Town of Dorset Zoning Board of Adjustment Findings and Decision on Conditional Use Application for an "Event Barn" on Barrows House property by Vermont Retreats, LLC; Deliberative Session of December 17, 2015.

On Monday, December 14, 2015 at 7:00 p.m., the Town of Dorset Zoning Board of Adjustment met to hear the conditional use application of Vermont Mountain Retreats LLC for the construction of an "event barn" at the Barrows House property on the corner of Route 30 and Dorset Hollow Road. Present were members Ruth Stewart, Tuck Rawls, Mike Connors, Bill Bridges, Steve Jones, Kevin O'Toole and John LaVecchia. Present via conference telephone was the remaining board member, David Wilson.

The Board heard testimony from the applicant and the original appellants, as well as members of the public, and admitted into evidence letters addressing the application from those who were unavailable to attend. The Board also heard testimony from the applicant's engineer, Frank Parent of Long Trail Engineering, as well as counsel for the original appellants, John C. Thrasher.

At approximately 11:00 p.m., the Board closed the hearing to further testimony and by acclamation, approved a motion to go into deliberative session on Thursday, December 17, 2015 at 6:00 p.m. at the Dorset Town Offices.

On December 17, 2015, the Board emerged from its deliberative session to announce its unanimous decision to approve the proposed use, having found that the proposed use, providing certain steps were taken, would not unduly adversely affect the six factors set forth in Section 3.5 of the Town of Dorset Zoning Bylaw for conditional uses. The Board attached the following conditions to each of the six factors:

A. The capacity of existing or planned community facilities.

The two existing community facilities that will be most directly impacted by this proposal are continued access to potable water and sufficient water flow to fight fires.

With the exception of Paragraph 5.1, the Board's approval of the proposed use is contingent upon adherence upon each of the findings and facts set forth in the Planning Commission's Findings and Fact and Decisions dated September 25, 2015. In addressing "the capacity of existing or planned community facilities," the Board specifically refers to Paragraphs 5.14 and 5.16 of those findings. The former stated that "the Dorset/East Dorset Fire Department has stated that they can provide adequate fire protection for the project," and refers to a letter it received from Chief Alan Casey, dated October 27, 2015. The latter finding states that "water for the project will be provided by either the Town of Dorset or a new drilled well." On behalf of the applicant, Frank Parent stated that the Vermont Division of Fire Safety would require testing to show that the project would meet State and local standards for water adequacy.

The Board's approval of the proposed use also is contingent the applicant's adherence to the

requirements of the Division of Fire Safety for the project, as well as the Agency of Natural Resources.

B. The character of the area affected as defined by the purpose or purposes of the zoning district within which the project is located, and specifically stated policies and standards of the Town Plan.

The project is located within the Village Commercial Zoning District. As per Section 4.2.1.2 of the Dorset Town Plan:

> *b) Purpose: Village Commercial areas provide space for a suitable business and service establishments to provide employment opportunities for local residents, and to provide such commercial and service facilities needed by residents. Maintaining commercial activities in these areas should be consistent with the character of a historical settlement pattern.*

Section 4.2.1.2 further notes as follows:

> *c) Uses: Uses in the Village Commercial areas shall be small scale retail and service commercial uses compatible with the Village surroundings that is, the historical settlement pattern and village scale defined earlier. In addition, residential uses small scale offices, tourist accommodation facilities, restaurants, and home occupations shall be permitted and encouraged.*

In addressing this criteria, the Board concentrated on the impact of the anticipated sound emanating from the event barn and surroundings at various events. The Board examined and found that the proposed event barn would have no undue adverse effect on the character of the area provided that the applicant adheres to the sound mitigation recommendations set forth in the the sound report submitted to Frank Parent, PE. by Eddie Duncan, INCE board certified, of RSG. This report was generated for the applicant and at the applicant's request. At the hearing, applicant Steve Bryant, for Vermont Retreats, LLC, stated that Vermont Retreats, LLC would agree to follow the terms and conditions of the RSG report. The Board specifically incorporates the RSG report dated December 11, 2015. Further, the Board directs the applicant abide by the provisions of the report in section 5.0 MITIGATION in constructing and operating the facility.

Reiterating language from the RSG report, the Board stated specifically that doors and windows of the event barn must remain closed during amplified music that results in interior sound levels of 75 decibels or greater, further stating that **all** amplified music be played inside of the event barn and that **all** music stop playing no later than 11:00 p.m. While the Board heard requests for earlier times for ending playing times, Town Manager Rob Giaotti had testified that for at least seven years, the nuisance ordinance had been enforced at 11:00 p.m., and the Board did not wish to introduce one time for this project and another time for other events in the Town of Dorset.

The proposed patio extending from the event barn would measure in excess of 3,000 square feet and there was concern voiced that tents erected to protect event goers from the elements would become *de facto* permanent structures, circumventing the 2,000 square foot limitation for buildings in the Village Commercial Zone. To this end, the Board conditions its finding on a requirement that the applicant dismantle any such tent erected within a reasonable time after a particular event has ended.

C. Traffic on roads and highways in the vicinity.

The Board understands and appreciates that traffic may increase because of the construction and use of the event barn, but finds that it will have no undue adverse effect on the traffic on roads and highways in the vicinity, provided the applicant adheres to the requirements to be set forth by the Agency of Transportation as part of the applicant's amendment to its Act 250 permit. In addition, and pursuant to §3.8.3.4(ii) of the Dorset Zoning Bylaw, the Board requires that fire lanes be kept clear and that there shall be no off-site parking on the shoulders of Dorset Hollow Road, Barrows Heights Lane, Meadow Lane or Route 30.

In its findings, the Planning Commission stated that the number of parking spaces available for the project is 83, as shown on the site plan submitted by the applicant, dated September 9, 2015. For the applicant, Frank Parent stated that some earmarked spaces are to be on the lawn and were not actually depicted on the site plan. The 83 spaces are to be earmarked for all people using the Barrows House facility, staff, and guests alike, not just event goers. Reference is made to §10.3.1.5 of the Dorset Zoning Bylaw, which addresses the number of spaces required for an inn, restaurant and staff. The applicant conceded that during events for more than 100 people, the restaurant would be closed to the general public, freeing some parking spaces for those events. For the applicant, Steve Bryant said that some event goers might be shuttled.

D. Is in accord with other applicable provisions of ordinances, regulations and bylaws of the Town.

Except as set forth herein above and below, the project meets the aesthetic and performance standards required by the Design Review Board and, in its Site Plan Review, the Planning Commission, demonstrating the project's compliance with ordinances, regulations and bylaws.

E. Utilization of renewable energy resources.

While the project is purportedly designed to be energy efficient, the Board agrees with the applicant that certain energy components, such as solar panels, would be inappropriate to the setting.

F. Each use so approved shall meet any standards applicable to the specific use as to lot and building dimensional requirements, landscaping, design, location of signs and service areas, the location of existing or proposed sewage systems, be in accordance with the Special Regulations in Section 10 of this Bylaw, and the standards listed in Section 3.8 of this Bylaw.

The project meets the building dimensional requirements of the Dorset Zoning Bylaw, and this Board cites findings 5.3 through 5.7 of the Planning Commission's Findings and Fact and Decisions.

In its finding 5.11, the Planning Commission stated that "proposed landscaping and screening will consist of a double-staggered row of an appropriate, deer resistant evergreen species that is quick growing located along the south end of the barn between the barn and the property line of Lindy Bowden." The submitted site plan appears to depict a row of plantings across a wider area than that. To minimize the visual and audio impacts of the project, this Board requires that the plantings specified by the Planning Commission be planted in an area not less than fifteen (15) feet in either direction from both east and west corners of the south end of the barn, between the barn and the property line of Lindy Bowden.

In its finding 5.12., the Planning Commission set forth the specifications for lighting for the project and this Board incorporates that finding by reference into its decision.

This Board approves Vermont Mountain Retreats LLC's application for a Conditional Use because it finds that the project will not have an undue adverse effect on the six factors set forth in Section 3.5 of the Town of Dorset Zoning Bylaw for Conditional Uses. In addition to the conditions set forth herein, this decision also is contingent upon the terms and conditions of an amendment to the applicant's existing Act 250 permit, Wastewater & Potable Water Supply Permit, and Division of Fire Safety requirements.

Tanenhaus.

- Letter from Dorset Fire Chief Alan Casey to Barrows House dated August 27, 2015.
- Copies of certified mail receipts to abutting property owners from Steven Bryant, postmarked 08/24/2015.
- Copy of posting for public hearing by Zoning Administrator date August 21, 2015.
- Legal ad order confirmation from Bennington Banner dated 8/22/2015.
- Legal ad published in Manchester Journal August 28, 2015.

12. Materials submitted after the hearing was closed which cannot be considered as evidence:

- Email from Lindy Bowden to Rob Gaiotti, Danny Pinsonault, Chris Brooks, and Tyler Yandow dated Sep. 7, 2015.
- Emails to and from Clarissa Lenox to the Dorset Selectboard dated Sep. 4, 2015.
- Letter from Phyllis Binkley to town manager Rob Gaiotti dated September 6, 2015.

The exhibits listed in items 11 and 12 are available at the Zoning Administrator's office.

13. During the hearing, the Planning Commission afforded those persons wishing to achieve status as an interested person an opportunity under 24 V.S.A. § 4465(b) to demonstrate that the criteria set forth in that statute could be met. A record of the name and address of persons wishing status as an interested person, a summary of their evidence with regard to the criteria, and a record of their participation at the hearing is attached hereto in the form of meeting minutes.

FINDINGS

Based on the application, testimony, exhibits, and other evidence, the Planning Commission makes the following findings:

1. The applicant seeks to obtain a zoning permit for an event barn.

2. Notice of Public Hearing was posted on August 21, 2015 and published in the Bennington Banner on Aug. 22, 2015 which is at least 7 days from the date of the September 1, 2015 hearing as required under 24 V.S.A. § 4464.

3. The subject property is a 5.9 acre parcel located at 3156 VT Route 30 in the Town of Dorset, tax map # 23- 20 - 004. The property is more fully described in a deed from recorded in book 169, page(s) 378 of the Town of Dorset Land Records.

4. The property is located in the Village Commercial and Design overlay zoning districts as described on the Town of Dorset Zoning Map which is part of the zoning Bylaw dated August

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dorsetza@gmail.com
Hours: Tues. Wed.
Thurs. : 11am-4pm

TOWN OF DORSET

Town Offices
112 Mad Tom Rd
PO Box 715
East Dorset, VT 05253

28, 2013.

5. Other facts pertinent to the decision:

1. The Barrows House is an inn. This is a permitted use requiring Site Development Plan review per Bylaw §6.3.4(b)6.
2. Accessory uses customarily incidental to a permitted use on the same lot are permitted in Bylaw §6.3.6.1.
3. The length and width of the proposed building are 55' x 35'.
4. The height of the proposed building is 29' – 11"and is less than or equal to the maximum allowable height of 35'permitted in §6.3.7.
5. The footprint of the proposed building is 1925 square feet, and is less than or equal to the maximum allowable footprint of 2000 sq. ft. in §6.3.7.
6. The setbacks of the proposed building are: front 185', left side 295', right side N/A, and rear 400'. These dimensions are less than or equal to the minimum setbacks permitted in §6.3.7 which are 30'front yard, 15' side yard, and 25' rear yard.
7. The maximum open space (not covered by buildings, drives, and parking) on the lot is 75% which is greater than or equal to the minimum allowable coverage in §6.3.7 which is 40%.
8. Access to the lot is from the following roads, and, or highways in the Town of Dorset:
    i. VT Route 30
    ii. Dorset Hollow Rd
9. New curb cuts will not be required.
10. The number of parking spaces available for the project is 83, and is shown on the site plan submitted by the applicant dated 9 Sept. 2015.
11. Proposed landscaping and screening will consist of a double staggered row of an appropriate, deer resistant evergreen species that is quick growing located along the south end of the barn between the barn and the property line of Lindy Bowden.
12. Proposed lighting will consist of the following:
    i. 9 path lights in locations shown on sheet S-1.1A dated 9 Sept. 2015. Lights to be custom wood bollard light 80mm x 80mm x 1500mm, with 7 watt LED lamp, color 2700 – 4000K, IP 65.
    ii. Surface mounted barn lights to be 20" traditional galvanized steel barn light with gooseneck mount. Two will be on the north elevation and four will be on the east elevation.
    iii. Three recessed 75 watt light fixtures will be located above the entry door on the north elevation.
13. Noise generated by the project can be characterized as that typically found at weddings, receptions, and family gatherings, and may include music from a live band or recordings. Noise generated inside the proposed building will be mitigated by the insulated walls and roof of the building. Noise generated outside the building will be no different from noise presently generated outside.
14. The Dorset/East Dorset Fire Department has stated they can provide adequate fire

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protection for the project. See letter from Chief Alan Casey dated August 27, 2015.

15. Sewage and solid waste disposal will be provided by a new on-site septic system.
16. Water for the project will be provided by either the Town of Dorset or a new drilled well.
17. Smoke, dust, odor, noxious gases, and other forms of air pollution will not be produced as a result of the proposed project.
18. The six "Resolved Issues" referred to in the memo of January 19, 2014 from Ed and Ruth Tanenhaus to the Planning Commission address topics not regulated by the Town of Dorset.

DECISIONS

Based on these findings, the Planning Commission concludes the following:

1. The applicant meets the requirements for a zoning permit for an event barn in the Village Commercial and Design districts.
2. Because the applicant meets these requirements, he is entitled to the zoning permit requested.
3. The Planning Commission encourages neighbors to discuss issues not covered in the Bylaw with the applicant and to reach agreements which suit both parties.
4. Conditions of this permit are as follows:
    i. This permit is contingent upon approval of an Act 250 amendment and Waste Water & Potable Water Supply permits issued by appropriate State of Vermont agencies.

For the Dorset Planning Commission: _____
(print name, position)

_____
(sign name)

_____
(date)

Town of Dorset Planning Commission
September 1, 2015

Members Present: Danny Pinsonault (Chairman), Brooks Addington (Vice-Chairman), Dave Lawrence, Kay Manly, Gay Squire, Brent Herrmann, Carter Rawson

Members Absent: Howard Coolidge, Charlie Wise

Also Present: Tyler Yandow (Zoning Administrator), Steve Bryant (Barrows House), Kevin Gecha (Barrows House), Ramsey Gourd (Barrows House), Jack Gilbert, Lindy Bowden, Kit Wallace (DRB), Tracey Mathyas, Peter Palmer (DRB), Janet St. Germain, Linda McGinnis, D. Green, Ruth Tanenhaus, Edward Tanenhaus, D. Streeter, Robin chandler, Suzanne Hittle, Richard Hittle, John Cave, Clarissa Lennox, Justine Cook, Richard Pistell, Jackie Pistell, John LaVecchia, Bob Allen, Karen Allen, Michael Bickford, Arnold Gottlieb, Carol Gottlieb, Jim Sullivan (BCRC), Megan Thorn, Angela Arkway, Henry Chandler

D. Pinsonault, Chairman, opened the meeting at 7:01 p.m.

Chair to Note Any Changes in Agenda
None

Have Board Members Introduce Themselves. Invite Other Attendees To Do The Same and State Why They Are Attending
Board members introduced themselves.

Approve Minutes of May 6, 2015
D. Lawrence moved and G. Squire seconded to approve the August 4, 2015 minutes as presented. Motion carried 5-0 (K. Manly abstained & C. Rawson was not present yet)

Report from the Zoning Administrator
T. Yandow reported as follows:

- The Albertsson application before the ZBA members was continued from August 10, 2015 to August 31, 2015 in the hope that the applicant would reconfigure the boundary line adjustment to conform to the ZBL. At the August 31st meeting the ZBA denied the non-complying application presented and a conforming application is expected to be submitted to the ZA. T. Yandow explained to B. Addington the basis of the variance denial for the boundary line adjustment.
- Zoning Bylaw booklet ~ printing of booklet is expected shortly
- BCRC ~ J. Sullivan will be giving a presentation tonight
- State Division of Historic Preservation ~ T. Yandow urged all Town Board members and the public to attend a presentation given by D. Coleman at the regular meeting of the

cc: PC Minutes, Conservation Commission & File, Design Review Board & File, Town Manager, Town Clerk, Listers, Select Board

MEMO

TO:	Frank Parent, P.E.
FROM:	Eddie Duncan, INCE Bd. Cert.
DATE:	December 11, 2015
SUBJECT:	Barrow's House Event Facility - Noise Model Results

At the request of the Barrow's House, RSG has conducted an analysis of the noise expected to be generated from the operation of a new event barn and terrace area.

1.0 SUMMARY OF KEY FINDINGS

We offer the following summary of key findings based on the analysis presented in this memorandum:

- Sound from the event facility is predicted to be less than 45 dBA at all neighboring residences with specific mitigation measures to be incorporated into the project design, including:
  - acoustical specifications for the construction of the barn,
  - interior sound level limits, and
  - sound emission limits for the new building's air conditioner units.

- Modeled sound levels from the event facility are compatible with the zoned use of the surrounding areas.

2.0 INTRODUCTION

The Barrows House is proposing to construct an event facility, which will include a new barn and paved terrace yard at its property on Route 30 in Dorset, Vermont. The proposed project will host events similar to what are currently in an outdoor event tent, except that the events in the barn will be held indoors. The new facility will host events such as weddings and receptions that would be held within the new building or out on the terrace, and their programs may include amplified music or speech.

This memorandum quantifies the expected sound levels resulting from the proposed event barn and contextualizes these sound levels in regard to compatible uses.

If the reader is less familiar with acoustics or have questions regarding some of the terminology used in this memorandum, Appendix A provides a primer on sound and noise.

The Barrows House is a "mini-resort" which has several facilities on its property including an inn, restaurant with outdoor seating area, swimming pool, tennis courts, gardens, and other buildings with accommodations. They currently host events at the site next to the restaurant's outdoor seating area and typically use an event tent that is approximately 40 by 60 feet. The events typically have amplified speech and music either from a band or DJ. Schedules vary from event to event, but the typical schedule for a wedding event is a ceremony around 4 or 5 PM, followed by cocktail/dinner around 6 or 7 PM, and then event music between 8 and 10:30 PM with a hard cutoff time for amplified sound at 11 PM.

The proposed project would involve the same type of events that are currently hosted outside in the event tent except that they would be held in a proposed event barn structure with an outdoor terrace. A map showing the location of the proposed facility and the area where outdoor events are typically held currently, is provided in Figure 1.

The Barrows House is located in the Village Commercial district. Generally, the area around The Barrows House is a mixture of residential and commercial land uses. The nearest residence to the proposed facility is approximately 75 feet to the southeast; that same residence is located approximately 250 feet southwest of the existing tented event area, so the new facility will be closer, but the amplified music or speech will be indoors in the proposed barn structure. Other residences in the area are located along:

- VT Route 30 to the southwest between 275 and 400 feet from the proposed facility and between 240 and 475 feet from the existing event tent area.
- Dorset Hollow Road to the northwest between 355 and 555 feet from the proposed facility and between 210 and 430 feet from the existing event tent area.
- Barrows Heights to the northeast between 420 and 545 feet from the proposed facility and between 475 and 500 feet from the existing event tent area.

The project area is generally flat with open yards and sporadic trees. The primary source of background sound levels in the area is traffic on VT Route 30 and local roads, and natural biogenic and geophonic sources. There are also occasional sounds typical of residential and light commercial areas such as lawn maintenance, snow blowing, ventilation fans, and air conditioners.

The proposed project involves the construction of a barn of timber-based construction, and a paved outdoor terrace on the northeast side of the barn for additional seating. The barn will have doors and windows on multiple sides of the structure. The primary source of noise from the new facility will be amplified speech or music, which is the same source that already exists during events in the outdoor event tent area. Air conditioner units are proposed for the southeast side of the barn adjacent to the property line and are considered minor secondary sources of noise.

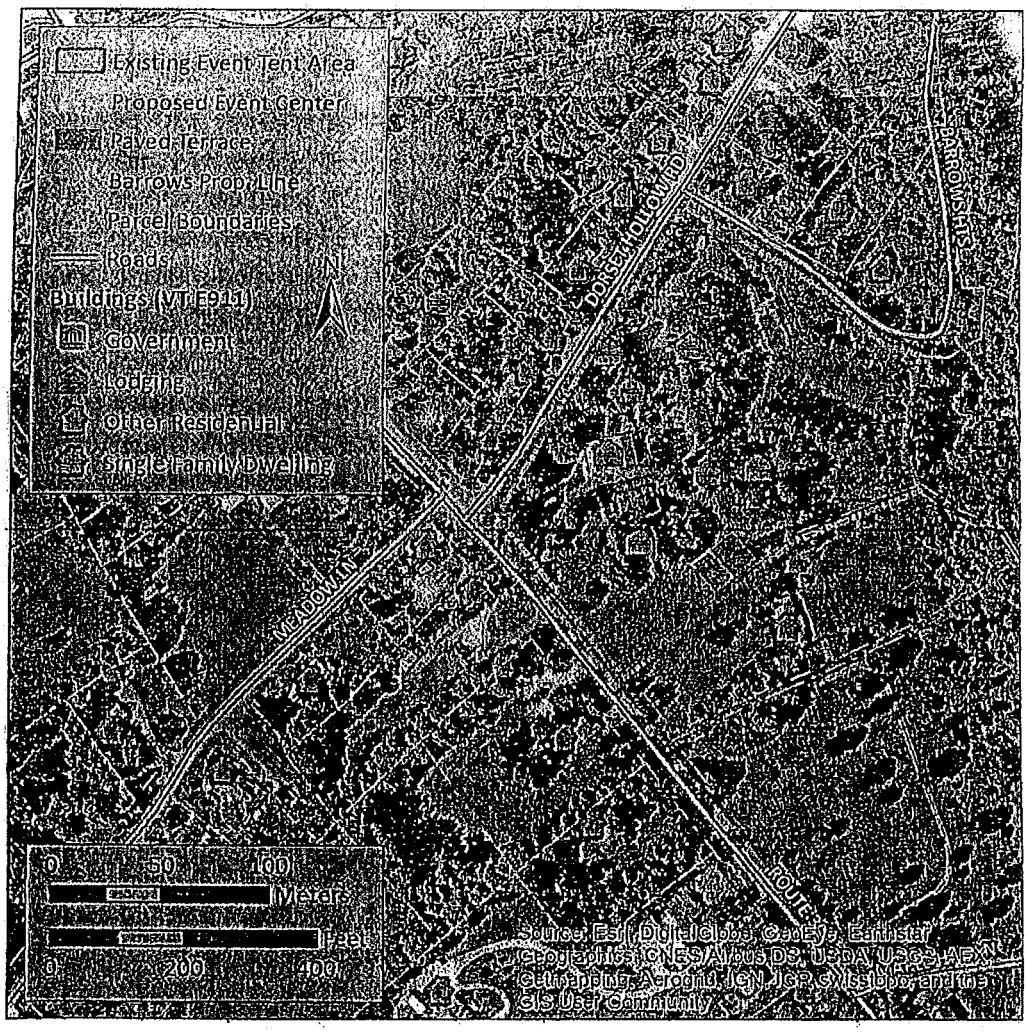

FIGURE 1: PROJECT SITE MAP

4.0 SOUND PROPAGATION MODELLING

A model describing sound propagation from the proposed site was developed utilizing a noise source derived from measurements during an actual event.

4.1 | MODELING METHODOLOGY

Modeling for the project was completed using the International Standards Organization ISO 9613-2 standard, "Acoustics – Attenuation of sound during propagation outdoors, Part 2: General Method of Calculation." The ISO standard states,

> This part of ISO 9613 specifies an engineering method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources. The method predicts the equivalent continuous A-weighted sound pressure level … under meteorological conditions favorable to propagation from sources of known sound emissions. These conditions are for downwind propagation

> ... or, equivalently, propagation under a well-developed moderate ground-based temperature inversion, such as commonly occurs at night.

The model takes into account source sound power levels, surface reflection and absorption, atmospheric absorption, geometric divergence, meteorological conditions, walls, barriers, berms, and terrain. The ISO standard was implemented in Cadna A acoustical modeling software. Made by Datakustik GmbH, Cadna A is an internationally accepted acoustical model, used by many other noise control professionals in the United States and abroad. It has also been accepted for many years as a reliable noise modeling methodology by Act 250 commissions, the former Environmental Board, and the Vermont Superior Court Environmental Division.

Standard modeling methodology takes into account moderate nighttime inversions or moderate downwind conditions. For this study, we modeled sound propagation in accordance with ISO 9613-2 with spectral ground attenuation, the proposed paved terrace area, pool, parking area, and tennis courts were modeled as reflective ground (G=0), and the yards around the site were modeled as semi-porous ground (G=0.5).

A 5-meter by 5-meter (16 foot by 16 foot) grid of 1.5 meter (5 foot) high receivers was set up in the model, covering approximately 40 acres around the site. A receiver is a point above the ground at which the computer model calculates a sound level. In addition, 23 discrete receivers were modeled at residences in the area around the site along Route 30, Dorset Hollow Road, Barrows Heights, and Meadow Lane. These were set at a height of 4 meters (13.2 feet), to represent second-story windows at houses.

4.2 | AMPLIFIED EVENT SOUND EMISSIONS

During a site visit on September 26, RSG conducted sound level measurements throughout the existing tent area while a band was playing. Sound measurements were made using a spatial scan method sampling sound levels throughout the tent. The sound level within the tent is provided in Table 1 and was used in the model as the indoor sound level within the proposed barn to project sound levels throughout the site. The kitchen hood ventilation fan was also measured, which is an existing source on the roof of the northern side of the restaurant. The sound power level of the ventilation fan is provided in Table 1 as well and was included as a source in the model.

TABLE 1: SOUND EMISSIONS OF AMPLIFIED MUSIC SOURCE AND KITCHEN HOOD MEASURED AT THE BAROWS HOUSE, SEPTEMBER 26, 2015

Sound Source	Type	1/1 Octave Band Center Frequency (Hz)									Overall (dBA)	Overall (dB)
		31.5	63	125	250	500	1000	2000	4000	8000		
Kitchen Hood Fan	Sound Power Level	35	50	63	82	77	75	72	67	61	84	92
Wedding Band	Sound Pressure Level	48	70	80	86	92	93	87	82	77	97	102

4.3 | MODEL RESULTS

Model results from the proposed facility are presenting in Figure 2. The different colored isolines represent different sound pressure levels throughout the area from the proposed facility, and the number on each residence is the modeled sound pressure level at the residence. The model shows

that sound levels from an event held in the new barn structure results in sound levels between 26 and 43 dBA at area residences with the highest level at the closest residence to the south.

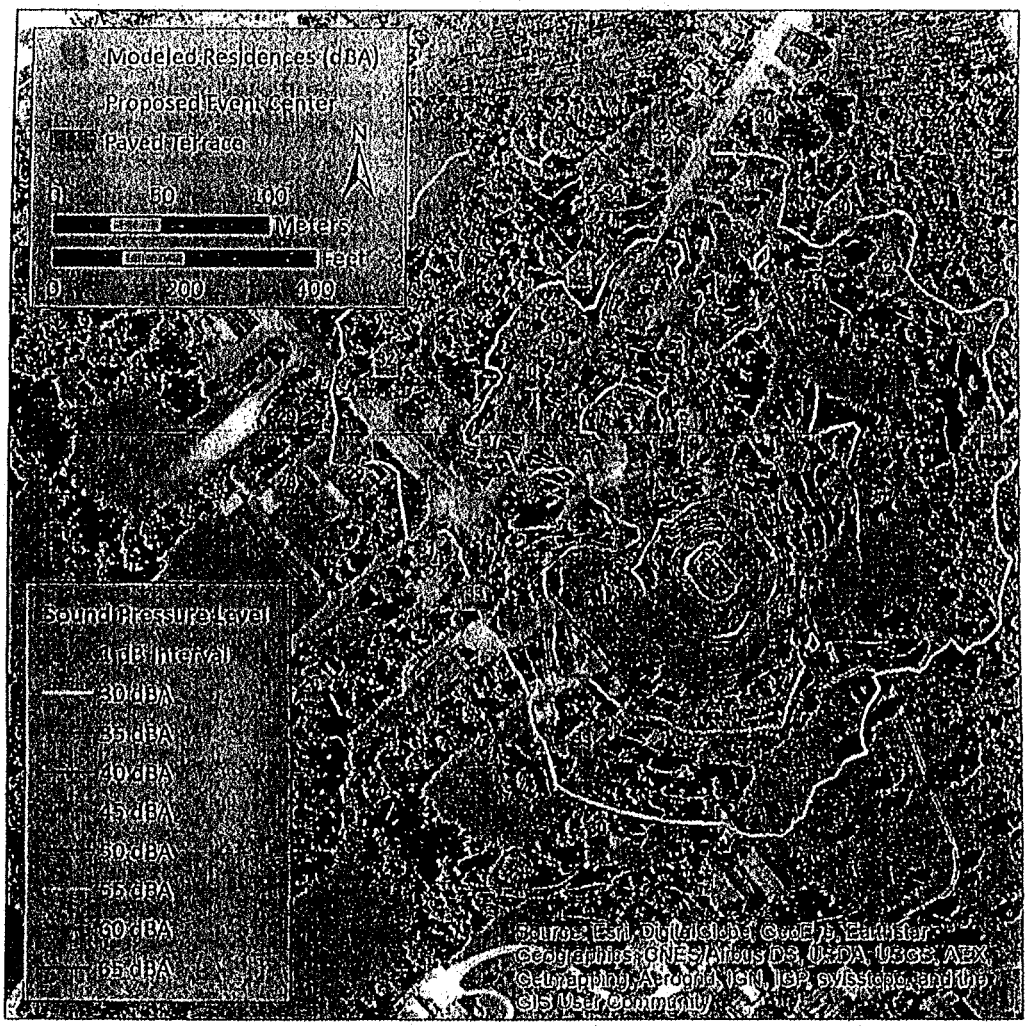

FIGURE 2: MODELED RESULTS OF AN EVENT LOCATED IN THE PROPOSED EVENT FACILITY (dBA)

6.0 MITIGATION

The model results presented in the previous section include a few mitigating elements to incorporate into the design and operation of the project. This mitigation includes the following:

1. The construction of the barn needs to sufficiently attenuate sound and the northeast and southeast walls may need to be of a more substantial construction. The transmission loss values of the walls, windows, and doors used in the model are provided below in Table 2. Particular attention should be paid to the transmission loss values between 63 Hz and 500 Hz provided in Table 2. These should be met with the design of the barn.[1]

TABLE 2: MODELED TRANSMISSION LOSS (dB) OF BARN BUILDING ELEMENTS

Building Elements	1/1 Octave Band Center Frequency								
	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Northeast Wall, Southeast Wall, & Roof	14	16	34	44	49	57	60	66	70
Northwest Wall & Southwest Walls	10	14	17	36	42	50	53	60	62
Windows & Doors	20	22	23	19	35	43	42	50	50

2. Interior sound levels should not exceed 99 dBA.
3. Doors and windows should remain closed during amplified music that results in interior sound levels of 75 dBA or greater.
4. Select air conditioner units for the barn with a sound power level of 65 dBA or less. Units with higher sound power may be selected, but additional mitigation such as a noise barrier may be necessary.

[1] Actual values could vary, but should be in this approximate range, or better.

[illegible]

As previously mentioned, the Barrows House is located within the Village Commercial District in the town of Dorset, VT. It is our understanding that the addition of the new event facility constitutes a conditional use. Section 3.5 of the Dorset Zoning Ordinance defines the requirements necessary to receive a conditional use permit. While the requirements do not provide a quantified noise limit, Section 3.5 does state that:

> *A conditional use may be approved provided that the Zoning Board of Adjustment shall have found that such use will not adversely affect:*
>
> *[…]*
>
> *b. the character of the area affected as defined by the purpose of the zoning district within which the project is located, and specifically stated policies and standards of the Town Plan;*

To aid in determining if the proposed project fits within the character of the area "as defined by the purpose of the zoning district", American National Standards Institute (ANSI) guidelines were applied to determine if the proposed project is compatible with the Village Commercial district in which it resides. If the project is compatible with the Village Commercial district, then it may fit the character of the area as defined by the zoning district.

ANSI Standard S12.9 Part 5 provides a guideline for determining the compatibility of an area based on the outdoor annual average of the day-night average sound level at the site. The day-night sound level (or DNL) is the equivalent sound level measured at a site, with a 10 dB penalty applied to the level during night hours (2200 to 0700). The annual average is then the energy average of these sound levels over an entire year. The ANSI/ASA recommended annual average DNL chart is reproduced below in Figure 3.

The modeled sound level from the event facility is 43 dBA at the nearest residence. The highest sound level that could be attributed to the event facility in the DNL calculation is 53 dBA (43 dBA + 10 dB nighttime penalty if it occurs after 10 PM). Taken as an annual average, the annualized average DNL of noise from the event facility would be much less since it is only an occasional operation. For context, if an event was held at the new facility with the modeled sound levels from amplified sound being emitted continuously from 5 PM to 11 PM, the DNL for that day from the facility would be 41 dBA. The DNL at the nearest residence resulting from the event facility only does not take into account ambient sound from traffic and other typical village activities, all of which would also typically inform the metric.

According to the ANSI chart, compatibility for almost all land uses, including residential, is achieved with an annualized average DNL of 55 dBA or below. That is, According to ANSI S12.9 Part 5, the proposed project would be compatible not only within a commercial district, but also for a residential area.

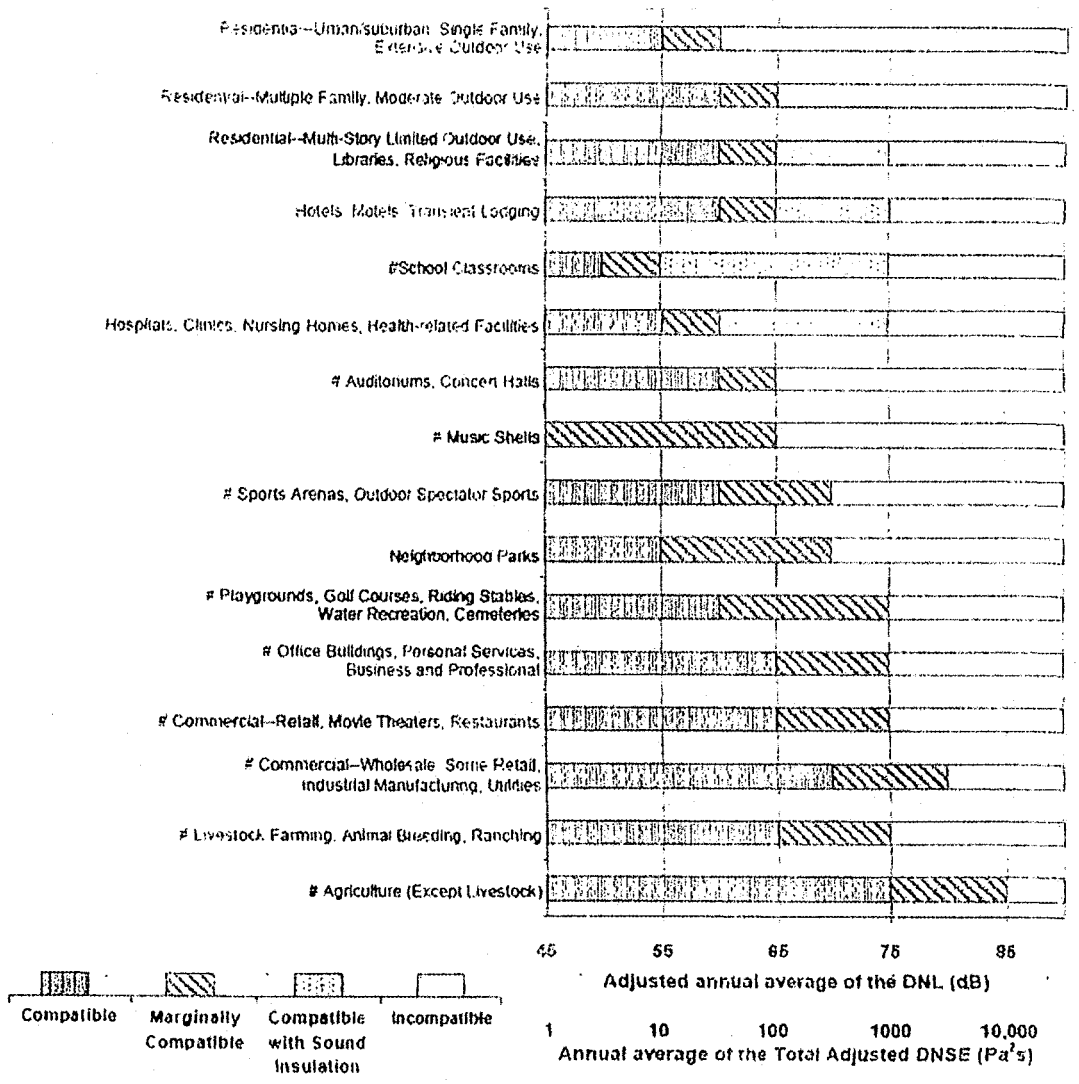

FIGURE 3. ANSI/ASA S12.9-2007 / PART 5 - TABLE A.1

CONCLUSION

The Barrows House is proposing to construct an event facility on the southeast side of its property in Dorset, Vermont. Events with amplified music and speech are currently held at the site in an event tent. The proposed project would provide an indoor structure for events.

Model results indicate that events held in the proposed project will result in sound levels at neighboring residences that are less than 45 dBA. However, in order to achieve these results, mitigation measures are recommended which are discussed in Section 5 of this memorandum and include acoustical specifications for the construction of the barn, interior sound level limits, and sound emission limits for the new building's air conditioner units.

As discussed in the previous section, model results from the proposed facility show that it is compatible with the commercial land use on which the project sits and the neighboring residential land uses with respect noise per the guidelines in ANSI S12.9 Part 5.

Sound consists of tiny, repeating fluctuations in ambient air pressure. The strength, or amplitude, of these fluctuations determines the sound pressure level (SPL). "Noise" can be defined as "a sound of any kind, especially when loud, confused, indistinct, or disagreeable."

Expressing Sound in Decibel Levels

The varying air pressure that constitutes sound can be characterized in many different ways. The human ear is the basis for the metrics that are used in acoustics. Normal human hearing is sensitive to sound fluctuations over an enormous range of pressures, from about 20 micropascals (the "threshold of audibility") to about 20 pascals (the "threshold of pain").[2] This factor of one million in sound pressure difference is challenging to convey in engineering units. Instead, sound pressure is converted to sound "levels" in units of "decibels" (dB, named after Alexander Graham Bell). Once a measured sound is converted to dB, it is denoted as a level with the letter "L".

The conversion from sound pressure in pascals to sound level in dB is a four-step process. First, the sound wave's measured amplitude is squared and the mean is taken. Second, a ratio is taken between the mean square sound pressure and the square of the threshold of audibility (20 micropascals). Third, using the logarithm function, the ratio is converted to factors of 10. The final result is multiplied by 10 to give the decibel level. By this decibel scale, sound levels range from 0 dB at the threshold of audibility to 120 dB at the threshold of pain.

Typical sources of noise, and their sound pressure levels, are listed on the scale in Figure 4.

Human Response to Sound Levels: Apparent Loudness

For every 20 dB increase in sound level, the sound pressure increases by a *factor* of 10; the sound *level* range from 0 dB to 120 dB covers 6 factors of 10, or one million, in sound *pressure*. However, for an increase of 10 dB in sound *level* as measured by a meter, humans perceive an approximate doubling of apparent loudness: to the human ear, a sound level of 70 dB sounds about "twice as loud" as a sound level of 60 dB. Smaller changes in sound level, less than 3 dB up or down, are generally not perceptible.

Frequency Spectrum of Sound

The "frequency" of a sound is the rate at which it fluctuates in time, expressed in Hertz (Hz), or cycles per second. Very few sounds occur at only one frequency: most sound contains energy at many different frequencies, and it can be broken down into different frequency divisions, or bands. These bands are similar to musical pitches, from low tones to high tones. The most common division is the standard octave band. An octave is the range of frequencies whose upper frequency limit is twice its lower frequency limit, exactly like an octave in music. An octave band is identified by its center frequency: each successive band's center frequency is twice as high (one octave) as the previous band. For example, the 500 Hz octave band includes all sound whose frequencies range between 354 Hz (Hertz, or cycles per second) and 707 Hz. The next band is centered at 1,000 Hz with a range between 707 Hz and 1,414 Hz. The range of human hearing is divided into 10 standard

[2] The pascal is a measure of pressure in the metric system. In Imperial units, they are themselves very small: one pascal is only 145 millionths of a pound per square inch (psi). The sound pressure at the threshold of audibility is only 3 one-billionths of one psi: at the threshold of pain, it is about 3 one-thousandths of one psi.

octave bands: 31.5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1,000 Hz, 2,000 Hz, 4,000 Hz, 8,000 Hz, and 16,000 Hz. For analyses that require finer frequency detail, each octave-band can be subdivided. A commonly-used subdivision creates three smaller bands within each octave band, or so-called 1/3-octave bands.

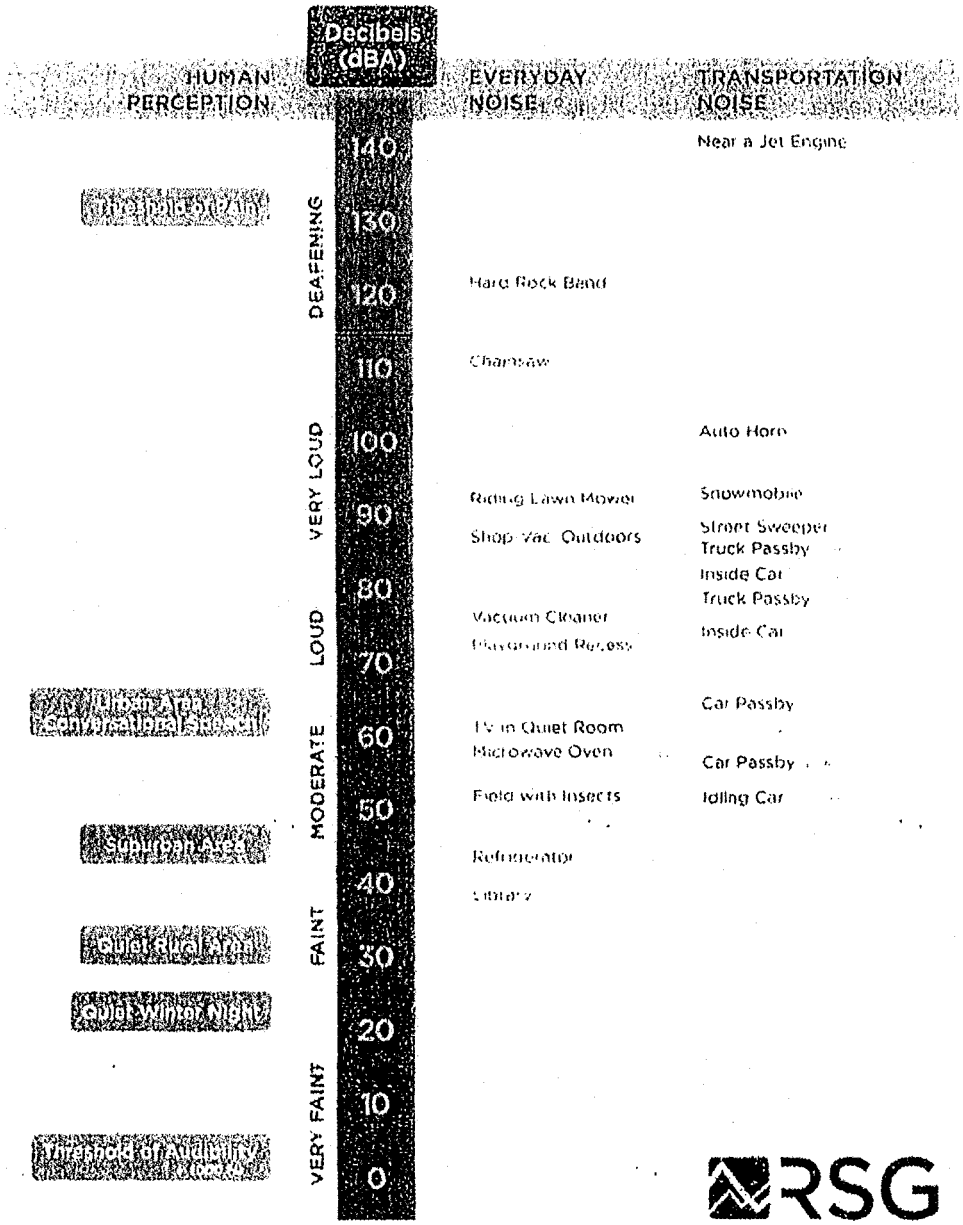

FIGURE 4: A SCALE OF SOUND PRESSURE LEVELS FOR TYPICAL NOISE SOURCES

Human Response to Frequency: Weighting of Sound Levels

The human ear is not equally sensitive to sounds of all frequencies. Sounds at some frequencies seem louder than others, despite having the same decibel level as measured by a sound level meter. In

particular, human hearing is much more sensitive to medium pitches (from about 500 Hz to about 4,000 Hz) than to very low or very high pitches. For example, a tone measuring 80 dB at 500 Hz (a medium pitch) sounds quite a bit louder than a tone measuring 80 dB at 60 Hz (a very low pitch). The frequency response of normal human hearing ranges from 20 Hz to 20,000 Hz. Below 20 Hz, sound pressure fluctuations are not "heard", but sometimes can be "felt". This is known as "infrasound". Likewise, above 20,000 Hz, sound can no longer be heard by humans; this is known as "ultrasound". As humans age, they tend to lose the ability to hear higher frequencies first; many adults do not hear very well above about 16,000 Hz. Most natural and man-made sound occurs in the range from about 40 Hz to about 4,000 Hz. Some insects and birdsongs reach to about 8,000 Hz.

To adjust measured sound pressure levels so that they mimic human hearing response, sound level meters apply filters, known as "frequency weightings", to the signals. There are several defined weighting scales, including "A", "B", "C", "D", "G", and "Z". The most common weighting scale used in environmental noise analysis and regulation is A-weighting. This weighting represents the sensitivity of the human ear to sounds of low to moderate level. It attenuates sounds with frequencies below 1000 Hz and above 4000 Hz; it amplifies very slightly sounds between 1000 Hz and 4000 Hz, where the human ear is particularly sensitive. The C-weighting scale is sometimes used to describe louder sounds. The B- and D- scales are seldom used. All of these frequency weighting scales are normalized to the average human hearing response at 1000 Hz: at this frequency, the filters neither attenuate nor amplify. When a reported sound level has been filtered using a frequency weighting, the letter is appended to "dB". For example, sound with A-weighting is usually denoted "dBA". When no filtering is applied, the level is denoted "dB" or "dBZ". The letter is also appended as a subscript to the level indicator "L", for example "L_A" for A-weighted levels.

Time Response of Sound Level Meters

Because sound levels can vary greatly from one moment to the next, the time over which sound is measured can influence the value of the levels reported. Often, sound is measured in real time, as it fluctuates. In this case, acousticians apply a so-called "time response" to the sound level meter, and this time response is often part of regulations for measuring noise. If the sound level is varying slowly, over a few seconds, "Slow" time response is applied, with a time constant of one second. If the sound level is varying quickly (for example, if brief events are mixed into the overall sound), "Fast" time response can be applied, with a time constant of one-eighth of a second.[3] The time response setting for a sound level measurement is indicated with the subscript "S" for Slow and "F" for Fast: L_S or L_F. A sound level meter set to Fast time response will indicate higher sound levels than one set to Slow time response when brief events are mixed into the overall sound, because it can respond more quickly.

In some cases, the maximum sound level that can be generated by a source is of concern. Likewise, the minimum sound level occurring during a monitoring period may be required. To measure these, the sound level meter can be set to capture and hold the highest and lowest levels measured during a given monitoring period. This is represented by the subscript "max", denoted as "L_{max}". One can define a "max" level with Fast response L_{Fmax} (1/8-second time constant), Slow time response L_{Smax}

[3] There is a third time response defined by standards, the "Impulse" response. This response was defined to enable use of older, analog meters when measuring very brief noises; it is no longer in common use.

(1-second time constant), or Continuous Equivalent level over a specified time period $L_{eq_{max}}$. Note that, in the precedents set by the former Environmental Board under Vermont Act 250, the time response is not specified, but in the Barre Granite case which set the 55 dBA Lmax precedent the metric LSmax (a 1-second response time) was used. Since that time, maximum Leq 1-second has also been used as it is comparable to the LSmax.

Accounting for Changes in Sound over Time

A sound level meter's time response settings are useful for continuous monitoring. However, they are less useful in summarizing sound levels over longer periods. To do so, acousticians apply simple statistics to the measured sound levels, resulting in a set of defined types of sound level related to averages over time. An example is shown in Figure 5. The sound level at each instant of time is the grey trace going from left to right. Over the total time it was measured (100 seconds in the figure), the sound energy spends certain fractions of time near various levels, ranging from the minimum (about 37 dB in the figure) to the maximum (about 68 dB in the figure). The simplest descriptor is the average sound level, known as the Equivalent Continuous Sound Level. Statistical levels are used to determine for what percentage of time the sound is louder than any given level. These levels are described in the following sections.

Equivalent Continuous Sound Level - LEQ

One straightforward, common way of describing sound levels is in terms of the Continuous Equivalent Sound Level, or L_{eq}. The L_{eq} is the average sound pressure level over a defined period of time, such as one hour or one day. L_{eq} is the most commonly used descriptor in noise standards and regulations. L_{eq} is representative of the overall sound to which a person is exposed. Because of the logarithmic calculation of decibels, L_{eq} tends to favor higher sound levels: loud and infrequent sources have a larger impact on the resulting average sound level than quieter but more frequent noises. For example, in Figure 5, even though the sound levels spends most of the time near about 47 dBA, the L_{eq} is 53 dBA, having been "inflated" by the maximum level of 68 dBA.

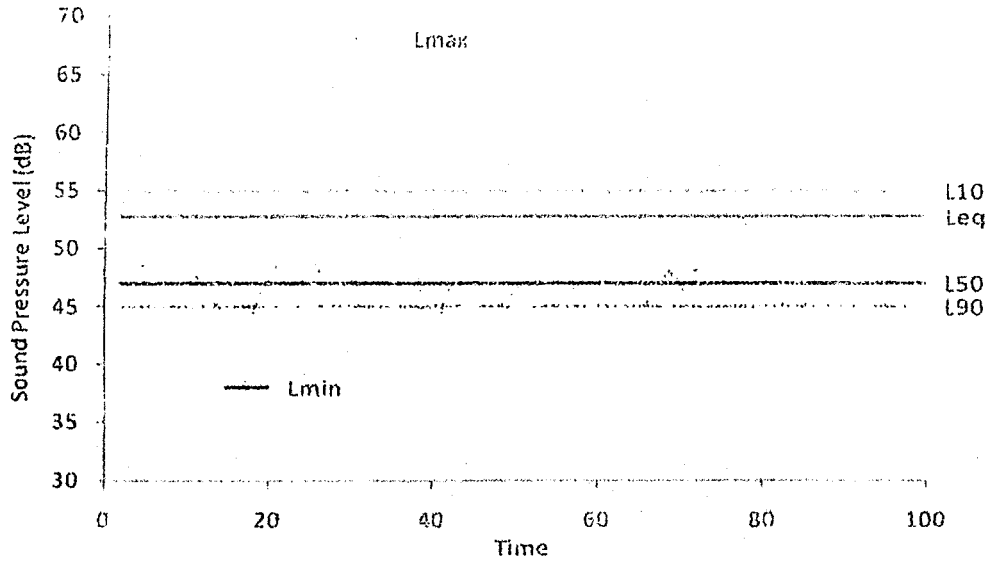

FIGURE 5: EXAMPLE OF DESCRIPTIVE TERMS OF SOUND MEASUREMENT OVER TIME

Percentile Sound Levels – L_N

Percentile sound levels describe the statistical distribution of sound levels over time. "L_N" is the level above which the sound spends "N" percent of the time. For example, L_{90} (sometimes called the "residual base level") is the sound level exceeded 90% of the time: the sound is louder than L_{90} most of the time. L_{10} is the sound level that is exceeded only 10% of the time. L_{50} (the "median level") is exceeded 50% of the time: half of the time the sound is louder than L_{50}, and half the time it is quieter than L_{50}. Note that L_{50} (median) and L_{EQ} (mean) are not always the same, for reasons described in the previous section.

L_{90} is often a good representation of the "ambient sound" in an area. This is the sound that persists for longer periods, and below which the overall sound level seldom falls. It tends to filter out other short-term environmental sounds that aren't part of the source being investigated. L_{10} represents the higher, but less frequent, sound levels. These could include such events as barking dogs, vehicles driving by and aircraft flying overhead, gusts of wind, and work operations. L_{90} represents the background sound that is present when these event noises are excluded.

Note that if one sound source is very constant and dominates the noise in an area, all of the descriptive sound levels mentioned here tend toward the same value. It is when the sound is varying widely from one moment to the next that the statistical descriptors are useful.

Sound Levels from Multiple Sources: Adding Decibels

Because of the way that sound levels in decibels are calculated, the sounds from more than one source do not add arithmetically. Instead, two sound sources that are the same decibel level increase the total sound level by 3 dB. For example, suppose the sound from an industrial blower registers 80 dB at a distance of 2 meters (6.6 feet). If a second industrial blower is operated next to the first one, the sound level from both machines will be 83 dB, not 160 dB. Adding two more blowers (a total of

four) raises the sound level another 3 dB to 86 dB. Finally, adding four more blowers (a total of eight) raises the sound level to 89 dB. It would take eight total blowers, running together, for a person to judge the sound as having "doubled in loudness".

Recall from the explanation of sound levels that a difference of 10 decibels is a factor of 20 in sound pressure and a factor of 10 in sound power. (The difference between sound pressure and sound power is described in the next Section.) If two sources of sound differ individually by 10 decibels, the louder of the two is generating *ten times* more sound. This means that the loudest source(s) in any situation always dominates the total sound level. Looking again at the industrial blower running at 80 decibels, if a small ventilator fan whose level alone is 70 decibels were operated next to the industrial blower, the total sound level increases by only 0.4 decibels, to 80.4 decibels. The small fan is only 10% as loud as the industrial blower, so the larger blower completely dominates the total sound level.

The Difference between Sound Pressure and Sound Power

The human ear and microphones respond to variations in sound *pressure*. However, in characterizing the sound emitted by a specific source, it is proper to refer to sound *power*. While sound pressure induced by a source can vary with distance and conditions, the power is the same for the source under all conditions, regardless of the surroundings or the distance to the nearest listener. In this way, sound power levels are used to characterize noise sources because they act like a "fingerprint" of the source. An analogy can be made to light bulbs. The bulb emits a constant amount of light under all conditions, but its perceived brightness diminishes as one moves away from it.

Both sound power and sound pressure levels are described in terms of decibels, but they are not the same thing. Decibels of sound pressure are related to 20 micropascals, as explained at the beginning of this primer. Sound power is a measure of the acoustic power emitted or radiated by a source; its decibels are relative to one picowatt.

Sound Propagation Outdoors

As a listener moves away from a source of sound, the sound level decreases due to "geometrical divergence": the sound waves spread outward like ripples in a pond and lose energy. For a sound source that is compact in size, the received sound level diminishes or attenuates by 6 dB for every doubling of distance: a sound whose level is measured as 70 dBA at 100 feet from a source will have a measured level of 64 dBA at 200 feet from the source and 58 dBA at 400 feet. Other factors, such as walls, berms, buildings, terrain, atmospheric absorption, and intervening vegetation will also further reduce the sound level reaching the listener.

The type of ground over which sound is propagating can have a strong influence on sound levels. Harder ground, pavement, and open water are very reflective, while soft ground, snow cover, or grass is more absorptive. In general, sounds of higher frequency will attenuate more over a given distance than sounds of lower frequency: the "boom" of thunder can heard much further away than the initial "crack".

Atmospheric and meteorological conditions can enhance or attenuate sound from a source in the direction of the listener. Wind blowing from the source toward the listener tends to enhance sound levels; wind blowing away from the listener toward the source tends to attenuate sound levels. Normal temperature profiles (typical of a sunny day, where the air is warmer near the ground and

gets colder with increasing altitude) tend to attenuate sound levels; inverted profiles (typical of nighttime and some overcast conditions) tend to enhance sound levels.