To John Langham & Robert Kelly – CORE Architects
From Russ Cooper
Date July 26, 2013
Project Arkansas Music Pavilion
Subject Acoustic Study

This report reviews the projected impact of concert events at the Arkansas Music Pavilion (AMP) in Rogers, Arkansas on the nearest residential communities near the project site.

Study Methodology

The study consisted of the following parts:

a) Review of current noise ordinances in Rogers
b) Measurement of existing ambient sound levels in the identified communities
c) Acoustical modeling of the sound projected from the AMP facility to the community
d) Comparison to levels at current AMP site in Fayetteville.
e) Analysis and Conclusions

Noise Ordinances

The Rogers, Arkansas noise ordinance states the following:

Sec. 18-24. Prohibited generally.

(a) Subject to the provisions of this article, no person shall create any unreasonably loud, disturbing and unnecessary noises within the city.

(b) No person shall create noise of such character, intensity or duration as to be detrimental to the life or health of any individual or in the disturbance of the public peace and welfare.

(c) The use of Jake brakes or other similar engine compression retarding devises is prohibited.

(Code 1982, § 11-2; Code 1997, § 42-31; Ord. No. 05-115, § 1, 8-23-2005)

Sec. 18-26. Unlawful acts enumerated.

The following acts, among others, are declared to be loud, disturbing and unnecessary noises and nuisances and in violation of this article, but this enumeration shall not be deemed to be exclusive:

(1) The maintenance and operation of an outside loudspeaker or public address system transmitting music, advertising or speaking, except upon a permit issued by the chief of police; and notwithstanding the permit, any such loudspeaker or public address

system shall not be operated in such a manner or at such volume as to annoy or disturb the quiet, comfort or repose of persons in any office, hospital, dwelling house, hotel, motel or other type of residence or any person in the vicinity. The aforesaid noise, when permitted, shall be restricted to the hours from 8:00 a.m. to:

a. 8:00 p.m. in residential zones, as delineated in chapter 14, article VI, zoning.

b. 11:00 p.m. on all nights but Saturday and 12:00 p.m. on Saturday nights for commercial zones, as prescribed in chapter 14, article VI, zoning.

Hence, the noise ordinance is a subjective one without any objective decibel readings or criteria to establish a violation. With this in mind, Jaffe Holden was asked to measure the background sound in the communities identified by the Client and compare them to the projected sound levels from concerts to see how loud the concerts will be in the communities to help gauge whether complaints might be a possibility.

Measurements of Ambient Sound Levels in the Community:

The following locations were selected for study:

1. The Manors
2. Overland
3. South 41st thru 43rd Street Residential Neighborhood @ Arapahoe
4. Mercy Hospital
5. Highland Knolls
6. Pinnacle
7. Beau Chene Farms

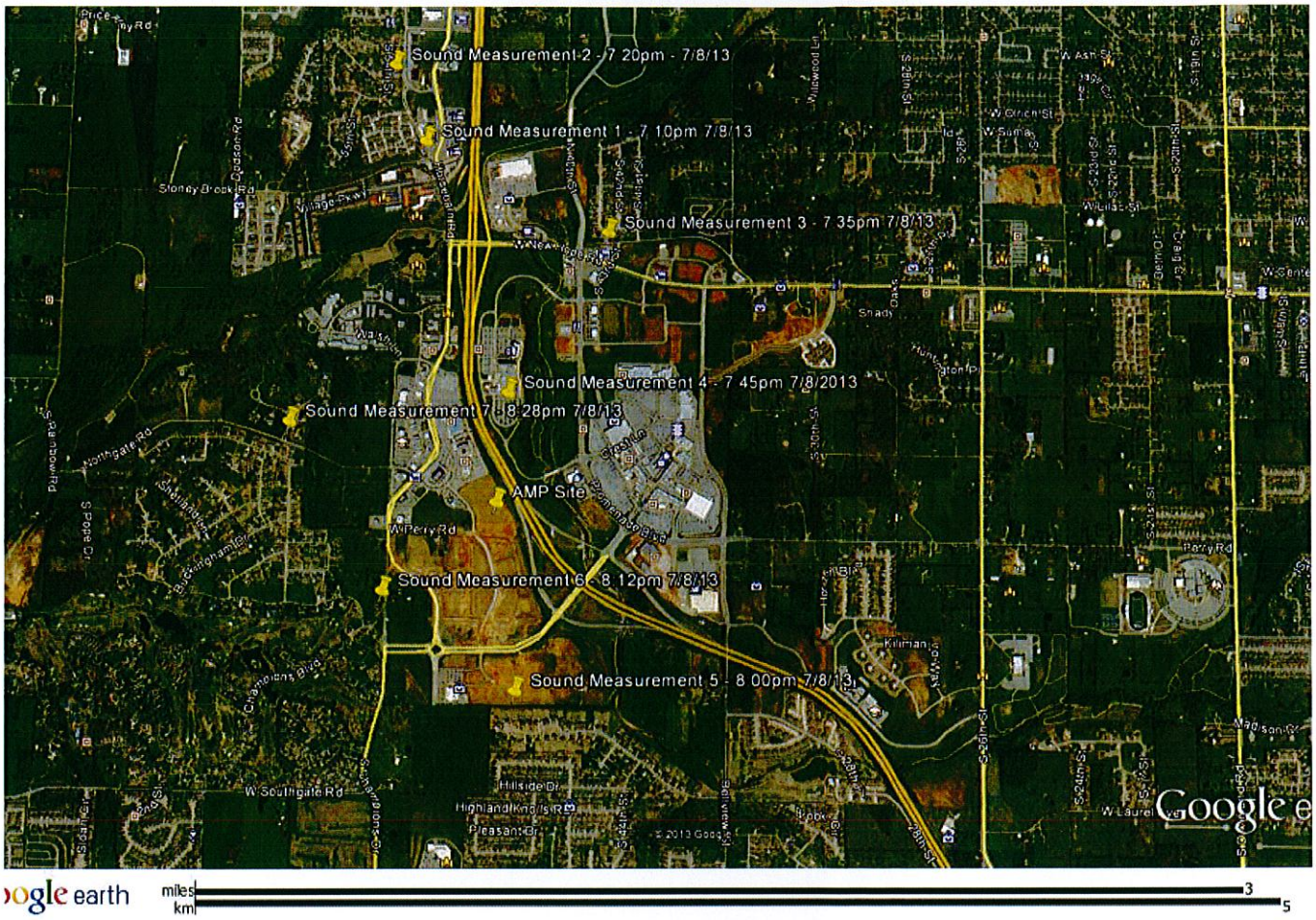
The measurements were conducted on July 8th in the early evening to simulate approximately when a concert might be occurring, after the evening rush hour, see Figures1 and 2.

FIGURE 1

NEIGHBORHOOD MAP

FIGURE 2

MEASUREMENT LOCATIONS



The results of the ambient measurements were as follows:

	LOCATION	AVERAGE SOUND PRESSURE LEVEL Leq
1.	The Manors	56.0
2.	Overland	53.2
3.	South 41st thru 43rd Street Residential Neighborhood @ Arapahoe	54.0
4.	Mercy Hospital	57.1
5.	Highland Knolls	42.1
6.	Pinnacle	46.7
7.	Beau Chene Farms	40.7

Acoustical Modeling Prediction:

We modeled the sound source by combining information from several sources. We used sound level readings Jaffe Holden has measured at the house mix positions of several outdoor rock and roll venues, combined with Meyer Sound's line array prediction software MAPP and SOUND PLAN acoustic prediction software to come up with the source sound levels of the speakers at the edge of the fabric pavilion facing out onto the grassy lawn.

See Figures 3through 5 for the MAPP prediction of the sound for various frequencies overlaid onto the angle of the lawn for the AMP. The house mix position is approximately 100 feet away from the speakers and we have assumed this would be the same sound level from the lawn speakers at 100 feet as well. The angle of the sloped line corresponds to the angle of the lawn in the drawings and the end of the line corresponds to the fence at the back of the lawn.

FIGURE 3

SOUND RADIATION PATTERN @ 4000Hz.

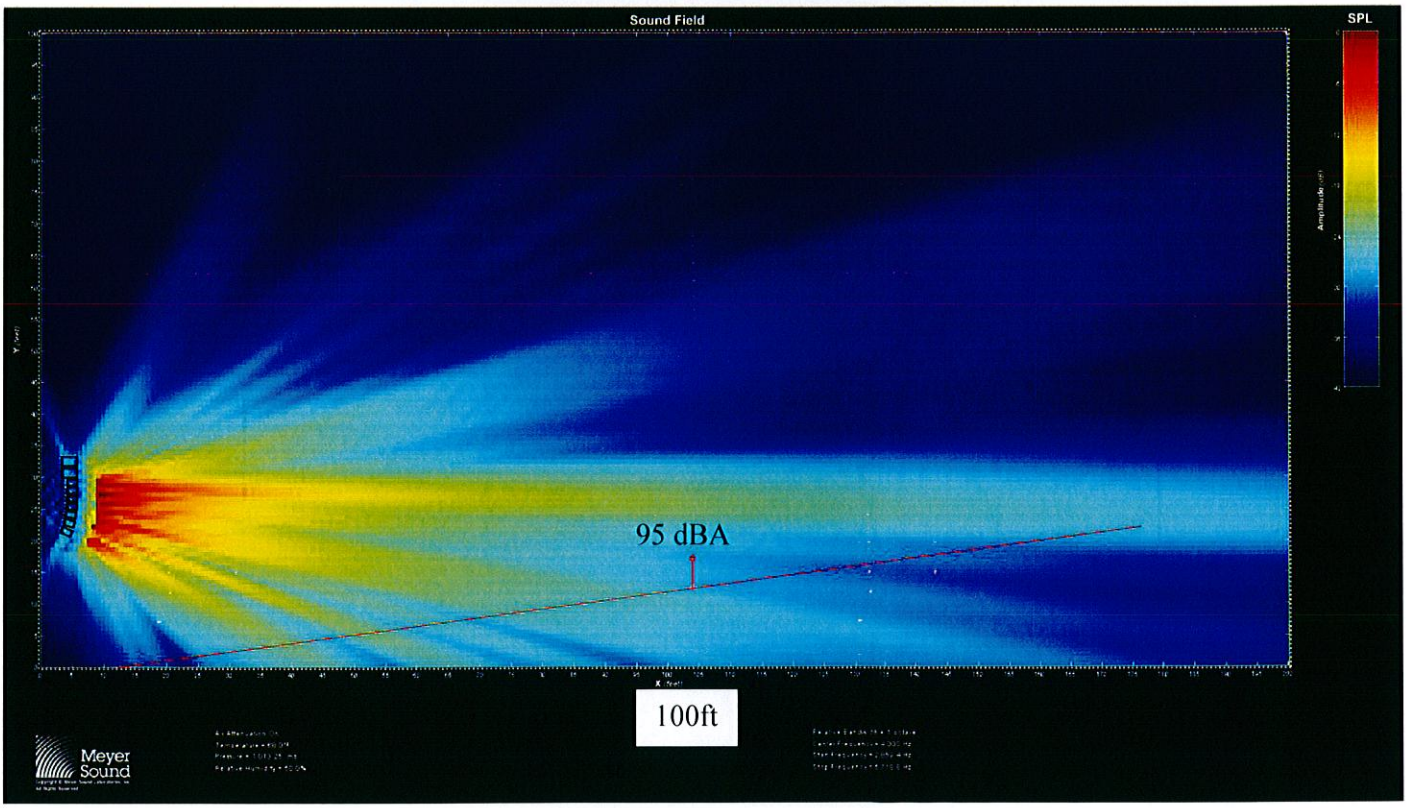


FIGURE 4

SOUND RADIATION PATTERN @ 1000Hz.

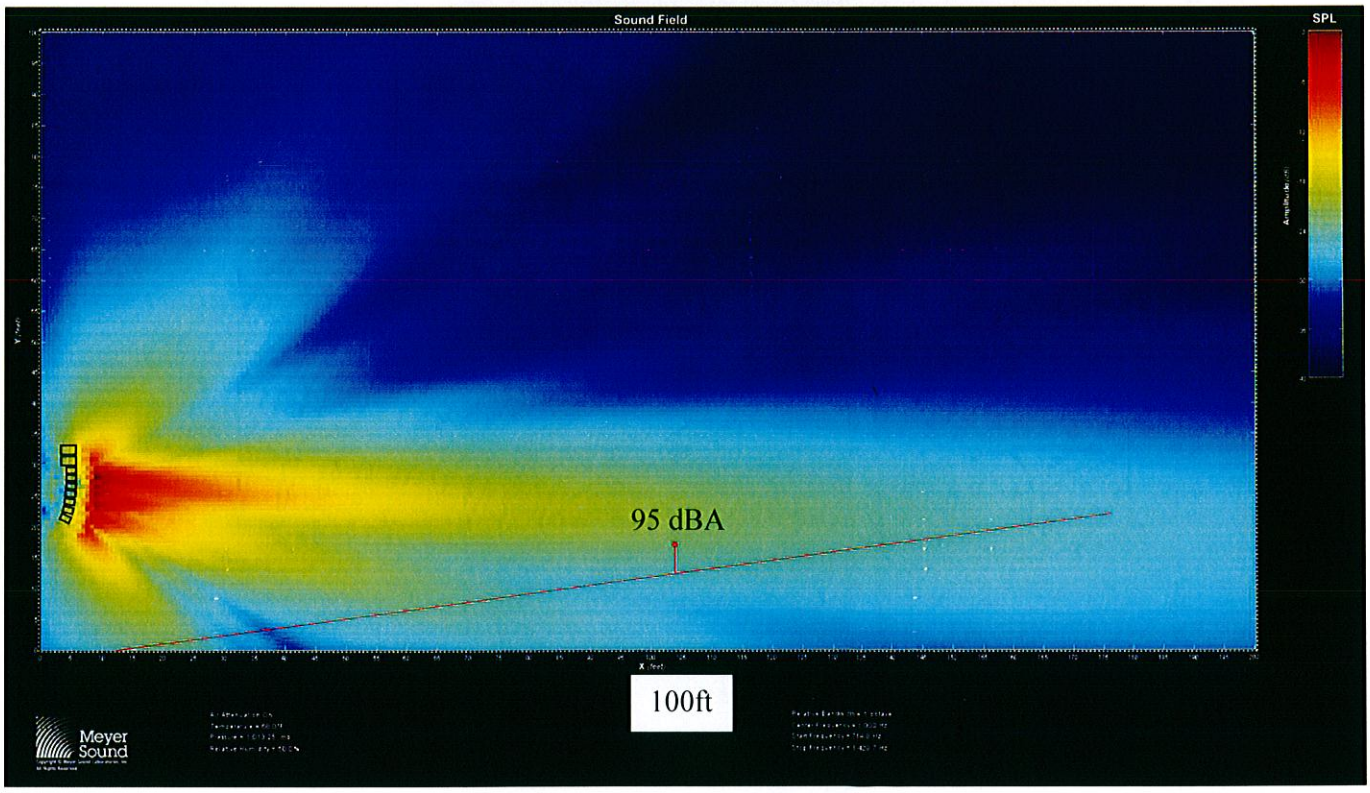


FIGURE 5

SOUND RADIATION PATTERN @ 63Hz.

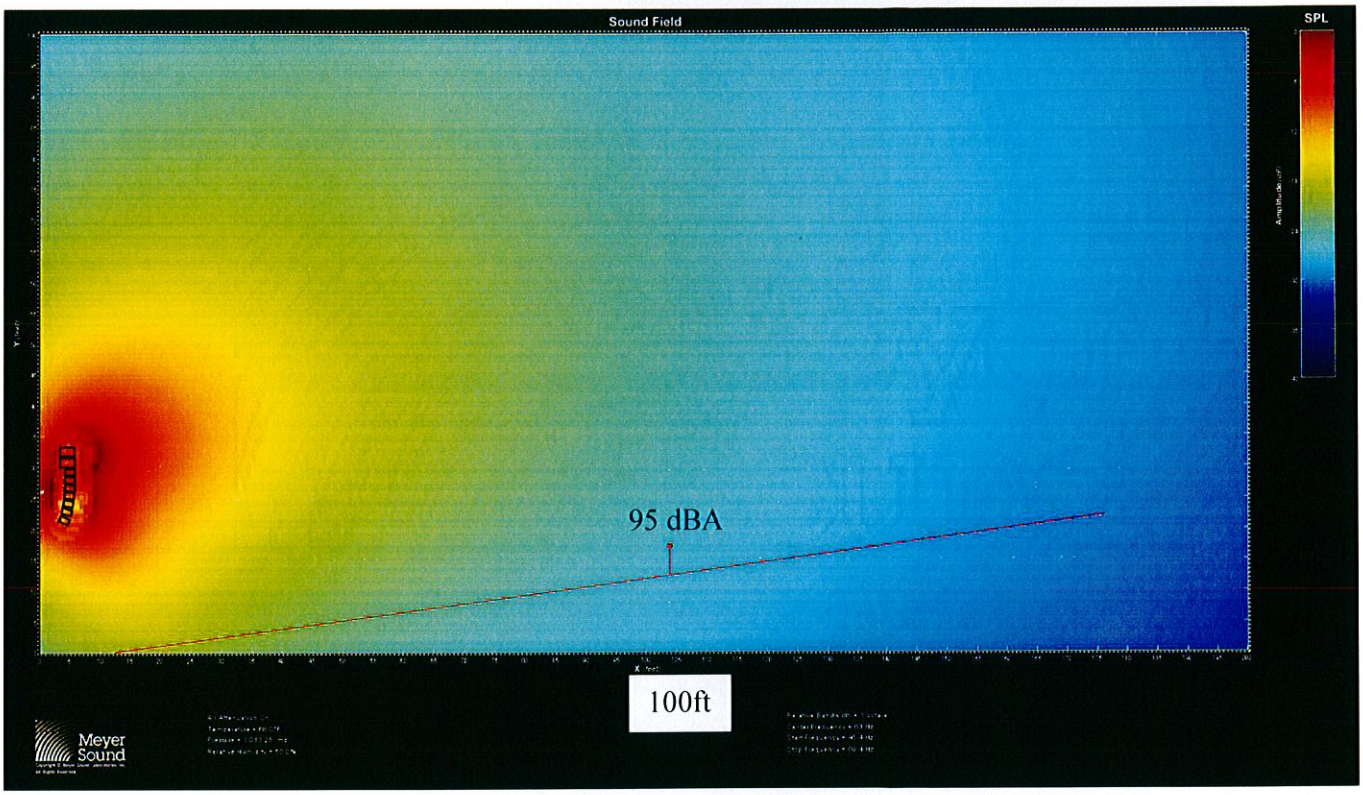
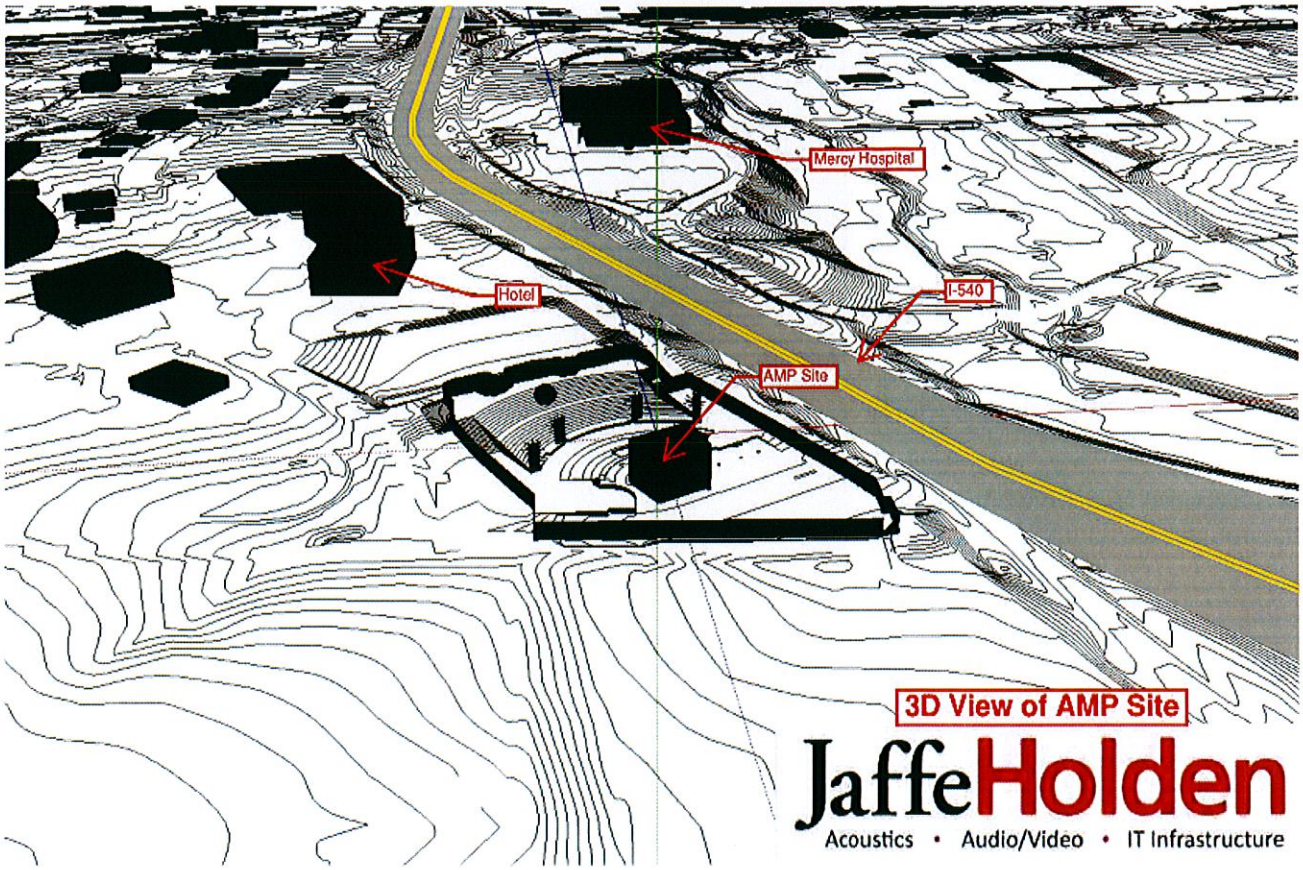


Figure 6 illustrates the AMP site in relation to the surrounding structures and highway in 3-dimensions.

FIGURE 6

3D VIEW OF AMP SITE



Taking this source information and inputting this into SOUNDPLAN, along with the map of the area which includes topography, elevations, buildings, ground plane materials, etc. we are able to predict the average sound pressure levels (SPL) at the receiver locations. The following is a table of the predicted average sound levels along with the corresponding measured ambient levels. Figures 7and 8 illustrates this on the area map.

LOCATION	AMBIENT SPL Leq	PREDICTED SPL Leq	DIFFERENCE
1. The Manors	56.0	55.8	-0.2
2. Overland	53.2	53.6	+0.4
3. South 41st thru 43rd Street Residential Neighborhood @ Arapahoe	54.0	56.1	+2.1
4. Mercy Hospital	57.1	68.5	+11.4
5. Highland Knolls	42.1	51.3	+9.2
6. Pinnacle	46.7	62.6	+15.9
7. Beau Chene Farms	40.7	60.0	+19.3

The following chart shows decibel levels of common indoor and outdoor sounds as a basis of comparison:

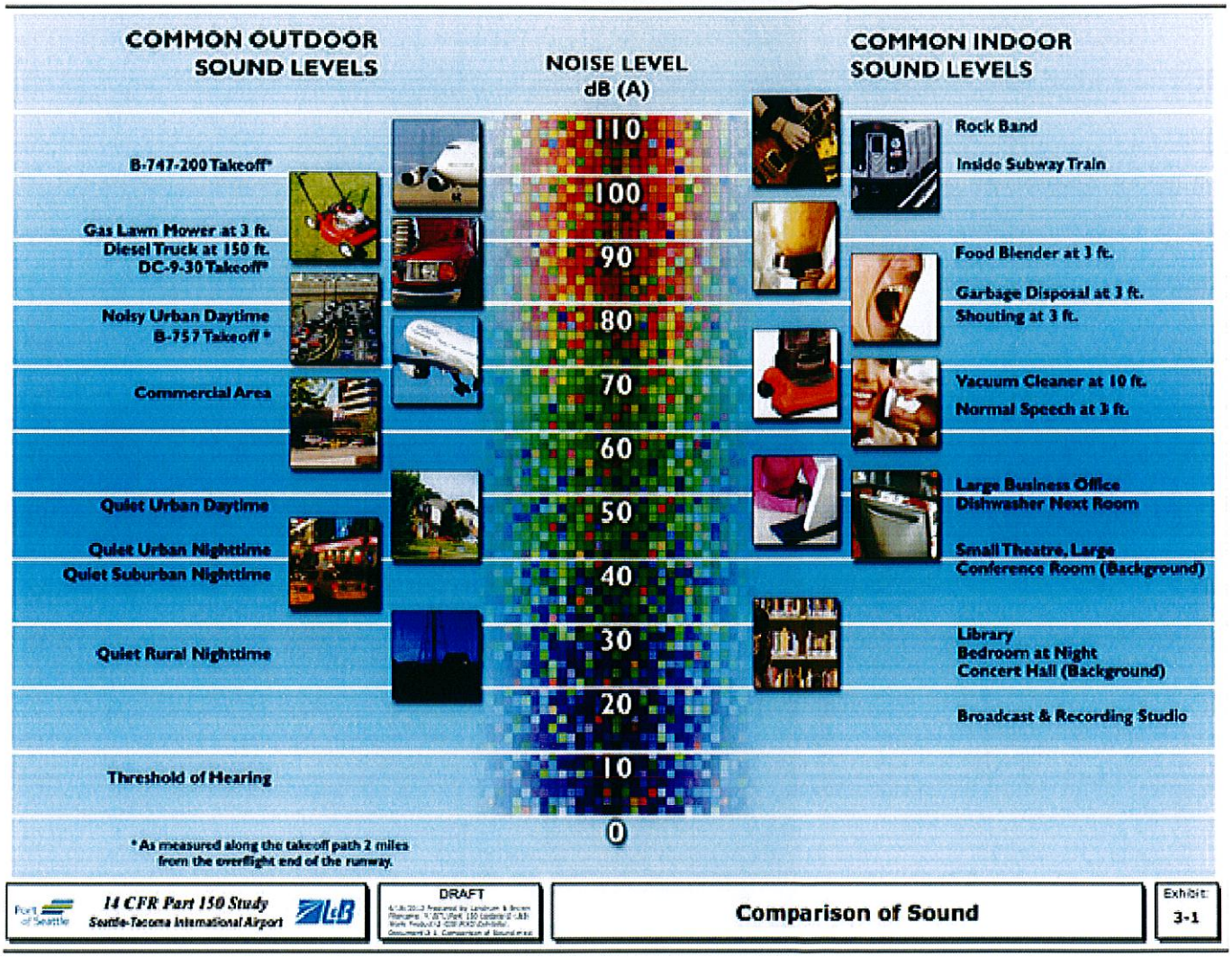


FIGURE 7

PREDICTED SOUND LEVELS AT
MEASUREMENT LOCATIONS

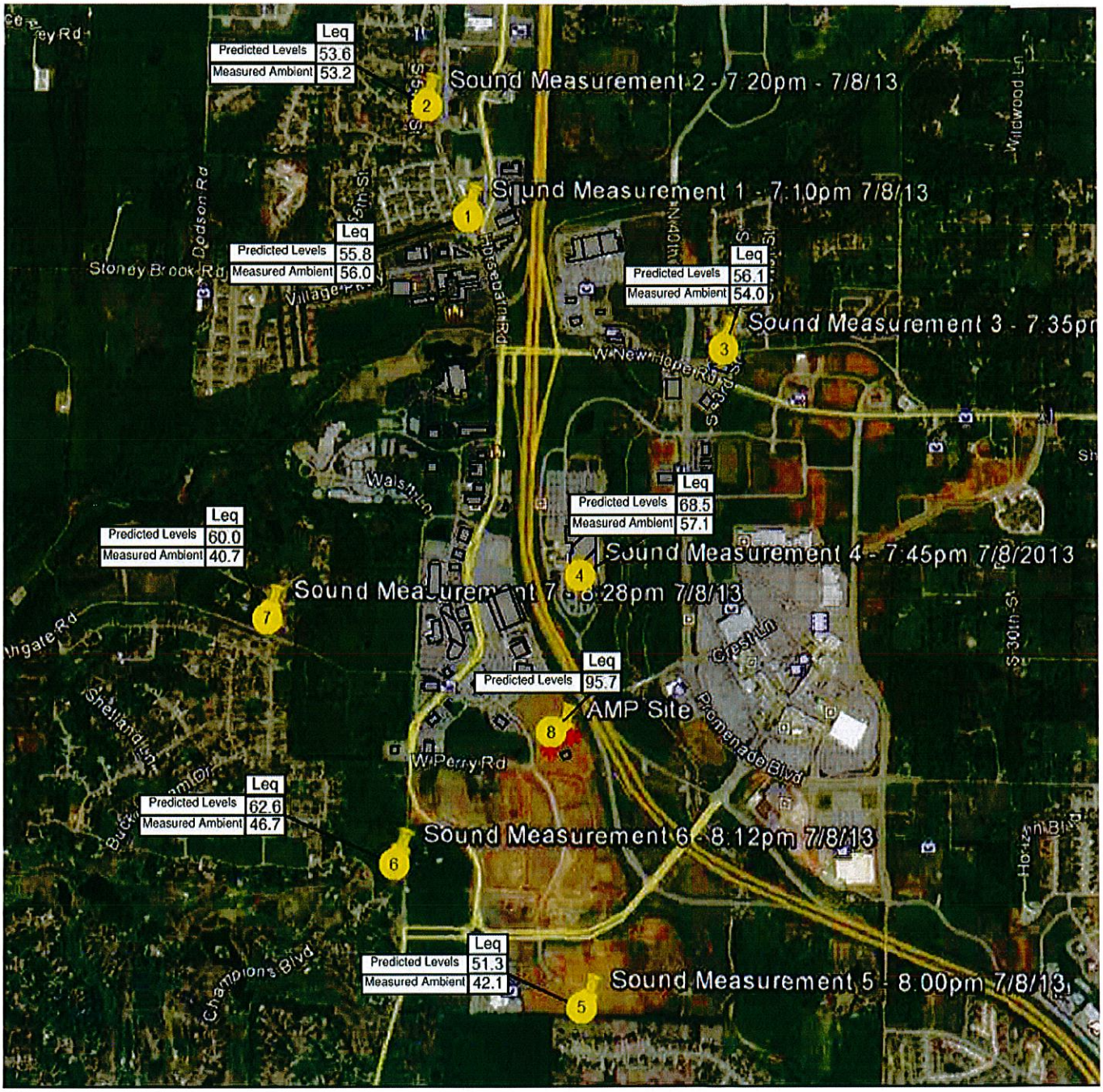
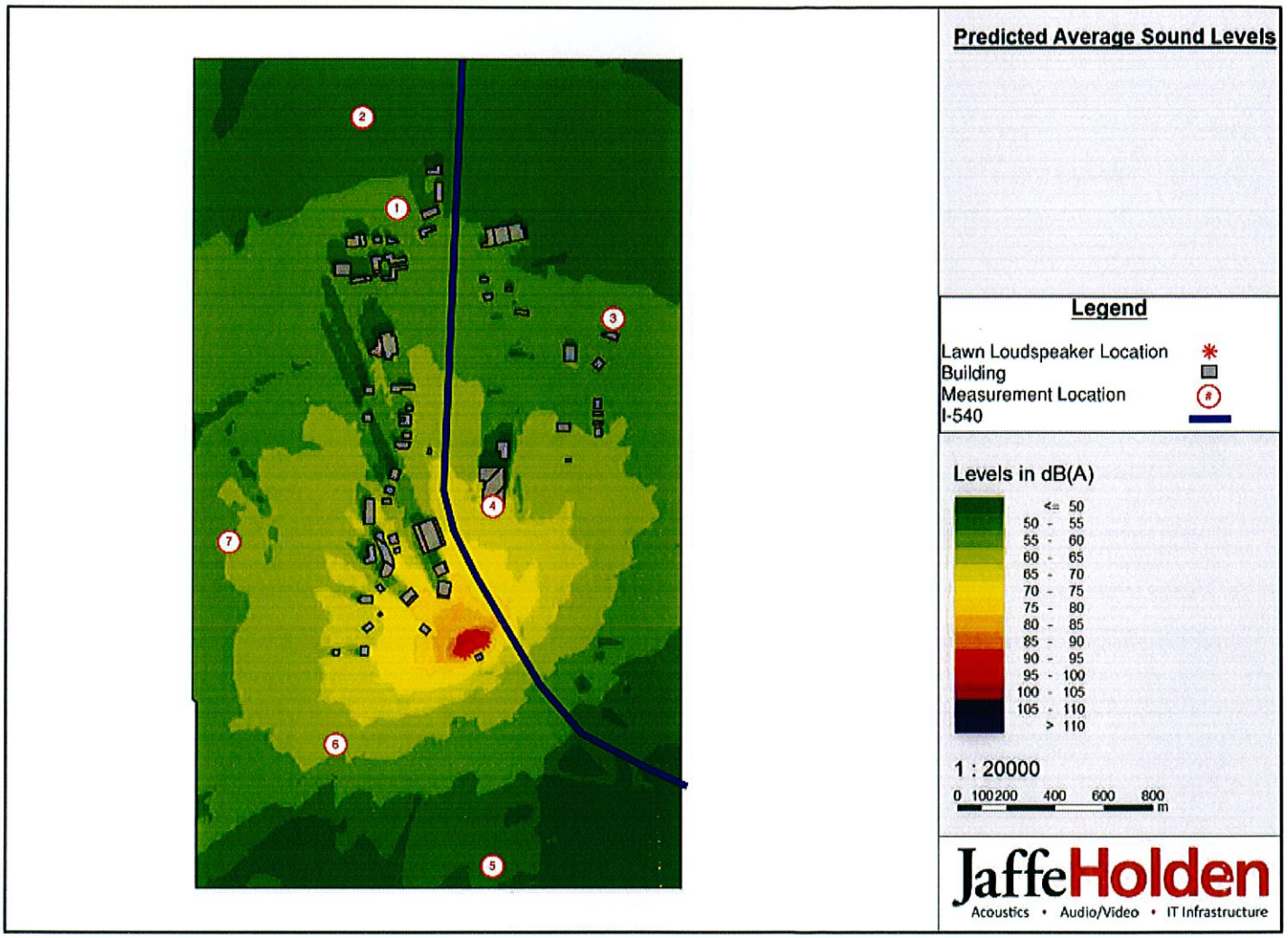


FIGURE 8

PREDICTED SOUND LEVEL AREA DISTRIBUTION MAP

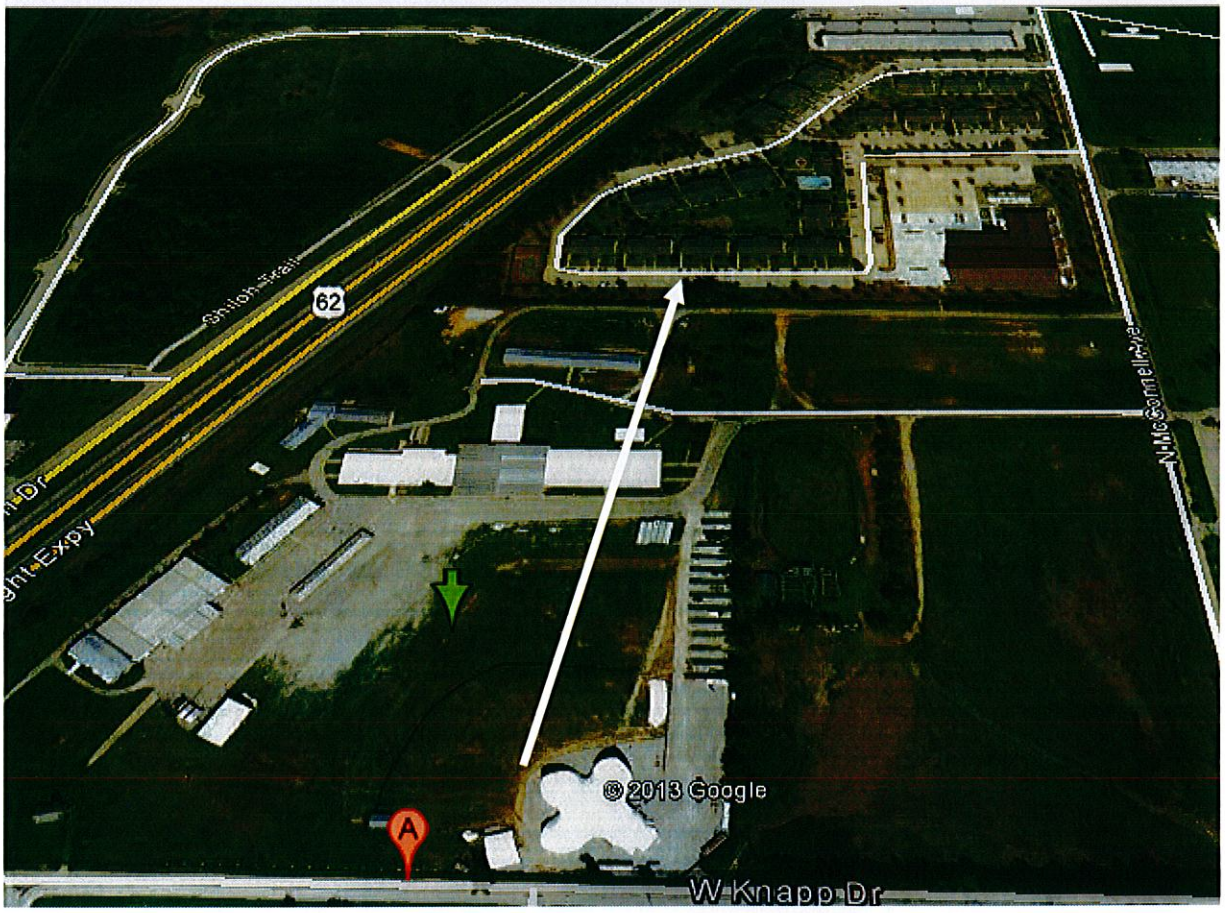


Comparison to AMP Fayetteville

The current site of the AMP is at the Fairgrounds in Fayetteville, see Figure 9. The sound levels at a recent event on July 24, 2013 measured 95 dBA at the house mix location and 91 dBA at the center field fence 350 feet away from the speakers. It appears that the closest residence to the north is 1200 feet away. We estimate that the sound levels at that housing property line would be in the mid 80 decibel range. Fayetteville does have a noise ordinance with decibel criteria and it states that the levels can not exceed 75 dBA at the commercial property line (The Fairgrounds property line).

FIGURE 9

AMP @ FAYETTEVILLE FAIRGROUNDS



Analysis and Conslusions

1. The predicted sound levels from the computer model assume that the lawn speakers are oriented straight out in space, which in reality will not be the case. The line arrays which will be used for this application, should be pointed down into the lawn and their sound pattern dispersion tightly controlled to avoid as much as possible sound spillage out into the area beyond the AMP perimeter fence. Hence the predicted sound levels are the worst-case scenario.
2. All of the measurements are for the sound levels outside at the property lines. Predicted levels inside the locations structures with closed windows and doors will be much less and in most cases not be discernible.
3. The measurement locations 1 through 3 will not be able to discern the sound over the background sound.
4. All of the other locations will be able to hear the music from the AMP outside their residences. It is difficult to determine if actual lyrics will be audible, but it is our conclusion that the music and low frequency bass will be audible at these locations. Whether they are objectionable is up to the listener and their bias.
5. It is interesting that the fairgrounds site which is a flat site and has the same programming and sound levels of the speaker system operates without issues. Again personal bias and resident's level of acceptance can vary.
6. We quickly looked at a sound mitigation attempt of creating a solid fence surrounding the site and this had no effect on reducing sound levels in the surrounding neighborhoods.
7. We strongly recommend our input into the selection of lawn loudspeakers and their orientation to provide the proper sound levels to the lawn in an attempt to avoid excessive sound spill into the surrounding areas.
8. Should complaints arise, it is possible to install a sound monitoring system which when properly calibrated can measure the sound levels at the AMP property line and through computer calculation of distances to the closest residences, predict what the sound level will be at the residence. The system then sends a signal to the house mix engineer and through a "traffic light" box, indicates a GREEN, YELLOW or RED when the sound levels are acceptable, close to excessive and excessive to what we have established for the site as a possible noise offense. The engineer is thus warned that the levels are in danger of or are exceeding the limits and should make the decision to turn the system down.