WILSON IHRIG
ACOUSTICS, NOISE & VIBRATION

CALIFORNIA
WASHINGTON
NEW YORK

WI #17-034

June 14, 2018

David Ford
President
Fulcrum Development Group
336 Bon Air Center #354
Greenbrae, California 94904

Subject: Church of the Valley
New School Building and Memory Care Facility
Final Design Plan Drawings

Dear Mr. Ford,

As requested, we have reviewed the Final Design drawings for substantial changes relative to the in-progress drawings we reviewed in May 2017 that informed our Acoustical Study, dated July 11, 2017.

The Final Design drawings are reflective of several changes, including moving the setback beyond 100 ft from the property line and the following updates:

	OLD	NEW
EDUCATIONAL BUILDING		
Building size did increase from	11,538 sq ft	11,650 sq ft
Student count	222	195
MEMORY CARE		
Total Beds:	58	54
Total Units:	31	29
Employee Count:	30	28

The 2017 Acoustical Study evaluated four issues:

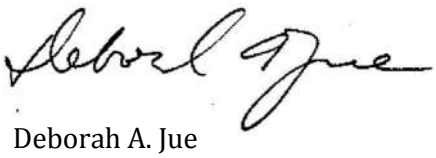
1. Land Use compatibility. Lowering the number of students, patients and employees would lower any noise effects at the neighboring properties, and the previous conclusion would be unchanged: The final design of the project still has no effect on the existing land use compatibility
2. Fixed operational noise. By moving the buildings further from the shared property lines with residential neighbors, the noise from stationary noise sources will be reduced. The expected noise control requirements should be less than or the same as those recommendations listed in the 2017 Acoustical Study for HVAC and the standby generator.
3. Traffic noise. Lowering the students, patients and employees would reduce the car trips associated with the project. The final design of the project would still have no material effect on local traffic noise.
4. Building sound transmission. These changes have no effect on the exterior shell recommendations provided in the 2017 Acoustical Study.

Thus, the Final Design will improve noise issues or have no effect to increase the noise requirements.

Please feel free to contact me with any questions on this information.

Very truly yours,

WILSON IHRIG



Deborah A. Jue
Principal

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Church of the Valley

New School Building and Memory Care Facility

Acoustical Study

July 11, 2017

Prepared for:

David Ford
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Prepared by:

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Principal

WI Project 17-034

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1 Background

The Church of the Valley proposes to construct two new buildings on its property at 19001 San Ramon Valley Boulevard, San Ramon. One building will be a new two-story school building near the northwest corner and the existing parking lot. Most of the exterior activity from the school building would be located at the south side of the building. The other building will be a memory care facility at the southwest corner of the property. No substantial human activity noise is expected from the memory care building.

The project site is bounded by San Ramon Valley Boulevard to the east, with residential land use abutting the property along the north, west and south property lines. Existing noise sources traffic on San Ramon Valley Boulevard and I-680 further to the east, the nearest land of which is approximately 180 ft. from the eastern edge of the property. Figure 1 shows the property and the project area.

A glossary of acoustical terms can be found at the end of this report.

Figure 1 Project Area with the Location of Proposed Buildings

2 Existing Noise Levels

An ambient noise survey was performed by Wilson Ihrig from May 25 to June 1, 2017 at several locations on the site as shown in Figure 2. Short-term measurements of 15–30 minutes duration were made at locations ST-A and ST-B on May 25, 2017. These were augmented with long-term measurements which continuously measured the noise and logged the results in 15 minute intervals at locations LT-1 and LT-2.

Figure 2 Project Site with Noise Measurement Locations

In addition to the traffic noise, the sound from recess at the existing school was also measured during the short-term measurements and as part of the long-term noise survey. Table 1 summarizes these

results, and Figure 3 and Figure 4 illustrate the daily variations in the noise measured during the long-term noise survey.

Table 1 Noise Survey Results, June 2017

ID	Location	Typical Noise Levels (dBA)	Comment
LT-1	North Property Line	60–61 L_{dn} weekdays 58–60 L_{dn} weekends/holiday	Consistent with "Normally Acceptable" environment for residential and school land use
LT-2	South Property Line	65–66 L_{dn} weekdays 63–64 L_{dn} weekends/holiday	"Conditionally Acceptable" environment for residential and nursing home facility land use
ST-A	Near new school building site	63 L_{eq} (32 minutes) 65 L_{eq} (20 minutes, only during jungle gym) 68 dBA frequent events	May 25, 12:00 to 12:32 PM Includes recess; activities include jungle gym, yelling/play sounds; ball play (~60 ft. from jungle gym)
ST-B	SW corner at memory care facility site	54 L_{eq}	May 25, 12:45 to 1:01 PM

The measured noise survey results are presented in 15-minute increments and show the equivalent noise level (L_{eq}) for each interval. In both cases, the daily variations are fairly consistent and typical of transportation-dominated noise environments, with very low noise levels during the early morning hours, rising during the morning commute and during daytime activities, and then diminishing following the afternoon commute during the evening hours. The effect of the weekend and the Memorial Day holiday is evident with lower morning noise levels and the lower Day-Night noise level (L_{dn}) on those days.

As noted above in Table1, noise from recess activities was measured at location ST-A at about 60 ft. from the jungle gym. The L_{eq} over the entire 32-minute noise measurement was 63 dBA, increasing to 65 dBA while children played on the jungle gym. The frequent sounds[1] from children at play, reached 68 dBA. Extrapolating to the nearest property line, these playground sounds are reduced some 6 to 8 dBA, so that the L_{eq} during recess is less than 60 dBA, and the frequent sounds are reduced to a range to 60 to 62 dBA.

[1] This noise level was obtained from the noise level exceeded 10% of the time, or L_{10}.Which corresponded to 192 total seconds during the 32-minute measurement.

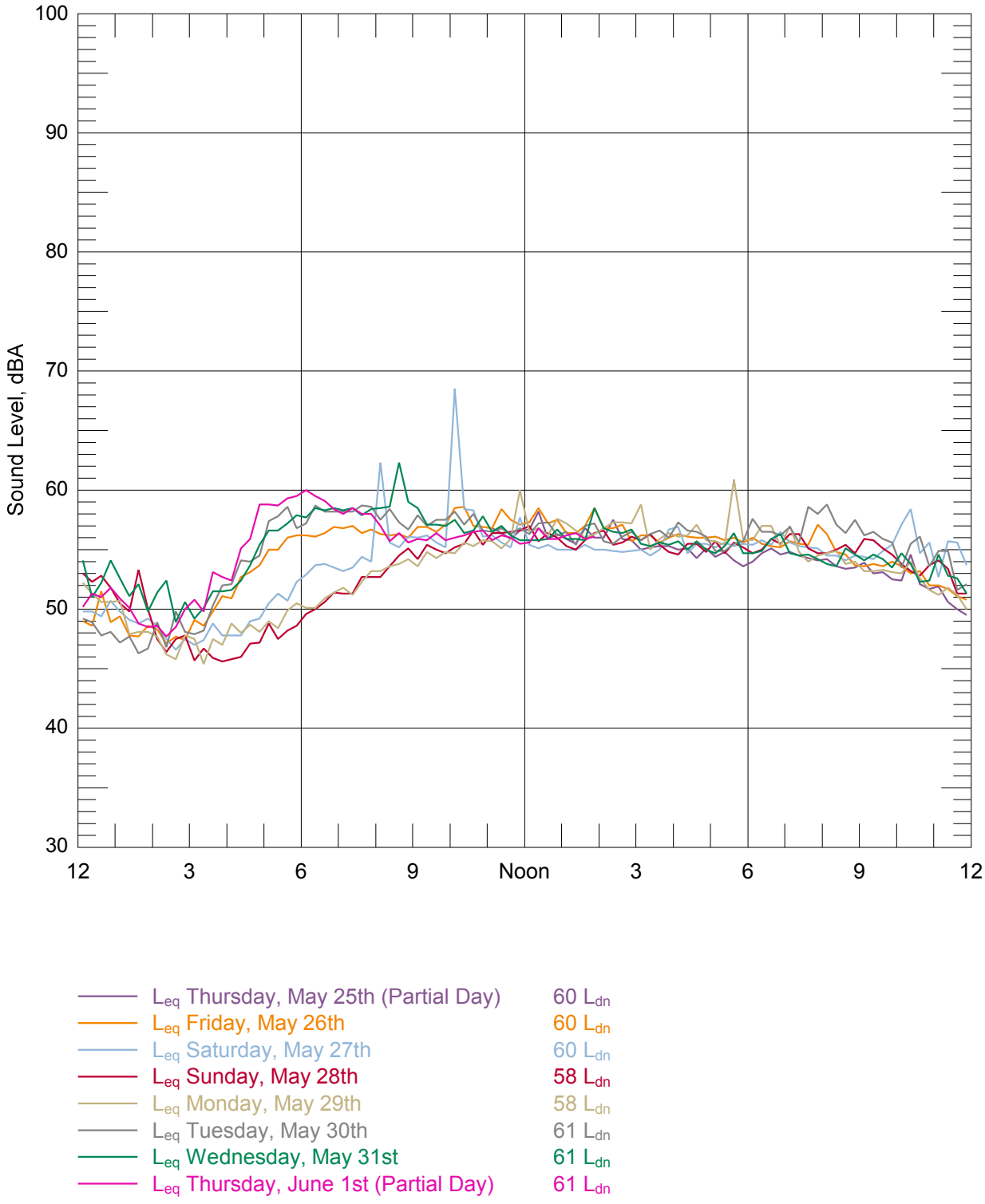

Figure 3 Noise Survey Results at Location LT-1, North Property Line

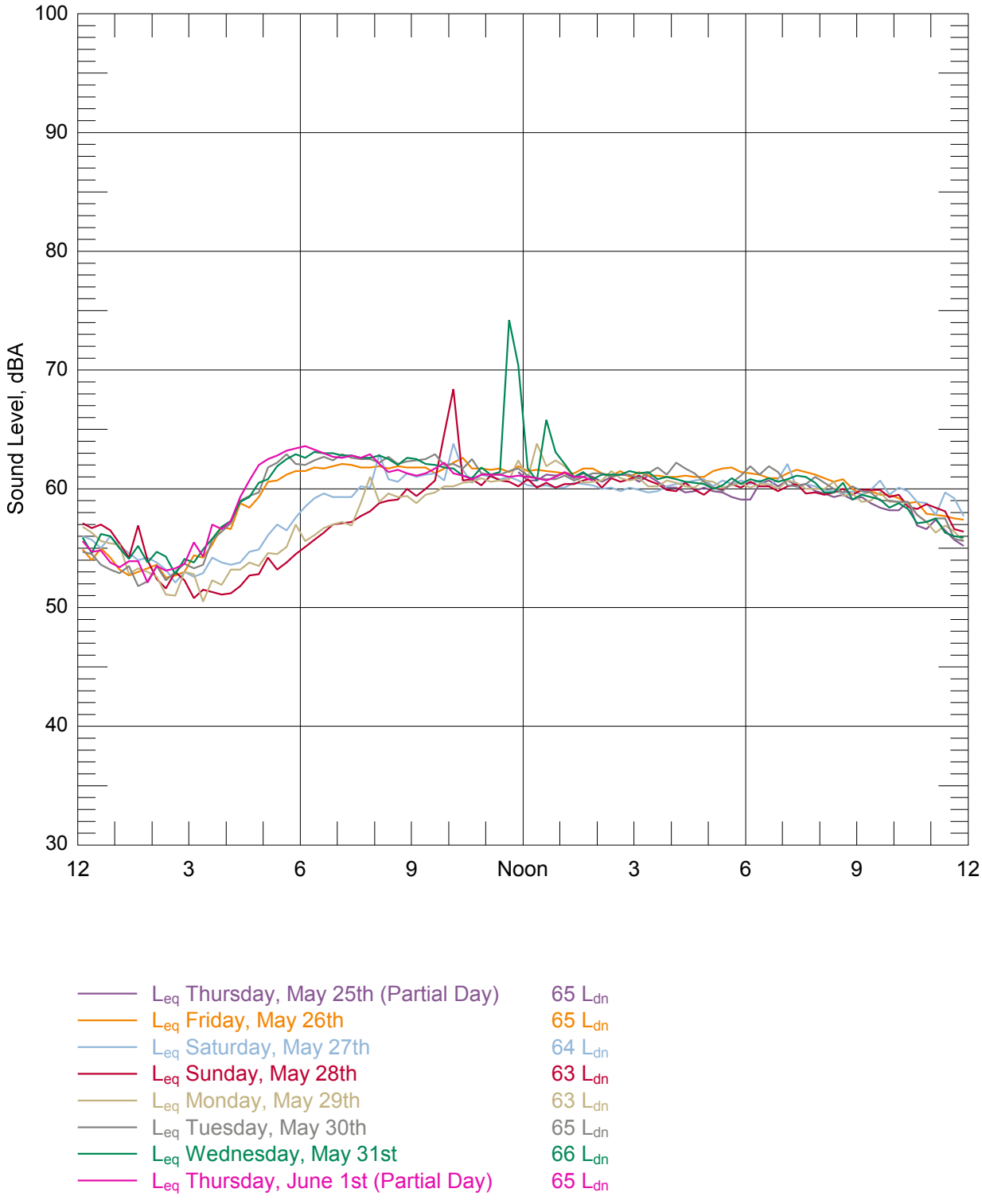

Figure 4 Noise Survey Results LT-2, South Property Line

3 Evaluation Criteria

3.1 San Ramon General Plan

Chapter 10 of the San Ramon *General Plan 2035* contains the Noise Element which identifies land use compatibility guidelines in Figure 10-2. An excerpt of this information is provided below in Figure 5. Noise environments for residential, school and nursing home land use are "normally acceptable"

Figure 10-2: Land Use Compatibility

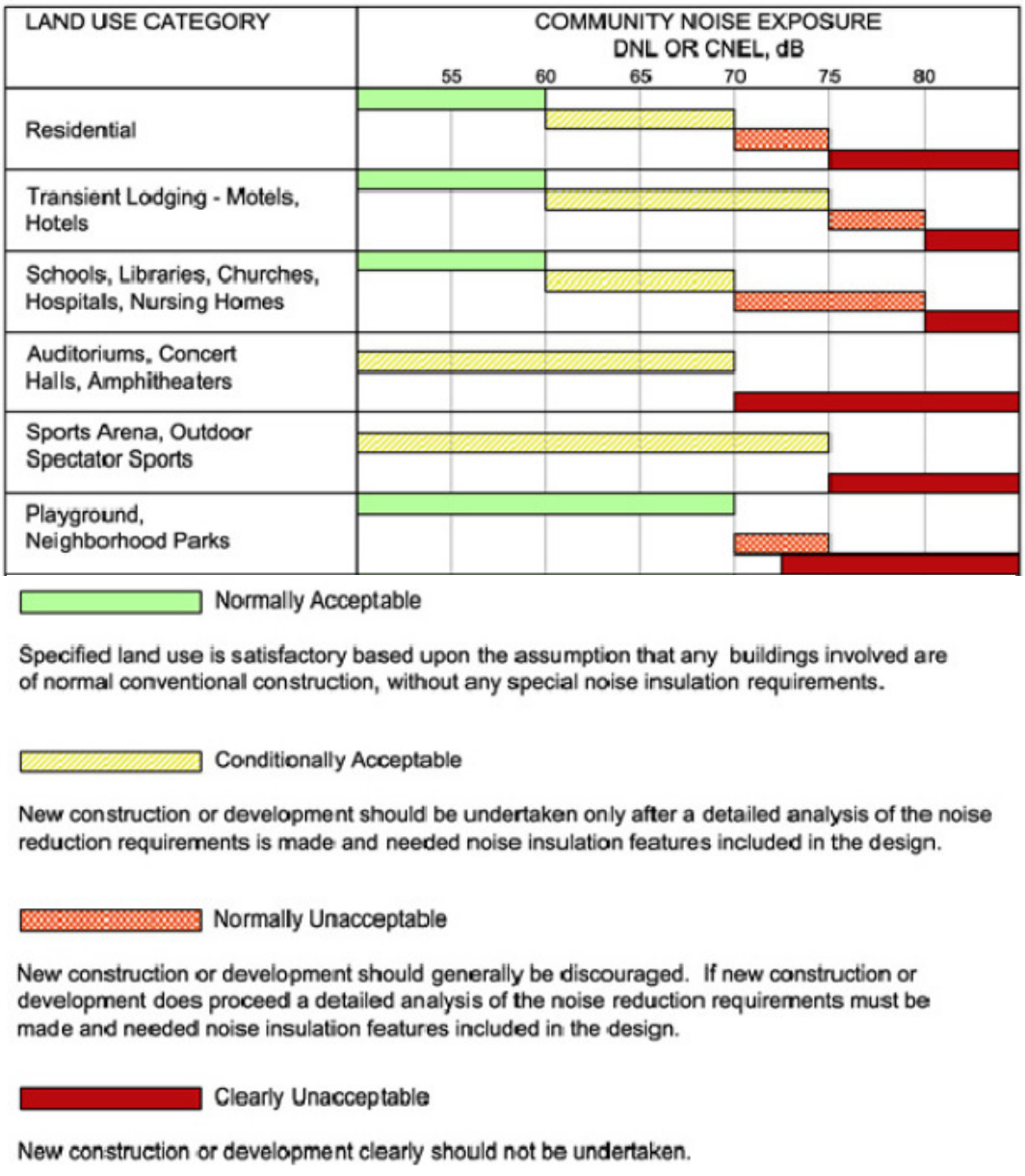

Figure 5 Excerpt from San Ramon Noise Element, Figure 10-2

when the noise is 60 L_{dn} or less. Noise environments of 60 to 70 L_{dn} are "conditionally acceptable", and new projects require evaluation of noise insulation features.

3.2 San Ramon Noise Ordinance

The Noise Ordinance is contained within the Municipal Code, Division B6, Chapter 5, Noise Control[2]. The Ordinance does not appear to include any quantitative noise limits, but does include a general guideline in Section B6-83:

Notwithstanding any other provision of this chapter, it is unlawful for a person to willfully make or continue, or cause to be made or continued, a loud, unnecessary or unusual noise which disturbs the peace or quiet of a neighborhood, or which causes discomfort or annoyance to a reasonable person residing in the area. The standards which shall be considered in determining whether a violation of this section exists shall include, but are not limited to, the following:

A. Volume of the noise;

B. Whether the nature of the noise is usual or unusual;

C. Proximity of the noise to residential sleeping facilities;

D. Nature and zoning of the area within which the noise emanates;

E. Time of day or night the noise occurs;

F. Duration of the noise;

G. Whether the noise is recurrent, intermittent or constant; and

H. Whether the noise is produced by a commercial or noncommercial activity.

To conform with these quantitative requirements, we recommend a target goal for continuous noise levels from new mechanical equipment from the New School Building and the Memory Care facility of 5 dBA below the ambient L_{eq} conditions, or 50 dBA from the school building (daytime use) and 55 or 45 dBA from the care facility (daytime or nighttime use, respectively).

In the case of an emergency, the provisions of the Ordinance are not applied. Typically, however, emergency generators are tested once a month for about 30 to 60 minutes during weekday and daytime conditions. To conform with these quantitative requirements, we recommend a target goal from the generator test of 57 dBA, 5 dBA below the ambient L_{eq} conditions.

3.3 State of California CalGreen

The State of California covers environmental comfort requirements for non-residential buildings in section 5.507. Applicable to the school building, the performance requirement of this standard requires exterior roof, wall and window assemblies to provide a 50 dBA L_{eq} interior noise

[2] https://library.municode.com/ca/san_ramon/codes/code_of_ordinances?nodeId=TITBRE_DIVB6HESAENQU_CHVNOCO, accessed online, June 21, 2017.

environment. Based on the noise survey, these elements of the school building should be designed to provide at least 10 dBA noise reduction.

3.4 State of California Sound Transmission

For residential buildings, such as the proposed memory care facility the State of California Building Standards, Section 1207, requires exterior roof, wall and window assemblies to provide a 45 L_{dn} interior noise environment. Based on the noise survey, these elements of the care building should be designed to provide at least 20 dBA noise reduction.

3.5 Noise Standards for Schools

The Acoustical Society of America has developed a standard for school acoustics, ANSI S12.60 - 2002 *Acoustical performance criteria, design requirements, and guidelines for schools*. This is a comprehensive standard that addresses the design of the exterior to interior sound transmission and other acoustical conditions, LEED for Schools and Collaborative for High Performance Schools (CHPS) include some elements of ANSI S12.60.

ANSI S12.60 requires exterior roof, wall and window assemblies to provide a 40 dBA L_{eq} interior noise environment from the peak traffic noise hour. Based on the noise survey, these elements of the care building should be designed to provide at least 18 dBA noise reduction at the east façade exposed to transportation noise.

4 Land Use Compatibility

The existing noise environment along the north side of the property shielded by the existing school building ranges from 58–61 L_{dn} which is substantially in the "normally acceptable" category for residential and school land use. The noise level during recess is discussed above, and any school activities at the south side of the new building would be at a similar or farther distance from the activities to the western property line. Noise from school activities outside the new building would be shielded by the new building to neighbors along the north property line, and neighbors along the west property line could experience some new noise the same or less than the values measured at location ST-A. The contribution of, for instance, three 30-minute play periods during the daytime hours over a 24-hour period would generate an L_{dn} of 51. Combined with an exterior noise level of 58–61 L_{dn}, the total noise would increase to a range of 59–61 L_{dn}, which does not affect the existing land use compatibility.

The new school building will shield some neighbors from the playground noise, and the new building will also benefit from shielding of transportation noise sources by the existing school building; the proposed location appears to take full advantage of that shielding, consistent with the General Plan requirements for new projects that are "conditionally acceptable" under the noise environment. The new school building would provide some shielding of transportation and school play yard sound sources to some of the neighboring homes to the north and west of the school building.

The existing noise environment along the south side of the property experiences less shielding than the north side, ranging from 63–66 L_{dn} which is squarely in the center of "conditionally acceptable" conditions for a nursing facility. New construction with stucco finished walls can easily provide 25 dBA noise reduction with the windows closed, which would result in an interior environment no

greater than 41 L_{dn}, in conformance with the Building Standards requirements for residential buildings. The existing play yard noise is difficult to detect at the south property line. The new care building would provide some shielding of transportation sound sources to some of the neighboring homes to the south and west of the care facility.

5 Fixed Operational Noise

Air conditioning units are probably the primary new noise sources that the projects will introduce, both at the school building and at the care facility. Typical HVAC equipment could have sound power levels (PWL) ranging from 77–87 dBA. Scaling such sources for distance, at a distance of 75 ft. the continuous sound from a unit would thus be 42–52 dBA. At a distance of 20 ft., such equipment could range from 54–64 dBA.

The memory care building will also have an emergency generator. For a project of this size, without an enclosure generators typically have a PWL of 100 to 105 dBA. Scaling for distance, at a distance of 50 ft. the continuous sound from a generator would thus be 69–74 dBA.

Design and selection of the HVAC equipment should consider the following to meet the recommended design target:

1. At the new school building, where HVAC equipment could be placed on the west side of the building, 75 ft. from the property line,
    a. Select equipment so that the total sound power level is 85 dBA or less. For instance, one unit at 85 dBA PWL or two units at 82 dBA PWL.
    b. If noisier equipment is required, provide a sound screen around the HVAC equipment or along the property line that provides the necessary noise reduction. Depending on placement, such a screen could be 5 to 8 ft., possibly higher.
2. At the new memory care building, the equipment could potentially operate into the quieter nighttime hours (12 AM to 6 AM). It appears that HVAC equipment could be placed on the roof or the south side of the building.
    a. If on the south side (e.g., 30 ft. from the property line), a combination of “quiet” equipment (<75 dBA PWL) and sound screen would be required
    b. If on the roof, a combination of “quiet equipment (<80 dBA PWL) and a parapet wall would be required

Design and selection of the emergency generator should consider the following to meet the recommended design target:

- Select as quiet as unit as possible. These are often published with sound pressure levels at 23 ft. distance. With an acoustic enclosure and a sound pressure level of 64 dBA, the generator could be placed at 50 ft. from the property line.
- Site the generator as far as possible from neighboring property lines and the school buildings.
- If placed on the roof, provide an acoustical screen and/or parapet wall as needed to meet the recommended design target.

6 Traffic Noise

The draft traffic impact study[3] indicates that Project trips would contribute additional traffic on San Ramon Valley Boulevard during peak traffic periods. Compared to the existing traffic volume, this is a minor change, which would increase the traffic noise from San Ramon Valley Boulevard by less than 0.25 dBA. In combination with the noise from I-680, the total noise increase would be even less.

7 Building Sound Transmission

As noted above, the new school building would need to provide 10 dBA noise reduction to comply with CalGreen, and 18 dBA noise reduction at the east façade to conform to ANSI S12.60. Modern construction such as wood framed stucco/wood siding and gypsum board walls and insulated windows easily provide 25 dBA noise reduction with the windows closed. The current drawings show limited windows on the east façade, none of which are operable into classroom spaces. With windows partially open, modern construction provides 15–20 dBA noise reduction, which would still be satisfactory to meet the ANSI S21.60 standard.

Metal-framed structures will typically perform the same or better as wood-framed structures. Thus, there would be no special wall or window requirements.

Flat roof designs can provide 18 dBA noise reduction, provided that there is a 5/8" gypsum board layer on the ceiling side and a similar weight product on the roof under the waterproofing membrane (e.g., DensDeck, cementitious board, etc.). A SIP panel could be sufficient; the roof design should be evaluated during design.

8 Conclusion and Recommendations

In conclusion, the proposed project would be consistent with the existing noise environment and neighboring land use. Typical wall and insulated window construction would be satisfactory to meet code and standards requirements for exterior to interior noise, and the roof assembly should be evaluated during design to select an appropriate roof configuration.

Traffic from the project will have no material effect on the noise environment in the project area. There are no quantitative limits for HVAC or emergency generator equipment noise, however based on the existing noise environment, several techniques have been recommended to control the noise from such equipment to meet the recommended design targets. These noise sources should be evaluated during the design process to verify conformance with recommended design targets.

The proposed school building would also serve to reduce noise at some neighbors at the northwest corner from both the playground area and traffic on San Ramon Valley Boulevard. The additional noise from school activities at the south side of the new school building would not change the existing land use compatibility for nearby residential land uses.

[3] "Draft Traffic Impact Study Report Church of the Valley Expansion and Memory Care Facility," prepared by TJKM, dated May 10, 2017.

ATTACHMENT A GLOSSARY OF ACOUSTICAL TERMS

A-Weighted Sound Level (dBA):

The sound pressure level in decibels as measured on a sound level meter using the internationally standardized A-weighting filter or as computed from sound spectral data to which A-weighting adjustments have been made. A-weighting de-emphasizes the low and very high frequency components of the sound in a manner similar to the response of the average human ear. A-weighted sound levels correlate well with subjective reactions of people to noise and are universally used for community noise evaluations.

Airborne Sound:

Sound that travels through the air, as opposed to structure-borne sound.

Ambient Noise:

The prevailing general noise existing at a location or in a space, which usually consists of a composite of sounds from many sources near and far. The City of San Francisco has a specific definition.

Community Noise Equivalent Level (CNEL):

The L_{eq} of the A-weighted noise level over a 24-hour period with a 5 dB penalty applied to noise levels between 7 p.m. and 10 p.m. and a 10 dB penalty applied to noise levels between 10 p.m. and 7 a.m.

Day-Night Sound Level (L_{dn}):

The L_{eq} of the A-weighted noise level over a 24-hour period with a 10 dB penalty applied to noise levels between 10 p.m. and 7 a.m.

Decibel (dB):

The decibel is a measure on a logarithmic scale of the magnitude of a particular quantity (such as sound pressure, sound power, sound intensity) with respect to a reference quantity.

Energy Equivalent Level (L_{eq}):

The level of a steady noise which would have the same energy as the fluctuating noise level integrated over the time period of interest. L_{eq} is widely used as a single-number descriptor of environmental noise. L_{eq} is based on the logarithmic or energy summation and it places more emphasis on high noise level periods than does L_{50} or a straight arithmetic average of noise level over time. This energy average is not the same as the average sound pressure levels over the period of interest, but must be computed by a procedure involving summation or mathematical integration.

Frequency (Hz):

The number of oscillations per second of a periodic noise (or vibration) expressed in Hertz (abbreviated Hz). Frequency in Hertz is the same as cycles per second.

Octave Band - 1/3 Octave Band:

One octave is an interval between two sound frequencies that have a ratio of two. For example, the frequency range of 200 Hz to 400 Hz is one octave, as is the frequency range of 2000 Hz to 4000 Hz. An octave band is a frequency range that is one octave wide. A standard series of octaves is used in acoustics, and they are specified by their center frequencies. In acoustics, to increase resolution, the frequency content of a sound or vibration is often analyzed in terms of 1/3 octave bands, where each octave is divided into three 1/3 octave bands.

Sound Pressure Level (SPL):

The sound pressure level of sound in decibels is 20 times the logarithm to the base of 10 of the ratio of the RMS value of the sound pressure to the RMS value of a reference sound pressure. The standard reference sound pressure is 20 micro-pascals as indicated in ANSI S1.8-1969, "Preferred Reference Quantities for Acoustical Levels".

Structure-Borne Sound:

Sound propagating through building structure. Rapidly fluctuating elastic waves in gypsum board, joists, studs, etc.

Statistical Distribution Terms:

L_{99} and L_{90} are descriptors of the typical minimum or "residual" background noise (or vibration) levels observed during a measurement period, normally made up of the summation of a large number of sound sources distant from the measurement position and not usually recognizable as individual noise sources. Generally, the prevalent source of this residual noise is distant street traffic. L_{90} and L_{99} are not strongly influenced by occasional local motor vehicle passbys. However, they can be influenced by stationary sources such as air conditioning equipment.

L_{50} represents a long-term statistical median noise level over the measurement period and does reveal the long-term influence of local traffic.

L_{10} describes typical or average levels for the maximum noise levels occurring, for example, during nearby passbys of trains, trucks, buses and automobiles, when there is relatively steady traffic. Thus, while L_{10} does not necessarily describe the typical maximum noise levels observed at a point, it is strongly influenced by the momentary maximum noise level occurring during vehicle passbys at most locations.

L_1, the noise level exceeded for 1% of the time is representative of the occasional, isolated maximum or peak level which occurs in an area. L_1 is usually strongly influenced by the maximum short-duration noise level events which occur during the measurement time period and are often determined by aircraft or large vehicle passbys.