



**POLYSONICS**

Acoustics & Technology Consulting

**NOISE PROPAGATION MODEL:  
PLAYGROUND NOISE ANALYSIS OF  
GREEN HEDGES SCHOOL  
VIENNA, VA**

**REPORT #6341**

PREPARED FOR: GREEN HEDGES SCHOOL

APRIL 24, 2026

*the sound of experience*



## **Executive Summary**

Polysonics has been asked to measure, analyze and document playground noise at the Green Hedges School at 415 Windover Avenue, N.W. in Vienna, VA, including the potential for improvement by the use of barriers and/or other administrative controls to limit noise exposure to neighbors beyond the property line. The school is immediately bordered by single family homes on two sides of the playground. Polysonics understands that the Town of Vienna does not have a noise ordinance to limit noise from one neighbor to another and has a height limit of 6' on any fence/barrier that can be implemented in this location.

Based on existing conditions, Polysonics has determined that adding a 6' barrier to the existing chain link fence will reduce the sound level by ~3 dB at the off-campus site immediately to the northwest of the property.

Based on future conditions, Polysonics has determined that adding a 6' barrier to the existing chain link fence and instituting administrative controls described herein will reduce the sound level by ~4.5 dB at the off-campus site immediately to the northwest of the property.

## **Vienna, VA: Applicable Municipal Noise Code**

The Vienna, VA noise ordinance can be found here:

[https://library.municode.com/va/vienna/codes/code\\_of\\_ordinances?nodeId=PTIICOOR\\_CH10OFMI\\_ART3OFAGPR\\_S10-20.1SAOI](https://library.municode.com/va/vienna/codes/code_of_ordinances?nodeId=PTIICOOR_CH10OFMI_ART3OFAGPR_S10-20.1SAOI)

It lists several activities known to produce high levels of noise and describes times where these activities are prohibited. Playing children is not one of these activities and, in general, sound level limits at the property line are not defined. Section 18-548 of this same code does provide some guidance for sound levels at/near property lines; however, these limits are understood to apply only to Corporate Park District properties between the hours of 9:00 PM and 7:00 AM.

After a review of the Vienna municipal code, Polysonics understands that there are no performance requirements applicable to this site and/or situation.

## **Existing Conditions: Observed and Measured**

Polysonics visited the school on March 10, 2026, to observe and acoustically measure schoolyard activity.

Polysonics placed two Sound Level Meters (SLMs) on the site at locations M1 and M2 as shown in Figure 1 (pg. 13). These two meters captured the sound from the playground area on the northwest side of the school structure as well as the grassy play area on the northeast side of the school structure. These measurements extended from about 9:40 AM until about 12:40 PM. It should be noted that this day was one of the first days over 80 °F of the spring.

Observations/comments about the site include:

- A nominal 6 ft tall chain link fence was seen around the perimeter which is the only barrier between playground and neighboring yards.
  - Students are able to directly approach the fence.
- Five play zones were observed on the playground – three play structures, swings, and a small ball game area.
- Active play per group appeared to last around 30 minutes.
- Students were allowed back on the playground during lunch.
- The largest group of students was observed to be approximately 60 elementary-age students.
  - This is an estimate based on an informal count of students entering and existing the play area as observed from the parking lot.
- Play on the northeast side field could not be directly observed from the parking lot.

Additional details observed during the measurements, including times of some events, are shown in Table 1 (pg. 17) in the appendix below.

Sound levels were measured and logged once per second. When sound is averaged over one second, the metric is called  $L_{EQ(1SEC)}$ . As is standard, Polysonics utilizes the A-Weighting network for these analyses; A-Weighting is a frequency weighting that represents the varying sensitivity to sound that humans have across frequency. These measurements are represented as time histories in Figures 2 & 3 (pgs. 14 & 15) and as histograms in Figures 4 and 5 (pg. 16).

### **Applicable Acoustic Concepts**

Several fundamental acoustic concepts apply to this project. This section of this report has been prepared to briefly describe each concept and how they are applicable to this analysis.

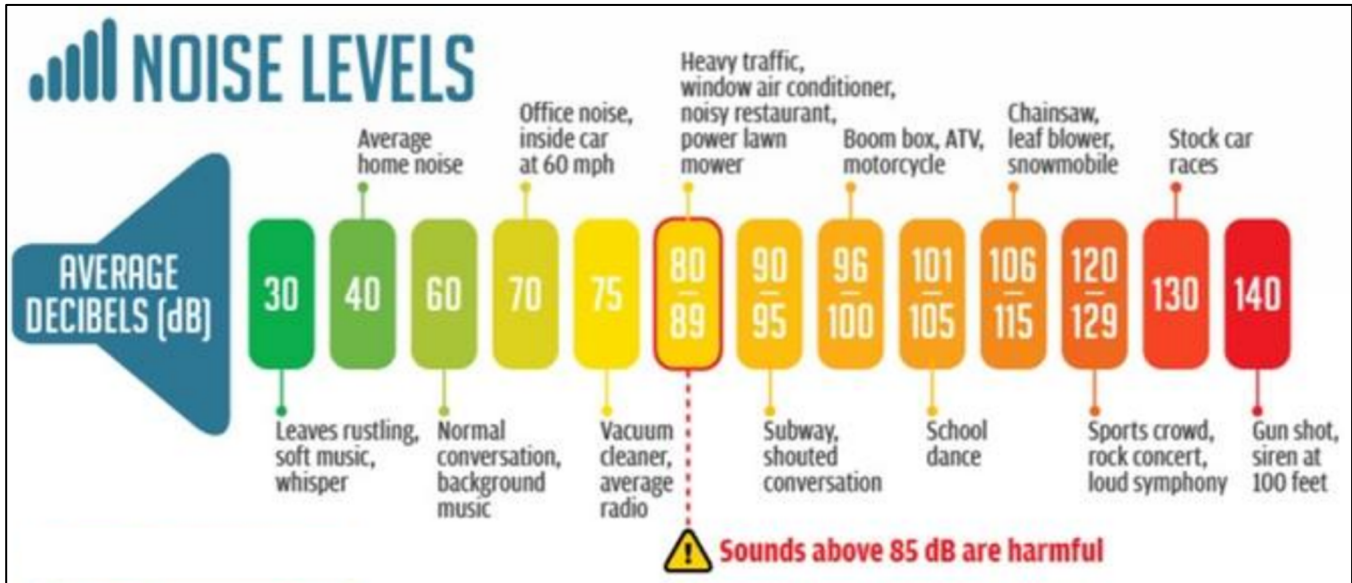
- Sound Pressure Level

Scientists and engineers quantify the amplitude of sound using the Sound Pressure Level (SPL). There are many different types of SPL but they all quantify how loud something is. SPLs are almost always given in units of decibels (dB) which is a logarithmic ratio as compared to the predefined threshold of human hearing (taken to be  $20 \mu\text{Pa}$ ). 0 dB represents this threshold (though this threshold can change dramatically as humans age). Please see Figure 6 (pg. 5) for typical sound pressure levels for common sounds.

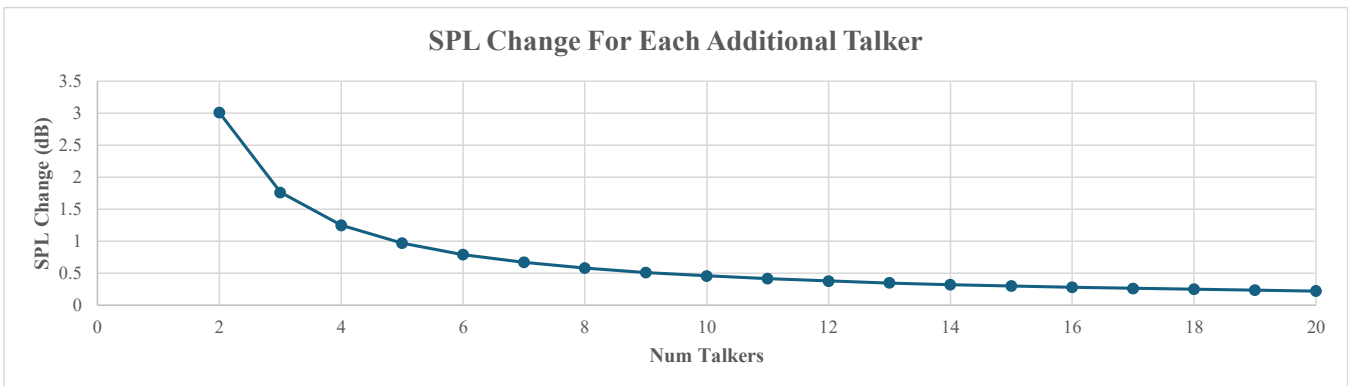
Because SPLs are logarithmic, they do not add together in the same way as linear quantities. In fact, the increase in SPL as a function of the number human talkers (all talking at the same level) very quickly falls below the threshold of human hearing to hear a difference in level, understood to be about 2 dB. This is illustrated in Figure 7 (pg. 5). For two talkers (or any other sound source with equal loudness) there is a 3 dB increase as compared to a single talker; for three talkers, there is a 1.7 dB increase as compared to 2 talkers; for 20 talkers, there is a 0.2 dB increase as compared to 19 talkers. This is why a choir of 60 singers is not that much louder

than a choir of 30 singers. In the context of this analysis, adding, for example, 5 additional students to a recess that already has 30 students will not make things louder.

**Figure 6: Typical Sound Pressure Levels for Common Sounds**



**Figure 7: Average Sound Pressure Levels for Common Sounds**



- Averaging Time

All acoustic quantities – i.e., the many types of SPL – have an associated averaging time which is also called a time constant. Some acoustic analyses require long time constants with sound measured over hours or days, e.g., determining the ambient sound level of rural settings. Some acoustic analyses require very short time constants with sound measured over fractions of a second, e.g., determining the loudness of gunshots or jack hammers. Acousticians choose a metric based on the needs of the task at hand.

Not surprisingly, sound measured with a long time constant will vary much less than sound measured with a short time constant. This is clearly demonstrated in the data currently under consideration. In Figure 2 (pg. 14) we note a peak above 100 dBA for the  $L_{EQ(1SEC)}$  metric (it's actually 110.31 dBA and this peak is discussed in more detail below), a peak in the  $L_{EQ(1MIN)}$  at the same time which is below 100 dBA (it's actually 97.0 dBA) and a "peak" in the  $L_{EQ(1HOUR)}$  at about 80 dBA (it's actually 79.32 dBA). The  $L_{EQ}$  for the entire data set (an equivalent averaging time of just over 3 hours) is 74.83 dBA. When acousticians balk at answering how loud something is, it is this time constant question that is often the root of their hesitation.

- Sound Attenuation

In the context of this project, there are two primary mechanisms that attenuate sound: distance (spherical spreading) and physical barriers (transmission loss).

Considering attenuation by distance, the sound energy of a given source is finite, moving away from that source distributes that finite energy over larger and larger areas (i.e., the surface of a sphere with increasing radius), the physical consequence of this is softer sound. Mathematically, this works out to be a 6 dB reduction in SPL for each doubling of distance from a sound source. If the sound level 10' from a sound source is 60 dB, the sound level 20' from the source will be 54 dB and the level 40' from the source will be 48 dB.

Considering sound attenuation by transmission loss, such as what happens with actual walls, either interior or exterior, sound energy in the air induces vibrations in the wall that get re-radiated on the other side of the wall with some loss of energy based on the nature of the wall. A wall made of brick will cause more energy loss than a wall made of plywood. A whole field of acoustic study called structural acoustics is dedicated to studying these phenomena.

In the context of this project, the transmission loss that is most applicable is the attenuation of the exterior walls of the nearby houses. Since the details of off-campus structures are not known, we rely on the department of Housing and Urban Development (HUD) to advise that even the flimsiest of home constructions will provide 20 dB of sound attenuation between outdoor and indoor levels. This assumes closed windows and, in practice, most exterior wall designs provide more than 20 dB of acoustic attenuation.

The practice of constructing outdoor sound barrier walls brings both of these mechanisms together. To have any impact, a sound barrier must be sufficiently "beefy" – have a solid structure that can provide ~25 dB of attenuation – and must break the line of sight between source and receiver. Achieving 25 dB of attenuation for an acoustic barrier is not difficult; all of the products suggested in this report achieve a suitable level of attenuation. Once these two things happen, sound attenuation as a function of distance comes into play with the top of the barrier effectively re-radiating the sound. The taller an outdoor sound barrier is, the greater the effective distance between source and receiver and the barrier is more effective. In practice, the level of sound attenuation outdoor acoustic barriers can usually achieve is about 10 dB which is perceived as a halving of the sound level.

## **Noise Model: Calibrating to Existing Conditions**

With no formal guidance from the Authority Having Jurisdiction (AHJ) on limits on sound radiated from this site, we are free to choose the acoustic metric best suited to this situation. In situations where there is impulsive noise that is not that much louder than the ambient or background sound such as the sudden exhortations typically made by playing children, Polysonics has had success using a metric called L1. This is a statistical metric and is defined as the level for a given data set that is exceeded by 1% of all other measured levels. Please see Figures 4 and 5 (pg. 16) for a graphical representation of these levels. The underlying metric for this data set is the A-Weighted  $L_{EQ(1SEC)}$ , i.e., sound averaged using a time constant of 1 second.

The L1 for Meter #1 is 74.84 dBA and the L1 for Meter #2 is 69.20 dBA. These represent the *highest levels* observed during active play on the site and are representative of the *absolute highest short-term sound levels* that will be experienced on the site when the sound source is playing children.

Statistically, assuming a normal distribution, an L1 level of 74.84 dBA equates to an average SPL of 56.90 dBA (Meter #1 data set) and an L1 level of 69.20 dBA equates to an average SPL of 54.80 dBA (Meter #2 data set). Subjectively, these average SPLs will be closer to the sounds experienced by people on or near the site over the course of any given day. The higher L1 levels are used in analyses like this because it is these peak levels that can be so noticeable.

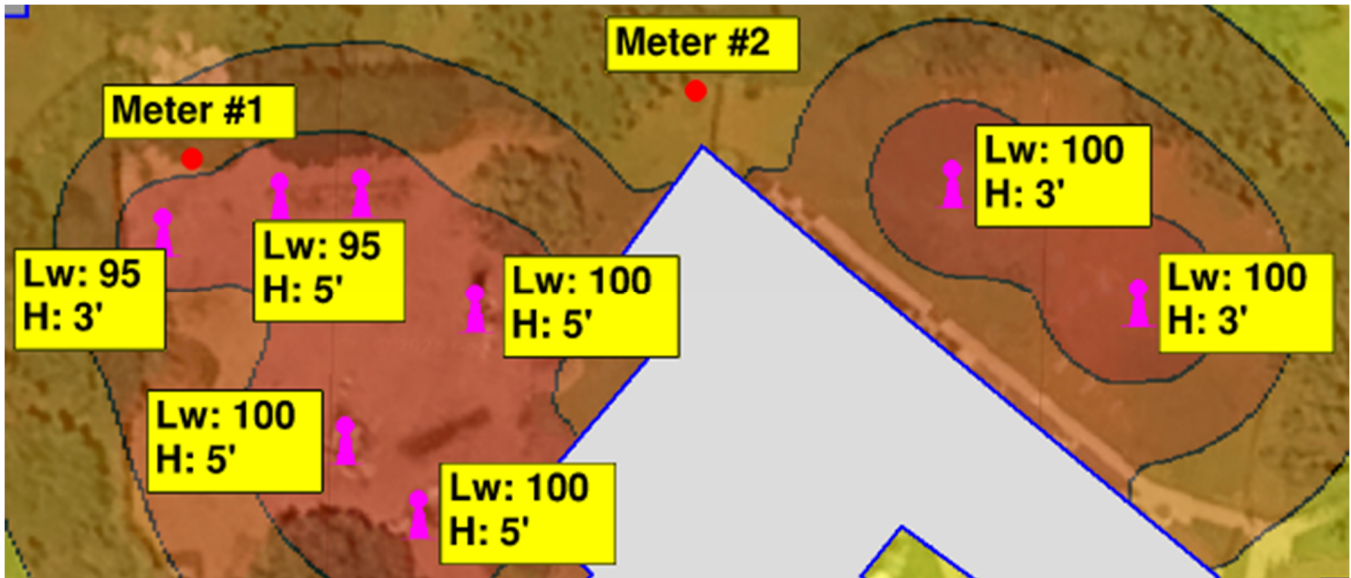
Another reason Polysonics uses the L1 metric is that it is less sensitive to “bad” data than a sound level averaged over some length of time. We have a priori knowledge that Meter #1 was bumped into by playing children at least once: at the end of the measurement it was not in the same place as it was at the start. Bumps like this are known to cause large spikes in data measured by Sound Level Meters. We see two peaks in Meter #1 that are consistent with someone bumping into the meter. If these were typical, airborne acoustic events at these high levels, we would clearly see evidence of these peaks in both meters which we do not see. In fact, we see a similar peak within the data for Meter #2 that is also not reflected in the data for Meter #1. We can, therefore, be confident that these three peaks do not represent normal noises produced by children playing on this site. If an “average” sound level were used, these false peaks would dominate; by using a statistical metric, their influence is minimal. The analogy to using the median price instead of the average price when discussing the cost of housing is direct.

Using a combination of observations, acoustical references and iteration, Polysonics has developed and calibrated a SoundPLAN model using the L1 metric. Children groups were modeled as single (“point”) sources to approximate sound spreading equally in all directions from each region of play. Please see Figure 8 (pg. 8) for these details. The Sound Power Levels of each source ( $L_w$ ) is shown in dB re 1 pW along with the height off the ground of each source. Children on play equipment were set at a height of 5’ while children playing on the ground were set at a height of 3’.

If the results of an acoustic model are within 3 dB of the measured data, it is considered calibrated. The model is then used to investigate the sound propagation throughout the area of interest. Please see Table 2 demonstrating the acceptable calibration of this model and please see Figure 9 (pg. 8) for a representation of specific off-campus measurement points that were analyzed.

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**Figure 8: Sound Source Location and Sound Power Level**



**Table 2: Model Calibration**

Meter	Measured L1 (dBA)	Modeled L1 (dBA)	Delta (dB)
M1	74.84	73.20	1.64
M2	69.20	67.30	1.90

**Figure 9: Location of Individual Points Where Modeled Levels Were Investigated**



**Current Conditions with Modeled 6’ Barrier At Current Fence Line**

Polysonics has prepared noise contours for the site and analyzed specific points for current conditions as well as for the addition of a barrier along the existing fence. Please see Figure 10 (pg. 18) for the unmitigated Average Sound Levels ( $L_{EQ}$ ) for this site. Please see Figure 11 (pg. 19) for the unmitigated Peak (maximum) Sound Level (L1) for the current conditions and see Figure 12 (pg. 20) for the L1 Sound Levels as mitigated by a 6’ high barrier along the existing fence line. Please see Table 3 for the results as modeled at the various points shown in Figure 9 (pg. 8).

**Table 3: Modeled L1 Sound Level at Various Locations Around the Site**

Position	Modeled $L_{EQ}$ (AVERAGE LEVEL)	Modeled L1 (PEAK LEVEL)	Modeled L1 (PEAK LEVEL)	Delta L1
	dBA	dBA	dBA	(dB)
5' Height	No Barrier	No Barrier	6ft Barrier	6ft Barrier
N1-1	45.8	60.8	59.2	1.6
N1-2	50.6	65.6	62.6	3.0
N1-3	47.6	62.6	60.9	1.7
N2	49.7	64.7	62.5	2.2
N3	48.8	63.8	62.2	1.6
N4	49.1	64.1	62.2	1.9
N5	49.5	64.5	62.2	2.3
N6	47.3	62.3	60.6	1.7
N7	43.3	58.3	57.3	1.0
N8	46.6	61.6	60.0	1.6

Polysonics understands that, per zoning ordinance, the highest fence that can be at this property line is 6’. The current fence on the site is nominally 6’ high. The barrier material expected to be used here consists of a mass-loaded vinyl type product that can be directly affixed to something like a chain link fence (more on this below). Any of the barrier products described in this report will have sufficient attenuation to enable effective operation.

**Future Conditions with 6’ Barrier At Fence Line and New Administrative Controls**

After the initial results detailed above were known and reviewed with The School, Polysonics was asked to investigate some changes to the playground configuration. Polysonics was informed that the school intends to enforce a 15’ buffer zone with no play on the playground side of the boundary fence. This required the movement of the swing set as well as moving an area where children were observed playing farther away from the fence. Please see Figure 13 (pg. 21) showing how this 15’ buffer was implemented in the acoustical model for general play. The School requested two different swing set locations to be investigated; the first one (Swing #1) places the swing set near the parking lot on the SW side of the school and the second one (Swing #2) places the swing set near the field on the NE side of the school. The initial swing set location is described as Swing #0. Please see Figures 14 (pg. 22) and

15 (pg. 23) for the noise contours for Swing #1 and Swing #2 configurations; please see Table 4 for these results as modeled at the various points shown in Figure 9 (pg. 8).

**Table 4: Modeled L1 Sound Level at Various Locations: Including Administrative Controls**

Position 5' Height	Modeled L1 (dBA)				Delta L1 (dB) - Comp to No Barrier		
	NO Barrier (Swing #0)	6ft Barrier (Swing #0)	6ft Barrier (Swing #1)	6ft Barrier (Swing #2)	6ft Barrier (Swing #0)	6ft Barrier (Swing #1)	6ft Barrier (Swing #2)
N1-1	60.8	59.2	58.6	58.2	1.6	2.2	2.6
N1-2	65.6	62.6	61.3	61.0	3.0	4.3	4.6
N1-3	62.6	60.9	59.8	59.7	1.7	2.8	2.9
N2	64.7	62.5	61.4	61.3	2.2	3.3	3.4
N3	63.8	62.2	61.6	61.6	1.6	2.2	2.2
N4	64.1	62.2	62.0	62.2	1.9	2.1	1.9
N5	64.5	62.2	62.1	62.5	2.3	2.4	2.0
N6	62.3	60.6	60.5	61.1	1.7	1.8	1.2
N7	58.3	57.3	57.1	57.7	1.0	1.2	0.6
N8	61.6	60.0	59.9	60.7	1.6	1.7	0.9

Per discussions with the client, adding an acoustical barrier is virtually certain so this analysis of the efficacy of the administrative controls includes the barrier in all cases. Table 4 shows that the additional administrative controls further reduce the sound levels seen at the off-campus site immediately to the northwest of the property for a total reduction of ~4.5 dB as compared to ~3 dB without the administrative controls. Given the small difference seen when the swing set is moved over to the other side of the campus, we understand that it is the implementation of the buffer (moving the playing children away from the fence) that had the biggest impact here.

Regarding where to put the swing set, this analysis shows that with respect to the sound levels experienced at the off-campus points that were evaluated, there is no difference in the two swing set locations that were evaluated. As discussed above, for a level difference to be perceived by humans, it needs to be at least 2 dB.

**Suitable Barrier Products**

A common barrier material when an existing chain link fence can be used consists of a limp mass based on a material called “mass-loaded vinyl”; many other constructions would also be viable, e.g., solid construction such as wood fencing with overlapping members to ensure no gaps or even masonry. This site is configured in such a way as to require the nominal STC rating of a barrier material to be only in the range of ~15 which is rather easy to achieve. While not under consideration, Polysonics advises that any fencing beyond a typical residential height be evaluated by a responsible professional engineer for wind-loading and other possible structural concerns.

It should be understood that increasing the nominal STC rating of the barrier material beyond a certain point *does not* increase the effective attenuation of the barrier. In this case, the STC rating of the barrier material needs to be at or above ~15, which is about what a low-cost hollow-core interior door can achieve. If this barrier were to be constructed from 2” of solid lead, it would perform the same as if it were fabricated with ½” plywood.

Here are some links to suitable mass loaded vinyl type products ready to affix to chain link fences:

- <https://www.fencescreen.com/Fence-Privacy-Screen-Netting/850-Series-SoundBlock.aspx>
- <https://acoustiblok.com/acoustiblok-soundproofing-product-lines/acoustifence-noise-reducing-fences/>
- <https://sportsonicguard.com/products/>

If further guidance regarding a suitable product in this category is needed, do not hesitate to reach out.

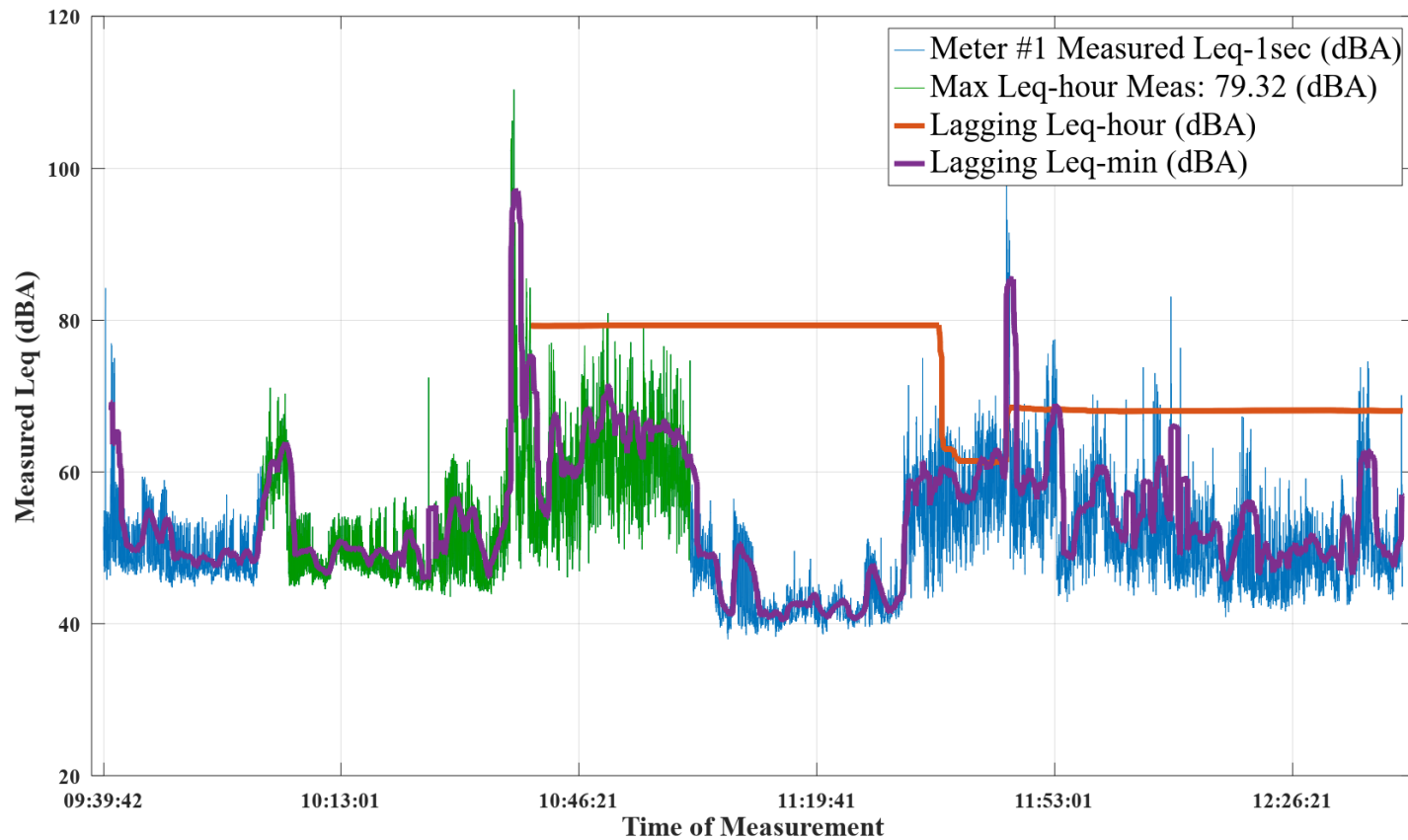
# APPENDIX

**Figure 1: Measurement Locations on Site**



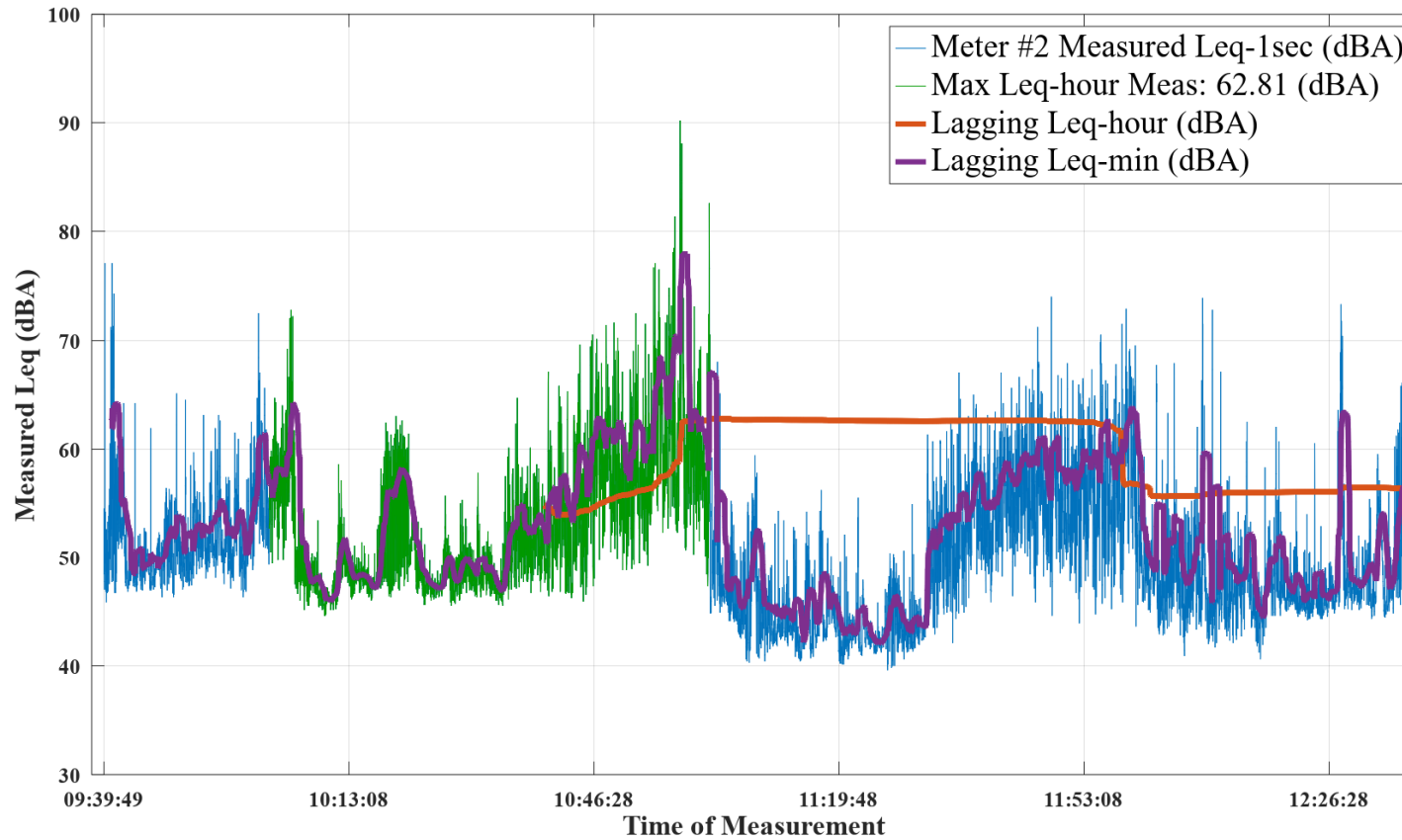
**Figure 2: Measurement Location M1 Data (Time History)**  
**Green Hedges, Ambient SPL: Meter #1**

Analysis Start: 10-Mar-2026 09:39:42 Analysis End: 10-Mar-2026 12:41:47

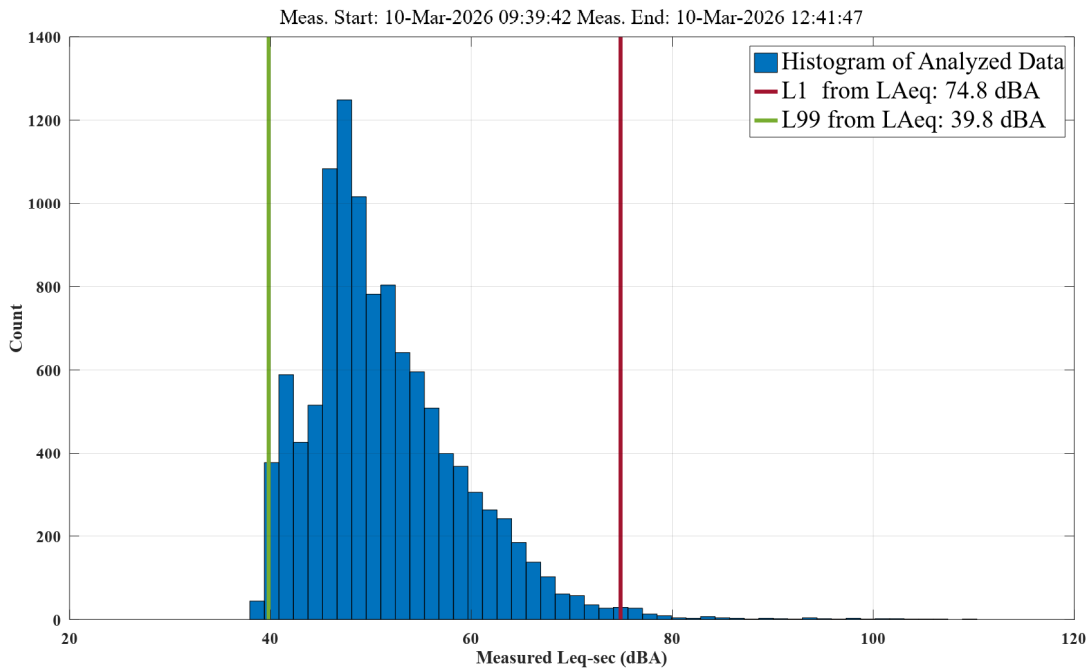


**Figure 3: Measurement Location M2 Data (Time History)**  
**Green Hedges, Ambient SPL: Meter #2**

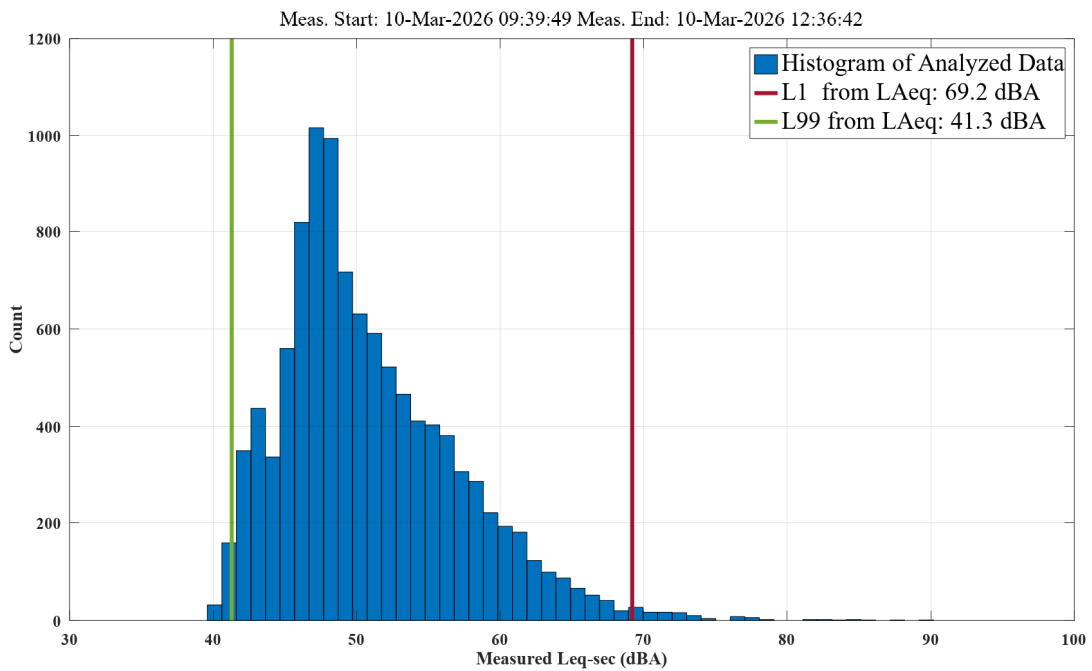
Analysis Start: 10-Mar-2026 09:39:49 Analysis End: 10-Mar-2026 12:36:42



**Figure 4: Measurement Location M1 Data (Histogram)**  
**Green Hedges, SPL Time History: Meter #1**



**Figure 5: Measurement Location M2 Data (Histogram)**  
**Green Hedges, SPL Time History: Meter #2**



**Table 1: Observations Made During Measurements**

Time	Notes
Start/Set Up	Consistent dog barking in neighbor's yard near M1
1001	Approximately 20 kids, older elementary, gather mainly around swings
1008	Kids go inside, no further playing
General	Children/classes regularly walk between buildings
1025	Approximately 30 kids (around 2nd or 3rd grade) PE class, running on pavement
1034	Approximately 15 kids (1st or 2nd) enter playground
1038	PE class stops running, more class activity on pavement play area
1045	Approximately 15 kids (1st or 2nd) enter playground
General	Kids allowed to go between playground and pavement play area freely
1053	One very loud child shouting
1055	Collective loud children shouting
1102	All kids on playground line up to leave
1104	Playground vacated except for kids from earlier PE class
1105	Playground empty
1107	PE class gone
1131	Small class arrives on playground, 5 kids (kindergarten?)
1132	6 more kids (kindergarten) on playground
1138	20 more kids (kindergarten) on playground
1142	Dog can be heard from inside my car, again at 1148
1147	Older kids come outside with lunch
1149	Emergency vehicle sirens
1200	Bell rung for kids on playground to line up
1202	Playground empty
1205	Older kids from lunch group allowed on playground, come and go (15 kid peak)
1216	Half of the older kids group goes inside
1228	1st, 2nd, or 3rd graders come out for lunch
1230	Playground mostly empty (2 older kids)
1235	1st, 2nd, 3rd graders allowed on playground, approximately 10 kids
General	M1 was moved or knocked into, observed on collection

Approx. 60 Children on Playground at Peak
Approx. 30 Children on Playground at Peak

**Figure 10: Site Noise Contours: Existing Conditions – AVERAGE SOUND LEVEL**



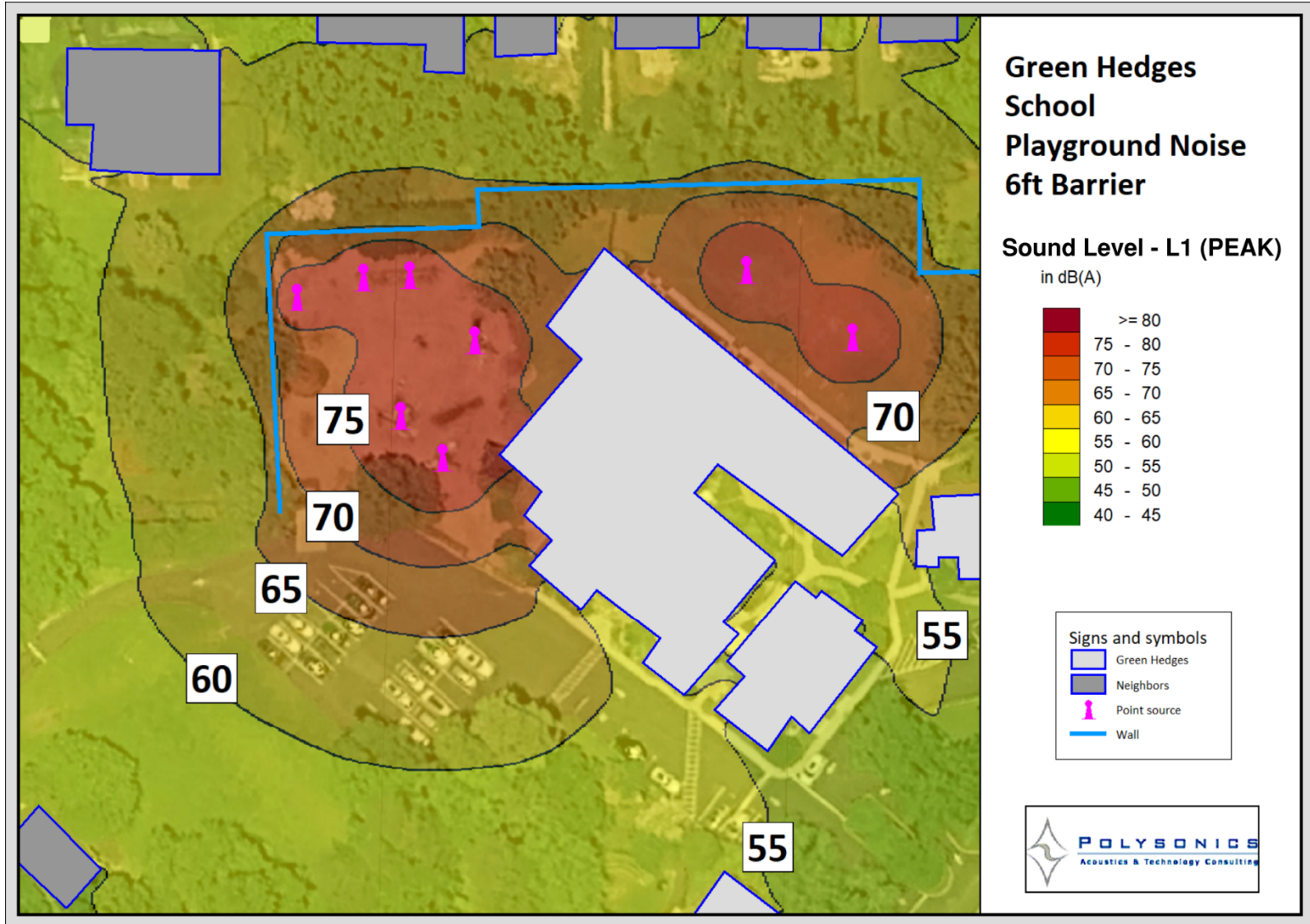
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**Figure 11: Site Noise Contours: Existing Conditions**



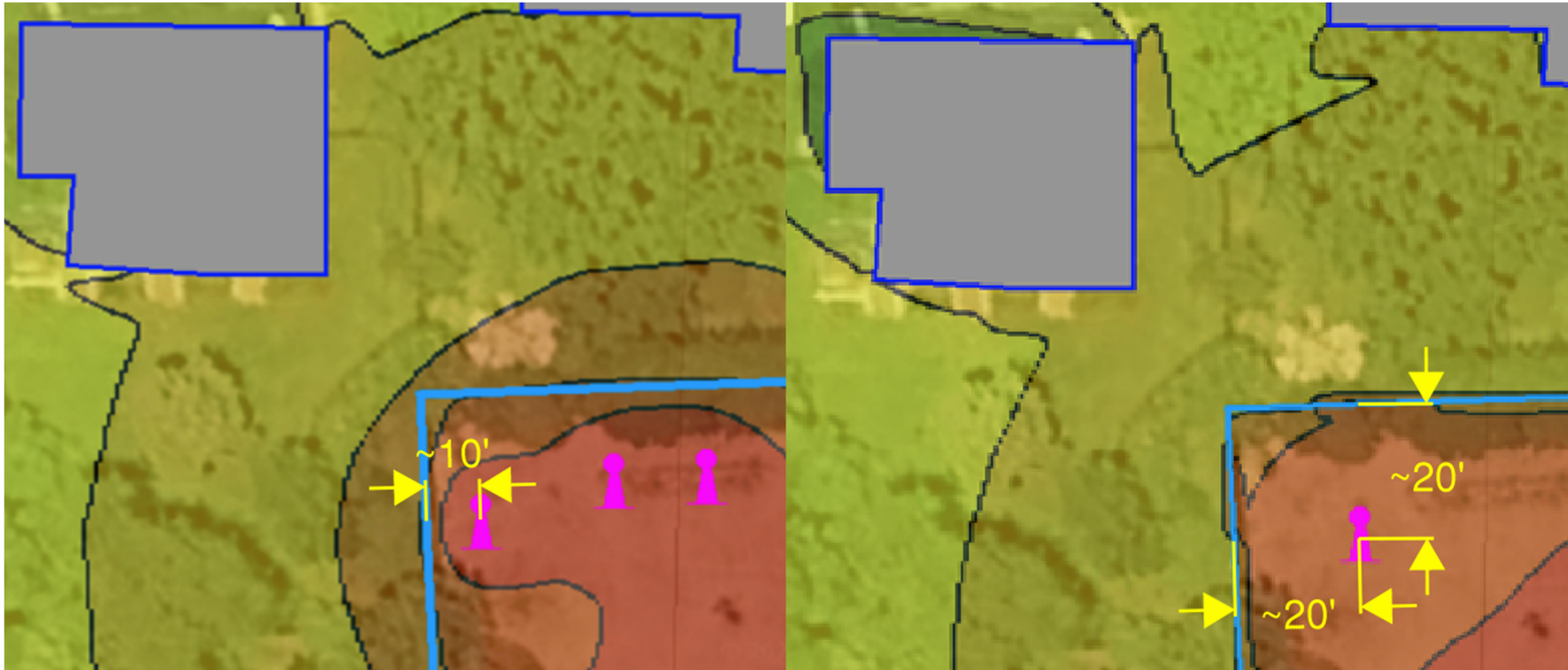
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**Figure 12: Site Noise Contours With 6' Barrier at Current Fenceline**



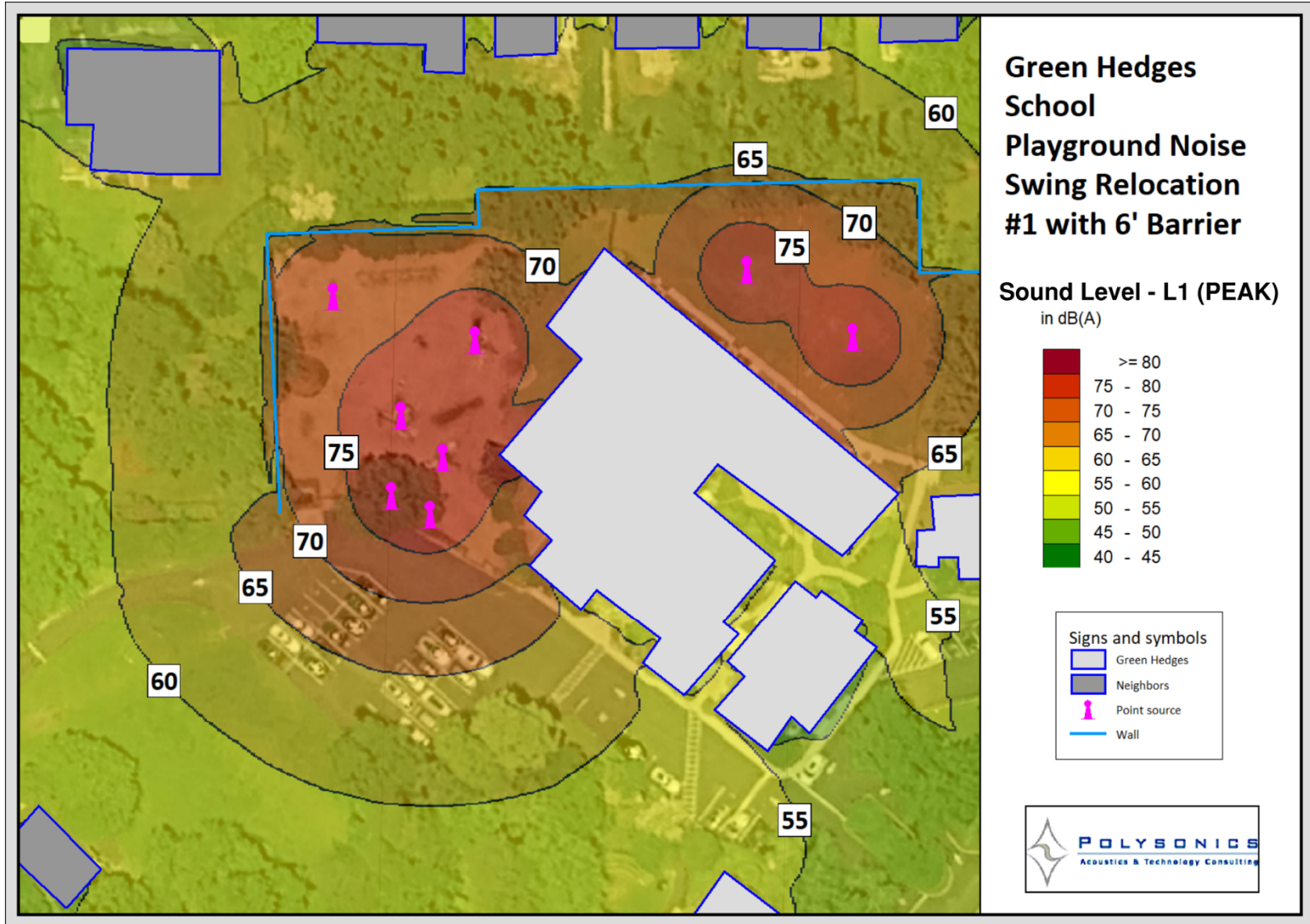
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**Figure 13: Figure Demonstrating New 15' “No Play” Buffer**



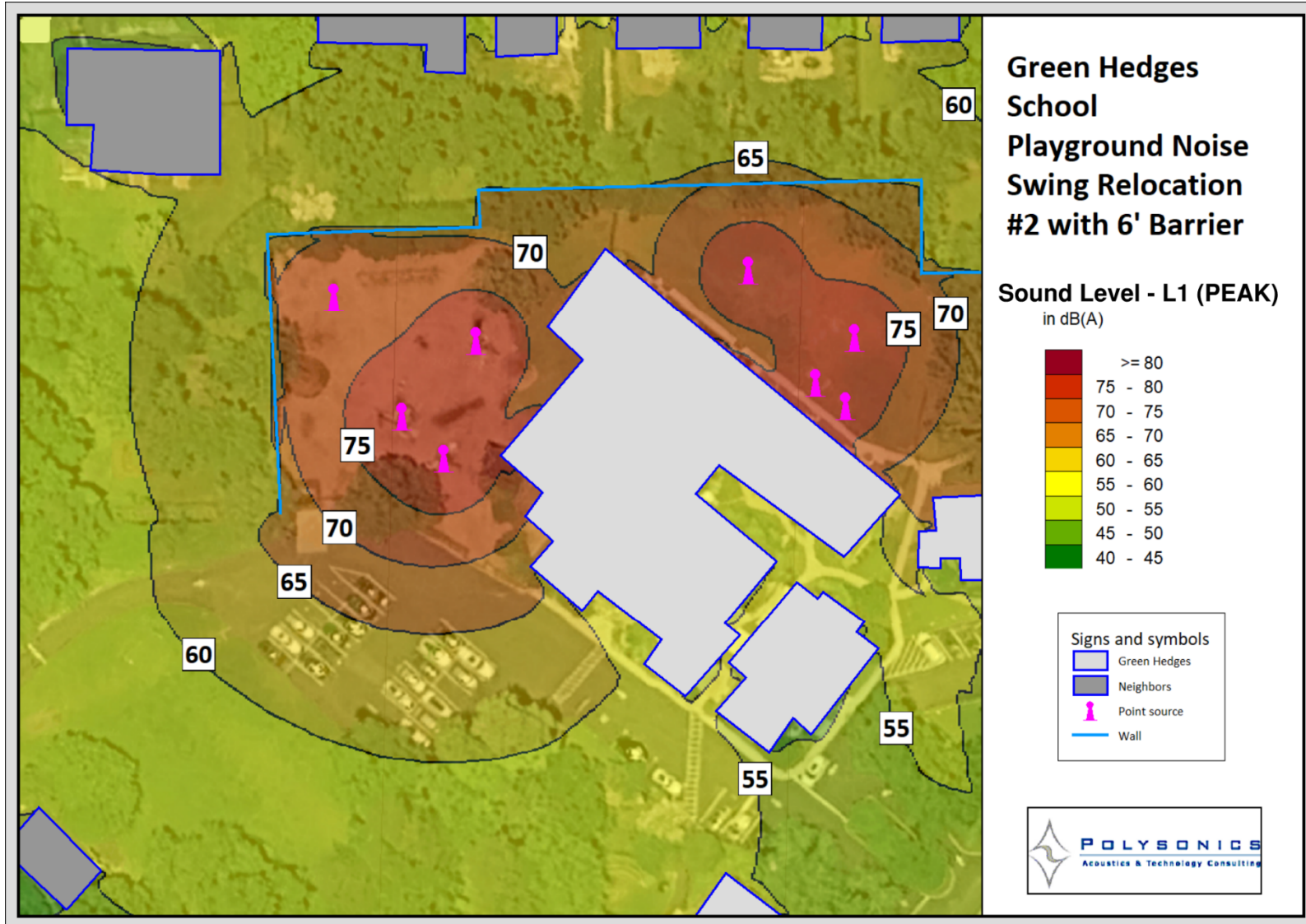
*Note: dimensions were measured with Google Earth and are, therefore, approximate.*

**Figure 14: Site Noise Contours With 6' Barrier and Administrative Controls (Swing #1)**



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**Figure 15: Site Noise Contours With 6' Barrier and Administrative Controls (Swing #2)**



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