# APPENDIX D

## Updated Noise Study

# DEER CREEK VILLAGE SHOPPING CENTER – TRAFFIC NOISE STUDY

## PETALUMA, CALIFORNIA

16 September 2011

Prepared for:

Heather Hines
**City of Petaluma**
11 English Street
Petaluma, CA 94952
hhines@ci.petaluma.ca.us

Prepared by:

**CHARLES M. SALTER ASSOCIATES, INC.**
Eric Broadhurst, PE
Senior Vice President
130 Sutter Street, Suite 500
San Francisco, CA 94104
Phone: (415) 397-0442
Fax: (415) 397-0454

CSA Project No. 11-0365

## INTRODUCTION

This report summarizes our traffic noise study for the Deer Creek Village Shopping Center in Petaluma. We have analyzed noise from the 101 freeway and noise from project traffic. This report summarizes the noise criteria, the noise environment at the site, and the calculated project traffic noise. This report supersedes our December 2009 report. The modifications were due to the receipt of an updated traffic study that included different traffic volumes. The differences in traffic volume were small enough that the conclusions of this report are the same as from our December 2009 report.

The project site is located on the west side of North McDowell Boulevard, just east of the US-101 freeway and north of Lynch Creek Way.

For those unfamiliar with the fundamental concepts of environmental acoustics, please refer to Appendix A and Figure A1.

## EXECUTIVE SUMMARY

- The future noise environment at the site ranges between $L_{dn}$[1] 60 and 75 dB. The City considers this noise level to be Conditionally Acceptable for commercial uses.

- In general, while the noise level is expected in increase by up to 2 dB (existing to existing-plus-project), which is less than significant, this increase is largely due to traffic volume increases on US-101. Noise from project traffic itself will not significantly increase the noise level at the surrounding land uses.

- Noise from a worst-case delivery truck schedule (all deliveries between 6 am and 7 am) will not increase the overall noise level. Therefore, noise from delivery trucks will be a less-than-significant impact.

- Overall, project traffic noise will not exceed the City's criteria; therefore, no mitigation is necessary.

- Due to the shielding provided by the project buildings, US-101 noise levels at the residential areas directly east of the project (across North McDowell Boulevard) will be reduced by 2 to 3 dB. A change of 3 dB is considered "just noticeable."

- The project mechanical equipment shall be installed per Table 21.1 of Section 21.040 of the City's Zoning Ordinance, which stipulates a property line noise limit of $L_{eq}$[2] 70 dB during

[1] Day-Night Average Sound Level ($L_{dn}$ or DNL) – A descriptor established by the U.S. Environmental Protection Agency to represent a 24-hour average noise level with a 10 dB penalty applied to noise occurring during the nighttime hours (10 p.m. to 7 a.m.) to account for the increased sensitivity of people during sleeping hours.

daytime hours and $L_{eq}$ 65 dB during nighttime hours, assuming the equipment operates at least 15 minutes per hour.

## SECTION 1: NOISE CRITERIA

*General Plan*

The City of Petaluma's 2025 General Plan contains noise criteria applicable to the project (Policy 10-P-3), summarized below:

- Require placement of fixed equipment, such as air condition units and condensers, inside or in the walls of new buildings or on roof-tops of central units in order to reduce noise impacts on any nearby sensitive receivers

- As part of development review, use Figure 10-2: Land Use Compatibility Standards (included below) to determine acceptable uses and installation requirements in noise-impacted areas

- Discourage the use of sound walls anywhere except along Highway 101 and/or along the NWPRA corridor, without findings that such walls will not be detrimental to community character. When sound walls are deemed necessary, integrate them into the streetscape

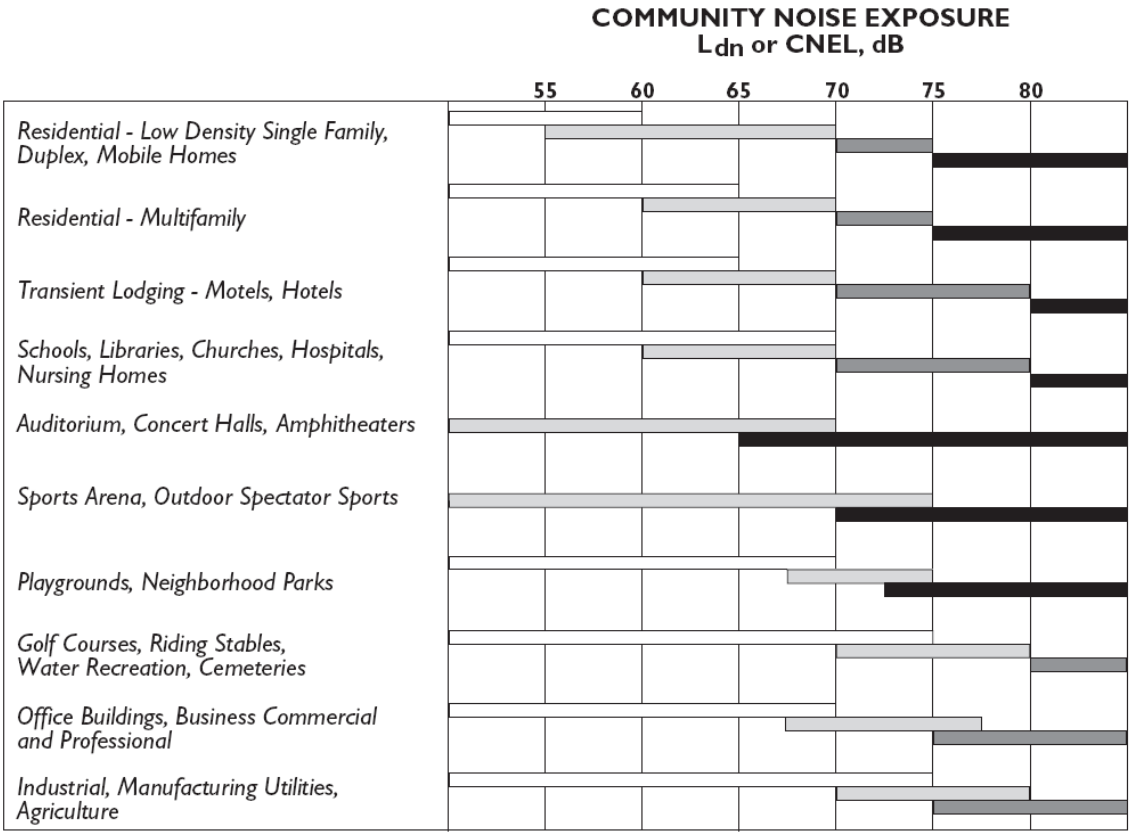
- In making a determination of impact under the California Environmental Quality Act (CEQA), consider an increase of [$L_{dn}$] four or more dBA to be "significant" if the resulting noise level would exceed that described as normally acceptable for the affected land use in Figure 10-2: Land Use Compatibility Standards

*Zoning Ordinance*

Table 21.1 of Section 21.040 of the City's Zoning Ordinance stipulates a property line noise limit of $L_{eq}$ 70 dB during daytime hours and $L_{eq}$ 65 dB during nighttime hours, assuming the equipment operates at least 15 minutes per hour. This limit may be raised in 5 dB increments if the ambient (background) noise level is above $L_{eq}$ 60 dB; however, the property line noise limit may not exceed $L_{eq}$ 80 dB during the daytime or $L_{eq}$ 75 dB.

[2] $L_{eq}$ – The equivalent steady-state A-weighted sound level that, in a stated period of time, would contain the same acoustic energy as the time-varying sound level during the same time period.

***Figure 10-2: Land Use Compatibility Standards (from General Plan)***




**INTERPRETATION:**

**NORMALLY ACCEPTABLE**
Specified land use is satisfactory, based upon the assumption that any building involved is of normal conventional construction, without any special noise insulation requirements.

**CONDITIONALLY ACCEPTABLE**
New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.

**NORMALLY UNACCEPTABLE**
New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.

**CLEARLY UNACCEPTABLE**
New construction or development should generally not be undertaken.

## SECTION 2: EXISTING NOISE ENVIRONMENT

We have reviewed the 2025 noise contours shown in Figure 10-1 of the City's General Plan to quantify the noise environment at the project site. The DNL across the site ranges from 65 dB to 75 dB, primarily due to US-101 traffic noise. We estimated the existing contours by subtracting the change in noise level of 1.7 dB due to US-101 traffic as shown in Table 3.9-5 (Traffic Noise Contours) of the Draft EIR for the General Plan 2025. Note 1 of the table states that the existing noise levels were calculated using data collected in 2001 and 2003, so the resultant DNL is conservative when compared to the project "existing" year of 2007. This conservativeness is because the increase in noise level from 2003 is greater than the increase in noise level from 2007.

## SECTION 3: ANALYSIS

*Auto Traffic Noise*

We have reviewed the traffic volumes presented in the WRA traffic impact study[3] for the "existing" (Figure IV.B-4 and 5) and "existing plus project" (Figure IV.B-15 and 16) scenarios. We calculated the increase in noise level due to the project using the Federal Highway Administration's (FHWA) RD-77-108 noise prediction method.

We have evaluated the road segments that will be most impacted by project traffic; the results of our calculations are presented in Table 1.

**Table 1: Traffic Volumes and Noise Level Increase**

| | *Existing* | | | | | *Existing plus Project* | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Road Segment** | **PM Peak Volume** | **PM Peak Hour $L_{eq}$ at 100 feet (dB)** | **Estimated $L_{dn}$ at 100 feet (dB)** | **US-101 $L_{dn}$ (dB)** | **Total $L_{dn}$ (dB)** | **PM Peak Volume** | **PM Peak Hour $L_{eq}$ at 100 feet (dB)** | **Estimated $L_{dn}$ at 100 feet (dB)** | **Max Trucks $L_{dn}$ at 100 feet (dB)** | **US-101 $L_{dn}$ (dB)** | **Total $L_{dn}$ (dB)** | **Increase in $L_{dn}$ (dB)** | **Significant Increase?** |
| North McDowell Boulevard, south of Rainier Avenue | 2222 | 67 | 67 | 63 | 68 | 2442 | 67 | 67 | 52 | 65 | 69 | 1 | No |
| North McDowell Boulevard, north of South Project Driveway | 2230 | 67 | 67 | 63 | 68 | 2666 | 68 | 68 | 52 | 65 | 70 | 1 | No |
| Rainier Avenue, west of North McDowell Boulevard | - | - | - | 63 | 63 | 532 | 61 | 61 | 52 | 65 | 67 | 3 | No |
| Rainier Avenue, east of North McDowell Boulevard | 674 | 62 | 62 | 58 | 63 | 723 | 62 | 62 | 52 | 60 | 64 | 1 | No |
| Professional Drive, east of North McDowell Boulevard | 274 | 56 | 56 | 58 | 60 | 362 | 57 | 57 | 52 | 60 | 62 | 2 | No |
| North Project Driveway, west of North McDowell Boulevard | - | - | - | 63 | 63 | 66 | 50 | 50 | 52 | 65 | 65 | 2 | No |
| South Project Driveway, west of North McDowell Boulevard | - | - | - | 63 | 63 | 60 | 49 | 49 | 52 | 65 | 65 | 2 | No |

The City's General Plan considers increases of less than DNL 4 dB to not be significant. As shown in Table 1, the future DNL will increase by up to 3 dB (along the new portion of Rainier Avenue). This is the unique case where a new roadway will have noticeable traffic (532 vehicles

[3] Deer Creek Village Shopping Center Traffic Impact Study, prepared by WRA, February 2011.

during peak hour). In the other cases, the increases are primarily due to the expected 1.7 dB increase in noise due to US-101. Increased noise from local roadways contributes less than one dB to the Total DNL.

*Delivery Truck Noise*

We understand that up to nine delivery trucks are expected per day, between 6 am and 7 pm. The majority of delivery trucks will service the four major stores, which are located on the western portion of the site adjacent to US-101. Assuming all nine deliveries occur during the "nighttime" hour between 6 am and 7 am (the most conservative analysis[4]), the delivery trucks will generate a noise level of DNL 52 dB at a distance of 100 feet. The addition of this DNL 52 dB noise source does not result in an increase of the Existing Plus Project DNL. Therefore, the impact from delivery trucks is less than significant.

*Land Use Compatibility*

Based on the 2025 noise contours contained in the City's General Plan and the project traffic noise levels presented in Table 1, the future noise environment at the project site will range from DNL 65 to 75 dB. The City considers this to be Conditionally Acceptable for commercial uses.

*US-101 Noise at Residences across North McDowell Boulevard*

The project buildings will reduce the noise levels at the residences directly east of the project (across North McDowell Boulevard). We estimate that US-101 noise levels will be reduced by 2 to 3 dB at these residences. For your reference, a change of 3 dB is considered "just noticeable."

*Property Line Mechanical Equipment Noise Limits*

The City's Zoning Ordinance provides property line noise limits for fixed mechanical equipment (e.g., HVAC); the property line noise limit is summarized in Section 1 of this report. The mechanical engineer should verify that the planned mechanical equipment will not exceed the Code requirements.

[4] This is the most conservative analysis because delivery noise during that hour is penalized 10 dB as part of the DNL calculation procedure. If the deliveries all occurred during the "daytime" hours, the resultant DNL would be 10 dB lower (i.e., DNL 42 dB).

# A P P E N D I X  A

## FUNDAMENTAL CONCEPTS OF ENVIRONMENTAL NOISE

This section provides background information to aid in understanding the technical aspects of this report.

Three dimensions of environmental noise are important in determining subjective response. These are:

a) The intensity or level of the sound;
b) The frequency spectrum of the sound;
c) The time-varying character of the sound.

Airborne sound is a rapid fluctuation of air pressure above and below atmospheric pressure. Sound levels are usually measured and expressed in decibels (dB), with 0 dB corresponding roughly to the threshold of hearing.

The "frequency" of a sound refers to the number of complete pressure fluctuations per second in the sound. The unit of measurement is the cycle per second (cps) or hertz (Hz). Most of the sounds that we hear in the environment do not consist of a single frequency, but of a broad band of frequencies, differing in level. The name of the frequency and level content of a sound is its sound spectrum. A sound spectrum for engineering purposes is typically described in terms of octave bands that separate the audible frequency range (for human beings, from about 20 to 20,000 Hz) into ten segments.

Many rating methods have been devised to permit comparisons of sounds having quite different spectra. Surprisingly, the simplest method correlates with human response practically as well as the more complex methods. This method consists of evaluating all of the frequencies of a sound in accordance with a weighting that progressively de-emphasizes the importance of frequency components below 1000 Hz and above 5000 Hz. This frequency weighting reflects the fact that human hearing is less sensitive at low frequencies and at extreme high frequencies relative to the mid-range.

The weighting system described above is called "A"-weighting, and the level so measured is called the "A-weighted sound level" or "A-weighted noise level." The unit of A-weighted sound level is sometimes abbreviated "dBA." In practice, the sound level is conveniently measured using a sound level meter that includes an electrical filter corresponding to the A-weighting characteristic. All U.S. and international standard sound level meters include such a filter. Typical sound levels found in the environment and in industry are shown in Figure A-1.

Although a single sound level value may adequately describe environmental noise at any instant in time, community noise levels vary continuously. Most environmental noise is a conglomeration of distant noise sources that results in a relatively steady background noise having no identifiable source. These distant sources may include traffic, wind in trees, industrial activities, etc. and are relatively constant from moment to moment. As natural forces change or as human activity follows its daily cycle, the sound level may vary slowly from hour to hour. Superimposed on this slowly varying background is a succession of identifiable noisy events of brief duration. These might include nearby activities such as single vehicle passbys, aircraft flyovers, and train passbys that cause the environmental noise level to vary from instant to instant.

To describe the time-varying character of environmental noise, statistical noise descriptors were developed. "$L_{10}$" is the A-weighted sound level equaled or exceeded during 10 percent of a stated time period. The $L_{10}$ is considered a good measure of the maximum sound levels caused by discrete noise events. "$L_{50}$" is the A-weighted sound level that is equaled or exceeded 50 percent of a stated time period; it represents the median sound level. The "$L_{90}$" is the A-weighted sound level equaled or exceeded during 90 percent of a stated time period and is used to describe the background noise.

As it is often cumbersome to quantify the noise environment with a set of statistical descriptors, a single number called the average sound level or "$L_{eq}$" is now widely used. The term $L_{eq}$ originated from the concept of a so-called ***eq***uivalent sound level that contains the same acoustical energy as a varying sound level during the same time period. In simple but accurate technical language, the $L_{eq}$ is the average A-weighted sound level in a stated time period. The $L_{eq}$ is particularly useful in describing the subjective change in an environment where the source of noise remains the same but there is change in the level of activity. Widening roads and/or increasing traffic are examples of this kind of situation.

In determining the daily measure of environmental noise, it is important to account for the different response of people to daytime and nighttime noise. During the nighttime, exterior background noise levels are generally lower than in the daytime; however, most household noise also decreases at night, thus exterior noise intrusions again become noticeable. Further, most people trying to sleep at night are more sensitive to noise.

To account for human sensitivity to nighttime noise levels, a special descriptor was developed. The descriptor is called the CNEL (Community Noise Equivalent Level), which represents the 24-hour average sound level with a penalty for noise occurring at night.

The CNEL computation divides the 24-hour day into three periods: daytime (7:00 am to 7:00 pm); evening (7:00 pm to 10:00 pm); and nighttime (10:00 pm to 7:00 am). The evening sound levels are assigned a 5 dB penalty and the nighttime sound levels are assigned a 10 dB penalty prior to averaging with daytime hourly sound levels.

For highway noise environments, the average noise level during the peak hour traffic volume is approximately equal to the CNEL.

The effects of noise on people can be listed in three general categories:

a) Subjective effects of annoyance, nuisance, dissatisfaction;
b) Interference with activities such as speech, sleep, and learning;
c) Physiological effects such as startle, hearing loss.

The sound levels associated with environmental noise usually produce effects only in the first two categories. Unfortunately, there has never been a completely predictable measure for the subjective effects of noise nor of the corresponding reactions of annoyance and dissatisfaction. This is primarily because of the wide variation in individual thresholds of annoyance and habituation to noise over time.

Thus, an important factor in assessing a person's subjective reaction is to compare the new noise environment to the existing noise environment. In general, the more a new noise exceeds the existing, the less acceptable the new noise will be judged.

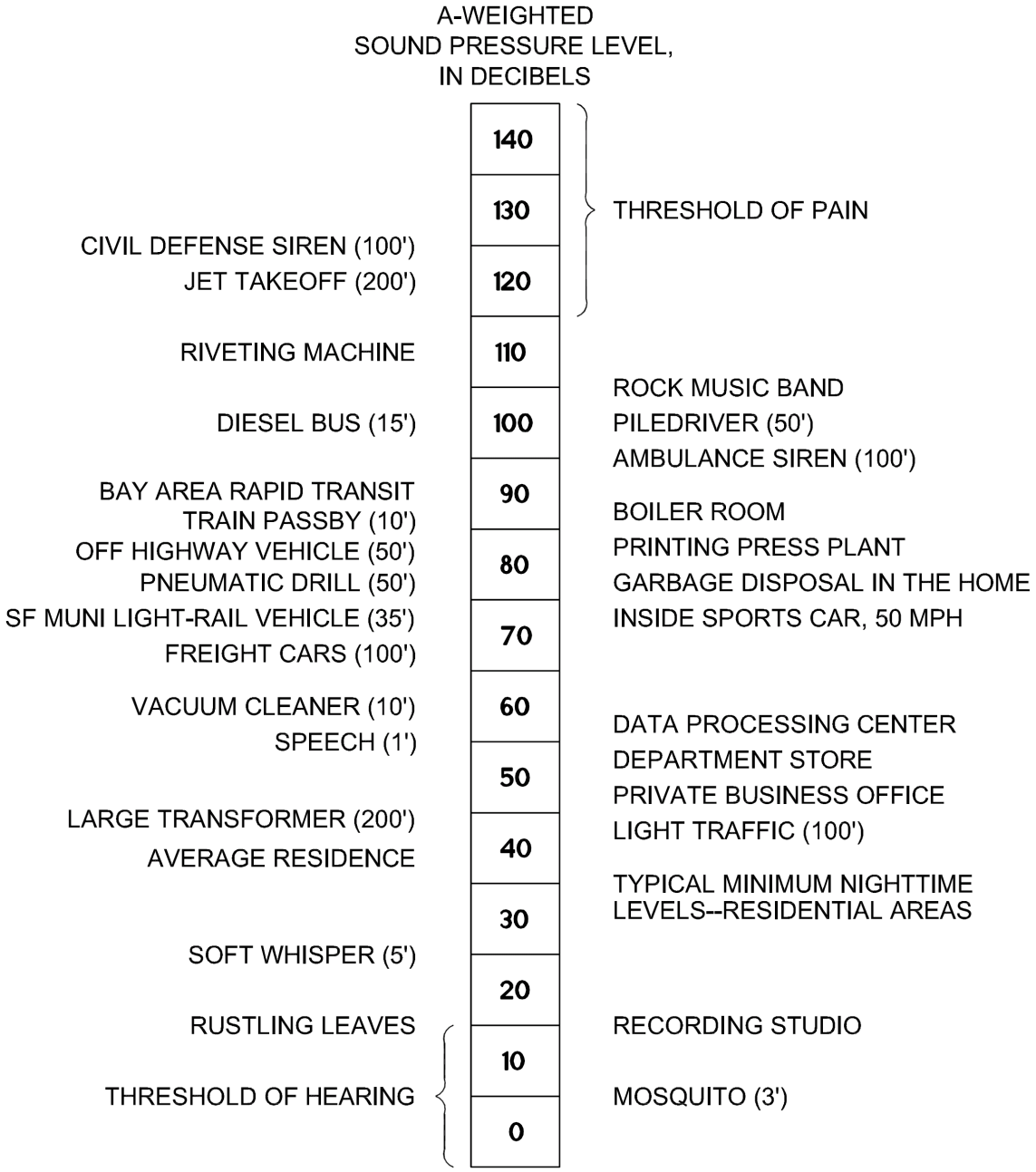
With regard to increases in noise level, knowledge of the following relationships will be helpful in understanding the quantitative sections of this report:

a) Except in carefully controlled laboratory experiments, a change of only 1 dB in sound level cannot be perceived.

b) Outside of the laboratory, a 3 dB change is considered a just-noticeable difference.

c) A change in level of at least 5 dB is required before any noticeable change in community response would be expected.

d) A 10 dB change is subjectively heard as approximately a doubling in loudness, and would almost certainly cause an adverse community response.




(100') = DISTANCE IN FEET BETWEEN SOURCE AND LISTENER



# TYPICAL SOUND LEVELS MEASURED IN THE ENVIRONMENT AND INDUSTRY

FIGURE A1

1107 C
11.25.03