



MEMORANDUM

23 May 2017

To: Andrew Crabtree, Juan Padilla, Lee Butler
Community Development Department, City of Santa Clara

Fr: Derek Watry

Re: Levi's Stadium Noise Level Monitoring Project
Attended Noise Level Readings of U2 Concert (17 May 2017)

This memorandum presents noise level data collected on the evening of Wednesday, 17 May 2017, during the U2 concert at Levi's Stadium. Data was collected live in the neighborhoods around the stadium. Equipment consisted of a Brüel & Kjær Type 2230 Sound Level Meter and a Sony PCM-D50 Audio Recorder. The measurement apparatus was calibrated immediately prior to use with a Brüel & Kjær Type 4230 Field Calibrator.

The noise level data was post-processed using proprietary software developed by Wilson Ihrig expressly for this purpose. For the analysis, we excluded other distinct sources such as cars, jet aircraft, and barking dogs. We then determined the statistical noise levels for the concert dominated portions of the recordings. While it's tempting look at the maximum and minimum levels, we prefer to report the noise levels exceed 1%, 10%, 50%, and 90% of the time. These statistical levels give a better indication of the variability of the sound levels without including potentially anomalously high or low readings. They represent, respectively, the louder moments, the typical loud moments, the median level, and the quieter moments during the show.

Measurements were made at four locations around the stadium (see Figure 1). At the first of these, Cheeney and Lenox, ambient data was collected when there was no audible sound coming from the stadium. The ambient recording included automobiles and jet aircraft. The levels for these distinct sources are reported below, but they were removed for the purposes of calculating the *background* noise levels at Cheeney and Lenox. The range of background noise levels is shown on all four data plots below because we did not have the opportunity to collect background levels at the other three locations. It is reasonable to assume they are similar at all four locations.

Table I presents a summary of the measured noise levels at all four locations. The ranges shown for the concert are the levels between that exceeded 90% of the time (characteristic of the quieter moments) and 1% of the time (characteristic of the louder moments).

It is important to realize that “audibility” is not just about the decibel levels. At Arboles and Lago, for example, the noise level readings are generally not much higher than the background levels, however, concert sound was still audible because singing, talking, and crowd cheers are distinct from other evening and nighttime sounds in a suburban neighborhood. Conversely, at Cheeney and Lenox and 4624 Cheeney, the concert noise levels were some 10 to 20 decibels higher than the background levels. At these locations, the concert sound not only prevailed, but lyrics and music were plainly audible. It was easy to identify every song.

TABLE I SUMMARY OF MEASURED NOISE LEVELS			
Cheeney & Lenox	Ambient		
	Background	48 – 53 dBA	
	Jet Aircraft	73 – 77 dBA	
	Cars	63 – 64 dBA	
	Concert	56 – 68 dBA	Lyrics plainly audible
4624 Cheeney	Concert	54 – 63 dBA	Lyrics plainly audible
Hughes Elementary	Concert	52 – 60 dBA	Lyrics audible. Includes some helicopter noise.
Arboles & Lago	Concert	46 – 54 dBA	Lyrics not audible

The 1/3-octave band spectra at the four locations are shown in Figures 2 to 5. The single-number A-weighted (dBA) value corresponding to each spectrum is indicated on the right-hand side of the graph (AW). Again, we’re showing the levels exceeded 1%, 10%, 50%, and 90% of the time. At Cheeney and Lenox and 4264 Cheeney, noise levels in the 500 to 2000 Hz frequency bands are particularly elevated. This is the frequency range that corresponds to the human voice, so those levels are mostly likely associated with singing. The lyrics were more plainly audible at the two Cheeney Street locations probably because that end of the stadium is somewhat open. Conversely, the locations northwest of the stadium are somewhat more shielded by the bleacher seating configuration.

Assessment Against Stadium Condition of Approval P23

Condition of Approval P23 for the Stadium project states:

In order to control noise, the stadium loudspeaker systems (permanent and temporary) shall be oriented in a manner consistent with Community Noise Analysis prepared by WJHW, dated May 27, 2010 for the proposed 49ers Stadium, in order to control noise impacts to adjacent residential neighborhoods. In accordance with Section 9.10.070(c) of the Santa Clara City Code, and the recommendations of the noise analysis, sound system levels shall be limited to 100 dBA for NFL

games and other used of the permanent speaker system, and not more than 105 dBA for temporary concert speaker systems as presented in the analysis. For sound system installations and modifications within the stadium site, the target for maximum sound level exposure in residential areas to the east and south shall be 60 dBA, in order to minimize noise impacts to sensitive receptors.

As seen in the data presented in Table I, concert noise levels exceeded 60 dBA at both of the locations on Cheeney Street. On Figure 2, it can be seen that concert noise exceeded 60 dBA very nearly 50% of the time (see the blue circle on the AW scale). On Figure 3, it can be seen that concert noise exceeded 60 dBA about 10% of the time (see the orange circle on the AW scale). As stated above, the concert was plainly audible at both of these locations, and the concert noise levels were some 10 to 20 dB above the prevailing background noise levels in the neighborhood.

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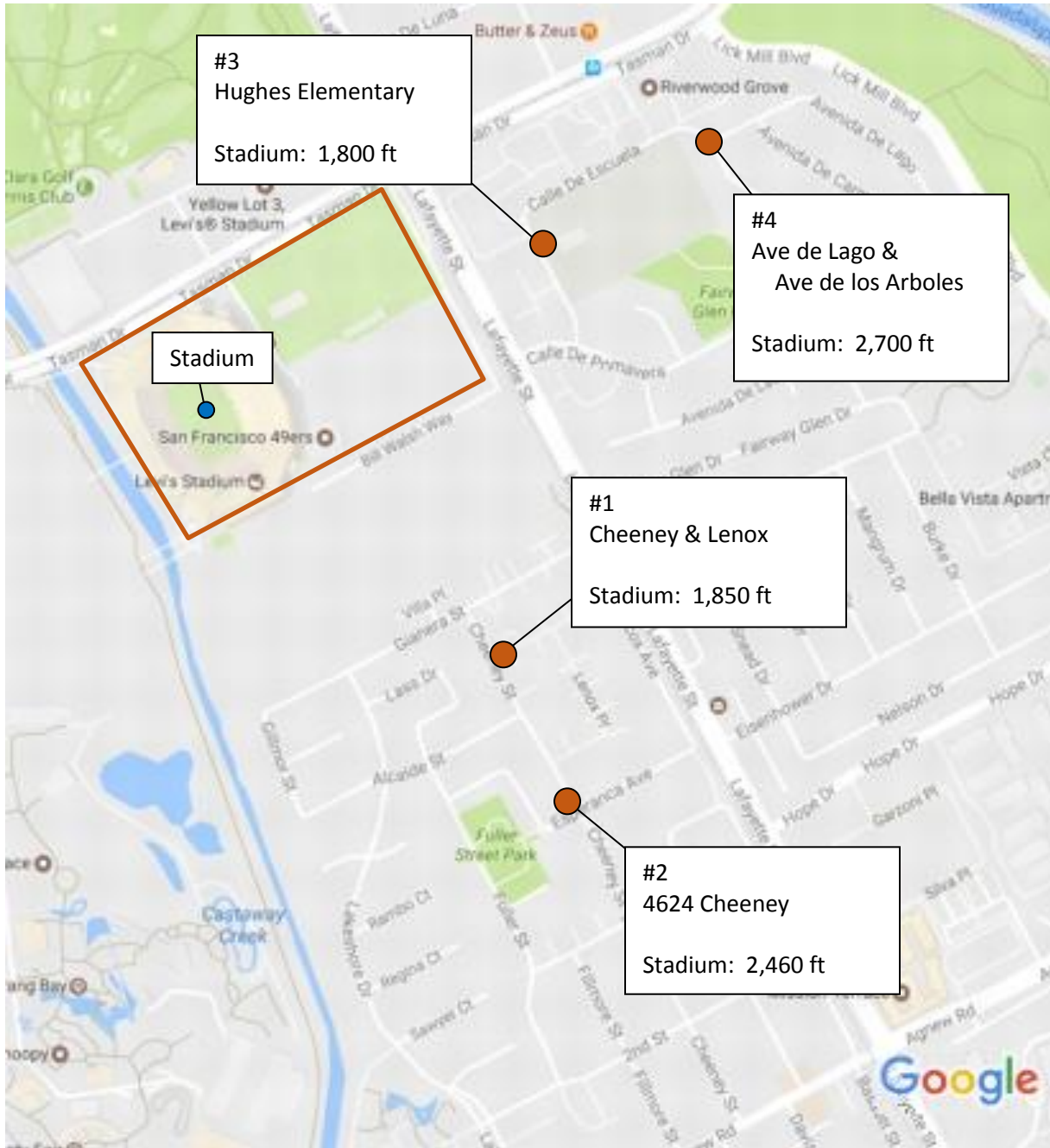


FIGURE 1 AREA MAP WITH NOISE MONITORING LOCATIONS
(DISTANCES ARE FROM BLUE DOTS)

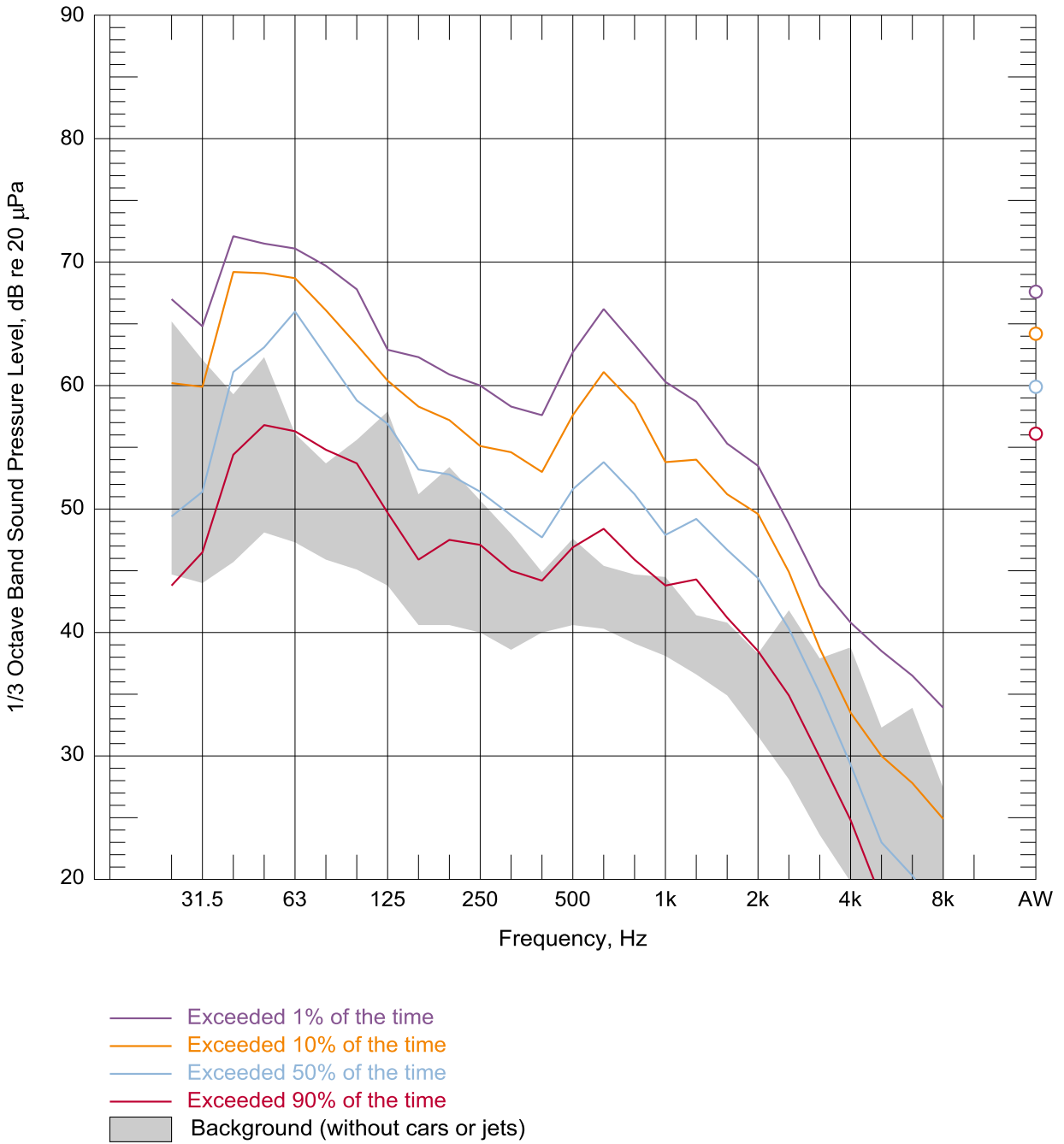


FIGURE 2 CHEENEY & LENOX

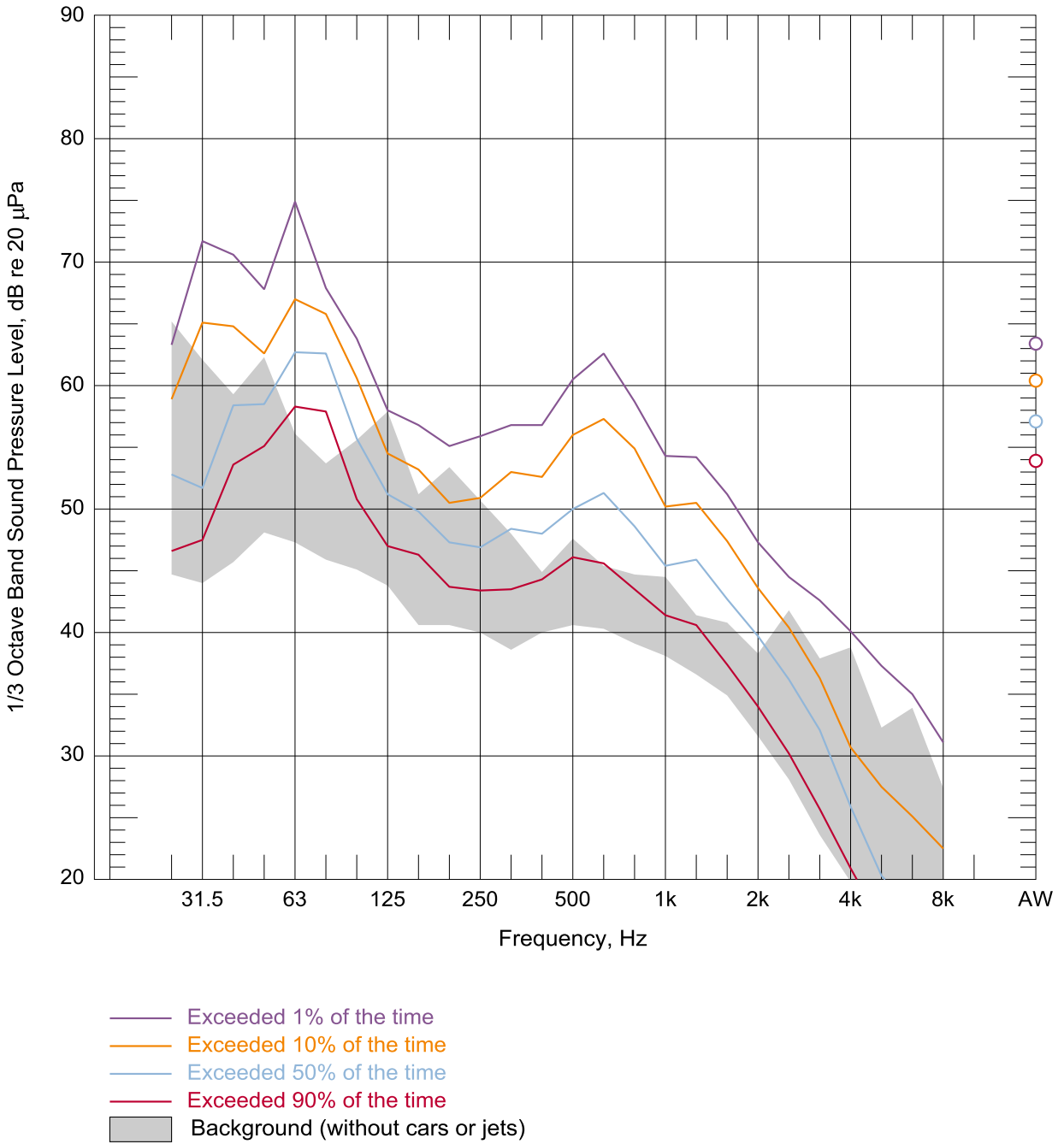


FIGURE 3 4624 CHEENEY

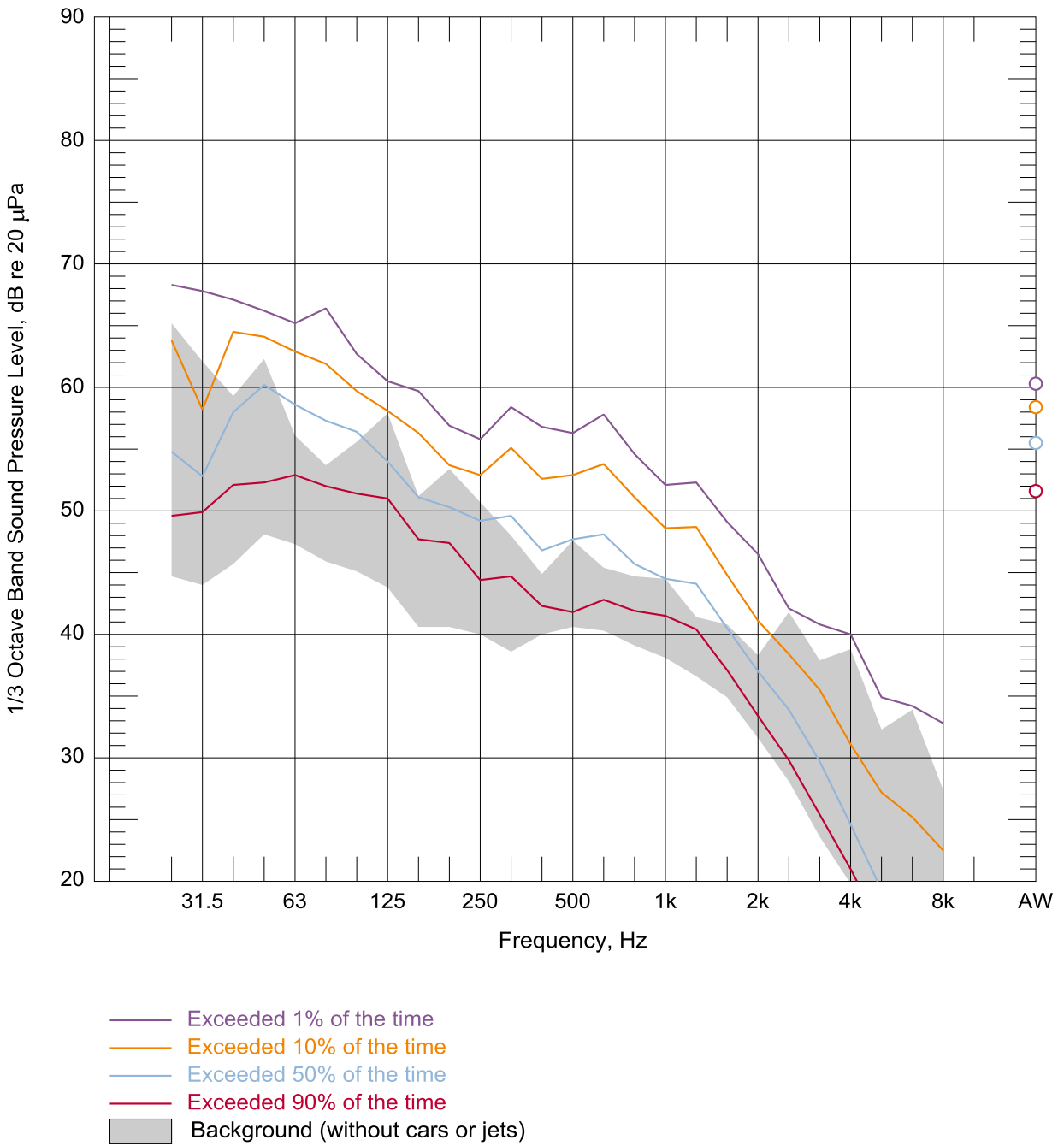


FIGURE 4 HUGHES ELEMENTARY (NEAR AVE. DE GUADELUPE)

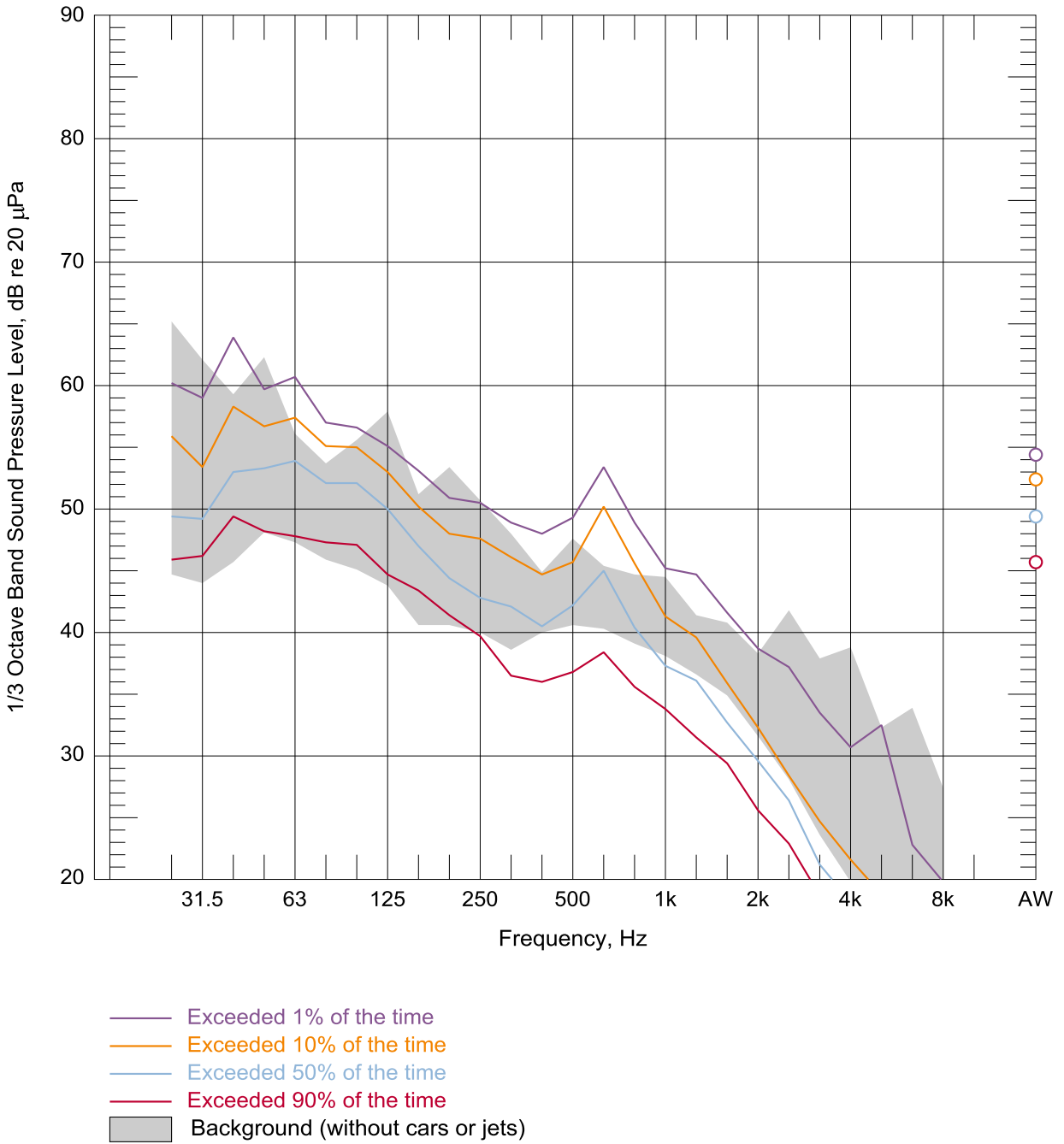


FIGURE 5 AVENIDA DE LOS ARBOLES & AVENIDA DE LAGO