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Acoustics and Noise

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David Lord, Ph.D.
Principal Consultant

August 28, 2006

Sound Level Assessment

RE: Condominium/Mixed-Use Project
803 N. Milpas St.
Santa Barbara, CA

Requested by :
Centerpoint Development Partners, LLC
1216 State St. Suite 605
Santa Barbara, CA 93101

Description and Noise Criteria:

The boundary dimensions, street locations, plans and elevations used in this noise analysis are taken from a boundary and topographic survey by Huitt-Zollars, Inc., dated 7/11/2006, and architectural drawings supplied by DesignARC Architects, Santa Barbara, dated July 2006. The potential noise issue is primarily the transportation source of Milpas Street to the northeast and De La Guerra Street to the southeast of the site. The potentially affected areas and the sound level findings are described in text and figures on the following pages.

With regard to land use, potential noise conflict and noise mitigation measures, the noise level standards contained in the Uniform Building Code and the Noise Element of the City of Santa Barbara General Plan, are used to evaluate the outdoor activity areas and residential unit layout and construction. The maximum acceptable noise exposure (Day-Night Average Level, **LDN**) is:

interior = 45 dBA
exterior = 60 dBA, normally

Existing Sound Levels along Milpas Street

The existing sound levels at the northeast property line on the affected side of the proposed mixed-use residential unit development was measured Friday and Saturday, August 18 and 19, 2008 (see Figure 1 for location of sound level measurement). Sound levels were measured every ten seconds continuously for 24 hours and the Day Night Level (**LDN)** was derived from the measurements. **LDN** is a single-number value that determines acceptability in the planning standards and in the

Noise Element of the General Plan for the City of Santa Barbara. Instantaneous noise peaks and valleys of a short time period (shown on pages 7 and 8 of this report) have only little individual influence on the overall daily **LDN** value.

Sound levels were measured at two locations for 24 hours (see Figure 1). The values from each measurement station were used to construct an existing noise contour map for the site, using CADNA noise mapping and prediction software. The existing noise contour map is shown in Figure 1. A second noise contour map was also generated for the future condition with proposed buildings in place (see Figure 2). Future sound levels at the northeast side are expected to grow slightly along with the growth in Average Daily Traffic. As sound level is a logarithmic value, it will require an estimated decade of growth in average daily traffic volume to result in an additional one dBA of **LDN** sound level increase. Sound levels for the 24-hour monitoring period are shown for each measurement station on pages 7 and 8. LDN values are shown on page 9. Wind speed can play a role in accuracy of measurements, and windspeeds are shown on page 10. Wind speed was marginally high during a few afternoon hours on Friday, but the results were examined for wind noise and judged to be acceptable.

North Milpas Street is a moderate-level transportation noise source, traveled by cars, trucks, and motorcycles, with a direct noise impact on the proposed mixed-use northeast elevation. Traffic on Milpas Street averages about 35 m.p.h. The intersection of Milpas St. with De La Guerra St., with resulting deceleration and acceleration of traffic, adds a small amount to the transportation noise load. Seasonal variations in traffic may be evident, due to the nearby commercial areas, which will contribute to somewhat higher traffic density during the holiday season. However, this would be at a time when residential unit windows may be shut due to cooler weather. Average Daily Traffic (ADT) is shown by City of Santa Barbara Public Works Department to be 15,000 to 17,000 on North Milpas Street and 4,000 to 5,000 vehicles on De La Guerra Street.

Both northbound and southbound travel lanes of North Milpas Street will be visible from the second and third floor of the proposed residential units. Noise from De La Guerra Street to the southeast of the site is not judged to be as significant in comparison to Milpas Street.

The LDN sound level at the northeast side and southeast side of the site at five feet above grade level and above is greater than the allowable LDN = 60 dBA. Sound level increases with elevation above grade for potential second and third floor dwelling units. Therefore, noise mitigation for habitable spaces and outdoor activity areas facing Milpas St. and facing De La Guerra Street is required in order to meet building code and General Plan requirements.

Recommended Outdoor Activity / Deck Front / Balcony Construction.

Outdoor activity areas are required by the Noise Element to have less than LDN = 60 dBA sound levels. For all proposed outdoor activity spaces facing Milpas Street and De La Guerra Street, the following construction specification will result in the required performance of less than 60 dBA exterior noise level:

> Proposed outdoor balconies or decks require a vertical, solid wall three feet high with reference to finish floor elevation, with no openings or gaps facing the noise source. The deck wall facing the noise source shall have a minimum ¾ inch solid thickness, sealed with non-hardening acoustical sealant at all edges, seams and construction joints. However, if glazing is used for this wall, the glazing shall be minimum 1/2 inch thick laminated glass (three unequal layers: ¼", 0.060 innerlayer, 3/16"). Floor drains facing the noise source shall have a 90 degree bend incorporated in their design, with one opening facing away from the transportation noise source.

Recommended Construction for East and South-facing Elevations.

The following construction specification will result in an acoustical performance of less than LDN = 45 dBA interior noise level along the east and south elevations, where construction assemblies face the transportation noise source. Noise mitigation may fail to perform if each and every following recommendation is not followed. A small crack or air leak in the construction may completely compromise all other sound-proofing.

> **Vents and roof penetrations:** Soffit vents, eave vents, dormer vents and other wall and roof penetrations shall be located on the walls and roofs facing away from the noise source (located on the north and west elevation) wherever possible. If kitchens or bathrooms are located on the east ore south side, remote venting to other elevations is required. If vents are required to be located facing the noise source, a 90 degree bend shall be incorporated in the design of the ductwork or vent opening.
>
> **Walls:** Only the east- and south-facing exterior walls closest to the transportation noise sources require mitigation. The wall enclosing habitable spaces nearest the noise source shall be constructed with an S.T.C. (Sound Transmission Class) rating of 30 or greater. For instance,

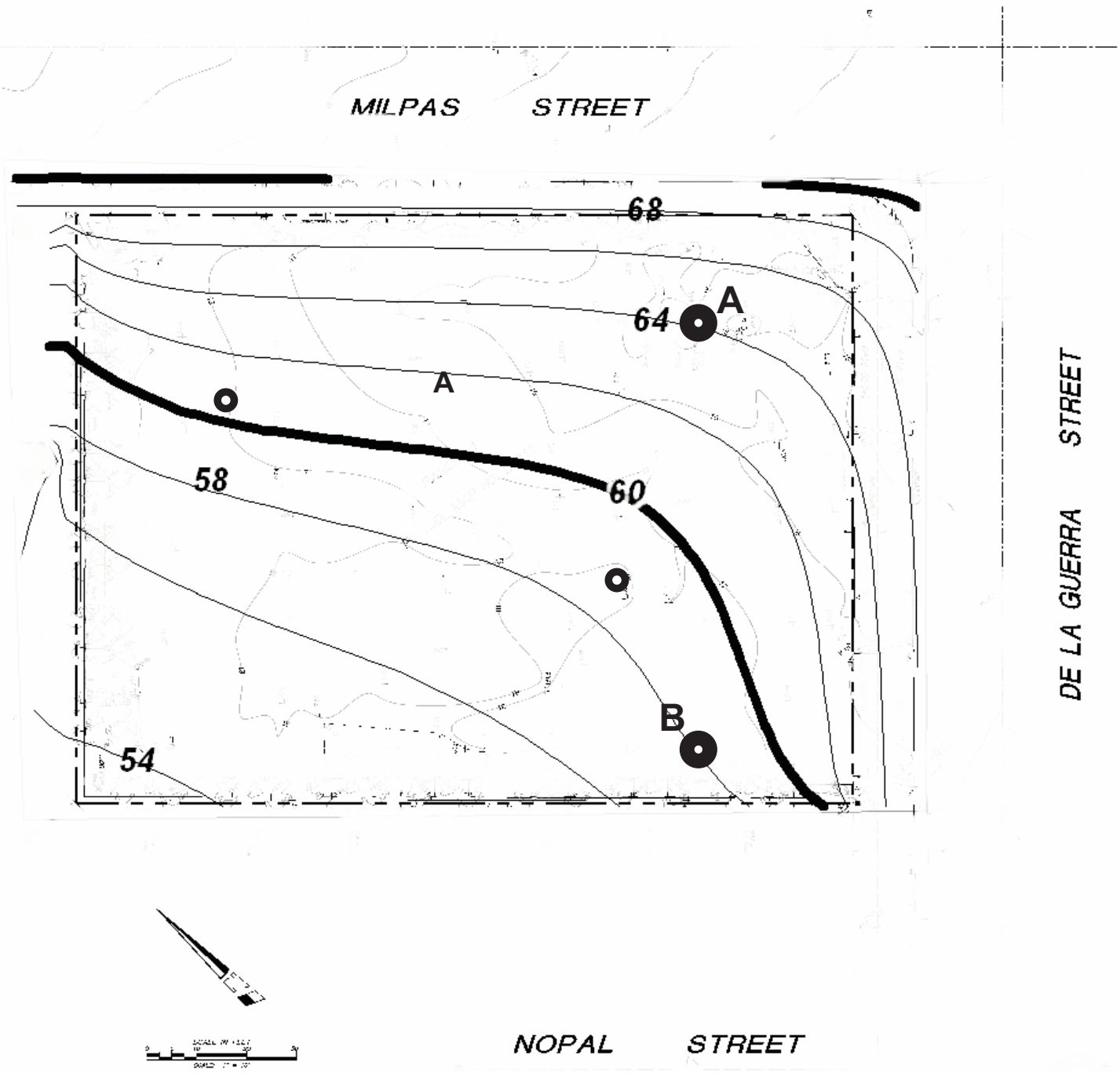
stucco exterior or fiber-cement panel siding, with 30 pound felt on 5/8” sheathing, on 2" x 6" stud walls with R-21 fiber glass batt insulation, a ½” layer of interior sound deadening board (Homasote 440 Sound Barrier or equivalent), and a layer of 5/8" Type X Gypsum Board will provide an S.T.C. rating of 30 or greater.

Construction of the east and south-facing walls must include the liberal use of non-hardening acoustical sealant at all construction joints, including the header and footer construction and the edges and corners of gypsum board intersecting ceiling, walls and floor, especially behind papered joints. Apply Homasote 440 Sound Barrier directly to the interior side of conventional 2" x 6" framing, 16"o.c. using 5d adhesive coated nails. Space nails 3/8" from edges, 6" apart around panel edges and 12" apart on each stud in panel field. Countersink all nails at least 1/16" below surface. Provide a gap of 1/8" between abutting edges, 1/4" between floor and ceiling. Using a good grade drywall laminating compound and a notched trowel, apply a 6" wide strip down the vertical center of 5/8" thick Type X Gypsum Board and a 6" wide strip down each side, 2" away from edges. Apply the compound coated Gypsum Board directly to the 440 Sound Barrier. Avoid coinciding butt joints of Gypsum with 440 Sound Barrier joints. Secure Gypsum with double headed nails, or bracing, until laminating compound sets. Apply resilient acoustical sealant (Johns Manville or equivalent) to gaps at intersecting walls, ceiling and floor before taping and spackling Gypsum Board in conventional manner. Seal all peripheries and apertures and joints around windows.

Acoustic Leaks: Common acoustic leaks, such as electrical outlets, pipes, vents, ducts, flues and other breaks in the integrity of the wall, ceiling or roof insulation and construction on the east and south sides of the dwelling units nearest transportation noise source shall receive special attention during construction. All construction openings and joints through the gypsum board on east- and south-facing walls shall be insulated, sealed and caulked with expanding foam and a resilient, non-hardening caulking material, as appropriate. All such openings and joints shall be airtight to maintain sound isolation.

Windows: To meet the interior LDN 45 DBA requirements, windows for habitable spaces on all floors of affected west elevation facing the noise source shall be of double-glazed construction with one light of laminated glass, and installed in accordance with the recommendations of the manufacturer. The windows shall be fully gasketed, with an S.T.C. rating of 35 or better, as determined in testing by an accredited acoustical laboratory. An example that meets this requirement is Milgard Quiet Line windows with laminated glass.

Doors: More than 90% of all exterior noise comes in through windows and doors. To meet the interior LDN 45 DBA requirements, doors directly facing the noise source shall be solid core with sound dampening and fully gasketed, sealed jambs and grouted frames, with an overall S.T.C. rating of 35 or better, as determined in testing by an accredited acoustical laboratory.



Existing noise contour map with no buildings on site.

August 24, 2006
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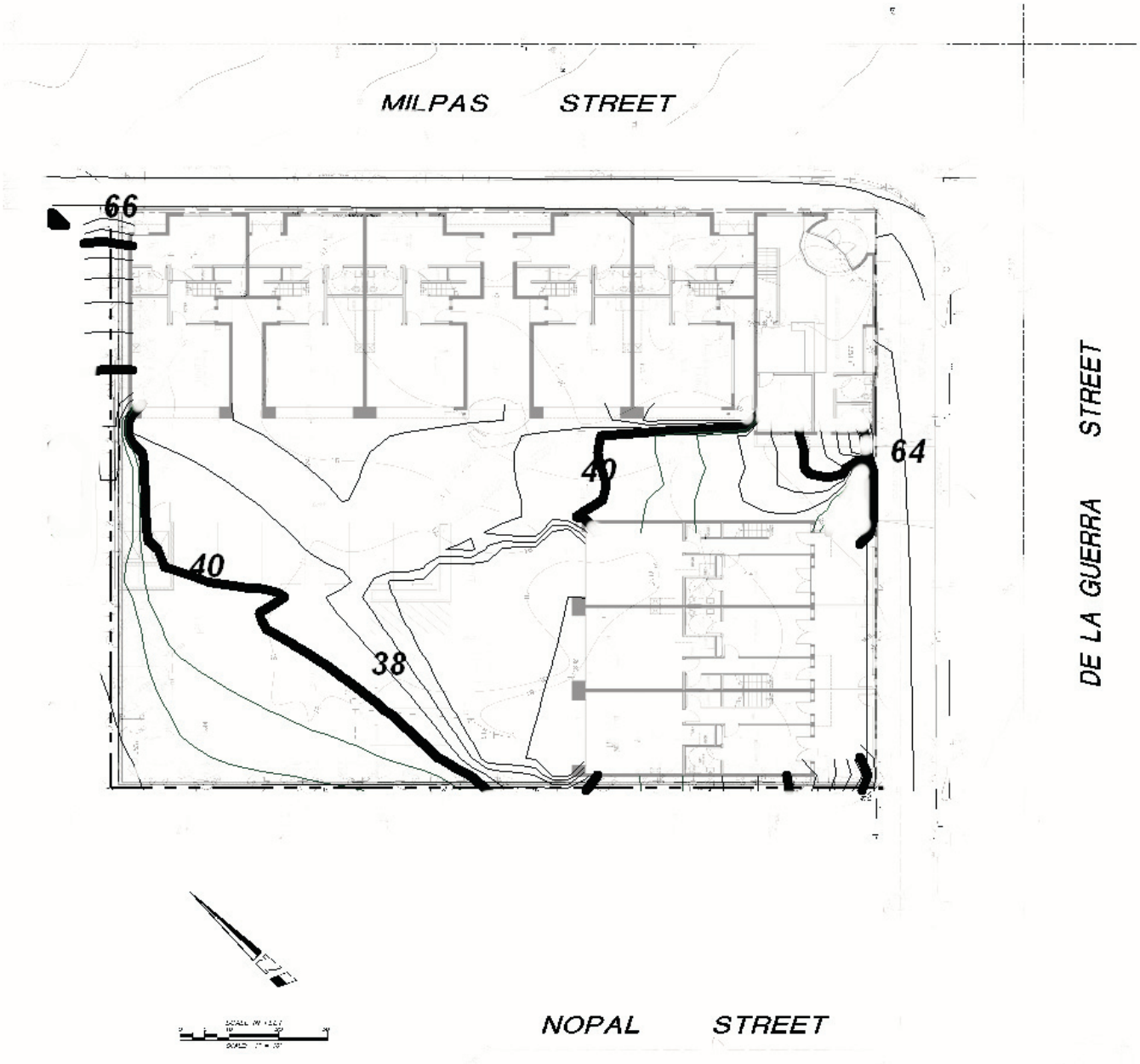
San Luis Obispo, CA 93405
tel 805.549.8046

803 N. Milpas St.
Noise Contour Map
LDN = 24 hour Day / Night Level

A **Long Term Measurement**

Short Term Measurement



Future noise contour map with proposed buildings in place

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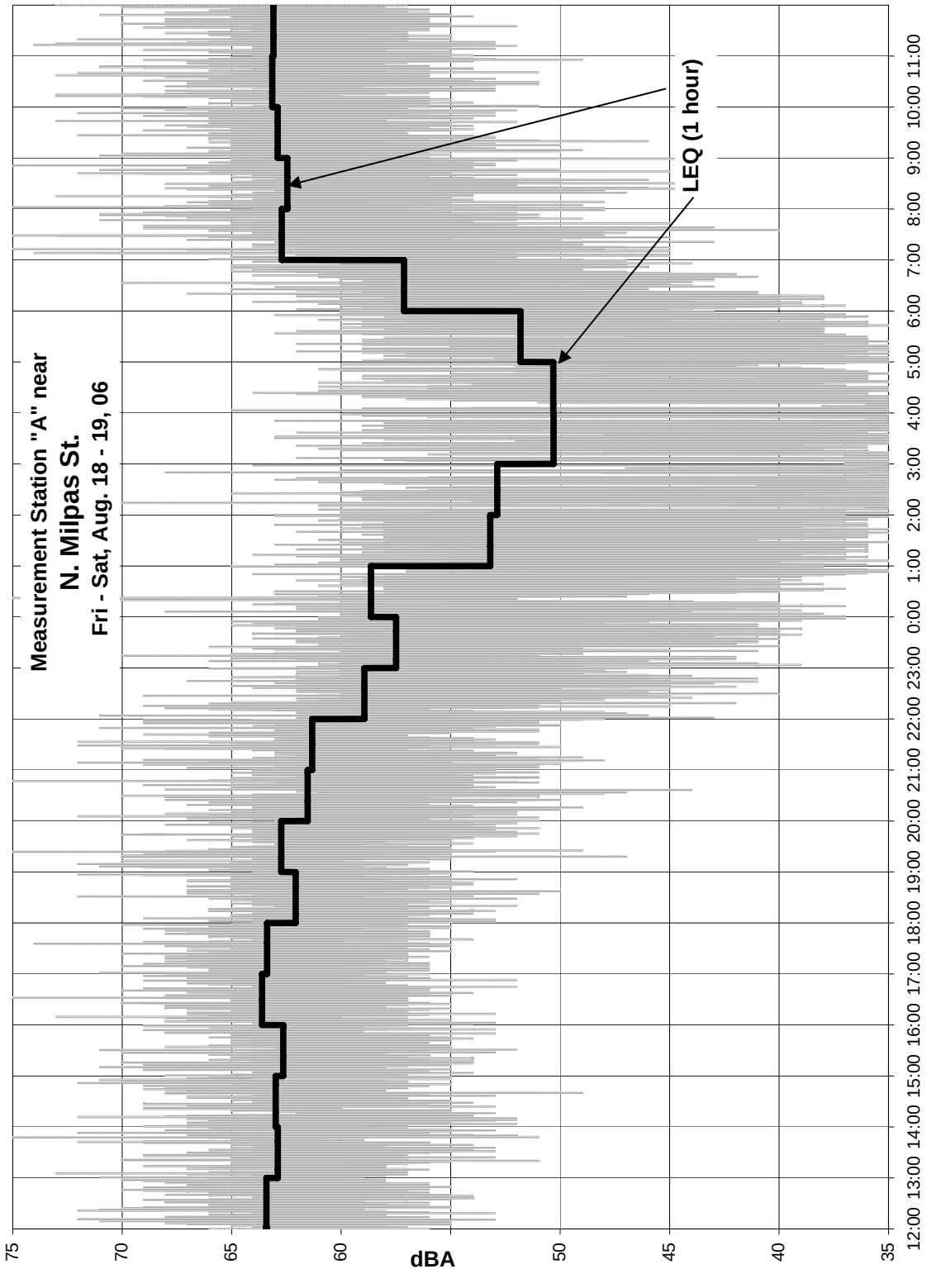
803 N. Milpas St.
Noise Contour Map
LDN = 24 hour Day / Night Level


Measurement Station "A" near
N. Milpas St.
Fri - Sat, Aug. 18 - 19, 06
LEQ (1 hour)
dBA
75
70
65
60
50
45
40
35
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
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6:00
7:00
8:00
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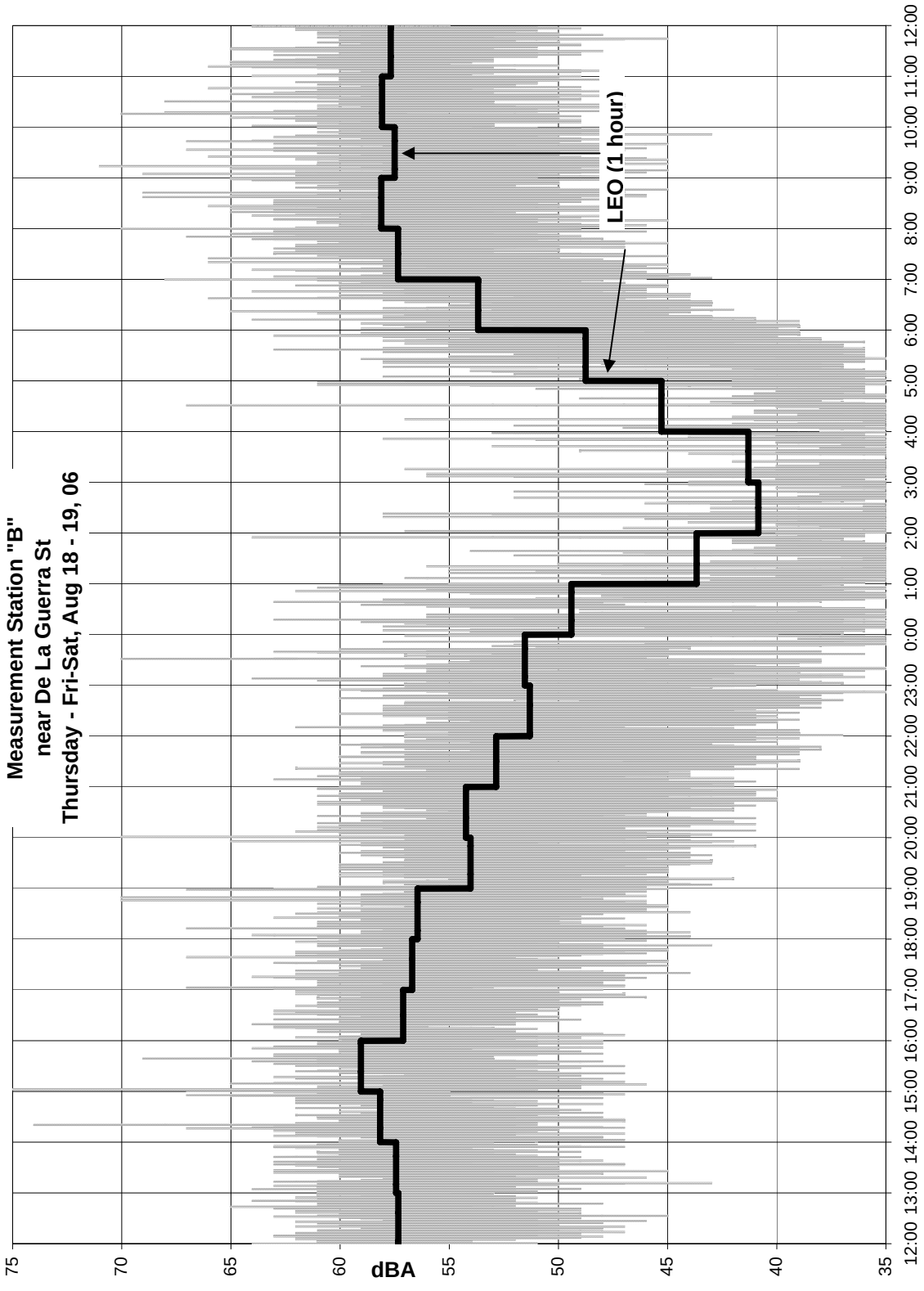
10:00
11:00


Measurement Station "B"
near De La Guerra St
Thursday - Fri-Sat, Aug 18 - 19, 06
LEO (1 hour)
dBA
75
70
65
60
55
50
45
40
35
12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00

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David Lord, Principal Consultant

803 N. Milpas St.

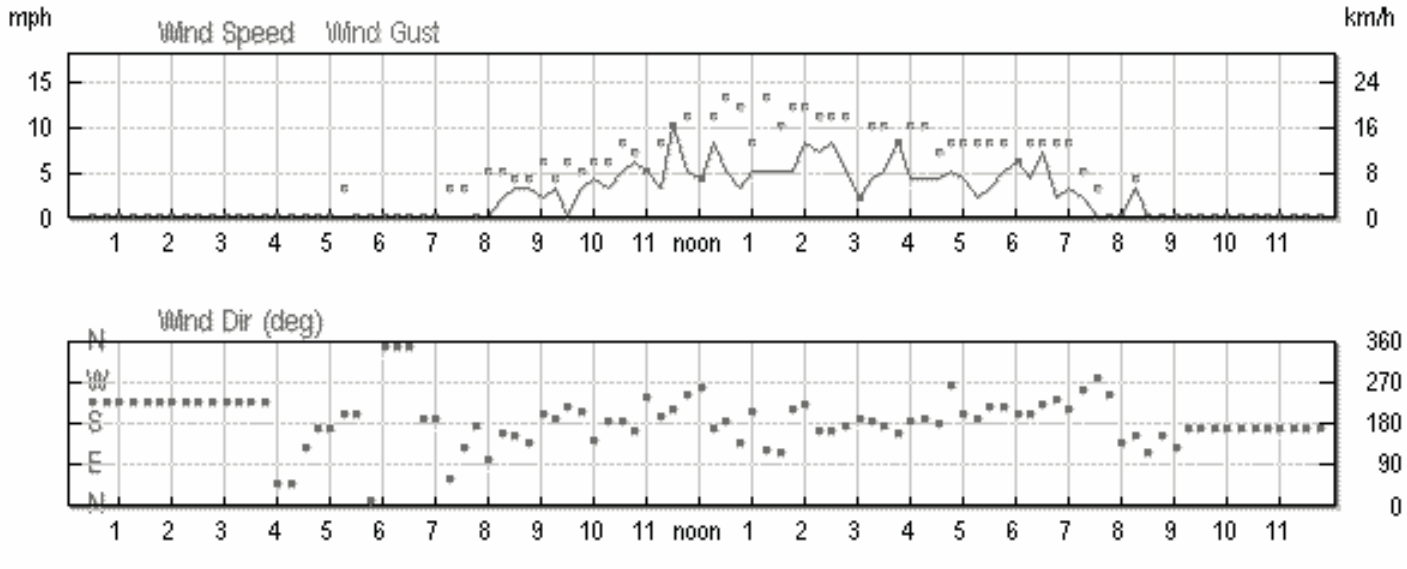
Santa Barbara, CA

5 feet above existing grade
Facing De La Guerra Aug. 18 - 19, 2006

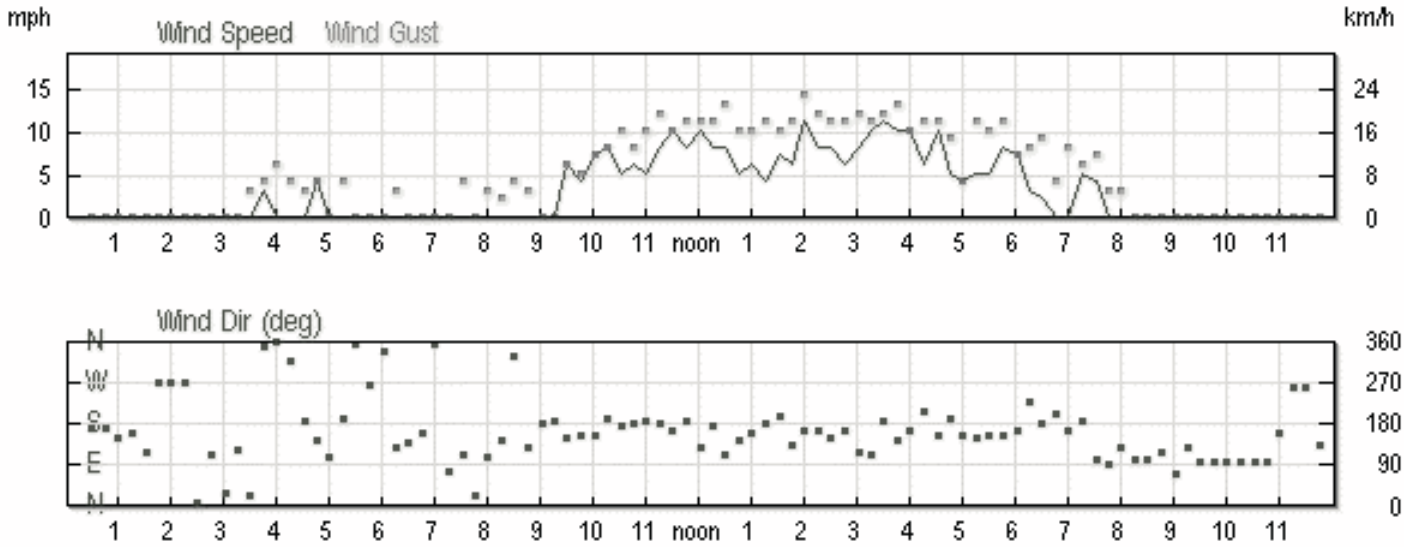
5 feet above existing grade
Facing Milpas St

LEQ (hour) calculated from 10 second continuous measurements

	dBA	hour	dBA	hour
Calculated DAY LEQ:	**57**	**0700**	**63**	**0700**
Calculated DAY LEQ:	**58**	**0800**	**62**	**0800**
Calculated DAY LEQ:	**57**	**0900**	**63**	**0900**
Calculated DAY LEQ:	**58**	**1000**	**63**	**1000**
Calculated DAY LEQ:	**58**	**1100**	**63**	**1100**
Calculated DAY LEQ:	**57**	**1200**	**63**	**1200**
Calculated DAY LEQ:	**57**	**1300**	**63**	**1300**
Calculated DAY LEQ:	**58**	**1400**	**63**	**1400**
Calculated DAY LEQ:	**59**	**1500**	**63**	**1500**
Calculated DAY LEQ:	**57**	**1600**	**64**	**1600**
Calculated DAY LEQ:	**57**	**1700**	**63**	**1700**
Calculated DAY LEQ:	**56**	**1800**	**62**	**1800**
Calculated DAY/EVE. LEQ:	**54**	**1900**	**63**	**1900**
Calculated DAY/EVE. LEQ:	**54**	**2000**	**62**	**2000**
Calculated DAY/EVE. LEQ:	**53**	**2100**	**61**	**2100**
Calculated NIGHT LEQ:	**51**	**2200**	**59**	**2200**
Calculated NIGHT LEQ:	**52**	**2300**	**57**	**2300**
Calculated NIGHT LEQ:	**49**	**0000**	**59**	**0000**
Calculated NIGHT LEQ:	**44**	**0100**	**53**	**0100**
Calculated NIGHT LEQ:	**41**	**0200**	**53**	**0200**
Calculated NIGHT LEQ:	**41**	**0300**	**50**	**0300**
Calculated NIGHT LEQ:	**45**	**0400**	**50**	**0400**
Calculated NIGHT LEQ:	**49**	**0500**	**52**	**0500**
Calculated NIGHT LEQ:	**54**	**0600**	**57**	**0600**
(penalty added for evening or night hours)				
LDN:	**58**	**dBA**	**64**	**dBA**
C.N.E.L.:	**58**	**dBA**	**65**	**dBA**



August 18, 2006



August 19, 2006

Wind speed and wind direction, nr. Las Positas Park.

Appendix I: Definitions, Terms, Sources

Sound Level, dB: Sound level - Ten times the common logarithm of the ratio of the square of the measured A-weighted sound pressure to the square of the standard reference pressure of 20 micropascals, SLOW time response, in accordance with ANSI S1.4-1971 (R1976) Unit: decibels(dB).

dBA or dB(A): A-weighted sound level. The ear does not respond equally to all frequencies, but is less sensitive 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 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. A-weighted, slow response time measurements are used exclusively for this assessment.

CNEL / LDN: Since the sensitivity to noise increases during the evening and at night--because excessive noise interferes with the ability to sleep--a 24-hour descriptor has been developed that incorporates an artificial noise penalty added to quiet-time noise events. The Community Noise Equivalent Level, CNEL, is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to evening (7 - 10 p.m.) and a 10 dB addition to nocturnal (10 p.m. - 7 a.m.) noise levels. The Day-Night Average Sound Level, LDN, is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this 3-hour period are grouped into the day-time period with no dB penalty.

LEQ The equivalent energy average sound level. Averaging time, commonly 1 hour, is indicated.

Subjective Loudness Changes. In addition to precision measurement of sound level changes, there is a subjective characteristic which describes how most people respond to sound:

A change in sound level of 3 dBA is *barely perceptible* by most listeners.
A change in level of 6 dBA is *clearly perceptible*.
A change of 10 dBA is perceived by most people as being *twice* (or *half*) as loud.

Sound Transmission Class (S.T.C.) The measure of sound transmission through elements of the building shell, such as a wall, door or window construction is the sound transmission coefficient or S.T.C. The S.T.C. in a specified frequency band is the fraction of the airborne sound incident on the partition that is transmitted by the partition and radiated on the other side.

Appendix II: Instrument Specifications, Measurement Protocol

Wind Measurement

Wind speed and direction were noted throughout the measurement period and compared with data from a private datalogging weather station "KSANTA23" near Las Positas Park, about four miles west of Milpas St. and De La Guerra St. in Santa Barbara. A magnetic compass was used to estimate wind direction. A Davis Turbo Wind meter was used to measure wind speed. The Turbo Wind meter is a high performance wind speed indicator with exceptional accuracy.

Features of the Turbo Wind Meter: Sapphire jewel bearings and Infra-red speed sensor provide almost no friction allowing the precision turbine to turn at a speed directly proportionate to wind velocity; the instrument measures low wind speeds accurately

Sound Level Meters

Precision: The American National Standards Institute (ANSI) specifies several types of sound level meters according to their precision. Types 1, 2, and 3 are referred to as "precision," "general-purpose," and "survey" meters, respectively. Most measurements carefully taken with a type 1 sound level meter will have an error not exceeding 1 dB. The corresponding error for a type 2 sound level meter is about 2 dB. The sound level meters used for measurements shown in this report are Larson-Davis Laboratories Model 812 and Model 820. These meters meet all requirements of ANSI s1.4, IEC 651 for Type 1 accuracy and include the following features:

110 dB dynamic range for error free measurements.

Measures FAST, SLOW, Unweighted PEAK, Weighted PEAK, Impulse, L_{eq}, LDOD, LOSHA, Dose, Time Weighted Average, SEL, Lmax, Lmin, $\mathbf{L_{DN}}$.

Time history sampling periods from 32 samples per second up to one sample every 255 seconds.

Calibration of the meter is made before and after all field measurements with an external calibrator. Laboratory calibration of the meter is performed biannually and can be traced to the U.S. NIST standard.

Sound Level Meter Used for this Study:

Type 1 Larson Davis model 812 Sound Level Meter with 2560 microphone, Serial Number 489.
Preamp 828, Serial Number 1482
Microphone 2560, Serial Number 3153
Certificate of Calibration and Conformance issued 26 Oct 2005.
The instrument meets factory specifications. Calibration due 26 Oct 2007.

Calibrator used in this study

Larson Davis CAL250 Acoustic Calibrator, Serial Number 1931. Certificate of Calibration and Conformance, Certificate Number 2005-66284. Calibrated on 02-22-2006. The instrument meets factory specifications per Procedure D0001.8192. The instrument was found to be in calibration as received. Calibration due 02-22-2008. Full calibration report available on request. Performed by Scott Montgomery, Larson Davis, Provo, UT. Tel 801.375.0177.

The Larson Davis Model CAL250 is an ultra precise microphone calibrator delivering a full 114.0 dB level output signal. Its accuracy has been verified against the reference issued by the National Institute of Standards and Technology (formerly National Bureau of Standards).

Sound Level Measurement Protocol:

The protocol for conducting sound level measurements is prescribed in detail by the American Society for Testing and Materials (ASTM) in their E 1014 publication. The procedures and standards in that document are met or exceeded for most sound level measurements shown in this report. Wind speed and direction data and temperature data are taken from National Weather Service records and "KSANTA23" Weather Station. Measurements were taken at times when wind speed was less than 20 km/h at the "KSANTA23" Weather Station. Wind speed measured at the microphone sites never exceeded 20 km/h. Urban density tends to slow the wind speed in the city, compared to the airport. Wind protection for all microphones was in place at all times.

The standards of E 1014 are exceeded in the present assessment by using Type 1 sound level meters for all measurements instead of the less accurate Type 2 meters called for in the standard. Therefore, the precision of the measurements in this report is likely to be nearer plus or minus 1 dB.

SIGNED: _____ August 28, 2006

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