NOISE STUDY

CarMax Auto Store
City of Oceanside, CA

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GLOSSARY OF TERMS

Sound Pressure Level (SPL): a ratio of one sound pressure to a reference pressure (L_{ref}) of 20 µPa. Because of the dynamic range of the human ear, the ratio is calculated logarithmically by 20 log (L/L_{ref}).

A-weighted Sound Pressure Level (dBA): Some frequencies of noise are more noticeable than others. To compensate for this fact, different sound frequencies are weighted more.

Minimum Sound Level (L_{min}): Minimum SPL or the lowest SPL measured over the time interval using the A-weighted network and slow time weighting.

Maximum Sound Level (L_{max}): Maximum SPL or the highest SPL measured over the time interval the A-weighted network and slow time weighting.

Equivalent sound level (L_{eq}): the true equivalent sound level measured over the run time. Leq is the A-weighted steady sound level that contains the same total acoustical energy as the actual fluctuating sound level.

Day Night Sound Level (LDN): Representing the Day/Night sound level, this measurement is a 24 –hour average sound level where 10 dB is added to all the readings that occur between 10 pm and 7 am. This is primarily used in community noise regulations where there is a 10 dB "Penalty" for nighttime noise. Typically, LDN's are measured using A weighting.

Community Noise Exposure Level (CNEL): The accumulated exposure to sound measured in a 24-hour sampling interval and artificially boosted during certain hours. For CNEL, samples taken between 7 pm and 10 pm are boosted by 5 dB; samples taken between 10 pm and 7 am are boosted by 10 dB.

Octave Band: An octave band is defined as a frequency band whose upper band-edge frequency is twice the lower band frequency.

Third-Octave Band: A third-octave band is defined as a frequency band whose upper band-edge frequency is 1.26 times the lower band frequency.

Response Time (F,S,I): The response time is a standardized exponential time weighting of the input signal according to fast (F), slow (S) or impulse (I) time response relationships. Time response can be described with a time constant. The time constants for fast, slow and impulse responses are 1.0 seconds, 0.125 seconds and 0.35 milliseconds, respectively.

EXECUTIVE SUMMARY

This noise study has been completed to determine the noise impacts associated with the proposed project. The project known as "CarMax Auto Center" consists of a 10.98-Acre project site located on the southside of the 4000 block of Plaza Drive west of the Oceanside DMV in Oceanside, California. The project site is 10.98 acres.

Operational Noise Levels

Based upon the property line noise levels determined for the Project none of the proposed noise sources directly or cumulatively exceeds the property line standards at the residential property lines. Therefore, the proposed development related operational noise levels comply with the City's daytime noise standards at surrounding residences. No impacts are anticipated and no mitigation is required.

Traffic Noise Levels

The Project does not create a noise increase of more than 3 dBA CNEL on any roadway segment. Therefore, the project's contributions to off-site roadway noise increases will not cause any significant impacts to any existing or future noise sensitive land uses.

Construction Noise Levels

It was determined that none of the proposed equipment will exceed the City of Oceanside 85 dBA standard at 100 feet from the source. The project will also meet the County of San Diego's 75 dBA standard from all proposed equipment. No impacts will occur and no mitigation measures are required.

1.0 PROJECT INTRODUCTION

1.1 Purpose of this Study

The purpose of this Noise study is to determine both operational impacts (if any) generated from the proposed project to offsite uses. Should impacts be determined, the intent of this study would be to recommend suitable mitigation measures classify impacts as less then significant.

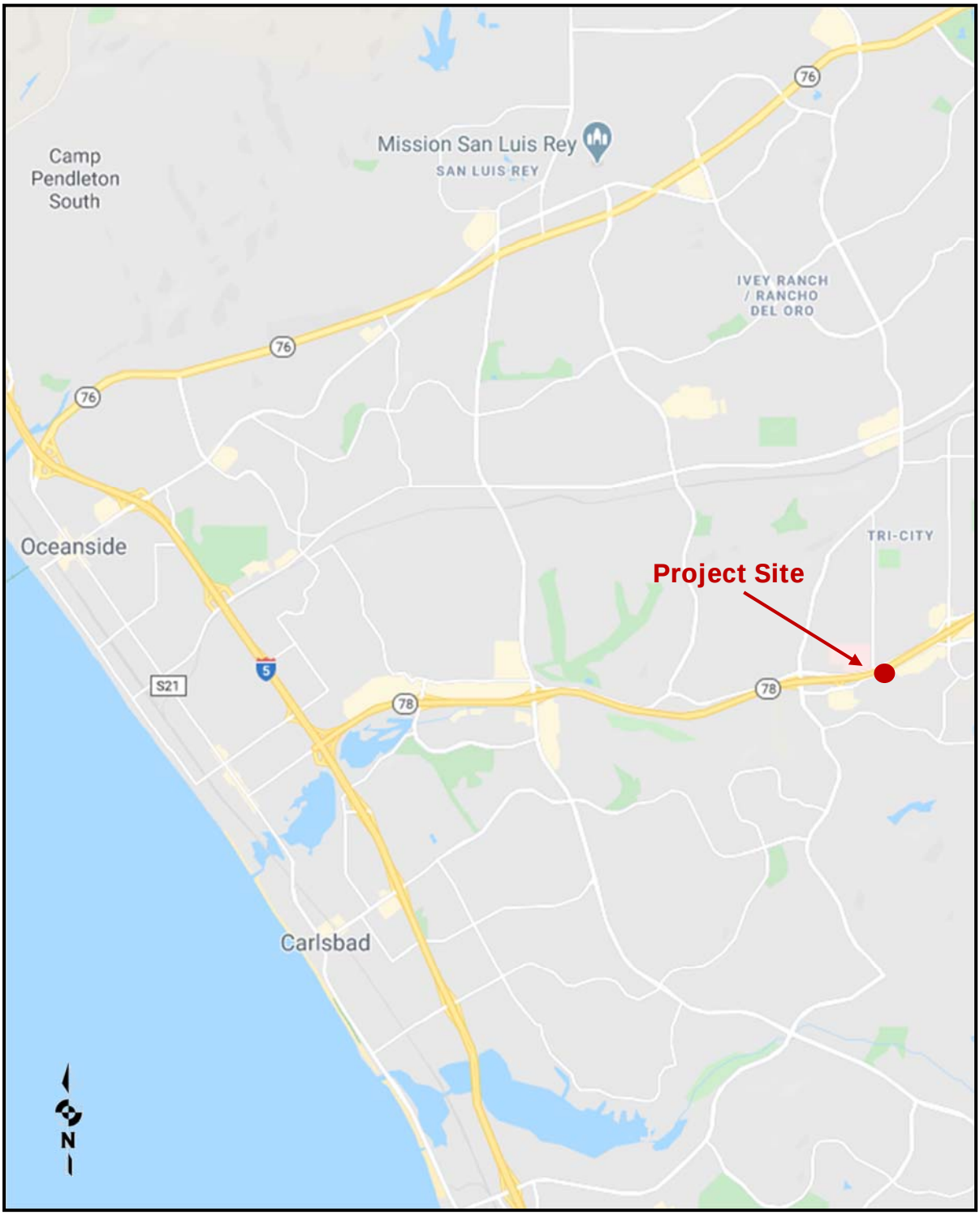
1.2 Project Location

The project is located on the south side of the 4000 block of Plaza Drive west of the Oceanside DMV in Oceanside, California. The project site is south of State Route 78 and approximately 4 miles east of Interstate 5. Locally, the project site is located south of the intersection of Plaza Drive and Thunder Drive. The project site is more specifically situated just south of the Tri-City Hospital. A general project vicinity map is shown in Figure 1-A.

1.3 Project Description

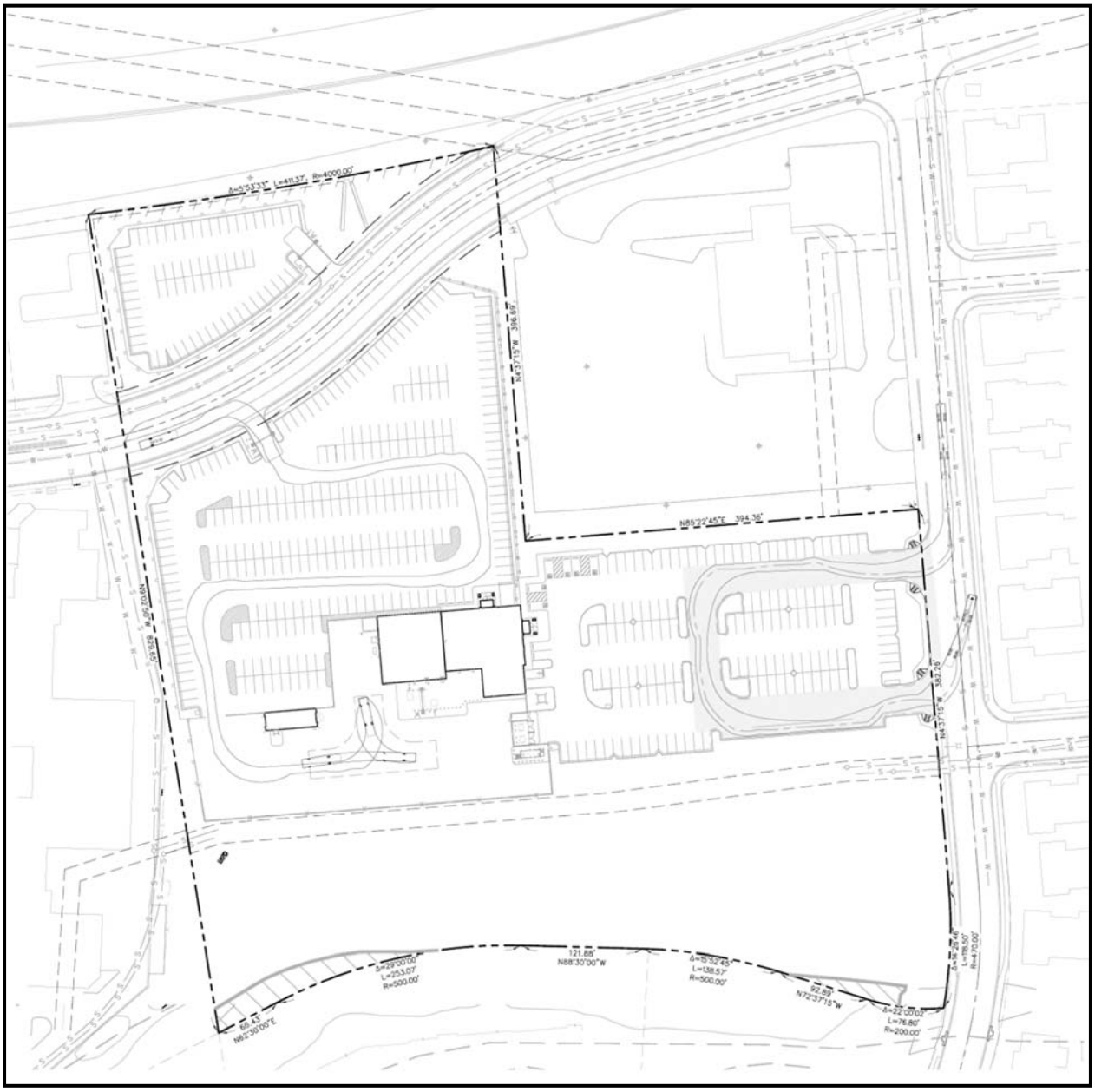
The proposed CarMax project would be situated on an overall vacant site which is 10.98 acres in total size. The project would consist of roughly 11,450 square feet (SF) of facilities and 476 parking spaces of which the majority of the locations would be for car sales. The project would also have roughly 2.34 acres of open space and landscaped areas. Construction of the project would begin early 2021 and be completed in just over one year. A site development plan is shown in Figure 1-B.

Figure 1-A: Project Vicinity Map



Source: Google 2020

Figure 1-B: Proposed Project Site Plan



Source: REC Consultants, 2020

2.0 ACOUSTICAL FUNDAMENTALS

Noise is defined as unwanted or annoying sound which interferes with or disrupts normal activities. Exposure to high noise levels has been demonstrated to cause hearing loss. The individual human response to environmental noise is based on the sensitivity of that individual, the type of noise that occurs and when the noise occurs.

Sound is measured on a logarithmic scale consisting of sound pressure levels known as a decibel (dB). The sounds heard by humans typically do not consist of a single frequency but of a broadband of frequencies having different sound pressure levels. The method for evaluating all the frequencies of the sound is to apply an A-weighting to reflect how the human ear responds to the different sound levels at different frequencies. The A-weighted sound level adequately describes the instantaneous noise whereas the equivalent sound level depicted as Leq represents a steady sound level containing the same total acoustical energy as the actual fluctuating sound level over a given time interval.

The Community Noise Equivalent Level (CNEL) is the 24 hour A-weighted average for sound, with corrections for evening and nighttime hours. The corrections require an addition of 5 decibels to sound levels in the evening hours between 7 p.m. and 10 p.m. and an addition of 10 decibels to sound levels at nighttime hours between 10 p.m. and 7 a.m. These additions are made to account for the increased sensitivity during the evening and nighttime hours when sound appears louder.

A vehicles noise level is from a combination of the noise produced by the engine, exhaust and tires. The cumulative traffic noise levels along a roadway segment are based on three primary factors: the amount of traffic, the travel speed of the traffic, and the vehicle mix ratio or number of medium and heavy trucks. The intensity of traffic noise is increased by higher traffic volumes, greater speeds and increased number of trucks.

Because mobile/traffic noise levels are calculated on a logarithmic scale, a doubling of the traffic noise or acoustical energy results in a noise level increase of 3 dBA. Therefore, the doubling of the traffic volume, without changing the vehicle speeds or mix ratio, results in a noise increase of 3 dBA. Mobile noise levels radiant in an almost oblique fashion from the source and drop off at a rate of 3 dBA for each doubling of distance under hard site conditions and at a rate of 4.5 dBA for soft site conditions.

Hard site conditions consist of concrete, asphalt and hard pack dirt while soft site conditions exist in areas having slight grade changes, landscaped areas and vegetation. On the other hand, fixed/point sources radiate outward uniformly as it travels away from the source. Their sound levels attenuate or drop off at a rate of 6 dBA for each doubling of distance.

The most effective noise reduction methods consist of controlling the noise at the source, blocking the noise transmission with barriers. Any or all of these methods may be required to reduce noise levels to an acceptable level. To be effective, a noise barrier must have enough mass to prevent significant noise transmission through it and high enough and long enough to shield the receiver from the noise source. A safe minimum surface weight for a noise barrier is 3.5 pounds/square foot (equivalent to 3/4-inch plywood), and the barrier must be carefully constructed so that there are no cracks or openings.

Barriers constructed of wood or as a wooden fence must have minimum design considerations as follows: the boards must be ¾ inch thick and free of any gaps or knot holes. The design must also incorporate either overlapping the boards at least 1 inch or utilizing a tongue-and-grove design for this to be achieved.

3.0 SIGNIFICANCE THRESHOLDS AND STANDARDS

3.1 Operational Noise

Fixed sources and operational noise standards are governed by the City of Oceanside Noise Ordinance Section 38.12. Except for exempted activities and sounds as provided in this chapter or exempted properties as referenced in Section 38.15. It shall be unlawful for any person to cause or allow the creation of any noise to the extent that the one-hour average sound level, at any point on or beyond the boundaries of the property in the applicable base district zone on which the sound is produced exceeds the applicable limits set forth below in Table 3-1.

Table 3-1: Sound Level Limits

Base District Zone	7:00 a.m. to 9:59 p.m.	10:00 p.m. to 6:59 a.m.
(1) Residential Districts:		
RE (Residential Estate)	50	45
RS (Single-Family)	50	45
RM (Medium Density)	50	45
RH (High Density)	55	50
RT (Residential Tourist)	55	50
(2) C (Commercial)	65	60
(3) I (Industrial)	70	65
(4) D (Downtown)	65	55
(5) A (Agricultural)	50	45
(6) OS (Open Space)	50	45

In addition to the sound level limits established above, there are established sound level limits for PD (planned development) base district zones. For any residential land use within a PD zone, the sound level limit is that limit which would be otherwise applicable in the residential district zone (RE, RS, RM, RH or RT) corresponding to density of the residential development in that PD zone.

For any nonresidential land use within a PD zone, the sound level limit is that limit corresponding to the C (commercial) or I (industrial) zone which would be applicable to that use if not subject to the PD zone. For the purposes of this section, a land use shall be that use shown on a duly approved planned development plan or specific plan.

When property lines form the joint boundary of two (2) base district zones, the sound level limit shall be the arithmetic mean of the limit applicable to each of the two (2) zones.

3.2 Transportation Related Noise

The City of Oceanside's Noise Element requires that all exterior sensitive areas shall limit noise exposure. For noise sensitive residential land uses, the City has adopted a policy which has established a "normally acceptable" exterior noise level goal of 65 dBA CNEL for the outdoor areas and an interior noise level of less than 45 dBA CNEL.

Interior noise levels should be mitigated to a maximum of 45 dBA CNEL in all habitual rooms when the exterior of the residence are exposed to levels of 60 dBA CNEL or more. If windows and doors are required to be closed to meet the interior noise standard, then mechanical ventilation shall be provided per City requirements.

3.3 Construction Noise

The City of Oceanside Noise Element controls noise levels due to construction operations. It shall be unlawful for any person to operate construction equipment at any construction site, except as outlined in subsections (a) and (b) below:

(a) It shall be unlawful for any person to operate any construction equipment at a level in excess of 85 dBA at 100 feet from the source.
(b) It should be unlawful for any person to engage in construction activities between 6 PM and 7 AM when such activities exceed the ambient noise level by 5 dBA. A special permit may be granted by the Director of Public Works if extenuating circumstances exist.

4.0 EXISTING NOISE ENVIRONMENT

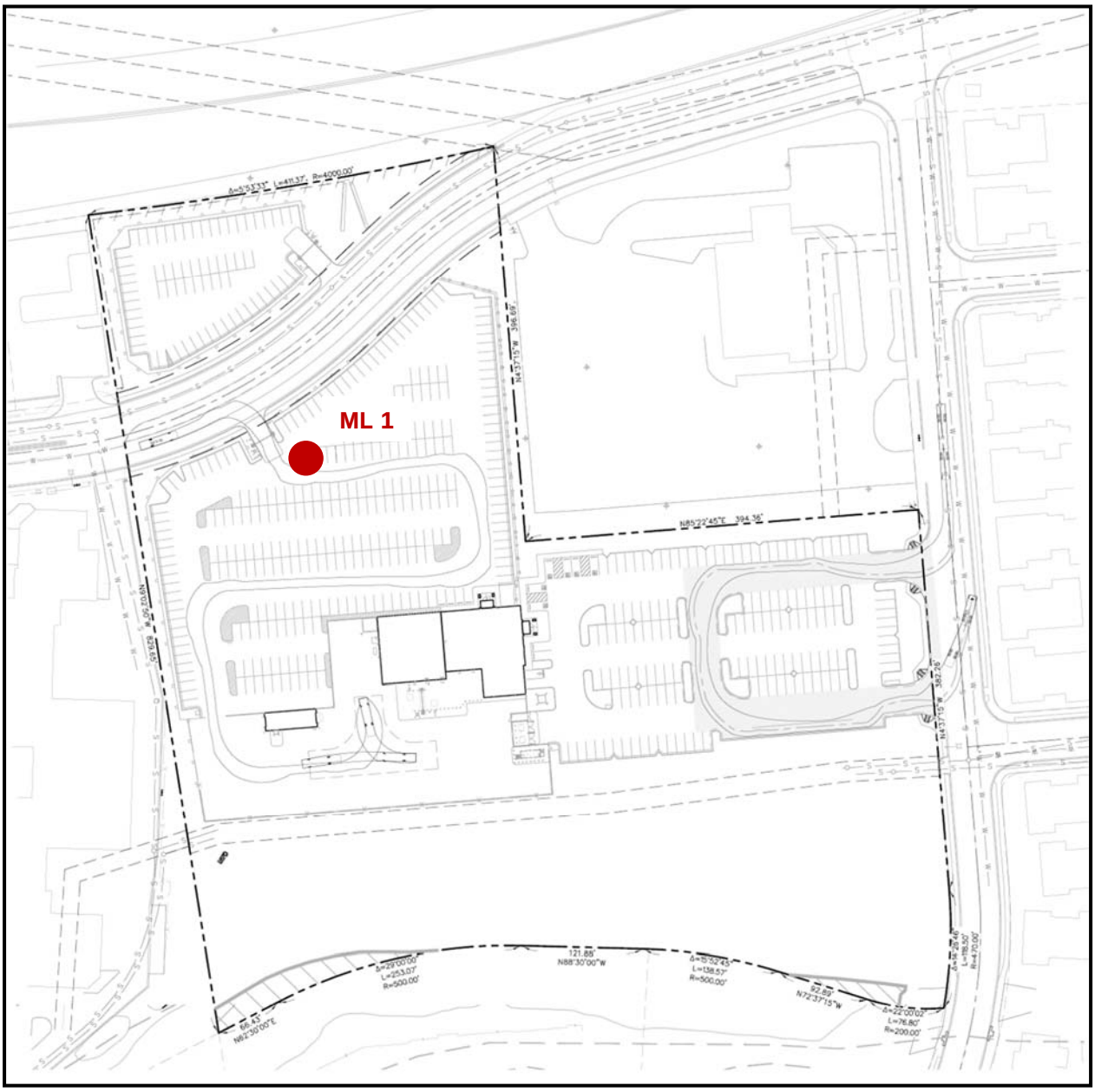
Noise measurements were taken January 13, 2020 in the afternoon hours using a Larson-Davis Model LxT Type 1 precision sound level meter, programmed, in "slow" mode, to record noise levels in "A" weighted form. The sound level meter and microphone were mounted on a tripod, five feet above the ground and equipped with a windscreen during all measurements. The sound level meter was calibrated before and after the monitoring using a Larson-Davis calibrator, Model CAL 200.

Monitoring location 1 (M1) was located along the northern portion of the site. The noise measurements were monitored for a time period of 15 minutes during normal traffic conditions. The results of the noise level measurements are presented in Table 4-1. The existing noise levels in the project area consisted primarily of traffic along the adjacent roadway during each measurement. The ambient Leq noise levels measured in the area of the project during the early afternoon were found to be between 64-71 dBA Leq along the roadways. The statistical indicators Lmax, Lmin, L10, L50 and L90, are given for the monitoring location. As can be seen from the L90 data, 90% of the time the noise level is roughly 46-50 dBA. The noise monitoring locations are provided graphically in Figure 4-1 on the following page.

Table 4-1: Measured Ambient Noise Levels

Measurement Identification	Primary Noise Source	Time	Noise Levels (dBA)					
			Leq	Lmax	Lmin	L10	L50	L90
M1	State Route 78	3:00-3:15 p.m.	61.8	73.1	57.4	63.1	60.5	59.3
Source: Ldn Consulting								

Figure 4-1: Ambient Noise Monitoring Locations



5.0 OPERATIONAL NOISE LEVELS

This section examines the potential operational noise source levels associated with the development and operation of the proposed project. Noise from a fixed or point source drops off at a rate of 6 dBA for each doubling of distance. Which means a noise level of 70 dBA at 5-feet would be 64 dBA at 10-feet and 58 dBA at 20-feet. Noise levels drop 3 decibels each time the duration of the source is reduced in half. Therefore, an hourly noise level if only operating over a 30 minute period would be reduced by 3 decibels based on the limited time of operation.

The required sound levels at a Project's property boundary depend on the time of day and the land use zone. The Project site is zoned for commercial, which allows an equivalent one-hour sound level of 65 dBA Leq-h between 7 A.M. and 9:59 P.M. and 60 dBA from 10 P.M. to 6:59 A.M at the property lines. The western and northern properties are zoned commercial. The existing residential uses located to the west and to the south allow an equivalent one-hour sound level of 50 dBA Leq-h between 7 A.M. and 9:59 P.M. and 45 dBA from 10 P.M. to 6:59 A.M at the property lines.

When two joint boundaries differ in zoning the City of Oceanside Noise Ordinance utilizes the arithmetic mean of the two standards. It should be noted: the hours of operation will only occur during the daytime hours and therefore the applicable property line standard would be 57.5 Leq-h at residential property lines.

5.1 Reference Noise Levels

This section provides a detailed description of the reference noise level measurement results. Each anticipated noise source is provided in more detail below to determine if direct noise impacts will occur. A cumulative noise level analysis with associated distances, noise reductions and calculations of the proposed sources is provided along with a table showing the individual noise sources and their associated property line noise levels.

Carwash

To examine the potential noise impacts associated with the operation of the proposed project, sound level measurements of the equipment were taken at the site. The noise measurements were taken using a Larson-Davis Model LxT Type 1 precision sound level

meter, programmed, in "slow" mode, to record noise levels in "A" weighted form. The sound level meter was mounted on a tripod, five feet above the ground and equipped with a windscreen. The results of the noise measurements are shown in Table 5-1.

Table 5-1: Reference Noise Levels

Equipment	Distance from Source (Feet)	Noise Level (dBA)	Quanity
Vacuum Equipment	3	81.8	1
Carwash Entrance	9	84.3	1
Carwash Exit (Blowers)	9	84.5	1

Air Conditioning Units

Rooftop mechanical ventilation units (HVAC) will be installed on the proposed buildings. In order to evaluate the HVAC noise impacts, the analysis utilized reference noise level measurements taken at a Von's Shopping Center in Murrieta, CA in 2010. The unshielded noise levels for the HVAC units were measured at 65.9 dBA Leq at a distance of 6 feet.

Even though the mechanical ventilation system will cycle on and off throughout the day, this approach presents the worst-case noise condition. Additionally, the noise levels associated with the roof-top mechanical ventilation system will be limited with the proposed parapet walls on each building that will vary in height but will be roughly 1-foot higher than the HVAC units to shield them both visually and acoustically. Hence, the parapet wall will block the line-of-sight from the nearest residential units. No additional reductions were taken from the parapet walls to represent a worst-case noise condition.

5.2 Property Line Noise Levels

To determine the anticipated property line noise levels from the proposed project the reference noise measurements above were utilized. Although the carwash activities and mechanical equipment are intermittent, no duty-cycle reductions were taken and the reference noise levels were considered to be continuous to establish the worst-case anticipated property line noise levels. The property line noise level projections were calculated based on the site plan showing the location of the proposed outdoor uses. The

site plan and some relative distances to the nearest property lines are provided in Figure 5-2 on the following page.

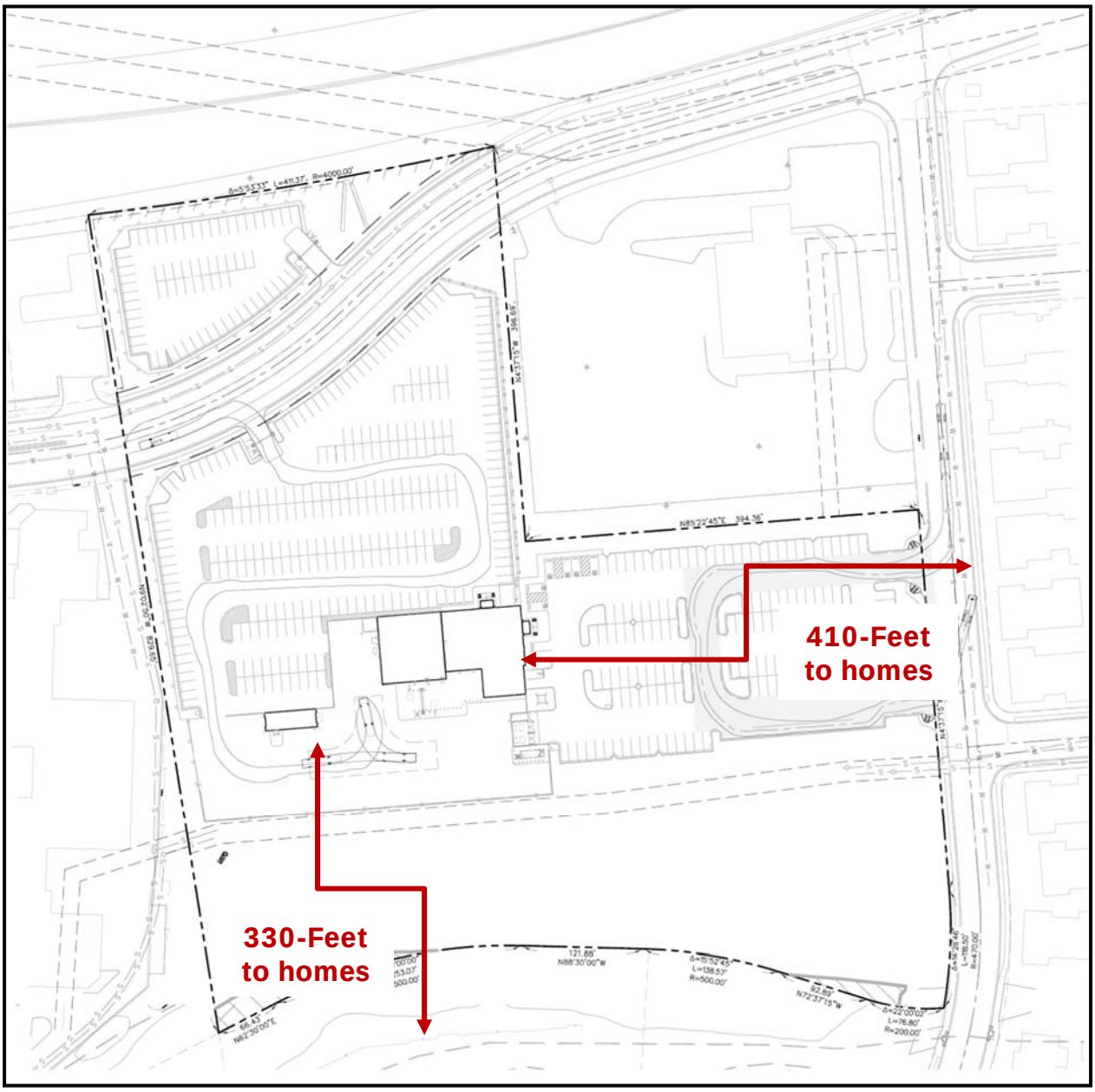
It is possible to calculate the cumulative noise levels from the proposed project to the nearest sensitive property line from the proposed noise sources. Each noise source was cumulatively added to determine the worst case outdoor activity noise levels. Although not all the noise sources are close enough to each other in distance or sound level to create a cumulative effect this method is considered conservative in determining impact potential. The results of this conservative approach are shown in Table 5-2 below for the propagated noise levels to the nearest sensitive property line located 330-410 feet from sources. It should be noted: the values given do not take into account the effect of any noise barriers, structures, or topography that may reduce the noise levels. As can be seen in Table 5-1, the noise level, without accounting for any reductions are below the most restrictive residential noise threshold as shown above in Table 3-1.

Table 5-2: Operational Noise Levels – Southern Property Line

Source	Distance from Source (Feet)	Measured Noise Level (dBA)	Distance to Nearest Property Line (Feet)	Noise Reduction due to distance (dBA)	Resultant Noise Level @ Property Line (dBA)
Vacuum Equipment	3	81.8	330	-40.8	16.5
Carwash Entrance	9	84.3		-31.3	38.1
Carwash Exit (Blowers)	9	84.5		-31.3	38.3
HVAC West Bldg	6	65.9		-34.8	12.7
HVAC East Bldg	6	65.9		-34.8	12.7
Cumulative Noise Level @ Property Line (dBA)					**41.3**

Based upon the property line noise levels determined above none of the proposed noise sources directly or cumulatively exceeds the property line standards at the surrounding property lines. Therefore, the proposed development related operational noise levels comply with the City's noise standards at surrounding residences. No impacts are anticipated and no mitigation is required.

Figure 5-1: Site Plan and Noise Sources



6.0 TRANSPORTATION NOISE LEVELS

6.1 Offsite Transportation Related Noise Levels

The off-site project-related roadway segment noise levels projected in this report were calculated using the methods in the Highway Noise Model published by the Federal Highway Administration (FHWA Highway Traffic Noise Prediction Model, FHWA-RD-77-108, December, 1978). The FHWA Model uses the traffic volume, vehicle mix, speed, and roadway geometry to compute the equivalent noise level. A spreadsheet calculation was used which computes equivalent noise levels for each of the time periods used in the calculation of CNEL. Weighting these equivalent noise levels and summing them gives the CNEL for the traffic projections. The noise contours are then established by iterating the equivalent noise level over many distances until the distance to the desired noise contour(s) are found.

Because mobile/traffic noise levels are calculated on a logarithmic scale, a doubling of the traffic noise or acoustical energy results in a noise level increase of 3 dBA. Therefore, the doubling of the traffic volume, without changing the vehicle speeds or mix ratio, results in a noise increase of 3 dBA. Mobile noise levels radiate in an almost oblique fashion from the source and drop off at a rate of 3 dBA for each doubling of distance under hard site conditions and at a rate of 4.5 dBA for soft site conditions. Hard site conditions consist of concrete, asphalt, and hard pack dirt, while soft site conditions exist in areas having slight grade changes, landscaped areas, and vegetation.

Community noise level changes greater than 3 dBA are often identified as audible and considered potential significant, while changes less than 1 dBA will not be discernible to local residents. In the range of 1 to 3 dBA, residents who are very sensitive to noise may perceive a slight change. There is no scientific evidence available to support the use of 3 dBA as the significance threshold; community noise exposures are typically over a long time period rather than the immediate comparison made in a laboratory situation. Therefore, the level at which changes in community noise levels become discernible is likely greater than 1 dBA and 3 dBA appears to be appropriate for most people. For the purposes for this analysis, a direct roadway noise impacts would be considered significant if the project increases noise levels for a noise sensitive land use by 3 dBA CNEL and if the project increases noise levels above an unacceptable noise level per the City's General Plan in the area adjacent to the roadway segment.

To determine if direct or cumulative off-site noise level increases associated with the development of the proposed project would create noise impacts. The traffic volumes for the existing conditions were compared with the traffic volume increase of existing plus the proposed project. The project's traffic assessment states that the proposed project site could generate 475 ADT including test drives (Source: CarMax Traffic Analysis – LOS Engineering, 2020). The existing ADT volumes adjacent to the project site along Thunder Drive between Plaza Drive to Tiberon Drive are 9,100 ADT and between Tiberon Drive to Lake Boulevard are 7,631 ADT. The project will result in the traffic volumes increases to 10,255 ADT and 7,796 ADT along those two segment of Thunder Drive, respectively. Typically, it requires a project to double (or add 100%) to the traffic volumes to have a direct impact of 3 dBA CNEL or be a major contributor to the cumulative traffic volumes. The project would result in only a 2-13 percent increase which would increase the noise levels less than 0.5 decibels. Cumulatively the traffic volumes along the roadway are expected to increase but the project related increase would not double the traffic volumes and therefore no impacts are anticipated.

6.2 Conclusions

The Project does not create a noise increase of more than 3 dBA CNEL on any roadway segment. Therefore, the project's contributions to off-site roadway noise increases will not cause any significant impacts to any existing or future noise sensitive land uses.

7.0 CONSTRUCTION NOISE LEVELS

Construction noise represents a short-term impact on the ambient noise levels. Noise generated by construction equipment includes haul trucks, water trucks, graders, dozers, loaders, and scrapers and can reach relatively high levels. Grading activities typically represent one of the highest potential sources for noise impacts. The most effective method of controlling construction noise is through local control of construction hours and by limiting the hours of construction to normal weekday working hours.

The City of Oceanside does not have property line standards for construction, the County of San Diego 75 dBA Leq standard is utilized in the analysis. The County's Noise Ordinance Code states that with the exception of an emergency, it should be unlawful to conduct any construction activity so as to cause, at or beyond the property lines, an average sound level greater than 75 decibels between 7:00 a.m. to 7:00 p.m.

The U.S. Environmental Protection Agency (U.S. EPA) has compiled data regarding the noise generating characteristics of specific types of construction equipment. Noise levels generated by heavy construction equipment can range from 60 dBA to in excess of 100 dBA when measured at 50 feet. However, these noise levels diminish rapidly with distance from the construction site at a rate of approximately 6 dBA per doubling of distance. For example, a noise level of 75 dBA measured at 50 feet from the noise source to the receptor would be reduced to 69 dBA at 100 feet from the source to the receptor, and reduced to 63 dBA at 200 feet from the source.

Using a point-source noise prediction model, calculations of the expected construction noise levels were completed. The essential model input data for these performance equations include the source levels of the equipment, source to receiver horizontal and vertical separations, the amount of time the equipment is operating in a given day (also referred to as the duty-cycle), and any transmission loss from topography or barriers.

7.1 Potential Noise Impact Identification

Based on the EPA noise emissions, empirical data and the amount of equipment needed, worst-case noise levels from the construction equipment operations would occur during the base operations (final site preparation). The construction schedule identifies that final site preparation activities will occur in a single phase all at the same time, with anticipated equipment including 3 tractor/backhoe/loader, 1 roller, 1 grader and 1

dozer.

Due to normal site preparation operations, most of the equipment will be spread out over the site. Based upon the proposed site plan, all the residential uses near the site are located more than 330 feet from all the site preparation activities. Therefore, the worst-case noise condition would occur when the equipment is working in close proximity to each other at distances near the property line. The noise levels utilized in this analysis are shown in Table 7-1.

As can be seen in Table 7-1, even if all the equipment was working in the same area, at a distance as close as 330 feet, the point source noise attenuation from the construction activities and the nearest property line is -16 dBA. This would result in an anticipated worst case eight-hour average combined noise level of 66 dBA at the property line.

Table 7-1: Construction Noise Levels

Equipment Type	Quantity Used	Source @ 50 Feet (dBA)	Cumulative Noise Level @ 50 Feet (dBA)
Tractor/Backhoe/Loader	3	72	77
Grader	1	73	73
Roller	1	74	74
Water Truck	1	70	70
Dozer	1	74	74
		Cumulative Level (dBA)	**82**
		Distance to Separation (Feet)	**330**
		Noise Reduction due to Distance (dBA)	**-16**
		Property Line Noise Level (dBA)	**66**

7.2 Construction Noise Conclusions

It was determined that none of the proposed equipment will exceed the City of Oceanside 85 dBA standard at 100 feet from the source. The project will also meet the County of San Diego's 75 dBA standard from all proposed equipment. No impacts will occur and no mitigation measures are required.