AVANT ACOUSTICS®

14827 West 95th St. Lenexa, Kansas 66215
ph. 913.888.9111 fx. 913.888.9193

September 7, 2023

Mr. Brandt Elwell
TRS Range Services
1025 South Bridgeway Place
Suite 290
Eagle, ID 83616

Re: City of Olathe Firing Range – Site 2
Olathe, Kansas
AVANT File: C2034.a

Dear Brandt:

We have reviewed the prospective firing range site and range layout in regard to noise levels produced in the surrounding areas. This report summarizes our observations on the site, our calculations, and the conclusions drawn from our calculations.

Observations

1. The prospective range site is situated in a currently empty field near the intersection of 167th street and I-35. The areas immediately neighboring the site are mostly industrial or agricultural, however, there are residential areas to the east and west. The nearest residential zone to the site is east of the range site approximately 1,500 feet distant. The nearest agricultural zone to the site is to the south and is approximately 1,000 feet distant. A map of the zoning of areas surrounding the prospective range site is attached at the end of this report for reference.

2. Interstate 35 runs diagonally along the southeast boundary of the proposed range property and railway line runs along the northwest boundary of the proposed range property. These are likely the most prevalent background noise sources in the area.

Calculations

1. Calculations were performed to develop a basic model of how sound emanates from the proposed range. These calculations are based on estimated firing activity at the range and include the expected noise attenuation and reflections due to barriers around the range and from noise propagation over distance.

2. The proposed range includes two 50-yard ranges with 20 lanes each and one 200-yard range with 5 lanes. The target position for all lanes remains fixed while the firing position can shift to various distances along the lanes (the noise model calculations assume the firing position is at the furthest distance from the target). The 50-yard ranges have 6-foot berms with 10-foot concrete ballistic walls on each side. A 30-foot-high target barrier, composed of a 20-foot berm topped with a 10-foot ballistic wall, is located beyond the target line of the 50-yard lanes. A 10-foot high ballistic concrete wall divides the two 50-yard ranges from each other. 10-foot-high dirt berms are located on either side of the 200-yard range and a 30-foot-high target barrier, composed of a 20-foot berm topped with a 10-foot ballistic wall, is located beyond the target line. See the attached Draft Range Concept detail R1.

3. The attached detail NS-01 shows calculated noise levels due to firing activity at the proposed range. The noise levels are reported as A-weighted equivalent continuous sound level (LA_{EQ}). A-weighting refers to a standardized set of adjustments to the measured sound levels at certain frequencies to account for changes in sensitivity in human hearing across the audible frequency range. The equivalent continuous sound level is a time-weighted averaging of the noise levels throughout the duration of a measurement. The calculations are based on a period of one hour of firing activity. The following assumptions were made in this calculation based on the provided expected worst-case range activity:

    a. Thirteen shooters per 50-yard range with 9mm pistols firing at a rate of 170 rounds per hour.

    b. Two shooters at the 200-yard range with .223 rifles firing at a rate of 170 rounds per hour.

    c. All firing activity mentioned above occurring concurrently.

4. The noise mapping does not take into account noise attenuation or amplification due to structures like nearby buildings and houses, topography, foliage, or varying atmospheric conditions.

Conclusions

1. The calculations shown in detail NS-01 show the anticipated noise levels from the expect worst case firing scenario from a noise perspective based on the information provided. This indicates that noise levels in the closest residential areas could reach 60 to 70 dBA. Note that the nearest residential zone is to the west is highlighted with a yellow boundary. This area is not currently part of Olathe. Noise levels in nearby agricultural zones could also reach levels of 60 to 70 dBA.

2. For reference, the City of Olathe noise ordinance sets a daytime noise level limit received by residential and agricultural land categories of 55 dBA or 5 dB above the ambient noise (if the ambient noise level is above the 55 dBA limit). The ordinance also calls for a 5 dB penalty applied to the measured sound level (in LA_{EQ}) for impulsive noise sources. This penalty helps to account for the higher degree of annoyance caused by impulsive noises compared to steady-state noise sources (some sources suggest a higher penalty of 8 to 12 dB for gunfire noise). This would indicate a noise level goal for residential and agricultural areas of less than 50 dBA from impulsive gunfire at the range. A portion of the Municipal Code is included below for reference and a map of the zoning in the area around the proposed range site is attached at the end of this report.

6.18.060 Sound Levels by Receiving Land Use.

(A) No person shall operate or cause to be operated on private property any source of sound in such a manner as to create a sound level which exceeds the limits set forth for the receiving land use category shown following when measured at or within the property boundary of the receiving land use:

Sound Levels by Receiving Land Use

Receiving land-use category	Time	Sound level limit, dba
R-A, R-A-1, R-1, R-2, R-3, R-4, R-5, PUD, A (Residential, public space, open space or agricultural or institutional)	7:00 a.m.-11:00 p.m.	55
	11:00 p.m.-7:00 a.m.	50
C-O, C-1, C-2, C-3 (Commercial or business)	At all times	65
M-1, M-2, M-3 (Industrial)	At all times	70

(B) For any source of sound which emits a pure tone or impulsive sound, the maximum sound level limits set forth in subparagraph (a) preceding shall be reduced by 5 dba.

(C) The provisions of this section shall not apply to the unamplified human voice, interstate railway locomotives and railway cars, and any agricultural activity.

(D) When background sound levels exceed those Sound Level Limits identified by the table in 6.18.060(A) due to indistinguishable noise sources (such as but not limited to; freeways, wind, birds, crickets, etc.) a particular sound is not a violation of this Noise Control Ordinance unless it exceeds a Leq of 5 dB(A) above the background sound level. Appropriate noise level measurements will be taken on the receiving property to determine the background noise level and the level of the suspect sound. If the suspect sound is determined to exceed a Leq of 5 dB(A) above the background sound level, the creation of this sound is a violation of the ordinance. (Ord. 00-89 § 5, 2000; Ord. 85-13 § 1, 1985.)

3. It is our experience that some people are particularly sensitive to gunfire noise. Once they have the perception of gunfire noise in their neighborhood, it can be difficult to satisfy their complaints with remediation, since the noise may still be audible even if it is below the noise ordinance goals. With this in mind, we recommend that strategies be implemented with the construction of the range to attenuate noise levels transmitted to the surrounding areas.

4. There are a number of strategies that can be utilized to minimize the noise leaving the shooting range. These include:

    a. Adding a rear barrier wall behind the firing lines to attenuate noise traveling towards the south. This barrier would connect with the side walls/berms surrounding each range. This wall could also have sound absorbing characteristics that would reduce further reflections back towards the north.

    b. Adding sound absorbing material to the wall behind the target line. This would reduce sound being reflected back towards the south. Reflections from this wall may be perceived as an echo in some instances as the reflected sound may arrive later than the sound traveling directly from the noise source (the shooters).

    c. Adding sound absorbing material to the side walls of the range. This material will absorb sound before it is reflected out of the range. Reductions from this treatment would be most noticeable to the east and west of the range.

d. Increasing the height of the side walls would marginally reduce the noise to the east and west but likely not to the level required by the noise ordinance. The side walls in the draft design are already fairly high and a significant increase in height (e.g., doubling of the current height) would likely be required to make a significant difference.

5. Even implementing all of the strategies above, there is a practical limit to the noise attenuation that can be achieved of about 10 dB. A second calculation was made with these noise reduction measures included, see NS-02. This calculation is presented to illustrate what would typically be achievable with the types of treatments recommended above. Note that the nearest residential zone is to the west is highlighted with a yellow boundary.

6. As can be seen on NS-02, noise levels in the nearest residential areas are expected to be above 50 dBA and some agricultural areas will still likely exceed 60 dBA. Consideration should also be given to areas that are zoned residential but do not currently have houses on them or areas that may be rezoned to residential in the future.

7. Note that atmospheric conditions can have a significant impact on how sound travels over long distances. Vertical wind gradients or inversion conditions can cause sound to travel much further than during more typical atmospheric conditions and there may be days when gunfire is heard more loudly or at greater distances than anticipated in this report.

8. We will be following up this report with further information on ambient noise levels after we have performed noise measurements at the proposed site. These measurements will give us a better understanding of the current noise levels near the proposed site from the nearby highway, railway, and KHP firing range. The measured ambient noise levels may also increase the noise level allowable by the City of Olathe noise ordinance if the ambient noise level at the site exceeds the allowable noise limit.

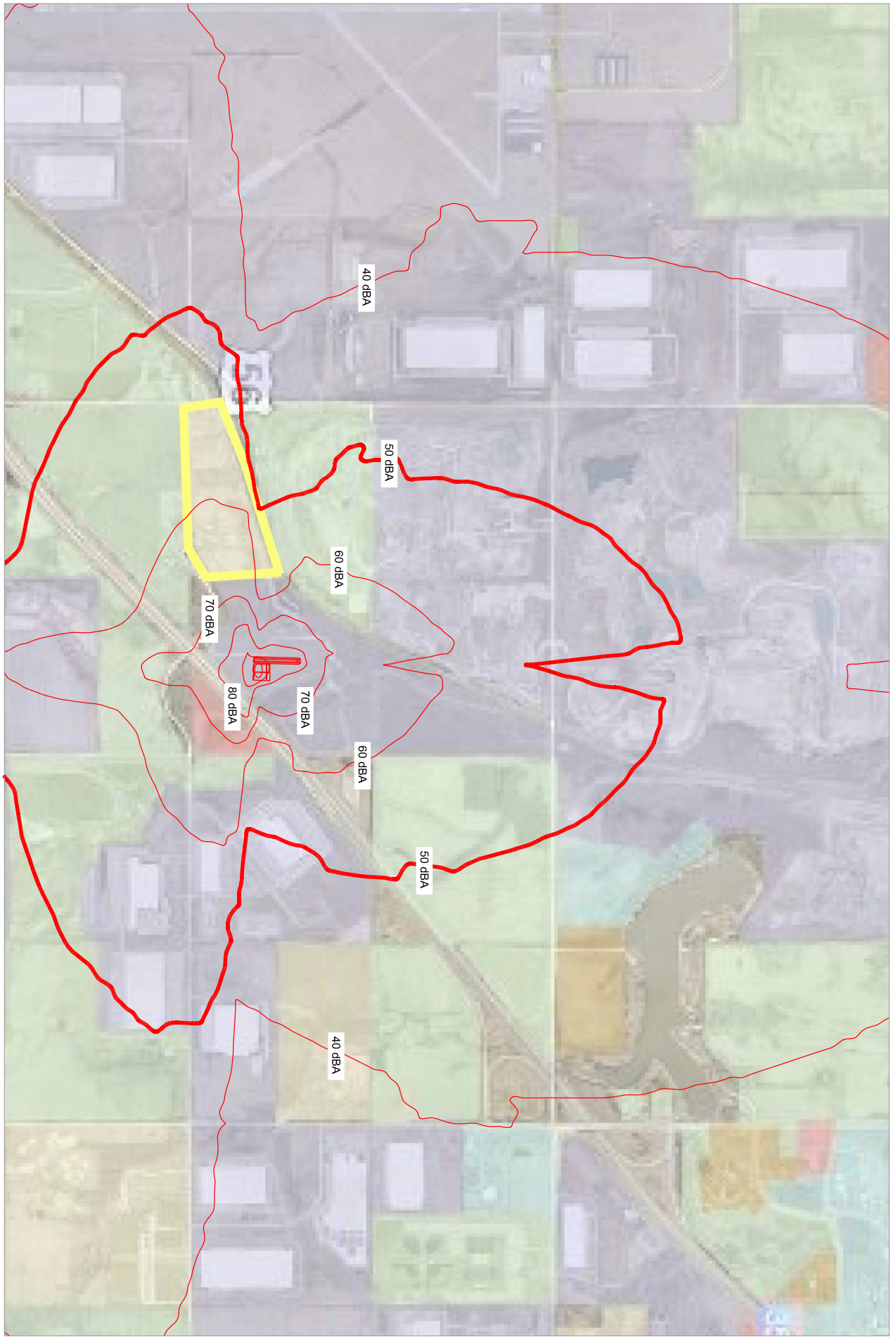
Please let us know if you have any questions.

Very truly yours,

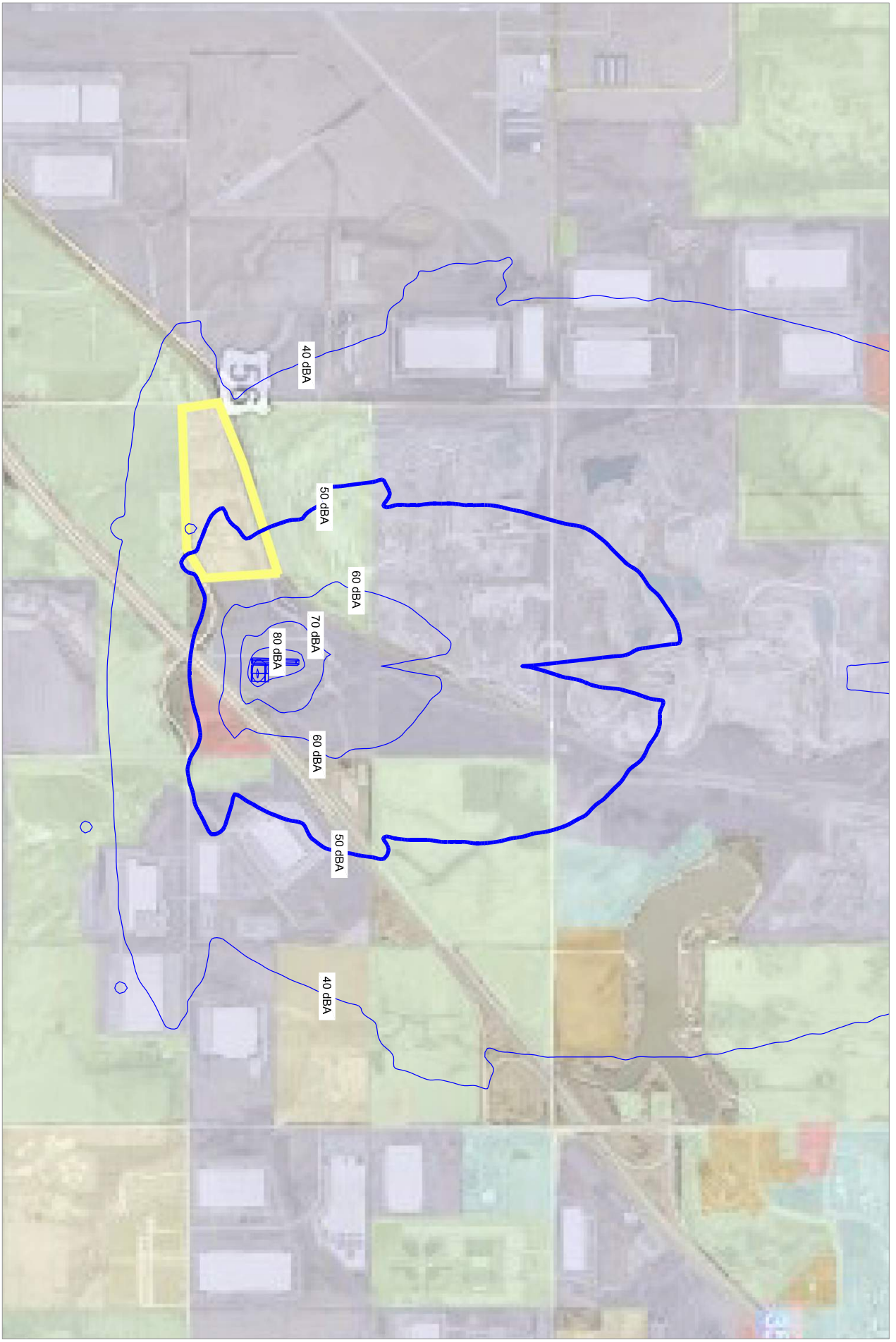
AVANT ACOUSTICS, LLC

An
Senior Associate

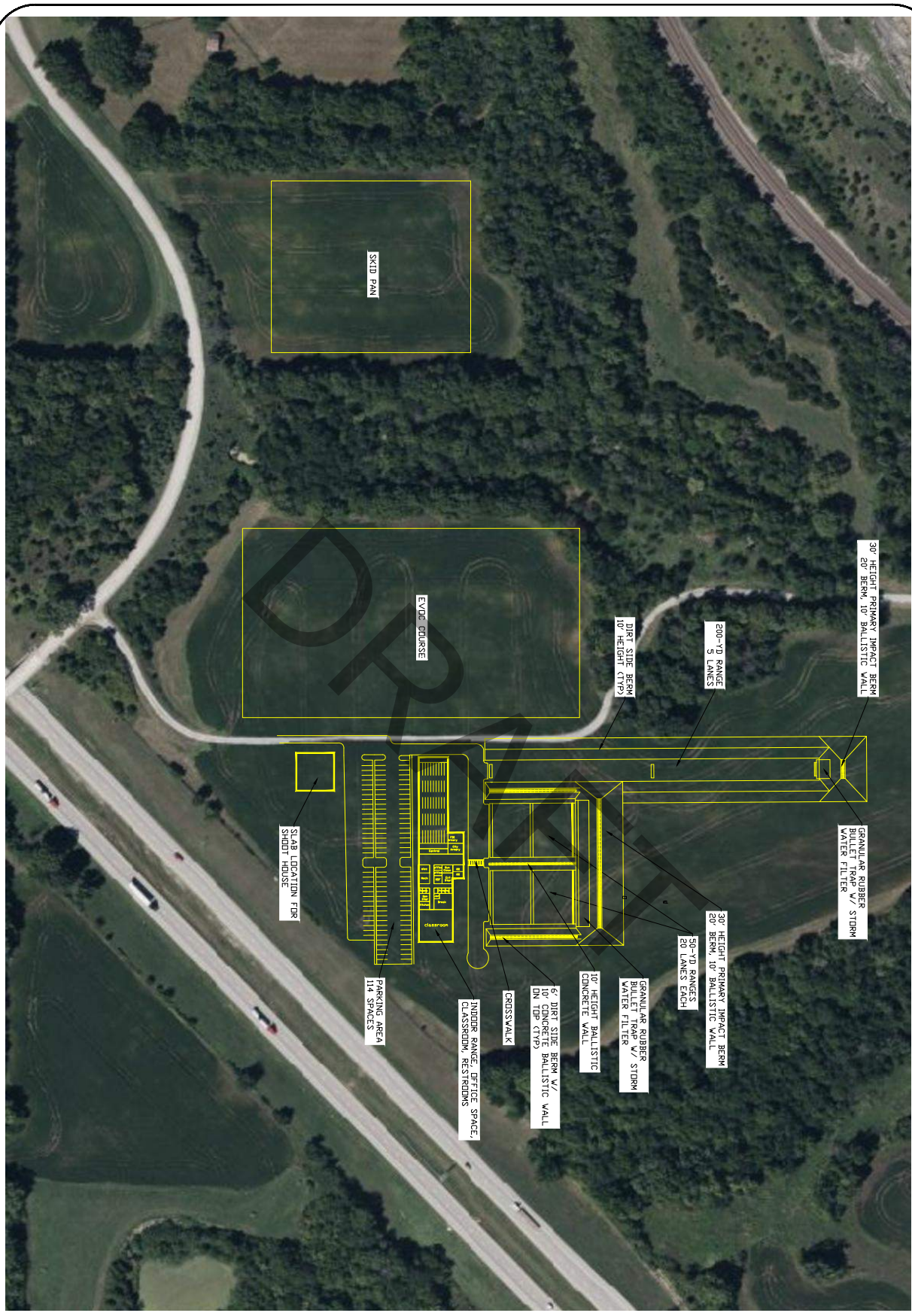
Enclosures:
NS-01 – Anticipated Noise Levels for Proposed Range
NS-02 – Anticipated Noise Levels for Range with Acoustical Treatments
R1 – Draft Range Concept
Zone Map of Area



SHEET: NS-01	OLATHE RANGE - SITE 2 OLATHE, KS LAEQ NOISE CONTOUR MAP	AVANT ACOUSTICS	14827 WEST 95TH STREET LENEXA, KS 66215 USA 913.888.9111 WWW.AVANTACOUSTICS.COM
			DATE: 9/7/23 BY: AJV FILE: C2034.a



SHEET: NS-02	OLATHE RANGE - SITE 2 OLATHE, KS LAEQ NOISE CONTOUR MAP - WITH RANGE TREATMENTS	AVANT ACOUSTICS	14827 WEST 95TH STREET LENEXA, KS 66215 USA 913.888.9111 WWW.AVANTACOUSTICS.COM
			DATE: 9/7/23 BY: AJV FILE: C2034.a



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Disadvantaged Minority Owned Small Business

1025 S Bridgeway PL., Suite 290
Eagle Idaho 83616
208.332.4533

Disclaimer:
All measurements require field verification prior to installation of designs. Field adjustments may be required to ensure safety and should be completed by experienced installation staff.

RANGE DESIGN SERVICES

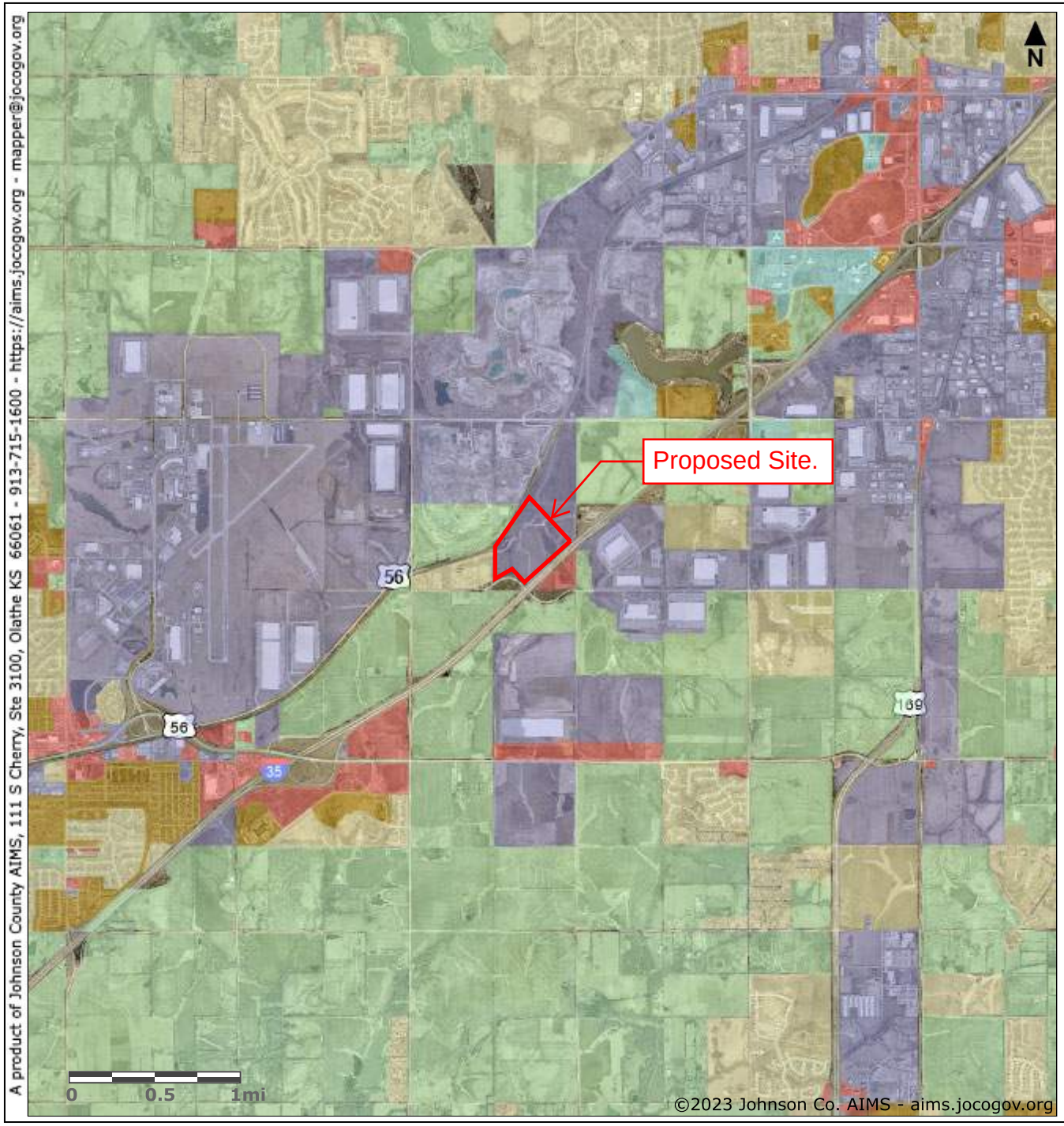
No.	Revision/Issue	Date
1		
2		
3		
4		

City of Olathe
Outdoor Shooting Ranges
167th Street
Olathe, KS

Outdoor Shooting Ranges

DRAFT
Range Concept

PROJECT: OR21006
DATE: 8-2023
SCALE: As Shown
SHEET: R1



Johnson Co AIMS Map

LEGEND

Proposed Zoning

Zoning (Countywide)

- Agricultural
- Business-Commercial
- Business-Office
- Civic/Parks
- Industrial
- Multi-Family Residential
- Multi-Use
- Single-Family Residential

JOHNSON COUNTY KANSAS
AIMS GIS & Mapping

8/29/2023

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September 19, 2023

Mr. Kerry O'Neal
TRS Range Services
1025 South Bridgeway Place
Suite 290
Eagle, ID 83616

Re: City of Olathe Firing Range – Site 2
Olathe, Kansas
AVANT File: C2034.a

Dear Kerry:

We visited the prospective site for the new City of Olathe Firing Range to take measurements of the existing ambient noise. Measurements were taken over a 24-hour period starting on September 8, 2023, and ending on September 9, 2023. This report lists our measurement results, and conclusions regarding the data we collected.

Measurements

1. Measurements were taken using an NTI XL2 sound level meter with an M2211 Type 1 microphone with a 4-inch diameter windscreen and weatherproof enclosure. The microphone was mounted to a stand during the measurements. The meter was calibrated before and after the measurements. Wind speed readings were taken at the measurement points and online meteorological data for the measurement period was reviewed to ensure that the sound level measurements were not compromised.

2. The primary noise metric evaluated from our measurements is the A-weighted equivalent continuous sound level (LA_{EQ}). A-weighting refers to a standardized set of adjustments to the measured sound levels at certain frequencies to account for changes in sensitivity in human hearing across the audible frequency range. The equivalent continuous sound level is a time-weighted averaging of the noise levels for a specified time period.

3. Long-Term Ambient Noise Measurement

    a. To get a clear understanding of the noise levels and characteristics in the area around the prospective firing range, we took a 24-hour noise measurement at the range site. The location of the measurement is indicated on the attached detail NS-03. The location was selected to be near the more noise sensitive residential areas to the west. Audio recordings were also taken during the measurement for further analysis and identifying noise sources throughout the measurement period. The primary noise sources that were captured in our measurements include wildlife noise (birds and insects), trains, motor vehicles, and firing activity from the nearby Kansas Highway Patrol (KHP) firing range. Descriptions of each of these contributing sources are listed below.

        i. Wildlife noise – Wildlife noise was prevalent throughout most of the 24-hour measurement. The noise was mostly made up of insects (primarily cicadas) noise and some birdsong. This noise varied somewhat throughout the measurement with levels loudest in the morning and evening and quietest around midday. The levels varied somewhere between 59 and 76 dBA.

ii. Trains – Numerous trains passed the site along the rail line to the northwest. The trains produced noise levels at the measurement location between 60 and 65 dBA. Trains passed through the area during both the daytime and nighttime.

iii. Motor Vehicles – Vehicular activity, mostly associated with I-35, also contributed to the noise levels at the site. The noise from vehicles was around 55 to 60 dBA and varied with the level of traffic. Some aircraft noise was also present in our recordings.

iv. KHP Range Noise – Noise from the nearby KHP firing range was similar in level to the motor vehicle noise but, due to the impulsive nature of the noise, was discernable in our audio recordings. Noise levels during the firing activity were around 55 to 60 dBA. Range activity was audible in the recordings from around 10 to 11 AM.

b. The overall LA_{EQ} rating from our long-term ambient measurement was 66 dBA. This is would typically be considered high for a non-industrial area.

Conclusions

1. For reference, the City of Olathe noise ordinance sets a daytime noise level limit received by residential and agricultural land categories of 55 dBA or 5 dB above the ambient noise (if the ambient noise level is above the 55 dBA limit). The ordinance also calls for a 5 dB penalty applied to the measured sound level (in LA_{EQ}) for impulsive noise sources. This penalty helps to account for the higher degree of annoyance caused by impulsive noises compared to steady-state noise sources (some sources suggest a higher penalty of 8 to 12 dB for gunfire noise). This would indicate a noise level goal for residential and agricultural areas of less than 50 dBA from impulsive gunfire at the range. A portion of the Municipal Code is included below for reference and a map of the zoning in the area around the proposed range site is attached at the end of this report.

6.18.060 Sound Levels by Receiving Land Use.

(A) No person shall operate or cause to be operated on private property any source of sound in such a manner as to create a sound level which exceeds the limits set forth for the receiving land use category shown following when measured at or within the property boundary of the receiving land use:

Sound Levels by Receiving Land Use

Receiving land-use category	Time	Sound level limit, dba
R-A, R-A-1, R-1, R-2, R-3, R-4, R-5, PUD, A (Residential, public space, open space or agricultural or institutional)	7:00 a.m.-11:00 p.m.	55
	11:00 p.m.-7:00 a.m.	50
C-O, C-1, C-2, C-3 (Commercial or business)	At all times	65
M-1, M-2, M-3 (Industrial)	At all times	70

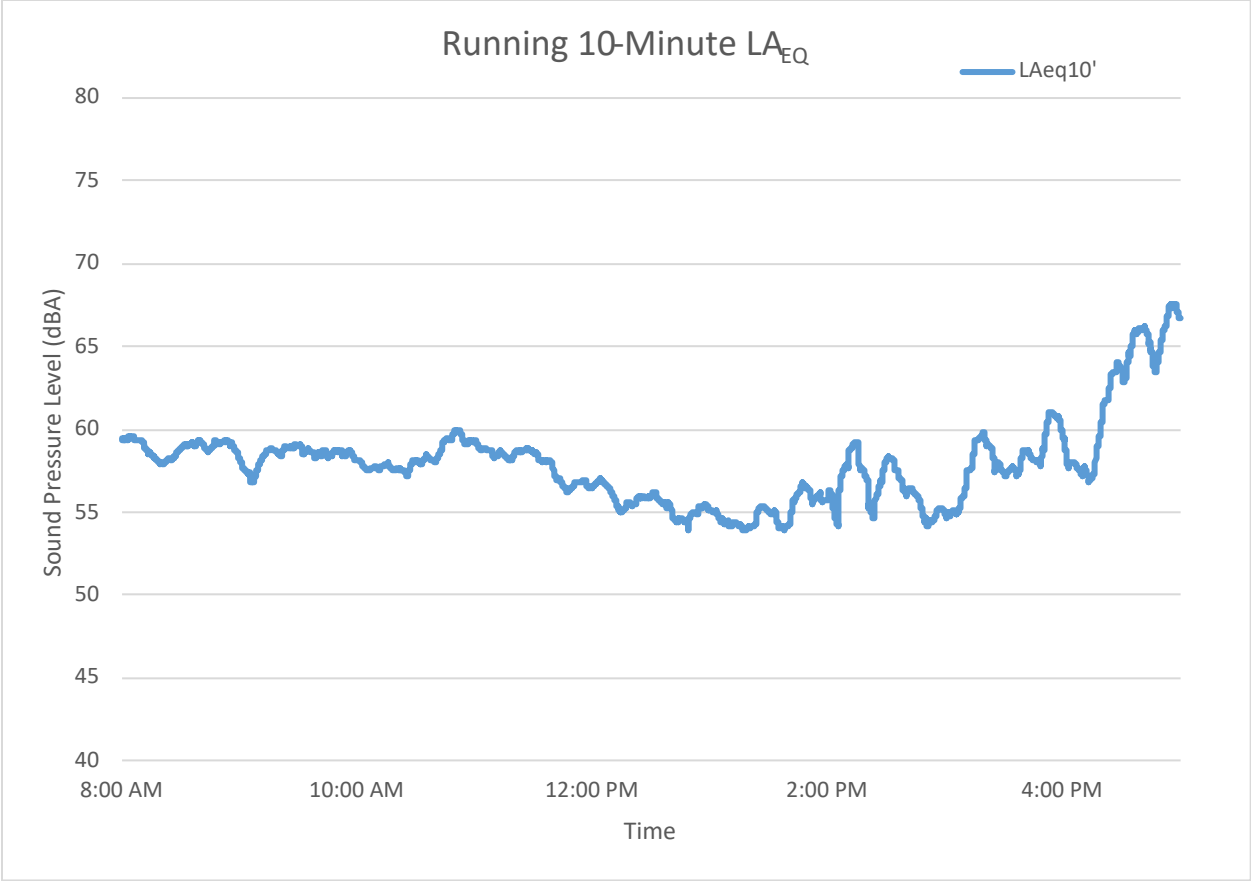
(B) For any source of sound which emits a pure tone or impulsive sound, the maximum sound level limits set forth in subparagraph (a) preceding shall be reduced by 5 dba.

(C) The provisions of this section shall not apply to the unamplified human voice, interstate railway locomotives and railway cars, and any agricultural activity.

(D) When background sound levels exceed those Sound Level Limits identified by the table in 6.18.060(A) due to indistinguishable noise sources (such as but not limited to; freeways, wind, birds, crickets, etc.) a particular sound is not a violation of this Noise Control Ordinance unless it exceeds a Leq of 5 dB(A) above the background sound level. Appropriate noise level measurements will be taken on the receiving property to determine the background noise level and the level of the suspect sound. If the suspect sound is determined to exceed a Leq of 5 dB(A) above the background sound level, the creation of this sound is a violation of the ordinance. (Ord. 00-89 § 5, 2000; Ord. 85-13 § 1, 1985.)

2. In cases where the ambient noise level at a site from traffic, wildlife, and other "indistinguishable" sources exceed the maximum allowable sound level limit, the ordinance provides that a sound does not violate the ordinance if it does not exceed a level 5 dB more than the background noise level.

3. The overall (24-hour) LA_{EQ} measurement for background noise at this site was around 66 dBA. Our understanding is that the range will typically be used during daytime hours. The measured overall daytime LA_{EQ} was 67 dBA. In general, the measured noise levels were between 55 to 60 dBA in the morning. At midday the insect noise decreased, reducing the measured noise levels to around 55 dBA. The noise level then increased through the afternoon to levels up to around 65 to 67 dBA around rush hour. The following graph shows a running 10-minute averaged LA_{EQ} noise level from 8 AM to 5 PM and illustrates how the noise levels varied throughout the day.



4. The noise levels at the quietest part of the day hovered around 54 to 55 dBA. This could potentially allow for an allowable ordinance noise limit of about 60 dBA. Applying the previously discussed 5 dB penalty for impulsive noise, this would result in a target maximum noise level of around 55 dBA for residential and agricultural adjacencies during daytime hours. This is a slight increase from the target maximum noise level indicated in our previous report.

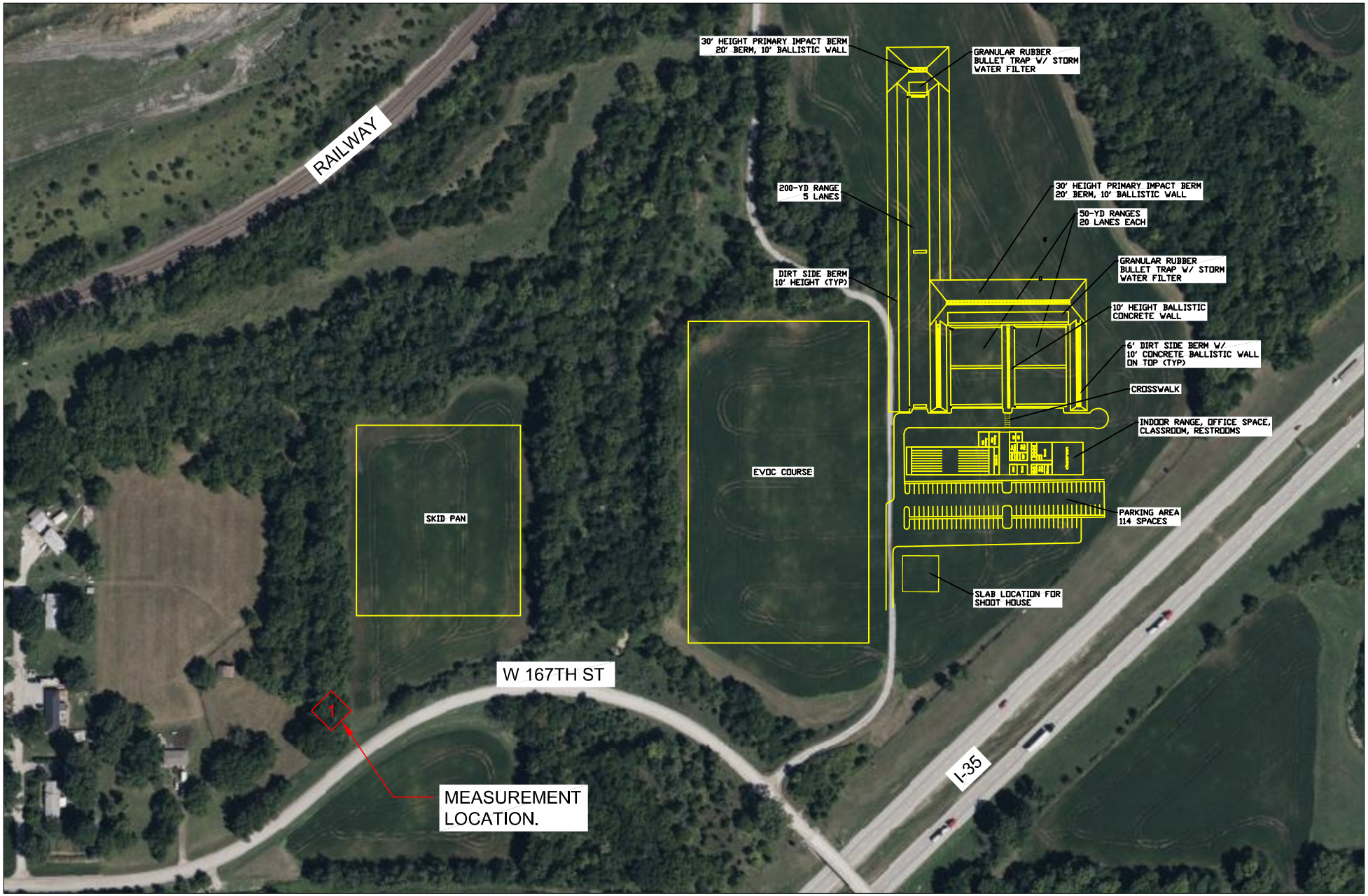
Please let us know if you have any questions.

Very truly yours,

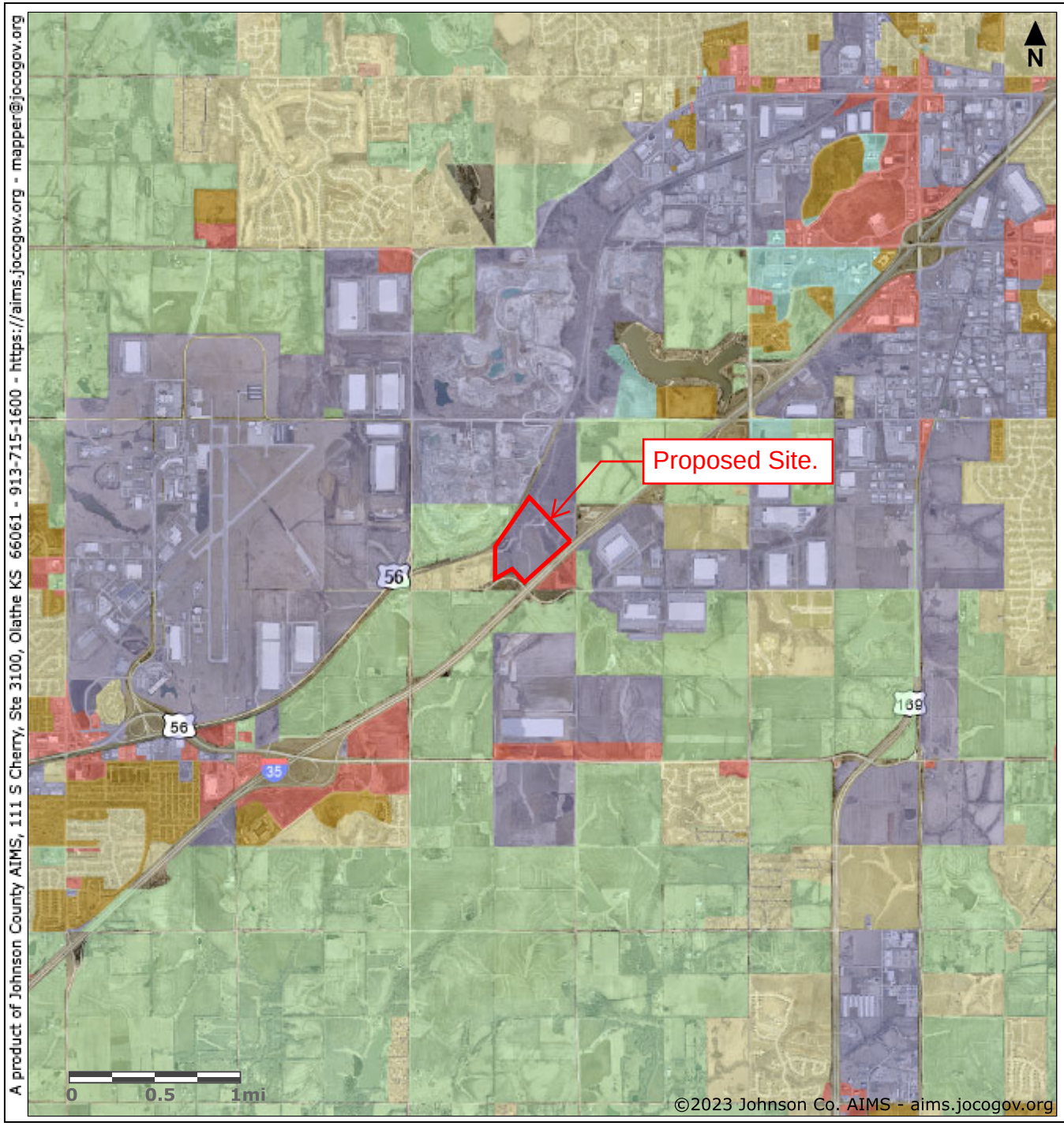
AVANT ACOUSTICS, LLC

Ar
Senior Associate

Enclosures:
NS-03 – Measurement Location Map
Zone Map of Area



NS-03	**OLATHE RANGE - SITE 2** OLATHE, KS 24-HOUR MEASUREMENT LOCATION	AVANT ACOUSTICS®	14827 WEST 95TH STREET LENEXA, KS 66215 USA 913.888.9111 WWW.AVANTACOUSTICS.COM	DATE: 9/19/23 BY: AJV FILE: C2034.a



Johnson Co AIMS Map

LEGEND

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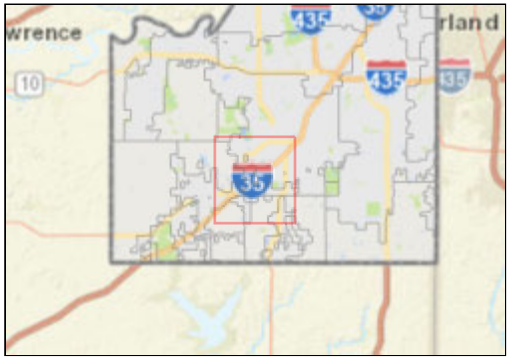

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