EXHIBIT E

FACILITY NOISE ASSESSMENT, TRUMBULL SUBSTATION PROJECT,

prepared by

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Environmental Noise Impact Assessment

Trumbull Substation Project
The United Illuminating Company
Trumbull, Connecticut

B&V Project 141417

REV	ISSUE DATE	DESCRIPTION	INITIALS
0	October 25, 2002	Initial Issue	*AKK*
1	July 13, 2005	Updated Ambient Survey	*WBF*
2	April 3, 2006	Additional Residential Receptors, Perimeter Architectural Wall, Existing Background Sound Level Considerations, Graphic Revisions	*WBF*

Notice

This Environmental Noise Impact Assessment report is intended as a working document to support design and commercial decisions related to the proposed project. It contains detailed technical information, design options, equipment specifications, and operational strategies related to the potential noise emissions from the facility. If a report is needed for agency or public review, it is recommended that a supplemental report be developed that is an abbreviated version of this report following final comments and revisions from the Owner.

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Executive Summary

The proposed site for the Trumbull Substation is located in the Town of Trumbull, Connecticut in Fairfield County, approximately 10 miles north of the City of Bridgeport. The facility will be an electrical substation with two 24/32/40 MVA transformers.

This report represents Revision 2 and includes changes to the July 13, 2005 (Revision 1) issue. The revisions since the last report include the incorporation and evaluation of additional residential receptor locations within the vicinity of the substation. The impact at all of the receptors was evaluated based on the measured median daytime, median nighttime, and quietest nighttime background sound levels, which constitutes a change from the July 13 report which, at that time, consider the daily median background sound level only. Lastly, the attenuation effect of the proposed perimeter architectural wall along the substation fence line has bee considered.

Prior to determining the potential noise emissions from the proposed substation facility, an environmental noise survey was conducted to assess the existing acoustical environment surrounding the proposed site. The existing acoustical environment is typical of urban residential areas. In general, the existing ambient sound levels in the areas surrounding the proposed site are influenced by noise sources such as local traffic, birds, insects, and nearby highway traffic. The ambient surveys indicate that the hourly background sound levels (L_{90}) ranged from 36 dBA to 59 dBA. The existing background sound levels at the measurement locations are generally consistent with urban residential areas highly influenced by traffic noise.

The major noise sources associated with the proposed substation facility are anticipated to include the transformers and the control/switchgear building cooling equipment. Noise modeling has been conducted to predict the environmental noise emissions from the proposed substation facility. Based on the available information, there are noise regulations that apply to the proposed facility. As such, the facility noise emissions have been evaluated based on meeting these regulations and reducing the noise impact on nearby residences.

The predicted substation sound levels are below 45 dBA at the nearest residential boundaries. As such, the substation noise emissions are anticipated to comply with the applicable local regulations, i.e. 45 dBA at the neighboring residential property boundaries.

In addition to regulatory compliance, the results have also been evaluated relative to the potential impact on neighboring residences. None of the residential locations are expected to show a noticeable increase during daytime hours. During nighttime hours (8:00 p.m. to 7:00 a.m.), nearby residential location R2 (located directly north of the facility) shows a 3 dB increase, which is expected to be “just barely perceptible”. Only during the quietest nighttime hour is a possibly perceptible increase shown at the nearest residential locations, R2, R4, and R5. However, if the optional perimeter architectural wall is erected, the impact during the quietest nighttime hour is either eliminated or reduced to a “just barely perceptible” increase.

It is important to note that periodically throughout the day the ambient sound levels were higher than the measured hourly background sound levels due to transient events such as vehicles, aircraft, highway traffic, etc. As such, the substation sound levels have been evaluated against the 24-hour sound level trends for each residential location. Not only are the substation sound levels often well below the ambient sound levels, but the period during which the substation sound level is at or above the ambient sound level is of short duration. With the installation of the perimeter architectural wall that is being considered, the substation sound levels are further reduced at the residential neighbors such that the substation sound levels are not higher than the lowest nighttime hourly background sound levels.

1.0 Introduction

The proposed site for the Trumbull Substation is located in the Town of Trumbull, Connecticut in Fairfield County, approximately 10 miles north of the downtown City of Bridgeport. The site is situated on the east side of a cul-de-sac at the end of Wildflower Lane within the triangular area bounded by Nichols Avenue, Huntington Turnpike, and Route 8. The proposed site is largely wooded with a clearing at the center of the property for a 115 kV transmission line and a transmission line switching structure as well as a former distribution line training area. The 4.85 acre site and surrounding properties are zoned residential.

The facility will be an electrical substation with two 24/32/40 MVA transformers. The potential environmental noise emissions associated with the proposed substation have been evaluated. The major noise sources associated with the proposed substation facility are anticipated to include the transformers and the control/switchgear building cooling equipment. Based on the available information, there are noise regulations that apply to the proposed facility. The facility noise emissions have been evaluated based on meeting these regulations and reducing the noise impact on nearby residences.

Prior to determining the potential noise emissions from the proposed substation facility, an environmental noise survey was conducted to assess the existing acoustical environment surrounding the proposed site.

2.0 Acoustical Terminology

A variety of terms are used in the field of acoustics. In order to familiarize the reader with the terminology included in this report, this section briefly introduces general acoustical terminology and describes basic acoustical parameters.

2.1 Sound Energy

Sound is generated by the propagation of energy in the form of pressure waves. Being a wave phenomenon, sound is characterized by amplitude and frequency. Sound amplitude is measured in decibels, dB, and sound frequency is measured in hertz, Hz (cycles per second). The decibel is the logarithmic ratio of a sound pressure to a reference sound pressure of 20 micropascals. Typically, 0 dB corresponds to the threshold of human hearing. A 3 dB change in a continuous broadband noise is generally considered "just barely perceptible" to the average listener. Similarly, a 5 dB change is generally considered "clearly noticeable" and a 10 dB change is generally considered a doubling (or halving) of the apparent loudness. For reference, the sound pressure levels and subjective evaluation associated with example noise sources are shown in Table 2-1.

The normal human ear can hear frequencies ranging from 20 Hz to 20,000 Hz. At typical sound pressure levels, the human ear is more sensitive to sounds in the middle and high frequencies (1,000 to 8,000 Hz) than sounds in the low frequencies. Various weighting networks have been developed to simulate the frequency response of the human ear. The A-weighting network was developed to simulate the frequency response of the human ear to sounds at typical environmental levels. The A-weighting network emphasizes sounds in the middle to high frequencies and de-emphasizes sounds in the low frequencies. Most sound level instruments can apply these weighting networks automatically. Any sound level to which the A-weighting network has been applied is expressed in A-weighted decibels, dBA.

2.2 Sound Level Metrics

Noise in the environment is constantly fluctuating, such as when a car drives by, a dog barks, or a plane passes overhead. Therefore, noise metrics have been developed to quantify fluctuating environmental noise levels. These metrics include the equivalent-continuous sound level and the exceedance sound levels.

The equivalent-continuous sound level, L_{eq}, is used to represent the equivalent sound pressure level over a specified time period. The L_{eq} metric is the sound level of a steady-state sound that has the same (equivalent) total energy as the time-varying sound of interest, taken over a specified time period and covering a specified set of conditions. Thus, L_{eq} is a single-value level that expresses the time-averaged total energy of a widely varying or fluctuating sound level.

The exceedance sound level, L_x, is the sound level exceeded “x” percent of the sampling period and is referred to as a statistical sound level. The most common L_x values are L_{90}, L_{50}, and L_{10}. L_{90} is the sound level exceeded 90 percent of the sampling period. The L_{90} sound level represents the sound level without the influence of loud, transient noise sources and is therefore often referred to as the *residual* or *background* sound level (ANSI S12.19 [2]). The L_{50} sound level is the sound level exceeded 50 percent of the sampling period or the median sound level. The L_{10} sound level is the sound level exceeded 10 percent of the sampling period. The L_{10} sound level represents the occasional louder noises and is often referred to as the *intrusive* sound level. As previously discussed, the L_{90} environmental sound level typically represents the background (residual) sound level.

The variation between the L_{90}, $L_{50,}$ and L_{10} sound levels can provide an indication of the variability of the acoustical environment. If the acoustical environment is perfectly steady, all values are identical. A large variation between the values indicates the environment experiences highly fluctuating sound levels. For instance, measurements near a roadway with frequent passing vehicles may cause a large variation in the statistical sound levels.

2.3 Typical Community Sound Levels

Typical background (residual) sound levels in various types of communities are outlined in Table 2-2 for reference. However, it is important to remember that each community is unique with regard to the sources of noise that contribute to the background sound levels.

2.4 Human Response to Sound

Human response to sound is highly individualized and subjective. Annoyance is the most common issue regarding community noise. The percentage of people claiming to be annoyed by noise will generally increase as environmental sound levels increase. However, many other factors will also influence people's response to noise. These factors can include the character of the noise, the variability of the sound level, the presence of tones or impulses, and the time of day of the occurrence. Additionally, non-acoustical factors, such as the person's opinion of the noise source, the ability to adapt to the noise, the attitude towards the noise and those associated with it, the appearance of the noise source, and the predictability of the noise can also influence people's response. As such, response to noise varies widely from one person to another and with any particular noise, individual responses will range from "highly annoyed" to "not annoyed".

Table 2-1
Typical Sound Pressure Levels Associated with Example Noise Sources

Sound Pressure Level (dBA)	Subjective Evaluation	Example Noise Source and/or Environment	
		Outdoor	Indoor
140	Deafening	Jet aircraft at 75 ft	
130	Threshold of pain	Jet aircraft during takeoff at a distance of 300 ft	
120	Threshold of feeling	Elevated Train	Hard rock band
110	Extremely Loud	Jet flyover at 1000 ft	Inside propeller plane
100	Very Loud	Power mower, motorcycle at 25 ft, auto horn at 10 ft	
90	Very Loud	Propeller plane flyover at 1000 ft, noisy urban street	Full symphony or band, food blender, noisy factory
80	Moderately Loud	Diesel truck (40 mph) at 50 ft	Inside auto at high speed, garbage disposal, dishwasher
70	Loud	B-757 cabin during flight	Close conversation, vacuum cleaner, electric typewriter
60	Moderate	Air-conditioner condenser at 15 ft, near highway traffic	General office
50	Quiet		Private office
40	Quiet	Farm field with light breeze, birdcalls	Soft stereo music in residence
30	Very quiet	Quiet residential neighborhood	Bedroom, average residence (without t.v. and stereo)
20	Very quiet	Rustling leaves	Quiet theater, whisper
10	Just audible		Human breathing
0	Threshold of hearing		

Source: Adapted from Architectural Acoustics, M. David Egan, 1988 and Architectural Graphic Standards, Ramsey and Sleeper, 1994.

Table 2-2
Typical Daytime Residual (Background) Sound Levels in Various Types of Communities

Type of Community	Typical Daytime Residual (Background) Sound Pressure Level
Very Quiet Rural Areas	31 to 35 dBA
Quiet Suburban Residential	36 to 40 dBA
Normal Suburban Residential	41 to 45 dBA
Urban Residential	46 to 50 dBA
Noisy Urban Residential	51 to 55 dBA
Very Noisy Urban Residential	56 to 60 dBA
Adjacent Freeway or Major Airport	n/a

Source: Adapted from U.S. Environmental Protection Agency, Community Noise, December, 1971.

3.0 Applicable Noise Regulations

Based on the available information, there are local and state noise regulations that apply to the proposed facility. As such, the facility noise emissions have been evaluated based on meeting these regulations as well as reducing the noise impact on nearby residences.

3.1 Town of Trumbull

The proposed site is located within the Town of Trumbull in the state of Connecticut. Based on the available information, there are local noise ordinances that apply to the proposed facility. The regulations are specified in the town noise control ordinance. Section 13-50 states that "*no person … shall emit noise beyond the boundaries of his premises exceeding the levels stated herein and applicable to adjacent residential, business/commercial and/or light industrial zones."* The project site is currently zoned as Residence-AA and therefore would be restricted to the regulations for noise sources emitting from a residential zone. The ordinance specifies limits of 55 dBA daytime and 45 dBA nighttime for residential to residential noise emissions. Daytime hours are those between 7:00 AM and 8:00 PM, Monday through Friday, and the hours of 9:00 AM through 8:00 PM on Saturday, Sunday and all federal and state holidays. Nighttime hours are those between 8:00 PM and 7:00 AM Sunday through Friday and the hours between 8:00 PM Saturday through 9:00 AM Sunday. During and state or federal holiday, the weekend schedule is in effect from the previous evening through the end of the holiday.

In Section 13-50 (c) of the ordinance, the regulations specify that in cases where the background noise level caused by other sources is greater than the limits specified, "*a source shall be considered to cause excessive noise if the noise emitted by such sources exceeds the background noise levels by five (5) dBA"* with a maximum noise limit of 80 dBA for a specific source.

Compliance for the specified limits is determined by measuring the A-weighed sound pressure level at one (1) foot beyond the emitter's boundary inside the receptor's noise zone. The emitter's zone includes contiguous rights of way for streets, highways, railroads, and waters of the state. For a continuously operating source in the presence of a variable background noise, the appropriate measurement metric is L_{90}.

3.2 Connecticut

The state ordinance governing noise is contained in the Connecticut General Statutes chapter 442. The statutes provide limits that are based on land use and time of day. Specifically, Section 22a-69-1.9 states that the limits for a noise source on a Class C type 4 land use (which covers utilities) when adjacent to a Class A land use (residential) are 61 dBA in the daytime and 51 dBA at nighttime. Daytime is defined as the hours between 7:00 AM and 10:00 PM and nighttime is defined as 10:00 PM to 7:00 AM.

In addition to these limits, there is an additional 5 dB penalty for prominent discrete tones. Per the statute, a prominent discrete tone is "the presence of acoustic energy concentrated in a narrow frequency range". The determination of the tone is relative to the sound level in the adjacent frequency bands. The relative sound level for each one-third octave band is specified in Section 22a-69-1.2 (r) and are listed in Table 3-1. Because transformers are capable of emitting tones in multiples of 120 Hz, this requirement must be met in addition to the overall noise requirement. For the discrete tone case, the daytime and nighttime limits would be 56 dBA and 46 dBA, respectively.

Section 22a-69-3.6 contains provisions for sources that are located in areas that already have a background noise higher than the limit. In these instances, the source noise will be considered excessive if it is greater than 5 dBA above the background.

Although these limits are objective and straightforward, the statute also contains language that can be used to file a complaint. For example, Section 22a-69-1.5 states that *"compliance of a source with these Regulations is not a bar to a claim of nuisance by any person. A violation of any portion of these regulations shall not be deemed to create a nuisance per se."* This would seem to permit some leeway in determining whether a source is a nuisance or not regardless of whether it meets the objective requirements.

Compliance for the specified limits is determined by measuring the A-weighted sound pressure level at one (1) foot beyond the emitter's boundary inside the receptor's noise zone. The emitter's zone includes contiguous rights of way for streets, highways, railroads, and waters of the state. The proposed facility has street rights of way along Wildflower Lane.

Table 3-1
Relative Sound Pressure Levels for Prominent Discrete Tones

1/3 Octave Band Center Frequency (Hz)	Relative Sound Pressure Level (dB)
100	16
125	14
160	12
200	11
250	9
315	8
400	7

3.3 Applicable Criteria

Based on the regulations reviewed, the local regulations are more stringent and should be used as the design basis for the facility. Thus the nighttime limits for a residential emitter to a residential receptor are the applicable criteria. The limits are 55 dBA daytime and 45 dBA nighttime. The regulations also specify a 5 dBA limit on the increase to the existing background sound level for areas with ambient levels that already exceed the residential limits. However, after conducting the ambient noise survey, it was determined that while at times the existing ambient sound levels do exceed 45 dBA at the nearby receptor locations, there were also times during which the existing ambient sound levels were below 45 dBA.

As such, the most restrictive applicable limit is the 45-dBA nighttime limit. This limit applies at the nearest adjacent residential property boundaries which are detailed in Figure 3-1.

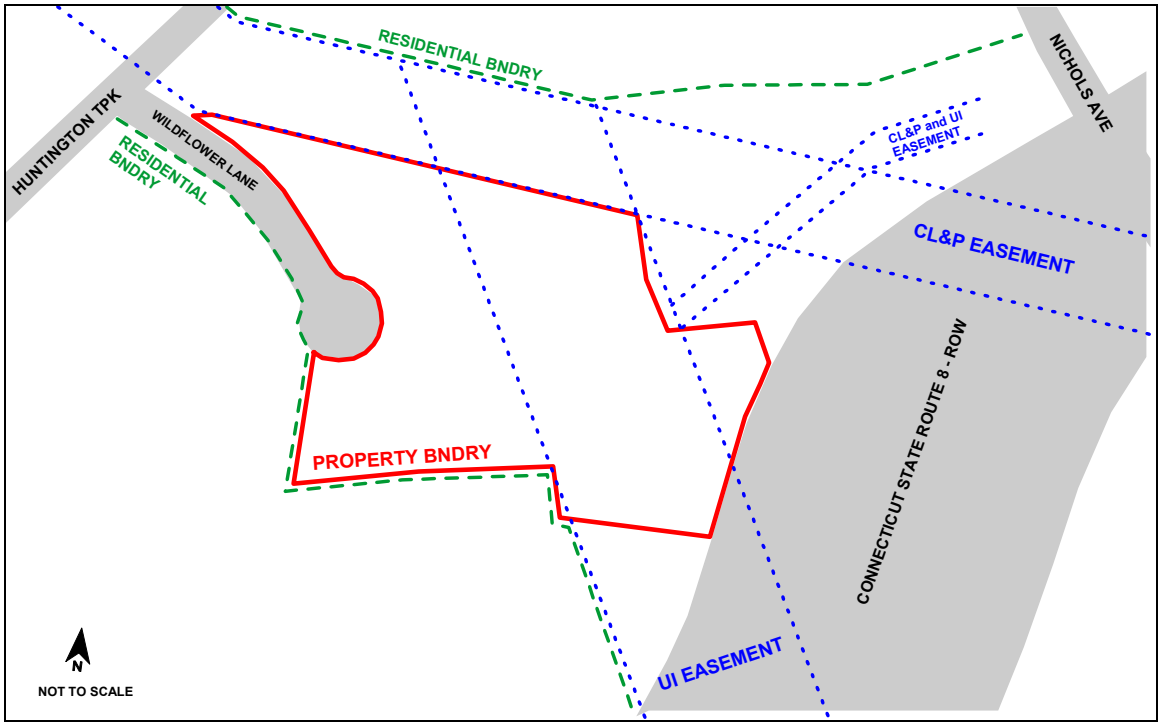

Figure 3-1. Location of the nearest adjacent residential property boundaries that represent the noise emissions compliance boundaries.

4.0 Existing Acoustical Environment

The proposed site and surrounding properties are zoned residential. The proposed site is largely wooded with a clearing at the center of the property for a 115 kV transmission line and a transmission line switching structure as well as a former distribution line training area. Nearby residences are located along the city roads surrounding the site. Traffic along the nearby roadways includes moderately heavy local traffic along Huntington Turnpike and heavy traffic along Route 8 and Nichols Avenue. An ambient noise survey was conducted on May 4 and 5, 2005, to characterize the existing acoustical environment within the vicinity of the proposed site.

4.1 Procedure

The ambient sound level survey procedure was based on general industry standards including ANSI S1.13, ANSI S12.9, ANSI S12.18, and ASTM E1014. In order to effectively quantify and qualify the existing daily sound levels within the area, the ambient survey included both continuous monitoring and short-term (manned) sound level measurements at three locations around the site. The continuous monitors collected sound level data at the monitoring locations throughout the survey period.

Short-term measurements were conducted periodically at the monitoring locations in order to qualify the existing overall conditions and quantify the existing spectral conditions during various daytime and nighttime hours.

Weather conditions during the measurement period were favorable for sound level measurements. Weather conditions generally included clear skies with little to no wind, temperatures from 45 to 57 °F, and relative humidity between 28 and 57 %.

4.2 Instrumentation

Sound level measurements were conducted using a sound level monitor that met the requirements of ANSI S1.4 and ANSI S1.43. The sound level monitor had integrating capabilities to determine the average and statistical sound levels on an hourly basis over the survey period. The sound level monitor continuously recorded the ambient sound levels and stored the hourly results for retrieval at the completion of the survey. The monitor was securely stored in an equipment case. The microphone was mounted to the top of a telescopic microphone pole and equipped with a windscreen provided by the manufacturer. The monitoring equipment was checked periodically throughout the survey period. The monitoring equipment is listed in Table 4-1.

A precision grade sound level meter, meeting the requirements of ANSI S1.4, was employed during the ambient survey. The sound level meter included integrating capabilities to determine the average and statistical 1/3-octave band sound pressure levels over the measurement duration. The sound level meter was mounted to a tripod and manned at all times. The microphone was equipped with a windscreen provided by the manufacturer. The sound level meter equipment is listed in Table 4-1.

All survey and measurement equipment had been laboratory calibrated within the previous 12 months and all calibrations are traceable to the National Institute of Standards and Technology (NIST). Calibration certificates are included in Appendix A.

Table 4-1
Ambient Survey Test Equipment

Model	Serial Number	Last Calibration Date
Rion Model NA-27	01191119	10/21/2004
Rion Type UC-53 Microphone	99858	10/21/2004
Norsonic Type 1251 Acoustic Calibrator	25762	10/21/2004
Rion Model NL-22	01110135	10/20/2004
Rion Model NL-22	01110133	10/20/2004
Rion Model NL-22	01110122	10/20/2004
Rion Model NC-73 Acoustic Calibrator	10527795	10/20/2004

4.3 Survey Locations

Noise monitoring was conducted at three locations surrounding the site. These locations were selected to capture an acoustical environment representative of the nearby residences. The nearest residences are located along Wildflower Lane approximately 100 feet west of the facility property line, along Huntington Turnpike approximately 100 feet north of the facility property line, and approximately 200 feet south of the facility property line. A description of each measurement location is listed in Table 4-2 and is based on the information and drawings provided. Additionally, the locations of the nearby residences and noise monitoring locations are shown in Figure 4-1.

Table 4-2
Descriptions of the Noise Monitoring Locations

Noise Monitoring Location (NML)	Description
1	On the east side of cul-de-sac on Wildflower Lane. This location was selected to represent the ambient noise at the residence in the cul-de-sac.
2	Near the CL&P transmission line tower near Huntington Turnpike. This location was selected due to the inaccessibility adjacent to the residential property at 1500 Huntington. It was at approximately the same distance from the proposed station as the residential southeastern boundary.
3	At the facility gate along Nichols Avenue near intersection with Route 8; adjacent to the residential property at 2911 Nichols Avenue.

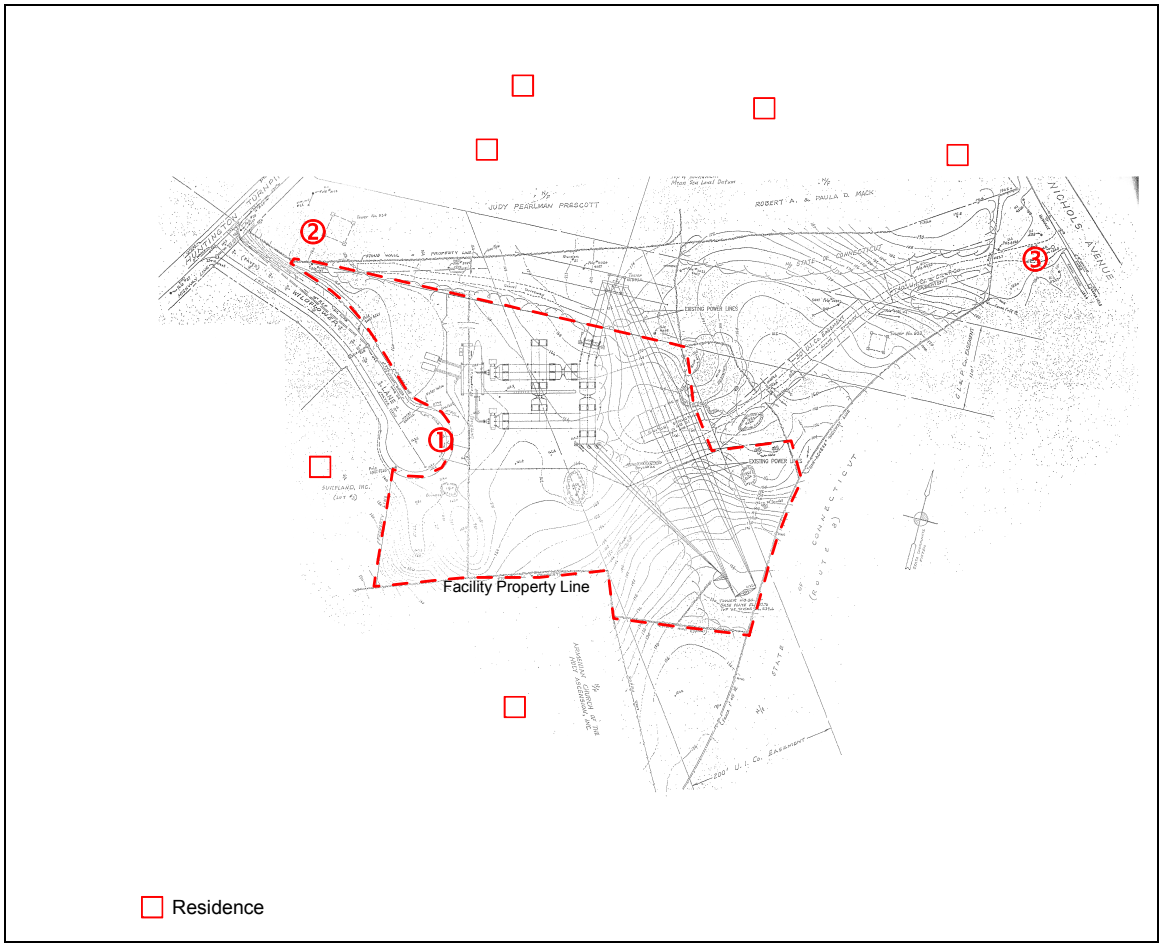

Figure 4-1. Nearby Residences and Ambient Noise Monitoring Locations.

4.4 Continuous Noise Monitoring

Continuous noise monitoring was conducted at each location for a 24-hour period to capture typical ambient daytime and nighttime sound levels. The measurements included the equivalent-continuous sound level, L_{eq}; the 90-percentile exceedance sound level, L_{90}; the 50-percentile exceedance sound level, L_{50}; and the 10-percentile exceedance sound level, L_{10}, during each one-hour period. As previously discussed, the L_{90} sound level is typically considered the residual or background sound level, the L_{50} sound level is generally considered the median sound level, and the L_{10} sound level is generally considered the intrusive sound level. The 24-hour noise monitoring results are summarized in Tables 4-3 and 4-4 and detailed in Figure 4-2. The corresponding measurement data is included in Appendix B.

Table 4-3 details the variation in the exceedance sound levels experienced over the 24-hour period. As shown, the hourly sound levels at each monitoring location were generally consistent with the other locations; however Location 3 experienced slightly higher levels due to the proximity of Nichols Avenue. Table 4-4 shows the variation at each location of the background

sound levels (L_{90}) during daytime (7:00 a.m. to 8:00 p.m.) and nighttime (8:00 p.m. to 7:00 a.m.) periods. During the nighttime period, the hourly background sound levels at each location were the lowest and dipped as low as 36 dBA at Location 2.

Figure 4-2 depicts the L_{10}, L_{50}, and L_{90} hourly sound levels during the 24-hour period at each location and shows the variation in the hourly sound levels during a typical day. The quietest background sound levels (L_{90}) at the monitoring locations were generally consistent and typically occurred during the 2:00 AM to 4:00 AM time periods when the volume of local traffic diminished. During daytime hours when the traffic volumes increased substantially, the hourly background sound levels (L_{90}) at the monitoring locations were higher.

Table 4-3
Continuous (24-hour) Ambient Sound Level Measurement Results

Noise Monitoring Location		Hourly (24-hour) Exceedance Sound Levels, dBA		
		L90	**L50**	**L10**
1	Min	37	41	46
	Median	47	49	52
	Max	54	55	57
2	Min	36	39	43
	Median	46	49	56
	Max	50	52	57
3	Min	39	45	52
	Median	54	57	61
	Max	59	61	64

Table 4-4
Daytime and Nighttime Background Sound Level Measurement Results (L90)

Noise Monitoring Location		Background (L90) Sound Pressure Levels, dBA	
		Daytime	**Nighttime**
1	Min	44	37
	Median	49	45
	Max	53	54
2	Min	42	36
	Median	46	41
	Max	50	50
3	Min	52	39
	Median	57	49
	Max	59	55

4.5 Short-Term Measurements

Short-term octave band noise measurements were conducted at each location in order to evaluate the spectral content of the existing acoustical environment. The short-term measurement results for the quietest time period are detailed in Figures 4-3 through 4-5. The measurement data for all short-term measurements are included in Appendix C. Figures 4-3 through 4-5 show the background octave band sound levels (L_{90}) recorded during the short-term measurement period at each location. The measurement period was 20 minutes in duration to capture representative sound levels. It should be noted that the sound pressure levels between approximately 500 and 2500 Hz were significantly influenced by road noise, which consequently affected the overall A-weighted sound pressure levels. The influence of the traffic noise was most prevalent at locations NML-2 and NML-3, which were both located near roadways. Location NML-1 was more remote from roadways but was still influenced by distant traffic noise.

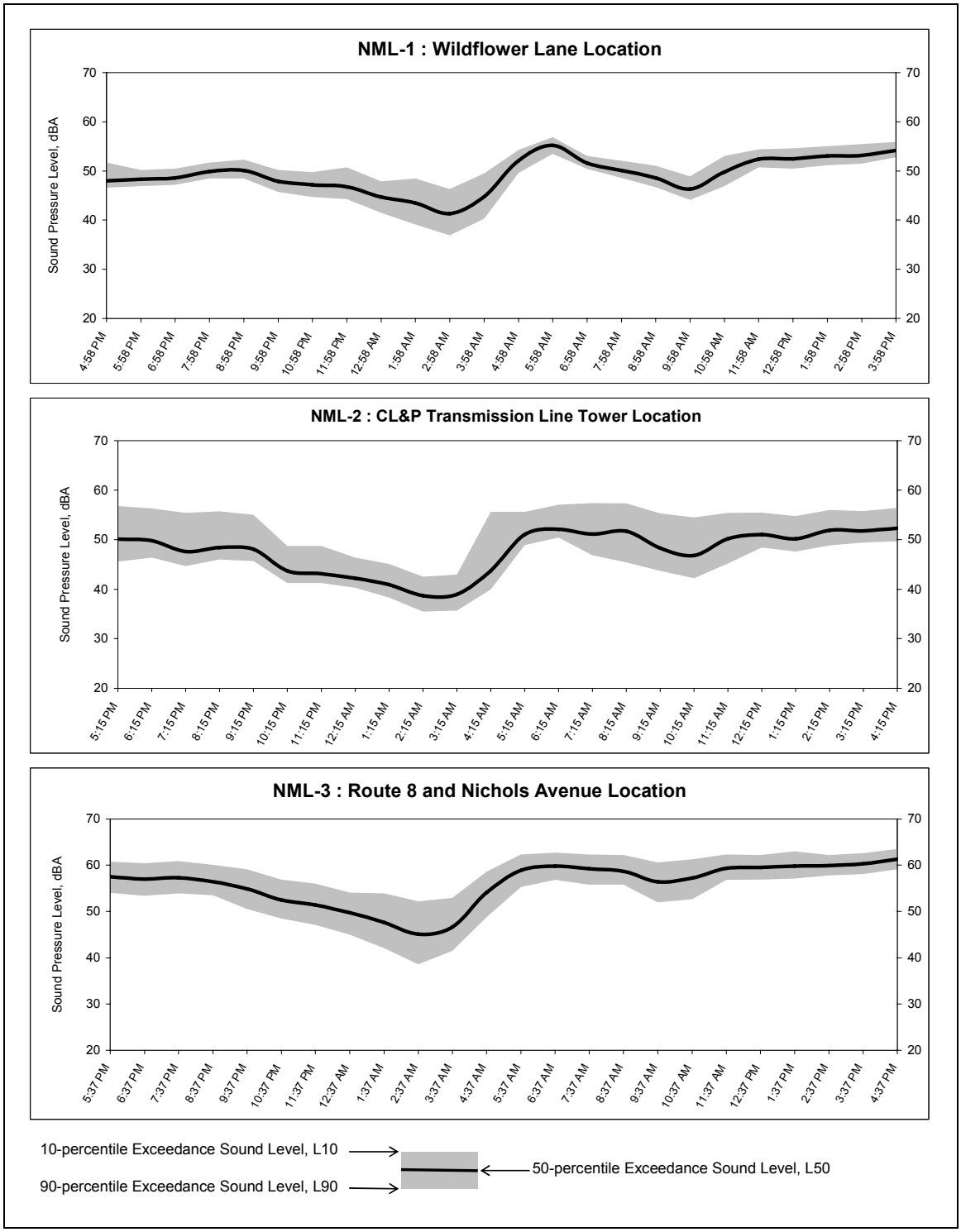

Figure 4-2. Continuous (24-hour) Ambient Noise Level Measurements.