# Acoustic Associates, Ltd.

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# Willowbrook Pickleball at Midway and Borse Memorial Parks

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*Prepared for:*
*Dustin Kleefish, Director of Parks and Recreation*
*Village of Willowbrook, Illinois*

Acoustic Associates was asked to study the noise radiated from the pickleball courts planned for Midway Park. There are homes near this park and the Village would like to evaluate the impact of locating these courts in this park.

Because we identified a significant impact at Midway Park, we turned our attention to locating these courts at Borse Memorial Park in place of the proposed amphitheater. This park already hosts baseball fields, volleyball courts, basketball courts, and a playground.


Figure 1 – Aerial view of the two parks showing the ambient noise recording stations.

## Ambient Noise Assessment

The impact of a noise source depends mostly on its audibility, that is, the level above the ambient noise. To assess the ambient noise, we set up professional-grade audio recorders at the locations shown in **FIGURE 1**. Our audio recording lasted over two hours. Our analysis of these recordings yielded **a time-averaged level of 53 dBA at Midway Park (Loc 1) and 53 dBA at Borse Park (Loc 2), both in the 7:00 PM hour.** The results of these recordings are shown below in **FIGURE 2 (Midway Park)** and **FIGURE 3 (Borse Park)**.

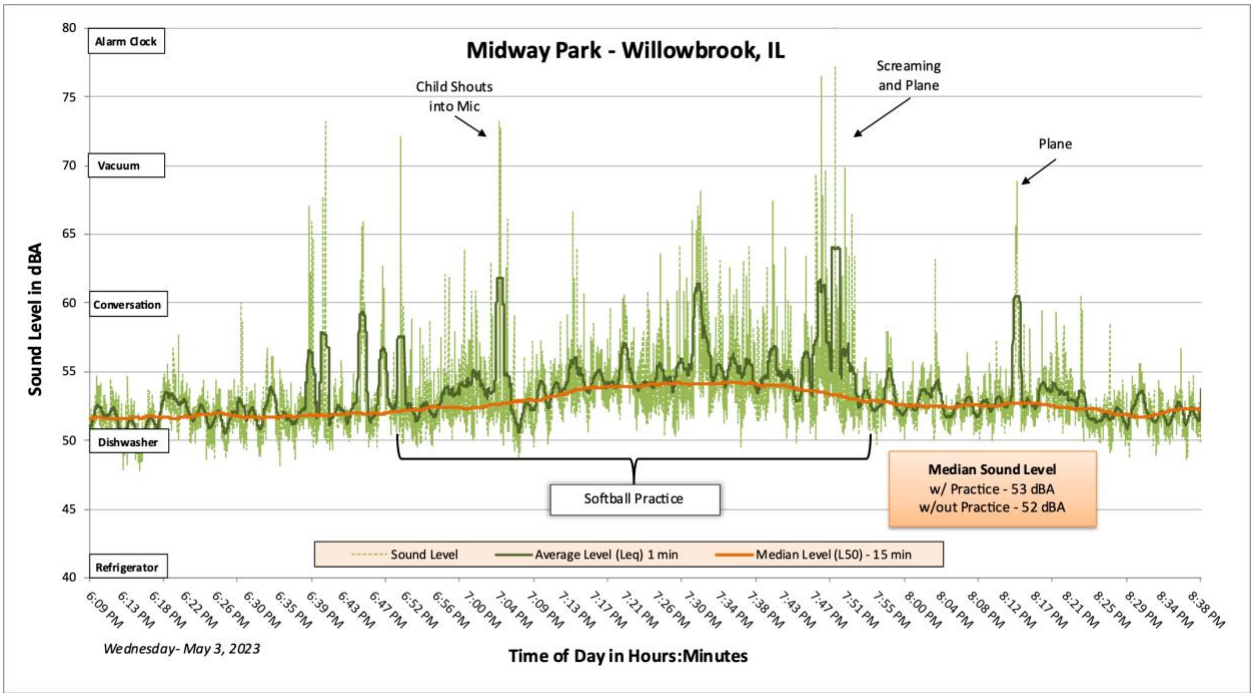


**Figure 2 – Ambient Recording at Midway Park.**

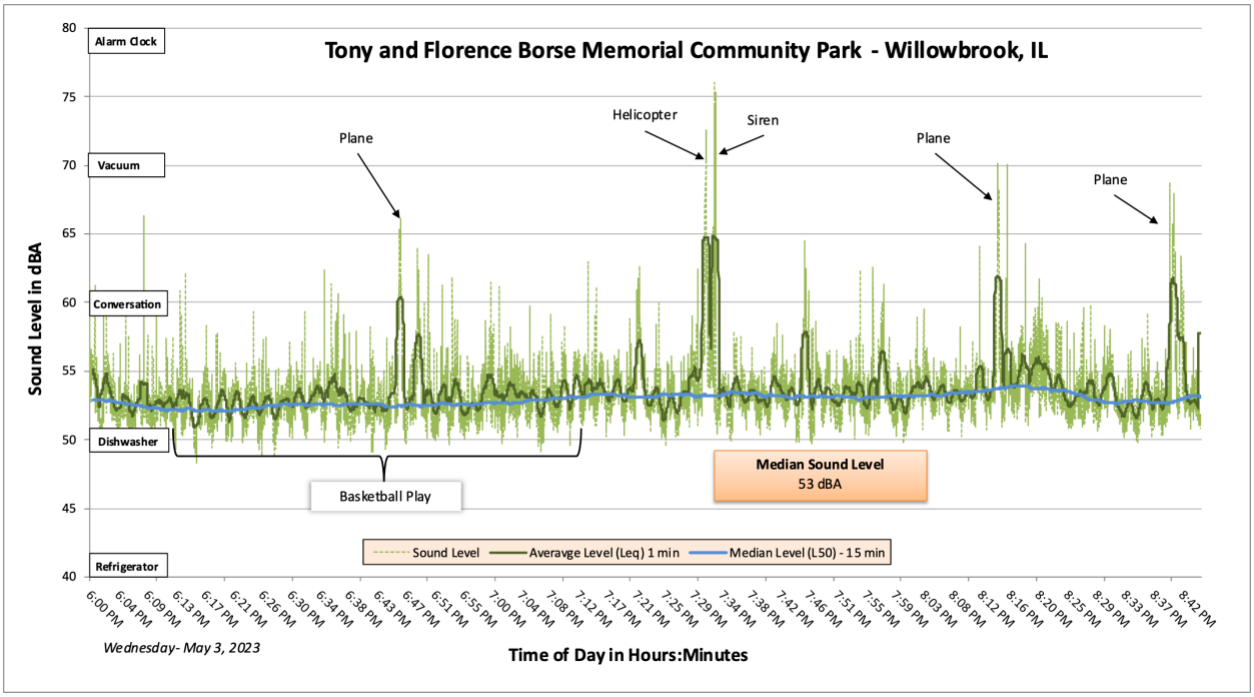


**Figure 3 – Ambient Recording at Tony and Florence Borse Memorial Community Park**

Both recordings included typical park sounds in the far field. At Brose Park, kids were playing basketball; farther away kids played at the playground; and all the softball fields were full of practices with one game starting later in the recording. At Midway Park, there was a softball practice where a child screamed into the mic, but there was enough averaging time that the event didn't influence the overall levels. The predominant noise at both locations was traffic noise and to a lesser extent airplanes flying overhead.

Because pickleball would be played at other hours than our measurement timeframe and because the ambient noise varies across the day, we estimated the hourly ambient noise levels at other hours using IDOT traffic data. This data was used because the ambient noise in most Chicago suburbs is dominated by the traffic on major roads in the area. Based on this analysis, we produced the charts shown in **FIGURE 8**.

## Source Noise Assessment

To evaluate the noise impact on the community, we used sound-level data we obtained at the pickleball courts at Willow Park in Northfield, IL, in 2019. This study revealed a level of 55 dBA measured at 70 feet from either side of the courts.

The chief complaint of noise from pickleball play is the impact noise from a hard paddle hitting a hard plastic ball. According to ANSI (S12.9-2005 Part 4), because these impacts are classified as "regular impulsive sound" the noise measurements should include a **5 dB adjustment** to account for the adverse character of this type of noise. Accordingly, **our modeling used an "effective sound level" of 55 + 5 = 60 dBA at 70 feet.**

## Reference Noise Standards

For reference, the Village of Willowbrook has a code under Section 9-5-10, "Performance Standards," that limits the noise level at each of nine octave-band frequencies from 32 Hz to 8,000 Hz, nearly the full range of hearing.

For simplicity and monitoring purposes, when no particular frequency dominates the sound (like the humming of a blower), these limits can be logarithmically summed to establish a single, overall noise level limit. When this is done, the limit for noise radiated from any use or activity is not to exceed an **overall level of 55 dB(A)** as measured at or beyond the nearest residential district boundary**.** For reference, this level is a bit lower than the level of casual conversation which is 60 dBA.

## Sound Modeling for Midway Park

To predict the sound levels radiated from the pickleball courts, we used an Internationally accepted software program called SoundPlan™. This program calculates the sound level at millions of distant points based on the source sound levels, the topography of the site, reflections from buildings, reflections from parking lots/courts, absorption by the atmosphere and vegetation, and shielding from berms and structures. Based on these calculations, the program then generates color sound-level contours surrounding the site. The program

calculates the time-average levels based on a pair of players on each side of the net in eight (8) courts (for a total of 32 total players). As indicated above, we added 5 dB in our model to account for the adverse effect of the impact noise.

**FIGURE 4** shows the projected contours for when the pickleball courts are in full use at Midway Park. For illustration, we set the green color on the legend to 52 dB(A), the estimated ambient noise level in the 8:00 PM hour. Each color change on the contours represents a 3 dB change. We choose a 3 dB interval because it is the "just noticeable" change to the human ear. We also chose three reference points (shown by the blue dots) to mark the property of nearby homeowners. As can be seen in the contours, the pickleball sound levels at

**Table 1 – Perceptual Difference as a Function of the Decibel Increase**

| Decibel Increase | Perceptual Difference | Impact |
|---|---|---|
| **1-2 dB** | Negligible | None |
| **3-4 dB** | Just Noticeable | Slight |
| **5-6 dB** | Clearly Noticeable | Mild |
| **7-8 dB** | Strongly Noticeable | Moderate |
| **9-10 dB** | Doubling in Loudness | Substantial |

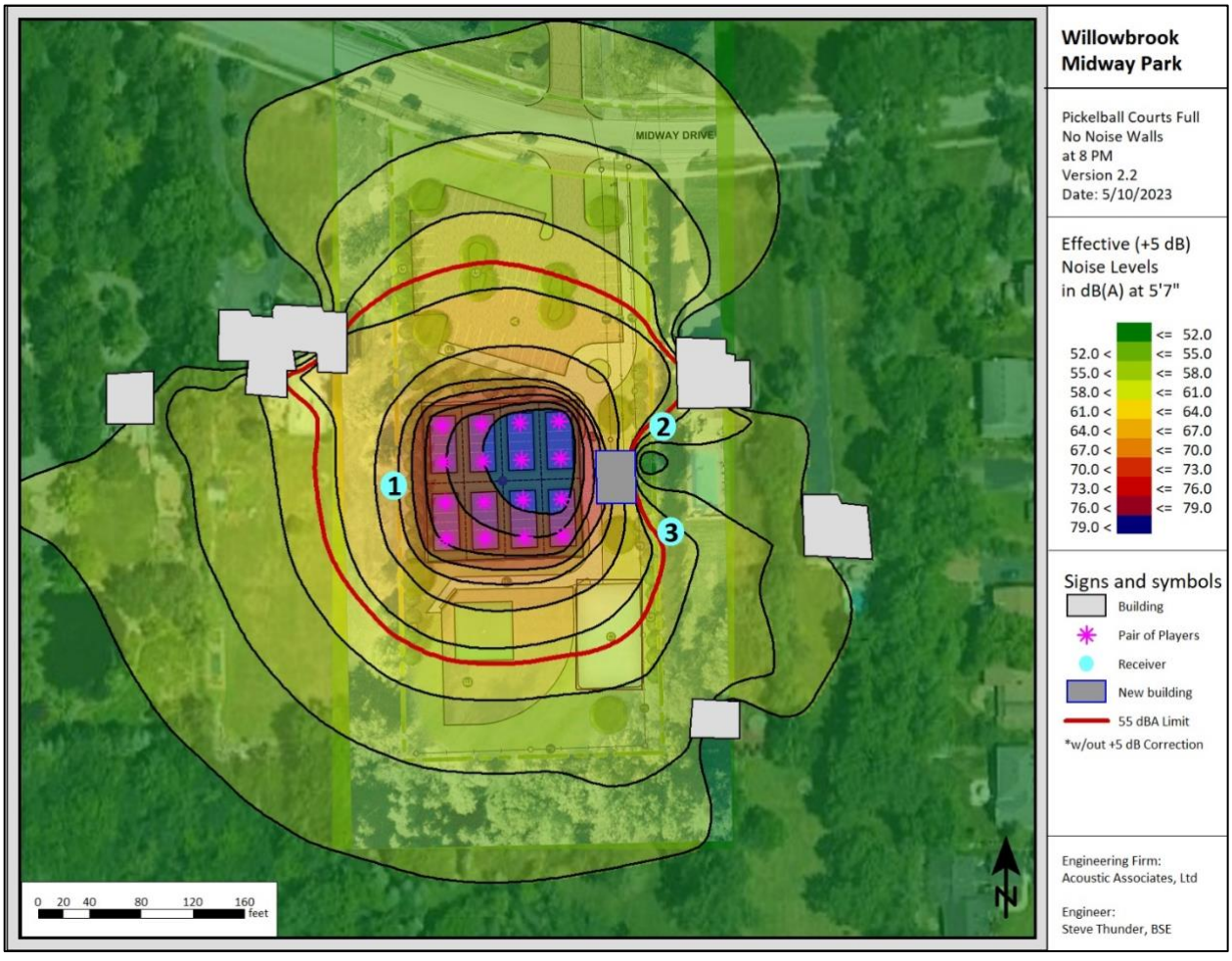


**Figure 4 – Sound Level Contours Around the Planned Pickleball Courts at Midway Park.**

these residential positions are well above the ambient noise and, therefore, would present a **substantial impact** on the residents.

## Source Modeling for Borse Memorial Park

Given that pickleball courts in Midway Park would present a substantial impact on the residents, the director of Parks and Recreation asked us to relocate the courts to where it had contemplated constructing an amphitheater with and without noise mitigation. This was modeled as shown in **FIGURE 5 (without noise walls)** and **FIGURE 6 (with 8 ft tall noise walls)** and shows the projected contours for when the pickleball courts are in full use. For illustration, we set the green color on the legend to 52 dB(A), the estimated ambient noise level in the 8:00 PM hour.

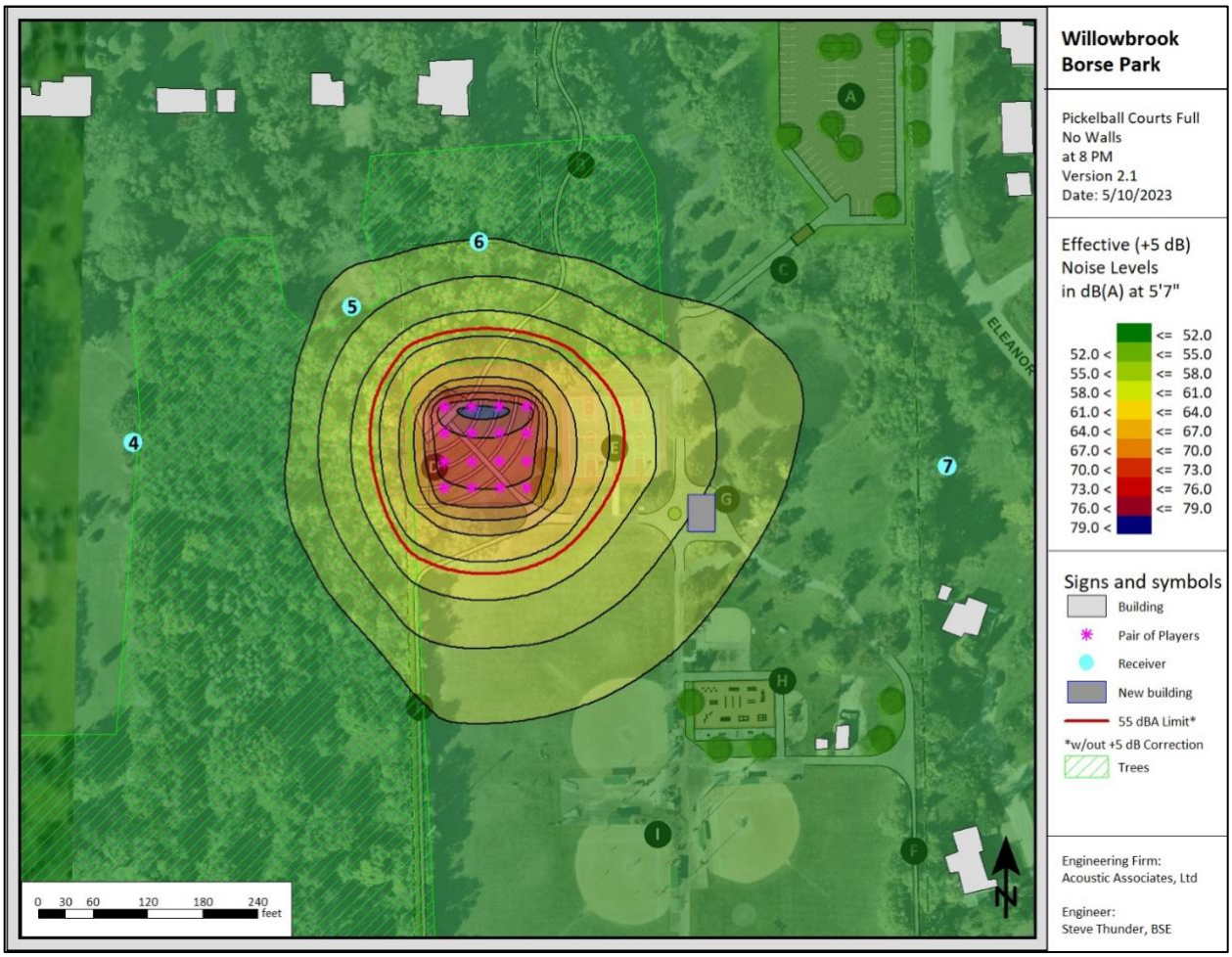


**Figure 5 – Sound Level Contours Around Pickleball Courts at Borse Memorial Park.**

As can be seen in each figure, four nearby receiver property locations have been marked by blue dots labeled 4-7. These were chosen based on where we believe people may use the property and thus could be impacted by the noise. Figure 5 shows that noise from full pickleball courts would exceed the ambient at locations 5 and 6 in the 8 PM hour, but only by up to 2 dB,

which would be considered no impact. However, the 55 dBA limit (per Willowbrook code) does extend past the property line to the west of the pickleball courts.

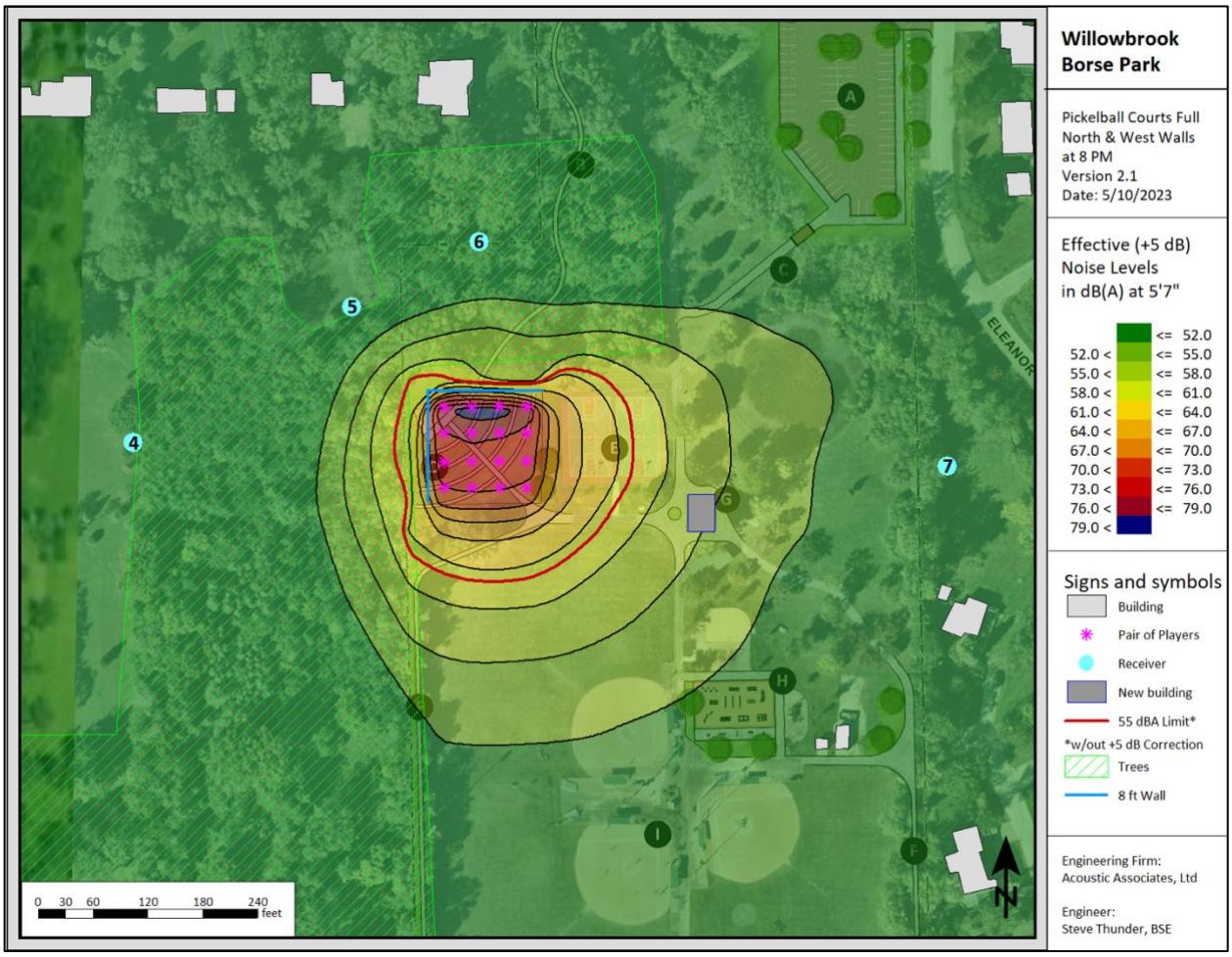


**Figure 6 – Sound Level Contours Around Pickleball Courts with an 8 ft Noise Wall at Borse Memorial Park.**

We also modeled the sound levels with mitigation, i.e., the addition of a "noise wall". There are several different ways that an equivalent noise wall can be constructed, but the important components to achieve the full effects of our model are:

1) It must be at least 8 feet tall.
2) It must extend to the ground.
3) It must not have any openings.
4) It must achieve a sound transmission loss of at least 15 dB (going through it).
5) It must be the length of the court area.
6) It must be in the same position we have shown.

**FIGURE 6** shows the projected contours when the pickleball courts are in full use but with the addition of a "sound wall" that meets the parameters above. All other elements are the same as in Figure 5. With the inclusion of a noise wall, the noise from pickleball play will be reduced

to the north and west. The wall can be constructed using a Trek composite fence, SimTek "stone/wood look" fences, or other more substantial construction. Acoustifence sheets on a traditional fence are another alternative but are more commonly used for retrofitting. If you select Acoustifence, we recommend you consult a fence company/engineer about the effect of the additional wind loads. Some examples of "noise walls" are shown in **FIGURE 7**.

**Figure 7 – Noise Wall Examples: SimTek wood look, concrete wall, and Acoustifence**

## Hourly Analysis

While FIGURES 4, 5, and 6 show the 2-dimensional radiation of sound from the site, we also prepared a time-series graph showing the hourly LEQ of the pickleball noise from Borse Park at location #5, compared with the estimated hourly ambient sound levels. Since the Park opens at sunrise, the courts could be in use during the 5:00 AM hour in the mid-summer months. As seen in **FIGURE 8**, the ambient noise at Borse Park is about 48 dBA at that hour. For play this early in the day, the chart shows that the Village would have to limit the courts to half use to not exceed 3 dB over the ambient. A 6:00 AM start time, however, would be acceptable for

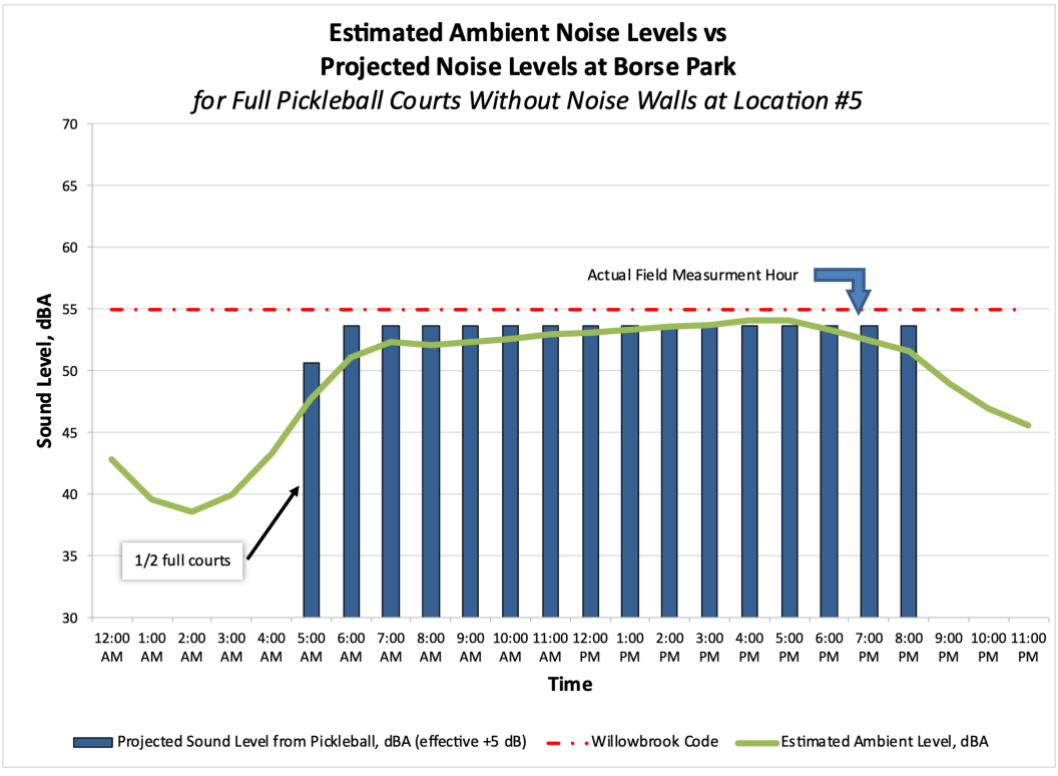


**Figure 8 – Graph showing the hourly ambient noise levels (green line) at Borse Memorial Park. The 7:00 PM hour was measured while the remaining hours were estimated based on IDOT traffic data in the area.**

even full use because the ambient noise would increase by then. Alternatively, if the village were to choose to add noise walls, playing at the 5:00 AM hour would not cause an impact. During the day there is enough traffic activity to keep the ambient noise steady until the evening. In the 8 PM hour, full-court play would only exceed the ambient noise by 2 dB, which is considered no impact (see TABLE 1).

## Conclusion

Placing pickleball courts in Midway would not allow a sufficient distance to ensure the noise radiated from the courts dissipated to near ambient sound levels. Instead, if the courts were located where the amphitheater was contemplated, there would be enough distance and vegetation to attenuate the noise to an acceptable level, that is, not more than a slight impact (i.e., 3 dB above the ambient noise) from 6 AM to 9 PM for all but the closest areas to the court. If more protection is desired, then noise mitigation can be added, although it may not be necessary to avoid noise complaints. Complaints would depend on the actual use of the land nearby the courts and always depends on individual susceptibility. If the village would like to avoid noise levels above 55 dBA from crossing over property lines, then at least a west wall noise wall as described above would be required.

This completes our report. We appreciate the opportunity to have investigated this issue for the Village.

Submitted by:

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