

Environmental Noise Assessment

Arco AM/PM Car Wash at 2375 Quimby Road

San Jose, California

BAC Job # 2017-191

Prepared For:

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July 2, 2019



Introduction

The proposed project consists of the construction of a new ARCO AM/PM and car wash tunnel located at 2375 Quimby Road in San Jose, California. Existing land uses in the project vicinity include commercial uses to the north, west and south, and residential uses to the distance east and southeast. The project site area, with identified land uses, is provided as Figure 1. The project site plan is provided as Figure 2.

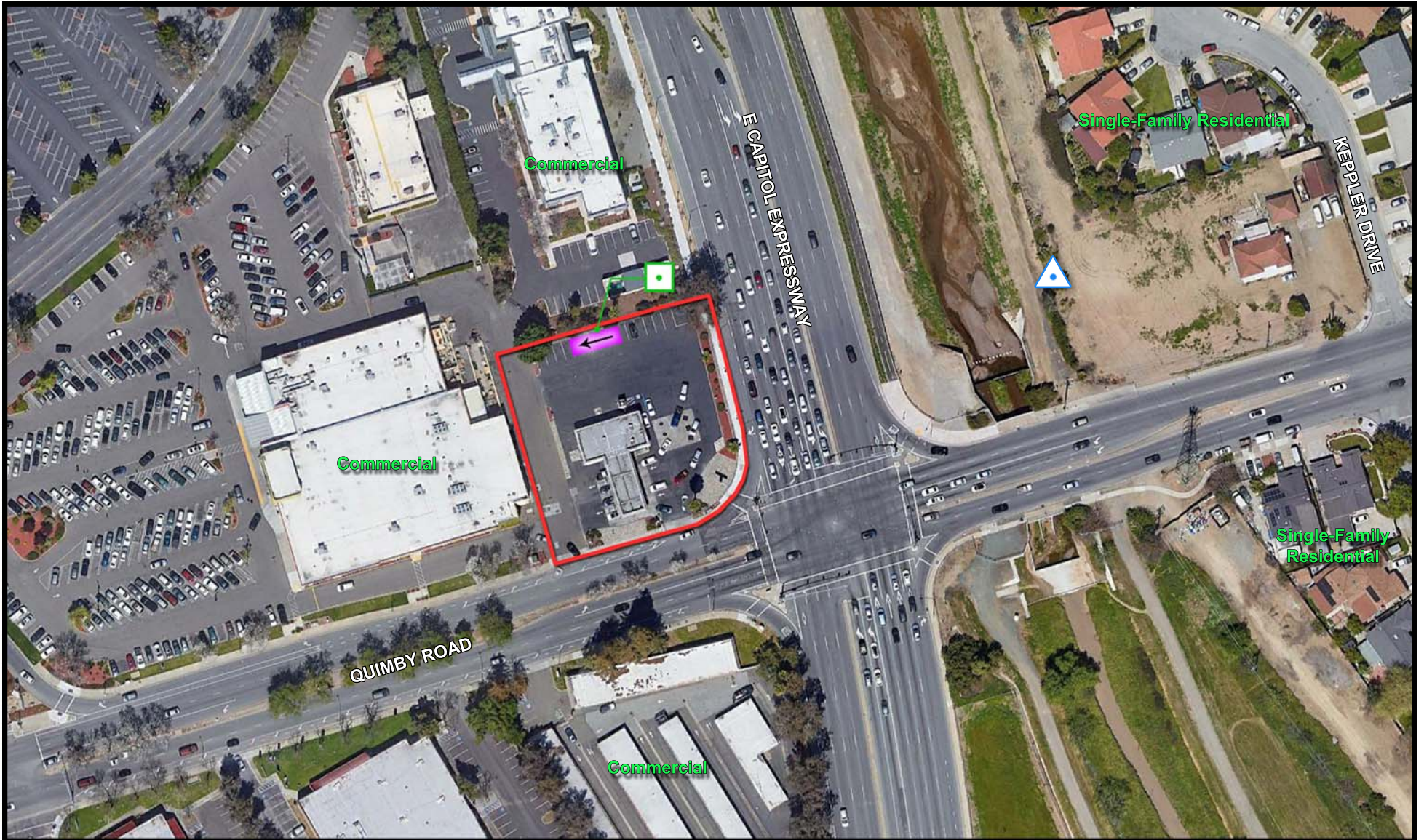
The project applicant has retained Bollard Acoustical Consultants, Inc. (BAC) to prepare an acoustical analysis for this project. The purposes of this analysis are to quantify noise levels associated with the proposed project, to assess the state of compliance of those noise levels with applicable noise standards, and if necessary, to recommend measures to reduce those noise levels to acceptable limits at the nearest noise sensitive uses.

Background on Noise and Acoustical Terminology





Noise is often described as unwanted sound. Sound is defined as any pressure variation in air that the human ear can detect. If the pressure variations occur frequently enough (at least 20 times per second), they can be heard and are called sound. The number of pressure variations per second is called the frequency of sound, and is expressed as cycles per second, called Hertz (Hz).

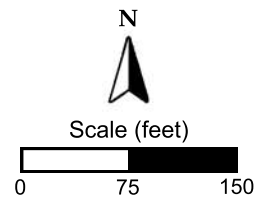
Measuring sound directly in terms of pressure would require a very large and awkward range of numbers. To avoid this, the decibel scale was devised. The decibel scale uses the hearing threshold (20 micropascals of pressure), as a point of reference, defined as 0 dB. Other sound pressures are then compared to the reference pressure, and the logarithm is taken to keep the numbers in a practical range. The decibel scale allows a million-fold increase in pressure to be expressed as 120 dB. Another useful aspect of the decibel scale is that changes in decibel levels correspond closely to human perception of relative loudness. Figure 3 illustrates common noise levels associated with various sources.

The perceived loudness of sound is dependent upon many factors, including sound pressure level and frequency content. However, within the usual range of environmental noise levels, perception of loudness is relatively predictable, and can be approximated by weighing the frequency response of a sound level meter by means of the standardized A-weighting network. There is a strong correlation between A-weighted sound levels (expressed as dBA) and community response to noise. For this reason, the A-weighted sound level has become the standard tool of environmental noise assessment. All noise levels reported in this section are in terms of A-weighted levels. Please see Appendix A for definitions of acoustical terminology used in this report.



Legend

-  Approximate Project Border
-  Proposed Car Wash Tunnel
-  Long-Term Noise Measurement Site
-  Short-Term Noise Measurement Site

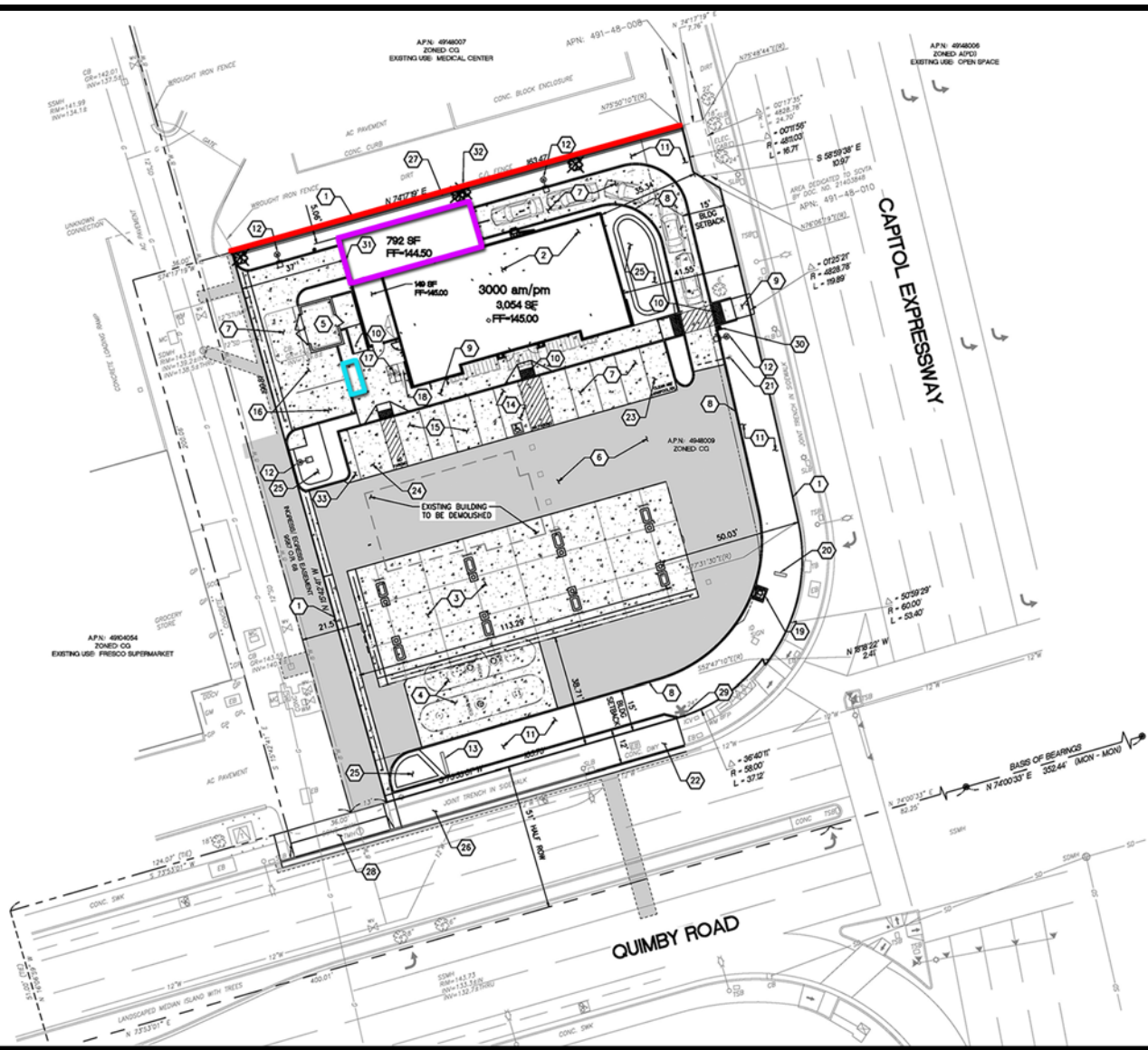


ARCO AM/PM at 2375 Quimby Road
San Jose, California

Project Area and Ambient
Noise Measurement Locations

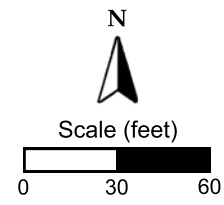
Figure 1





Legend

- Proposed Vacuum Station - Motors within CMU Enclosure
- Proposed Car Wash Tunnel
- Proposed 8-Foot Tall Noise Barrier



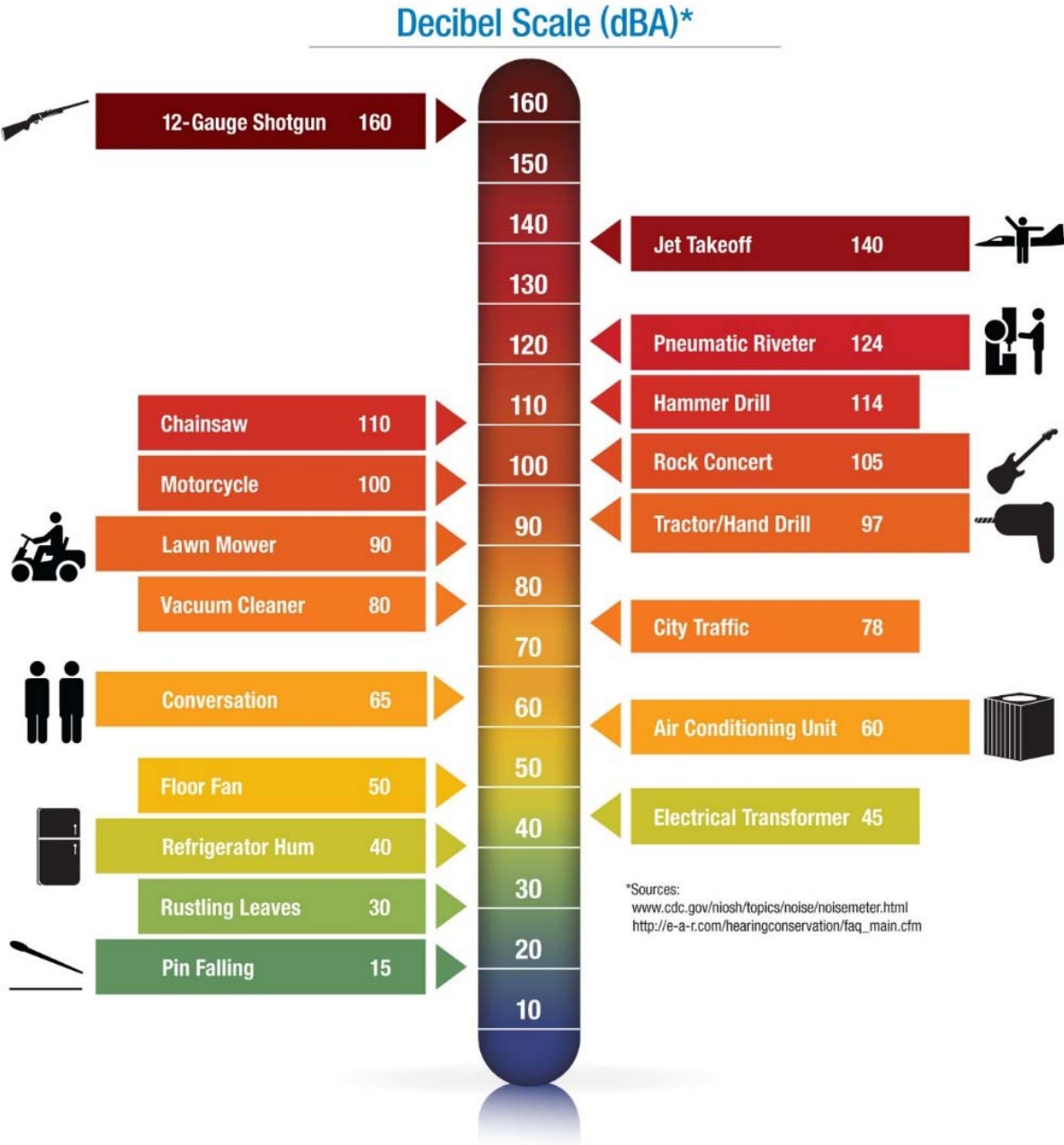
ARCO AM/PM at 2375 Quimby Road
San Jose, California

Project Site Plan

Figure 2



Figure 3
Typical A-Weighted Sound Levels of Common Noise Sources



*Sources:
www.cdc.gov/niosh/topics/noise/noisemeter.html
http://e-a-r.com/hearingconservation/faq_main.cfm

Criteria for Acceptable Noise Exposure

City of San Jose General Plan

Chapter 3 of the City of San Jose General Plan (SJGP) pertains to Environmental Leadership, and contains the City’s noise-related policies. City of San Jose planning staff have indicated that the following policy is applicable to this project.

EC-1.2 Minimize the noise impacts of new development on land uses sensitive to increased noise levels (Categories 1, 2, 3 and 6) by limiting noise generation and by requiring use of noise attenuation measures such as acoustical enclosures and sound barriers, where feasible. The City considers significant noise impacts to occur if a project would:

- Cause the DNL at noise sensitive receptors to increase by five dBA DNL or more where the noise levels would remain “Normally Acceptable”; or
- Cause the DNL at noise sensitive receptors to increase by three dBA DNL or more where noise levels would equal or exceed the “Normally Acceptable” level.

Table EC-1: Land Use Compatibility Guidelines for Community Noise in San José

LAND USE CATEGORY	EXTERIOR NOISE EXPOSURE (DNL IN DECIBELS (DBA))					
	55	60	65	70	75	80
1. Residential, Hotels and Motels, Hospitals and Residential Care ¹						
2. Outdoor Sports and Recreation, Neighborhood Parks and Playgrounds						
3. Schools, Libraries, Museums, Meeting Halls, Churches						
4. Office Buildings, Business Commercial, and Professional Offices						
5. Sports Arena, Outdoor Spectator Sports						
6. Public and Quasi-Public Auditoriums, Concert Halls, Amphitheaters						

¹Noise mitigation to reduce interior noise levels pursuant to Policy EC-1.1 is required.

Normally Acceptable:

- Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.

Conditionally Acceptable:

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

Unacceptable:

- New construction or development should generally not be undertaken because mitigation is usually not feasible to comply with noise element policies.

The SJGP EC-1.2 increase criteria would be applicable to the residential land use to the west and to the hospital use to the north since both land uses fall under the Category 1. The increase criteria would not be applicable to the commercial use to the west (Fresco Supermarket) since that land use does not fall under Categories 1, 2, 3, or 6.

City of San Jose Municipal Code

Section 20.40.600 of the City of San Jose Municipal Code (SJMC) provides noise level performance standards for commercially zoned land uses. The section requires that the maximum noise level generated on the subject property not exceed 55 dBA when the adjacent land use is zoned residential. When the adjacent land use is zoned commercial, the section requires that the maximum noise level generated on the subject property not exceed 60 dBA.

Because the subject property and the adjacent properties to the west and north are zoned commercial, the 60 dBA L_{max} (instantaneous) noise level standard would be applicable to the proposed noise-generating project equipment (i.e., car wash and vacuums). Although the nearest residential land uses are not adjacent to the project site, the 55 dBA L_{max} noise level standard was nonetheless conservatively applied to the proposed project equipment at those nearest residential uses.

For the nearest residential land uses to the east, the SJMC standards were applied at the receiving property line. The adjacent commercial property lines would not typically be considered noise-sensitive since those areas consist of a parking lot (north) and a loading dock area (west). Loading docks and parking lots are generally considered noise-generating uses. For the adjacent commercial uses, the SJMC standards were nonetheless applied at both the property line and at areas where customers or employees could be impacted by noise (i.e. store fronts).

Existing Ambient Noise Environment

The noise environment in the vicinity of the nearest noise-sensitive receivers is defined primarily by traffic noise from East Capitol Expressway and Quimby Road. To generally quantify background noise levels at the project site and at the nearest residential locations, Bollard Acoustical Consultants, Inc. conducted short-term (15-minute) and long-term (48-hour) ambient noise level measurements at the locations shown on Figure 1. The short-term survey was conducted on the late morning of October 24, 2017 and the long-term survey was conducted from October 24 through October 26, 2017. A summary of the measurement results is provided in Table 1. Detailed long-term noise measurement results are presented in Appendices B and C.

Larson Davis Laboratories (LDL) Model 820 precision integrating sound level meters were used to complete the noise level measurement surveys. The meters were calibrated before use with an LDL Model CAL200 acoustical calibrator to ensure the accuracy of the measurements. The equipment used meets all pertinent specifications of the American National Standards Institute for Type 1 sound level meters (ANSI S1.4).

<p align="center">Table 1 Summary of Ambient Noise Monitoring^{1,2} ARCO AM/PM Car Wash at 2375 Quimby Road (October 24-26, 2017)</p>							
Site	Duration ²	Date	DNL (dBA)	Average Measured Hourly Noise Levels (dBA) ³			
				Daytime (7 a.m. to 10 p.m.)		Nighttime (10 p.m. to 7 a.m.)	
				L _{eq}	L _{max}	L _{eq}	L _{max}
A	24 hrs	Oct. 24-25	68	63	80	62	75
A	24 hrs	Oct. 25-26	68	63	81	62	78
B	15 min	Oct. 24 11:40 AM	--	64	73	--	--

Notes:

¹ Noise monitoring locations shown on Figure 1.

² Noise monitoring conducted at site A were continuous with a duration of 48 hours. Noise monitoring at Site B was short-term with a duration of 15 minutes.

³ Detailed long-term noise monitoring results are provided in Appendices B and C.

As indicated above in Table 1, measured Day-Night Levels at Site A near the residences to the east, were 68 dBA on both days, exceeding the SJGP (Table EC-1) normally acceptable level of 60 dBA DNL and within the conditionally acceptable range of 60 dBA DNL to 75 dBA DNL. Because existing ambient noise levels exceed the conditionally acceptable range, the ambient plus 3 dB DNL criteria would be applicable to the project.

Average maximum noise levels were 80-81 dBA during daytime hours and 75-78 dBA during nighttime hours. Short-term noise level measurements conducted on the project site at Site B indicate that maximum noise levels were 73 dBA along the northern property line. The measured ambient noise levels presented above in Table 1 indicate that existing noise levels in the project area already exceed the commercial and residential SJMC maximum noise level criteria by a wide margin.

Evaluation of Project-Related Noise Levels

Vacuum Noise

According to the project applicant, the proposed vacuum will be a JE Adams Super Vac Model 9200-3LD. The location of the proposed vacuum system can be seen on Figure 2. The vacuum motors will be located within a masonry enclosure, effectively screening the motors from view. The vacuum hoses will extend over the top of the masonry enclosure and feed the stalls via an arch stanchion.

The manufacturer's specifications, provided as Appendix D, indicate that the reference noise level depends on one of three operating conditions: wide open with attachment, sealed attachment, or attachment removed. Out of the three operating conditions, the "sealed attachment" operating condition generates the highest noise levels. This analysis is based on the worst-case operating condition of, "sealed attachment." Because the motors will be fully screened from view, a conservative -5 dB offset was applied to the predicted vacuum noise levels.

Based upon the manufacturer's data and the proposed location of the vacuum units, vacuum noise exposure at the nearest commercial and residential locations was calculated assuming standard spherical spreading loss (-6 dB per doubling of distance). The analysis takes into consideration the screening provided by the proposed 8-foot tall noise barrier along the northern property line, shown on Figure 2. Barrier insertion loss calculation worksheets are provided as Appendix E. Tables 2 provides predicted vacuum noise levels relative to the SJMC noise level standards.

In order to calculate ambient DNL noise level increases due to vacuum operations, the total number of hours of vacuum operation during a typical day must be known. Because the project is proposing 24-hour operation, it was conservatively assumed that vacuum usage would consist of 30 minutes of continuous operation during each daytime hour and 10 minutes of continuous operation during each nighttime hour. Table 3 provides predicted vacuum noise levels relative to the DNL metric and calculates the ambient increase relative to the existing DNL measured in the project area (68 dBA DNL, Table 1).

Table 2 Predicted Vacuum Noise Levels¹ – Relative to Municipal Code L_{max} ARCO AM/PM Car Wash at 2375 Quimby Road – San Jose, California					
Site #	Land Use	Assessment	Distance (feet)	Predicted Vacuum Noise Levels, L _{max} (dBA) ²	
				w/ 8' Barrier ^{3,4}	w/o 8' Barrier
1 – North	COM	Property Line	50	53	62
		Store Front	180	42	50
2 – West	COM	Property Line	60	60	60
		Store Front ⁵	300	31	31
3 – East	RES	Property Line	520	41	41

Notes:

¹ The proposed vacuum location is illustrated on Figure 2.

² Manufacturers' reference noise level data sheet is provided as Appendix D. Because the vacuum motors will be located within a CMU enclosure, a conservative offset of -5 dB was applied to predicted noise levels.

³ The results provided at the northern property line take into consideration the shielding provided by the proposed 8-foot tall noise barrier (-8 dB). Barrier insertion loss calculations are provided in Appendix E. No shielding was assumed for the western commercial property line or the more distant eastern residential property line.

⁴ Because the proposed noise barrier would be located along the northern property line, calculating vacuum noise levels right at the property line would not take into account the shielding provided by the noise barrier. In order to calculate the amount of noise level attenuation provided by the barrier, vacuum noise levels were projected to a point 10 feet beyond the property line.

⁵ A conservative offset of -15 dB was applied predicted vacuum noise levels to account for the considerable shielding provided by the intervening commercial building structure.

⁶ Numbers highlighted in **RED** indicate an exceedance of the city's standards.

Source: Bollard Acoustical Consultants, Inc. (2018)

**Table 3
Predicted Vacuum Noise Levels¹ – Relative to General Plan DNL Increase
ARCO AM/PM Car Wash at 2375 Quimby Road – San Jose, California**

Site #	Land Use	Assessment	Distance (feet)	Predicted Vacuum Noise Levels, DNL (dBA) ²		Ambient ⁵ + Proj. (dBA)		Increase	
				w/ 8' Barrier ^{3,4}	w/o 8' Barrier	w/ 8' Barrier	w/o 8' Barrier	w/ 8' Barrier	w/o 8' Barrier
1 – North	COM	Property Line	50	52.2	61.2	68.1	68.8	0.1	0.8
		Store Front	180	42.1	50.1	68.0	68.1	0.0	0.1
2 – West	COM	Property Line	60	59.6	59.6	68.6	68.6	0.6	0.6
		Store Front ⁶	300	30.6	30.6	68.0	68.0	0.0	0.0
3 – East	RES	Property Line	520	40.9	40.9	68.0	68.0	0.0	0.0

Notes:

- ¹ The proposed vacuum location is illustrated on Figure 2.
- ² Manufacturers' reference noise level data sheet is provided as Appendix D.
- ³ The results provided at the northern property line take into consideration the shielding provided by the proposed 8-foot tall noise barrier (-8 dB). Barrier insertion loss calculations are provided in Appendix E. No shielding was assumed for the western commercial property line or the more distant eastern residential property line.
- ⁴ Because the proposed noise barrier would be located along the northern property line, calculating vacuum noise levels right at the property line would not take into account the shielding provided by the noise barrier. In order to calculate the amount of noise level attenuation provided by the barrier, vacuum noise levels were projected to a point 10 feet beyond the property line.
- ⁵ Ambient conditions in the project area were assumed to be 68 DNL, based on measurements conducted in the project vicinity (Table 1).
- ⁶ A conservative offset of -15 dB was applied predicted vacuum noise levels to account for the considerable shielding provided by the intervening commercial building structure.

Source: Bollard Acoustical Consultants, Inc. (2019)

Assessment Relative to SJMC Residential 55 dB L_{max} Noise Level Standard – Property Line

As shown in Table 2, predicted vacuum noise levels of 41 dB L_{max} at the nearest residential property line would satisfy the SJMC residential noise level standard of 55 dB L_{max}. As a result, no further consideration of vacuum noise mitigation measures would be warranted relative to the residential noise level standard.

Assessment Relative to SJMC Commercial 60 dB L_{max} Noise Level Standard – Property Line

Predicted vacuum noise levels at the commercial property line to the north would satisfy the SJMC commercial noise level standard of 60 dB L_{max} with the inclusion of a property line 8-foot tall barrier. Furthermore, predicted vacuum noise levels at the commercial property line to the west would also satisfy the SJMC commercial noise level standard of 60 dB L_{max}. As a result, no further consideration of vacuum noise mitigation measures would be warranted relative to the commercial noise level standard.

Assessment Relative to SJMC Commercial 60 dB L_{max} Noise Level Standard – Store Fronts

As shown in Table 2, predicted vacuum noise levels at the commercial store fronts to the north and to the west would satisfy the SJMC commercial noise level standard of 60 dB L_{max} by a wide margin without the need for a property line 8-foot tall barrier to the north. As a result, no further consideration of noise mitigation measures would be warranted for this aspect of the project if the city elects to apply the standard at the commercial store fronts.

Assessment Relative to SJGP Increase Criteria

At the residential land use to the east, the Table 3 data indicate that the project would not significantly increase ambient noise levels given the high existing noise environment (68 dB DNL). At the hospital use to the north, the Table 3 data indicate that the project would not significantly increase ambient noise levels when assessed at either the property line or at the store front areas. Increases at the hospital use to the north would be less than 1 dB and would not exceed the SJGP 3 dB criteria. As a result, no further consideration of noise mitigation measures would be warranted for this aspect of the project relative to the SJGP increase criteria.

Car Wash Noise

According to the project applicant, the proposed car wash will be manufactured by Ryko and will contain an on-board drying system. Based on the experience of Bollard Acoustical Consultants, Inc., noise levels generated by car washes are primarily due to the drying portion of car wash operations. It is our understanding that the average wash cycle for the proposed car wash would be 5 minutes in duration and that the dryers would operate during the last 1 minute of the cycle. Therefore, during a worst-case hour, the car wash would go through 12 full cycles and the dryer would operate for approximately 12 minutes during a busy hour.

The project applicant has proposed to include polycarbonate doors at the entrance and exit of the car wash tunnel. Because the doors remain closed during the entire car wash cycle, completely enclosing the car wash tunnel, the doors provide a significant amount of dryer noise level attenuation. In order to quantify the noise-generation of a Ryko car wash with polycarbonate doors, BAC utilized reference noise level data obtained from a previous project. Specifically, the car wash referenced was a Ryko SoftGloss Maxx which is equipped with an on-board drying system. At a reference distance of 20 feet, car wash noise levels at the entrance and exit (with the doors in the closed position) were 66 dB and 67 dB, respectively. An aerial and photographs indicating the car wash location and noise level measurement positions are provided as Appendix F.

Based upon BAC's reference noise level data and the proposed location of the car wash tunnel, car wash noise exposure at the nearest commercial and residential locations was calculated assuming standard spherical spreading loss (-6 dB per doubling of distance). The analysis considered car wash noise levels with and without the proposed 8-foot tall noise barrier along the northern property line, shown on Figure 2. Barrier insertion loss calculation worksheets are provided as Appendix G. Table 4 provides predicted car wash noise levels relative to the SJMC noise level standards.

In order to calculate ambient DNL noise level increases due to car wash operations, the total duration of car wash dryer operation during a typical day must be known. Because the project is proposing 24-hour operation, it was conservatively assumed that the car wash would have 12 cycles per hour during daytime hours and 3 cycles per hour during nighttime hours. This equates to 12 minutes of dryer operation per hour during daytime hours and 3 minutes of dryer operation per hour during nighttime hours. Table 5 provides predicted car wash noise levels relative to the DNL metric and calculates the ambient increase relative to the existing DNL measured in the project area (68 DNL, Table 1).

Table 4
Predicted Car Wash Noise Levels¹ – Relative to Municipal Code L_{max}
ARCO AM/PM Car Wash at 2375 Quimby Road – San Jose, California

Site #	Land Use	Assessment	Distance (feet)	Predicted Car Wash Noise Levels, L _{max} (dB) ²	
				w/ 8' Barrier ^{3,4}	w/o 8' Barrier
1 – North	COM	Property Line	10	60	67
		Store Front	140	43	50
2 – West	COM	Property Line	50	59	59
		Store Front ⁵	310	28	28
3 – East	RES	Property Line	460	40	40

Notes:

- ¹ The proposed car wash tunnel location is illustrated on Figures 1 and 2.
- ² Reference noise levels based on measurements conducted at a similar car wash facility with entrance and exit polycarbonate doors in Hayward, CA (21501 Foothill Boulevard), see Appendix E.
- ³ The results provided at the northern property line take into consideration the shielding provided by the proposed 8-foot tall noise barrier (-7 dB). Barrier insertion loss calculations are provided in Appendix G. No shielding was assumed for the western commercial property line or the more distant eastern residential property line.
- ⁴ Because the proposed noise barrier would be located along the northern property line, calculating car wash dryer noise levels right at the property line would not take into account the shielding provided by the noise barrier. In order to calculate the amount of noise level attenuation provided by the barrier, car wash dryer noise levels were projected to a point 10 feet beyond the property line.
- ⁵ A conservative offset of -15 dB was applied predicted car wash noise levels to account for the considerable shielding provided by the intervening commercial building structure.
- ⁶ Numbers highlighted in **RED** indicate an exceedance of the city's standards.

Source: Bollard Acoustical Consultants, Inc. (2018)

Table 5
Predicted Car Wash Noise Levels¹ – Relative to General Plan DNL Increase
ARCO AM/PM Car Wash at 2375 Quimby Road – San Jose, California

Site #	Land Use	Assessment	Distance (feet)	Predicted Car Wash Noise Levels, DNL (dB) ²		Ambient ⁵ + Proj. (dB)		Increase	
				w/ 8' Barrier ^{3,4}	w/o 8' Barrier	w/ 8' Barrier	w/o 8' Barrier	w/ 8' Barrier	w/o 8' Barrier
1 – North	COM	Property Line	10	54.9	61.9	68.2	69.0	0.2	1.0
		Store Front	140	38.0	45.0	68.0	68.0	0.0	0.0
2 – West	COM	Property Line	50	54.0	54.0	68.2	68.2	0.2	0.2
		Store Front ⁶	310	23.1	23.1	68.0	68.0	0.0	0.0
3 – East	RES	Property Line	460	34.7	34.9	68.0	68.0	0.0	0.0

Notes:

¹ The proposed car wash tunnel location is illustrated on Figures 1 and 2.

² Reference noise levels based on measurements conducted at a similar car wash facility with entrance and exit polycarbonate doors in Hayward, CA (21501 Foothill Boulevard), see Appendix E.

³ The results provided at the northern property line take into consideration the shielding provided by the proposed 8-foot tall noise barrier (-7 dB). Barrier insertion loss calculations are provided in Appendix G. No shielding was assumed for the western commercial property line or the more distant eastern residential property line.

⁴ Because the proposed noise barrier would be located along the northern property line, calculating car wash noise levels right at the property line would not take into account the shielding provided by the noise barrier. In order to calculate the amount of noise level attenuation provided by the barrier, car wash noise levels were projected to a point 10 feet beyond the property line.

⁵ Ambient conditions in the project area were assumed to be 68 DNL, based on measurements conducted in the project vicinity (Table 1).

⁶ A conservative offset of -15 dB was applied predicted vacuum noise levels to account for the considerable shielding provided by the intervening commercial building structure.

Source: Bollard Acoustical Consultants, Inc. (2018)

Assessment Relative to SJMC Residential 55 dB L_{max} Noise Level Standard – Property Line

As shown in Table 4, predicted car wash noise levels of 40 dB L_{max} at the nearest residential property line to the east would satisfy the SJMC residential noise level standard of 55 dB L_{max} by a wide margin. As a result, no further consideration of car wash noise mitigation measures would be warranted relative to the residential noise level standard.

Assessment Relative to SJMC Commercial 60 dB L_{max} Noise Level Standard – Property Line

Predicted car wash noise levels at the commercial property line to the north would satisfy the SJMC commercial noise level standard of 60 dB L_{max} with the inclusion of a property line 8-foot tall barrier. At the commercial property line to the west, predicted car wash noise levels of 59 dB L_{max} would satisfy the SJMC commercial noise standard. As a result, no further consideration of noise mitigation measures would be warranted for this aspect of the project.

Assessment Relative to SJMC Commercial 60 dB L_{max} Noise Level Standard – Store Fronts

Predicted car wash noise levels at the commercial store fronts to the north and to the west would satisfy the SJMC commercial noise level standard of 60 dB L_{max} by a wide margin without the need for a property line 8-foot tall barrier to the north. As a result, no further consideration of noise mitigation measures would be warranted for this aspect of the project if the city elects to apply the standard at the commercial store fronts.

Assessment Relative to SJGP Increase Criteria

At the residential land use to the east, the Table 3 data indicate that the project would not significantly increase ambient noise levels given the high existing noise environment (68 dB DNL). At the hospital use to the north, the Table 3 data indicate that the project would not significantly increase ambient noise levels when assessed at either the property line or at the store front areas. Increases at the hospital use to the north would be less than 1 dB and would not exceed the SJGP 3 dB criteria. As a result, no further consideration of noise mitigation measures would be warranted for this aspect of the project relative to the SJGP increase criteria.

Conclusions

The proposed ARCO AM/PM Car Wash at 2375 Quimby Road will require varying degrees of mitigation depending on where the City of San Jose noise level standards are applied. Relative to the general plan noise level increase criteria, noise-generation from the project is not expected to significantly increase ambient noise levels in the project area beyond the 3 dB threshold given the high existing ambient noise environment. Relative to the municipal code, project noise-generation is not anticipated to exceed the city's standards at the nearest residential property lines. At the adjacent commercial properties, the noise-generation of the project is predicted to satisfy the municipal code standards for commercial uses by a wide margin if those standards are applied at the noise-sensitive commercial store fronts.

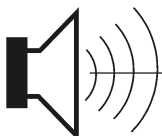
Furthermore, if the municipal code standards are applied at the commercial store fronts, the project would not require the construction of an 8-foot tall masonry noise barrier along the northern property line. However, if the municipal code standards are applied at the commercial property lines, where there is no sensitivity to noise, the following mitigation measure would be required of the project:

1. Construction of 8-foot tall masonry noise barrier along northern property line. The location of the recommended noise barrier is illustrated on Figure 2.

These conclusions are based on the site plan provided by the project applicant and on the reference noise level data cited herein. Deviations from these plans or data could cause noise levels to differ from those predicted in this assessment. Please contact BAC at (916) 663-0500 or paulb@bacnoise.com with any questions or requests for additional information.

Appendix A Acoustical Terminology

Acoustics	The science of sound.
Ambient Noise	The distinctive acoustical characteristics of a given space consisting of all noise sources audible at that location. In many cases, the term ambient is used to describe an existing or pre-project condition such as the setting in an environmental noise study.
Attenuation	The reduction of an acoustic signal.
A-Weighting	A frequency-response adjustment of a sound level meter that conditions the output signal to approximate human response.
Decibel or dB	Fundamental unit of sound, A Bell is defined as the logarithm of the ratio of the sound pressure squared over the reference pressure squared. A Decibel is one-tenth of a Bell.
CNEL	Community Noise Equivalent Level. Defined as the 24-hour average noise level with noise occurring during evening hours (7 - 10 p.m.) weighted by a factor of three and nighttime hours weighted by a factor of 10 prior to averaging.
Frequency	The measure of the rapidity of alterations of a periodic signal, expressed in cycles per second or hertz.
L_{dn}	Day/Night Average Sound Level. Similar to CNEL but with no evening weighting.
Leq	Equivalent or energy-averaged sound level.
L_{max}	The highest root-mean-square (RMS) sound level measured over a given period of time.
Loudness	A subjective term for the sensation of the magnitude of sound.
Masking	The amount (or the process) by which the threshold of audibility is for one sound is raised by the presence of another (masking) sound.
Noise	Unwanted sound.
Peak Noise	The level corresponding to the highest (not RMS) sound pressure measured over a given period of time. This term is often confused with the Maximum level, which is the highest RMS level.
RT₆₀	The time it takes reverberant sound to decay by 60 dB once the source has been removed.
Sabin	The unit of sound absorption. One square foot of material absorbing 100% of incident sound has an absorption of 1 sabin.
SEL	A rating, in decibels, of a discrete event, such as an aircraft flyover or train passby, that compresses the total sound energy of the event into a 1-s time period.
Threshold of Hearing	The lowest sound that can be perceived by the human auditory system, generally considered to be 0 dB for persons with perfect hearing.
Threshold of Pain	Approximately 120 dB above the threshold of hearing.



B O L L A R D

Acoustical Consultants

Appendix B-1
Ambient Noise Monitoring Results - Site A
ARCO AM/PM Car Wash at 2375 Quimby Road
October 24-25, 2017

Hour	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
11:00	62	74	59	66	64	62	61	60
12:00	62	77	58	67	64	62	61	60
13:00	61	70	58	65	63	62	61	59
14:00	62	78	59	67	64	62	61	60
15:00	63	79	58	68	64	63	61	60
16:00	62	78	59	66	64	62	61	60
17:00	62	77	59	67	65	63	62	60
18:00	65	92	59	69	65	63	62	60
19:00	64	91	59	67	65	63	62	61
20:00	63	81	59	69	64	63	62	60
21:00	63	84	59	67	64	62	61	60
22:00	63	84	59	70	64	62	61	59
23:00	61	74	58	66	63	61	61	59
0:00	62	84	58	64	62	61	60	59
1:00	60	71	59	63	61	61	60	59
2:00	60	78	59	63	61	61	60	59
3:00	60	73	59	63	61	61	60	59
4:00	61	72	59	64	63	62	61	60
5:00	63	72	60	67	64	63	62	61
6:00	64	72	60	67	66	64	63	62
7:00	65	83	61	68	66	65	64	63
8:00	63	72	59	66	65	64	63	61
9:00	63	85	58	66	64	63	62	60
10:00	62	82	58	66	64	62	61	60

Daytime	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
Average	63	80	59	67	64	63	62	60
High	65	92	61	69	66	65	64	63
Low	61	70	58	65	63	62	61	59

Nighttime	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
Average	62	75	59	65	63	62	61	60
High	64	84	60	70	66	64	63	62
Low	60	71	58	63	61	61	60	59

DNL:	68
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% Daytime Energy:	68%	% Nighttime Energy:	32%
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Appendix B-2
Ambient Noise Monitoring Results - Site A
ARCO AM/PM Car Wash at 2375 Quimby Road
October 25-26, 2017

Hour	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
11:00	64	87	59	68	65	63	62	60
12:00	66	92	58	68	64	62	61	60
13:00	63	84	58	68	64	62	61	60
14:00	62	77	58	66	64	62	61	60
15:00	64	86	58	68	64	62	61	59
16:00	63	77	58	69	65	63	61	59
17:00	62	76	59	67	64	63	61	60
18:00	63	77	59	68	64	63	61	60
19:00	63	76	59	68	65	63	62	61
20:00	64	84	59	69	65	63	62	60
21:00	62	79	58	66	63	62	61	60
22:00	62	82	58	67	63	62	61	59
23:00	62	78	58	69	63	61	60	59
0:00	62	84	58	66	62	61	60	59
1:00	61	84	58	62	61	60	60	59
2:00	61	71	58	66	62	60	60	59
3:00	60	78	58	63	61	60	60	59
4:00	61	72	58	64	62	61	60	59
5:00	62	72	59	65	64	62	62	60
6:00	64	76	60	67	65	64	63	62
7:00	66	85	61	69	67	65	64	62
8:00	63	78	59	67	65	64	63	61
9:00	63	72	59	66	64	63	62	61
10:00	64	88	59	67	65	63	62	61

Daytime	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
Average	63	81	59	68	64	63	62	60
High	66	92	61	69	67	65	64	62
Low	62	72	58	66	63	62	61	59

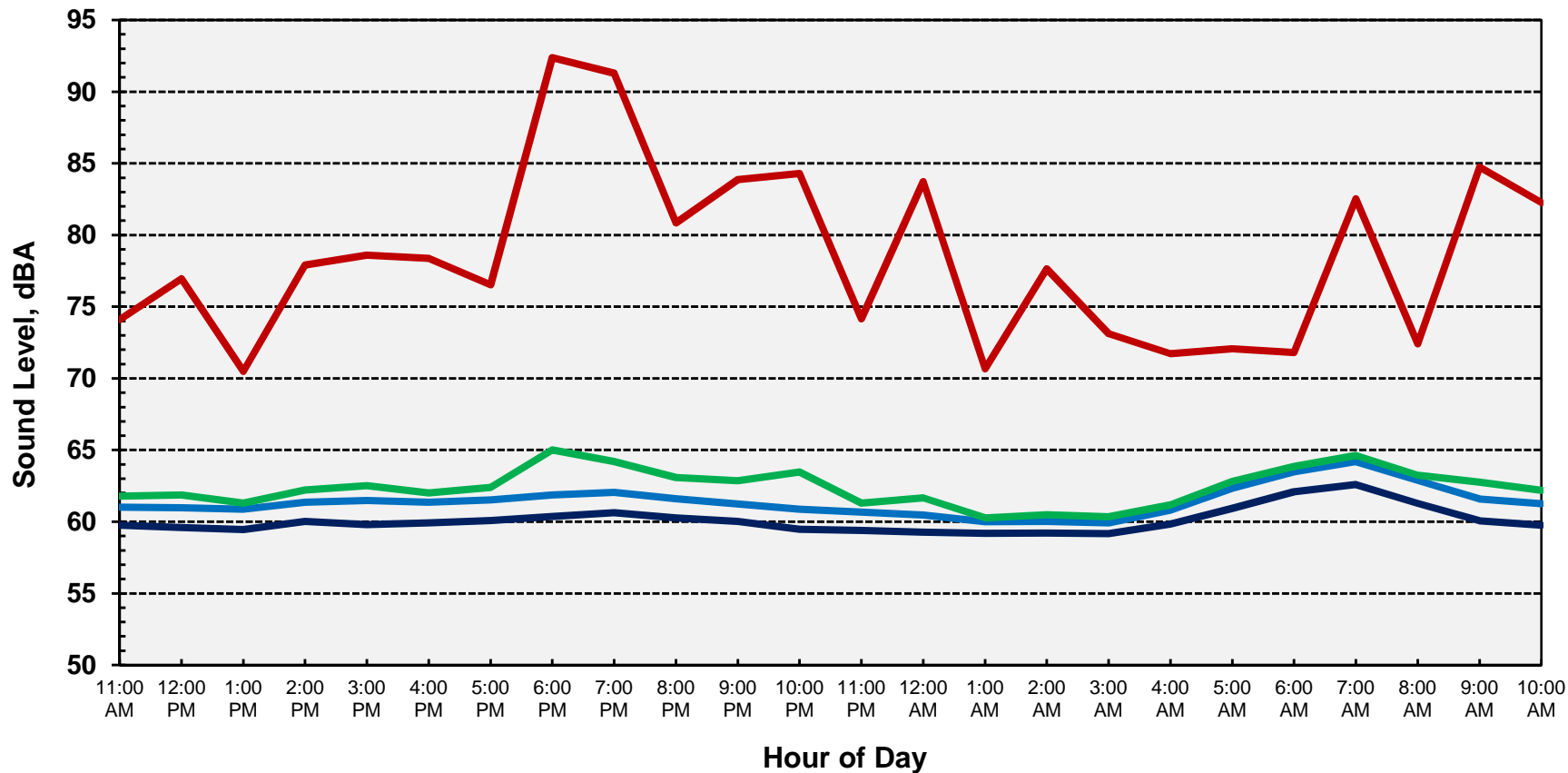
Nighttime	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
Average	62	78	58	66	63	61	61	59
High	64	84	60	69	65	64	63	62
Low	60	71	58	62	61	60	60	59

DNL:	68
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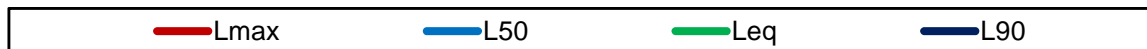
% Daytime Energy:	71%	% Nighttime Energy:	29%
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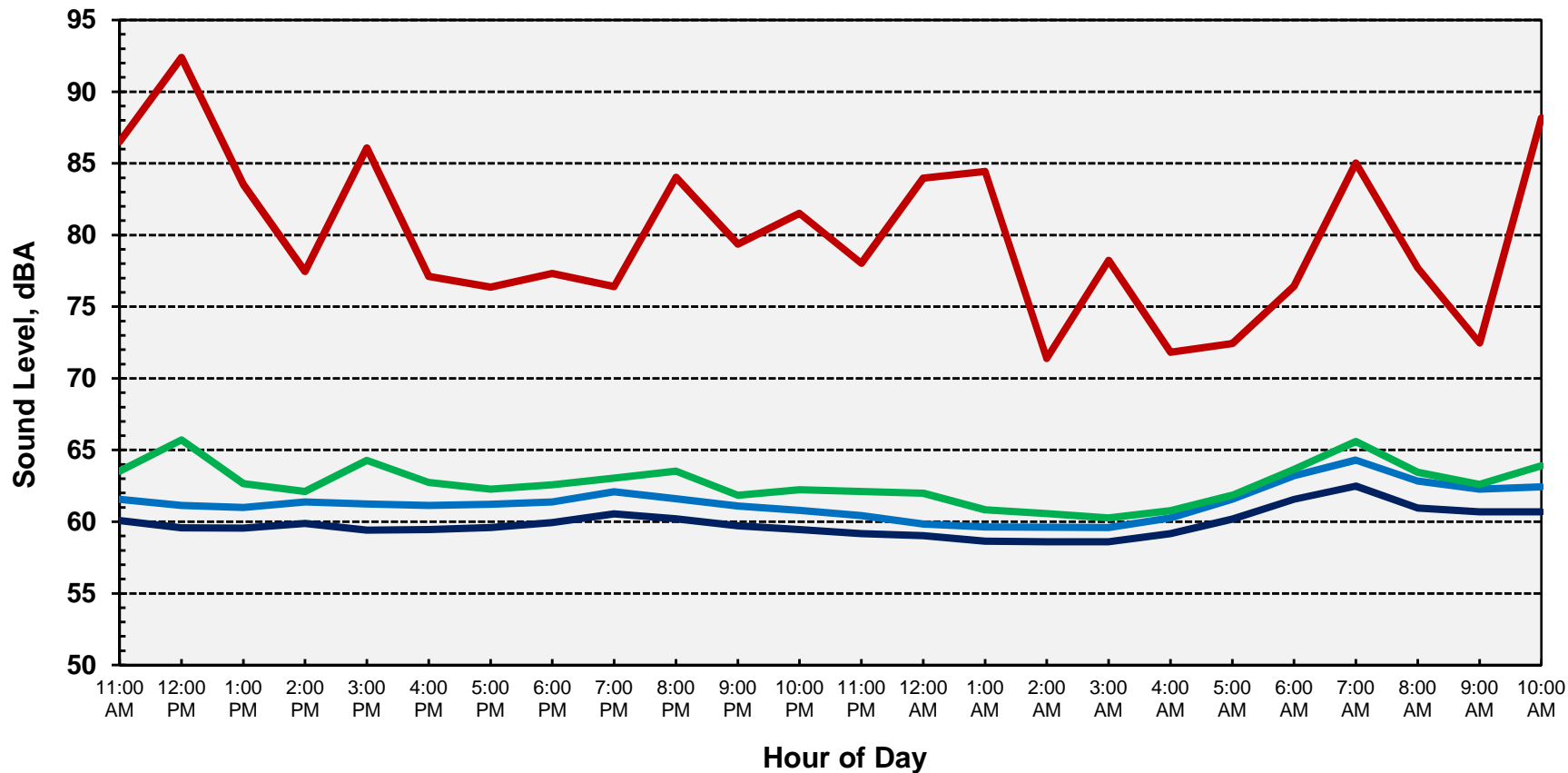
Appendix C-1
Ambient Noise Monitoring Results - Site A
ARCO AM/PM Car Wash at 2375 Quimby Road
October 24-25, 2017



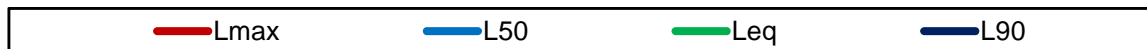
DNL (dBA): 68



Appendix C-2
Ambient Noise Monitoring Results - Site A
ARCO AM/PM Car Wash at 2375 Quimby Road
October 25-26, 2017



DNL (dBA): 68



Appendix D

JE Adams Vacuum Reference Noise Level Data



9209

2 Motor Vac - Small Dome															
Wide Open With Attachment	Distance From Vac in Feet														
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Sound Level (dB)	76.4	70.4	66.9	64.4	62.4	60.9	59.5	58.4	57.3	56.4	55.6	54.8	54.1	53.5	52.9
Sealed Attachment	Distance From Vac in Feet														
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Sound Level (dB)	80.5	74.5	71.0	68.5	66.5	64.9	63.6	62.4	61.4	60.5	59.7	58.9	58.2	57.6	57.0
Attachment Removed	Distance From Vac in Feet														
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Sound Level (dB)	74.5	68.5	65.0	62.5	60.6	59.0	57.6	56.5	55.4	54.5	53.7	52.9	52.3	51.6	51.0

Appendix E
Barrier Insertion Loss Calculation (Vacuums)

Project Information: Job Number: 2017-191
 Project Name: ARCO AM/PM Car Wash at 2375 Quimby Road
 Location(s): Northern property line

Noise Level Data: Source Description: Vacuum
 Source Noise Level, dBA: 62
 Source Frequency (Hz): 500
 Source Height (ft): 4

Site Geometry: Receiver Description: Northern property line
 Source to Barrier Distance (C₁): 50
 Barrier to Receiver Distance (C₂): 10

 Pad/Ground Elevation at Receiver: 0
 Receiver Elevation¹: 5
 Base of Barrier Elevation: 0
 Starting Barrier Height 6

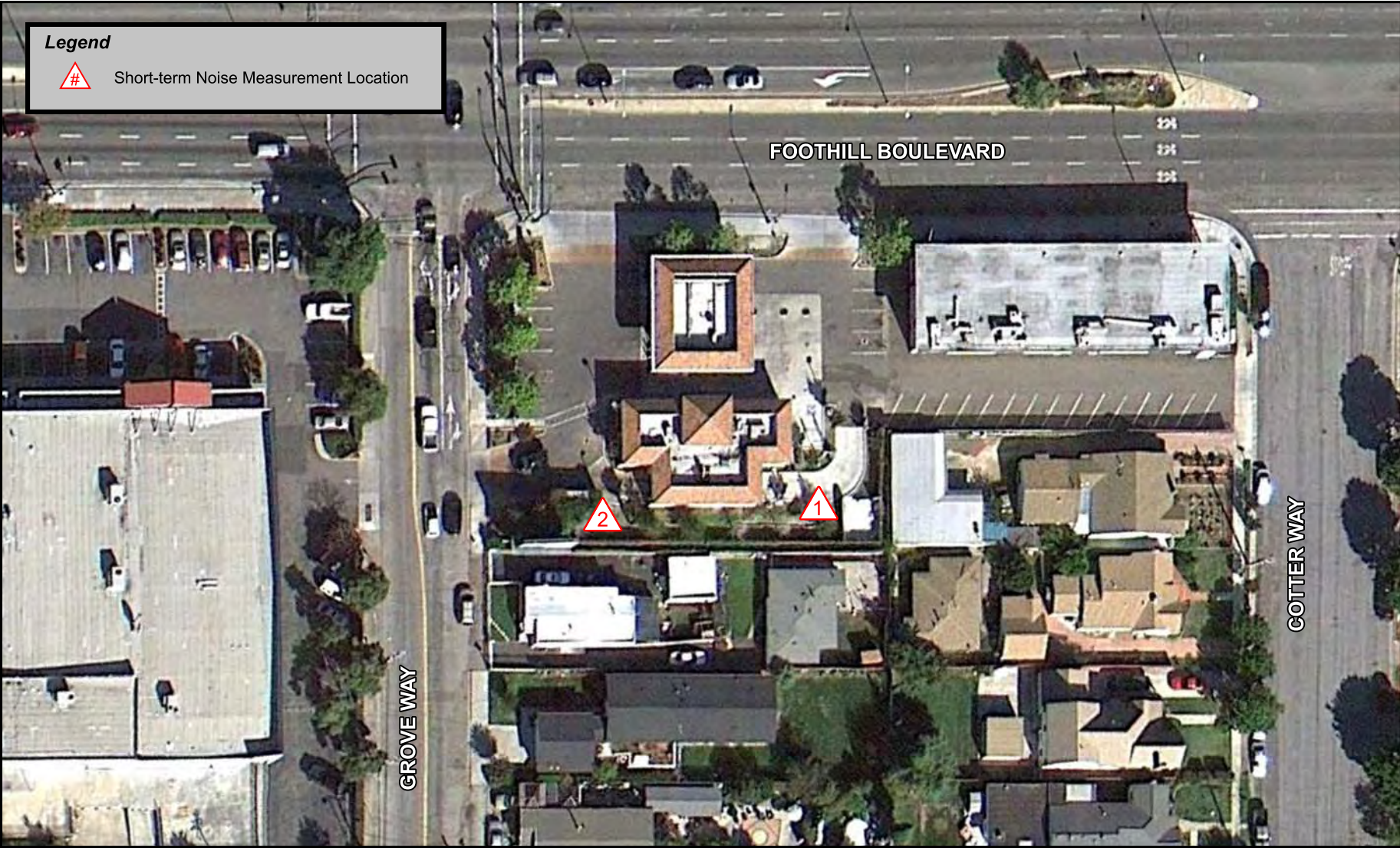
Barrier Effectiveness:

Top of Barrier Elevation (ft)	Barrier Height (ft)	Insertion Loss, dB	Noise Level, dB	Barrier Breaks Line of Site to Source?
6	6	-5.7	56.3	Yes
7	7	-7.1	54.9	Yes
8	8	-8.6	53.4	Yes
9	9	-9.9	52.1	Yes
10	10	-10.9	51.1	Yes
11	11	-12.1	49.9	Yes
12	12	-13.0	49.0	Yes
13	13	-13.8	48.2	Yes
14	14	-14.5	47.5	Yes
15	15	-14.6	47.4	Yes
16	16	-15.3	46.7	Yes

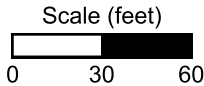
Notes: 1. Standard receiver elevation is five feet above grade/pad elevations at the receiver location(s).

Appendix F-1

Reference Noise Level Measurements of Car Wash with Entrance & Exit Doors



- Notes:
- 1. Car wash located at 21501 Foothill Boulevard, Hayward, California.
 - 2. Car wash model: Ryko SoftGloss Maxx with Entry and Exit Automatic Polycarbonate Doors.



Attachment F-2

Reference Noise Level Measurements of Car Wash with Entrance & Exit Doors



Car wash entrance



Car wash exit

- Notes:
1. Car wash located at 21501 Foothill Boulevard, Hayward, California.
 2. Car wash Model: Ryko SoftGloss Maxx with Entry and Exit Automatic Polycarbonate Doors.

Appendix G
Barrier Insertion Loss Calculation (Car Wash Dryers)

Project Information: Job Number: 2017-191
 Project Name: ARCO AM/PM Car Wash at 2375 Quimby Road
 Location(s): Northern property line

Noise Level Data: Source Description: Car wash dryers
 Source Noise Level, dBA: 67
 Source Frequency (Hz): 500
 Source Height (ft): 8

Site Geometry: Receiver Description: Northern property line (car wash exit)
 Source to Barrier Distance (C₁): 10
 Barrier to Receiver Distance (C₂): 10

 Pad/Ground Elevation at Receiver: 0
 Receiver Elevation¹: 5
 Base of Barrier Elevation: 0
 Starting Barrier Height 6

Barrier Effectiveness:

Top of Barrier Elevation (ft)	Barrier Height (ft)	Insertion Loss, dB	Noise Level, dB	Barrier Breaks Line of Site to Source?
6	6	-4.6	62.4	No
7	7	-5.2	61.8	Yes
8	8	-6.7	60.3	Yes
9	9	-8.6	58.4	Yes
10	10	-10.3	56.7	Yes
11	11	-11.5	55.5	Yes
12	12	-12.9	54.1	Yes
13	13	-13.9	53.1	Yes
14	14	-14.6	52.4	Yes
15	15	-15.3	51.7	Yes
16	16	-15.9	51.1	Yes

Notes: 1. Standard receiver elevation is five feet above grade/pad elevations at the receiver location(s).