BENEDETTI CAR WASH
NOISE AND VIBRATION ASSESSMENT

Sebastopol, California

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INTRODUCTION

The project proposes to construct an automated car wash and office space at 6809 Sebastopol Avenue in downtown Sebastopol, California. The car wash would be located on the ground level of the proposed two-story building and have a two-vehicle capacity. Office space would be located on the ground and second level of the building. Seventeen self-service vacuum stations would occupy the western portion of the site. The car wash and vacuum stations would operate between 7 a.m. and 7 p.m., Monday through Saturday. The site is adjacent to the existing Benedetti Tire Center and Express Lube.

This report evaluates the project's potential to result in significant noise and vibration impacts with respect to applicable California Environmental Quality Act (CEQA) guidelines. The report is divided into two sections: 1) the Setting Section provides a brief description of the fundamentals of environmental noise, summarizes applicable regulatory criteria, and discusses the results of the ambient noise monitoring survey completed to document existing noise conditions; 2) the General Plan Consistency section discusses land use compatibility utilizing noise policies in the City's General Plan; and 2) the Impacts and Mitigation Measures Section describes the significance criteria used to evaluate project impacts, provides a discussion of each project impact, and presents measures, where necessary, to mitigate the impacts of the project on sensitive receptors in the vicinity.

SETTING

Fundamentals of Environmental Noise

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound could be caused by its *pitch* or its *loudness*. *Pitch* is the height or depth of a tone or sound, depending on the relative rapidity (frequency) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. *Loudness* is intensity of sound waves combined with the reception characteristics of the ear. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave.

In addition to the concepts of pitch and loudness, there are several noise measurement scales which are used to describe noise in a particular location. A *decibel (dB)* is a unit of measurement which indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10 decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Technical terms are defined in Table 1.

There are several methods of characterizing sound. The most common in California is the *A-weighted sound level (dBA).* This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA

are shown in Table 2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This *energy-equivalent sound/noise descriptor* is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

The scientific instrument used to measure noise is the sound level meter. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends upon the distance the receptor is from the noise source. Close to the noise source, the models are accurate to within about plus or minus 1 to 2 dBA.

Since the sensitivity to noise increases during the evening and at night -- because excessive noise interferes with the ability to sleep -- 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The *Community Noise Equivalent Level* (*CNEL*) is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to evening (7:00 pm - 10:00 pm) and a 10 dB addition to nocturnal (10:00 pm - 7:00 am) noise levels. The *Day/Night Average Sound Level* (L_{dn} or *DNL*) is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.

Effects of Noise

Sleep and Speech Interference

The thresholds for speech interference indoors are about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating. Outdoors the thresholds are about 15 dBA higher. Steady noises of sufficient intensity (above 35 dBA) and fluctuating noise levels above about 45 dBA have been shown to affect sleep. Interior residential standards for multi-family dwellings are set by the State of California at 45 dBA L_{dn}. Typically, the highest steady traffic noise level during the daytime is about equal to the L_{dn} and nighttime levels are 10 dBA lower. The standard is designed for sleep and speech protection and most jurisdictions apply the same criterion for all residential uses. Typical structural attenuation is 12 to 17 dBA with open windows. With closed windows in good condition, the noise attenuation factor is around 20 dBA for an older structure and 25 dBA for a newer dwelling. Sleep and speech interference is therefore possible when exterior noise levels are about 57 to 62 dBA L_{dn} with open windows and 65 to 70 dBA L_{dn} if the windows are closed. Levels of 55 to 60 dBA are common along collector streets and secondary arterials, while 65 to 70 dBA is a typical value for a primary/major arterial. Levels of 75 to 80 dBA are normal noise levels at the first row of development outside a freeway right-of-way. In order to achieve an acceptable interior noise environment, bedrooms facing secondary roadways need to be able to have their windows closed; those facing major roadways and freeways typically need special glass windows.

Annoyance

Attitude surveys are used for measuring the annoyance felt in a community for noises intruding into homes or affecting outdoor activity areas. In these surveys, it was determined that the causes for annoyance include interference with speech, radio and television, house vibrations, and interference with sleep and rest. The L_{dn} as a measure of noise has been found to provide a valid correlation of noise level and the percentage of people annoyed. People have been asked to judge the annoyance caused by aircraft noise and ground transportation noise. There continues to be disagreement about the relative annoyance of these different sources. When measuring the percentage of the population highly annoyed, the threshold for ground vehicle noise is about 50 dBA L_{dn}. At an L_{dn} of about 60 dBA, approximately 12 percent of the population is highly annoyed. When the L_{dn} increases to 70 dBA, the percentage of the population highly annoyed increases to about 25 to 30 percent of the population. There is, therefore, an increase of about 2 percent per dBA between an L_{dn} of 60 to 70 dBA. Between an L_{dn} of 70 to 80 dBA, each decibel increase increases by about 3 percent the percentage of the population highly annoyed. People appear to respond more adversely to aircraft noise. When the L_{dn} is 60 dBA, approximately 30 to 35 percent of the population is believed to be highly annoyed. Each decibel increase to 70 dBA adds about 3 percentage points to the number of people highly annoyed. Above 70 dBA, each decibel increase results in about a 4 percent increase in the percentage of the population highly annoyed.

Fundamentals of Groundborne Vibration

Ground vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One method is the Peak Particle Velocity (PPV). The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. In this report, a PPV descriptor with units of mm/sec or in/sec is used to evaluate construction generated vibration for building damage and human complaints. Table 3 displays the reactions of people and the effects on buildings that continuous or frequent intermittent vibration levels produce. The guidelines in Table 3 represent syntheses of vibration criteria for human response and potential damage to buildings resulting from construction vibration.

Construction activities can cause vibration that varies in intensity depending on several factors. The use of pile driving and vibratory compaction equipment typically generates the highest construction related groundborne vibration levels. Because of the impulsive nature of such activities, the use of the PPV descriptor has been routinely used to measure and assess groundborne vibration and almost exclusively to assess the potential of vibration to cause damage and the degree of annoyance for humans.

The two primary concerns with construction-induced vibration, the potential to damage a structure and the potential to interfere with the enjoyment of life, are evaluated against different vibration limits. Human perception to vibration varies with the individual and is a function of physical setting and the type of vibration. Persons exposed to elevated ambient vibration levels, such as people in an urban environment, may tolerate a higher vibration level.

Structural damage can be classified as cosmetic only, such as paint flaking or minimal extension of cracks in building surfaces; minor, including limited surface cracking; or major, that may threaten the structural integrity of the building. Safe vibration limits that can be applied to assess the potential for damaging a structure vary by researcher. The damage criteria presented in Table 3 include several categories for ancient, fragile, and historic structures, the types of structures most at risk to damage. Most buildings are included within the categories ranging from “Historic and some old buildings” to “Modern industrial/commercial buildings”. Construction-induced vibration that can be detrimental to the building is very rare and has only been observed in instances where the structure is at a high state of disrepair and the construction activity occurs immediately adjacent to the structure.

The annoyance levels shown in Table 3 should be interpreted with care since vibration may be found to be annoying at lower levels than those shown, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying. Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors, or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage.

TABLE 1 Definition of Acoustical Terms Used in this Report

Term	Definition
Decibel, dB	A unit describing, the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20 micro Pascals.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e. g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sound are below 20 Hz and Ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level, L_{eq}	The average A-weighted noise level during the measurement period.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Day/Night Noise Level, L_{dn} or DNL	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 pm and 7:00 am.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 pm to 10:00 pm and after addition of 10 decibels to sound levels measured in the night between 10:00 pm and 7:00 am.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Source: Handbook of Acoustical Measurements and Noise Control, Harris, 1998.

TABLE 2 Typical Noise Levels in the Environment

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	110 dBA	Rock band
Jet fly-over at 1,000 feet		
	100 dBA	
Gas lawn mower at 3 feet		
	90 dBA	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	80 dBA	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawn mower, 100 feet	70 dBA	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	60 dBA	
		Large business office
Quiet urban daytime	50 dBA	Dishwasher in next room
Quiet urban nighttime	40 dBA	Theater, large conference room
Quiet suburban nighttime		
	30 dBA	Library
Quiet rural nighttime		Bedroom at night, concert hall (background)
	20 dBA	
		Broadcast/recording studio
	10 dBA	
	0 dBA	

Source: Technical Noise Supplement (TeNS), California Department of Transportation, September 2013.

TABLE 3 Reaction of People and Damage to Buildings from Continuous or Frequent Intermittent Vibration Levels

Category	Velocity Level, PPV (in/sec)	Human Reaction	Effect on Buildings
1	0.01	Barely perceptible	No effect
2	0.04	Distinctly perceptible	Vibration unlikely to cause damage of any type to any structure
3	0.08	Distinctly perceptible to strongly perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
4	0.1	Strongly perceptible	Threshold at which there is a risk of damage to fragile buildings with no risk of damage to most buildings
5	0.25	Strongly perceptible to severe	Threshold at which there is a risk of damage to historic and some old buildings.
6	0.3	Strongly perceptible to severe	Threshold at which there is a risk of damage to older residential structures
7	0.5	Severe - Vibrations considered unpleasant	Threshold at which there is a risk of damage to new residential and modern commercial/industrial structures

Source: Transportation and Construction Vibration Guidance Manual, California Department of Transportation, September 2013.

Regulatory Background - Noise

The State of California and the City of Sebastopol have established regulatory criteria that are applicable in this assessment. The State CEQA Guidelines, Appendix G, California Building Code, and the City of Sebastopol General Plan are used to assess the potential significance of impacts. A summary of the applicable regulatory criteria is provided below.

State CEQA Guidelines. CEQA contains guidelines to evaluate the significance of effects of environmental noise attributable to a proposed project. Under CEQA, noise impacts would be considered significant if the project would result in:

(a) Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local General Plan or Noise Ordinance, or applicable standards of other agencies;

(b) Generation of excessive groundborne vibration or groundborne noise levels; or

(c) For a project located within the vicinity of a private airstrip or an airport land use plan or where such a plan has not been adopted within two miles of a public airport or public use

airport, if the project would expose people residing or working in the project area to excessive noise levels.

2019 California Building Code, Title 24, Part 2. The current version of the California Building Code (CBC) requires interior noise levels attributable to exterior environmental noise sources to be limited to a level not exceeding 45 dBA L_{dn} in any habitable room.

2019 California Green Building Standards Code (Cal Green Code). The State of California established exterior sound transmission control standards for new non-residential buildings as set forth in the 2019 California Green Building Standards Code (Section 5.507.4.1 and 5.507.4.2). Section 5.507 states that either the prescriptive (Section 5.507.4.1) or the performance method (Section 5.507.4.2) shall be used to determine environmental control at indoor areas. The prescriptive method is very conservative and not practical in most cases; however, the performance method can be quantitatively verified using exterior-to-interior calculations. For the purposes of this report, the performance method is utilized to determine consistency with the Cal Green Code. The sections that pertain to this project are as follows:

> **5.507.4.1 Exterior noise transmission, prescriptive method.** Wall and roof-ceiling assemblies exposed to the noise source making up the building envelope shall meet a composite STC rating of at least 50 or a composite OITC rating of no less than 40, with exterior windows of a minimum STC of 40 or OITC of 30 when the building falls within the 65 dBA L_{dn} noise contour of a freeway or expressway, railroad, industrial source or fixed-guideway noise source, as determined by the local general plan noise element.
>
> **5.507.4.2 Performance method.** For buildings located, as defined by Section 5.507.4.1, wall and roof-ceiling assemblies exposed to the noise source making up the building envelope shall be constructed to provide an interior noise environment attributable to exterior sources that does not exceed an hourly equivalent noise level ($L_{eq\ (1\text{-}hr)}$) of 50 dBA in occupied areas during any hour of operation.

The performance method, which establishes the acceptable interior noise level, is the method typically used when applying these standards.

City of Sebastopol General Plan. Chapter 6 of the Sebastopol General Plan sets forth policies with the goal of addressing major noise sources and promoting safe and comfortable noise levels throughout the City of Sebastopol. The following policies are applicable to the proposed project:

N 1-1 Ensure the noise compatibility of existing and future developments when making land use planning decisions.

N 1-2 Require development and infrastructure projects to be consistent with the Land Use Compatibility for Community Noise Environments standards indicated in Table N-1 to ensure acceptable noise levels for existing and future development.

N 1-3 Require new development to mitigate excessive noise through best practices, including building location and orientation, building design features, placement of

noise-generating equipment away from sensitive receptors, shielding of noise-generating equipment, placement of noise-tolerant features between noise sources and sensitive receptors, and use of noise-reducing materials.

N 1-6 Require acoustical studies for new developments, projects seeking use permits related to activities that would increase noise levels, and transportation improvements that affect noise-sensitive uses such as schools, hospitals, libraries, group care facilities, convalescent homes, and residential areas.

N 1-7 For projects that are required by the California Environmental Quality Act (CEQA) to analyze noise impacts, the following criteria shall be used to determine the significance of those impacts:

Stationary and Non-Transportation Noise Sources

A significant impact will occur if the project results in an exceedance of the noise level standards contained in this element, or the project will result in an increase in ambient noise levels by more than 3 dB, whichever is greater. This does not apply to construction activities which are conducted according to the best practices outlined in Action N 1f. Compliance with the requirements outlined in Action N 1f shall be sufficient to reduce construction-related noise impacts to a less than significant level.

Transportation Noise Sources

Where existing traffic noise levels are less than 60 dB L_{dn} at the outdoor activity areas of noise-sensitive uses, a +5 dB L_{dn} increase in roadway noise levels will be considered significant; and

Where existing traffic noise levels range between 60 and 65 dB L_{dn} at the outdoor activity areas of noise-sensitive uses, a +3 dB L_{dn} increase in roadway noise levels will be considered significant; and

Where existing traffic noise levels are greater than 65 dB L_{dn} at the outdoor activity areas of noise-sensitive uses, a +1.5 dB L_{dn} increase in roadway noise levels will be considered significant.

N 1-8 Support noise-compatible land uses along existing and future roadways, including County, State, and Federal routes.

N 1-11 Ensure that existing development is protected, to the greatest extent feasible, from noise impacts due to construction on adjacent or nearby properties through implementation of best practices, as outlined in Action N 1f.

N 1-13 Control non-transportation related noise from site specific noise sources to the standards shown in Table N-2.

N 1-15 Require construction activities to comply with standard best practices (see Action N 1f).

N 1-18 Ensure that an acceptable noise environment is maintained in residential areas and areas with sensitive uses by ensuring that uses, operations, and fixed equipment maintain compliance with City standards and by providing for the regulation of short-term increases in non-transportation noise levels through the Municipal Code.

N 1-19 Ensure that indoor noise levels at public and community buildings do not reach harmful levels, generally considered to be 100 dB or higher.

Action N 1f Require construction projects that may generate excessive noise impacts to implement the following types of standard best practices, as applicable, to reduce construction noise impacts to the extent feasible:

- Noise-generating construction activities, including truck traffic coming to and from the construction site for any purpose, shall be limited as specified in the Noise Ordinance.

- All equipment driven by internal combustion engines shall be equipped with mufflers, which are in good condition and appropriate for the equipment.

- The construction contractor shall utilize "quiet" models of air compressors and other stationary noise sources where technology exists.

- At all times during project grading and construction, stationary noise-generating equipment shall be located as far as practicable from sensitive receptors and placed so that emitted noise is directed away from residences.

- Unnecessary idling of internal combustion engines shall be prohibited.

- Construction staging areas shall be established at locations that will create the greatest distance between the construction-related noise sources and noise-sensitive receptors nearest the project site during all project construction activities, to the extent feasible.

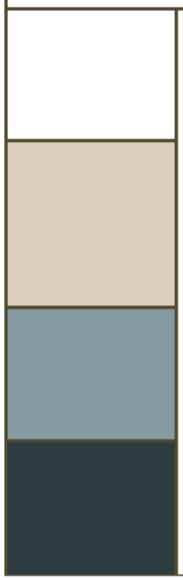
- Neighbors located adjacent to the construction site shall be notified of the construction schedule in writing.

- The construction contractor shall designate a "noise disturbance coordinator" who will be responsible for responding to any local complaints about construction noise. The disturbance coordinator shall be responsible for determining the cause of the noise complaint (e.g., starting too early, poor muffler, etc.) and instituting reasonable measures as warranted to

correct the problem. A telephone number for the disturbance coordinator shall be conspicuously posted at the construction site.

TABLE N-1 LAND USE COMPATIBILITY FOR COMMUNITY NOISE ENVIRONMENT

Land Use Category	Exterior Noise Exposure (Ldn) 55 60 65 70 75 80 90
Residential	
Transient Lodging; Motel, Hotel	
School, Library, Church, Hospital, Nursing Home	
Auditorium, Concert Hall, Amphitheater, Sports Arena	
Playground, Recreational Open Space, Park	
Golf Course, Stables, Water Recreation, Cemetery	
Office Buildings, Business, Commercial	
Industrial, Utilities, Manufacturing, Agriculture	



NORMALLY ACCEPTABLE
Specified land use is satisfactory, assuming that any buildings involved are of conventional construction without any special insulation requirements.

CONDITIONALLY ACCEPTABLE
Specified land use may be permitted only after detailed analysis of the noise reduction requirements and noise insulation features included in the design.

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

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

TABLE N-2 STATIONARY (NON-TRANSPORTATION) NOISE SOURCE STANDARDS

Land Use Receiving the Noise	Hourly Noise-Level Descriptor	Exterior Noise-Level Standard (dBA)	
		Daytime (7am-10pm)	Nighttime (10pm-7am)
Residential	L_{eq} L_{max}	55 70	45 65

Notes:

a) The residential standards apply to all properties that are zoned for residential use. The exterior noise level standard is to be applied at the property line of the receiving land use or at a designated outdoor activity area (at the discretion of the Planning Director) of the new development. For mixed-use projects, the exterior noise level standard may be waived (at the discretion of the Planning Director) if the project does not include a designated activity area and mitigation of property line noise for on-site uses is not practical. These noise level standards do not apply to residential units established in conjunction with industrial or commercial uses (e.g., caretaker dwellings). The City can impose standards that are more restrictive than specified above based upon determination of existing low ambient noise levels.

b) Each of the noise levels specified above shall be lowered by 5 dBA for tonal noises characterized by a whine, screech, or hum, noises consisting primarily of speech or music, or recurring impulsive noises. In no case shall mitigation be required to a level that is less than existing ambient noise levels, as determined through measurements conducted during the same operational period as the subject noise source.

c) In situations where the existing noise level exceeds the noise levels indicated in the above table, any new noise source must include mitigation that reduces the noise level of the noise source to the existing level plus 3 dB.

City of Sebastopol Municipal Code. Section 8.25 of the Sebastopol Municipal Code sets forth policies to prohibit unnecessary, excessive, and annoying noises. The following policies are applicable to the proposed project:

8.25.060 Noise Levels

A. It shall be unlawful for any person to emit or cause to be emitted any noise beyond the boundaries of his/her premises in excess of the noise levels established in these regulations.

B. Noise Level Standards

2. No person in a commercial zone shall emit noise beyond the boundary of his/her premises exceeding the levels stated herein and applicable to adjacent residential, commercial, or industrial zones. Noise levels shall not exceed:

a. Daytime hours: 55 dBA

b. Nighttime hours: 45 dBA

Regulatory Background – Vibration

City of Sebastopol General Plan. Chapter 6 of the Sebastopol General Plan sets forth policies to achieve the goal of minimizing vibration impacts on people, residences, and business operations in the City of Sebastopol. The following policies are applicable to the proposed project:

N 1-16 Require new development to minimize vibration impacts to adjacent uses during demolition and construction. For sensitive historic structures, a vibration limit of 0.08 in/sec PPV (peak particle velocity) will be used to minimize the potential for cosmetic damage to the building. A vibration limit of 0.30 in/sec PPV will be used to minimize the potential for cosmetic damage at buildings of normal conventional construction.

Existing Noise Environment

The 1.5-acre project site is located at 6809 Sebastopol Avenue in downtown Sebastopol, California. Existing uses in the site vicinity are primarily commercial and include automotive shops and repair centers, retail stores, restaurants, and a commercial creative space. The site is bounded by Sebastopol Avenue to the north, Barnes Avenue to the west, undeveloped lands and segments of the Joe Rodota Trail to the south and southeast, and commercial uses and parking to the east. Noise-sensitive uses nearest the site include the Joe Rodota Trail, the nearest residence approximately 600 feet to the south, and the Sebastopol Inn approximately 250 feet to the east.

A noise monitoring survey was performed in the project vicinity between Thursday, June 4, 2020 and Tuesday, June 9, 2020 to quantify and characterize ambient noise levels at the site and in the surrounding area. The survey included two long-term measurements and three short-term measurements at the locations shown in Figure 1. The predominant sources of noise in the project vicinity were traffic along Sebastopol Avenue and Petaluma Avenue and localized activities taking place on the adjacent commercial properties.

On June 4, 2020, between 12:20 p.m. and 1 p.m., three attended, short-term (10-minute) measurements, ST-1, ST-2a, and ST-2b were made to quantify existing ambient noise levels at the Sebastopol Inn, the closest noise sensitive use to the project site, and traffic noise levels generated along Petaluma Avenue. Measurement ST-1 was located at 220 Petaluma Avenue. The primary source of noise at this location was traffic along Petaluma Avenue. Measurements ST-2a and ST-2b were located at the pool area of the Sebastopol Inn. The primary sources of noise at this location were distant traffic along Sebastopol Avenue and vehicular activity in parking lots adjacent to the site. A summary of short-term noise measurement data is presented below in Table 4.

Long-term measurements LT-1 and LT-2 were made starting on Thursday June 4, 2020 and concluding on Tuesday, June 9, 2020. Measurement LT-1 was made to quantify the ambient noise level at the project site. Hourly average noise levels at this location typically varied between 49 and 60 dBA L_{eq} during the day, and between 39 and 56 dBA L_{eq} at night. Local activities occurring on the project site or the adjacent commercial property occasionally resulted in elevated noise

levels ranging from 61 to 67 dBA L_{eq}. The day-night average noise level, including existing local commercial noise, was 57 to 58 dBA L_{dn} on weekdays, 56 dBA L_{dn} on Saturday, and 54 dBA L_{dn} on Sunday. Measurement LT-2 was made to quantify the ambient noise level at the nearest residence to the site, approximately 600 feet to the south. Hourly average noise levels at this location varied between 44 and 58 dBA L_{eq} during the day, and between 35 and 57 dBA L_{eq} at night. The day-night average noise level was 54 dBA L_{dn} on weekdays and 53 dBA L_{dn} on Sunday. On Saturday, June 6, 2020, a localized noise source, such as truck idling or landscaping type activities, generated relatively steady state noise levels of 53 to 56 dBA L_{eq} from 5:00 am to 6:30 am, resulting in an elevated day-night noise level of 56 dBA L_{dn}. The daily trend in long-term measurement noise levels is shown in Appendix Figures A1 – A12.

TABLE 4 Summary of Short-Term Noise Measurement Data

ID	Measurement Location	Measured Noise Levels (dBA)						Primary Noise Source
		L_{10}	L_{50}	L_{90}	L_{eq}	Weekday L_{dn}*	Saturday L_{dn}*	
ST-1	220 Petaluma Avenue, Thursday, 6/4/20, 12:20 p.m. – 12:30 p.m.	68	63	57	65	70	68	Traffic along Petaluma Avenue
ST-2	Sebastopol Inn Outdoor Pool, Thursday, 6/4/20, 12:40 p.m. – 1:00 p.m.	51	45	42	48	51	49	Distant traffic, parking lot activities
		46	44	42	44			

*L_{dn} levels for short-term measurements are calculated through comparison with corresponding long-term noise measurements.

FIGURE 1 Noise Measurement Locations

Source: Google Earth, 2020

GENERAL PLAN CONSISTENCY ANALYSIS

The impacts of site constraints such as exposure of the proposed project to excessive levels of noise and vibration are not considered under CEQA. This section addresses Noise and Land Use Compatibility for consistency with the policies set forth in the City's General Plan and Cal Green Code.

Noise and Land Use Compatibility

Chapter 6 of the Sebastopol General Plan sets forth policies with the goal of addressing major noise sources and promoting safe and comfortable noise levels throughout the City of Sebastopol. The applicable General Plan policies were presented in detail in the Regulatory Background section and are summarized below for the proposed project:

- For the proposed commercial/office land use, the City's "normally acceptable" exterior noise level standard is 70 dBA L_{dn} or less.

- The Cal Green Code standards specify an interior noise environment attributable to exterior sources not to exceed an hourly equivalent noise level of 50 dBA $L_{eq\ (1\text{-}hr)}$ in occupied areas of non-residential uses during any hour of operation.

The future noise environment at the project site would continue to result primarily from vehicular traffic along Sebastopol Avenue and Petaluma Avenue. Noise from parking lots and operations of surrounding uses will also contribute to the future noise environment.

Future Exterior Noise Environment

The exterior noise threshold established in the City's General Plan for new commercial or office uses is 70 dBA L_{dn} at usable outdoor activity areas. According to site plans dated February 20, 2019, there will be no usable outdoor spaces at the project site. Vacuum stalls include their own self-generating noise sources and would not be considered noise sensitive spaces. The future exterior noise environment would be compatible with City General Plan standards.

Future Interior Noise Environment

The Cal Green Code specifies that interior noise attributable to exterior sources not exceed 50 dBA $L_{eq\ (1\text{-}hr)}$ in non-residential uses during any hour of operation. Hours of operation for the proposed use would be 7 a.m. to 7 p.m., Monday through Saturday. This would be applicable to office uses inside the proposed building. Peak hour noise levels measured at the project site reached 67 dBA $L_{eq\ (1\text{-}hr)}$. The project's traffic study[1] indicates an increase in future traffic volumes on nearby roads that would result in an increase of traffic noise in the site vicinity of 1 to 2 dBA L_{dn}. Considering a future noise increase of 2 dBA as a result of increased traffic volumes, peak hour noise levels at the proposed building would reach 69 dBA $L_{eq\ (1\text{-}hr)}$. Standard commercial construction with windows closed provides approximately 25 dBA of noise reduction in interior spaces. As a result,

[1] W-Trans, *Traffic Impact Study for the Benedetti Car Wash*, June 3, 2020

peak hour interior noise levels attributable to exterior sources would reach 44 dBA $L_{eq\ (1\text{-}hr)}$. The future interior noise environment would be compatible with the Cal Green Code standard.

NOISE IMPACTS AND MITIGATION MEASURES

This section describes the significance criteria used to evaluate project impacts under CEQA, provides a discussion of each project impact, and presents mitigation measures, where necessary, to reduce project impacts to less-than-significant levels.

Significance Criteria

The following criteria were used to evaluate the significance of environmental noise and vibration resulting from the project:

- **Temporary or Permanent Noise Increases in Excess of Established Standards.** A significant noise impact would be identified if the project would generate a substantial temporary or permanent noise level increase in ambient noise levels at existing noise-sensitive receptors in excess of the applicable noise standards presented in the General Plan or Municipal Code, as follows:

    - Temporary Noise Increase. A significant noise impact would be identified if construction-related noise would temporarily increase ambient noise levels at sensitive receptors. City General Plan Policies N 1-11, and N 1-15 require that the construction best practices outlined in Action N 1f be followed to reduce the impact of construction noise on adjacent or nearby properties to a less-than-significant level.

    - Permanent Noise Increase. General Plan Policy N 1-7 states that a significant permanent noise level increase would occur if project traffic would result in: a noise level increase of 5 dBA L_{dn} or greater, with a future noise level of less than 60 dBA L_{dn} at outdoor activity areas of noise-sensitive uses; a noise level increase of 3 dBA L_{dn} or greater, with a future noise level of 60 to 65 dBA L_{dn} at outdoor activity areas of noise sensitive uses; or a noise level increase of 1.5 dBA L_{dn} or greater, with a future noise level of 65 dBA L_{dn} or greater at outdoor activity areas of noise-sensitive uses.

    - Operational Noise in Excess of Standards. General Plan Policies N 1-3, N 1-7, N 1-13, N 1-18, and City Municipal Code Section 8.25.060 establish impact criteria for operational noise. A significant impact would occur if project operational noise exceeds these standards or if the project would result in an increase in ambient noise levels of greater than 3 dBA.

- **Generation of Excessive Groundborne Vibration.** General Plan Policy N 1-16 requires new development to minimize vibration impacts to adjacent uses during demolition and construction. A vibration limit of 0.08 in/sec PPV is used for sensitive historic structures,

and a vibration limit of 0.30 in/sec PPV will be used to minimize the potential for cosmetic damage at buildings of normal conventional construction.

- **Excessive Aircraft Noise Levels.** A significant noise impact would be identified if the project would expose people residing or working in the project area to excessive aircraft noise levels.

Impact 1a: **Temporary Construction Noise.** Existing noise-sensitive land uses would be exposed to a temporary increase in ambient noise levels due to project construction activities. The incorporation of construction best management practices, as outlined in the General Plan, would result in a **less-than-significant** temporary noise impact.

Temporary noise increases resulting from construction vary depending upon the noise levels generated by various pieces of construction equipment, the timing and duration of noise-generating activities, the distance between construction noise sources and noise-sensitive areas, and the presence of intervening shielding features such as buildings or terrain. Construction noise impacts primarily result when construction activities occur during noise-sensitive times of the day (e.g., early morning, evening, or nighttime hours), the construction occurs in areas immediately adjoining noise-sensitive land uses, or when construction lasts over extended periods of time.

Project construction is anticipated to occur in one phase with a duration of ten months. Minimal demolition would be required outside of tree and fence removal. Pile driving would not be used as a method of construction. Typical construction noise levels at a distance of 50 feet are shown in Tables 5 and 6. Table 5 shows average noise level ranges by construction phase, and Table 6 shows maximum noise level ranges for different construction equipment. Most demolition and construction noise falls with the range of 80 to 90 dBA at a distance of 50 feet from the source.

TABLE 5 Construction Equipment 50-Foot Noise Emission Limits

Equipment Category	L_{max} Level (dBA)[1,2]	Impact/Continuous
Arc Welder	73	Continuous
Auger Drill Rig	85	Continuous
Backhoe	80	Continuous
Bar Bender	80	Continuous
Boring Jack Power Unit	80	Continuous
Chain Saw	85	Continuous
Compressor[3]	70	Continuous
Compressor (other)	80	Continuous
Concrete Mixer	85	Continuous
Concrete Pump	82	Continuous
Concrete Saw	90	Continuous
Concrete Vibrator	80	Continuous
Crane	85	Continuous
Dozer	85	Continuous
Excavator	85	Continuous
Front End Loader	80	Continuous
Generator	82	Continuous
Generator (25 KVA or less)	70	Continuous
Gradall	85	Continuous
Grader	85	Continuous
Grinder Saw	85	Continuous
Horizontal Boring Hydro Jack	80	Continuous
Hydra Break Ram	90	Impact
Impact Pile Driver	105	Impact
Insitu Soil Sampling Rig	84	Continuous
Jackhammer	85	Impact
Mounted Impact Hammer (hoe ram)	90	Impact
Paver	85	Continuous
Pneumatic Tools	85	Continuous
Pumps	77	Continuous
Rock Drill	85	Continuous
Scraper	85	Continuous
Slurry Trenching Machine	82	Continuous
Soil Mix Drill Rig	80	Continuous
Street Sweeper	80	Continuous
Tractor	84	Continuous
Truck (dump, delivery)	84	Continuous
Vacuum Excavator Truck (vac-truck)	85	Continuous
Vibratory Compactor	80	Continuous
Vibratory Pile Driver	95	Continuous
All other equipment with engines larger than 5 HP	85	Continuous

Notes:

[1] Measured at 50 feet from the construction equipment, with a "slow" (1 sec.) time constant.

[2] Noise limits apply to total noise emitted from equipment and associated components operating at full power while engaged in its intended operation.

[3] Portable Air Compressor rated at 75 cfm or greater and that operates at greater than 50 psi.

Source: Mitigation of Nighttime Construction Noise, Vibrations and Other Nuisances, National Cooperative Highway Research Program, 1999.

TABLE 6 Typical Ranges of Construction Noise Levels at 50 Feet, L_{eq} (dBA)

	Domestic Housing		Office Building, Hotel, Hospital, School, Public Works		Industrial Parking Garage, Religious Amusement & Recreations, Store, Service Station		Public Works Roads & Highways, Sewers, and Trenches	
	I	II	I	II	I	II	I	II
Ground Clearing	83	83	84	84	84	83	84	84
Excavation	88	75	89	79	89	71	88	78
Foundations	81	81	78	78	77	77	88	88
Erection	81	65	87	75	84	72	79	78
Finishing	88	72	89	75	89	74	84	84

I - All pertinent equipment present at site.
II - Minimum required equipment present at site.

Source: U.S.E.P.A., Legal Compilation on Noise, Vol. 1, p. 2-104, 1973.

Construction noise modeling was conducted using the list of construction equipment provided. The Federal Highway Administration's (FHWA) Roadway Construction Noise Model (RCNM) was used to calculate a credible 'worst-case' scenario of hourly average noise levels, assuming every piece of equipment would operate simultaneously. Based on noise modeling, construction noise levels would reach 83 dBA L_{eq} and 84 dBA L_{max} at a distance of 50 feet.

Land uses surrounding the site include commercial uses just northeast of the project site, the Sebastopol Inn to the east, commercial uses to the north across Sebastopol Avenue, the existing Benedetti Tire Center and Express Lube just north of the project site, segments of the Joe Rodota Trail to the southeast, and additional commercial uses to the west and southwest. Hourly average and maximum construction noise levels assuming all equipment operating simultaneously are shown in Table 7 for each of the nearby noise sensitive land uses relative to the center of the active construction site. Construction-generated noise levels drop off at a rate of about 6 dBA per doubling of the distance between the source and receptor. Noise levels in shielded areas would be anticipated to be 5 to 20 dBA lower.

TABLE 7 Calculated Construction Noise Levels at Nearby Land Uses

Location	Distance from Center of Construction (feet)	Calculated Noise Levels (dBA)	
		Hourly Average Noise Level (L_{eq})	Maximum Noise Level (L_{max})
Attico Furniture Store, Chimera Arts and Maker Space	80	79	80
Benedetti Tire Center	115	76	77
Benedetti Express Lube	125	75	76
The Feed Store	245	69	70
Sebastopol Inn	300	68	68
Goodwill – Redwood Empire	315	67	68
Peet's Coffee	330	67	68
Joe Rodota Trail	470	64	65
Nearest Residence	700	60	61

Project construction would result in a temporary increase in the ambient noise level at the nearest land uses. Based on General Plan Policies N 1-11 and N-15, construction-related noise impacts would be reduced to a less-than-significant level through implementation of construction best practices outlined in General Plan Action N 1f, as follows:

- Noise-generating construction activities, including truck traffic coming to and from the construction site for any purpose, shall be limited as specified in the Noise Ordinance.

- All equipment driven by internal combustion engines shall be equipped with mufflers, which are in good condition and appropriate for the equipment.

- The construction contractor shall utilize "quiet" models of air compressors and other stationary noise sources where technology exists.

- At all times during project grading and construction, stationary noise-generating equipment shall be located as far as practicable from sensitive receptors and placed so that emitted noise is directed away from residences.

- Unnecessary idling of internal combustion engines shall be prohibited.

- Construction staging areas shall be established at locations that will create the greatest distance between the construction-related noise sources and noise-sensitive receptors nearest the project site during all project construction activities, to the extent feasible.

- Neighbors located adjacent to the construction site shall be notified of the construction schedule in writing.
- The construction contractor shall designate a "noise disturbance coordinator" who will be responsible for responding to any local complaints about construction noise. The disturbance coordinator shall be responsible for determining the cause of the noise

complaint (e.g., starting too early, poor muffler, etc.) and instituting reasonable measures as warranted to correct the problem. A telephone number for the disturbance coordinator shall be conspicuously posted at the construction site.

With implementation of the above best practices, noise resulting from project construction would result in a **less-than-significant impact**.

Mitigation Measure 1a: No additional measures required.

Impact 1b: Permanent Noise Level Increase. The proposed project is not expected to cause a substantial permanent noise level increase at the existing residential or commercial land uses in the project vicinity. **This is a less-than-significant impact.**

General Plan Policy N 1-7 establishes that where existing traffic noise levels are less than 60 dBA L_{dn} at the outdoor activity areas of noise-sensitive uses, a 5 dBA L_{dn} increase in roadway noise levels will be considered significant. Where existing traffic noise levels are between 60 and 65 dBA L_{dn} at the outdoor activity areas of noise-sensitive uses, a 3 dBA L_{dn} increase in roadway noise level will be considered significant. Where existing traffic noise levels are greater than 65 dBA L_{dn} at the outdoor activity areas of noise-sensitive uses, a 1.5 dBA L_{dn} increase in roadway noise levels would be considered significant.

The traffic study prepared for the proposed project by W-Trans included peak hour turning movements for three intersections in the project vicinity. By comparing future cumulative traffic levels with and without the project, the project's contribution to the future noise level increase was determined to be 1 dBA L_{dn} or less along all studied roadway segments. Project-generated traffic would not result in a significant increase in noise levels at any noise-sensitive uses. This is a **less-than-significant impact**.

Mitigation Measure 1b: None required.

Impact 1c: Noise Levels in Excess of Standards. The proposed project would generate noise in excess of standards established in the City's General Plan at nearby sensitive receptors. Installation of a silencer system to the car wash blower dryer would reduce noise levels below limits. **This is a potentially significant impact.**

General Plan Policy N 1-7 states that a noise impact resulting from stationary and non-transportation sources would occur if noise levels resulting from the project would exceed General Plan standards or increase the ambient noise level by greater than 3 dB, whichever is greater. Table N-2 establishes a daytime limit of 55 dBA from stationary noise sources measured at residential uses. Although the project is not located in a 'commercial zone', this analysis also applies the daytime limit to noise sensitive commercial uses and the trail, based on Municipal Code 8.25.060.

The proposed project would construct an automated drive-through car wash and 17 self-service vacuum stations. The car wash and vacuums would be operational Monday through Saturday from 7:00 a.m. to 7:00 p.m. Vehicles would enter the car wash through a door along the southern façade of the building and exit through a door along the northern façade.

Existing noise sensitive land uses in the vicinity include the Sebastopol Inn, located approximately 300 feet to the east, Peet's Coffee outdoor patio, located 340 feet to the west, Joe Rodota Trail, located 360 feet to the southeast, and residences, located approximately 600 feet to the south. Other land uses in the vicinity, such as the Benedetti Tire Center, Benedetti Express Lube, Attico Furniture Store, Chimera Arts and Maker Space, Goodwill Redwood Empire, and CVS Drug Store do not include any noise sensitive outdoor use areas. Based on the noise monitoring survey, existing ambient noise levels are between 53 and 56 dBA L_{dn} at the nearest residences, with daytime hourly average noise levels of 44 to 58 dBA L_{eq}. Existing ambient noise levels at the outdoor pool area of the Sebastopol Inn are between 47 and 51 dBA L_{dn}, with daytime hourly average noise levels of 42 to 53 dBA L_{eq}. Existing ambient noise levels at the patio area of Peet's Coffee are between 66 and 70 dBA L_{dn}, with daytime hourly average noise levels of 61 to 72 dBA L_{eq}. Based on the project's traffic study, increased traffic volumes under future conditions would result in a traffic noise increase of about 1 dBA L_{dn} in these areas.

The primary noise source at the site would be the blower dryer used in the automated drive-through car wash. A Proto-Vest S130 drying system is proposed to be used. Noise data provided indicates the system produces noise levels of 91 dBA at a distance of 10 feet, and 77 dBA at a distance of 50 feet. An optional silencer would reduce noise levels by 14 dBA. Based on the relative difference in overall sound power level at the entrance and exit doors of other car wash studies, the entrance door is assumed to have 3 dB lower overall sound power level than at the exit door. Manufacturer data used for vacuum stations in other studies indicate that an individual vacuum station when in use generates a noise level of about 66 dBA at a distance of 3 feet. Minimal noise is generated when vacuum hoses are hooked.

Noise resulting from the proposed car wash and vacuum station operations was evaluated using SoundPLAN 8.2, a 3-dimensional noise modeling software which considers characteristics of noise sources and project geometry. Noise levels were modeled under two scenarios, with and without the inclusion of the car wash silencer. Both scenarios assume a worst-case of continuous use of the car wash and all vacuum stalls for the full 12-hour period they are proposed to be operational. Realistically, levels of car wash use would vary throughout the day, and the blower dryer system would not be in continuous operation. Based on past car wash studies, peak hour use of the automated drive-through would see around 50 to 60 vehicles, with 250 to 350 total vehicles per day. Results of the noise model are summarized in Table 8. Maps of the noise exposure generated by the project on the surrounding area are shown in Figures 2 and 3.

TABLE 8 Predicted Car Wash Noise Levels at Nearby Receivers

Receiving Location	Calculated Noise Level (dBA)			
	Without Silencer		With Silencer	
	Peak Hour (L_{eq})	Day-night Average (L_{dn})	Peak Hour (L_{eq})	Day-night Average (L_{dn})
Sebastopol Inn Pool	60	58	46	44
Peet's Coffee Outdoor Patio	47	45	40	38
Joe Rodota Trail	47 – 54	45 – 52	36 – 42	34 – 40
Nearest Residence	43	41	31	29

FIGURE 2 Noise Exposure Resulting from Car Wash Operations – No Silencer

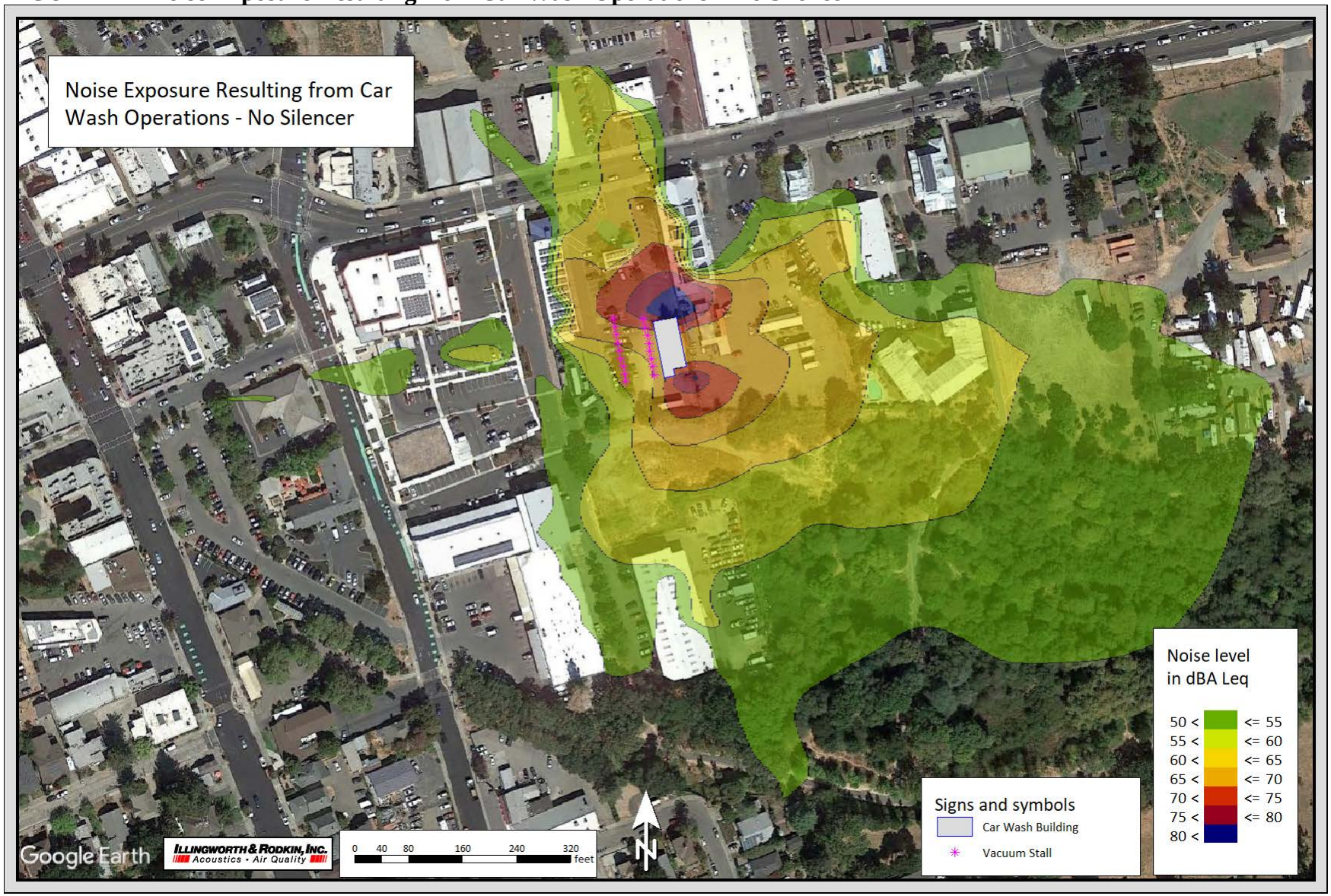


FIGURE 3 Noise Exposure Resulting from Car Wash Operations – With Silencer

As indicated in Table 8, hourly average L_{eq} noise levels generated by the car wash and vacuum system operations would exceed projected future daytime ambient levels in the site vicinity and the 55 dBA L_{eq} daytime noise threshold at the Sebastopol Inn. Without installation of the silencer, noise levels at the pool area of the Sebastopol Inn would reach 60 dBA L_{eq}. Noise generated by the project would exceed existing ambient noise levels at the pool area by 12 to 16 dBA L_{eq}. Installation of the blower dryer silencer would result in project-generated noise levels at the pool area to 46 dBA L_{eq}, which would not exceed measured existing ambient levels by more than 3 dBA and would also meet the daytime 55 dBA L_{eq} noise limit. Noise levels at the nearest residences, the Joe Rodota Trail, and at other noise sensitive commercial land uses in the vicinity (Peet's Coffee) would meet the criteria with or without the use of the silencer. Installation of the blower dryer system silencer would also lower project-generated noise levels at adjoining non-noise sensitive commercial land uses to 64 to 65 dBA L_{eq} and would not result in an exceedance of the City of Sebastopol General Plan's "normally acceptable" limit of 70 dBA L_{dn} for commercial uses.

All other noise-generating equipment associated with the project would be stored within the second level of the proposed building and would not be anticipated to generate substantial noise outside of the building. This is a **potentially significant impact**.

Mitigation Measure 1c: To reduce noise generated by project operations to levels that would be in compliance with the City of Sebastopol General Plan and Municipal Code, the proposed Proto-Vest S130 Drying System shall be equipped with the silencer. The silencer should mitigate the dryer system noise as specified to result in noise levels of 77 dBA at 10 feet and 63 dBA at 50 feet. Installation of the silencer would reduce project-generated noise levels at sensitive uses in the surrounding vicinity to below General Plan limits and would result in a **less-than-significant impact**.

Impact 2: Exposure to Excessive Groundborne Vibration due to Construction. Construction-related vibration levels are expected to potentially exceed applicable vibration thresholds at a nearby structures. **This is a potentially significant impact.**

Demolition and construction activities required for construction often generate perceptible vibration levels and levels that could affect nearby structures when heavy equipment or impact tools (e.g. jackhammers, pile drivers, hoe rams) are used in the vicinity of nearby sensitive land uses. Building damage generally falls into three categories. Cosmetic damage (also known as threshold damage) is defined as hairline cracking in plaster, the opening of old cracks, the loosening of paint or the dislodging of loose objects. Minor damage is defined as hairline cracking in masonry or the loosening of plaster. Major structural damage is defined as wide cracking or the shifting of foundation or bearing walls.

Policy N 1-16 of the City of Sebastopol General Plan establishes a vibration limit of 0.08 in/sec PPV to minimize the potential for cosmetic damage to sensitive historic structures, and a vibration limit of 0.3 in/sec PPV to minimize damage at buildings of normal conventional construction. The vibration limits contained in this policy designed to provide the ultimate level of protection for existing buildings in Sebastopol and are more conservative that the California Department of

Transportation vibration criteria, as shown in Table 3 of the Setting section. One historic structure exists in the project vicinity, located approximately 330 feet west of the project site at 238 – 258 Petaluma Avenue.

Construction activities associated with the project would include minimal demolition such as tree and fence removal, site preparation, new building framing and finishing, and paving. Pile driving would not be used as a method of construction. Table 9 presents typical vibration levels from construction equipment at 25 feet. Vibration levels would vary depending on soil conditions, construction methods, and equipment used. Table 9 also presents construction vibration levels at representative distances from the construction equipment located at the closest property line to the nearest structures. Calculations were made to estimate vibration levels at distances of 18 feet from the site to represent the distance between the site and the commercial building at 6791 Sebastopol Avenue, at distances of 30 and 50 feet from the site to represent distances to the Benedetti Tire Center and Benedetti Express Lube buildings, and at 330 feet to represent the distance between the site and the historic building at 238 – 258 Petaluma Avenue. Vibration levels are highest close to the source, and then attenuate with increasing distance at the rate $(D_{ref}/D)^{1.1}$, where D is the distance from the source in feet and D_{ref} is the reference distance of 25 feet.

TABLE 9 Vibration Levels for Construction Equipment at Various Distances

Equipment		PPV at 18 ft. (in/sec)	PPV at 25 ft. (in/sec)	PPV at 30 ft. (in/sec)	PPV at 50 ft. (in/sec)	PPV at 330 ft. (in/sec)
Clam shovel drop		0.290	0.202	0.165	0.094	0.012
Hydromill (slurry wall)	in soil	0.011	0.008	0.007	0.004	0.000
	in rock	0.024	0.017	0.014	0.008	0.001
Vibratory Roller		**0.301**	0.210	0.172	0.098	0.012
Hoe Ram		0.128	0.089	0.073	0.042	0.005
Large bulldozer		0.128	0.089	0.073	0.042	0.005
Caisson drilling		0.128	0.089	0.073	0.042	0.005
Loaded trucks		0.109	0.076	0.062	0.035	0.004
Jackhammer		0.050	0.035	0.029	0.016	0.002
Small bulldozer		0.004	0.003	0.002	0.001	0.000

Source: Transit Noise and Vibration Impact Assessment, United States Department of Transportation, Office of Planning and Environment, Federal Transit Administration, May 2006 as modified by Illingworth & Rodkin, Inc., June 2020.

As indicated in Table 9, heavy vibration generating construction equipment, such as vibratory rollers, would have the potential to produce vibration levels greater than the General Plan threshold of 0.3 in/sec PPV within about 18 feet of construction. The commercial uses at 6791 Sebastopol Avenue are located within 18 feet of construction. Vibration levels would not exceed the historic building threshold of 0.08 in/sec PPV at any historic buildings in the vicinity.

The US Bureau of Mines has analyzed the effects of blast-induced vibration on buildings in USBM RI 8507[2], and these findings have been applied to vibrations emanating from construction equipment on buildings[3]. Figure 4 presents the damage probability as reported in USBM RI 8507 and reproduced by Dowding assuming a maximum vibration level of 0.4 in/sec PPV. As shown on Figure 4, these studies indicate a less than 5% probability of "threshold damage" (referred to as cosmetic damage elsewhere in this report) at vibration levels of 0.4 in/sec PPV or less and no observations of "minor damage" or "major damage" at vibration levels of 0.4 in/sec PPV or less. Based on these data, cosmetic or threshold damage would be manifested in the form of hairline cracking in plaster, the opening of old cracks, the loosening of paint or the dislodging of loose objects. However, minor damage (e.g., hairline cracking in masonry or the loosening of plaster) or major structural damage (e.g., wide cracking or shifting of foundation or bearing walls) to the residential and commercial structures adjacent to the site would not be anticipated to occur assuming a maximum vibration level of 0.4 in/sec PPV.

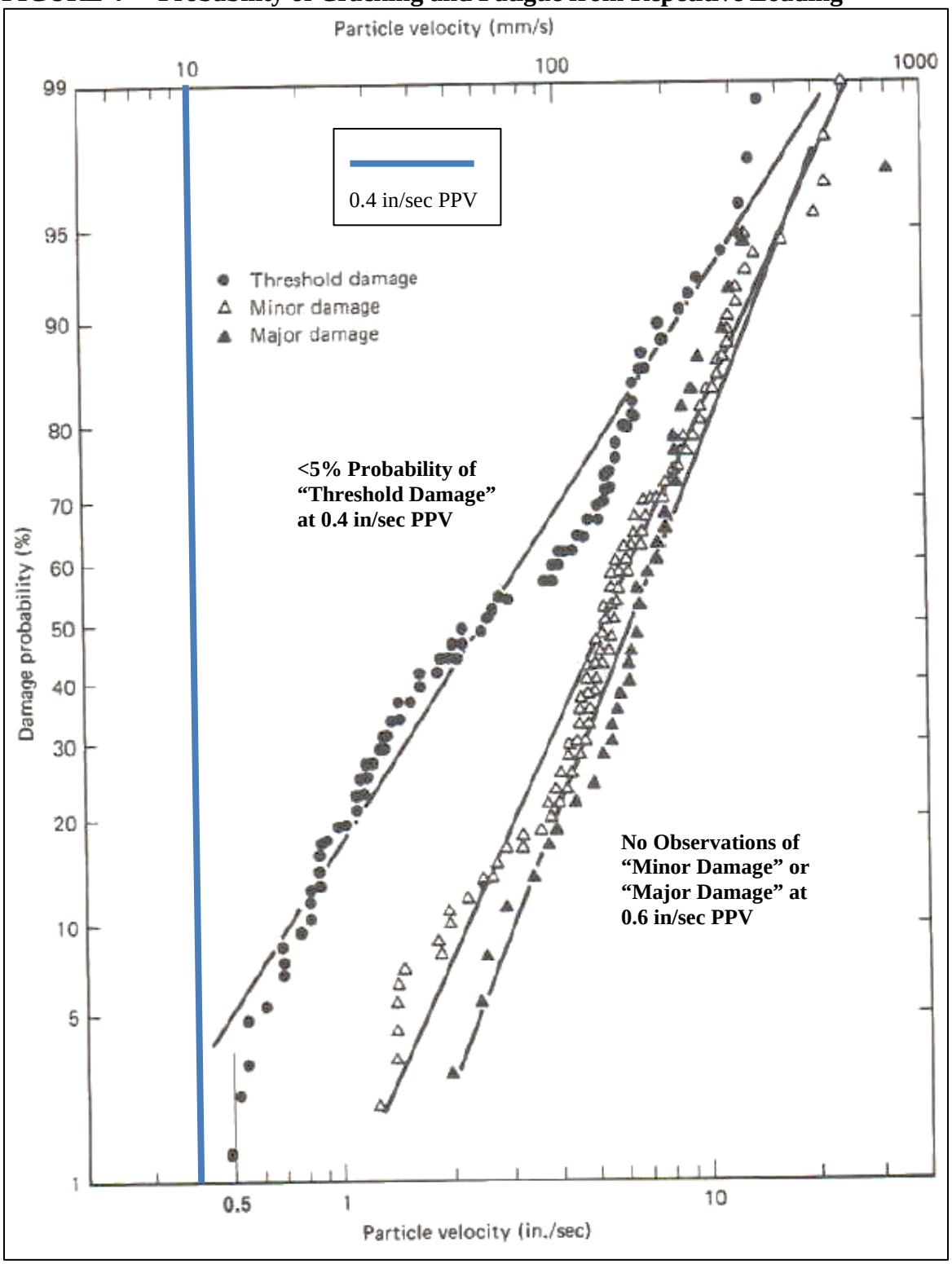
Groundborne vibration levels from project construction would be anticipated to exceed 0.3 in/sec PPV when heavy construction, such as the use of vibratory rollers, is located within 18 feet existing structures. Vibration levels may still be perceptible in areas further from the site during periods of heavy construction but would not be expected to cause structural damage. This is a **potentially significant impact**.

Mitigation Measure 2: The following measures are recommended to reduce vibration impacts from construction activities to a less-than-significant impact:

- Avoid the use of vibratory rollers within 18 feet of existing structures.
- Place operating equipment on the construction site as far as possible from vibration-sensitive receptors.
- Use smaller equipment to minimize vibration levels below the limits.
- Select demolition methods not involving impact tools.
- Avoid dropping heavy objects or materials near vibration sensitive locations.
- A list of all heavy construction equipment to be used for this project known to produce high vibration levels (tracked vehicles, vibratory compaction, jackhammers, hoe rams, etc.) shall be submitted to the City by the contractor. This list shall be used to identify equipment and activities that would potentially generate substantial vibration and to define the level of effort required for continuous vibration monitoring.

[2] Siskind, D.E., M.S. Stagg, J.W. Kopp, and C.H. Dowding, Structure Response and Damage Produced by Ground Vibration form Surface Mine Blasting, RI 8507, Bureau of Mines Report of Investigations, U.S. Department of the Interior Bureau of Mines, Washington, D.C., 1980.
[3] Dowding, C.H., Construction Vibrations, Prentice Hall, Upper Saddle River, 1996.

FIGURE 4 Probability of Cracking and Fatigue from Repetitive Loading



Source: Dowding, C.H., Construction Vibrations, Prentice Hall, Upper Saddle River, 1996 as modified by Illingworth & Rodkin, Inc., June 2020.

Implementation of these measures would reduce the impact to a **less-than-significant** level.

Impact 3: **Excessive Aircraft Noise.** The project site is located approximately 7 miles from a public airport or public use airport and would not expose people residing or working in the project area to excessive aircraft noise levels. **This is a less-than-significant impact.**

Charles M. Schulz Sonoma County Airport is a public-use airport located approximately 7 miles north of the project site. The project site is not located within the established aircraft noise contours of the Sonoma County Airport or any other public or private airport. Future exterior noise levels due to aircraft would not be excessive. This would be a **less-than-significant** impact.

Mitigation Measure 3: **None required.**