PRELIMINARY NOISE IMPACT ANALYSIS REPORT

Reconstruction and Widening of the Pennsylvania Turnpike (I-76) from Milepost 298 to Milepost 302.5

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Table of Contents

List of Tables

List of Figures

List of Appendices

Executive Summary

The Pennsylvania Turnpike Commission (PTC) has initiated preliminary engineering design for the roadway reconstruction and widening of the Pennsylvania Turnpike (I-76) from Milepost (MP) 298 to MP 302.5 in Berks and Chester Counties, Pennsylvania.

This report addresses the potential for noise impacts based on the noise analysis performed during the preliminary engineering design phase of this project. Traffic noise impact analysis and abatement measures were evaluated according to the methodology and procedures set forth by the Federal Highway Administration (FHWA) in *Highway Traffic Noise: Analysis and Abatement Guidance* (FHWA-HEP-10-025, December 2011); and the Pennsylvania Department of Transportation (PennDOT) in the *Project Level Highway Traffic Noise Handbook, Publication No. 24* (December 2013).

This analysis has focused on all sensitive receptors and land uses within the project area of the proposed roadway design. A total of nine Noise Study Areas (NSAs) were identified from west to east, with three NSAs located on the north side of the Turnpike and six NSAs located to the south of the Turnpike.

Noise monitoring was conducted at 14 representative sites within the project study area in September 2014. The monitoring data was used to validate computer models capable of predicting the worst case noise levels for existing and future roadway conditions. 56 modeled-only receptors were then chosen as potentially impacted receptors within each NSA. When worst case existing traffic data is applied to these receptors, noise levels are predicted to range from 54 dB(A) to 75 dB(A), with levels approaching or above the requisite noise abatement criteria for the specific land use at 16 sites involving five of the nine NSAs identified for this analysis.

Travel volumes are expected to increase approximately 63 percent by the design year 2046 (traffic data can be referenced in Appendix A). The 2046 No Build traffic noise levels throughout the project area range from 56 dB(A) to 77 dB(A), with an average increase of 2 dB(A) over existing conditions observed. The geographic concentration of elevated noise levels is consistent with those identified in the existing worst case scenario.

The existing conditions noise model was then modified to incorporate design changes to the existing roadways and changes to the surrounding topography. This revised model was used to predict design year (2046) Build traffic noise levels at all monitored sites. With the proposed improvements, 2046 Build traffic noise levels through the corridor range from 56 dB(A) to 73 dB(A), with an average increase of 2 dB(A) over existing conditions observed.

Design year build traffic noise impacts were identified within seven of the nine NSAs. Therefore, abatement consideration is warranted for NSAs 1, 3, 4, 5, 6, 7, and 9 within the project study area. No traffic noise impacts were identified for NSAs 2 and 8. For NSA 2, future noise levels are predicted to reach 66 dB(A). However, this is not sufficient to create an impact for the Category F gas station and car dealership located within this NSA. NSAs where no impacts were identified do not warrant abatement consideration; therefore no further analysis was performed for NSAs 2 and 8.

Since noise impacts have been identified, this study included an evaluation of noise abatement. Alternative forms of abatement can be effective under certain circumstances. These include the installation of barriers or earthen berms, inclusion of traffic control measures, and modification of the alignment. Given the nature of the Turnpike through the project area, restrictions on travel speeds or truck traffic utilization to control noise would not serve the roadway's intended function and would be difficult to enforce. Therefore, this study focused on noise barriers as the only abatement consideration. Table 1 provides a summary of the noise barrier analysis outlined in this report.

Based on the analysis in this report, none of the evaluated noise barriers were found to be warranted, feasible and reasonable. Due to the large area of each NSA relative to the number of receptors located within them, the length of each barrier required to provide sufficient reduction to achieve the feasibility criteria provides a square-foot per benefitted receptor larger than that permitted by the reasonableness criteria. The proximity of many receptors to local roads is also a contributing factor to the lack of effectiveness of the barriers evaluated. Specifications for the barriers evaluated are outlined in Section 5.2.1, and Appendices E and F of this report.

Table 1: Summary of Evaluated Noise Barrier Analysis

NSA - Barrier Number	# of Impacted Receptors	Warranted?	# of Benefited Receptors	Feasible?	Barrier Length (feet)	Barrier Height (feet)	Barrier Sq.Ft.	Sq. Ft. per Benefited Receptor	Reasonable?
NSA 1 – Barrier 1	6	Yes	0	*No*	750	8 - 20	5,600 – 14,000	-	*No*
NSA 2	0	*No*	-	-	-	-	-	-	-
NSA 3 – Barrier 3	2	Yes	2	Yes	1,150	14	16,100	8,050	*No*
NSA 4 – Barrier 4	6	Yes	1	*No*	1,750	18	31,500	-	-
NSA 5 – Barrier 5	1	Yes	1	Yes	1,050	14	14,700	14,700	*No*
NSA 6 – Barrier 6	1	Yes	0	*No*	950	8 - 20	7,600 – 19,000	-	-
NSA 7 – Barrier 7	3.92*	Yes	5.20*	Yes	1,400	18	25,200	4,846	*No*
NSA 8	0	*No*	-	-	-	-	-	-	-
NSA 9 – Barrier 9	1	Yes	1	Yes	350	8	2,800	2,800	*No*

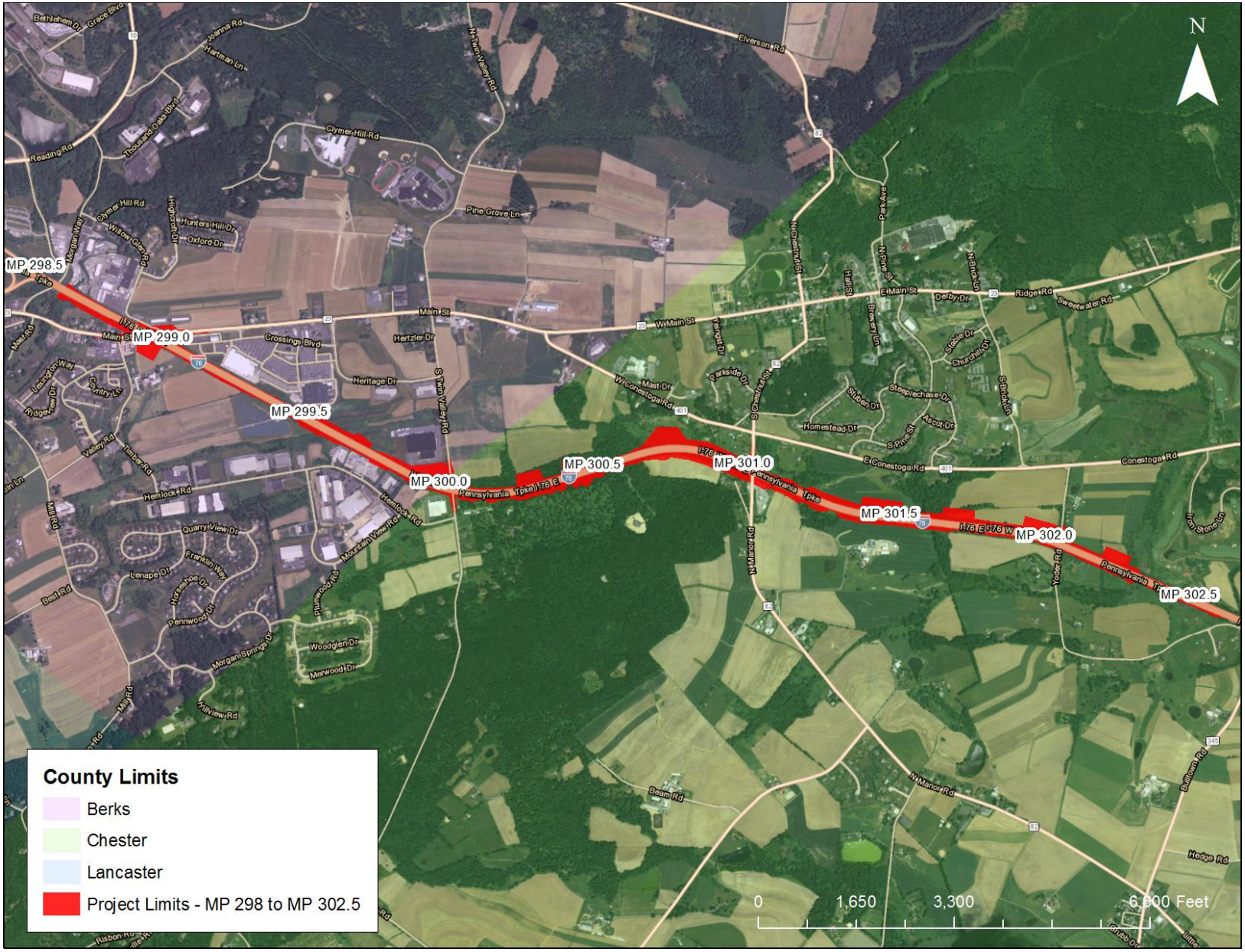
** Fractional receptor value attributed to calculated ERU of golf course receptors in this NSA*

1 Introduction

This report describes the methodology and presents the findings of the traffic noise analysis conducted by AECOM for the Pennsylvania Turnpike Commission. The project location extends from MP 298 to MP 302.5 in Berks and Chester Counties, Pennsylvania (Figure 1). The western limit of the study area is approximately 0.4 miles east of the Morgantown Road crossing of I-76; the eastern limit of the study area is approximately 0.3 miles west of the Bulltown Road (SR345) crossing of I-76. The project involves the widening of the Turnpike from four to six lanes (three lanes per travel direction) and includes full depth roadway reconstruction, widening roadway bridges, and the replacement of overhead bridges, culvert extensions, drainage, stormwater management, and side road adjustments. In addition, roadway shoulders and medians will be widened. All construction for this project will follow the existing centerline of the Turnpike.

This traffic noise assessment has been undertaken to determine if project-related noise impacts will occur along the roadway corridor, and determine whether noise abatement for affected areas in the form of noise barriers or other mitigation measures would be warranted, feasible, and reasonable, based upon FHWA and PennDOT criteria as utilized by the PTC.

Figure 1: Project Location



2 Methodology

Traffic noise impact analysis and abatement measures were evaluated according to the methodology and procedures set forth by the Federal Highway Administration (FHWA) in *Highway Traffic Noise: Analysis and Abatement Guidance* (FHWA-HEP-10-025, December 2011); and the Pennsylvania Department of Transportation (PennDOT) in the *Project Level Highway Traffic Noise Handbook, Publication No. 24* (December 2013).

Per FHWA and PennDOT noise guidance, the roadway reconstruction and widening of the Turnpike from MP 298 to MP 302.5 qualifies as a Type I project. A Type I project is a project considered for noise abatement that involves "the construction of a highway on a new location or the physical alteration of an existing highway, which significantly changes either the horizontal or vertical alignment or increases the number of through-traffic lanes."

2.1 Modeling & Analysis

Noise studies involve monitoring and modeling components. Short-term noise monitoring for this project was conducted at 14 representative receptor locations dispersed throughout the nine NSAs located within the project corridor. The noise monitoring was performed in September 2014 using B&K 2250 and Larson Davis LXT sound level meters. To ensure accurate readings, the meters were field calibrated prior to each daily monitoring session with Larson Davis CAL200 external calibrators. The sound level meter microphones, preamps and calibrators are laboratory calibrated annually to ensure accurate recordings of sound level data. The laboratory calibration certificates are included in Appendix B. Typical free-flow conditions were present during all monitoring periods. In addition, 24 hour monitoring was undertaken at two separate monitoring locations along the Turnpike (eastbound and westbound) using Larson Davis 812 and 820 environmental noise monitors. This was undertaken in accordance with PennDOT's guidance for validating the peak periods of traffic flow for use in establishing the existing worst case traffic conditions. Short and long-term monitoring results are outlined in Sections 3.2 and 3.3 of this report.

In order to accurately validate the traffic noise model, comprehensive traffic data were gathered concurrent to the short-term monitoring periods. Traffic speeds, number of vehicles, and compositions for both the Turnpike and any nearby local roads were recorded with a video camera during the monitoring periods, allowing for accurate computer model validation (Appendix B). See Section 4.1 for details regarding the noise model validation process. Once a model is validated, it allows for accurate prediction of existing and future no build and build worst case traffic noise impacts. Additionally, other significant localized factors affecting the recorded noise levels, such as non-traffic noise sources (aircraft flyovers, train horns, barking dogs, etc.) and intervening terrain, were noted on field sheets for each monitoring location (Appendix B).

The FHWA, under the U.S. Department of Transportation (USDOT), has developed and refined the methodology employed to model and predict traffic noise levels in this study. The latest computer model, called the FHWA Traffic Noise Model version 2.5 (TNM), predicts highway traffic noise levels at user-defined receptors, and aids in the design of highway noise barriers. TNM includes a database of speed-related noise emission levels for a variety of vehicle types (automobiles, medium trucks, heavy trucks, buses, and motorcycles). In addition, TNM contains a database of emission levels that accounts for the effects of accelerating vehicles, such as those affected by traffic control devices (stop signs, signals, or on-ramps) as well as the effects of roadway gradients. Sound propagation is calculated by accounting for the effects of ground and atmospheric absorption, divergence (i.e., geometric spreading of sound energy over distance), topography, man-made barriers, vegetation, and rows of buildings. To ensure a high level of accuracy, all TNM databases and calculations are based on 1/3-octave band data, and the results are recombined to give noise levels in the A-weighted dB(A).

TNM enables the user to evaluate a variety of traffic conditions and to develop and analyze proposed abatement. TNM model validation was completed according to PennDOT procedures prior to modeling future conditions.

Initially, predicted noise levels generated in TNM from the traffic data collected during field monitoring are compared to the field measured noise levels to ensure that the model is reasonably validated (within ±3 dB[A]) to the observed site conditions. Predictions are then made using the "worst case" assumptions, including peak-hour traffic data provided by the PTC (Appendix A). Section 772.17(b) of 23 CFR states, "For proposed roadways, it may be difficult to determine the potential operating speed of the future roadway. In these situations, it is recommended to consider using either design speeds or posted speeds plus five miles per hour (5 mph) to ensure worst case noise level predictions in the design year of the project". Therefore, the traffic noise model uses the design speed on I-76 of 70 mph throughout the project corridor.

2.2 Evaluation Criteria

The evaluation criteria followed the methodologies and criteria specified in PennDOT's Publication No. 24 (December 2013). Under state and federal guidelines, noise abatement is considered if it is warranted (noise levels approaching or exceeding abatement criteria). Determinations are evaluated following the identification of areas warranting abatement consideration, feasibility (constructability and effectiveness) of proposed abatement, and reasonableness (sq. ft./benefit). For this study, the existing year (2013) and the design year (2046) traffic noise levels were used to determine traffic noise impacts through the corridor.

Table 2: Hourly Weighted Sound Levels dB(A) for Various Land Use Activity Categories

Land Use Activity Category	Leq(h) [1]	Evaluation Location	Description of Land Use Activity Category
A	57	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purposes.
B [2]	67	Exterior	Residential.
C [2]	67	Exterior	Active sports areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E [2]	72	Exterior	Hotels; motels; offices; restaurants/bars; and other developed lands, properties, or activities not included in A-D or F.
F	--	--	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	--	--	Undeveloped lands that are not permitted.

Source: PennDOT - *Project Level Highway Traffic Noise Handbook, Publication No. 24* (December 2013)

1. Impact thresholds should not be used as design standards for noise abatement purposes.

2. Includes undeveloped lands permitted for this activity category.

2.2.1 Warranted Criteria

Noise abatement consideration is warranted if a noise impact is identified. A noise impact occurs when the existing or predicted level "approaches or exceeds" the FHWA's Noise Abatement Criteria (NAC) (Table 2). The listed activity groups were established by the FHWA based on a variety of noise-sensitive land uses. Noise-sensitive land usage in this project area consists of a mix of Activity Categories B, C, E, and F. PennDOT defines the approach criterion as 1 dB(A) less than the FHWA NAC. Therefore, there is a traffic noise impact if predicted exterior noise levels are 66 dB(A) or greater (for Categories B and C noise-sensitive land usage). Alternatively, the noise policy also considers properties as impacted if there is a 10 dB(A) increase over existing traffic noise levels even if the absolute level falls below 66 dB(A). This type of impact is addressed under the policy's substantial increase criteria. The impacts identified in this study are a result of traffic noise levels exceeding the 66 dB(A) criterion.

2.2.2 Feasibility Criteria

Feasibility deals primarily with acoustical and engineering considerations. Effective abatement is considered feasible if the predicted insertion loss (i.e., reduction in noise level as a result of the proposed abatement) is at least 5 dB(A) for the majority (50 percent or greater) of the impacted sites. Additionally, a variety of engineering constraints must be considered when determining the feasibility of the proposed abatement. Engineering considerations include restrictions to vehicular or pedestrian traffic (including driveways); safety concerns (such as sight distances or recovery zones); barrier constructability and maintainability; utility and drainage impacts; and overall adverse social, economic, and environmental effects.

2.2.3 Reasonableness Criteria

Reasonableness determination primarily focuses on a maximum square foot per benefited receptor (Max SF/BR) measurement to determine the relative value of the proposed abatement solution. PennDOT's noise barrier cost reasonableness value is based on a Max SF/BR value of 2,000 square feet. The square footage of a barrier is based on its length multiplied by its height above the finished ground at its base to the top elevation. The benefited receptor values are determined by counting all receptors receiving a 5 dB(A) or greater insertion loss (IL). Although at least a 5 dB(A) IL for the majority of receptors is required to meet the feasibility criteria, the proposed barrier must reduce noise levels by at least 7 dB(A) for at least one benefited receptor. It is desirable to provide this IL for additional impacted receptors while conforming to the Max SF/BR criteria and if justified by a "point of diminishing returns" evaluation. While optimizing a proposed noise barrier, the desired abatement goals should be evaluated in terms of establishing noise reductions for impacted receptors only.

For recreational land use the equivalent dwelling unit guidance outlined in Appendix E of Publication No. 24 was employed during the feasibility and reasonableness screening for mitigation. This methodology was developed by PennDOT to represent a degree of use for a particular site that is different from a typical single-dwelling residence. An Equivalent Receptor Unit (ERU) value for receptors locations is applied in order to best represent the person-hours spent on such a site, and provide a direct comparison to single-dwelling households for mitigation assessment purposes. For the French Creek Golf Club in NSA 7, the PennDOT methodology was applied to establish receptor values less than 1, in order to represent the smaller amount of hours people would spend on a private golf course versus a residential home. Appendix E of Publication 24 provides guidance for establishing a grid of receptors at 130 foot spacing in usable outdoor space (such as a golf course), avoiding any unusable areas (such as sand traps or ponds). When necessary for verifying benefited dwelling units, additional modeled-only second and third row receptors established using this method were included for the mitigation analysis.

For The French Creek Golf Course located in NSA 7, the following assumptions were made:

- The French Creek Golf Course is open 9 hours a day, 250 days a year.
- An average of 3.7 people play in each group.
- An average of 4.25 hours per round.
- 45 minute tee-time increments.

Using these assumptions, an ERU value of 0.32 per grid point was established, and used for all further mitigation analysis. This value equates to roughly a third of the person-hours spent within a single-dwelling home, and is applied to each golf course grid receptor for mitigation analysis purposes. A table outlining the ERU calculation methodology can be found in Appendix F, following the barrier feasibility worksheet for NSA 7.

2.3 Noise Abatement Measures

A variety of measures can be considered to address an identified noise impact. Placement of noise barriers within the ROW are most commonly recommended and were considered in this analysis due to their ease of implementation.

Alternative actions can be effective under certain circumstances. These include acquisition of additional ROW for installing barriers or earthen berms, inclusion of traffic control measures, and modification of the alignment. Given the nature of the Turnpike through the project area, restrictions on travel speeds or truck traffic utilization to control noise would not serve the roadway's intended function and would be difficult to enforce. Therefore, this study focused on noise barriers as the only abatement consideration.

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3 Existing Highway Traffic Noise Environment (Monitored Data)

3.1 Identification of Noise Study Areas (NSAs)

PennDOT Publication No. 24 (December 2013) states that NSAs "should be delineated as areas of common highway traffic noise influence throughout the entire project limits of the proposed transportation improvement project. NSA boundaries typically do not traverse over any major and/or significant highway traffic noise influence sources (i.e., existing or proposed roadways). Grouping common areas into NSAs also assists in evaluating mitigation, organizing reports, and facilitating discussions."

The project study area was sorted into nine NSAs from west to east, with three NSAs located to the north of the Turnpike and six NSAs located to the south of the Turnpike. All NSA's were identified in a Noise Monitoring Work Plan that was reviewed and approved by the PTC in July 2014. Figures 2A through 2E are located in Appendix C and present the limits of the nine NSAs; each one is described below. NSA boundaries were established approximately 500-feet from the existing edge-of-shoulder of the Turnpike roadway, as stipulated for projects involving an expansion of an existing roadway.

3.1.1 NSA 1 (see Figure 2A)

NSA 1 is located on the eastbound side of the Turnpike along East Main Street. NSA 1 encompasses nine single family homes, a three-dwelling apartment block and three mixed commercial & residential buildings situated along East Main Street. The NSA is bound by woods to the west, the Turnpike to the north and East Main Street to the east. NSA 1 is classified as land use Category B with some areas of Category E.

3.1.2 NSA 2 (see Figure 2A)

NSA 2 is located on the eastbound side of the Turnpike along East Main Street. NSA 2 encompasses three single family homes situated along Valley Road, a gas station and a car dealership along East Main Street. The NSA is bound by East Main Street to the west, the Turnpike to the north and agricultural lands to the east. NSA 2 is classified as land use Category B with the areas of farm activities classified as Category F.

3.1.3 NSA 3 (see Figure 2B)

NSA 3 is located on the eastbound side of the Turnpike along South Twin Valley Road. NSA 3 encompasses three single family homes situated along South Twin Valley Road. The NSA is bound by South Twin Valley Road to the west, the Turnpike to the north and woods to the east. NSA 3 is classified as land use Category B.

3.1.4 NSA 4 (see Figure 2C)

NSA 4 is located on the westbound side of the Turnpike along North Manor Road. NSA 4 encompasses two single family homes situated along North Manor Road, and eight single family homes along West Conestoga Road. The NSA is bound by woods to the west, the Turnpike to the south and North Manor Road to the east. NSA 4 is classified as land use Category B.

3.1.5 NSA 5 (see Figure 2C & 2D)

NSA 5 is located on the westbound side of the Turnpike along North Manor Road. NSA 5 encompasses four single family homes situated along East Conestoga Road. The NSA is bound by North Manor Road to the west, the Turnpike to the south and agricultural lands to the east. NSA 5 is classified as land use Category B.

3.1.6 NSA 6 (see Figure 2C)

NSA 6 is located on the eastbound side of the Turnpike along North Manor Road. NSA 6 encompasses four single family homes situated along Goodfellow Road and an industrial office building along North Manor Road. The NSA is bound by forest to the west, the Turnpike to the north and agricultural lands to the east. North Manor Road runs perpendicular to the Turnpike through the area. NSA 6 is classified as land use Category B and E with areas of farm activities classified as Category F.

3.1.7 NSA 7 (see Figure 2E)

NSA 7 is located on the westbound side of the Turnpike along Yoder Road. NSA 7 encompasses one single family home situated along Yoder Road, two single family homes situated along Bulltown Road, and the French Creek Golf Course. The NSA is bound by Yoder Road to the west, the Turnpike to the south and agricultural lands to the north. NSA 7 is classified as land use Category B, with the areas of farm activities classified as Category F, and active sports area classified as Category C.

3.1.8 NSA 8 (see Figure 2E)

NSA 8 is located on the eastbound side of the Turnpike along Yoder Road. NSA 8 encompasses one single family home situated along Yoder Road. The NSA is bound by agricultural lands to the west, the Turnpike to the north and Yoder Road to the east. NSA 8 is classified as land use Category B with the areas of farm activities classified as Category F.

3.1.9 NSA 9 (see Figure 2E)

NSA 9 is located on the eastbound side of the Turnpike along Yoder Road. NSA 9 encompasses one single family homes situated along Yoder Road. The NSA is bound by Yoder Road to the west, the Turnpike to the north and agricultural lands and woods to the east. NSA 9 is classified as land use Category B with the areas of farm activities classified as Category F.

3.2 Short-Term Noise Monitoring

Short-term noise monitoring sessions, 20 minutes in duration, were conducted at 14 locations within the project limits between September 15 and September 17, 2014. Figures 2, and 2A through 2E (Appendix C) show the locations of the noise monitoring sites, and Table 3 provides a summary of the measurement results. The measured existing noise levels for receptors which are impacted are highlighted in red.

The objectives of the short-term noise measurements were to:

- Obtain noise measurement data used to “validate” the traffic-noise prediction modeling for each NSA, thereby increasing confidence in calculated noise levels;
- Obtain counted traffic data used as input to the TNM during validation of the noise modeling for each NSA; and
- Document existing ambient sound levels at noise study locations within each NSA.

The short-term measurement sites were selected according to the following requirements:

Represent noise-sensitive land uses within each NSA. Short-term measurement sites were selected to represent various categories or “clusters” of noise-sensitive receptors within each NSA. Distinguishing characteristics of various clusters included some or all of the following:

- Distance to the Turnpike;
- Absence or presence of shielding (e.g., first-row vs. second-row receptors);

- Roadway/receiver geometry (e.g., Turnpike depressed or on-fill, receptors on hillside overlooking Turnpike, presence of entrance/exit ramps, etc.); and
- Influence of other traffic-noise sources such as local streets.

When possible, represent areas of frequent human use. Alternatively, measurement sites were selected in areas that did not have frequent human use but were acoustically equivalent to nearby locations with frequent human use (e.g., on the grass along a side street or set back the same distance from the Turnpike as the yard of the adjacent house);

Give primary consideration to first-row receivers. Typically, traffic noise levels will be highest at the closest receivers and noise barriers will provide the greatest benefit at these locations; and

Conduct additional measurements at second-row and third-row locations. Additional measurements were conducted at these locations to assist in the noise modeling validation and in determining the effects of shielding;

For each site, these procedures were followed:

The short-term measurements were conducted with ANSI Type 2 instruments with calibrations traceable to the National Institute of Standards and Technology (NIST); The sound level meters were field calibrated before and after each short-term measurement (see Appendix B for annual calibration certifications);

Measurements were conducted for a minimum of 20-minute periods. Individual one minute average sound levels (L_{eq}) were recorded so that periods including events not representative of the ambient noise environment or not traffic-related could be separated or excluded. Specifically, notes on the site sketches were included indicating potential periods of non- traffic noise influence (i.e., barking dogs and aircraft over-flights). The data collected for these individual periods is further scrutinized following the field monitoring to identify outlier data and potentially exclude these periods from the calculation of the overall average sound level;

A short-term field measurement data sheet (see Appendix B) was completed for each measurement site;

Ambient weather data including wind speed and direction, temperature, and relative humidity were recorded during each measurement period to ensure requisite meteorological conditions were present for noise model validation. For example, monitoring should not be performed during periods of excessive wind as this will potentially cause mechanical interference (microphone and windscreens) or abnormal noise propagation patterns;

During each short-term noise measurement, simultaneous traffic volume and classification counts were conducted for all roads on which traffic was judged to make a significant contribution to the measured sound level at an individual site. Traffic volumes and classes were noted on the site sketches (see Appendix B) for each short-term measurement;

No short-term measurements were conducted during periods of stop-and-go traffic or if the average speed was judged to vary significantly during the measurement period; No short-term measurements were conducted during periods when the Turnpike pavement was wet; and

Noise meter location sketches were drawn indicating nearby landmarks to allow for accurate model validation and duplication of monitoring sites if necessary.

Table 3: Summary of Short-Term Measurement Results

NSA	Measurement Location	Address	Monitored Level Leq dB(A)
1	M1	3825 Main Street	**69**
	M2	3801 Main Street	57
2	M3	2025 Valley Road	52
3	M4	308 S Twin Valley Road	65
	M5	316 S Twin Valley Road	**66**
4	M6	309 N Manor Road	64
	M7	11 W Conestoga Road	**75**
5	M8	33 E Conestoga Road	59
6	M9	18 Goodfellow Road	**72**
	M10	35 Goodfellow Road	60
7	M11	130 Yoder Road	53
	M12	626 Bulltown Road	63
8	M13	375 Yoder Road	56
9	M14	372 Yoder Road	59

3.3 24 Hour Noise Monitoring

PennDOT Publication No. 24 (December 2013) states that “If there is some question as to the worst-case highway traffic noise hour, it may be necessary to conduct long-term monitoring to determine the worst-case highway traffic noise hour(s). In this case, long-term monitoring should be done in conjunction with evaluating the existing diurnal traffic patterns to determine the existing worst-case highway traffic noise hour”.

Accordingly, 24 hour noise monitoring was conducted at two locations within the project limits between September 15 and September 17, 2014. Figures 2 and 3 (Appendix C) shows the locations of the monitoring sites, and Figures 4A and 4B (Appendix D) outlines the 24 hour monitoring results.

The results of this monitoring confirm that the peak traffic noise hours occur between 6:00 AM and 9:00 AM.

4 Future Highway Traffic Noise Environment (Existing and Future Calculations)

4.1 Validation of Noise Modeling

The FHWA has developed a computer noise model that is used for traffic noise emissions prediction and abatement evaluation. As referenced in Section 2.1, the FHWA's TNM includes a database of speed-related noise emission levels for a variety of vehicle types (i.e., automobiles, medium trucks, and heavy trucks). TNM also includes a database of noise emission levels that accounts for acceleration noise on roadway facilities that would be associated with traffic control devices (stop lights, stop signs, tollbooths, and on-ramps) or gradient changes. TNM uses these emissions data to calculate sound energy propagation over distances and estimate noise levels at discrete locations. Ground and atmospheric absorption of sound energy as well the spreading of energy over distance (divergence) are considered, as are the effects of man-made barriers, topography, vegetation, and rows of buildings. PennDOT Publication No. 24 stipulates the use of the most current version of TNM when assessing traffic noise levels for highway projects.

The TNM modeling for a specific project area is typically "validated" by comparison of TNM calculated results with the field-measured noise data. Publication No. 24 describes the purpose of modeling validation and describes the procedure. To help accomplish the modeling validation, simultaneous noise measurements and traffic counts were conducted during the 14 short-term measurements described in Section 4.2. The directional traffic counts included vehicle class identification broken down into cars, medium trucks, and heavy trucks. Following the measurements, the short-term traffic counts were normalized to hourly volumes and used as input to the noise prediction model. Based on a comparison of measured and calculated sound levels, refinements were made to the TNM model to more accurately represent the surrounding landscape. Refinements included adjustments to variables within the propagation path, including but not limited to alterations of building row characteristics and adjustments to terrain lines and tree zones.

Table 4 presents the measured and TNM-calculated noise levels for the 14 short-term measurement sites following refinement of the noise modeling. Note that the measured and calculated sound levels do not represent the annual worst case conditions. The prediction of the annual worst case noise levels is discussed in Section 4.2 below.

PennDOT Publication No. 24, Section 2.5.3.3 states that "if the difference between the [measured and calculated] values is less than +/- 3 dB(A), this is an indication that the model is within the accepted level of accuracy." 13 of the 14 short-term monitoring locations predicted noise levels within these prescribed parameters. This correlation between measured and computed sound levels provides a high level of confidence in TNM's calculations throughout the project area. In addition, the average difference between the calculated hourly L_{eq} and the measured L_{eq} was approximately 1.1 dB(A). This bias towards slight over-prediction implies that the noise model is appropriately conservative and would tend to slightly over-predict, rather than under-predict, noise impacts.

The one monitoring site that was not able to be validated (M3) represents the single-family residence located at 2025 Valley Road, within NSA 2. Despite best efforts, this receptor continued to over-predict by approximately 8 dB(A), 5 dB(A) over the accepted level for validation. However, due to the fact the model is over-predicting (providing a more conservative result for mitigation analysis), and the distance of the other receptors within NSA 2 to the Turnpike, the results of the model were still utilized in the screening evaluation for potential noise abatement.

Table 4: Measured vs. Calculated Sound Levels for TNM Validation

NSA	Measurement Location	Address	Monitored Level Leq dB(A)	Modeled Level Leq dB(A)	Validates? (Y/N)
1	M1	3825 Main Street	69	70	**Yes**
	M2	3801 Main Street	57	60	**Yes**
2	M3	2025 Valley Road	52	60	***No***
3	M4	308 S Twin Valley Road	65	66	**Yes**
	M5	316 S Twin Valley Road	66	66	**Yes**
4	M6	309 N Manor Road	64	66	**Yes**
	M7	11 W Conestoga Road	75	72	**Yes**
5	M8	33 E Conestoga Road	59	62	**Yes**
6	M9	18 Goodfellow Road	72	69	**Yes**
	M10	35 Goodfellow Road	60	60	**Yes**
7	M11	130 Yoder Road	53	56	**Yes**
	M12	626 Bulltown Road	63	66	**Yes**
8	M13	375 Yoder Road	56	59	**Yes**
9	M14	372 Yoder Road	59	61	**Yes**

4.2 Worst Case Calculations

Following validation of the noise model, TNM was used to calculate worst case noise levels at 56 modeled receptor locations, distributed throughout the nine NSAs. These modeled-only receptor sites represent noise-sensitive receptors within each NSA, and the predicted levels at these locations were used in all further mitigation analysis. All significant sound propagation and shielding assumptions used in the model "validation" phase were retained for the worst case prediction modeling except where altered or otherwise rendered invalid due to the proposed design. Equivalent receptors for the 14 monitoring sites used in the validation model were included in the 56 receptors chosen. Receptor locations are referenced in Appendix E and outlined in Figures 5, and 5A through 5E.

Table 5 provides the worst case sound levels calculated for existing (2013) and future (2046) conditions. The table is organized by NSA, starting at the western end of the project area and proceeding eastward. Traffic data for the worst case calculations for both existing and future conditions were developed through data made available by the PTC. Appendix A of this report provides additional traffic details, including modeled traffic volumes, growth factors and vehicle classification breakdown, as sourced from the PTC. Traffic speeds were modeled at the design speed of 70 miles per hour (70 mph) in order to represent the worst case scenario for noise impacts.

4.2.1 Existing Condition Sound Levels

The validated noise models were used as the baseline for the calculation of existing (2013) worst case noise levels. Field-recorded traffic data was replaced in the models with the peak-hour data supplied by the PTC.

Calculated worst case L_{eq} sound levels for the existing condition ranged from 54 to 75 dB(A) among all receptors. Typically, locations closest to the Turnpike had the highest calculated sound levels. In Table 5, receptor sites with worst case sound levels approaching or exceeding the NAC as discussed in Section 2.2 are identified in red. L_{eq} sound levels of 66 dB(A) or higher approach or exceed the NAC for residential or other noise-sensitive outdoor land uses. Under the modeled existing conditions, 16 receptor locations are predicted to experience noise impacts during the loudest hour of the day. Noise impacts presently occur in five out of the nine NSAs evaluated.

4.2.2 Future (2046) No Build Condition Calculated Sound Levels

Worst case conditions were also calculated for the future (2046) No Build condition. This scenario represents the future Turnpike facility incorporating no changes to the roadway geometry. This information is useful for evaluating the scope of the effect that the proposed facility will have on the overall noise environment. The Turnpike is typical of highway facilities where future noise levels are anticipated to increase regardless of the proposed design changes due to an increase in traffic projections. By evaluating differences in sound levels between the No Build and Build conditions, the relative effect of the project on ambient noise levels can be better understood and considered in project planning.

The validated noise models were used as the baseline for the calculation of future No Build worst case noise levels. Field-recorded traffic data was replaced in the models with the peak hour No Build (2046) data supplied by the PTC.

Calculated worst case L_{eq} sound levels for the Future No Build condition ranged from 56 to 77 dB(A) at all receptors. Typically, locations closest to the Turnpike had the highest calculated sound levels. In Table 5, prediction sites with worst case sound levels approaching or exceeding the NAC as discussed in Section 2.2 are identified in red. L_{eq} sound levels of 66 dB(A) or higher approach or exceed the NAC for residential or other noise-sensitive outdoor land uses. The substantial increase over existing noise levels criterion did not trigger additional noise impacts. Under the modeled Future No Build conditions, 22 receptor locations are anticipated to experience noise impacts during the loudest hour of the day. Noise impacts are anticipated to occur in five out of the nine NSAs evaluated.

4.2.3 Future (2046) Build Condition Calculated Sound Levels

Worst case conditions were also calculated for the Future (2046) Build condition. This scenario represents the future Turnpike facility incorporating design changes to the roadway geometry and intervening terrain. This information is used to identify the number and location of NSAs that warrant mitigation consideration. As referenced in Section 2.2, those areas warranting mitigation consideration are subject to further mitigation analysis in order to determine if sound walls are feasible and reasonable.

The validated noise models were modified to incorporate the proposed design changes, and then used as the baseline for the calculation of future Build (2046) worst case noise levels. Field observed traffic data was replaced in the models with the peak-hour Build (2046) traffic data supplied by the PTC. The same 56 modeled receptor locations used in the existing and future No Build (2046) worst case models were incorporated as previously described.

The properties on which receptors R1, R2 and R3 are located have been or will be acquired by the PTC, and the homes demolished to accommodate the proposed Turnpike improvements. Therefore, these three receptors have been excluded from the Future (2046) Build Condition assessment.

Calculated worst case L_{eq} sound levels for the future Build condition ranged from 56 to 73 dB(A) among all receptor sites. Typically, locations closest to the Turnpike had the highest calculated sound levels. In Table 5, receptor sites with worst case sound levels approaching or exceeding the NAC, as discussed in Section 2.2, are identified in red. L_{eq} sound levels of 66 dB(A) or higher approach or exceed the NAC for residential or other noise-sensitive outdoor land uses. No receptors have been identified as being impacted due to the substantial increase over the existing noise levels in this analysis. Under the modeled Future Build conditions, 25 receptor sites are anticipated to experience noise impacts during the loudest hour of the day. Noise impacts are anticipated to occur in seven out of the nine NSAs evaluated, outlined as follows:

NSA 1 - Noise levels are expected to be between 64 dB(A) and 69 dB(A) in this NSA. Increases above existing noise levels range between 1 dB(A) and 3 dB(A) in this NSA. These noise levels represent a traffic noise impact to 6 receptors in the NSA. *Mitigation analysis is warranted for this NSA.*

NSA 2 - Noise levels are expected to be between 60 dB(A) and 70 dB(A) in this NSA. Increases above existing noise levels range between 0 dB(A) and 3 dB(A) in this NSA. These noise levels represent no traffic noise impacts in this NSA, due to some receptors falling under Category F land use. *Mitigation analysis is not warranted for this NSA.*

NSA 3 - Noise levels are expected to be between 65 dB(A) and 73 dB(A) in this NSA. Increases above existing noise levels range between 4 dB(A) and 5 dB(A) in this NSA. These noise levels represent a traffic noise impact to 2 noise-sensitive receptors in the NSA. *Mitigation analysis is warranted for this NSA.*

NSA 4 - Noise levels are expected to be between 63 dB(A) and 70 dB(A) in this NSA. Increases above existing noise levels range between 1 dB(A) and 5 dB(A) in this NSA. These noise levels represent a traffic noise impact to 6 noise-sensitive receptors in the NSA. *Mitigation analysis is warranted for this NSA.*

NSA 5 - Noise levels are expected to be between 56 dB(A) and 66 dB(A) in this NSA. Increases above existing noise levels range between 2 dB(A) and 3 dB(A) in this NSA. These noise levels represent a traffic noise impact to 1 noise-sensitive receptor in the NSA. *Mitigation analysis is warranted for this NSA.*

NSA 6 - Noise levels are expected to be between 62 dB(A) and 66 dB(A) in this NSA. Increases above existing noise levels range between 2 dB(A) and 3 dB(A) in this NSA. These noise levels represent a traffic noise impact to 1 noise-sensitive receptor in the NSA. *Mitigation analysis is warranted for this NSA.*

NSA 7 - Noise levels are expected to be between 58 dB(A) and 71 dB(A) in this NSA. Increases above existing noise levels range between 1 dB(A) and 3 dB(A) in this NSA. These noise levels represent a traffic noise impact to 3.92 noise-sensitive receptors in the NSA. *Mitigation analysis is warranted for this NSA.*

NSA 8 - Noise levels are expected to be 65 dB(A) in this NSA. Increases above existing noise levels for the single receptor is 3 dB(A). These noise levels represent no traffic noise impacts in this NSA. *Mitigation analysis is not warranted for this NSA.*

NSA 9 - Noise levels are expected to be 70 dB(A) in this NSA. Increases above existing noise levels for the single receptor is 3 dB(A). These noise levels represent a traffic noise impact to 1 noise-sensitive receptor in the NSA. *Mitigation analysis is warranted for this NSA.*

Note that per the FHWA and Pennsylvania Department of Transportation traffic noise analysis guidelines, noise values, comparisons and insertion losses are calculated to the tenth of a dB(A) and are rounded for presentation purposes.

Table 5: Calculated Worst Case Existing (2013) and Future (2046) Noise Levels

NSA	Receptor ID	Address	Criteria dB(A)	Existing Worst Case (2013) dB(A)	Future No Build (2046) dB(A)	Future Build (2046) dB(A)
1	R1	3825 Main Street	66	**75**	**77**	***To be demolished***
	R2	3823 Main Street	66	**66**	**67**	***To be demolished***
	R3	3821 Main Street	66	**68**	**70**	***To be demolished***
	R4	3817 Main Street	66	61	63	65
	R5	3813 Main Street	66	61	63	64
	R6	3809 Main Street	66	63	64	65
	R7	3807 Main Street	66	62	64	65
	R8	3801 Main Street	66	62	64	65
	R9	3605 Main Street	66	64	65	**66**
	R10	3740 Main Street	71	68	68	69
	R11	3800 Main Street	66	**67**	**67**	**68**
	R12	3804 Main Street	66	**66**	**67**	**67**
	R13*	3808 Main Street	66	**66**	**66**	**67**
	** Represents 3 dwelling units*					
2	R14	3820 Main Street	N/A	69	70	70
	R15	3830 Main Street	N/A	63	64	66
	R16	2019 Valley Road	66	58	60	61
	R17	2021 Valley Road	66	57	59	60
	R18	2025 Valley Road	66	62	64	64
3	R19	308 S Twin Valley Road	66	**68**	**70**	**72**
	R20	316 S Twin Valley Road	66	**68**	**70**	**73**
	R21	344 S Twin Valley Road	66	60	62	65
4	R22	51 W Conestoga Road	66	63	65	**66**
	R23	43 W Conestoga Road	66	64	65	**67**
	R24	35 W Conestoga Road	66	65	**67**	**68**
	R25	33 W Conestoga Road	66	**67**	**69**	**69**
	R26	27 W Conestoga Road	66	65	**66**	**67**
	R27	25 W Conestoga Road	66	64	65	65
	R28	23 W Conestoga Road	66	63	64	65
	R29	11 W Conestoga Road	66	63	64	64
	R30	301 N Manor Road	66	61	62	63
	R31	309 N Manor Road	66	65	**67**	**70**
5	R32	23 E Conestoga Road	66	63	64	65
	R33	33 E Conestoga Road	66	63	65	**66**
	R34	117 E Conestoga Road	66	57	59	59
	R35	121 E Conestoga Road	66	54	56	56
6	R36	35 Goodfellow Road	66	59	61	62
	R37	18 Goodfellow Road	66	63	65	**66**
	R38	15 Goodfellow Road	66	61	62	64
	R39	11 Goodfellow Road	66	60	61	62
	R40	316 N Manor Road	66	62	63	64

NSA	Receptor ID	Address	Criteria dB(A)	Existing Worst Case (2013) dB(A)	Future No Build (2046) dB(A)	Future Build (2046) dB(A)
7	R41+	130 Yoder Road	66	55	58	58
	R42_1+	French Creek Golf Club	66	63	65	63
	R42_2+	French Creek Golf Club	66	60	63	61
	R42_3+	French Creek Golf Club	66	**66**	**68**	**66**
	R42_4+	French Creek Golf Club	66	64	**66**	65
	R42_5+	French Creek Golf Club	66	61	63	63
	R42_6+	French Creek Golf Club	66	**67**	**70**	**70**
	R42_7+	French Creek Golf Club	66	65	**67**	**68**
	R42_8+	French Creek Golf Club	66	62	64	65
	R42_9+	French Creek Golf Club	66	**68**	**71**	**71**
	R42_10+	French Creek Golf Club	66	65	**67**	**68**
	R42_11+	French Creek Golf Club	66	63	65	**66**
	R43	634 Bulltown Road	66	63	65	**66**
	R44	626 Bulltown Road	66	**68**	**70**	**71**
	+ *Represents 0.32 dwelling units (ERU = 0.32)*					
8	R45	375 Yoder Road	66	61	63	65
9	R46	372 Yoder Road	66	**67**	**69**	**70**

Note: Noise values, comparisons and insertion losses are calculated to the tenth of a dB(A) and are rounded for presentation purposes.

5 Highway Traffic Noise Consideration and Mitigation Alternatives

5.1 Mitigation Alternatives

FHWA has identified certain noise mitigation measures to reduce traffic noise impact that may be incorporated into either new roadway projects or roadway improvement projects that increase traffic capacity. These include:

- Traffic management measures (e.g., traffic control devices and signing for prohibition of certain vehicle types and time-use restrictions for certain vehicle types);
- Alteration of horizontal and vertical alignments;
- Acquisition of property to serve as a buffer zone to preempt development which would be adversely impacted by traffic noise;
- Sound insulation of public or nonprofit institutional structures; and
- Construction of noise barriers

Possible traffic management measures include reducing speeds and truck restrictions. Speed restrictions provide only a slight reduction in noise levels without significant reductions in speed. For example, to achieve a five-decibel reduction in noise from heavy trucks, average speeds would need to be reduced from 70 to 50 mph. Therefore, speed restrictions are not a feasible noise mitigation measure for this project. Truck restrictions would not be practical because the Turnpike is a major east-west interstate highway in Pennsylvania. Therefore, truck restrictions also are not a feasible noise mitigation measure for this project.

There are no planned changes in grading of the Turnpike within the scope of this project that will limit potential noise impacts. Significant traffic noise level reductions would require substantial changes to either the Turnpike's horizontal or vertical alignment. Such alignment shifts are beyond the scope of this roadway improvement project and therefore, are beyond the scope of this analysis.

Although there is a considerable amount of undeveloped land adjacent to the Turnpike, buffer zones are typically not a viable mitigation option, due to their substantial cost compared to noise barriers.

Although sound insulation of public or nonprofit institutional structures may be considered, federal and state policies require that primary consideration in determining and abating highway traffic noise impact must be given to exterior areas. The interior criterion (NAC Category D, see Section 2.2) is intended to be used "in those situations where there are no outdoor activities to be affected by the traffic noise, or where the exterior activities are far from or physically shielded from the roadway in a manner that prevents an impact on exterior activities." No impacts that would be associated with Category D land use have been identified through this analysis.

5.2 Noise Barrier Evaluation

Construction of noise barriers is the only remaining highway traffic noise abatement measure to be considered. A noise barrier evaluation was conducted for each NSA meeting the warranted criteria described in Section 2.2.1. The objective of each evaluation was to determine whether a noise barrier could meet the feasibility and reasonableness criteria described in Section 2.2.2 and Section 2.2.3. The evaluations were conducted to determine the preferred alignment, approximate noise barrier end points, and the approximate average height of each proposed noise barrier.

The noise barrier design was conducted at a preliminary level requiring further optimization during the final design stage of the project. Specifically, ranges of barrier heights were evaluated in two-foot increments with the noise barrier assumed to be of constant height for its entire length. In general, noise barriers were evaluated for feasibility and reasonableness with constant heights of 8, 10, 12, 14, 16, 18, and 20 feet above ground level

(see Table 6) to determine whether a barrier could be designed to meet the feasibility and reasonableness criteria. For any recommended noise barriers, further acoustical and engineering design would be necessary prior to construction.

Figures 5A through 5E (Appendix E) outline the approximate locations of the evaluated noise barriers, and Table 6 provides a summary of the barrier analysis including noise reduction values for each barrier.

Table 6: Summary of Evaluated Noise Barriers

NSA / Barrier Number	Barrier Height	Noise Reduction - dB(A)			# of Units Impacted	# of Impacted Units at NR Goal	Feasible?	# of Units Benefited	Barrier Sq.Ft.	Barrier Sq.Ft. per Unit Benefited	Reasonable?
		Min.	Avg.	Max.							
NSA 1 - Barrier 1	8	0	0.2	0.5	6	0	No	0	5,600	-	No
	10	0	0.2	0.6	6	0	No	0	7,000	-	No
	12	0	0.2	0.8	6	0	No	0	8,400	-	No
	14	0	0.3	0.9	6	0	No	0	9,800	-	No
	16	0	0.3	1.0	6	0	No	0	11,200	-	No
	18	0.0	0.4	1.1	6	0	No	0	12,600	-	No
	20	0.0	0.4	1.2	6	0	No	0	14,000	-	No
NSA 3 - Barrier 3	8	0.8	1.7	2.7	2	0	No	0	9,200	-	No
	10	1.2	2.5	3.7	2	0	No	0	11,500	-	No
	12	1.5	3.3	4.7	2	1	Yes	1	13,800	13,800	No
	14	1.9	4.2	5.6	2	2	Yes	2	16,100	8,050	No
	16	2.2	4.8	6.1	2	2	Yes	2	18,400	9,200	No
	18	2.3	5.3	7.1	2	2	Yes	2	20,700	10,350	No
	20	2.4	5.7	7.9	2	2	Yes	2	23,000	11,500	No
NSA 4 - Barrier 4	8	0	0.9	5.3	6	1	No	1	14,000	-	No
	10	0	1.1	5.8	6	1	No	1	17,500	-	No
	12	0.3	1.4	6.4	6	1	No	1	21,000	-	No
	14	0.3	1.7	7.0	6	1	No	1	24,500	-	No
	16	0.3	1.9	7.4	6	1	No	1	28,000	-	No
	18	0.3	2.2	7.9	6	1	No	1	31,500	-	No
	20	0.3	2.4	8.4	6	1	No	1	35,000	-	No
NSA 5 - Barrier 5	8	0.8	1.6	2.3	1	0	No	0	8,400	-	No
	10	1.5	2.3	3.0	1	0	No	0	10,500	-	No
	12	1.8	2.6	3.4	1	0	No	0	12,600	-	No
	14	2.1	3.4	4.7	1	1	Yes	1	14,700	14,700	No
	16	2.9	4.2	5.5	1	1	Yes	1	16,800	16,800	No
	18	3.3	4.6	5.9	1	1	Yes	1	18,900	18,900	No
	20	3.5	4.9	6.2	1	1	Yes	1	21,000	21,000	No
NSA 6 - Barrier 6	8	0.1	0.2	0.3	1	0	No	0	7,600	-	No
	10	0.1	0.2	0.3	1	0	No	0	9,500	-	No
	12	0.1	0.3	0.5	1	0	No	0	11,400	-	No
	14	0.1	0.3	0.5	1	0	No	0	13,300	-	No
	16	0.1	0.4	0.7	1	0	No	0	15,200	-	No
	18	0.1	0.4	0.8	1	0	No	0	17,100	-	No
	20	0.2	0.5	0.9	1	0	No	0	19,000	-	No

NSA / Barrier Number	Barrier Height	Noise Reduction - dB(A)			# of Units Impacted	# of Impacted Units at NR Goal	Feasible?	# of Units Benefited	Barrier Sq.Ft.	Barrier Sq.Ft. per Unit Benefited	Reasonable?
		Min.	Avg.	Max.							
NSA 7 Barrier 7	8	0	0.9	2.5	3.92	0	*No*	0	11,200	-	*No*
	10	0.7	1.8	3.3	3.92	0	*No*	0	14,000	-	*No*
	12	1.7	2.8	4.4	3.92	0	*No*	0.32	16,800	-	*No*
	14	2.3	3.7	6.3	3.92	0.96	*No*	0.96	19,600	-	*No*
	16	2.6	4.7	7.5	3.92	1.96	Yes	2.92	22,400	7,671	*No*
	18	4.2	6.1	8.2	3.92	3.92	Yes	5.20	25,200	4,846	*No*
	20	4.5	6.7	8.9	3.92	3.92	Yes	5.52	28,000	5,385	*No*
NSA 9 Barrier 9	8	4.5	4.5	4.5	1	1	Yes	1	2,800	2,800	*No*
	10	5	5	5	1	1	Yes	1	3,500	3,500	*No*
	12	5.4	5.4	5.4	1	1	Yes	1	4,200	4,200	*No*
	14	5.7	5.7	5.7	1	1	Yes	1	4,900	4,900	*No*
	16	5.9	5.9	5.9	1	1	Yes	1	5,600	5,600	*No*
	18	6.1	6.1	6.1	1	1	Yes	1	6,300	6,300	*No*
	20	6.3	6.3	6.3	1	1	Yes	1	7,000	7,000	*No*

5.2.1 Detailed Noise Barrier Descriptions

This section of the report provides further information on the noise barrier analysis for each of the impacted NSAs. Table 7 provides barrier-included sound levels and insertion loss values at all receptors screened for mitigation. In Table 7, impacted receptors are shown in red and the insertion loss for benefited receptors is shown in green. The results outlined in Table 7 represent the barrier heights for each NSA which best fulfil the feasibility and reasonableness criteria, and are described below.

NSA 1 – Barrier 1 - Noise barriers ranging in height of between 8 and 20 feet and extending for approximately 700 feet would not provide noise reductions of 5 dB(A) to any of the six impacted receptors identified in this NSA, therefore not providing at least five decibels of noise reduction at 50 percent or more of the impacted receptor units. It is noted that this NSA is impacted by local traffic on East Main Street, which reduces the effectiveness of potential noise barriers along the Turnpike. The barrier analysis runs outlining these results are saved in the "MITIGATION" TNM file as "Barrier 1 – 8 ft" through "Barrier 1 – 20 ft". Presented in Table 7 are the results for "Barrier 1 – 20 ft".

This noise barrier does not satisfy the minimum feasibility criteria. Therefore, based on the results of the analysis completed for this project, this noise barrier is not recommended.

NSA 3 – Barrier 3 - A noise barrier with a height of 14 feet and extending for approximately 1,150 feet would provide noise reductions of 6 dB(A) for both of the impacted receptors identified in this NSA, therefore providing at least five decibels of noise reduction at 50 percent or more of the impacted receptor units. The barrier would also satisfy each of the other feasibility criteria. The noise barrier would not provide at least 5 dB(A) of noise reduction at any non-impacted receptor units. The total square footage of the resulting barrier would be approximately 16,100 square feet with a square foot per benefited unit value of 8,050 sq. ft., which is greater than the maximum 2,000 sq. ft. per benefited unit allowed for the reasonableness criteria. The barrier analysis run outlining these results is saved in the "MITIGATION" TNM file as "Barrier 3 – 14 ft".

This noise barrier satisfies the feasibility criteria but not the reasonableness criteria. Therefore, based on the results of the analysis completed for this project, this noise barrier is not recommended.

NSA 4 – Barrier 4 - A noise barrier with a height of 8 feet and extending for approximately 1,750 feet would provide noise reductions of 5 dB(A) to one of the six impacted receptors identified in this NSA, therefore not providing at least five decibels of noise reduction at 50 percent or more of the impacted receptor units. It is noted that this NSA is impacted by local traffic on West Conestoga Road, which reduces the effectiveness of potential noise barriers along the Turnpike. The barrier analysis run outlining these results is saved in the "MITIGATION" TNM file as "Barrier 4 – 8 ft".

This noise barrier does not satisfy the minimum feasibility criteria. Therefore, based on the results of the analysis completed for this project, this noise barrier is not recommended.

NSA 5 – Barrier 5 - A noise barrier with a height of 14 feet and extending for approximately 1,050 feet would provide noise reductions of 5 dB(A) for the one impacted receptor identified in this NSA, therefore providing at least five decibels of noise reduction at 50 percent or more of the impacted receptor units. The barrier would also satisfy each of the other feasibility criteria. The noise barrier would not provide at least 5 dB(A) of noise reduction at any non-impacted receptor units. The total square footage of the resulting barrier would be approximately 14,700 square feet with a square foot per benefited unit value of 14,700 sq. ft., which is greater than the maximum 2,000 sq. ft. per benefited unit allowed for the reasonableness criteria. The barrier analysis run outlining these results is saved in the "MITIGATION" TNM file as "Barrier 5 – 14 ft".

This noise barrier satisfies the feasibility criteria but not the reasonableness criteria. Therefore, based on the results of the analysis completed for this project, this noise barrier is not recommended.

NSA 6 – Barrier 6 - Noise barriers ranging in height of between 8 and 20 feet and extending for approximately 950 feet would not provide noise reductions of 5 dB(A) for the one impacted receptor identified in this NSA, therefore not providing at least five decibels of noise reduction at 50 percent or more of the impacted receptor units. It is noted that this NSA is impacted by local traffic on North Manor Road, which reduces the effectiveness of potential noise barriers along the Turnpike. The barrier analysis runs outlining these results are saved in the "MITIGATION" TNM file as "Barrier 6 – 8 ft" through "Barrier 6 – 20 ft". Presented in Table 7 are the results for "Barrier 6 – 20 ft".

This noise barrier does not satisfy the minimum feasibility criteria. Therefore, based on the results of the analysis completed for this project, this noise barrier is not recommended.

NSA 7 – Barrier 7 - A noise barrier with a height of 18 feet and extending for approximately 1,400 feet would provide noise reductions of 4 dB(A) to 8 dB(A) for all 3.92 of the impacted receptors identified in this NSA, therefore providing at least five decibels of noise reduction at 50 percent or more of the impacted receptor units. The barrier would also satisfy each of the other feasibility criteria. The noise barrier would provide at least 5 dB(A) of noise reduction at 0.96 non-impacted receptor units. These fractional receptor totals are the result of the ERU calculation for the golf course receptors outlined in Section 2.2.3 and Appendix F. The total square footage of the resulting barrier would be approximately 25,200 square feet with a square foot per benefited unit value for 5.20 units of 4,846 sq. ft., which is greater than the maximum 2,000 sq. ft. per benefited unit allowed for the reasonableness criteria. The barrier analysis run outlining these results is saved in the “MITIGATION” TNM file as “Barrier 7 – 18 ft”.

This noise barrier satisfies the feasibility criteria but not the reasonableness criteria. Therefore, based on the results of the analysis completed for this project, this noise barrier is not recommended.

NSA 9 – Barrier 9 - A noise barrier with a height of 8 feet and extending for approximately 350 feet would provide noise reductions of 5 dB(A) for the one impacted receptor identified in this NSA, therefore providing at least five decibels of noise reduction at 50 percent or more of the impacted receptor units. The barrier would also satisfy each of the other feasibility criteria. The noise barrier would not provide at least 5 dB(A) of noise reduction at any non-impacted receptor units. The total square footage of the resulting barrier would be approximately 2,800 square feet with a square foot per benefited unit value of 2,800 sq. ft., which is greater than the maximum 2,000 sq. ft. per benefited unit allowed for the reasonableness criteria. The barrier analysis run outlining these results is saved in the “MITIGATION” TNM file as “Barrier 9 – 8 ft”.

This noise barrier satisfies the feasibility criteria but not the reasonableness criteria. Therefore, based on the results of the analysis completed for this project, this noise barrier is not recommended.

Table 7: Future Build Sound Levels and Insertion Loss Values

NSA	Receptor	Represented Dwelling Units	Worst-Case Leq Sound Levels - dB[A]		
			Future Build (2046)		
			No Barrier	With Barrier	Insertion Loss
NSA 1	R4	1	65	63	1
	R5	1	64	63	1
	R6	1	65	64	1
	R7	1	65	65	0
	R8	1	65	65	0
	R9	1	**66**	**66**	0
	R10	1	69	69	0
	R11	1	**68**	**68**	0
	R12	1	**67**	**67**	0
	R13	3	**67**	**67**	0
NSA 3	R19	1	**72**	**67**	**6**
	R20	1	**73**	**68**	**5**
	R21	1	65	63	2
NSA 4	R22	1	**66**	66	0
	R23	1	**67**	**67**	0
	R24	1	**68**	**68**	0
	R25	1	**69**	**68**	1
	R26	1	**67**	**66**	0
	R27	1	65	65	0
	R28	1	65	63	1
	R29	1	64	64	0
	R30	1	63	63	0
	R31	1	**70**	64	**5**
NSA 5	R32	1	65	63	2
	R33	1	**66**	62	**5**
NSA 6	R36	1	62	61	1
	R37	1	**66**	65	1
	R38	1	64	63	0
	R39	1	62	62	0
	R40	1	64	64	0
NSA 7	R42_1	1	63	58	**5**
	R42_2	1	61	57	**4**
	R42_3	1	**66**	60	**7**
	R42_4	1	65	59	**6**
	R42_5	1	63	57	**5**
	R42_6	1	**70**	61	**8**
	R42_7	1	**68**	62	**7**
	R42_8	1	65	59	**6**
	R42_9	1	**71**	63	**8**
	R42_10	1	**68**	62	**6**
	R42_11	1	**66**	61	**5**
	R43	1	**66**	62	**5**
	R44	1	**71**	65	**6**
NSA 9	R46	1	**70**	**66**	**5**

Note: Noise values, comparisons and insertion losses are calculated to the tenth of a dB(A) and are rounded for presentation purposes.

5.2.2 Summary of Results

Based on the analysis in this report, none of the evaluated noise barriers were found to be warranted, feasible and reasonable. Due to the large area of each NSA relative to the number of receptors located within them, the length of each barrier required to provide sufficient reduction to achieve the feasibility criteria provides a square-foot per benefitted receptor value larger than that permitted by the reasonableness criteria. The close proximity of receptors to local roads is also a contributing factor to the lack of effectiveness of noise barriers placed along the Turnpike.

6 Construction Noise Consideration and Mitigation Alternatives

Increased noise levels from construction activities associated with the proposed roadway improvements may occur within the project study area. Noise levels during construction are difficult to predict and vary depending on the types of construction activity and the types of equipment used for each stage of work. Heavy machinery, the major source of noise in construction, is constantly moving in unpredictable patterns and is not usually at one location very long. The PTC is committed to reasonable abatement of construction noise, recognizing that these impacts will be temporary in nature.

7 Public Involvement Process

Consideration of the public's needs is taken into account when evaluating the reasonableness of noise mitigation along the Turnpike, and a public involvement process is undertaken is included to allow public input. Public meetings with regards to noise as well as other aspects of the project are tentatively planned for 2015.

During the project's development, an important aspect of the coordination efforts is public comment. Appropriate consideration and action will be taken with regard to public comments, and to providing effective mitigation to those receptors affected by the project.

Bibliography

Pennsylvania Department of Transportation. December 2013. *Project Level Highway Traffic Noise Handbook, Publication No. 24.* PennDOT, Harrisburg, Pennsylvania.

The Federal Highway Administration. Revised December 12, 2011. "Highway Traffic Noise: Analysis and Abatement Guidance" FHWA-HEP-10-025, FHWA, Washington, D.C.

Appendix A. Pennsylvania Turnpike Commission Traffic Data

Traffic Data for MP 298 to MP 312
Between Morgantown I/C and Downingtown I/C

Traffic Volumes

	2013	2046
Eastbound ADT	21,880	35,762
Westbound ADT	31,052	50,754
Peak Hour (EB) 11.16%	2,442	3,991
Peak Hour (WB) 8.71%	2,705	4,421

Peak Month: EB=November, WB=October

Vehicle Composition(%) (Peak Hour):

	EB	WB
PTC Class 1=	86%	92%
PTC Classes 2-3=	5%	3%
PTC Classes 4-9=	9%	5%
Growth Factors:	1.50%	1.50%

Appendix B. Noise Monitoring Field Sheets, Traffic Counts & Instrument Calibration Certificates

Noise Monitoring Data Sheet

Project: PA Turnpike Widening Operators: MS JS MS Date: 9/15/14

Site ID: 24 WB Address: Singer Food

Land Use: ☐ Residential ☐ Commercial ☒ Institutional ☐ Mixed ☐ Other

Measurement Data SLM Model: LD 820 ID #: Serial #:

Weather: Temp (°F): 73 Wind: Humidity: Cloud Cover:

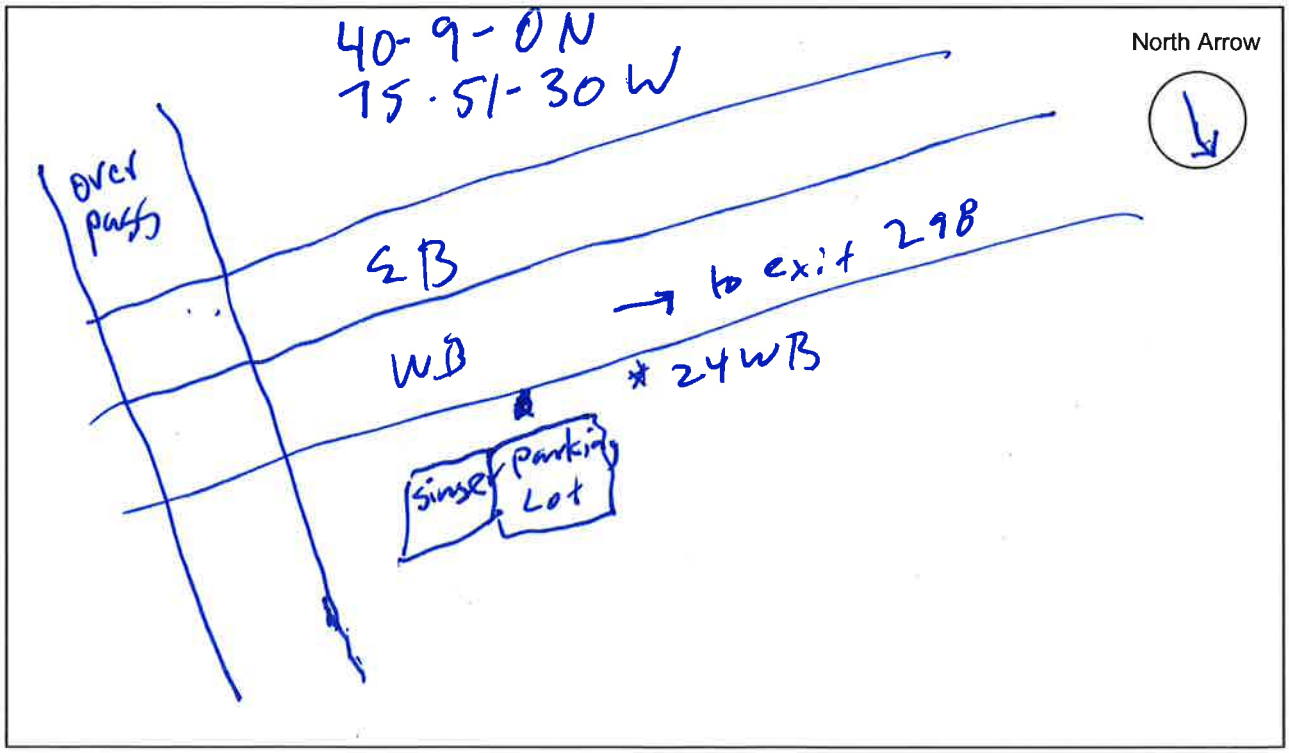
Time:		Results:				Calibration:	
Start:	14:15	Leq05min:		Lmax:		Before:	
Stop:	10:15	Leq10min:		Lmin:		After:	
Total:	9/17	Leq15min:		L10:		Ref:	94.0
		Leq20min:		L90:		Model:	

Notes:

Directly outside current WB ROW. SLM locked to Guardrail.

Proj- 008-2250

Site Sketch:



Noise Monitoring Data Sheet

Project: PA Turnpike Widening Operators: MS JS MS Date: 9/15

Site ID: 24EB Address: Hemlock Rd - Taylor, Northeast

Land Use: ☐ Residential ☐ Commercial ☐ Institutional ☐ Mixed ☑ Other Fac.

Measurement Data SLM Model: 4 B 12 ID # Serial #

Weather: Temp (°F) 73 Wind 5-7 Humidity Cloud Cover

Time:	15:20	Results:				Calibration:	
Start:	~~14:50~~	Leq05min:		Lmax:		Before:	113.9
Stop:	10:40	Leq10min:		Lmin:		After:	114.0
Total:		Leq15min:		L10:		Ref:	~~94.0~~ 114.0
		Leq20min:		L90:		Model:	

Notes:

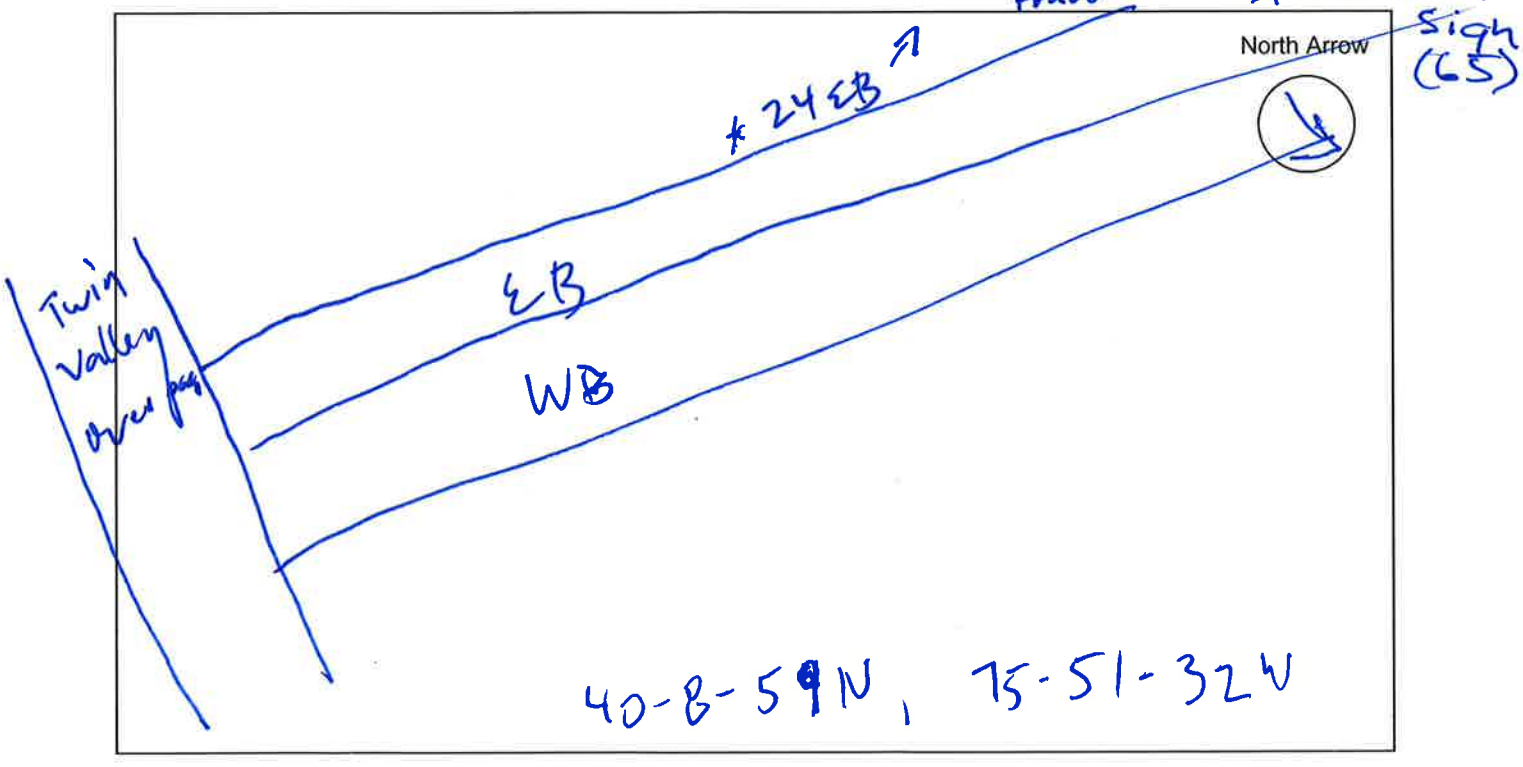
Kevin 81.4 Leq

9:10AM - 9/16 - 81.2 Leq reading. operations noise at Taylor N.E.

B&K proj 007 - Spectrum on EB @ 24EB

81.5 Leq 6:00 PM 9/16

Site Sketch:



Noise Monitoring Data Sheet

Project: PTL 298 Operators: MSS Date: 9/15/14

Site ID: M1 Address: 3825 Main st.

Land Use: ☒ Residential ☐ Commercial ☐ Institutional ☐ Mixed ☐ Other

Measurement Data SLM Model: 2250 ID # Serial #

Weather: Temp (°F) 66 Wind 0 Humidity 52 Cloud Cover Clear

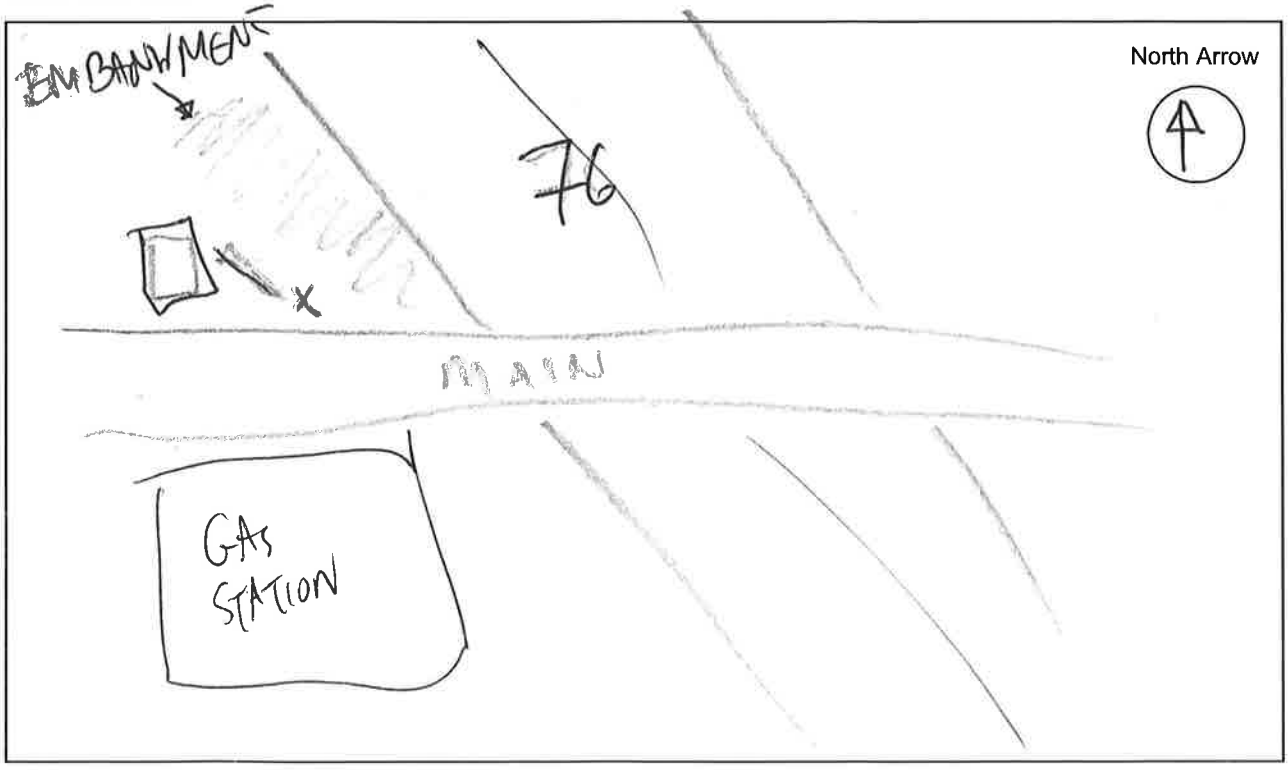
Time:		Results:				Calibration:	
Start:	4:48	Leq05min:		Lmax:		Before:	113
Stop:		Leq10min:		Lmin:		After:	114
Total:	20.00	Leq15min:		L10:		Ref:	94.0
		Leq20min:		L90:		Model:	CAL200

Notes:

MOSTLY LOCAL TRAFFIC
ALSO SOME HIGHWAY NOISE

Project 002

Site Sketch:



Noise Monitoring Data Sheet

Project: PTC 298 Operators: MSS Date: 9/15/14

Site ID: M2 Address: 3801 Main St.

Land Use: ❑ Residential ❑ Commercial ❑ Institutional ❑ Mixed ❑ Other

Measurement Data SLM Model: 2250 ID #~~4~~ Serial #

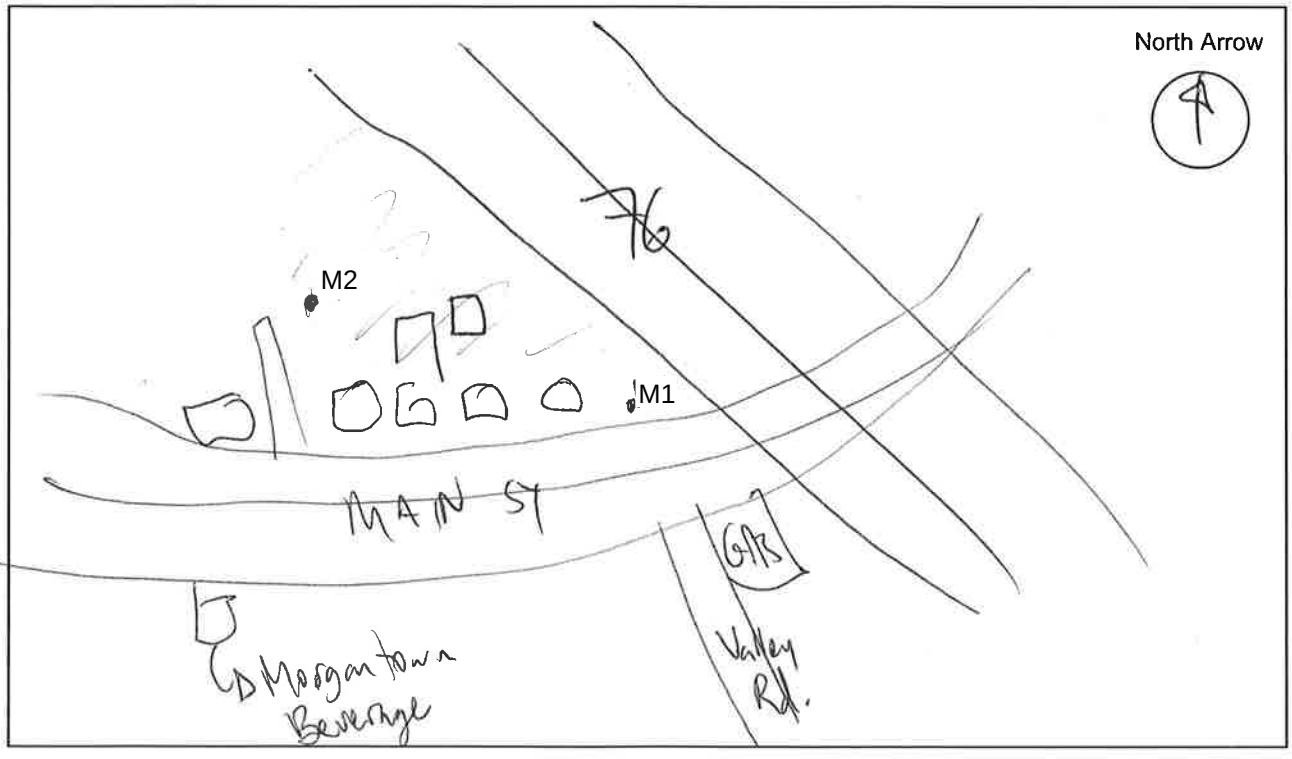
Weather: Temp (°F) 66 Wind 1 mph Humidity 52% Cloud Cover Clear

Time:		Results:				Calibration:	
Start:	5:25	Leq05min:		Lmax:		Before:	~~#4~~
Stop:		Leq10min:		Lmin:		After:	114
Total:		Leq15min:		L10:		Ref:	~~1250~~ 114
		Leq20min:		L90:		Model:	CAL 200

Notes:

Project 003

Site Sketch:



Noise Monitoring Data Sheet

Project: PA - Turnpike | Operators: JS | Date: 9/15

Site ID: M3 | Address: 2025 Valley Road

Land Use: ☒ Residential ☒ Commercial ☐ Institutional ☐ Mixed ☐ Other

Measurement Data | SLM Model: LxT | ID # | Serial #

Weather: Temp (°F) 70 | Wind 3-5 | Humidity | Cloud Cover

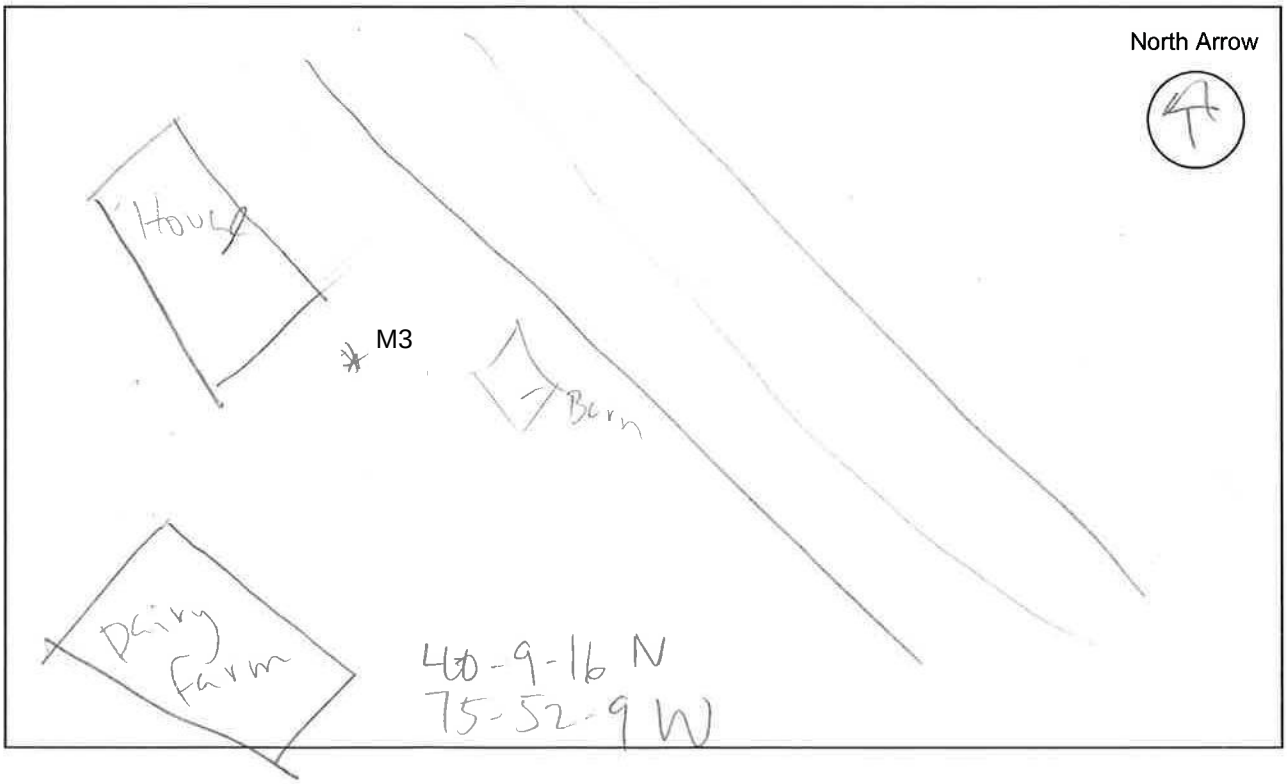
Time:		Results:				Calibration:	
Start:	4:55	Leq05min:	51.8	Lmax:		Before:	114.0
Stop:	5:15	Leq10min:	51.6	Lmin:		After:	114.0
Total:	20m	Leq15min:	51.5	L10:		Ref:	~~94.0~~ 114
		Leq20min:	52.1	L90:		Model:	

Notes:

2025 Valley Rd. Some distance from Tpk.
Stationary source ventilation from dairy farm

*Penn_tur_2

Site Sketch:



Noise Monitoring Data Sheet

Project: PA Tpk | Operators: JS | Date: 9/15

Site ID: M4 | Address: 308 S Twin Valley Road

Land Use: ❑ Residential ❑ Commercial ❑ Institutional ❑ Mixed ❑ Other

Measurement Data | SLM Model: LD LxT | ID # | Serial #

Weather: Temp (°F) | Wind | Humidity | Cloud Cover

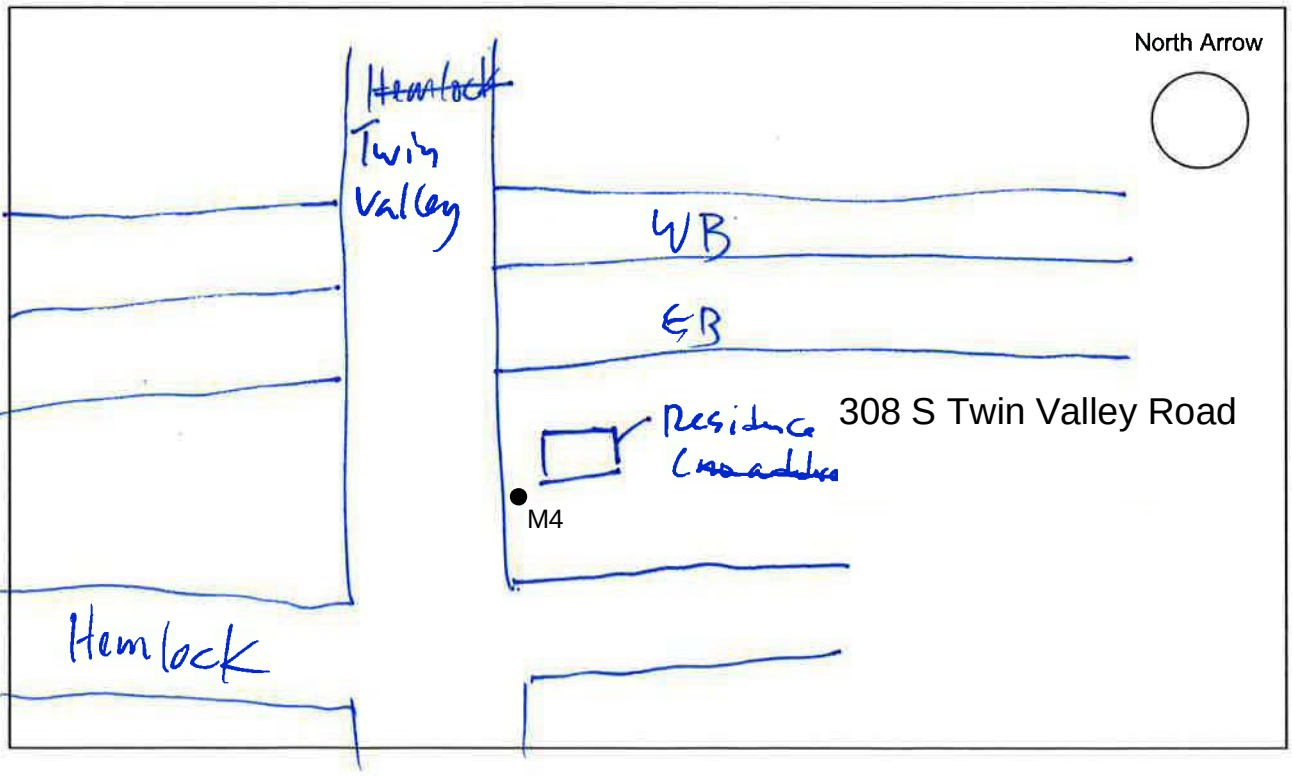
Time:		Results:				Calibration:	
Start:	16:15	Leq05min:	63.9	Lmax:		Before:	113.5
Stop:	16:35	Leq10min:	65.1	Lmin:		After:	114.0
Total:	20 m	Leq15min:	65.3	L10:		Ref:	~~94.0~~ 114
		Leq20min:	65.0	L90:		Model:	

Notes:

several truck passby on Twin Valley Rd. 5-10 MPH

&Pen_tur_01

Site Sketch:



Noise Monitoring Data Sheet

Project: PTC 278 Operators: MSS Date: 9/15/14

Site ID: M5 Address: 316 S Twin Valley Road

Land Use: ☒ Residential ☐ Commercial ☐ Institutional ☐ Mixed ☐ Other

Measurement Data SLM Model: 7250 ID #: Serial #:

Weather: Temp (°F) 66 Wind 0 mph Humidity 52 Cloud Cover PC

Time:		Results:				Calibration:	
Start:	4:07 pm	Leq05min:		Lmax:	65.5	Before:	113.72
Stop:		Leq10min:		Lmin:	64.1	After:	114
Total:	20 min	Leq15min:		L10:	65.3	Ref:	~~94.0~~ 114
		Leq20min:	64.8	L90:	64.4	Model:	CAL200

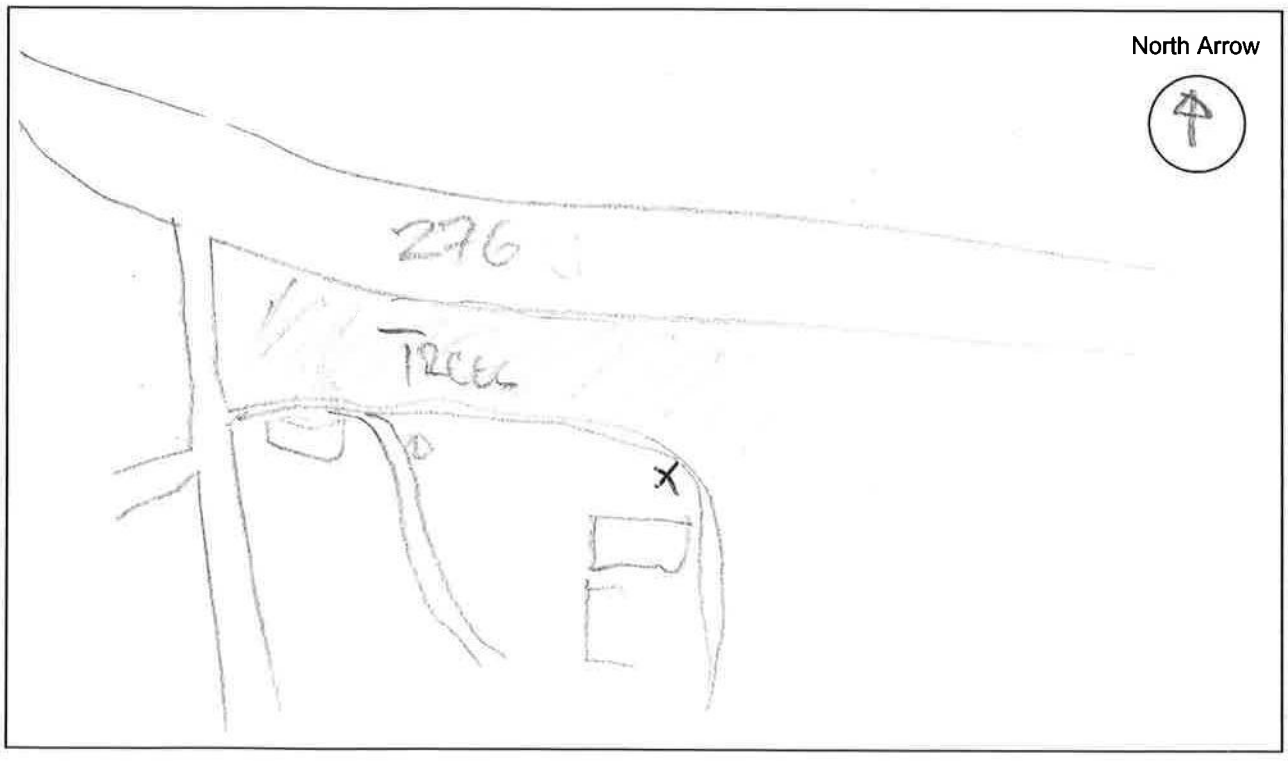
Notes:

M2

HWY Traffic dominates noise.
Some bugs - No local traffic.

Project001

Site Sketch:



Noise Monitoring Data Sheet

Project: PTC 298 Operators: MSS Date: 9/16/14

Site ID: M6 Address: 309 Manor Rd.

Land Use: ☒ Residential ☐ Commercial ☐ Institutional ☐ Mixed ☐ Other

Measurement Data SLM Model: 2250 ID #: Serial #:

Weather: Temp (°F) 57 Wind 0 Humidity 94 Cloud Cover PC

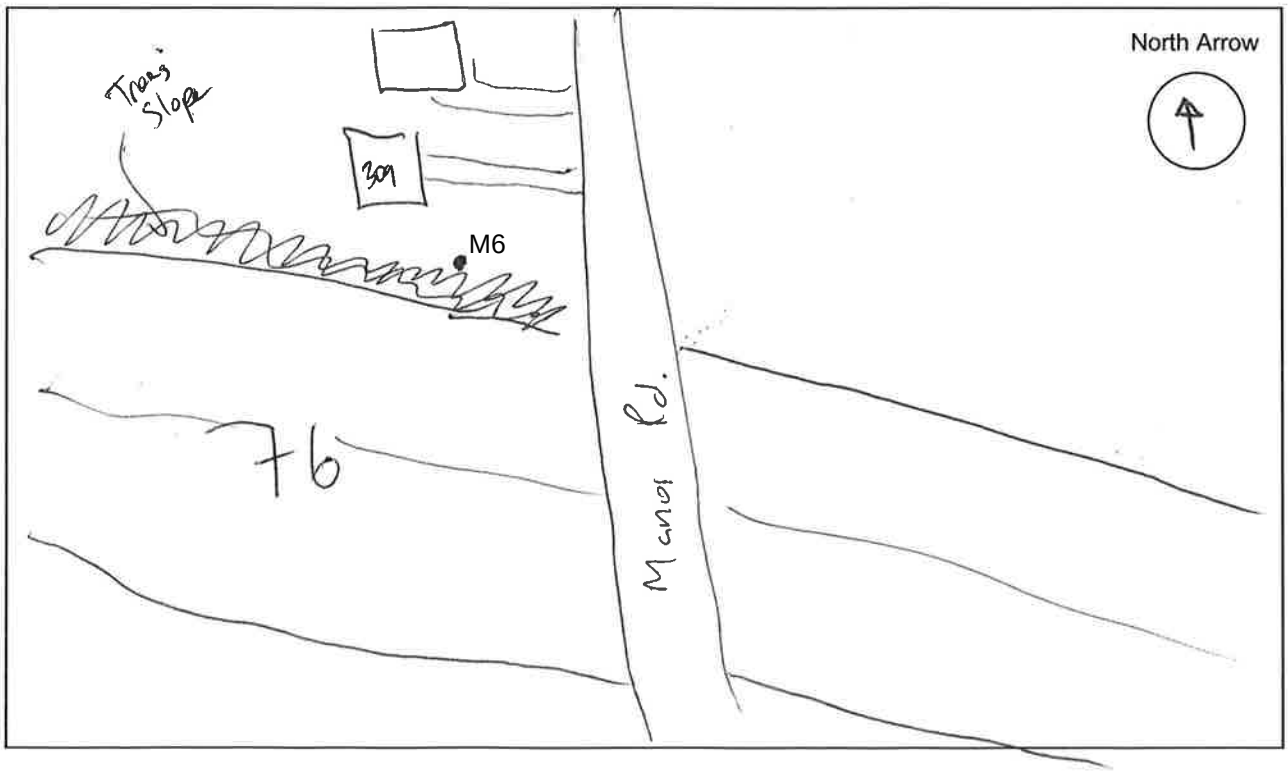
Time:		Results:				Calibration:	
Start:	7:07AM	Leq05min:		Lmax:		Before:	114
Stop:		Leq10min:		Lmin:		After:	114
Total:		Leq15min:		L10:		Ref:	94.0
		Leq20min:	61.2	L90:		Model:	CAL200

Notes:

Mostly highway noise

Project 004

Site Sketch:



Noise Monitoring Data Sheet

Project: Pa Tpk | Operators: JS | Date: 9/16

Site ID: M7 | Address: 11 West Conestoga

Land Use: ❑ Residential ❑ Commercial ❑ Institutional ❑ Mixed ❑ Other

Measurement Data | SLM Model: | ID # | Serial #

Weather: Temp (°F) | Wind | Humidity | Cloud Cover

Time:		Results:				Calibration:	
Start:	7:08	Leq05min:		Lmax:		Before:	
Stop:	7:28	Leq10min:		Lmin:		After:	
Total:		Leq15min:		L10:		Ref:	94.0
		Leq20min:		L90:		Model:	

Notes:

Proj # 03

All local traffic Noise

Ambulance passby w/siren

Car - 243
LT - 15
HT - 8
MC - 1
Bus - 7. all school buses

Site Sketch:

Noise Monitoring Data Sheet

Project: PA Tpk | Operators: JS | Date: 9/16

Site ID: M8 | Address: 33 Lonesfoga Rd

Land Use: ☑ Residential ☐ Commercial ☐ Institutional ☐ Mixed ☐ Other

Measurement Data | SLM Model: LxT | ID # | Serial #

Weather: Temp (°F) | Wind | Humidity | Cloud Cover

Time:		Results:				Calibration:	
Start:	8:07	Leq05min:		Lmax:		Before:	
Stop:		Leq10min:		Lmin:		After:	
Total:		Leq15min:		L10:		Ref:	94.0
		Leq20min:		L90:		Model:	

Notes:

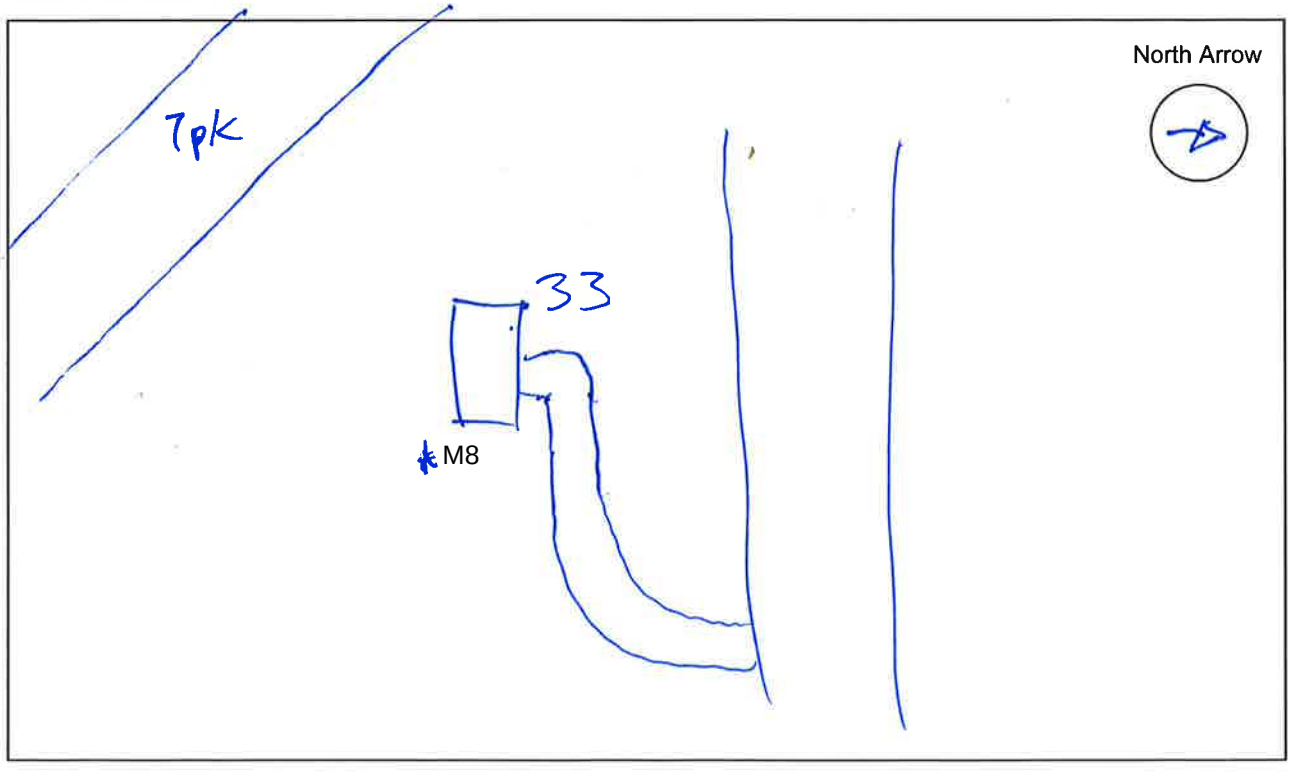
Local traffic mostly inaudible.

Tpk noise predominant source

#05

Site Sketch:

40-8-55 W, 75-50-5 W



Noise Monitoring Data Sheet

Project: PA Tpk Operators: JS Date 9/16

Site ID: M9 Address: 18 Goodellow Road

Land Use: ☐ Residential ☐ Commercial ☐ Institutional ☐ Mixed ☐ Other

Measurement Data SLM Model: LxT ID # Serial #

Weather: Temp (°F) Wind Humidity Cloud Cover

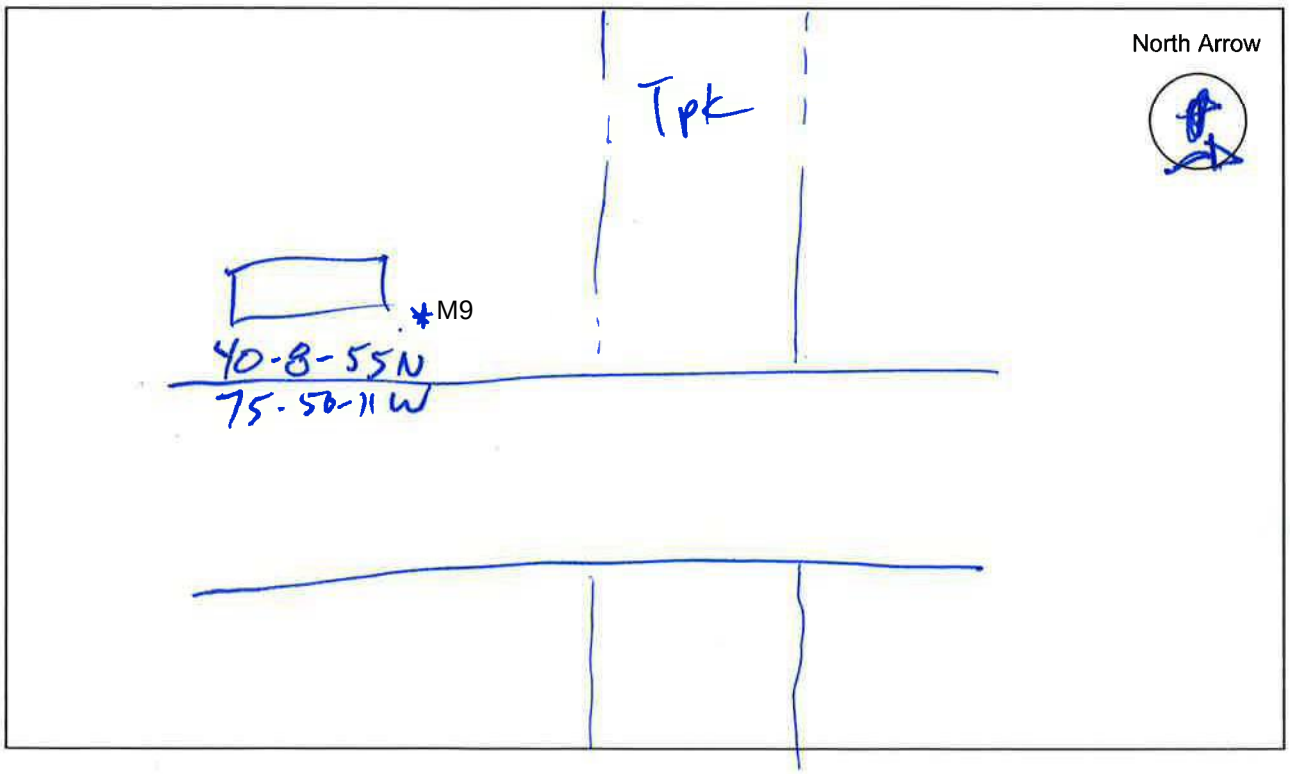
Time:		Results:				Calibration:	
Start:	7:35	Leq05min:		Lmax:		Before:	
Stop:	7:55	Leq10min:		Lmin:		After:	
Total:	20min	Leq15min:		L10:		Ref:	94.0
		Leq20min:		L90:		Model:	

Notes:

Pen_04

Car - 161
LT - 13
HT - 2
MC - 1
Bus - 2

Site Sketch:



Noise Monitoring Data Sheet

Project: PTC 298 Operators: MSS Date: 9/16/14

Site ID: M10 Address: 35 Goodfellow Rd

Land Use: ☑ Residential ☐ Commercial ☐ Institutional ☐ Mixed ☐ Other

Measurement Data SLM Model: 2250 ID #: Serial #:

Weather: Temp (°F) 55 Wind 0.0 Humidity 100% Cloud Cover Clear

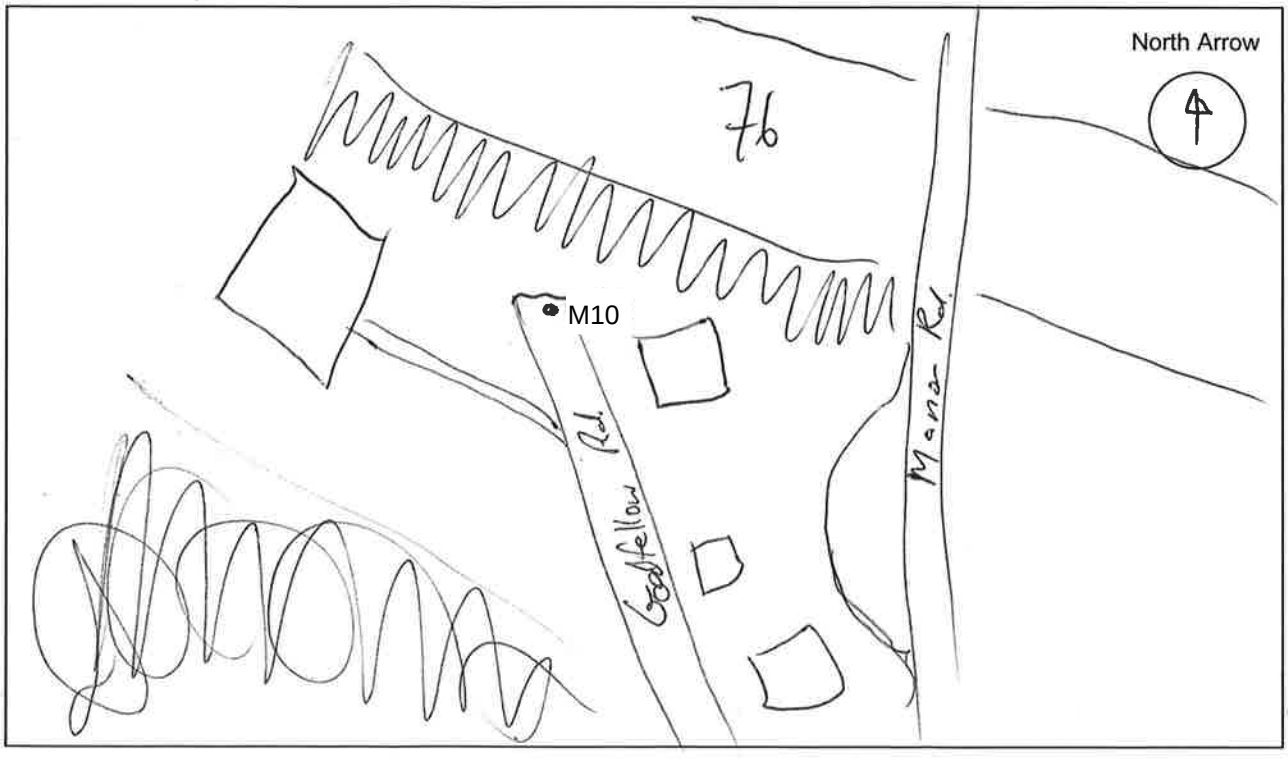
Time:		Results:				Calibration:	
Start:	7:35 AM	Leq05min:		Lmax:		Before:	114
Stop:		Leq10min:		Lmin:		After:	114
Total:	20	Leq15min:		L10:		Ref:	94.0
		Leq20min:		L90:		Model:	CAL200

Notes:

Highway Noise

Project 005

Site Sketch:



Noise Monitoring Data Sheet

Project: DTC 298 Operators: MSS Date: 9/6/14

Site ID: M11 Address: 130 Yoder

Land Use: ☒ Residential ☐ Commercial ☐ Institutional ☐ Mixed ☐ Other

Measurement Data SLM Model: 2250 ID # Serial #

Weather: Temp (°F) Wind Humidity Cloud Cover Clear

Time:		Results:				Calibration:	
Start:	4:25	Leq05min:		Lmax:		Before:	114
Stop:		Leq10min:		Lmin:		After:	114
Total:		Leq15min:		L10:		Ref:	94.0
		Leq20min:		L90:		Model:	

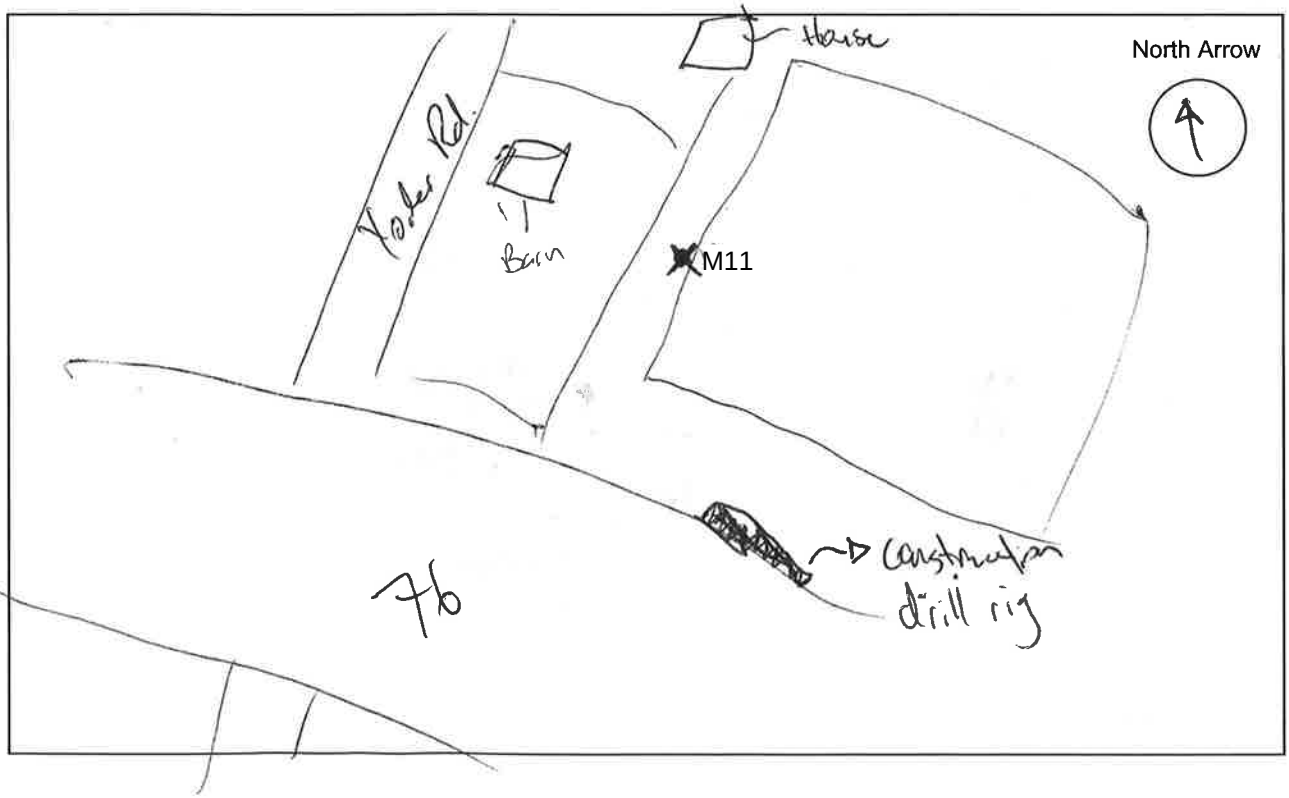
Notes:

Highway below grade
All highway noise.

Sheep

Project 006

Site Sketch:



Noise Monitoring Data Sheet

Project: Pa Tpk | Operators: MS JS | Date: 9/16

Site ID: M12 | Address: 626 Bulltown Road

Land Use: ☑ Residential ☐ Commercial ☐ Institutional ☐ Mixed ☐ Other

Measurement Data | SLM Model: Bk 2250 | ID # | Serial #

Weather: Temp (°F) 70 | Wind | Humidity | Cloud Cover

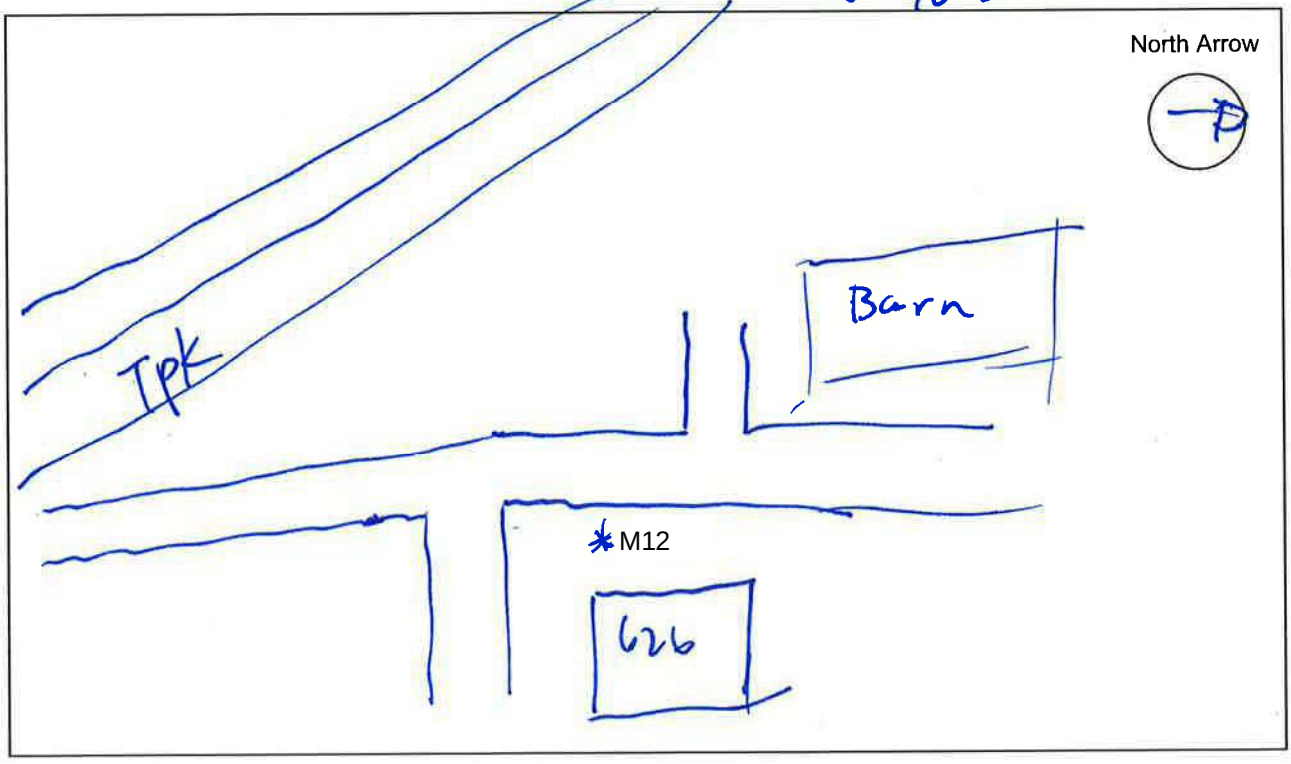
Time:		Results:				Calibration:	
Start:	4:59	Leq05min:		Lmax:		Before:	
Stop:	5:19	Leq10min:		Lmin:		After:	
Total:	20m	Leq15min:		L10:		Ref:	94.0
		Leq20min:		L90:		Model:	

Notes:

Bk proj 10 - several local cars- 5 mph.
Sole source freeway noise

40-8-37 N
75-48-36 W

Site Sketch:



Noise Monitoring Data Sheet

Project: Pa Tpk | Operators: JS | Date: 9/16

Site ID: M13 | Address: 375 Yoder Rd - ~~Selle~~ Seelenrichte

Land Use: ☒ Residential ❑ Commercial ❑ Institutional ❑ Mixed ❑ Other

Measurement Data | SLM Model: LXT | ID #: | Serial #:

Weather: Temp (°F): 70 | Wind: | Humidity: | Cloud Cover:

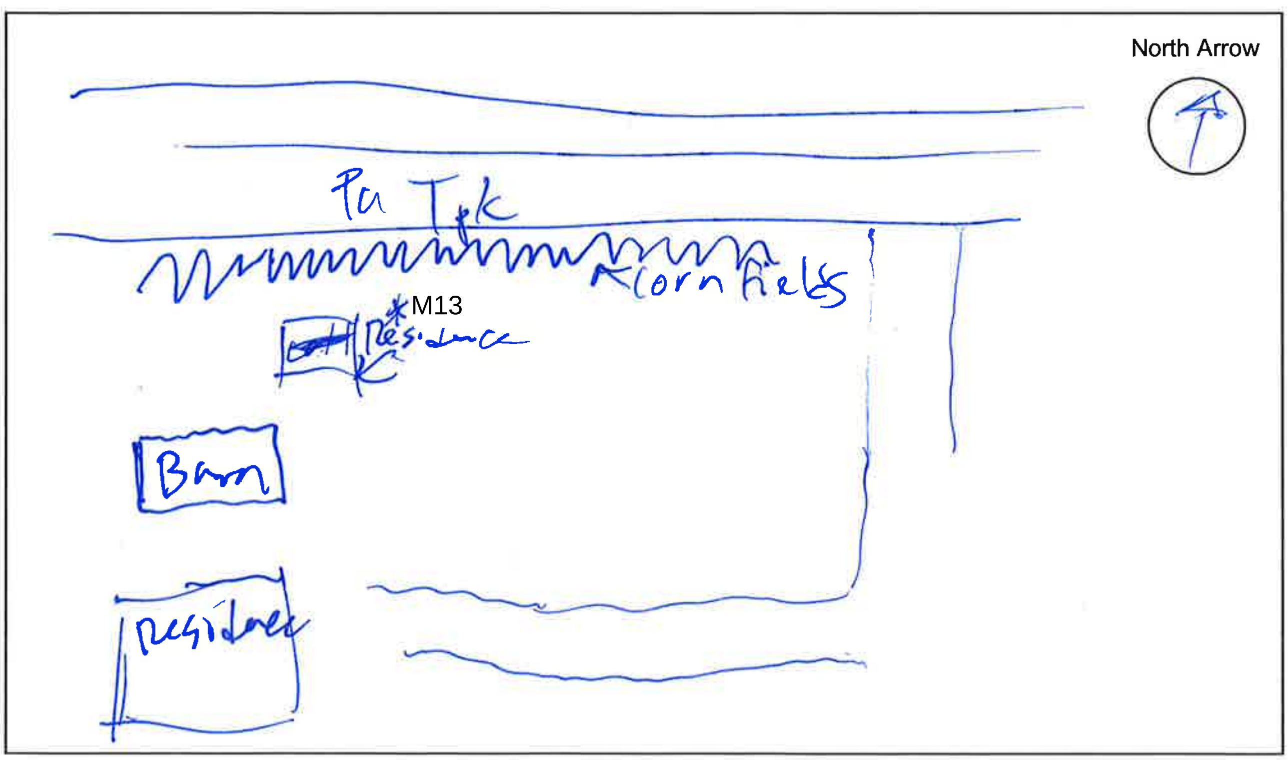
Time:		Results:				Calibration:	
Start:	4:23	Leq05min:	56.2	Lmax:		Before:	94.3
Stop:		Leq10min:	56.1	Lmin:		After:	94.0
Total:		Leq15min:	56.4	L10:		Ref:	94.0
		Leq20min:	56.4	L90:		Model:	

Notes:

Tpk traffic noise almost exclusively

Proj # 006

Site Sketch: 40-8-41 N, 75-49-9 W



PTC 298

9/16/19

M14 372 Yoder 22200

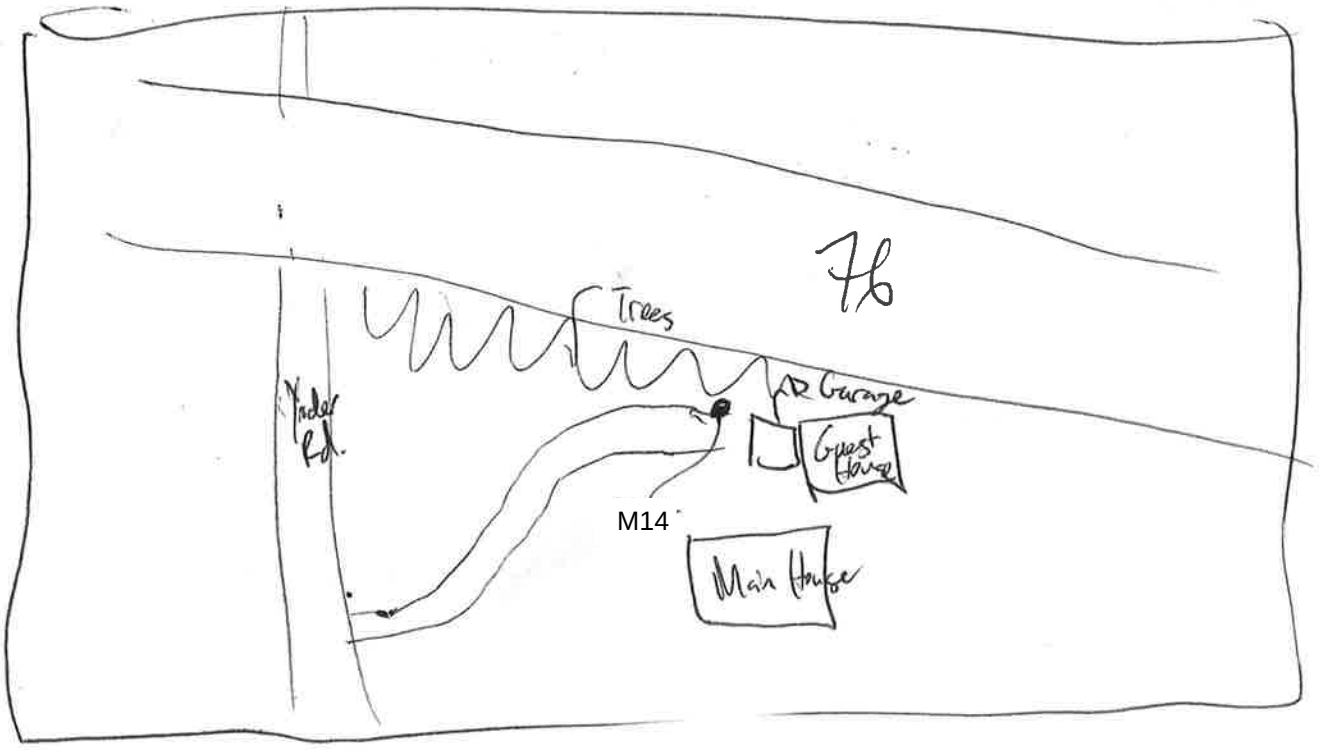
Temp: ~~40~~ F Humid: 56% Wind: 7.0 mph Mostly Cloudy

4:28

20 min

NY
NY
CAL200

Project 009
Mostly Highway Noise



Turnpike Traffic Counts & Vehicle Breakdown by Monitoring Position

Monday Sept 15th 2014 - 4:54 pm **M1/M2/M3**

WB	**EB**
Auto 570	Auto 379
Med 23	Med 6
Heavy 57	Heavy 42
Moto 1	Moto 0

Tuesday Sept 16th 2014 – 7:12 am **M6/M7/M9/M10**

WB	**EB**
Auto 332	Auto 705
Med 27	Med 21
Heavy 41	Heavy 70
Moto 0	Moto 0

Tuesday Sept 16th 2014 – 8:32 am **M8/M11**

WB	**EB**
Auto 282	Auto 500
Med 20	Med 14
Heavy 50	Heavy 78
Moto 0	Moto 0

Tuesday Sept 16th 2014 – 4:28 pm **M12/M13/M14**

WB	**EB**
Auto 549	Auto 407
Med 19	Med 7
Heavy 65	Heavy 39
Moto 1	Moto 1

Monday Sept 15th 2014 – 4:15 pm **M4/M5**

WB	**EB**
Auto 580	Auto 363
Med 20	Med 9
Heavy 53	Heavy 43
Moto 2	

Local Traffic Counts & Vehicle Breakdown by Monitoring Position

M1	**M4**	**M6**	**M7**	**M9**
Auto 439	Auto 32	Auto 147	Auto 243	Auto 161
Med 3	Med 3	Med 3	Med 15	Med 13
Heavy 8	Heavy 1	Heavy 0	Heavy 8	Heavy 2
Moto 3	Moto 1	Moto 1	Moto 1	Moto 1
		Bus 8	Bus 7	Bus

Source: AECOM Field Video Recordings, September 2014

West Caldwell Calibration Laboratories Inc.

Certificate of Calibration

for

HAND-HELD ANALYZER

Manufactured by:	**BRUEL & KJAER**
Model No:	**2250**
Serial No:	**2505860**
Calibration Recall No:	**23516**

Submitted By:

Customer:	**BRIAN BROWNWORTH**
Company:	**AECOM**
Address:	**20 EXCHANGE PLACE**
	NEW YORK NY 10005

The subject instrument was calibrated to the indicated specification using standards traceable to the National Institute of Standards and Technology or to accepted values of natural physical constants. This document certifies that the instrument met the following specification upon its return to the submitter.

West Caldwell Calibration Laboratories Procedure No. 2250 BRUE

Upon receipt for Calibration, the instrument was found to be:

Within (X) see attached Report of Calibration.

the tolerance of the indicated specification.

West Caldwell Calibration Laboratories' calibration control system meets the following requirements, ISO 10012-1 MIL STD 45662A, ANSI/NCSL Z540-1, IEC Guide 25, ISO 9001:2008 and ISO 17025

Note: With this Certificate, Report of Calibration is included.

Calibration Date: 15-Oct-13

Certificate No: 23516 - 1

Approved by:

FC

Felix Christopher (QA Mgr.)
ISO/IEC 17025:2005

ACCREDITED
Calibration Lab. Cert. # 1533.01

uncompromised calibration
West Caldwell Calibration Laboratories, Inc.
1575 State Route 96, Victor, NY 14564, U.S.A.

West Caldwell Calibration Laboratories Inc.

Certificate of Calibration

for

ACOUSTICAL CALIBRATOR

Manufactured by:	LARSON DAVIS
Model No:	CAL200
Serial No:	0724
Calibration Recall No:	23516

Submitted By:

Customer:	BRIAN BROWNWORTH
Company:	AECOM
Address:	20 EXCHANGE PLACE
	NEW YORK NY 10005

The subject instrument was calibrated to the indicated specification using standards traceable to the National Institute of Standards and Technology or to accepted values of natural physical constants. This document certifies that the instrument met the following specification upon its return to the submitter.

West Caldwell Calibration Laboratories Procedure No. CAL200 LARS

Upon receipt for Calibration, the instrument was found to be:

Within (X) see attached Report of Calibration.

the tolerance of the indicated specification.

West Caldwell Calibration Laboratories' calibration control system meets the following requirements, ISO 10012-1 MIL STD 45662A, ANSI/NCSL Z540-1, IEC Guide 25, ISO 9001:2008 and ISO 17025

Note: With this Certificate, Report of Calibration is included.

Calibration Date: 15-Oct-13

Certificate No: 23516 - 6

Approved by:

FC

Felix Christopher (QA Mgr.)
ISO/IEC 17025:2005

uncompromised calibration
West Caldwell Calibration Laboratories, Inc.
1575 State Route 96, Victor, NY 14564, U.S.A.

ACCREDITED

Calibration Lab. Cert. # 1533.01

West Caldwell Calibration Laboratories Inc.

Certificate of Calibration

for

MICROPHONE

Manufactured by:	BRUEL & KJAER
Model No:	4189
Serial No:	2503101
Calibration Recall No:	23516

Submitted By:

Customer:	BRIAN BROWNWORTH
Company:	AECOM
Address:	20 EXCHANGE PLACE
	NEW YORK NY 10005

The subject instrument was calibrated to the indicated specification using standards traceable to the National Institute of Standards and Technology or to accepted values of natural physical constants. This document certifies that the instrument met the following specification upon its return to the submitter.

West Caldwell Calibration Laboratories Procedure No. 4189 BRUE

Upon receipt for Calibration, the instrument was found to be:

Within (X) see attached Report of Calibration.

the tolerance of the indicated specification.

West Caldwell Calibration Laboratories' calibration control system meets the following requirements, ISO 10012-1 MIL STD 45662A, ANSI/NCSL Z540-1, IEC Guide 25, ISO 9001:2008 and ISO 17025

Note: With this Certificate, Report of Calibration is included.

Calibration Date: 16-Oct-13

Certificate No: 23516 - 8

QA Doc. #1051 Rev. 2.0 10/1/01

Approved by:

FC

Felix Christopher (QA Mgr.)
ISO/IEC 17025:2005

ACCREDITED
Calibration Lab. Cert. # 1533.01

uncompromised calibration
West Caldwell Calibration Laboratories, Inc.
1575 State Route 96, Victor, NY 14564, U.S.A.

West Caldwell Calibration Laboratories Inc.

Certificate of Calibration

for

SLM & PERSONAL DOSE / EXPOSURE METER

Manufactured by:	**LARSON DAVIS**
Model No:	**LxT1**
Serial No:	**0003332**
Calibration Recall No:	**24422**

Submitted By:

Customer:	**BRIAN BROWNWORTH**
Company:	**AECOM**
Address:	**125 BROAD STREET**
	NEW YORK NY 10004

The subject instrument was calibrated to the indicated specification using standards traceable to the National Institute of Standards and Technology or to accepted values of natural physical constants. This document certifies that the instrument met the following specification upon its return to the submitter.

West Caldwell Calibration Laboratories Procedure No. LxT1 LARS

Upon receipt for Calibration, the instrument was found to be:

Outside (X) see attached Report of Calibration.

the tolerance of the indicated specification.

West Caldwell Calibration Laboratories' calibration control system meets the requirements, ISO 10012-1 MIL-STD-45662A, ANSI/NCSL Z540-1, IEC Guide 25, ISO 9001:2008 and ISO 17025.

Note: With this Certificate, Report of Calibration is included.

Approved by:

FC

Calibration Date: 01-Aug-14

Certificate No: 24422 - 1

Felix Christopher (QA Mgr.)
ISO/IEC 17025:2005

uncompromised calibration **West Caldwell Calibration Laboratories, Inc.**
1575 State Route 96, Victor, NY 14564, U.S.A.

ACCREDITED

Calibration Lab. Cert. # 1533.01

West Caldwell Calibration Laboratories Inc.

Certificate of Calibration

for

MICROPHONE

Manufactured by:	PCB PIEZOTRONICS
Model No:	377B02
Serial No:	146482
Calibration Recall No:	24422

Submitted By:

Customer:	BRIAN BROWNWORTH
Company:	AECOM
Address:	125 BROAD STREET
	NEW YORK NY 10004

The subject instrument was calibrated to the indicated specification using standards traceable to the National Institute of Standards and Technology or to accepted values of natural physical constants. This document certifies that the instrument met the following specification upon its return to the submitter.

West Caldwell Calibration Laboratories Procedure No. 377B02 PCB PI

Upon receipt for Calibration, the instrument was found to be:

Within (X) see attached Report of Calibration.

the tolerance of the indicated specification.

West Caldwell Calibration Laboratories' calibration control system meets the requirements, ISO 10012-1 MIL-STD-45662A, ANSI/NCSL Z540-1, IEC Guide 25, ISO 9001:2008 and ISO 17025.

Note: With this Certificate, Report of Calibration is included.

Calibration Date: 03-Sep-14

Certificate No: 24422 - 5

QA Doc. #1051 Rev. 2.0 10/1/01

Approved by:

FC

Felix Christopher (QA Mgr.)
ISO/IEC 17025:2005

ACCREDITED

Calibration Lab. Cert. # 1533.01

uncompromised calibration
West Caldwell Calibration Laboratories, Inc.
1575 State Route 96, Victor, NY 14564, U.S.A.

West Caldwell Calibration Laboratories Inc.

Certificate of Calibration

for

PRECISION ACOUSTIC CALIBRATOR

Manufactured by:	**LARSON DAVIS**
Model No:	**CAL200**
Serial No:	**10241**
Calibration Recall No:	**24422**

Submitted By:

Customer:	**BRIAN BROWNWORTH**
Company:	**AECOM**
Address:	**125 BROAD STREET**
	NEW YORK NY 10004

The subject instrument was calibrated to the indicated specification using standards traceable to the National Institute of Standards and Technology or to accepted values of natural physical constants. This document certifies that the instrument met the following specification upon its return to the submitter.

West Caldwell Calibration Laboratories Procedure No. CAL200 LARS

Upon receipt for Calibration, the instrument was found to be:

Outside (X) see attached Report of Calibration.

the tolerance of the indicated specification.

West Caldwell Calibration Laboratories' calibration control system meets the requirements, ISO 10012-1 MIL-STD-45662A, ANSI/NCSL Z540-1, IEC Guide 25, ISO 9001:2008 and ISO 17025.

Note: With this Certificate, Report of Calibration is included.

Calibration Date: 04-Aug-14

Certificate No: 24422 - 3

QA Doc. #1051 Rev. 2.0 10/1/01

Approved by:

FC

Felix Christopher (QA Mgr.)
ISO/IEC 17025:2005

ACCREDITED

Calibration Lab. Cert. # 1533.01

uncompromised calibration **West Caldwell Calibration Laboratories, Inc.**
1575 State Route 96, Victor, NY 14564, U.S.A.

Appendix C. Noise Monitoring & NSA Site Locations

Figure 2: Key Index - NSA & Monitoring Locations

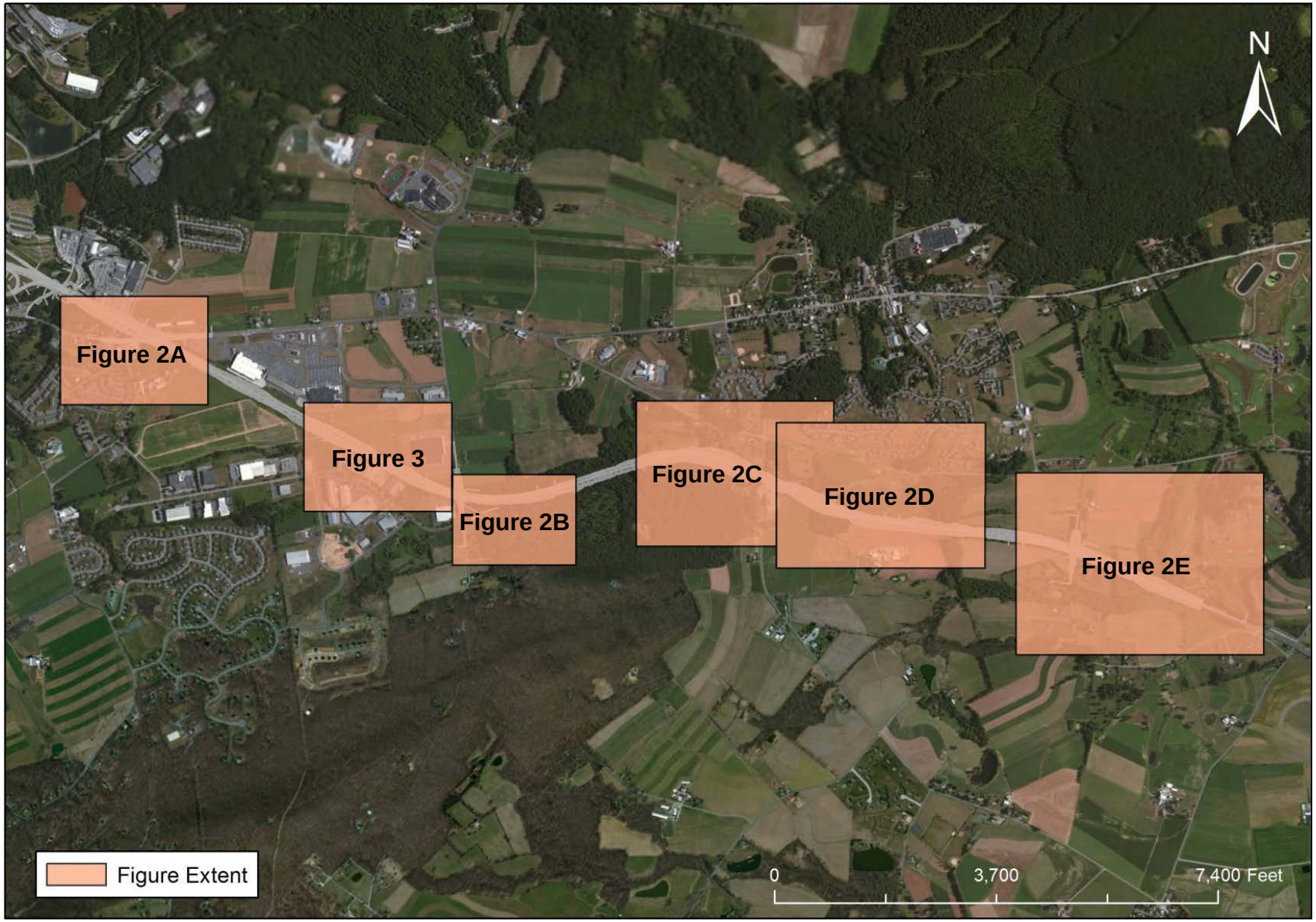


Figure 2A: NSA & Short-Term Monitoring Locations

Figure 2B: NSA & Short-Term Monitoring Locations

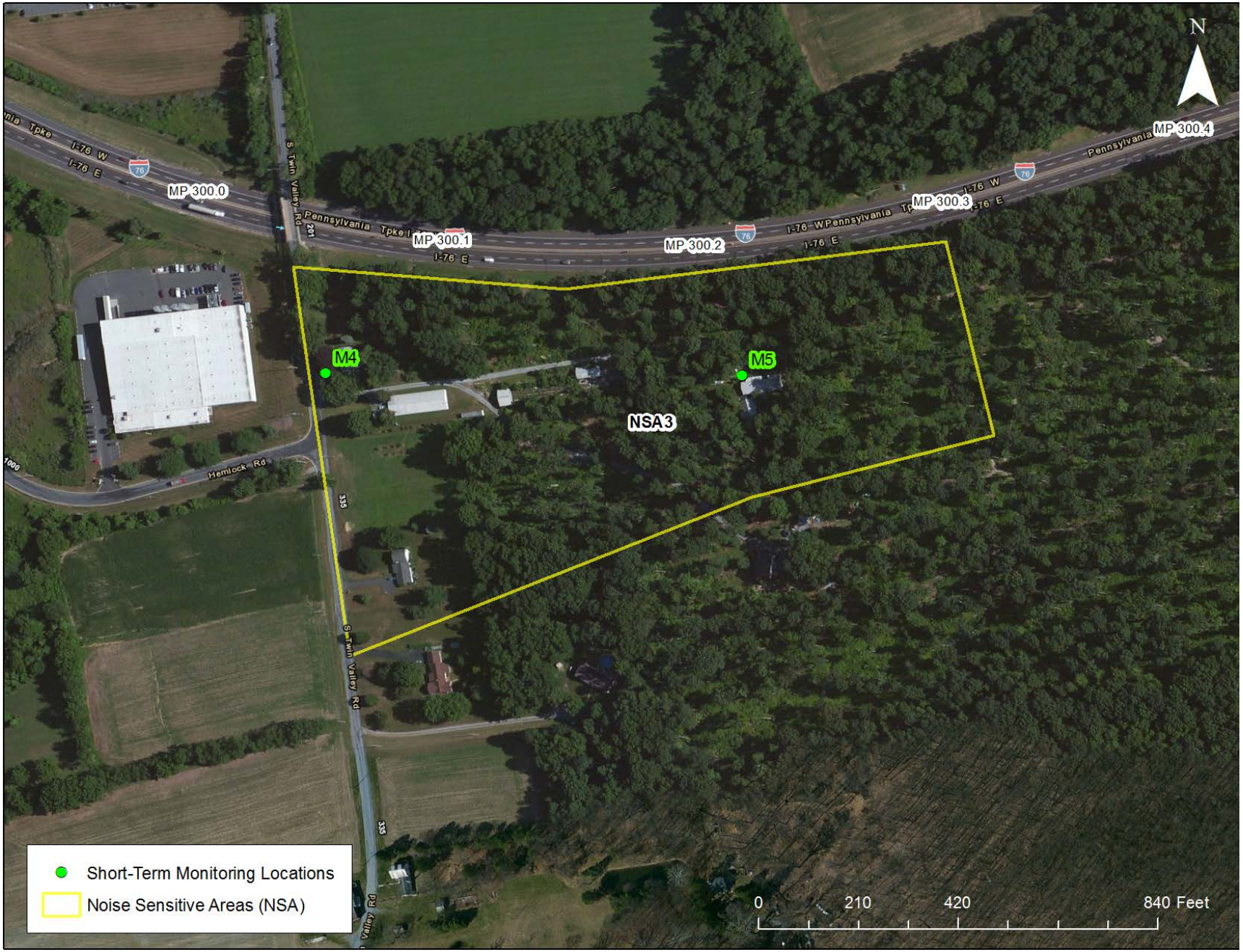


Figure 2C: NSA & Short-Term Monitoring Locations

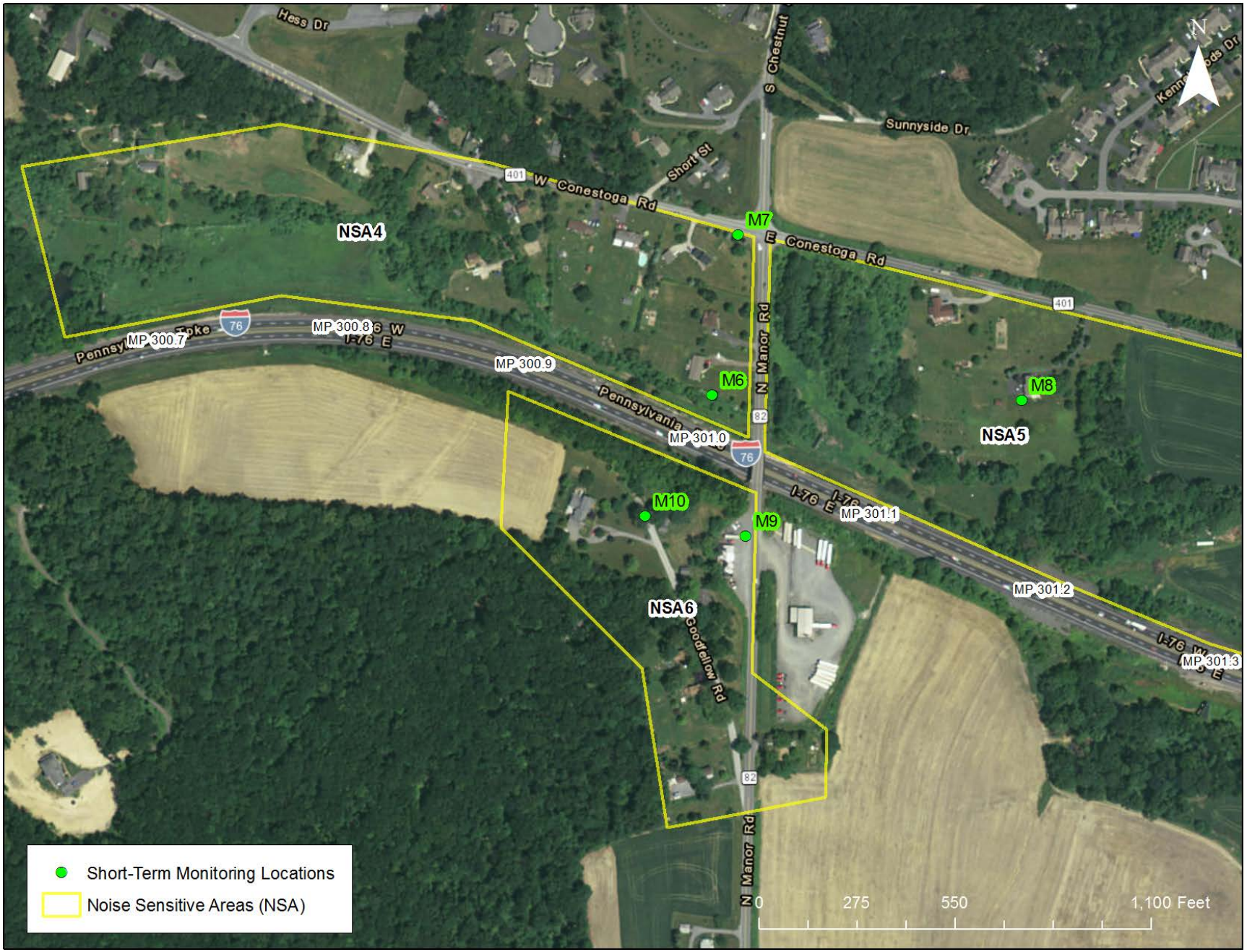


Figure 2D: NSA & Short-Term Monitoring Locations

Figure 2E: NSA & Short-Term Monitoring Locations

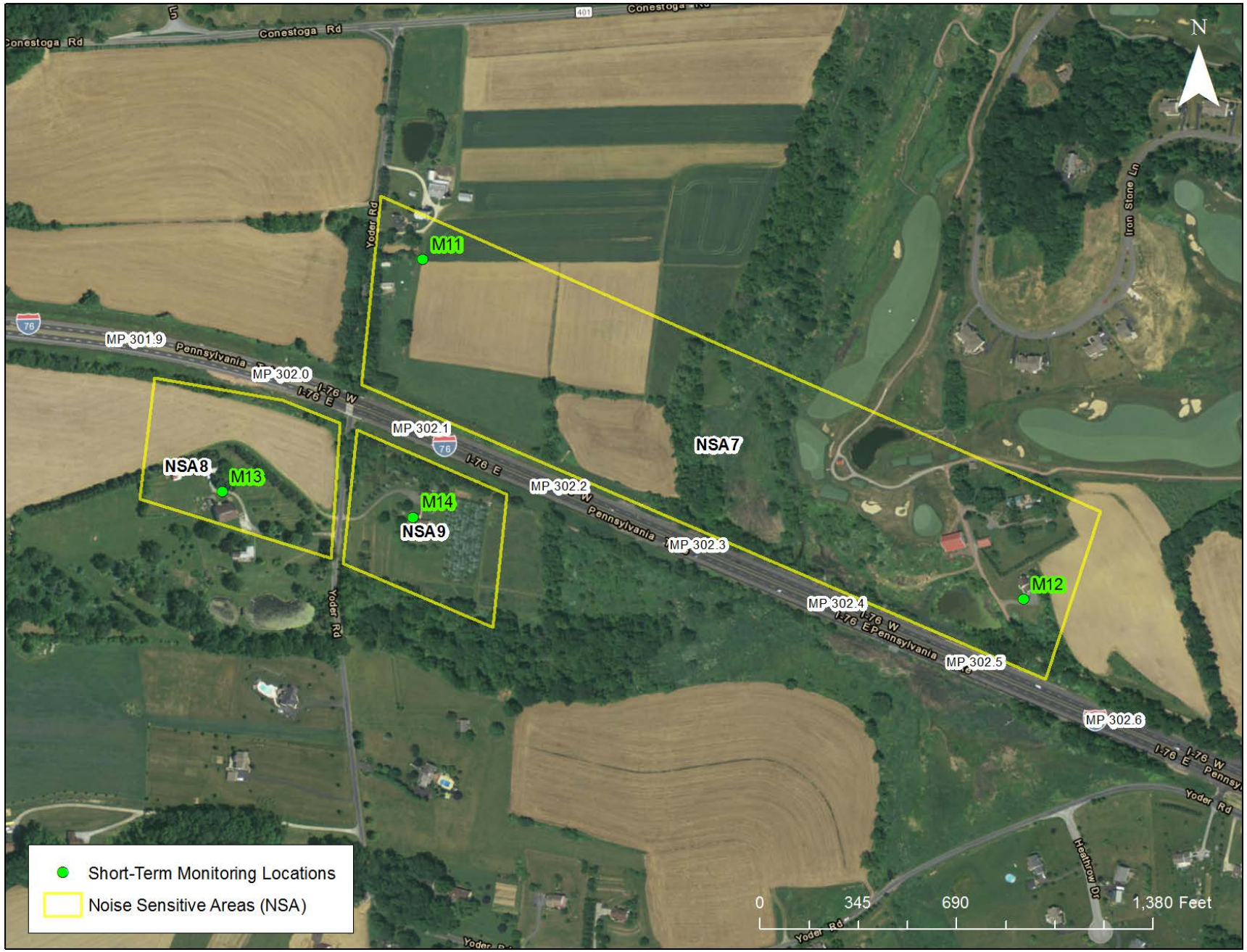


Figure 3: 24 Hour Monitoring Locations

Appendix D. 24-Hour Noise Monitoring Results

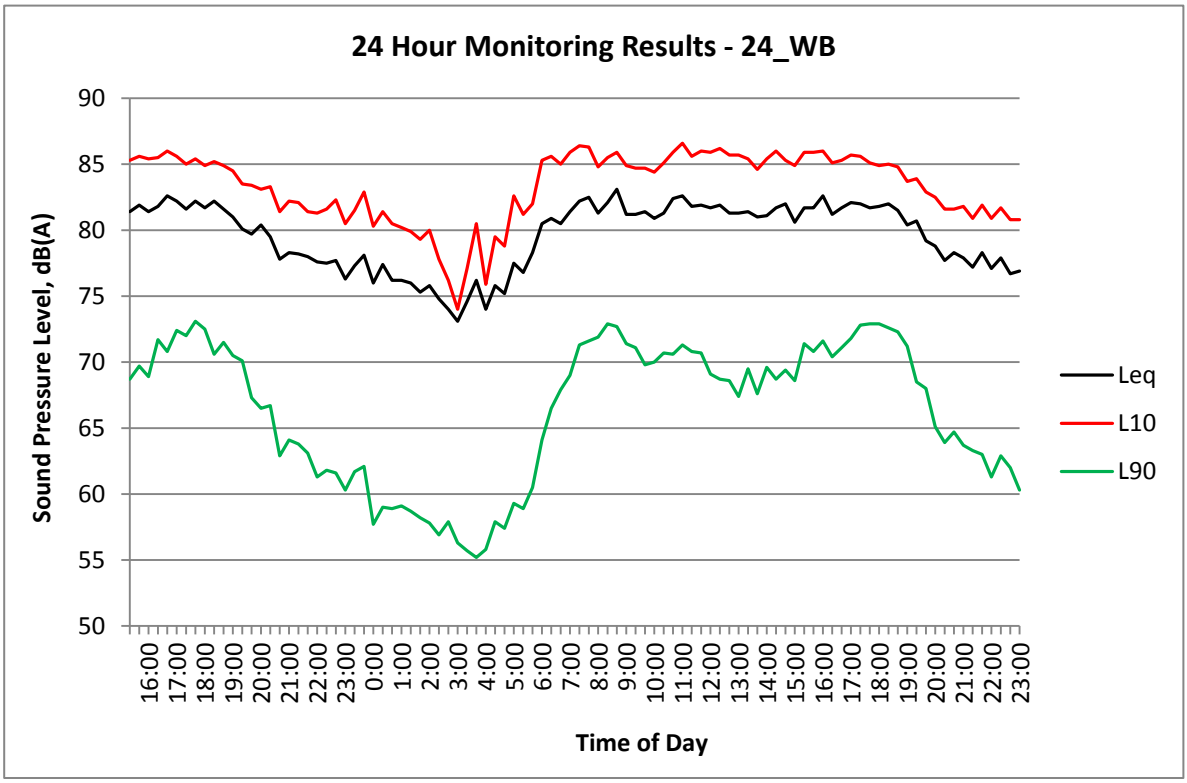


Figure 4A: 24 Hour Monitoring Results for 24_WB monitoring position

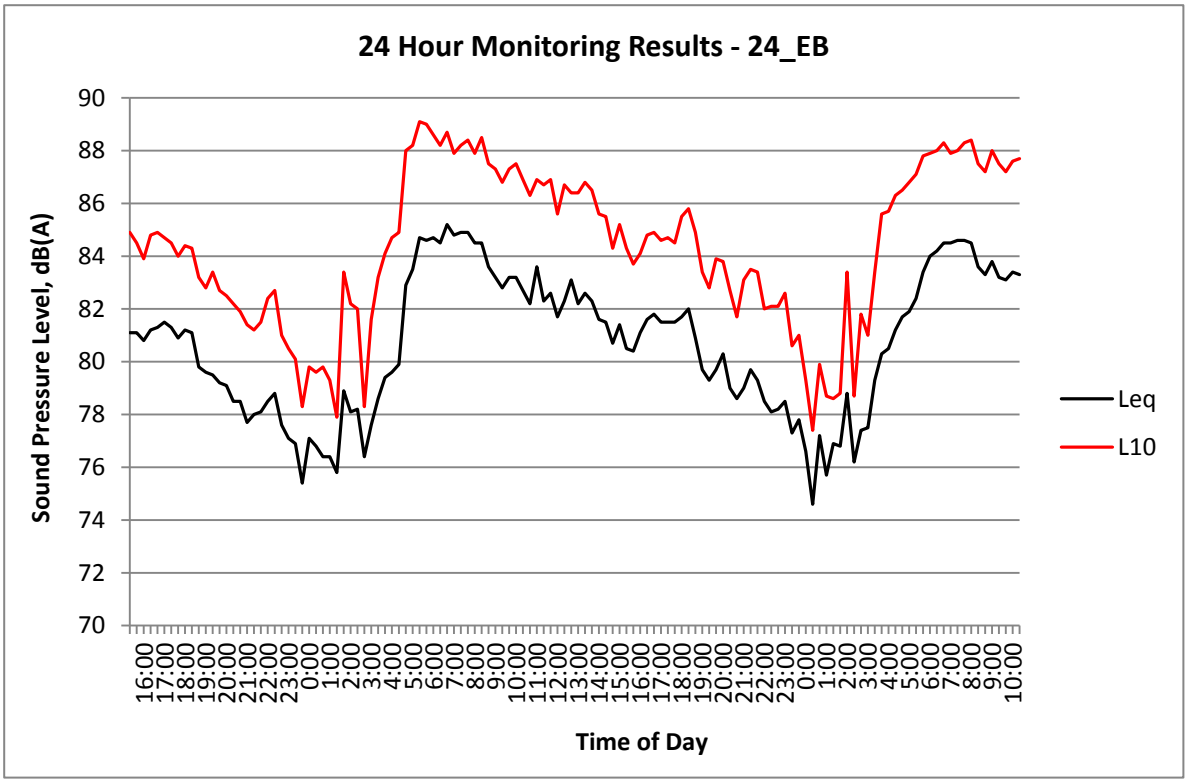


Figure 4B: 24 Hour Monitoring Results for 24_EB monitoring position

Appendix E. Modeled Receptors & Evaluated Barrier Locations

Figure 5: Key Index - Modeled Receptors & Evaluated Barrier Locations

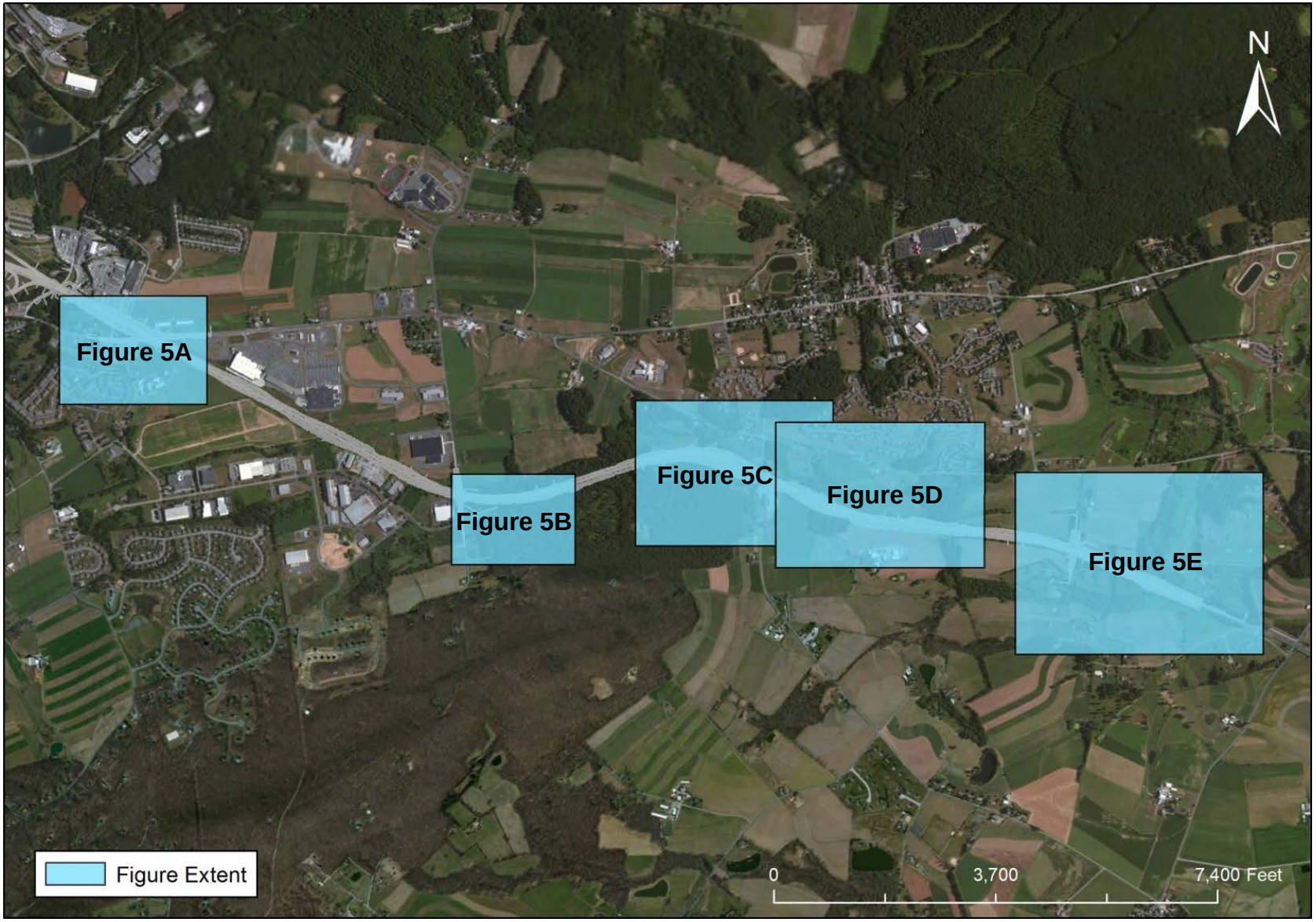


Figure 5A: Modeled Receptors & Evaluated Barrier Locations

Figure 5B: Modeled Receptors & Evaluated Barrier Locations

Figure 5C: Modeled Receptors & Evaluated Barrier Locations

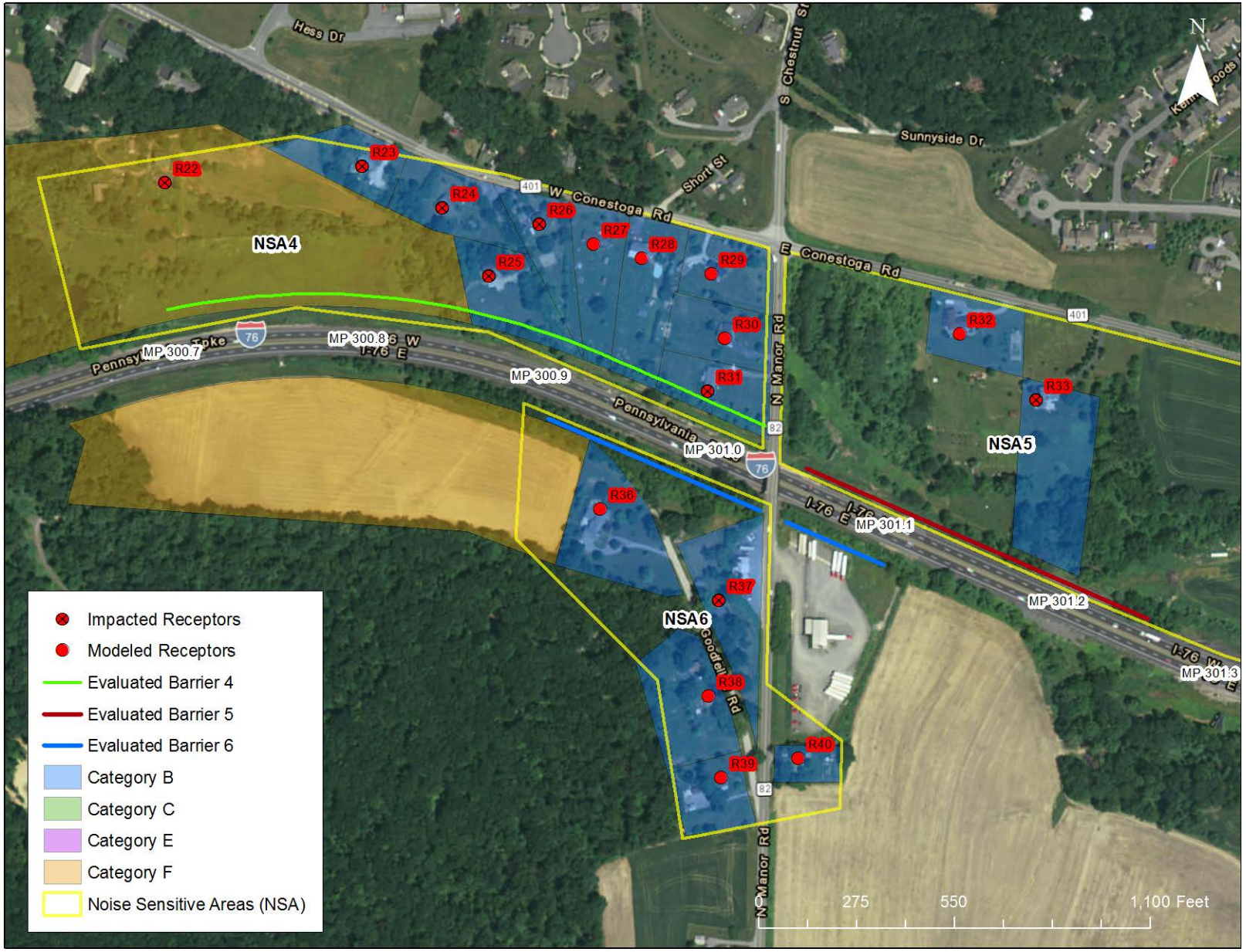
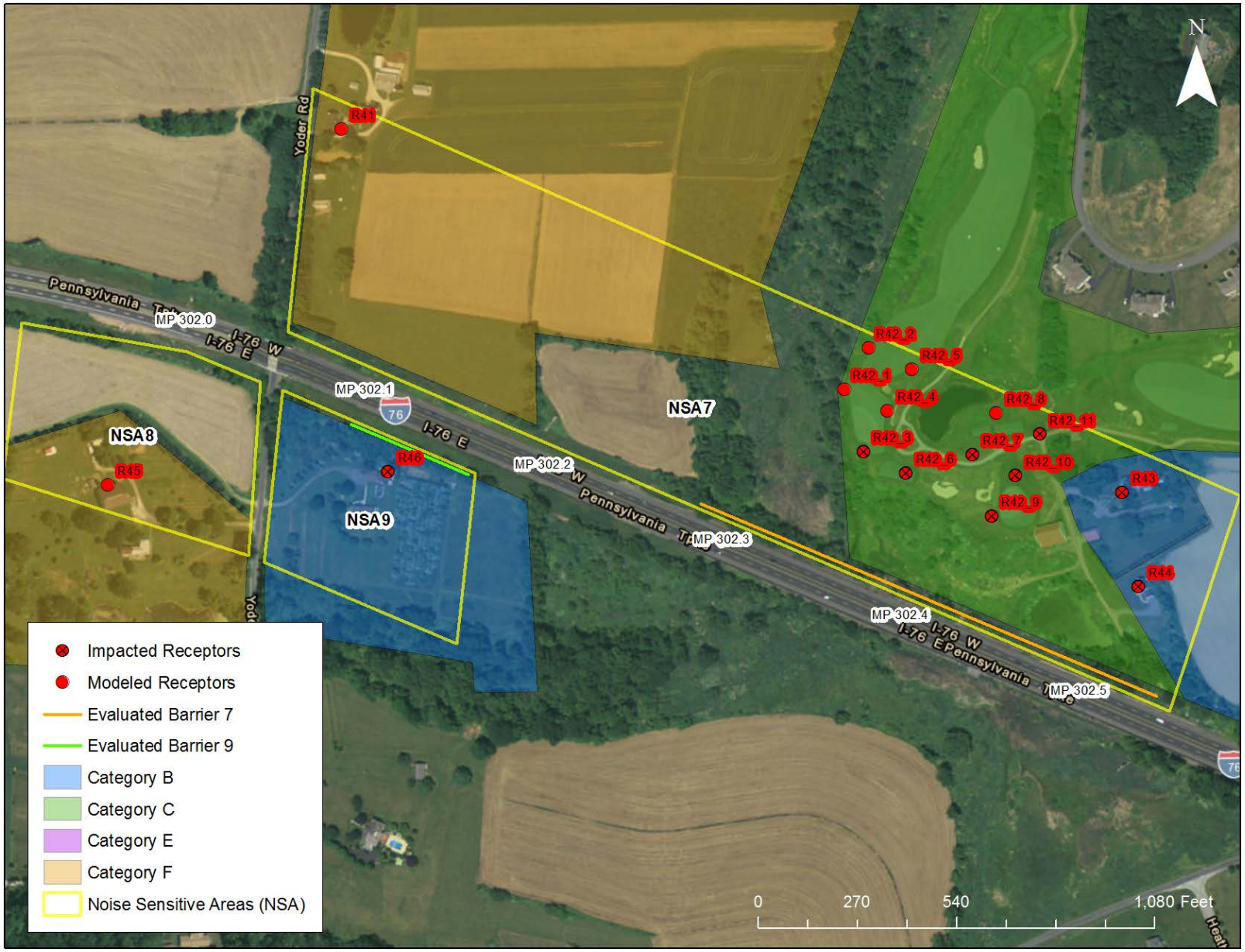


Figure 5D: Modeled Receptors & Evaluated Barrier Locations

Figure 5E: Modeled Receptors & Evaluated Barrier Locations



Appendix F. Noise Barrier Warranted, Feasibility and Reasonableness Worksheets

Highway Traffic Noise Abatement
Warranted, Feasible, and Reasonable Worksheet – Noise Wall

Date 11/06/15
Project Name Reconstruction and Widening of the Pennsylvania Turnpike (I-76) from Milepost 298 to Milepost 302.5
County Berks & Chester
SR, Section I-76 MP 298 - MP 302
Community Name and/or NSA # NSA 1
Noise Wall Identification (i.e., Wall 1) Barrier 1

General

1. Type of project (new location, reconstruction, etc.): Reconstruction & Widening

2. Total number of impacted receptor units in community
   - Category A units impacted: 0
   - Category B units impacted: 6
   - Category C units impacted: 0
   - Category D units impacted (if interior analysis required): 0
   - Category E units impacted: 0

Warranted

1. Community Documentation
   a. Date community was permitted (for new developments or developments planned for or under construction): N/A
   b. Date of approval for the Categorical Exclusion (CE), Record of Decision (ROD), or Finding of No Significant Impact (FONSI): N/A
   c. Does the date in 1.a precede the date in 1.b? If yes, proceed to Warranted Item 2. If no, consideration of noise abatement is not warranted. Proceed to "Decision" block and answer "no" to warranted question. As the reason for this decision, state that "Community was permitted after the date of approval of *CE, ROD, or FONSI, as appropriate*." ☐ Yes ☐ No N/A

2. Criteria requiring consideration of noise abatement (note N/A if category is not impacted or present or analysis not required). A "yes" answer to any of the following three questions requires the consideration of noise abatement.
   a. With the proposed project, are design year noise levels predicted to approach or exceed the NAC level(s) in Table 1? ☑ Yes ☐ No
   b. With the proposed project, is there predicted to be a substantial design year noise level increase of 10 dB(A) or more at Activity Category A, B, C, D, or E receptor(s)? ☐ Yes ☑ No

c. With the proposed project, are design year noise levels predicted to be less than existing noise levels, but still approach or exceed the NAC levels in Table 1 for the relevant Activity Category? ☐ Yes ☑ No

Feasibility – Questions 1c through 7 must all be answered "yes" for a noise barrier to be determined to be feasible.

1. Impacted receptor units
   a. Total number of impacted receptor units: 6
   b. Percentage of impacted receptor units receiving 5 dB(A) or more insertion loss: 0%
   c. Is the percentage 50 or greater? ☐ Yes ☑ No
2. Can the noise wall be designed and physically constructed at the proposed location? ☑ Yes ☐ No
3. Can the noise wall be constructed without causing a safety problem? ☑ Yes ☐ No
4. Can the noise wall be constructed without restricting access to vehicular or pedestrian travel? ☑ Yes ☐ No
5. Can the noise wall be constructed in a manner that allows for access for required maintenance and inspection operations? ☑ Yes ☐ No
6. Can the noise wall be constructed in a manner that permits utilities to function in a normal manner? ☑ Yes ☐ No
7. Can the noise wall be constructed in a manner that permits drainage features to function in a normal manner? ☑ Yes ☐ No

Reasonableness

1. Community Desires Related to the Barrier
   a. Do at least 50 percent of the responding benefited receptor unit owner(s) and renters desire the noise wall? If yes, continue with Reasonableness questions. If no, the noise wall can be considered not to be reasonable. Proceed to "Decision" block and answer "no" to reasonableness question. As the reason for this decision, state that "The majority of the benefited receptor unit owners do not desire the noise wall." ☐ Yes ☐ No N/A

2. Square Footage Per Benefited Receptor (SF/BR) Evaluation
   a. Area (SF) of the proposed noise wall N/A
   b. Number of benefited receptor units (any unit receiving 5 dB(A) or more insertion loss) N/A
   c. SF/BR = 2a/2b N/A
   d. Is 2c less than or equal to the MaxSF/BR value of 2000? ☐ Yes ☐ No N/A

3. Noise Reduction Design Goals (Activity Categories A, B, C, and E) A "yes" answer is required to Question 3a. for the noise wall to be determined to be reasonable. Questions 3b through 3e represent desirable goals that need not be met for a noise wall to be determined reasonable. However, they must be addressed and should be considered in the determination of the recommended noise wall.

   a. Does the noise wall reduce design year exterior_noise levels by at least 7 dB(A) for at least one benefited receptor? ☐ Yes ☐ No

   b. Does the noise wall provide an insertion loss of at least 7 dB(A) for more receptors than required under 3a.while still conforming to the MaxSF/BR value of 2,000 and a "point of diminishing returns" evaluation? ☐ Yes ☐ No

   c. Does the noise wall provide insertion losses of greater than 7 dB(A) while still conforming to the MaxSF/BR value of 2,000 and a "point of diminishing returns" evaluation? ☐ Yes ☐ No N/A

   d. Does the noise wall reduce future exterior levels to the low-60-decibel range (60-63) for Category B and C receptors and the upper-60 dB(A) range (65-68) for Category E receptors? ☐ Yes ☐ No

   e. Does the noise wall reduce design year noise levels back to existing levels? ☐ Yes ☐ No

4. Noise Reduction Design Goals (Activity Category D) A "yes" answer is required to Question 4a. for the barrier to be determined to be reasonable. Question 4b represents a desirable goal that need not be met for a noise wall to be determined reasonable. However, this goal must be addressed and should be considered in the determination of the recommended noise wall.

   a. Does noise wall reduce design year interior_noise levels by at least 7 dB(A) for the facility's analysis point? ☐ Yes ☐ No

   b. While conforming to the MaxSF/BR criteria and justified by a "point of diminishing returns' evaluation, does the noise wall provide an interior insertion loss above the 7 dB(A) minimum ☐ Yes ☐ No N/A

Decision

Is the Noise Wall WARRANTED? ☑ Yes ☐ No

Is the Noise Wall FEASIBLE? ☐ Yes ☑ No

Is the Noise Wall REASONABLE? ☐ Yes ☑ No

Additional Reasons for Decision:

Less than 50% of impacted receptors will be benefitted. Therefore, this noise barrier is not feasible.

Responsible/Qualified Individuals Making the Above Decisions

_____ Date:_____

PennDOT, Engineering District Environmental Manager

Matthew Shriffer, Noise & Vibration Specialist, AECOM Date: 11/06/15

Qualified Professional Performing the Analysis
(name, title, and company name)

Highway Traffic Noise Abatement
Warranted, Feasible, and Reasonable Worksheet – Noise Wall

Date 11/06/15
Project Name Reconstruction and Widening of the Pennsylvania Turnpike (I-76) from Milepost 298 to Milepost 302.5
County Berks & Chester
SR, Section I-76 MP 298 - MP 302
Community Name and/or NSA # NSA 2
Noise Wall Identification (i.e., Wall 1) N/A

General

1. Type of project (new location, reconstruction, etc.): Reconstruction & Widening

2. Total number of impacted receptor units in community
   - Category A units impacted: 0
   - Category B units impacted: 0
   - Category C units impacted: 0
   - Category D units impacted (if interior analysis required): 0
   - Category E units impacted: 0

Warranted

1. Community Documentation
   a. Date community was permitted (for new developments or developments planned for or under construction): N/A
   b. Date of approval for the Categorical Exclusion (CE), Record of Decision (ROD), or Finding of No Significant Impact (FONSI): N/A
   c. Does the date in 1.a precede the date in 1.b? If yes, proceed to Warranted Item 2. If no, consideration of noise abatement is not warranted. Proceed to "Decision" block and answer "no" to warranted question. As the reason for this decision, state that "Community was permitted after the date of approval of *CE, ROD, or FONSI, as appropriate*." ☐ Yes ☐ No ☒ N/A

2. Criteria requiring consideration of noise abatement (note N/A if category is not impacted or present or analysis not required). A "yes" answer to any of the following three questions requires the consideration of noise abatement.
   a. With the proposed project, are design year noise levels predicted to approach or exceed the NAC level(s) in Table 1? ☐ Yes ☑ No
   b. With the proposed project, is there predicted to be a substantial design year noise level increase of 10 dB(A) or more at Activity Category A, B, C, D, or E receptor(s)? ☐ Yes ☑ No

c. With the proposed project, are design year noise levels predicted to be less than existing noise levels, but still approach or exceed the NAC levels in Table 1 for the relevant Activity Category? ☐ Yes ☑ No

Feasibility – Questions 1c through 7 must all be answered "yes" for a noise barrier to be determined to be feasible.

1. Impacted receptor units
   a. Total number of impacted receptor units: N/A
   b. Percentage of impacted receptor units receiving 5 dB(A) or more insertion loss: N/A
   c. Is the percentage 50 or greater? ☐ Yes ☐ No
2. Can the noise wall be designed and physically constructed at the proposed location? ☐ Yes ☐ No
3. Can the noise wall be constructed without causing a safety problem? ☐ Yes ☐ No
4. Can the noise wall be constructed without restricting access to vehicular or pedestrian travel? ☐ Yes ☐ No N/A
5. Can the noise wall be constructed in a manner that allows for access for required maintenance and inspection operations? ☐ Yes ☐ No
6. Can the noise wall be constructed in a manner that permits utilities to function in a normal manner? ☐ Yes ☐ No
7. Can the noise wall be constructed in a manner that permits drainage features to function in a normal manner? ☐ Yes ☐ No

Reasonableness

1. Community Desires Related to the Barrier
   a. Do at least 50 percent of the responding benefited receptor unit owner(s) and renters desire the noise wall? If yes, continue with Reasonableness questions. If no, the noise wall can be considered not to be reasonable. Proceed to "Decision" block and answer "no" to reasonableness question. As the reason for this decision, state that "The majority of the benefited receptor unit owners do not desire the noise wall." ☐ Yes ☐ No

2. Square Footage Per Benefited Receptor (SF/BR) Evaluation
   a. Area (SF) of the proposed noise wall N/A
   b. Number of benefited receptor units (any unit receiving 5 dB(A) or more insertion loss) N/A
   c. SF/BR = 2a/2b N/A
   d. Is 2c less than or equal to the MaxSF/BR value of 2000? ☐ Yes ☐ No N/A

3. Noise Reduction Design Goals (Activity Categories A, B, C, and E) A "yes" answer is required to Question 3a. for the noise wall to be determined to be reasonable. Questions 3b through 3e represent desirable goals that need not be met for a noise wall to be determined reasonable. However, they must be addressed and should be considered in the determination of the recommended noise wall.

   a. Does the noise wall reduce design year exterior_noise levels by at least 7 dB(A) for at least one benefited receptor? ☐ Yes ☐ No

   b. Does the noise wall provide an insertion loss of at least 7 dB(A) for more receptors than required under 3a.while still conforming to the MaxSF/BR value of 2,000 and a "point of diminishing returns" evaluation? ☐ Yes ☐ No

   c. Does the noise wall provide insertion losses of greater than 7 dB(A) while still conforming to the MaxSF/BR value of 2,000 and a "point of diminishing returns" evaluation? ☐ Yes ☐ No N/A

   d. Does the noise wall reduce future exterior levels to the low-60-decibel range (60-63) for Category B and C receptors and the upper-60 dB(A) range (65-68) for Category E receptors? ☐ Yes ☐ No

   e. Does the noise wall reduce design year noise levels back to existing levels? ☐ Yes ☐ No

4. Noise Reduction Design Goals (Activity Category D) A "yes" answer is required to Question 4a. for the barrier to be determined to be reasonable. Question 4b represents a desirable goal that need not be met for a noise wall to be determined reasonable. However, this goal must be addressed and should be considered in the determination of the recommended noise wall.

   a. Does noise wall reduce design year interior_noise levels by at least 7 dB(A) for the facility's analysis point? ☐ Yes ☐ No

   b. While conforming to the MaxSF/BR criteria and justified by a "point of diminishing returns' evaluation, does the noise wall provide an interior insertion loss above the 7 dB(A) minimum ☐ Yes ☐ No N/A

Decision

Is the Noise Wall WARRANTED? ☐ Yes ☑ No

Is the Noise Wall FEASIBLE? ☐ Yes ☐ No

Is the Noise Wall REASONABLE? ☐ Yes ☐ No

Additional Reasons for Decision:

Predicted noise levels do not approach or exceed the NAC criteria at any receptors in this NSA. Therefore, mitigation is not warranted.

Responsible/Qualified Individuals Making the Above Decisions

_____ Date:_____

PennDOT, Engineering District Environmental Manager

Matthew Shriffer, Noise & Vibration Specialist, AECOM Date: 11/06/15

Qualified Professional Performing the Analysis
(name, title, and company name)

Highway Traffic Noise Abatement
Warranted, Feasible, and Reasonable Worksheet – Noise Wall

Date 11/06/15
Project Name Reconstruction and Widening of the Pennsylvania Turnpike (I-76) from Milepost 298 to Milepost 302.5
County Berks & Chester
SR, Section I-76 MP 298 - MP 302
Community Name and/or NSA # NSA 3
Noise Wall Identification (i.e., Wall 1) Barrier 3

General

1. Type of project (new location, reconstruction, etc.): Reconstruction & Widening

2. Total number of impacted receptor units in community
   - Category A units impacted: 0
   - Category B units impacted: 2
   - Category C units impacted: 0
   - Category D units impacted (if interior analysis required): 0
   - Category E units impacted: 0

Warranted

1. Community Documentation
   a. Date community was permitted (for new developments or developments planned for or under construction): N/A
   b. Date of approval for the Categorical Exclusion (CE), Record of Decision (ROD), or Finding of No Significant Impact (FONSI): N/A
   c. Does the date in 1.a precede the date in 1.b? If yes, proceed to Warranted Item 2. If no, consideration of noise abatement is not warranted. Proceed to "Decision" block and answer "no" to warranted question. As the reason for this decision, state that "Community was permitted after the date of approval of *CE, ROD, or FONSI, as appropriate*." ☐ Yes ☐ No N/A

2. Criteria requiring consideration of noise abatement (note N/A if category is not impacted or present or analysis not required). A "yes" answer to any of the following three questions requires the consideration of noise abatement.
   a. With the proposed project, are design year noise levels predicted to approach or exceed the NAC level(s) in Table 1? ☑ Yes ☐ No
   b. With the proposed project, is there predicted to be a substantial design year noise level increase of 10 dB(A) or more at Activity Category A, B, C, D, or E receptor(s)? ☐ Yes ☑ No

c. With the proposed project, are design year noise levels predicted to be less than existing noise levels, but still approach or exceed the NAC levels in Table 1 for the relevant Activity Category? ☐ Yes ☑ No

Feasibility – Questions 1c through 7 must all be answered "yes" for a noise barrier to be determined to be feasible.

1. Impacted receptor units
   a. Total number of impacted receptor units: 2
   b. Percentage of impacted receptor units receiving 5 dB(A) or more insertion loss: 100% (2 benefitted receptors)
   c. Is the percentage 50 or greater? ☑ Yes ☐ No
2. Can the noise wall be designed and physically constructed at the proposed location? ☑ Yes ☐ No
3. Can the noise wall be constructed without causing a safety problem? ☑ Yes ☐ No
4. Can the noise wall be constructed without restricting access to vehicular or pedestrian travel? ☑ Yes ☐ No
5. Can the noise wall be constructed in a manner that allows for access for required maintenance and inspection operations? ☑ Yes ☐ No
6. Can the noise wall be constructed in a manner that permits utilities to function in a normal manner? ☑ Yes ☐ No
7. Can the noise wall be constructed in a manner that permits drainage features to function in a normal manner? ☑ Yes ☐ No

Reasonableness

1. Community Desires Related to the Barrier
   a. Do at least 50 percent of the responding benefited receptor unit owner(s) and renters desire the noise wall? If yes, continue with Reasonableness questions. If no, the noise wall can be considered not to be reasonable. Proceed to "Decision" block and answer "no" to reasonableness question. As the reason for this decision, state that "The majority of the benefited receptor unit owners do not desire the noise wall." ☐ Yes ☐ No TBD

2. Square Footage Per Benefited Receptor (SF/BR) Evaluation
   a. Area (SF) of the proposed noise wall 16,100
   b. Number of benefited receptor units (any unit receiving 5 dB(A) or more insertion loss) 2
   c. SF/BR = 2a/2b 8,050
   d. Is 2c less than or equal to the MaxSF/BR value of 2000? ☐ Yes ☑ No

3. Noise Reduction Design Goals (Activity Categories A, B, C, and E) A "yes" answer is required to Question 3a. for the noise wall to be determined to be reasonable. Questions 3b through 3e represent desirable goals that need not be met for a noise wall to be determined reasonable. However, they must be addressed and should be considered in the determination of the recommended noise wall.

   a. Does the noise wall reduce design year exterior_noise levels by at least 7 dB(A) for at least one benefited receptor? ☐ Yes ☑ No

   b. Does the noise wall provide an insertion loss of at least 7 dB(A) for more receptors than required under 3a.while still conforming to the MaxSF/BR value of 2,000 and a "point of diminishing returns" evaluation? ☐ Yes ☑ No

   c. Does the noise wall provide insertion losses of greater than 7 dB(A) while still conforming to the MaxSF/BR value of 2,000 and a "point of diminishing returns" evaluation? ☐ Yes ☑ No

   d. Does the noise wall reduce future exterior levels to the low-60-decibel range (60-63) for Category B and C receptors and the upper-60 dB(A) range (65-68) for Category E receptors? ☐ Yes ☑ No

   e. Does the noise wall reduce design year noise levels back to existing levels? ☑ Yes ☐ No

4. Noise Reduction Design Goals (Activity Category D) A "yes" answer is required to Question 4a. for the barrier to be determined to be reasonable. Question 4b represents a desirable goal that need not be met for a noise wall to be determined reasonable. However, this goal must be addressed and should be considered in the determination of the recommended noise wall.

   a. Does noise wall reduce design year interior_noise levels by at least 7 dB(A) for the facility's analysis point? ☐ Yes ☐ No N/A

   b. While conforming to the MaxSF/BR criteria and justified by a "point of diminishing returns' evaluation, does the noise wall provide an interior insertion loss above the 7 dB(A) minimum ☐ Yes ☐ No

Decision

Is the Noise Wall WARRANTED? ☑ Yes ☐ No

Is the Noise Wall FEASIBLE? ☑ Yes ☐ No

Is the Noise Wall REASONABLE? ☐ Yes ☑ No

Additional Reasons for Decision:

The noise barrier exceeds the max BR/SF value of 2,000. Therefore, it is not reasonable.

Responsible/Qualified Individuals Making the Above Decisions

_____ Date:_____

PennDOT, Engineering District Environmental Manager

Matthew Shriffer, Noise & Vibration Specialist, AECOM Date: 11/06/15

Qualified Professional Performing the Analysis
(name, title, and company name)

Highway Traffic Noise Abatement
Warranted, Feasible, and Reasonable Worksheet – Noise Wall

Date 11/06/15
Project Name Reconstruction and Widening of the Pennsylvania Turnpike (I-76) from Milepost 298 to Milepost 302.5
County Berks & Chester
SR, Section I-76 MP 298 - MP 302
Community Name and/or NSA # NSA 4
Noise Wall Identification (i.e., Wall 1) Barrier 4

General

1. Type of project (new location, reconstruction, etc.): Reconstruction & Widening

2. Total number of impacted receptor units in community
   - Category A units impacted: 0
   - Category B units impacted: 6
   - Category C units impacted: 0
   - Category D units impacted (if interior analysis required): 0
   - Category E units impacted: 0

Warranted

1. Community Documentation
   a. Date community was permitted (for new developments or developments planned for or under construction): N/A
   b. Date of approval for the Categorical Exclusion (CE), Record of Decision (ROD), or Finding of No Significant Impact (FONSI): N/A
   c. Does the date in 1.a precede the date in 1.b? If yes, proceed to Warranted Item 2. If no, consideration of noise abatement is not warranted. Proceed to "Decision" block and answer "no" to warranted question. As the reason for this decision, state that "Community was permitted after the date of approval of *CE, ROD, or FONSI, as appropriate*." ☐ Yes ☐ No N/A

2. Criteria requiring consideration of noise abatement (note N/A if category is not impacted or present or analysis not required). A "yes" answer to any of the following three questions requires the consideration of noise abatement.
   a. With the proposed project, are design year noise levels predicted to approach or exceed the NAC level(s) in Table 1? ☑ Yes ☐ No
   b. With the proposed project, is there predicted to be a substantial design year noise level increase of 10 dB(A) or more at Activity Category A, B, C, D, or E receptor(s)? ☐ Yes ☑ No

c. With the proposed project, are design year noise levels predicted to be less than existing noise levels, but still approach or exceed the NAC levels in Table 1 for the relevant Activity Category? ☐ Yes ☑ No

Feasibility – Questions 1c through 7 must all be answered "yes" for a noise barrier to be determined to be feasible.

1. Impacted receptor units
   a. Total number of impacted receptor units: 6
   b. Percentage of impacted receptor units receiving 5 dB(A) or more insertion loss: 17% (1 benefited receptor)
   c. Is the percentage 50 or greater? ☐ Yes ☑ No
2. Can the noise wall be designed and physically constructed at the proposed location? ☑ Yes ☐ No
3. Can the noise wall be constructed without causing a safety problem? ☑ Yes ☐ No
4. Can the noise wall be constructed without restricting access to vehicular or pedestrian travel? ☑ Yes ☐ No
5. Can the noise wall be constructed in a manner that allows for access for required maintenance and inspection operations? ☑ Yes ☐ No
6. Can the noise wall be constructed in a manner that permits utilities to function in a normal manner? ☑ Yes ☐ No
7. Can the noise wall be constructed in a manner that permits drainage features to function in a normal manner? ☑ Yes ☐ No

Reasonableness

1. Community Desires Related to the Barrier
   a. Do at least 50 percent of the responding benefited receptor unit owner(s) and renters desire the noise wall? If yes, continue with Reasonableness questions. If no, the noise wall can be considered not to be reasonable. Proceed to "Decision" block and answer "no" to reasonableness question. As the reason for this decision, state that "The majority of the benefited receptor unit owners do not desire the noise wall." ☐ Yes ☐ No N/A

2. Square Footage Per Benefited Receptor (SF/BR) Evaluation
   a. Area (SF) of the proposed noise wall N/A
   b. Number of benefited receptor units (any unit receiving 5 dB(A) or more insertion loss) N/A
   c. SF/BR = 2a/2b N/A
   d. Is 2c less than or equal to the MaxSF/BR value of 2000? ☐ Yes ☐ No N/A

3. Noise Reduction Design Goals (Activity Categories A, B, C, and E) A "yes" answer is required to Question 3a. for the noise wall to be determined to be reasonable. Questions 3b through 3e represent desirable goals that need not be met for a noise wall to be determined reasonable. However, they must be addressed and should be considered in the determination of the recommended noise wall.

   a. Does the noise wall reduce design year exterior_noise levels by at least 7 dB(A) for at least one benefited receptor? ☐ Yes ☐ No

   b. Does the noise wall provide an insertion loss of at least 7 dB(A) for more receptors than required under 3a.while still conforming to the MaxSF/BR value of 2,000 and a "point of diminishing returns" evaluation? ☐ Yes ☐ No

   c. Does the noise wall provide insertion losses of greater than 7 dB(A) while still conforming to the MaxSF/BR value of 2,000 and a "point of diminishing returns" evaluation? ☐ Yes ☐ No N/A

   d. Does the noise wall reduce future exterior levels to the low-60-decibel range (60-63) for Category B and C receptors and the upper-60 dB(A) range (65-68) for Category E receptors? ☐ Yes ☐ No

   e. Does the noise wall reduce design year noise levels back to existing levels? ☐ Yes ☐ No

4. Noise Reduction Design Goals (Activity Category D) A "yes" answer is required to Question 4a. for the barrier to be determined to be reasonable. Question 4b represents a desirable goal that need not be met for a noise wall to be determined reasonable. However, this goal must be addressed and should be considered in the determination of the recommended noise wall.

   a. Does noise wall reduce design year interior_noise levels by at least 7 dB(A) for the facility's analysis point? ☐ Yes ☐ No

   b. While conforming to the MaxSF/BR criteria and justified by a "point of diminishing returns' evaluation, does the noise wall provide an interior insertion loss above the 7 dB(A) minimum ☐ Yes ☐ No N/A

Decision

Is the Noise Wall WARRANTED? ☑ Yes ☐ No

Is the Noise Wall FEASIBLE? ☐ Yes ☑ No

Is the Noise Wall REASONABLE? ☐ Yes ☑ No

Additional Reasons for Decision:

Less than 50% of impacted receptors will be benefitted. Therefore, this noise barrier is not feasible.

Responsible/Qualified Individuals Making the Above Decisions

_____ Date:_____

PennDOT, Engineering District Environmental Manager

Matthew Shriffer, Noise & Vibration Specialist, AECOM Date: 11/06/15

Qualified Professional Performing the Analysis
(name, title, and company name)

Highway Traffic Noise Abatement
Warranted, Feasible, and Reasonable Worksheet – Noise Wall

Date 11/06/15
Project Name Reconstruction and Widening of the Pennsylvania Turnpike (I-76) from Milepost 298 to Milepost 302.5
County Berks & Chester
SR, Section I-76 MP 298 - MP 302
Community Name and/or NSA # NSA 5
Noise Wall Identification (i.e., Wall 1) Barrier 5

General

1. Type of project (new location, reconstruction, etc.): Reconstruction & Widening

2. Total number of impacted receptor units in community
   - Category A units impacted: 0
   - Category B units impacted: 1
   - Category C units impacted: 0
   - Category D units impacted (if interior analysis required): 0
   - Category E units impacted: 0

Warranted

1. Community Documentation
   a. Date community was permitted (for new developments or developments planned for or under construction): N/A
   b. Date of approval for the Categorical Exclusion (CE), Record of Decision (ROD), or Finding of No Significant Impact (FONSI): N/A
   c. Does the date in 1.a precede the date in 1.b? If yes, proceed to Warranted Item 2. If no, consideration of noise abatement is not warranted. Proceed to "Decision" block and answer "no" to warranted question. As the reason for this decision, state that "Community was permitted after the date of approval of *CE, ROD, or FONSI, as appropriate*." ☐ Yes ☐ No N/A

2. Criteria requiring consideration of noise abatement (note N/A if category is not impacted or present or analysis not required). A "yes" answer to any of the following three questions requires the consideration of noise abatement.
   a. With the proposed project, are design year noise levels predicted to approach or exceed the NAC level(s) in Table 1? ☑ Yes ☐ No
   b. With the proposed project, is there predicted to be a substantial design year noise level increase of 10 dB(A) or more at Activity Category A, B, C, D, or E receptor(s)? ☐ Yes ☑ No

c. With the proposed project, are design year noise levels predicted to be less than existing noise levels, but still approach or exceed the NAC levels in Table 1 for the relevant Activity Category? ☐ Yes ☑ No

Feasibility – Questions 1c through 7 must all be answered "yes" for a noise barrier to be determined to be feasible.

1. Impacted receptor units
   a. Total number of impacted receptor units: 1
   b. Percentage of impacted receptor units receiving 5 dB(A) or more insertion loss: 100% (1 benefited receptor)
   c. Is the percentage 50 or greater? ☑ Yes ☐ No
2. Can the noise wall be designed and physically constructed at the proposed location? ☑ Yes ☐ No
3. Can the noise wall be constructed without causing a safety problem? ☑ Yes ☐ No
4. Can the noise wall be constructed without restricting access to vehicular or pedestrian travel? ☑ Yes ☐ No
5. Can the noise wall be constructed in a manner that allows for access for required maintenance and inspection operations? ☑ Yes ☐ No
6. Can the noise wall be constructed in a manner that permits utilities to function in a normal manner? ☑ Yes ☐ No
7. Can the noise wall be constructed in a manner that permits drainage features to function in a normal manner? ☑ Yes ☐ No

Reasonableness

1. Community Desires Related to the Barrier
   a. Do at least 50 percent of the responding benefited receptor unit owner(s) and renters desire the noise wall? If yes, continue with Reasonableness questions. If no, the noise wall can be considered not to be reasonable. Proceed to "Decision" block and answer "no" to reasonableness question. As the reason for this decision, state that "The majority of the benefited receptor unit owners do not desire the noise wall." ☐ Yes ☐ No TBD

2. Square Footage Per Benefited Receptor (SF/BR) Evaluation
   a. Area (SF) of the proposed noise wall 16,800
   b. Number of benefited receptor units (any unit receiving 5 dB(A) or more insertion loss) 1
   c. SF/BR = 2a/2b 16,800
   d. Is 2c less than or equal to the MaxSF/BR value of 2000? ☐ Yes ☑ No

3. Noise Reduction Design Goals (Activity Categories A, B, C, and E) A "yes" answer is required to Question 3a. for the noise wall to be determined to be reasonable. Questions 3b through 3e represent desirable goals that need not be met for a noise wall to be determined reasonable. However, they must be addressed and should be considered in the determination of the recommended noise wall.

   a. Does the noise wall reduce design year exterior_noise levels by at least 7 dB(A) for at least one benefited receptor? ☐ Yes ☑ No

   b. Does the noise wall provide an insertion loss of at least 7 dB(A) for more receptors than required under 3a.while still conforming to the MaxSF/BR value of 2,000 and a "point of diminishing returns" evaluation? ☐ Yes ☑ No

   c. Does the noise wall provide insertion losses of greater than 7 dB(A) while still conforming to the MaxSF/BR value of 2,000 and a "point of diminishing returns" evaluation? ☐ Yes ☑ No

   d. Does the noise wall reduce future exterior levels to the low-60-decibel range (60-63) for Category B and C receptors and the upper-60 dB(A) range (65-68) for Category E receptors? ☐ Yes ☑ No

   e. Does the noise wall reduce design year noise levels back to existing levels? ☑ Yes ☐ No

4. Noise Reduction Design Goals (Activity Category D) A "yes" answer is required to Question 4a. for the barrier to be determined to be reasonable. Question 4b represents a desirable goal that need not be met for a noise wall to be determined reasonable. However, this goal must be addressed and should be considered in the determination of the recommended noise wall.

   a. Does noise wall reduce design year interior_noise levels by at least 7 dB(A) for the facility's analysis point? ☐ Yes ☐ No N/A

   b. While conforming to the MaxSF/BR criteria and justified by a "point of diminishing returns' evaluation, does the noise wall provide an interior insertion loss above the 7 dB(A) minimum ☐ Yes ☐ No

Decision

Is the Noise Wall WARRANTED? ☑ Yes ☐ No

Is the Noise Wall FEASIBLE? ☑ Yes ☐ No

Is the Noise Wall REASONABLE? ☐ Yes ☑ No

Additional Reasons for Decision:

The noise barrier exceeds the max BR/SF value of 2,000. Therefore, it is not reasonable.

Responsible/Qualified Individuals Making the Above Decisions

_____ Date:_____

PennDOT, Engineering District Environmental Manager

Matthew Shriffer, Noise & Vibration Specialist, AECOM Date: 11/06/15

Qualified Professional Performing the Analysis
(name, title, and company name)

Highway Traffic Noise Abatement
Warranted, Feasible, and Reasonable Worksheet – Noise Wall

Date 11/06/15
Project Name Reconstruction and Widening of the Pennsylvania Turnpike (I-76) from Milepost 298 to Milepost 302.5
County Berks & Chester
SR, Section I-76 MP 298 - MP 302
Community Name and/or NSA # NSA 6
Noise Wall Identification (i.e., Wall 1) Barrier 6

General

1. Type of project (new location, reconstruction, etc.): Reconstruction & Widening

2. Total number of impacted receptor units in community
   - Category A units impacted: 0
   - Category B units impacted: 1
   - Category C units impacted: 0
   - Category D units impacted (if interior analysis required): 0
   - Category E units impacted: 0

Warranted

1. Community Documentation
   a. Date community was permitted (for new developments or developments planned for or under construction): N/A
   b. Date of approval for the Categorical Exclusion (CE), Record of Decision (ROD), or Finding of No Significant Impact (FONSI): N/A
   c. Does the date in 1.a precede the date in 1.b? If yes, proceed to Warranted Item 2. If no, consideration of noise abatement is not warranted. Proceed to "Decision" block and answer "no" to warranted question. As the reason for this decision, state that "Community was permitted after the date of approval of *CE, ROD, or FONSI, as appropriate*." ☐ Yes ☐ No N/A

2. Criteria requiring consideration of noise abatement (note N/A if category is not impacted or present or analysis not required). A "yes" answer to any of the following three questions requires the consideration of noise abatement.
   a. With the proposed project, are design year noise levels predicted to approach or exceed the NAC level(s) in Table 1? ☑ Yes ☐ No
   b. With the proposed project, is there predicted to be a substantial design year noise level increase of 10 dB(A) or more at Activity Category A, B, C, D, or E receptor(s)? ☐ Yes ☑ No

c. With the proposed project, are design year noise levels predicted to be less than existing noise levels, but still approach or exceed the NAC levels in Table 1 for the relevant Activity Category? ☐ Yes ☑ No

Feasibility – Questions 1c through 7 must all be answered "yes" for a noise barrier to be determined to be feasible.

1. Impacted receptor units
   a. Total number of impacted receptor units: 1
   b. Percentage of impacted receptor units receiving 5 dB(A) or more insertion loss: 0% (0 benefited receptors)
   c. Is the percentage 50 or greater? ☐ Yes ☑ No
2. Can the noise wall be designed and physically constructed at the proposed location? ☑ Yes ☐ No
3. Can the noise wall be constructed without causing a safety problem? ☑ Yes ☐ No
4. Can the noise wall be constructed without restricting access to vehicular or pedestrian travel? ☑ Yes ☐ No
5. Can the noise wall be constructed in a manner that allows for access for required maintenance and inspection operations? ☑ Yes ☐ No
6. Can the noise wall be constructed in a manner that permits utilities to function in a normal manner? ☑ Yes ☐ No
7. Can the noise wall be constructed in a manner that permits drainage features to function in a normal manner? ☑ Yes ☐ No

Reasonableness

1. Community Desires Related to the Barrier
   a. Do at least 50 percent of the responding benefited receptor unit owner(s) and renters desire the noise wall? If yes, continue with Reasonableness questions. If no, the noise wall can be considered not to be reasonable. Proceed to "Decision" block and answer "no" to reasonableness question. As the reason for this decision, state that "The majority of the benefited receptor unit owners do not desire the noise wall." ☐ Yes ☐ No N/A

2. Square Footage Per Benefited Receptor (SF/BR) Evaluation
   a. Area (SF) of the proposed noise wall N/A
   b. Number of benefited receptor units (any unit receiving 5 dB(A) or more insertion loss) N/A
   c. SF/BR = 2a/2b N/A
   d. Is 2c less than or equal to the MaxSF/BR value of 2000? ☐ Yes ☐ No N/A

3. Noise Reduction Design Goals (Activity Categories A, B, C, and E) A "yes" answer is required to Question 3a. for the noise wall to be determined to be reasonable. Questions 3b through 3e represent desirable goals that need not be met for a noise wall to be determined reasonable. However, they must be addressed and should be considered in the determination of the recommended noise wall.

   a. Does the noise wall reduce design year exterior_noise levels by at least 7 dB(A) for at least one benefited receptor? ☐ Yes ☐ No

   b. Does the noise wall provide an insertion loss of at least 7 dB(A) for more receptors than required under 3a.while still conforming to the MaxSF/BR value of 2,000 and a "point of diminishing returns" evaluation? ☐ Yes ☐ No

   c. Does the noise wall provide insertion losses of greater than 7 dB(A) while still conforming to the MaxSF/BR value of 2,000 and a "point of diminishing returns" evaluation? ☐ Yes ☐ No N/A

   d. Does the noise wall reduce future exterior levels to the low-60-decibel range (60-63) for Category B and C receptors and the upper-60 dB(A) range (65-68) for Category E receptors? ☐ Yes ☐ No

   e. Does the noise wall reduce design year noise levels back to existing levels? ☐ Yes ☐ No

4. Noise Reduction Design Goals (Activity Category D) A "yes" answer is required to Question 4a. for the barrier to be determined to be reasonable. Question 4b represents a desirable goal that need not be met for a noise wall to be determined reasonable. However, this goal must be addressed and should be considered in the determination of the recommended noise wall.

   a. Does noise wall reduce design year interior_noise levels by at least 7 dB(A) for the facility's analysis point? ☐ Yes ☐ No

   b. While conforming to the MaxSF/BR criteria and justified by a "point of diminishing returns' evaluation, does the noise wall provide an interior insertion loss above the 7 dB(A) minimum ☐ Yes ☐ No N/A

Decision

Is the Noise Wall WARRANTED? ☑ Yes ☐ No

Is the Noise Wall FEASIBLE? ☐ Yes ☑ No

Is the Noise Wall REASONABLE? ☐ Yes ☑ No

Additional Reasons for Decision:

Less than 50% of impacted receptors will be benefitted. Therefore, this noise barrier is not feasible.

Responsible/Qualified Individuals Making the Above Decisions

_____ Date:_____

PennDOT, Engineering District Environmental Manager

Matthew Shriffer, Noise & Vibration Specialist, AECOM Date: 11/06/15

Qualified Professional Performing the Analysis
(name, title, and company name)

Highway Traffic Noise Abatement
Warranted, Feasible, and Reasonable Worksheet – Noise Wall

Date 11/06/15
Project Name Reconstruction and Widening of the Pennsylvania Turnpike (I-76) from Milepost 298 to Milepost 302.5
County Berks & Chester
SR, Section I-76 MP 298 - MP 302
Community Name and/or NSA # NSA 7
Noise Wall Identification (i.e., Wall 1) Barrier 7

General

1. Type of project (new location, reconstruction, etc.): Reconstruction & Widening

2. Total number of impacted receptor units in community
   - Category A units impacted: 0
   - Category B units impacted: 3.92 (using ERU values for golf course receptors)
   - Category C units impacted: 0
   - Category D units impacted (if interior analysis required): 0
   - Category E units impacted: 0

Warranted

1. Community Documentation
   a. Date community was permitted (for new developments or developments planned for or under construction): N/A
   b. Date of approval for the Categorical Exclusion (CE), Record of Decision (ROD), or Finding of No Significant Impact (FONSI): N/A
   c. Does the date in 1.a precede the date in 1.b? If yes, proceed to Warranted Item 2. If no, consideration of noise abatement is not warranted. Proceed to "Decision" block and answer "no" to warranted question. As the reason for this decision, state that "Community was permitted after the date of approval of *CE, ROD, or FONSI, as appropriate*." ☐ Yes ☐ No N/A

2. Criteria requiring consideration of noise abatement (note N/A if category is not impacted or present or analysis not required). A "yes" answer to any of the following three questions requires the consideration of noise abatement.
   a. With the proposed project, are design year noise levels predicted to approach or exceed the NAC level(s) in Table 1? ☑ Yes ☐ No
   b. With the proposed project, is there predicted to be a substantial design year noise level increase of 10 dB(A) or more at Activity Category A, B, C, D, or E receptor(s)? ☐ Yes ☑ No

c. With the proposed project, are design year noise levels predicted to be less than existing noise levels, but still approach or exceed the NAC levels in Table 1 for the relevant Activity Category? ☐ Yes ☑ No

Feasibility – Questions 1c through 7 must all be answered "yes" for a noise barrier to be determined to be feasible.

1. Impacted receptor units
   a. Total number of impacted receptor units: 3.92
   b. Percentage of impacted receptor units receiving 5 dB(A) or more insertion loss: 100%
   c. Is the percentage 50 or greater? ☑ Yes ☐ No
2. Can the noise wall be designed and physically constructed at the proposed location? ☑ Yes ☐ No
3. Can the noise wall be constructed without causing a safety problem? ☑ Yes ☐ No
4. Can the noise wall be constructed without restricting access to vehicular or pedestrian travel? ☑ Yes ☐ No
5. Can the noise wall be constructed in a manner that allows for access for required maintenance and inspection operations? ☑ Yes ☐ No
6. Can the noise wall be constructed in a manner that permits utilities to function in a normal manner? ☑ Yes ☐ No
7. Can the noise wall be constructed in a manner that permits drainage features to function in a normal manner? ☑ Yes ☐ No

Reasonableness

1. Community Desires Related to the Barrier
   a. Do at least 50 percent of the responding benefited receptor unit owner(s) and renters desire the noise wall? If yes, continue with Reasonableness questions. If no, the noise wall can be considered not to be reasonable. Proceed to "Decision" block and answer "no" to reasonableness question. As the reason for this decision, state that "The majority of the benefited receptor unit owners do not desire the noise wall." ☐ Yes ☐ No TBD

2. Square Footage Per Benefited Receptor (SF/BR) Evaluation
   a. Area (SF) of the proposed noise wall 25,200
   b. Number of benefited receptor units (any unit receiving 5 dB(A) or more insertion loss) 5.20
   c. SF/BR = 2a/2b 4,846
   d. Is 2c less than or equal to the MaxSF/BR value of 2000? ☐ Yes ☑ No

3. Noise Reduction Design Goals (Activity Categories A, B, C, and E) A "yes" answer is required to Question 3a. for the noise wall to be determined to be reasonable. Questions 3b through 3e represent desirable goals that need not be met for a noise wall to be determined reasonable. However, they must be addressed and should be considered in the determination of the recommended noise wall.

   a. Does the noise wall reduce design year exterior_noise levels by at least 7 dB(A) for at least one benefited receptor? ☑ Yes ☐ No

   b. Does the noise wall provide an insertion loss of at least 7 dB(A) for more receptors than required under 3a.while still conforming to the MaxSF/BR value of 2,000 and a "point of diminishing returns" evaluation? ☐ Yes ☑ No

   c. Does the noise wall provide insertion losses of greater than 7 dB(A) while still conforming to the MaxSF/BR value of 2,000 and a "point of diminishing returns" evaluation? ☐ Yes ☑ No

   d. Does the noise wall reduce future exterior levels to the low-60-decibel range (60-63) for Category B and C receptors and the upper-60 dB(A) range (65-68) for Category E receptors? ☐ Yes ☑ No

   e. Does the noise wall reduce design year noise levels back to existing levels? ☑ Yes ☐ No

4. Noise Reduction Design Goals (Activity Category D) A "yes" answer is required to Question 4a. for the barrier to be determined to be reasonable. Question 4b represents a desirable goal that need not be met for a noise wall to be determined reasonable. However, this goal must be addressed and should be considered in the determination of the recommended noise wall.

   a. Does noise wall reduce design year interior_noise levels by at least 7 dB(A) for the facility's analysis point? ☐ Yes ☐ No N/A

   b. While conforming to the MaxSF/BR criteria and justified by a "point of diminishing returns' evaluation, does the noise wall provide an interior insertion loss above the 7 dB(A) minimum ☐ Yes ☐ No

Decision

Is the Noise Wall WARRANTED? ☑ Yes ☐ No

Is the Noise Wall FEASIBLE? ☑ Yes ☐ No

Is the Noise Wall REASONABLE? ☐ Yes ☑ No

Additional Reasons for Decision:

The noise barrier exceeds the max BR/SF value of 2,000. Therefore, it is not reasonable.

Responsible/Qualified Individuals Making the Above Decisions

_____ Date:_____

PennDOT, Engineering District Environmental Manager

Matthew Shriffer, Noise & Vibration Specialist, AECOM Date: 11/06/15

Qualified Professional Performing the Analysis
(name, title, and company name)

Highway Traffic Noise Abatement
Warranted, Feasible, and Reasonable Worksheet – Noise Wall

Date 11/06/15
Project Name Reconstruction and Widening of the Pennsylvania Turnpike (I-76) from Milepost 298 to Milepost 302.5
County Berks & Chester
SR, Section I-76 MP 298 - MP 302
Community Name and/or NSA # NSA 8
Noise Wall Identification (i.e., Wall 1) N/A

General

1. Type of project (new location, reconstruction, etc.): Reconstruction & Widening

2. Total number of impacted receptor units in community
   - Category A units impacted: 0
   - Category B units impacted: 0
   - Category C units impacted: 0
   - Category D units impacted (if interior analysis required): 0
   - Category E units impacted: 0

Warranted

1. Community Documentation
   a. Date community was permitted (for new developments or developments planned for or under construction): N/A
   b. Date of approval for the Categorical Exclusion (CE), Record of Decision (ROD), or Finding of No Significant Impact (FONSI): N/A
   c. Does the date in 1.a precede the date in 1.b? If yes, proceed to Warranted Item 2. If no, consideration of noise abatement is not warranted. Proceed to "Decision" block and answer "no" to warranted question. As the reason for this decision, state that "Community was permitted after the date of approval of *CE, ROD, or FONSI, as appropriate*." ☐ Yes ☐ No ☒ N/A

2. Criteria requiring consideration of noise abatement (note N/A if category is not impacted or present or analysis not required). A "yes" answer to any of the following three questions requires the consideration of noise abatement.
   a. With the proposed project, are design year noise levels predicted to approach or exceed the NAC level(s) in Table 1? ☐ Yes ☑ No
   b. With the proposed project, is there predicted to be a substantial design year noise level increase of 10 dB(A) or more at Activity Category A, B, C, D, or E receptor(s)? ☐ Yes ☑ No

c. With the proposed project, are design year noise levels predicted to be less than existing noise levels, but still approach or exceed the NAC levels in Table 1 for the relevant Activity Category? ☐ Yes ☑ No

Feasibility – Questions 1c through 7 must all be answered "yes" for a noise barrier to be determined to be feasible.

1. Impacted receptor units
   a. Total number of impacted receptor units: N/A
   b. Percentage of impacted receptor units receiving 5 dB(A) or more insertion loss: N/A
   c. Is the percentage 50 or greater? ☐ Yes ☐ No
2. Can the noise wall be designed and physically constructed at the proposed location? ☐ Yes ☐ No
3. Can the noise wall be constructed without causing a safety problem? ☐ Yes ☐ No
4. Can the noise wall be constructed without restricting access to vehicular or pedestrian travel? ☐ Yes ☐ No N/A
5. Can the noise wall be constructed in a manner that allows for access for required maintenance and inspection operations? ☐ Yes ☐ No
6. Can the noise wall be constructed in a manner that permits utilities to function in a normal manner? ☐ Yes ☐ No
7. Can the noise wall be constructed in a manner that permits drainage features to function in a normal manner? ☐ Yes ☐ No

Reasonableness

1. Community Desires Related to the Barrier
   a. Do at least 50 percent of the responding benefited receptor unit owner(s) and renters desire the noise wall? If yes, continue with Reasonableness questions. If no, the noise wall can be considered not to be reasonable. Proceed to "Decision" block and answer "no" to reasonableness question. As the reason for this decision, state that "The majority of the benefited receptor unit owners do not desire the noise wall." ☐ Yes ☐ No

2. Square Footage Per Benefited Receptor (SF/BR) Evaluation
   a. Area (SF) of the proposed noise wall N/A
   b. Number of benefited receptor units (any unit receiving 5 dB(A) or more insertion loss) N/A
   c. SF/BR = 2a/2b N/A
   d. Is 2c less than or equal to the MaxSF/BR value of 2000? ☐ Yes ☐ No N/A

3. Noise Reduction Design Goals (Activity Categories A, B, C, and E) A "yes" answer is required to Question 3a. for the noise wall to be determined to be reasonable. Questions 3b through 3e represent desirable goals that need not be met for a noise wall to be determined reasonable. However, they must be addressed and should be considered in the determination of the recommended noise wall.

   a. Does the noise wall reduce design year exterior_noise levels by at least 7 dB(A) for at least one benefited receptor? ☐ Yes ☐ No

   b. Does the noise wall provide an insertion loss of at least 7 dB(A) for more receptors than required under 3a.while still conforming to the MaxSF/BR value of 2,000 and a "point of diminishing returns" evaluation? ☐ Yes ☐ No

   c. Does the noise wall provide insertion losses of greater than 7 dB(A) while still conforming to the MaxSF/BR value of 2,000 and a "point of diminishing returns" evaluation? ☐ Yes ☐ No N/A

   d. Does the noise wall reduce future exterior levels to the low-60-decibel range (60-63) for Category B and C receptors and the upper-60 dB(A) range (65-68) for Category E receptors? ☐ Yes ☐ No

   e. Does the noise wall reduce design year noise levels back to existing levels? ☐ Yes ☐ No

4. Noise Reduction Design Goals (Activity Category D) A "yes" answer is required to Question 4a. for the barrier to be determined to be reasonable. Question 4b represents a desirable goal that need not be met for a noise wall to be determined reasonable. However, this goal must be addressed and should be considered in the determination of the recommended noise wall.

   a. Does noise wall reduce design year interior_noise levels by at least 7 dB(A) for the facility's analysis point? ☐ Yes ☐ No

   b. While conforming to the MaxSF/BR criteria and justified by a "point of diminishing returns' evaluation, does the noise wall provide an interior insertion loss above the 7 dB(A) minimum ☐ Yes ☐ No N/A

Decision

Is the Noise Wall WARRANTED? ☐ Yes ☑ No

Is the Noise Wall FEASIBLE? ☐ Yes ☐ No

Is the Noise Wall REASONABLE? ☐ Yes ☐ No

Additional Reasons for Decision:

Predicted noise levels do not approach or exceed the NAC criteria at any receptors in this NSA. Therefore, mitigation is not warranted.

Responsible/Qualified Individuals Making the Above Decisions

_____ Date:_____

PennDOT, Engineering District Environmental Manager

Matthew Shriffer, Noise & Vibration Specialist, AECOM Date: 11/06/15

Qualified Professional Performing the Analysis
(name, title, and company name)

Highway Traffic Noise Abatement
Warranted, Feasible, and Reasonable Worksheet – Noise Wall

Date 11/06/15
Project Name Reconstruction and Widening of the Pennsylvania Turnpike (I-76) from Milepost 298 to Milepost 302.5
County Berks & Chester
SR, Section I-76 MP 298 - MP 302
Community Name and/or NSA # NSA 9
Noise Wall Identification (i.e., Wall 1) Barrier 9

General

1. Type of project (new location, reconstruction, etc.): Reconstruction & Widening

2. Total number of impacted receptor units in community
   - Category A units impacted: 0
   - Category B units impacted: 1
   - Category C units impacted: 0
   - Category D units impacted (if interior analysis required): 0
   - Category E units impacted: 0

Warranted

1. Community Documentation
   a. Date community was permitted (for new developments or developments planned for or under construction): N/A
   b. Date of approval for the Categorical Exclusion (CE), Record of Decision (ROD), or Finding of No Significant Impact (FONSI): N/A
   c. Does the date in 1.a precede the date in 1.b? If yes, proceed to Warranted Item 2. If no, consideration of noise abatement is not warranted. Proceed to "Decision" block and answer "no" to warranted question. As the reason for this decision, state that "Community was permitted after the date of approval of *CE, ROD, or FONSI, as appropriate*." ☐ Yes ☐ No N/A

2. Criteria requiring consideration of noise abatement (note N/A if category is not impacted or present or analysis not required). A "yes" answer to any of the following three questions requires the consideration of noise abatement.
   a. With the proposed project, are design year noise levels predicted to approach or exceed the NAC level(s) in Table 1? ☑ Yes ☐ No
   b. With the proposed project, is there predicted to be a substantial design year noise level increase of 10 dB(A) or more at Activity Category A, B, C, D, or E receptor(s)? ☐ Yes ☑ No

c. With the proposed project, are design year noise levels predicted to be less than existing noise levels, but still approach or exceed the NAC levels in Table 1 for the relevant Activity Category? ☐ Yes ☑ No

Feasibility – Questions 1c through 7 must all be answered "yes" for a noise barrier to be determined to be feasible.

1. Impacted receptor units
   a. Total number of impacted receptor units: 1
   b. Percentage of impacted receptor units receiving 5 dB(A) or more insertion loss: 100% (1 benefited receptor)
   c. Is the percentage 50 or greater? ☑ Yes ☐ No
2. Can the noise wall be designed and physically constructed at the proposed location? ☑ Yes ☐ No
3. Can the noise wall be constructed without causing a safety problem? ☑ Yes ☐ No
4. Can the noise wall be constructed without restricting access to vehicular or pedestrian travel? ☑ Yes ☐ No
5. Can the noise wall be constructed in a manner that allows for access for required maintenance and inspection operations? ☑ Yes ☐ No
6. Can the noise wall be constructed in a manner that permits utilities to function in a normal manner? ☑ Yes ☐ No
7. Can the noise wall be constructed in a manner that permits drainage features to function in a normal manner? ☑ Yes ☐ No

Reasonableness

1. Community Desires Related to the Barrier
   a. Do at least 50 percent of the responding benefited receptor unit owner(s) and renters desire the noise wall? If yes, continue with Reasonableness questions. If no, the noise wall can be considered not to be reasonable. Proceed to "Decision" block and answer "no" to reasonableness question. As the reason for this decision, state that "The majority of the benefited receptor unit owners do not desire the noise wall." ☐ Yes ☐ No TBD

2. Square Footage Per Benefited Receptor (SF/BR) Evaluation
   a. Area (SF) of the proposed noise wall 2,800
   b. Number of benefited receptor units (any unit receiving 5 dB(A) or more insertion loss) 1
   c. SF/BR = 2a/2b 2,800
   d. Is 2c less than or equal to the MaxSF/BR value of 2000? ☐ Yes ☑ No

3. Noise Reduction Design Goals (Activity Categories A, B, C, and E) A "yes" answer is required to Question 3a. for the noise wall to be determined to be reasonable. Questions 3b through 3e represent desirable goals that need not be met for a noise wall to be determined reasonable. However, they must be addressed and should be considered in the determination of the recommended noise wall.

   a. Does the noise wall reduce design year exterior_noise levels by at least 7 dB(A) for at least one benefited receptor? ☐ Yes ☑ No

   b. Does the noise wall provide an insertion loss of at least 7 dB(A) for more receptors than required under 3a.while still conforming to the MaxSF/BR value of 2,000 and a "point of diminishing returns" evaluation? ☐ Yes ☑ No

   c. Does the noise wall provide insertion losses of greater than 7 dB(A) while still conforming to the MaxSF/BR value of 2,000 and a "point of diminishing returns" evaluation? ☐ Yes ☑ No

   d. Does the noise wall reduce future exterior levels to the low-60-decibel range (60-63) for Category B and C receptors and the upper-60 dB(A) range (65-68) for Category E receptors? ☐ Yes ☑ No

   e. Does the noise wall reduce design year noise levels back to existing levels? ☑ Yes ☐ No

4. Noise Reduction Design Goals (Activity Category D) A "yes" answer is required to Question 4a. for the barrier to be determined to be reasonable. Question 4b represents a desirable goal that need not be met for a noise wall to be determined reasonable. However, this goal must be addressed and should be considered in the determination of the recommended noise wall.

   a. Does noise wall reduce design year interior_noise levels by at least 7 dB(A) for the facility's analysis point? ☐ Yes ☐ No N/A

   b. While conforming to the MaxSF/BR criteria and justified by a "point of diminishing returns' evaluation, does the noise wall provide an interior insertion loss above the 7 dB(A) minimum ☐ Yes ☐ No

Decision

Is the Noise Wall WARRANTED? ☑ Yes ☐ No

Is the Noise Wall FEASIBLE? ☑ Yes ☐ No

Is the Noise Wall REASONABLE? ☐ Yes ☑ No

Additional Reasons for Decision:

The noise barrier exceeds the max BR/SF value of 2,000. Therefore, it is not reasonable.

Responsible/Qualified Individuals Making the Above Decisions

_____ Date:_____

PennDOT, Engineering District Environmental Manager

Matthew Shriffer, Noise & Vibration Specialist, AECOM Date: 11/06/15

Qualified Professional Performing the Analysis
(name, title, and company name)

ERU Calculation for French Creek Golf Course
NSA 7 - Barrier 7

Days open per year	250	days	
Hours open per day	9	hours	
Average persons per group	3.7	people	
Average length of golf round	4.25	hours	
Tee-time increment	0.75	hours	
Person-hours for equivalent single-family residential dwelling	13,578	hours	
Number of groups per day (hours open divided by tee-time)	9 / 0.75	12	groups
Total number of people per day (groups multiplied by average persons per group)	12 x 3.7	44.4	people
Person-hours per day (total people per day multiplied length of golf round)	44.4 x 4.25	188.7	hours
Person-hours per year (person-hours per day multiplied days open per year)	188.7 x 250	47175	hours
Single-family dwelling reference (PennDOT Pub 24)	47,175 / 13,578	3.47	hours
Divided equally among 11 established grid receptors	3.47 / 11	**0.32**	**ERU value per receptor**

Appendix G. Traffic Noise Model (TNM 2.5) Files

(Attached as CD-R)

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