MEMO

TO:	Justin Worthley
FROM:	Eddie Duncan, INCE Bd. Cert.
CC:	Brian Dunkiel, Esq.
DATE:	August 3, 2020
SUBJECT:	Burton's Hub Project - Additional Context and Information on Noise

The purpose of this memorandum is to provide additional context and information on noise based on comments from the Burlington DRB meeting on July 7, 2020 and feedback from Les Blomberg (Noise Pollution Clearinghouse)[1] related to RSG's Noise Assessment (April 20, 2020) of the Hub Project ("Noise Assessment"). The topics addressed in this memorandum include:

- Sound from music including low-frequency sound
- Sound from vehicles in the parking lot
- Acoustical context of the existing character of the area
- Sound Level Metrics: L_{eq} & L_{max}
- Burlington Noise Ordinance

Sound from Music

Low-Frequency Sound

Low-frequency sound was evaluated in the Noise Assessment for the Hub Project (April 20, 2020), but this memorandum provides additional context related to low-frequency sound.

Bass is low-frequency sound which ranges from 20 Hz to approximately 200 Hz. The Noise Assessment for the Hub Project evaluated a hard rock concert using the full music frequency range including bass, midrange, and treble from 25 Hz to 10,000 Hz. This is detailed in Table 2 of the Noise Assessment. As discussed in Section 5.3 of the Noise Assessment, Higher Ground is working with another acoustical consultant to fit-up the interior of the concert venue and this mitigation takes into account reducing low-frequency sound.

[1] Blomberg, L., Critique of RSG Noise Assessment, July 29, 2020.

The proposed project will produce low-frequency sound that is comparable to or less than in level to other sound sources in the area. There are many other mobile and non-mobile sources of low-frequency sound in the Project area. Examples of mobile and non-mobile sources of low-frequency sound located between the Project facility and residences include:

- Electrical equipment at the substations adjacent to the Project which produce 120 Hz sound;
- Pumps at the Champlain Water District water treatment facility;
- Mechanical equipment at manufacturing facilities along Queen City Park Road; and
- Transportation sources, including the train passbys, bus activity at CCTA and commercial truck delivery on Queen City Park Road, and other roadway traffic.

These are existing sources that produce low-frequency sound within the zoning district. Residences in the surrounding area are closer to these other sources than they are to the proposed facility. For example:

- Residences along Maple Avenue in South Burlington are 200 to 300 feet from a VELCO substation, but over 700 feet from the proposed concert venue.
- Residences along Arthur Court are between 110 and 280 feet from the adjacent railway, but 470 to 660 feet from the proposed concert venue.
- Residences along Austin Drive and Redrock Drive are between 200 and 390 feet from other manufacturing facilities on Queen City Park Road and the CCTA facilty, but over 1,000 feet from the proposed concert venue.

Low-frequency sound from these other sources of noise located closer to residences than the proposed facility are part of the existing background in the area. In addition, considering the purpose of the Enterprise Zoning District (intended to accommodate enterprises engaged in the manufacturing, processing, distribution … of goods, merchandise and equipment"), other sources of noise are permitted in the area. The proposed project will produce levels of low frequency sound that is comparable to or less than other existing sources in the area. As such, this sound from the proposed facility is consistent with the character of the area.

Sound Levels from Music Versus Other Sources

As discussed in Section 5.2 of the Noise Assessment, the project involves several sources of exterior noise which includes rooftop mechanical equipment, socialization in the outdoor lounge area, and vehicles accessing the parking lot. All of these sources are in addition to the interior noise source, music, which was modeled as breakout noise that is transmitted through the building structure to the outside environment.

The model results that are presented in Section 5.4 of the Noise Assessment represent the summation of sound levels from all of these sources together, producing a total

sound level projection that can be evaluated against applicable limits and guidelines discussed in Section 3 of the Noise Assessment.

It is important to note that music is just one component of the overall projected sound levels. For example, the highest projected sound level during the Concert Model scenario is 42 dBA at 20 Arthur Court, but the breakdown of what is contributing to that 42 dBA is:

- Music from concert: 32 dBA
- Rooftop mechanical equipment: 41 dBA
- Outdoor lounge: 8 dBA
- Vehicles accessing the parking lot: 34 dBA

As another example, the highest projected sound level during the Concert Model Scenario at a South Burlington residence occurs at 26 Central Avenue on the corner of Central Avenue and Maple Street. The total projected sound level at that location is 37 dBA, but the breakdown of what is contributing to that 37 dBA is:

- Music from concert: 31 dBA
- Rooftop mechanical equipment: 34 dBA
- Outdoor lounge: 28 dBA
- Vehicles accessing the parking lot: 31 dBA

These breakdowns of contributing sound levels show that the level of sound due to music in neighboring residential areas are notably less than the total projected sound at each residence, and are in fact, at levels that would be perceived as more than four times quieter than conversational speech.[2]

Sound from Vehicles in the Parking Lot

During the July 7 DRB hearing, there were some comments or questions about extraneous sounds from vehicles in the Project parking lot, such as car doors “slamming” or “beeps” from people locking their cars. These types of sources are occasionally brought up as potential concerns of parking lot noise, but they are minor sources of sound. The closing of car doors, and the sounds from locking the doors are common sources both in parking lots and in residential areas. These are also sources that would be present if the building was being used as a manufacturing facility with first, second, and third shifts.

While it varies from vehicle to vehicle, the maximum sound level of forcefully closing car doors is typically between 55 and 65 dBA at 30 feet. Most residences are over 600 feet

[2] Conversational speech (at a distance of approximately 3 feet) typically occurs between 55 and 65 dBA. Generally, a 10 dB change in broadband sound level is perceived as a halving or doubling of loudness. As such 31 to 32 dBA, is over 20 dB less than conversational speech and would generally be perceived as 4 times quieter.

from the parking areas. Accounting for distance alone, the sound of a car door forcefully closing would be between 29 and 39 dBA outside nearby residences. Even for the closest residence to a Project parking area (20 Arthur Court), a car door forcefully closing would be between 34 and 44 dBA.

Similarly, the maximum sound level of the short “beep” from locking a car door is generally between 50 and 55 dBA at 30 feet. Accounting for distance alone, this would produce a sound level between 24 and 29 dBA outside nearby residences and between 29 and 34 dBA at the closest residence.

Acoustical Context of the Area

As discussed in the Noise Assessment, average background sound levels are generally 47 and 52 dBA during the day, and between 40 and 45 dBA at night, although some areas along Queen City Park Road are higher than this. Additional details on background sound levels at two residential property line locations near Queen City Park Road are provided below.

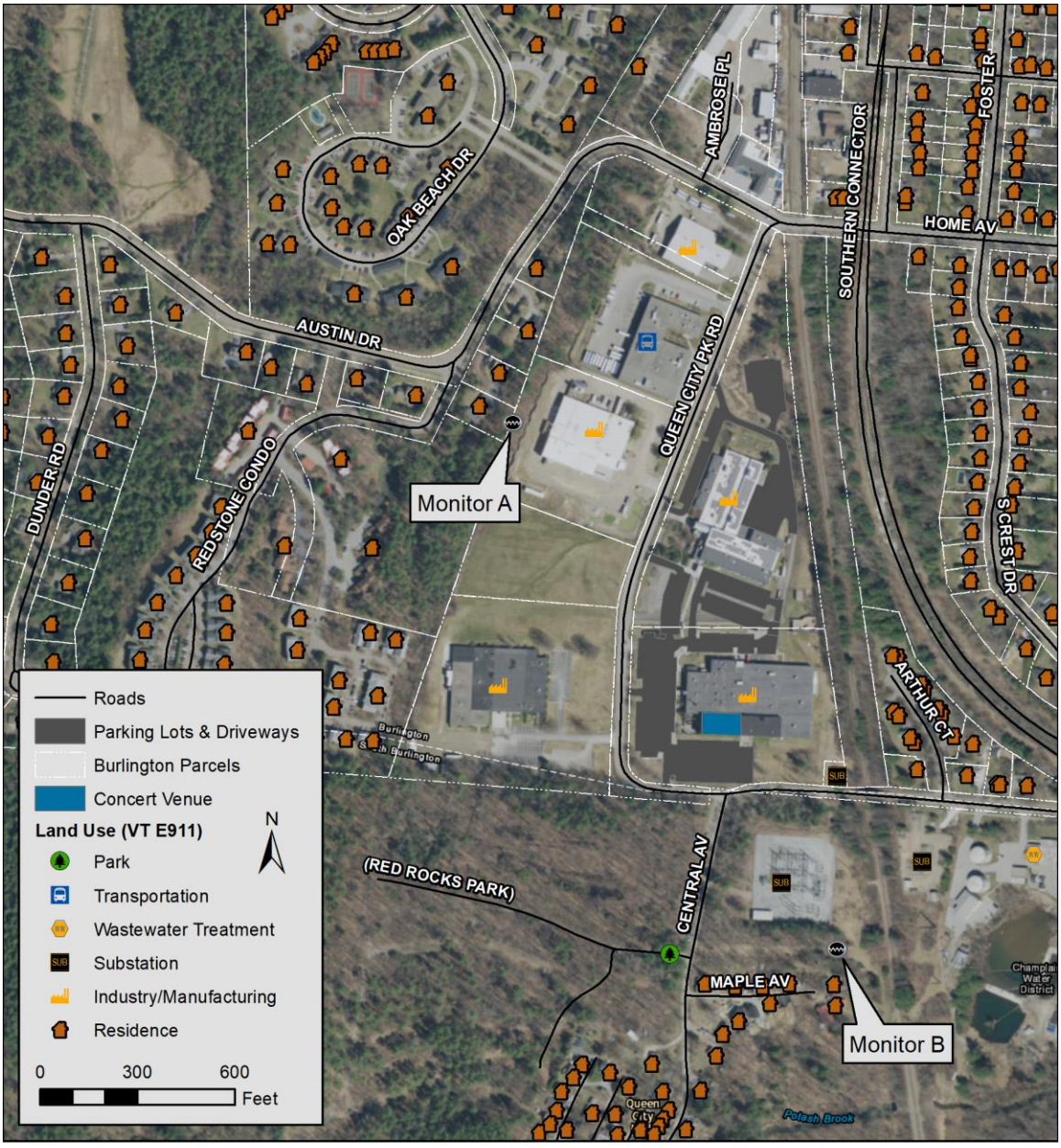
In June of 2017, RSG conducted background sound monitoring at the property line of a residence that abuts the “Enterprise – Light Manufacturing” zone along Queen City Park Road (Monitor A). In June and July of 2010, RSG conducted background sound monitoring near the property line of a residence along Maple Avenue in South Burlington (Monitor B). These monitor locations are shown in Figure 1.

These monitors collected background sound level data in the area for several days. The monitors logged sound level data using ANSI/IEC Type 1 sound level meters set to long A-weighted and 1/3 octave band sound levels once each second. Microphones were mounted approximately 5 feet above ground and were covered with wind screens. Both monitors were field-calibrated before and after the monitoring periods.

Background sound level data from Monitor A, summarized into 10-minute intervals, is provided in Figure 2. The average daytime background sound level at this location was 54 dBA, while the average nighttime background sound level was 52 dBA. Maximum sound levels however are higher both during the day and night with levels typically between 55 and 67 dBA. This is an example of an area along Queen City Park Road that is higher than the average background sound levels discussed in the Noise Assessment, and is an example from the borderline between the “Enterprise – Light Manufacturing” zone and the “Waterfront Residential – Low Density” zone.

Background sound level data from Monitor B, summarized into 10-minute intervals, is provided in Figure 3. The average daytime background sound level at this monitor was 49 dBA, and the average nighttime background sound level was 41 dBA. Maximum sound levels during the day are generally between 50 and 70 dBA, and at night vary between 35 and 55 dBA, although there are some maximum sound levels between 60 and 70 dBA at night.

These levels are representative of the types land uses in the area which includes a mixture of industrial, transportation (roadway, rail, and bus), utilities, and residential areas, and they speak to the acoustical character of the area. When compared with the projected sound levels in the Noise Assessment, this shows that the proposed Project will generate sound that is comparable to or less than that which is typically generated by other permitted uses in the zoning district.



Service Layer Credits: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

FIGURE 1: BACKGROUND MONITOR LOCATIONS

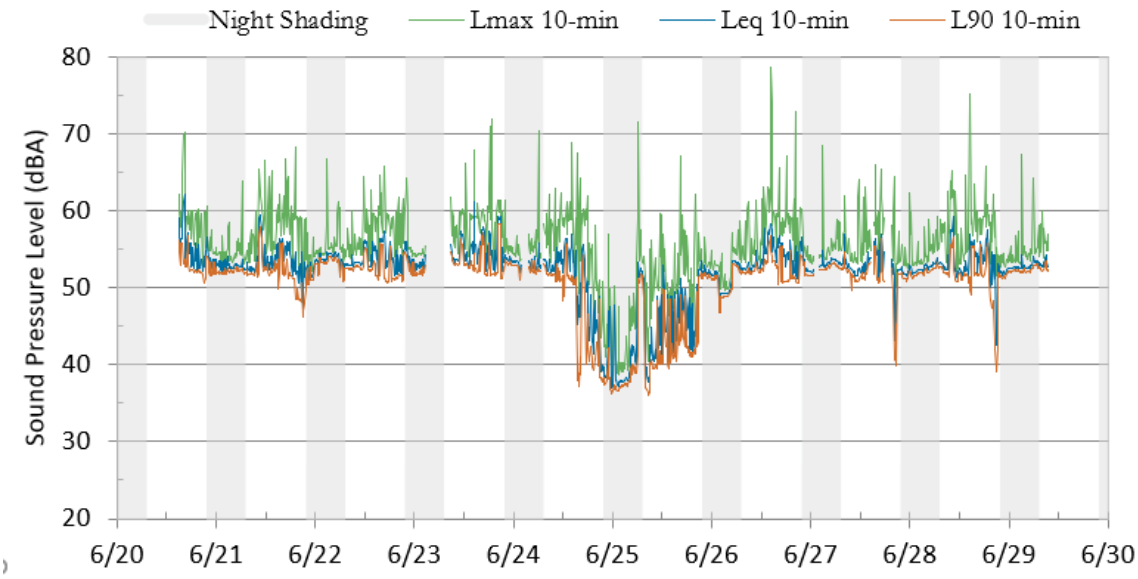


FIGURE 2: BACKGROUND SOUND LEVELS - MONITOR A, JUNE 2017

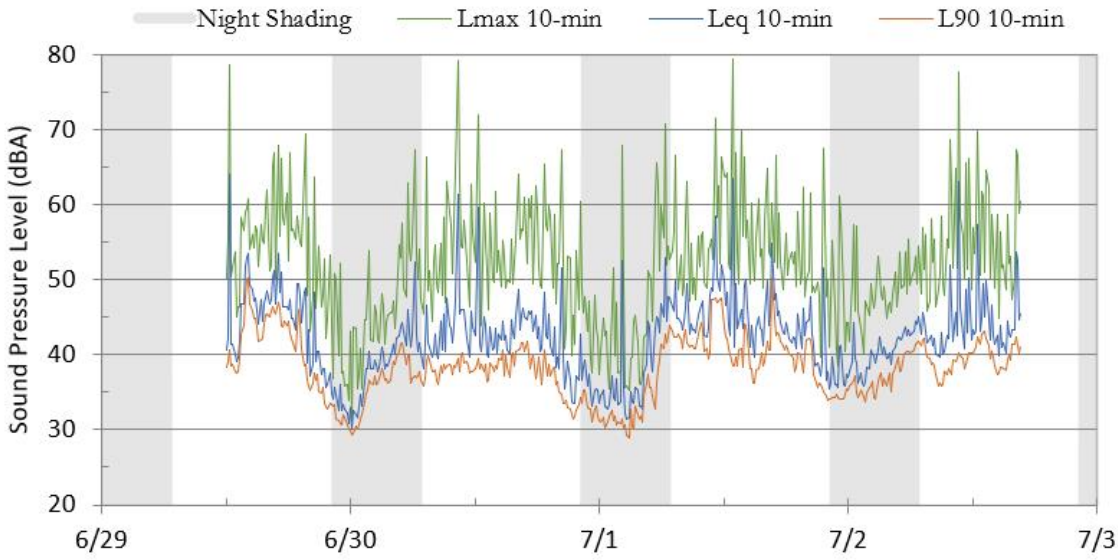


FIGURE 3: BACKGROUND SOUND LEVELS - MONITOR B, JUNE/JULY 2010

Sound Level Metrics: L_{eq} & L_{max}

The projected sound levels in the Noise Assessment are reported as hourly average equivalent sound levels, $L_{eq\ (1\text{-}hour)}$, for two conservative scenarios that include the:

- Concert Model with all existing and proposed rooftop mechanical equipment operating simultaneously, hard rock music playing for the entire hour (no breaks between sets or songs are considered), 100 vehicles accessing the parking lot, and people socializing in the outdoor lounge.

- End-of-Concert Model with all existing and proposed rooftop mechanical equipment operating simultaneously and 500 vehicles accessing the parking lot.

The L_{eq} is an appropriate metric for assessing the noise impact of the proposed facility, especially under these conservative scenarios for several reasons:

1. It allows for comparison between the projected sound levels of the facility and community noise guidelines that speak to health and compatibility such as the WHO and ANSI guidelines discussed in Section 3.3 of the Noise Assessment. Those community noise guidelines use average sound levels to assess noise. Those guidelines are actually based on longer term averages than what is modeled for this Project, making the comparisons more conservative.
2. It allows for comparison between the projected sound levels of the facility and the existing average sound levels throughout the area and provide an element of quantification to the acoustical character of the area.
3. Many of the sources of sound associated with the facility are consistent, such as the rooftop mechanical equipment. The level of sound from such equipment does not fluctuate much, making the L_{eq} nearly equivalent to the L_{max}.

In addition, it should be noted that the South Burlington Zoning Ordinance uses the exact same metric, $L_{eq\ (1\text{-}hour)}$. The Noise Assessment compares projected sound levels from the proposed facility to the $L_{eq\ (1\text{-}hour)}$ standard set in the South Burlington Zoning ordinance in Section 6.

Standards that utilize L_{max} help to evaluate startle, particularly from sources that have rapid increases and decreases of sound that are high relative to the background. For example, trucks passing by a sensitive receptor on a remote roadway or a tailgate banging as it loosens material from the back of a dump truck. As discussed above, many of the non-mobile noise sources in the Enterprise Zoning District are moderately consistent sources of sound. Indeed, even hard rock music is a moderately consistent source of sound. For example, at the hard rock concert that RSG monitored at Higher Ground on August 17, 2019 and is discussed in Section 5.2 of the Noise Assessment, the quietest 10% of music (L_{90}) was 95 dBA while the loudest 10% of music (L_{10}) was 101 dBA. A difference of only 6 dB.

The CRZ argues that L_{max} must be considered based on Act 250 case law from Lathrop (2015 VT 49). Virtually all of the analysis in Lathrop and the cases it references involve projects (all but one, Act 250 permits), involving the introduction of new truck traffic to relatively rural settings. This context is critical. The context is one of low average background sound levels with periodic short-term increases in sound level due to truck passbys. This is different from the context of this project where there are numerous non-mobile sound sources, which are fairly consistent, and within the range of the existing background sound levels.

As discussed in the Noise Assessment, the sound propagation model used the average sound level during times when music was playing during the hard rock concert which

was 99 dBA. The L_{max} for one second during the evening of monitoring was 106 dBA. Even if the model utilized the L_{max} of the music at 106 dBA, the projected sound level due to music would only be up to 7 dB higher. Based on the breakdown of sound levels from 20 Arthur Court provided on page 3 of this memo, the sound levels using the L_{max} of music would be:

- Music from concert: 39 dBA
- Rooftop mechanical equipment: 41 dBA
- Outdoor lounge: 8 dBA
- Vehicles accessing the parking lot: 34 dBA

This would result in a sound level of 44 dBA at 20 Arthur Court that would occur during a 1-second maximum sound level from the concert while all the rooftop mechanical equipment is operating simultaneously. Thus, even considering the L_{max} metric, the music component is still not the dominant sound from the proposed facility, and sound levels remain not higher than those typical in the area.

This additional L_{max} information compares existing L_{max} from in the area with projections for the proposed facility. This information demonstrates for the DRB, even considering L_{max} data, noise from the proposed facility satisfies the applicable Burlington Zoning Ordinance ("Ordinance") standards.

Burlington Noise Ordinance

Although the proposed concert venue is likely exempt[3] from the Ordinance, the Noise Assessment demonstrates compliance with Conditional Use Review Standard #6 and the factors contained in the Ordinance. The purpose of the noise ordinances is to, "preserve the public health, safety, and welfare by prohibiting excessive and disturbing noise and to prevent noise which is prolonged or unsuitable for the time and place and which is detrimental to the peace and good order of the community." As stated in Section 6 of the Noise Assessment, the projected sound levels are comparable to existing nighttime sound levels in the area, below WHO's nighttime noise guideline, and considered compatible with urban/suburban residential areas per ANSI guidelines. This analysis in the noise assessment is a quantitative method for evaluating specific factors discussed in the Ordinance.

Mr. Blomberg argues that RSG did not evaluate the "plainly audible" clauses under Section 21-13(b)(2) a. & c. of the Ordinance. Mr. Blomberg states that there is "no discussion of whether noise will be *detectable.*" (emphasis added). Plainly audible is a vague and ambiguous standard. This is evidenced by Mr. Blomberg's interpretation that it equates to whether a sound is detectable. One can detect a lot of sound that is not audible and discernible by a human listener with instrumentation. Rather, the plainly audible standards should be read within the context of the purpose of the ordinance,

[3] Sec. 21-13.(c)(5).

which as discussed previously speaks to public welfare, health, and safety and preventing sound that is prolonged or unsuitable for the time and place.

It is our understanding that the DRB is tasked with determining if the project will cause an undue adverse effect on nuisance impacts from noise, and factors identified in the Ordinance. The noise modelling and evaluation of community noise guidelines contained in the Noise Assessment and the clarifying information provided in this memorandum demonstrate compliance with these standards.