TRAFFIC NOISE REPORT

95TH STREET AND BOOK ROAD
PHASE I INTERSECTION IMPROVEMENTS
NAPERVILLE, WILL COUNTY, ILLINOIS
CIP# SC196

MARCH 20, 2019

PREPARED FOR:

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INTRODUCTION

The 95th Street and Book Road Phase I Intersection Improvements project is located in southern Naperville, Will County, Illinois. The project area is a relatively recently developed, high density suburb of Chicago which experienced the beginning of platted residential development in the mid-1970s; most project area buildings were constructed between 1994 and 2005. Book Road and 95th Street each remained two-lane rural roads with no turn lanes or sidewalks through the mid-1990s. Improvements constructed in the mid-1990s created the current configurations of both roadways.

Development surrounding the intersection includes retail uses on the northeast and southwest corners, offices and a day care on the northwest and a church on the southeast. Residential uses are located further north and east of the intersection, residential and institutional/office uses are located further to the west, and office and residential uses are located further to the south.

The purpose of the current project is to improve the safety and capacity of the intersection and to minimize the impact of intersection operations at nearby access points including side streets and commercial entries. The intersection is currently experiencing three times the expected crash frequency of similar intersections in Illinois. Traffic at the intersection is experiencing delays in the peak hours which are expected to worsen by the design year of 2040 to the point at which the intersection would be considered to fail by accepted Illinois traffic engineering standards. In addition, the delays create access issues at the intersection of Book Road and Tamahawk Lane during current afternoon traffic peaks, and additional blockages are anticipated by the design year at the entrance to Fry Family YMCA west of the intersection and the entrances to Wheatland Salem Church, 95th Street Shops and the adjacent office buildings south of the intersection.

The proposed project extends on Book Road from Rebecca Court on the south to Joyce Lane on the north. On 95th Street, the project extends from approximately 600 feet west of the intersection to approximately 425 feet east of the intersection. The existing 95th Street includes the following:

- Two 11-foot travel lanes in each direction
- Center turn lane with low concrete median dividing eastbound from westbound, providing left turn lanes for westbound 95th Street at Fry Family YMCA entrance, Book Road and Wheatland Salem Church entrance, and for eastbound 95th Street at Edward-Elmhurst Health Center/Childtime Care Center entrance, Book Road and Tamahawk Lane

Proposed 95th Street improvements include the following:

- Add one 11-foot right turn lane in each direction at Book Road
- Resurface; retain existing horizontal and vertical alignments
- Accompanying signal, sidewalk and utility location changes/upgrades

The existing Book Road includes the following:

- One 11-foot travel lane in each direction
- Center 11-foot turn lane added by a gore beginning at Rebecca Court and reaching full width approximately 500 feet south of the Wheatland Salem Church/95th Street Shops entrances, providing left turn lanes for northbound Book Road at 95th Street Shops

entrance, 95th Street, Tamahawk Lane and Joyce Lane, and for southbound Book Road at Wheatland Salem Church entrance, Book Road and Tamahawk Lane

Proposed Book Road improvements include the following:

- Add one 11-foot travel lane in each direction, tapering to existing approximately 605 feet south of 95th Street and 185 feet north of 95th Street
- Add one 11-foot right turn lane in each direction at 95th Street
- Resurface; retain existing horizontal and vertical alignments
- Accompanying signal, sidewalk and utility location changes/upgrades

The proposed alternative adds through-traffic lanes on Book Road north and south of its intersection with 95th Street. Therefore, the entire project is a Type I project and noise analysis and abatement procedures apply. An alternative limited to adding right turn lanes to eastbound 95th Street and southbound Book Road was considered but discarded due to projected operational issues and is not included in this noise analysis. The No Build alternative was also considered.

NOISE BACKGROUND AND REGULATIONS

NOISE BACKGROUND

Noise is generally defined as unwanted sound. Its loudness is measured in terms of sound pressure levels expressed in decibels (dB) and is composed of a wide range of frequencies. The decibel scale is logarithmic and expresses the ratio of the sound pressure unit being measured to a standard reference level. Most sounds occurring in the environment do not consist of a single frequency, but rather a broad band of differing frequencies. Frequencies are measured in hertz (Hz), which is the number of cycles per second. The human ear is typically capable of hearing frequencies from approximately 20 to 20,000 Hz, and is less sensitive to higher and lower frequencies than mid-range frequencies. To compensate for low-end and high-end frequency insensitivity and to render noise levels readings more relevant to human experience, an "A-weighting" scale is used to approximate the response of the human ear. The A-weighted decibel (dB(A)) unit emphasizes measurement of perceptible sound energy and factors out the frequencies not perceptible to humans.

The dB(A) unit may indicate the level of environmental noise at an instant in time, but community noise levels vary continuously. Most environmental noise includes a composite of noise from different sources, creating a relatively steady background noise in which no particular source is identifiable. To describe the time-varying character of traffic noise, the equivalent hourly sound level Leq(h), is commonly used. Leq(h) is defined as the equivalent steady-state sound level over a one-hour period which contains the same acoustic energy as the time-varying sound level during the same period. Noise levels referred to in this report are stated as hourly-equivalent sound pressure levels Leq(h) expressed in units of dB(A).

As decibels are logarithmic units, sound levels cannot be added by ordinary arithmetic means. The following general relationships provide a basic understanding of sound generation and propagation:

- The noise level from a line source, such as moving traffic on a road, will decrease approximately 3 dB(A) with every doubling of distance from the source.
- Research has indicated that a difference of 10 dB(A) is perceived as twice as loud (or half as loud) to the human ear.
- Typically, the human ear can barely perceive a 3 dB(A) change in loudness.

FEDERAL REGULATIONS

The Federal Aid Highway Act of 1970 required the Federal Highway Administration (FHWA) to develop noise standards and abatement requirements for highway traffic noise. These standards are contained in Title 23, Code of Federal Regulations (CFR), Part 772, Procedures for Abatement of Highway Traffic Noise and Construction Noise. This regulation applies to highway construction projects where a state department of transportation has requested federal funding for participation in the project. 23 CFR 772 provides procedures for preparing operational and construction noise studies and evaluating noise abatement considered for federal and federal-aid highway projects. The regulations do not mandate that the abatement criteria be met in all situations, but rather require that reasonable and feasible efforts be made to provide noise mitigation when the abatement criteria are approached or exceeded. Per 23 CFR 772.3, all highway projects that are developed in conformance with this regulation are deemed to be in conformance with FHWA noise standards.

FHWA has developed three "project types" to assess noise analysis applicability. Federal regulations only apply to Type I and Type II projects. Type III projects are ones that do not meet the definition of a Type I or Type II project and do not require a noise analysis. The 95th Street and Book Road Intersection Improvements project is a Type I project because it will add through-traffic lanes to northbound and southbound Book Road. Therefore, a traffic noise analysis is required for the full project limits. The FHWA regulations establish Noise Abatement Criteria (NAC) activity categories based on land use to assess potential traffic noise impacts as defined in 23 CFR 772. The FHWA NAC and description of activity categories are shown in Table 1. Traffic noise impacts occur when predicted design year noise levels under the build scenario approach, meet or exceed the NAC, or if there are substantial increases in traffic noise over existing conditions, independent of the NAC.

The FHWA NAC are used to identify locations where traffic noise impacts occur. The NAC are not used as goals for noise attenuation design criteria or design targets. FHWA requires use of FHWA Traffic Noise Model (TNM) 2.5 to determine current and future traffic noise levels created by a proposed project; TNM 2.5 has been used to perform this noise analysis. FHWA has deferred to the state agencies to define the noise level that "approaches" the NAC and to define a substantial increase in traffic noise levels.

TABLE 1: FHWA NOISE ABATEMENT CRITERIA (NAC) ACTIVITY CATEGORIES

Activity Category	Leq (1 hour)	Description of Activity Category
A	57 dB(A) (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.
B	67 dB(A) (exterior)	Residential.
C	67 dB(A) (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 dB(A) (interior)	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools and television studios.
E	72 dB(A) (exterior)	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F.
F	-	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical) and warehousing.
G	-	Undeveloped lands that are not permitted.

Source: 23CFR772, Table 1

If one or both of these conditions (noise level approaching the NAC or substantial increase in noise level) are met as a result of the proposed project, 23 CFR 772 requires that noise abatement measures must be considered. Noise abatement measures may include the following:

- Noise barrier construction: Noise barriers reduce noise by blocking the path of sound between the source of the noise and the receiver. To be effective, a noise barrier should be located adjacent to either the noise source or the receiver. There must be a long, continuous break of the line-of-sight from the highway to the receiver.
- Traffic management measures: These may include restrictions on speed, restrictions on traffic volumes, restricted access for certain motor vehicle types, and restricted times of travel.
- Alteration of horizontal and vertical alignments: Alignment of the road refers to the physical layout and location of the highway. A highway's noise impacts may be altered by shifting it in the horizontal or vertical direction.
- Noise insulation of public use or non-profit institution structures: For buildings listed under Category D in Table 1, insulation may be considered as a noise mitigation strategy; this strategy is not available to other types of noise-sensitive development.
- Acquisition of real property: In this case, the DOT acquires, or acquires interest in, primarily undeveloped property near the roadway that is the noise source, to preempt its future development with noise-sensitive uses.

IDOT POLICY

FHWA requires that all states have an approved policy to identify and address highway traffic noise impacts. The Illinois Department of Transportation (IDOT) Highway Traffic Noise Assessment Manual, effective April 2018, was developed to implement the requirements of 23 CFR Part 772 and the noise-related requirements of the National Environmental Policy Act (NEPA) of 1969. The manual carries out the Illinois state policy established in Chapter 26-6 of IDOT's Bureau of Design and Environment (BDE) Manual, which includes:

- Criteria and procedures for noise analyses
- Noise abatement measures and related coordination
- Noise abatement criteria prescribed by Federal regulations

IDOT policy defines noise impacts as modeled traffic-generated noise levels that are predicted to be within 1 dB(A) of (to approach), meet, or exceed the NAC for the appropriate activity category (the Noise Abatement Criterion) in the design year if the project is constructed, or that increase by 15 dB(A) or more over the existing traffic-generated noise levels (the Substantial Increase Criterion) in the design year if the project is constructed. Modeled noise levels are rounded to the nearest whole number; thus a result of 65.5 dB(A) at an Activity Category B receptor is considered an impact.

To evaluate noise impacts, IDOT requires that all property uses within 500 feet of the project alignment be grouped into Common Noise Environments (CNE) that include receptors in the same Activity Category that are exposed to similar noise sources and levels; traffic volumes, traffic mix and speed; and topographic features. One Representative Receptor per CNE is modeled; the Representative Receptor has the worst-case noise condition of all receptors in its CNE. If a

Representative Receptor is found to have a noise impact then all of the receptors in the CNE, including the Representative Receptor, are studied for abatement.

IDOT policy states that barriers to mitigate traffic noise impacts are considered only if they are feasible and reasonable to construct. To be feasible, the barrier must provide a substantial decrease in noise levels, defined as at least 5 decibels for at least two impacted receptors, and must meet engineering requirements of constructability. A barrier that is reasonable to construct must achieve the noise reduction design goal of at least 8 decibels for at least one benefited receptor, must not exceed the allowable noise abatement cost and must be desired by more than 50% of benefited receptors as reflected by received votes in viewpoints solicitation.

The allowable noise abatement cost is based on a cost per benefited receptor comparison, where a benefited receptor is defined as a receptor receiving at least 5 decibels of noise reduction. Adjustments are made to the per-benefited-receptor cost based on the magnitude of predicted noise levels, the increase in predicted noise levels in the design year over existing noise levels, and the construction date of the receptor compared to that of the original construction of the highway. Cost of right of way obtained solely for purposes of constructing the noise abatement measures is included in the total cost of the abatement. IDOT allows cost averaging among CNEs when multiple CNEs are being considered for abatement and the proposed abatement measures meet certain requirements.

The objectives of this noise study are to:

- Identify noise sensitive land uses within the traffic noise analysis area.
- Characterize the existing noise environment through field noise measurement at representative noise receptor sites. Validate the computer model using traffic data collected during the field measurement period. Use TNM to predict the existing year and design year traffic noise levels at noise receptor sites using current and projected traffic volumes developed from March 2018 peak hour traffic counts.
- Identify impacted receptor sites and use TNM to determine if noise abatement measures are reasonable and feasible.

NOISE RECEPTOR SELECTION

The area around the 95th Street and Book Road intersection is fully developed with commercial, institutional and residential land uses. The following noise sensitive areas were identified and were submitted to IDOT for review in July 2018:

- Residential neighborhoods along Joyce Road east and west of Book Road, along Tamahawk Lane east and west of Book Road and north of 95th Street, along Beth Lane north of 95th Street, along Rebecca Court west of Book Road and Frost Lane east of Book Road. The neighborhoods consisted of single-family homes or condominiums; the homes and condominiums each had yards, patios and/or porches classified in NAC Activity Category B
- Wheatland Salem Church southeast of the intersection had a ballfield with benches and bleachers, a church entrance, a daycare entrance and play area and assorted exterior benches classified in NAC Activity Category C
- The Compass Church and Fry Family YMCA south of 95th Street across from Beth Lane had a daycare entrance and multiple exterior benches and play areas classified in NAC Activity Category C
- Edward-Elmhurst Health Center northwest of the intersection had a bench and an employee picnic table identified during noise measurement activities that have been classified in NAC Activity Category E
- Childtime Care Center (daycare) west of Edward-Elmhurst Health Center had a daycare entrance and outdoor play area classified in NAC Activity Category C

Area land uses that were determined not to be noise sensitive included the retail shops (95th Street Shops, Walgreen), restaurants (Burger King, restaurants within 95th Street Shops) and offices (Charles Rutenberg Realty, Caputo Dental) in the southwest quadrant of the intersection and the BP filling station and retail shops (95th Street Plaza) in the northeast quadrant of the intersection. No exterior noise-sensitive uses were present in any of these NAC Activity Category E and F areas, either on aerial photographs or as reviewed during field activities.

Based on the identified noise-sensitive areas, initial Common Noise Environments (CNEs) and Representative Receptor locations were developed. IDOT/BDE concurred with the proposed locations on July 27, 2018.

During project design and after noise field work and initial noise modeling were complete, the project limits were adjusted to reflect use of Highway Capacity Software storage lengths for the proposed turn lanes, which resulted in the eastern and western legs of the project becoming shorter. As a result of that change and the IDOT policy not to consider noise impacts to neighborhoods located beyond the project termini, CNE-4 and CNE-6 were eliminated from consideration and CNE-3, CNE-5, CNE-7 and CNE-8 were truncated. The residences that were originally included in CNE-6 and that are within 500 feet of Book Road were moved to CNE-9. Because this put a greater emphasis on noise from Book Road for this CNE, a secondary Representative Receptor for CNE-9 was modeled along Book Road at these reassigned residences, in a location at the patio closest to the northern end of the added through lane on that roadway.

Table 2 identifies the CNEs and Representative Receptor locations for the project.

TABLE 2: REPRESENTATIVE RECEPTOR LOCATIONS

CNE/ Representative Receptor	Activity Category/ NAC	Type of Development	Adjacent Road	Distance to Existing Edge of Pavement, ft
CNE-1/RR-1	B/67	SFR[1] (Joyce Ln W of Book Rd)	Book Rd	83
CNE-2/RR-2	B/67	SFR (Joyce Ln E of Book Rd)	Book Rd	64
CNE-3/RR-3	B/67	SFR (Tamahawk Dr W of Book Rd)	Book Rd	61
CNE-4/RR-4	*Receptor no longer within noise study area following project design refinement*			
CNE-5/RR-5	C/67	Daycare (Childtime Care Center)	95th St	149
CNE-6/RR-6	*Receptor no longer within noise study area following project design refinement*			
CNE-7/RR-7[2]	C/67	Recreation Area (Fry Family YMCA)	95th St	99
CNE-8/RR-8 & RR-8eq[2]	C/67	Church/Recreation Area (Wheatland Salem Church at entrance)	95th St	200
CNE-9/RR-9	B/67	Condominiums (Tamahawk Ln E of Book Rd)	Book Rd	48
CNE-9/RR-9a				63
CNE-10/RR-10	B/67	SFR (Rebecca Ct W of Book Rd)	Book Rd	108
CNE-11/RR-11	B/67	SFR (Frost Ln E of Book Rd)	Book Rd	62
CNE-12/RR-12	E/72	Office (Edward-Elmhurst Health Center, exterior seating area)	Book Rd	247

1 SFR = Single-family residence
2 RR-7 and RR-8/RR-8eq were retained as originally proposed despite the revised project area because CNE-7 and CNE-8 were retained and road and traffic conditions in the vicinity of the retained Representative Receptors were similar to or more exposed to noise than those in other representative locations that could have been substituted

FIELD NOISE MEASUREMENTS

FIELD NOISE MEASUREMENT METHODOLOGY

CMT collected field noise measurements on August 22, 2018. Six noise measurement locations were selected for measurement. Noise measurement locations are shown on the sensitive area map in Appendix A.

Field data collection sheets are included in Appendix B and show measurement times, weather conditions and details of each measurement location. Measurement times were selected based on traffic peaks identified during previous traffic data collection events performed for design. Traffic was counted manually at the edge of the adjacent roadway. Weather at the time of field noise measurements included temperatures ranging from 79 to 86°F, wind speeds ranging from calm to 8 miles per hour (mph) with occasional brief gusts not exceeding 12 mph, and relative humidity ranging from 79% to 90%. Pavement was dry throughout the field measurement effort. Weather conditions met those specified by IDOT's Highway Traffic Noise Assessment Manual and by the instrument manual.

All noise measurements were collected with a Quest SoundPro DL2 sound level meter that had been laboratory-calibrated by Premier Safety on March 14, 2018 and field-calibrated with a Quest QC-10 acoustical calibrator at the time of field measurements. The meter was mounted on a tripod to establish a sampling height of five feet. The meter was set to Leq mode with slow response and 3 dB exchange rate, and the frequency response was set to the A-weighted scale as required by FHWA. All measurements were collected over 15-minute periods with simultaneous traffic counts on the applicable roadway(s).

FIELD NOISE MONITORING RESULTS

The TNM model of the existing condition was adjusted to reflect atmospheric conditions observed during the noise measurements. The traffic data collected during noise measurement were used to validate the model by multiplying the traffic counts from the 15-minute measurement period by four to obtain hourly traffic counts that were then entered into each model. A model is considered validated when the modeled and measured noise levels are within 3 dB(A) for at least 25% of the Representative Receptors. Model validation results are provided in Table 2. All of the modeled results were within 3 dB(A) of the measured results, which represents more than 25% of the ten CNEs/Representative Receptors, and therefore the model is validated.

TABLE 3: MODEL VALIDATION RESULTS

Model Measurement Location	Address	Field Measurement (dB(A))	TNM Model Result (dB(A))	Difference
RR-2	23155 Joyce Ln	60	63	3
RR-5	2015 95th St	57	60	3
RR-7	Compass Church	63	63	0

Model Measurement Location	Address	Field Measurement (dB(A))	TNM Model Result (dB(A))	Difference
RR-8a[1]	1852 95th St	59	57	2
RR-10	23200 Rebecca Ct	58	60	2

1 Measurement point was offset from church entrance due to concrete canopy columns and other structures surrounding the entrance

NOISE ANALYSIS METHODOLOGY

TRAFFIC VOLUMES AND COMPOSITION

For the 2018 Existing, 2040 No Build and 2040 Build TNM models, traffic volumes and composition were developed by CMT, Inc. using standard traffic projection methods from manual turn counts performed on March 13 and 18, 2018. Where traffic is split between two lanes in the model, traffic volumes were divided evenly between the two lanes. Traffic was not modeled on turn lanes.

Initially, conditions were modeled for the AM Peak, School Peak and PM Peak traffic in the 2018 Existing model. The PM Peak model had the most results that were highest among the three peak periods and also had the highest results for Representative Receptors whose results were closest to the applicable noise abatement criterion. Therefore, PM Peak traffic is considered to represent the worst-case traffic noise environment and was used for all models in this noise study.

The TNM models of the intersection were set up using signalized intersection modeling methods described in NCHRP Report 791, Supplemental Guidance on the Application of FHWA's Traffic Noise Model (TNM). Book Road was selected as the continuously modeled roadway due to its greater number of adjacent receivers. Queue lengths for Book Road in each model were taken from CMT's traffic analysis results. Queue lengths calculated by the traffic analysis for the existing condition were representative of those observed in the field during noise measurements and therefore the Validation model uses the 2018 Existing queue lengths.

RECEPTOR DISTANCE/ELEVATION

Representative Receptor locations that were used for noise measurement were collected in the field using a GPS receiver with an accuracy of +/- 2 feet. The field data points were added to a GIS map using ArcMap, which was also used to develop the x-y locations of all other TNM model objects. The objects were exported to .dxf files and imported into TNM. Elevations were developed using the surveyed roadway profiles for the roadway objects, coordinated with a one-foot contour layer developed from LIDAR by Will County that provided elevations for all other TNM objects. The distance of each Representative Receptor from the nearest edge of existing pavement is provided in Table 2.

SPEED CONDITIONS

Traffic speed on each leg of the intersection was calculated using data collected during field measurements. Near the end of each leg of the project adjacent to field noise measurement locations, starting and ending points were set up along the roadway. The points were set at least 250 feet apart. Three times for each location and traffic direction, a stopwatch was used to measure the speed of a vehicle travelling between the starting and ending points. Measurements were taken only when traffic was free-flowing. The speed of each vehicle was calculated and the three results were averaged. On most of the roadway segments, the average rounded to the nearest whole number was used in all TNM models. A review of the field data indicated overestimated speed on the north leg of the intersection, likely due to the greater distance between the starting and ending points compared to those on the other legs of the intersection and a related difficulty in accurately determining the start and end points of the timed interval from the measurement point. For this

reason, the modeled speeds on this leg were adjusted downward from the calculated average but remained within the limits of the individual field observations.

TNM RESULTS

Once the model was determined valid, TNM was used to predict existing and future traffic noise impacts at noise sensitive land uses throughout the analysis area. The majority of the project's noise-sensitive Common Noise Environments consist of Activity Category B residential single-family homes or condominiums. The exceptions include CNE-5 (Childtime Care Center), CNE-7 (Fry Family YMCA) and CNE-8 (Wheatland Salem Church), which fall in Activity Category C, and CNE-12 (Edward-Elmhurst Health Center), which falls in Activity Category E.

The model results were evaluated to assess whether the proposed project results in noise levels that meet one or both of the traffic noise impact criteria described in the "Traffic Noise Analysis Overview" section discussed on page 5.

Table 4 provides the TNM results for the project area receptors. Future noise levels for the receptors would not approach, meet, or exceed the noise abatement criteria, or substantially exceed existing noise levels.

TABLE 4: NOISE IMPACT SUMMARY – TNM MODELING RESULTS

Representative Receptor	Number of Dwelling Units (DUs) Represented[1]	Adjusted NAC (dB(A))[2]	Existing Noise Level (2018) (dB(A))	Future No Build Noise Level (2040) (dB(A))	Build Noise Level (2040) (dB(A))	Noise Level Change (Build minus Existing) (dB(A))	Is there a traffic noise impact?
RR-1	12 residences	66	61	62	62	1	No
RR-2	5 residences	66	62	64	63	1	No
RR-3	24 residences	66	63	65	64	1	No
RR-5	1 day care	66	61	62	62	1	No
RR-7	1 recreation center	66	63	64	64	1	No
RR-8a	1 church/ 1 sports area	66	56	58	58	2	No
RR-9	41 residences	66	64	65	65	1	No
RR-9a	(see RR-9)	66	65	66	65	0	No
RR-10	5 residences	66	60	61	61	1	No
RR-11	30 residences	66	63	64	64	1	No
RR-12	1 office	71	58	59	60	2	No

1 Equivalent receptor calculations were not performed for the non-residential Representative Receptors because noise modeling at the worst-case receptor point did not show noise impacts at any of these CNEs. A description of the use(s) represented is provided.
2 Adjusted to 1 dB below the FHWA NAC for the category to reflect IDOT's noise policy

ABATEMENT ANALYSIS

Because future noise levels for the receptors would not approach, meet, or exceed the noise abatement criteria, or substantially exceed existing noise levels, no abatement measures were considered.

COORDINATION WITH LOCAL OFFICIALS FOR UNDEVELOPED LANDS

No undeveloped properties are present in the project study area, and therefore no coordination with local government officials to identify permitted development or to communicate future noise level contours was required.

CONSTRUCTION NOISE

Noise from construction activities, including operation of construction machinery, will add to the average noise level for residents and businesses along the project alignment during the construction phase of the project. Noise may also be generated by increases in heavy truck traffic to and from the project area.

To minimize or eliminate the effect of construction noise on these receptors, mitigation measures have been incorporated into the Illinois Department of Transportation's Standard Specifications for Road and Bridge Construction as Article 107.35.

CONCLUSIONS

A traffic noise analysis was performed for the 95th Street and Book Road Intersection Improvements project in Naperville, Will County, Illinois. The study initially identified twelve Common Noise Environments (CNEs) including eight residential neighborhoods, a medical office, a day care, a YMCA and church with day care, and a church with a day care and athletic fields. When the project area was revised in January 2019 due to revised turn lane length calculations, two residential neighborhoods were removed from the study.

Field noise measurements were collected at six locations including one of the CNEs that was later removed from the study. All of the remaining field noise measurements were within 3 dB(A) of the results modeled using FHWA TNM 2.5, representing over 25% of the total number of Representative Receptors included in the project, and therefore the noise model was validated.

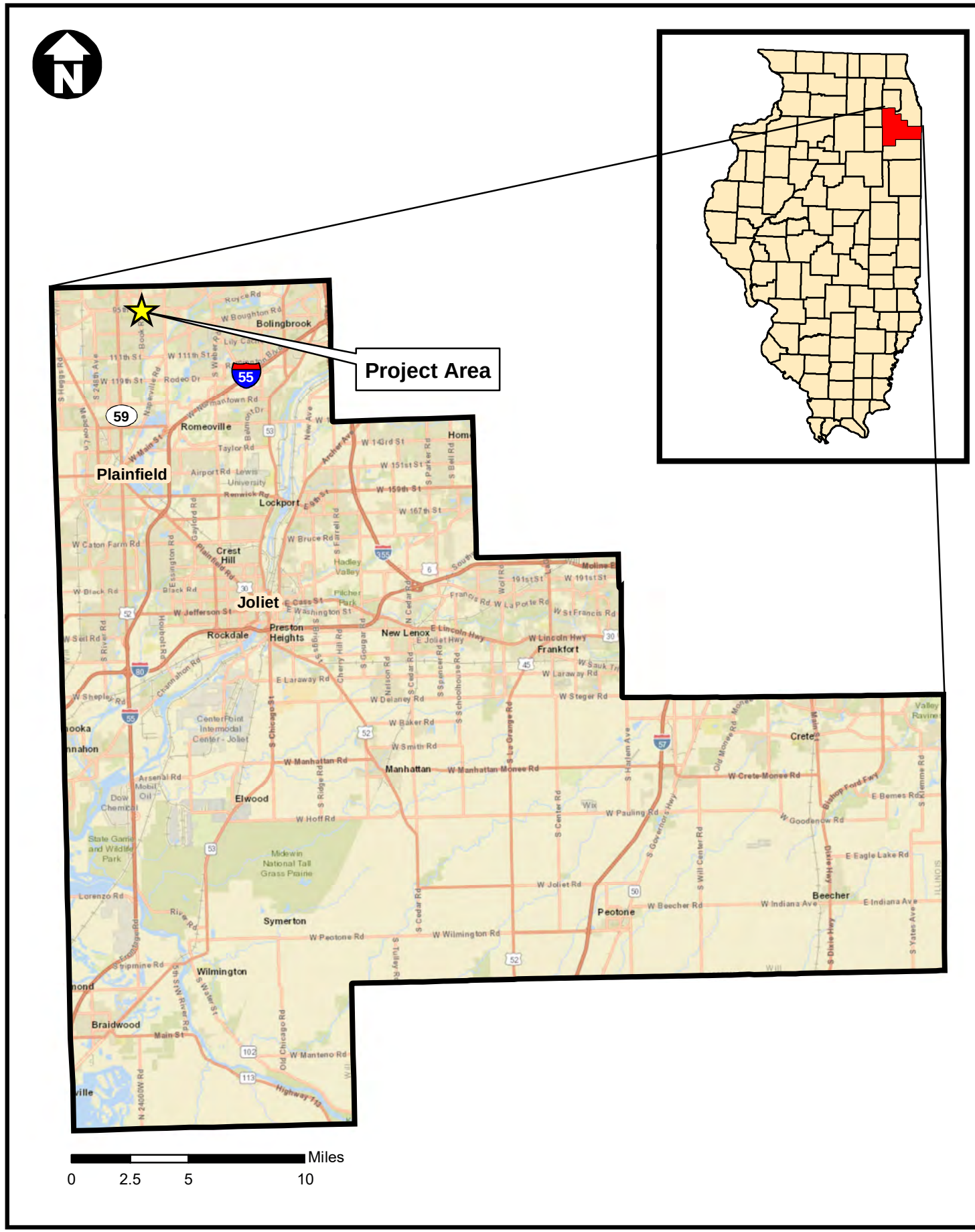
Models were prepared for 2018 Existing, 2040 No Build and 2040 Build conditions. The highest calculated noise level for any Representative Receptor in the 2040 Build condition was 65 dB(A), in a CNE with an adjusted NAC of 66 dB(A). Results ranged from 58 to 65 dB(A). The greatest increase from 2018 Existing to 2040 Build calculated noise levels was 2 dB(A).

Future noise levels for the receptors would not approach, meet, or exceed the noise abatement criteria, or substantially exceed existing noise levels.

95th Street and Book Road

APPENDIX A: FIGURES

CMT



95th St & Book Rd Intersection Improvements - Naperville, IL

Location Map - Will County, Illinois

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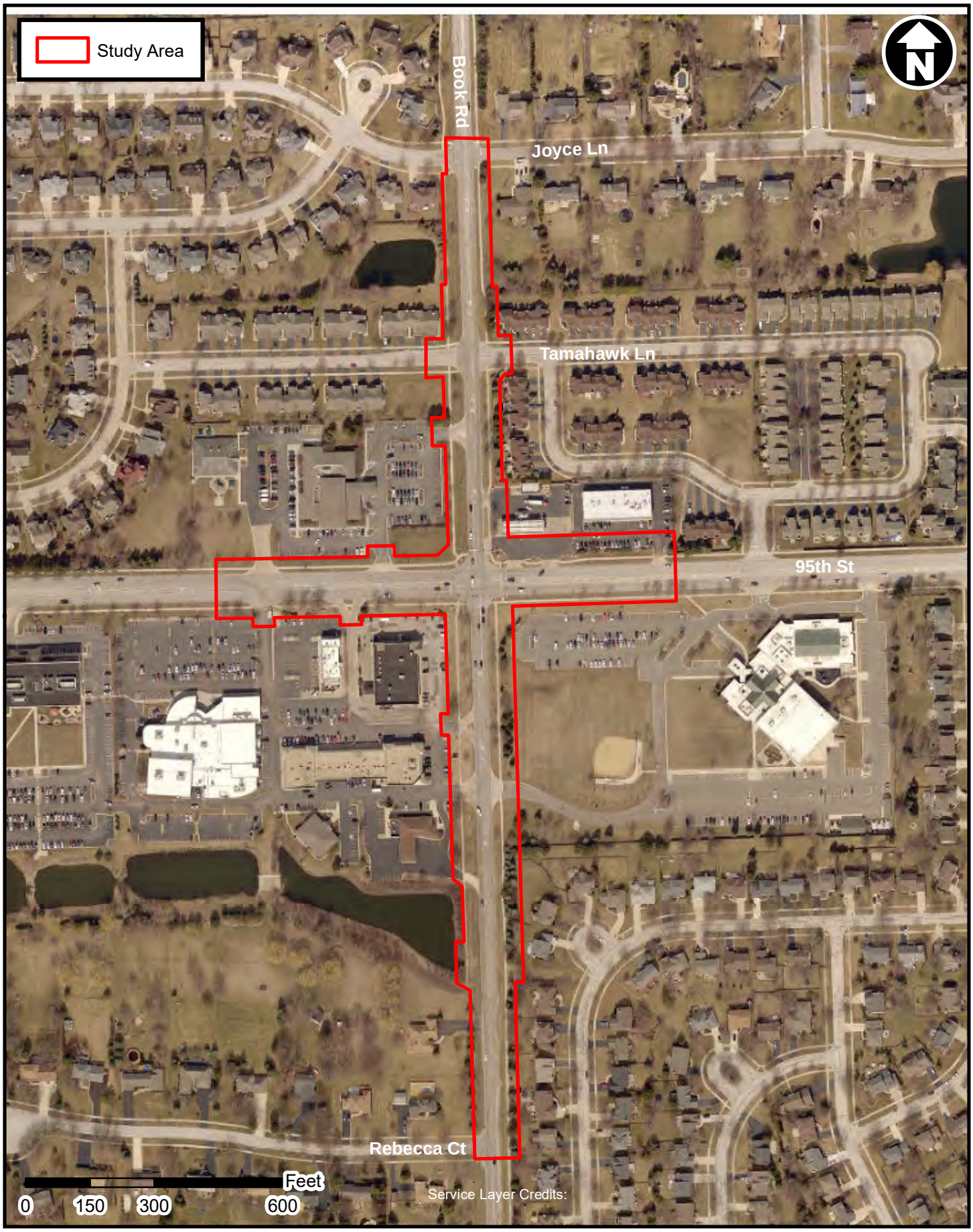

95th St & Book Rd Intersection Improvements - Naperville, Will Co., IL

Aerial Map

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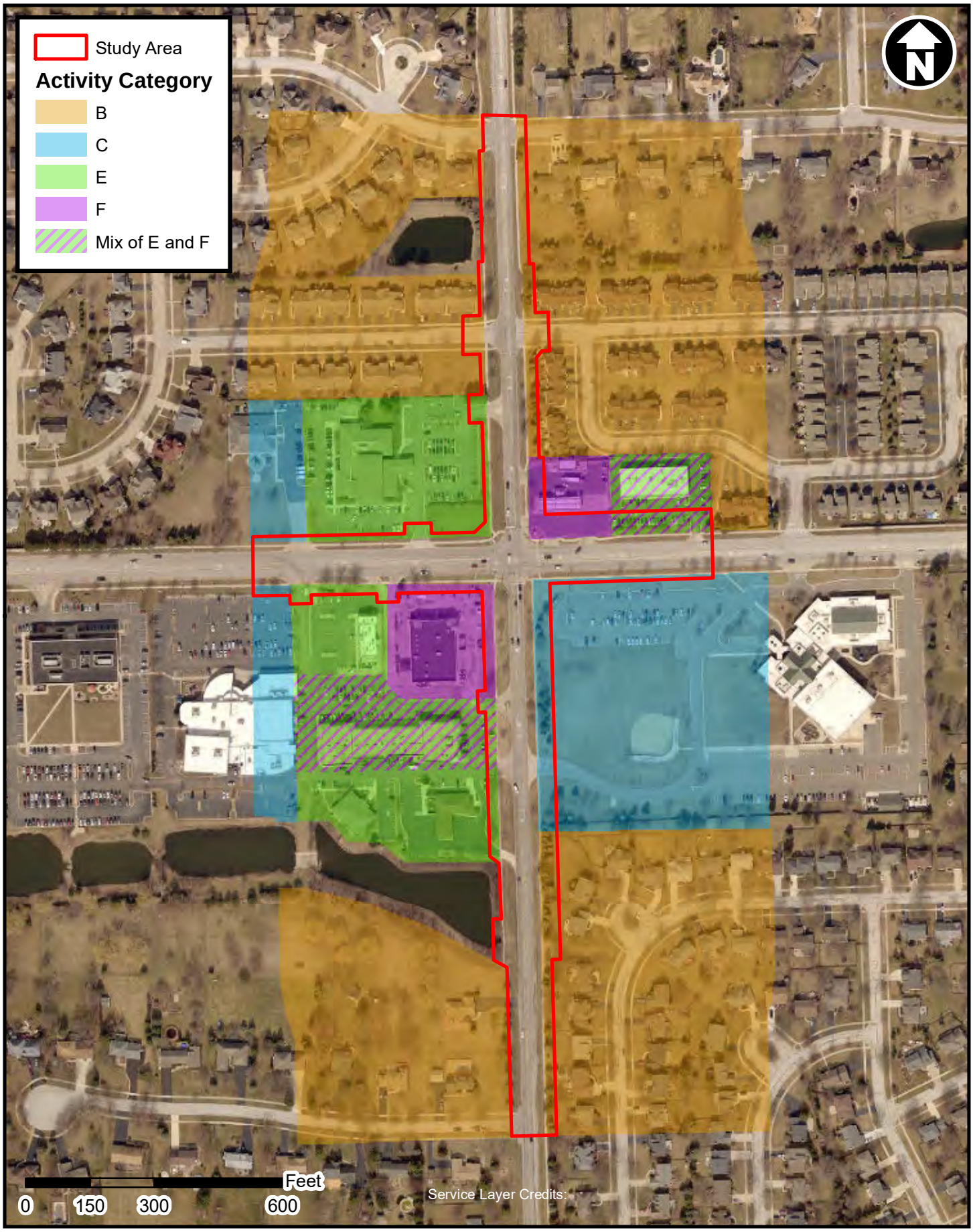

95th St & Book Rd Intersection Improvements - Naperville, Will Co., IL

FHWA Land Use Categories

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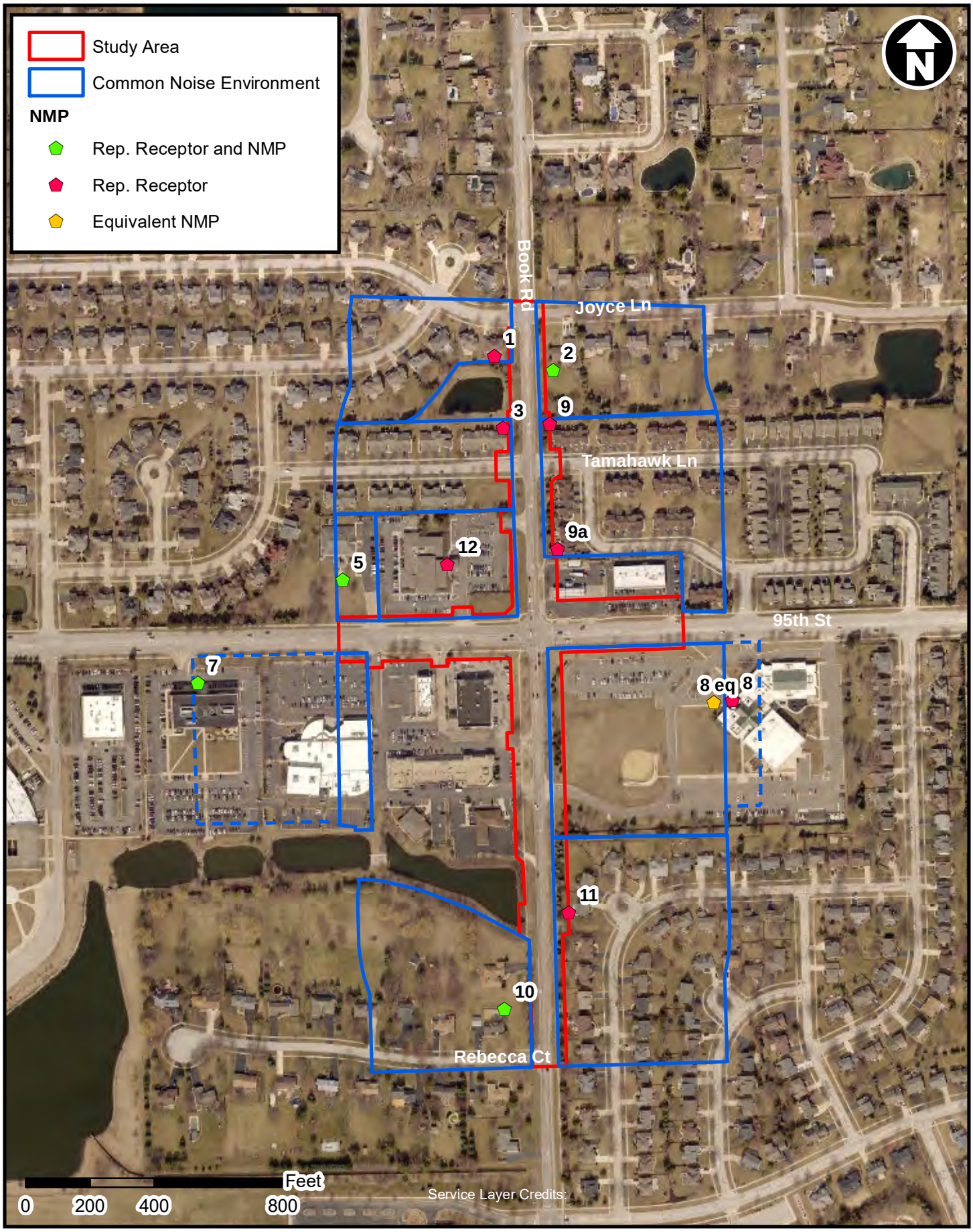

95th St & Book Rd Intersection Improvements - Naperville, Will Co., IL

Representative Receptor Locations

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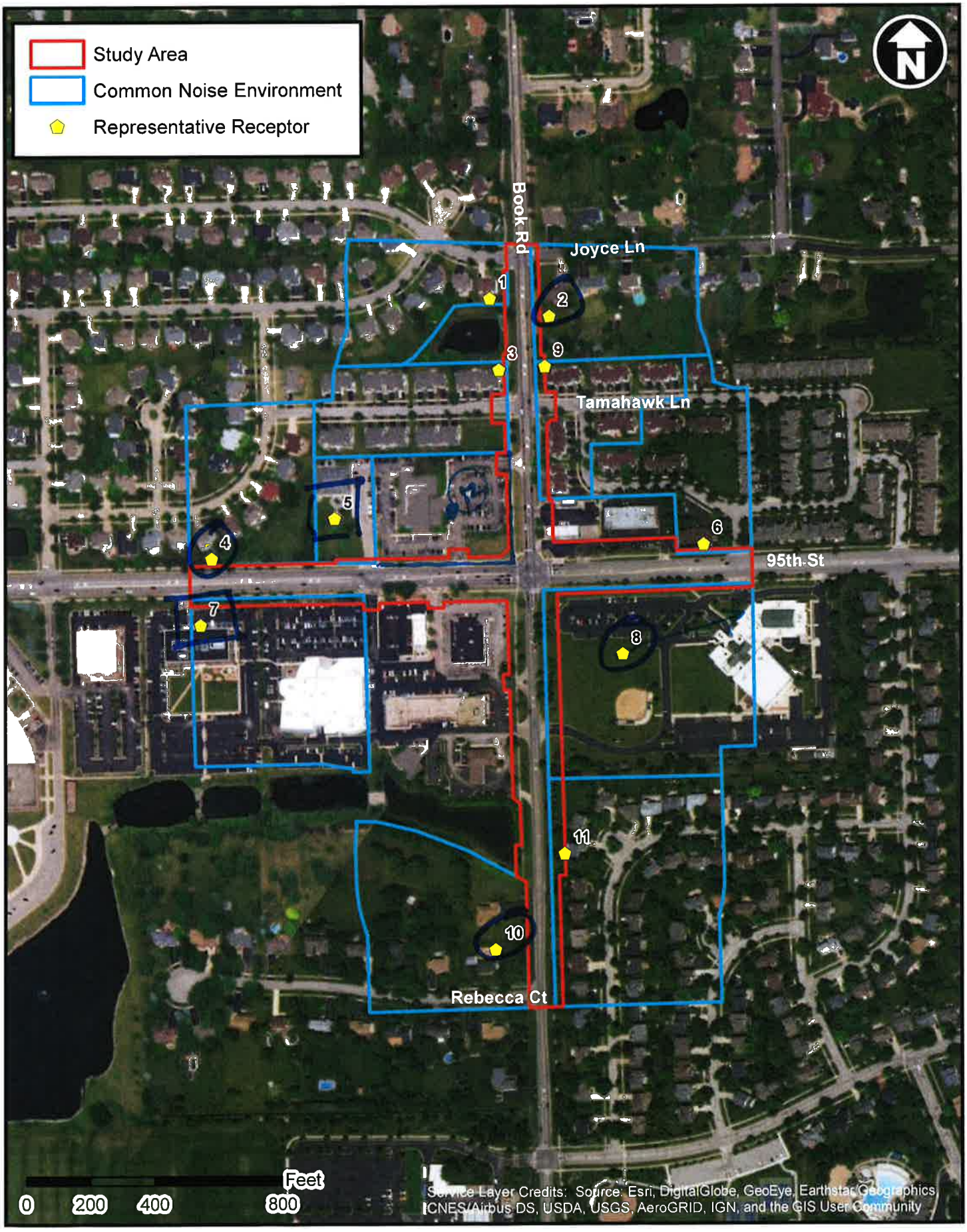
95th Street and Book Road

APPENDIX B: FIELD DATA



95th St & Book Rd Intersection Improvements - Naperville, Will Co., IL

CNEs and Representative Receptors

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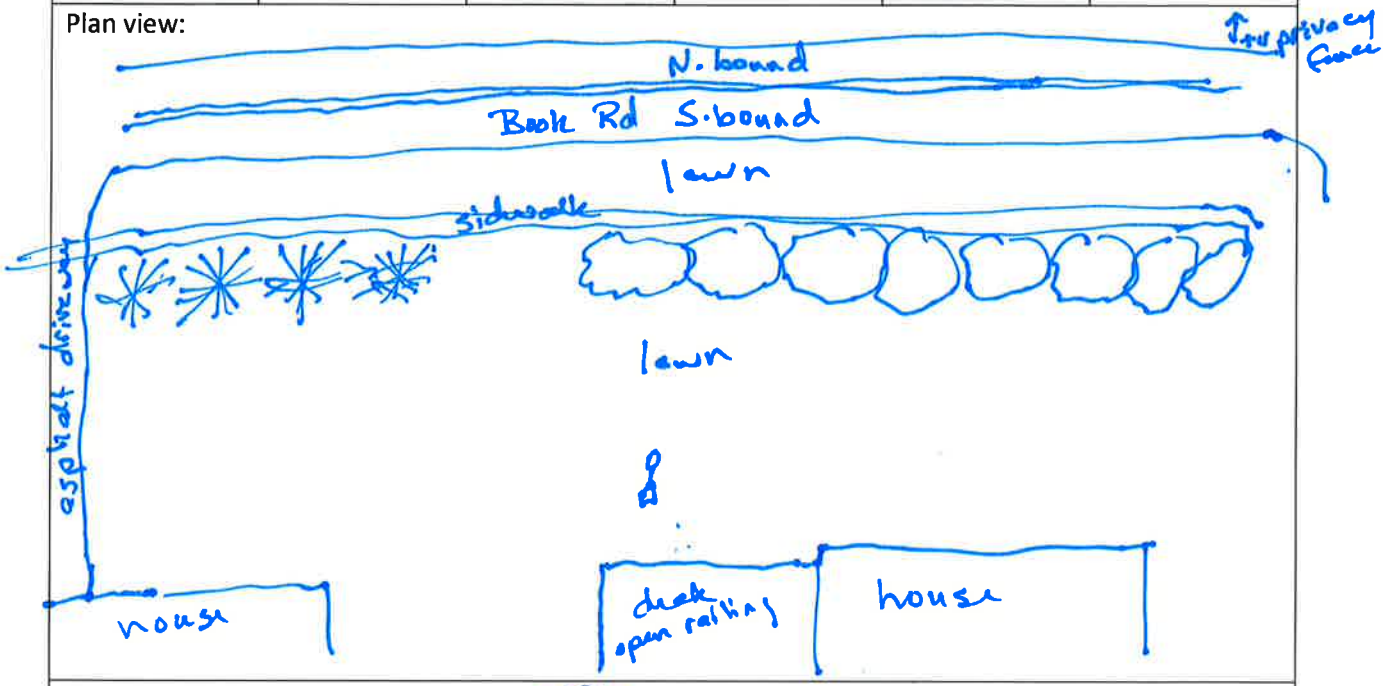
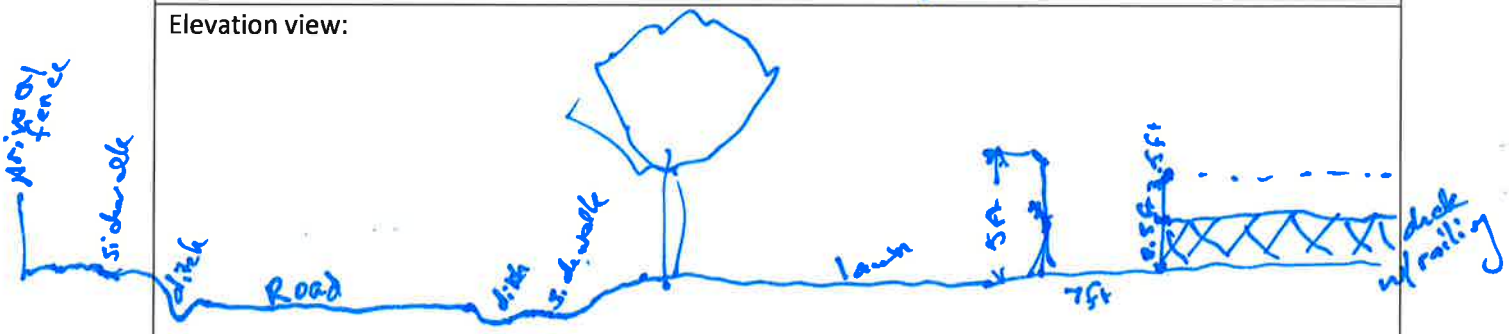
Site ID:	23200 Rebecca Ct		Location	95th & Book Sr int. imp. Naperville IL	
Observer	JKM	Date	8/22/18	Count location	NMP-10
Temperature	83 °F	Cloud cover	Partly Cloudy	Humidity	79%
Wind direction	Shifting S & W	Wind speed, avg	< 3 mph	Wind speed, max	8 mph
Start time	15:05	Stop time	15:20	Leq/avg and Lmax	58.1 dB(A) 66.1 dB(A)

Plan view:



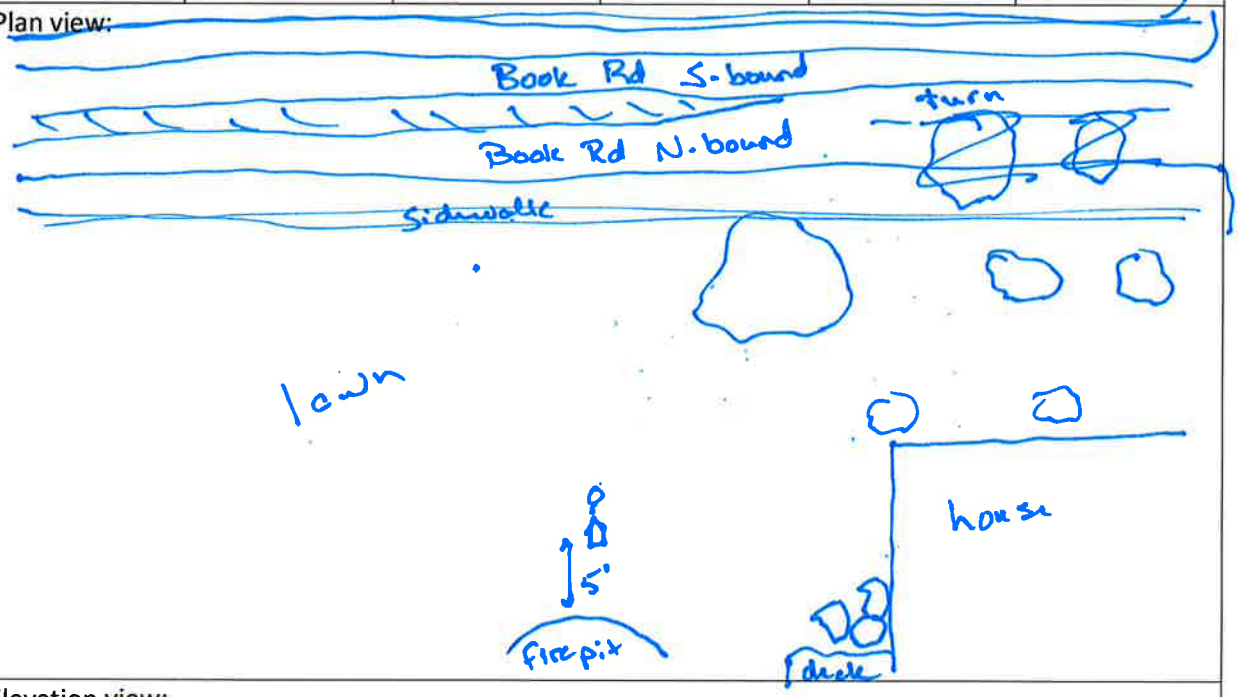
Elevation view:



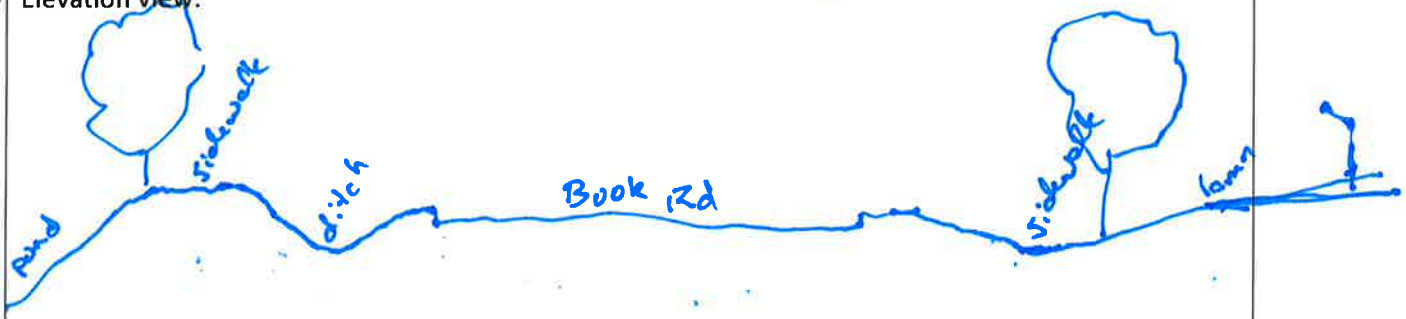
14:05 - 14:43 Airplane overhead (jet, passenger)

Site ID:	23155 Joyce Ln		Location	95th: Book Rd int. impr. Naperville, IL	
Observer	JKM	Date	8/22/18	Count location	NMP-2
Temperature	83°F	Cloud cover	Partly Cloudy	Humidity	82%
Wind direction	W. N variable	Wind speed, avg	<3 mph	Wind speed, max	8 mph
Start time	15:40	Stop time	16:00	Leq/avg and Lmax	60.3 dB(A) 71.7 dB(A)

Plan view:



Elevation view:



Lawnmower operating to E throughout 13:05 min
Traffic light limiting backing up to NMP by 5:50 - clears immediately

Traffic Count

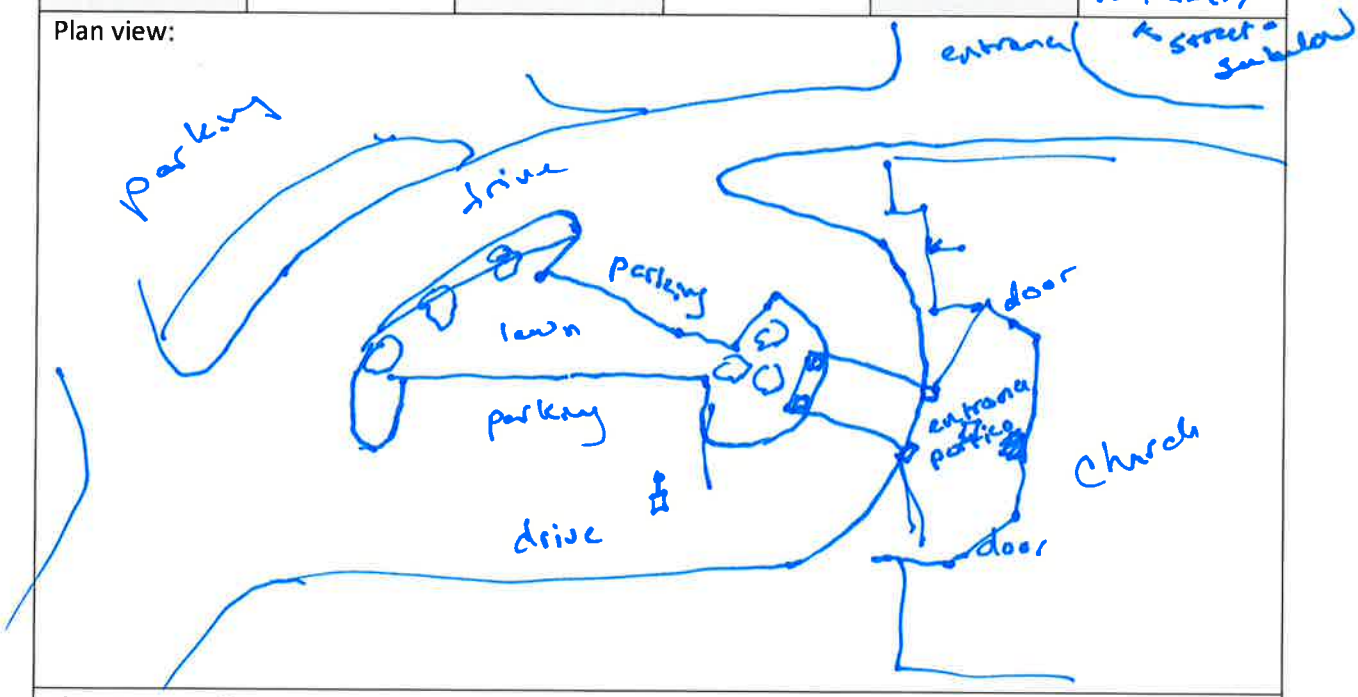
Primary roadway/direction: Book Rd. - North		
Cars (94)	Med Trucks 11 (2)	Heavy Trucks Timing (sec.) 4.06 4.71 3.86
Primary roadway/2nd direction: Book Rd. - South		
Cars (59)	Med Trucks (6)	Heavy Trucks Timing (sec.) 4.66 4.59 4.25
Secondary roadway/direction: Book Rd - South		
Cars (198)	Med Trucks 11 (2)	Heavy Trucks Timing (sec.) 5.17 6.02 5.31
Secondary roadway/2nd direction: Book Rd - North		
Cars (155)	Med Trucks 1111 (4)	Heavy Trucks Timing (sec.) 5.42 5.10 5.11

NMP 1D

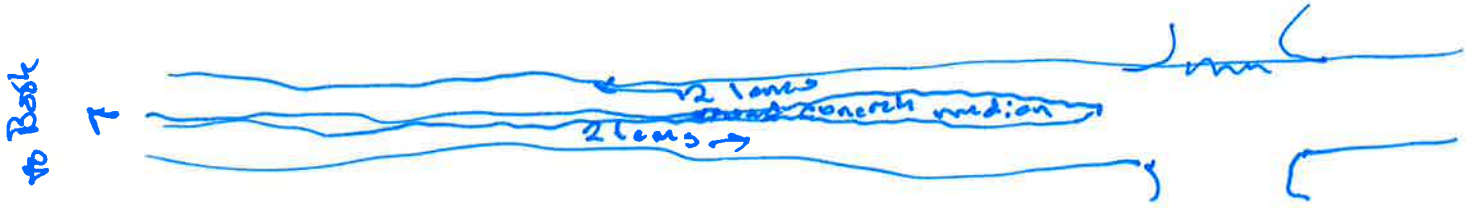
NMP 2

Site ID:	Wheatland - Salem UMC 1852 95th St Front entrance - offset W		Location	95th & Book Rd int. impr. Naperville IL	
Observer	JKM	Date	8/22/18	Count location	NMP. 8
Temperature	86°F	Cloud cover	Partly Cloudy	Humidity	85%
Wind direction	W with occ. shift N	Wind speed, avg	5 mph or less	Wind speed, max	12 mph (W)
Start time	16:20	Stop time	16:35	Leq/avg and Lmax	59.3 dB(A) 70.4 dB(A)

Plan view:

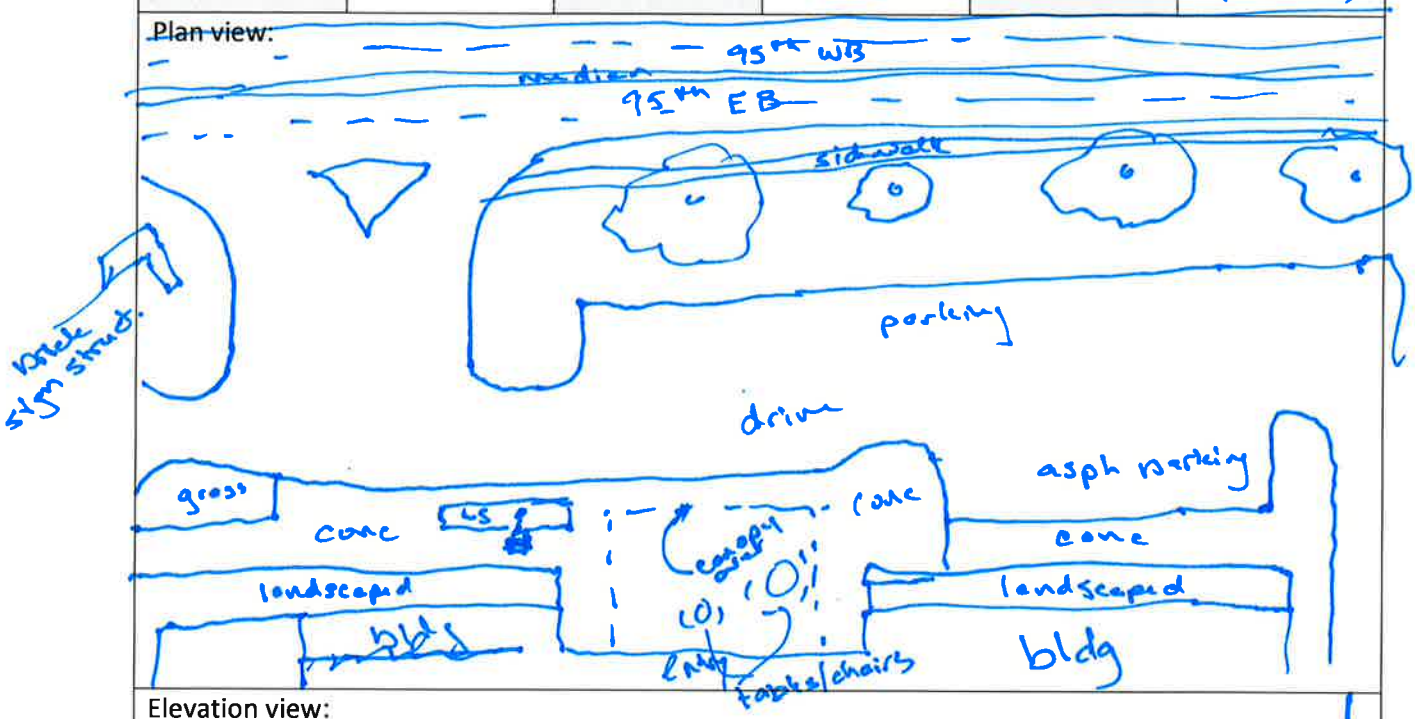


Elevation view:



Site ID:	Compass Church bldg Main ent. - offset to avoid canopy effects		Location	95th St, Book Rd int. imp. Naperville, IL	
Observer	JKM	Date	8/22/18	Count location	NMP-7
Temperature	80°F	Cloud cover	Partly Cloudy	Humidity	89%
Wind direction	W w/variable gusts E	Wind speed, avg	< 3 mph	Wind speed, max	10 mph
Start time	17:00	Stop time	17:15	Leq/avg and Lmax	63.0 dB(A) 72.1 dB(A)

Plan view:



Elevation view:

Traffic Count

Primary roadway/direction: 95th - ~~EAST~~ West		
Cars	Med Trucks	Heavy Trucks
157	19	1
		Timing (sec.)
		~~7.46~~ 4.06
		~~5.43~~ 3.78
		3.55

Primary roadway/2nd direction: 95th - ~~west~~ east		
Cars	Med Trucks	Heavy Trucks
159	3	Timing (sec.)
		3.99
		3.41
		3.67

NMP 8

Secondary roadway/direction: 95th St. - ~~east~~ West		
Cars	Med Trucks	Heavy Trucks
213	2	1
		Timing (sec.)
		4.58
		4.45
		5.16

NMP 7

Secondary roadway/2nd direction: 95th St. - ~~west~~ east		
Cars	Med Trucks	Heavy Trucks
189	1	Timing (sec.)
		4.71
		4.24
		4.20

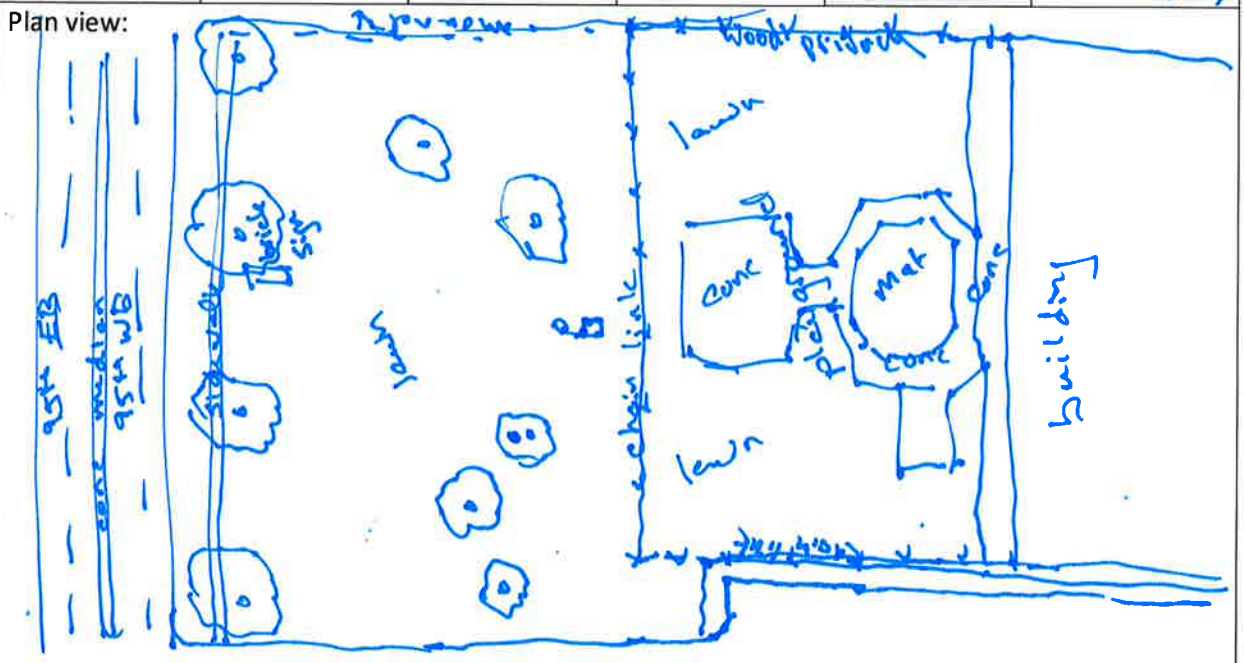
17 8 6 6

+189

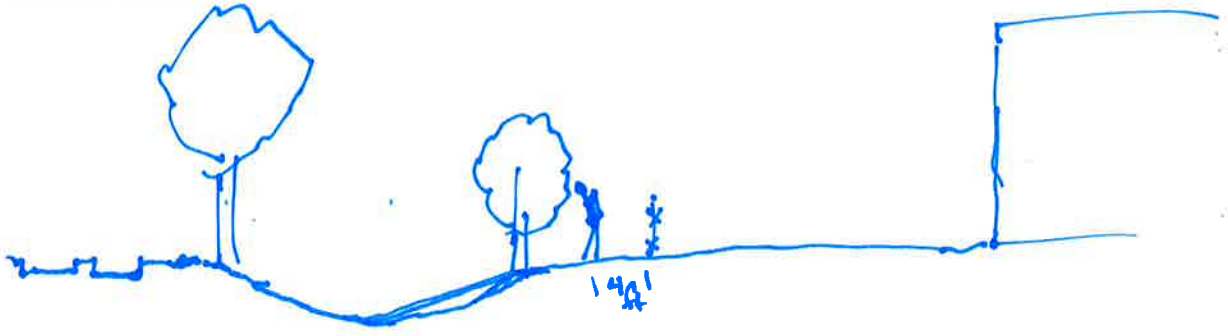
226

Site ID:	Childtime Learning Center 2015 95th St		Location	95th & Book Rd inters. imp. Naperville, IL	
Observer	JKM	Date	8/22/18	Count location	NMP-5
Temperature	79°F	Cloud cover	Clear	Humidity	90%
Wind direction	W-NW-N	Wind speed, avg	< 3 mph	Wind speed, max	11 mph infrequent 8 mph typ
Start time	17:54	Stop time	18:11	Leq/avg and Lmax	56.7 dB(A) 65.4 dB(A)

Plan view:

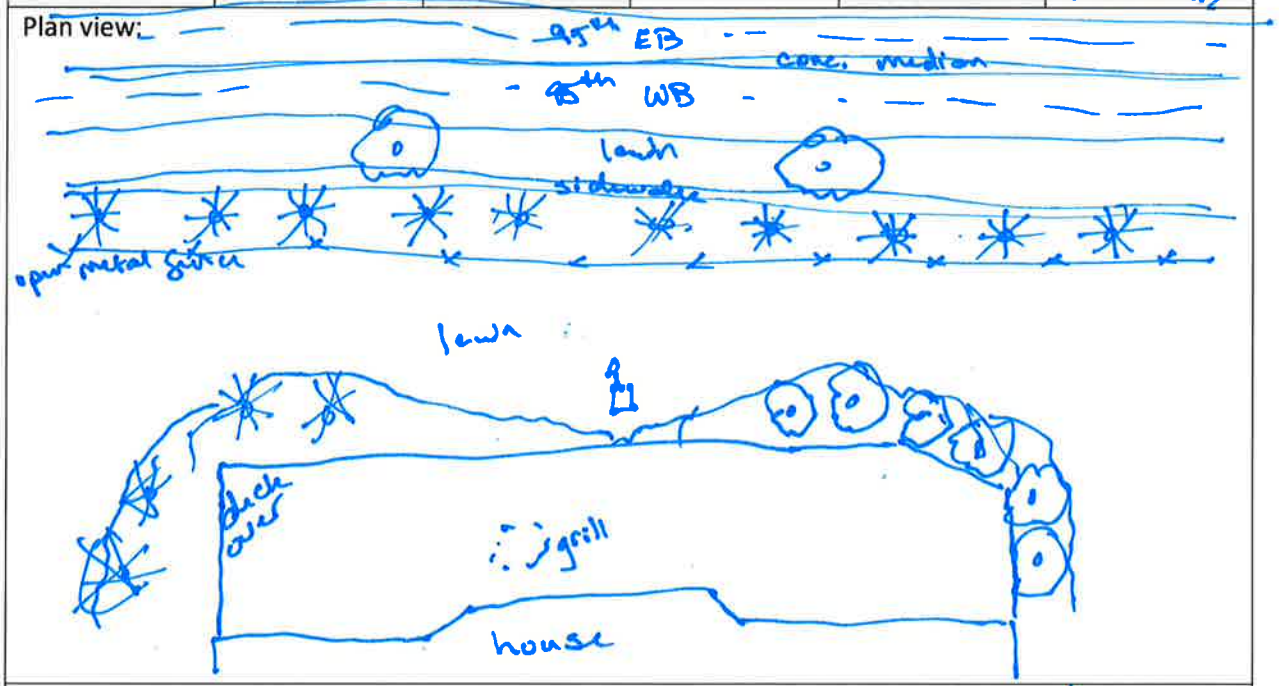


Elevation view:

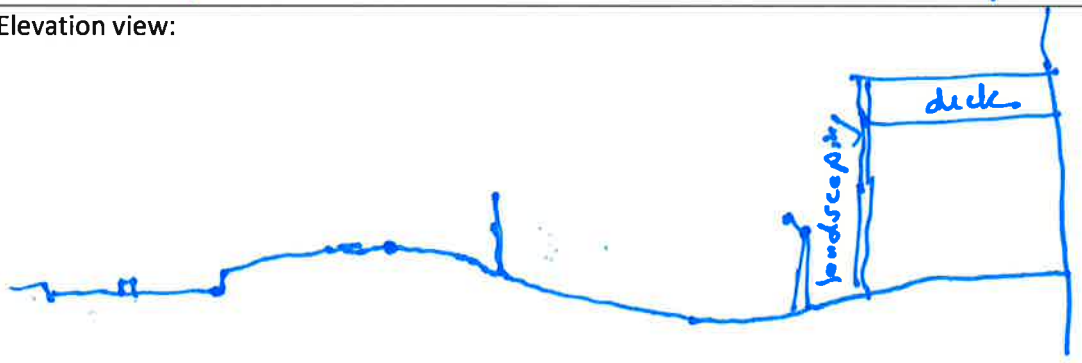


Site ID:	2940 Bath Ln Rear yard @ base of deck		Location	95th & Book Rd intx. imp. Naperville, IL	
Observer	JKM	Date	8/22/18	Count location	NMP-4
Temperature	81°F	Cloud cover	Clear	Humidity	90%
Wind direction	W	Wind speed, avg	<1 mph	Wind speed, max	3 mph
Start time	13:30	Stop time	17:45	Leq/avg and Lmax	44.4 dB(A) 77.4 dB(A)

Plan view:



Elevation view:



Motorcycle @ 5:15
loud truck @ 10:15

lots of insect noise

Traffic Count

Primary roadway/direction: 95th St - east		
Cars	Med Trucks	Heavy Trucks
12 5 9 2	1 (1)	214 (242)
Primary roadway/2nd direction: 95th St - West		
Cars	Med Trucks	Heavy Trucks
12 6 6 5	(5)	240 (269)
Secondary roadway/direction: 95th St - east		
Cars	Med Trucks	Heavy Trucks
	1 (1)	1 (211)
Secondary roadway/2nd direction: 95th St - West		
Cars	Med Trucks	Heavy Trucks
	1 (1)	1 (1)

NMP 4

NMP 5

(219)

PREMIER SAFETY
CALIBRATION LABORATORY

Calibration Certificate No. ELM1291

Instrument:	**Sound Level Meter**	*Date Calibrated:* **3/14/2018**	*Cal Due:* **3/14/2019**
Model:	**SoundPro SE_DL2**	*Status:*	**Received** / **Sent**
Manufacturer:	**Quest**	*In tolerance:*	X / X
Serial number:	**BIF030006**	*Out of tolerance:*	
Tested with:	**Microphone QE7052 s/n 44472**	*See comments:*	
	Preamplifier n/a s/n 0215 0302	*Contains non-accredited tests:*	**__Yes _X_ No**
Type (class):	**2**	*Calibration service:*	**__ Basic _X_ Standard**
Customer:		*Address:*	
Tel/Fax:	/		

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. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31079	June 22. 2017	Norsonic SA	June 22, 2018
DS-360-SRS	Function Generator	123268	June 22, 2017	SRS	June 22, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY53003818	July 14, 2017	Agilent Provider #93107	July 14,2018
SD700-Extech	Meteo Station	Q769118	June 22,2017	INNOCAL	June 22, 2018
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	34103	July 18, 2017	Scantek, Inc./ NVLAP	July 18, 2018

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 (%)
21.0	99.00	26.0

Calibrated by:	Steven Boertmann	**Authorized signatory:**	Eric Ford
Signature	STEVEN BOERTMANN	Signature	ERIC FORD
Date	3-14-18	Date	3-14-18

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

Results summary: Device complies with following clauses of mentioned specifications:

CLAUSES [1] FROM IEC/ANSI STANDARDS REFERENCED IN PROCEDURES:	RESULT [2,3]	EXPANDED UNCERTAINTY (coverage factor 2) [dB]
INDICATION AT THE CALIBRATION CHECK FREQUENCY - ANSI S1.4 CLAUSE 3.2	Passed	0.20.15
FREQUENCY WEIGHTINGS: A NETWORK - IEC 61672-3 ED.1 CLAUSE 12	Passed	0.2
FREQUENCY WEIGHTINGS: C NETWORK - IEC 61672-3 ED.1 CLAUSE 12	Passed	0.2
FREQUENCY WEIGHTINGS: Z NETWORK - IEC 61672-3 ED.1 CLAUSE 12	Passed	0.2
FREQUENCY AND TIME WEIGHTINGS AT 1 KHZ IEC 61672-3 ED.1 CLAUSE 13	Passed	0.2
LEVEL LINEARITY ON THE REFERENCE LEVEL RANGE - IEC 61672-3 ED.1 CLAUSE 14	Passed	0.3
LEVEL LINEARITY INCLUDING THE LEVEL RANGE CONTROL - IEC 61672-3 ED.1 CLAUSE 15	Passed	0.3
TONEBURST RESPONSE - IEC 61672-3 ED.1 CLAUSE 16	Passed	0.3
PEAK C SOUND LEVEL - IEC 61672-3 ED.1 CLAUSE 17	Passed	0.35
FILTER TEST 1/1OCTAVE: FLAT FREQUENCY RESPONSE - IEC 61260, CLAUSE 4.10 & #5.9	Passed	0.25
FILTER TEST 1/3OCTAVE: FLAT FREQUENCY RESPONSE - IEC 61260, CLAUSE 4.10 & #5.9	Passed	0.25

[1] The results of this calibration apply only to the instrument type with serial number identified in this report.

[2] Parameters are certified at actual environmental conditions.

[3]

Comments: The instrument was tested and met all specifications found in the referenced procedures.

Note: The instrument was tested for the parameters listed in the table above, using the test methods described in the listed standards. All tests were performed around the reference conditions. The test results were compared with the manufacturer's or with the standard's specifications, whichever are larger.
Compliance with any standard cannot be claimed based solely on the periodic tests.

Tests made with the following attachments to the instrument:

Microphone: Quest QE7052 s/n 44472 for acoustical test
Preamplifier: Quest n/a s/n 0215 0302 for all tests
Other: line adaptor ADP005 (18pF) for electrical tests and 1448 (18pF) for noise test
Accompanying acoustical calibrator: Quest QC-10 s/n QIB030186
Windscreen: none

Measured Data: in Test Report # of ... pages.

Place of Calibration: Premier Safety
46410 Continental Dr.
Chesterfield, MI 48047
Ph/Fax: 586-840-3220/ -3221
www.premier safety.com

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

SoundPro SE_DL2 s/n: BIF030006 ID:
Date: 3/14/2018 By: SB
Due: 3/14/2019

PREMIER SAFETY
CALIBRATION LABORATORY

Calibration Certificate 0040294

Instrument: **Acoustical Calibrator**
Model: **QC-10**
Manufacturer: **Quest**
Serial number: **QE2120254**
Class (IEC 60942): **1**
Barometer type:
Barometer s/n:

Date Calibrated: **3/13/2018** *Cal Due:* **3/13/2019**

Status:	**Received**	**Sent**
In tolerance:	**X**	**X**
Out of tolerance:		
See comments:		

Contains non-accredited tests: __**Yes** _**X**_ **No**

Customer:
Tel/Fax: /

Address:

Tested in accordance with the following procedures and standards:
Calibration of Noise Dosimeters, Sound Meters, and Calibratos., Rev. Chf 04

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

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31079	June 22. 2017	Norsonic SA	June 22, 2018
DS-360-SRS	Function Generator	123268	June 22, 2017	SRS	June 22, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY53003818	July 14, 2017	Agilent Provider #93107	July 14,2018
SD700-Extech	Meteo Station	Q769118	June 22,2017	INNOCAL	June 22, 2018
140-Norsonic	Real Time Analyzer	1405966	June 22, 2017	Norsonic SA	June 22, 2018
PC Program 1018 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
40AG-GRAS	Microphone	173539	July 18, 2017	Scantek, Inc. / NVLAP	July 18, 2018
NN1203-Norsonic	Preamplifier	138531	July 18, 2017	Norsonic SA	July 18, 2018

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

Calibrated by:	Steven Boertmann	**Authorized signatory:**	Eric Ford
Signature	STEVEN BOERTMANN	Signature	ERIC FORD
Date	3-13-18	Date	3-13-18

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.

Results summary: Device was tested and complies with following clauses of mentioned specifications:

CLAUSES[1] FROM STANDARDS REFERENCED IN PROCEDURES:	MET[2]	NOT MET	COMMENTS
Manufacturer specifications			
Manufacturer specifications: Sound pressure level	X		
Manufacturer specifications: Frequency	X		
Manufacturer specifications: Total harmonic distortion	X		
Current standards			
ANSI S1.40:2006 B.3 / IEC 60942: 2003 B.2 - Preliminary inspection	X		Unit older than the standard
ANSI S1.40:2006 B.4.4 / IEC 60942: 2003 B.3.4 - Sound pressure level	X		Unit older than the standard
ANSI S1.40:2006 A.5.4 / IEC 60942: 2003 A.4.4 - Sound pressure level stability	-	-	Unit older than the standard
ANSI S1.40:2006 B.4.5 / IEC 60942: 2003 B.3.5 - Frequency	X		Unit older than the standard
ANSI S1.40:2006 B.4.6 / IEC 60942: 2003 B.3.6 - Total harmonic distortion	X		Unit older than the standard
Older standards (obsolete)			
IEC 60942: 1997 B.2 - Preliminary inspection	X		
IEC 60942: 1997 B.3.3 - Sound pressure level	X		
IEC 60942: 1997 B.3.4 - Sound pressure level stability	X		
IEC 60942: 1997 B.3.5 - Frequency	X		
IEC 60942: 1997 B.3.6 - Total harmonic distortion	X		
ANSI S1.40: 1984 (R1997) 4.4.2 Sound pressure level in the coupler	X		Not applicable
ANSI S1.40: 1984 (R1997) 4.4 Frequency sound in the coupler	X		Not applicable
ANSI S1.40: 1984 (R1997) 4.10 Total harmonic distortion	X		Not applicable

[1] The results of this calibration apply only to the instrument type with serial number identified in this report.

[2]

Main measured parameters [3]:

Measured[4]/Acceptable[5] Tone frequency (Hz):	Measured[4]/Acceptable[5] Total Harmonic Distortion (%):	Measured [4]/Acceptable Level[5] (dB):
1017.24 ± 1.0/1000.0 ± 10.0	0.40 ± 0.10/ < 3	114.05 ± 0.00/114.0 ± 0.4

[3] The stated level is valid at reference conditions.

[4] The above expanded uncertainties for frequency and distortion are calculated with a coverage factor k=2; for level k=2.00

[5] Acceptable parameters values are from the current standards

Barometer indication	Nominal indication

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
21.0 ± 1.0	99.00 ± 0.001	26.0 ± 2.0

Tests made with following attachments to instrument:

Calibrator ½" Adaptor Type:
Other:

Adjustments: Unit was not adjusted.
Comments: The instrument was tested and met all specifications found in the referenced procedures.

Note: The instrument was tested for the parameters listed in the table above, using the test methods described in the listed standards. All tests were performed around the reference conditions. The test results were compared with the manufacturer's or with the standard's specifications, whichever are larger.
Compliance with any standard cannot be claimed based solely on the periodic tests.

Place of Calibration: Premier Safety
46410 Continental Dr.
Chesterfield, MI 48047
Ph/Fax: 586-840-3220/ -3221
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