

ALLY OUTFITTERS GUN RANGE ENVIRONMENTAL SOUND ASSESSMENT

Prepared by: Wrightson, Johnson, Haddon, and Williams, Inc. TX Engineering Firm
Number F19548 under the direction of Emily Piersol, PE (TX-120506)

31 May 2019



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INTRODUCTION

This report is indented to describe the findings of a community sound review of the proposed Ally Outfitters Gun Range in the City of Allen, Texas. Our analysis is specifically related to the potential for sound from gun fire emanating from the range to the surrounding community.

Our analysis is based on information provided by the Project Architect (Pross Design Group).

This report includes details related to the acoustical analysis including pertinent environmental noise standards for the City of Allen, project building orientation on the project site, interior sound levels, sound source locations, project building shell construction design, and acoustical modeling software. Each input used in our analysis is outlined in our report to convey the effect of proposed constructions on project-related sound exposure in the community as well as to provide insight regarding assumptions made to complete our calculations.

Our analysis provides a reasonable expectation for sound emission from the proposed project building based on the construction materials and methods shown in the preliminary design documents as well as assumptions made regarding sound sources, frequency characteristics of those sources, frequency of range operation, and location of the range within the overall project.

DEFINITIONS

The following definitions are relevant to this discussion.

Sound Pressure Level (SPL) – The logarithmic value of the measured sound pressure to a standard reference value. SPL describes how loud a sound is perceived and is measured in decibels.

Decibel (dB) – The unit of measure of sound pressure level. dB is the logarithmic ratio of the measured sound pressure level to a standard value (p_{ref}). The reference sound pressure level (p_{ref}) used in acoustics is 2×10^{-5} Pa.

Decibel A-weighted (dBA) – The A-weighted sound pressure level. A-weighting attempts to simulate the unequal sensitivity of human hearing at various frequencies. This weighting system generally reduces the impact of low frequency sound as human hearing is less sensitive to lower frequencies. The City of Allen's noise ordinance is based on dB(A) criteria.

Sound Transmission Class (STC) – A single-number classification for noise isolation of a barrier material (e.g. partition or door) construction. Higher STC values relate to higher sound isolation.

ENVIRONMENTAL SOUND REQUIREMENTS

The City of Allen Land Development Code specifically establishes acceptable sound exposure levels that are allowable to adjacent properties. Section 7.08 of the Zoning Development Standards states:

At no point at the bounding property line of any use shall the sound pressure level of any operation or activity exceed 65 dB(A) for daytime (between 7:00 am and 8:00 pm) and 58 dB(A) at nighttime.

WJHW's analysis assumes the more stringent nighttime sound level of 58 dB(A) as the appropriate standard for this project. Using the more conservative nighttime level assures the sound ordinance is met during all project building operating times.

PROJECT BOUNDARY

The City of Allen Code of Ordinances defines sound limits at the project boundary. The following graphic indicates the location of the project boundary as well as the project building on the property. These physical relationships as shown in Figure 1 below.

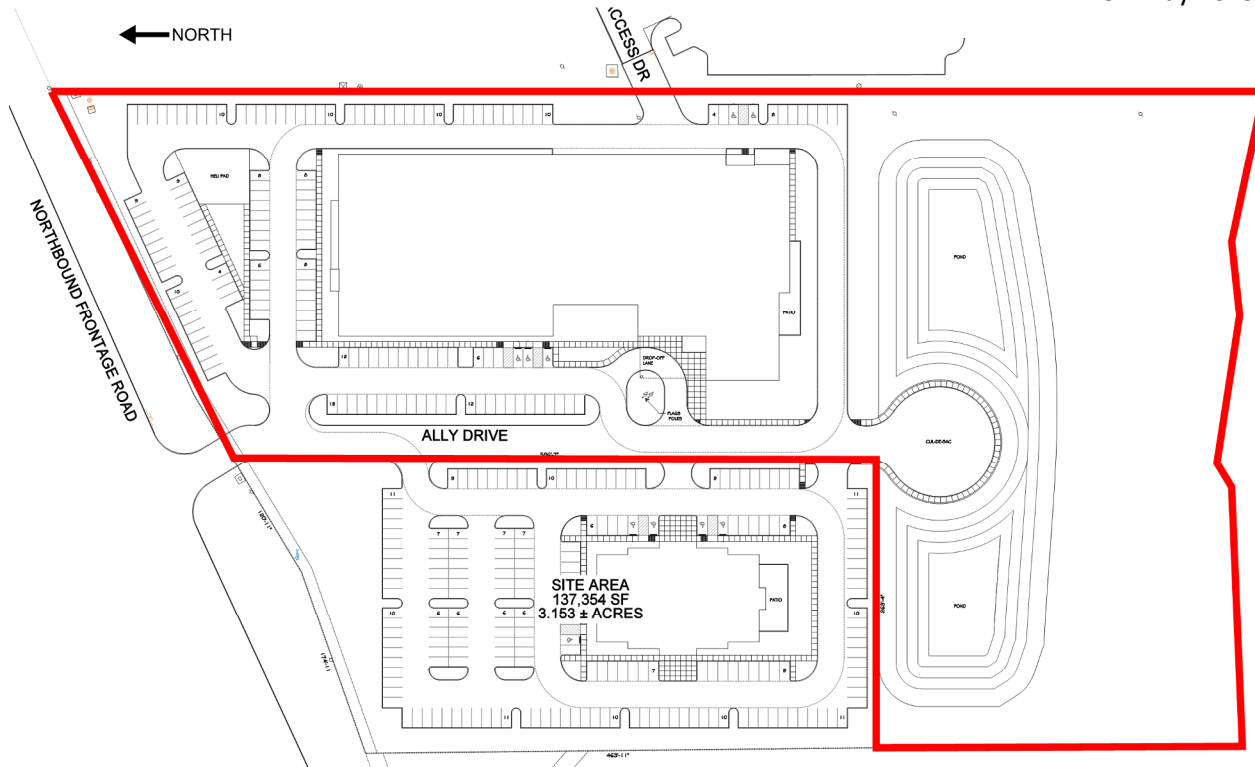


Figure 1: Project Boundary

INTERIOR SOUND SOURCE LOCATIONS

The Ally Outfitters Facility consists of five separate range areas; one 50 Yard Range, three 25 Yard Ranges, and a Skeet Range. WJHW modeled the sound sources within the project building at each of the range firing positions within those five ranges as shown in the architectural drawings. A total of thirty one (31) firing positions were modeled. Our modeling procedure assumed each position was firing simultaneously – i.e. all positions generate sound at the same time – to document the “worst case” sound level generated within the building. This provides the most conservative (i.e. loudest) sound level potential for the project building. Sound source locations are shown in Figure 2 below.

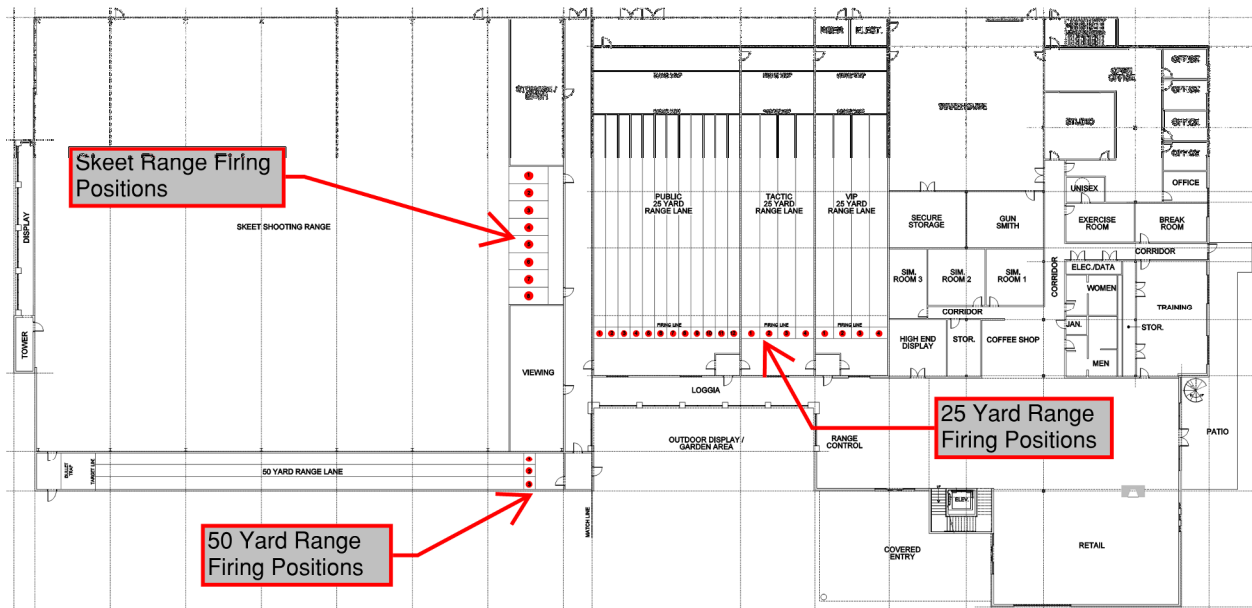


Figure 2: Sound Source Locations

INTERIOR SOUND SOURCE LEVELS

Reference sound levels used for the project environmental sound analysis were measured at the City of Plano Police Training Facility during live fire operations. WJHW collected this data as part of a City of Plano project related to their training facility. Sound pressure level data was collected within the Training facility during various exercises performed by the City's SWAT team including the use of handguns, shotguns, and fully automatic rifles. Average sound level values for each of the firearm types is as follows (measured at approximately 5 feet to the side of the weapon), measured over a 10 second period.

Table 1: Measured SPL Values at Plano Police Training Facility

Firearm Type	A-Weighted Decibel (dBA) @ 5 Feet
.45 Caliber Handgun	116.2
12- Gauge Shotgun	118.4
.223 Caliber Fully Automatic Rifle	123.7

Based on the data collected at the Plano Police facility, WJHW has determined the loudest individual sound source which may occur at the project gun range is approximately 123.7 dB(A) at a distance of 5 feet to the side of the weapon, measured over a 10 second period. The sound sources within the Skeet Range will be modeled as 12-Gauge Shotguns with a sound pressure level of 118.4 dB(A) at 5 feet. To produce a conservative analysis, WJHW assumes each sound source within the 25 Yard and 50 Yard Ranges at the Ally Outfitters facility acoustical model will be equivalent to the loudest sound pressure level measured at the Plano facility. Therefore, each sound source modeled will have a sound pressure level of 123.7 dB(A) at 5 feet. While we do not assume the facility will operate at this potentially "worst case" sound level, we have adopted this conservative estimate of interior sound production at each

firing lane as they operate simultaneously. Octave-band sound level data for the project sound source is presented in Table 2.

Table 2: Octave-Band SPL Values for Representative Sound Sources

	Octave Band Center Frequency, Hz							
	63	125	250	500	1000	2000	4000	8000
Fully Automatic Source SPL at 5 ft, dB	111.5	111.9	118.5	124.1	122.6	118.5	114.2	109.6
12-Gauge Shotgun SPL at 5 ft, dB	102.2	105.6	107.8	112.5	110.1	107.9	104.3	99.8

INTERIOR BUILDING PARTITIONS

The sound attenuating characteristics of the interior building partitions were included in our model. Partitions were placed within the project building in accordance with the architectural drawings. The following interior sound isolating elements and their respective STC Ratings are included in Table 3 below. Figure 3 shows the interior space plan of the building.

Table 3: Interior Sound Isolation Construction

Sound Isolation Element	STC Rating
7-inch Concrete Partition	STC 57
4-7/8-inch Insulated Gypsum Board Partition	STC 45
1-inch thick Laminated, Insulated Glazing	STC 36
Insulated Metal Door	STC 31

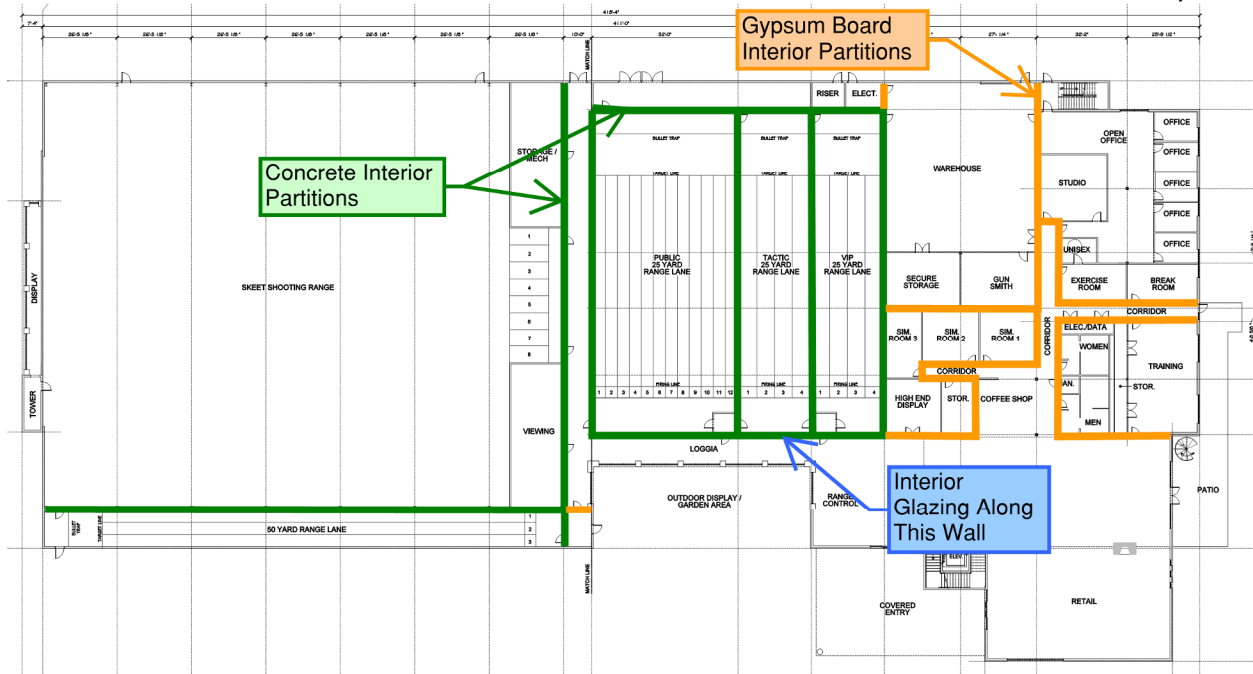


Figure 3: Interior Sound Isolation Partitions

Bullet traps and baffles were not included as part of our interior sound analysis. We anticipate the actual interior sound levels at the exterior façades and the roof will be lower than reported below as the bullet traps and ceiling baffles will provide some additional sound mitigation.

INTERIOR ABSORPTIVE TREATMENTS

Sound absorptive treatments were included in our model. 2-inch thick board insulation with minimum NRC 0.90 was modeled at the underside of the roof structure in the Skeet Range, the three 25 Yard Ranges, and the 50 Yard Range. Figure 4 below shows the locations of this absorptive treatment.

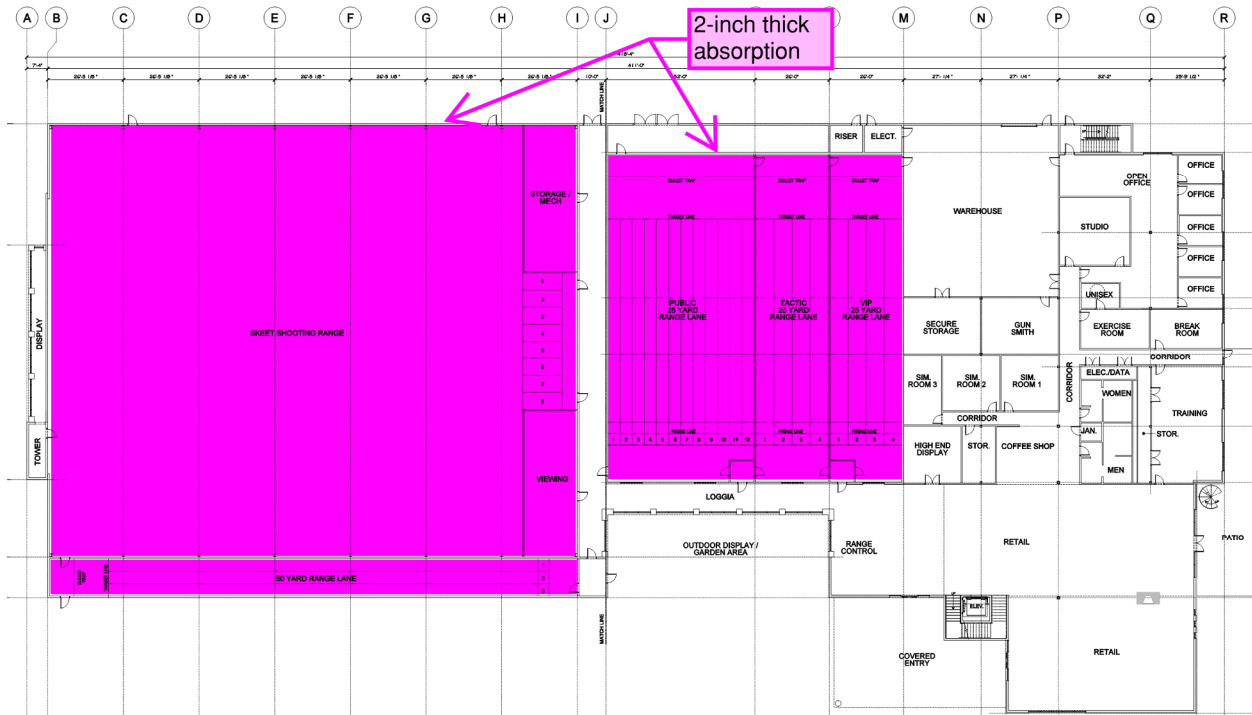


Figure 4: Interior Absorptive Treatments

EXTERIOR BUILDING CONSTRUCTION

The nature of the exterior building wall and roof construction is critical to containing sound generated within the project building and, therefore, limiting sound transmission to the surrounding community. WJHW's analysis included the exterior walls and roof constructions as described below to determine total sound energy emitted from the building shell. This sound energy is representative of the potential sound transmission to adjacent properties. The following exterior sound isolating elements and their respective STC Ratings are included in Table 4. Figure 5 shows the location of these elements at the building exterior.

Table 4: Exterior Sound Isolation Construction

Sound Isolation Element	STC Rating
7-inch Concrete Partition	STC 57
6-1/4-inch Insulated Gypsum Board Partition	STC 48
1-inch thick Laminated, Insulated Glazing	STC 36
Typical Metal Roof Deck	STC 23
2-inch thick Normal Weight Concrete on Corrugated Deck	STC 42
4-inch thick Normal Weight Concrete on Corrugated Deck	STC 49
Insulated Metal Door	STC 31
Overhead Coiling Door	STC 30

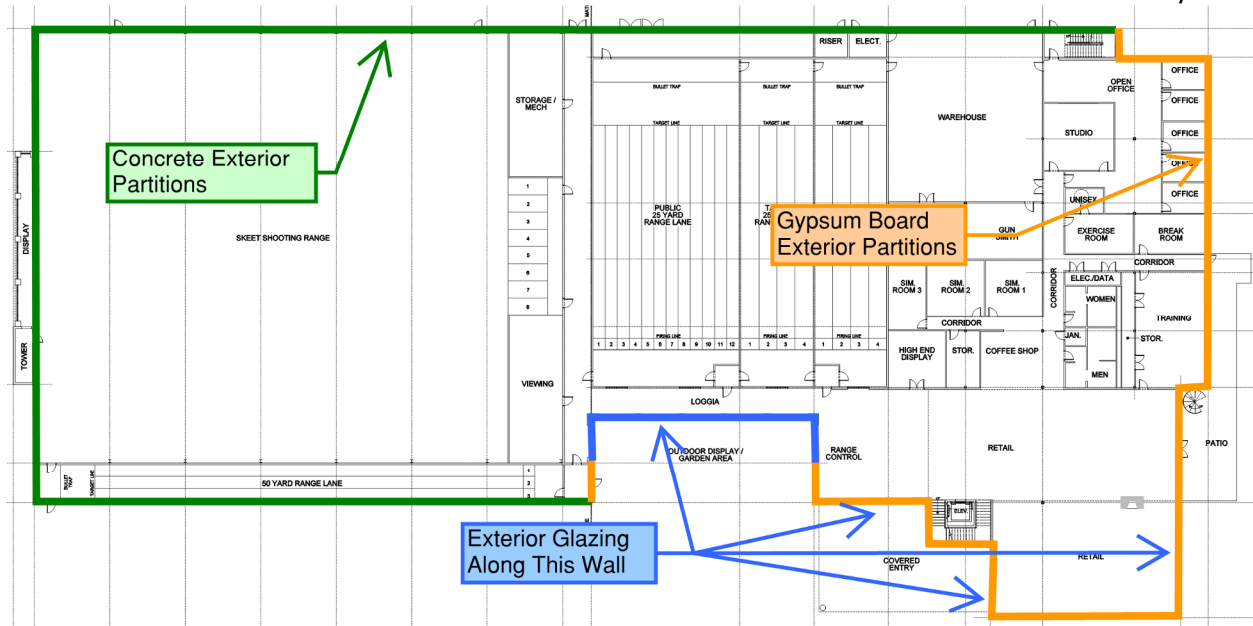


Figure 5: Location of Exterior Sound Isolation Elements

COMMUNITY SOUND LEVEL MODELING

Sound modeling was completed using SoundPlan™, an industry standard environmental sound modeling software. This software analyzes environmental sound propagation using inputs such as sound sources and locations, building interiors, exterior barriers (include buildings and walls), ground absorption, and other environmental factors. WJHW modeled the proposed building based on the site and building plans provided by the project architect. WJHW input topography from Google Maps GIS data and aerial imagery. The building interior was modeled based on the proposed building layout, and sound sources and levels were input as described above. Excluded from the sound modeling were ambient sound levels on site, the sound produced by mechanical equipment or other building services, and atmospheric effects such as wind.

The output of the modeling software is a series of sound contours indicating A-weighted decibel levels overlaid on a site map of the property and surrounding areas.

Figure 6 below shows the calculated sound contours. As previously stated, the City of Allen maximum allowable nighttime sound level is 58 dB(A).

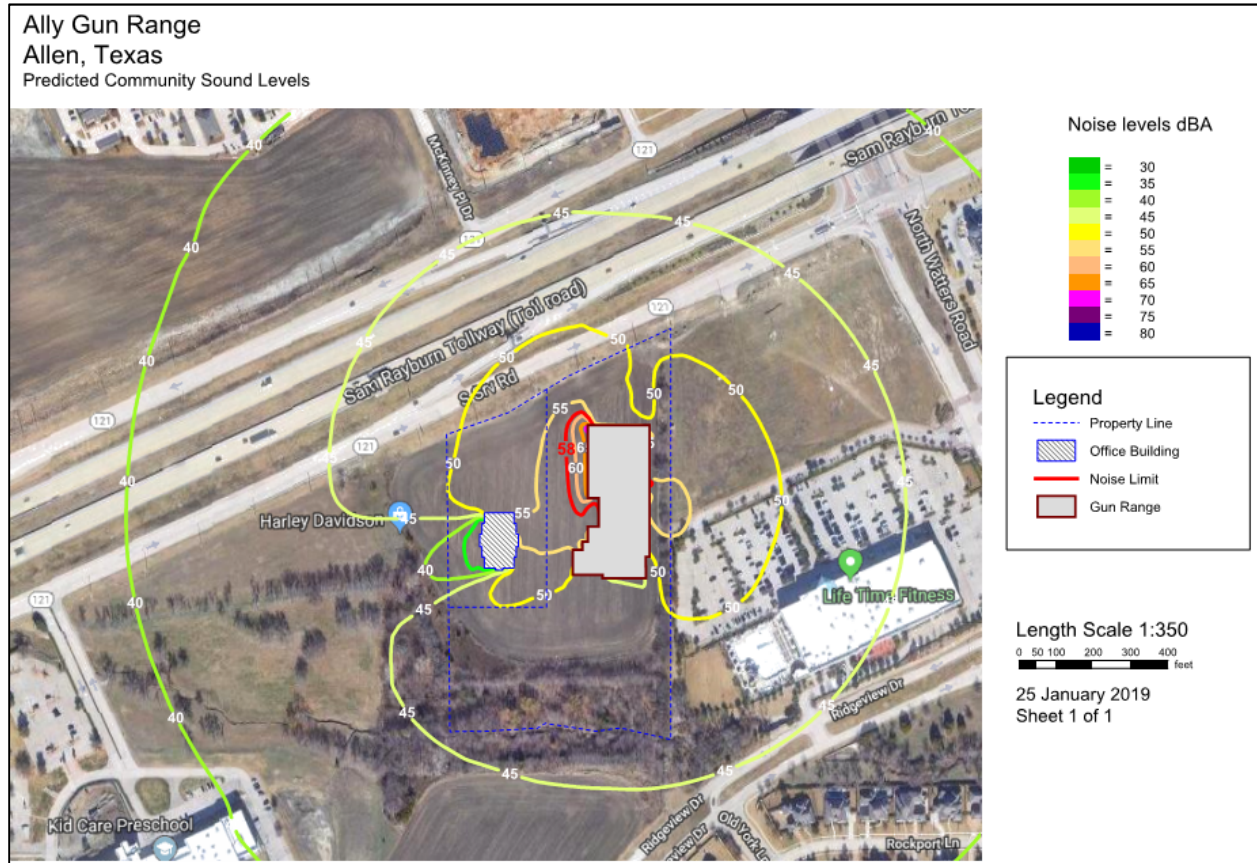


Figure 6: Predicted Sound Contours, Ally Outfitters Gun Range

CONCLUSIONS

Based on the calculated community sound levels, based on the current project site plan and architectural drawings with the built-up roof constructions described above, the maximum sound level is 57 dBA at the west property line and 56 dBA at the east property line. At the residences to the south of the project property, sound levels are anticipated to be less than 45 dBA. If built as described in the Pross Design Group construction documents incorporating the recommendations made by Wrightson, Johnson, Haddon, and Williams, Inc., the building should sufficiently reduce interior sound sources to at or below the City of Allen noise regulations of 58 dBA (per the zoning ordinance) at the project bounding lines. These levels, however, do not ensure that sound from the proposed shooting range will be inaudible under all conditions. There may be quiet times during day when a nearby listener might hear sound from the range, detectable due to the nature of the sound source.