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September 9, 2016

Mr. Erick Serrano
Associate Planner
City of Cupertino
10300 Torre Avenue
Cupertino, CA 95014

RE: Noise Impact and Mitigation Study for Good Shepherd Christian Preschool,
940 S. Stelling Road, Cupertino

Dear Mr. Serrano,

In response to your request I have evaluated the potential noise impacts that could be produced at nearby residential receptor locations by the proposed new preschool activities at Good Shepherd Lutheran Church in Cupertino. The report discusses the present environment, the proposed project and its associated noise-related aspects, the potential new activities and operational noise impacts at the nearest receptors in the area, and compliance with Cupertino noise guidelines.

To summarize the conclusions of the report, the proposed changes to the on-site activities would meet the City noise ordinance limitations and would not produce any significant noise disturbance in the vicinity of the site.

Project Description [1] [2]

The proposed new preschool activity would provide weekday daytime care for toddler and preschool-age kids from ages 2 through 6 on the subject church site. This full-day activity would replace the present afterschool program for school age kids 5 through 12 years old that is onsite from noon to 6 pm on weekdays during the school year. The preschool proposes to use the same 3 classrooms and the outdoor play yard as at present, and in addition, an outdoor play structure would be constructed. The site and the school-related elements are shown in Exhibit 1. There are six-foot wood fences bordering the outdoor play area on the north and east property lines facing the adjacent residential areas. Temporary parking for drop-off and pickup of children would use the church parking lot that has 55 regular and 2 handicapped spaces.

School Program [2]

The preschool program would serve 60-70 kids with a staff of 8-9, on a normal workday schedule of 7:00 am to 6:00 pm, Monday through Friday year round. There could be occasional evening or major holiday activities held on site. The school would be closed on 11 major holidays and would be closed 10 days between Christmas and New Years, and one week in April. There would be 5 different drop-off and pick-up schedules to spread out arrivals and departures, as follows:

Drop off time will begin at 7:00 AM and staggered between 7 AM and 9:30 AM

Pick up time will begin at 3:00 PM and staggered between 3:00PM and 6:00PM

The peak drop off time will be between 9:00AM and 10:00 AM

The peak pick up time will be between 5:00 PM and 6:00PM.

Late pick time: 6:00 PM to 6:30 PM

Playground time (recess) will be 30 minutes per classroom. The playground schedule will be staggered between 9AM and 11:30 AM in the morning and 30 minutes per room staggered between 3 PM and 5:30 PM in the afternoon. A new outdoor climbing and play structure appropriate for the 2-6 age group would be constructed in the existing outdoor play area, as shown in Exhibit 1. There would be at least one staff person for every 6 infants/toddlers, and one staff person for every 12 preschoolers. The adjacent Jollyman Park would be used occasionally for special activities, such as nature walks or picnics.

Inside activities would include normal school educational, creative, and play activities in church classrooms and the multipurpose room.

Sensitive Receptor Locations

The project area is a mixed residential and city park neighborhood on the east side of Jollyman Avenue in Cupertino, south of McClelland Drive. The nearest sensitive receptor locations for noise generated by the project includes two single-family dwellings along the east property line. There is a driveway between the church play area fence on the property line and the garages of both homes, with the homes on the other side of the garages. The two closest homes across Jollyman Lane are about 100 feet from the play area and 200 feet from the play structure, with an intervening 6 foot wood fence on the church property, so they are not considered significant receptors for preschool noise. Other residential receptors in the area would have less noise due to increased distance and building obstruction.

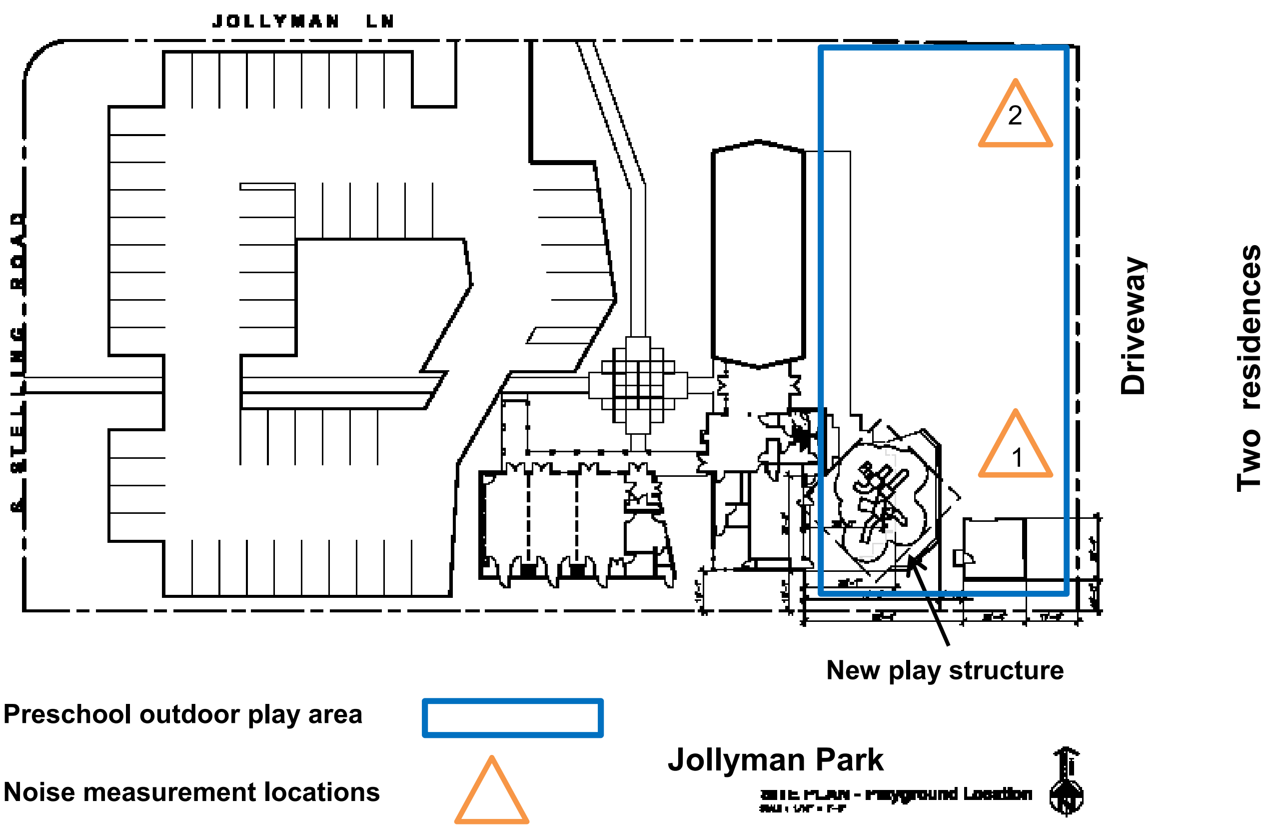

Exhibit 1 - Good Shepherd Christian Preschool site plan

This study investigates the extent to which the closest adjacent residences could be impacted by noise from preschool activities. The existing ambient noise environment and potential noise impacts are discussed in the following sections.

Ambient Noise Levels and Noise Sources in the Area

The primary source of ambient noise in the project area is traffic on South Stelling Road, a two-lane residential street on the west side of the Church site. Typical vehicle passby noise levels are in the 60-70 dBA range at 25 feet. Trucks, buses, motorcycles, and poorly-muffled vehicles produce peak levels 5 to 15 dBA higher on passby. Large and small aircraft and helicopter overflights create infrequent noise incidents of 55 to 65 dBA. Typical sporadic neighborhood activities are garbage pickup and also residential yard maintenance. There are no other significant noise sources in the project area.

Field noise measurements were made during the afternoon period of September 1, 2016 with a CEL-440 Precision Noise Meter and Analyzer, calibrated with a B & K Model 4230 Sound Level Calibrator. Measurement locations were chosen to represent ambient noise levels adjacent to key receptor locations, as shown in Exhibit 1 and described below. There was no play yard activity, since the present afterschool program does not have summer activities.

- Location 1 – in the southeast corner of the play yard and adjacent to one of the adjacent Jollyman Lane residence garages
- Location 2 -- in the northeast corner of the play yard and adjacent to the other adjacent Jollyman Lane residence garage

Noise levels were measured and are reported using percentile noise descriptors, as follows: L_{90} (the background noise level exceeded 90 % of the time), L_{50} (the median noise level exceeded 50% of the time), L_1 (the peak level exceeded 1% of the time), and L_{eq} (the average energy-equivalent noise level). Measured noise levels are presented in Exhibit 2 below. The Ldn noise levels were computed as the long-term average of the L_{eq} using the daily traffic distribution in the area, with standard weighted penalties for the nighttime hours, and modeled with an enhanced version of the National Cooperative Highway Research Board traffic noise model [5].

EXHIBIT 2

AMBIENT NOISE LEVELS (dBA)

Good Shepherd Christian Preschool project area

Receptor location	L_{90}	L_{50}	L_{eq}	L_1	L_{dn}
1. southeast corner of play area	44	45	47	54	49
2. northeast corner of play area	41	43	46	56	48

Traffic is the dominant noise source near the project site, with noise levels at any location in the area depending upon volume, speed and distance to traffic on South Stelling Road. The low noise measurements reflect the fact that the outdoor play area for the preschool and the sensitive receptor residences beyond are at least 350 feet from the road, with the several-story tall church building also shielding the area from traffic noise.

Relevant Cupertino Noise Ordinance Limits [3]

Section 10.48.040 of the Cupertino Noise Ordinance is applicable to this project, which limits noise during daytime hours (7 am to 8 pm) on residential property to 55 dBA, and 50 dBA during evening hours (8pm to 7am). In addition, brief daytime noise incidents are allowed with somewhat higher noise levels by Ordinance section 10.48.050. For example, noise incidents that last less than 15 minutes during any two hour period are allowed to be 5 dB higher than the long-term general limits.

Potential Christian Preschool Noise Impacts

Outdoor playground activities

Most outdoor activities would occur in the existing play area behind the church building, as shown in Exhibit 1. This is a mostly bare dirt area with some foliage and trees, which has been used in the existing after-school program. The only changes to be made would be the installation of a children's play structure, with a poured-in-place smooth rubberized ground cover around it. Several types of play activities would be included in the back yard area for the post-toddler kids, including climbing structure play, use of tricycles and other plastic riding toys, group games, games with balls, and other appropriate outdoor play activities.

Playground time (recess) will be 30 minutes for each of the three classrooms, 16 to 24 kids at a time. The playground schedule for each class will be 30 minutes at different times between 9AM and 11:30 AM in the morning and 30 minutes per class at different times between 3 PM and 5:30 PM in the afternoon. Each play period would be supervised by one or two adults, as appropriate.

All of the project noise would be from sporadic voices of the young kids and staff during outdoor play periods. Activities of this type can create intermittent brief noise from voices of 50 to 60 dBA at a distance of 30-40 feet within the play yard. The closest adjacent residence is approximately40 feet from the play yard, with two 6-foot wood fences intervening. The other residence is 60 feet from the play yard. In both cases the garage is between the play yard and the house. Distance and the property line wood fences reduce the play yard noise at each residence by 12 to 13 dBA. The expected worst-case noise levels in the nearest residential yards from outdoor play activities are shown in Exhibit 2.

EXHIBIT 2
PROJECT NOISE LEVELS (dBA)
Good Shepherd Cristian School, Cupertino

Receptor location	Max Yard Noise Levels
1. adjacent Jollyman Lane residence - south	43-48
2. adjacent Jollyman Lane residence - north	45-50

Noise levels from voices during outdoor play periods would be noticeable in the adjacent residential yards, but would be much below the 55 dBA City noise ordinance limits, and would not be considered disturbing with existing normal daytime noise levels. The project adds three new morning play periods of 30 minutes, causing sporadic noise levels above the ambient in residential yards, which would increase the morning Leq by 2 dB or less, and so would have less than one dB impact on the present 24-hr Ldn less than 50 dBA.

Note that project parking lot noise generated by school-related trips would be similar to parking lot trips for previous uses at the location, and would be less than noise from traffic on S. Stelling Road.

Project Traffic Noise [4] [5]

Because of relatively high traffic volumes on S. Stelling Road, in the range of 9,000 trips per day, the new trips generated by the Preschool program, approximately 70 trips over a couple hours in the morning and 70 trips over a couple hours in the afternoon, would produce less than a 10% increase in traffic on Stelling Road, which would produce much less than a 1 dB change in the traffic noise level at residences on Stelling Road.

Temporary Construction Noise

The only construction associated with the Preschool would be the construction of the play structure next to the church building (see Exhibit 1), and the pouring of a rubberized play surface under and around it. This could create several days of sporadic noise from small motorized equipment and small tool construction activity, in the range of 60-70 dBA at 50 feet, which could create intermittent noise levels in this range for residences on adjacent properties.

Conclusions and Summary

Overall ambient noise levels in the project area now depend primarily on traffic noise, and this will continue to be the dominant noise source in the area in the foreseeable future. The primary noticeable noise would be intermittent and brief voice incidents from young children playing in the area behind the Church building. With the informal type of play activities, the age of the kids, and the distances and/or fence protection involved, these activities would be within City noise ordinance limits, and would not create any noise impacts in the adjacent residential areas. Thus the new preschool use, adding new morning outdoor playtimes, would not create any noticeable noise impact and would result in a “Less than Significant” noise impact on any nearby properties

If I may be of further assistance on this project, please do not hesitate to contact me.

Respectfully submitted,

Stan Shelly

H. Stanton Shelly
Acoustical Consultant
Board Certified Member (1982)
Institute of Noise Control Engineering

REFERENCES

1. Project drawings A1.1 and A1.2, Good Shepherd Christian School, RCUSA Corp, San Jose, CA; July 2016,
2. Project description and preschool schedules, Diane Hsu, Consultant, Christian Light and Salt Foundation, 940 S. Stelling Road, Cupertino; August 2016.
3. Noise Ordinance, Municipal Code Section 10.48, Noise levels for residential and commercial zones; City of Cupertino. .
4. Cupertino ADT Traffic Volumes, Public Works, Oct 2013.
5. Highway Noise - A Design Guide for Highway Engineers, National Cooperative Highway Research Program Report 117, Highway Research Board, National Academy of Sciences, Washington, D.C., 1971 (model enhanced and field validated by ECS).

Appendix Contents

Environmental Noise Concepts and Definitions

Sound is the rapid fluctuation of air pressure higher and lower than normal atmospheric pressure. The term noise is used to mean unwanted or undesirable sound, but this a very subjective matter depending upon the individual; the terms noise and sound are often considered interchangeable in normal usage. The frequency of the sound, or pitch if it has a dominant pure tone, is the number of fluctuations of air pressure each second. If the sound frequency is within a range of roughly 50 to 15,000 cycles per second (Hertz), it is audible to persons with normal hearing. Another characteristic of sound is its loudness, usually measured and reported in decibels (dB), a shorthand logarithmic unit that avoids having to deal in the very large numbers describing the range of sound levels in its basic engineering units. Examples of common noise sources and their sound levels are found on Page A 4.

The basic issues in dealing with the community and environmental noise are its effects and the way it is perceived by most persons (see the Effects section, Page A 2). Therefore, the noise must be measured or modeled, and then compared to guidelines, regulations, and known effects. For these purposes the decibel is used with "A-weighting", meaning that the lower and higher frequencies are de-emphasized to match the sensitivity of human hearing at different frequencies, as opposed to a "flat" frequency response in which all frequencies are equal. Unless otherwise stated, all references to decibels relative to human effects and community impacts are in "A-weighted" decibels, or dBA, in the usual abbreviated form. These decibel values are then referred to as noise levels, or sound levels. The equipment used to measure noise levels is called a sound level meter.

In spite of the tendency to describe environmental noise levels with single-number descriptors for simplicity, the most characteristic feature of noise that people experience in their communities is its extreme variability. So to better understand what a particular noise environment is really like, more than one descriptor is generally used to describe its variability. For example, the average noise level may be accompanied by the maximum or highest noise level, and also the minimum noise level occurring during a particular time period. For example, in some cases it would be more important to know that the minimum noise level is 45 dBA and the maximum noise level is 90 dBA, than that the average noise level is 55 dBA.

There are literally dozens of different types of noise environment descriptors, each developed to give information on the effect of a specific type of noise under certain conditions--such as for aircraft noise, for speech intelligibility, or for hearing impairment. In recent years governmental agencies have been standardizing on the use of L_n, L_{eq}, or L_{dn}. L_n, where n is a number in percent, refers to the noise level exceeded n percent of the time. For example, traffic noise may be generated along a freeway such that at a distance of 100 feet from the roadway the noise level is 70 dB or higher ten percent of the time. Hence its L_{10} noise level is reported as 70 dBA. The L_{50}, or median noise level, is also often used as a noise descriptor. The L_{eq} also often is used, since it reflects the single noise level that has the same energy as the varying noise environment, and reflects more accurately the impact of high noise incidents. L_{dn} is a 24-hour L_{eq} computation with a 10-dB "penalty" during the 10 p.m. to 7 am time period, when a quieter environment is expected. In other words, a location with a 55 dBA daytime L_{eq} would have a 55 dBA L_{dn} if the noise level dropped to 45 dB during the night time hours. The

State of California and many local agencies use the CNEL, which is nearly the same as L_{dn} with an additional 5 dB “penalty” from 7 pm to 10 pm. In normal community environments, L_{dn} and CNEL are nearly the same. The equipment for measuring statistical noise descriptors is called a Noise Level Analyzer.

The "ambient" noise level refers to the combination of all sources of noise at a given location. The "background" noise is similar, but refers to the combination of distant sources that determines the minimum sound levels in any location. The L_{90} or L_{99} statistical descriptors often are used as a measure of the background noise level.

To more readily understand and compare differences in noise levels from one location to another, equal noise contours are often developed for a given site. Most often L_{10} or L_{dn} noise level contours are used, joining locations on a site that have the same noise level, in 5 or 10 dB increments. Noise contour maps are similar to plotting equal elevations on a topographic contour map.

Several concepts are particularly important in discussing what to do about unwanted noise —mitigation, reduction and attenuation; the terms have the same meaning in general usage-- to lower noise levels in a receptor area. Reflection is one common noise reduction method, which diverts sound energy from a location of high impact to an area of less impact, such as when using a noise barrier. Noise absorption is a mechanism by which some materials, such as thick foliage outdoors or fiberglass batts used as insulation, absorb sound energy and thus reduce its impact.

Mathematical noise models are often used in projecting noise levels that cannot be directly measured, such as in the case of future traffic or airport conditions. Noise models use previously-measured and analyzed relationships between noise source characteristics and physical and geometric conditions to compute future noise levels with relatively good accuracy. A number of models for projecting aircraft noise, roadway traffic noise and railroad noise have been developed and are in widespread use.

The Impacts of Noise on People

Noise is a part of our modern society—noise from motorized laborsaving devices, transportation sources, and recreation devices. The use or conversion of energy for any purpose is seldom accomplished silently. Humans typically have a capacity to tolerate or ignore a certain amount of noise in the environment. But adverse effects are present in many exposures to noise, and dangers to health other than outright hearing impairment also are recognized.

The problem of controlling noise is difficult because it affects each individual differently. People do not hear sounds similarly, hence they do not react to sound in the same way. First of all, each person's reaction to noise depends upon the characteristics of the noise itself:

- loudness
- frequency
- duration
- time of occurrence
- unfamiliarity or uniqueness

But the effect of a noise on people also depends upon the situation:

- background or ambient noise level
- individual sensitivity to noise intrusion
- activity or preoccupation of listener
- perceived need or justification for noise

The factors that determine how much a person is disturbed by a noise include physiological effects, psychological/emotional effects, and activity interference.

To better understand the use of the decibel as a measure of relative loudness, a list of common noise sources and their approximate sound levels are given on Page A 4.

Recognizing Noise Level Changes

When a noise environment or a noise level changes, typical responses to it are as follows:

- A change of 1 dBA is not noticeable
- A change of 3 dBA typically is heard
- A change of 5 dbA is very noticeable and can be intrusive
- A change of 10 dBA is a substantial and disturbing change (representing a doubling of the loudness)

  Note that combining noise from two sources with the same noise level, because of the logrithmic nature of the decibel, increases the combined noise level by 3 dB. So adding two 50 dB sources results in a combined noise level of 53 dB.

Physiological Noise Effects

At relatively high noise levels above 80 dBA, the delicate internal ear mechanism can be altered to cause Temporary Threshold Shift (TTS), resulting in partial deafness for a period of a few minutes to a few weeks, depending upon the noise level and the exposure duration. If these excessive levels over 80 dBA are continued over long periods of time (for example, eight hours a day for several years), or very high levels (over 100 dB) are experienced for shorter periods, Permanent Threshold Shift (PTS) may occur. PTS is an irreversible loss in normal hearing capacity.

Fortunately, few exposures to levels causing hearing damage occur in the typical community noise environment. However, some problems can be experienced by those attending or participating in regular musical and recreational events with high noise environments, or by those engaged in occupations involving high workplace noise levels, regulated by State and Federal Occupational Safety and Health codes. The potential for other less damaging, but nonetheless disturbing, noise effects exists throughout our normal daily schedules--at home, school, shopping center, park, or highway. These noise impacts can cause subtle physical, mental and emotional stresses of varying degrees of seriousness.

Activity Interference

Noise can disrupt human activities such as sleep, conversation, or stereo and TV enjoyment. Studies have shown that noise not only can prevent sleep because of its intensity or characteristics, but also can seriously disturb the quality of sleep without waking the sleeper. Conditions such as these, community noise causing bedroom noise levels between 35 and 50 dBA, are encountered to some extent in many urbanized areas, particularly near high volume traffic or airports. At interior noise levels over 55 dBA, all types of normal speaking and listening activities are disrupted. Speech intelligibility drops sharply, music listening and TV watching become strained, and aural communications must be carried out at much higher volumes to be successful. Obviously, shouting to be heard and understood is both undesirable and unpleasant for all concerned.

Psychological and Emotional Impacts

Less well-documented and understood, but probably more widely experienced, are those impact of noise that cause such subtle effects as distraction, annoyance, startle, privacy interruption, stress and tension. These effects as a class can, if continued, cause very serious emotional and psychological anxieties and disturbances. Often the increased irritability and tenseness are not directly attributed to the noise environment, as the listener may not be consciously aware of the noise intrusion. Our human ability to "tolerate" and "adapt to" disturbing noise levels thus can adversely affect our subconscious body processes. Protection against the intrusion of disturbing noise is particularly important to mental and emotional health in an active and complex urban community.

Typical Noise Levels and Effects

Noise Sources	Noise Level (dBA)	Human Response or Impact
Jet aircraft takeoff (100')	**130**	
Auto horn (3')	**120**	Threshold of pain
Rock music in a club	**110**	Deafening
Motorcycle accelerating, no muffler (25')	**100**	Very loud
Motorcycle accelerating, stock muffler (25')	**90**	Intrusive
Food blender (3') Power lawn mower (20')	**80**	Very disturbing to most activities
Steady urban traffic (25')	**70**	Communications difficult
Normal conversation (3')	**60**	
Daytime street, distant traffic	**50**	Sleep disturbance
Quiet office	**40**	
Inside quiet home. Soft whisper (10')	**30**	Very quiet
Movie or recording studio	**20**	Seldom-experienced ambient
	10	Barely audible to good hearing
Threshold of hearing	**0**	

Environmental Noise Measurement and Analysis Procedures

1. Select monitoring sites representative of worst-case sensitive receptor areas, topography, noise sources, and noise transmission characteristics.
2. Perform field noise measurements of long-term statistical variation in the project area and, if appropriate for project traffic, on access routes to the project, 20-30 minutes in each location. Record key statistical descriptors, including L_{90}, L_{50}, L_{10}, L_1, and L_{eq}.

   Equipment:

   Precision Sound Level Meter and Analyzer, CEL Model 440

   Sound Level Calibrator, Bruel and Kjaer Model 4230
3. Record noise levels for significant individual sources and incidents in the project area.
4. Compute L_{dn}/CNEL values based on field measurements and traffic noise model based on traffic volume variation throughout the day. Without specific hourly traffic count data, use typical commute-based daily volumes as follows for the daily traffic modeling:

Period	Hours	Hourly Vol (% ADT)
A. 7 a.m. — 9 a.m.	2	7.5
B. 9 a.m. — 4 p.m.	7	5.6
C. 4 p.m. — 7 p.m. (no peak)	2	7.0
D. 7 p.m. — 10 p.m.	3	4.0
E. 10 p.m. — Midnight	2	2.5
F. Midnight — 7 a.m.	7	0.7
G. Peak Hour	1	10.0