APPENDIX F

NOISE DATA

Fundamentals of Noise

NOISE

Noise is most often defined as unwanted sound; whether it is loud, unpleasant, unexpected, or otherwise undesirable. Although sound can be easily measured, the perception of noise and the physical response to sound complicate the analysis of its impact on people. People judge the relative magnitude of sound sensation in subjective terms such as "noisiness" or "loudness."

Characteristics of Sound

When an object vibrates, it radiates part of its energy in the form of a pressure wave. Sound is that pressure wave transmitted through the air. Technically, airborne sound is a rapid fluctuation or oscillation of air pressure above and below atmospheric pressure that creates sound waves.

Sound can be described in terms of amplitude (loudness), frequency (pitch), or duration (time). Loudness or amplitude is measured in dB, frequency or pitch is measured in Hertz [Hz] or cycles per second, and duration or time variations is measured in seconds or minutes.

Amplitude

Unlike linear units such as inches or pounds, decibels are measured on a logarithmic scale. Because of the physical characteristics of noise transmission and perception, the relative loudness of sound does not closely match the actual amounts of sound energy. Table 1 presents the subjective effect of changes in sound pressure levels. Ambient sounds generally range from 30 dBA (very quiet) to 100 dBA (very loud). Changes of 1 to 3 dB are detectable under quiet, controlled conditions, and changes of less than 1 dB are usually not discernible (even under ideal conditions). A 3 dB change in noise levels is considered the minimum change that is detectable with human hearing in outside environments. A change of 5 dB is readily discernible to most people in an exterior environment, and a 10 dB change is perceived as a doubling (or halving) of the sound.

Table 1 Noise Perceptibility

Change in dB	Noise Level
± 3 dB	Barely perceptible increase
± 5 dB	Readily perceptible increase
± 10 dB	Twice or half as loud
± 20 dB	Four times or one-quarter as loud

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

Frequency

The human ear is not equally sensitive to all frequencies. Sound waves below 16 Hz are not heard at all, but are "felt" more as a vibration. Similarly, though people with extremely sensitive hearing can hear sounds as

high as 20,000 Hz, most people cannot hear above 15,000 Hz. In all cases, hearing acuity falls off rapidly above about 10,000 Hz and below about 200 Hz.

When describing sound and its effect on a human population, A-weighted (dBA) sound levels are typically used to approximate the response of the human ear. The A-weighted noise level has been found to correlate well with people's judgments of the "noisiness" of different sounds and has been used for many years as a measure of community and industrial noise. Although the A-weighted scale and the energy-equivalent metric are commonly used to quantify the range of human response to individual events or general community sound levels, the degree of annoyance or other response also depends on several other perceptibility factors, including:

- Ambient (background) sound level
- General nature of the existing conditions (e.g., quiet rural or busy urban)
- Difference between the magnitude of the sound event level and the ambient condition
- Duration of the sound event
- Number of event occurrences and their repetitiveness
- Time of day that the event occurs

Duration

Time variation in noise exposure is typically expressed in terms of a steady-state energy level equal to the energy content of the time varying period (called L_{eq}), or alternately, as a statistical description of the sound level that is exceeded over some fraction of a given observation period. For example, the L_{50} noise level represents the noise level that is exceeded 50 percent of the time; half the time the noise level exceeds this level and half the time the noise level is less than this level. This level is also representative of the level that is exceeded 30 minutes in an hour. Similarly, the L_2, L_8 and L_{25} values represent the noise levels that are exceeded 2, 8, and 25 percent of the time or 1, 5, and 15 minutes per hour, respectively. These "n" values are typically used to demonstrate compliance for stationary noise sources with many cities' noise ordinances. Other values typically noted during a noise survey are the L_{min} and L_{max}. These values represent the minimum and maximum root-mean-square noise levels obtained over the measurement period, respectively.

Because community receptors are more sensitive to unwanted noise intrusion during the evening and at night, state law and many local jurisdictions use an adjusted 24-hour noise descriptor called the Community Noise Equivalent Level (CNEL) or Day-Night Noise Level (L_{dn}). The CNEL descriptor requires that an artificial increment (or "penalty") of 5 dBA be added to the actual noise level for the hours from 7:00 PM to 10:00 PM and 10 dBA for the hours from 10:00 PM to 7:00 AM. The L_{dn} descriptor uses the same methodology except that there is no artificial increment added to the hours between 7:00 PM and 10:00 PM. Both descriptors give roughly the same 24-hour level, with the CNEL being only slightly more restrictive (i.e., higher). The CNEL or L_{dn} metrics are commonly applied to the assessment of roadway and airport-related noise sources.

Sound Propagation

Sound dissipates exponentially with distance from the noise source. This phenomenon is known as "spreading loss." For a single-point source, sound levels decrease by approximately 6 dB for each doubling of distance from the source (conservatively neglecting ground attenuation effects, air absorption factors, and

barrier shielding). For example, if a backhoe at 50 feet generates 84 dBA, at 100 feet the noise level would be 79 dBA, and at 200 feet it would be 73 dBA. This drop-off rate is appropriate for noise generated by on-site operations from stationary equipment or activity at a project site. If noise is produced by a line source, such as highway traffic, the sound decreases by 3 dB for each doubling of distance over a reflective ("hard site") surface such as concrete or asphalt. Line source noise in a relatively flat environment with ground-level absorptive vegetation decreases by an additional 1.5 dB for each doubling of distance.

Psychological and Physiological Effects of Noise

Physical damage to human hearing begins at prolonged exposure to noise levels higher than 85 dBA. Exposure to high noise levels affects the entire system, with prolonged noise exposure in excess of 75 dBA increasing body tensions, thereby affecting blood pressure and functions of the heart and the nervous system. Extended periods of noise exposure above 90 dBA results in permanent cell damage, which is the main driver for employee hearing protection regulations in the workplace. For community environments, the ambient or background noise problem is widespread, through generally worse in urban areas than in outlying, less-developed areas. Elevated ambient noise levels can result in noise interference (e.g., speech interruption/masking, sleep disturbance, disturbance of concentration) and cause annoyance. Since most people do not routinely work with decibels or A-weighted sound levels, it is often difficult to appreciate what a given sound pressure level number means. To help relate noise level values to common experience, Table 2 shows typical noise levels from familiar sources.

Table 2 Typical Noise Levels

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
Onset of physical discomfort	120+	
	110	Rock Band (near amplification system)
Jet Flyover at 1,000 feet		
	100	
Gas Lawn Mower at three feet		
	90	
Diesel Truck at 50 feet, at 50 mph		Food Blender at 3 feet
	80	Garbage Disposal at 3 feet
Noisy Urban Area, Daytime		
	70	Vacuum Cleaner at 10 feet
Commercial Area		Normal speech at 3 feet
Heavy Traffic at 300 feet	60	
		Large Business Office
Quiet Urban Daytime	50	Dishwasher Next Room
Quiet Urban Nighttime	40	Theater, Large Conference Room (background)
Quiet Suburban Nighttime		
	30	Library
Quiet Rural Nighttime		Bedroom at Night, Concert Hall (background)
	20	
		Broadcast/Recording Studio
	10	
Lowest Threshold of Human Hearing	0	Lowest Threshold of Human Hearing

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

Vibration Fundamentals

Vibration is an oscillatory motion through a solid medium in which the motion's amplitude can be described in terms of displacement, velocity, or acceleration. Vibration is normally associated with activities stemming from operations of railroads or vibration-intensive stationary sources, but can also be associated with construction equipment such as jackhammers, pile drivers, and hydraulic hammers. As with noise, vibration can be described by both its amplitude and frequency. Vibration displacement is the distance that a point on a surface moves away from its original static position; velocity is the instantaneous speed that a point on a surface moves; and acceleration is the rate of change of the speed. Each of these descriptors can be used to correlate vibration to human response, building damage, and acceptable equipment vibration levels. During construction, the operation of construction equipment can cause groundborne vibration. During the operational phase of a project, receptors may be subject to levels of vibration that can cause annoyance due to noise generated from vibration of a structure or items within a structure.

Vibration amplitudes are usually described in terms of either the peak particle velocity (PPV) or the root mean square (RMS) velocity. PPV is the maximum instantaneous peak of the vibration signal and RMS is the

square root of the average of the squared amplitude of the signal. PPV is more appropriate for evaluating potential building damage and RMS is typically more suitable for evaluating human response.

As with airborne sound, annoyance with vibrational energy is a subjective measure, depending on the level of activity and the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying. Persons accustomed to elevated ambient vibration levels, such as in an urban environment, may tolerate higher vibration levels. Table 3 displays the human response and the effects on buildings resulting from continuous vibration (in terms of various levels of PPV).

Table 3 Human Reaction to Typical Vibration Levels

Vibration Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.006–0.019	Threshold of perception, possibility of intrusion	Vibrations unlikely to cause damage of any type
0.08	Vibrations readily perceptible	Recommended upper level of vibration to which ruins and ancient monuments should be subjected
0.10	Level at which continuous vibration begins to annoy people	Virtually no risk of "architectural" (i.e. not structural) damage to normal buildings
0.20	Vibrations annoying to people in buildings	Threshold at which there is a risk to "architectural" damage to normal dwelling – houses with plastered walls and ceilings
0.4–0.6	Vibrations considered unpleasant by people subjected to continuous vibrations and unacceptable to some people walking on bridges	Vibrations at a greater level than normally expected from traffic, but would cause "architectural" damage and possibly minor structural damage

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

LOCAL REGULATIONS AND STANDARDS

NOISE ELEMENT
OF THE ALAMEDA COUNTY GENERAL PLAN

Alameda County Planning Commission
July 31, 1975
Revised September 29, 1975

AMENDMENTS TO
ALAMEDA COUNTY NOISE ELEMENT
(Adopted January 8, 1976)

Amended May 5, 1994
Board of Supervisors Resolution 94-272

New language is indicated in *italics;* deletions are shown in ~~strikeout~~.

Page 4-12, The following was inserted as the first paragraph under the title "III. Noise Levels In Alameda County."

> *Existing and future noise conditions for the East County Area are contained in the East County Area Plan (see Volume I - Goals, Policies and Programs, Figure 7). The discussion in this Noise Element refers exclusively to noise conditions in that part of Alameda County west of the Pleasanton/Dublin ridgeline.*

Page 4-12, The third paragraph on the page was deleted, as follows:

> ~~Some of the areas where data is lacking are: Highway 84 between Sunol and Livermore and the Livermore Airport. This information will be provided as it becomes available.~~

Page 4-13a, Index Map of Noise Element Maps, Subareas 7 through 12 have been deleted; readers are referred to East County Area Plan (see Volume I - Goals, Policies and Programs, Figure 7).

Maps 5 and 6, Existing noise contours, Portions of map within East County Area Plan were blacked out and readers are referred to East County Area Plan (see Volume I - Goals, Policies and Programs, Figure 7).

Maps 7 through 12, have been deleted.

Page 4-16, A reference was inserted under Section VI., Unincorporated Area Policies, to read as follows:

> *See East County Area Plan for policies and programs addressing noise in the East County Area (Policies 265 through 267 and Implementation Program 100.*

4 - NOISE ELEMENT

I. INTRODUCTION

Noise, for the purposes of the Noise Element, may be briefly defined as unwanted sound. Increasing urbanization and greater volumes of traffic are creating noise problems which adversely affect the quality of the environment for both humans and animals. Although sounds that are pleasant to one person may be noise to another person, it is recognized that excessive sound can be physiologically and psychologically harmful for man and beast. Federal, state, and local governments and private industry are presently involved in attempts to achieve noise reduction through source emission reduction, improved highway design, and land use control.

II. BACKGROUND

Authority:

Under Section 65302 (g) of the California Government Code, all counties and cities in the State must prepare a noise element to their general plans, as follows:

> A noise element in quatitative, numerical terms, showing contours of present and projected noise levels associated with all existing and proposed major transportation elements. These include but are not limited to the following:
>
> 1. Highways and freeways
> 2. Ground rapid transit systems
> 3. Ground facilities associated with all airports operating under a permit from the State Department of Aeronautics.

All agencies, public and private, who are responsible for the construction and maintenance of such transportation facilities are to provide to the local agency producing the noise element of the general plan a statement of the present and projected noise levels of the facility and any information that was used in the development of such levels.

Sources of Noise:

Noise is produced by transportation vehicles, the operation of machinery, radios, and other forms of human activity. It is generally recognized that noise from transportation vehicles has had the most significant effect on the quality of the urban environment. Transportation noise sources are governed by many factors such as: (a) the design, construction, maintenance, and manner of operating a vehicle, and (b) the path that the sound waves travel to meet the observer-distance, obstructions, reflections off surfaces, etc.

Definition of Noise and Methods of Measurement:

> Noise is usually defined as unwanted sound. One person's music may be nothing but noise to another. For example, the sound of rock music from your teenager's hi-fi may be music to him or her, but noise to you if you are trying to converse or relax in an adjoining room. To describe

> noise and its effects on people in a quantitative way, we must include human factors related to the way we perceive noise. These factors include differences in the way our ears hear sounds at different frequencies, whether the sound contains any irritating "screech," such as squeaky chalk on the blackboard, and how long the sound lasts. Applying all these factors enables us to translate from a physical measurement of a sound to its value on a subjective scale.
>
> Sound travels through the air in the form of small waves of tiny air pressure fluctuations. (these waves are similar to the circular waves of motion seen on the surface of the water when a stone is dropped into a pool.) Sound is measured by letting these air pressure fluctuations strike a microphone, and then measuring the electrical signal produced by the microphone. A complete description of the sound must include the magnitude of the pressure at the audible frequencies contained in the sound, and the way the magnitude and frequencies change with time.[1]

Sound levels are commonly measured in units called decibels (dB), and these units are used in a logarithmic scale to define noise according to the perceptions of the human ear. A sound level of zero decibels (0 dB) is the weakest sound normal human ears can detect. Because the scale is logarithmic, a sound ten times more intense than a 0 dB sound has a sound level of 10 dB. A sound 100 times greater than 0 dB has a sound level of 20 dB. In terms of loudness, a sound which is measured as being ten times more intense than another (10 dB higher) is perceived by the human ear as being twice as loud, not ten times as loud.

When combining two sounds, each with equal sound levels, the sum of the sounds is not twice the original level but the original level plus 3 dB. The resulting sound pressure level in decibels from the combined sources would be 3 dB higher than the level produced by either source alone. When combining significantly different sound levels (10 dB or more between the two), the sum is a level not significantly different from that produced by the greater source alone. This is illustrated in Figure 1. Applying this concept to community noise reduction means that the loudest sounds must be quieted in order to achieve real reductions in ambiant levels.

Because of the complex way in which the ear works, strict measurement of noises does not always correlate with their relative loudness of annoyance. Consequently, different scales have been developed to aid in evaluating the importance of different noise sources. Sound, and noise, is usually a variable quantity in the environment. Sounds have variable levels and frequencies, and both of these variables may change with time. The precise measurement of all these variables becomes so complex that the general usefulness is lost except for some scientific purposes. A way is needed to make accurate, comparable measurements of sounds which are related to the effects of those sounds on the human ear.

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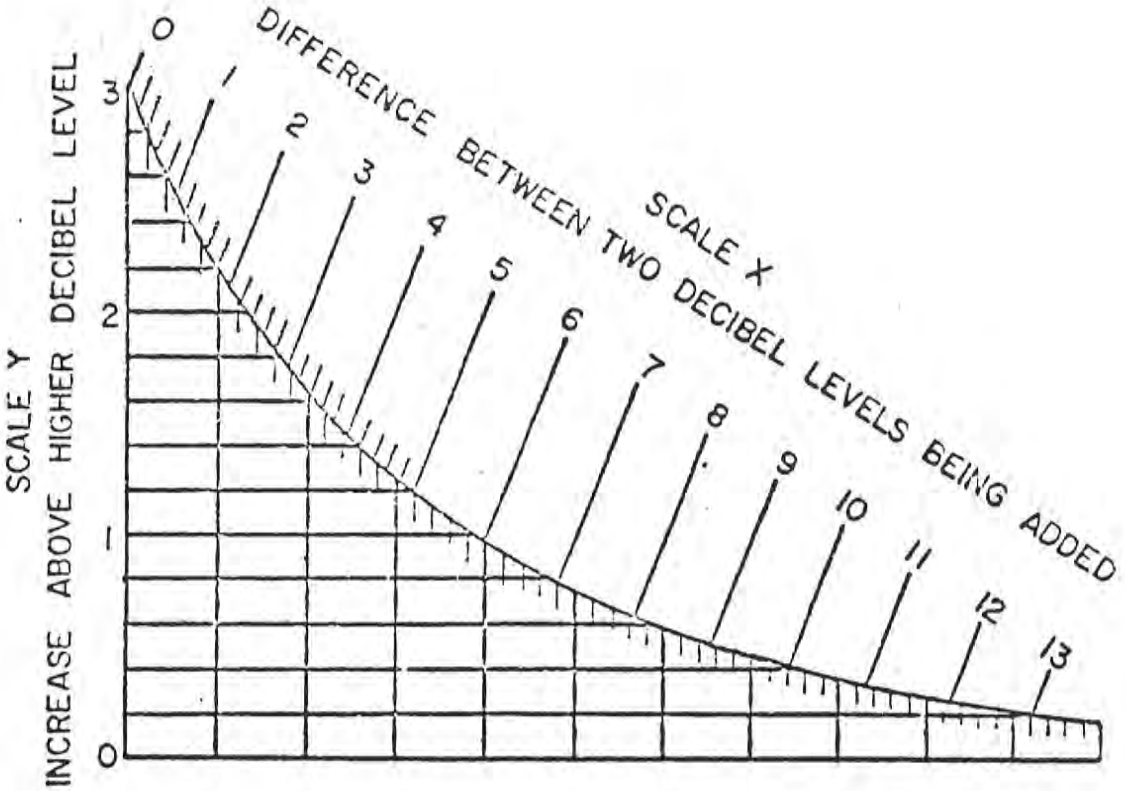
[1] U.S. Department Transportation, Transportation Noise and Its Control (June, 1972), p. 19.

FIGURE 1

CHART FOR COMBINING LEVELS OF UNCORRELATED SOUNDS



The combined noise of a truck (90 dB) and a bus (84 dB) can be calculated in the following manner:

1. Determine the difference in levels (6 dB).
2. Locate 6 dB on Scale X.
3. Read directly across to the left-hand scale (Y) to the answer (approximately 1.0 dB).
4. Add this amount to the higher noise, the truck noise (90 dB + 1.0 dB = 91.0 dB).

The aggregate of these two noise sources is 91 dB.

Source: Measurement of Noise, County of Santa Clara Planning Department, October 1972.

For most purposes, the variable of sound frequency has been eliminated by using a weighting which accounts for the frequency response of the human ear. The human ear is more sensitive to mid-frequency sounds than it is to both high and low frequency sounds. The "A" scale weighting on a sound level meter accounts for the frequency response of the human ear in its measurements and frequency is thus eliminated as a variable in common sound measurements. When a sound level is measured on the A scale, the unit of measurement is the dBA, for example 45 dBA. All measurements of environmental and community noise are made on the dBA scale because they relate to human noise perceptions.

With the sound level being the most important factor for sound measurements, time is the only remaining variable to be eliminated by assumption. There has not been a unanimity of opinion as to the best method of fixing time for environmental noise measurements. Two types of noise measurements are affected by time: (1) the length of exposure to a given sound level, or energy averaged sound level, if the level changes; and (2) the time in the 24 hour day that the sound occurs. Length of exposure is important because this effects the potential for hearing loss as well as the degree to which sounds become annoying to people. Time of day is important because the same sound level occuring at night will usually be much more offensive than during the daytime.

The three systems for dealing with the time variable in sound which are relevant to the sound level measurements taken in Alameda County are presented below:

L_{10}: The most commonly used of a family of statistical sound level measurements, the L_{10} system reflects the level of sound which is exceeded 10% of the time. Intuitively, this results in a sound level measure which reflects nearly the peak sound level during the test period, excluding the top 10% of the noise level as unrepresentative. The L_{10} system used in the California Department of Transportation[1] work was measured at the loudest one hour period of the morning or evening commute. No attempt was made to present noise levels with respect to the different times of day.

L_{dn}: The L_{dn} system of sound level measurement attempts to show a composite, 24 hour representation of the sound level. The exact definition of L_{dn} is complex[2] but it is generally a 24 hour sound measurement which adds a 10 dBA penalty to sounds produced between the night time hours of 10 p.m. and 7 a.m. the next day. Sound levels of this type are sometimes called community sound levels. Bay Area Rapid Transit District, Western Pacific Railroad and the Southern Pacific Transportation Company sound level data will all be in the L_{dn} system.

CNEL: A method very similar to the L_{dn} method, CNEL is a complex expression of community noise levels[2].

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[1] Formerly California State Division of Highways.

[2] See glossary.

The only difference between L_{dn} and CNEL is that CNEL divides the 24 hour day into three parts and uses slightly different penalties. The CNEL system adds a 5 dBA penalty to sounds produced between 7 p.m. and 10 p.m. and a 10 dBA penalty on sounds between 10 p.m. and 7 a.m. the next day. The results of CNEL and L_{dn} measurements may be compared directly with an insignificant loss of accuracy. L_{10} measurements cannot be compared with L_{dn} or CNEL data. Noise levels of the Metropolitan Oakland International Airport are presented in the CNEL system.

Effects of Noise on Human Health:

The effects of noise on man are the basic motivation for understanding and controlling noise. At the upper extreme, noise can cause temporary or permanent loss of hearing. Additionally, noise may cause changes in cardiovascular, gastro-intestinal, endocrine, neurologic, and other physiologic functions, although the medical evidence is not conclusive. At much lower levels of noise, the unwanted sound begins to obscure the wanted sounds such as speech, music or signals; when discussing environmental or community noise levels, this problem of activity interference is the major issue.

Noise Level Standards and References:

Table 1 shows the sound (noise) levels identified by the Federal Environmental Protection Agency (EPA) as requisite to protect the public health and welfare with an adequate margin of safety. The table gives several land use categories, indoors or outdoors, and type of noise problem, activity interference or hearing loss, as factors in specifying problematical noise levels. The noise levels are given in either the L_{dn} noise measurement system explained above or in the L_{eq} system. The L_{eq} method is called the equivalent sound level and represents the average of the energy in the sound over the specified time period. The specified time period is the number in parentheses immediately after the L_{eq}, for example, L_{eq} (24). It should be restated that the energy in sound increases many times faster than the decibel level; louder sounds are counted more heavily in the L_{eq} system than are quieter sounds.

Figure 2 shows information similar to that in Table 1 but from a different source and in another sound measuring system. The noise levels for each land use category were selected in the ABAG sponsered Regional Airport Systems Study and converted from the NEF system to CNEL. The figure gives another interpretation of desirable noise levels similar to the levels of Table 1. (L_{dn} and CNEL are approximately comparable)

Effective August, 1974, the Alameda County Building Code includes specifications for noise levels inside and outside of any new hotels, motels, apartment houses, and attached dwellings. These specifications are contained in Section 3502, Noise Insulation from Exterior Sources". The ordinance adopted a standard of an annual CNEL of 45 dB inside all new residential construction. Further, any proposed residential construction within a CNEL contour of 60 dB requires an acoustical analysis showing that the structure has been designed to limit intruding noise to the prescribed allowable level (45 dB). Noise sources considered are proposed and existing airports, rapid transit systems, railroads, highways, freeways, etc.

Table 1

YEARLY AVERAGE* EQUIVALENT SOUND LEVELS IDENTIFIED AS REQUISITE TO PROTECT THE PUBLIC HEALTH AND WELFARE WITH AN ADEQUATE MARGIN OF SAFETY

	Measure	Indoor Activity Interference	Indoor Hearing Loss Consideration	Indoor To Protect Against Both Effects (b)	Outdoor Activity Interference	Outdoor Hearing Loss Consideration	Outdoor To Protect Against Both Effects (b)
Residential with Outside Space and Farm Residences	L_{dn}	45		45	55		55
	$L_{eq(24)}$		70			70	
Residential with No Outside Space	L_{dn}	45		45			
	$L_{eq(24)}$		70				
Commercial	$L_{eq(24)}$	(a)	70	70(c)	(a)	70	70(c)
Inside Transportation	$L_{eq(24)}$	(a)	70	(a)			
Industrial	$L_{eq(24)(d)}$	(a)	70	70(c)	(a)	70	70(c)
Hospitals	L_{dn}	45		45	55		55
	$L_{eq(24)}$		70			70	
Educational	$L_{eq(24)}$	45		45	55		55
	$L_{eq(24)(d)}$		70			70	
Recreational Areas	$L_{eq(24)}$	(a)	70	70(c)	(a)	70	70(c)
Farm Land and General Unpopulated Land	$L_{eq(24)}$				(a)	70	70(c)

Code:

a. Since different types of activities appear to be associated with different levels, identification of a maximum level for activity interference may be difficult except in those circumstances where speech communication is a critical activity. (See Figure D-2 for noise levels as a function of distance which allow satisfactory communication.)
b. Based on lowest level.
c. Based only on hearing loss.
d. An $L_{eq(8)}$ of 75 dB may be identified in these situations so long as the exposure over the remaining 16 hours per day is low enough to result in a negligible contribution to the 24-hour average, i.e., no greater than an L_{eq} of 60 dB.

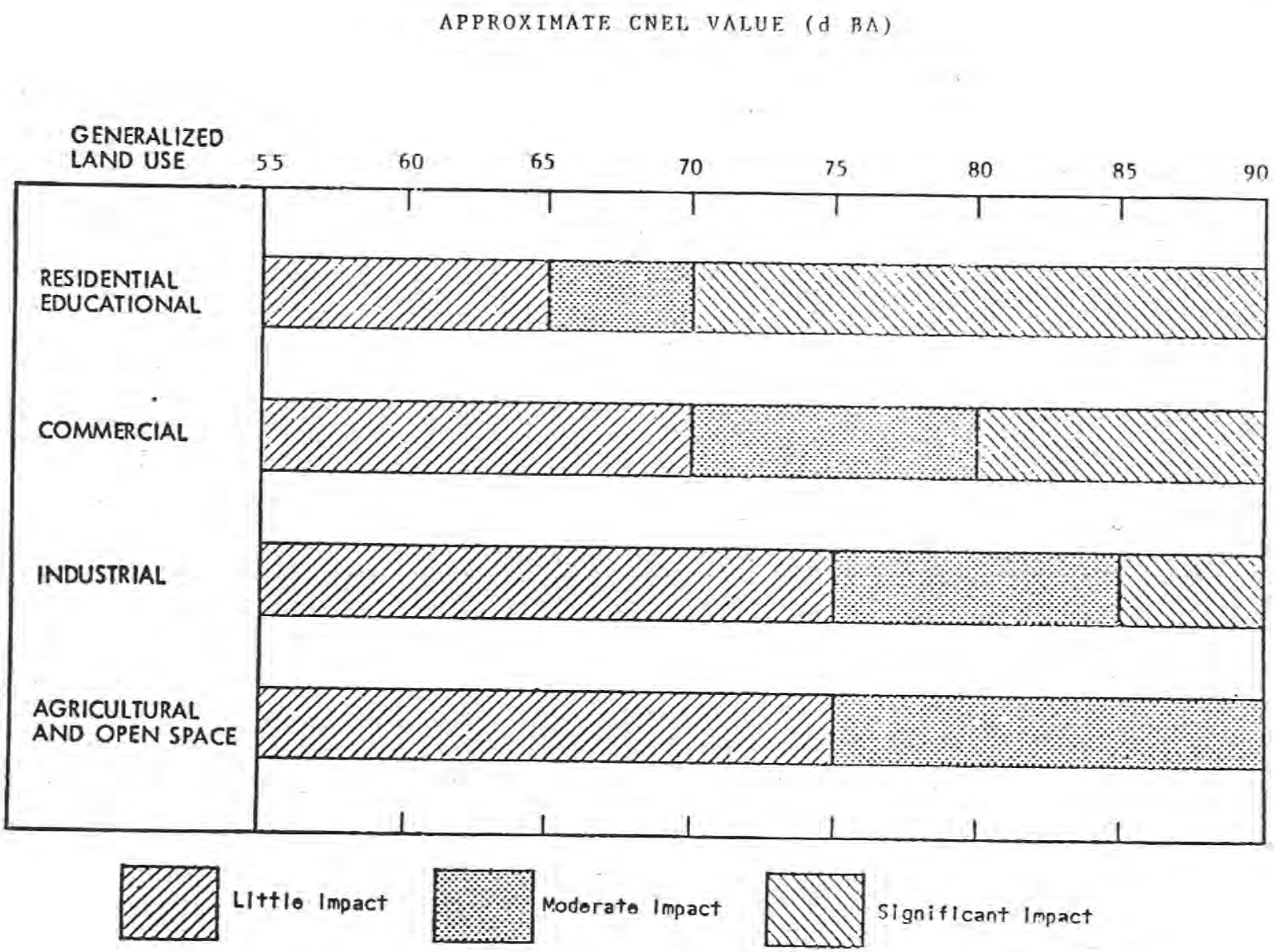
Note: Explanation of identified level for hearing loss: The exposure period which results in hearing loss at the identified level is a period of 40 years.

*Refers to energy rather than arithmetic averages.

Source: U.S. Environmental Protection Agency, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety (March, 1974), p. 29.

Figure 2

SIMPLIFIED LAND USE INTERPRETATIONS OF COMMUNITY EQUIVALENT LEVEL NOISE EXPOSURE

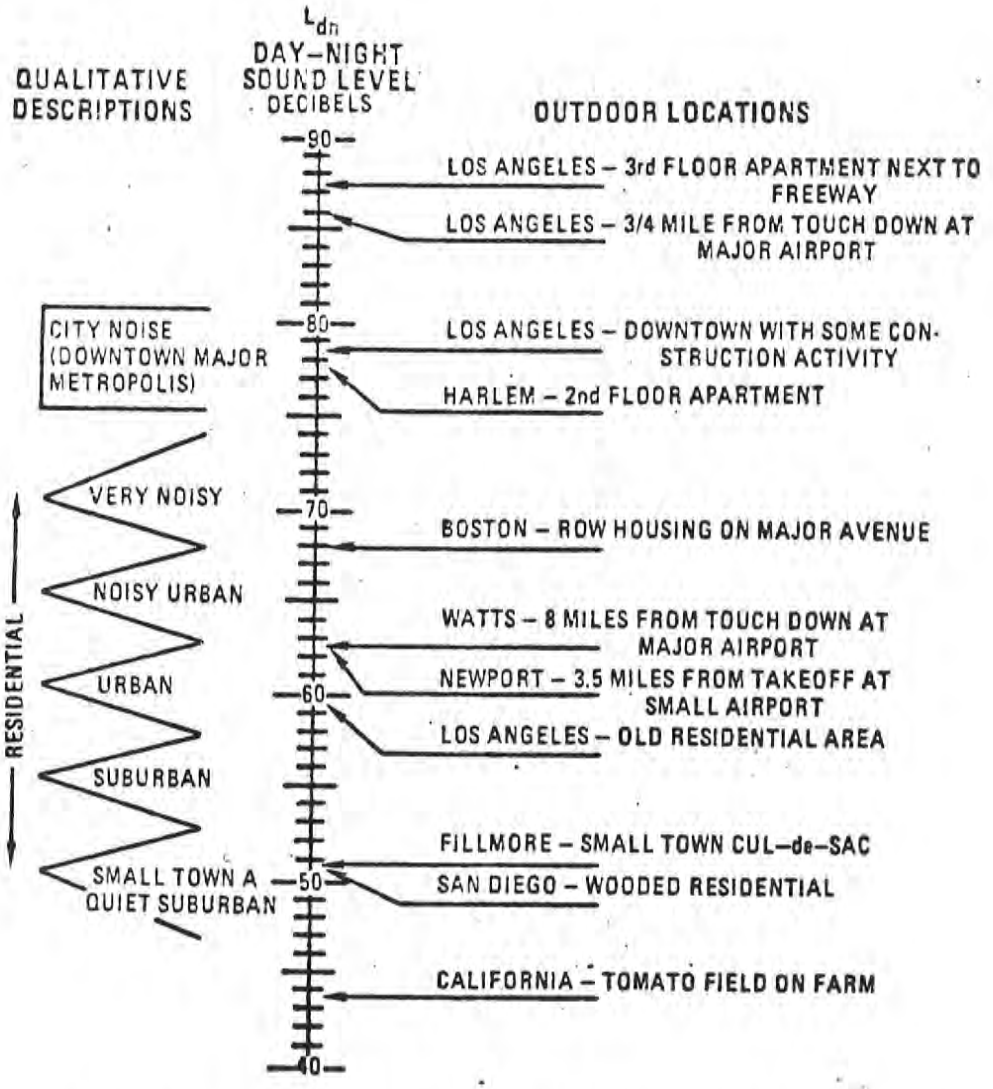


Source: Adopted from Regional Airport Systems Study, Final Plan (June, 1972), by Alameda County Planning Department, July, 1975.

As a qualitative reference, Figure 3 shows some typical community noise level measurements for different outdoor locations. Table 2 also correlates decibel levels with familar sounds.

Figure 3

OUTDOOR DAY-NIGHT SOUND LEVEL IN dB AT VARIOUS LOCATIONS



Source: U.S. Environmental Protection Agency, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety (March, 1974), p. 14.

TABLE 2

SOUND LEVEL AND LOUDNESS OF TYPICAL SOUNDS
IN INDOOR AND OUTDOOR ENVIRONMENTS

dBA	SUBJECTIVE IMPRESSION	COMMUNITY* (Outdoor)	HOME OR INDUSTRY* (Indoor)	RELATIVE LOUDNESS (Human Judgment of Different Sound Levels)
130	Painful	Military Jet Aircraft Take-Off With After-Burner From Aircraft Carrier @ 50 Ft. (130)	Oxygen Torch (121)	32 Times as Loud
120	Uncomfortably Loud	Turbo-Fan Aircraft @ Take-Off Power @ 200 Ft. (118)	Rock-N-Roll Band (108-114)	16 Times as Loud
110		Jet Flyover @ 1000 Ft. (103) Boeing 707, DC-8 @ 6080 Ft. Before Landing (106), Bell J-2A Helicopter @ 100 Ft. (100)		8 Times as Loud
100	Very Loud	Boeing 737, DC-9 @ 6080 Ft. Before Landing (97), Motorcycle @ 25 Ft. (90)	Newspaper Press (97)	4 Times as Loud
90		Car Wash @ 20 Ft. (89), Prop. Plane Flyover @ 1000 Ft. (88), Diesel Truck, 40 MPH @ 50 Ft. (84), Diesel Train, 45 MPH @ 100 Ft. (83)	Food Blender (88) Milling Machine (85)	2 Times as Loud
80				

*Numbers in parenthesis are A-Levels

(CONTINUED NEXT PAGE)

TABLE 2 (Contd.)

dBA	SUBJECTIVE IMPRESSION	COMMUNITY* (Outdoor)	HOME OR INDUSTRY* (Indoor)	RELATIVE LOUDNESS (Human Judgment of Different Sound Levels)
80	Moderately Loud	High Urban Ambient Sound (80), Passenger Car, 65 MPH @ 25 Ft. (77), Freeway @ 50 Ft. from Pavement Edge, 10 a.m. (76 ± 6)	TV-Audio, Vacuum Cleaner (70)	REFERENCE LOUDNESS 70 dBA
70		Air Conditioning Unit @ 100 Ft. (60)	Cash Register @ 10 Ft. (65-70), Electric Typewriter @ 10 Ft. (64), Dishwasher (Rinse) @ 10 Ft. (60), Conversation (60)	1/2 as Loud
60		Large Transformers @ 100 Ft. (50)		1/4 as Loud
50	Quiet			
40		Bird Calls (44), Lower Limit Urban Ambient Sound (40)		1/8 as Loud
	Just Audible	(dBA Scale Interrupted)		
10	Threshold of Hearing			
0				

Source: HUD Noise Assessment Guidelines Technical Background, Bolt, Beranek and Newman, Inc., December 1971.

Cities within Alameda County have provided input to the County Noise Element during the preparations and hearing stages. In addition the County, at the request of the City Managers is investigating means of providing a continuing data base on noise for use of all jurisdictions within the County.

Airport Land Use Commission (ALUC):

The Alameda County Airport Land Use Commission staffed by the Alameda County Planning Department consists of seven members and has a basic assignment of formulating a comprehensive, long range plan for each airport and its surroundings so as to provide for orderly growth of the airport and airport planning area, to safeguard the general welfare of the inhabitants in the County and the public in general. Within the airports planning area the Commissioners may determine standards, including soundproofing adjacent to airports.

California Airport Noise Standards[1]

In 1969, the California Public Utilities Code was amended, directing the Division of Aeronautics to

> "...adopt noise standards governing the operation of aircraft and aircraft engines for airports operating under a valid permit issued by the department (division) to an extent not prohibited by federal law. The standards shall be based upon the level of noises acceptable to a reasonable person residing in the vicinity of the airport."

The legislation stated that:

> "Statewide uninformity in standards of acceptable airport noise need not be required, and the maximum amount of local control and enforcement shall be permitted.
>
> Due consideration shall be given to the economic and technological feasibility of complying with the standards promulagated".

Implementation of the legislation has been slow due to the requirement for complex and expensive noise monitoring systems at noise problem airports.

Airport Noise Standards, in the California Administrative Code (1970) are measured in CNEL with 65 dB as the level of noise acceptable to a reasonable person residing in the vicinity of an airport.

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[1] Source: An Investigative Study of California Experience in Airport Noise Regulation, Harrison C. Dunning. Final Report to Environmental Protection Agency, June 12, 1975.

III. Noise Levels in Alameda County

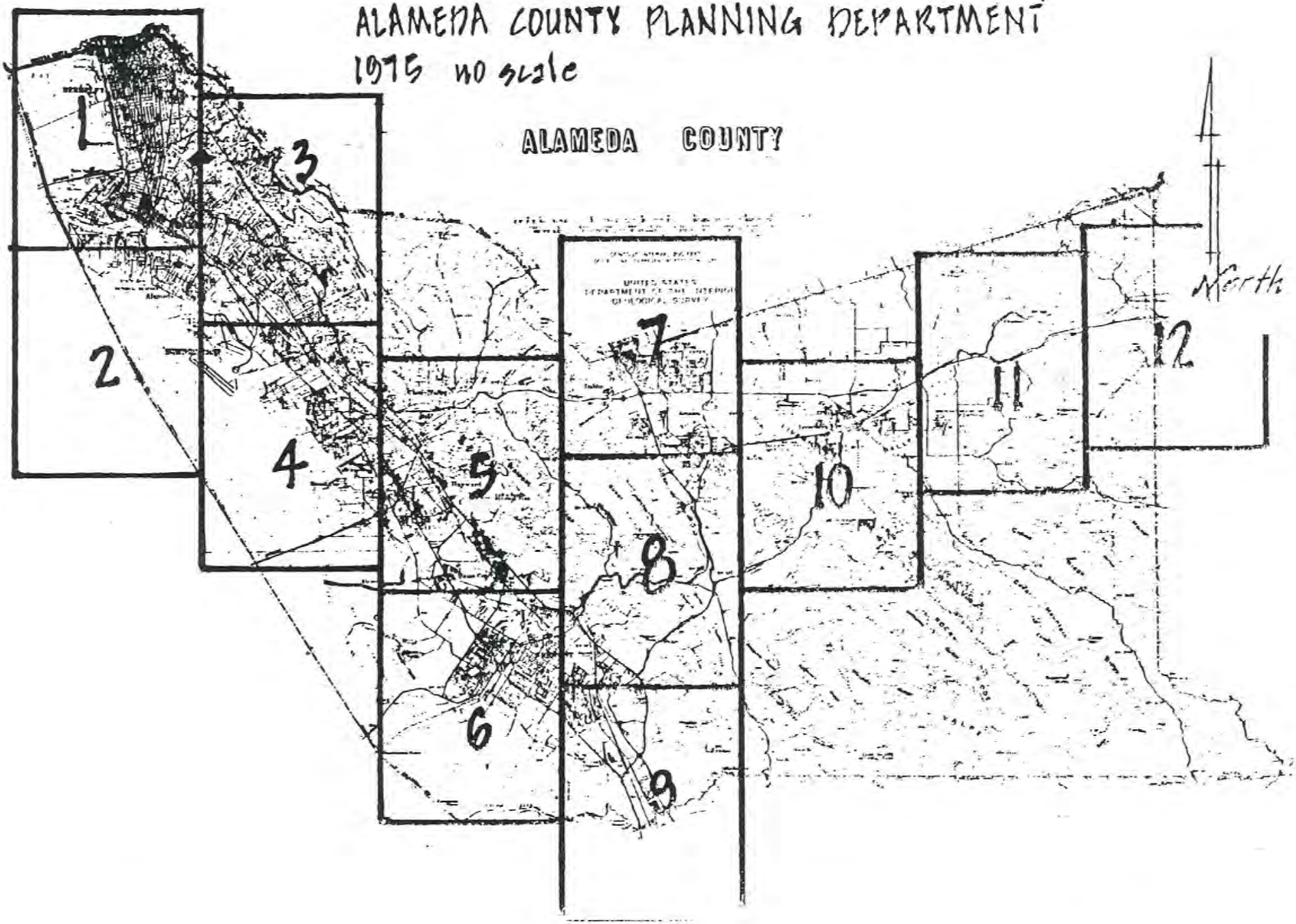
The existing noise environment in Alameda County is the result of many noise sources, however, transportation systems are the largest single contributor. Noise contours, representing lines of equal sound/noise levels, have been shown adjacent to selected transportation facilities in the County. For purposes of clarity, only the lower level contours have been shown for most transportation facilities.[1] Generally, the projected noise contours are based on the existing conditions and the assumptions on growth of the particular facility. Not all of the noise levels are projected to the same year.

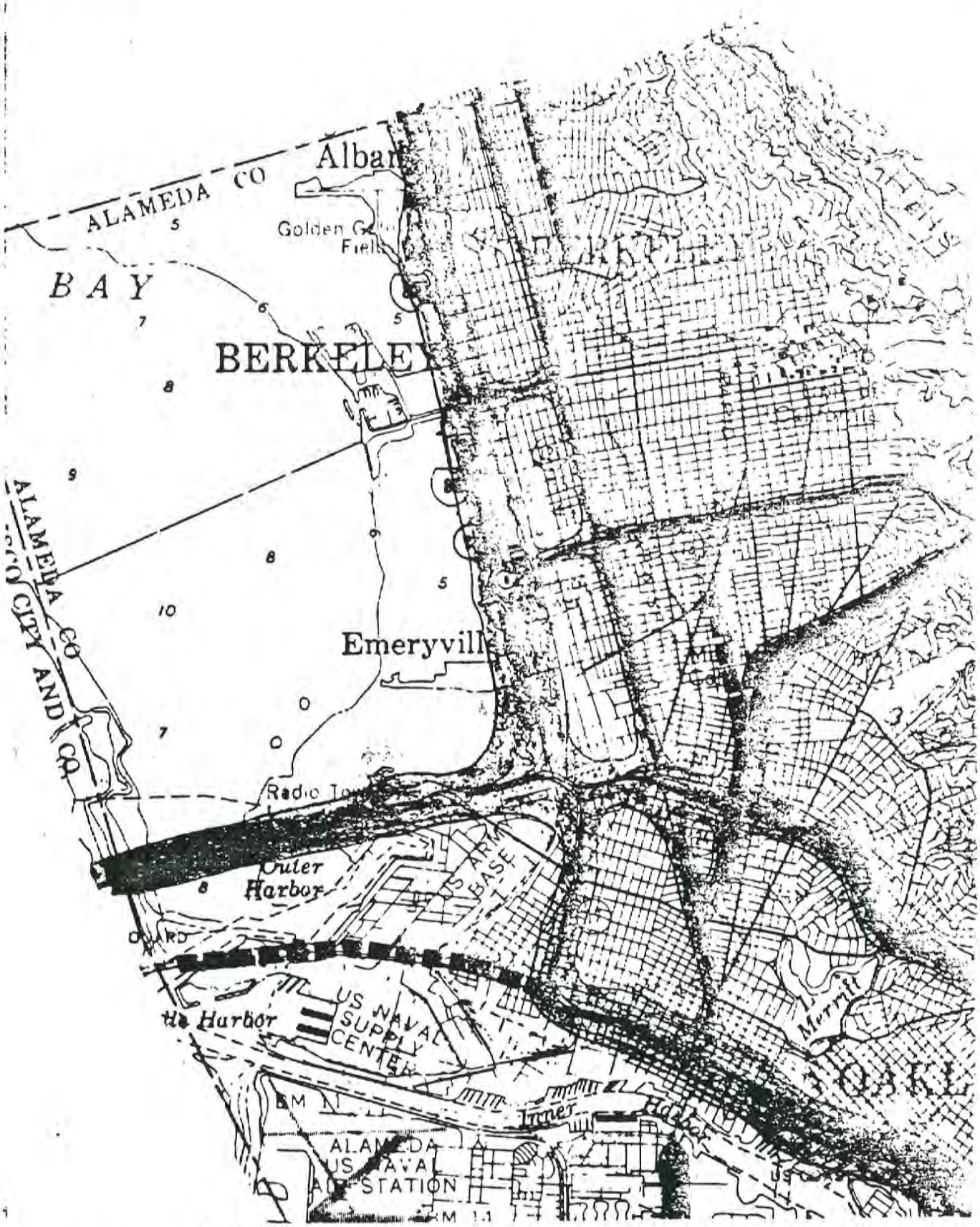
This section contains maps of 65 dB CNEL, L_{dn}, or L_{10} noise contours for major highways and BART. The scale of these maps is 1" to 62,500 feet and show only the existing 65 dB 1975 contour. Because of the small scale the 1990 65 dB contours would vary from 1/16 of an inch wider on each side to that shown for 1975. Information on these maps is plotted directly from maps prepared by Cal Trans and BART. The BART noise contours are shown in constant width only to identify the location of the impacted area. The noise contours vary significantly and are only relevant at the large scale originals on file with BART.

Some of the areas where data is lacking are: Highway 84 between Sunol and Livermore and the Livermore Airport. This information will be provided as it becomes available.

[1] The complete background data showing greater detail is available at the Alameda County Planning Department, 399 Elmhurst Street, Hayward.

INDEX MAP OF NOISE ELEMENT MAPS
ALAMEDA COUNTY PLANNING DEPARTMENT
1975 no scale

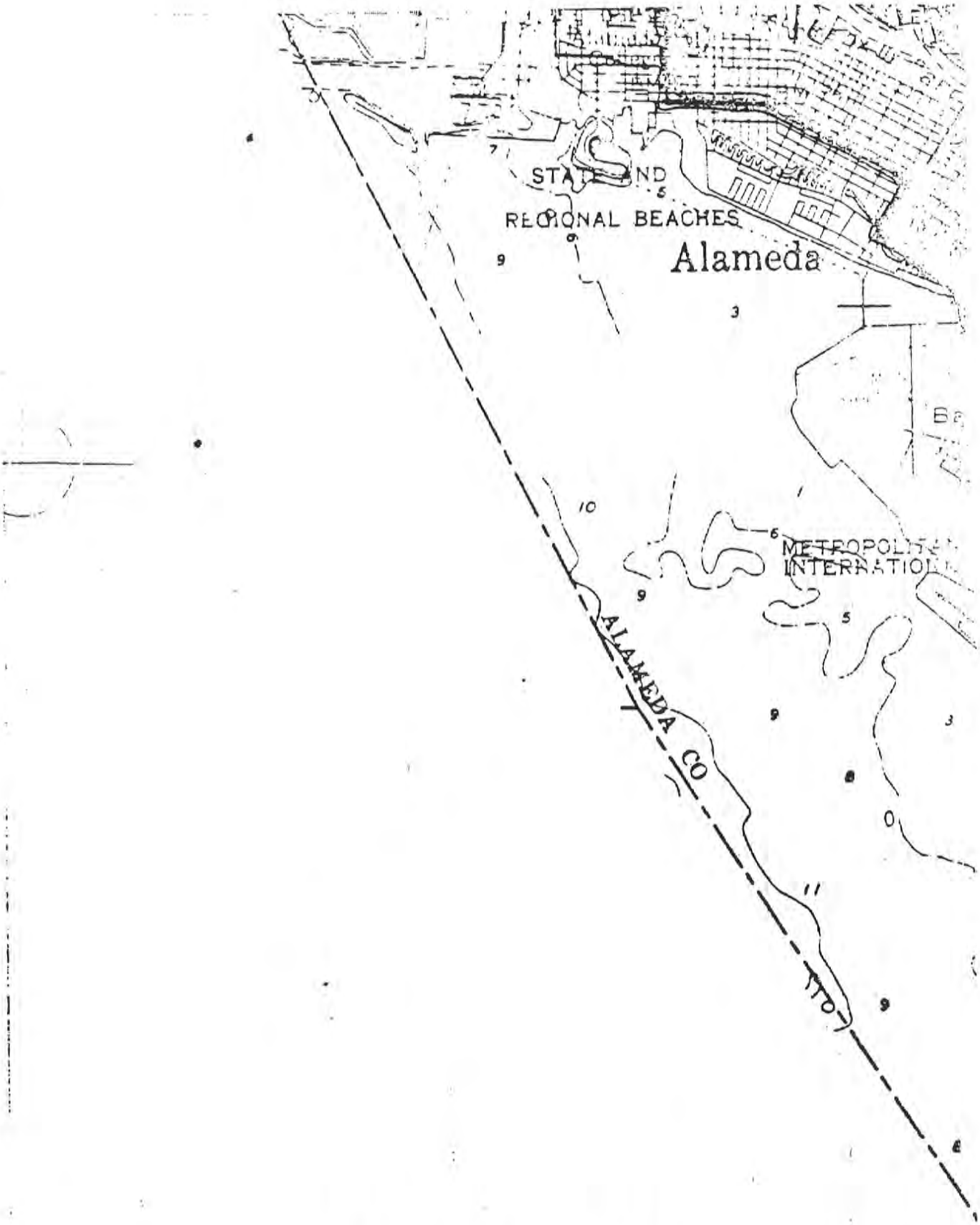




NOISE ELEMENT

ALAMEDA COUNTY

SOURCE: 1975 - CNEL dB L-10 SCALE: 1" = 1 mile
CALIF. DEPT. OF TRANSPORTATION



NOISE ELEMENT

ALAMEDA COUNTY

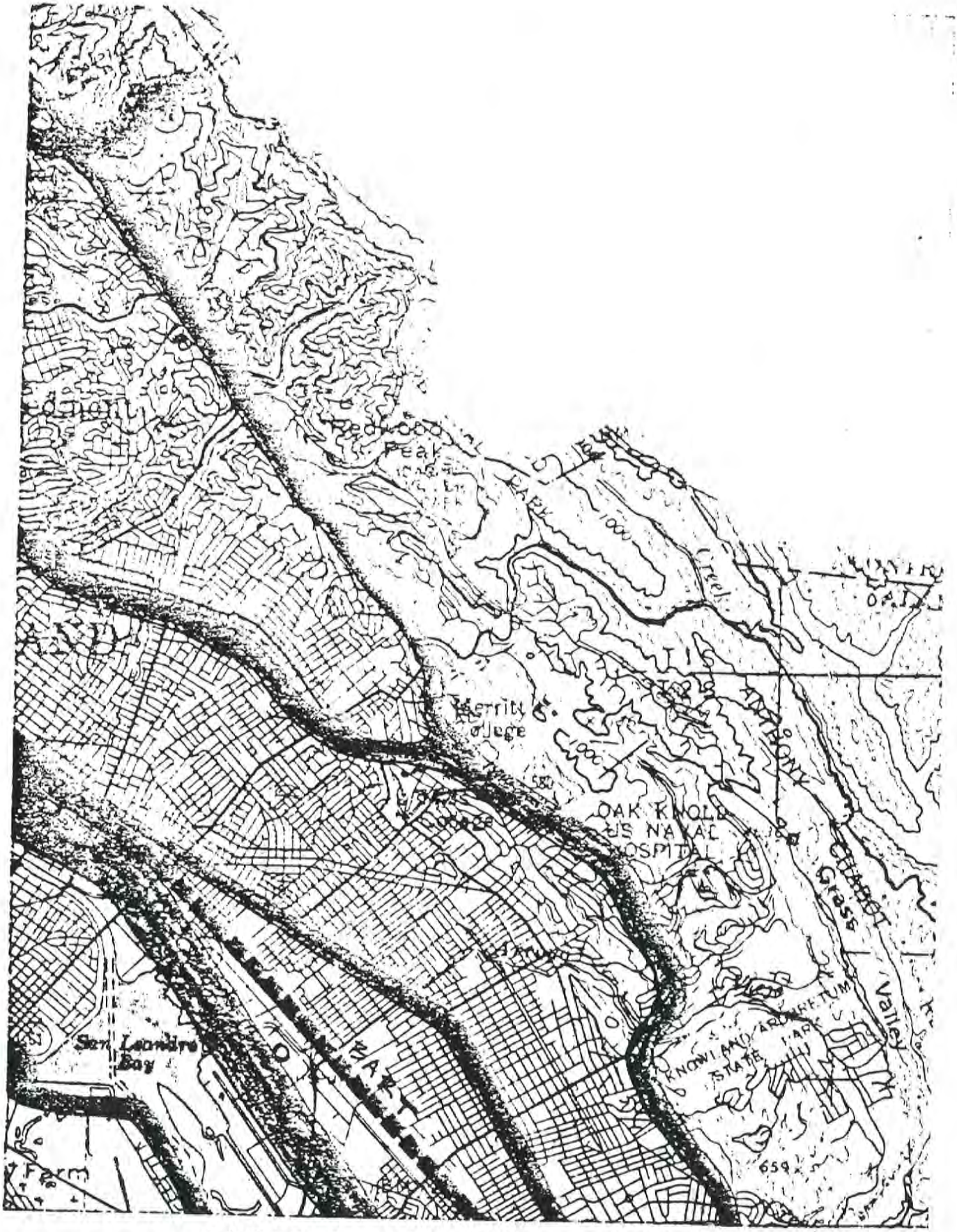
SOURCE: 1975 - CSdb$_{L-10}$ SCALE: 1" = 1 mile

CALIF. DEPT. OF TRANSPORTATION

North

4-13c

2



NOISE ELEMENT

ALAMEDA COUNTY

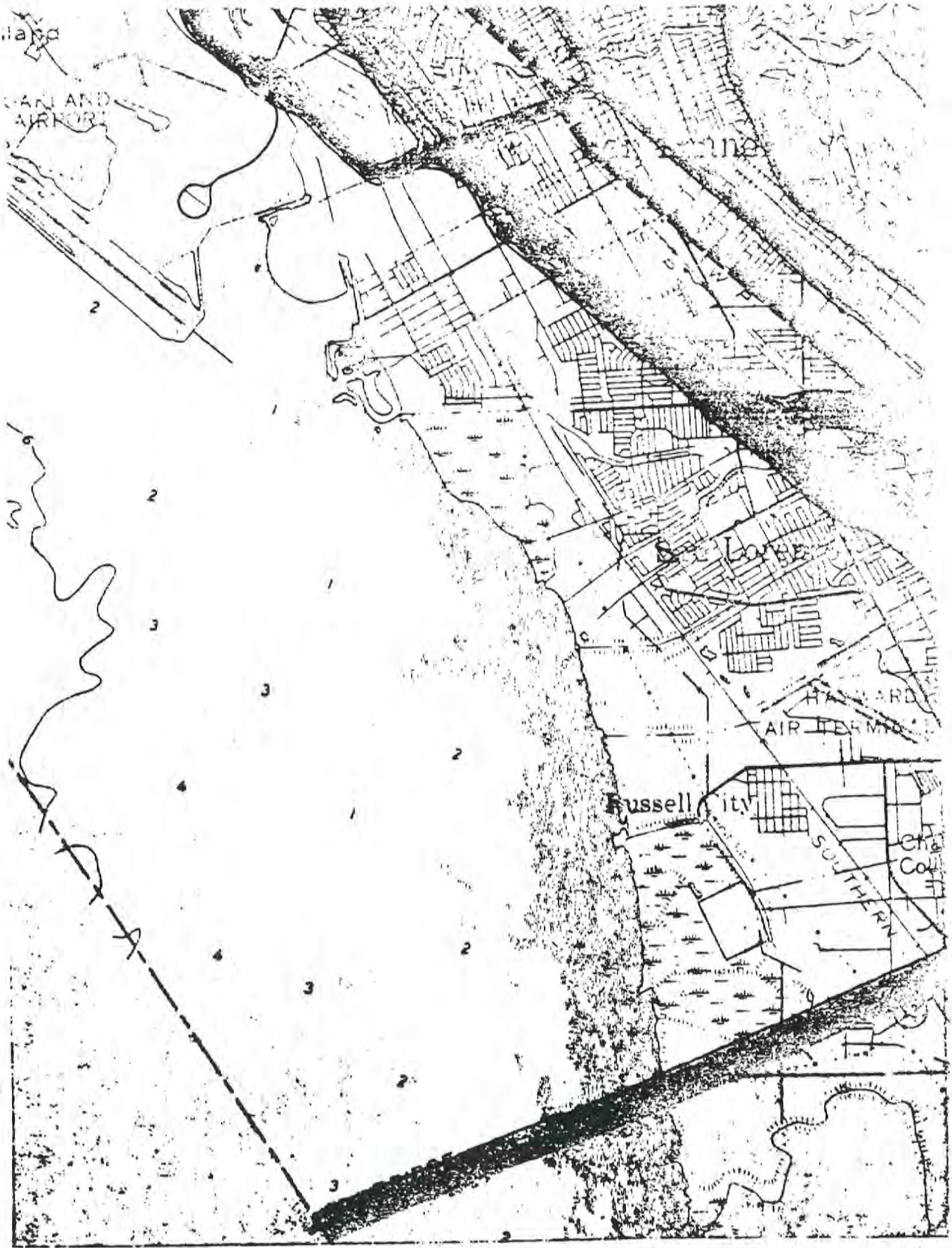
SOURCE: 1975 - 65 dB L-10 SCALE: 1" = 1 mile

CALIF. DEPT. OF TRANSPORTATION

4-13d

North

3



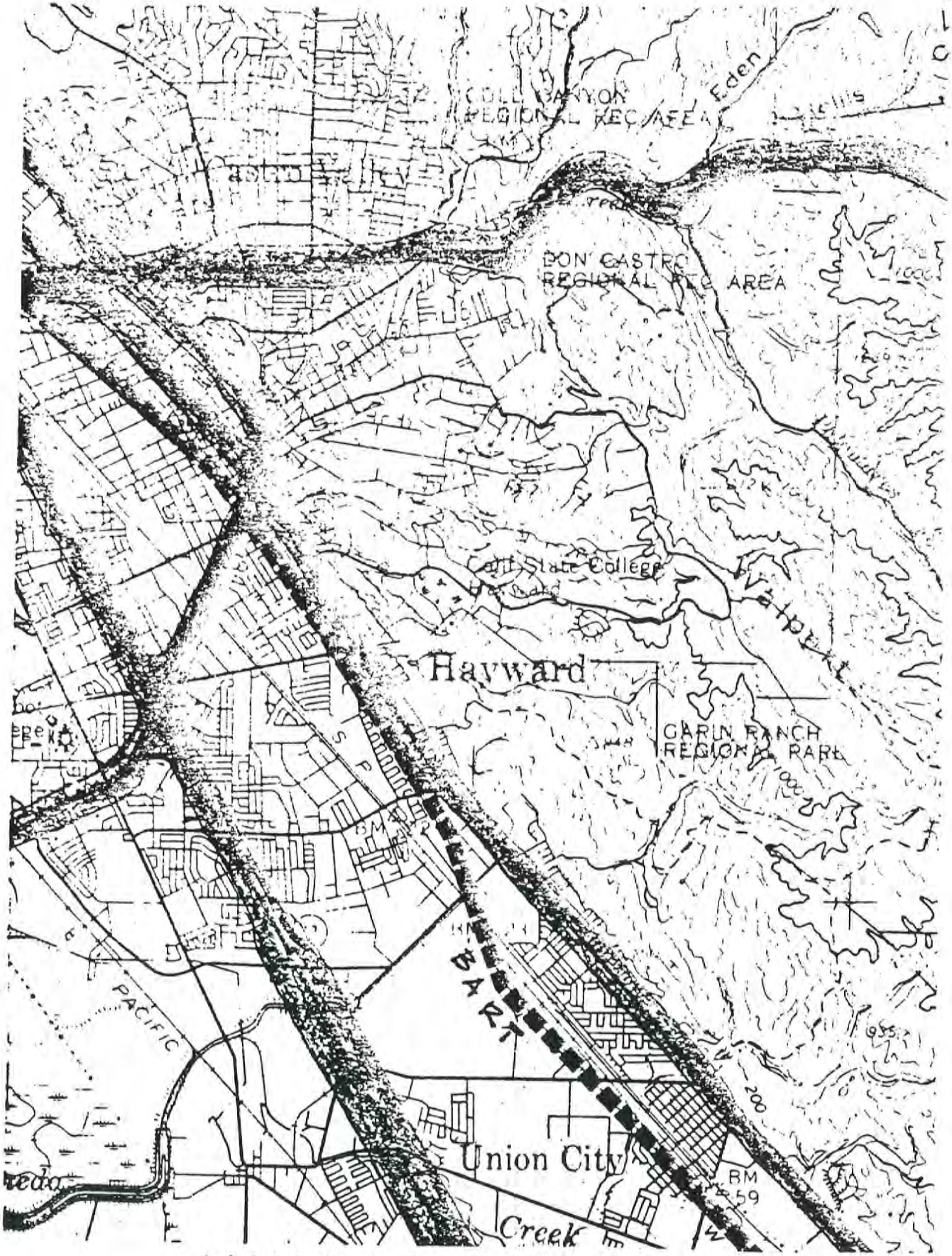
NOISE ELEMENT

ALAMEDA COUNTY

SOURCE: 1975 - CSdb$_{L-10}$ SCALE: 1" = 1 mile
CALIF. DEPT. OF TRANSPORTATION

North

4



NOISE ELEMENT

ALAMEDA COUNTY

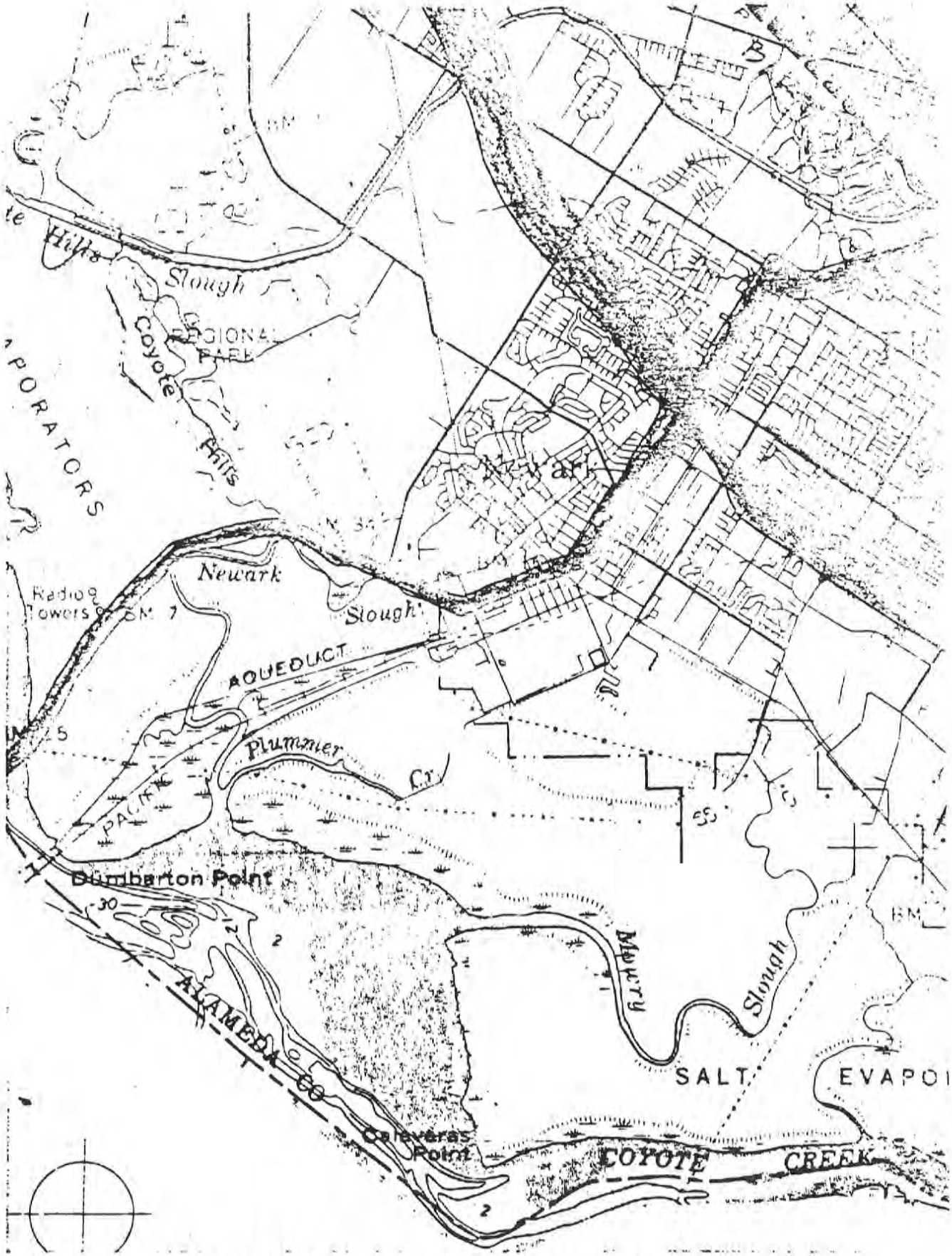
SOURCE: 1975 - 65 dB_{L-10} SCALE: 1" = 1 mile

CALIF. DEPT. OF TRANSPORTATION

North

5

4-13f

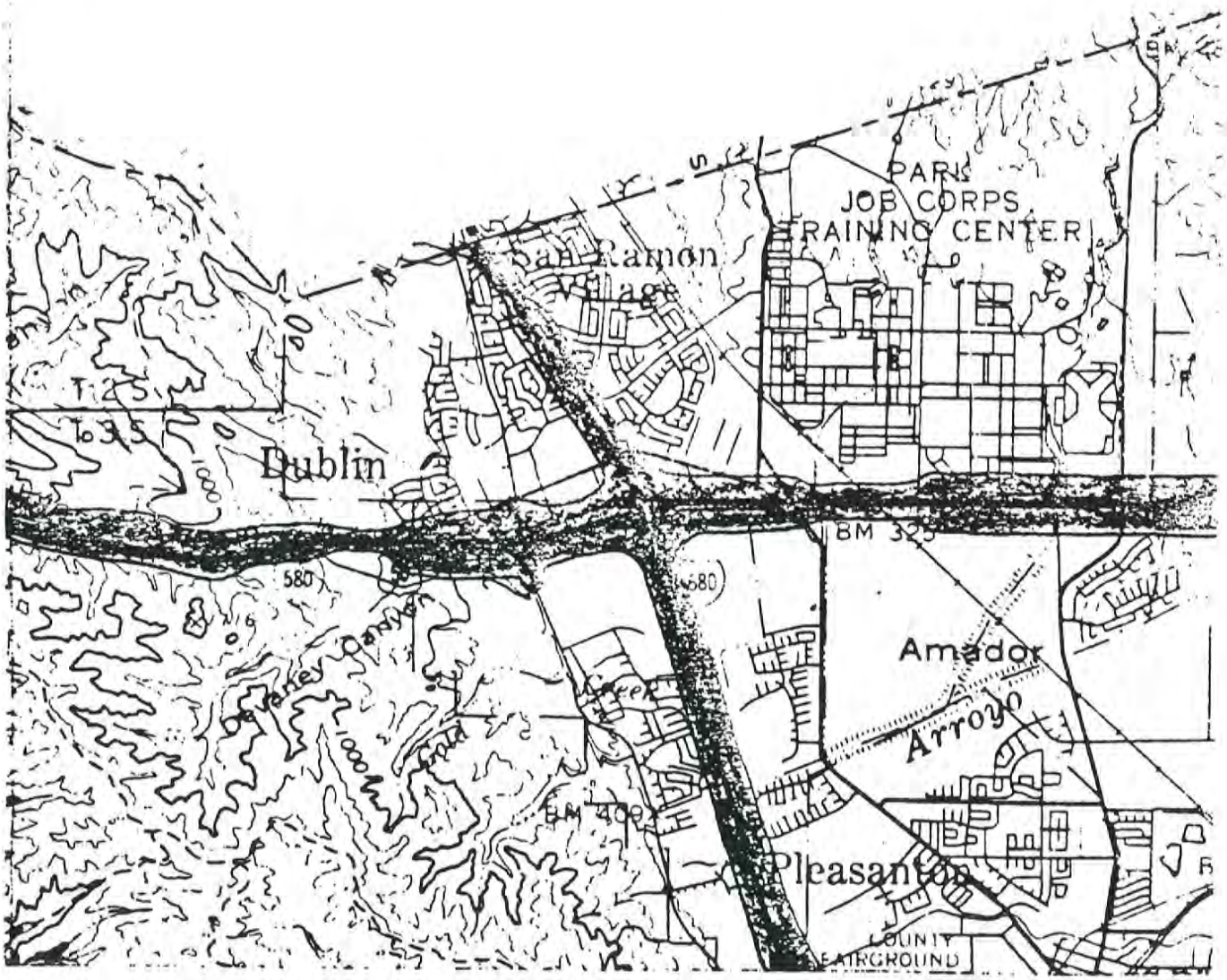


NOISE ELEMENT

ALAMEDA COUNTY

SOURCE: 1975 - 65 db L-10 SCALE: 1" = 1 mile 4-13g

CALIF. DEPT. OF TRANSPORTATION



NOISE ELEMENT

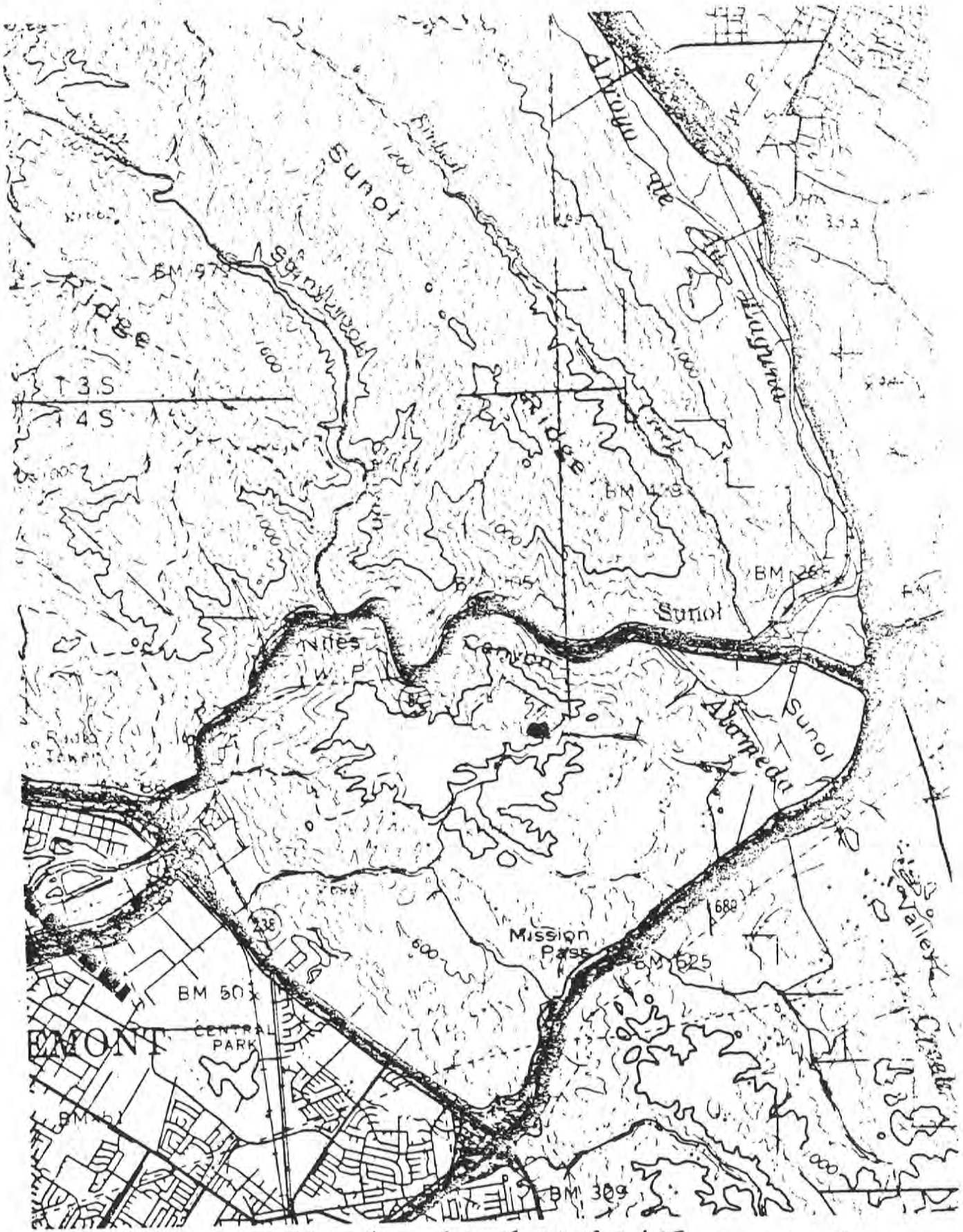
ALAMEDA COUNTY

SOURCE: 1975 - CS dbL-10 SCALE: 1" = 1 mile
CALIF. DEPT. OF TRANSPORTATION

North

4-13h

7



NOISE ELEMENT

ALAMEDA COUNTY

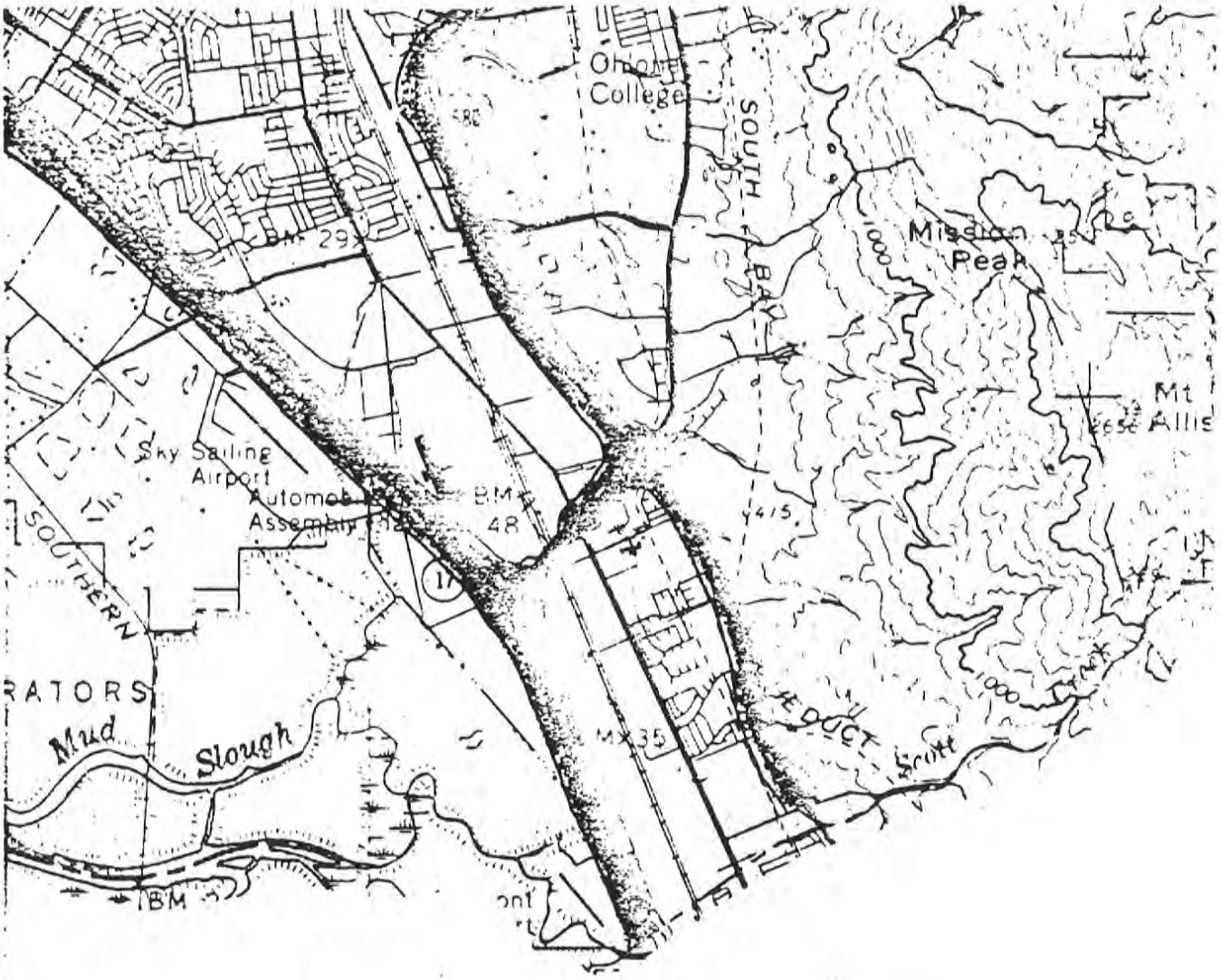
SOURCE: 1975 - US 66 L-10 SCALE: 1" = 1 mile

CALIF. DEPT. OF TRANSPORTATION

4-13i

North

8



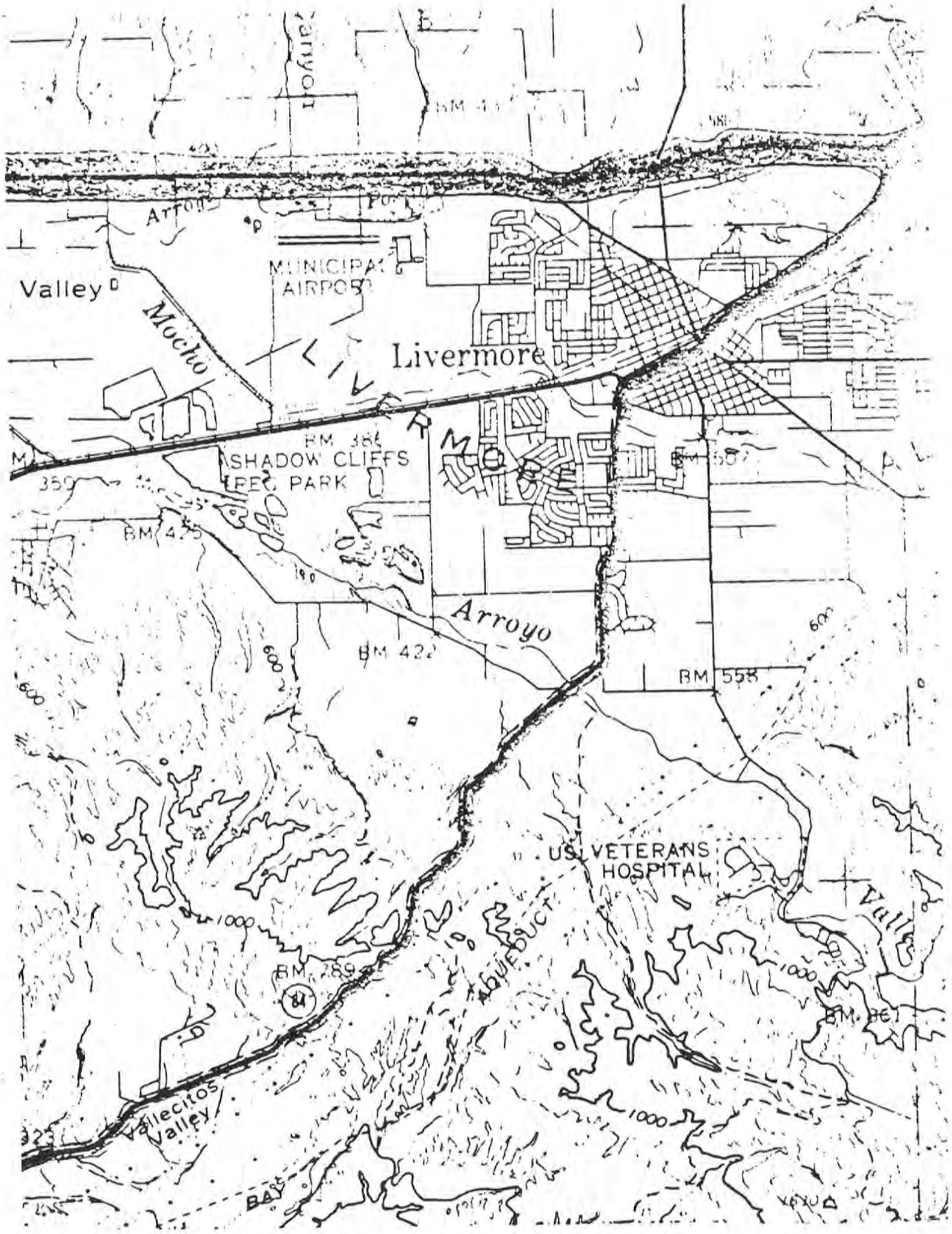
NOISE ELEMENT

ALAMEDA COUNTY

SOURCE: 1975 - US dbL-10 SCALE: 1" = 1 mile
CALIF. DEPT. OF TRANSPORTATION

North

4-13j



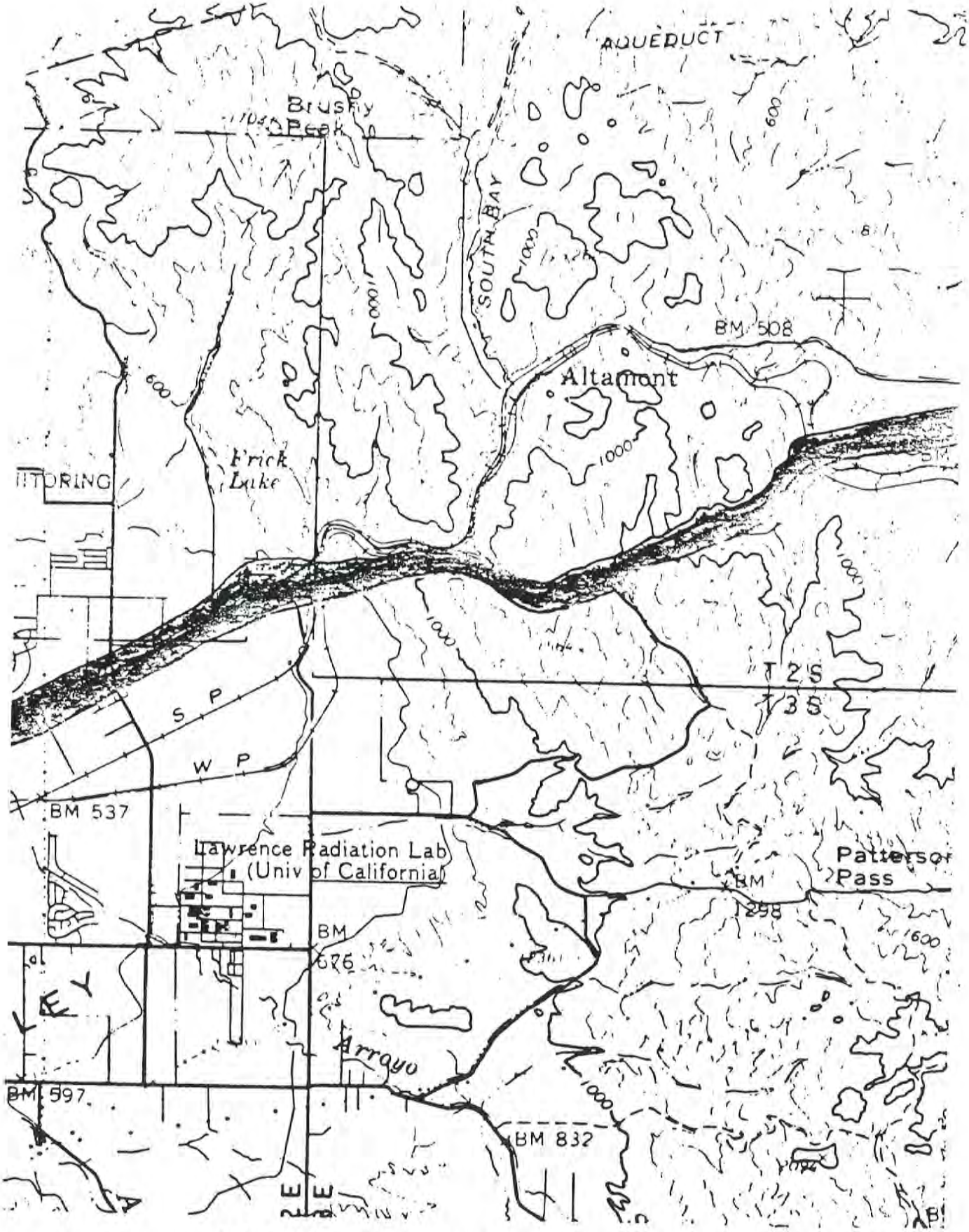
NOISE ELEMENT

ALAMEDA COUNTY

SOURCE: 1975 - 65 db L_{10} SCALE: 1" = 1 mile

CALIF. DEPT. OF TRANSPORTATION

4-13k



NOISE ELEMENT

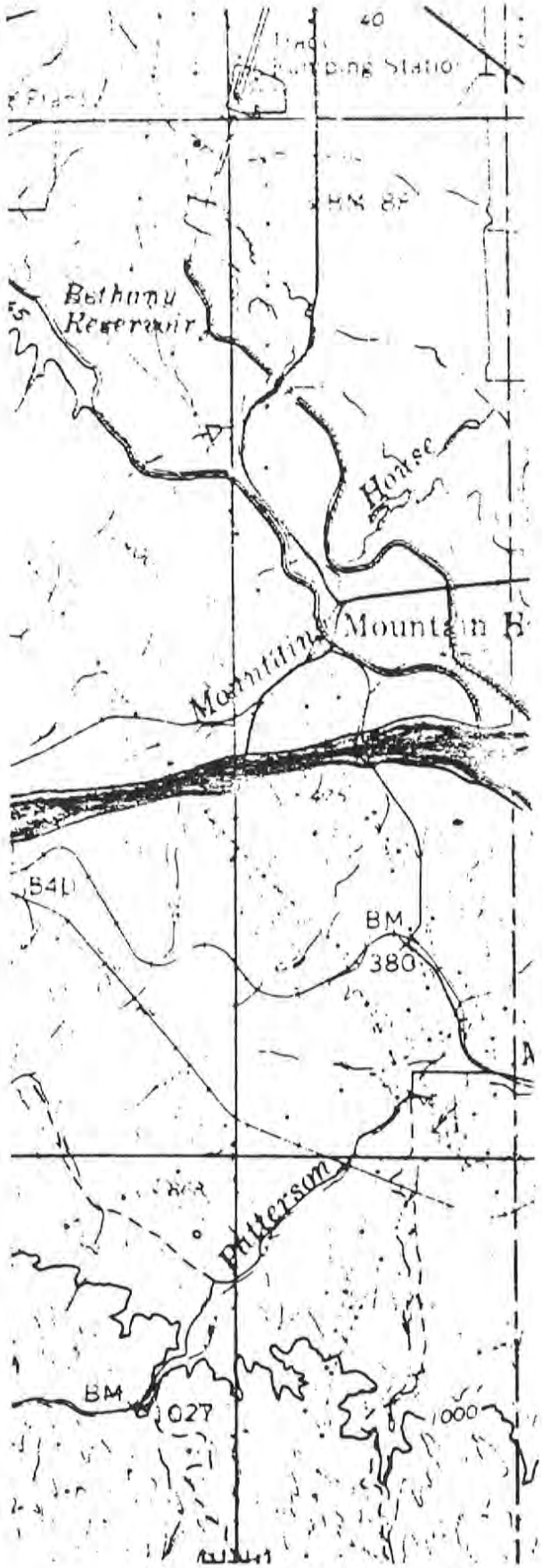
ALAMEDA COUNTY

SOURCE 1975 - CSdbL-10 SCALE: 1" = 1 mile

CALIF. DEPT. OF TRANSPORTATION

North

11



NOISE ELEMENT

ALAMEDA COUNTY

SOURCE: 1975 - 65 dB L-10 SCALE: 1" = 1 mile
CALIF. DEPT. OF TRANSPORTATION

North

4-13m

12

IV. PLANNING CONSIDERATIONS IN UNINCORPORATED AREA, ALAMEDA COUNTY

Because noise is a type of environmental pollution which has detrimental effects on human health, it is a responsibility of all levels of government to control undesirable noise. Local government can discourage the development of noise sensitive land uses-homes, schools, hospitals, libraries, rest homes, etc - in highway noise impacted areas. or local government can ensure that any development which occurs is planned to minimize the adverse effects of noise.

A major planning consideration is the compatibility of land uses with respect to noise. Users of residential land are sensitive to noise, while users of industrial and agricultural land are less sensitive, for example, there are two basic types of methods available for the prevention of noise incompatible with land use: (1) the physical techniques which reduce noise impacts, and (2) the administrative methods available to local governments to encourage their use.

1. Physical Techniques: Architectural designers, developers and builders can employ acoustical site planning, acoustical architectural design, acoustical construction methods, and barrier construction.

> "Acoustical site design uses the arrangement of buildings on a tract of land to minimize noise impacts by capitalizing on the sites natural shape and contours. Open space, non-residential land uses, and barrier buildings can be arranged to shield residential areas or other noise sensitive activities from noise, and residences can be oriented away from noise".
>
> "Acoustical architectural design incorporates noise reducing concepts in the details of individual buildings. The areas of architectural concern include building height, room arrangement, window placement, and balcony and courtyard design.
>
> "Acoustical construction involves the use of building materials and techniques to reduce noise transmission through walls, windows, doors, ceilings, and floors. This area includes many of the new and traditional (soundproofing) concepts.
>
> "Noise barriers can be erected between noise sources and noise-sensitive areas. Barrier types include beams made of sloping mounds of earth, walls and fences constructed of a variety of materials, thick plantings of trees and shrubs, and combinations of these materials."[1]

2. Administrative Techniques: Administrative techniques to ensure that physical methods of noise minimization are implemented may be categorized into five groups: (1) zoning; (2) legal restrictions such as subdivision control,building and health codes; (3) public ownership or control of the land; (4) financial incentives for compatible development; and (5) educational and advisory services.

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[1] Urban Systems Research and Engineering, Inc. for U.S. Department of Transportation, The Audible Landscape: A Manual for Highway Noise and Land Use (November, 1974),p.34.

While certain land uses are associated with higher noise levels (quarry, industrial, commercial, circulation), areas within a community which suffer from excessive noise may not coincide with traditional zoning districts. As a result, a method to define the areas where acoustical regulations could apply needs to be investigated. Zoning specifications could be applied to newly created noise impacted zones or to a single "overlay zone" which is superimposed over regular zoning.

> "Zoning can be used in four ways to insure that future development will be compatible with nearby noise sources:
> 1. by exclusion of typically incompatible uses from noise impacted areas,
> 2. by regulating specific details of development design or construction,
> 3. by permitting, special development techniques such as cluster and planned unit development which enable noise compatible site design, and
> 4. by defining the areas of applicability of other local regulations."[1]

Noise compatible land use controls also include other ordinances besides zoning. Subdivision ordinances can require acoustical site planning of the development or noise barrier construction. Building codes may specify construction techniques and details (such as insulation and sealed windows). Health codes may establish noise level standards for habitable buildings. If they are exceeded, the building can be declared uninhabitable, or local laws may require that an occupancy permit be received before a building can be used. The individual review of each building application is a special permit procedure which can be included in the zoning ordinance or the general city/county ordinance code. Also, the environmental impact review process could include noise impacts of the project which would require site-specific acoustical analysis.

If the local government owns the noise-impacted land, it could keep the land vacant or develop it with noise compatible land uses. Financial incentives to deal with noisy areas could include assessing undeveloped and underdeveloped land at a low rate, reducing pressures on landowners to sell because of high property taxes. Government could also provide, at low cost, information concerning noise compatibility measures to builders, developers, architects, and the general public.

Another planning consideration is the abatement of highway and circulation noise. Noise created by highway traffic permeates communities quite distant from the highway. Community noise levels are controlled or influenced by noise from one or more highways within a certain distance and by single-vehicle noise from immediately adjacent streets. While trucks are the greatest source of highway noise, motorcycles and sports cars can be as noisy as trucks and are often judged by the public to be even more annoying. The way in which these vehicles are operated is

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1 Urban Systems Research and Engineering, Inc., for U. S. Department of Transportation, The Audible Landscape: A Manual for Highway Noise and Land Use (November, 1974), p. 11.

a particular problem and accounts for much of the noise problem on both highways and local streets. Thus, highway and land use planners can curtail the noise from traffic that adversely affects sensitive land uses by constructing barriers, elevating or depressing highways, regulating speed limits, limiting access of certain vehicles to particular routes by time of day, and providing for compatible use of land adjacent to highways and expressways.

While a noise ordinance has little or no effect on controlling the compatibility of land uses constructed in areas where noise exists, it can have a significant effect in reducing noise at its source if it is well-written and enforced. Alameda County does not have a noise ordinance, but standards and limitations concerning acceptable levels of noise are prescribed in the Building Code and Zoning Ordinance. The Zoning Ordinance sets performance standards with respect to exterior levels of noise on industrial properties. No discernable noise from an industrial (M) district is to impinge on adjacent residential (R) districts. The County Zoning Ordinance also places restrictions on noise levels at quarries and car washes. Within residential districts, home occupation noise is restricted. Enforcement of a community noise ordinance could be assigned to the police, building inspectors, and/or environmental control officers.

V. COUNTYWIDE POLICIES

Goal #1: The peace, health, safety, and welfare of the residents of Alameda County require protection from excessive, unnecessary, and unreasonable noises from any and all sources in the cities and unincorporated territory.

Goal #2: Promote the compatibility of land uses with respect to noise generation by legislatively protecting sensitive land uses from noise sources.

Objective #1: Investigate and implement physical and legislative techniques to reduce noise impacts where appropriate.

Principle #1: Community noise control standards which establish maximum permitted noise levels for sensitive land uses-residential, community care facilities (hospitals, nursing homes, etc.), schools, and any other use considered by the community to be sensitive to noise should be developed and implemented by each jurisdiction.

Principle #2: Local govenments in cooperation with transportation agencies should promote the abatement of highway, circulation, aircraft,and rapid transit noise.

Principle #3: Local governments should exercise significant authority in controlling the noise problem because they have the responsibility for land development control and zoning.

VI. UNINCORPORATED AREA POLICIES

Goal #1: Alameda County should provide its residents and wildlife with an environment which is free from excessive noise pollution by preventing and suppressing undesirable levels, frequencies, and time durations of noise.

Goal #2: Alameda County should encourage noise compatible land uses near highways and other noise generators.

Objective #1: In order to control objectionable noise, Alameda County should survey noise sources and impacts in the unincorporated area and develop acceptable noise level standards for noise impacted areas.

Objective #2: The County should seek to develop regional planning agreements for zoning and soundproofing to reduce noise incompatibilities across jurisdictional boundaries.

Objective #3: The County should examine existing County ordinances and regulations to determine the effectiveness of existing controls and where additional performance standards are needed to reduce noise problems.

Objective #4: Alameda County should develop and adopt a County Noise Ordinance to prohibit unwanted and unnecessary sounds of all types within the unincorporated territory.

Objective #5: The County should encourage architectural designers, developers, and builders to employ physical techniques to reduce noise impacts.

Objective #6: The public should be informed of the significant financial and social costs of noise incompatibilities.

XII. IMPLEMENTATION PROGRAM, UNINCORPORATED AREA

1. Problem Identification:

   a. Continue to study existing noise problems in the unincorporated communities. Collect data on ambient noise levels, source noise levels, and frequency of occurrence.

   b. Survey public attitudes toward noise in order to determine desirable noise levels and to further define noise compatibility goals.

   c. Study potential noise incompatibilities and potential land uses in noise impacted areas.

2. Preventing and Minimizing Noise Impacts:

   a. Examine the existing administrative structure to determine which administrative techniques are most desirable for implementing physical solutions to minimize noise. These techniques include zoning; subdivision, building, and health codes; public ownership of land; financial incentives; and advisory services.

   b. Develop and adopt a County Noise Ordinance to prevent unwanted and excessive sound. The ordinance would contain the County's philosophy toward noise and standards, such as residential property noise limits, to prevent noise.

c. Contact state and federal officials to convey the County's concern over noise problems beyond the County's immediate control, i.e. source emission reduction on highways and improved highway design.

d. Require environmental impact reports for proposed projects to include an examination of anticipated noise impacts.

3. Study of Legal Status:

a. Examine legal limitations on powers of County government to restrict and regulate land use control. Not all of the desirable physical solutions may be possible under existing administrative structures.

4. Public Participation:

a. Increase public awareness of noise incompatibility in the County.

b. Examine local traditions and attitudes toward noise compatibility control techniques.

5. City-County Coordination:

a. Continue liason with the cities and investigate methods to reduce noise problems across city-county boundaries.

GLOSSARY

AIRBORNE SOUND. Sound that reaches the point of interest by propagation through air.

AMPLITUDE. Peak value of a periodically varying quantity such as traveling sound wave.

ATTENUATION. A reduction in strength,effect, or amplitude of a sound.

A-WEIGHTING NETWORK (A-Scale). The ear does not respond equally to sounds of all frequencies, but is less efficient at low and high frequencies than it is at medium or speech range frequencies. Thus, to obtain a single number representing the sound level of a noise containing a wide range of frequencies in a manner representative of the ear's response, it is necessary to reduce, or weight, the effects of the low and high frequencies with respect to the medium frequencies. The resultant sound level is said to be A-weighted, and the units are dBA. The A-weighted sound level is also called the noise level. Sound level meters have an A-weighting network for measuring A-weighted sound level.

COMMUNITY NOISE EQUIVALENT LEVEL (CNEL). A scale which takes account of all the A-weighted acoustic energy received at a point, from all noise events causing noise levels above some prescribed value. Weighting factors are included which place greater importance upon noise events occurring during the evening hours (7:00 p.m. to 10:00 p.m.) and even greater importance upon noise events at night (10:00 p.m. to 6:00 a.m.).

CONTINOUS NOISE. On-going noise whose intensity remains at measurable level (which may vary) without interruption over an indefinite period or a specified period of time.

DEAFNESS. 100 percent impairment of hearing associated with an organic condition. Note: This is defined for medical and cognate purposes as the hearing threshold level for speech or the average hearing threshold level for pure tones of 500, 1000 and 2000 Hz in excess of 92 dB.

DECIBEL. A unit measure of sound (noise) level relative to a standard reference sound on a logarithmic scale. The quantity "zero decibels" corresponds to the sound pressure level of the least powerful sound --the standard reference sound —that a very sensitive human ear can hear. (This standard reference sound has a sound pressure level which is .00002 times atmospheric pressure.)

ENVIRONMENTAL NOISE. By Sec.3(11) of the Noise Control Act of 1972, the term "environmental noise" means the intensity, duration, and character of sounds from all sources.

FREQUENCY. The number of oscillations per second of a sine-way of sound; now expressed in Hertz (Hz),formerly in cycles per second (cps).

L10 (level). The noise level that is exceeded for 10% of any specific sampling time.

NOISE EXPOSURE FORECAST (NEF). A scale (analogous to CNEL) which has been used by the Federal government and other agencies in land use planning guides for use in connection with airports. The noise exposure level at a point expressed in the NEF scale is numerically about 35 dB lower than if expressed in the CNEL scale.

NOISE LEVEL CONTOURS. Noise sources such as airports and trafficways generate a noise environment which can be described by drawing contours on a map. The contour lines connect the points on a land surface map that have the same noise level. and are analogous to lines of equal elevation on a topographic map.

SOUND EXPOSURE LEVEL. The level of sound accumulated over a given time interval or event. Technically,the sound exposure levels is the level of the time integrated mean square A-weighted sound for a stated time interval or event, with a reference time of one second.

SOUND LEVEL. The quantity in decibels measured by a sound level meter satisfying the requirements of American National Standards Specification for Sound Level Meters S1.4-1971. Sound level is the frequency-weighted sound pressure level obtained with the standardized dynamic characteristic "fast" or "slow" and weighting A, B or C; unless indicated otherwise, the A-weighting is understood. The unit of any sound level is the decibel, having the unit symbol dB.

SOUND LEVEL METER. An instrument, comprising a microphone, an amplifier, an output meter, and frequency-weighting networks, that is used for the measurement of noise and sound levels.

SOUND PRESSURE LEVEL. The variation from atmospheric pressure caused by a sound wave. (Expressed mathematically, the sound pressure level of a sound in question is, in decibels, 20 times the logarithm to the base 20 of the ratio of the pressure of the sound in question to the reference pressure, where the reference pressure is .00002 times atmospheric pressure.) Generally, the greater the sound pressure, the louder the sound.

APPENDIX A

TERMINOLOGY FOR COMMUNITY NOISE CNEL AND L_{dn}[1]

Community Noise Equivalent Level (CNEL)

The following simplified expressions are derived from the exact definitions in the report, "Supporting Information for the Adopted Noise Regulations for California Airports." They can be used to estimate values of CNEL where one type of aircraft and one flight path dominate the noise exposure level.

Single event noise is specified by the single event noise exposure level (SENEL) in dB and can be closely approximated by:

$$SENEL = NL_{max} + 10 \log t_{ea}, \quad dB$$

where

NL_{max} = maximum noise level as observed on the A scale of a standard sound level meter

and

t_{ea} = effective time duration of the noise level (on A scale) in seconds

The effective duration is equal to the "energy" of the integrated noise level (NL), divided by the maximum noise level, NL_{max}, when both are expressed in terms of antilogs. It is approximately 1/2 of the 10 dB down duration, which is the duration for which the noise level is within 10 dB of NL_{max}.

A measure of the average integrated noise level over 1 hour is also used in the California Airport Noise Regulation. This is the hourly noise level (in dB), defined as:

$$HNL = \overline{SENEL} + 10 \log n - 35.6, \quad dB$$

where

$\overline{SENEL}$ = energy mean value of SENEL for each single event,

and

n = number of flights per hour

The total noise exposure for a day is specified by the community noise equivalent level (CNEL) in dB, and may be expressed as:

Source: American Standard Acoustical Terminology, S1.1-1960, Revision of Z24.1-1951 and including Z24.1a, American Standards Association, May 26, 1960.

$$CNEL = \overline{SENEL} + 10 \log N_c - 49.4, \text{ dB}$$

where

$$N_c = (N_d + 3N_e + 10N_n)$$

or

$$= (12\bar{n}_d + 9\bar{n}_e + 90\bar{n}_n)$$

$N_d, \bar{n}_d$ = total number and average number per hour, respectively, of flights during the period 0700 to 1900

$N_e, \bar{n}_e$ = total number and average number per hour, respectively, of flights during the period 1900 to 2200

and

$N_n, \bar{n}_n$ = total number and average number per hour, respectively, of flights during the period 2200 to 0700

Day-Night Average Level (L_{dn})

A new composite noise scale is currently under consideration by the Environmental Protection Agency for specification of community noise from all sources. Called Day-Night Average Level, it is nearly the same as CNEL except that the weighting for the evening time period in CNEL is eliminated and the "day" extends from essentially 7 a.m. to 10 p.m. while the "night," with a 10 dB weighting penalty, extends from 10 p.m. to 7 a.m.

Defined in the approximate manner as above,

$$L_{dn} \simeq \overline{SENEL} + 10 \log N_e - 49.4$$

where

$$N_e = N_d' + 10 N_n$$

N_d' = total number of events (flights) during the daytime (0701 to 2200)

N_n = total number of events (flights) during the nighttime (2201 to 0700)

$\overline{SENEL}$ = energy mean value of SENEL for each single event

When defined in the more general way for application to continuous monitoring of community noise, L_{dn} would be given by

$$L_{dn} = 10 \log \left[\frac{15}{24} \cdot \log^{-1} \left(\frac{\overline{L_d}}{10} \right) + \frac{9}{24} \cdot \log^{-1} \left(\frac{\overline{L_n} + 10}{10} \right) \right]$$

where

$\overline{L_d}$ = energy mean A-weighted noise level during the daytime (0701 to 2200)

$\overline{L_n}$ = energy mean A-Weighted noise level during the nighttime (2201 to 0700)

$\log^{-1}$ denotes an inverse logarithm

Chapter 6.60 - NOISE

Sections:

6.60.010 - Declaration of policy.

In order to control unnecessary, excessive and annoying noise in the county, it is hereby declared to be the policy of the county to prohibit such noise generated from or by all sources as specified in this chapter. It shall be the policy of the county to maintain quiet in areas which exhibit low noise levels and to implement programs aimed to reduce noise in those areas within the county where noise levels are above acceptable values.

It is determined that certain noise levels are detrimental to the public health, welfare and safety, and are contrary to public interest. Therefore, the Board of Supervisors does ordain and declare that creating, maintaining, causing or allowing to be created, caused or maintained, any noise in a manner prohibited by or not in conformity with the provisions of this chapter, is a public nuisance and shall be punishable as such.

(Prior gen. code 3-107.101)

6.60.020 - Definitions.

"Ambient noise level" means the all encompassing noise level associated with a given environment, being a composite of sounds from all sources, excluding the alleged offensive noise, at the location and approximate time at which a comparison with the alleged offensive noise is to be made.

"'A' weighted sound level" means the total sound level in decibels of all sound as measured with a sound level meter with a reference pressure of twenty (20) micropascals using the 'A' weighted network (scale) at slow response. The unit of measurement shall be defined as dB(A).

"Church" means any building or portion thereof regularly used by people as a place to worship God and known by those familiar with the neighborhood to be so used.

"Commercial properties" means any building, structure, premise or portion thereof used for wholesale or retail purposes on which the property user or employees are engaged in work for which it is intended that compensation be received for goods or services.

"Construction" means construction, erection, enlargements, alteration, conversion or movement of any building, structures or land together with any scientific surveys associated therewith.

"Cumulative period" means an additive period of time composed of individual time segments which

may be continuous or interrupted.

"Decibel (dB)" means a unit for measuring the amplitude of sounds, equal to twenty (20) times the logarithm to the base ten of the ratio of the pressure of the sound measured to the reference pressure, which is twenty (20) micropascals.

"Director" means the director of environmental health of the county or his duly authorized deputy.

"Dwelling unit" means a single unit providing complete independent living facilities for one or more persons including permanent provisions for living, sleeping, eating, cooking and sanitation.

"Emergency work" means the use of any machinery, equipment, vehicle, manpower or other activity in a short term effort to protect or restore safe conditions in the community, or work by private or public utilities when restoring utility service.

"Hospital" means any building or portion thereof used for the accommodation and medical care of the sick, injured or infirm persons and includes rest homes and nursing homes.

"Impulsive noise" means a noise of short duration usually less than one second and of high intensity with an abrupt onset and rapid decay.

"Intruding noise level" means the total sound level in decibels, created, caused, maintained or originating from an alleged offensive source at a specified location while the alleged offensive source is in operation.

"Noise disturbance" means any sound as judged by any person empowered to enforce this chapter, which (A) endangers or injures the safety or health of human beings or animals, or (B) endangers or injures personal or real property, or (C) annoys or disturbs a reasonable person of normal sensitivity. The factors which shall be considered in determining whether a violation of (C) exists shall include, but not be limited to the following:

1. The relative sound level of the objectionable noise to the ambient noise;
2. The proximity of the objectionable noise to residential sleeping facilities or public camping facilities;
3. The number of persons affected by the objectionable noise;
4. The day of the week and time of day or night the objectionable noise occurs;
5. The duration of the objectionable noise and its tonal, informational or musical content;
6. Whether the objectionable noise is continuous, recurrent or intermittent;
7. The nature and zoning of the area within which the objectionable noise emanates.

"Person" means a person, firm, association, partnership, joint venture, corporation or any entity, public or private in nature.

"Recreational motor vehicle" means any motor vehicle (as that term is defined in the California Vehicle Code) and shall also include, but not be limited to, motorcycles, go-carts, campers, dune buggies and commercial or noncommercial racing vehicles. A "recreational motor vehicle" does not include a motorboat.

"Residential property" means a parcel of real property which is developed and used either in whole or in part for residential purposes.

"School" means public or private institutions, including vocational schools, conducting regular academic instruction at preschool, kindergarten, elementary, secondary or collegiate levels.

"Simple tone noise" means any sound which is distinctly audible as a single pitch or a set of single pitches as judged by any person empowered to enforce this chapter.

"Sound level meter" means an instrument used for measurement of sound levels, which meets the American National Standard Institute's Standard S14-1971 or most recent revision thereof for Type 1 or Type 2 sound level meters or an instrument and the associated recording and analyzing equipment which will provide equivalent data.

"Sound pressure level" of a sound, in decibels, means twenty (20) times the logarithm to the base ten of the ratio of the pressure of the sound to a reference pressure which is twenty (20) micropascals.

(Prior gen. code §§ 3-107.201—3-107.221)

6.60.030 - Noise measurement criteria.

A. Any noise measurement made pursuant to the provisions of this chapter shall be made with a sound level meter using the 'A' weighted network (scale) at slow meter response. Fast meter response shall be used for an impulsive noise. Calibration of the measurement equipment, utilizing an acoustic calibrator, shall be performed immediately prior to recording any noise date.

B. The exterior noise levels shall be measured at any point on the affected residential property, school, hospital, church, public library or commercial property. Where practical, the microphone shall be positioned three to five feet above the ground and away from reflective surfaces.

(Prior gen. code §§ 3-107.301, 3-107.302)

6.60.040 - Exterior noise level standards.

A. It is unlawful for any person at any location within the unincorporated area of the county to create any noise or to allow the creation of any noise on property owned, leased, occupied or

otherwise controlled by such person which causes the exterior noise level when measured at any single- or multiple-family residential, school, hospital, church, public library or commercial properties situated in either the incorporated or unincorporated area to exceed the noise level standards as set forth in Table 6.60.040A or Table 6.60.040B following:

Table 6.60.040A

RECEIVING LAND USE — SINGLE- OR MULTIPLE-FAMILY RESIDENTIAL, SCHOOL, HOSPITAL, CHURCH OR PUBLIC LIBRARY PROPERTIES

NOISE LEVEL STANDARDS, dB(A)

Category	Cumulative Number of Minutes in any one hour time period	Daytime 7 a.m. to 10 p.m.	Nighttime 10 p.m. to 7 a.m.
1	30	50	45
2	15	55	50
3	5	60	55
4	1	65	60
5	0	70	65

Table 6.60.040B

RECEIVING LAND USE — COMMERCIAL PROPERTIES

NOISE LEVEL STANDARDS, dB(A)

Category	Cumulative Number of Minutes in any one hour time period	Daytime 7 a.m. to 10 p.m.	Nighttime 10 p.m. to 7 a.m.
1	30	65	60
2	15	70	65
3	5	75	70
4	1	80	75
5	0	85	80

B. In the event the measured ambient noise level exceeds the applicable noise level standard in any category above, the applicable standard shall be adjusted so as to equal said ambient noise level.

C. Each of the noise level standards specified in Tables 6.60.040A and B shall be reduced by five dB(A) for simple tone noises, noises consisting primarily of speech or music or for recurring impulsive noises.

D. If the intruding noise source is continuous and cannot reasonably be discontinued or stopped for a time period whereby the ambient noise level can be measured, the noise level measured while the source is in operation shall be compared directly to the applicable noise level standards in Table 6.60.040A and Table 6.60.040B.

E. Notwithstanding the noise level standards set forth in this section, the noise level standard applicable to the emission of sound from transformers, regulators, or associated equipment in electrical substations shall be 60 dB(A).

(Prior gen. code §§ 3-107.401—3-107.405)

6.60.050 - Prohibited noise disturbances.

A. No person shall make or cause to be made any noise disturbance as defined in Section

6.60.020 of this chapter.

B. Notwithstanding any of the provisions of this chapter, the following acts are prohibited within the unincorporated area of the county of Alameda, subject only to the exceptions of Section 6.60.070:

1. Radio, Television Sets, Musical Instruments and Similar Devices. Operating, playing or permitting the operation or playing of any radio, stereo, television set, audio equipment, electronic equipment, drum, musical instrument, or device which produces or reproduces sound at any time of day plainly audible at a distance of fifty (50) feet from such device. This section does not apply to places of public entertainment or to events for which a lawful permit has been obtained, provided that the activities producing sound are being conducted in compliance with the permit. This section does not apply to the operation of sound amplification systems in vehicles to the extent those systems are subject to California Vehicle Code Section 27007.
2. Animals and Birds. The keeping of any animal or bird, as pet or livestock, which causes frequent or continuous noise plainly audible at a distance of fifty (50) feet from such animal. For the purposes of this subsection, the animal noise shall not be deemed a disturbance or nuisance if the noise is in response to a person trespassing or threatening to trespass upon private property in or upon which the animal is situated or if the noise is in response to someone teasing or provoking the animal.

However, any person teasing or provoking the animal noise shall be guilty of a violation of this chapter.

3. Electric/Gas Powered Tools in Residential Areas: Vehicle Maintenance.
   a. Operation or use in residential areas between the hours of seven p.m. and seven a.m. on a weekday or between the hours of seven p.m. and eight a.m. on a weekend, of any electric or gasoline powered leaf blower, sweeper, vacuum, lawn mower, trimmer, edger, hedger or similar tool or device which produces sound which is plainly audible at a distance of fifty (50) feet from such device.
   b. Repairing, rebuilding, modifying or testing any vehicle in residential areas between the hours of seven p.m. and seven a.m., in such a manner as to produce sound which is plainly audible at a distance of fifty (50) feet from the vehicle.
4. Emergency Signaling Devices. The intentional sounding or permitting the sounding outdoors of any fire, burglar, or civil defense alarm, siren, whistle, or similar stationary emergency signaling device, except for emergency purposes or for testing; provided such testing is conducted as follows:
   a. The testing of a stationary emergency signaling device shall not occur before seven

a.m. or after seven p.m. Any such testing shall use only the minimum cycle test time, in no case shall such test time exceed sixty (60) seconds.

b. The testing of the complete emergency signaling system, including the functioning of the signaling device, and the personnel response to the signaling device, shall not occur more than once in each calendar month. Such testing shall not occur before seven a.m. or after ten p.m. The time specified in subsection (B)(4)(a) of this section shall not apply to such complete system testing;

5. Sounding or permitting the sounding of any exterior burglar or fire alarm or any motor vehicle burglar alarm unless such alarm is terminated within fifteen (15) minutes of activation. Pre-existing installations will be allowed a period of ninety (90) days for correction;

6. Stationary Nonemergency Signaling Devices.

   a. Sounding or permitting the sounding of any electronically amplified signal from any stationary bell, chime, siren, whistle, or similar device, intended primarily for nonemergency purposes, from any place, for more than ten seconds in any hourly period,

   b. Churches shall be exempt from the operation of this provision,

   c. Sound sources covered by this provision and not exempted under subsection (B)(6)(b) of this section may be exempted by a variance issued by the director of environmental health;

7. Loading and Unloading. Loading, unloading, opening, closing or other handling of boxes, crates, containers, building materials, garbage cans, or similar objects between the hours of nine p.m. and six a.m. in such a manner as to cause a noise disturbance across a residential real property line or at any time to violate the provisions of Section 6.60.040.

8. Vibration. Operating or permitting the operation of any device that creates a vibration which is above the vibration perception threshold of an individual at or beyond the property boundary of the source if on private property or at one hundred fifty (150) feet (forty-six (46) meters) from the source if on a public space or public right-of-way.

C. Notwithstanding the provisions of Section 6.60.040, where the intruding noise source, as measured pursuant to Section 6.60.030, is a residential air conditioning or refrigeration system or associated equipment installed prior to July 1, 1980, the exterior noise level shall not exceed fifty-five (55) dB(A). The exterior noise level shall not exceed fifty (50) dB(A) for such equipment installed after July 1, 1980.

D. "Plainly audible" means any sound that can be detected by a person using his or her unaided hearing faculties. As an example, if the sound source under investigation is a portable or

personal vehicular sound amplification or reproduction device, the enforcement officer need not determine the title of a song, specific words, or the artist performing the song. The detection of the rhythmic base component of the music is sufficient to constitute a plainly audible sound.

E. The restrictions contained in Section 6.60.050(B)(1), (2) and (3) shall not apply to:

1. Activities which are governed by conditional use permits or other permits issued by the county, if those permits expressly regulate or control the amount of noise or sound which may be generated by the activities which are governed by the permit;
2. Unincorporated areas of the county within the east county area plan; or
3. Unincorporated areas of the county outside the urban growth boundary, as defined by "Measure D" ("Save Agricultural and Open Space Lands Initiative of 2000").

(Ord. 2005-16 §§ 1-4; prior gen. code §§ 3-107.501—3-107.503)

6.60.060 - Vehicle noise limits.

A. Recreational Motorized Vehicles Operating Off A Public Highway. No person shall operate or cause to be operated any recreational motorized vehicle off a public highway in such a manner as to create a noise disturbance or exceed the standards set forth in Section 6.60.040 of this chapter.

B. Vehicle, Motorboat or Aircraft Repair and Testing. No person shall repair, rebuild, modify or test any vehicle, motorboat, or aircraft in such a manner as to create a noise disturbance or exceed the standards set forth in Section 6.60.040 of this chapter.

(Prior gen. code §§ 3-107.601—3-107.602)

6.60.070 - Special provisions or exceptions.

A. Emergency Exception. The provisions of this chapter shall not apply to:

1. The emission of sound for the purpose of alerting persons to existence of an emergency; or
2. The emission of sound in the performance of emergency work.

B. Warning Devices. Warning devices, necessary for the protection of public safety as, for example, police, fire and ambulance sirens and train horns shall be exempted from the provisions of this chapter.

C. Federal or State Preempted Activities. The provisions of this chapter shall not apply to any other activity to the extent regulation thereof has been preempted by state or federal law.

D. Public Health, Welfare and Safety Activities. The provisions of this chapter shall not apply to

construction or maintenance and repair operations conducted by public agencies and/or utility companies or their contractors which are deemed necessary to serve the best interests of the public and to protect the public health, welfare and safety, including, but not limited to street sweeping, debris and limb removal, removal of downed wires, restoring electrical service, repairing traffic signals, unplugging sewers, vacuuming catch basins, repairing of water hydrants and mains, gas lines, oil lines, sewers, storm drains, roads, sidewalks, etc.

E. Construction. The provisions of this chapter shall not apply to noise sources associated with construction, provided said activities do not take place before seven a.m. or after seven p.m. on any day except Saturday or Sunday, or before eight a.m. or after five p.m. on Saturday or Sunday.

F. Maintenance of Residential Property. The provisions of this chapter shall not apply to noise sources associated with the maintenance of residential property provided said activities take place between the hours of seven a.m. and nine p.m. on any day except Saturday or Sunday, or between the hours of nine a.m. and eight p.m. on Saturday or Sunday.

G. Proviso. Notwithstanding the provisions of subsections D, E and F of this section, no exemptions from the provisions at this chapter shall be granted for activities specified in said sections where equipment used for those activities, including mufflers, is not maintained in the condition for which it was designed or intended and thereby unnecessarily increases noise levels so as to cause a noise disturbance or exceed the standards set forth in Section 6.60.040 of this chapter.

(Prior gen. code §§ 3-107.701—3-107.707)

6.60.080 - Zone change.

Prior to the approval of any zone change, general plan amendment, precise development plan, conditional, use permit, zone variance or specific plan; upon request

A. The director shall review the noise impact of the proposed action by identifying existing and projected noise sources and the associated sound levels.

B. The director shall recommend usage of adequate control measures on noise sources identified in subsection A of this section which will be in violation of any provision of this chapter or the noise quality standards of the noise element of the county general plan.

(Prior gen. code § 3-107.801)

6.60.090 - Violations.

A. Any violation of this chapter is an infraction punishable by (1) a fine of one hundred dollars

($100.00) for a first violation; (2) a fine of two hundred dollars ($200.00) for a second violation of this chapter within one year; (3) a fine of five hundred dollars ($500.00) for each additional violation of this chapter within one year.

B. As an additional remedy, the operation or maintenance of any device, instrument, vehicle or machinery in violation of any provision of this chapter, so as to cause a noise disturbance, shall be deemed and is hereby declared to be a public nuisance and may be subject to abatement summarily by a restraining order or injunction issued by a court of competent jurisdiction.

(Ord. 2005-16 § 5: prior gen. code §§ 3-107.901—3-107.903)

6.60.100 - Manner of enforcement.

A. The director is directed to enforce the provisions of this chapter except for Section 6.60.050(B)(1), (2) and (3) which shall be enforced by peace officers. The director and peace officers may jointly enforce Sections 6.60.050(A) and 6.60.060 of this chapter.

B. No person shall interfere with, oppose or resist any authorized person charged with the enforcement of this chapter while such person is engaged in the performance of his duties.

(Ord. 2005-16 § 6: prior gen. code § 3-107.904)

6.60.110 - Variances.

A. The owner or operator of a noise source which the director has determined violates any of the provisions of this chapter may file an application with the director for variance from strict compliance with any particular provision of this chapter where such variance will not result in a hazardous condition or a nuisance and strict compliance would be unreasonable in view of all the circumstances. Said owner or operator shall set forth all actions taken to comply with said provision(s) and the reasons why immediate compliance cannot be achieved. A separate application shall be filed for each noise source; provided, however, that several mobile sources under common ownership or fixed sources under common ownership on a single property may be combined into one application.

Upon receipt of said application and within thirty (30) days thereof, the director shall either approve such request, in whole or in part, or deny the request. In the event the variance is approved, reasonable conditions may be imposed which may include restrictions on noise level, noise duration and operating hours, an approved method of achieving compliance and a time schedule for its implementation.

Factors which the director must consider shall include but not be limited to the following:

1. Uses of property within the area affected by the noise;

2. Factors related to initiating and completing all remedial work;
3. Age and useful life of the existing noise source;
4. The general public interest, welfare and safety;
5. Conditions, policies, or guidelines imposed by other agencies or other commissions including the planning commission conditions and planning commission or ALUC policies and guidelines.

B. Within thirty (30) days following the decision of the director on an application for a variance, the applicant may appeal the decision to the Board of Supervisors for a hearing de novo by filing a notice of appeal with the clerk of the Board of Supervisors. The Board of Supervisors shall either affirm, modify or reverse the decision of the director. Such decision shall be final and shall be based upon the considerations set forth in this section.

(Prior gen. code § 3-107.905)

6.60.120 - Construction.

This chapter shall be liberally construed so as to effectuate its purposes.

(Prior gen. code § 3-107.906)

CONSTRUCTION NOISE MODELING

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 02/09/2022
Case Description: Site Prep

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
50 ft	Residential	60.0	55.0	50.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Backhoe	No	40		77.6	50.0	0.0
Front End Loader	No	40		79.1	50.0	0.0
Man Lift	No	20		74.7	50.0	0.0
Excavator	No	40		80.7	50.0	0.0

Results

Noise Limits (dBA)

Noise Limit Exceedance (dBA)

Calculated (dBA) Day Evening Night

Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Backhoe	77.6	73.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Front End Loader	79.1	75.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Man Lift	74.7	67.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Excavator	80.7	76.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	80.7	80.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 02/09/2022
Case Description: Utility Trenching

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
50 feet	Residential	60.0	55.0	50.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Backhoe	No	40		77.6	50.0	0.0
Excavator	No	40		80.7	50.0	0.0
Front End Loader	No	40		79.1	50.0	0.0
Compactor (ground)	No	20		83.2	50.0	0.0

Results

Noise Limits (dBA)

Noise Limit Exceedance (dBA)

Calculated (dBA)	Day		Evening		Night		Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Backhoe	77.6	73.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Excavator	80.7	76.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Front End Loader	79.1	75.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Compactor (ground)	83.2	76.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	83.2	81.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 02/09/2022
Case Description: PV Installation

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
50 feet	Residential	60.0	55.0	50.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Man Lift	No	20		74.7	50.0	0.0
Auger Drill Rig	No	20		84.4	50.0	0.0
Backhoe	No	40		77.6	50.0	0.0
Excavator	No	40		80.7	50.0	0.0
Front End Loader	No	40		79.1	50.0	0.0

Results

Noise Limits (dBA)

Noise Limit Exceedance (dBA)

Calculated (dBA) Day Evening Night

Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Man Lift	74.7	67.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Auger Drill Rig	84.4	77.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Backhoe	77.6	73.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Excavator	80.7	76.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Front End Loader	79.1	75.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

	Total	84.4	82.1		N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A
N/A		N/A		N/A		N/A		N/A		N/A		N/A							