PLANNING & DEVELOPMENT SERVICES MEMORANDUM
22-66

DATE: August 3, 2022

TO: The Chairman and Members of the Planning and Zoning Commission

FROM: Kristy Stone, Interim Planning & Development Services Director

RE: **(#22-02) Bannerman's Sportsgrill – Sound Study**

PETITIONER

The petitioner, Mac Maqsood, has submitted the attached sound study by Acoustic Associates, Ltd dated July 8, 2022. The petitioner and his consultant met with staff and the Village's environmental consultant to discuss sound mitigation measures on July 27, 2022. Based on that discussion, the petitioner submitted the attached Sound Study Addendum 1 dated August 1, 2022.

The petitioner has agreed to rotate the stage 5 degrees clockwise, install a sound stage and reduced the sound level limit to 92 dBC at the mixing station. While Figure 2 in the addendum indicates a sound level of 98 dBC during daytime hours, the petitioner has agreed to the reduced limit of 92 dBC at all times (see Figure 1 in the addendum for the sound contours).

Staff would like to replace conditions B & C in their recommendation (PDS Memo #22-62) with the following:

B. Rotate the stage 5 degrees clockwise and install a sound wall on the east side of the stage as recommended in the sound study addendum #1 prepared by Acoustics Associates, Ltd dated August 1, 2022.

C. The band sound level at the mixing station shall not exceed 92 dBC at any time. The sound engineer shall determine the Leq of the music based on 15-minute periods. This measurement shall be done on an hourly basis. Logs of this data shall be kept for Village review.

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Bannerman's Sports Grill Outdoor Venue Sound Study

July 8, 2022

Prepared for:
Bannerman's Sports Grill
858 S. Route 59
Bartlett, IL 60103

A new outdoor music venue has been proposed by Bannerman's Sports Grill in Bartlett. The new facility would be located at the southwest end of Hardt Circle. In addition to an indoor restaurant, there would be an approximately 36x36-foot raised outdoor stage with a roof and back building. The stage would be oriented facing a southwestern direction with bench and lawn seating nearby. Because amplified live music can propagate into the community, Acoustic Associates was asked to investigate the potential impact of this new venue on the residential community.

Village of Bartlett Noise Code

Under Section 4-3-4, *Excessive Noise*, the Village has adopted the State of Illinois Noise Regulations *(Title 35: Environmental Protection, Subtitle H: Noise, Chapter I: Pollution Control Board)*. Under these regulations, the music venue would be classified as Class B (commercial) property and the nearby homes would be classified as Class A (residential) property. For sound radiated from the venue to the homes, the State would limit the 1-hour time-average sound level to an equivalent of 73 dBC during the daytime hours and 64 dBC during the nighttime hours, defined as 10:00 PM to 7:00 AM. Because outdoor performances could last until midnight, the more restrictive 64 dBC limit would apply.

In our experience, the evening and nighttime ambient sound levels in the Chicago suburbs often exceed this 64 dBC limit. When this occurs, the ambient noise level is the defacto limit. This is because there is a negligible impact of sound if it does not exceed the existing background sound levels. This means that the sound level of the band music alone should not exceed the sound level of the ambient noise already present near the residential homes. Accordingly, it was important in this study to establish the existing ambient levels.

Ambient Noise Measurements

The ambient noise in most suburbs is dominated by vehicle traffic noise. Because the hourly traffic volume in the area varies over a 24-hour period, so too does the ambient noise. Furthermore, because the hourly traffic volume is different on the weekends compared to the weekdays, the ambient sound levels are different as well. Since the Bannerman outdoor music would occur on the weekend and in the

evening, it was important for us to assess this noise on a Friday or Saturday evening. Accordingly, we set up professional-grade digital recording equipment in the area to record the ambient noise from 6:00-11:59 PM on Friday, June 17, 2022.

We located the equipment as indicated in **FIGURE 1**. Normally, we locate our equipment near the closest receivers which, in this case, would be near the homes on Groton Lane about 1500 feet east of the proposed venue. However, we chose the location indicated here because: 1) it was safe and easy to access, 2) this location would yield a lower, more conservative, ambient sound level because there would be minimal influence from local noise sources (since the surrounding businesses were closed) and this location would be further from Route 59, a highway that carries a major amount of traffic, and 3) we did not have the authorization to access any residential properties in the area.

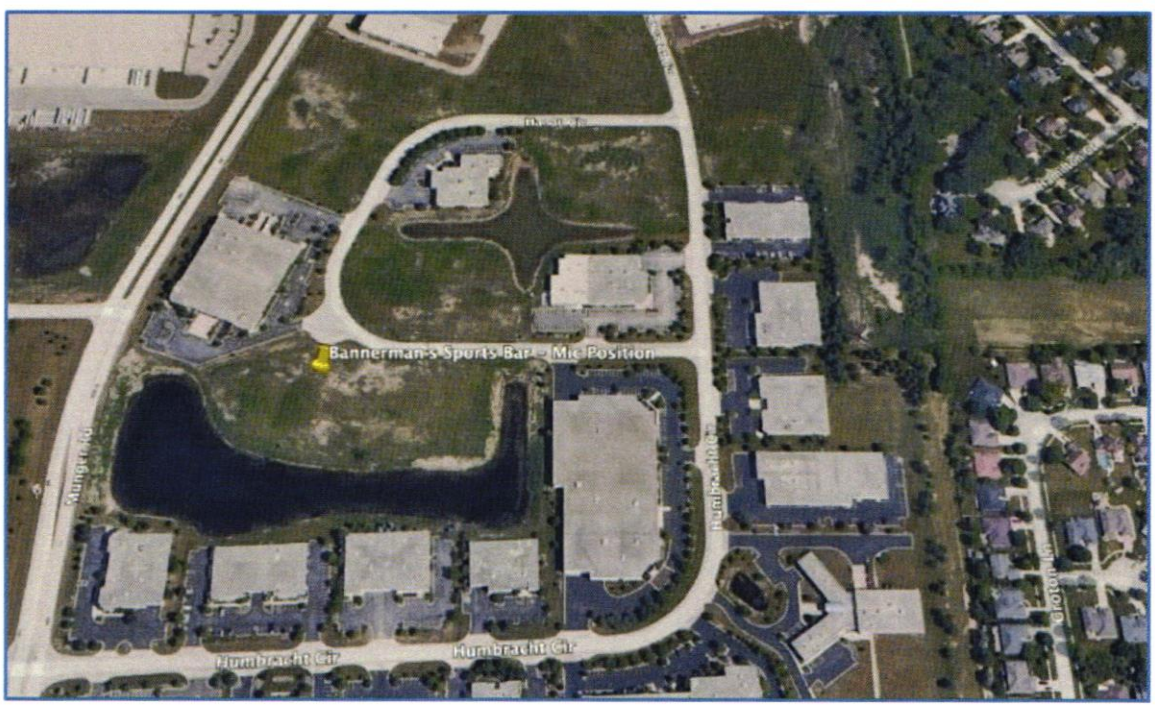

Figure 1 - Aerial view showing the location of the digital audio recording equipment.

After the calibrated recording was retrieved and verified, we ran a lab analysis to produce sound levels at 1-second intervals. This resulted in over 21,000 samples. Because live music is somewhat heavy in the low frequencies, we chose to use the C-weighting for our sound metric – instead of the normally used A-weighting – because the former is more sensitive to bass sound.

The results of our analysis can be seen in **Figure 2**. In this graph, the thin, blue lines show the instantaneous (1-second) sound levels. These lines show a small drop in the minimum ambient levels over the 6-hour period. However, the maximum levels remain largely the same because of continued traffic in the area and because of air traffic over the site.

To better visualize the trend of the ambient noise, we determined the 10-minute time-averaged level (called the equivalent level or Leq) which is shown by the thick, red line. This averaging period was chosen based on the State of Illinois procedure for assessing background noise. It shows that the ambient noise at the site is comparable to the level of normal conversation. It also shows that the ambient noise does not decline much on the weekends as the evening draws closer to midnight. To establish the criterion

limit for this project, we calculated that the time-averaged level during the nighttime hours (i.e., 10:00 to 11:59 PM) was 64 dBC.

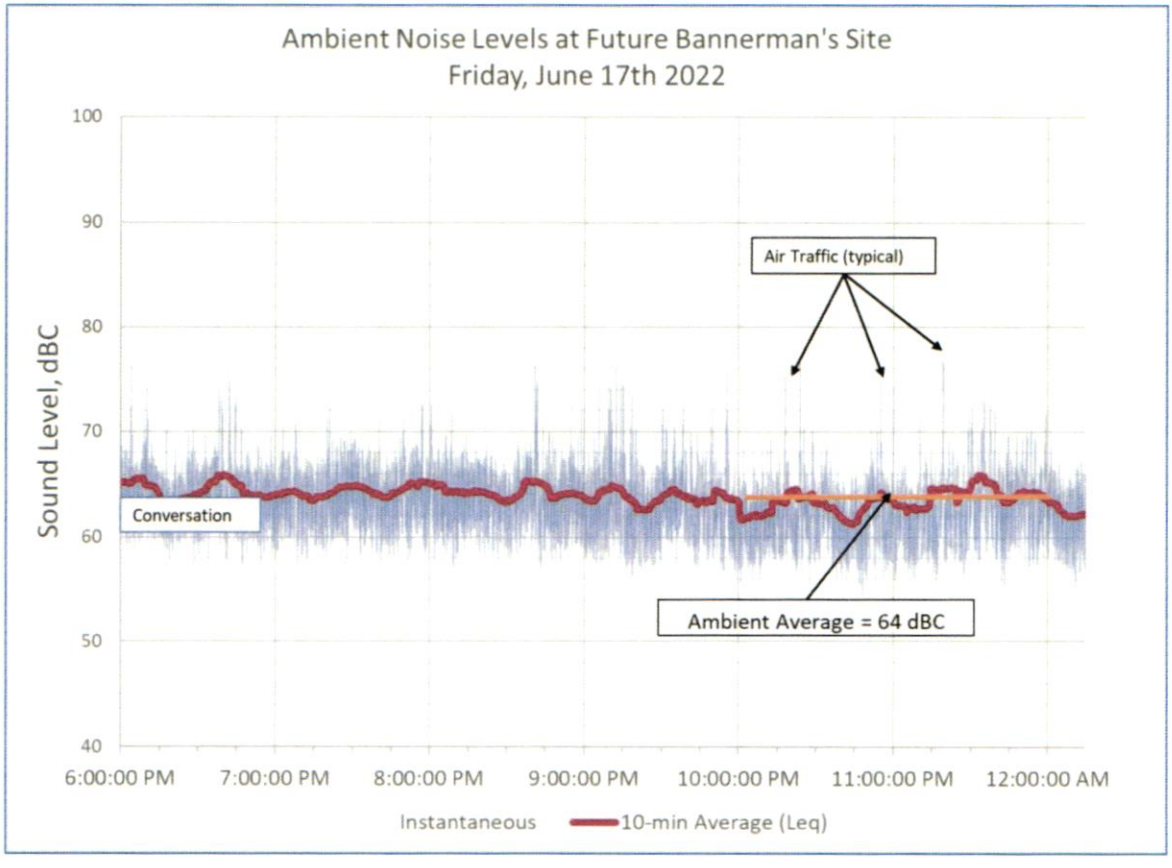

Figure 2 - Sound level trace showing the 1-second and 10-minute time-averaged, C-weighted sound levels of ambient noise in the area.

Sound Modeling

To visualize the propagation of sound into the community, we acoustically modeled the loudspeakers and stage using a program called SoundPlan™. Based on the height and orientation of the loudspeakers (4 full-range speakers elevated above the stage and 4 subwoofers placed below the stage), a rock-pop live band spectrum inherent in our computer model, the topography of the land, and the reflectivity of nearby buildings, the software produced the C-weighted sound level contours shown in **Figure 3**. These contours represent the level of the outdoor restaurant music only.

The dark blue area around the stage represents levels that exceed 91 dBC. The dark green in the outlying areas represents the ambient sound level of 64 dBC that we measured in the 10:00-11:59 PM period. Each incremental color is a change of 3 dB which is the just-noticeable difference to the human ear.

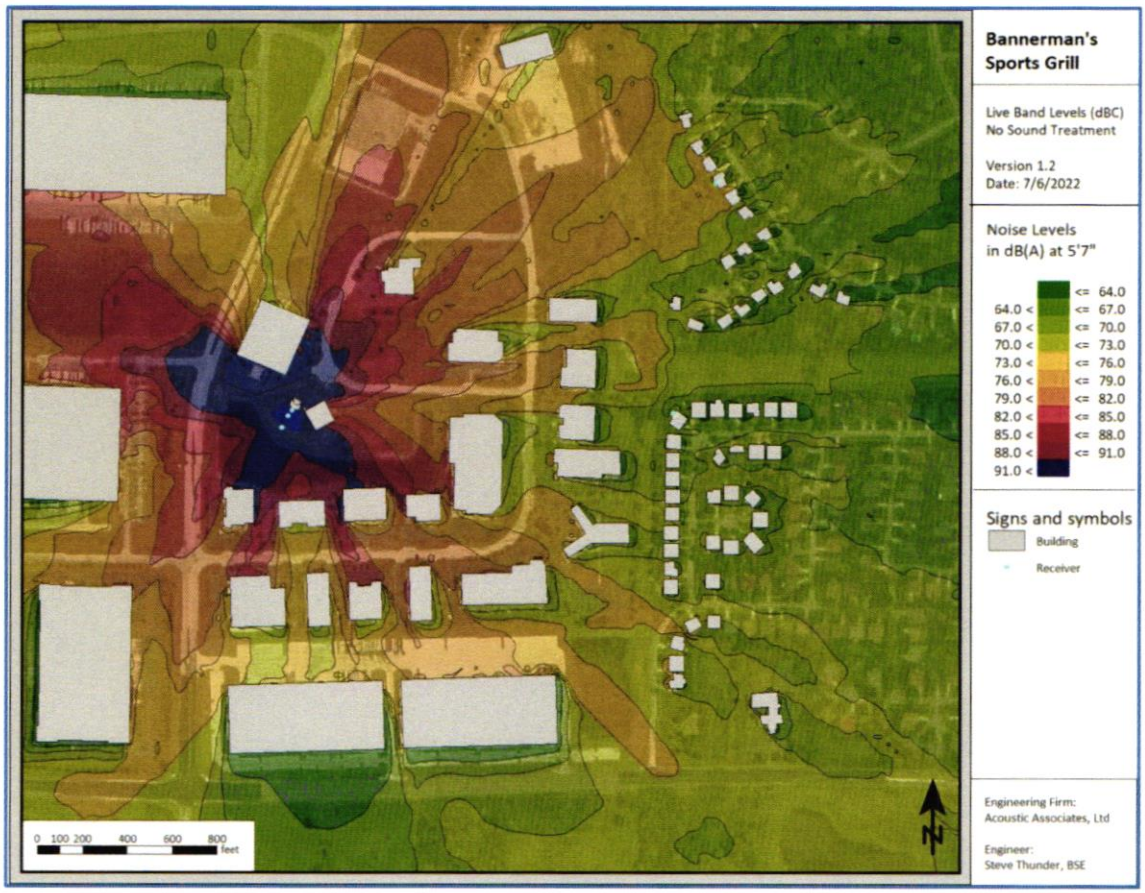

Figure 3 - C-weighted sound contours while a live band is playing on the stage.

While sound normally spreads in a circular manner, the contours near the stage show a star-shaped pattern. We attribute this to the directivity of the stage structure and to the reflections from nearby buildings. The model also reveals that while the closest homes are 1500 feet to the east, the more affected homes would actually be those at 1900 feet to the northeast. We attribute this to the shielding effect of the multiple commercial buildings. Since there is a direct line of sight from the stage to the homes along Lichfield Lane, there is little shielding effect by these buildings.

Mitigation

The results in **Figure 3** indicate that live music would exceed the ambient noise for the nearby homes – especially for those homes to the northeast. Accordingly, we used our computer modeling software to explore options to reduce the live band sound at these residential locations. We determined that the optimum approach was to modify the stage design to incorporate a sound barrier wall on the northeast (house-right) side of the stage. This is shown schematically in **Figure 4**.

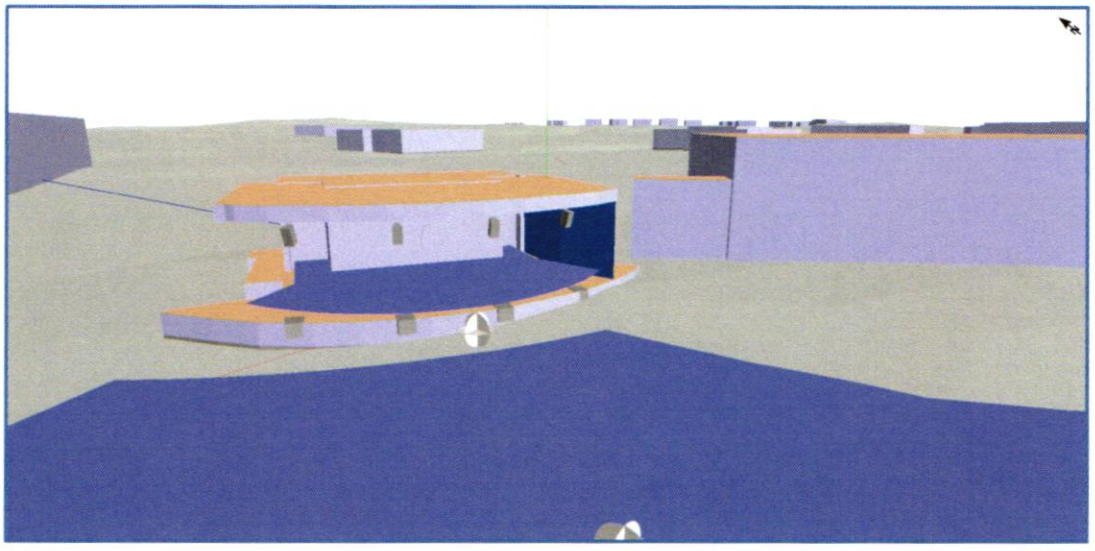

Figure 4 - 3D perspective of the stage wall on the northeast side (in dark blue)

A wall that meets our definition of a "sound wall" is a solid wall that provides a sound transmission loss of at least 20 dB and is constructed without gaps and extends from the stage floor to the roof. It is okay to incorporate doors, if necessary, but they should also be solid with at least 20 dB transmission loss. This guarantees that the sound will not transmit through the wall but instead be "forced" to pass around it. Since sound will still pass around the stage and this wall, this treatment will not eliminate the sound radiated from the stage, but it would offer a significant reduction.

Since this treatment will not result in enough reduction to meet the ambient noise criterion of 64 dBC – the defacto IL code limit, we recommend that in addition to the sound wall, the sound level from the live bands must be monitored at the mixing station and lowered by 5 dB compared to the typical sound mixing levels. When we incorporated the effect of the sound wall and of lowering the music volume into our computer model, the software generated the contours shown in **Figure 5**. As can be seen, when these two controls are used together, the residential areas become a dark green color meaning that the Bannerman music venue would meet the ambient sound levels. While the model shows a higher sound level for a few homes to the south near Sterns Road, these homes are also much closer to Sterns Road than our measurement position and therefore we would expect the ambient noise levels to be higher at that location.

Lowering the band sound level by 5 dB translates to a level of **95 dBC** at the mixing station (100 ft from the front of the stage). Because the sound level of live music varies a lot and depends on the genre and energy in each song, the sound engineer should determine the Leq (time-average) of the music based on 15-minute periods. This measurement should be done on an hourly basis.

This mitigation does not mean that live band sound would always be inaudible. As mentioned above, live sound can vary a lot. Also, as shown in **Figure 2**, the ambient noise varies a lot. Accordingly, if the band is playing a high-energy song at a time when the ambient sound happens to be low (e.g., between airplanes or lulls in traffic), then the band would be audible. What is important, however, is that the time-average sound of the bands would not exceed the time-average sound of the ambient noise.

We should also note that the audibility of the bands will vary from night to night depending on meteorological effects. To clarify, the bands would be more audible when winds are blowing from the southwest (i.e., toward the homes), but hardly audible for winds blowing in the opposite direction. And

although rare at night, a temperature inversion would bend the sound down toward the homes to make the bands more audible. For conservative modeling, our computer program uses a prediction approach known as "favorable propagation conditions." This means that the contours were generated based on a mild wind blowing toward the receivers.

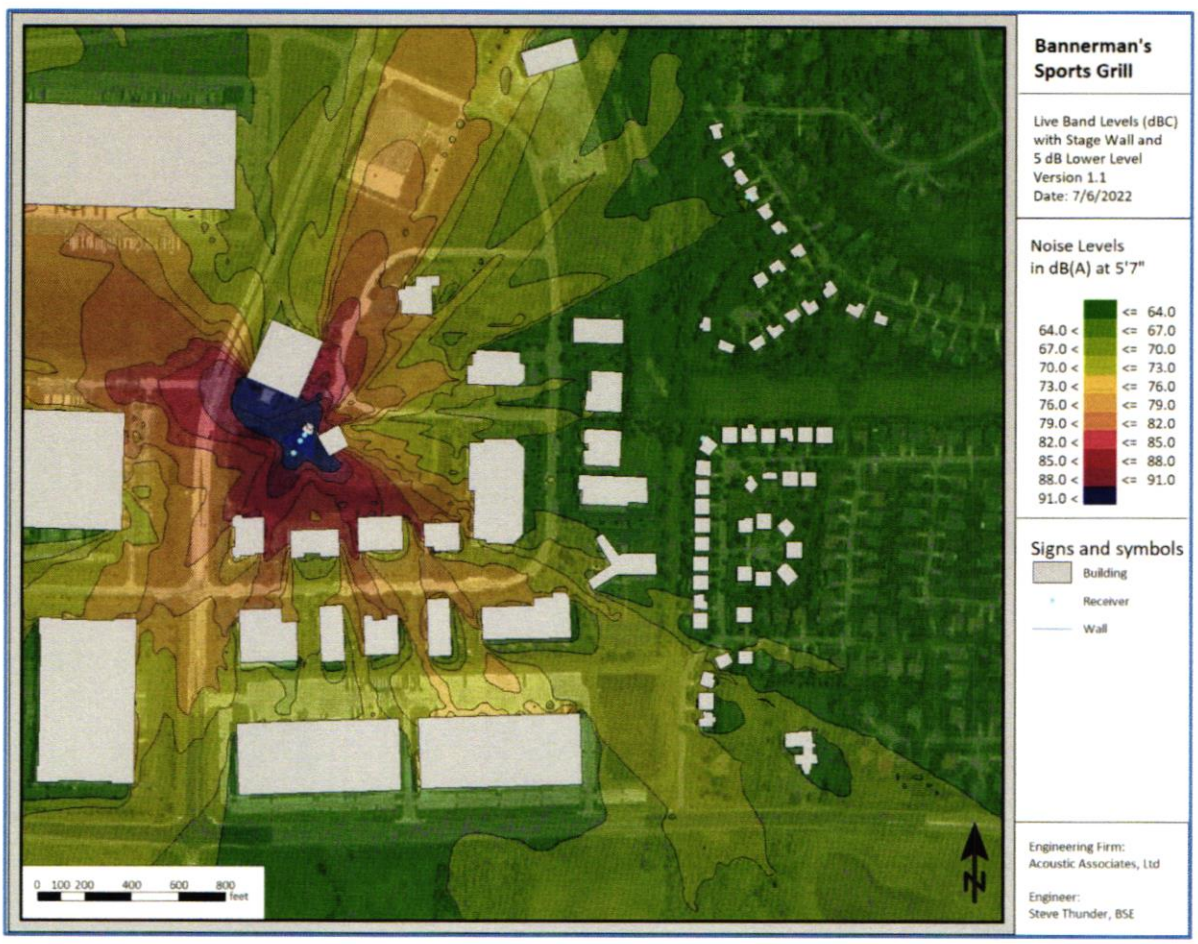

Figure 5 - C-weighted sound contours with stage wall and 5 dB lower level

Conclusions

Based on our analysis, if Bannerman's Sports Grill implements the recommended stage wall and limits the sound level to 95 dBC at the mixing location (100 ft from the front of the stage) we don't expect live band sound from the stage to have an adverse impact on the community.

Submitted,

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Bannerman's Sports Grill Outdoor Venue Sound Study Addendum 1

August 1, 2022

Prepared for:
Bannerman's Sports Grill
858 S. Route 59, Bartlett, IL 60103

This report is an addendum to our original report dated July 8th, 2022, where we reviewed the applicable regulations, discussed our ambient sound measurements, presented the computer modeling we did, and recommended a specific mitigation approach. The purpose of this addendum is to add additional details about daytime vs. nighttime regulations and to reveal new computer modeling showing lower sound levels.

Village of Bartlett Noise Code

The Bartlett noise code references the Illinois noise code which gives different limits for daytime and nighttime noise. In this code, nighttime is defined as the hours of 10:00 PM to 7:00 AM. This distinction is common because noise sources are more audible at night when the ambient noise is lower and because people are more sensitive to noise because of the desire to relax and sleep.

For sound radiated from the Bannerman music venue (a Class B land use) to the residential homes (a Class A land use), the State limits the 1-hour time-average sound level to an equivalent of 73 dBC during the daytime hours and 64 dBC during the nighttime hours.

Although the Illinois noise code limits the sound levels at different octave band frequencies, to simplify our analysis and the monitoring to occur at the mix station, we computed the equivalent overall level using the C-weighting scale instead of the often-used A-scale. We chose the C-weighting because live band pop-rock music is heavy in the bass frequencies and the A-scale diminishes the importance these frequencies. In short, the C-scale is a better measurement of live band sound than the A-scale.

Since our original report was issued, Bannerman's Sports Grill intends to limit its operating hours to 10:00 PM Sunday through Wednesday and 11:00 PM Thursday through Saturday. Accordingly, the venue would operate past 10:00 PM for only one hour on Thursday, Friday, and Saturday. It should also be noted that our ambient measurements were conducted on a Friday evening to better reflect the noise observed on a weekend as opposed to the levels observed during the normal week at the same time.

Sound Modeling

To visualize the propagation of sound into the community, we acoustically modeled the loudspeakers and stage using a program called SoundPlan™. In our modeling, we used the height and orientation of four full-range loudspeakers elevated above the stage and four subwoofers placed below the stage. In addition, we modelled the sound generated by a live, rock-pop band as opposed to the quieter sound generated by bands of other music genres such as acoustic rock, jazz, or country. The computer model also factored the topography of the land and the reflectivity of nearby buildings. Based on these parameters, the software generated the C-weighted sound level contours shown in the figures below which represent the sound radiated from the outdoor music.

The dark blue area immediately around the stage represents levels that exceed 91 dBC. The dark green in the outlying areas represent the ambient sound level of 64 dBC that we measured in the 10:00-11:59 PM period (see the full report for details about the ambient noise levels). Each incremental color is a change of 3 dB which is the just-noticeable difference to the human ear.

Figure 1 represents the sound levels after 10:00 PM and includes a stage sound wall on the east side of the stage, a 5-degree clockwise rotation of the stage (from the original position), and sound level limit of 92 dBC at the mixing station (100 ft from the front of the stage).

Figure 1 - C-weighted sound contours with stage wall, stage rotation, and a 92 dBC limit at the mix station (Nighttime)

Figure 2 represents the daytime sound levels (before 10:00 PM) and includes a stage sound wall on the east side of the stage, a 5-degree clockwise rotation of the stage (from the original position), and a sound level limit of 98 dBC at the mixing station (100 ft from the front of the stage). The red line represents the daytime (7 AM – 10 PM) sound limit regulation of 73 dBC.

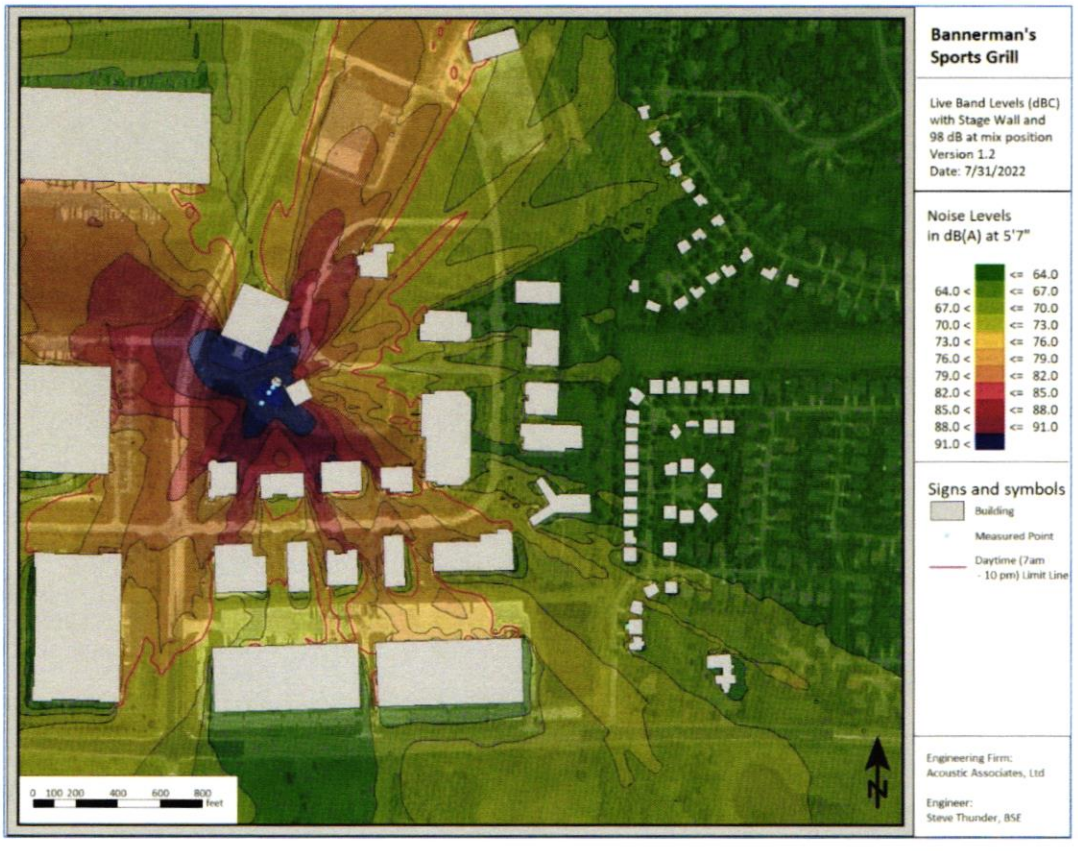

Figure 2 - C-weighted sound contours with stage wall, stage rotation, and a 98 dBC limit at the mix desk (Daytime)

Conclusions

Based on our analysis, if Bannerman's Sports Grill implements the recommended stage wall, a 5-degree clockwise rotation, and limits the sound level at the mix desk to 98 dBC for daytime hours and 92 dBC for nighttime hours, live band sound from the stage will not have an adverse impact on the community and will meet local and state sound emission regulations.

Since live music is a time-varying sound source, we recommend that all monitoring be done using a 15-minute time-average metric called the equivalent level or Leq. This averaging is the preferred metric in making acoustic measurements and is accomplished with an "integrating" sound level meter.

Submitted,

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