PRELIMINARY ENGINEERING NOISE ANALYSIS REPORT



Pennsylvania Turnpike Commission SAP Contract No. 4400003204 WBS Element A-037.50T001-2 Full-Depth Roadway Reconstruction MP-A38 to MP-A44 Montgomery and Bucks Counties, Pennsylvania

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Widening the Northeast Extension (I-476) from MP A38 to MP A44 Bucks and Montgomery Counties PRELIMINARY ENGINEERING NOISE ANALYSIS

November 2014

Executive Summary

The Pennsylvania Turnpike Commission (PTC) proposes to reconstruct its Northeast Extension toll road. The proposed project entails the full depth reconstruction and widening of the Pennsylvania Turnpike Northeast Extension (I-476) from approximately Milepost (MP) A38 to MP A44 and the reconstruction of the Quakertown Interchange. The project will result in widening I-476 from four (4) travel lanes to six (6) travel lanes with full, twelve (12) -foot left and right-hand shoulders. The proposed widening consists of approximately seven (7) miles of roadway and will include full depth roadway reconstruction, widening of mainline bridges and medians, the replacement of overhead bridges, culvert extensions, drainage modifications, construction of storm water management facilities, and necessary horizontal or vertical adjustments to approach roadways associated with modified overhead bridges. Construction would generally follow the existing centerline. The study corridor traverses Salford Township in Montgomery County and West Rockhill and Milford Townships in Bucks County, Pennsylvania. Noise abatement has been evaluated for the noise study areas which meet the Pennsylvania Department of Transportation (PennDOT) and Federal Highway Administration (FHWA) criteria for Type I noise abatement.

For analysis purposes, the project study area was divided into fifteen (15) Noise Study Areas (NSAs) as shown in Figures 2A through 2L. Noise measurements and concurrent traffic counts were conducted in all NSAs and are reported in Table 2. Based on the evaluation of existing and future noise levels and the noise abatement criteria (NAC) described in Table 1, project-related noise impacts were identified in all NSAs except NSAs 3 and 11.

Based on the evaluation of the noise levels associated with the preliminary engineering plans developed to date, noise abatement features were determined to be feasible and reasonable within NSA 12. Various noise barrier options were considered and evaluated in terms of abatement feature lengths, heights and costs. This process resulted in the development of the following feasible and reasonable noise barriers along I-476:

• NSA 12 Barrier – A noise barrier averaging 18.9 feet in height along I-476 Southbound, with a length of approximately 1,159 feet.

Introduction

The Pennsylvania Turnpike Commission (PTC) proposes to reconstruct its Northeast Extension toll road. The proposed project entails the full depth reconstruction and widening of the Pennsylvania Turnpike Northeast Extension (I-476) from approximately Milepost (MP) A38 to MP A44 and the reconstruction of the Quakertown Interchange. The project will result in widening I-476 from four (4) travel lanes to six (6) travel lanes with full, twelve (12) -foot left and right-hand shoulders. The proposed widening consists of approximately seven (7) miles of roadway and will include full depth roadway reconstruction, widening of mainline bridges and medians, the replacement of overhead bridges, culvert extensions, drainage modifications, construction of storm water management facilities, and necessary horizontal or vertical adjustments to approach roadways associated with modified overhead bridges. Construction would generally follow the existing centerline. The study corridor traverses Salford Township in Montgomery County and West Rockhill and Milford Townships in Bucks County, Pennsylvania. Noise abatement has been evaluated for the noise study areas which meet the Pennsylvania Department of Transportation (PennDOT) and Federal Highway Administration (FHWA) criteria for Type I noise abatement. The project location and the study area are depicted in Figure 1.

PennDOT Noise Abatement Criteria (NAC), described in Table 1, for specific land use activities were used in the evaluation of traffic noise impacts. These criteria are based on criteria established in Title 23 Code of Federal Regulations, Part 772, U.S. Department of Transportation, Federal Highway Administration (FHWA), *Procedures for Abatement of Highway Traffic Noise and Construction Noise*, and guidelines for "increase over existing" noise levels as set forth in PennDOT Publication *Project Level Highway Traffic Noise Handbook Publication No.24*, dated December, 2013. Predicted noise levels were determined using Version 2.5 of the FHWA Traffic Noise Model (FHWA TNM).

The noise level descriptor used for this project was the hourly equivalent noise level $(L_{eq}(h))$. $L_{eq}(h)$ is the steady state, A-weighted sound level, which contains the same amount of acoustic energy as the actual time-varying A-weighted noise level over a one-hour period. The FHWA and PennDOT define noise impact based upon seven activity categories, as identified in Table 1. Individual sites located within a given activity category are designated as noise sensitive receptors.

Noise impacts were also evaluated by comparing the predicted noise levels with existing noise levels. A noise impact was identified if the future (year 2039) noise level was predicted to equal or exceed 66 dB(A) or if future noise levels within the project were predicted to cause a substantial noise increase (\geq 10 dB(A)) as compared to existing noise levels.

Noise Study Areas

For noise analysis purposes, the project study area was divided into the following noise study areas (NSAs) as shown in Figure 2A through 2L:

NSA 1: Activity Category B land uses are located adjacent to the northbound travel lanes (east side) of I-476, from Clump Road to approximately 1,300 feet north of Wambold Road. See Figures 2A and 2B.

NSA 2: Activity Category B land uses are located adjacent to the southbound travel lanes (west side) of I-476, from Badman Road to Reller Road. See Figures 2A and 2B.

NSA 3: Activity Category B land uses are located adjacent to the northbound travel lanes (east side) of I-476, from south of Skymount Road to Upper Ridge Road. See Figure 2D.

NSA 4: Activity Category B and C land uses are located adjacent to the southbound travel lanes (west side) of the I-476, from South of Skymount Road to Upper Ridge Road. See Figures 2C and 2D.

NSA 5: Activity Category B land uses are located adjacent to the northbound travel lanes (east side) of I-476, from Upper Ridge Road to Trumbauersville Road. See Figures 2D and 2E.

NSA 6: Activity Category B land uses are located adjacent to the southbound travel lanes (west side) of the I-476, from Upper Ridge Road to Trumbauersville Road. See Figures 2D and 2E.

NSA 7: An Activity Category C land use (Fox Hollow golf course) is located adjacent to the northbound travel lanes (east side) of I-476. See Figure 2F.

NSA 8: Activity Category B land uses are located adjacent to the southbound travel lanes (west side) of I-476, from north of Trumbauersville Road to Doerr Road. See Figures 2F and 2G.

NSA 9: Activity Category B land uses are located adjacent to the northbound travel lanes (east side) of I-476, from north of Kumry Road to 2,500 feet north of Kumry Road. See Figure 2H.

NSA 10: Activity Category B and C land uses are located adjacent to the southbound travel lanes (west side) of I-476, from Doerr Road to John Fries Highway. See Figures 2H, 2I and 2K.

NSA 11: An Activity Category E land use (motel) is located adjacent to the northbound travel lanes (east side) of I-476, adjacent to John Fries Highway. See Figure 2J.

NSA 12: Activity Category B land uses are located adjacent to the southbound travel lanes (west side) of I-476 on Red Bud Road within the Spinnerstown Crossing subdivision. See Figure 2K.

NSA 13: Activity Category B land uses are located adjacent to the northbound travel lanes (east side) of I-476, from 350 feet south of Steinsburg Road to Steinsburg Road. See Figure 2L.

NSA 14: Activity Category B land uses are located adjacent to the southbound travel lanes (west side) of I-476, from Steinsburg Road to approximately 2,700 feet north of Steinsburg Road. See Figure 2L.

NSA 15: Activity Category B land uses are located adjacent to the northbound travel lanes (east side) of I-476, from Steinsburg Road to approximately 2,200 feet north of Steinsburg Road. See Figure 2L.

Noise Measurements and Model Validation

Ambient noise measurements were conducted throughout the project study area. Within each of the above NSAs, short-term (20 minute duration) noise measurements were taken along with concurrent traffic counts at 36 locations using American National Standards Association (ANSI) Type I noise meters. See Appendix A for field data sheets. Calibration certificates related to noise meters and calibrators are contained in Appendix B.

It should be noted that short-term measurements were taken at various times of the day between June 5 and 25, 2013 and did not necessarily represent the noisiest condition at any particular measurement site (receiver¹). In addition, measurement sites were positioned in order to enable validation of the noise prediction model and to assist in defining existing noise levels for second-row residences and for receivers located approximately 500 feet from I-476. As such, in certain locations, noise measurement sites do not exactly correspond with noise analysis sites (receivers). Measurements were used primarily for purposes of noise model validation, with year 2014 peak hour traffic volumes assumed in the prediction of worst-case existing noise levels. Measured existing Leq noise levels at short-term measurement sites (receptors) ranged from 56 to 69 dB(A).

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¹*In this report, the term "receptor" is used to represent a dwelling unit, or in the case of an Activity Category C non-residential land use, an equivalent residential receptor (ERU. The term "receiver" is used to describe a particular analysis point in the FHWA TNM. It is important to note that, while in most cases one receiver represents one receptor, there are locations identified in this report where a receiver represents more than one receptor. These locations are identified in the various tables, where the "Receptor ID" column represents the FHWA TNM receiver point and the "Number of Units" column represents the number of receptors represented by that receiver.

Using the traffic data obtained concurrently with the short-term noise measurements, noise levels were modeled and compared to measured noise levels. Existing short-term measured noise levels and hourly traffic data based on concurrent traffic counts are summarized in Table 2, with field measurement data sheets contained in Appendix A. Validation results are shown in Table 3, with FHWA TNM validation data files included on the CD-ROM which accompanies this report. Measured versus modeled noise levels were within the acceptable 3 dB(A) range for all sites evaluated, except Site M9-2 due to loud noise from expansion joints. The results of the validation process was used to "build" the FHWA TNM used for purposes of modeling existing and future year noise levels, determining future year impacts, and evaluating potential noise abatement options.

Noise Modeling

The model used to predict worst case existing and future noise levels and to evaluate noise abatement options was the FHWA's TNM, Version 2.5. The FHWA TNM predicts noise levels at selected locations based on traffic data, roadway design, topographic features, and the relationship of the analysis site (receiver) to nearby roadways. Traffic data used for prediction of existing (year 2014) and future (year 2039) noise levels for both nobarrier and barrier conditions is contained in Appendix C. In addition, it was assumed that the Future No-Build and Future Build traffic are similar. The percentages of automobiles, medium trucks, and heavy trucks used in the FHWA TNM modeling process were developed from review of traffic classification data obtained during the noise measurement periods corresponding to the periods of highest noise levels.

Evaluation of Noise Impacts

Consideration of noise abatement is required if noise levels are approaching or exceeding 67 dB(A) (66 dB(A) or higher) or create a substantial noise increase (10 dB(A)) in Pennsylvania. The future year noise levels were compared to the absolute NAC levels (66 dB(A)) and to the increases over existing year noise levels using PennDOT's NAC to determine if there would be any noise impacts. These comparisons are contained in the noise summary tables for each NSA, with the noise measurement sites and analysis sites (receivers) indicated within each NSA. Noise impacts were identified in each NSA based on predicted exterior noise levels exceeding the absolute 66 dB(A) criteria level for Activity Category land uses B and C and the absolute 71 dB(A) criteria level for Activity Category land use E. "Increase over existing" noise levels were generally the result of normal traffic growth predicted to occur between 2014 and 2039.

In addition to their use in evaluating noise impacts, noise analysis sites (receivers) were used in the consideration of noise abatement for noise sensitive receptors within each NSA. Abatement measures such as traffic management devices and roadway realignment were determined not to be feasible since the purpose of the project is to widen along the existing alignment and any traffic management techniques would be contrary to the efficient functioning of I-476 as an Interstate highway. In addition, the topography and

development in the area does not lend itself to the use of noise berms as an effective noise abatement technique. Therefore, noise abatement evaluations focused on the design of noise barrier walls.

Consideration of noise abatement was required in all NSAs (except NSAs 3 and 11) due to noise levels approaching or exceeding 67 dB(A) (66 dB(A) or higher). Under PennDOT noise criteria, feasible noise barriers are those that provide at least 5 dB(A) of noise reduction for at least 50% of impacted receptors, while posing no safety, engineering, maintenance, constructability, drainage, or utility impacts or access restrictions. If determined to be feasible, a barrier was then evaluated for reasonableness. For a barrier to be reasonable based on PennDOT noise criteria, it must be cost-effective (square footage per benefited residential receptor (SF/BR) must be less than or equal to 2000), and the desires of the affected property owners and residents must be considered. Receptors are considered to be benefited if they receive 5 dB(A) or more noise reduction (insertion loss) from a barrier. To meet PennDOT's reasonableness criteria, a barrier must achieve at least a 7 dB(A) noise reduction at one receptor.

A summary of abatement considerations within each NSA follows. See referenced tables for more details related to all barrier options considered.

NSA 1 (See Figures 2A, 2B and Table 4): Five of the seven receptors evaluated within this NSA were predicted to have levels at or above 66 dB(A) with the Build Alternative. As such, consideration of noise abatement within this NSA was warranted.

The following five abatement options were considered for NSA 1:

- Case 1 consisted of a 10 feet high wall and was determined to be feasible (≥5 dB(A) insertion loss provided for 80% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was achieved but square footage per benefited receptor SF/BR was 10,758 > 2000).
- Case 2 consisted of a 12 feet high wall and was determined to be feasible (≥5 dB(A) insertion loss provided for 100% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was achieved but square footage per benefited receptor SF/BR 10,327 > 2000).
- Case 3 consisted of a shorter 10 feet high wall and was determined to be feasible (≥5 dB(A) insertion loss provided for 80% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was achieved but square footage per benefited receptor SF/BR 6,003 > 2000).
- Case 4 consisted of a shorter 8 feet high wall and was determined to be not feasible (>5 dB(A) insertion loss provided for 40% of impacted receptors).
- Case 5 consisted of an optimizing of Case 4 and was determined to be feasible (>5

dB(A) insertion loss provided for 80% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was achieved but square footage per benefited receptor SF/BR 5,751 > 2000).

NSA 2 (See Figure 2A, 2B and Table 5): One of the four receptors evaluated within this NSA was predicted to have levels at or above 66 dB(A) with the Build Alternative. As such, consideration of noise abatement within this NSA was warranted.

The following three abatement options were considered for NSA 2:

- Case 1 consisted of a 10 feet high wall and was determined to be feasible (≥5 dB(A) insertion loss provided for 100% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was achieved but square footage per benefited receptor SF/BR 27,535 > 2000).
- Case 2 consisted of a shorter 10 feet high wall and was determined to be feasible (≥5 dB(A) insertion loss provided for 100% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was achieved but square footage per benefited receptor SF/BR 7,002 > 2000).
- Case 3 consisted of an optimizing of Case 2 and was determined to be feasible (≥5 dB(A) insertion loss provided for 100% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was achieved but square footage per benefited receptor SF/BR 6,602 > 2000).

NSA 3 (See Figures 2C, 2D and Table 6): The receptor representative of the property within this NSA was not predicted to have levels at or above 66 dB(A) and was not predicted to create a substantial noise increase of 10 dB(A) with the Build Alternative. Therefore consideration of abatement is not required for this NSA.

NSA 4 (See Figure 2C, 2D and Table 7): One of the six receptors evaluated within this NSA are predicted to have levels at or above 66 dB(A) with the Build Alternative. As such, consideration of noise abatement within this NSA was warranted.

The following three abatement options were considered for NSA 4:

- Case 1 consisted of a 10 feet high wall and was determined to be not feasible (≥5 dB(A) insertion loss not provided for the lone impacted receptor).
- Case 2 consisted of a 14 feet high wall and was determined to be not feasible (≥5 dB(A) insertion loss not provided for the lone impacted receptor).
- Case 3 consisted of a 20 feet high wall and was determined to be not feasible (≥5 dB(A) insertion loss not provided for the lone impacted receptor).

NSA 5 (See Figure 2D, 2E and Table 8): One of the two receptors evaluated within this NSA was predicted to have levels at or above 66 dB(A) with the Build Alternative. As such, consideration of noise abatement within this NSA was warranted.

The following three abatement options were considered for NSA 5:

- Case 1 consisted of a 10 feet high wall and was determined to be feasible (≥5 dB(A) insertion loss provided for 100% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was not achieved and square footage per benefited receptor SF/BR 10,029 > 2000).
- Case 2 consisted of a 12 feet high wall and was determined to be feasible (≥5 dB(A) insertion loss provided for 100% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was not achieved and square footage per benefited receptor SF/BR 12,035 > 2000).
- Case 3 consisted of a 20 feet high wall and was determined to be feasible (>5 dB(A) insertion loss provided for 100% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was not achieved and square footage per benefited receptor SF/BR 20,058 > 2000).

NSA 6 (See Figure 2D, 2E and Table 9): Two of the two receptors evaluated within this NSA were predicted to have levels at or above 66 dB(A) with the Build Alternative. As such, consideration of noise abatement within this NSA was warranted.

The following three abatement options were considered for NSA 6:

- Case 1 consisted of a 10 feet high wall and was determined to be feasible (≥5 dB(A) insertion loss provided for 50% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was not achieved and square footage per benefited receptor SF/BR 9,845 > 2000).
- Case 2 consisted of a 12 feet high wall and was determined to be feasible (≥5 dB(A) insertion loss provided for 50% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was not achieved and square footage per benefited receptor SF/BR 11,815 > 2000).
- Case 3 consisted of a 20 feet high wall and was determined to be feasible (≥5 dB(A) insertion loss provided for 50% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was not achieved and square footage per benefited receptor SF/BR 19,691 > 2000).

NSA 7 (See Figure 2F and Table 10): This NSA includes the Fox Hollow golf course, the receptors were predicted to have levels at or above 66 dB(A) with the Build Alternative. As such, consideration of noise abatement within this NSA was warranted. In accordance

with PennDOT Pub. 24 and after consultation with PennDOT, PTC has suggested that the equivalent receptor unit (ERU) to be calculated based on the following assumptions:

- Average Round Length: 4.25 hours
- Tee Time Increment (new group tees off): 15 minutes
- Average Persons Per Round: 3.70 persons
- Closing Time (last group tees off): these times are generally set 1.5 hours earlier than the end of Civil Twilight for each month

Based on these assumptions, the ERU was calculated to be 0.15 < 1 and consistent with the techniques used on previous PTC projects, a grid of receptors spaced at 130 feet was established to represent the property and to evaluate noise impacts and abatement options.

The following three abatement options were considered for NSA 7:

- Case 1 consisted of a 10 feet high wall and was determined to be feasible (≥5 dB(A) insertion loss provided for 83% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was achieved but square footage per benefited receptor SF/BR 27,344 > 2000).
- Case 2 consisted of a shorter 10 feet high wall and was determined to be feasible (≥5 dB(A) insertion loss provided for 67% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was achieved but square footage per benefited receptor SF/BR 10,003 > 2000).
- Case 3 consisted of a shorter 10 feet high wall and was determined to be feasible (≥5 dB(A) insertion loss provided for 67% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was achieved but square footage per benefited receptor SF/BR 9,673 > 2000).

NSA 8 (See Figure 2F, 2G and Table 11): All three receptors evaluated within this NSA were predicted to have levels at or above 66 dB(A) with the Build Alternative. As such, consideration of noise abatement within this NSA was warranted.

The following three abatement options were considered for NSA 8:

- Case 1 consisted of a 10 feet high wall and was determined to be feasible (≥5 dB(A) insertion loss provided for 67% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was not achieved and square footage per benefited receptor SF/BR 11,499 > 2000).
- Case 2 consisted of a 12 feet high wall and was determined to be feasible (≥5 dB(A) insertion loss provided for 67% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was achieved but square footage per

benefited receptor SF/BR 13,799 > 2000).

Case 3 consisted of an optimizing of Case 2 and was determined to be feasible (≥5 dB(A) insertion loss provided for 67% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was achieved but square footage per benefited receptor SF/BR 10,009 > 2000).

NSA 9 (See Figure 2H and Table 12): Two of the four receptors evaluated within this NSA were predicted to have levels at or above 66 dB(A) with the Build Alternative. As such, consideration of noise abatement within this NSA was warranted.

The following three abatement options were considered for NSA 9:

- Case 1 consisted of a 10 feet high wall and was determined to be feasible (≥5 dB(A) insertion loss provided for 50% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was not achieved and square footage per benefited receptor SF/BR 11,041 > 2000).
- Case 2 consisted of a 12 feet high wall and was determined to be feasible (≥5 dB(A) insertion loss provided for 50% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was achieved but square footage per benefited receptor SF/BR 17,666 > 2000).
- Case 3 consisted of an optimizing of Case 2 and was determined to be feasible (≥5 dB(A) insertion loss provided for 50% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was achieved but square footage per benefited receptor SF/BR 5,996 > 2000).

NSA 10A (See Figure 2H and Table 13A): NSA 10 was studied as two separate areas for mitigation purposes. Two of the four receptors evaluated within NSA 10A were predicted to have levels at or above 66 dB(A) with the Build Alternative. As such, consideration of noise abatement within NSA 10A was warranted.

The following three abatement options were considered for NSA 10A:

- Case 1 consisted of a 10 feet high wall and was determined to be feasible (≥5 dB(A) insertion loss provided for 50% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was achieved and square footage per benefited receptor SF/BR 20,938 > 2000).
- Case 2 consisted of a 12 feet high wall and was determined to be feasible (<u>></u>5 dB(A) insertion loss provided for 50% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was achieved but square footage per benefited receptor SF/BR 8,375 > 2000).

Case 3 consisted of an optimizing of Case 2 and was determined to be feasible (≥5 dB(A) insertion loss provided for 50% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was achieved but square footage per benefited receptor SF/BR 13,521 > 2000).

NSA 10B (See Figure 2I, 2K and Table 13B): NSA 10 was studied as two separate areas for mitigation purposes. Three of the seven receptors evaluated within NSA 10B were predicted to have levels at or above 66 dB(A) with the Build Alternative. As such, consideration of noise abatement within NSA 10B was warranted.

The following four abatement options were considered for NSA 10B:

- Case 1 consisted of a 10 feet high wall and was determined to be not feasible (≥5 dB(A) insertion loss provided for 0% of impacted receptors).
- Case 2 consisted of a 14 feet high wall and was determined to be feasible (≥5 dB(A) insertion loss provided for 100% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was achieved but square footage per benefited receptor SF/BR 7,823 > 2000).
- Case 3 consisted of an optimizing of Case 2 and was determined to be feasible (≥5 dB(A) insertion loss provided for 100% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was achieved but square footage per benefited receptor SF/BR 8,293 > 2000).
- Case 4 consisted of providing mitigation to R10-7 only and was determined to be feasible (≥5 dB(A) insertion loss provided for 67% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was achieved but square footage per benefited receptor SF/BR 9,087 > 2000).

NSA 11 (See Figure 2J and Table 14): The FHWA TNM receiver in this NSA represents the 30 units in this motel that faces the highway within this NSA was not predicted to have levels at or above 71 dB(A) and was not predicted to create a substantial noise increase of 10 dB(A) with the Build Alternative. Therefore consideration of abatement was not required for this NSA.

NSA 12 (See Figure 2K and Table 15): This NSA includes the Spinnerstown Crossing subdivision, Six of the thirty-one receptors were predicted to have levels at or above 66 dB(A) with the Build Alternative. As such, consideration of noise abatement within this NSA was warranted.

The following five abatement options were considered for NSA 12:

• Case 1 consisted of a 10 feet high wall and was determined to be not feasible (≥5 dB(A) insertion loss provided for only 33% of impacted receptors.

- Case 2 consisted of a 12 feet high wall and was determined to be not feasible (≥5 dB(A) insertion loss provided for only 33% of impacted receptors.
- Case 3 consisted of a 14 feet high wall and was determined to be not feasible (≥5 dB(A) insertion loss provided for only 33% of impacted receptors.
- Case 4 consisted of a 20 feet high wall and was determined to be feasible (≥5 dB(A) insertion loss provided for 83% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was achieved but square footage per benefited receptor SF/BR 5,686 > 2000).
- Case 5 consisted of an optimizing of Case 4 and was determined to be feasible (≥5 dB(A) insertion loss provided for 80% of impacted receptors) and reasonable (goal of 7 dB(A) insertion loss for at least one receptor was achieved also square footage per benefited receptor SF/BR 1,997 < 2000). The recommended barrier is approximately 1,159 feet in length with an average height of 18.9 feet and was predicted to provide an average I.L. of 6.8 dB(A) for the 11 benefited receptors as shown in Figure 3.

NSA 13 (See Figure 2L and Table 16): The one property evaluated within this NSA is predicted to have levels at or above 66 dB(A) with the Build Alternative. As such, consideration of noise abatement within this NSA was warranted.

The following three abatement options were considered for NSA 13:

- Case 1 consisted of a 10 feet high wall and was determined to be not feasible (≥5 dB(A) insertion loss provided for 0% of impacted receptors).
- Case 2 consisted of a 18 feet high wall and was determined to be feasible (≥5 dB(A) insertion loss provided for 100% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was achieved but square footage per benefited receptor SF/BR 18,054 > 2000).
- Case 3 consisted of an optimizing of Case 2 and was determined to be feasible (≥5 dB(A) insertion loss provided for 100% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was achieved but square footage per benefited receptor SF/BR 14,626 > 2000).

NSA 14 (See Figure 2L and Table 17): Two of the twelve receptors evaluated within this NSA were predicted to have levels at or above 66 dB(A) with the Build Alternative. As such, consideration of noise abatement within this NSA was warranted.

The following three abatement options were considered for NSA 14:

- Case 1 consisted of a 10 feet high wall and was determined to be not feasible (≥5 dB(A) insertion loss provided for 0% of impacted receptors).
- Case 2 consisted of a 12 feet high wall and was determined to be feasible (≥5 dB(A) insertion loss provided for 100% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was achieved but square footage per benefited receptor SF/BR 3,843 > 2000).
- Case 3 consisted of an optimizing of Case 2 and was determined to be feasible (≥5 dB(A) insertion loss provided for 100% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was achieved but square footage per benefited receptor SF/BR 2,245 > 2000). Since the 2,245 SF/BR value approaches the 2,000 SF/BR reasonableness criteria and all other reasonableness criteria are met, this case will be reevaluated during the final design noise analysis phase when more detailed project-related plans, cross sections, and other information are available.

NSA 15 (See Figure 2L and Table 18): Two of the five receptors evaluated within this NSA were predicted to have levels at or above 66 dB(A) with the Build Alternative. As such, consideration of noise abatement within this NSA was warranted.

The following three abatement options were considered for NSA 15:

- Case 1 consisted of a 10 feet high wall and was determined to be not feasible (≥5 dB(A) insertion loss provided for 0% of impacted receptors).
- Case 2 consisted of a 14 feet high wall and was determined to be feasible (≥5 dB(A) insertion loss provided for 100% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was achieved but square footage per benefited receptor SF/BR 6,838 > 2000).
- Case 3 consisted of an optimizing of Case 2 and was determined to be feasible (≥5 dB(A) insertion loss provided for 100% of impacted receptors) but not reasonable (goal of 7 dB(A) insertion loss for at least one receptor was achieved but square footage per benefited receptor SF/BR 5,858 > 2000).

Construction Noise Considerations

It is recognized that construction, while temporary in nature, will result in increased noise levels during certain periods and at certain locations. If required during the final design noise analysis, a more detailed consideration of construction noise and associated abatement/mitigation will be undertaken, consistent with the availability and detail of anticipated construction scheduling and operations. Construction of temporary noise barriers and the early construction of permanent noise barriers will be considered as will

the possibility of developing construction noise specifications and/or special provisions related to construction time periods, duration of construction activities, types of construction equipment, and/or equipment noise levels.

Conclusion

Normal traffic growth can be expected to generally increase noise levels in the project area. Based on the analysis of noise reported herein, noise impacts exist within most NSAs. Based on the evaluation of the noise levels associated with the engineering plans developed to date, a noise barrier was determined to be feasible and reasonable for NSA 12.

During the final design phase, a detailed optimization of barrier lengths, heights, costs and locations will be coordinated with the final design engineering process to insure compatibility and the most cost-effective and efficient barrier design. This process may result in barrier heights, lengths, and locations changing from those discussed in this document.

The PTC is committed to construction of the feasible and reasonable noise abatement measures discussed above contingent upon the following conditions:

- Detailed noise analyses during the final design process;
- Analysis and determination of the feasibility and reasonableness of noise abatement measures, methodology, and criteria;
- Community input regarding desires, types, heights, and locations, as well as aesthetic considerations;
- Preferences regarding compatibility with adjacent land uses, particularly as addressed by officials having jurisdiction over such land uses;
- Safety and engineering aspects as related to the roadway user and the adjacent property owner

It is likely that the noise abatement measures for the identified noise impacted areas will be constructed if found to be feasible and reasonable based on the contingencies listed above.

TABLES

		Table 1
Hou	ırly Weighted Sou	and Levels dB(A) For Various Land Use Activity Categories*
Land Use Activity Category	Leq(h)	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 purpose.
В	67 (exterior)	Residential
С	67 (exterior)	Active sport 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.
Е	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.

^{*} PennDOT has chosen to use Leq(h) [not L10(h)] on all of its transportation improvement projects.

Table 2. Noise Measurement Results

Site ID	Address of Measurement Site	Date	Time Period		Hour	ly Traffic l	Based on C	Concurren	t Traffic C	Counts	Measured Noise Level
Number	radices of freesoftement site	Date	Teriou	Roadway	Autos	Medium Trucks	Heavy Trucks	Buses	Motor- cycles	Total	(dBA)
M1-1	17 Wambold Rd	6.5.13	9:15am	I-476 NB I-476 SB	1011 1242	57 21	252 213	30 9	3	1353 1485	64.5
M1-2	67 Wambold Rd	6.5.13	8:47am	I-476 NB	855	51	189	0	3	1098	65.7
				I-476 SB I-476 NB	1185 2271	24 27	177 13	0	6	1389 2317	
M1-3	1960 Wambold Rd	6.4.13	9:15am	I-476 SB	1311	27	102	6	6	1452	60.3
M1-4	Wambold Rd	6.5.13	8:15am	I-476 NB I-476 SB	932 1656	63 18	126 186	3	3	1124 1866	66.7
M2-1	97 Badman Rd	6.5.13	9:52am	I-476 NB	939	60 39	192	63	3	1257	67.5
M2-2	143 Badman Rd	6.5.13	10:34am	I-476 SB I-476 NB	1089 828	96	234 213	6	3 21	1365 1164	56.8
				I-476 SB I-476 NB	999 894	24 48	153 246	6	0	1182 1188	
M2-3	127 Badman Rd	6.5.13	11:01am	I-476 SB	1080	15	186	0	0	1281	57.3
M3-1	1905 Upper Ridge Rd	6.25.13	3:02pm	I-476 NB I-476 SB	1700 1040	120 30	190 130	20	0	2020 1220	61.8
M4-1	Boulder Woods Campground (pond)	6.25.13	10:15am	I-476 NB	1323	66 66	201 222	15	0	1605 1581	61.7
M4-2	Residence Camp Skymount Rd	6.25.13	11:34am	I-476 SB I-476 NB	1290 1080	51	240	3 21	0	1392	61.8
1014-2				I-476 SB I-476 NB	1065 1227	60 54	255 318	3 21	0	1383 1620	
M4-3	1100 Camp Skymount Rd	6.25.13	11:00am	I-476 SB	1227	48	204	18	3	1500	60.3
M4-4	1190 Skymount Rd.	6.6.13	10:16am	I-476 NB I-476 SB	996 1101	48 39	213 201	0	9	1287 1341	62.3
M5-1	Residence Old Wood Rd	6.25.13	12:16pm	I-476 NB	1068	57	267	0	3	1395	62.6
M5 2	1000 OLLW I.P. I			I-476 SB I-476 NB	1062 1791	39 27	216 180	3	3	1320 2004	
M5-2	1960 Old Wood Rd	6.6.13	3:46pm	I-476 SB I-476 NB	1170 1254	30 57	153 243	3	3 0	1359 1560	65.4
M5-3	Cabins off of Trumbauersville Rd	6.26.13	9:14am	I-476 NB	1344	54	198	12	3	1611	68.4
M6-1	Residence Upper Ridge Rd	6.25.13	2:25pm	I-476 NB I-476 SB	1419 1185	96 81	246 183	9	6	1764 1464	64.6
M6-2	Cabins off of Trumbauersville Rd	6.26.13	8:45am	I-476 NB	1008	69	159	0	0	1236	67.8
M7-1	Fox Hollow Golf Club 2020 Trumbauersville, Rd Frt. Meter	6.6.13	9:12am	I-476 SB I-476 NB	1506 990	36 42	255 225	9 15	6	1812 1275	68.6
	Fox Hollow Golf Club 2020 Trumbauersville, Rd Hk Meter			I-476 SB I-476 NB	1215 990	33 42	237 225	9	3	1494 1275	
M7-2	@60'	6.6.13	9:12am	I-476 SB	1215	33	237	9	0	1494	64.7
M8-1	1575 Doerr Rd	6.26.13	8:15am	I-476 NB I-476 SB	1212 1752	48 42	156 168	3	0	1419 1965	65.5
M8-2	1605 Doerr Rd	6.26.13	7:47am	I-476 NB I-476 SB	1236 1926	66 90	111 201	0 15	3	1416 2238	66.7
M9-1	Rosenberger Rd	6.5.13	1:51pm	I-476 NB	1152	63	279	0	15	1509	56.9
			-	I-476 SB I-476 NB	975 1188	27 60	159 327	3	0	1161 1578	
M9-2	Rosenberger Rd	6.5.13	1:21pm	I-476 SB	924	48	126	0	0	1098	58.2
M10-1	Kumry Rd	6.5.13	3:03pm	I-476 NB I-476 SB	1251 1198	48 33	228 153	0	9	1527 1393	66.3
M10-2	1890 Kumry Rd	6.5.13	2:27pm	I-476 NB I-476 SB	1209 1041	54 27	258 204	3	9	1533 1272	65.9
M10-3	Kumry Rd	6.5.13	3:35pm	I-476 NB	1683	39	198	6	0	1926	60.1
	<u> </u>			I-476 SB I-476 NB	1080 1767	42 27	159 180	6	6	1293 1986	
M10-4	Krammes Rd	6.5.13	4:14pm	I-476 SB	1341	33	126	21	6	1527	59.6
M10-5	Molasses Creek Park, Krammes Rd	6.4.13	9:44am	I-476 NB I-476 SB	873 957	63 63	240 222	24 12	0	1203 1254	58.6
M11-1	Comfort Inn, John Fries Highway	6.4.13	7:49am	I-476 NB I-476 SB	951 1713	45 39	75 195	0 12	3	1074 1962	58.3
M12-1	1782 Redbud Rd	6.4.13	8:32am	I-476 NB	951	48	216	0	12	1227	60.3
				I-476 SB I-476 NB	1632 867	33 48	231 180	9	0	1899 1104	
M12-2	1774-1770 Redbud Rd	6.4.13	9:01am	I-476 SB	1143	21	192	12	3	1371	57.7
M13-1	Farmhouse @ MB Research Labs Wentz Rd	6.3.13	4:45pm	I-476 NB I-476 SB	1491 1071	24 9	150 141	9	6	1668 1236	63.4
M14-1	Heiter Rd	6.4.13	11:26am	I-476 NB I-476 SB	804 816	78 36	282 195	9	9	1182 1050	61.8
M15-1	2300 Steinsburg Rd	6.4.13	12:10pm	I-476 NB	825	60	228	9	12	1134	66.8
				I-476 SB I-476 NB	777 762	24 48	189 315	0	3	993 1125	
M15-2	Steinsburg Rd	6.4.13	12:39pm	I-476 SB	741	33	201	0	0	975	67.1
M15-3	2324 Steinsburg Rd	6.6.13	7:52am	I-476 NB I-476 SB	1005 906	48 36	132 66	6	0	1188 1014	55.5

Table 3. Noise Validation Results

Site ID	Address of Measurement Site		I Model Valid ise Levels in d	
Number	Address of Medsurement Site	Modeled Leq(h)	Measured Leq	Difference
M1-1	17 Wambold Rd	66.8	64.5	2
M1-2	67 Wambold Rd	66.1	65.7	0
M1-3	1960 Wambold Rd	62.0	60.3	2
M1-4	Wambold Rd	68.4	66.7	2
M2-1	97 Badman Rd	67.8	67.5	0
M2-2	143 Badman Rd	57.5	56.8	1
M2-3	127 Badman Rd	57.4	57.3	0
M3-1	1905 Upper Ridge Rd	58.6	61.8	-3
M4-1	Boulder Woods Campground (pond)	62.2	61.7	1
M4-2	Residence Camp Skymount Rd	64.0	61.8	2
M4-3	1100 Camp Skymount Rd	59.6	60.3	-1
M4-4	1190 Skymount Rd.	62.0	62.3	0
M5-1	Residence Old Wood Rd	62.0	62.6	-1
M5-2	1960 Old Wood Rd	65.6	65.4	0
M5-3	Cabins off of Trumbauersville Rd	70.7	68.4	2
M6-1	Residence Upper Ridge Rd	66.4	64.6	2
M6-2	Cabins off of Trumbauersville Rd	68.8	67.8	1
M7-1	Fox Hollow Golf Club 2020 Trumbauersville, Rd Frt. Meter	68.7	68.6	0
M7-2	Fox Hollow Golf Club 2020 Trumbauersville, Rd Bk Meter @60'	65.0	64.7	0
M8-1	1575 Doerr Rd	64.3	65.5	-1
M8-2	1605 Doerr Rd	65.7	66.7	-1
M9-1	Rosenberger Rd	60.0	56.9	3
M9-2	Rosenberger Rd	64.6	58.2	6
M10-1	Kumry Rd	68.1	66.3	2
M10-2	1890 Kumry Rd	67.9	65.9	2
M10-3	Kumry Rd	62.0	60.1	2
M10-4	Krammes Rd	61.8	59.6	2
M10-5	Molasses Creek Park, Krammes Rd	56.6	58.6	-2
M11-1	Comfort Inn, John Fries Highway	60.4	58.3	2
M12-1	1782 Redbud Rd	60.0	60.3	0
M12-2	1774-1770 Redbud Rd	55.9	57.7	-2
M13-1	Farmhouse @ MB Research Labs Wentz Rd	62.8	63.4	-1
M14-1	Heiter Rd	63.2	61.8	1
M15-1	2300 Steinsburg Rd	67.7	66.8	1
M15-2	Steinsburg Rd	67.0	67.1	0
M15-3	2324 Steinsburg Rd	56.7	55.5	1

Table 4
NSA 1 Noise Barrier Evaluation

		N 1 6		E (N B III	Future No Ba	arrier (2039)					Future Bar	rier (2039)				
NSA	Site ID	Number of Units	Existing 2014	Future No-Build 2039	Noise Levels	Increase Over Existing	Noise Levels	I.L.	Noise Levels	I.L.	Noise Levels	I.L.	Noise Levels	I.L.	Noise Levels	I.L.
	M1-1	1	65	66	73	8	68	6	65	8	68	6	68	5	68	5
	M1-2	1	66	67	69	4	61	8	60	9	61	8	63	6	61	8
	M1-3	1	61	62	65	4	63	1	63	2	64	1	64	1	64	1
NSA 1	M1-4	1	70	71	76	6	70	6	67	9	71	5	72	4	71	5
	R1-5	1	60	61	61	1	60	1	59	2	60	1	60	1	60	1
	R1-6	1	61	62	67	5	63	3	60	6	63	3	63	3	63	3
	R1-7	1	61	62	66	5	60	6	58	8	60	6	62	4	60	6
FHW	VA TNM Dat	a File	Existing 2014	Future No-Build 2039	Future Bu	aild 2039	NSA 1 (Case 1		NSA 1 (Case 2	,	NSA 1 Case 3: 1	· /	NSA 1 Case 4: 8	· /	NSA 1 (Case 5: O	
RECOMME	ENDED NOI	SE ABATEN	IENT SYSTEM D	ETAILS:												
	(-)							43031		51637		24010		19208		23004
	1	1						5		5		5		5		5
								4		5		4		2		4
	•							80%		100%		80%		40%		80%
								Yes		Yes		Yes		No		Yes
								4		5	_	4				4
								10,758		10,327		6,003				5,751
								No		No		No				No
								6.4		8.3		7.1				6.1
		at least one be	enefited receptor?					Yes		Yes		Yes				Yes
	FHWA TNM Data File Existing 2014 Future Build 2039						4303	1	4303	4	2401	1	2401	1	2401	
								10	1	12	4	10	1	8	1	8 to 10
Average Bar	rier Height (f	t)						10.0		12.0		10.0		8.0		9.6

dBA = Decibels on the A-weighted scale

Leq = Equivalent noise level

I.L. = Insertion Loss

All noise levels are calculated to the tenth of a dBA and rounded for presentation purposes to the nearest whole number.

Impacted Receptors (Build noise levels ≥ 66 dBA)

Table 5
NSA 2 Noise Barrier Evaluation

		N. J. C		Future No-Build	Future No Ba	arrier (2039)			Future Bar	rier (2039)		
NSA	Site ID	Number of Units	Existing 2014	2039	Noise Levels	Increase Over Existing	Noise Levels	I.L.	Noise Levels	I.L.	Noise Levels	I.L.
	M2-1	1	66	69	72	6	65	8	66	7	66	7
NSA 2	M2-2	1	56	57	61	5						
NSA Z	M2-3	1	55	56	60	5	58	2	59	1	59	1
	R2-4	1	57	59	64	7	-		-			
FHW	A TNM Data	a File	Existing 2014	Future No-Build 2039	Future Bu	aild 2039	NSA 2 (Case 1:		NSA 2 (Case 2: 10		NSA 2 (Case 3: O	
RECOMME	ENDED NOI	SE ABATEN	MENT SYSTEM D	ETAILS:			•		•			
Barrier Area	(ft ²)							27535		7002		6602
Total Number	er of Receptor	s Impacted						1		1		1
Impacted Re	ceptors Recei	$ving \ge 5 dBA$	I.L.					1		1		1
			$g \ge 5 \text{ dBA I.L.}$					100%		100%		100%
Barrier Feasi	ble Based on	5 dBA Reduc	tion Criteria?					Yes		Yes]	Yes
		e receiving ≥ 3						1		1		1
			$(SF/BR) \le 2000$					27,535		7,002]	6,602
		SF/BR Stand	•					No		No]	No
Average Noi	se Reduction	for Benefited	Receptors (dBA)					7.6		6.6]	6.5
		at least one be	enefited receptor?					Yes		Yes]	Yes
Total Barrier								2753		700]	700
Barrier Heigl								10		10]	8 to 10
Average Barr	rier Height (ft	:)						10.0		10.0		9.4

dBA = Decibels on the A-weighted scale

Leq = Equivalent noise level

I.L. = Insertion Loss

All noise levels are calculated to the tenth of a dBA and rounded for presentation purposes to the nearest whole number.

Impacted Receptors (Build noise levels \geq 66 dBA)

Table 6
NSA 3 Noise Barrier Evaluation

		Number of		Endama No Duild	Future No Barrier (2039)			
NSA	Site ID	Number of Units	Existing 2014	Future No-Build 2039	Noise Levels	Increase Over Existing		
NSA 3	M3-1	1	57	59	63	5		
FHW	A TNM Data	a File	Existing 2014	Future No-Build 2039	Future Bi	uild 2039		

dBA = Decibels on the A-weighted scale

Leq = Equivalent noise level

I.L. = Insertion Loss

All noise levels are calculated to the tenth of a dBA and rounded for presentation purposes to the nearest who

Table 7
NSA 4 Noise Barrier Evaluation

					Future No B	arrier (2039)		Section Sect				
NSA	Site ID	Number of Units	Existing 2014	Future No-Build 2039	Noise Levels	Increase Over Existing	Noise Levels	I.L.	Noise Levels	I.L.	Noise Levels	I.L.
	M4-1	1	60	62	64	4	62	1	62	1	62	1
	M4-2	1	59	61	67	7	64	2	64	3	64	3
NSA 4	M4-3	1	58	60	62	4	61	1	60	1	60	2
	M4-4	1	60	62	63	3	61	3		3		3
	R4-5	2	58	59	59	1	58	1	58	1	58	1
FHW	/A TNM Dat	a File	Existing 2014	Future No-Build 2039	Future Bi	aild 2039		. ,				
RECOMMI	ENDED NOI	SE ABATEN	IENT SYSTEM D	ETAILS:					-		-	
Barrier Area	` /							12314		17239		24628
	er of Receptor							1		1		1
		iving≥ 5 dBA						1]	1]	1
			ng≥ 5 dBA I.L.					0%		0%]	0%
	0.0 - 0.0 0 0 0.0	5 dBA Reduc						No		No		No
		e receiving≥ 5	·									
			(SF/BR)≤2000]	
		a SF/BR Stand	*]	
			Receptors (dBA)								ļ	
		at least one be	enefited receptor?]]	
Total Barrier	Length (ft)							1231]	1231]	1231
Barrier Heig								10]	14]	20
Average Bar	rier Height (f	t)						10.0		14.0		20.0

dBA = Decibels on the A-weighted scale

Leq = Equivalent noise level

I.L. = Insertion Loss

All noise levels are calculated to the tenth of a dBA and rounded for presentation purposes to the nearest whole number.

Impacted Receptors (Build noise levels≥ 66 dBA)

Table 8
NSA 5 Noise Barrier Evaluation

		N. I. G.		E . N B	Future No Ba	arrier (2039)			Future Bar	rier (2039)		
NSA	Site ID	Number of Units	Existing 2014	Future No-Build 2039	Noise Levels	Increase Over Existing	Noise Levels	I.L.	Noise Levels	I.L.	Noise Levels 64 62 NSA 5 (Case 3)	I.L.
	M5-1	1	60	61	65	5	64	1	64	1	64	1
	M5-2	1	62	62	69	6	63	5	63	6	62	6
NSA 5	M5-3	2	69	70	72	2			Demo	lished		
	R5-4	2	65	66	68	3			Demo	lished		
	R5-5	2	60	61	64	5			Demo	lished		
FHV	VA TNM Dat	a File	Existing 2014	Future No-Build 2039	Future Bu	aild 2039	NSA 5 (Case 1		NSA 5 (Case 2			
RECOMMI	ENDED NOI	SE ABATEN	IENT SYSTEM D	ETAILS:					-		=	
Barrier Area	()							10029		12035		20058
	er of Recepto							1		1		1
Impacted Re	ceptors Rece	iving≥5 dBA	I.L.					1		1] [1
Percent of In	npacted Rece	ptors Receivin	ng≥ 5 dBA I.L.					100%		100%] [100%
Barrier Feas	ible Based on	5 dBA Reduc	tion Criteria?					Yes		Yes] [Yes
Benefited Re	eceptors (thos	e receiving≥ 5	5 dBA I.L.)					1		1] [1
Square Foota	age per Benef	fited Receptor	(SF/BR)≤2000					10,029		12,035] [20,058
Barrier Reas	onable from a	a SF/BR Stand	lpoint?					No		No		No
Average Noi	ise Reduction	for Benefited	Receptors (dBA)					5.2		5.7] [6.5
Is 7 dBA I.L	.goal met for	at least one be	enefited receptor?					No		No] [No
Total Barrier	r Length (ft)							1003		1003] [1003
Barrier Heig	ht Range (ft)							10		12] [20
Average Bar	rier Height (f	t)				•		10.0		12.0] [20.0

dBA = Decibels on the A-weighted scale

Leq = Equivalent noise level

I.L. = Insertion Loss

All noise levels are calculated to the tenth of a dBA and rounded for presentation purposes to the nearest whole number.

Impacted Receptors (Build noise levels > 66 dBA)

Table 9 NSA 6 Noise Barrier Evaluation

		N 6		Future No-Build	Future No Ba	arrier (2039)			Future Bar	rier (2039)		
NSA	Site ID	Number of Units	Existing 2014	2039	Noise Levels	Increase Over Existing	Noise Levels	I.L.	Noise Levels	I.L.	Noise Levels	I.L.
	M6-1	1	64	65	69	5	64	5	64	5	63	6
NSA 6	M6-2	1	68	70	72	4	_		Demo	lished	_	
	R6-3	1	63	65	69	6	69	0	69	0	67	2
FHW	VA TNM Data	a File	Existing 2014	Future No-Build 2039	Future Bu	nild 2039	NSA 6 (Case 1		NSA 6 (Case 2		NSA 6 (Case 3	
RECOMMI	ENDED NOI	SE ABATEN	MENT SYSTEM D	ETAILS:								
Barrier Area	(ft²)							9845		11815		19691
Total Numbe	er of Receptor	rs Impacted						2		2		2
Impacted Re	ceptors Recei	ving≥ 5 dBA	I.L.					1		1	1 [1
Percent of In	npacted Recep	ptors Receivir	ng≥ 5 dBA I.L.					50%		50%	1 [50%
Barrier Feasi	ble Based on	5 dBA Reduc	ction Criteria?					Yes		Yes]	Yes
Benefited Re	eceptors (those	e receiving≥ 5	5 dBA I.L.)					1		1		1
Square Foota	ige per Benef	ited Receptor	(SF/BR)≤2000					9,845		11,815] [19,691
Barrier Reas	onable from a	SF/BR Stand	lpoint?					No		No]	No
Average Noi	se Reduction	for Benefited	Receptors (dBA)					4.6		4.9	1 [5.8
Is 7 dBA I.L	.goal met for	at least one be	enefited receptor?					No		No] [No
Total Barrier	Length (ft)							984		984] [984
Barrier Heigh	ht Range (ft)							10		12] [20
Average Bar	rier Height (f	t)	·					10.0		12.0] [20.0

dBA = Decibels on the A-weighted scale

Leq = Equivalent noise level

I.L. = Insertion Loss

All noise levels are calculated to the tenth of a dBA and rounded for presentation purposes to the nearest whole number.

Impacted Receptors (Build noise levels≥ 66 dBA)

Table 10 NSA 7 Noise Barrier Evaluation

					Future No Ba	arrier (2039)			Future Bar	rier (2039)		
NSA	Site ID	Number of Units	Existing 2014	Future No-Build 2039	Noise Levels	Increase Over Existing	Noise Levels	I.L.	Noise Levels	I.L.	Noise Levels	I.L.
	3A	1	66	67	70	4	63	7	65.5	5	66	5
	3B	1	64	65	67	3	62	6	62.3	5	62	5
	4C	1	58	59	63	5	59 57	4	59.8	3	60	3
	5C 2D	1	56 64	57 64	60 69	5	63	6	57.9 62.9	6	58 63	6
	3D	1	60	61	65	5	61	4	61.0	4	61	4
	4D	1	57	58	62	5	59	3	59.1	3	59	3
	5D	1	55	56	59	4	56	3	57.3	2	57	2
	1E	1	67	67	71	5	63	8	63.4	8	64	8
	2E	1	62	63	68	6	62	6	62.3	6	62	6
	3E	1	59	60	65	6	61	4	61.1	3	61	3
	4E	1	56	57	62	5	58	3	59.0	3	59	2
	5E	1	54	55	59	5	56	3	57.1	2	57	2
	6E	1	53	54 66	57	5	55	7	56.0	7	56	7
	1F 2F	1	65 61	62	70 67	5	63 62	5	63.0 62.3	5	63 62	5
	3F	1	58	59	64	6	60	4	60.8	3	61	3
	4F	1	56	56	61	6	58	3	59.0	2	59	2
	5F	1	54	55	59	5	56	2	57.0	2	57	2
I	6F	1	52	53	57	5	55	2	55.7	1	56	1
	1G	1	64	64	69	5	63	6	63.4	5	64	5
	2G	1	60	60	66	6	62	4	63	3	63	3
I	3G	1	58	59	63	5	60	3	61	2	61	2
	4G	1	55	56	60	6	58	3	59	2	59	2
	5G	1	55	56	58	4	56	2	57	1	57	1
	6G	1	52	53	57	5	55	2	55	1	56	1
	1H	1	62	63	68	6	63	6	64	4	64	4
	2H	1	59	60	65	6	61 59	4	62	3	62	2 2
	3H 4H	1	56 54	57 55	62 60	6 5	57	3 2	60 58	2 2	60 58	2
	5H	1	53	54	58	5	56	2	57	1	57	1
	6H	1	51	52	56	5	54	2	55	1	55	1
	1I	1	61	61	67	6	62	5	64	3	64	2
	2I	1	58	59	64	6	60	3	62	2	62	2
	3I	1	56	56	61	6	58	3	59	2	60	2
	4I	1	54	54	59	6	57	2	58	1	58	1
	5I	1	52	53	57	5	55	2	56	1	56	1
	6I	1	51	52	56	5	54	2	55	1	55	1
	1J	1	59	60	66	6	61	4	64	2	64	1
	2J	1	57	58	63	6	60	3	61	1	61	1
	3J	1	55	56	60	6	58	3	59	1	59	1
	4J	1	53	54	58	5	56	2	57	1	58	1
	5J	1	52	53	57	5	55	2	56	1	56	1
NSA 7	6J	1	50	51	55	5	54	2	54	1	54	1
1,021	1K	1	59	59	64	6	61	4	64	1	64	1
	2K	1	56	57	62	6	59	3	61	1	61	11
I	3K	1	54	56	60	5	57	2	59	1	59	1
	4K	1	52	53	58	5	56	2	57	1	57	1
	5K	1	51	52	56 55	5	55	2	56 54	1 1	56	1
I	6K 1L	1	50 58	51 58	55 63	5	53 60	3	54 63	<u> </u>	54 63	0
	2L	1	55	56	61	6	58	3	61	1	61	1
I	3L	1	53	54	59	6	57	2	58	1	59	1
	4L	1	52	53	57	5	56	2	57	1	57	1
	5L	1	51	52	56	5	54	2	55	1	55	1
1	6L	1	50	51	54	5	53	2	54	1	54	1
	7L	1	49	50	53	5	52	2	53	1	53	1
I	1M	1	57	57	62	6	60	3	62	0	62	0
	2M	1	55	55	60	6	58	3	60	0	60	0
I	3M	1	53	54	58	5	57	2	58	0	58	0
	4M	1	52	53	57	5	55	2	56	1	56	1
I	5M	1	50	51	55	5	54	2	55	1	55	1
	6M	1	49	50	54	5	52	2	53	0	53	0
	7M	1	48	49	53	5	51	2	52	1	52	1
	1N	1	56	57	62	6	59	3	61	0	61	0
	2N	1	54	55	60	6	57	2	59	0	59	0
	3N	1	52	53	58	5	56	2	57	0	57	0
	4N	1	51	52	56	5	55	2	56	0	56	0
	5N	1	50	51	55	5	53	2	54	0	54	0
I	6N	1	49	50	53	5	52	2	53	0	53	0
i	7N	1	48	49	52	5	51	2	52	0	52	0

Table 10 NSA 7 Noise Barrier Evaluation

					Future No Ba	arrier (2039)			Future Bar	rier (2039)		
NSA	Site ID	Number of Units	Existing 2014	Future No-Build 2039	Noise Levels	Increase Over Existing	Noise Levels	I.L.	Noise Levels	I.L.	Noise Levels	I.L.
	10	1	55	56	61	6	58	3	61	0	61	0
	20	1	53	54	59	6	57	2	59	0	59	0
	30	1	52	53	57	5	56	2	57	0	57	0
	40	1	51	52	56	5	54	2	55	0	55	0
	50	1	49	50	54	5	53	1	54	0	54	0
	60	1	48	50	53	5	52	2	53	0	53	0
	70	1	48	49	52	4	50	2	52	0	52	0
	2P	1	53	54	58	6	57	2	58	0	58	0
	3P	1	51	52	57	5	55	2	56	0	56	0
	4P	1	50	51	55	5	54	1	55	0	55	0
	5P	1	50	51	54	4	52	1	53	0	54	0
	6P	1	48	49	53	5	51	2	52	0	52	0
	7P	1	47	48	52	4	50	2	51	0	51	0
	3Q	1	51	52	56	5	55	2	56	0	56	0
	4Q	1	50	51	55	5	53	2	54	0	54	0
	7Q	1	47	49	51	4	50	1	51	0	51	0
FHV	VA TNM Data	a File	Existing 2014	Future No-Build 2039	Future Bu	iild 2039	NSA 12 Case 1	,	NSA 12 Case 2: 1	. ,	NSA 12 Case 3: O	` /
RECOMM	ENDED NOI	SE ABATEN	IENT SYSTEM D	ETAILS:	•		•				•	
Barrier Area	(ft^2)							41016		12004		11607
Total Number	er of Receptor	rs Impacted *	ERU (0.15)					1.8		1.8		1.8
	1	iving≥5 dBA						1.5		1.2		1.2
			ng≥5 dBA I.L.					83%		67%		67%
		5 dBA Reduc						Yes		Yes		Yes
		se receiving \geq :						1.5		1.2		1.2
	· ·	•	$(SF/BR) \le 2000$		27,344		10,003		9,673			
		a SF/BR Stand				No		No		No		
			Receptors (dBA)			6.1		5.7		5.6		
	_	at least one be	enefited receptor?			Yes		Yes		Yes		
Total Barrie							4102		1200		1200	
	tht Range (ft)							10		10		8 to 10
Average Bar	rier Height (f	t)						10.0		10.0		9.7

NOTES:

dBA = Decibels on the A-weighted scale

Leq = Equivalent noise level

I.L. = Insertion Loss

All noise levels are calculated to the tenth of a dBA and rounded for presentation purposes to the nearest whole number.

Impacted Receptors (Build noise levels ≥ 66 dBA)

Table 11 NSA 8 Noise Barrier Evaluation

		N. I. C		E. V. D. III	Future No Ba	Future No Barrier (2039)		Future Barrier (2039)							
NSA	Site ID	Number of Units	Existing 2014	Future No-Build 2039	Noise Levels	Increase Over Existing	Noise Levels	I.L.	Noise Levels	Noise Levels	I.L.				
	M8-1	1	63	66	69	6	64	5	62	7	63	7			
NSA 8	M8-2	1	64	66	72	8	67	5	67	5	68	5			
	R8-3	1	60	61	67	7	65	3	64	3	66	1			
FHWA TNM Data File Existing 2014 Future No-Build 2039 Future Build 2039 NSA 8 Case 1							,	NSA 8 (9.1.14) Case 2: 12 ft		NSA 8 (9.1.14) Case 3: Optimized					
RECOMME	RECOMMENDED NOISE ABATEMENT SYSTEM DETAILS:														
Barrier Area (ft ²)								22997		27597		20018			
Total Number of Receptors Impacted								3		3		3			
	•	ving≥ 5 dBA						2		2		2			
Percent of In	npacted Rece	ptors Receivir	ng≥ 5 dBA I.L.					67%		67%		67%			
Barrier Feasi	ble Based on	5 dBA Reduc	tion Criteria?					Yes		Yes		Yes			
Benefited Re	eceptors (thos	e receiving≥ 5	5 dBA I.L.)					2		2		2			
Square Foota	ige per Benef	ited Receptor	(SF/BR)≤2000					11,499		13,799		10,009			
Barrier Reas	onable from a	SF/BR Stand	lpoint?					No		No		No			
			Receptors (dBA)					4.9		6.2		5.6			
Is 7 dBA I.L.	goal met for	at least one be	enefited receptor?					No		Yes		Yes			
Total Barrier								2300		2300		1701			
Barrier Heigl	ht Range (ft)							10		12		10 to 12			
Average Bar	rier Height (f	t)						10.0		12.0		11.8			

dBA = Decibels on the A-weighted scale

Leq = Equivalent noise level

I.L. = Insertion Loss

All noise levels are calculated to the tenth of a dBA and rounded for presentation purposes to the nearest whole number.

Impacted Receptors (Build noise levels≥ 66 dBA)

Table 12 NSA 9 Noise Barrier Evaluation

	Site ID	N. 1. 6	Existing 2014	- V - N	Future No Barrier (2039)		Future Barrier (2039)							
NSA		Number of Units		Future No-Build 2039	Noise Levels	Increase Over Existing	Noise Levels	I.L.	Noise Levels	Noise Levels	I.L.			
	M9-1	1	57	58	62	5	61	1	61	1	61	1		
NSA 9	M9-2	1	62	62	66	4	61	5	59	7	59	7		
NSA 9	R9-3	1	57	57	61	5	60	1	60	1	60	1		
	R9-4	1	62	62	67	5	66	1	66	1	66	1		
FHWA TNM Data File Existing 2014 Future No-Build 2039 Future Build 2039 NSA 9 Case								. ,	NSA 9 (9.1.14) Case 2: 16 ft		NSA 9 (9.1.14) Case 3: Optimized			
RECOMMENDED NOISE ABATEMENT SYSTEM DETAILS:														
Barrier Area (ft ²)										17666		5996		
	er of Receptor	-						2		2		2		
		iving≥ 5 dBA						1		1		1		
Percent of In	npacted Recep	ptors Receivin	ng≥ 5 dBA I.L.					50%		50%		50%		
Barrier Feasi	ble Based on	5 dBA Reduc	tion Criteria?					Yes		Yes		Yes		
Benefited Re	eceptors (those	e receiving≥ 5	5 dBA I.L.)					1		1		1		
Square Foota	ige per Benef	ited Receptor	(SF/BR)≤ 2000					11,041		17,666		5,996		
Barrier Reas	onable from a	SF/BR Stand	lpoint?					No		No		No		
Average Noi	se Reduction	for Benefited	Receptors (dBA)					5.1		6.9		6.5		
Is 7 dBA I.L	goal met for	at least one be	enefited receptor?					No		Yes		Yes		
Total Barrier	Length (ft)							1104		1104		401		
Barrier Heigh	ht Range (ft)							10		16		12 to 16		
Average Bar	rier Height (f	t)	•					10.0		16.0		14.9		

dBA = Decibels on the A-weighted scale

Leq = Equivalent noise level

I.L. = Insertion Loss

All noise levels are calculated to the tenth of a dBA and rounded for presentation purposes to the nearest whole number.

Impacted Receptors (Build noise levels≥ 66 dBA)

Table 13A NSA 10A Noise Barrier Evaluation

	Site ID	N 1 6			Future No Barrier (2039)		Future Barrier (2039)							
NSA		Number of Units	Existing 2014	Future No-Build 2039	Noise Levels	Increase Over Existing	Noise Levels	I.L.	Noise Levels	Noise Levels	I.L.			
	M10-1	1	68	71	71	3	68	3	68	3	70	1		
NSA 10A	M10-2	1	67	69	69	3	63	7	62	7	63	7		
	M10-3	2	61	63	64	3	61	3	59	5	61	4		
FHWA TNM Data File Existing 2014 Future No-Build 2039 Future Build 2039 NSA 10A Case 1								NSA 10A (9.1.14) Case 2: 12 ft		NSA 10A (9.1.14) Case 3: Optimized				
	RECOMMENDED NOISE ABATEMENT SYSTEM DETAILS: Barrier Area (ft²) 20938 25126 13521													
Barrier Area (ft²)										25126		13521		
Total Number of Receptors Impacted								2		2		2		
		ving≥ 5 dBA						1		1		1		
			ng≥ 5 dBA I.L.					50%		50%		50%		
		5 dBA Reduc						Yes		Yes		Yes		
		e receiving≥ 5						1		3		1		
	<u> </u>	•	(SF/BR)≤ 2000					20,938		8,375		13,521		
		SF/BR Stand	•					No		No		No		
			Receptors (dBA)					6.7		5.9		6.5		
		at least one be	enefited receptor?					Yes		Yes		Yes		
Total Barrier								2094		2094		1193		
Barrier Heigl	ht Range (ft)							10		12		10 to 12		
Average Bar	rier Height (f	t)						10.0		12.0		11.3		

dBA = Decibels on the A-weighted scale

Leq = Equivalent noise level

I.L. = Insertion Loss

All noise levels are calculated to the tenth of a dBA and rounded for presentation purposes to the nearest whole number.

Impacted Receptors (Build noise levels≥ 66 dBA)

Table 13B NSA 10B Noise Barrier Evaluation

				F (N P II	Future No Ba	arrier (2039)	Future Barrier (2039)								
NSA	Site ID	Number of Units	Existing 2014	Future No-Build 2039	Noise Levels	Increase Over Existing	Noise Levels	I.L.	Noise Levels	I.L.	Noise Levels	I.L.	Noise Levels	I.L.	
	M10-4	1	60	61	68	8	65	3	63	5	63	5	67	1	
	M10-5	1	58	59	62	5	59	3	59	3	59	3	59	3	
NSA 10B	R10-6	2	57	58	64	7	60	4	58	6	61	3	61	3	
	R10-7	2	59	60	66	7	62	4	58	8	60	7	60	7	
	R10-8	1	60	61	63	3	60	3	59	4	61	2	62	1	
FHV							NSA 10E Case 1		NSA 10B Case 2	. ,	NSA 10B (9.1.14) Case 3: Optimized		NSA 10B (9.1.14) Case 4: R10-7 only		
RECOMME	RECOMMENDED NOISE ABATEMENT SYSTEM DETAILS:														
Barrier Area	Barrier Area (ft ²)							27939		39115		24879		18174	
Total Number	er of Receptor	s Impacted						3		3		3		3	
Impacted Re	ceptors Recei	$ving \ge 5 dBA$	I.L.					0		3] [3		2	
Percent of In	npacted Recep	otors Receivin	g≥5 dBA I.L.					0%		100%] [100%		67%	
		5 dBA Reduct						No		Yes		Yes		Yes	
Benefited Re	ceptors (those	e receiving ≥ 5	dBA I.L.)					0		5]	3		2	
Square Foota	ige per Benefi	ited Receptor ((SF/BR)≤2000							7,823] [8,293		9,087	
Barrier Reas	onable from a	SF/BR Stand	point?							No] [No		No	
			Receptors (dBA)							6.3] [5.8		6.5	
Is 7 dBA I.L.	goal met for a	at least one be	nefited receptor?							Yes		Yes		Yes	
Total Barrier	Length (ft)							2794	j	2794	j [1805		1312	
Barrier Heigh	ht Range (ft)							10		14	j l	12 to 14		12 to 14	
Average Bar	rier Height (ft	t)						10.0		14.0		13.8		13.9	

NOTES:

dBA = Decibels on the A-weighted scale

Leq = Equivalent noise level

I.L. = Insertion Loss

All noise levels are calculated to the tenth of a dBA and rounded for presentation purposes to the nearest whole number.

Impacted Receptors (Build noise levels ≥ 66 dBA)

Table 14 NSA 11 Noise Barrier Evaluation

		Nameh on of		Endama No Duild	Future No Barrier (2039)		
NSA	Site ID	Number of Units	Existing 2014	Future No-Build 2039	Noise Levels	Increase Over Existing	
NSA 11	M11-1	30	56	58	59	3	
FHW	A TNM Data	a File	Existing 2014	Future No-Build 2039	Future Build 2039		

dBA = Decibels on the A-weighted scale

Leq = Equivalent noise level

I.L. = Insertion Loss

All noise levels are calculated to the tenth of a dBA and rounded for presentation purposes to the nearest who

Table 15 NSA 12 Noise Barrier Evaluation

NSA Site ID Number of Units Existing 2014 Existing 2014 Site ID Noise Levels Noi	7 8 7 8 8 5 2 3 1 1 1 1 0 0 0 0 2 2 3 4 6 6 3	Noise Levels 55 55 55 55 56 56 56 56 56 5	9 11 10 11 8 5 6 5 4 4 4 3 1 0 5 5	Noise Levels 56 56 56 56 58 57 58 58 58 58 58 54 54 56	8 10 9 11 7 4 5 3 2 1 1 0 3 4 5	Noise Levels 56 57 56 56 56 58 57 58 58 58 58 56 56 56 54	8 9 9 10 7 4 5 3 2 1 1 0 2	Noise Levels 55 56 56 55 57 57 57 57 58 57 58 57 55 56	8 10 9 10 7 5 5 5 4 3 2 1
R12-3 1 60 62 66 7 58 R12-4 1 56 58 65 8 57 R12-3A 1 58 60 66 8 58 M12-2A 1 55 57 62 7 57 R12-5A 1 55 56 62 7 60 R12-5 1 55 57 62 7 59 R12-6 1 54 56 61 7 60 R12-7 1 54 56 60 6 59 R12-8 1 53 55 59 6 58 R12-9 1 52 54 56 5 56 R12-10 1 52 53 56 4 56 R12-11 1 52 54 56 4 56 R12-12 1 53 54 57	8 7 8 5 2 3 1 1 1 1 0 0 0 2 3 4	55 55 55 55 56 56 56 56 55 53 55 56 55 53 55 55 56 56 57 58 58 58 58 58 58 58 58 58 58	11 10 11 8 5 6 5 4 4 3 1 0 5 6	56 56 55 56 58 57 58 58 58 58 56 56 56 54	10 9 11 7 4 5 3 2 1 1 0 3 4	57 56 56 56 58 57 58 58 58 58 58 58 58 58 58 58	9 9 10 7 4 5 3 2 1 1 0	56 56 55 55 57 57 57 57 58 57 58	10 9 10 7 5 5 4 3 2
R12-4 1 56 58 65 8 57 R12-3A 1 58 60 66 8 58 M12-2A 1 55 57 62 7 57 R12-5A 1 55 56 62 7 60 R12-5 1 55 57 62 7 59 R12-6 1 54 56 61 7 60 R12-7 1 54 56 60 6 59 R12-8 1 53 55 59 6 58 R12-9 1 52 54 56 5 56 R12-10 1 52 53 56 4 56 R12-11 1 52 54 56 4 56 R12-11 1 52 54 56 4 56 R12-12 1 53 54 57	7 8 5 2 3 1 1 1 1 0 0 0 2 3 4	55 55 55 56 56 56 56 56 55 53 55 56 55 53 55 56	10 11 8 5 6 5 4 4 3 1 0 5 5 6	56 55 56 58 57 58 58 58 58 56 56 56 54 54	9 11 7 4 5 3 2 1 1 0 3 4	56 56 56 58 57 58 58 58 58 56 56 56	9 10 7 4 5 3 2 1 1 0 2	56 55 55 57 57 57 57 58 57 58	9 10 7 5 5 4 3 2
R12-3A 1 58 60 66 8 58 M12-2A 1 55 57 62 7 57 R12-5A 1 55 56 62 7 60 R12-5 1 55 57 62 7 59 R12-6 1 54 56 61 7 60 R12-7 1 54 56 60 6 59 R12-8 1 53 55 59 6 58 R12-9 1 52 54 56 5 56 R12-10 1 52 53 56 4 56 R12-11 1 52 54 56 4 56 R12-11 1 52 54 56 4 56 R12-12 1 53 54 57 4 55 R12-13 1 54 55 58	8 5 2 3 1 1 1 1 0 0 2 3 4 6	55 55 56 56 56 56 55 53 55 56 52 53 54	11 8 5 6 5 4 4 4 3 1 0 5 6	55 56 58 57 58 58 58 58 56 56 56 54 54	111 7 4 5 3 2 1 1 0 3 4	56 56 58 57 58 58 58 58 56 56 56 54	10 7 4 5 3 2 1 1 0 2	55 55 57 57 57 57 58 57 55	10 7 5 5 4 3 2
M12-2A 1 55 57 62 7 57 R12-5A 1 55 56 62 7 60 R12-5 1 55 56 62 7 60 R12-5 1 55 57 62 7 59 R12-6 1 54 56 61 7 60 R12-7 1 54 56 60 6 59 R12-8 1 53 55 59 6 58 R12-9 1 52 54 56 5 56 R12-10 1 52 53 56 4 56 R12-11 1 52 53 56 4 56 R12-11 1 52 54 56 4 56 R12-12 1 53 54 57 4 55 R12-13 1 54 55 58 5 55 R12-14 1 56 58 60 4 56 R12-15 3 64 65 64 0 58 \$8 50 58 R12-15 3 64 65 64 0 58 \$8 50 58 60 64 65 64 0 58 \$8 50 58 60 64 65 64 0 58 \$8 50 58 60 64 65 64 0 58 \$8 50 58 56 58 60 64 65 64 0 58 \$8 50 58 56 58 60 64 65 64 0 58 \$8 50 58 56 58 60 64 65 64 0 58 \$8 50 58 56 58 60 64 65	5 2 3 1 1 1 1 0 0 0 2 3 4 6	55 56 56 56 56 55 53 55 56 52 53 54	8 5 6 5 4 4 4 3 1 0 5 5	56 58 57 58 58 58 56 56 56 54 54	7 4 5 3 2 1 1 0 3 4	56 58 57 58 58 58 56 56 56 54 54	7 4 5 3 2 1 1 0 2	55 57 57 57 57 58 57 55	7 5 5 4 3 2
R12-5A 1 55 56 62 7 60 R12-5 1 55 57 62 7 59 R12-6 1 54 56 61 7 60 R12-7 1 54 56 60 6 59 R12-8 1 53 55 59 6 58 R12-9 1 52 54 56 5 56 R12-10 1 52 53 56 4 56 R12-11 1 52 54 56 4 56 R12-11 1 52 54 56 4 56 R12-12 1 53 54 57 4 55 R12-12 1 53 55 58 5 55 R12-14 1 56 58 60 4 56 R12-15 3 64 65 64	2 3 1 1 1 1 0 0 2 3 4 6	56 56 56 56 55 53 55 56 52 53 54	5 6 5 4 4 3 1 0 5 5	58 57 58 58 58 56 56 56 54 54 54	4 5 3 2 1 1 0 3 4	58 57 58 58 58 58 56 56 56 54 54	3 2 1 0 2	57 57 57 58 57 55	5 5 4 3 2
R12-5 1 55 57 62 7 59 R12-6 1 54 56 61 7 60 R12-7 1 54 56 60 6 59 R12-8 1 53 55 59 6 58 R12-9 1 52 54 56 5 56 R12-10 1 52 53 56 4 56 R12-11 1 52 54 56 4 56 R12-12 1 53 54 57 4 55 R12-12 1 53 54 57 4 55 R12-13 1 54 55 58 5 55 R12-14 1 56 58 60 4 56 R12-15 3 64 65 64 0 58	3 1 1 1 1 0 0 0 2 3 4 6	56 56 56 55 53 55 56 52 53 54 55	6 5 4 4 3 1 0 5 5	57 58 58 58 56 56 56 54 54 54	5 3 2 1 1 0 3 4	57 58 58 58 58 56 56 56 54 54	5 3 2 1 1 0 2	57 57 58 57 55	5 4 3 2 1
R12-6 1 54 56 61 7 60 R12-7 1 54 56 60 6 59 R12-8 1 53 55 59 6 58 R12-9 1 52 54 56 5 56 R12-10 1 52 53 56 4 56 R12-11 1 52 54 56 4 56 R12-11 1 52 54 56 4 56 R12-12 1 53 54 57 4 55 R12-13 1 54 55 58 5 55 R12-14 1 56 58 60 4 56 R12-15 3 64 65 64 0 58	1 1 1 0 0 2 3 4 6	56 56 55 53 55 56 52 53 54 55	5 4 4 3 1 0 5 5	58 58 58 56 56 54 54 54	3 2 1 1 0 3 4	58 58 58 56 56 54 54	3 2 1 1 0 2	57 58 57 55	4 3 2 1
R12-7 1 54 56 60 6 59 R12-8 1 53 55 59 6 58 R12-9 1 52 54 56 5 56 R12-10 1 52 53 56 4 56 R12-11 1 52 54 56 4 56 R12-12 1 53 54 57 4 55 R12-13 1 54 55 58 5 55 R12-14 1 56 58 60 4 56 R12-15 3 64 65 64 0 58	1 1 0 0 2 3 4 6	56 55 53 55 56 52 53 54 55	4 4 3 1 0 5 5	58 58 56 56 54 54 54	2 1 1 0 3 4	58 58 56 56 54 54	2 1 1 0 2	58 57 55	3 2 1
R12-8 1 53 55 59 6 58 R12-9 1 52 54 56 5 56 R12-10 1 52 53 56 4 56 R12-11 1 52 54 56 4 56 R12-12 1 53 54 57 4 55 R12-13 1 54 55 58 5 55 R12-14 1 56 58 60 4 56 R12-15 3 64 65 64 0 58	1 1 0 0 2 3 4 6	55 53 55 56 52 53 54 55	4 3 1 0 5 5 6	58 56 56 54 54 54	1 1 0 3 4	58 56 56 54 54	1 1 0 2	57 55	2
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R12-26 1 59 60 61 2 60	1	58	3	59	2	59	0	59	2
R12-27 1 65 66 63 -2 63	0	63	1	63	0	63	Ŭ	63	0
	12 (10.16.14) ase 1: 12 ft	NSA 12 (Case 2	,	` ,			A 12 (10.16.14) NSA 12 (10.16.14) 4: 20 ft Optimized Case 5: 22 ft Optimized		,
RECOMMENDED NOISE ABATEMENT SYSTEM DETAILS:							-		•
Barrier Area (ft ²)	38416		64027		21001		18292		21963
Total Number of Receptors Impacted	2		2		2	1	2		2
Impacted Receptors Receiving ≥ 5 dBA I.L.	2		5		2		2	1	2
Percent of Impacted Receptors Receiving ≥ 5 dBA I.L.	100%	1	250%		100%	1	100%	1	100%
Barrier Feasible Based on 5 dBA Reduction Criteria?	Yes		Yes		Yes	1	Yes	1	Yes
Benefited Receptors (those receiving ≥ 5 dBA I.L.)	5	1	14	1	10	<u> </u>	9	1 1	11
Square Footage per Benefited Receptor (SF/BR) \(\leq 2000	7,683	1	4,573	1	2,100	1	2,032	1 1	1,997
Barrier Reasonable from a SF/BR Standpoint?	No	1	No	1	No	1	No	1 1	No
Average Noise Reduction for Benefited Receptors (dBA)	7.0	1	7.7	1	7.4	1	6.8	1 1	6.8
Is 7 dBA I.L.goal met for at least one benefited receptor?	Yes	1	Yes	1	Yes	1	Yes	1 1	Yes
Total Barrier Length (ft)	3201	1	3201	1	1050	1	1050	†	1159
Barrier Height Range (ft)	12	1	20	1	20	1	13 to 20	†	12 to 22
Average Barrier Height (ft)	12.0	1	20.0	1	20.0	1	17.4	†	18.9
	12.0	I	20.0		20.0		1	Recomm	

dBA = Decibels on the A-weighted scale

Leq = Equivalent noise level

I.L. = Insertion Loss

All noise levels are calculated to the tenth of a dBA and rounded for presentation purposes to the nearest whole number.

Impacted Receptors (Build noise levels ≥ 66 dBA)

Table 16 NSA 13 Noise Barrier Evaluation

		NY 1 0	Existing 2014		Future No B	Future No Barrier (2039)		Future Barrier (2039)							
NSA	Site ID	Number of Units		Future No-Build 2039	Noise Levels	Increase Over Existing	Noise Levels	I.L.	Noise Levels	I.L.	Noise Levels	I.L.			
NSA 13	M13-1	1	62	63	69	7	66	3	62	7	62	7			
FHWA TNM Data File Existing 2014 2039 Future Build 2039 Case							(9.1.14) : 10 ft	,		NSA 13 (9.1.14) Case 3: Optimized					
RECOMMENDED NOISE ABATEMENT SYSTEM DETAILS: Barrier Area (ft²) 10030 18054 14626															
Barrier Area (ft²)										18054		14626			
Total Number of Receptors Impacted										1		1			
		ving≥ 5 dBA						0	<u>]</u>	1		1			
Percent of Im	npacted Recep	otors Receivin	g≥ 5 dBA I.L.					0%]	100%		100%			
Barrier Feasi	ble Based on	5 dBA Reduc	tion Criteria?					No		Yes		Yes			
Benefited Re	ceptors (those	e receiving≥ 5	dBA I.L.)							1		1			
Square Foota	ge per Benef	ited Receptor	(SF/BR)≤2000						1	18,054		14,626			
Barrier Reaso	onable from a	SF/BR Stand	point?						1	No		No			
Average Nois	se Reduction	for Benefited	Receptors (dBA)						1	6.7		6.5			
Is 7 dBA I.L.	goal met for	at least one be	enefited receptor?						1	Yes		Yes			
Total Barrier	Length (ft)							1003	1	1003		902			
Barrier Heigh	nt Range (ft)							10]	18		14 to 18			
Average Barr	rier Height (fi	t)						10.0	1	18.0		16.2			

dBA = Decibels on the A-weighted scale

Leq = Equivalent noise level

I.L. = Insertion Loss

All noise levels are calculated to the tenth of a dBA and rounded for presentation purposes to the nearest whole number.

Impacted Receptors (Build noise levels > 66 dBA)

Table 17 NSA 14 Noise Barrier Evaluation

		N 1 6		E (N B III	Future No B	arrier (2039)			Future Bar	rier (2039)		
NSA	Site ID	Number of Units	Existing 2014	Future No-Build 2039	Noise Levels	Increase Over Existing	Noise Levels	I.L.	Noise Levels	I.L.	Noise Levels	I.L.
	M14-1	2	61	63	66	5	62	4	59	7	60	7
	R14-18	2	56	57	61	5	59	2	59	2	59	2
NSA 14	R14-19	2	58	60	61	3	55	6	54	7	54	7
NSA 14	R14-20	2	57	58	62	5	60	2	57	5	57	5
	R14-21	3	58	59	63	5	59	3	57	6	58	5
	R14-22	1	55	56	60	4	57	3	54	5	57	3
	A TNM Data		Existing 2014 IENT SYSTEM D	Future No-Build 2039	Future Bi	aild 2039	NSA 14 Case 1		NSA 14 Case 2		NSA 14 Case 3: O	
Barrier Area		SE ADATEM	IEM SISIEM D	ETAILS.				32026		38431		20205
	er of Receptor	rs Impacted						2		2		2
		ving≥ 5 dBA	I.L.					0	1	2		2
			ıg≥ 5 dBA I.L.					0%	1	100%		100%
		5 dBA Reduc	-					No	1	Yes		Yes
Benefited Re	ceptors (thos	e receiving≥ 5	dBA I.L.)							10		9
			(SF/BR)≤ 2000						1	3,843		2,245
Barrier Reas	onable from a	SF/BR Stand	point?						1	No		No
Average Noi	se Reduction	for Benefited	Receptors (dBA)						1	6.0		5.6
Is 7 dBA I.L.	goal met for	at least one be	enefited receptor?]	Yes		Yes
Total Barrier	Length (ft)							3203]	3203		1700
Barrier Heigl	ht Range (ft)							10]	12		10 to 12
Average Bar	rier Height (f	t)						10.0		12.0		11.9

NOTES:

dBA = Decibels on the A-weighted scale

Leq = Equivalent noise level

I.L. = Insertion Loss

All noise levels are calculated to the tenth of a dBA and rounded for presentation purposes to the nearest whole number.

Impacted Receptors (Build noise levels > 66 dBA)

Impacted Receptors Units Receiving≥ 5 dBA I.L.

Table 18 NSA 15 Noise Barrier Evaluation

		N 1 C		E 4 N D 11	Future No Ba	arrier (2039)			Future Bar	rier (2039)		
NSA	Site ID	Number of Units	Existing 2014	Future No-Build 2039	Noise Levels	Increase Over Existing	Noise Levels	I.L.	Noise Levels	I.L.	Noise Levels	I.L.
	M15-1	2	61	62	66	5	64	3	60	7	60	7
NSA 15	M15-2	1	59	60	64	5	62	2	58	6	60	5
	M15-3	2	54	55	58	4	57	2	53	5	55	3
FHW	VA TNM Data	a File	Existing 2014	Future No-Build 2039	Future Bu	aild 2039	NSA 15 Case 1		NSA 15 Case 2		NSA 15 Case 3: O	
RECOMME	ENDED NOI	SE ABATEN	MENT SYSTEM D	ETAILS:								
Barrier Area	(ft ²)							24421		34190		17574
Total Numbe	er of Receptor	rs Impacted						2		2		2
Impacted Re	ceptors Recei	ving≥ 5 dBA	I.L.					0		2		2
Percent of In	npacted Recep	ptors Receivir	ng≥ 5 dBA I.L.					0%		100%	1	100%
Barrier Feasi	ble Based on	5 dBA Reduc	ction Criteria?					No	1	Yes	1	Yes
Benefited Re	eceptors (those	e receiving≥ 5	5 dBA I.L.)							5		3
Square Foota	ige per Benef	ited Receptor	(SF/BR)≤ 2000							6,838]	5,858
Barrier Reaso	onable from a	SF/BR Stand	lpoint?							No		No
Average Noi	se Reduction	for Benefited	Receptors (dBA)							5.7	1	5.9
Is 7 dBA I.L.	.goal met for	at least one be	enefited receptor?						1	Yes]	Yes
Total Barrier	Length (ft)							2442		2442] [1198
Barrier Heigl	ht Range (ft)							10]	14] [10 to 16
Average Bar	rier Height (f	t)		•				10.0		14.0		14.7

NOTES:

dBA = Decibels on the A-weighted scale

Leq = Equivalent noise level

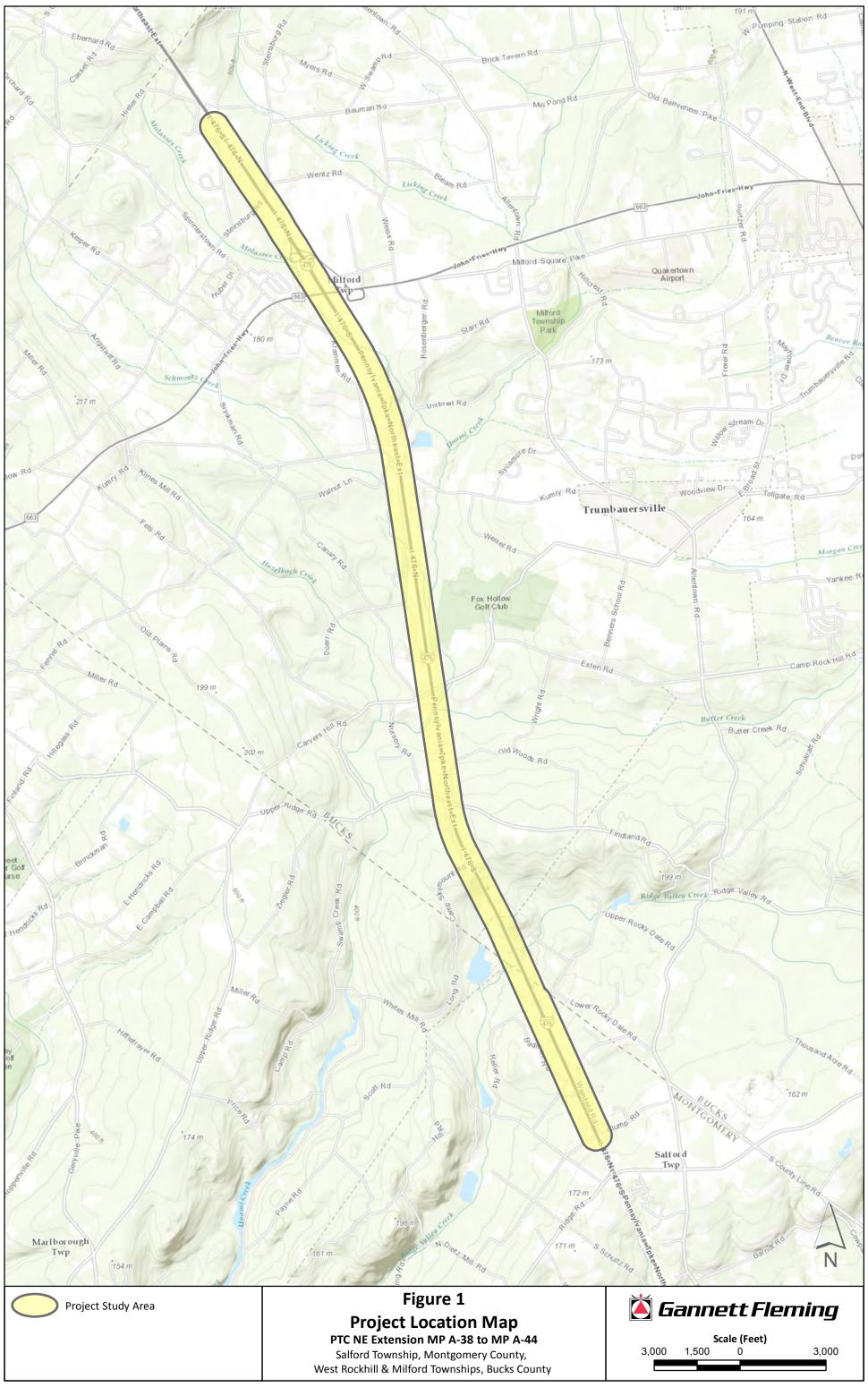
I.L. = Insertion Loss

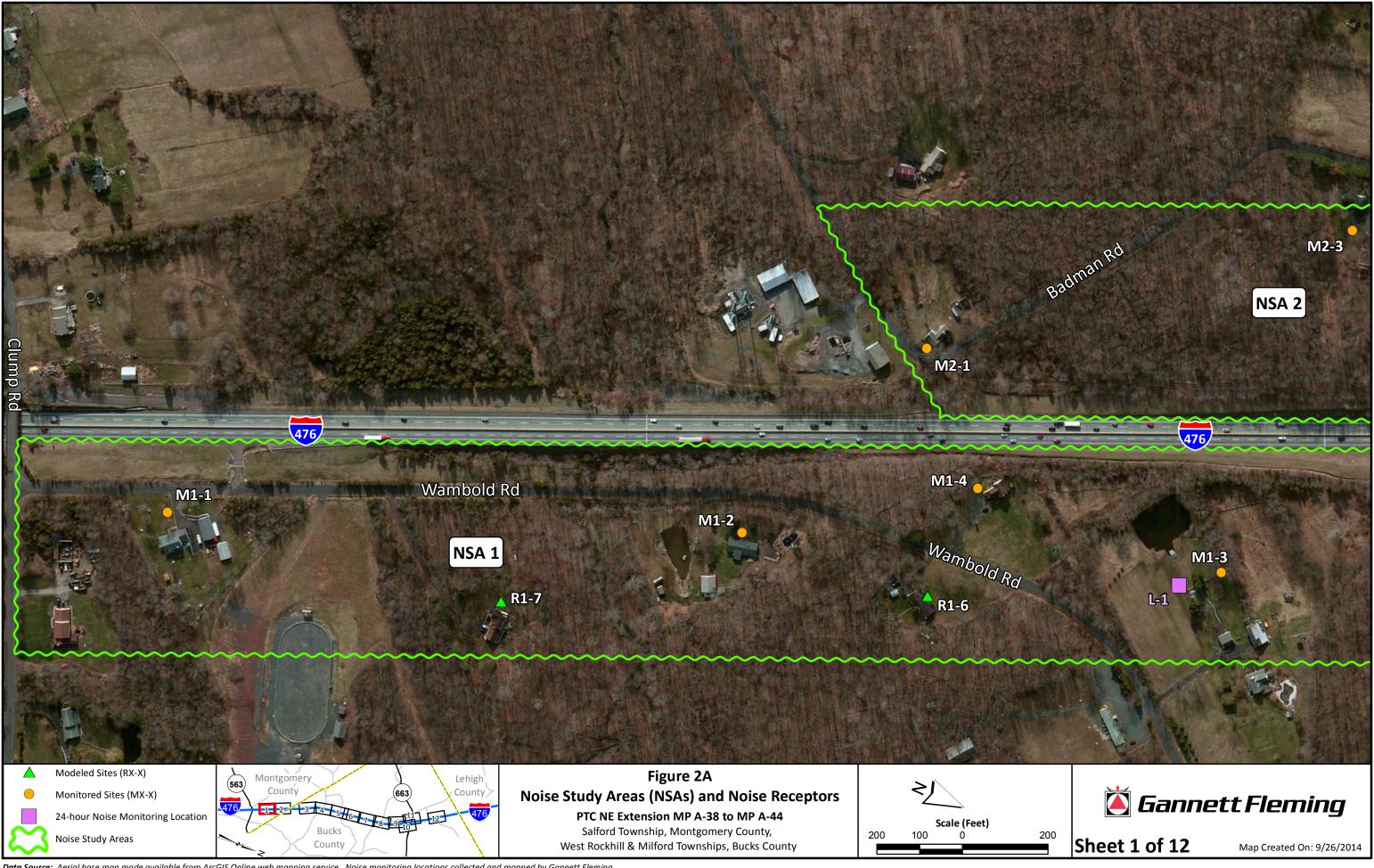
All noise levels are calculated to the tenth of a dBA and rounded for presentation purposes to the nearest whole number.

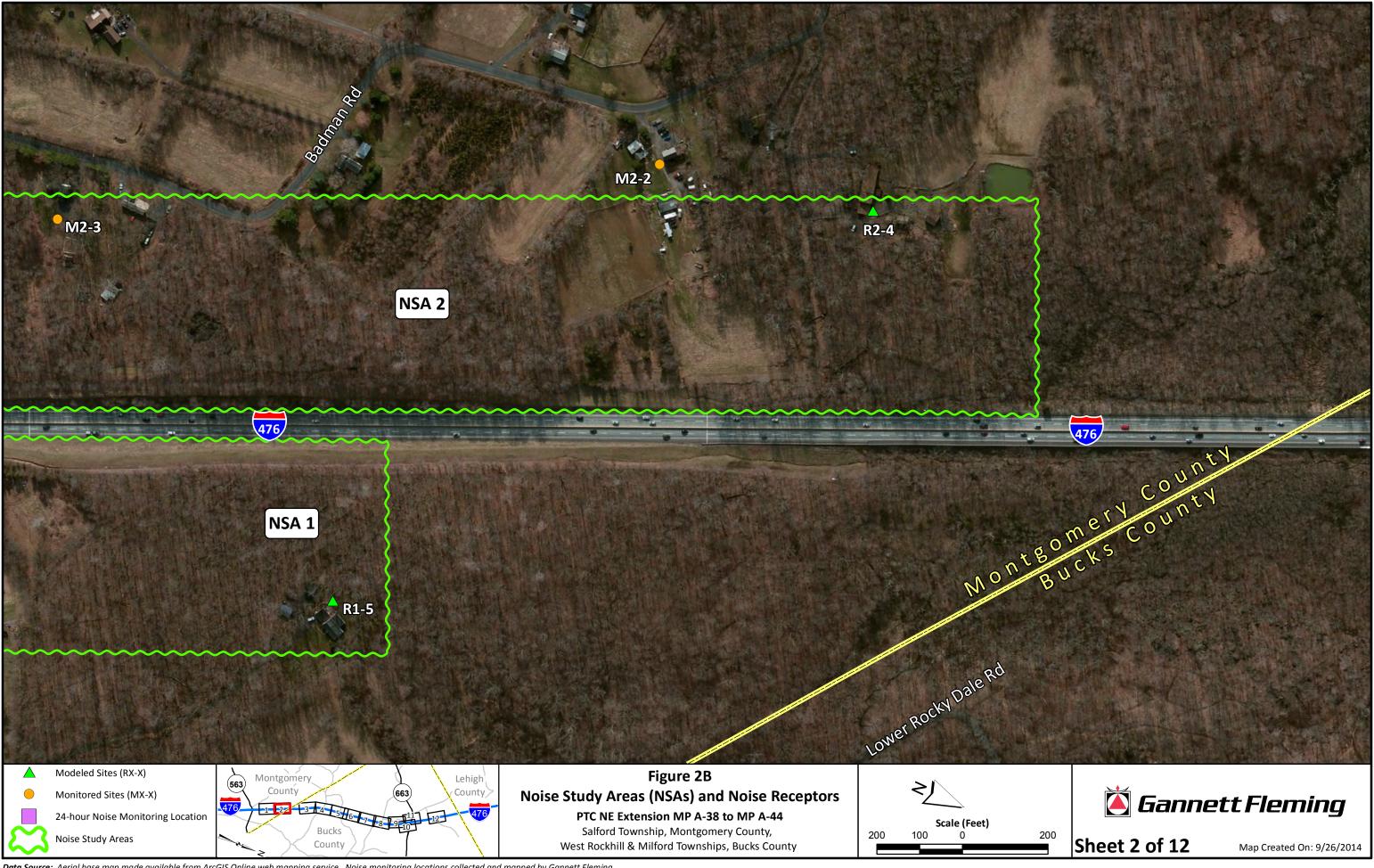
Impacted Receptors (Build noise levels≥ 66 dBA)

Impacted Receptors Units Receiving≥ 5 dBA I.L.

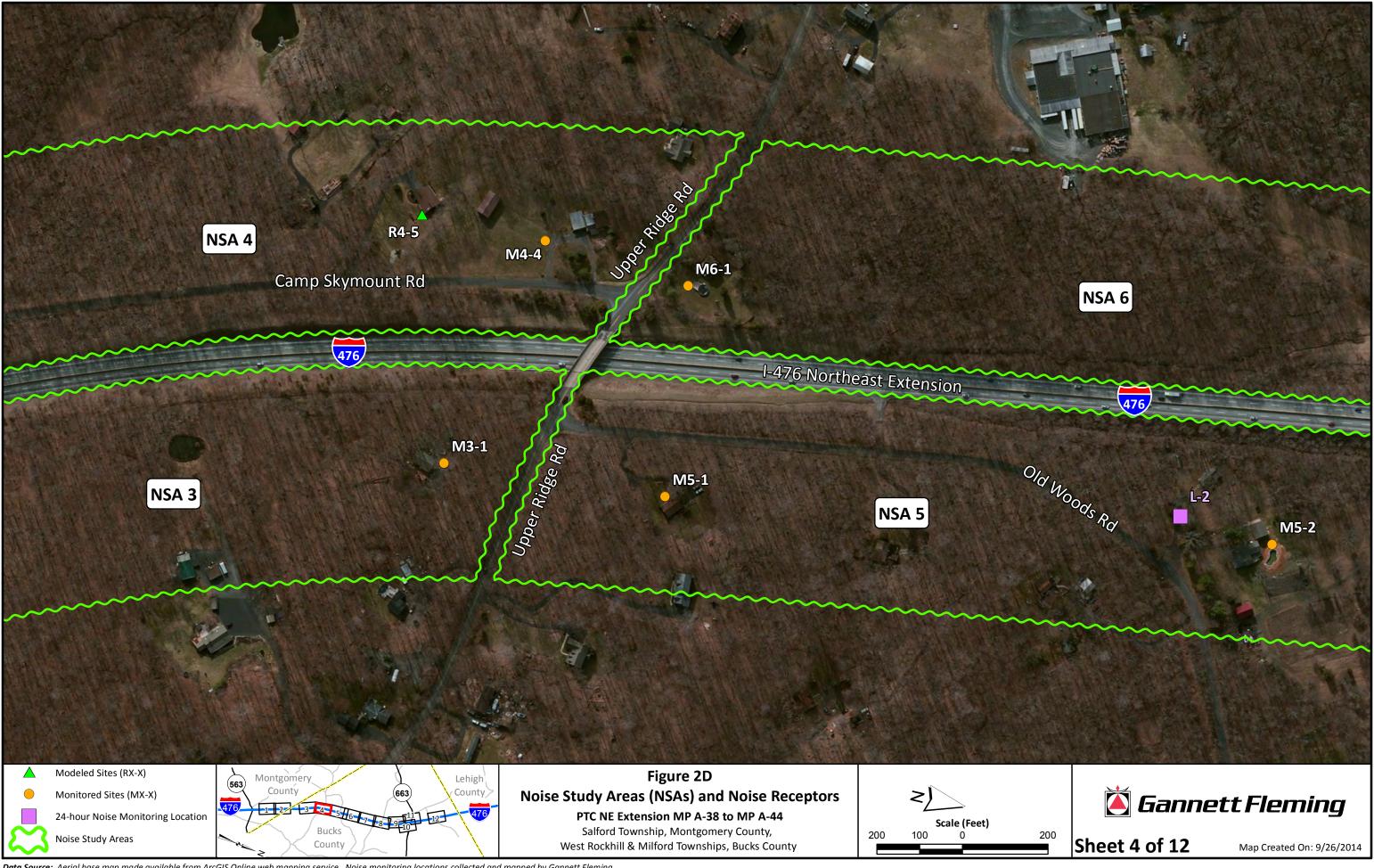
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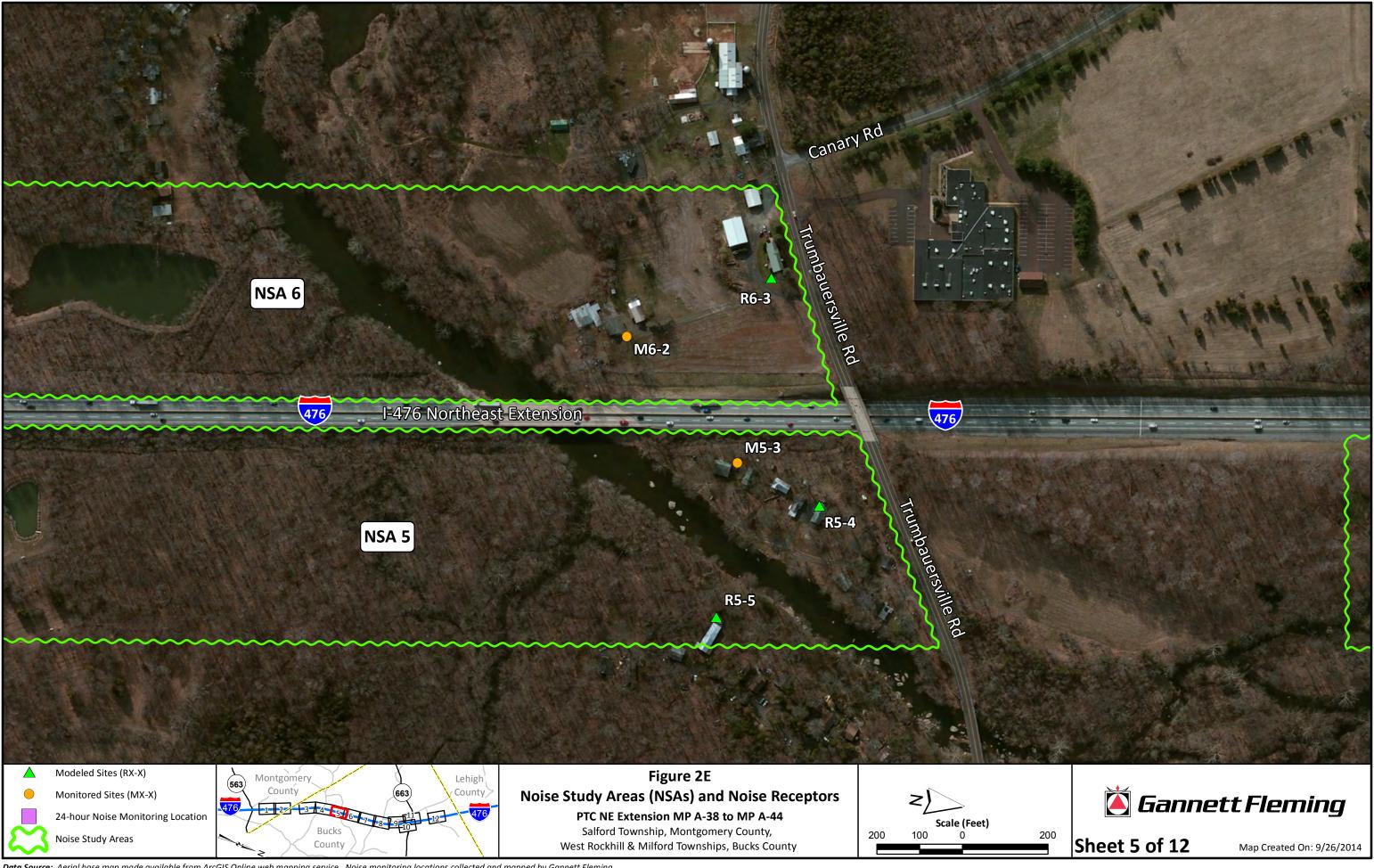


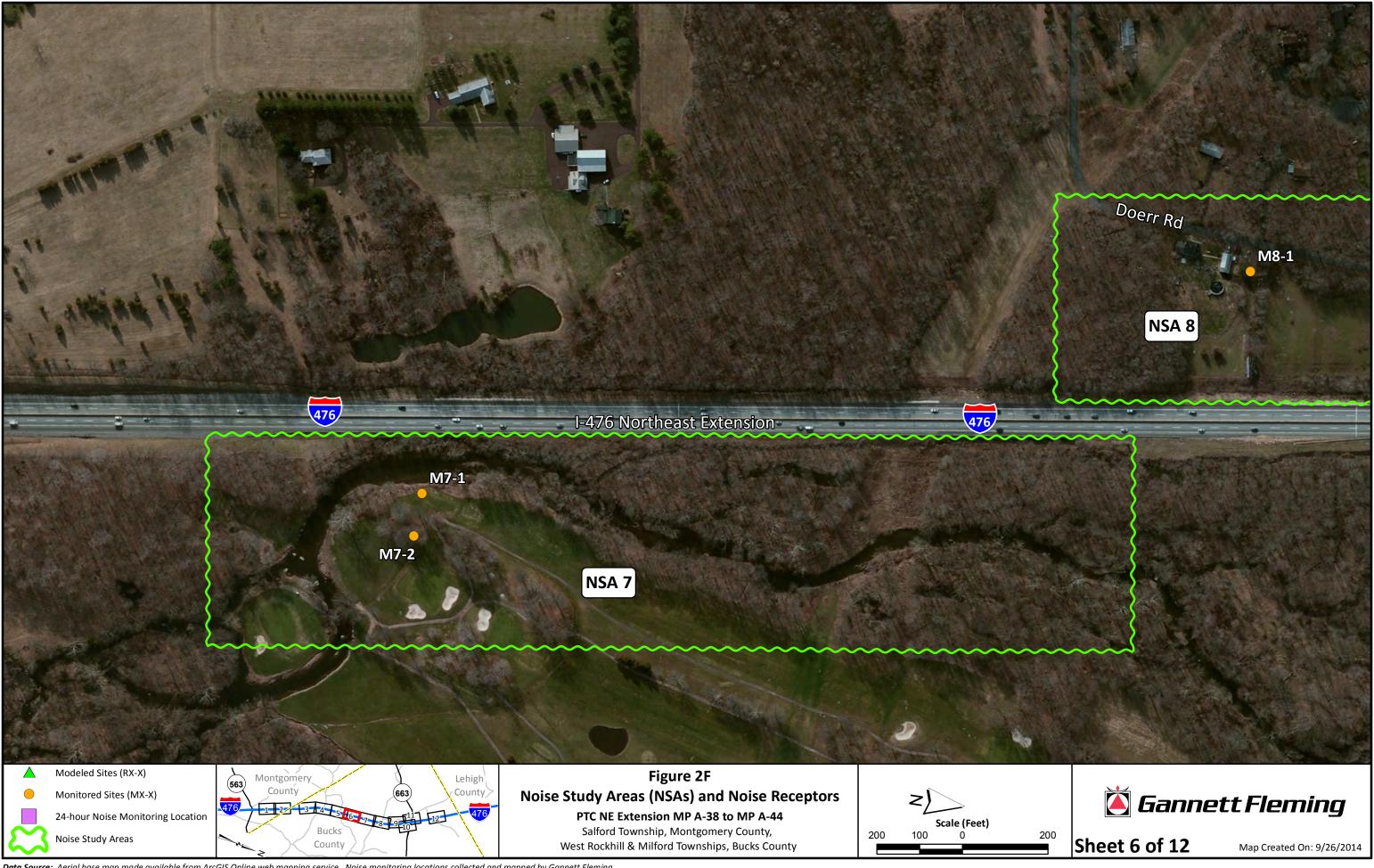




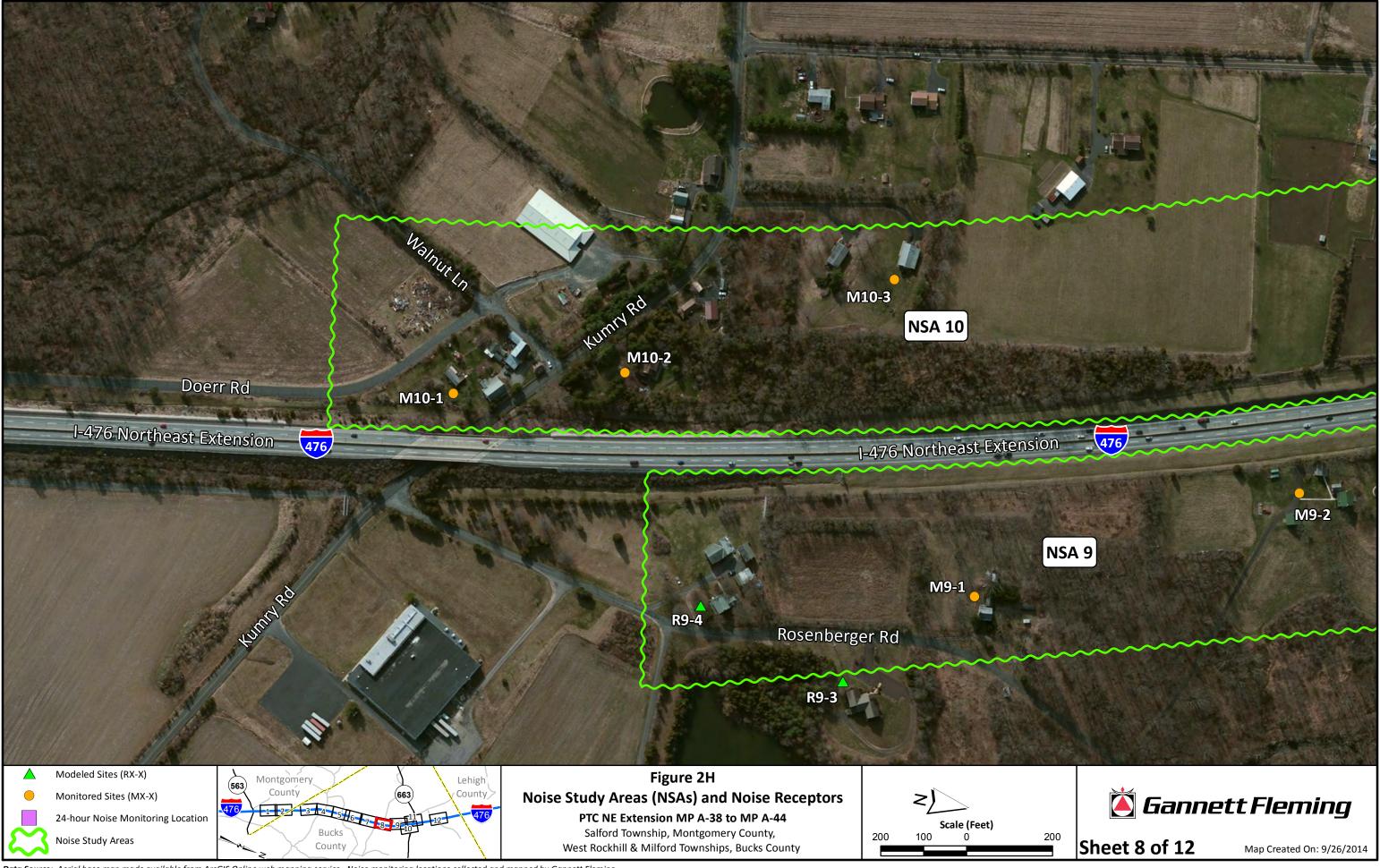


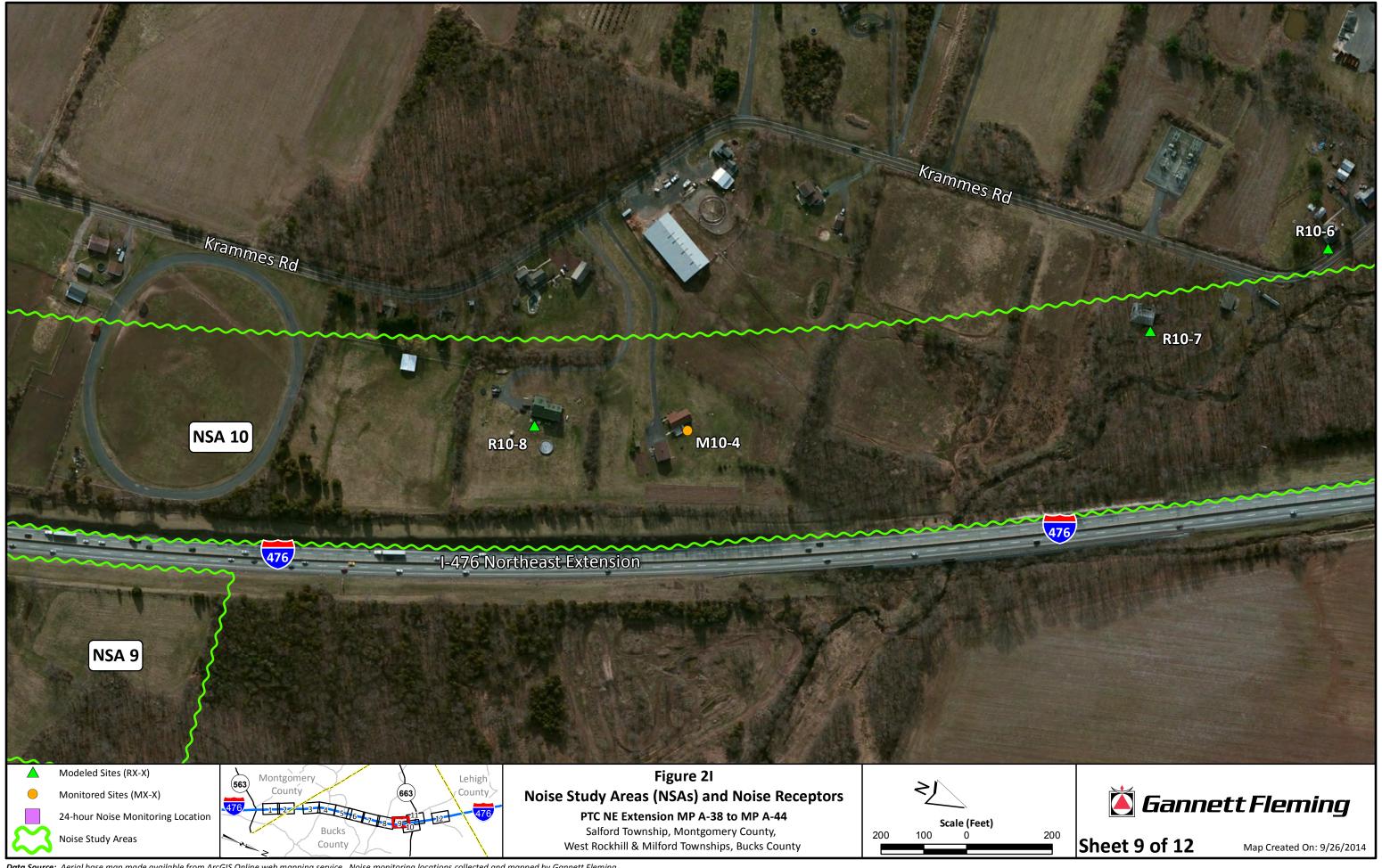




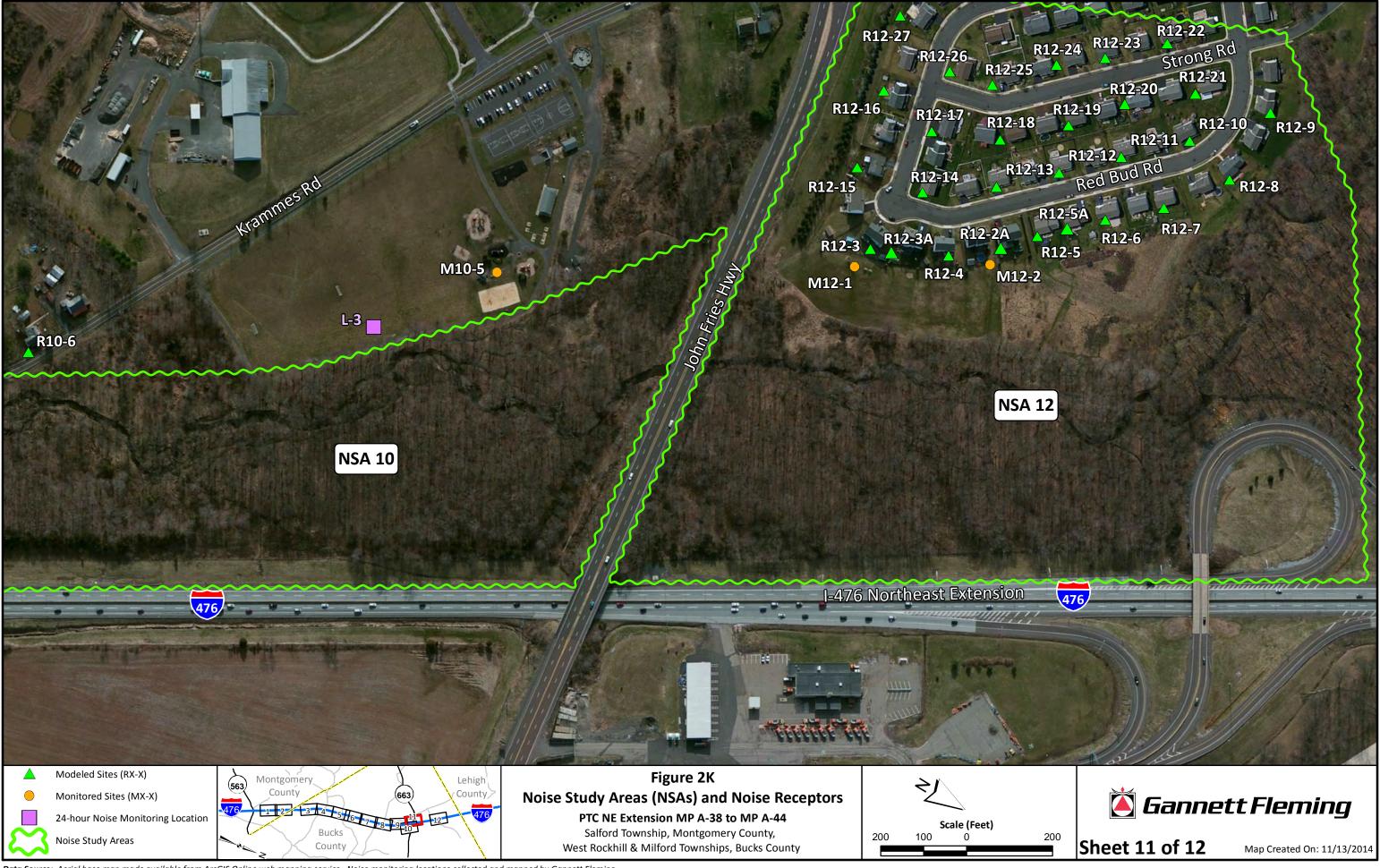


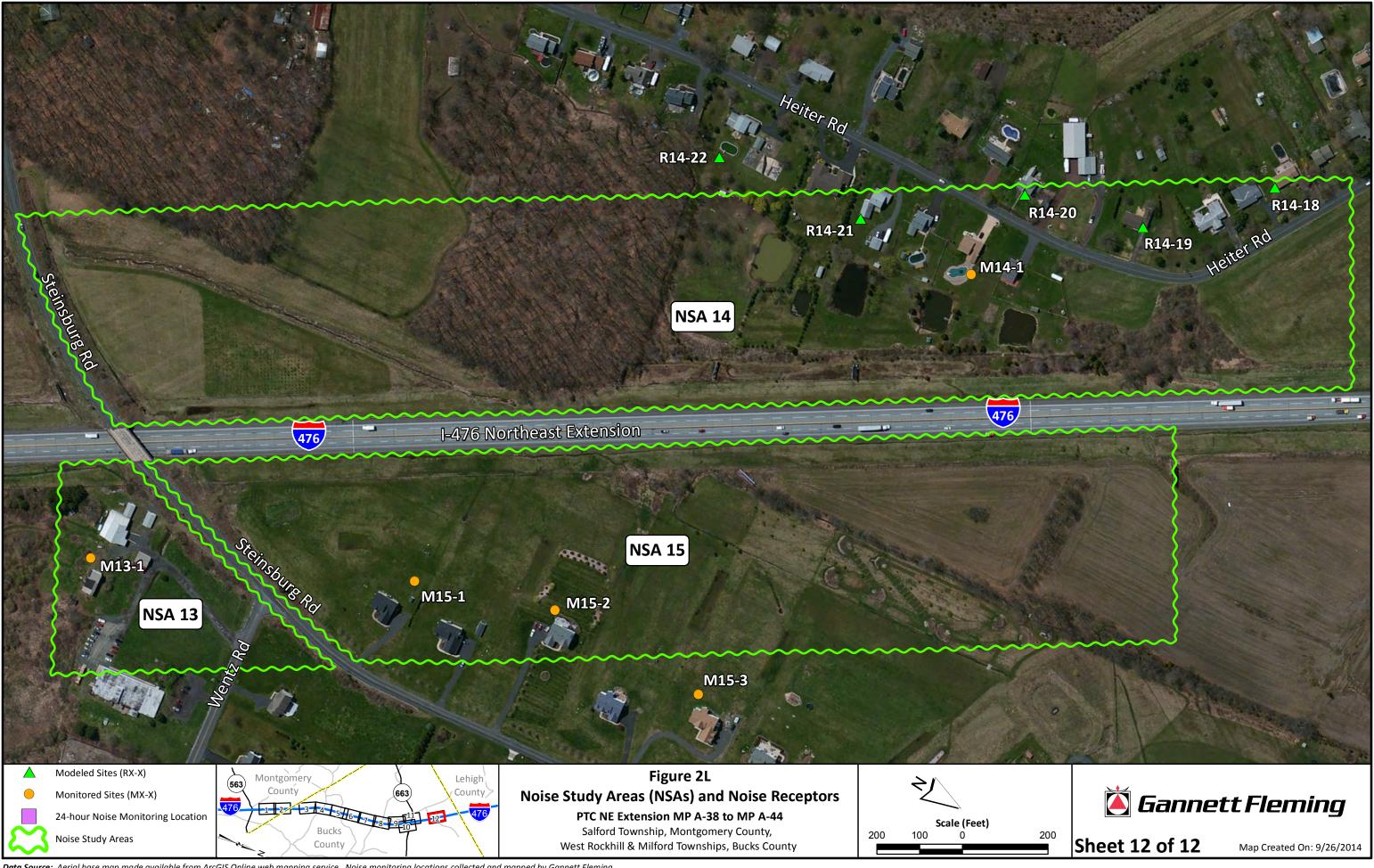


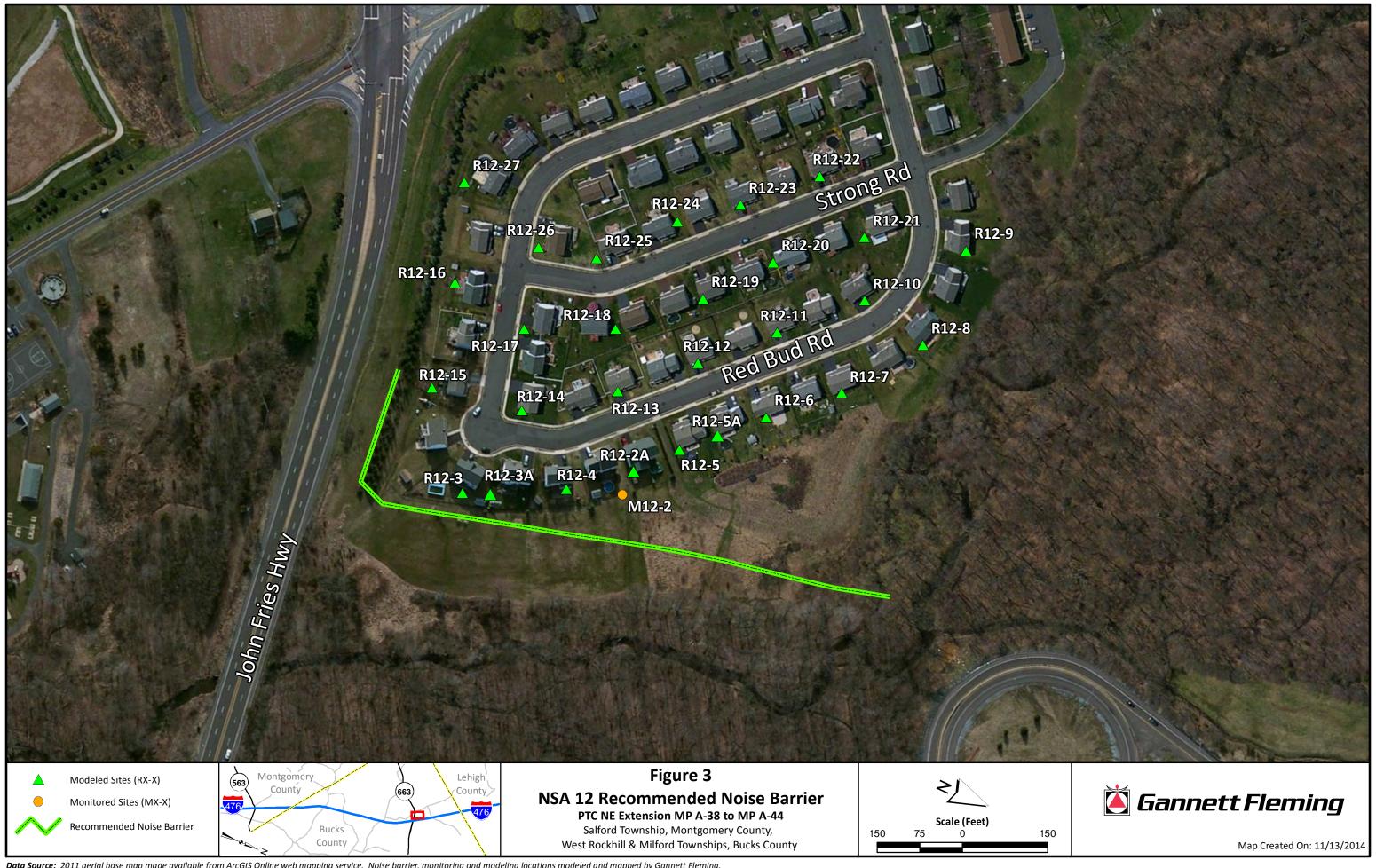












APPENDIX A

Short-term Measurements Field Data Sheets

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TYPE [] Resid	ential	☐ Co	mm	erci.	al [Reli	gion	ı 🗆	Ed	luca	tior	nal		Oth	er						
Measure	ment	Data										Pł	noto	gra	ph #	¥'s	<u>333</u>	<u>- 3</u>	43		243	5-2	<u>52</u>
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JOB #5	<u> </u>	-102	<u> 35</u>	1				Gannett	_			4.5			_			
SITE ID	<u>m2</u> -	1					Fl	eming, I	nc.		Met	er S	tor	age	# .		38	
TYPE 🖂	Resid	ential		Com	mer	cial 🗀	Reli	gion [] Educa	tional	П	Othe	er					
Measure																		5-28
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OJECT:	-476					BA	PMAN F	<u>د ۲</u>	
B # <u>5539</u>	8-1023	51		Gannett	J				
TE ID	m2-2			Fleming, l	nc .	Meter Sto	orage # _	39	
PE 🛛 Re	esidential	Comme	ercial 🗌	Religion] Educational	☐ Other			
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STE ID	JOB #_ \$	5398-	1023	51			Gannet	i j	_				
Measurement Data	SITE ID	ma.	3				Fleming,	Inc.	Ме	ter Sto	rage #	40	
Measurement Data	TYPE 🖂	Reside	ntial [☐ Cor	mmerc	ial 🗍	Religion [☐ Educati	ional 🗍	Other			
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Weather: temperature 5. vind speed 0 cloud cover 25.7.				1	,				rograpn	# 5 <u>55</u>			
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PROJECT:	I-47	6							<u> </u>	ould	here L	Noc	Za	
JOB # 55	398	-1023	SI			Garage	2			CA	MDA	රුරන	MM (Pond
SITE ID						Ganne Fleming			Mete				002	
TYPE [Reside	ential [] Coi	mmer	cial 🗌	Religion	☐ Educ	ational	<u> </u>	ther	CA	w.Ç.	Other is 3	<u> </u>
Measure	ment	Data					P	hotogra	ph #'	s				<u> </u>
SLM Calib	ration				after		_					_	70	<u> </u>
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Traffic	Data													
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SITE IDMU	DATE: 6-25 PROJECT: 1-47 JOB # 55398	16				: Skymo	ion RD
Measurement Data					Meter Sto	rage # <u>ල</u>	026
Measurement Data	TYPE Reside	ential 📋 Commer	cial 🗌 Religion	Educational	Other		
SIM Calibration						13-18	
Weather: temperature wind speed cloud cover			after			GPS PT _	936
Data: 1st Leq Limax Limin SU, 8 SEL Q 2, 4	Weather:	temperature	wind speed				
Roadway#1 LUTU NIB Roadway#2 LUTU SB Roadway#3 Roadway#4	Data: 1st	Leq Call	Lmax <u>(45.3</u>	Lumin <u>54</u> ,		92.6	_
Direction	Traffic Data	-					_
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DATE: PROJECT: JOB #SS	Î-47	6			Ga	nnett				SK					
SITE ID	174-	3				ng, Inc.		Meter	Stor	age	# _	<u>00</u>	25		
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SLM Calib	ration	before	<u> 94</u>	after	·					GPS	PT _	93	<u>35</u>		
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Measurement Data			Photograp	h #'s <u>44</u>	3-	<u>352</u>	-
SLM Calibration before 114.C	after	<u> </u>			GPS PT _	879	<u> </u>
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Highway Noise Monitoring Sheet 1960 ADDRESS: OID WOOD RD DATE: 6-4-13 PROJECT: L-476 JOB # 55398-102351-T1802 Gannett Fleming, Inc. Meter Storage # _ 3 SITE ID M5-2 TYPE Residential Commercial Religion Educational Other Photograph #'s _ Measurement Data GPS PT <u>853</u> SLM Calibration _____after before _ 0-8 _ cloud cover_1003 Weather: wind speed temperature Time: 1st 4:06 20 stop total 2nd 51.4 78.2 stop total Data: 1st Lmax Lanin 2nd Lmax Lmin Traffic Data Roadway#3 Roadway#1 Roadway#4 NB Direction Direction Direction Direction 1st 2nd 1st 2nd 1st 2nd $\mathcal{G}^{0,\phi}_{\text{auto}}$ auto auto auto 30 med. trk. 10 med. trk. med. trk. med. trk. 010 hvy trk. hvy trk. hvy trk. hvy trk. bus bus bus bus \mathcal{V} motorcycle > motorcycle motorcycle motorcycle Low Rumble of Expansion "him? SITE SKETCH 3 OLD WOUD RD

PROJECT: 1-40 JOB # 55298-102551 THE CARBON TRANSCRIPT Residential Commercial Religion Educational Other CARDS TYPE Residential Commercial Religion Educational Other CARDS Measurement Data Photograph #'s 69- SIM Calibration before 240 of after GPS PT 948 Weather: temperature 90 wind speed cloud cover Intel 1st start 9:14 stop 9:24 total 20 2nd start stop total 20 2nd leq Lenax Lenin SEL 99.2 Intel 2nd Leq Lenax Lenin SEL 99.2 Intel 2nd Leq Lenax Lenin SEL 99.2 Prection Traffic Data Readway#2 T-476-56 Readway#3 Readway#4 Direction 19 50 24 auto 14 24 14 14 14 14 14 14	DATE: 6-26	- 13				ADDRESS:			
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TYPE Residential Commercial Religion Educational Other Measurement Data Photograph #'s SLM Calibration before 90 after Weather: temperature wind speed cloud cover Time: 1st start 2:25 stop 2:45 total 20 2nd start stop total Data: 1st Leq 04.6 Lmax 72.9 Lmin 57.3 SEL 20 2nd Leq Lmax 72.9 Lmin 57.3 SEL 20 Traffic Data Roadway#1 Land MB Roadway#2 1-476.56 Roadway#3 Roadway#4 Direction Direction Direction Direction	
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SITE ID	M71-1	M7-2			Fleming,		Meter Sto	rage #	145- 42
TYPE [ial 🗀	Religion [_ Educational			
			_ commerc	101 <u> </u>	rengion [
Measure	ment I	ata				Photogra	ph #'s <u>43</u>		340-351
SLM Calib	ration	before	114.0	after		_		GPS PT S	73- 874
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SHE ID	11100	l .					M	erer D	orage # _	<u>30 5 0</u>	
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јов # <i>5</i> 5	7398-	102351	-71802		Ganne	2					
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Traffic	Data										
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JOB # 5	5398	1023	51		Gannet		_			1	
SITE ID	9.4				Fleming,		Me	eter Sto	rage #	42	
түрк 🖂	Reside	ntial [Commer	cial 🗆	Religion [☐ Educat				-	
			_ commer	CIAI []	rengion [
Measure	ment	Data				Pho	otograph	#'s <u>24</u>	1-396		
SLM Calib	ration	before	114.0	_ after		_			GPS PT _	366	7
Weather:			erature <u>8</u>								
Time:	1st 2nd		1:51					_			
Data:	1st	start Leq	56.9		80.(46.4	— Sel	87.6		
	2nd	Leq								_	
Traffic	Data										
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auto	1st 3841	2nd 1152	auto	1st 325	2nd 1975	auto	1st 	2nd	auto	1st	2nd
med. trk.	21	63			27	med. trk.			med. trk.		
•		279	hvy trk.	<u> 53</u>	159	hvy trk.			hvy trk.		·
bus motorcycle	5	<u>0</u> 15	bus motorcycle	. 0	0	bus motorcycle	-		bus motorcycle		
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	6-5	- 13				_		ADDRESS	S:		
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JOB # <u>5</u>	5988-	10235			Ganne	<u> </u>		Dog	TRAINER	1	
SITE ID					Fleming,		M		rage #		
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Measure							rograpi	. # S	GPS PT		
SLM Calib	ration		114.0		*	*				800	
Weather:	4_4	_	erature 85		_				205		
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	2nd	Leq		Lmax		Lmin		SEL			
Traffic	Data										
Roadway#1	7-47	6 MB	Roadway#2	<u> </u>	6513	Roadway#3			Roadway#4		
Direction			Direction	_		Direction			Direction		
auto	1st 396	2nd 188	auto	1st 30 B	2nd 924	auto	1st	2nd	auto	1st	2nd
med. trk.	<u>20</u>	60	med. trk.		48_				med. trk.		-
•	109	327	hvy trk.	<u> 62</u>	126	-			hvy trk.		
bus motorcycle			bus motorcycle			bus motorcycle	-		bus motorcycle		
SITE SKE	тсн									***	
	1011								····		
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JOB # <u>S</u>	5 398-	10235	5.1			Gan	nett.					
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TYPE 🔀	} Reside	ential	□ c ₀	ommer	cial 🔲	Religion	Educa	tional [Other			
Measure								_		03-411	31	<u>2-3</u> 2
SLM Calib	oration	befo	re	4.0	after					GPS PT _	8એ8	
Weather:							ed	clo	ud cover	0		-
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hvy trk.	76	228	_	y trk.	51	153				med. trk. hvy trk.		
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SITE SKE	TCH		•]
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TYPE Residential Commercial Religion Educational Other Measurement Data Photograph #'s 397-402 306-311 SLM Calibration before 114 after Weather: temperature 86.1 wind speed O cloud cover 50.70 Time: 1st start 2.27 stop 2.47 total 20 2nd start stop total Data: 1st Leq (65.9 Lmax 78.4 Lmin 51.0 SEL 96.7 2nd Leq Lmax Lmin SEL Traffic Data Roadway#1 7-476 NB Roadway#2 1.476 58 Roadway#3 Roadway#4 Kouky 5ND Direction Direction Direction 1st 2nd auto 40.3 1.20.9 auto 34.7 10.41 auto 1st 2nd auto 12 med trk. 18 5.4 med trk. 9 27 med trk. med trk.	DATE:				•		1			ss: <u>18-90</u>		
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JOB #	5398	- 105	1351		Gannet	<u> </u>	_				
SITE ID	m1	0-3			Fleming,		Ме	ter Sto	rage #	44	
TYPE 🔽	Reside	ential [□ Comme	ercial	Religion [_ Educatio	onal \square	Other			
Measure									2-416		
							- BF	<i>"</i>	GPS PT		
SLM Calib	ration								-		<u> </u>
Weather: Time:	1.04	_			_	<u> </u>			3		
mine.	1st 2nd	start start		_	3:33	_ total _ total					
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	4		Direction			Direction _			Direction		
auto	1st 561	2nd 1683	auto	1st 3(40)	2nd 1080_	auto	1st i	2nd	auto	1st i	2nd
	13	39	med. trl	- 1	42	med. trk.			med. trk.		
hvy trk.	66	198	hvy trk.	53	159	hvy trk.			hvy trk.		
bus	<u>2</u>	6	bus	<u>a</u>	<u> </u>	bus _			bus .		
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JOB #_5	5398	<u> 109-</u>	35	!					Gan	nett													
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TYPE 🔽	Resid	ential	□ c	omm	erc	ial		Reli	gion	· [] E	luca	tior	ıal		Oth	er						
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leasure	ement	Data						P	hotog	grap	h #	's _	<u>28</u>	<u>5 -</u>	291		19	<u>4-20</u>
SLM Calib	oration	befor	e <u>113</u>	3,9	after			_					G	PS	PT .			
Weather:		-	erature ,			wind	speed	0-8		clo	ng c	over_		<u> </u>				
lime:	1st		4:1					_ total		<u>ာ</u>								
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Julu.	2nd	Leq					<u>····</u>	_					-	- 5	117			
Traffic	Data																	
Roadway#1			Road	iway#2	上心			Roadway	#3				1	Road	way#	4		
Direction	4		Direc	ction		<u> </u>		Direction				_	:	Direc	tion	_		
uto	1st 291	2nd 873	auto	,	1st 319	95		auto		st	_ z	nd ——		auto			lst	2nd
ned. trk.	<u>21</u>	63	med.	. trk.	21		3	med. trl	τ				:	med.	trk.			ļ
vy trk.	80	240	hvy	trk.	74		2	hvy trk.					;	hvy 1	trk.			-
us	8_	24	bus		<u> 4</u>		<u> </u>	bus					•	bus				<u> </u>
•		,3	moto	orcycle			<u>o_</u>	motorcy	cle		<u> </u>			moto	rcycl	le		
IOTES:		13	moto	orcycle			<u>o</u>	motorcy	cle				:	moto	rcycl	le		
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JOB #	<u>55398</u>	3-1023	<u>51-7180</u>	2	_	Ganne					_								
SITE ID		11-1			P.	leming,	inc.			1	Met	er S	tor	age	# .				
TYPE [Resid	ential [_ Comm	ercial [Reli	gion	E	duce	tion	ıal [Othe	er						
Measure	ement	Data						Pł	noto	grap	h #	l's	25.	1 - 2	65			16.	7-17
SLM Calil	oration	befor	e 113.9	after			_						(GPS	PT .	8	45		
Weather:		temp	erature	5 8	wind	speed				clo	ud c	over		<u> </u>					
Time:	1st	start	7:49			3:09													
Data:	2nd 1st	start												~	> 1				
Data.	2nd	Leq Leq		Lmax	•					1. 10				<u> </u>	1.1		•		
Traffic		204			-								•				•		
		. .																	
Roadway#1 Direction	<u> </u>		Roadway Direction	#2 <u>I</u>	4-			iway# ction							way#- ction	4			—
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JOB # 55									1,500		P
					Gann Fleming	ett , Inc.		St	"	21	
SITE ID	1041						J.	deter St	orage #		
TYPE 🖸	Reside	ential [Commerc	ial 🗌	Religion	☐ Educa	tional [Other	r		
Measure	ment	Data				Pł	notograp	h #'s <u>2</u>	46-273		5-181
) \ D	_					GPS PT	947	,
SLM Calil	oration		113.9	•	•					•	
Weather: Time:	1st		8:32			1 <u>0-8</u> total			<u> </u>	•	
inne.	2nd	start start		-							
Data:	1st	Leq	60.3	•					91.1		
	2nd	Leq		Lmax		Lmin		SEL			
Traffic	Data								·~·		
Roadway#1	7 -177	L NE	Roadway#2	6 - M	16 SR	Pagd#	3 70HH	Fa	10 Pand	4 JOHA	<u>-</u>
Direction	4		Direction			Direction	<u>√</u>	FEB	Direction		+ WB
	1st	2nd		1st	2nd		1st	2nd		1st	2nd
auto	317	9 <u>51</u>		<u> 544</u> 11	33	auto med. trk.	126	756	auto	ही	522
med. trk. hvy trk.	72	216	med. trk. hvy trk.	77	231	hvy trk.	<u> </u>	0	med. trk.	5	30
bus	0	۵	bus		3	bus		6	bus		6
motorcycle	4	12	motorcycle	0	0	motorcyc	le <u>()</u>	S	motorcyc	le <u> </u>	
SITE SKE	тсн										
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			1.60	Continues							· · · · · · · · · · · · · · · · · · ·

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PROJECT:	エー	176						REDI	BUB RA	.	
JOB # <u>5</u> S	5398-1	02351-	71802		Gannet						
SITE ID	12-	٧			Fleming,	Inc.	M	eter St	orage # _	27	
TYPE 🖸	Reside	ntial [] Commerci	ial 🗌	Religion [Educat	ional [Other			
Measure	ment	Data				Pho	otograph	#'s 2 <u>7</u>	3-284	182-	193
SLM Calib	ration	before	113.1	after		<u> </u>			GPS PT _	४ ५8	>
Weather:		_	rature <u>60</u>		_	'			<u>s</u>		
Time:	1st		9:01	_		total _					
Dala	2nd	start							~c	-	
Data:	1st 2nd	Leq Leq	57.7		12.5		44.0		88.5	_	
Traffic		red		max				566	-		
Roadway#1	 	76	Roadway#2	1-4	ا ما	Roadway#3			Roadway#4		
Direction		- NIB	Direction	STREET	> 5ℝ	Direction			Direction		
auto	289	2nd 867	auto	1st 381	2nd 1143	auto	1st	2nd	auto	1st	2nd
med. trk.	ما ا	48	med. trk.	7	21	med. trk.			med. trk.		,
hvy trk.	<u>60</u> 3	180	hvy trk.	104	192	hvy trk.			hvy trk.		
bus	~	9	bus .	4	12	bus			bus		
motorcycle NOTES:	O Tuent		motorcycle	هر ماع							
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PROJECT:	1.47	-م					<u>-</u>	ראזציו	of LAB-	POLIT	70
JOB #	<u>5398</u>	10235			Ganne	■ tt	7	Newiz	STEIN	at it in	
SITE ID	13-	1			Fleming,	Inc.			rage # _		
TYPE 💆	Resid	ential [Commer	cial 🗌	Religion	Educa					
Measure											
SLM Calib			114.1	after					GPS PT _		
Weather:		tempe	rature		wind speed		cloud	cover			
lime:	1st		4.42		<u>5:05</u>						
Data:	2nd 1st	start Leo	63.4		74.5		52.5		94.2		
	2nd	Leq	· · · · · · · · · · · · · · · · · · ·		-					_	
Traffic	Data										
Roadway#1	アガ	. (.	Roadway#2	1.4	~~	Roadway#	3		Roadway#4		
Direction	1-4		Direction		<u> </u>	Direction	4-4	<u></u>	Direction	4-4	
auto	1st <u>497</u>	1491	auto	1st 357	brs	auto	1st	2nd	auto	1st	2nd
		24			19	med. trk.	-		med. trk.		-
hvy trk. bus	<u>50</u>	3	hvy trk. bus	<u>47</u> 3	141	hvy trk. bus			hvy trk.		
notorcycle		0	motorcycle		6		e		bus motorcycle		
SITE SKE	тсн										
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DATE: PROJECT: JOB #S	<u>1-4-</u> 5398-	76 <u>.</u> 102351-	T1802		Gann			Ne:	s:R	D	
SITE ID									rage # _		
TYPE 🗾	Reside	ential [Commo	ercial 🗌	Religion	Educat					
Measure	ment	Data				Ph	otograph	ı #'s			
SLM Calib	ration	before	114.0	after					GPS PT _	850	7
Weather:						i					
Time:	1st 2nd	start start	11:20			total _ total					
Data:	1st	Leq				Lmin _			92.5	•	
	2nd	Leq		Lmax		Lmin _	•	Sel			
Traffic	Data										
Roadway#1			_	#2 <u>I-1</u>					Roadway#4		
Direction	1st	2nd	Direction	n	2nd	Direction		2nd	Direction	1st	2nd
	268	804	auto	<u> 272</u>	816	auto			auto		
med. trk. hvy trk.	94	7 <u>9</u> 282	med. tr.	k. <u>12</u> 65	195	med. trk. hvy trk.			med. trk. hvy trk.		
bus	3	9	bus		0	bus			pus		
motorcycle	_3_	9	motorcy	rcle	3	motorcycle	e		motorcycle		<u></u>
SITE SKE						az -Jak					
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DATE:	6-4-	13				1				AD:	DRE	SS:		246	5			
PROJECT:		16									H	عتن	-13 <u>-</u>	R	>			
JOB # 55	398-1	02.351-	T190:	_ 2														
SITE ID							nnett ng, Inc.		1		r S	tore	ge	# _	کر	<u>1</u>		
TYPE 🔽	Reside	ntial [Con	nmerci	al 🔲	Religio	n 🔲 Ed	lucati	onal [the	r .						
Measure	ement	Data						Pho	tograp	h #	's _				• •			
SLM Calib	oration	before	114	<u>, o</u>	after							G	PS	P T _				
Weather:		tempe	rature	65		wind spe	ed		clo	ud c	over_	٥						
Time:	1st	start	10:5	5	stop	11:15	to	tal	20									
	2nd	start		. 1									_	<i>~</i> ^				
Data:	1st	_					Ln					•	· ·	9.2				
	2nd	Leq			Lmax		Lm	un			SEI							
Traffic	<u>Data</u>																	
Roadway#1	_I-4-	ص ا	Road	dway#2	12-U	176	_ Road	way#3				:	Road	way#4	·			
Direction		NB	Dire	ction _		<u> 58</u> €	Direc	tion				:	Direc	tion				
auto	1st 2 8명	2nd Sb7	auto	.	1st ZSZ	2nd . 756	auto		1st	2	nd		auto		1	st	2n	ıd
med. trk.		108		l. trk.			_							trk.				
hvy trk.	103	309	hvy	trk.	73	219							h vy 1	rk.				
bus		0	bus	_	1	3	_ bus			<u> </u>			bus				<u> </u>	
motorcycle		3_	mot	orcycle _	_2	6	_ moto	rcycle					moto	rcycl	-			
NOTES:	Maria	3	akas	<i>a</i> = <i>a</i> :	LAKO	Ca LV	. (
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SITE SKE	TCH																	
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JOB #	<u> 5530</u>	8-102	2351		Ganne						
SITE ID	_14-	3			Fleming	, Inc.	Me	eter Sto	rage # .	19	
TYPE L	Reside	ential [Commerc	cial 🗌	Religion	_ Educat	tional [Other			
Measure	ment	Data				Ph	otograph	#'s			
SLM Calib	ration	before	11411	_ after	<u> </u>				GPS PT	836	2
Weather:			erature <u>8</u> ,								
Time:	1st		2:19		•	total _					
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Direction	4		Direction			Direction			Direction		
auto	1st 341	2nd 1023	auto	1st 314	2nd 942	auto	1st	2nd	auto	1st	2nd
med. trk.	_19_	57	med. trk.		36	med. trk.			med. trk.		
hvy trk.	84	252	hvy trk.	62	186	hvy trk.			hvy trk.		<u> </u>
bus motorcycle		3	bus motorcycle	2	0	bus motorcycle	_		bus	le	
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JOB # 55	398-1	02351	TIROS		Gannet	□ j t						
SITE ID	714-1	4	1000		Fleming,	Inc.	M	eter St	ora	ge # _	18	 -
TYPE 🔽	Reside	ntial)	Commerci	ial 🗌	Religion [='				_
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D-4	2nd	start	1.0 2		<u> </u>		-1 ~	_				
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Traffic		nod							_	,		
Roadway#1	I. U	16	Roadway#2	<u> 7 \</u>	1	Roadway#3			R	oadway#4		
Direction	A comme	1.0	Direction	No. of Concession, Section, Se	tipe cole	Direction			D	irection		
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hvy trk.	84	252		<u>కర</u>	165	hvy trk.			h	vy trk.		
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JOB # 55	398-	10235	1		Gannet	<u> </u>					
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TYPE	Reside	ntial [Commerc	ial 🗌	Religion [] Educat	ional [Othe	r		
Measure	ment	Data				Ph	otograp	oh #'s _			
SLM Calib	ration	before	114.1						GPS PT	838	
Weather:		•	rature		•				100%		
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auto	1st 416	2nd 1248	auto	356	2nd 1068	auto	1st	2nd	auto	1st 	2nd
med. trk.	_17	SI	med. trk.	8	24	med. trk.			med. trk.		
hvy trk.	69	207	hvy trk.	_58_	1174	hvy trk.		 	hvy trk.		<u> </u>
bus	0		bus	4	13	bus		 	bus		
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PROJECT:	1-47	6							Ebert	IARD	RD
`			51-71802								
SITE ID					Ganne Fleming,		Met	er Sto	rage # _	೩૩	
TYPE 🔽	Reside	ential [Commerc	ial 🗌	Religion	Educa	tional [Other			
Measure	ment	Data				Ph	notograph	#'s			
SLM Calib	ration	before	114	after					GPS PT	<u>3</u> 39- 8	<u>~0</u>
Weather:		_	rature		-				000		
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Roadway#1 Direction		- MQ			> 25	Roadway# Direction	3		Roadway#4 Direction		
	1st	2nd		1st	2nd	,		2nd		1st	2nd
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med. trk. hvy trk.	78	234	med. urk. hvy trk.	52		med. trk. hvy trk.			med. trk. hvy trk.		
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JOB #_5		. •			Gannet	<u> </u>					
SITE ID					Fleming,		Мe	eter Sto	orage #	ao -	21
	,			cial 🗆	Religion [□ Educat					
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Measure							orogi apii	#5	GPS PT		
SLM Calib	ration		114.1							<u> </u>	
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Roadway#1	1-4	7(0	Roadway#2	t. 4	76	Roadway#3			Roadway#4		
Direction		NB			SK	Direction			Direction		
auto	1st 35/	2nd 1653	auto	1st	2nd [101	auto	1st	2nd	auto	1st	2nd
med. trk.		48	med. trk.		36	med. trk.			med. trk.		
hvy trk.	81	243	hvy trk.	57	171	hvy trk.			hvy trk.		
bus	<u> </u>	<u>(a</u>	bus		3	bus			bus		
motorcycle	<u> </u>	6	motorcycle	• <u> </u>	3	motorcycle	·L		motorcycle		
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JOB # 5	5398.	102351	-71802		Gannet		_			r	
SITE ID	15-1	ı			Fleming,		Ме	ter Sto	orage #	31	
TYPE	Reside	ntial [Commerci	ial 🗌	Religion [_ Educat	ional 🗌	Other			
Measure	ment	Data				Pho	otograph	#'s			
SLM Calib	ration	before	·	after		_			GPS PT _		
Weather:		tempe	rature <u>72</u>		wind speed	0-8	cloud	cover	0		
Time:	1st	start	12:16	_			20	_			
Data:	2nd 1st	start	/ / 54				- (6		_97.5		
Data.	2nd	Геd	(00.8		· ·						
Traffic	Data							_			
Roadway#1	1.4-	16	Roadway#2	エー	476	Roadway#3	<u></u>		Roadway#4		
Direction	>	JB_	Direction	SB 4	· ·	Direction			Direction		
auto	1st 275	Snd Sas	auto	1st 259	2nd	auto	1st	2nd	auto	1st	2nd
med. trk.	20	60	med. trk.	8	24	med. trk.			med. trk.		
hvy trk.	76	<u> 228</u>	hvy trk.	63	189	hvy trk.			hvy trk.		
bus	3	9	bus		3	bus	•		bus		
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TIFE [reside	encial [rciai 📋	rengion [
Measure	ment	Data				Pho	otograph	ı #'s _			
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Traffic	Data	-								_	
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	1st	2nd		1st	2nd		1st		22 0000	1st	2nd
auto med. trk.	254	762 48		<u>247</u> 11	33	auto med. trk.			auto med. trk.		
	105	315		<u> </u>		hvy trk.			hvy trk.		
bus	_0_	0	bus		0	bus			bus		
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JOB #	5398	3 - 10a	351		Ganne	2					
SITE ID					Fleming,		1	Meter Sto	rage #	46	
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Measure					-				3-430		
							aro soga up	πυ <u>12</u>	GPS PT		
SLM Calib	ration	befor	e 114	after					GFS PI _	818	
Weather:	4.	_	erature		-				503		
Time:	1st 2nd	start start	7:52	_		total					
Data:	1st		55.5		65.5		46,7		86.3		
	2nd	Leq		_						<u> </u>	
Traffic	Data										
Roadway#1	T-476	NB	Roadway#2	T. 470	. SR	Roadway4	3		Roadway#4		
Direction			Direction						Direction		
	1st	2nd		1st	2nd		1st			1st	2nd
auto med. trk.		1605	auto med. trk.		36	auto med. trk.			auto med. trk.		
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JOB # <u>05</u>	<u>5398-</u>	102351	-TINUE		Gannet	at.			E		
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Measure	ment	<u>Data</u>				Pno	tograpi	n #s / <u>/</u>	9.185 OR	_	
SLM Calib	oration	before	114	after					GPS PT _	832	
Weather:		-	rature <u>75</u>		=						
Time:	1st 2nd	start start	11:16			total total	20	<u>—</u>			
Data:	1st	Leq	53.6	-	47.6		23.5	SEL	4.48		
	2nd	Leq						SEL		_	
Traffic	Data										
Roadway#1	 I ~47 (۵	Roadway#2	I.47	lu SR	Roadway#3			Roadway#4		
Direction	NB		Direction	4-	-	Direction			Direction		
auto	1st 340	2nd	auto	1st 267	2nd &G	auto	1st	2nd	auto	1st	2nd
	a5	75	med. trk.	9	27	med. trk.			med. trk.		
hvy trk.	89	267	hvy trk.	<u> 45</u>	192	hvy trk.			hvy trk.		<u> </u>
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PROJECT: 1-47 JOB #0 \$398- SITE ID 40-2 TYPE Reside Measurement SLM Calibration Weather: Time: 1st 2nd Data: 1st 2nd Traffic Data Roadway#1 147 Direction auto 282 med. trk. 14 hvy trk. 85 bus 2 motorcycle 1 NOTES: 5TRC	ntial [Data before tempe start start Leq Leq 2nd	Commercial	stop stop Imax Imax	2nd 943 27 207	Ph total total Lmin Lmin Lmin Roadway#3 Direction auto med. trk. hvy trk. bus	cloud 20	eter Sto Other #'s d cover SEL SEL	GPS PT _	F33	
SITE ID	ntial [Data before tempe start start Leq Leq 2nd 255	Commercial	stop stop Imax Imax	Religion 114.0 wind speed 12:10 7(a) 2nd 943 27 207	Ph total total Lmin Lmin Lmin Roadway#3 Direction auto med. trk. hvy trk. bus	cloud 20	Other a #'s d cover SEL SEL 2nd	GPS PT	833	
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Measurement SLM Calibration Weather: Time: 1st 2nd Data: 1st 2nd Traffic Data Roadway#1 197 Direction auto 282 med. trk. 199 hvy trk. 85 bus 2 motorcycle 1	Data before tempe start start Leq Leq 2nd 8444	Roadway#2 Direction auto med. trk. hvy trk. bus	stop stop Imax Imax	2nd 943 27 207	total total Imin	cloud 20	d cover SEL SEL	GPS PT	\$33	
SLM Calibration Weather: Time: 1st 2nd Data: 1st 2nd Traffic Data Roadway#1 147 Direction auto 282 med. trk. 14 hvy trk. 85 bus 2 motorcycle 1	before tempe start start Leq Leq 2nd 844	Roadway#2 Direction auto med. trk. hvy trk. bus	stop stop Lmax Lmax 1st 281	2nd 943 27 207	totaltotal Lmin Roadway#3 Direction auto med. trk. hvy trk. bus	Cloud 20 49,9 Ist	d cover	GPS PT	\$33 	
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Direction auto 282 med. trk. 14 85 bus 2 motorcycle	2nd 844 42 255	Direction auto med. trk. hvy trk. bus	1st 281 9 69	2nd 843 27 207	Direction auto med. trk. hvy trk. bus	1st	2nd	Direction auto med. trk. hvy trk.		
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TYPE] Reside	ential [Commerci	ial 🗌	Religion	☐ Educa	ational [Other		· 	
Measure	ment	Data				P	hotograp	h #'s <u>\</u>	12-178	1	
SLM Calib	oration		1114.0						GPS PT _	831	
Weather:		_	rature						50% <u>.</u>		
Time:	1st 2nd	start start	10:40			total total	20				
Data:	1st	Leq	60.1	-	73.2	Lotai	43.9	SEL	90.9		
	2nd	Leq									
Traffic	Data										
Roadway#1	I470	MB	Roadway#2	1-47	6-53	Roadway	/3		Roadway#4		
Direction	-	₩	Direction	-		Direction			Direction		
auto	1st 니요	2nd 1236	auto	1st	2nd 5.73	auto	1st	2nd 	auto	1st	2nd
med. trk.	19	57	med. trk.	10	30	med. trk			med. trk.		
hvy trk.	127	381	hvy trk.	<u> 41</u>	123	hvy trk.			hvy trk.		
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# **APPENDIX B**

# Noise Meters Certification of Calibration





NVLAP Lab Code: 200625-0

# Calibration Certificate No.28008

Instrument:

Microphone

Date Calibrated: 2/5/2013

Cal Due:

Model:

UC-59

Status:

Sent Received

Manufacturer:

X

Serial number:

Rion 00591 In tolerance: Out of tolerance:

See comments:

Contains non-accredited tests: Yes X No

Composed of:

Customer: Tel/Fax:

Environmental Acoustics, Inc.

Address:

1400 Hummel Avenue

717-737-4751 / -4754

Lemoyne, PA 17043

### Tested in accordance with the following procedures and standards:

Calibration of Measurement Microphones, Scantek, Inc., Rev. 11/30/2010

Instrumentation used for calibration: N-1504 Norsonic Test System:

All the March Corn	arrena da Com	200	POL BOAY	Traceability evidence	Cal. Due	
Instrument - Manufacturer	Description	5/N	Cal. Date	Cal. Lab / Accreditation	Cal. Due	
483B-Norsonic	SME Cal Unit	25747	Jul 2, 2012	Scantek, Inc./ NVLAP	Jul 2, 2013	
DS-360-SRS	Function Generator	61646	Nov 20, 2012	ACR Env./ AZLA	Nov 20, 2014	
34401A-Agilent Technologies	Digital Voltmeter	MY41022043	Nov 20, 2012	ACR Env. / A2LA	Nov 20, 2013	
DPI 141-Druck	Pressure Indicator	790/00-04	Nov 21, 2012	ACR Env. / A2LA	Nov 21, 2014	
HMP233-Vaisala Oyj	Humidity & Temp. Transmitter	V3820001	Sep 6, 2012	ACR Env / AZLA	Mar 6, 2014	
PC Program 1017 Norsonic	Calibration software	v.5.2	Validated Mar 2011	Scantek, Inc.		
1253-Norsonic	Calibrator	28326	Dec 14, 2012	Scantek, Inc./ NVLAP	Dec 14, 2013	
1203-Norsonic	Preamplifier	14059	Jan 4, 2013	Scantek, Inc./ NVLAP	Jan 4, 2014	
4180 Bruel&Kjær	Microphone	2245115	Nov 21, 2011	NPL-UK / UKAS	Nov 21, 2013	

### Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by:	Valentio Buzduga	Authorized signatory:	Mariana Buzduga
Signature	1	Signature	e lub-
Date	2/05/2013	Date	2/6/2013

Calibration Certificates or Test Reports shall not be reproduced, except in full, without written approval of the laboratory. This Calibration Certificate or Test Reports shall not be used to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the federal government.

Document stored as: Z:\Calibration Lab\Mic 2013\Rion59_00591_M1.doc





NVLAP Lab Code: 200625-0

# Calibration Certificate No.28011

Instrument:

Microphone

Date Calibrated: 2/5/2013

Cal Due:

Model:

UC-59

Received

Sent

Status: In tolerance:

X

Manufacturer: Serial number:

Rion 00699

Out of tolerance: See comments:

Contains non-accredited tests: __Yes X No

Composed of:

X

Customer:

Environmental Acoustics, Inc.

Address:

1400 Hummel Avenue

Tel/Fax:

717-737-4751 / -4754

Lemoyne, PA 17043

### Tested in accordance with the following procedures and standards:

Calibration of Measurement Microphones, Scantek, Inc., Rev. 11/30/2010

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence	Cal. Due	
Instrument - Manufacturer	Description	3/14	Cal. Date	Cal. Lab / Accreditation		
483B Norsonic	SME Cal Unit	25747	Jul 2, 2012	Scantek, Inc./ NVLAP	Jul 2, 2013	
DS-360-SRS	Function Generator	51546	Nov 20, 2012	ACR Env./ A2LA	Nov 20, 2014	
34401A-Agilent Technologies	Digital Voltmeter	MY41022043	Nov 20, 2012	ACR Env. / A2LA	Nov 20, 2013	
DPI 141 Druck	Pressure Indicator	790/00-04	Nov 21, 2012	ACR Env./ AZLA	Nov 21, 2014	
HMP233-Vaisala Oyj	Humidity & Temp. Transmitter	V3820001	Sep 6, 2012	ACR Env./ AZLA	Mar G, 2014	
PC Program 1017 Norsonic	Calibration software	v.5.2	Validated Mar 2011	Scantek, Inc.		
1253-Norsonic	Calibrator	28326	Dec 14, 2012	Scantek, Inc./ NVLAP	Dec 14, 2013	
1203-Norsonic	Preamplifier	14059	Jan 4, 2013	Scantek, Inc./ NVLAP	Jan 4, 2014	
4180-Brüel&Kiær	Microphone	2246115	Nov 21, 2011	NPL-UK / UKAS	Nov 21, 2013	

### Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by:	Valentin Buzduga	Authorized signatory:	Mariana Buzduga
Signature	17/1	Signature	· dut
Date	2/05/2013	Date	2/6/2013

Calibration Certificates or Test Reports shall not be reproduced, except in full, without written approval of the laboratory. This Calibration Certificate or Test Reports shall not be used to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the federal government.

Document stored as: 2:\Calibration Lab\Mic 2013\Rion59_00699_M1.doc





NVLAP Lab Code: 200625-0

Received

Sent

X

# Calibration Certificate No.28007

Sound Level Meter Instrument:

Model: NA28

Rion Manufacturer:

Serial number:

Tested with:

Microphone UC-59 s/n 00591 Preamplifier NH23 s/n 70511

Type (class):

Customer: Tel/Fax:

Environmental Acoustics, Inc.

00870496_80430.000

717-737-4751 / 717-737-4754

Date Calibrated:2/5/2013 Cal Due:

Status:

In tolerance: Out of tolerance:

See comments:

Contains non-accredited tests: __Yes X No Calibration service: __ Basic X Standard

Address:

1400 Hummel Avenue. Lemoyne, PA 17043

Tested in accordance with the following procedures and standards:

Calibration of Sound Level Meters, Scantek Inc., Rev. 6/22/2012 SLM & Dosimeters - Acoustical Tests, Scantek Inc., Rev. 7/6/2011

### Instrumentation used for calibration: Nor-1504 Norsonic Test System:

	William Robert	cia	Cit Divis	Traceability evidence	Cal. Due	
Instrument - Manufacturer	Description	S/N	Cal. Date	Cal. Lab / Accreditation		
483B-Norsonic	SME Cal Unit	31052	Sep 14, 2012	Scantek, Inc./ NVLAP	Sep 14, 2013	
DS-360 SRS	Function Generator	33584	Sep 9, 2011	ACR Env. / AZLA	Sep 9, 2013	
34401A-Agilent Technologies	Digital Voltmeter	U\$36120731	Sep 12, 2012	ACR Env. / A2LA	Sep 12, 2013	
HM30-Thommen	Meteo Station	1040170/39633	Dec 6, 2012	ACR Env. / AZLA	Dec 6, 2013	
PC Program 1019 Norsonic	Calibration software	v.5.2	Validated Mar 2011	Scantek, Inc.	18	
1251-Norsonic	Calibrator	30878	Dec 14, 2012	Scantek, Inc./ NVLAP	Dec 14, 2013	

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

#### **Environmental conditions:**

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
24.1 °C	99.790 kPa	30.4 %RH

Calibrated by:	Preston Mackin	Authorized signatory:	Mariana Buzduga
Signature	Wrest Mack	Signature	-lub-
Date	2/5/2013	Date	2/6/2013

Calibration Certificates or Test Reports shall not be reproduced, except in full, without written approval of the laboratory This Calibration Certificate or Test Reports shall not be used to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the federal government.

Document stored Z:\Calibration Lab\SLM 2013\Riona28_00870496_80430.000_M1.doc



CALIBRATION LABORATORY

ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC and APLAC signatory)



NVLAP Lab Code: 200625-0

# Calibration Certificate No.28010

Instrument: Sound Level Meter

Model: NA28 Manufacturer: Rion

Serial number: 01170630

Tested with:

01170630_80427.000

Microphone UC-59 s/n 00699 Preamplifier NH23 s/n 70648

Type (closs): 1

Customer: E

Tel/Fax:

Environmental Acoustics, Inc. 717-737-4751 / 717-737-4754 Date Calibrated: 2/5/2013 Cal Due:

Status: Received Sent
In tolerance: X X
Out of tolerance:

See comments:

Contains non-accredited tests: __Yes X No Calibration service: __ Basic X Standard

Address: 1400 Hummel Avenue,

Lemovne, PA 17043

#### Tested in accordance with the following procedures and standards:

Calibration of Sound Level Meters, Scantek Inc., Rev. 6/22/2012 SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

### Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence	Cal. Due	
instrument - manufacturer	Description	3/14	Cal. Date	Cal. Lab / Accreditation	Can. Due	
483B-Norsonic	SME Cal Unit	31052	Sep 14, 2012	Scantek, Inc./ NVLAP	Sep 14, 2013	
DS-360-SRS	Function Generator	33584	Sep 9, 2011	ACR Env./ AZLA	Sep 9, 2013	
34401A-Agilent Technologies	Digital Voltmeter	US36120731	Sep 12, 2012	ACR Env. / AZLA	Sep 12, 2013	
HM30-Thommen	Meteo Station	1040170/39633	Dec 6, 2012	ACR Env./ AZLA	Dec 6, 2013	
PC Program 1019 Norsonic	Calibration software	v.5.2	Validated Mar 2011	Scantek, Inc.	1	
1251-Norsonic	Calibrator	30878	Dec 14, 2012	Scantek, Inc./ NVLAP	Dec 14, 2013	

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

#### **Environmental conditions:**

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
24.4 °C	99.570 kPa	30.7 %RH

Calibrated by:	Preston Mackin	Authorized signatory:	Mariana Buzduga
Signature	Presta Mack-	Signature	- lut-
Date	2/5/2013	Date	7-1612013

Calibration Certificates or Test Reports shall not be reproduced, except in full, without written approval of the laboratory.

This Calibration Certificate or Test Reports shall not be used to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the federal government.

Document stored Z:\Calibration Lab\SLM 2013\Riona28_01170630_80427.000_M1.doc





NVLAP Lab Code: 200625-0

# Calibration Certificate No.28009

**Acoustical Calibrator** Instrument:

NC-74

Rion

Manufacturer: 01200033_80289.000

Serial number:

Class (IEC 60942):

Barometer type: Barometer s/n:

Customer: Tel/Fax:

Model:

Environmental Acoustics, Inc.

717-737-4751 / 717-737-4754

Date Colibrated: 2/5/2013 Cal Due:

Received Sent Status: In tolerance: X

Out of tolerance:

See comments: Contains non-accredited tests: __Yes X No

Lemoyne, PA 17043

1400 Hummel Avenue, Address:

Tested in accordance with the following procedures and standards:

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Calibration of Acoustical Calibrators, Scantek Inc., Rev. 10/1/2010

S-1-6-707-340-4-00-4-0	2001000	****	24 545	Traceability evidence	
Instrument - Manufacturer	Description	S/N	Cal. Date	Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31052	Sep 14, 2012	Scantek, Inc./ NVLAP	Sep 14, 2013
DS-360-SRS	Function Generator	33584	Sep 9, 2011	ACR Env./ A2LA	Sep 9, 2013
34401A-Agilent Technologies	Digital Voltmeter	U\$36120731	Sep 12, 2012	ACR Env. / A2LA	Sep 12, 2013
HM30-Thommen	Meteo Station	1040170/39633	Dec 6, 2012	ACR Env. / AZLA	Dec 6, 2013
8903-HP	Audio Analyzer	2514A05691	Dec 1, 2010	ACR Env. / AZLA	Dec 1, 2013
PC Program 1018 Norsonic	Calibration software	v.5.2	Validated March 2011	Scantek, Inc.	-
4184-Brüel&Kjær	Microphone	950698	Dec 14, 2012	Scantek, Inc. / NVLAP	Dec 14, 2013
1203-Norsonic	Preamplifier	14052	Nov 19, 2012	Scantek, Inc./ NVLAP	Nov 19, 2013

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK)

Calibrated by:	Preston Mackin	Authorized signatory:	Mariana Buzduga
Signature	Front Which	Signature	lub
Date	2/5/2013	Date	2/6/20/3

Calibration Certificates or Test Reports shall not be reproduced, except in full, without written approval of the laboratory. This Calibration Certificate or Test Reports shall not be used to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the federal government.

Document stored as: Z:\Calibration Lab\Cal 2013\RIONNC74-0.5in_01200033_80289.000_M1.doc



# Certificate of Calibration and Conformance

Certificate Number 2013-168235

Instrument Model 706, Serial Number 01595, was calibrated on 02JAN2013. The instrument meets factory specifications per Procedure D0001.8035, ANSI S1.4-Type 2 1983, ANSI S1.25-Type 2 1991 IEC 60651-Type 2 1979. IEC 60804-Type 2 1985 and IEC 61252-am1-2000.

1991, IEC 60651-Type 2 1979, IEC 60804-Type 2 1985 and IEC 61252-am 1-2000.
Instrument found to be in calibration as received: NO Date Calibrated: 02JAN2013
Calibration due:  Calibration Standards Used
MANUFACTURER         MODEL         SERIAL NUMBER         INTERVAL         CAL DUE         TRACEABILITY NO.           Larson Davis         LDSigGn/2209         10589 / 0103         12 Months         12DEC2013         2012-167424
Reference Standards are traceable to the National Institute of Standards and Technology (NIST)
Calibration Environmental Conditions
Temperature: 23 ° Centigrade Relative Humidity: 19 %
Affirmations
This Certificate aftests that this instrument has been calibrated under the stated conditions with Measurement and Test Equipment (M&TE) Standards traceable to the U.S. National Institute of Standards and Technology (NIST). All of the Measurement Standards have been calibrated to their manufacturers' specified accuracy / uncertainty. Evidence of traceability and accuracy is on file at Provo Engineering & Manufacturing Center. An acceptable accuracy ratio between the Standard(s) and the item calibrated has been maintained. This instrument meets or exceeds the manufacturer's published specification unless noted.
The collective uncertainty of the Measurement Standard used does not exceed 25% of the applicable tolerance for each characteristic calibrated unless otherwise noted.
The results documented in this certificate relate only to the item(s) calibrated or tested. A one year calibration is recommended, however calibration interval assignment and adjustment are the responsibility of the end user. This certificate may not be reproduced, except in full, without the written approval of the issuer.
"As Received" data unavailable due to unit failure.
Signed: Nick Downwar-
Signed: / Control of the Signed in the Signe



# Certificate of Calibration and Conformance

Certificate Number 2013-168236

Instrument Model MPR002, Serial Number B0565, was calibrated on 02JAN2013. The instrument meets factory specifications per Procedure D0001.8159.

Instrument found to be in calibration as received: NO

Date Calibrated: 02JAN2013

Calibration due:

### Calibration Standards Used

MANUFACTURER Larson Davis PCB	MODEL	SERIAL NUMBER 0612 / 0102 126869 1603	INTERVAL 12 Months 12 Months 12 Months	CAL_DUE   06JAN2013   09MAR2013   18APR2013	TRACEABILITY NO. 2012-153446 2012-156214 2012-157947
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Reference Standards are traceable to the National Institute of Standards and Technology (NIST)

Calibration Environmental Conditions

Temperature: 23 ° Centigrade

Relative Humidity: 19 %

#### Affirmations

This Cortificate attests that this instrument has been calibrated under the stated conditions with Measurement and Test Equipment (M&TE) Standards traceable to the U.S. National Institute of Standards and Technology (NIST). All of the Measurement Standards have been calibrated to their manufacturers' specified accuracy / uncertainty. Evidence of traceability and accuracy is on file at Provo Engineering & Manufacturing Center. An acceptable accuracy ratio between the Standard(s) and the item calibrated has been maintained. This instrument meets or exceeds the manufacturer's published specification unless noted.

The collective uncertainty of the Measurement Standard used does not exceed 25% of the applicable tolerance for each characteristic calibrated unless otherwise noted.

The results documented in this certificate relate only to the item(s) calibrated or tested. A one year calibration is recommended, however calibration interval assignment and adjustment are the responsibility of the end user. This certificate may not be reproduced, except in full, without the written approval of the issuer.

"As Received" data unavailable due to unit failure.

Signed:

echnician: Nick Rasmussen

# **APPENDIX C**

# **Traffic Data**

PA Turnpike NB Lanes					
County BUCKS					
<b>Growth Rate</b>	2.04				
Count Year	2011 = 24728 ADT Existing Count Year				
Build ADT	2019 <b>= 290</b> 6	ADT Build Year			
Projected ADT	2039 <b>= 4352</b>	7 ADT Design Year			

PA Turnpike SB Lanes					
County	County BUCKS				
<b>Growth Rate</b>	2.04				
Count Year	2011 = 24719 ADT Existing Count Year				
Build ADT	2019 <b>= 29053</b>	ADT	Build Year		
Projected ADT	<b>2039 = 43511</b>	ADT	Design Year		

NB Acceleration Ramp (On Ramp C)					
County	County BUCKS				
<b>Growth Rate</b>	2.04				
Count Year	2011 = 3319 ADT Existing Count Year				
Build ADT	2019 = 3901 ADT Build Year				
Projected ADT	2039 = <b>5842</b> A	DT Design Year			

SB Acceleration Ramp (On Ramp A)					
County BUCKS					
<b>Growth Rate</b>	2.04				
Count Year	2011 = 5644 ADT Existing Count Year				
Build ADT	2019 = 6634 ADT Build Year				
Projected ADT	2039 = 9935 ADT Design Year				

NB Deceleration Ramp (Off Ramp D)					
County	County BUCKS				
<b>Growth Rate</b>	2.04				
Count Year	2011 = 5778 ADT Existing Count Year				
Build ADT	2019 = 6791 ADT Build Year				
Projected ADT	<b>2039 = 10171</b>	ADT Design Year			

SB Deceleration Ramp (Off Ramp B)					
County		BUCKS			
<b>Growth Rate</b>		2.04			
Count Year	2011	2011 = 3161 ADT Existing Count Year			
Build ADT	2019	= 3715	ADT	Build Year	
Projected ADT	2039	= 5564	ADT	Design Year	

### **Mainline 2011 AADT**

	A-31 to A-44		A-44 t	o A-56
	NB	SB	NB	SB
Total	24,728	24,719	22,269	22,236
Class 1	20,948	20,874	18,557	18,466
Class 2	764	836	733	801
Class 3	219	243	209	233
Class 4	867	673	856	660
Class 5	931	878	934	853
Class 6	400	534	402	537
Class 7	587	657	568	665
Class 8	11	23	10	22
Class 9	1	1	0	1

### **Design Hourly Volumes (DHV) and corresponding daily traffic**

	A-31 to A-44  NB SB		A-44 to A-56		
			NB	SB	
9% <b>DHV</b>	3,057	2,642	2,768	<mark>2,710</mark>	
6.5%% Trucks	6.6%	6.3%	8.0%	5.5%	
Daily Volume	31,988	28,630	36,118	30,913	

Based on Field Observation, our spilt between Heavy Truck and Medium Truck is 81% and 19%.

### **Quakertown Interchange AADT**

	Quakertown I/C	
	Entry	Exit
Total	9,098	9,100
Class 1	8,146	8,157
Classes 2-9	952	943

Heavy Truck is three axles and above. Medium Truck is similar to local truck delivery "Fedex/UPS"

### **Growth Rate**

2.04% per year for all segments as well as the interchange

<u>SR 0663</u>				
County	BUCKS			
<b>Growth Rate</b>	1.43			
Count Year	2014	= 24182	ADT	<b>Existing Count Year</b>
Build ADT	2019	= 25961	ADT	Build Year
Projected ADT	2039	= 34487	ADT	Design Year

Approach	2039 Peak Hour Volumes		
	AM	PM	
NB On-Ramp	323	382	
NB Off-Ramp	461	1480	
SB On-Ramp (from WB SR 0663)	1006	403	
SB On-Ramp (from EB SR 0663)	485	129	
SB Off-Ramp	379	495	
EB SR 0663 @ SB Ramps	1196	891	
WB SR 0663 @ SB Ramps	635	1653	

SITE NO: 24895		
County	BUCKS (09)	
Route	0663	
Segment	0050	
Dir	N	
Current Avg Daily Traffic	12694	
Current Avg Daily Truck Volume	901	
K Factor	9	
D Factor	65	
T Factor	4	
Truck Percent	7	
Base Traffic Year	2013	
Traffic Pattern Group	URBAN - OTHER PRINCIPAL ARTERIALS	



SITE NO: 24895		
County	BUCKS (09)	
Route	0663	
Segment	0051	
Dir	S	
Current Avg Daily Traffic	11488	
Current Avg Daily Truck Volume	837	
K Factor	9	
D Factor	65	
T Factor	4	
Truck Percent	7	
Base Traffic Year	2013	
Traffic Pattern Group	URBAN - OTHER PRINCIPAL ARTERIALS	

