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Environmental Noise Assessment Report
Kapolei Harborside Center
Kapolei, Oahu, Hawaii

April 2006

DLAA Project No. 06-13

Prepared for:
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1.0 EXECUTIVE SUMMARY

1.1 The proposed project area includes approximately 345 acres of land in Kapolei, Hawaii and is located between Kalaeloa/Barbers Point Harbor and the existing industrial areas of Campbell Industrial Park and Kapolei Business Park. The land use designation will be changed from agricultural to industrial as the site is proposed to be developed to include industrial lands, preservation, roadways, and support infrastructure. Industrial uses in the project area include light manufacturing, warehousing, and other industrial service businesses. Planned roadway improvements include Hanua Street, Opakapaka Street, and Lauwiliwili Street in addition to the minor roads that are proposed for internal site circulation.

1.2 The sound levels in the project area are dynamic and depend significantly on the vehicular traffic patterns and industrial activities. The hourly L_{eq} noise levels generally range from 48 dBA during the low traffic times to approximately 62 dBA during peak hour traffic at the long term measurement locations. The average calculated day-night level, $L_{dn,}$ at the southern end of the project site was 56 dBA and the average calculated L_{dn} was 58 dBA near the eastern edge of the project site.

1.3 During the project construction, the dominant noise sources will probably be earth moving equipment, such as bulldozers and diesel powered trucks. Noise from construction activities will occur on the project site. Noise from construction activities should be short term and must comply with State of Hawaii Community Noise Control Rules and a construction noise permit issued by the Department of Health.

1.4 The Kapolei Harborside West development will incorporate mechanical equipment that is typical for commercial buildings and industrial lands. Noise from this equipment must meet the State DOH maximum permissible noise limits at the property line. For industrial areas adjacent to other industrial, commercial, and residential areas, the noise limits are 70 dBA during the day and night.

1.5 The traffic noise analysis shows that existing and future noise levels are below the FHWA/DOT maximum noise limit of 72 dBA at the commercial areas adjacent Kalaeloa Boulevard during peak traffic hours. Traffic noise levels within the project site near the proposed Hanua Street is also predicted to be within the maximum noise limit of 72 dBA. Vehicular traffic noise levels are expected to increase by 3 dB or less in the future due to the Kapolei Harborside Center project but will still comply with the FHWA/DOT maximum noise limit.

Vehicular traffic noise from Kapolei Parkway and Hanua Street extensions may exceed the FHWA/DOT maximum permissible noise limit at the planned neighboring residential development, Kapolei West. Although the development does not yet exist, a traffic noise impact is expected in the future. Therefore, design of the residential development should take into account appropriate noise mitigation in order to comply with the FHWA's maximum exterior Leq noise limit of 67 dBA. Mitigation measures include creating a buffer between the

roadway and the buildings, construction of noise barriers (i.e., earth berms, walls, etc.) and air conditioning the impacted residences.

1.6 The Kapolei Harborside Center project site is outside of the 55 L_{dn} noise contour of the Kalaeloa Airport. Therefore, the project will not be impacted by aircraft noise.

2.0 PROJECT DESCRIPTION

The proposed project area includes approximately 345 acres of land in Kapolei, Hawaii and is located between Kalaeloa/Barbers Point Harbor and the existing industrial areas of Campbell Industrial Park and Kapolei Business Park. The project area is currently bounded on the east, west and south by existing industrial areas and on the north by vacant land. The land use designation will be changed from agricultural to industrial as the site is proposed to be developed to include industrial lands, preservation, roadways, and support infrastructure. Industrial uses in the project area include light manufacturing and warehousing, industrial service businesses, and land uses within the current City and County of Honolulu Land Use Ordinance parameters for industrially zoned lands. Roadway improvements planned for the proposed project development include Hanua Street, Opakapaka Street, and Lauwiliwili Street in addition to the minor roads that are proposed for internal site circulation.

The project area currently has several uses operating on-site although the majority of the parcel is vacant. Existing uses include a nursery, intermittent agricultural use, a green waste collection and compost processing operation, fill material stockpiling, and a coal conveyor belt that transports coal from the harbor to HECO power stations to the south of the site.

3.0 NOISE STANDARDS

Various local and federal agencies have established guidelines and standards for assessing environmental noise impacts and set noise limits as a function of land use. A brief description of common acoustic terminology used in these guidelines and standards is presented in Appendix A.

3.1 State of Hawaii, Community Noise Control (DOH)

The State of Hawaii Community Noise Control Rule [Reference 1] defines three classes of zoning districts and specifies corresponding maximum permissible sound levels due to *stationary* noise sources such as air-conditioning units, exhaust systems, generators, compressors, pumps, etc. The Community Noise Control Rule does not address most *moving* sources, such as vehicular traffic noise, air traffic noise, or rail traffic noise. However, the Community Noise Control Rule does regulate noise related to agricultural, construction, and industrial activities, which may not be stationary.

The maximum permissible noise levels are enforced by the State Department of Health (DOH) for any location at or beyond the property line and shall not be exceeded for more than 10% of the time during any 20-minute period. The specified noise limits which apply are a function of the zoning and time of day as shown in Figure 1. With respect to mixed zoning districts, the rule specifies that the primary land use designation shall be used to determine the applicable zoning district class and the maximum permissible sound level. In determining the maximum permissible sound level, the background noise level is taken into account by the DOH.

3.2 U.S. Environmental Protection Agency (EPA)

The U.S. EPA has identified a range of yearly day-night equivalent sound levels, L_{dn}, sufficient to protect public health and welfare from the effects of environmental noise [Reference 2]. The EPA has established a goal to reduce exterior environmental noise to an L_{dn} not exceeding 65 dBA and a future goal to further reduce exterior environmental noise to an L_{dn} not exceeding 55 dBA. Additionally, the EPA states that these goals are not intended as regulations as it has no authority to regulate noise levels, but rather they are intended to be viewed as levels below which the general population will not be at risk from any of the identified effects of noise.

3.3 U.S. Federal Highway Administration (FHWA)

The FHWA defines four land use categories and assigns corresponding maximum hourly equivalent sound levels, $L_{eq(h)}$, for traffic noise exposure [Reference 3], which are listed in Figure 2. For example, Category B, defined as picnic and recreation areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals, has a corresponding maximum exterior L_{eq} of 67dBA and a maximum interior L_{eq} of 52 dBA. These limits are viewed as design goals, and all projects meeting these limits are deemed in conformance with FHWA noise standards.

3.4 Hawaii Department of Transportation (HDOT)

The HDOT has adopted FHWA's design goals for traffic noise exposure in its noise analysis and abatement policy [Reference 5]. According to the policy, a traffic noise impact occurs when the predicted traffic noise levels "approach" or exceed FHWA's design goals or when the predicted traffic noise levels "substantially exceed the existing noise levels." The policy also states that "approach" means at least 1 dB less than FHWA's design goals and "substantially exceed the existing noise levels" means an increase of at least 15 dB.

3.5 Federal Aviation Administration (FAA)

The FAA addresses guidelines for compatible land use that surrounds airports [Reference 6]. Noise contour maps are expressed in terms of yearly day-night average sound levels, L_{dn}, due to aircraft operations. The FAA states that residences outside of the L_{dn} 65 noise contour are compatible without restrictions. Residences between the L_{dn} 65 and 75 contours are only compatible if noise mitigation measures are incorporated into the building structure. Residences inside of the L_{dn} 75 noise contour are generally not compatible. The compatibility of other land uses, such as commercial, manufacturing, public, and recreation, are shown in Table 1.

3.6 Hawaii Department of Transportation (HDOTA), Airports Division

The State of Hawaii, Department of Transportation, Airports Division (HDOTA) has adopted noise restrictions that are similar to, but stricter than, the FAA's noise restrictions [Reference 7]. Like the FAA, HDOTA expresses land use compatibility guidelines based on yearly day-night average sound levels, L_{dn}, due to aircraft operations. In most cases, the HDOTA allows maximum noise limits

that are 5 dB lower than the FAA. For example, the HDOTA states that residences outside of the 60 L_{dn} noise contour are compatible. Residences within the 60 and 70 L_{dn} contours require noise mitigation treatments be incorporated into the construction of the homes. HDOTA also states:

> "Where the community determines that these uses must be allowed, Noise Level Reduction (NLR) measures to achieve interior levels of 45 L_{dn}, or less should be incorporated into building codes and be considered in individual approvals. Normal local construction employing natural ventilation can be expected to provide an average NLR of approximately 9 dB. Total closure, plus air conditioning, may be required to provide additional outdoor to indoor NLR, and will not eliminate outdoor noise problems."

The HDOTA guidelines also specify 60 dBA as the maximum allowable L_{dn} level for school, day care center, and church uses without any mitigation measures. Commercial uses such as retail shops, restaurants, shopping centers, etc. are compatible with L_{dn} levels up to 65 dBA without any mitigation measures. With noise mitigation measures implemented, such commercial uses are allowed in areas exposed to an L_{dn} as high as 75 dBA. The compatibility of other land uses, such as manufacturing, public, and recreation, are shown in Table 2.

In addition to the HDOTA compatibility guidelines, The Hawaii Revised Statutes, Chapter 0508D, Section 15 states a notification is required to the buyer for real estate property that lies,

> "Within the boundaries of the noise exposure area shown on maps prepared by the department of transportation in accordance with Federal Aviation Regulation Part 150-Airport Noise Compatibility Planning (14 Code of Federal Regulations Part 150) for any public airport;"

The FAR Part 150 noise exposure area boundary is defined as the 55 L_{dn} noise contour. Therefore, a notification to the buyer is required for all real estate transactions within the 55 L_{dn} noise contour.

4.0 EXISTING ACOUSTICAL ENVIRONMENT

Two types of noise measurements were conducted to assess the existing acoustical environment in the vicinity of the project location. The first noise measurement type consisted of continuous long-term ambient noise level measurements (Location L1 and L2), as shown in Figure 3. The second type of noise measurement was short-term and included traffic counts (Location S1). The purpose of the short-term noise measurements and corresponding traffic counts were to calibrate a traffic noise prediction model. Both long term and short term measurements were conducted between May 16, 2006 and May 18, 2006.

4.1 Noise Measurement Procedure

Long-Term Noise Measurement Procedure

Continuous, hourly, statistical sound levels were recorded for 55 hours at each location. The measurements were taken using a Larson-Davis Laboratories,

Model 820, Type-1 Sound Level Meter together with a Larson-Davis, Model 2560 Type-1 Microphone. Calibration was checked before and after the measurements with a Larson-Davis Model CAL200 calibrator. Both the sound level meter and the calibrator have been certified by the manufacturer within the recommended calibration period. The microphone was mounted on a tripod, approximately 6 feet above grade. A windscreen covered the microphone during the entire measurement period. The sound level meter was secured in a weather resistant case.

Short-Term Noise Measurement Procedure

An approximate 30-minute equivalent sound level, L_{eq}, was measured. Vehicular traffic counts and traffic mix were documented during the measurement period. The noise measurement was taken using a Larson-Davis Laboratories, Model 824, Type-1 Sound Level Meter together with a Larson-Davis, Model 2541 Type-1 Microphone. Calibration was checked before and after the measurements with a Larson-Davis Model CAL200 calibrator. Both the sound level meter and the calibrator have been certified by the manufacturer within the recommended calibration period. The microphone and sound level meter were mounted on a tripod, approximately 6 feet above grade. A windscreen covered the microphone during the entire measurement period.

4.2 Noise Measurement Locations

Long-Term Noise Measurement Locations

Location L1: Positioned approximately 350 feet west of a dirt road that is an extension of the existing Hanua Road. The area is partially forested (at the 7.4 acre preservation parcel) and partially paved (at the industrial waste parcel). The dirt road is infrequently trafficked by heavy trucks making pick-ups and/or deliveries to the green waste collection station and fill material stockpile area.

Location L2: Positioned 400 feet west of Kalaeloa Boulevard between Opakapaka and Malakole Streets. This location was not within the boundaries of the project site.

Short-Term Noise Measurement Locations

Location S1: Positioned adjacent adjacent to Kalaeloa Boulevard between Opakapaka and Lauwiliwili Streets, approximately 40 feet east of the edge-of-pavement.

4.3 Long-Term Noise Measurement Results

The results from the long-term noise measurements are graphically presented in Figure 4, which shows the measured equivalent sound level, L_{eq}, in A-weighted decibels (dBA) as a function of the measurement date and time.

The sound levels are relatively dynamic and depend significantly on the vehicular traffic patterns and industrial activities in the area for both measurement locations. The hourly L_{eq} noise levels generally range from 48 dBA during the low traffic

times to approximately 62 dBA during peak hour traffic times. The average calculated day-night level, L_{dn}, at the southern end of the project site (location L1) was 56 dBA for the measurement period. The average calculated L_{dn} at location L2 was 58 dBA for the measurement period. Although L2 was not within the boundaries of the project site, the calculated L_{dn} is representative of the parcels bordering the future Hanua Street. The dominant and secondary noise sources for both locations are described below:

The dominant and secondary noise sources are described below:

Dominant: Vehicular traffic on Malakole Hanua Streets was audible at location L1. Vehicular traffic on Kalaeloa Boulevard was audible at location L2

Secondary: Industrial activities, birds, wind.

4.4 Kalaeloa Airport and Honolulu International Airport Noise Contours

The project site is located west of the Kalaeloa Airport. Therefore, the project site was assessed for aircraft noise using airport noise contour maps. The Kalaeloa Master Plan [Reference 8] includes year 2020 projections of airport operations and noise contour maps for airport alternates. Also included in the airport noise contour maps is the affect of the Honolulu International Airport operations [Reference 7]. A complete description of the Kalaeloa Airport alternates can be found in the Kalaeloa Master Plan. The Kapolei Harborside Center project site is outside of the L_{dn} 55 noise contours for both airports based on year 2020 aircraft noise projections.

5.0 POTENTIAL NOISE IMPACTS DUE TO THE PROJECT

5.1 Project Construction Noise

Development of project areas will involve excavation, grading, and other typical construction activities during construction. The various construction phases of the project may generate significant amounts of noise. The actual noise levels produced during construction will be a function of the methods employed during each stage of the construction process. Typical ranges of construction equipment noise are shown in Figure 5. Earthmoving equipment, e.g., bulldozers and diesel-powered trucks, will probably be the loudest equipment used during construction.

5.2 Project Generated Stationary Mechanical Noise and Compliance with State of Hawaii Community Noise Control Rule

The new land development will incorporate stationary and non-stationary mechanical equipment that is typical for commercial buildings and industrial areas. Noise from this equipment must meet the State noise rules, which stipulate maximum permissible noise limits at the property line. For industrial areas adjacent to other industrial, commercial, and residential areas, the noise limits are 70 dBA during the day and night. Mitigation of mechanical noise to meet the State DOH noise rules should be incorporated into the project design.

Intermittent industrial noises may be audible at the adjacent Kapolei West and Koolina residential communites. It is recommended that the industrial lands closest to the proposed golf course, park, and residences be dedicated for light industrial and low noise operations.

5.3 Compliance with FHWA/HDOT Noise Limits

A vehicular traffic noise analysis was completed for the existing conditions, future year 2018 projections without the Kapolei Harborside Center project, and future year 2018 projections with the project using the FHWA Traffic Noise Model Look-up Tables Software Version 2.5 (2004) [Reference 9]. The traffic noise analysis is based on the traffic counts provided by the Traffic Consultant [Reference 10]. Vehicular traffic noise levels were calculated for 4 locations, Locations A, B, C, and D, as shown in Figure 3. The short-term noise measurement and corresponding traffic counts were used to calibrate the software at the noise prediction location along Kalaeloa Boulevard (Location A). Only future noise level predictions were made for Locations B and C because the corresponding roadways do not yet exist. The results of the traffic noise analysis for the existing and future year projections are described below and summarized in Table 3.

5.3.1 Vehicular Traffic Noise Impacts on the Surrounding Community

Noise Prediction Location A

For the commercial areas adjacent Kalaeloa Boulevard, existing and future noise levels were calculated to be below the FHWA/DOT maximum noise limit of 72 dBA during peak traffic hours. Vehicular traffic noise levels at Location A, 100 feet from the roadway, are expected to increase by less than 2 dB in the future without the project. A traffic noise decrease of less than 1 dB due to the project is expected because many vehicles will utilize the proposed Hanua Street extension. A 3 dB change is not considered to be significant.

Noise Prediction Location B

Future year traffic projections show that traffic noise levels at the proposed Kapolei West residential development at least 100 feet from the proposed Kapolei Parkway extension (Location B) are expected to equal the FHWA/DOT maximum noise limit of 67 dBA both with and without the project. The increase in traffic noise due to the Kapolei Harborside Center project is expected to be minimal.

Noise Prediction Locations C

Future year traffic projections without the project show that traffic noise levels at the proposed Kapolei West residential development at least 150 feet from the proposed Hanua Street extension (Location C) are expected to be below the FHWA/DOT maximum noise limit of 67 dBA. The projected increase in traffic noise due to the Kapolei Harborside Center

project is approximately 3 dB and noise levels are expected to approach the FHWA/DOT maximum noise limit.

Noise Prediction Location D

Year 2018 projections of traffic volumes along the H-1 corridor with the project indicate an increase in traffic noise of less than 1 dB, which is not a significant noise increase.

5.3.2 Vehicular Traffic Noise Impacts on the Project

The industrial parcels on the eastern edge of the project site adjacent to the proposed Hanua Street are expected to experience noise levels within the FHWA/DOT maximum noise limit of 72 dBA during peak traffic hours. Vehicular traffic noise levels are expected to increase by 3 dB or less in the future due to the Kapolei Harborside Center project and will comply with the FHWA/DOT maximum noise limit.

5.4 Compliance with EPA Noise Guidelines

The EPA has an existing design goal of $L_{dn} \leq$ 65 dBA and a future design goal $L_{dn} \leq$ 55 dBA for exterior noise levels. The results from the long-term noise measurements conducted at the proposed Kapolei Harborside Center project site show an average calculated day-night level, L_{dn}, of 57 dBA which exceeds the future EPA design goal. In the future, industrial noises will contribute to the overall noise level in addition to increased traffic noise throughout the project site due to Hanua, Lauwiliwili, and Opakapaka Street extensions and additional service roads. Noise levels at the project site may exceed the existing EPA design goal of 65 dBA depending on the type of industrial activities and proximity to roadways. It is important to note that the EPA noise guidelines are design goals and not enforceable regulations. However, these guidelines and design goals are useful tools for assessing the noise environment.

5.5 Compliance with FAA and HDOT Airports Division Guidelines

The Kapolei Harborside Center project site is outside of the 55 L_{dn} noise contour. Therefore, the project will not be impacted by aircraft noise.

6.0 NOISE IMPACT MITIGATION

6.1 Mitigation of Construction Noise

In cases where construction noise exceeds, or is expected to exceed the State's "maximum permissible" property line noise levels [Reference 1], a permit must be obtained from the State DOH to allow the operation of vehicles, cranes, construction equipment, power tools, etc., which emit noise levels in excess of the "maximum permissible" levels.

In order for the State DOH to issue a construction noise permit, the Contractor must submit a noise permit application to the DOH, which describes the construction activities for the project. Prior to issuing the noise permit, the State DOH may require action by the Contractor to incorporate noise mitigation into the

construction plan. The DOH may also require the Contractor to conduct noise monitoring or community meetings inviting the neighboring residents and business owners to discuss construction noise. The Contractor should use reasonable and standard practices to mitigate noise, such as using mufflers on diesel and gasoline engines, using properly tuned and balanced machines, etc. However, the State DOH may require additional noise mitigation, such as temporary noise barriers, or time of day usage limits for certain kinds of construction activities.

Specific permit restrictions for construction activities [Reference 1] are:

> "No permit shall allow any construction activities which emit noise in excess of the maximum permissible sound levels ... before 7:00 a.m. and after 6:00 p.m. of the same day, Monday through Friday."
>
> "No permit shall allow any construction activities which emit noise in excess of the maximum permissible sound levels... before 9:00 a.m. and after 6:00 p.m. on Saturday."
>
> "No permit shall allow any construction activities which emit noise in excess of the maximum permissible sound levels on Sundays and on holidays."

The use of hoe rams and jack hammers 25 lbs. or larger, high pressure sprayers, chain saws, and pile drivers are restricted to 9:00 a.m. to 5:30 p.m., Monday through Friday. In addition, construction equipment and on-site vehicles or devices whose operations involve the exhausting of gas or air, excluding pile hammers and pneumatic hand tools weighing less than 15 pounds, must be equipped with mufflers [Reference 1].

The DOH noise permit does not limit the noise level generated at the construction site, but rather the times at which noisy construction can take place. Therefore, noise mitigation for construction activities should be addressed using project management, such that the time restrictions within the DOH permit are followed.

6.2 Mitigation of Kapolei Harborside Center Generated Noise

The design of the new industrial development should give consideration to controlling the noise emanating from mechanical equipment so as to comply with the State Department of Health *Community Noise Control* rules [Reference 1]. An acoustical wall that surrounds the industrial facility may be required to reduce noise levels at adjoining properties. In addition, buildings that are enclosed and include air-conditioning may emit less noise than buildings that are naturally ventilated. The most effective noise mitigation is to properly plan the project site by creating a buffer zone between noisy industrial activities and noise sensitive areas.

Accordingly, light or low noise industrial activities should be planned for the parcels that border the north and northwest property lines and should only occur during the day so there will be a minimal noise impact on the neighboring

residential developments. Light industrial activities include warehousing, light manufacturing or processing, and packaging or repair establishments.

6.3 Mitigation of Vehicular Traffic Noise

The Kapolei Harborside Center project will not be impacted by vehicular traffic noise from roadways within and surrounding the project. Therefore, mitigation of traffic noise is not necessary at the project site.

Vehicular traffic noise from Kapolei Parkway and Hanua Street extensions may exceed the FHWA/DOT maximum permissible noise limit at the planned neighboring residential development, Kapolei West. Although the development does not yet exist, a traffic noise impact is expected in the future. Therefore, design of the residential development should take into account appropriate setbacks from the aforementioned two roads in order to comply with the FHWA's maximum exterior Leq noise limit of 67 dBA. Other possible mitigation measures include construction of noise barriers (i.e., earth berms, walls, etc.) and air conditioning the impacted residences.

6.4 Mitigation of Aircraft Noise

The Kapolei Harborside Center project site is well outside the L_{dn} 55 dBA noise contour. Therefore, noise mitigation to attenuate aircraft noise is not necessary.

REFERENCES

1. Chapter 46, *Community Noise Control*, Department of Health, State of Hawaii, Administrative Rules, Title 11, September 23, 1996.

2. *Toward a National Strategy for Noise Control*, U.S. Environmental Protection Agency, April 1977.

3. *Department of Transportation, Federal Highway Administration Procedures for Abatement of Highway Traffic Noise*, Title 23, CFR, Chapter 1, Subchapter J, Part 772, 38 FR 15953, June 19, 1973; Revised at 47 FR 29654, July 8, 1982.

4. *Federal Highway Administration's Traffic Noise Model*, FHWA-RD-77-108; U.S. Department of Transportation, December 1978.

5. *Noise Analysis and Abatement Policy*, Department of Transportation, Highways Division, State of Hawaii, June 1977.

6. FAA Regulations on Airport Noise Compatibility Planning Programs, Code of Federal Regulations, Title 14, Chapter 1, Subchapter 1, Part 150; Issued by 49 FR 49269, December 18, 1984; corrected by 50 FR 5063, February 6, 1985; amended by 53 FR 8723, March 16, 1988; corrected by 53 FR 9726, March 24, 1988.

7. *Honolulu International Airport Master Plan Update and Noise Compatibility Program*, State of Hawaii Department of Transportation, Airports Division, Vol. 2, December 1989.

8. *Kalaeloa Airport Master Plan,* State of Hawaii Department of Transportation, Airports Division, November 1998.

9. *Federal Highway Administration's Traffic Noise Model Look-up Tables Software*, Ver. 2.5; U.S. Department of Transportation, December 17, 2004.

10. *Kapolei Harborside Center Traffic Impact Analysis Report Appendices,* Wilbur Smith Associates, March 30, 2006.

TABLE 1:
FAR Part 150 Recommendations for Land Use Compatibility in Yearly Day-Night Average Sound Levels

TYPE OF LAND USE	Yearly Day-Night Average Sound Level (L_{dn})					
	< 65	65-70	70-75	75-80	80-85	> 85
RESIDENTIAL:						
Residential (except mobile homes & transient lodgings)	Y	N(1)	N(1)	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N(1)	N(1)	N(1)	N	N
PUBLIC USE:						
Schools	Y	N(1)	N(1)	N	N	N
Hospitals and nursing homes	Y	25	30	N	N	N
Churches, auditoriums, and concert halls	Y	25	30	N	N	N
Government services	Y	Y	25	30	N	N
Transportation	Y	Y	Y(2)	Y(3)	Y(4)	Y(4)
Parking	Y	Y	Y(2)	Y(3)	Y(4)	N
COMMERCIAL USE:						
Offices, business and professional	Y	Y	25	30	N	N
Wholesale/Retail:(bldg. Mater., hardware, & farm equip.)	Y	Y	Y(2)	Y(3)	Y(4)	N
Retail trade – general	Y	Y	25	30	N	N
Utilities	Y	Y	Y(2)	Y(3)	Y(4)	N
Communication	Y	Y	25	30	N	N
MANUFACTURING AND PRODUCTION:						
Manufacturing, general	Y	Y	Y(2)	Y(3)	Y(4)	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y(6)	Y(7)	Y(8)	Y(8)	Y(8)
Livestock farming and breeding	Y	Y(6)	Y(7)	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
RECREATIONAL USE:						
Outdoor sports arenas and spectator sports	Y	Y(5)	Y(5)	N	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusements, parks, resorts and camps	Y	Y	Y	N	N	N
Golf courses, riding stables and water recreation	Y	Y	25	30	N	N

Note: Numbers in parentheses refer to the following notes.

(1) Where the community determines that residential or school uses must be allowed, measures to achieve outdoor-to-indoor Noise Level Reduction (NLR) of at least 25 dB and 30 dB should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide a NLR of 20 dB, thus, the reduction requirements are often stated as 5, 10, or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year round. However, the use of NLR criteria will not eliminate outdoor noise problems.

(2) Measures to achieve NLR 25 must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

(3) Measures to achieve NLR 30 must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

(4) Measures to achieve NLR 35 must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

(5) Land use compatible provided special sound reinforcement systems are installed.

(6) Residential buildings require a NLR of 25.

(7) Residential buildings require a NLR of 30.

(8) Residential buildings are not permitted.

Abbreviations:

Y(Yes) = Land Use and related structures compatible w/o restrictions.

N(No) = Land Use and related structures are not compatible and should be prohibited.

NLR = Noise Level Reduction (outdoor-to-indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.

25, 30, or 35 = Land use and related structures general compatible; measures to achieve NLR of 25, 30, or 35 dB must be incorporated into design and construction of structures.

Regulatory Note.
The designations contained in this table do not constitute a Federal determination that any use of land covered by the program is acceptable or unacceptable under Federal, State, or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with the local authorities. FAA determinations under Part 150 are not intended to substitute federally determined land uses for those determined to be appropriate by local authorities in response to locally determined needs and values in achieving noise compatible land uses.

Source: FAR Part 150, Appedix A, Table 1. "Land Use Compatibility with Yearly Day-Night Average Sound Levels."

TABLE 2:
State Department of Transportation Airports Division Recommendations for Local Land Use Compatibility in Yearly Day-Night Average Sound Levels (Ldn)

TYPE OF LAND USE	Yearly Day-Night Average Sound Level (L_{dn})					
	< 60	60-65	65-70	70-75	75-80	80-85
RESIDENTIAL:						
Low density residential, resorts, & hotels (w/ outdoor fac)	Y(a)	N(b)	N	N	N	N
Low density apartment w/ moderate outdoor use	Y	N(b)	N	N	N	N
High density apartment with limited outdoor use	Y	N(b)	N(b)	N	N	N
Transient lodgings (w/limited outdoor use)	Y	N(b)	N(b)	N	N	N
PUBLIC USE:						
Schools, day care centers, libraries, and churches	Y	N(c)	N(c)	N(c)	N	N
Hospitals, nursing homes, clinics, and health facilities	Y	Y(d)	Y(d)	Y(d)	N	N
Indoor auditoriums, and concert halls	Y(c)	Y(c)	N	N	N	N
Government services and offices serving the public	Y	Y	Y(d)	Y(d)	N	N
Transportation and parking	Y	Y	Y(d)	Y(d)	Y(d)	Y(d)
COMMERCIAL USE:						
Offices - government, business and professional	Y	Y	Y(d)	Y(d)	N	N
Wholesale/Retail: bldg. Mater., hardware, & heavy equip	Y	Y	Y(d)	Y(d)	Y(d)	Y(d)
Airport businesses - car rental, ticketing, lei stands, etc	Y	Y	Y(d)	Y(d)	N	N
Retail trade, restaurants, shp. Centers, financial inst., etc	Y	Y	Y(d)	Y(d)	N	N
Power plants, sweage treatment plants, & base yards	Y	Y	Y(d)	Y(d)	Y(d)	N
Studios w/o outdoor sets, broadcasting & Production fac	Y(c)	Y(c)	N	N	N	N
MANUFACTURING AND PRODUCTION:						
Manufacturing, general	Y	Y	Y(d)	Y(d)	Y(d)	N
Photographic and optical	Y	Y	Y(d)	Y(d)	N	N
Agriculture (except livestock) and forestry	Y	Y(e)	Y(e)	Y(e)	Y(e)	Y(e)
Livestock farming and breeding	Y	Y(e)	Y(e)	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
RECREATIONAL USE:						
Outdoor sports arenas and spectator sports	Y	Y(f)	Y(f)	N	N	N
Outdoor music shells, amphitheaters	Y(f)	N	N	N	N	N
Nature exhibits and zoos, neighborhood parks	Y	Y	Y	N	N	N
Amusements, beach parks, active playgrounds, etc	Y	Y	Y	Y	N	N
Public golf courses, riding stables, cemeteries, gardens, etc	Y	Y	N	N	N	N
Professional/resort sports facil., media event facil., etc	Y(f)	N	N	N	N	N
Extensive natural wildlife and recreation areas	Y(f)	N	N	N	N	N

Note: Letters in parentheses refer to the following notes.

(a) A noise level of 60 L_{dn} does not eliminate all risks of adverse noise impacts from aircraft noise. However, the 60 L_{dn} planning level has been selected by the State Airports Division as an appropriate compromise between the minimal risk of level of 55 L_{dn} and the significant risk level of 65 L_{dn}.

(b) Where the community determines that these uses should be allowed, Noise Level Reduction (NLR) measures to achieve interior levels of 45 L_{dn} or less should be incorporated into building codes and be considered in individual approvals. Normal local construction employing natural ventilation can be expected to provide an average NLR of approximately 9 dB. Total closure plus air conditioning may be required to provide additional outdoor-to-indoor NLR, but will not eliminate outdoor noise problems.

(c) Because the L_{dn} noise descriptor system represents a 24-hour average of individual aircraft noise events, each of which can be unique in respect to amplitude, duration, and tonal content, the NLR requirements should be evaluated for the specific land use, interior acoustical requirements, and properties of the aircraft noise events. NLR requirements should not be based solely upon the exterior L_{dn} exposure level.

(d) Measures to achieve required NLR must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

(e) Residential buildings require NLR. Residential buildings should not be located where exterior noise is greater than 65 L_{dn}.

(f) Impact of amplitude, duration, frequency, and tonal content of aircraft noise events should be evaluated.

Abbreviations:

Y(Yes) = Land Use and related structures compatible without restrictions.

N(No) = Land Use and related structures are not compatible and should be prohibited.

Source: Airports Division, Department of Transportation, State of Hawaii

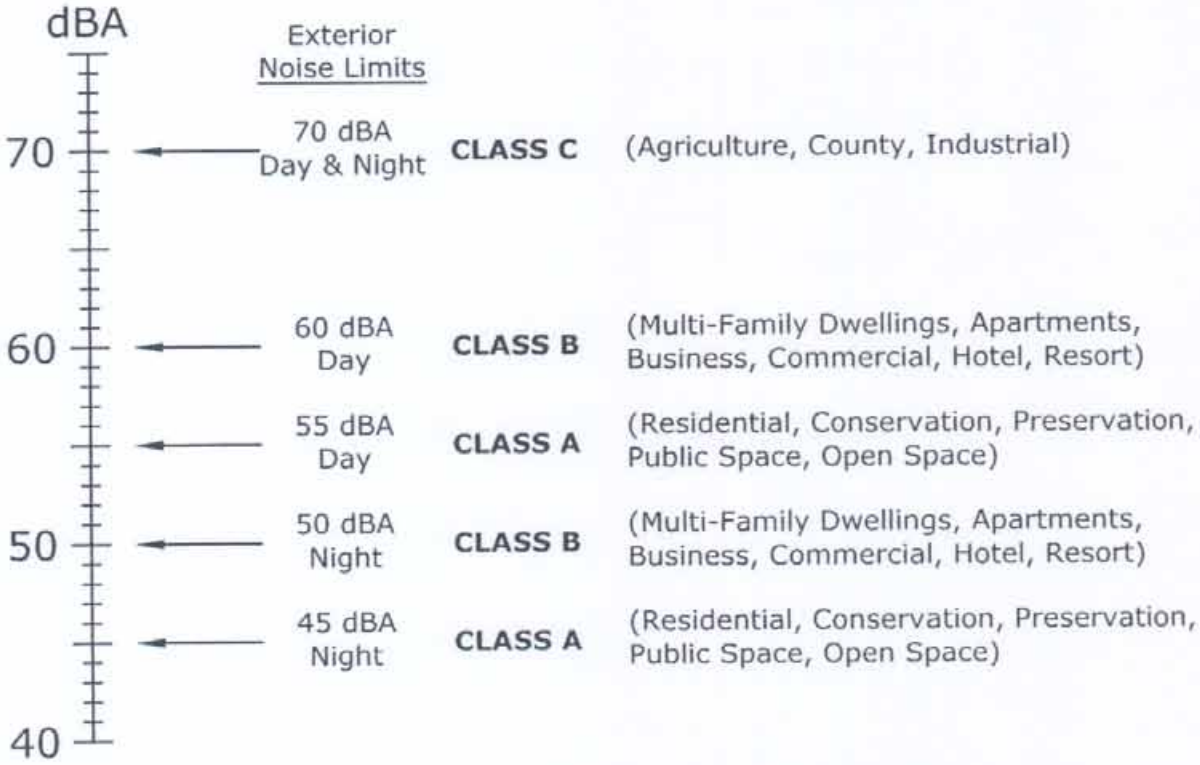
TABLE 3:
Predicted Traffic Noise Levels With and Without the Project and Resulting Increases Due to the Project[+]

Noise levels shown in the table are based on peak-hour traffic volumes, and are expressed in A-weighted decibels (dBA).

	Location A[*]		Location B[*]		Location C[*]		Location D[*]	
	AM	PM	AM	PM	AM	PM	AM	PM
Existing (Calculated)	69.4	67.3	N/A	N/A	N/A	N/A	N/A	N/A
Future Without Project (2018)	70.9	69.4	65.1	66.5	64.3	60.0	68.0	68.4
Future With Project (2018)	70.6	68.7	65.3	67.0	66.5	62.8	68.5	68.9
Future Increase Without Project (2018)	1.5	2.1	N/A	N/A	N/A	N/A	N/A	N/A
Future Increase With Project (2018)	1.2	1.4	N/A	N/A	N/A	N/A	N/A	N/A
Future Increase Due to Project (2018)	**-0.3**	**-0.7**	**0.2**	**0.5**	**2.2**	**2.8**	**0.5**	**0.5**

[+] The noise level calculations were based on the traffic study provided by the Traffic Consultant [Reference 10].
[*] Location A - 100 feet east of Kalaeloa Boulevard edge of pavement
Location B - 100 feet north of the Kapolei Parkway edge of pavement
Location C - 150 feet west of the proposed Hanua Road edge of pavement
Location D - 100 feet south of the H-1 Freeway edge of pavement

Zoning District	Day Hours (7 AM to 10 PM)	Night Hours (10 PM to 7 AM)
CLASS A Residential, Conservation, Preservation, Public Space, Open Space	55 dBA (Exterior)	45 dBA (Exterior)
CLASS B Multi-Family Dwellings, Apartments, Business, Commercial, Hotel, Resort	60 dBA (Exterior)	50 dBA (Exterior)
CLASS C Agriculture, Country, Industrial	70 dBA (Exterior)	70 dBA (Exterior)



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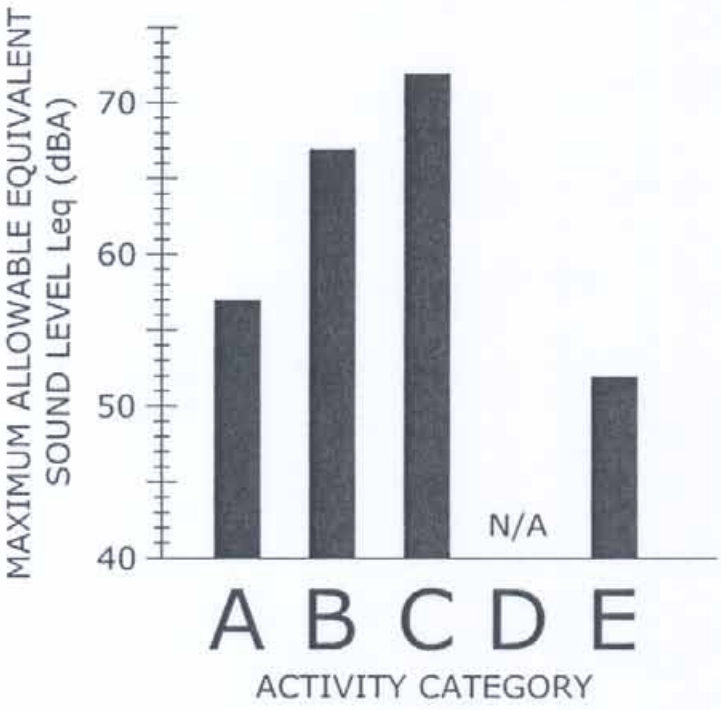
Hawaii Maximum Permissible Sound Levels for Various Zoning Districts

Kapolei Harborside Center

Not to Scale

Figure No 1

Date	Project No.	Drawn By
June 2006	06-13	TRB



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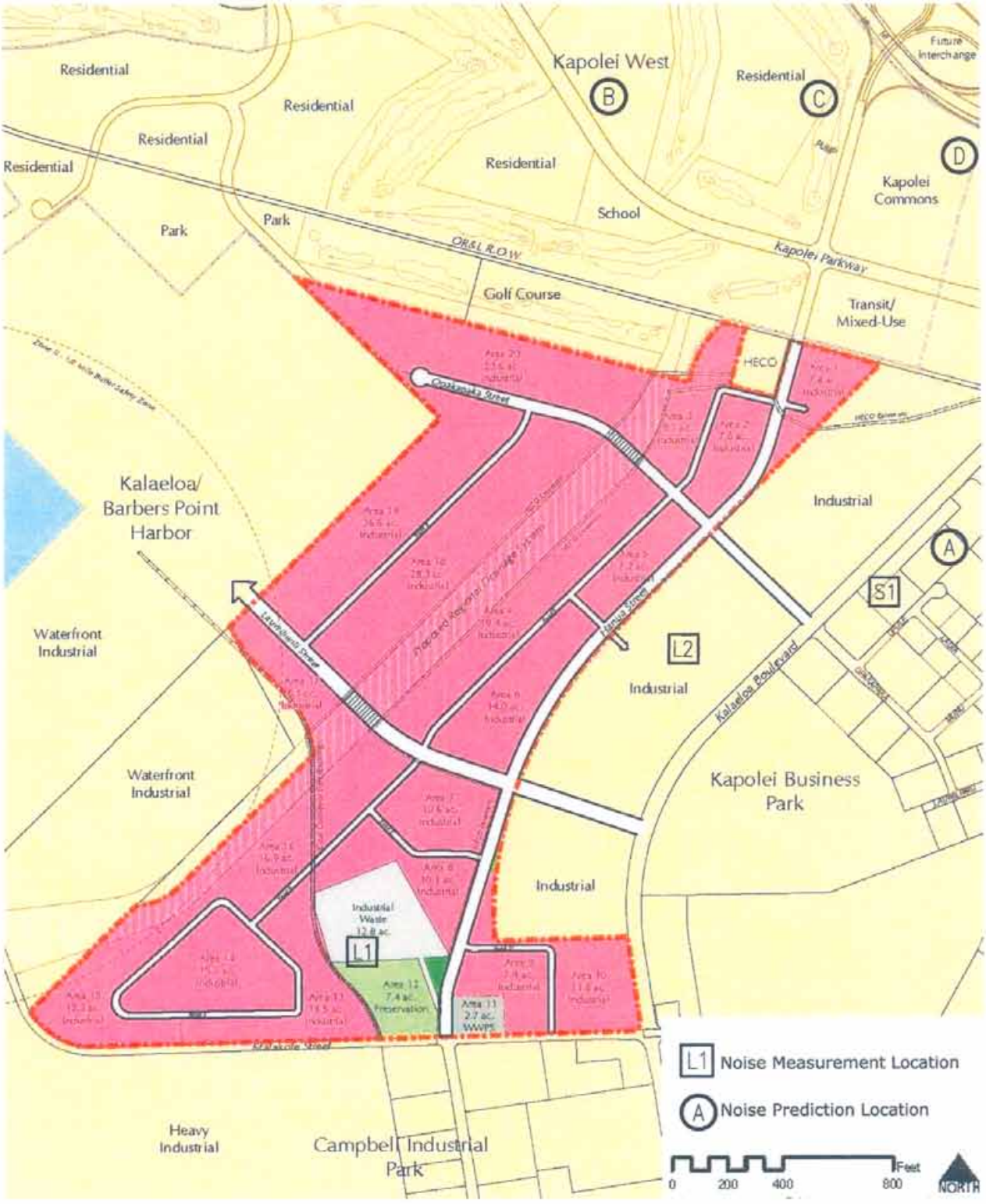
Federal Highways Administration Recommended Equivalent Hourly Sound Levels Based on Land Use

Kapolei Harborside Center

Not to Scale

Date	Project No.	Drawn By
June 2006	06-13	TRB

Figure No 2



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Noise Measurement and Prediction Locations

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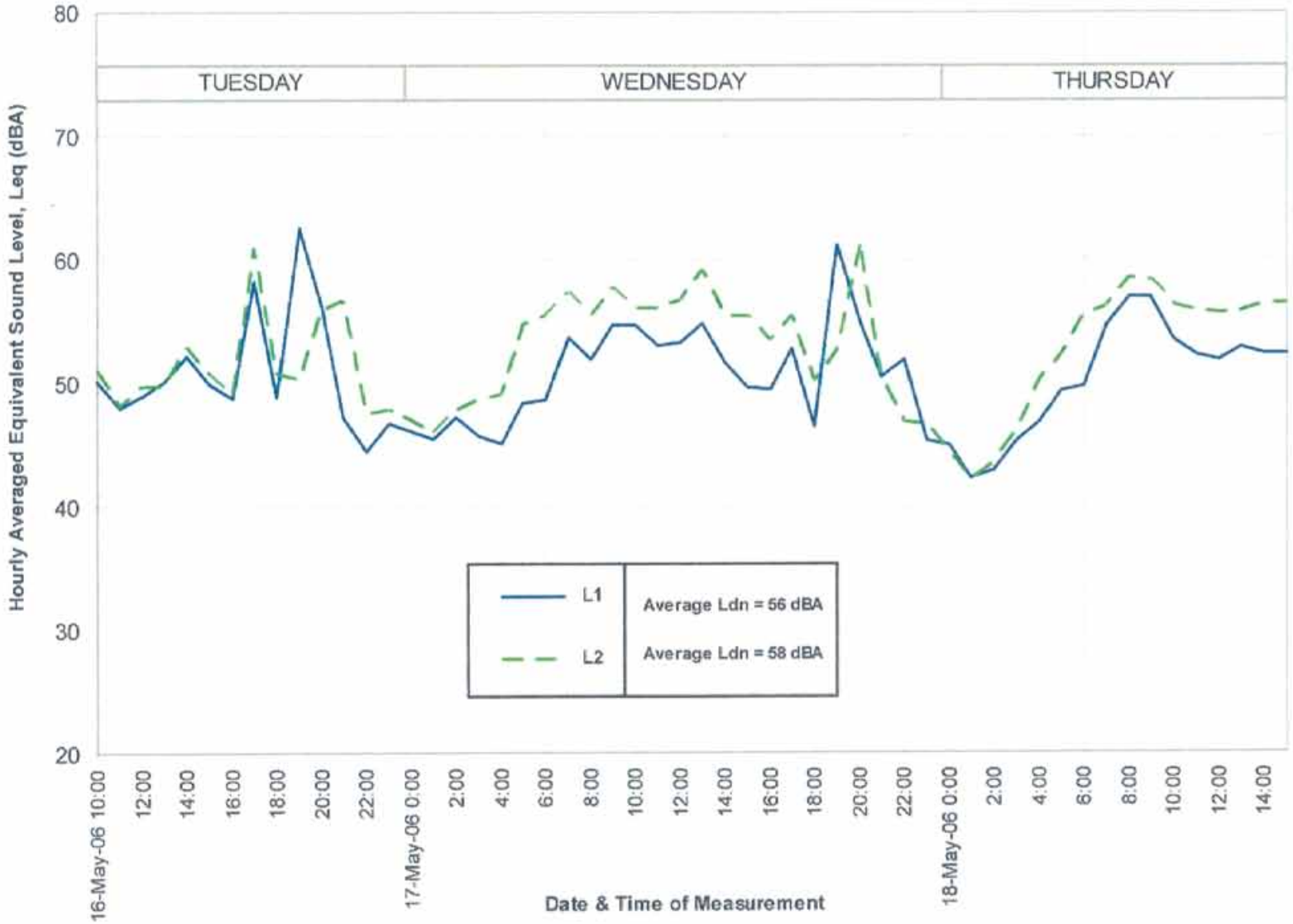
Not to Scale

Date	Project No.	Drawn By
June 2006	06-13	DFD

Figure No
3



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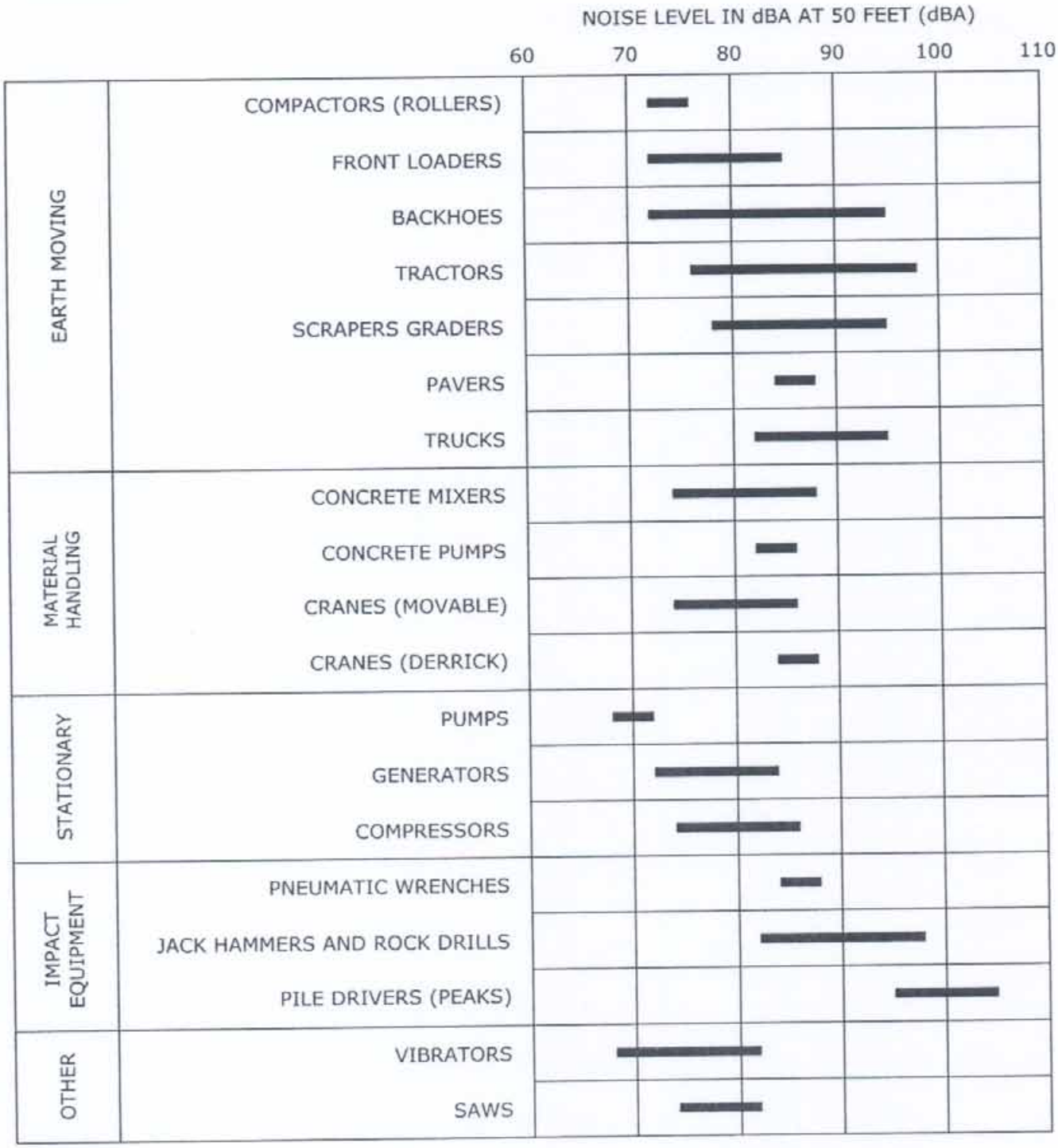
Graph of Long Term Noise Measurements

Kapolei Harborside Center

Not to Scale

Date	Project No.	Drawn By
June 2006	06-13	DFD

Figure No
4



NOTE: BASED ON LIMITED AVAILABLE DATA SAMPLES

Typical Sound Levels from Construction Equipment

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not to scale

Figure No 5

Date	Project No.	Drawn By
June 2006	06-13	TRB

APPENDIX A

Acoustic Terminology

Acoustic Terminology

Sound Pressure Level

Sound, or noise, is the term given to variations in air pressure that are capable of being detected by the human ear. Small fluctuations in atmospheric pressure (sound pressure) constitute the physical property measured with a sound pressure level meter. Because the human ear can detect variations in atmospheric pressure over such a large range of magnitudes, sound pressure is expressed on a logarithmic scale in units called decibels (dB). Noise is defined as "unwanted" sound.

Technically, sound pressure level (SPL) is defined as:

$$SPL = 20 \log (P/P_{ref}) \text{ dB}$$

where P is the sound pressure fluctuation (above or below atmospheric pressure) and P_{ref} is the reference pressure, 20 μPa, which is approximately the lowest sound pressure that can be detected by the human ear. For example:

If P = 20 μPa, then SPL = 0 dB
If P = 200 μPa, then SPL = 20 dB
If P = 2000 μPa, then SPL = 40 dB

The sound pressure level that results from a combination of noise sources is not the arithmetic sum of the individual sound sources, but rather the logarithmic sum. For example, two sound levels of 50 dB produce a combined sound level of 53 dB, not 100 dB. Two sound levels of 40 and 50 dB produce a combined level of 50.4 dB.

Human sensitivity to changes in sound pressure level is highly individualized. Sensitivity to sound depends on frequency content, time of occurrence, duration, and psychological factors such as emotions and expectations. However, in general, a change of 1 or 2 dB in the level of sound is difficult for most people to detect. A 3 dB change is commonly taken as the smallest perceptible change and a 6 dB change corresponds to a noticeable change in loudness. A 10 dB increase or decrease in sound level corresponds to an approximate doubling or halving of loudness, respectively.

A-Weighted Sound Level

Studies have shown conclusively that at equal sound pressure levels, people are generally more sensitive to certain higher frequency sounds (such as made by speech, horns, and whistles) than most lower frequency sounds (such as made by motors and engines)[1] at the same level. To address this preferential response to frequency, the A-weighted scale was developed. The A-weighted scale adjusts the sound level in each frequency band in much the same manner that the

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[1] D.W. Robinson and R.S. Dadson, "A Re-Determination of the Equal-Loudness Relations for Pure Tones," *British Journal of Applied Physics*, vol. 7, pp. 166 - 181, 1956. (Adopted by the International Standards Organization as Recommendation R-226.

human auditory system does. Thus the A-weighted sound level (read as "dBA") becomes a single number that defines the level of a sound and has some correlation with the sensitivity of the human ear to that sound. Different sounds with the same A-weighted sound level are perceived as being equally loud. The A-weighted noise level is commonly used today in environmental noise analysis and in noise regulations. Typical values of the A-weighted sound level of various noise sources are shown in Figure A-1.

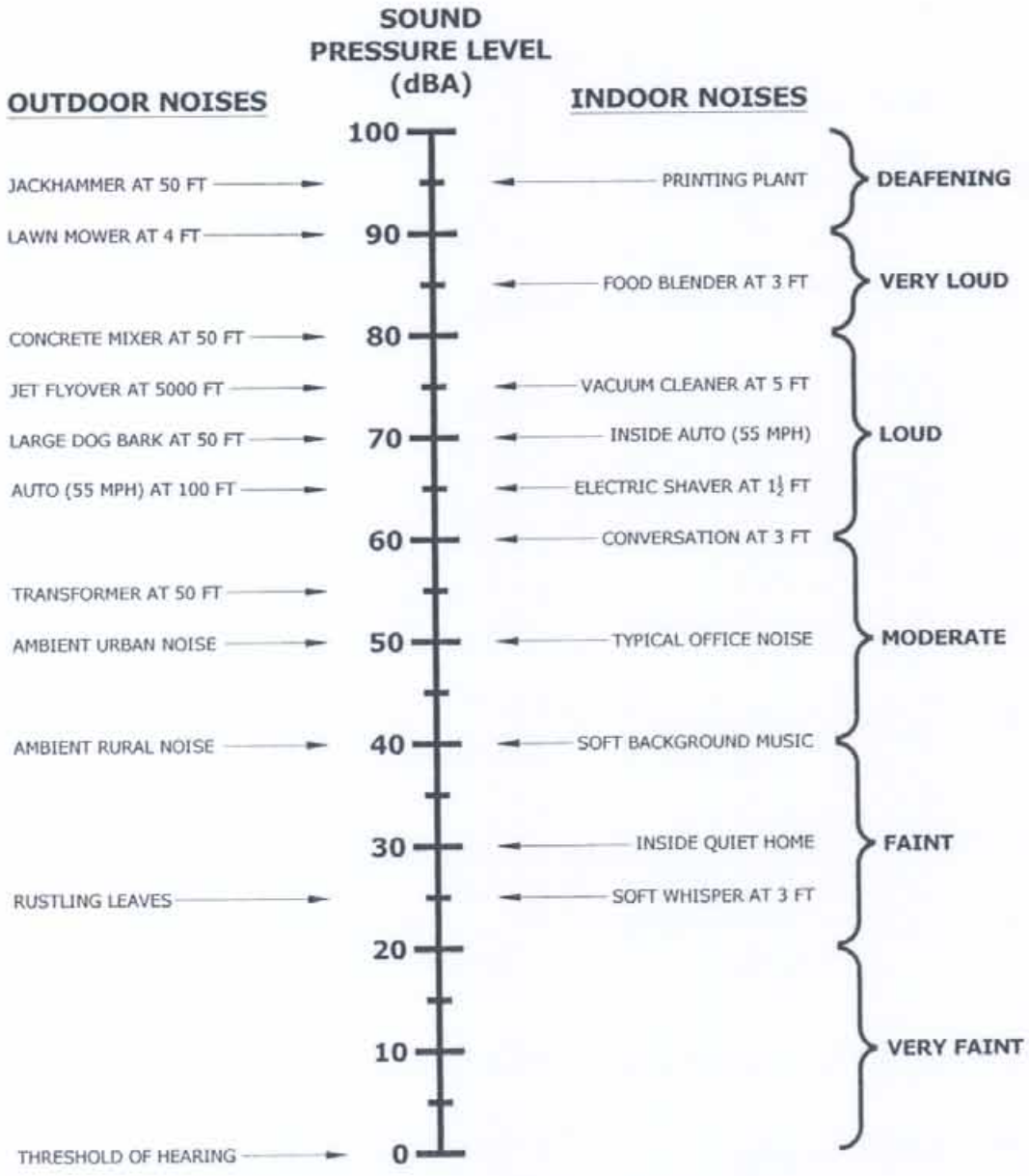

Figure A-1. Common Outdoor/Indoor Sound Levels

Equivalent Sound Level

The Equivalent Sound Level (L_{eq}) is a type of average which represents the steady level that, integrated over a time period, would produce the same energy as the actual signal. The actual *instantaneous* noise levels typically fluctuate above and below the measured L_{eq} during the measurement period. The A-weighted L_{eq} is a common index for measuring environmental noise. A graphical description of the equivalent sound level is shown in Figure A-2.

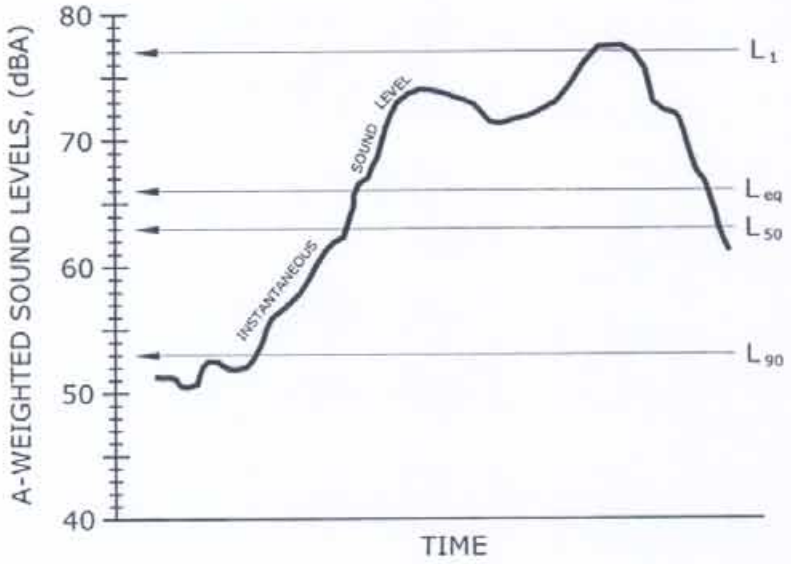

Figure A-2. Example Graph of Equivalent and Statistical Sound Levels

Statistical Sound Level

The sound levels of long-term noise producing activities such as traffic movement, aircraft operations, etc., can vary considerably with time. In order to obtain a single number rating of such a noise source, a statistically-based method of expressing sound or noise levels has been developed. It is known as the Exceedence Level, L_n. The L_n represents the sound level that is exceeded for n% of the measurement time period. For example, L_{10} = 60 dBA indicates that for the duration of the measurement period, the sound level exceeded 60 dBA 10% of the time. Typically, in noise regulations and standards, the specified time period is one hour. Commonly used Exceedence Levels include L_{01}, L_{10}, L_{50}, and L_{90}, which are widely used to assess community and environmental noise. A graphical description of the equivalent sound level is shown in Figure A-2.

Day-Night Equivalent Sound Level

The Day-Night Equivalent Sound Level, L_{dn}, is the Equivalent Sound Level, L_{eq}, measured over a 24-hour period. However, a 10 dB penalty is added to the noise levels recorded between 10 p.m. and 7 a.m. to account for people's higher sensitivity to noise at night when the background noise level is typically lower. The L_{dn} is a commonly used noise descriptor in assessing land use compatibility, and is widely used by federal and local agencies and standards organizations.

Location L1:
Approximately 350 feet west of Hanua Road, adjacent to the 7.4 acre preservation area.

Location L2:
Approximately 400 feet west of Kalaeloa Boulevard on the vacant parcel between Kapolei Business Park and the proposed Kapolei Harborside Center project.