

Prepared For: Cohen & Wolf, P.C.

Point of Contact: Philip C. Pires

**Prepared by: Acoustical Technologies Inc.
 50 Myrock Avenue
 Waterford, CT 06385-3008**

**Subject: Mayflower Special Permit Application
 116 Woodbury Road
 Washington, CT 06793
 Airborne Acoustic Analysis**

Author: Carl Cascio

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Summary

Acoustical Technologies Inc (“**ATI**”) has reviewed (i) the letter dated November 12, 2021 (the “**BAC Letter**”) from Brooks Acoustic’s Corporation (“**BAC**”) to Mr. Mohit Girdhar - Interim General Manager at Auberge Resorts Collection², (ii) Mitigation Plan White Paper (the “**White Paper**”) prepared for the Mayflower Inn dated November 12, 2021 from Powerstation Events (“**Powerstation**”) ⁴, (iii) the application for Special Permit (the “**Special Permit Application**”) from MSFPA2013 (“**Auberge/Mayflower**”) dated November 15, 2021⁷, and, in particular, the following statement from reference 2.

BAC in its BAC Letter indicates that its proposed noise mitigation is calculated to result in a 35 dBA noise level at the nearest neighbor: *“Based on this analysis, it is the opinion of BAC that with a reasonable degree of engineering certainty that the establishment of the special use will be in harmony with or compatible with its neighbors and generally consistent with the comprehensive plan. Therefore, the proposed facility will have little or no impact on the surrounding residential neighborhood.” (See page 12 of the BAC Letter)*

ATI disagrees. This document makes a negative acoustic assessment that should assist in denying the Special Permit Application made by Mayflower Inn 2013, LLC in Washington, CT. An acoustic assessment plan was developed and executed to provide airborne acoustic information useful in explaining the potential airborne noise issues associated with music during weddings and other events at the Hospitality Tent. **It is important to state that the airborne noise generated by the events, based upon the proposed BAC and Powerstation designs, will seriously impact the neighbors surrounding the Auberge/Mayflower facility.**

The airborne noise levels produced by the Hospitality Tent operating at the Mayflower site were calculated both with and without the noise mitigation designs proposed by Brooks Acoustics and Powerstation Events. Nearby Residential property locations see the event noise at airborne noise levels as high as 75 dBA with the current (2021) tent configuration. These noise levels are about 20 dB higher than the daytime Residential noise limits in the CT Noise Ordinance¹. The proposed designs reduce these noise levels by about 10 dB resulting in 65 dBA estimated levels.

Brooks Acoustics² proposed noise mitigation that they calculated to result in a 35 dBA noise level at the nearest neighbor. Unfortunately, the noise mitigation proposed by BAC and Powerstation cannot provide 40 dB of mitigation needed to reach 35 dBA airborne noise levels at the nearest neighbors. From the BAC report: *“It is conservatively estimated that these features will reduce the level of sound which leaves the Hospitality Tent by about **25 to 30 dBA.**”²*

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Our summary findings are as follows:

Brooks Acoustics proposes a music shed that effectively attenuates the sound transmission through the walls of the music shed. All the sound is directed out of the shed in the south easterly direction. Powerstation Events adds speakers inside the tent to effectively smooth out the directed sound leaving the music shed. The result of these combined efforts provides the ability to make a more uniform music environment of approximately 100 dBA at 5 feet when there are 120 people in the tent. This approach defeats the purpose of having a music shed since the music is no longer directed to the south east. The noise mitigation is reduced approximately to that provided by the BAC absorber panel design (8 to 10 dB).

Assume the Powerstation design is eliminated and there are no multiple small format loudspeakers in the tent and then just look at the sound directly leaving the music shed. Some of that sound will diffract around the west edge of the shed and head towards the neighbors. This diffraction was calculated and the sound level at the closest neighbor dropped from 75.4 dBA to 65.3 dBA. If we add another 10 dB for the absorber panels on the tent walls the result is about 55 dBA, not the 35 dBA that was predicted by Brooks Acoustics. Because of the diffraction around the west edge, the shed is probably capable of only about a 10 dB improvement over not having a shed. This means that with the proposed BAC mitigation approach only a 20 dB total improvement is possible if the Powerstation speakers are either turned off or eliminated.

The CT Noise Ordinance calls for review of acoustic issues associated with prominent discrete tones. Event music may invoke the 5 dB lower noise limit for discrete tones. The proposed design will also require a noise vestibule to avoid violating the CT noise ordinance when doors are opened and music is playing. A closed building would be a more appropriate event location.

- For 2021 events at Auberge/Mayflower, nearby residential property locations experienced the event noise at airborne noise levels as high as 75 dBA with the current (2021) tent configuration. BAC/Powerstation proposals only provide about 10 dB reduction in noise levels from 2021 levels, resulting in 65 dBA estimated noise levels for a typical Wedding Event at nearby neighbors. **The 65 dBA airborne noise levels do not comply with the CT Noise Ordinance.**
- **BAC's proposed noise mitigation fails to meet BAC's stated goals:** The noise mitigation proposed cannot provide the 40 dB of mitigation needed to reach the 35 dBA noise level at the nearest neighbor proposed by BAC. Powerstation adds multiple small format loudspeakers inside the Hospitality Tent to effectively smooth out the directed sound leaving the Music Shed. This approach defeats the purpose of having a Music Shed since the music is no longer directed to the south east. The noise mitigation is reduced approximately to that provided by the absorber panels proposed in the BAC Letter. This mitigation is only 8 to 10 dB, not the 40 dB needed to reach 35 dBA.
- The results show that the currently planned noise mitigation does not meet the State of Connecticut airborne noise requirements at the closest nearby properties in the R-1 Residential Zone. ATI's Recommendation: **Deny the Special Permit Application.**

Introduction

Acoustical Technologies Inc. was tasked with an assessment of potential acoustic issues associated with a Mayflower Inn 2013, LLC Special Permit Application⁷ requesting permission to hold wedding and other events at the Mayflower site at 116 Woodbury Road in Washington, CT. Responding to a request from Philip Pires acoustical analysis of the airborne noise leaving a tent on the Mayflower property and reaching the adjacent residential properties is to be studied. A survey of the property line airborne noise levels produced by the amplified music from previous and future wedding ceremonies will be made in order to identify any potential airborne noise issues. These airborne noise estimates will be based on estimated tent airborne noise levels supplied by Brooks Acoustics Corporation² as well as the proposed acoustic mitigation. This document provides an acoustic assessment to assist in addressing acoustic noise concerns for the special permitting of events for the Mayflower Inn 2013, LLC in Washington, CT.

Development of the Acoustic Assessment

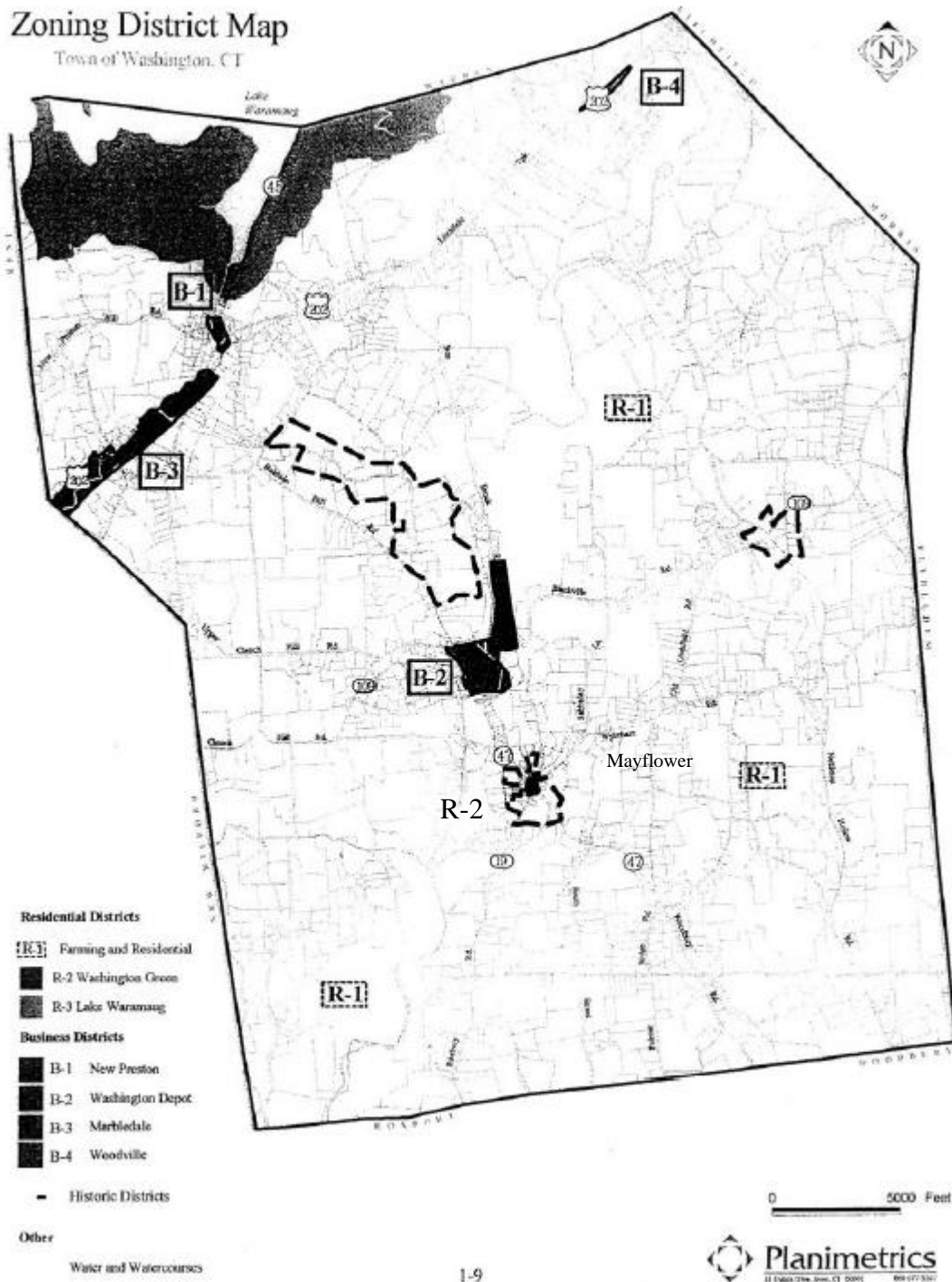
The purpose of this effort is to develop acoustic information useful in understanding the potential airborne noise issues associated with Mayflower Inn 2013, LLC events at the 116 Woodbury Road site. The Mayflower tent site is located in a R-1 Residential zone. The site is adjacent to a R-2 Residential Historic District to the southwest. A B-2 Business zone is about a mile away to the northwest. (The Washington zoning map is given in Figure 1.) It is important to determine whether the Mayflower events' airborne noise will negatively impact the residential neighbors.

The acoustic impact is assessed in the following way. The event operating airborne noise levels were measured during 2021 by a neighbor. Using this data and the source level data from reference 2, the noise levels at nearby property lines will be calculated using the Noise Tools application³. The noise calculations are then compared to the allowable noise levels in the State of Connecticut Noise Ordinance. This approach then follows the traditional "What is the airborne noise level at the neighbor's property line?". Is the airborne noise below the allowable airborne noise levels? This estimated data can also be used to estimate noise levels after including the noise mitigation proposed by Brook Acoustics. The effect of background noise can also be considered. The acoustic data is then used to evaluate the effectiveness of the noise treatments. Because of the closeness of the tent to the nearest neighbors, noise mitigation is included in the Special Permit Application and will be reviewed to see if it is sufficient to address the neighbor's concerns about the airborne noise.

Table 1 provides the results of the Noise Tools' calculations based on a 100 dBA source level at a distance of 5 feet as given in ref. 2 for a party of 120 people. See the following on page 6². *"For a larger venue such as the Mayflower Inn Hospitality Tent with up to 120 guests, the sound level can increase up to about 100 dBA at 5 feet."*

The hospitality tent is at an elevation of approximately 696 feet. Table 1 includes the property line elevations taken from Google Earth Pro so that the difference in elevations can be included in the Noise Tools Calculations. Location 15 is both calculated and was measured during a wedding event. The homeowner's measurement was about 6 dB higher than the calculation indicating the possibility that levels higher than 100 dBA at 5 feet may occur for some events.

Figure 1. Washington Zoning Map



At the Mayflower site event operating airborne noise calculations were made at the following fifteen nearby locations in the Residential Zone:

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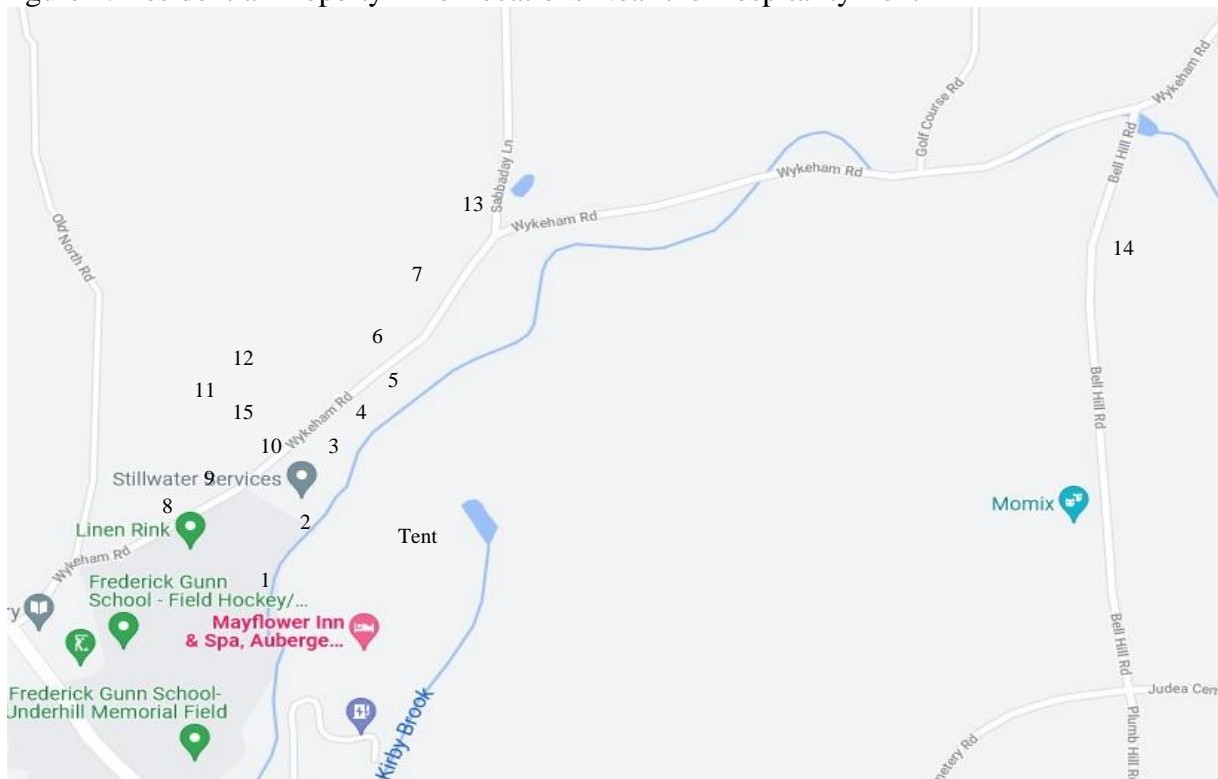
Table 1. 2021 Estimates of Airborne Noise at Nearby Property Lines

| | Distance | Elevation | Difference | dB(A) |
|---|------------|-----------|--------------|-------|
| 1. 21 Wykeham Road | 134 meters | 653 feet | -13.1 meters | 75.5 |
| 2. 23 Wykeham Road | 135 meters | 650 feet | -14 meters | 75.4 |
| 3. 25 Wykeham Road | 177 meters | 670 feet | -7.9 meters | 73.1 |
| 4. 27 Wykeham Road | 164 meters | 664 feet | -9.8 meters | 73.7 |
| 5. 29 Wykeham Road | 154 meters | 658 feet | -11.6 meters | 74.3 |
| 6. 32 Wykeham Road | 220 meters | 682 feet | -4.3 meters | 71.2 |
| 7. 42 Wykeham Road | 260 meters | 673 feet | -7 meters | 69.7 |
| 8. 2 Old North Road | 303 meters | 720 feet | 7.3 meters | 68.3 |
| 9. 4 Old North Road | 270 meters | 701 feet | 1.5 meters | 70.8 |
| 10. 6 Old North Road near property line | 213 meters | 683 feet | -4 meters | 71.5 |
| 11. 8 Old North Road | 305 meters | 693 feet | -0.8 meters | 70.1 |
| 12. 16 Old North Road | 288 meters | 753 feet | 17.4 meters | 68.7 |
| 13. 3 Sabbaday Lane | 430 meters | 698 feet | 0.3 meters | 67.5 |
| 14. 14 Bell Hill Road | 890 meters | 854 feet | 48.2 meters | 58.6 |
| 15. 6 Old North Road near house | 274 meters | 734 feet | 11.6 meters | 69.2 |

Measurement by homeowner → mid 70's

The Google satellite map in Figure 2 shows the approximate property line locations. Figures 3 and 4 show the Noise Tools Calculation at 23 Wykeham Road and 6 Old North Road. Note that the tent is about 14 meters above 23 Wykeham Road and about 11.6 meters below the 6 Old North Road locations. The elevation difference reduces the noise level by 1 dB(1st) or 2 dB(2nd).

Figure 2. Residential Property Line Locations Near the Hospitality Tent



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Figure 3. Noise Tools Prediction at 23 Wykeham Road for 2001 Events (Position 2)

Sound Propagation Level Calculator

[Interactive noise source-to-receiver diagram with barrier calculations](#)

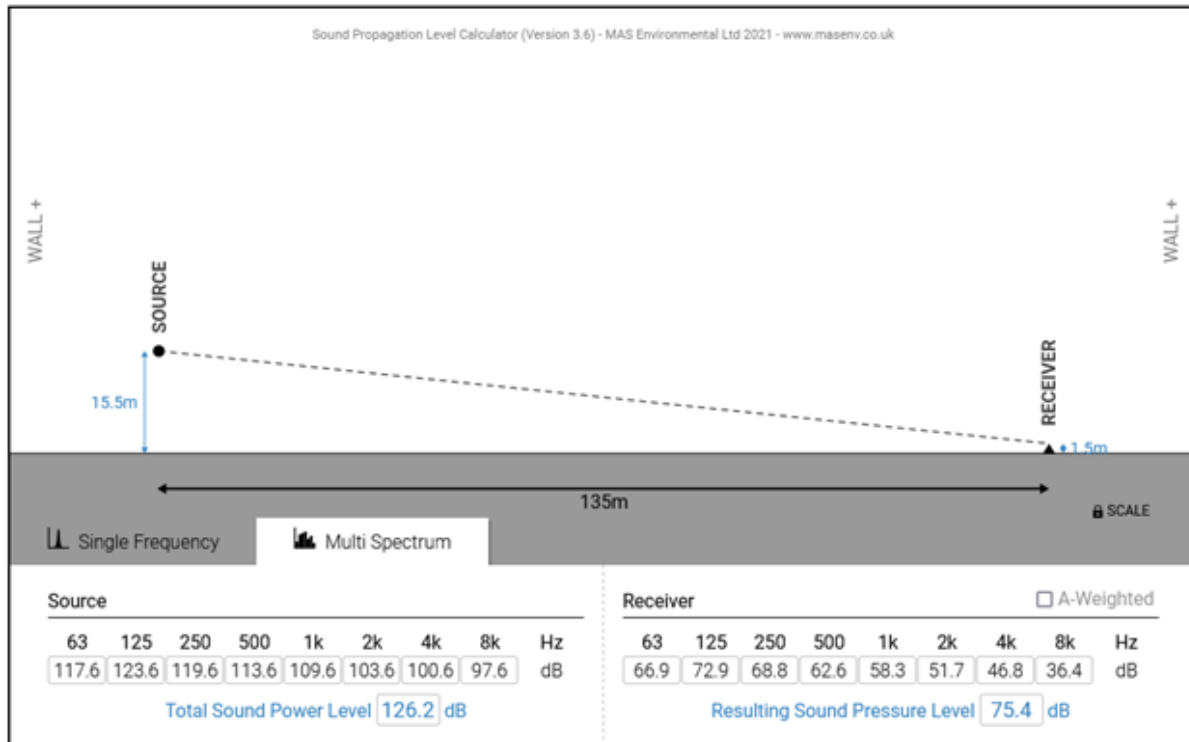
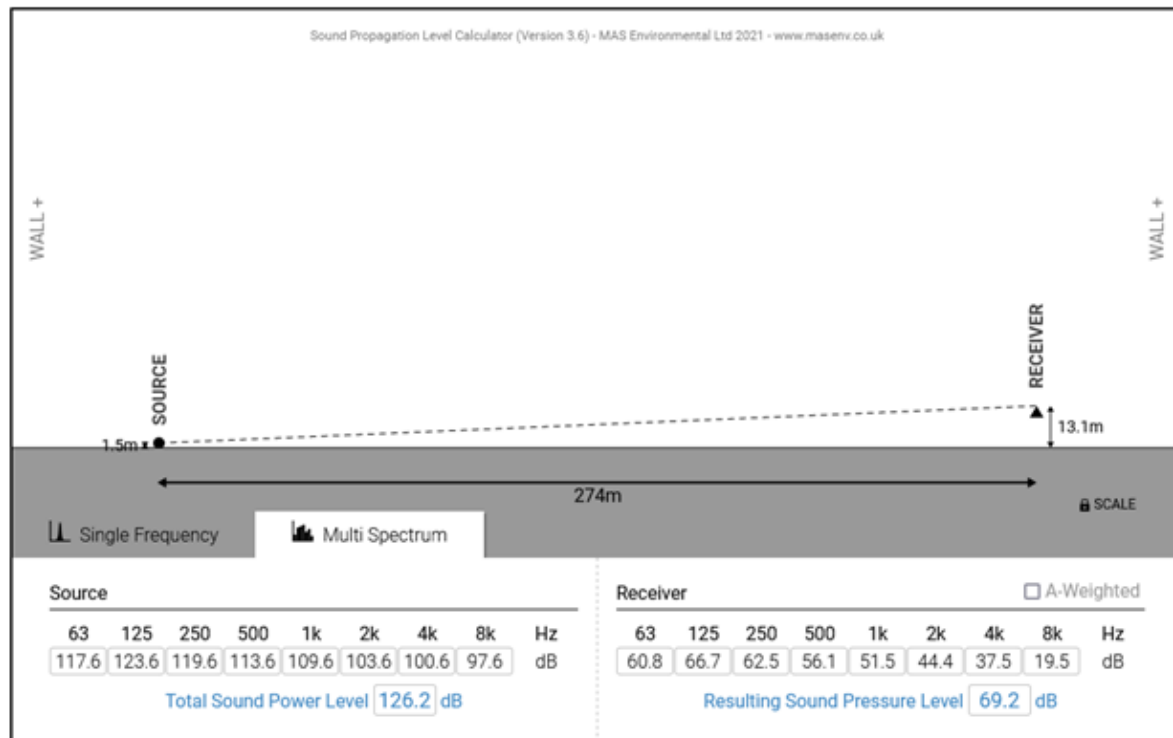


Figure 4. Noise Tools Prediction at 6 Old North Road for 2001 Events (Position 15)

Sound Propagation Level Calculator

[Interactive noise source-to-receiver diagram with barrier calculations](#)



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Table 2. 2022 Estimates of Airborne Noise at Nearby Property Lines with 4 Mitigation Levels

| | 2021 | 2022 – 20 dB | 2022 – 25 dB | 2022-30 dB | 2022-40 dB |
|-----------------------|------|--------------|--------------|------------|------------|
| 1. 21 Wykeham Road | 75.5 | 55.5 | 50.5 | 45.5 | 35.5 |
| 2. 23 Wykeham Road | 75.4 | 55.4 | 50.4 | 45.4 | 35.4 |
| 3. 25 Wykeham Road | 73.1 | 53.1 | 48.1 | 43.1 | 33.1 |
| 4. 27 Wykeham Road | 73.7 | 53.7 | 48.7 | 43.7 | 33.7 |
| 5. 29 Wykeham Road | 74.3 | 54.3 | 49.3 | 44.3 | 34.3 |
| 6. 32 Wykeham Road | 71.2 | 51.2 | 46.2 | 41.2 | 31.2 |
| 7. 42 Wykeham Road | 69.7 | 49.2 | 44.2 | 39.2 | 29.2 |
| 8. 2 Old North Road | 68.3 | 48.3 | 43.3 | 38.3 | 28.3 |
| 9. 4 Old North Road | 70.8 | 50.3 | 45.3 | 40.3 | 30.3 |
| 10. 6 Old North Road | 71.5 | 51.5 | 46.5 | 41.5 | 31.5 |
| 11. 8 Old North Road | 70.1 | 50.1 | 45.1 | 40.1 | 30.1 |
| 12. 16 Old North Road | 68.7 | 48.7 | 43.7 | 38.7 | 28.7 |
| 13. 3 Sabbaday Lane | 67.5 | 47.5 | 42.5 | 37.5 | 27.5 |
| 14. 14 Bell Hill Road | 58.6 | 38.6 | 33.6 | 28.6 | 18.6 |
| 15. 6 Old North Road | 69.2 | 49.2 | 44.2 | 39.2 | 29.2 |

Brooks Acoustics predicts a 35 dBA airborne noise level at the nearest house (Page 10²). Their report assumes a distance of 500 feet. The CT Noise Ordinance stipulates measurements at the property line.

“(g) Measurements taken to determine compliance with Section 3 shall be taken at about one foot beyond the boundary of the Emitter Noise Zone within the receptors’s Noise Zone.”¹

Section 22a-69-5 Page 16. The property line for the closest property is about 135 meters (443 feet) which raises Brooks estimate by about 1 dB at the property line. In any case, it is clear from Table 2 that **the noise mitigation has to be about 40 dB, not 25 to 30 dB in order to achieve the 35 dBA level displayed in the Brooks Acoustics report.**

“When the green light is on, the music level will be such that the resulting sound at the nearest neighbor (~ 500 feet distance) is within the limits set by the Regulations of Connecticut State Agencies (RCSA Section 22a – 69) and be at or below the design target level.”²

*“Musical entertainment acts will be housed inside a sound-isolating Music Shed building inside the Hospitality Tent. Also, sound absorbing and blocking materials will be installed and added to the existing tent which will further reduce the amount of sound which may escape the tent facility. It is conservatively estimated that these features will reduce the level of sound which leaves the Hospitality Tent by about **25 to 30 dBA.**”²*

Analysis

This section analyzes the airborne noise levels predicted at the Mayflower site with the new mitigation measures suggested in reference 2. An estimate of the source level and transmission loss to nearby properties during event operation is then calculated by two methods. These levels are then compared to the noise limits in the Connecticut noise ordinance and the predictions from the Mayflower Mitigation Plans. These estimated levels will identify which nearby locations do or do not meet the airborne noise requirements.

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Brooks Acoustics proposes a music shed in reference 2 that effectively attenuates the sound transmission through the walls of the music shed. All the sound is directed out of the shed in the south easterly direction and then into the tent. Powerstation Events in reference 4 adds speakers inside the tent to effectively smooth out the directed sound leaving the music shed.

“Multiple small format loudspeakers will be focused and individually controlled providing a near-field audio environment throughout the event space.” Page 2⁴

The result of these combined efforts is essentially to provide the ability to make a more uniform music environment of approximately 100 dBA at 5 feet when there are 120 people in the tent. To a great extent this approach defeats the purpose of having a music shed since the music is no longer directed in just the south easterly direction. We would now have a tent where the majority of its surface area is exposed to a sound level radiating approximately 100 dBA when measured at 5 feet. Airborne noise levels in 2021 had just the tent walls to attenuate the music and the results for the nearby neighbors are shown in Table 1. The airborne noise levels in 2022 will have the tent walls plus the acoustic absorber material placed on the walls of the tent. Given this approach the mitigation is limited to roughly 10 dB not the 40 dB needed to reach the much lower 35 dBA noise levels at the nearest neighbor. Closest neighbors would see 65 dBA levels.

“The sound absorbent panels will decrease the emitted sound from the tent by between 8 and 10 dB.” Page 4²

Another very important issue of concern is the music that is diffracted around the edge of the music shed. Assume that we turn off the multiple small format loudspeakers that are in the tent and just look at the sound directly leaving the music shed. Some of that sound will diffract around the west edge of the shed and head towards the nearby neighbors. This diffraction is depicted in Figure 5. We assume the shed is about 20 feet wide and the source is in the center about 1 meter back from the front edge of the shed. Figure 5 shows that the level at the closest neighbor has dropped from 75.4 dBA to 65.3 dBA. If we add another 10 dB for the absorber material on the tent walls the result is about 55 dBA, not the 35 dBA that was predicted in reference 2. If we move the source further back from the edge by a half meter the noise level at 23 Wykeham only drops by 1 dB. If we move the source from the middle to 5 feet from the west edge the noise level at 23 Wykeham again only drops by 1 dB. Because of the diffraction around the west edge, the shed is probably capable of only about a 10 dB improvement over not having a shed. This means that by this mitigation approach only a 20 dB total improvement is possible. The nearest neighbors would see 55 dBA levels, near or just below the daytime CT noise limit.

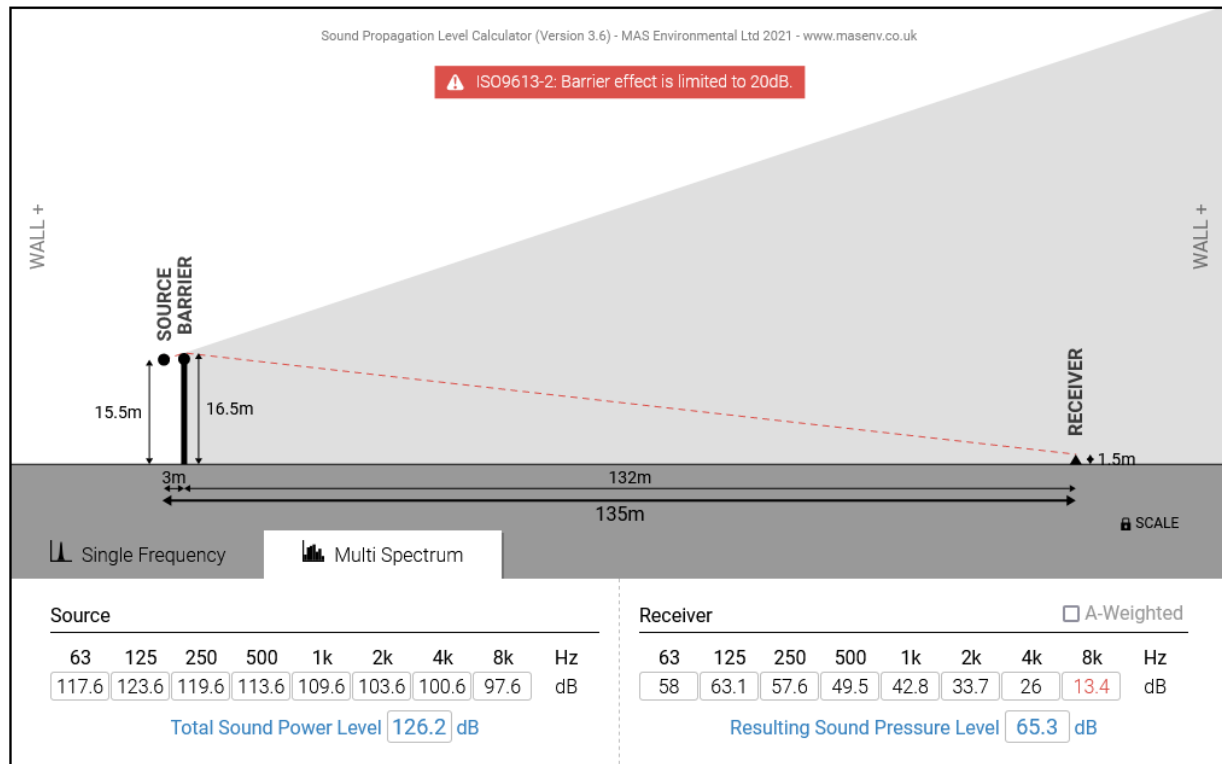
Brooks Acoustics mentions that site observations were made but no measurements of the noise level at neighboring property lines were included in their report.² Without actual measurements, estimates of the transmission loss must be used that can be inaccurate. It is recommended that an acoustic test be conducted with a measured source at the tent location and receivers at the ten closest neighbors in order to determine how much propagation loss actually occurs. With this information the amount of necessary noise mitigation can accurately be determined.

“As part of this study, site observations were made to assist in the evaluation of the Tent acoustics and visits were made to the neighborhood in the vicinity.” Page 1²

Figure 5. Diffraction Estimate at 23 Wykeham Rd for Music Shed with Source Centered in Shed

Sound Propagation Level Calculator

[Interactive noise source-to-receiver diagram with barrier calculations](#)



“Sound levels will be monitored inside the Hospitality Tent on a continuous basis. The monitor equipment will provide a visual indication to the entertainment providers and to the facility management regarding the acceptable volume level of the musical entertainment. This can take the form of green, yellow and red indicator lights. When the green light is on, the music level will be such that the resulting sound at the nearest neighbor (~ 500 feet distance) is within the limits set by the Regulations of Connecticut State Agencies (RCSA Section 22a – 69) and be at or below the design target level.” Page 5²

Given that the noise mitigation will probably be no more than 20 dB the only way to achieve the 35 dBA level at the nearest house will be to turn down the music within the tent using the musical entertainment management program. The 100 dBA at 5 feet will need to be lowered to about 80 dBA at 5 feet. Unfortunately, that level of sound is probably near or below the level of speaking noise generated by the 120 people in the tent. Music at 80 dBA at 5 feet is not going to work. The noise mitigation should be increased from the proposed 20 dB to about 40 dB.

Table 3 provides estimates of the sound attenuation produced by different types of wall construction⁵. These construction methods all provide a STC of at least 40 and would be capable of mitigating the airborne noise concerns. Note that addition of absorbing material provides 6 to 11 dB of improvement in the wall performance, similar to the 8 to 10 dB indicated by Brooks Acoustics. The Hospitality tent cannot provide the 40 dB of mitigation whereas a building can.

Table 3. STC Ratings for Walls Formed from Two Layers of Wallboard*

| Wall construction | Number of Layers of Wallboard on Each Wall Surface | | |
|---|--|------------|------------|
| | 1+1 | 1+2 | 2+2 |
| 38 x 89 mm wood studs with resilient steel channels on one side | 48 [40] | 52 [44] | 56 [52] |
| Staggered 38 x 89 mm wood studs | 50 [41] | 53 [47] | 55 [52] |
| Double row of 38 x 89 mm wood studs with small gap between them | 57 [46] | 60 [52] | 63 [57] |
| 90 mm steel studs | 45 [39] | 49 [45] | 56 [50] |
| 150 mm load-bearing steel studs with resilient metal channels on one side | 58 | 60 | 63 |

*Values not in brackets are for walls filled with sound absorbing material. Values in brackets are for walls without sound absorbing material.

Another issue is a lack of a vestibule in the current design. Opening the doors to the tent will defeat the mitigation currently planned. While the doors are open the noise levels at nearby properties will increase by 10 to 20 dB depending on whether 1, 2, 3 or 4 doors are open.

Prominent Discrete Tones

The Connecticut regulation for the control of noise states in *CT section 22a-69-3.3 Prominent discrete tones*: Continuous noise measured beyond the boundary of the Noise Zone of the noise emitter in any other Noise Zone which possesses one or more audible discrete tones shall be considered excessive noise when a level of 5 dBA below the levels specified in section 3 of these Regulations is exceeded. By my reading of the regulations the Hospitality Tent site is a Class A emitter in a Residential Zone. The noise zone standards in *CT section 22a-69-3.5* state that a Class A emitter cannot exceed the following overall sound pressure levels:

To Class C 62 dBA To Class B 55 dBA To Class A **55 dBA (day) 45 dBA (night)**

The discrete tones limits are 5 dBA lower so that no tone may be higher than the following:

To Class C 57 dBA To Class B 50 dBA To Class A **50 dBA (day) 40 dBA (night)**

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The presence or absence of significant tones in the music played in the tent has not been identified in the documents submitted for the Special Permit Application. For most music this will probably not be an issue. For some music it could be significant in that the music could meet the overall dBA limit but not the discrete tone limit which is 5 dB lower. This uncertainty makes it more necessary to aim for a 35 dBA goal at the closest property line with 40 dB of noise mitigation.

“Events will occur between 11 a.m. and 10:30 p.m.”⁷ After 10 pm the noise ordinance requires a 10 dB reduction in airborne noise in residential areas. (The Special Permit Application could be modified to end events at 10 pm so that the lower night time noise limit would not apply.)

Conclusions

The purpose of this effort is to evaluate the acoustical environment for the neighbors of the Mayflower site during operation of the Hospitality Tent. This effort has been accomplished and the results show that the currently planned noise mitigation does not meet the State of Connecticut airborne noise requirements at the closest nearby properties in the R-1 Residential Zone. As planned the nearest airborne noise levels would be as much as 65 dBA. Additional noise treatment is needed to address the noise issue and bring the currently excessive airborne noise levels down to the proposed 35 dBA level at the closest property.

References

- 1) CT DE&EP *Noise Control Regulation RCSA Section 22a-69-1 to 22a-69-7.4*
<http://www.ct.gov/dep/lib/dep/regulations/22a/22a-69-1through7.pdf>
- 2) Hospitality Tent Acoustical Design, Brooks Acoustics Corporation, 12 November 2021
- 3) <http://noisetools.net/noisecalculator2>
- 4) Mayflower Inn & Spa Mitigation Plan ..., Powerstation Events, 12 November 2021
- 5) http://web.mit.edu/parmstr/Public/NRCan/CanBldgDigests/cbd239_e.html
- 6) ASHRAE Handbook, page 224, ASHRAE-HANDBOOK-Sound-and-Vibration-Control.pdf,
[http://thermairsystems.com > uploads > 2011/10, 279 pages](http://thermairsystems.com/uploads/2011/10/279_pages)

7) **Special Permit Application** from MSFPA2013 (“**Auberge/Mayflower**”) dated November 15, 2021

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Appendix

The Sound Power level in the Sound Propagation Level Calculator is found from the following equation⁶. The Sound Pressure was taken from page 10 of reference 2.

$$\text{Sound Power} = \text{Sound Pressure} + 20 \text{ Log } (d) + 0.7 - 10 \text{ Log } (Q) = \text{Sound Pressure} + 11.6 \text{ dB}$$

Where $Q = 2$ for a hemisphere and $d = 5$ feet

Also, if the distance is greater than about 500 ft, wind, thermal gradients, and atmospheric sound absorption need to be considered. This means the calculations for the closest neighbors are reasonably accurate but at greater distances the accuracy probably falls off suggesting that actual measurements might be needed to determine the propagation loss.