3 NOISE MEASUREMENTS

This chapter summarizes the portable noise measurement program conducted in the Noise Exposure Map phase of this Part 150 Update Study. Section 3.1 summarizes measurement program objectives. Section 3.2 summarizes measurement program design and execution. Section 3.3 presents a summary of the DNL measurements. Section 3.4 presents site-by-site single event and cumulative exposure results.

3.1 Measurement Program Objectives

Part 150 does not require airport operators to measure noise levels. Moreover, the FAA does not permit airports to use noise measurements to "adjust" or "calibrate" the noise modeling process.[19] However, most airports operators and other noise stakeholders find that measurements are valuable for a number of informational and assessment purposes, which the FAA supports considering.

CAK, the Advisory Committee, and the consulting team identified the following primary measurement objectives:

- assessing the reasonableness of modeled estimates
- illustrating the effect of existing operations
- comparing aircraft and non-aircraft noise levels
- sampling cumulative exposure over several days at a few key locations
- documenting noise exposure patterns over a sample of days

3.2 Measurement Program Design and Execution

To accomplish the measurement objectives, HMMH staff conducted noise measurements over the week of June 3 – 10, 2013, at the six locations shown on Figure 11.

3.2.1 *Measurement Site Selection*

CAK and the consulting team selected measurement locations in consultation with the Advisory Committee, including discussions at committee meetings prior to the measurements and input provided by committee members in follow-up communications. Actual flight operations data ("radar data") that CAK and the consulting team obtained for the months of January, April, July, and October of 2012 provided factual input on actual flight paths for consideration in the site selection process.[20] Section 4.7 discusses these radar data, which the consulting team also used for the development of a variety of noise modeling inputs.

Major site-selection criteria included:

- Sites were in residential areas, to focus on the most sensitive land use.
- Sites were near major flight corridors, to maximize the number of operations monitored.

[19] Draft FAA Advisory Circular 150/5020-1, "Airport Noise and Land Use Compatibility Planning," paragraph 6.10, "Using Short-Term Monitoring Data," page 56, January 13, 2009.

[20] The operations data were purchased from PASSUR Aerospace. See: http://www.passur.com/.

- Sites were at a variety of distances from the airport, to assist in assessing variation associated with aircraft altitude.
- In each general measurement area, pragmatic reasons determined specific sites, such as: (1) reasonable isolation from unusual non-aircraft levels, (2) equipment security, (3) measurement staff access, and (4) line-of-sight views from the microphone to the most common flight paths, to avoid acoustic shielding and to permit the measurement staff to observe and log the activity.

The overall objective was to select sites that provided representative data on a broad range of representative aircraft operations and geographic areas around the airport.

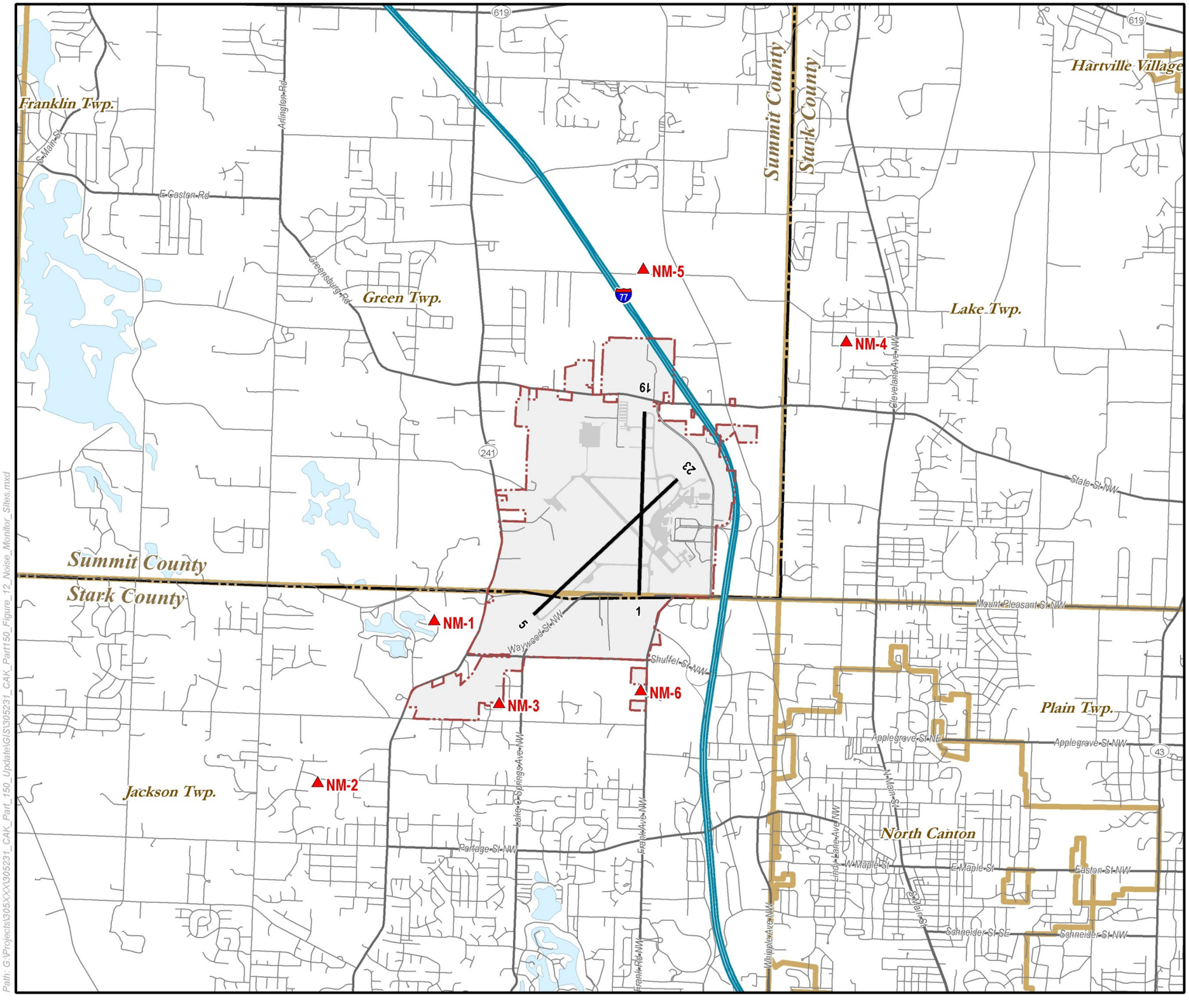
3.2.2 *Measurement Procedures and Equipment*

Measurements were conducted in accordance with requirements of Part 150 Section A150.5 "Noise measurement procedures and equipment," using HMMH-owned Larson-Davis Model 870 ("LD 870") monitors. These instruments are portable devices capable of long-term unattended operation. The monitors meet American National Standards Institute (ANSI) S1.4-1983 standards for Type I "precision" sound level meters, which exceed Part 150 accuracy requirements. HMMH staff calibrated every monitor in the field before and after each of the measurement sessions. The calibrations are traceable to the United States National Institute of Standards and Technology ("NIST").

The monitors measure cumulative exposure levels, such as hourly equivalent sound level (L_{eq}) and the 24-hour day-night average sound level (DNL), and noise levels associated with individual aircraft events, including maximum sound level (L_{max}) and sound exposure level (SEL). Section 2.1 introduces these metrics. All measurements were A-weighted, as discussed in Section 2.1.2, and as required in Part 150 Section A150.5.

The units operated on a 24-hour basis during the eight-day measurement session, with breaks for relocation, battery changes, calibrations, and other maintenance requirements. Two HMMH staff conducted the measurements. To the extent feasible during daylight hours, the staff spent time at the monitoring locations on a rotating basis, to observe and log aircraft and non-aircraft noise-producing events, weather data, and other relevant information. The clocks on each of the noise monitors were time-synchronized to facilitate the correlation of aircraft noise events measured at multiple sites and of aircraft noise events with flight events.

Table 4 lists the monitoring locations, the dates and times of measurements, and the number of hours of monitoring and observations at each site. Overall, the monitoring program encompassed approximately 493 hours of measurements and 59 hours of observations at the six locations.



AKRON-CANTON AIRPORT

Figure 12
Portable Noise Monitoring Sites
June 3 – 10, 2013
14 CFR Part 150 Update

- Airport Property Boundary
- Airport Runway
- NM-# Portable Noise Monitoring Sites
- County Boundary
- Township Boundary
- Interstate Highways
- Primary Roads
- Local Roads
- Water Bodies

North

0 4,000 8,000 Feet

HARRIS MILLER MILLER & HANSON INC.

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Table 4 Summary of Noise Measurement Site Visits, June 3 – 10, 2013
Source: HMMH, June 2013

Site #	Address	Start		End		Approximate Hours	
		Date	Time	Date	Time	Monitored	Observed
1	95 Spruce Dr. NW	6/3/2013	7:02 p.m.	6/10/2013	9:38 a.m.	159	20
2	7601 Pine Ridge St. NW	6/7/2013	5:03 p.m.	6/10/2013	10:03 a.m.	66	6
3	6167 Redford Rd. NW	6/4/2013	2:34 p.m.	6/10/2013	10:26 a.m.	141	20
4	3527 Northgate St. NW	6/4/2013	3:46 p.m.	6/7/2013	4:17 p.m.	74	4
5	2475 Wise Rd. NW	6/3/2013	12:44 p.m.	6/4/2013	1:40 p.m.	26	5
6	7979 Frank Ave. NW	6/3/2013	1:40 p.m.	6/4/2013	3:04 p.m.	27	4
Total						493	59

3.3 Day-Night Average Sound Level Results

Table 5 summarizes the Day-Night Average Sound Level (DNL) measurement results at the six measurement locations.

Table 5 Summary of Day-Night Average Sound Level (DNL) Measurements
Source: HMMH, June 2013

Site #	Daily DNL (dBA)								Overall DNL (dBA)[2]
	Monday June 3	Tuesday June 4	Wednes. June 5	Thursday June 6	Friday June 7	Saturday June 8	Sunday June 9	Monday June 10	
1	49[1]	54	52	64	51	52	50	58[1]	57
2	-	-	-	-	51[1]	53	50	52[1]	52
3	-	55[1]	54	56	51	56	52	55[1]	54
4	-	51[1]	55	54	54[1]	-	-	-	54
5	63[1]	64[1]	-	-	-	-	-	-	64
6	60[1]	59[1]	-	-	-	-	-	-	59

[1] DNL for partial day calculated using proper weighting of day and night contributions.
[2] Overall DNL values calculated using proper weighting of day and night contributions.

3.4 Site-by-Site Results

This section provides site-by-site discussions of the measurement results. The summaries present the maximum A-weighted sound level (L_{max}) and hourly equivalent sound level (L_{eq}) results in graphical form, as described below.

3.4.1 *Presentation of L_{max} Measurements*

L_{max} measurements provide a basis for comparing noise produced by aircraft and non-aircraft sources at a site, and for comparing single event levels among sites. For each measurement location, a figure presents L_{max} data in a "thermometer" form. Representative sound levels from illustrative non-aircraft sources are on the right of the thermometer. The ranges of L_{max} values for observed aircraft operations (and for any events caused by non-aircraft sources measured at the site) are on the right.

These figures provide a visual basis for comparing levels caused by different types of aircraft and operations, and for comparing sound levels at different sites. The figures group the aircraft data by major aircraft type and operation categories. (Only a subset of the categories applies at any site.)

The aircraft type categories include:

- "Air Carrier Jet" – commercial jet aircraft with greater than 90 passenger seats[21]
- "Regional Jet" – commercial jet aircraft with less than 90 passenger seats
- "Corporate Jet" – corporate jet aircraft
- "Unknown Jet" – jet-powered aircraft of unknown size
- "Twin Engine Turbo Prop" – twin engine, turbine-powered, propeller-driven aircraft
- "Twin Engine Piston Prop" – twin engine, piston-powered, propeller-driven aircraft
- "Single Engine Turbo Prop" – single engine, turbine-powered, propeller-driven aircraft
- "Single Engine Piston Prop" – single engine, piston-powered, propeller-driven aircraft
- "Unknown Prop" – propeller-driven aircraft, type and number of engines unknown
- "Other" – includes noise events from non-aircraft sources

The monitors automatically identified a "noise event" – regardless of source – when the measured level exceeded 65 decibels for at least five seconds. Consistent with accepted practice, these decibel and time thresholds are as non-restrictive as feasible, to maximize the number of noise events captured; i.e., set as low as possible without being so low that background noise would cause events to merge together. The thresholds have no effect on the cumulative noise exposure measurements; i.e., L_{eq} or DNL. During periods when an observer was at a site, the observer read the maximum level directly from the monitor display regardless of duration; i.e., for events which never exceeded 65 dBA. In some cases, the observers could not identify the type of aircraft visually, but could identify the powerplant (jet vs. propeller) audibly, leading to the "Unknown Jet" and "Unknown Prop" categories.

3.4.2 *Presentation of Hourly L_{eq} Results*

Each site discussion also includes figures that graphically present hourly L_{eq} results in two formats: (1) for the full period of measurement and (2) for each calendar day. The calendar day figures identify the DNL value. For any days with fewer than 24 hours of data, the DNL calculations take into account the proper weighting of day and night hours. The hours indicated on the figures represent the starting time of the measurement interval; e.g., hour 10 is the hour starting at 10 a.m. The figures use a 24-hour clock ("military time"), where the hour starting at 1 p.m. is hour 13; 2 p.m. is hour 14, through the hour starting at 11 p.m., which is hour 23.

[21] "Reverse Thrust" – At some sites, the noise from thrust reversers used to slow aircraft on arrival were measured and reported.

3.4.3 *Site 1: 95 Spruce Dr. NW*

Site 1 is located approximately 2,500 feet northwest of the extended centerline of Runway 5/23, approximately 4,000 feet southwest of the Runway 5 approach end (Runway 23 departure end). The monitor was in the rear yard of a single-family residence, between the house and a lake that abuts the property (at a lower elevation). It was in a small community with little vehicular traffic, so traffic noise was not an issue.

As shown in Figure 13, arrivals and departures on and off both ends of Runway 5/23 were the principal aircraft operations affecting the site during the measurements. Other monitored operations include start-of-takeoff roll thrust from jet departures on Runway 5, a few Runway 1 departures (largely start-of-takeoff roll thrust as well), and reverse thrust from jet arrivals on Runways 5 and 23. During the measurement period, arrivals and departures of jet aircraft made up almost 80% of the observed operations. Tree cover at the site often made it difficult to see aircraft clearly (or at all), so many of the measured jet operations are classified as "Unknown Jets." The identified jet operations include corporate and air carrier aircraft.

Runway 23 departures generally produced the highest L_{max} values during the measurement period. A single-engine piston-propeller aircraft produced an L_{max} of 74 dBA. One session of Lakota helicopter pattern work by the Ohio Army National Guard produced four events, for which the highest L_{max} was also 74 dBA. A jet departure on Runway 23 produced a similarly high L_{max} of 73 dBA. The highest measured L_{max} for Runway 5 start-of-takeoff-roll operations was 68 dBA.

Of the approximately 159 hours of measurements at Site 1, 157 were full hours. As shown in Figure 14, the hourly L_{eq} ranged approximately from 30 to 63 dBA. The long measurement duration at the site requires a small scale in that figure. For easier detailed review, Figure 15 presents the hourly data for each calendar day.

The measured hourly levels follow a typical daily pattern, falling during late-night hours, increasing in the morning, usually starting around 7 a.m. (0700 hour), and remaining high until the early evening, through the hour starting at 7 p.m. (1900). This type of pattern is very common at locations affected by human activity – whether it relates to aircraft operations, surface traffic, or other community sources, and occurred at the other measurement locations.

The highest hourly L_{eq} was for the hour starting at 5 a.m. (0500) on the morning of June 6, with similarly high levels from 3 a.m. (0300) to 6 a.m. (0600). Non-aircraft sources almost certainly produced these relatively high levels. Investigation into noise events occurring during this hour revealed that they were above the 65-dBA threshold for several minutes, whereas an aircraft event would only last about 30 seconds or less. In addition, the events had maximum levels that were only slightly above the threshold and the level held relatively steady in the 60- to 65-dBA range over the duration of each event. All of these characteristics suggest that the most likely source was insects or – somewhat less likely – a bird chirping near the microphone.

It rained most of the day on June 6, resulting in artificially elevated noise levels associated with water hitting the microphone, in addition to the normal increase in noise associated with the rain hitting leaves and other surrounding surfaces.

Including the effects of rain on the 6th, the overall measured DNL at Site 1 was 57 dBA, seven decibels below Site 5 (the site with the highest overall DNL), and five decibels above Site 2 (the site with the lowest overall DNL).

Figure 13 Site 1 Measured Maximum A-Weighted Levels
Source: HMMH June 2013

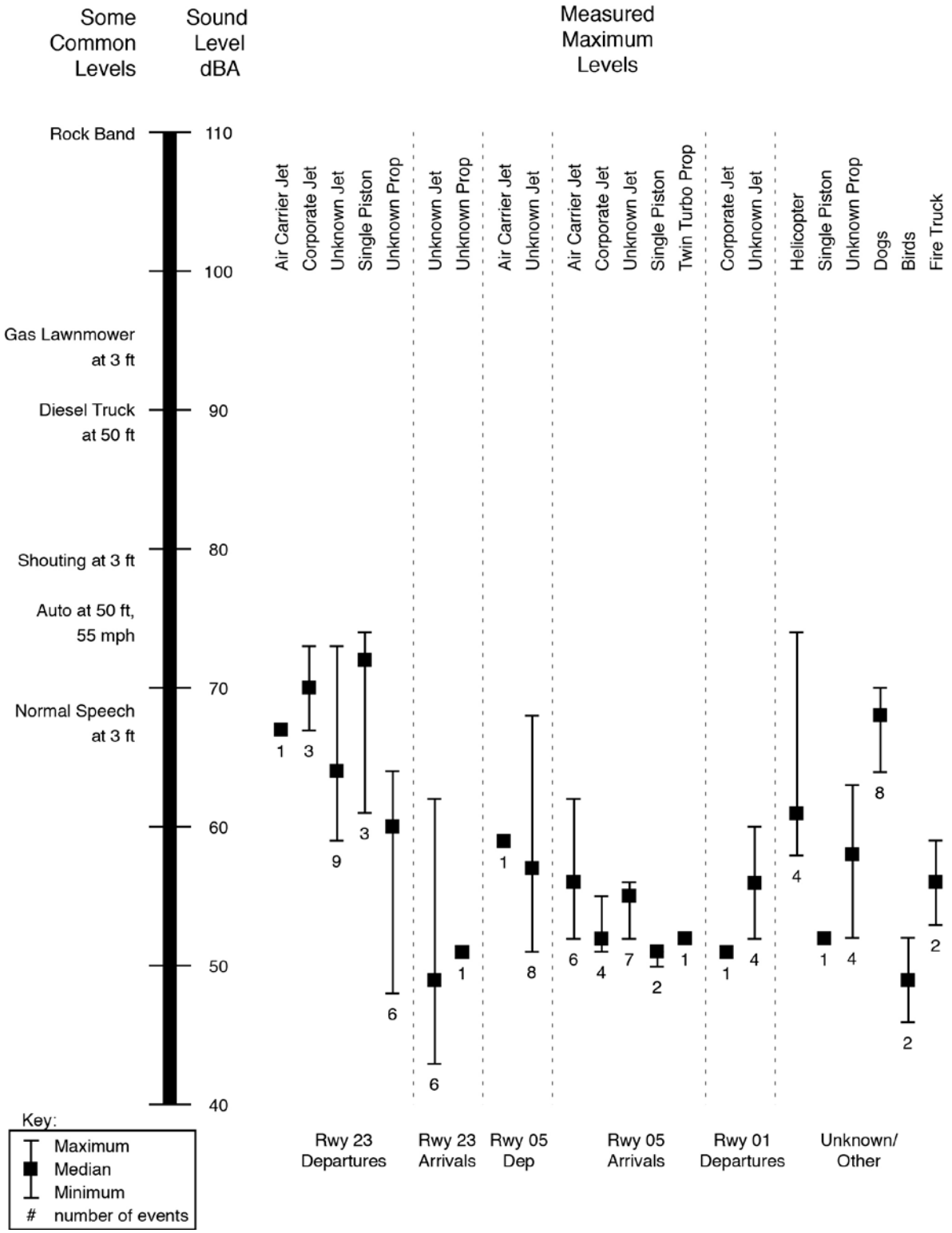


Figure 14 Site 1 Measured Hourly Noise Levels (L_{eq}), Full Duration
Source: HMMH June 2013

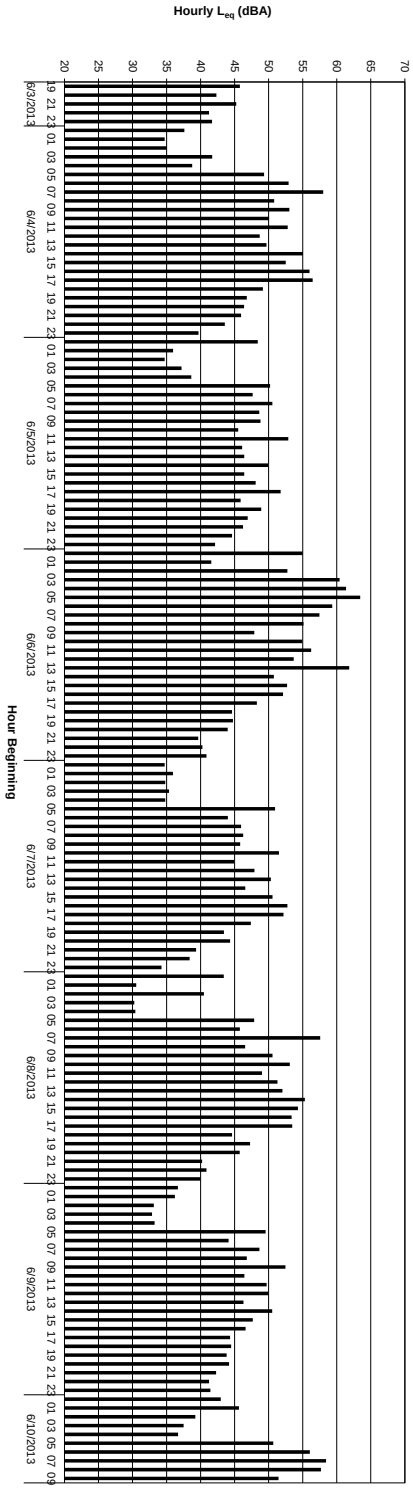
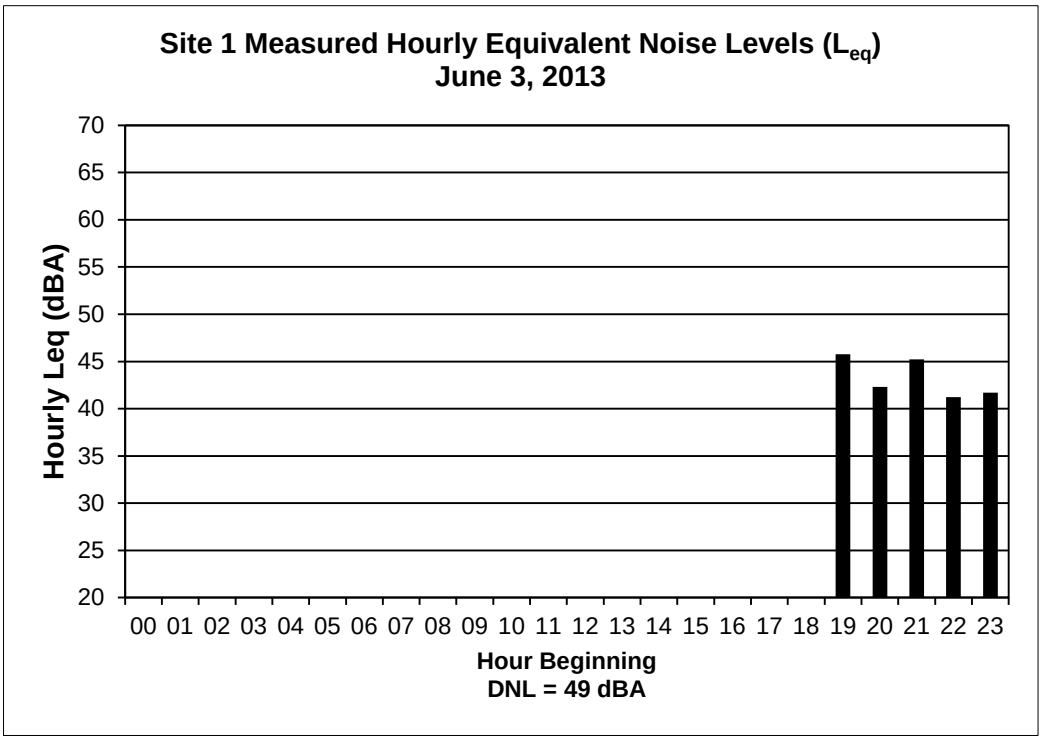
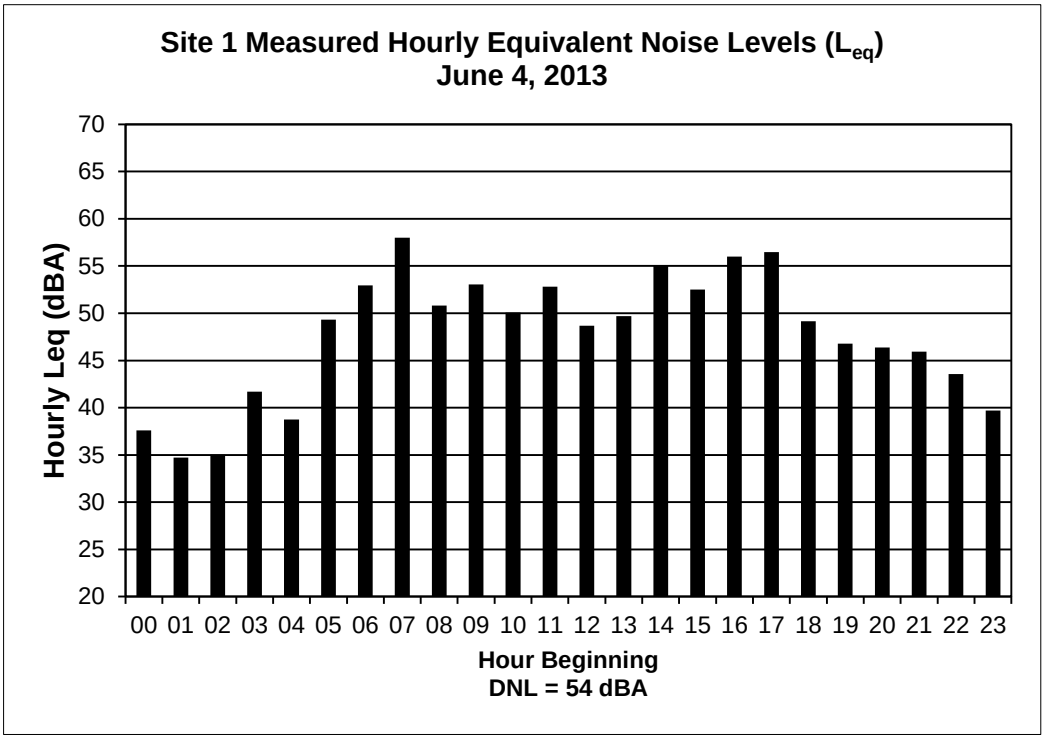
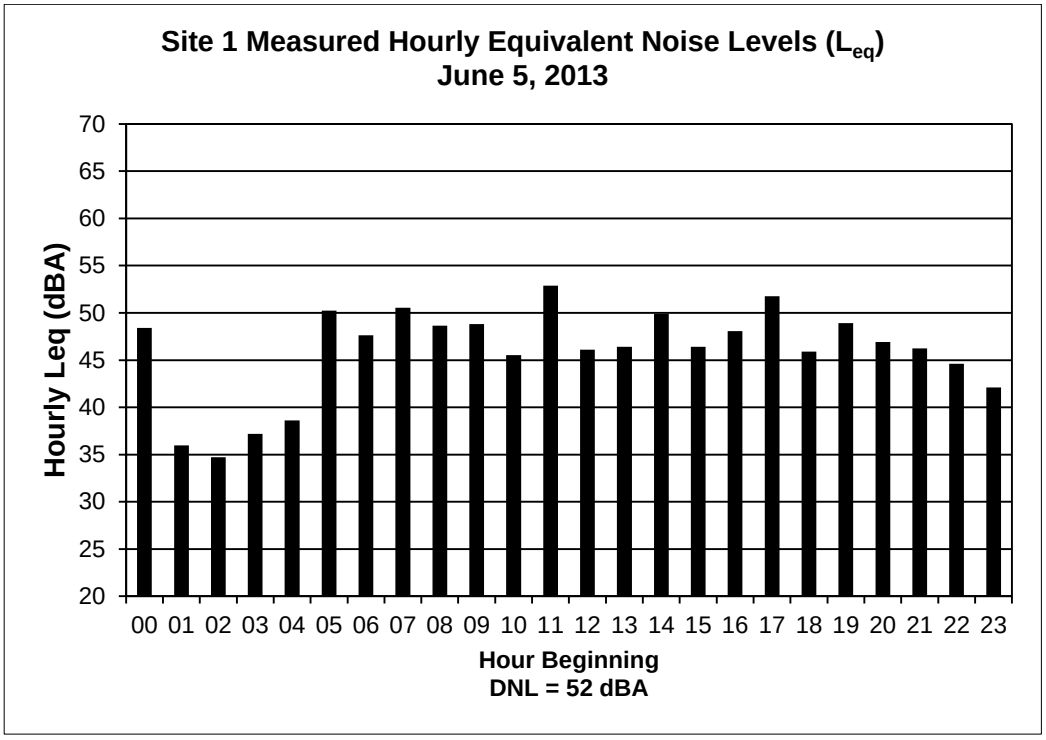
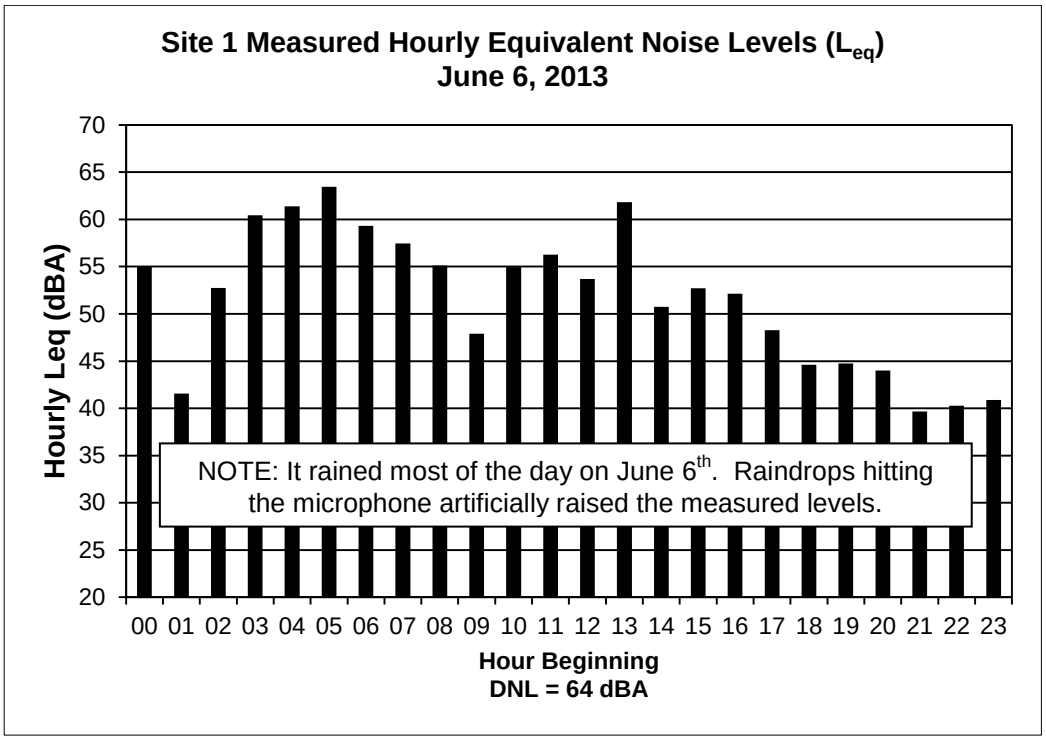


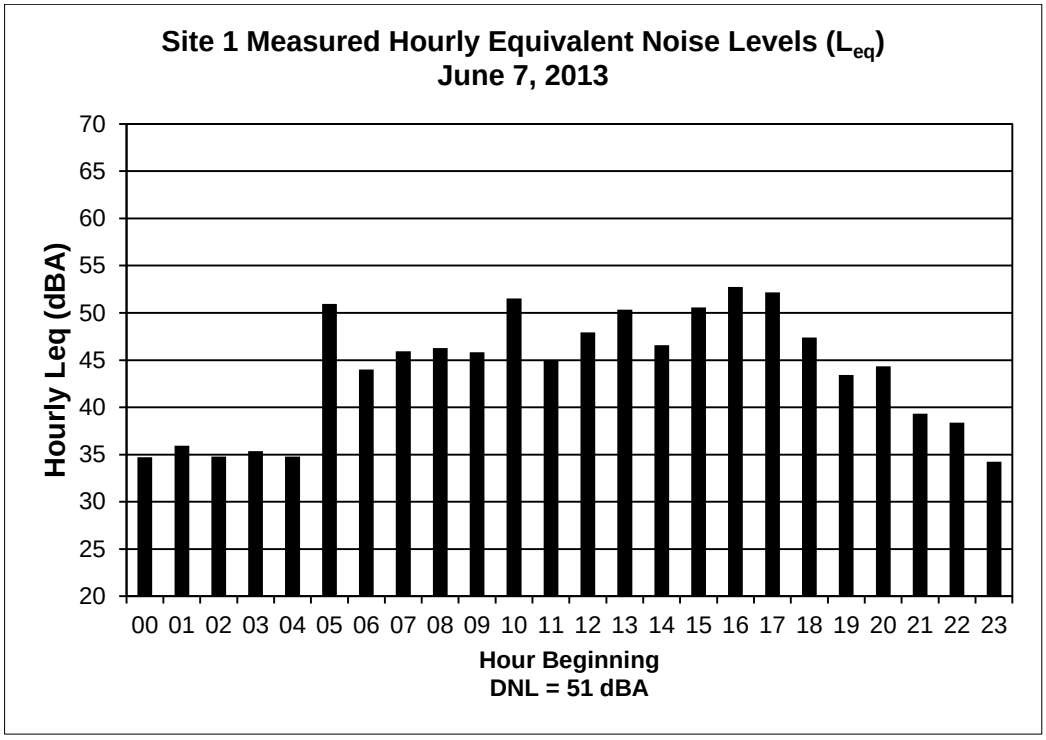
Figure 15 Site 1 Measured Hourly Noise Levels (L_{eq}), Calendar Days
Source: HMMH June 2013

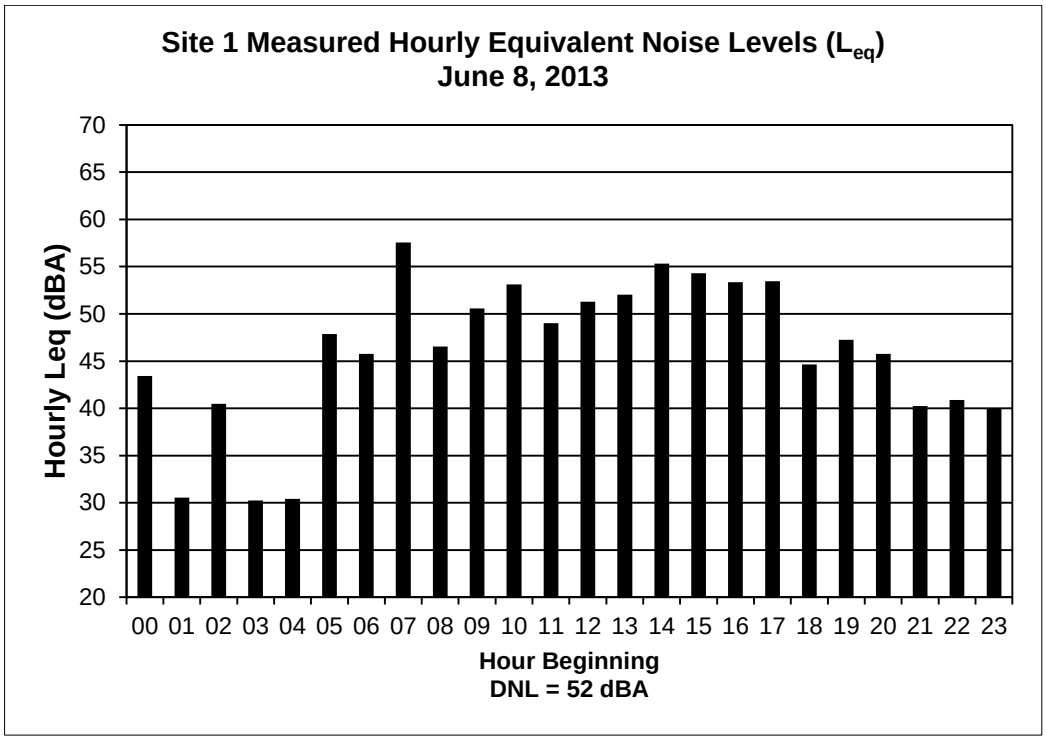


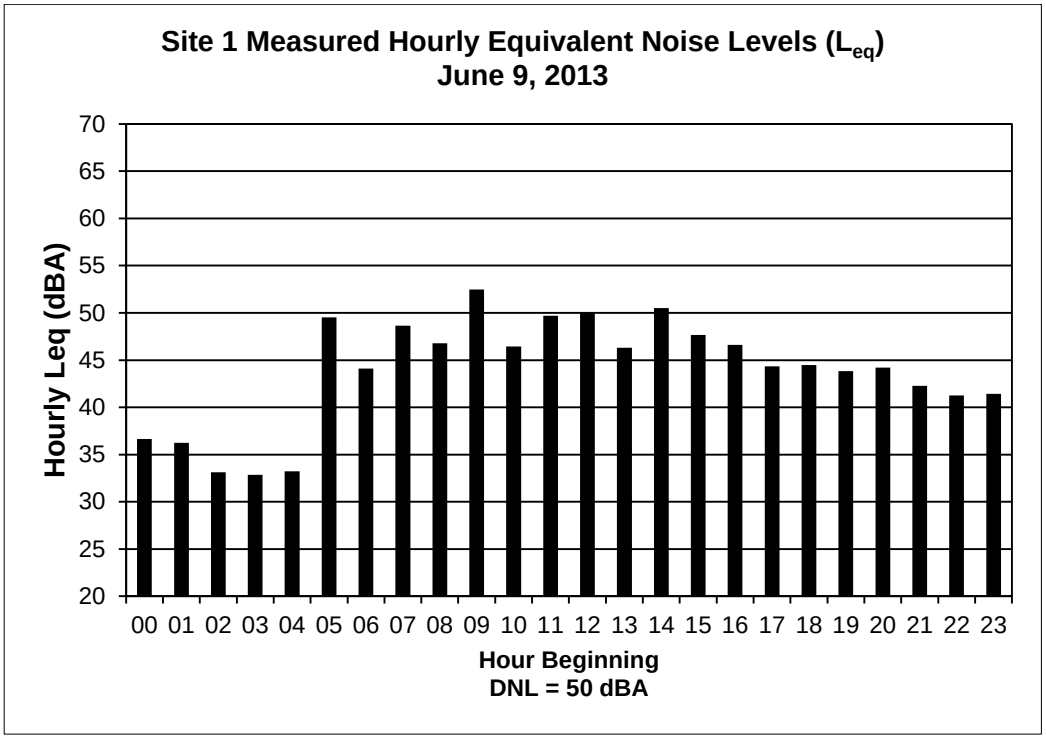


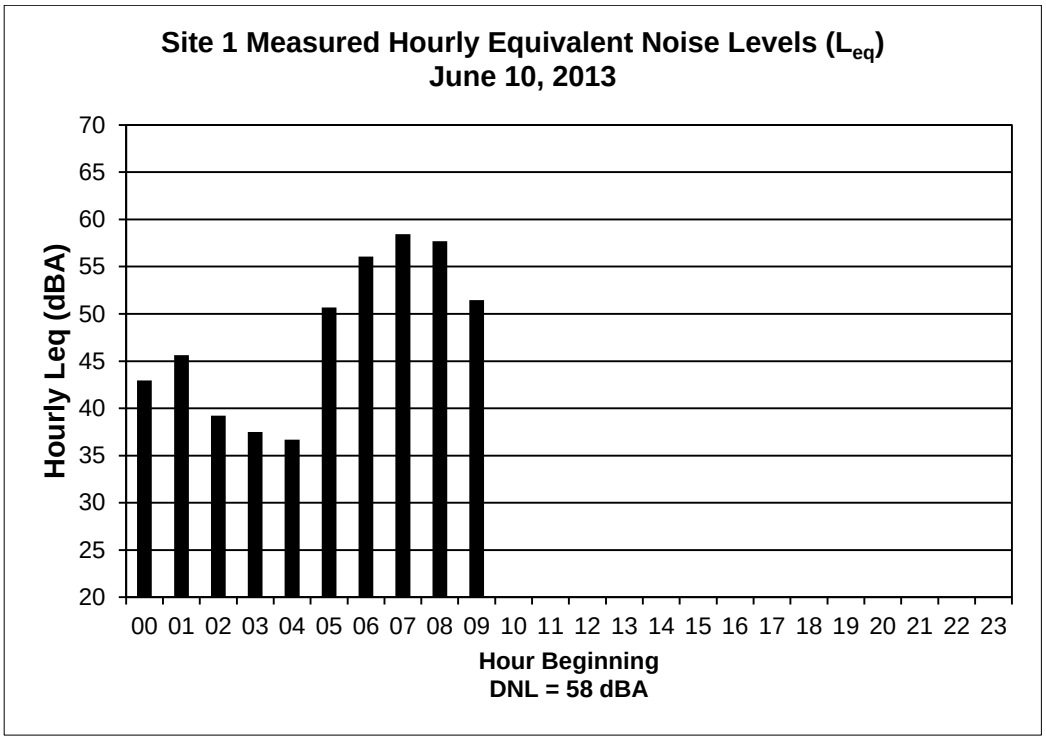

Site 1 Measured Hourly Equivalent Noise Levels (L_{eq})
June 5, 2013
Hourly Leq (dBA)
70
65
60
55
50
45
40
35
30
25
20
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Hour Beginning
DNL = 52 dBA


Site 1 Measured Hourly Equivalent Noise Levels (L_{eq})
June 6, 2013
Hourly Leq (dBA)
70
65
60
55
50
45
40
35
30
25
20
NOTE: It rained most of the day on June 6th. Raindrops hitting the microphone artificially raised the measured levels.
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Hour Beginning
DNL = 64 dBA


Site 1 Measured Hourly Equivalent Noise Levels (L_{eq})
June 7, 2013
Hourly Leq (dBA)
70
65
60
55
50
45
40
35
30
25
20
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Hour Beginning
DNL = 51 dBA


Site 1 Measured Hourly Equivalent Noise Levels (L_{eq})
June 8, 2013
Hourly Leq (dBA)
70
65
60
55
50
45
40
35
30
25
20
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Hour Beginning
DNL = 52 dBA


Site 1 Measured Hourly Equivalent Noise Levels (L_{eq})
June 9, 2013
Hourly Leq (dBA)
70
65
60
55
50
45
40
35
30
25
20
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Hour Beginning
DNL = 50 dBA


Site 1 Measured Hourly Equivalent Noise Levels (L_{eq})
June 10, 2013
Hourly Leq (dBA)
70
65
60
55
50
45
40
35
30
25
20
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Hour Beginning
DNL = 58 dBA

3.4.4 *Site 2: 7601 Pine Ridge St. NW*

Site 2 is located approximately 900 feet northwest of the extended centerline of Runway 5/23, approximately two miles southwest of the Runway 5 approach end (Runway 23 departure end). The monitor was in the rear yard of a single-family residence, approximately 200 feet from the house and 200 feet from a local road.

Runway 23 was the primary runway in use during the measurements at this site. Runway 23 departures in regional jets and propeller aircraft were the only identified aircraft operations affecting the site during the measurements. A relatively small number of operations were measured because of the distance from the airport and because most Runway 23 departures turn away from runway centerline before reaching Site 2.

As shown in Figure 16, a jet departure produced the highest L_{max} of 73 dBA. A variety of propeller aircraft produced measurable levels. In some cases, the observer could not determine the runway used and type of operation because of the distance from the site to the runway and the fact that the observer could hear but not see the aircraft. The L_{max} for one single-piston operation was 69 dBA

Of the approximately 66 hours of measurements at Site 2, 64 were full hours. As shown in Figure 17, the hourly L_{eq} ranged approximately from 30 to 59 dBA. As at other sites, the hourly levels followed a typical daily pattern, with the lowest levels during the late night and early morning hours.

The highest hourly L_{eq} was for the hour starting at 7 a.m. (0700) on the morning of June 8. While no observer was present, that hour may reflect the effect of relatively high aircraft overflight activity. Six events in the hour exceeded 65 dBA for at least five seconds. This is consistent with the early morning "push" of departures at CAK. The hour starting at 5 a.m. on that day also shows a spike in exposure. A monitor operating at Site 3 (see following discussion) was exposed to the same departures (but much closer to the airport). That monitor measured a similar pair of spikes for these hours, reinforcing the conclusion that aircraft operations were the primary source.

Site 2 had the lowest overall DNL, of 52 dBA, two decibels lower than Sites 3 and 4, the next quietest sites, and 11 dB lower than Site 5, the site with the highest overall DNL.

Figure 16 Site 2 Measured Maximum A-Weighted Levels
Source: HMMH June 2013

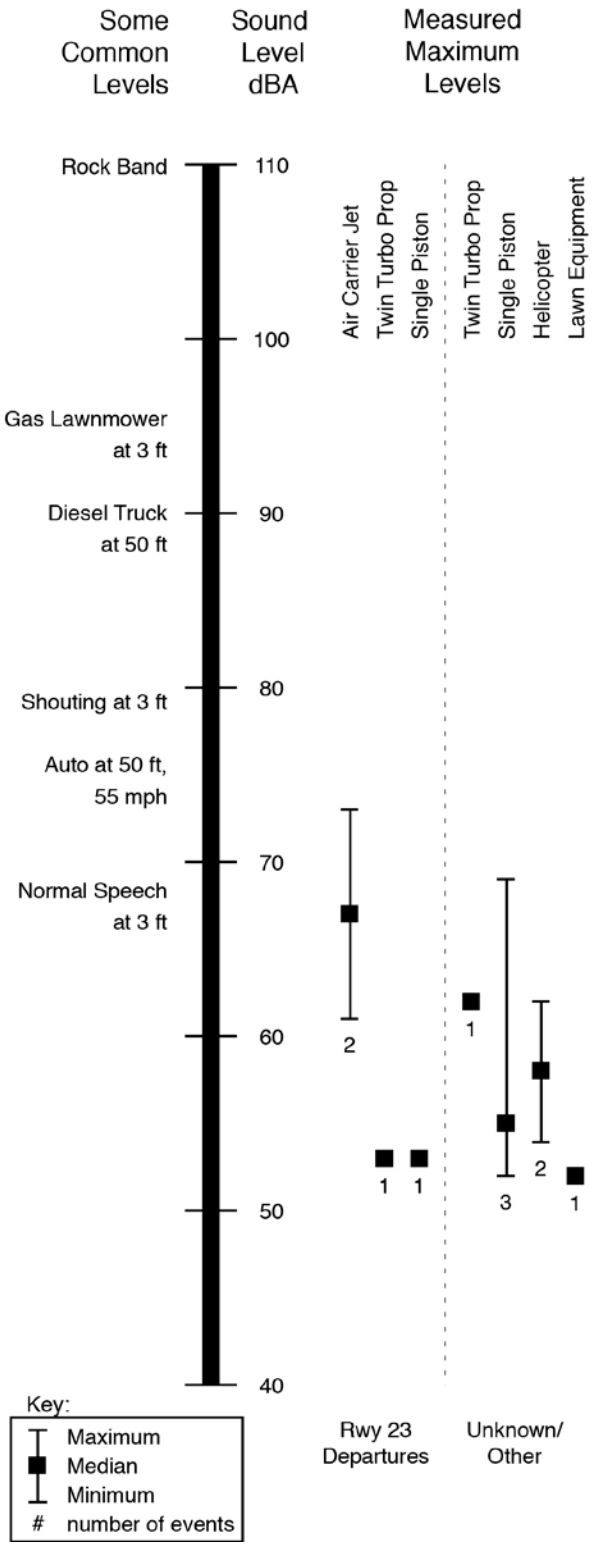


Figure 17 Site 2 Measured Hourly Noise Levels (L_{eq}), Full Duration
Source: HMMH June 2013

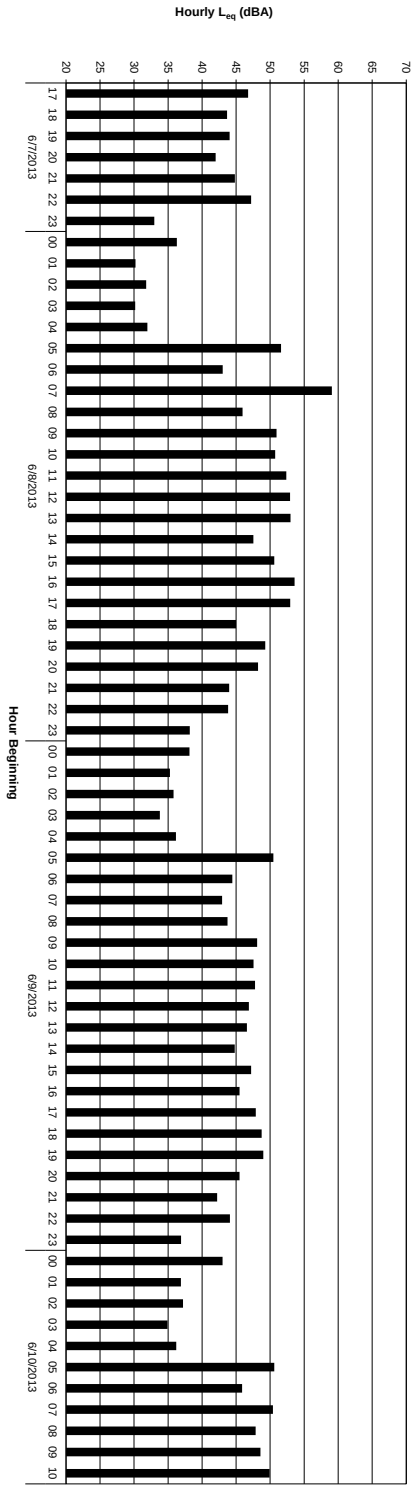
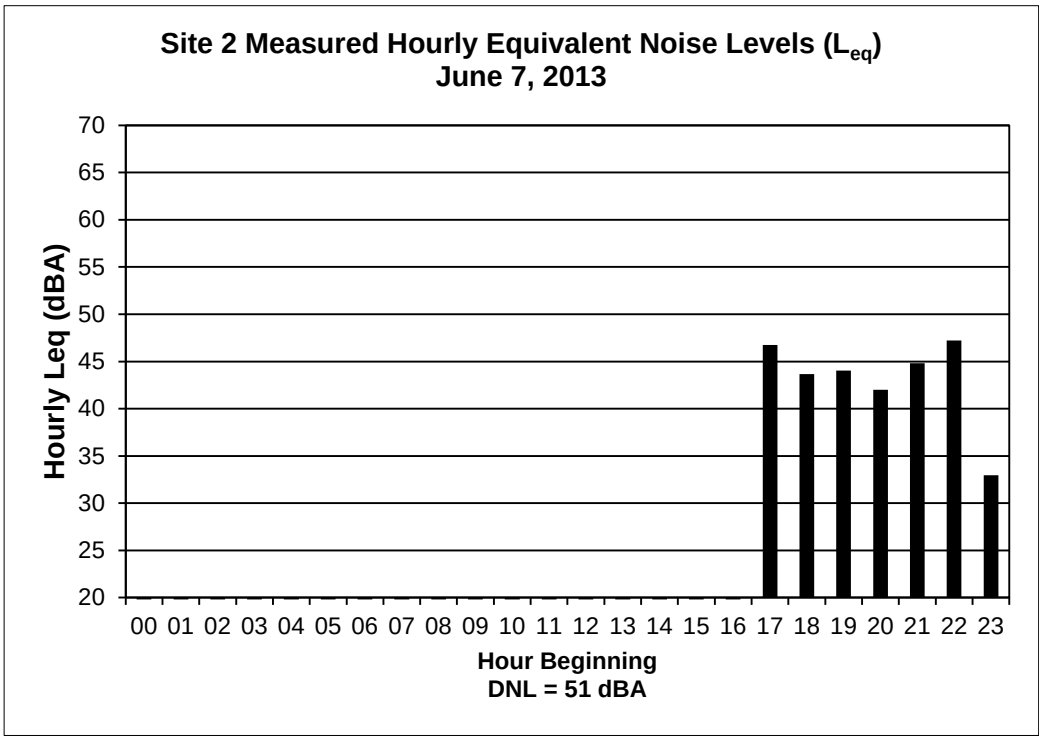
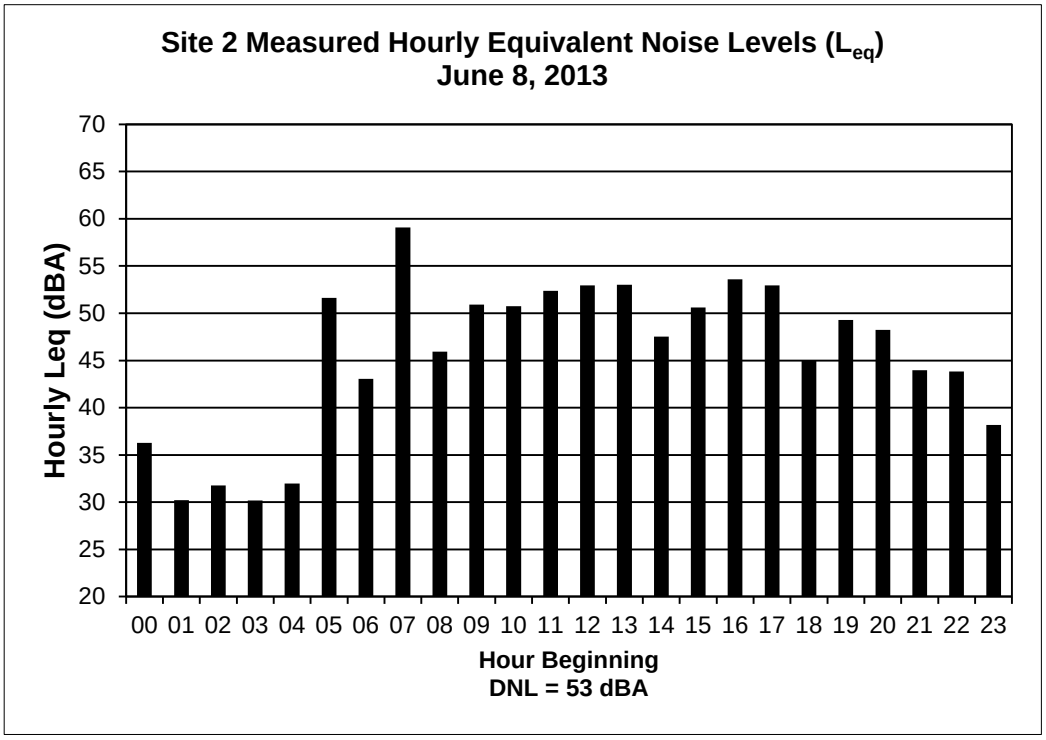
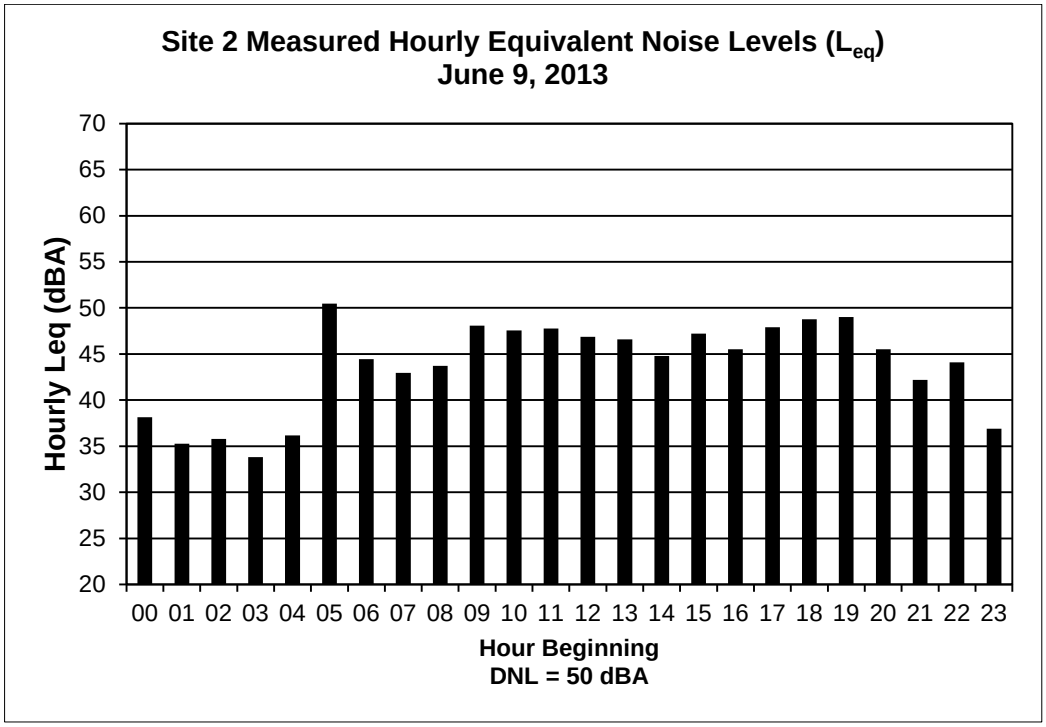
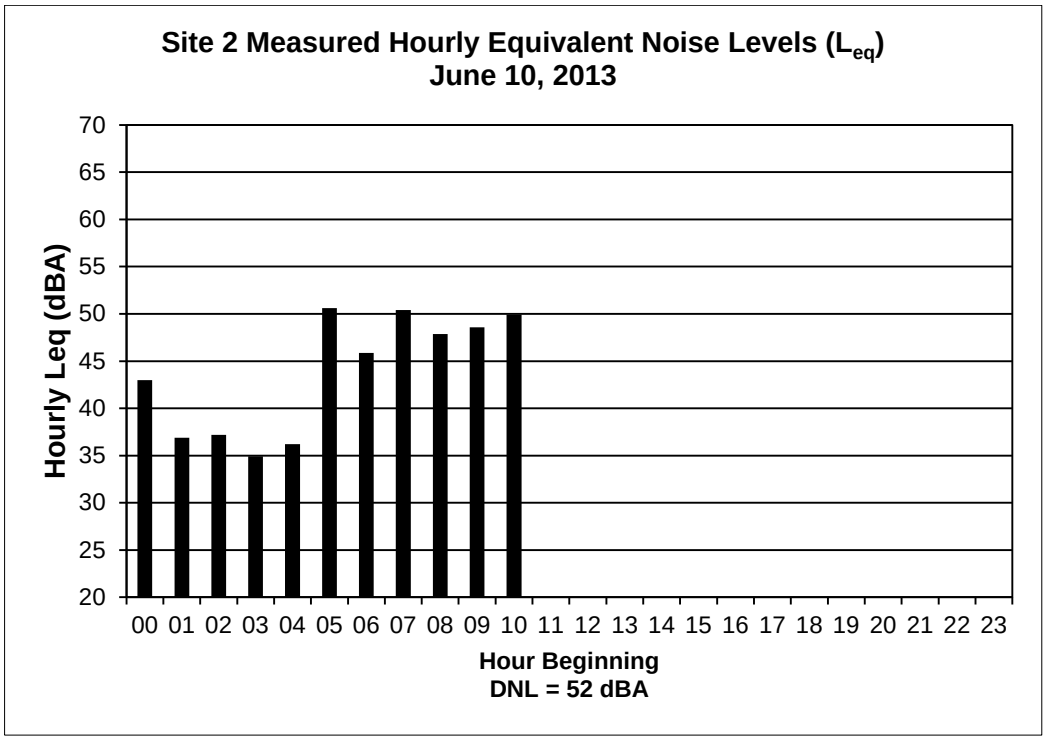


Figure 18 Site 2 Measured Hourly Noise Levels (L_{eq}), Calendar Days
Source: HMMH June 2013






Site 2 Measured Hourly Equivalent Noise Levels (L_{eq})
June 9, 2013
Hourly Leq (dBA)
70
65
60
55
50
45
40
35
30
25
20
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Hour Beginning
DNL = 50 dBA


Site 2 Measured Hourly Equivalent Noise Levels (L_{eq})
June 10, 2013
Hourly Leq (dBA)
70
65
60
55
50
45
40
35
30
25
20
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Hour Beginning
DNL = 52 dBA

3.4.5 *Site 3: 6167 Redford Rd. NW*

Site 3 is approximately 1,700 feet southeast of the extended centerline of Runway 5/23, roughly three-quarters of a mile south-southwest of the arrival end of Runway 5 (Runway 23 departure end). The monitor was in the rear yard of a single-family residence, with the house shielding it from local traffic noise. The north side of the property – to which the monitor was directly exposed – borders undeveloped airport property.

Runway 5/23 was the primary runway in use during the measurements at this site. As shown in Figure 19, the principal aircraft operations affecting the site were Runway 5 arrivals and departures from both ends of Runway 5/23. A small number of Runway 1 operations also caused noise events. Runway 23 departures were the loudest. A twin-engine piston-propeller aircraft produced the highest L_{max} of 80 dBA. The highest L_{max} values for air carrier and regional jet were 78 dBA and 77 dBA, respectively.

Of the approximately 141 hours of monitoring at Site 3, 139 were full hours. As shown in Figure 20, the hourly L_{eq} ranged from approximately 28 to 64 dBA. As at other sites, the levels followed a normal daily pattern, with the lowest levels during the late night and early morning hours.

The hour starting at 7 a.m. (0700) on the mornings of both June 8 and 10th had the highest hourly L_{eq} values, of approximately 64 and 59 dBA respectively. On the 8th, there was a secondary spike for the hour starting at 5 a.m. (0500). As noted in the preceding section, a monitor operating at Site 2 measured the same departures (but much further from the airport). It reported similar spikes for those two hours on the 8th, which reinforces the conclusion that CAK's early morning departure push was the primary source.

As at Site 1, it rained most of the day on June 6, resulting in artificially elevated noise levels associated with water hitting the microphone, in addition to the normal increase in noise associated with the rain hitting leaves and other surrounding surfaces.

Including the effects of rain on the 6th, the overall measured DNL for Site 3 was 54 dBA, equal to the overall DNL at Site 4, two decibels higher than Site 2 (the site with the lowest overall DNL), and 10 dB lower than Site 5 (the site with the highest overall DNL).

Figure 19 Site 3 Measured Maximum A-Weighted Sound Levels
Source: HMMH June 2013

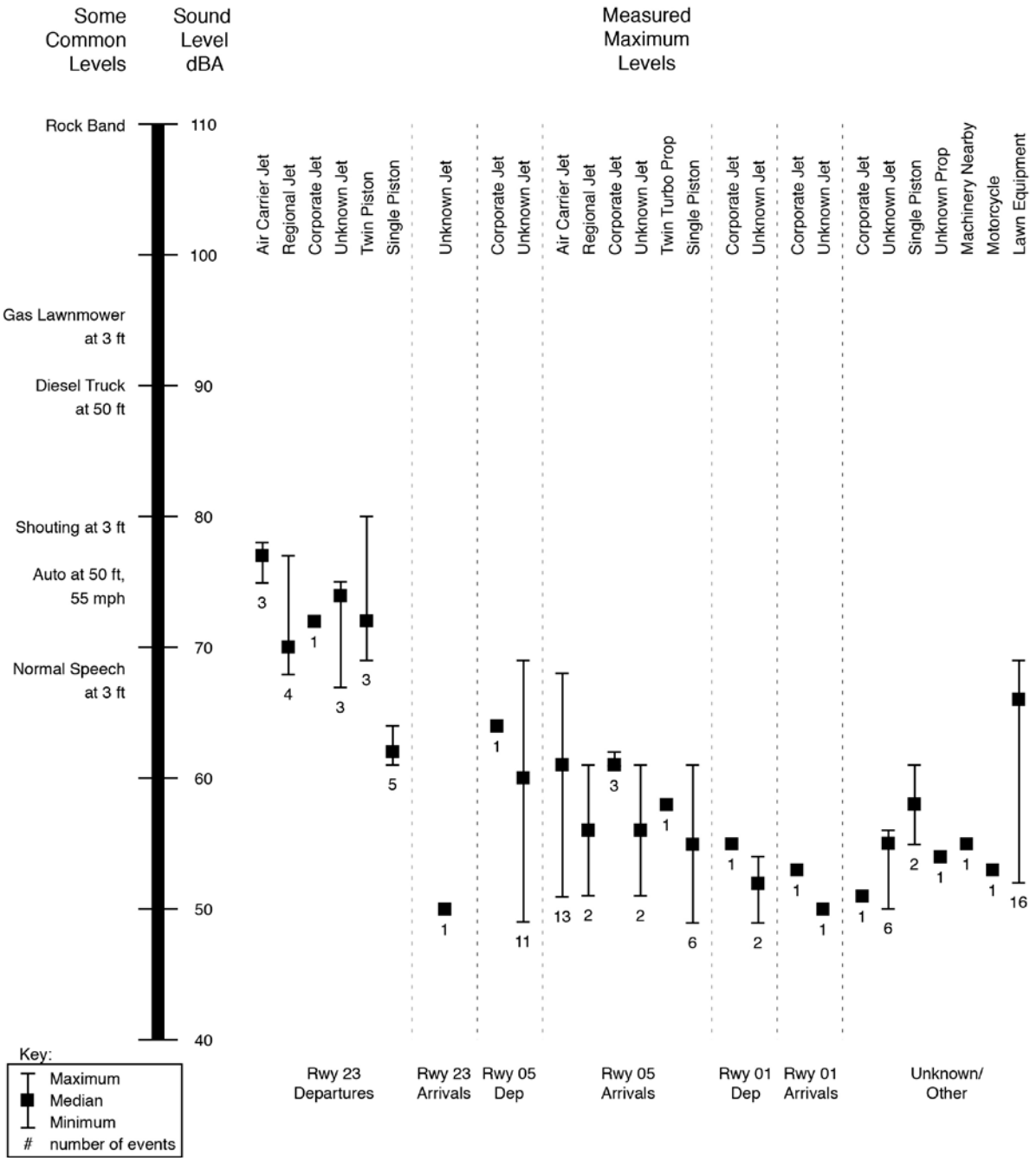


Figure 20 Site 3 Measured Hourly Noise Levels (L_{eq}), Full Duration
Source: HMMH June 2013

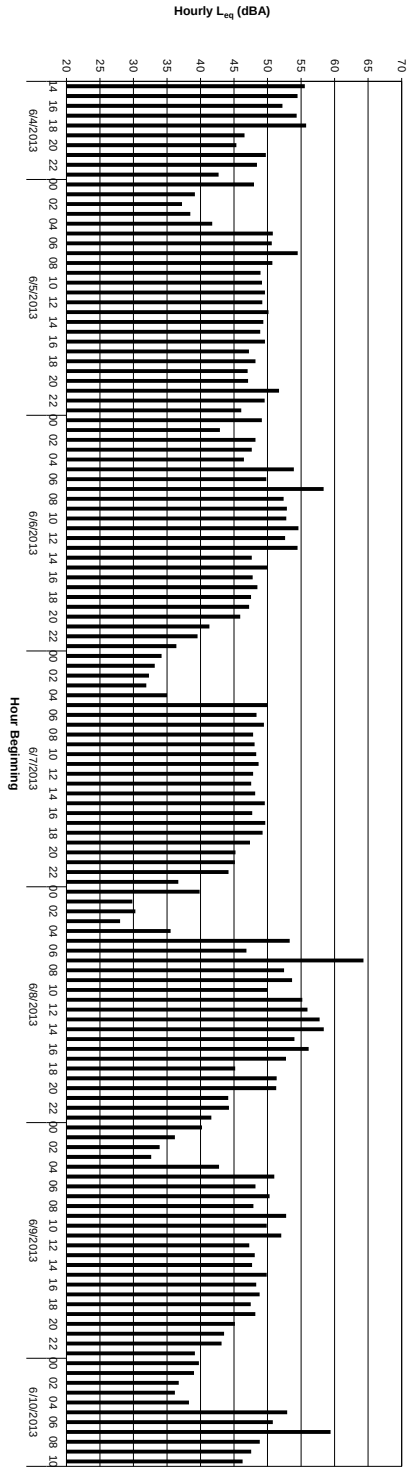
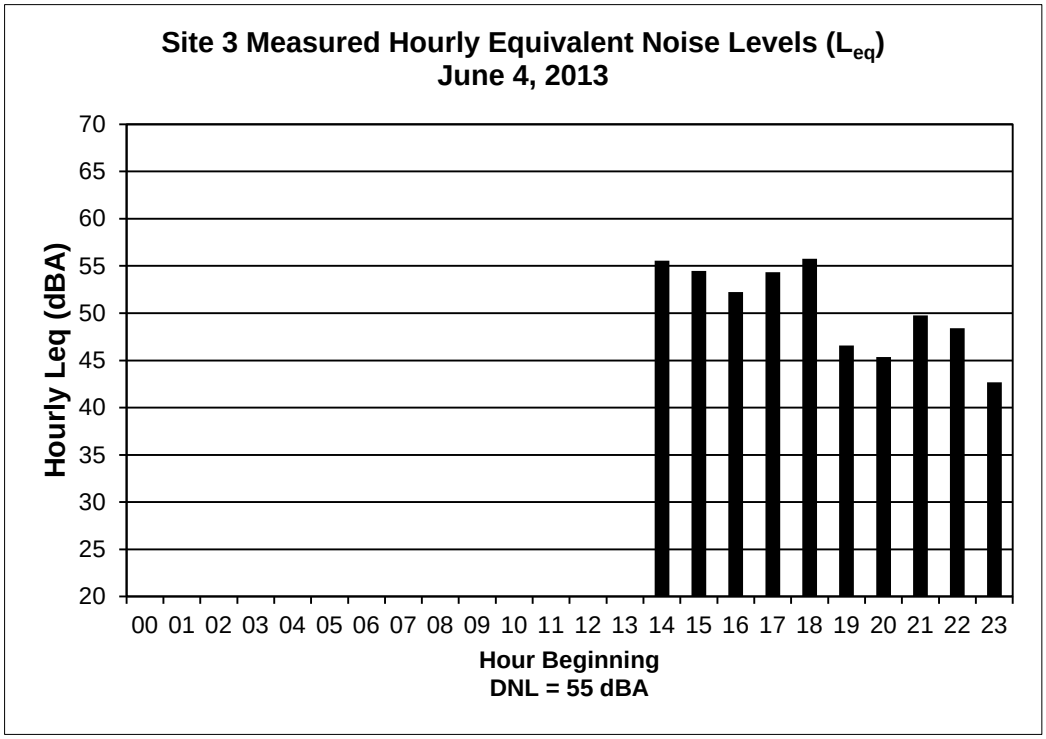
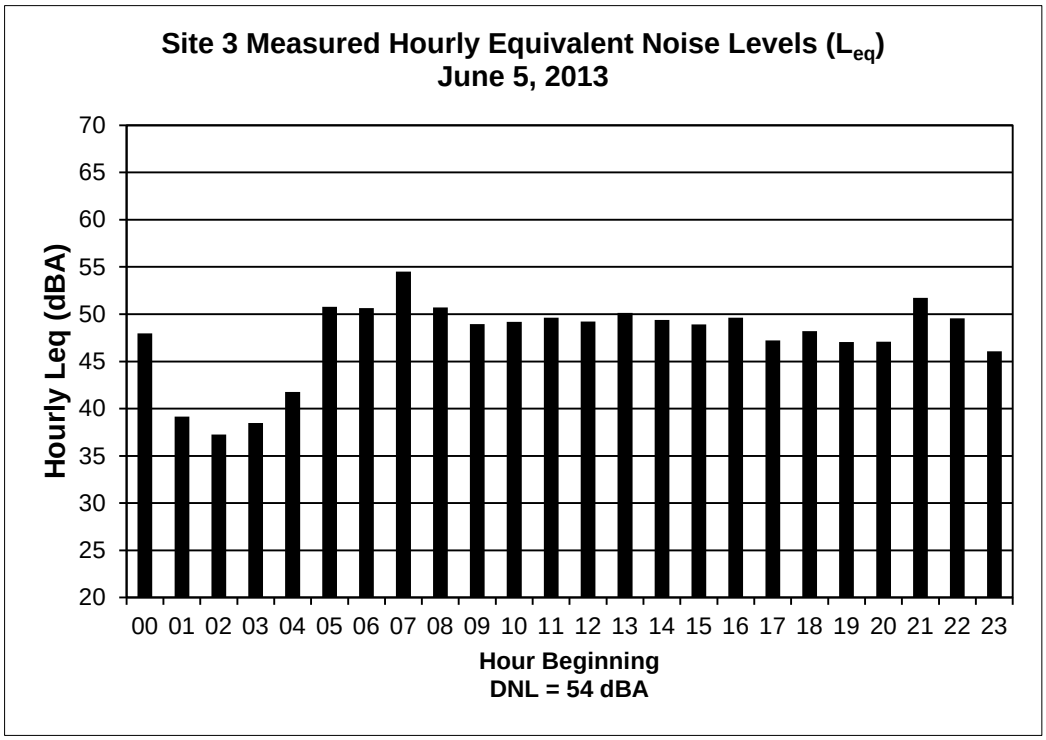
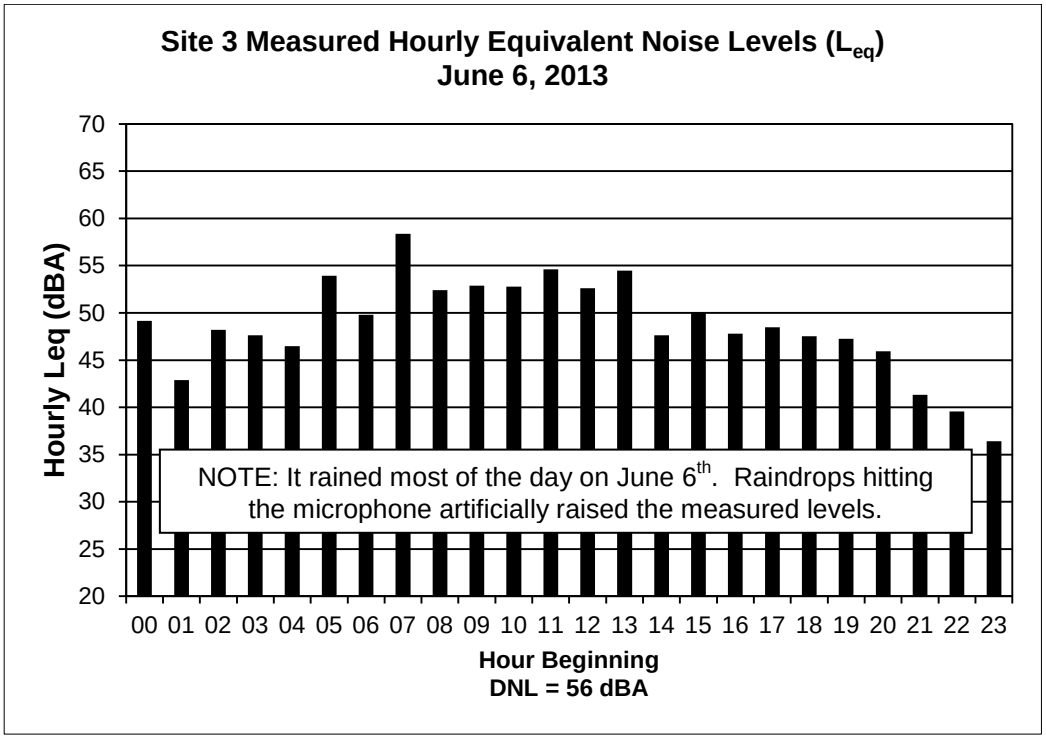
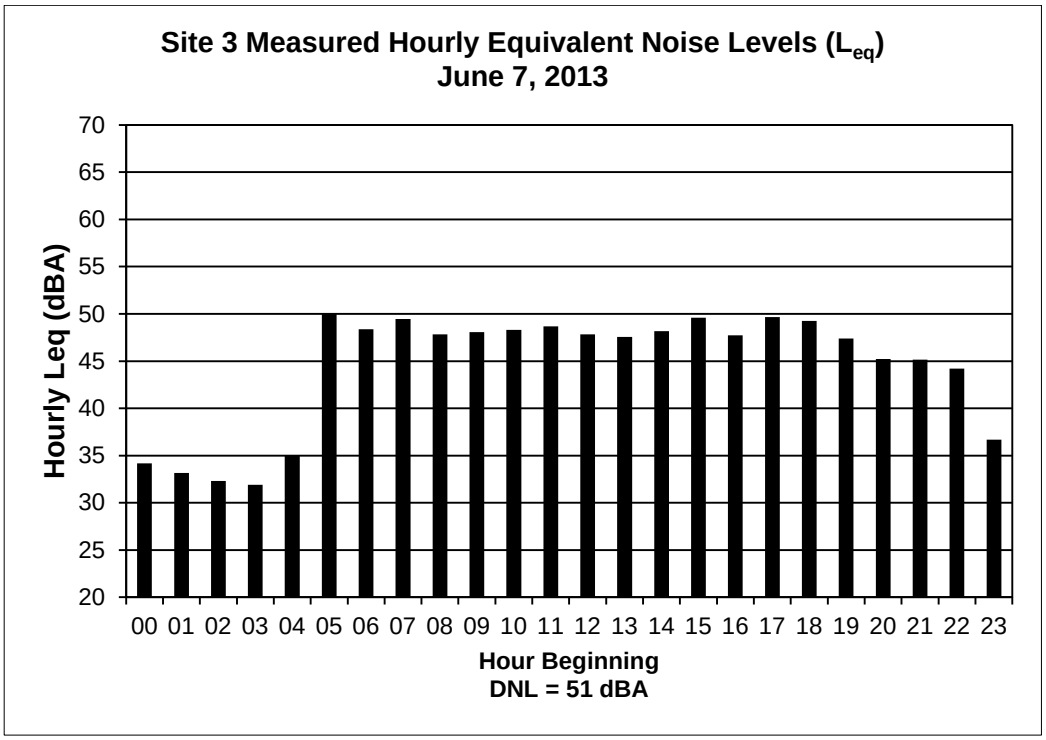


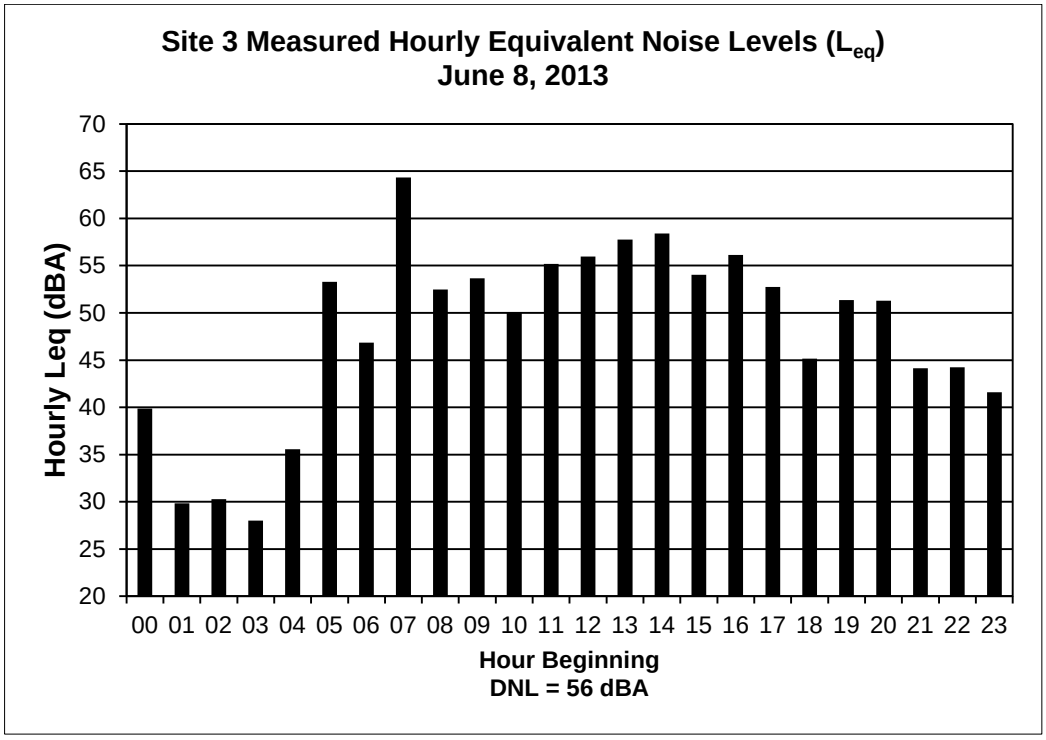
Figure 21 Site 3 Measured Hourly Noise Levels (Leq), Calendar Days
Source: HMMH June 2013

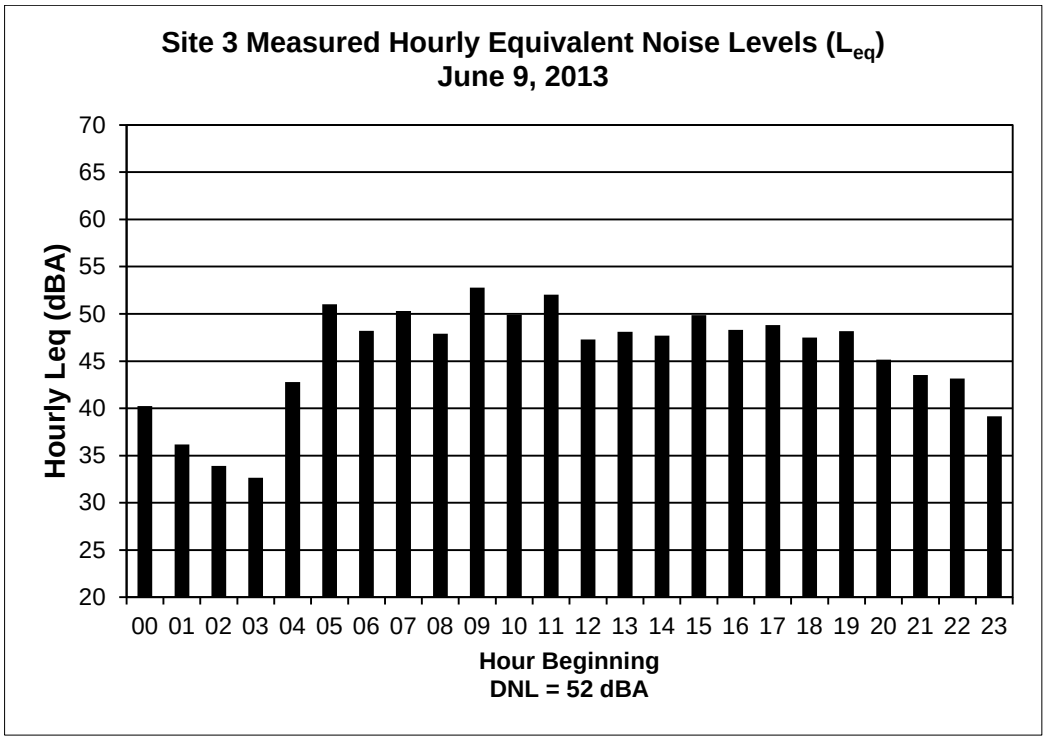


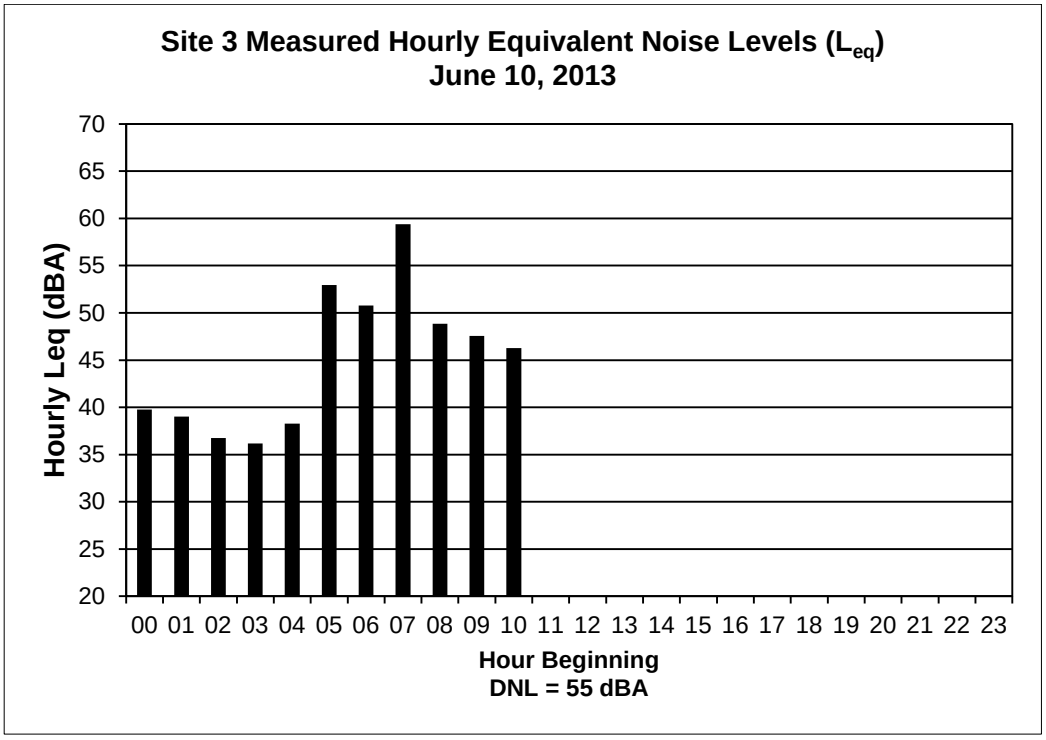



Site 3 Measured Hourly Equivalent Noise Levels (L_{eq})
June 6, 2013
Hourly Leq (dBA)
70
65
60
55
50
45
40
35
30
25
20
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Hour Beginning
DNL = 56 dBA
NOTE: It rained most of the day on June 6th. Raindrops hitting the microphone artificially raised the measured levels.


Site 3 Measured Hourly Equivalent Noise Levels (L_{eq})
June 7, 2013
Hourly Leq (dBA)
70
65
60
55
50
45
40
35
30
25
20
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Hour Beginning
DNL = 51 dBA


Site 3 Measured Hourly Equivalent Noise Levels (L_{eq})
June 8, 2013
Hourly Leq (dBA)
70
65
60
55
50
45
40
35
30
25
20
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Hour Beginning
DNL = 56 dBA


Site 3 Measured Hourly Equivalent Noise Levels (L_{eq})
June 9, 2013
Hourly Leq (dBA)
70
65
60
55
50
45
40
35
30
25
20
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Hour Beginning
DNL = 52 dBA


Site 3 Measured Hourly Equivalent Noise Levels (L_{eq})
June 10, 2013
Hourly Leq (dBA)
70
65
60
55
50
45
40
35
30
25
20
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Hour Beginning
DNL = 55 dBA

3.4.6 *Site 4: 3527 Northgate St. NW*

Site 4 is located approximately 500 feet southeast of the extended centerline of Runway 5/23, approximately 9,000 feet (1.5 to 2 miles) northeast of the Runway 5 departure end (Runway 23 arrival end). The monitor was in the rear yard of a single-family residence in a location largely shielded from street traffic noise.

Runway 5 departures and Runway 23 arrivals were the principal aircraft operations affecting the site during the measurements. Jet aircraft were the sole source of measured aircraft noise events, with a maximum L_{max} value of 78 dBA for Runway 5 departures and 72 dBA for Runway 23 arrivals.

Of the approximately 74 hours of monitoring at Site 3, 72 were full hours. As shown in Figure 23, the hourly L_{eq} approximately ranged from 31 to 58 dBA. The levels followed a normal daily pattern, with the lowest levels during the late night and early morning hours.

As at Sites 1 and 3, it rained most of the day on June 6, resulting in artificially elevated noise levels associated with water hitting the microphone, in addition to the normal increase in noise associated with the rain hitting leaves and other surrounding surfaces.

Including the effects of rain on the 6th, the overall measured DNL for Site 4 was 54 dBA, equal to the overall DNL at Site 3, two decibels higher than Site 2 (the site with the lowest overall DNL), and 10 dB lower than Site 5 (the site with the highest overall DNL).

Figure 22 Site 4 Measured Maximum A-Weighted Levels
Source: HMMH, June 2013

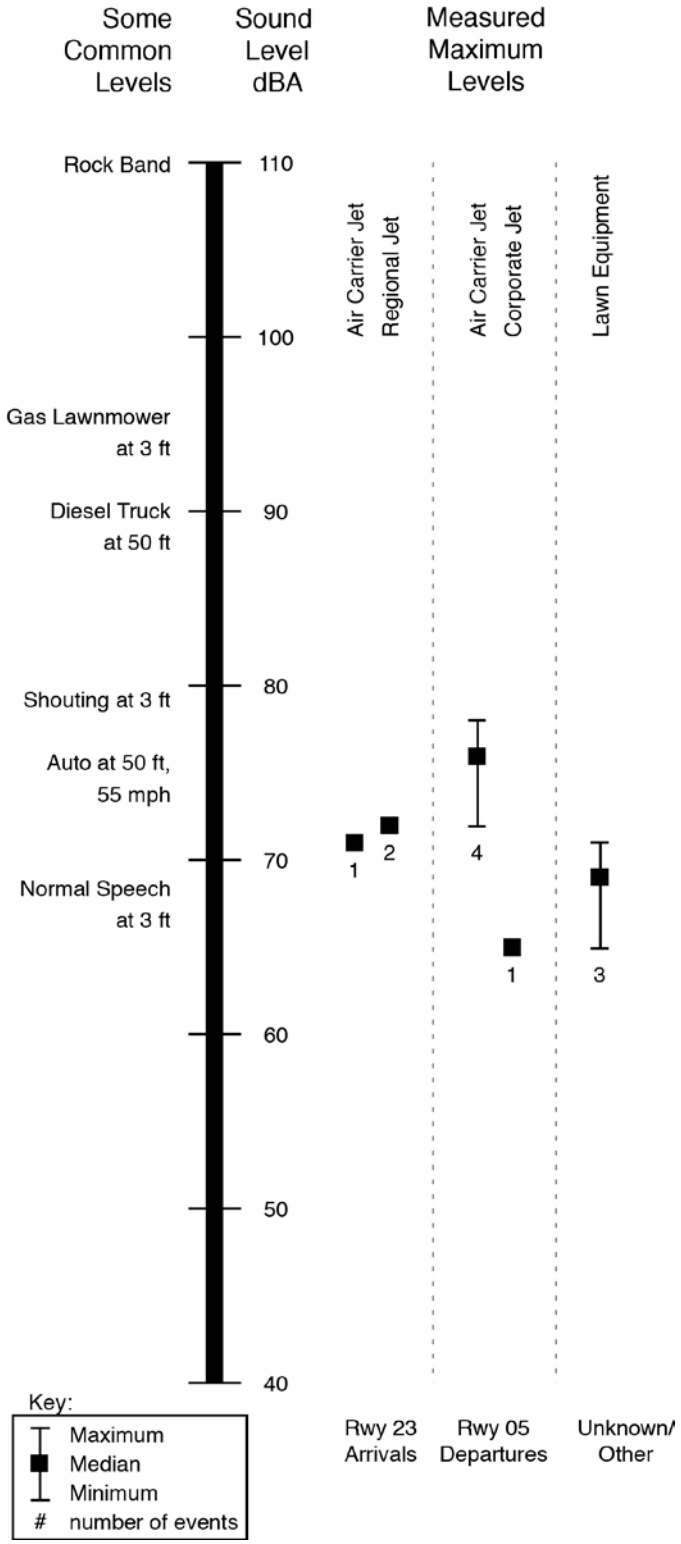


Figure 23 Site 4 Measured Hourly Noise Levels (L_{eq}), Full Duration
Source: HMMH June 2013

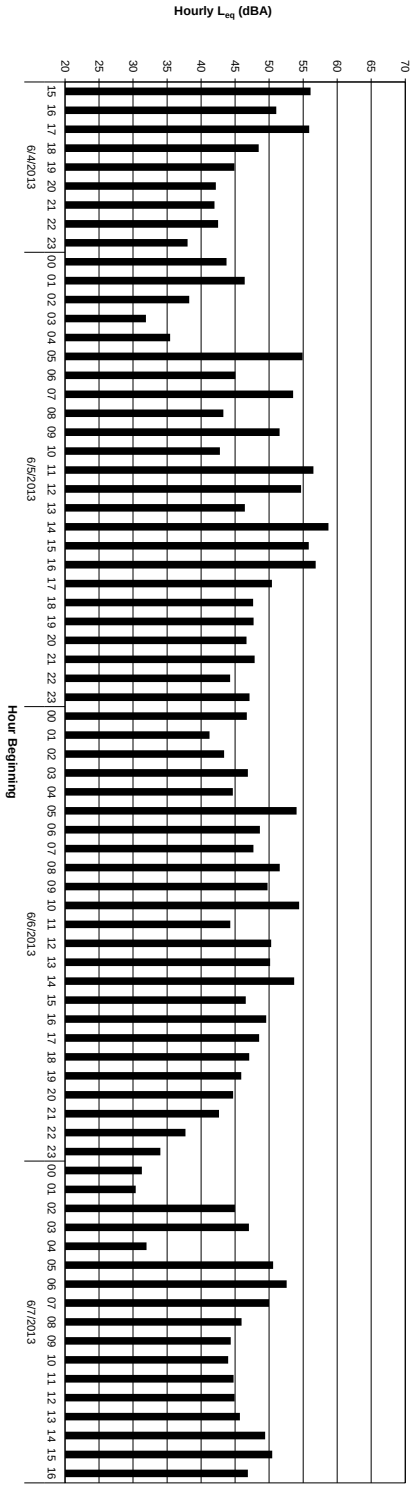
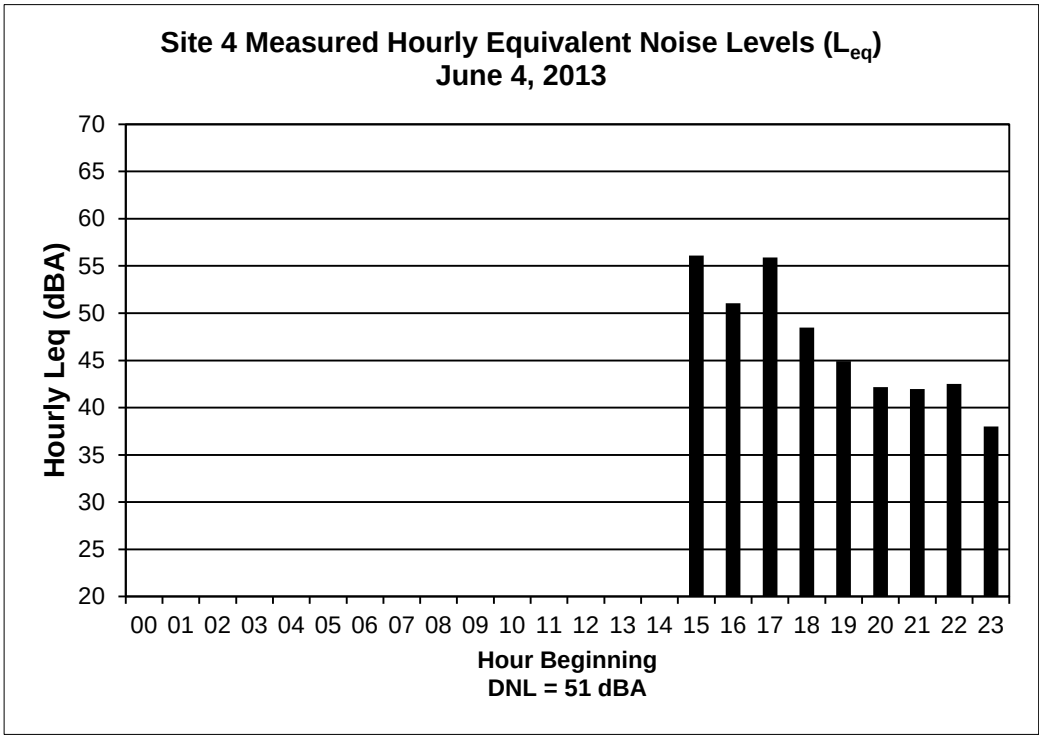
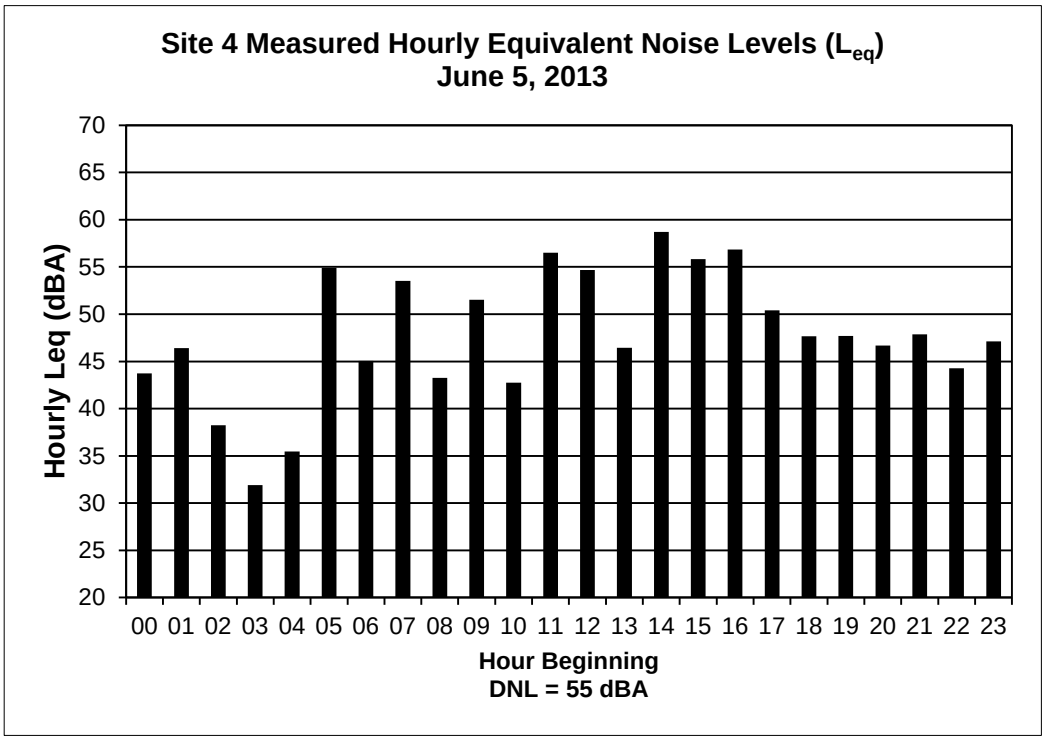
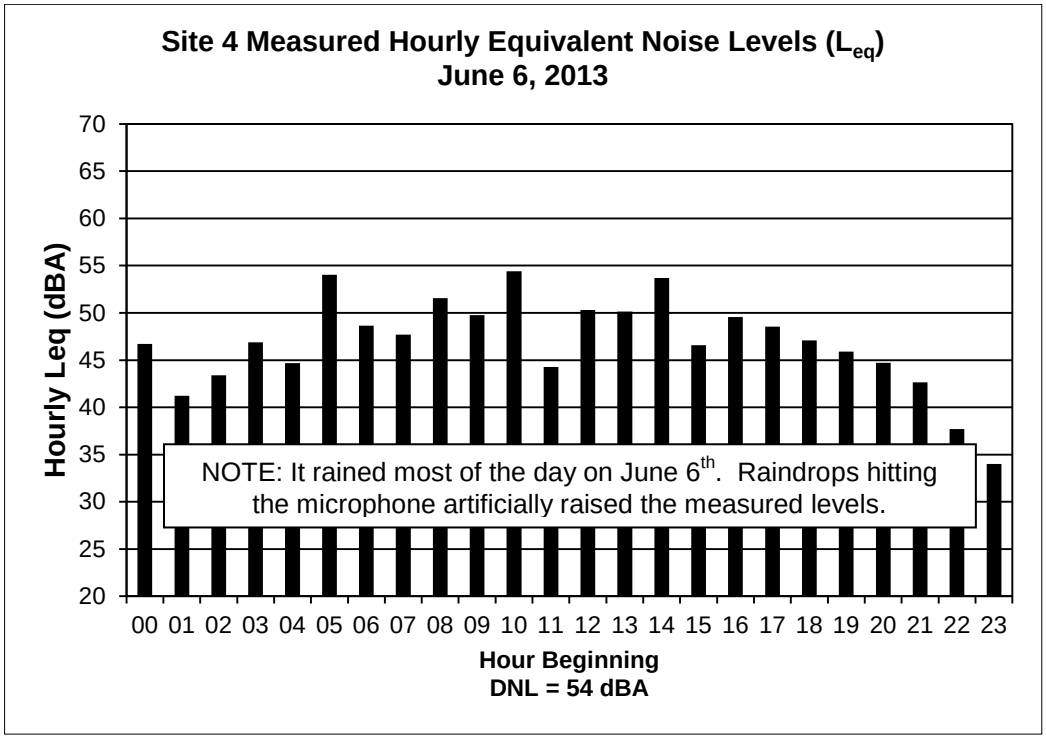
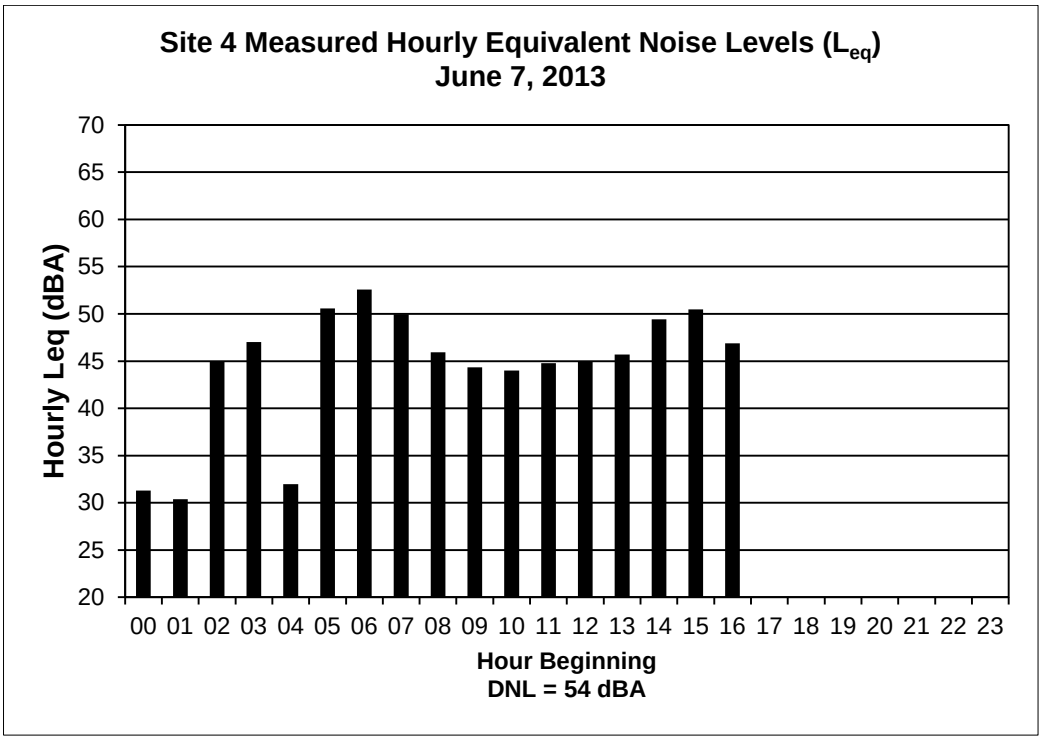


Figure 24 Site 4 Measured Hourly Noise Levels (Leq), Calendar Days
Source: HMMH June 2013






Site 4 Measured Hourly Equivalent Noise Levels (L_{eq})
June 6, 2013
Hourly Leq (dBA)
70
65
60
55
50
45
40
35
30
25
20
NOTE: It rained most of the day on June 6th. Raindrops hitting the microphone artificially raised the measured levels.
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Hour Beginning
DNL = 54 dBA


Site 4 Measured Hourly Equivalent Noise Levels (L_{eq})
June 7, 2013
Hourly Leq (dBA)
70
65
60
55
50
45
40
35
30
25
20
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Hour Beginning
DNL = 54 dBA

3.4.7 *Site 5: 2475 Wise Rd. NW*

Site 5 is located approximately 200 feet west of the extended centerline of Runway 1/19, almost due north of the runway, approximately 6,000 feet (1.2 miles) from the northern runway end. The monitor was in the rear yard of a single-family residence, shielded from local street traffic. The rear yard bordered a golf course, with a cart path adjacent to the property. During the observed measurements, no golf course activity produced any noise events.

As shown in Figure 25, Runway 1 departures were the principal operations affecting the site during the measurements. Air carrier jets were responsible for nearly 60% of the identified noise events. Overall, air carrier departures at Site 5 caused the highest L_{max} values recorded at any site during the measurement period. One air carrier jet departure produced the highest overall maximum L_{max} measured at any site, of 96 dBA. Regional jets and corporate jets departing from Runway 1 also caused relatively high L_{max} values of 81 dBA and 83 dBA, respectively.

Approximately 26 hours of monitoring were conducted at Site 5, including 24 consecutive full hours starting at 1 p.m. (hour 13) on June 3. As shown in Figure 26, the hourly L_{eq} values ranged from 49 to 70 dBA. The general variation in hourly L_{eq} is consistent with activity at the airport and normal patterns of non-aircraft activities in a residential setting. An MD-88 departure on Runway 1, with an SEL of 105 dBA (the same event with the Lmax of 96 dBA), caused the abnormally high L_{eq} value on June 3 for the hour starting at 5 p.m. (hour 17).

The overall measured DNL for Site 5 was 64 dBA, the highest overall DNL measured, 12 dB higher than Site 2 (the site with the lowest overall DNL).

Figure 25 Site 5 Measured Maximum A-Weighted Levels
Source: HMMH, June 2013

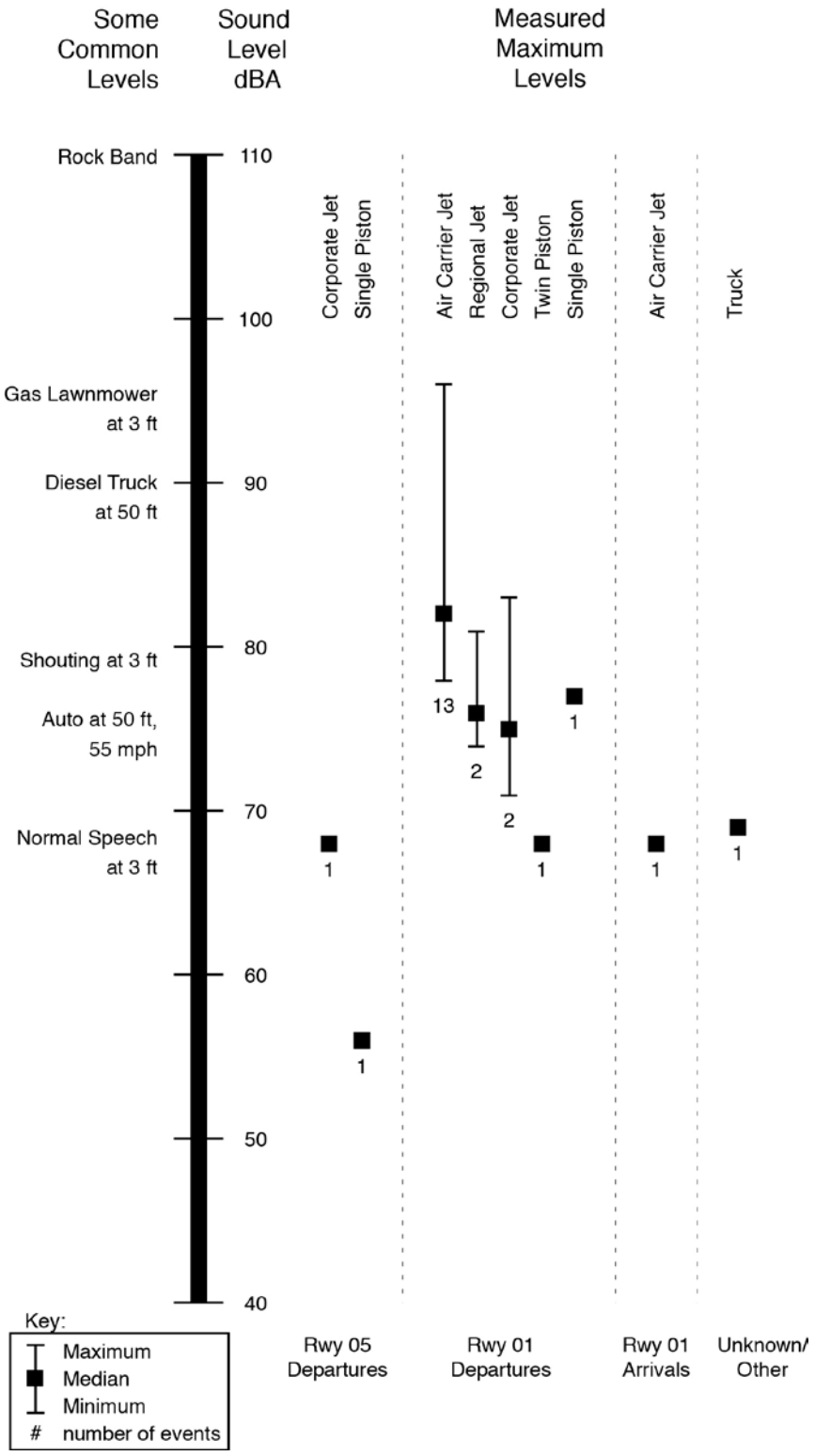


Figure 26 Site 5 Measured Hourly Noise Levels (L_{eq}), Full Duration
Source: HMMH, June 2013

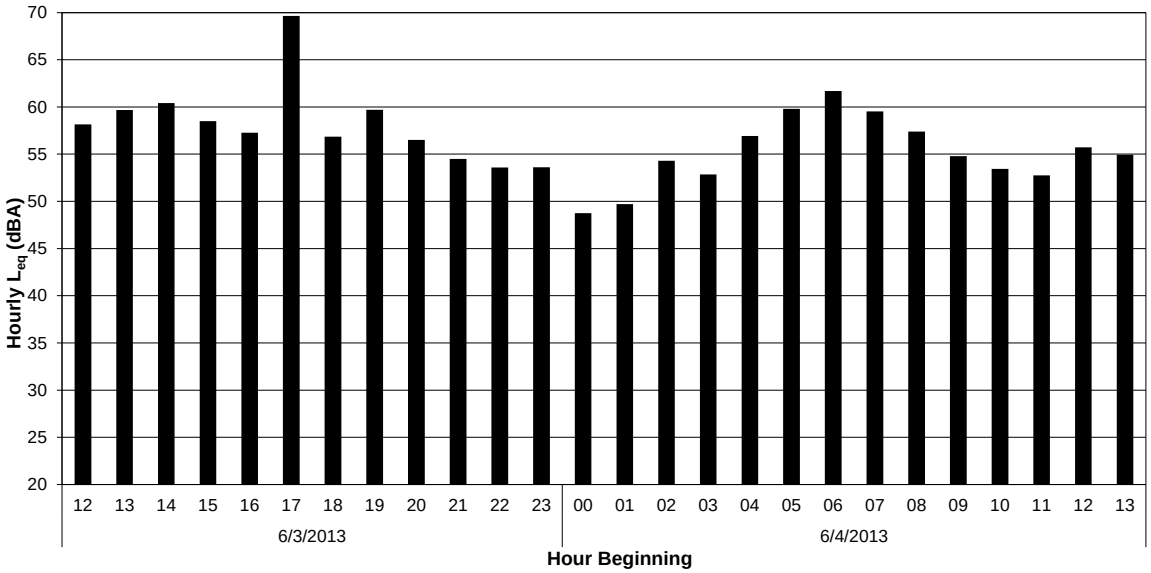
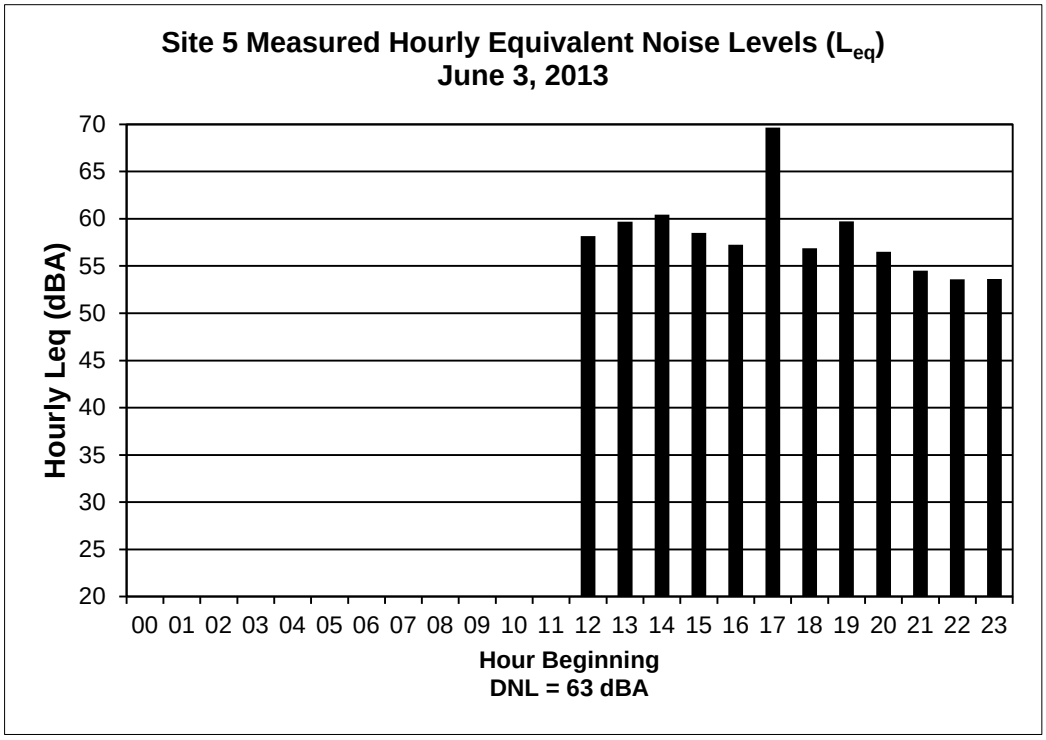
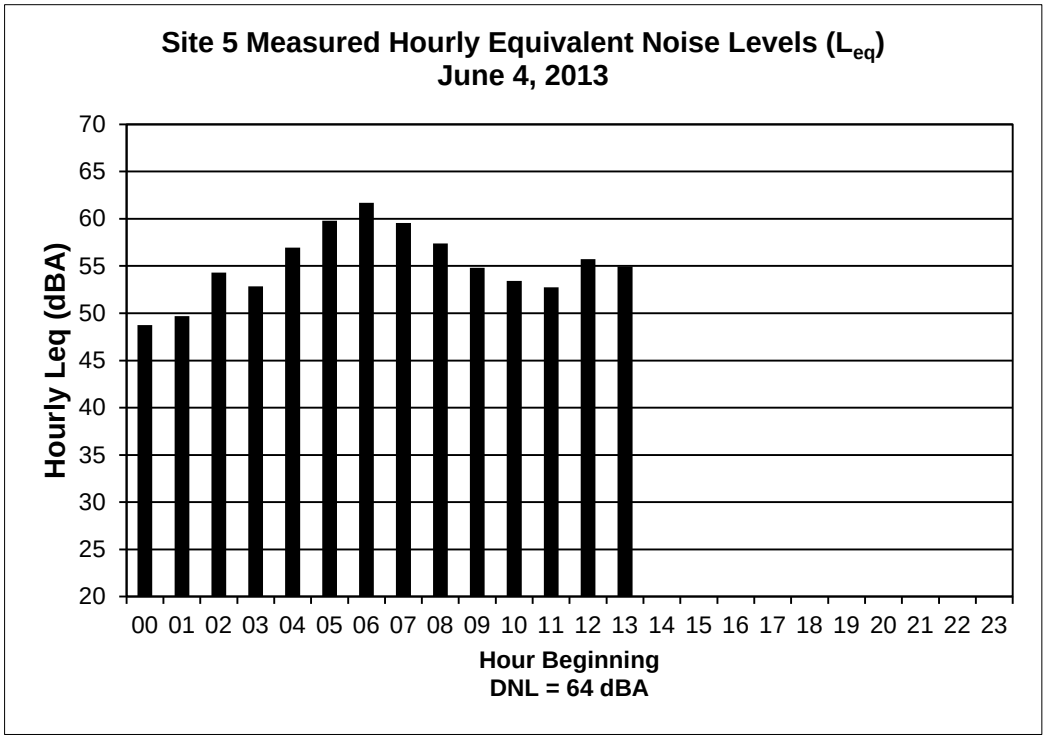


Figure 27 Site 5 Measured Hourly Noise Levels (L_{eq}), Calendar Days
Source: HMMH, June 2013





3.4.8 *Site 6: 7979 Frank Ave. NW*

Site 6 is located approximately 200 feet east of the extended centerline of Runway 1/19, approximately three-quarters of a mile south of the departure end of Runway 19, almost directly in line with the runway. The monitor was located in the rear yard of a single-family residence, shielded from any significant local traffic noise

Runway 1 arrivals were the principal aircraft operations affecting the site during the measurements. Air carrier jet, regional jet, and corporate jet operations caused nearly all of the observed noise events. As shown in Figure 28, an air-carrier jet arrival produced the highest L_{max} of 89 dBA. This aircraft type category had an overall median L_{max} of 84 dBA. Reverse thrust from jet aircraft arrivals on Runway 1 was sometimes audible, but did not trigger noise events.

Site 6 measurements covered 27 hours. As shown in Figure 29, the hourly L_{eq} approximately ranged from 46 to 61 dBA. The highest hourly L_{eq} was for the hour starting at 5 p.m. (hour 17) on the afternoon of June 3. A relatively high number of jet aircraft arriving on Runway 01 were the cause of the somewhat elevated exposure in that hour. The monitor operating at Site 5 during this same hour also measured a high exposure level during this hour.

The overall measured DNL for Site 6 was 59 dBA, 5 dB lower than Site 5 (the site with the highest overall DNL) and 7 dB higher than Site 2 (the site with the lowest overall DNL).

Figure 28 Site 6 Measured Maximum A-Weighted Levels
Source: HMMH, June 2013

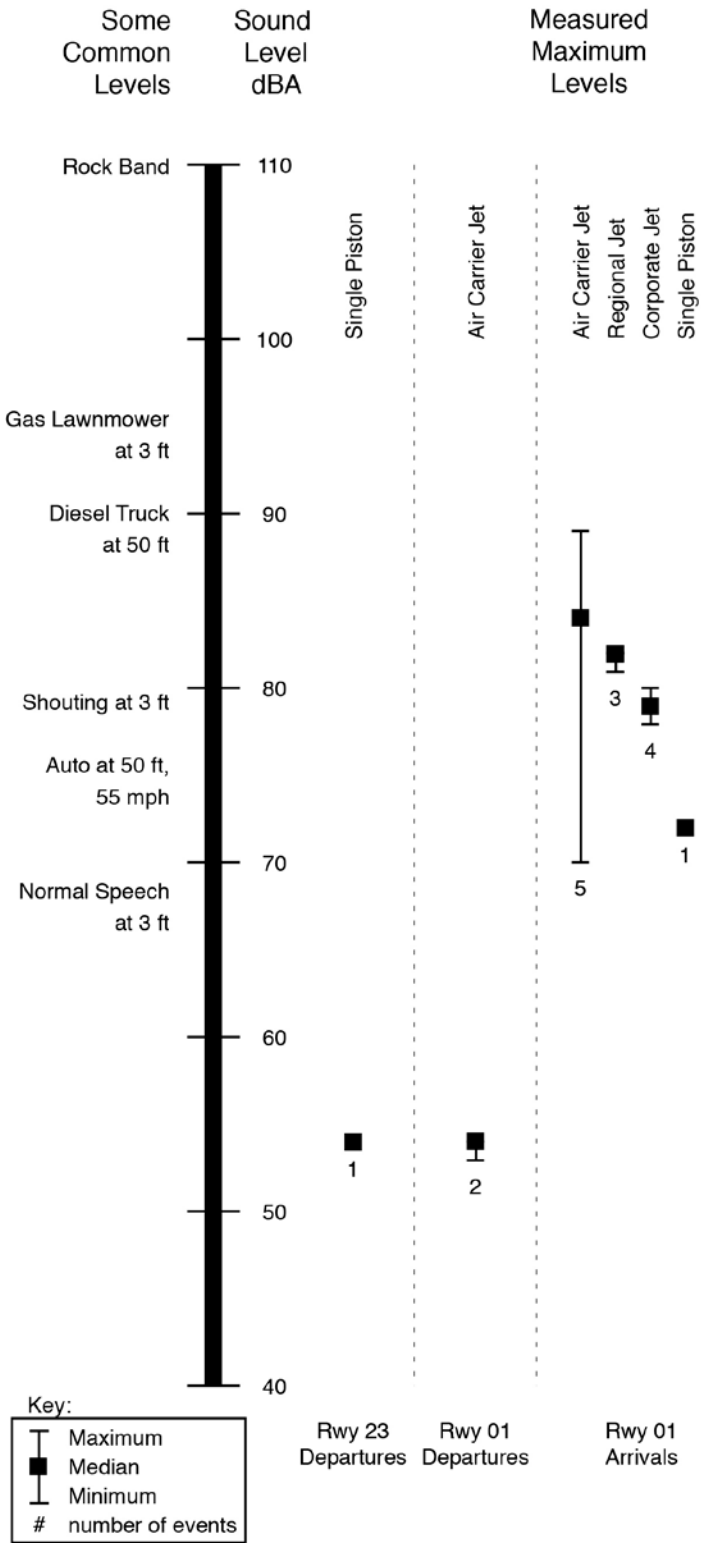


Figure 29 Site 6 Measured Hourly Noise Levels (L_{eq}), Full Duration
Source: HMMH, June 2013

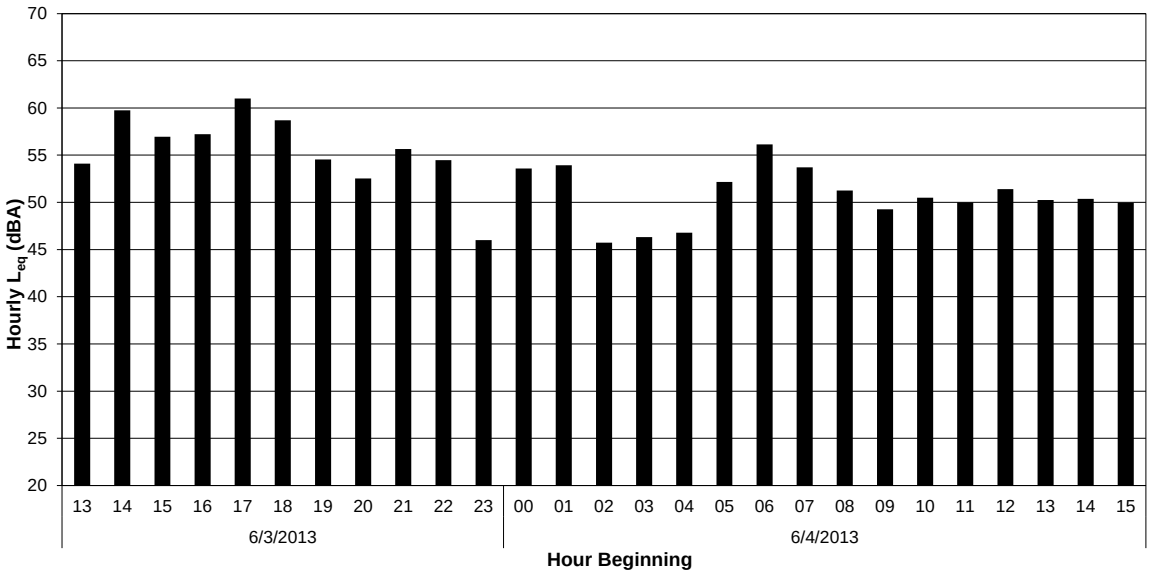


Figure 30 Site 6 Measured Hourly Noise Levels (L_{eq}), Calendar Days
Source: HMMH, June 2013