he was Chairman of the second specialty conference on Transportation Planning and Air Quality that was held in Boston, Massachusetts. He was Co-Chair of ASCE's third Transportation Planning and Air Quality conference, which was held in Lake Tahoe, California. Mr. Wholley is also involved with the Transportation Research Board and has recently lectured at the World Bank on international air quality issues. Additionally, Mr. Wholley has conducted numerous training workshops on mobile source modeling and policy issues for State agencies throughout the Northeast.

Mr. Wholley is experienced in providing **technical assistance to EPA's mobile source enforcement efforts** including activities related to Inspection and Maintenance programs, Anti- Tampering/Anti-Fuel Switching programs, and vehicle importation requirements. Mr. Wholley has spoken to many organizations on air quality policy and technical issues, including the NEPA process, the Clean Air Act, and transportation planning requirements.

Air/Noise Assessments - Massachusetts Highway Department

Prior to joining US EPA Mr. Wholley was with MassHighway. He was responsible for preparing and processing the air quality and noise analyses for all Massachusetts highway environmental documents and he was responsible for processing the highway projects with the Massachusetts Environmental Policy Act (MEPA).

Education

BSCE, University of Massachusetts at Lowell

Affiliations

ASCE's National Transportation Policy Committee Transportation and Development Institute
Transportation Research Board Air Quality (ADC20) and Noise Committees (ADC40)
Sperry Board of Award

Honors

1986 and 1992 - Environmental Protection Agency (EPA) Regional Bronze Medal
1985 - EPA Special Achievement Award
1984, 1986-1991 - EPA Sustained Superior Performance Award

EXHIBIT 2

Noise Evaluation

Wind Colebrook North

Winsted-Norfolk Road and Rock Hall Road Colebrook, Connecticut

Prepared for BNE Energy Inc. Producer of green clean energy

Prepared by *VHB*/**Vanasse Hangen Brustlin, Inc.**
Middletown, Connecticut

March 2011

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Executive Summary

The purpose of the noise analysis was to evaluate the potential noise impacts associated with the proposed construction of up to three 1.6-megawatt wind turbines on property northeast of the intersection of Winsted-Norfolk Road (Route 44) and Rock Hall Road in Colebrook, Connecticut. This noise analysis evaluated the existing and future build sound levels. Existing condition sound levels were determined by a noise monitoring program. The project-generated sound levels were calculated using manufacturer's sound data for the wind turbines and the principles of acoustical propagation of sound over distance.

This report is an update of the November 2010 noise report. It includes the revised sound levels for new wind turbine locations, it revises the noise analysis to change the nighttime wind speeds from 8 m/s to 9 m/s, and a new receptor location has been added (R14). The sound levels were projected to nearby residential noise receptor locations. These receptor locations were selected based on land use considerations, and represent the most sensitive locations (i.e., the residential areas) that may experience changes in sound levels resulting from the operation of three turbines. The results of this analysis demonstrate that the operation of three turbines will meet the Connecticut Department of Environmental Protection's noise impact criteria.

Noise Impact Analysis

Introduction

The purpose of this noise analysis was to evaluate the potential noise impacts associated with construction of up to three (3) 1.6-megawatt ("MW") wind turbines ("Wind Colebrook North" or the "Project") proposed for installation by BNE Energy, Inc. ("BNE") on property located at the intersection of Winsted-Norfolk Road (Route 44) and Rock Hall Road in Colebrook, Connecticut (the "Property" or "Site"). This noise analysis evaluated the existing condition and build condition sound levels. The sound levels were compared to the noise control regulations (Regulations of Connecticut State Agencies (RCSA), Title 22a, Section 22a-69-1 to 22a-69-7) established by the Connecticut Department of Environmental Protection ("CTDEP").

Noise Background

Noise is defined as unwanted or excessive sound. Sound becomes unwanted when it interferes with normal activities such as sleep, work, or recreation. How people perceive sound depends on several measurable physical characteristics. These factors include:

- Intensity - Sound intensity is often equated to loudness.
- Frequency - Sounds are comprised of acoustic energy distributed over a variety of frequencies. Acoustic frequencies, commonly referred to as tone or pitch, are typically measured in Hertz. Pure tones have all their energy concentrated in a narrow frequency range.

Sound levels are most often measured on a logarithmic scale of decibels (dB). The decibel scale compresses the audible acoustic pressure levels which can vary from the threshold of hearing (0 dB) to the threshold of pain (120 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 level. Research indicates the following general relationships between sound level and human perception:

- A 3 dB increase is a doubling of acoustic energy and is the threshold of perceptibility to the average person.
- A 10 dB increase is a tenfold increase in acoustic energy but is perceived as a doubling in loudness to the average person.

The human ear does not perceive sound levels from each frequency as equally loud. To compensate for this phenomenon in perception, a frequency filter known as A-weighted (dBA) is used to evaluate environmental noise levels.
A variety of sound level indicators can be used for environmental noise analysis. These indicators describe the variations in intensity and temporal pattern of the sound levels. The indicators used in this analysis are defined as follows:

- Lmax is the maximum A-weighted sound level measured during the time period.
- L_{10} is the A-weighted sound level, which is exceeded for 10 percent of the time during the time period.
- L_{90} is the A-weighted sound level, which is exceeded for 90 percent of the time during the time period. The L_{90} is generally considered to be the background sound level. It should be noted that the L_{90} eliminates the highest 10 percent of the sound levels that occur in the study area.

It should be noted that CTDEP requires that the noise analysis use the L_{90} A-weighted sound levels. Table 1 presents a list of common indoor and outdoor sound levels.

Table 1
Indoor and Outdoor Sound Levels

Outdoor Sound Levels	Sound Pressure (μPa)		Sound Level (dBA)	Indoor Sound Levels
	6,324,555	-	110	Rock Band at 5 m
Jet Over-Flight at 300 m		-	105	
	2,000,000	-	100	Inside New York Subway Train
Gas Lawn Mower at 1 m		-	95	
	632,456	-	90	Food Blender at 1 m
Diesel Truck at 15 m		-	85	
Noisy Urban Area—Daytime	200,000	-	80	Garbage Disposal at 1 m
		-	75	Shouting at 1 m
Gas Lawn Mower at 30 m	63,246	-	70	Vacuum Cleaner at 3 m
Suburban Commercial Area		-	65	Normal Speech at 1 m
	20,000	-	60	
Quiet Urban Area—Daytime		-	55	Quiet Conversation at 1 m
	6,325	-	50	Dishwasher Next Room
Quiet Urban Area—Nighttime		-	45	
	2,000	-	40	Empty Theater or Library
Quiet Suburb—Nighttime		-	35	
	632	-	30	Quiet Bedroom at Night
Quiet Rural Area—Nighttime		-	25	Empty Concert Hall
Rustling Leaves	200	-	20	
		-	15	Broadcast and Recording Studios
	63	-	10	
		-	5	
Reference Pressure Level	20	-	0	Threshold of Hearing

μPA MicroPascals describe pressure. The pressure level is what sound level monitors measure.
dBA A-weighted decibels describe pressure logarithmically with respect to 20 μPa (the reference pressure level).
Source: Highway Noise Fundamentals, Federal Highway Administration, September 1980.

Impact Criteria

The CTDEP has developed noise impact criteria that establish noise thresholds deemed to result in adverse impacts. The noise analysis for Wind Colebrook North used these criteria to evaluate whether the proposed Project will generate sound levels that result in adverse impacts.

Connecticut DEP Criteria

The CTDEP's noise control regulations identify the limits of sound that can be emitted from specific premises and what activities are exempt. The noise control regulations (Title 22a, §§ 22a-69-1 to 22a-69-7) are contained in the Regulations of Connecticut State Agencies (RCSA). This policy states that a source located in a "Class C Noise Zone" shall not emit noise exceeding the levels stated in Table 2 at the adjacent noise zones.

Table 2
Noise Zone Standards, L_{90} (dBA)

	Receptor Noise Zone			
Emitter Zone	**Class A (Daytime)**	**Class A (Nighttime)**	**Class B**	**Class C**
Class A (Residential)	55	45	55	62
Class B (Commercial)	55	45	62	62
Class C (Industrial)	61	51	66	70

Source: Control of Noise (Title 22a, Section 22a-69-1 to 22a-69-7.4), Regulations of Connecticut State Agencies, June 1978.

A Class C land use is defined as generally industrial where protection against damage to hearing is essential, and the necessity for conversation is limited. The land use for Class B is defined as generally commercial in nature, where human beings converse and such conversations are essential to the intended use of the land. The land use in Class A is defined as generally residential where human beings sleep or areas where serenity and tranquility are essential to the intended use of the land.

The noise analysis assumed that the Emitter Zone for the proposed wind turbines is Class C (Industrial) and that the Receptor Noise Zone for the receptor locations is Class A (Residential).

Methodology

This noise analysis evaluated the sound levels of Wind Colebrook North. The noise analysis consists of two components: existing ambient sound levels and Project contributions. The existing condition sound levels were determined by conducting noise measurements at sensitive receptor locations surrounding the Project Site. The Project-generated sound levels were calculated using manufacturer's sound data and the principles of acoustical propagation of sound over distance.

Noise monitoring was conducted to determine the existing sound levels in the vicinity of the Project Site following procedures established in Section 22a-69-4 of the CTDEP noise control regulations. Noise monitoring was conducted at one location that is representative of the receptor locations during the weekday daytime and nighttime periods. The noise monitoring data was used to establish existing conditions in areas that may experience changes in sound levels associated with Wind Colebrook North and to determine if the noise impact criteria should be changed in this specific study area.

Noise associated with wind turbines consists of two sources: the aerodynamic sound produced by air flow over the rotor blades and sound from the mechanical components that drive the blades. The Project-generated sound levels were calculated for each receptor location based on manufacturer reference sound level data of the 1.6-MW wind turbines. The noise analysis assumed that the proposed wind turbines would be operating at the maximum wind speed during the daytime and nighttime periods. The wind speed was based upon wind data collected from the region by BNE to determine the feasibility of the Project. The manufacturer's sound level data for these operating conditions were projected to the receptor locations using the acoustical properties of sound propagation over terrain.

The calculations of the sound level projections to the receptor locations follow the methodology outlined by the International Organization of Standardization (ISO). The following equation, from the publication *ISO 9613-2: Attenuation of sound during propagation outdoors – Part2: General method of calculation*, was used to calculate the sound levels at the receptor locations.

Lft(DW) = Lw + Dc – A, where…

- Lw is the sound power level produced by the sound source.
- Dc is the directivity correction to account for deviation of the sound power level in a specified direction. For an omni-directional sound source radiating into open space, Dc = 0.
- A is the attenuation occurring during propagation from sound source to receptor location. Attenuation may include geometrical divergences (or spherical spreading), atmospheric absorption, ground effect, barrier, and other miscellaneous effects, such density of vegetation and buildings.

The calculation of the proposed Project's sound levels took into consideration geometric divergences and atmospheric absorption due to the surrounding environment.

Receptor Locations

Fourteen noise receptor locations were identified in the vicinity of Wind Colebrook North. The receptor locations were selected based on their proximity to the Site and their land use. These receptor locations represent the most sensitive locations in the immediate area that may experience changes in sound levels once Wind Colebrook North is in operation. These receptor locations represent the residential parcels that surround the Project Site. They include:

- Receptor Location 1 (R1) – Residence on Rock Hall Road,
- Receptor Location 2 (R2) – Residence on Rock Hall Road,
- Receptor Location 3 (R3) – Residence on Greenwoods Turnpike,
- Receptor Location 4 (R4) – Residence on Greenwoods Turnpike,
- Receptor Location 5 (R5) – Residence on Greenwoods Turnpike,
- Receptor Location 6 (R6) – Residence on Greenwoods Turnpike,
- Receptor Location 7 (R7) – Residence on Winsted Norfolk Road (Route 44)
- Receptor Location 8 (R8) – Residence on Pinney Street,
- Receptor Location 9 (R9) – Residence on Pinney Street,
- Receptor Location 10 (R10) – Residence on Pinney Street,
- Receptor Location 11 (R11) – Residence on Stillman Hill Road (Route 182)
- Receptor Location 12 (R12) – Residence on Rock Hall Road,
- Receptor Location 13 (R13) – Residence on Rock Hall Road, and
- Receptor Location 14 (R14) – Residence on Rock Hall Road.

The primary land use in the vicinity of the Project Site is residential. The receptor and existing conditions noise monitoring locations used in the noise analysis are presented in Figure 1.

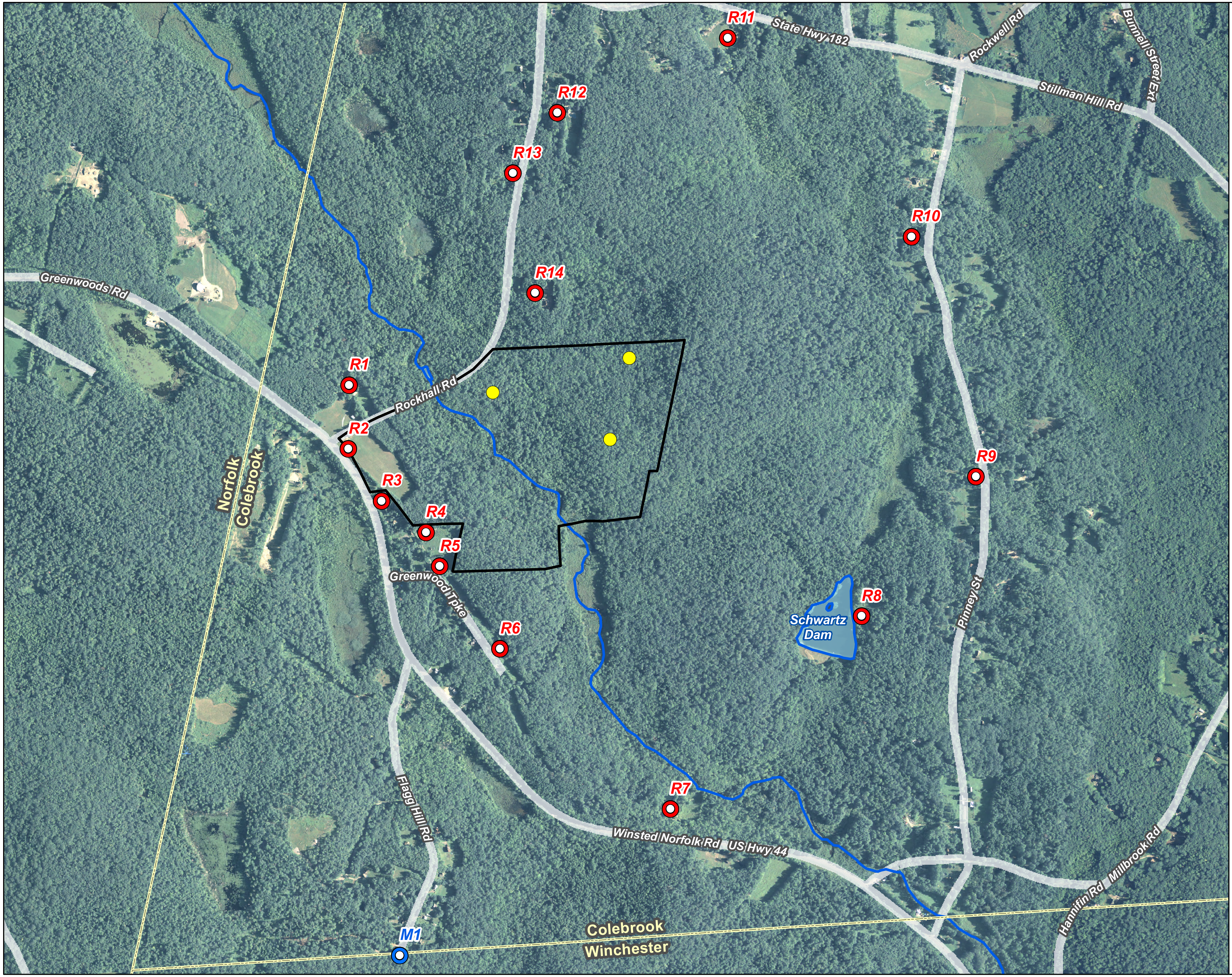
Existing Conditions

The existing sound levels in the vicinity of the Project Site were established by conducting actual measurements of sound levels at the neighborhood of Flagg Hill Road to the south of the Project Site. The measured sound levels were used to establish a baseline for the study area.

The noise monitoring was conducted using a Larson Davis 824 Type I sound level analyzer and followed noise monitoring procedures outlined in Section 22a-69-4 of the CTDEP's noise control regulations. The sound levels were measured at each location during both the weekday daytime (7 AM. to 10 PM) on April 1, 2010 and weekday nighttime periods (10:00 PM. to 7:00 AM) on April 1, 2010 to April 2, 2010. The noise sources included local vehicular traffic and natural occurrences, such as wind, birds and other animals. The sound levels represent conservative values because the wind conditions during the measurements were calm.

Figure 1
Wind Colebrook North Noise Monitoring and Receptor Locations

Winsted-Norfolk Road
Colebrook, CT



Legend

- Receptor Location
- Monitoring Location
- Potential Wind Turbine Location
- Approximate Site Property Boundary
- Town Boundary

Base Map Source: 2010 aerial photograph with 1-meter resolution.

N

1,000 500 0 1,000
Feet

Vanasse Hangen Brustlin, Inc.

\\ctmiddat\projects\41604.00\graphics\FIGURES\WC_North_Receptor_Locations_Map.pdf

The existing sound levels do not exceed the local and State criteria of 61 dBA and 51 dBA during the daytime and nighttime, respectively. The recorded hourly L_{90} sound levels are presented in Table 3.

Table 3
Existing Sound Levels, L_{90} (dBA)

Monitoring Location*	Daytime Sound Level	Nighttime Sound Level
M1 - Flagg Hill Road	37	38

* Refer to Figure 1 for location

Project-Generated Sound Levels

There are two noise sources associated with a wind turbine. These sources include aerodynamic noise associated with the blade movement through air and the mechanical noise associated with the interaction of parts that drive the blades. Aerodynamic sound from the movement of the blade through air is a function of wind speed, which can be controlled by the rotational speed of the blades. Existing background sound levels are also dependent of wind speed. Therefore louder background sound levels would be result from higher wind conditions. With increasing wind speeds, the sound from wind turbines can often be masked by increasing wind noise.

Each of the wind turbines consists of three blades with the hub located at 100 meters from the ground. Under operational conditions, the blades will rotate at speeds between 3 meters per second (m/s) to 12m/s. The maximum daytime sound levels from the proposed wind turbines will occur with the maximum wind speeds of 9 m/s. The Project-generated sound levels based upon this wind speed were projected to each receptor location based upon the properties of sound propagation over distance, terrain, and geometry. Following the methodology outlined in ISO 9613-2, the calculation of Wind Colebrook North's sound levels included attenuation due to geometric divergences and atmospheric absorption. The Project-generated hourly L_{90} sound level contribution for each receptor location is presented in Table 4.

Table 4
Project-Generated Sound Levels, L_{90} (dBA)

Receptor Location*	Daytime Noise Criteria**	Nighttime Noise Criteria**	Maximum Project Daytime/Nighttime Sound Levels
R1 – Rock Hall Road	61	51	41
R2 – Rock Hall Road	61	51	41
R3 – Greenwoods Turnpike	61	51	41
R4 – Greenwoods Turnpike	61	51	42
R5 – Greenwoods Turnpike	61	51	41
R6 – Greenwoods Turnpike	61	51	40
R7 – Winsted Norfolk Road (Rt 44)	61	51	34
R8 – Pinney Street	61	51	34
R9 – Pinney Street	61	51	32
R10 – Pinney Street	61	51	33
R11 – Stillman Hill Road (Rt 182)	61	51	32
R12 – Rock Hall Road	61	51	36
R13 – Rock Hall Road	61	51	39
R14 – Rock Hall Road	61	51	46

* Refer to Figure 1 for receptor locations.

The results of the preliminary noise analysis demonstrate that Wind Colebrook North will generate sound levels that range from 32 dBA to 46 dBA. These sound levels are below the daytime or nighttime noise criteria of 61 and 51 dBA respectively.

Conclusion

The noise analysis demonstrates that the operation of up to three (3) 1.6 MW wind turbines to be located on property northeast of the intersection of Winsted-Norfolk Road (Route 44) and Rock Hall Road in Colebrook, Connecticut will meet the CTDEP's noise impact criteria contained in the noise control regulations (Regulations of Connecticut State Agencies (RCSA), Title 22a, Section 22a-69-1 to 22a-69-7). The noise analysis evaluated the worst-case daytime and nighttime sound levels, based upon operational wind speeds, calculated sound levels for the receptor locations (residential area) adjacent to Wind Colebrook North. It should be noted that the actual sound levels for the majority of the time will be lower because the wind speeds will be lower.