Castilleja School

Palo Alto, California

CONSTRUCTION NOISE LOGISTICS PLAN

26 June 2023

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Salter Project 23-0172

INTRODUCTION

The purpose of this plan is to outline potential noise impacts from construction activities and provide a plan to address them for the Castilleja School project at 1310 Bryant Street in Palo Alto, California. The project includes a new underground parking garage, new academic building, and relocation of the pool. Construction is planned for June 2023 through November 2025 and will not include pile driving. For readers less familiar with the fundamental concepts of environmental noise, please refer to Appendix A attached.

The nearest adjacent residences are located at 1215, 1235, and 1263 Emerson Street and are to the immediate southwest of the new underground parking garage. Other nearby residences are across the streets that enclose the site: Bryant Street, Kellogg Avenue, Emerson Street, and Embarcadero Road.

ACOUSTIC CRITERIA

Palo Alto Municipal Code

Section 9.10.060(b) of the Palo Alto Municipal Code contains the following language for construction noise on a non-residential property:

b) *Construction. Except for construction on residential property as described in subsection (c) of this section, construction, alteration and repair activities which are authorized by valid city building permit shall be prohibited on Sundays and holidays and shall be prohibited except between the hours of eight a.m. and six p.m. Monday through Friday, nine a.m. and six p.m. on Saturday provided that the construction, demolition or repair activities during those hours meet the following standards:*

(1) No individual piece of equipment shall produce a noise level exceeding one hundred ten dBA at a distance of twenty-five feet. If the device is housed within a structure on the property, the measurement shall be made out-side the structure at a distance as close to twenty-five feet from the equipment as possible.

(2) The noise level at any point outside of the property plane of the project shall not exceed one hundred ten dBA.

(3) The holder of a valid construction permit for a construction project in a non-residential zone shall post a sign at all entrances to the construction site upon commencement of construction, for the purpose of informing all contractors and subcontractors, their employees, agents, materialmen and all other persons at the construction site, of the basic requirements of this chapter.

(A) Said sign(s) shall be posted at least five feet above ground level, and shall be of a white background, with black lettering, which lettering shall be a minimum of one and one-half inches in height.

(B) Said sign shall read as follows:

CONSTRUCTION HOURS
FOR NON-RESIDENTIAL PROPERTY

(Includes Any and All Deliveries)

MONDAY - FRIDAY.....8:00 a.m. to 6:00 p.m.

SATURDAY.....9:00 a.m. to 6:00 p.m.

SUNDAY/HOLIDAYS.....Construction prohibited.

DEIR Mitigation Measure 8b

Mitigation measure of the July 2020 Castilleja School Project Draft EIR reads as follows:

> *Prior to issuance of demolition, grading and/or building permits for each construction phase, Castilleja School shall submit to the City a technical analysis of the noise levels that could be generated during construction and recommended measures to ensure that noise levels during construction meet the City's standards. This analysis must include and be based on a list of the construction equipment proposed to be used (including horsepower), a schedule for the use of each piece of equipment during that phase, and the general location where each piece of equipment would operate. Noise reduction measures may include modifying the equipment list, restrictions on the number of individual pieces of equipment that may be used at one time, modifying the location of individual pieces of equipment, providing shielding for individual pieces of equipment, use of temporary noise attenuation barriers, and/or other measures that are demonstrated to be sufficient to ensure that the maximum noise level at the property boundary would remain at or below 110 dB and increases in hourly noise levels at the property boundary would not exceed 10 dBA above the ambient noise level for two or more hours per day, more than five days per week, for a period of 12 months or more.*

CONSTRUCTION SCHEDULE, EQUIPMENT, AND NOISE

Noise levels from construction activities will vary depending on the type of equipment being used, the process, and the location. Construction of the project will be completed in the phases as listed below, and the expected construction equipment for each of these phases is listed in Tables 1 and 2, below, based on coordination with Vance Brown Builders on 10 May 2023[1]. The Site Logistics Plan, provided by Vance Brown Builders and attached for reference, shows planned locations of major equipment at the site and the overall construction areas.

- Parking Garage and Field (Field over Parking) –
  - Site Prep and Demolition – June 2023
  - Shoring and Excavation – June 2023 to August 2023
  - Foundation – July 2023 to September 2023

[1] Construction equipment on-site considered in tables and analysis. Future paving and/or grinding of nearby roadways not included

- Podium Construction – September to December 2023
- Finishes – March 2017 to January 2024
- Sitework, Landscaping, and Inspections – February to June 2024

- Upper/Middle School Buildings and Pool
  - Site Prep and Demolition – June to December 2023
  - Shoring and Excavation – December 2023 to February 2024
  - Foundation – February to July 2024
  - Structure and Roof – July 2024 to January 2025
  - Exterior Skin, Roofing, Interiors – January 2025 to November 2025

Table 1: Construction Equipment Expected by Phase: Parking Garage and Field

Site Prep and Demolition	Shoring and Excavation	Foundation	Podium Construction	Finishes	Sitework Landscaping Inspections
Backhoe (72 hp)	Excavator Large (380 hp)	Medium excavator (70 hp)	Crane (173 hp)	Forklift (130 hp)	Forklift (130 hp)
Skid Steer (97 hp)	Skid Steer (97 hp)	Forklift (130 hp)	Concrete pump	Welder	Skid Steer (97 hp)
Crane (173 hp)	Dump Trucks	Concrete Pump	Shotcrete pump and compressor		Welder
Flat Bed Tractor Trailer	Cat Dozer (244 hp)	Crane (173 hp)	Forklift (130 hp)		Trencher (49 hp)
Air Compressor	Forklift (130 hp)	Excavator	Concrete trucks		Skip loader (78 hp)
Cat Dozer (244 hp)		Dump Trucks			
Dump Trucks					
Excavator Medium (70 hp)					

Table 2: Construction Equipment Expected by Phase: Upper/Middle School Buildings and Pool

Site Prep and Demolition	Shoring and Excavation	Foundation	Structure and Roof	Exterior Skin Roofing Interiors
Air Compressor (49 hp)	Large Drill Rig (450 hp)	Large Drill Rig (450 hp)	Crane (173 hp)	Forklift (130 hp)
Forklift (130 hp)	Skid Steer (97 hp)	Skid Steer (97 hp)	Concrete pump	Skid Steer (97 hp)
Backhoe (72 hp)	Excavator Large (380 hp)	Forklift (130 hp)	Shotcrete pump and compressor	Welder (30 hp)
Skid Steer (97 hp)	Cat Dozer (244 hp)	Crane (173 hp)	Forklift (130 hp)	Trencher (49 hp)
Crane (173 hp)	Forklift (130 hp)	Concrete Pump	Concrete trucks	Skip loader (78 hp)
Flat Bed Tractor Trailer	Dump Trucks	Concrete Trucks	Delivery Semi Trucks	Crane (173 hp)
Jack Hammer	Mini Excavator (74 hp)		Crane (362 hp)	Track Paver (37 hp)
	Skip loader		Welder	Smooth Drum Roller
			Small Tool Compressor	Mini Excavator (74 hp)

This analysis is based on the following construction equipment noise levels, provided in Table 3 below, at a reference distance of 25 feet. Construction equipment noise typically drops off or increases at a rate of approximately 6 dB for each doubling or halving of distance between the source and receiver.

Table 3: Typical Equipment Noise Levels Used for the Analysis[2]

Equipment	Noise Level (dB) at 25 feet
Compactor (Ground), Front End Loader, Backhoe	86 dB
Concrete Trucks, Pneumatic Tools, Gradall, Grader, Skid Steer, Drill Rig, Dozer, Shotcrete Pump	91 dB
Crane	89 dB
Excavator, Air Compressor, Trencher	87 dB
Concrete Pump	88 dB
Jack Hammer	94 dB
Paver	95 dB
Rebar Saw	82 dB
Forklift, Skip Loader	85 dB
Roller	80 dB
Trucks (traveling)	90 dB
Welder	79 dB

As shown in Table 3, no single piece of the planned equipment is expected to exceed the City's limit of 110 dB at 25 feet. Assuming the loudest piece of equipment is at the closest part of the construction area to a residence, and all other equipment scheduled for the construction phase is operating simultaneously, estimated noise levels from on-site construction are as follows:

- Parking Garage and Field:

[2] Based on the Federal Highway Administration document "FHWA Highway Construction Noise Handbook" Tables 7.3 and 9.9, Federal Transit Administration document "Transit Noise and Vibration Impact Assessment" Table 12-1, US EPA document, "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances" (1971), and data from other Salter construction noise monitoring projects, unless otherwise noted.

- 102 dB and below at 1215, 1235, and 1263 Emerson Street shared property line (residences to the immediate southwest of parking garage)
- 89 dB and below at residences across street from Castilleja (i.e., residences across Bryant Street, Kellogg Avenue, Emerson Street, and Embarcadero Road)

- Upper/Middle School Buildings and Pool: 89 dB and below at all neighboring residences

These levels are consistent with the 110 dB property line limit from the Palo Alto Municipal Code and DEIR Mitigation Measure 8b.

CONSTRUCTION NOISE REDUCTION MEASURES

1. Hours of Construction – Construction activities will be limited to between 8:00 a.m. and 6:00 p.m. Monday through Friday, and between 9:00 a.m. and 6:00 p.m. on Saturday. Mitigation Measure 8b states that "hourly noise levels at the property boundary would not exceed 10 dBA above the ambient noise level for two or more hours per day, more than five days per week, for a period of 12 months or more". After 12 months of construction, construction should be limited to Monday through Friday, unless it can be shown that planned Saturday activities at that point will not exceed the limit of 10 dBA above ambient from Mitigation Measure 8b. For reference, Mitigation Measure 8b would likely only allow quieter activities (e.g., indoor construction) on Saturdays after 12 months of construction.
2. Construction of the project will use the best available and feasible noise control techniques. This will be implemented as follows:
    a. The contractor will coordinate with contractors and sub-contractors to ensure that all heavy earthmoving equipment, impact tools, compressors, engine generators, and diesel fueled trucks use the best available noise control techniques wherever feasible (e.g., improved mufflers, equipment redesign, use of intake silencers, ducts, engine enclosures and acoustically attenuating shields or shrouds, wherever feasible).
    b. Internal combustion engines shall be equipped with intake and exhaust mufflers that are in good condition and appropriate for the equipment. They will be turned off when not in use to avoid unnecessary idling.
    c. Impact tools used for this project will generally be hydraulically or electrically powered to avoid noise associated with compressed air exhaust from pneumatically powered tools; however, where use of pneumatic tools is unavoidable an exhaust muffler on the compressed air exhaust will be used.
    d. Where commercially available and feasible, impact tools shall use external jackets to reduce noise generation.
    e. Utilize "quiet" air compressors and other stationary noise sources where technology exists.
    f. Locate stationary noise-generating equipment, such as air compressors, pumps, and similar equipment, as far to the east as possible to maximize the distance to the nearest residential

receptors and take advantage of any shielding that may be provided by other on-site equipment or buildings.

g. Noise from construction workers' radios will be limited to a point where they are not audible at existing residences bordering the site.

3. Posting and Notification – The Construction hours and days of the week should be posted per Section 9.10.060(b) of the Palo Alto Municipal Code

4. Noise Disturbance Coordinator – The construction team will include a noise disturbance coordinator who will track and respond to any complaints that arise from this construction activity.

   a. The disturbance coordinator will determine the cause of the complaint and implement reasonable measures to correct the problem as feasible. All complaints will be logged, with at minimum, the following information:

      i. Date of complaint

      ii. Name, address, phone number of individual(s) complaining

      iii. Reason for the complaint

      iv. Action taken

      v. Resolution notes – Note: The complainants will be notified by phone, email or other means of the corrective measures to address their complaints

   b. In response to complaints, noise barriers in the form of solid plywood fences or temporary noise control blankets shall be considered if they would effectively shield the objectionable source or activity. Noise control blankets could be hung on construction fencing or scaffolding.

   c. A telephone number for the disturbance coordinator will be posted at the site and will be included in any construction notices sent to adjacent neighbors. The contractor shall provide photographic evidence to the City that the posting of the contact information for the noise disturbance coordinator is posted to the public at the site.

* * *

APPENDIX 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:

- The intensity or level of the sound
- The frequency spectrum of the sound
- 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, which 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, which 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 "dB." 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, which 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 may include nearby activities such as single vehicle pass-bys, aircraft flyovers, etc. which 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. "L10" is the A-weighted sound level equaled or exceeded during 10 percent of a stated time period. The L10 is considered a good measure of the maximum sound levels caused by discrete noise events. "L50" 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 "L90" 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 equivalent sound level which 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 L_{dn} (Day/Night Average Sound Level), which represents the 24-hour average sound level with a penalty for noise occurring at night. The L_{dn} computation divides the 24-hour day into two periods: daytime (7:00 am to 10:00 pm); and nighttime (10:00 pm to 7:00 am). 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 L_{dn}.

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

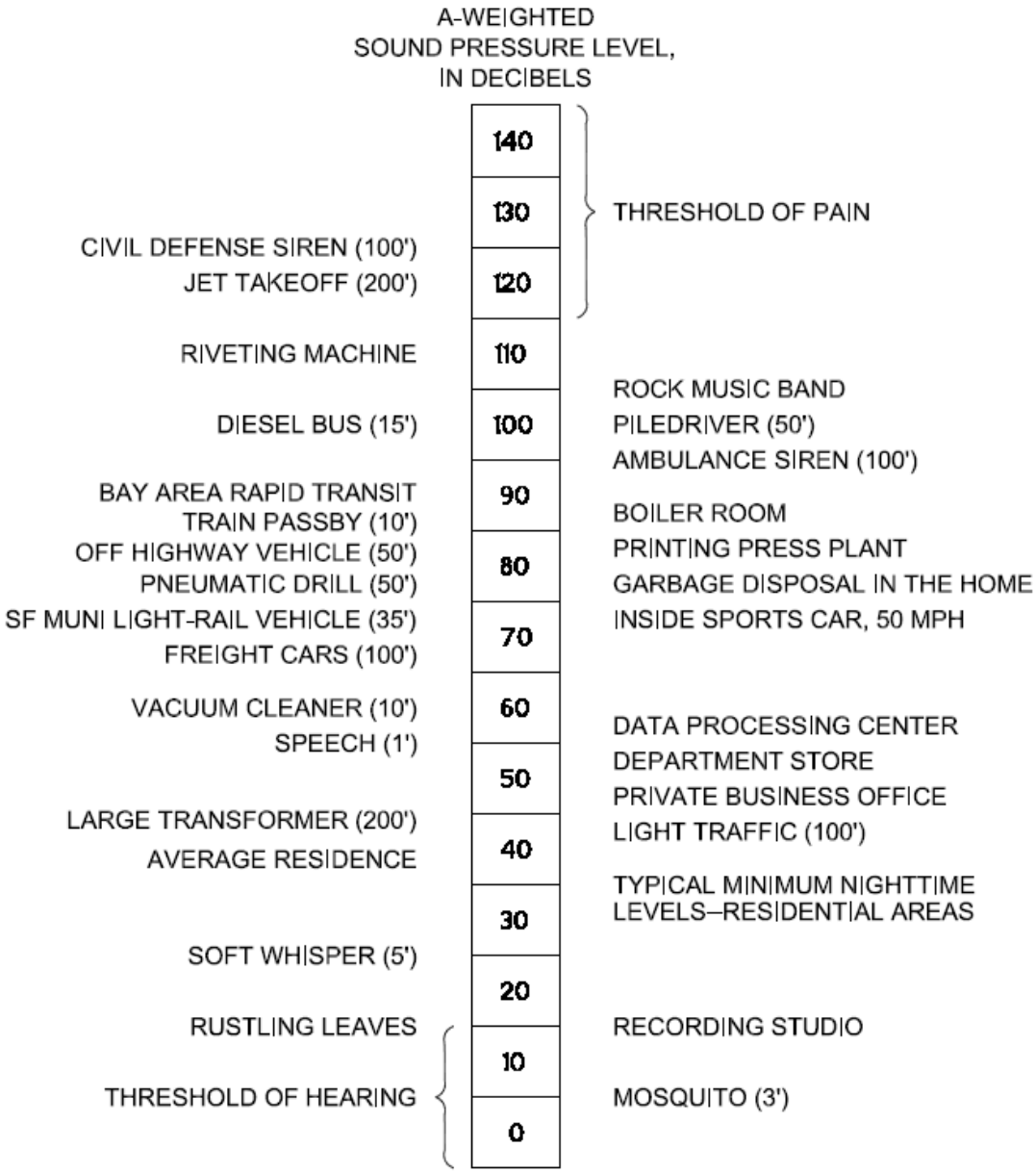
- Subjective effects of annoyance, nuisance, dissatisfaction
- Interference with activities such as speech, sleep, and learning
- Physiological effects such as startle, hearing loss

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:

Except in carefully controlled laboratory experiments, a change of only 1 dB in sound level cannot be perceived. Outside of the laboratory, a 3 dB change is considered a just-noticeable difference. A change in level of at least 5 dB is required before any noticeable change in community response would be expected. A 10 dB change is subjectively heard as approximately a doubling in loudness and would almost certainly cause an adverse community response.



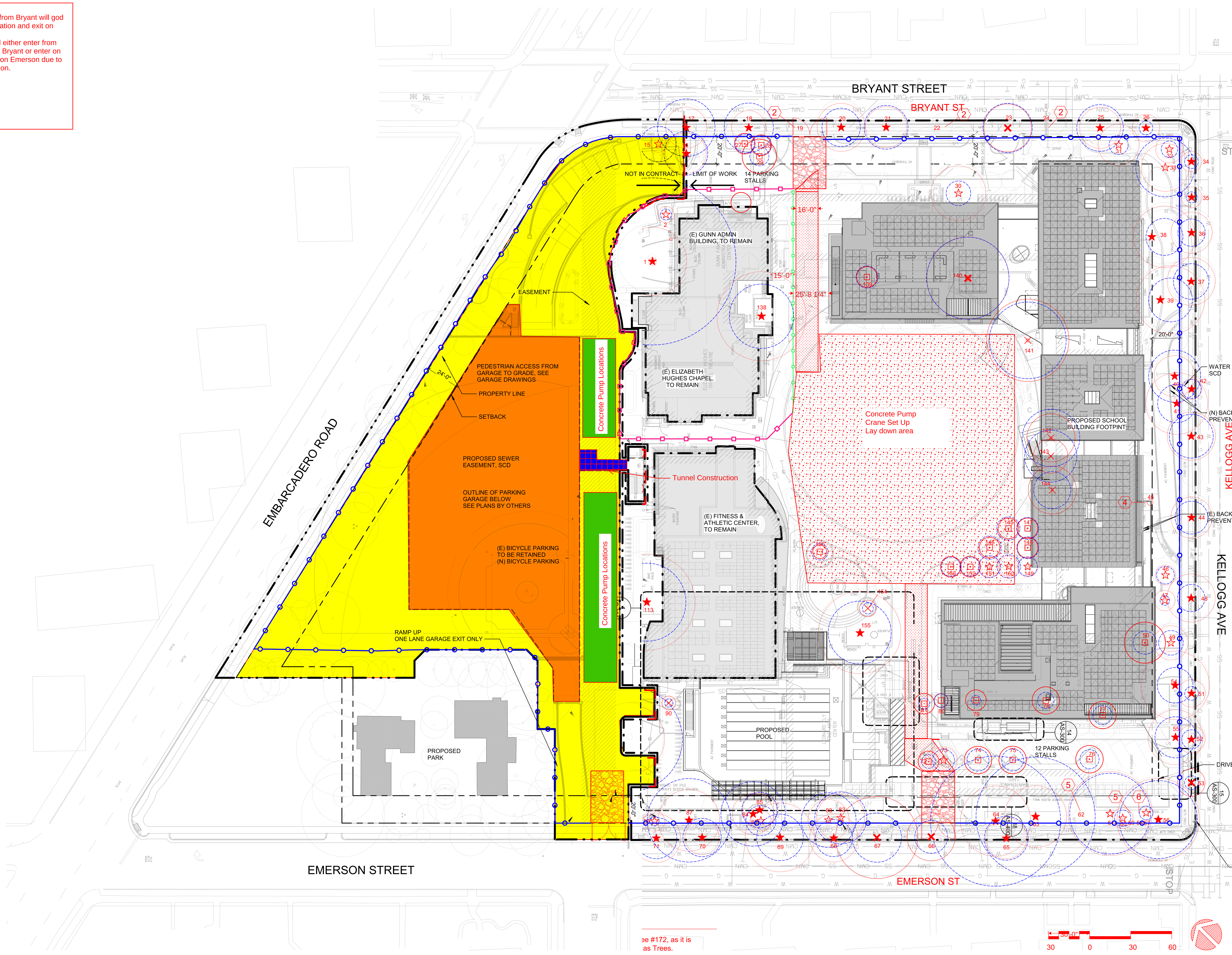
TYPICAL SOUND LEVELS MEASURED IN THE ENVIRONMENT AND INDUSTRY

FIGURE A1

1107 C 11.25.03

Garage Notes:
Dump Trucks enter from Bryant will god down into the excavation and exit on Emerson
Concrete Trucks will either enter from Bryant and leave on Bryant or enter on Emerson and leave on Emerson due to the tunnel construction.

School Notes:
During Demolition trucks will enter from Emerson and Exit onto Emerson
Once Buildings are demoed Dump Trucks/Concrete trucks enter from Bryant and exit on Emerson



#	Tree Name	202[illegible]
1	Sequoia sempervirens	73
2	Arbutus 'Marina'	5
3	Arbutus 'Marina'	6
4	Cornus sp.	2
5	Arbutus 'Marina'	7
6	Quercus agrifolia	20
7	Pyrus calleryana 'Aristocrat'	10
8	Pyrus calleryana 'Aristocrat'	12
9	Pyrus calleryana 'Aristocrat'	9
10	Quercus agrifolia	12
11	Crataegus laevigata	6
12	Magnolia grandiflora	12
13	Quercus agrifolia	17
14	Quercus agrifolia	9
15	Liquidambar styraciflua	8
16	Quercus agrifolia	19
17	Liquidambar styraciflua	25
18	Liquidambar styraciflua	21
19	Liquidambar styraciflua	-
20	Liquidambar styraciflua	17
21	Liquidambar styraciflua	19
22	Liquidambar styraciflua	-
23	Liquidambar styraciflua	21
24	Liquidambar styraciflua	-
25	Liquidambar styraciflua	20
26	Acer rubrum	6
27	Acer palmatum	5/4/3
28	Prunus sp.	8
29	Acer palmatum	5/4/3
30	Acer buegerianum	12
31	Fagus sylvatica 'Atropunicea'	8
32	Fagus sylvatica 'Atropunicea'	7
33	Ligustrum japonicum	13 /1
34	Acer rubrum	6
35	Acer rubrum	5
36	Magnolia grandiflora	12
37	Magnolia grandiflora	15
38	Quercus agrifolia	16
39	Quercus agrifolia	19
40	Quercus agrifolia	23
41	Quercus agrifolia	17
42	Magnolia grandiflora	8
43	Magnolia grandiflora	19
44	Magnolia grandiflora	14
45	Cedrus atlantica 'Glauca' *see note	
46	Citrus sp.	[illegible]
47	Fagus sylv[illegible] 'Atropunice[illegible]	[illegible]
48	Magnolia grandiflora	12
49	Eriobotrya [illegible]	[illegible]
50	Pistacia ch[illegible]	[illegible]
51	Celtis aust[illegible]	[illegible]
52	Celtis australis	[illegible]
53	Celtis australis	6
54	Quercus agrifolia	15
55	Quercus agrifolia	18
56	Quercus agrifolia	34
57	Pittosporum tenuifolium	3 / 3
58	Pittosporum tenuifolium	-
59	Pittosporum tenuifolium	-
60	Sequoia sempervirens	7
61	Acacia melanoxylon	15/ 1
62	Sequoia sempervirens	-
63	Sequoia sempervirens	52
64	Quercus agrifolia	23/2[illegible]
65	Ulmus parvifolia	19
66	Ulmus parvifolia	14
67	Ulmus parvifolia	21
68	Ulmus parvifolia	16
69	Ulmus parvifolia	20
70	Ulmus parvifolia	17
71	Ulmus parvifolia	18
72	Pistacia chinensis	6
73	Arbutus 'Marina'	9
74	Arbutus 'Marina'	9
75	Arbutus 'Marina'	9
76	Pistacia chinensis	8
77	Pistacia chinensis	8
78	Arbutus 'Marina'	7
79	Arbutus 'Marina'	4
80	Arbutus 'Marina'	6
81	Pistacia chinensis	5
82	Acacia melanoxylon	23
83	Acacia melanoxylon	12/ 1
84	Quercus agrifolia	28
85	Quercus agrifolia	15
86	Umbellularia californica	7/6
87	Quercus agrifolia	27 / [illegible]
88	Crataegus laevigata	4

Garage Area of Construction
Garage Excavation
School Area Of Construction
Entrance Gates
Gunn Bldg Protection Fence
Temporary Fence
Entrance Road
Stabilized Construction Entrance

ee #172, as it is as Trees.
ere included in the roject start, so not

1 SITE PLAN
1/32" = 1'-0"

SHEET NOTES

1. SEE PROJECT INFO ON G.001 FOR COMPLETE ABOVE GRADE AND BELOW GRADE PARKING COUNTS
2. SEE CIVIL DRAWINGS FOR GRADING PLANS

KEY NOTES

LEGEND

PROPERTY LINE
N.I.C.
L.O.W.

If this drawing is not 30"x42", then the drawing has been revised from its original size. Noted scales must be adjusted. This line should be equal to one inch.

11/29/2022 3:37:42 PM

WRNS STUDIO
501 SECOND STREET
4TH FLOOR, STE. 402
SAN FRANCISCO
CALIFORNIA 94107
415.489.2224 TEL
415.358.9100 FAX
WWW.WRNSSTUDIO.COM

LICENSED ARCHITECT PAULINE SOUZA NO. C24532 REN. 8/31/23 STATE OF CALIFORNIA

ISSUES	DATE
PERMIT SET	11/30/2022
HEALTH DEPT SET - FOOD SERVICE	11/30/2022
HEALTH DEPT SET - POOL	11/30/2022

REVISION LIST DATE

ISSUED FOR PERMIT

CASTILLEJA SCHOOL
1310 Bryant St, Palo Alto, CA 94301

KEYPLAN

PROJECT NO.: 18043.00
DATE: 11/30/22
SCALE: As indicated

SHEET TITLE:
SITE PLAN

VBI Site Logistics Plan
5/11/2023

SHEET NO:
AS-101