Acoustic Associates, Ltd.

Specialists in Hearing and Acoustics

867 Scottsdale Drive, Pingree Grove, IL 60140
Office: *847-359-1068* • Fax: *847-359-1207*
Website: www.AcousticAssociates.com

Tom Thunder, AuD, FAAA, INCE – *Principal*
Greg Andorka, BSEE, MCS – *Senior Field Engineer*
Steve Thunder, BSE – *Acoustical Engineer*

Glenview Park District – Flick Park Sound Study

November 14, 2022

Prepared for:
Glenview Park District 1930 Prairie Street, Glenview, IL 60025

Acoustic Associates was asked to study the potential noise radiated from the planned pickleball courts addition in Flick Park. This is part of a larger project involving improvements to several different areas like new volleyball courts, ballfield improvements, fitness stations, renovations to the existing basketball courts, and others. Acoustic Associates was specifically asked to evaluate the noise impact from the new pickleball courts because of the type of sound that playing pickleball generates and the growing popularity of the sport. Evaluating this before construction is important because mitigation is easier to implement in the design stage.

Ambient Noise Assessment

The impact of a noise source depends mostly on its audibility. To assess the degree of audibility, the existing ambient noise must be evaluated. We conducted this work by visiting the site on Friday, October 14, 2022. During this visit, we inspected the topography of the site, examined the surrounding area, characterized the ambient noise, identified its sources, and set up professional-grade equipment to record the noise. The equipment was located to the east of the existing pickleball courts, as shown in FIGURE 1, and was centered 30 feet from the side of the courts.

Figure 1 - View from the south showing the location of the digital audio equipment.

The recording ran for two hours to sample when the courts were active and when they were empty. The recording was analyzed to determine the sound levels at 1-second intervals. The result of this analysis can be seen in FIGURE 2. In this graph, you can see pickleball hits, planes flying overhead, and a train passing by. During the second half of the recording, the wind picked up. While the windscreen on the microphone limited wind noise across the microphone, there was some additional wind-induced ambient noise arising from leaves on the trees. The activity on the pickleball courts can be seen as well where the spikes from the ball-paddle impacts are shown by the thin green line. As more players are on the courts, pickleball strikes are more frequent. (Note, only a few of the pickleball strikes are labeled in Figure 2.)

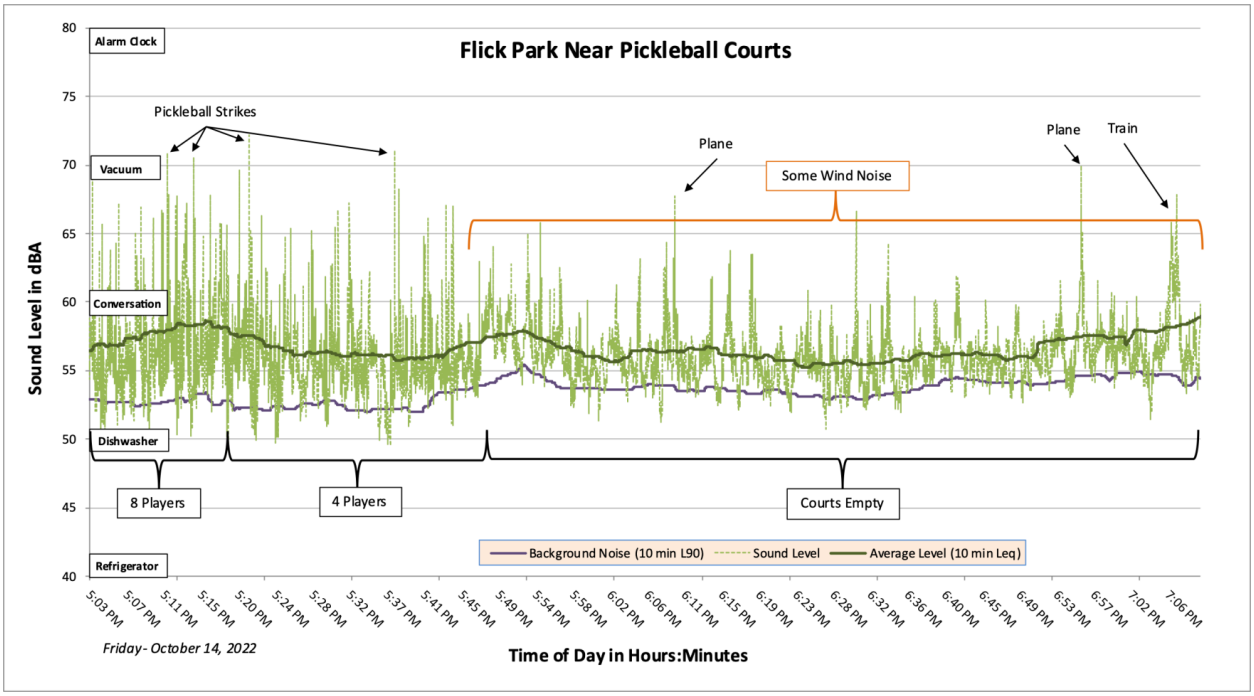


Figure 2 – Sound level trace of ambient and pickleball noise at the site from 5:00-7:00 PM

To better visualize the trend of the ambient noise when there were no players, we computed the 10-minute time-averaged level, also known as the LEQ, which varies between 56-59 dB(A). However, due to additional background noise from the weather, to establish the existing ambient noise level, we used a statistical approach, called the L90. The 10-min L90 can be seen on the chart as a thin purple line. The L90 is a common acoustical measure that gives the level of sound exceeded 90% of the time and is a good measure of ambient noise. This measure gives that background ambient that does not include typical park activity or weather activity. **The L90 of the entire sample was 53 dB(A).**

Source Noise Assessment

To evaluate the noise impact on the community, we also needed to establish the "source level", which is the sound level generated during pickleball play. We used the same overall data shown in Figure 2 but isolated the times when pickleball was being played. While we didn't feel the

sample of pickleball data was clean enough to use as source data in this study, we did examine it with several different acoustical metrics and found that it had good agreement with our existing source data for pickleball play. Our existing pickleball noise data was calculated from noise sampling in Willow Park in Northfield, IL in 2019. Furthermore, according to ANSI (S12.9-2005 Part 4), the pickleball impacts are classified as "regular impulsive sound" and therefore should include a **5 dB adjustment** to the measured sound level to account for the additional sensitivity to noise of this character. We added this to the source levels of our model.

Reference Noise Standards

For reference, the Village of Glenview has a code 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, 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. For noise radiated from a non-exempt source to any point beyond the property boundary, **this overall limit is 53 dB(A) for all hours.** For reference, 60 dB(A) is the level of casual conversation while 50 dB(A) is half as loud and is the typical level of a dishwasher.

The Glenview noise limit of 53 dBA is in good agreement with the ambient noise we measured for the area. Typically, however, because the ambient noise drops at night, most codes have a separate nighttime limit. Glenview does not. For example, the Illinois state noise code has a daytime limit of 55 dBA (from 7 AM to 10 PM) and a nighttime limit of 45 dBA (from 10 PM to 7 AM) for sound radiated to residential property.

Sound Modeling

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 our source data for a pair of people playing pickleball, plus the 5 dB addition mentioned earlier. We modeled the 8 new courts, where each court has a doubles game (32 total people) positioned based on the expected court layout.

Table 1 – Perceptual difference as a function of the decibel increase

Decibel Increase	Perceptual Difference
1-2 dB	Negligible
3-4 dB	Just Noticeable
5-6 dB	Clearly Noticeable
7-8 dB	Strongly Noticeable
9-10 dB	Doubling in Loudness

FIGURE 3 shows the projected contours when the pickleball courts are in full use. For illustration, we set the green color on the legend to 53 dB(A), the ambient noise level

at the 6:00 PM hour. For illustration, the red line in FIGURE 3 shows the 53 dB(A) contour. Hourly sound levels beyond this contour line are lower than 53 dB(A), the Glenview noise limit (see "Reference Noise Standards" section). Each color change on the contours represents a 3 dB level change (see TABLE 1). We choose this because 3 dB is considered a "just noticeable" change to the typical person. We also chose three points to virtually "measure" the sound levels. These receiver points are represented by blue dots and 210 ft (1), 330 ft (2), and 175 ft (3) from the courts. As shown in Figure 3, we expect the noise levels from the pickleball courts in full use to be above the ambient level and above the Glenview code limit of 53 dBA.

Figure 3 – Sound level contours around the proposed pickleball courts in full use at 6 PM

Mitigation

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

1) It must be at least 9 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 plus a 10-foot extension on the north side (can be an "L" shape or straight out)
6) It must be in the same position we have shown

FIGURE 4 shows the projected contours when the pickleball courts are in full use, but with the addition of a "sound wall/fence" that meets the parameters above. All other elements are the same as in Figure 3.

Figure 4 – Sound level contours around the proposed pickleball courts with mitigation

The dominant noise at this site was from traffic. Based on the hourly traffic data for Lake Ave. published by IDOT, we estimated the hourly ambient sound level over a 24-hour period. This

analysis revealed a peak hourly level of 53 dB(A) in the 7:00 AM hour and 54 dB(A) in the 4:00 PM hour.

While Figures 3 and 4 show the 2-dimensional radiation of sound from the site, we also prepared a time-series graph showing the hourly LEQ of the noise compared with the estimated hourly ambient sound levels. This graph, given in FIGURE 5, shows that the noise at location #1 is below the existing ambient noise for the 7 AM to 6 PM time periods, but only exceeds the ambient by 3 dB, for the 6 AM to 9 PM time periods. *Note, the 9 PM hour period ends at 10 PM.* In addition, it is likely that near the opening and closing times, the courts will be less than 100% full, which would mean the projected noise levels would be lower than our chart at those times.

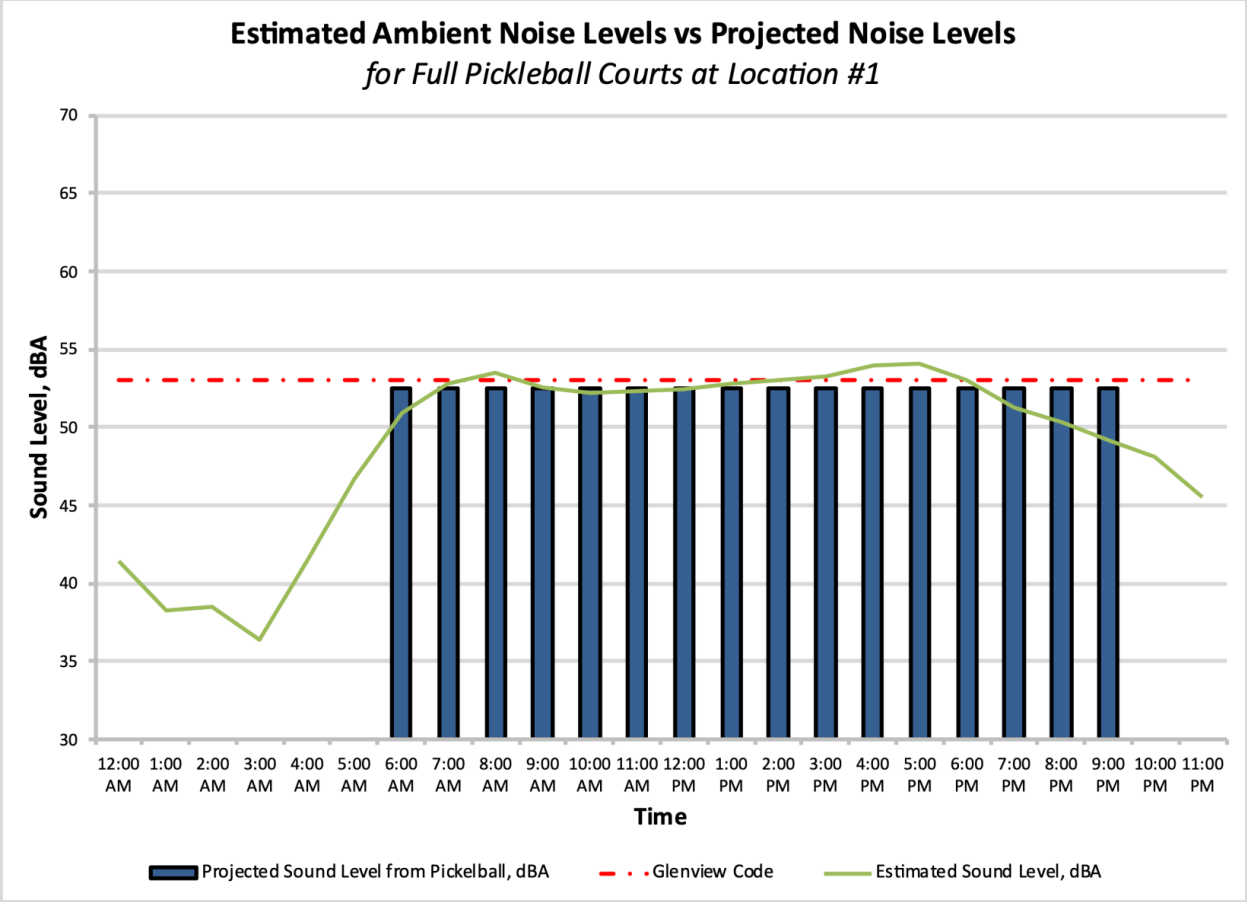


Figure 5 – Hourly sound levels for the existing ambient noise (green line) compared with the hourly sound levels generated by full pickleball courts (blue bars) at location #1

Conclusion

To evaluate the potential impact of noise on the adjacent community, we used a sophisticated computer program to project the time-averaged sound levels in the surrounding community by drawing sound contours around the site. With the inclusion of a sound wall, the noise from pickleball play when it reaches the residential community will be below the Glenview noise

limit. The sound 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 are shown in FIGURE 6.

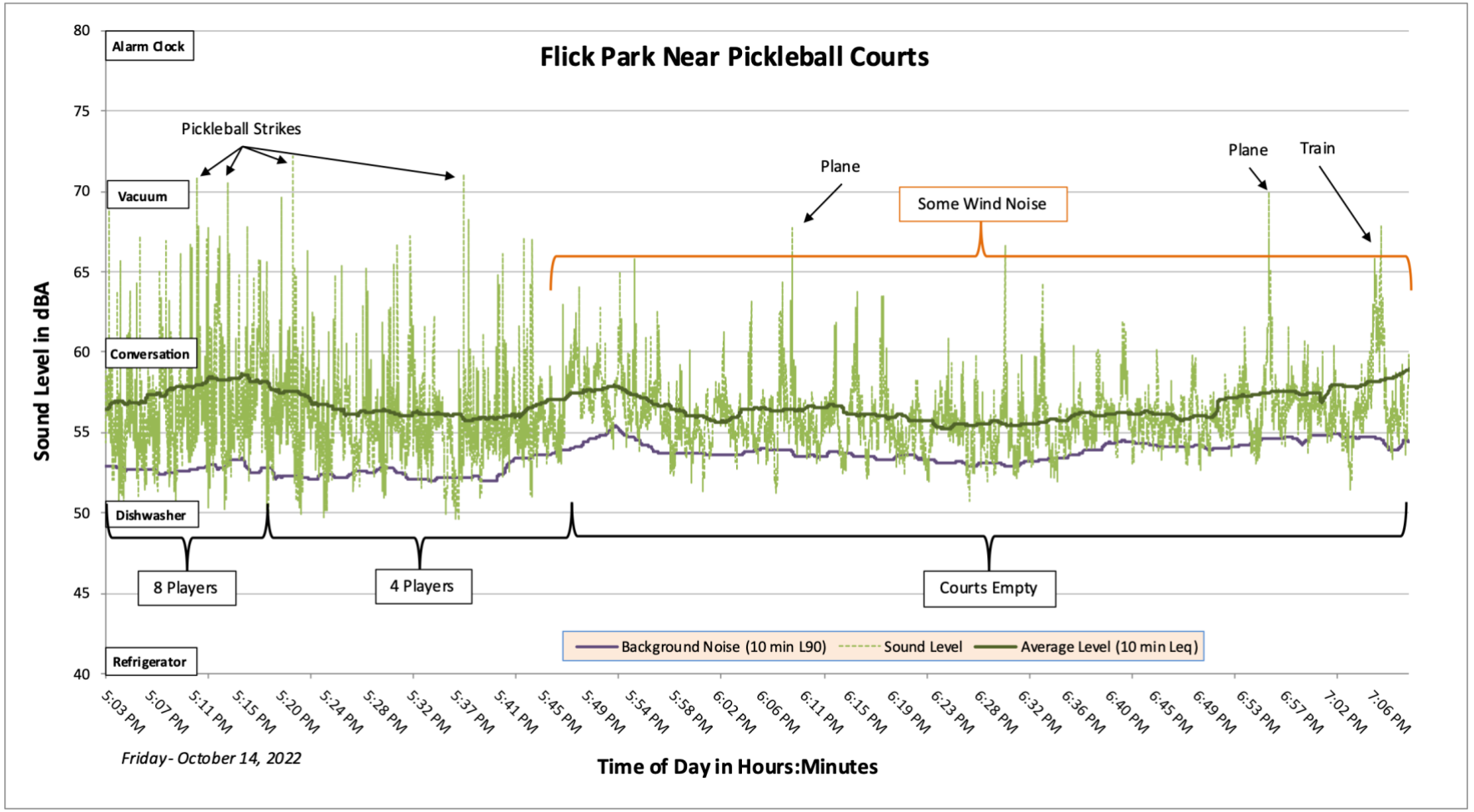
Figure 6 – Mitigation Examples: SimTek wood look, SimTek stone look, and Acoustifence

Furthermore, we recommend limiting the time of play to no more than 6 AM to 10 PM, because at these times the noise will be no more than 3 dB above the ambient level, which would be considered a just significant impact. This is not to say that all sounds from the court will be inaudible. At times the play or cheers may be louder, but the long-term impact is assessed by using the time-averaging approach advocated by the US EPA and stipulated by the State of Illinois. Thus, this is the approach we have used in evaluating the impact. In addition, the noise character is also in-line with the expected noises from a community park, it’s very common to hear cheers, whistles, basketballs, etc. at this park. So, hearing more pickleball noise at this site would not be out of place.

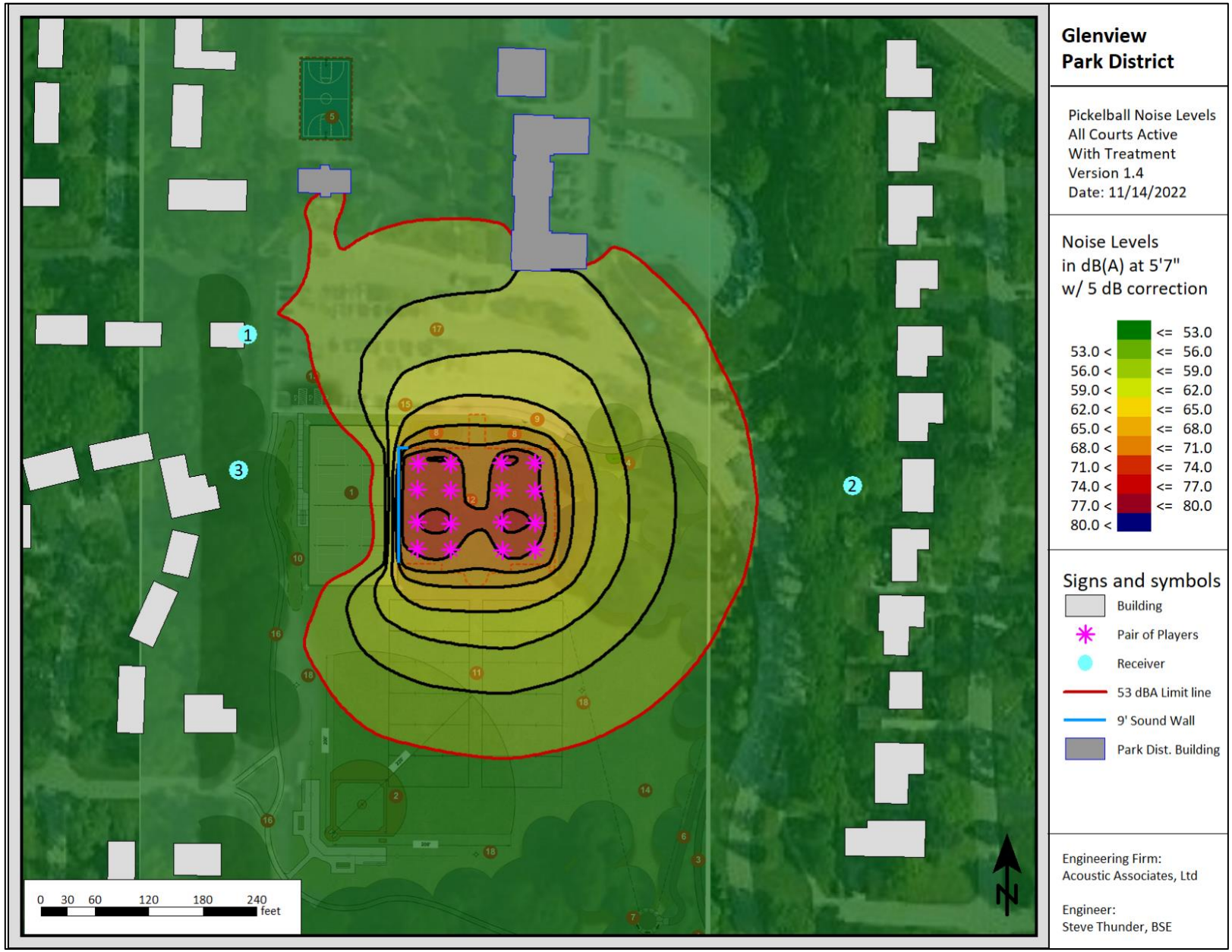
This completes our report. We appreciate the opportunity to have investigated this issue for the Park District.

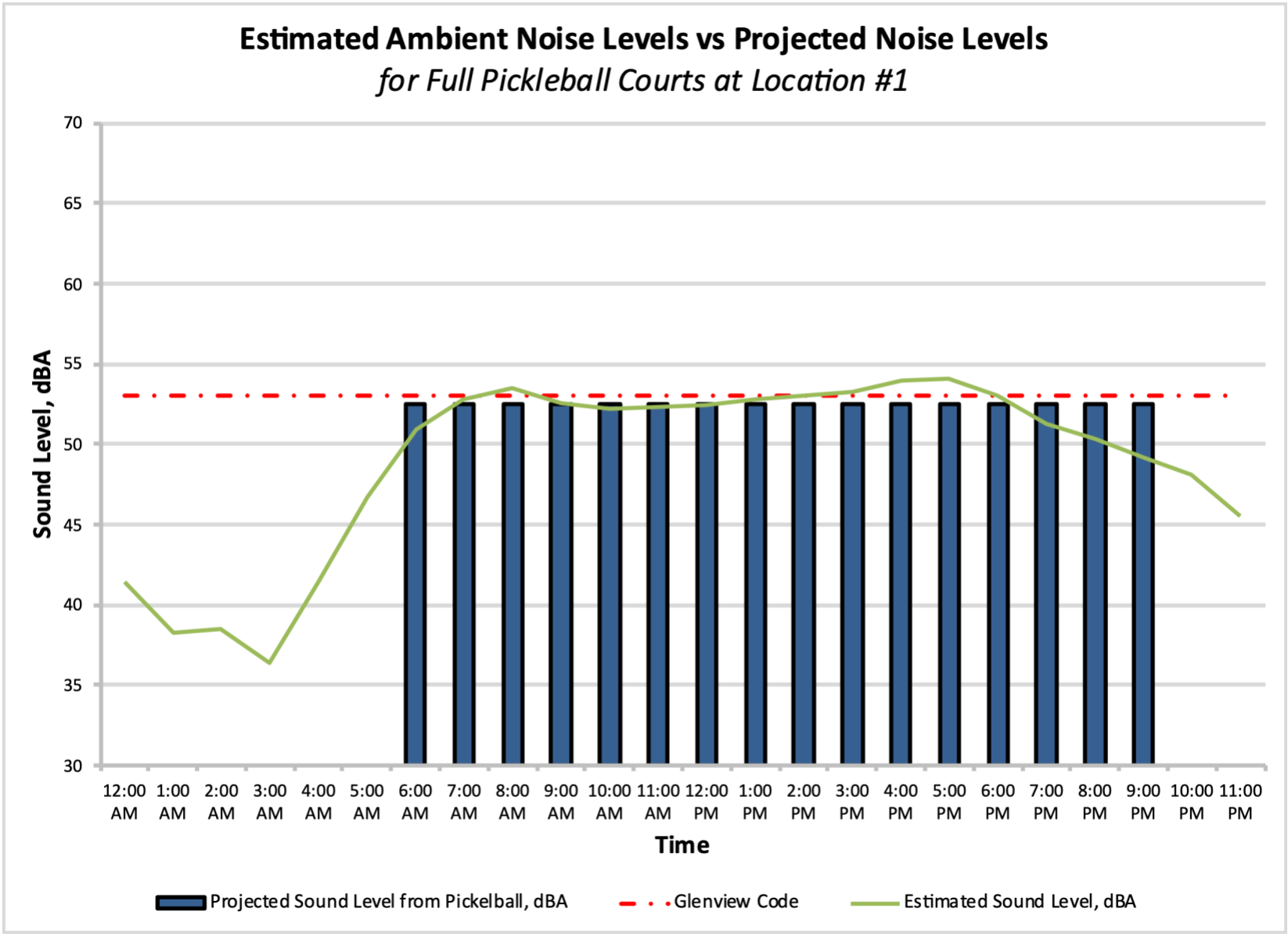
Submitted by:

Steve Thunder, BSE
Acoustical Engineer


Flick Park Near Pickleball Courts
Alarm Clock
Vacuum
Conversation
Dishwasher
Refrigerator
Pickleball Strikes
Plane
Some Wind Noise
Plane
Train
8 Players
4 Players
Courts Empty
Background Noise (10 min L90)
Sound Level
Average Level (10 min Leq)
Sound Level in dBA
80
75
70
65
60
55
50
45
40
5:03 PM
5:07 PM
5:11 PM
5:15 PM
5:20 PM
5:24 PM
5:28 PM
5:32 PM
5:37 PM
5:41 PM
5:45 PM
5:49 PM
5:54 PM
5:58 PM
6:02 PM
6:06 PM
6:11 PM
6:15 PM
6:19 PM
6:23 PM
6:28 PM
6:32 PM
6:36 PM
6:40 PM
6:45 PM
6:49 PM
6:53 PM
6:57 PM
7:02 PM
7:06 PM
Friday - October 14, 2022
Time of Day in Hours:Minutes


Glenview
Park District
Pickelball Noise Levels
All Courts Active
No Treatment
Version 1.5
Date: 11/14/2022
Noise Levels
in dB(A) at 5'7"
w/ 5 dB correction
<= 53.0
53.0 < <= 56.0
56.0 < <= 59.0
59.0 < <= 62.0
62.0 < <= 65.0
65.0 < <= 68.0
68.0 < <= 71.0
71.0 < <= 74.0
74.0 < <= 77.0
77.0 < <= 80.0
80.0 <
Signs and symbols
Building
Pair of Players
Receiver
53 dBA Limit line
Park Dist. Building
Engineering Firm:
Acoustic Associates, Ltd
Engineer:
Steve Thunder, BSE
0 30 60 120 180 240
feet
N
1
2
3


Glenview
Park District
Pickelball Noise Levels
All Courts Active
With Treatment
Version 1.4
Date: 11/14/2022
Noise Levels
in dB(A) at 5'7"
w/ 5 dB correction
<= 53.0
53.0 < <= 56.0
56.0 < <= 59.0
59.0 < <= 62.0
62.0 < <= 65.0
65.0 < <= 68.0
68.0 < <= 71.0
71.0 < <= 74.0
74.0 < <= 77.0
77.0 < <= 80.0
80.0 <
Signs and symbols
Building
Pair of Players
Receiver
53 dBA Limit line
9' Sound Wall
Park Dist. Building
Engineering Firm:
Acoustic Associates, Ltd
Engineer:
Steve Thunder, BSE
0 30 60 120 180 240
feet
N
1
2
3


Estimated Ambient Noise Levels vs Projected Noise Levels
for Full Pickleball Courts at Location #1
Sound Level, dBA
70
65
60
55
50
45
40
35
30
12:00 AM
1:00 AM
2:00 AM
3:00 AM
4:00 AM
5:00 AM
6:00 AM
7:00 AM
8:00 AM
9:00 AM
10:00 AM
11:00 AM
12:00 PM
1:00 PM
2:00 PM
3:00 PM
4:00 PM
5:00 PM
6:00 PM
7:00 PM
8:00 PM
9:00 PM
10:00 PM
11:00 PM
Time
Projected Sound Level from Pickelball, dBA
Glenview Code
Estimated Sound Level, dBA

Virtual Receiver Points					
No.	Receiver	Base (dBA)	With Sound Wall/Fence (dBA)	Difference (dBA)	Distance From Courts (Ft)
1	Receiver Northwest	55.3	52.5	-2.8	210
2	Receiver East	51.5	52.1	0.6	330
3	Receiver West	54.9	48.7	-6.2	175