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CONSULTANTS IN ACOUSTICS

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September 18, 2012

Geoff Sawyer
Great Bay Kennel
27 Newmarket Road
Durham, NH 03824

SUBJECT: Great Bay Kennel - Day Care Acoustical Study

Dear Geoff,

At your request, I have conducted a study of community noise impacts associated with the proposed new day care facility at Great Bay Kennel. This study was intended to compare the existing noise levels from dogs barking to the levels that are expected after the operation moves into the proposed building. This letter presents the results of my analysis.

The existing facility is comprised of a modular building, located at the top of a hill that slopes down to Newmarket Road. There is a large fenced-in play area for the dogs, which includes two smaller areas just outside, and downhill, of the building.

The proposed facility includes two buildings to be constructed at the base of the same hill. This location was chosen in order to maximize acoustical shielding between dogs (when outdoors) and the nearest residential neighbors.

Observations

I visited the day care on three separate occasions in order to observe operations and conduct sound pressure level measurements of dogs barking for use in this study. I have no expertise in dog behavior. However, during my visits I observed the following:

- When the dogs are in the yard area and a day care employee is present, the dogs rarely bark. If the employee plays catch with a ball, one or two dogs (of a dozen or more) will bark in anticipation of the ball being thrown.
- When a new dog arrives, the group of dogs will crowd the entrance area and many will bark simultaneously. This event generated the most simultaneous barking during my observation. It should be noted that dogs arrive via an outdoor gate in a chain-link fence, and the arriving dog and owner are clearly visible to the dogs already present. I understand that this will not be the case at the proposed facility.
- During a new dog arrival, approximately half of the already-present dogs bark. I found that when I tried to incite barking in order to conduct a measurement, the same held true.

Measurements

In order to model noise propagation from the existing and proposed facilities, it was necessary to measure sound pressure levels of dogs barking. In order to do this, I had the day care employees corral approximately 12 dogs in one of the small fenced areas. I then taunted them from a distance of 25 feet from the fence and measured the sound pressure level at this location. Approximately 6 dogs of various sizes and breeds barked during this exercise.

Measurements were conducted with a Norsonic 140 sound level analyzer, which complies with ANSI S1.4 specification for Type 1 instrumentation. The instrument was calibrated immediately prior to the measurement. The measurement consisted of a profile of 1-second L_{EQ} values in one-third-octave bands.

The spectrum used in the model was calculated by taking the maximum level in each one-third-octave band reached during a ten-second sample of the profile, which was centered on the time of highest barking activity. From this sound pressure level spectrum, sound power level was calculated using a quality factor of 1.5. This sound power level spectrum was then increased by 3 dB to account for the potential for 12 dogs barking simultaneously instead of the 6 measured. This sound power spectrum is presented in the attached Figure 1.

It should be noted, however, that the overall sound pressure level of the barking is not of particular importance to this study, as the goal of the study is to determine the *difference* in levels at the residences between the existing and proposed facilities. More critical is the shape of the sound pressure level spectrum – i.e. the relative sound pressure levels at various frequencies. The spectrum shape measured here is very similar to measurements conducted by other consultants in different parts of the country.

Modeling

A computer model was generated in the SoundPlan software to assess noise impacts from both the existing and proposed facilities. The model includes terrain, buildings, sound barriers and other physical attributes of the environment that affect sound propagation. Calculations were based on ISO 9613.

All of the sources used in the model are omnidirectional point sources and use the sound power level spectrum calculated as detailed above. Note that this is conservative, as a barking dog is not omnidirectional. It effectively models the worst case (all dogs facing the same way) at every receiver.

Eight scenarios were modeled, and are presented in the attached figures. Three typical source locations were chosen for the existing facility, and five for the proposed facility. In each case, the sources are in areas where dogs are likely to congregate.

Figures 2a through 2c present calculations for the existing facility and Figures 3a through 3e present calculations for the proposed facility. Levels shown in the plotted sound contour lines are in dBA.

The green lines extending to the northeast and to the south of the proposed facility represent sound barrier walls. Both are eight feet tall. Note that no sound barriers have been included in the analysis of the existing facility, as none of the existing fencing (chain link or lightweight stockade) is of a type that attenuates a significant amount of sound.

The dashed line in Figures 3a through 3e represents a fenced area that will be available for subdivision and containment of dogs. This will be a chain-link fence, and is not intended to be a sound barrier.

Results and Conclusions

While the proposed facility moves the primary dog activity closer to the nearest homes, the shielding provided by the buildings and sound barriers exceeds the increase in level that results from the shorter distance between the dogs and the homes. Moving the dogs down the hill to an elevation more similar to the homes further increases the effectiveness of the buildings and walls as sound barriers.

For the locations modeled (the primary play area for each scenario), the resulting sound pressure levels at the nearest residences are lower (by nearly 10 dB in some cases) for the proposed facility than then they are for the existing facility. For the proposed facility, the worst-case scenario would be a group of dogs congregating and barking at the top of the hill, near the existing building. Under this (presumably unusual) condition, levels would be the same as they are today, but not higher.

For reference, a change of 10 dB is generally considered to be twice (or half) as loud.

It can be concluded that sound levels from the proposed facility will typically be lower than those from the existing facility. Further, the worst-case levels will be the same as for the existing facility, but not higher.

Please feel free to call with any questions.

Sincerely,

Eric L. Reuter, INCE Bd. Cert.
Principal

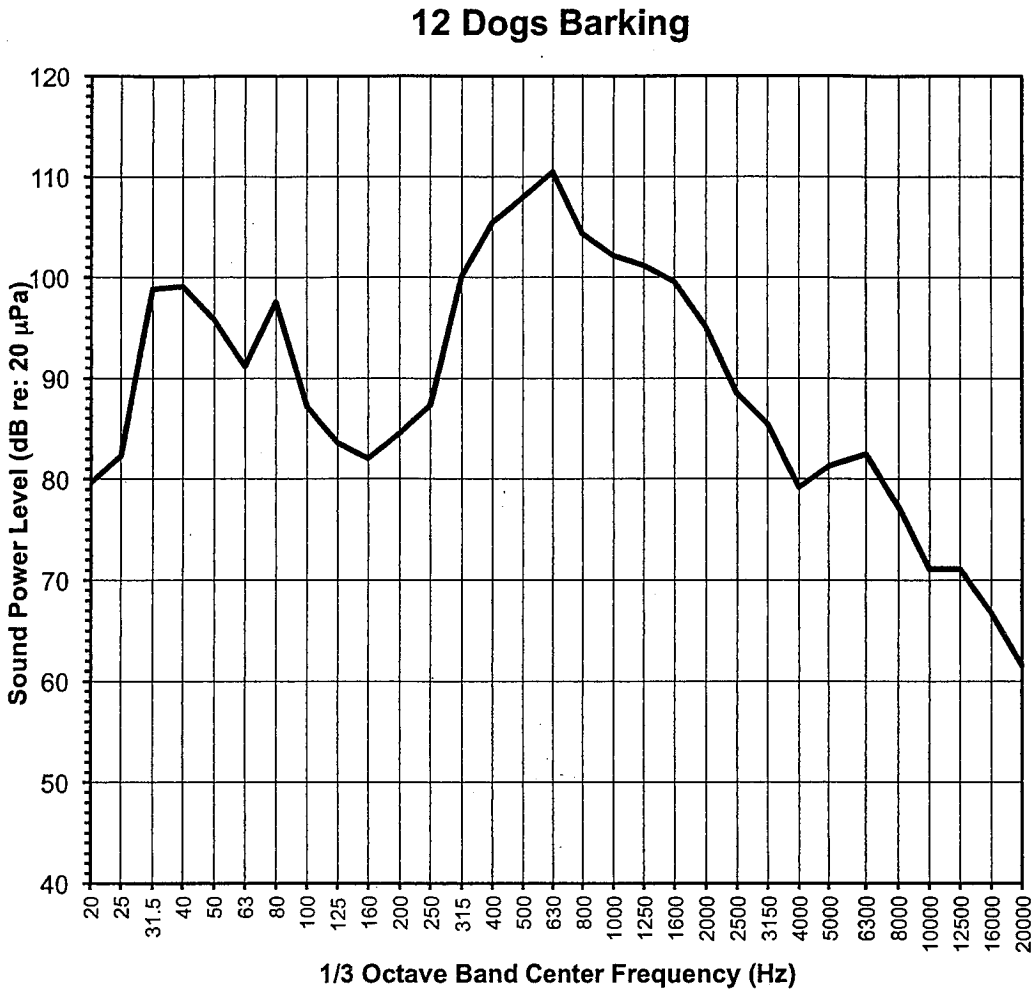
12 Dogs Barking
Sound Power Level (dB re: 20 µPa)
120
110
100
90
80
70
60
50
40
20
25
31.5
40
50
63
80
100
125
160
200
250
315
400
500
630
800
1000
1250
1600
2000
2500
3150
4000
5000
6300
8000
10000
12500
16000
20000
1/3 Octave Band Center Frequency (Hz)

Figure 1

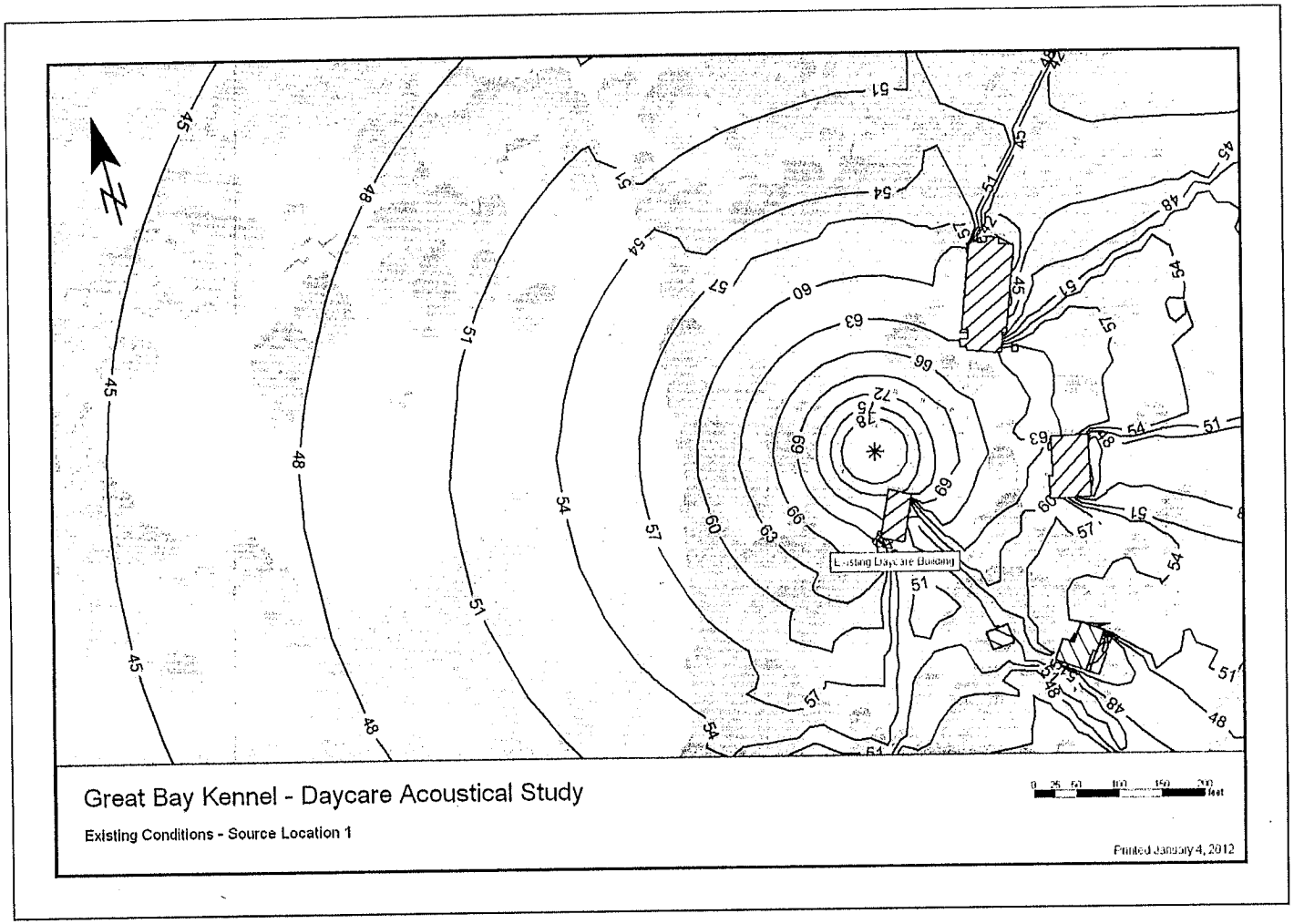
Great Bay Kennel - Daycare Acoustical Study
Existing Conditions - Source Location 1
Printed January 4, 2012
Existing Daycare Building

Figure 2a

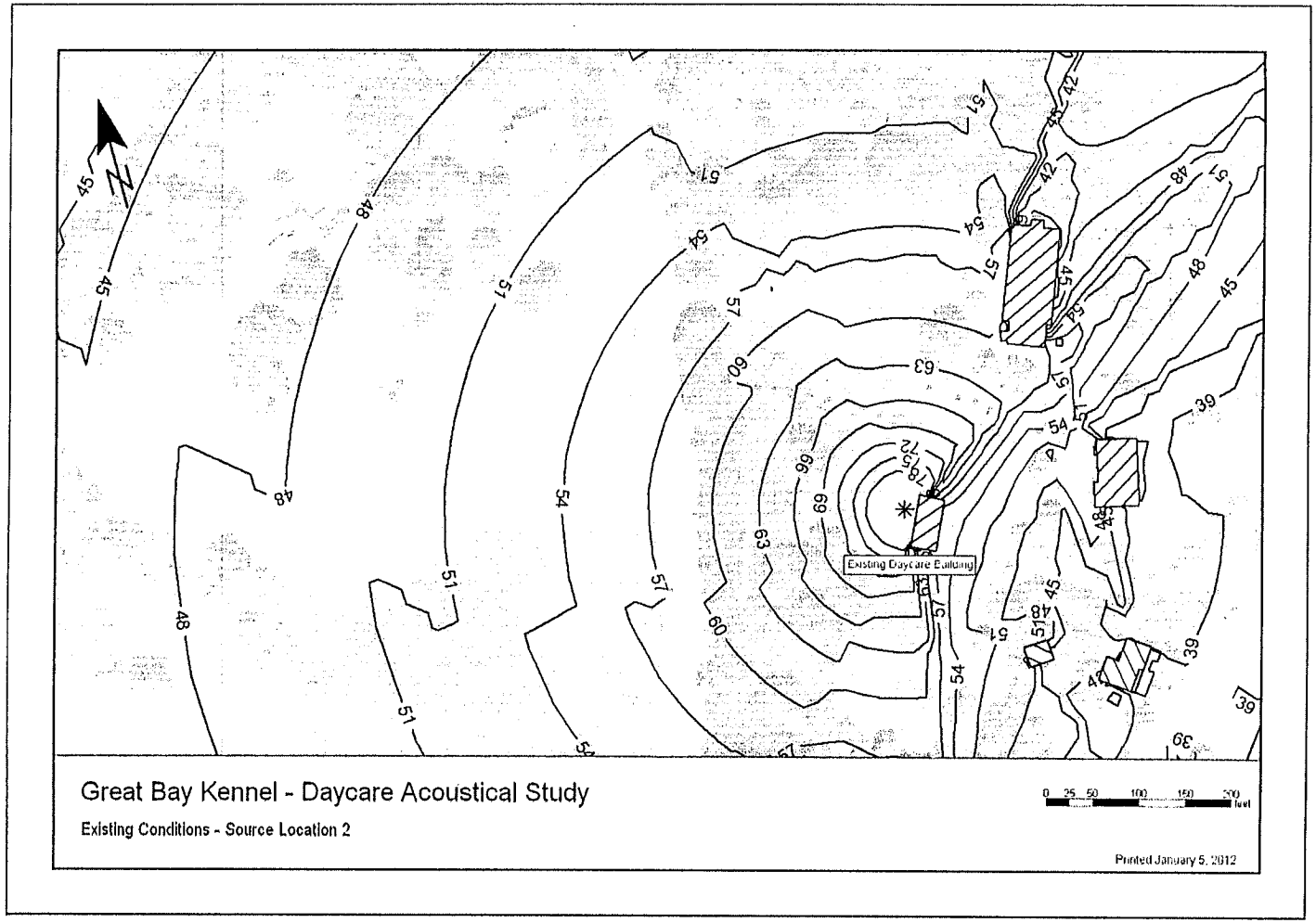
Existing Daycare Building
Great Bay Kennel - Daycare Acoustical Study
Existing Conditions - Source Location 2
Printed January 5, 2012

Figure 2b

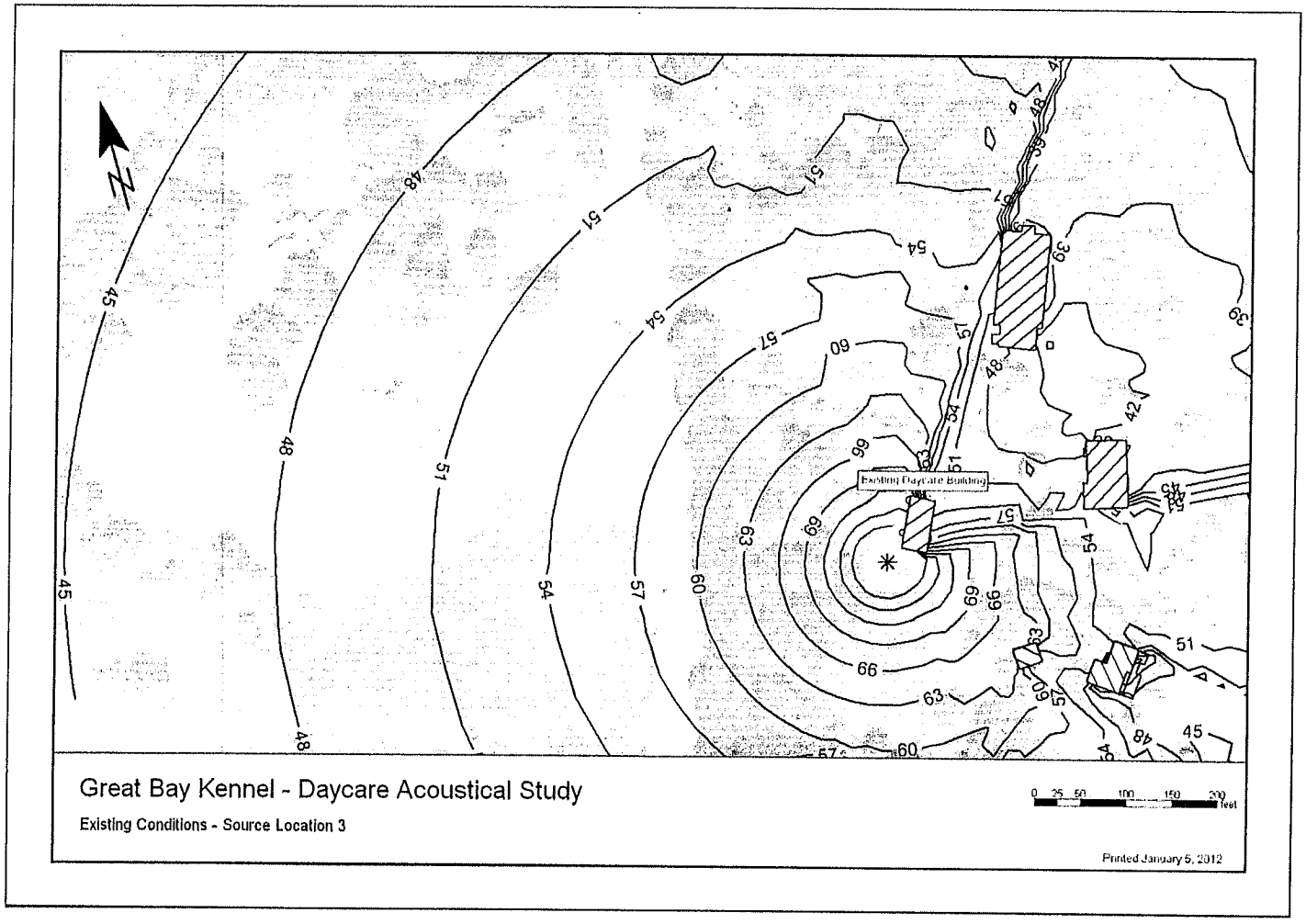
N
Existing Daycare Building
Great Bay Kennel - Daycare Acoustical Study
Existing Conditions - Source Location 3
0 25 50 100 150 300 feet
Printed January 5, 2012

Figure 2c

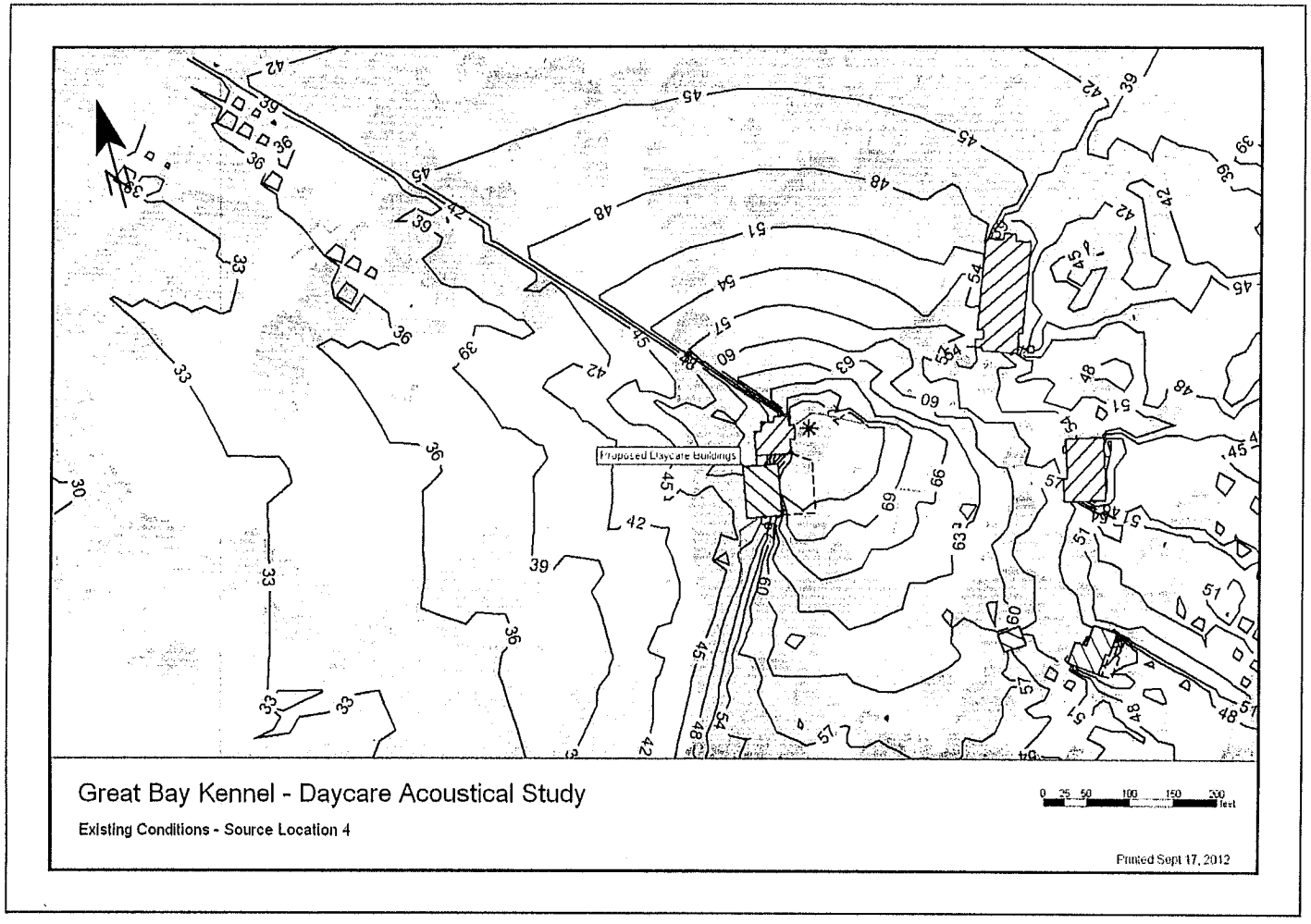
Proposed Daycare Buildings
Great Bay Kennel - Daycare Acoustical Study
Existing Conditions - Source Location 4
Printed Sept 17, 2012

Figure 3a

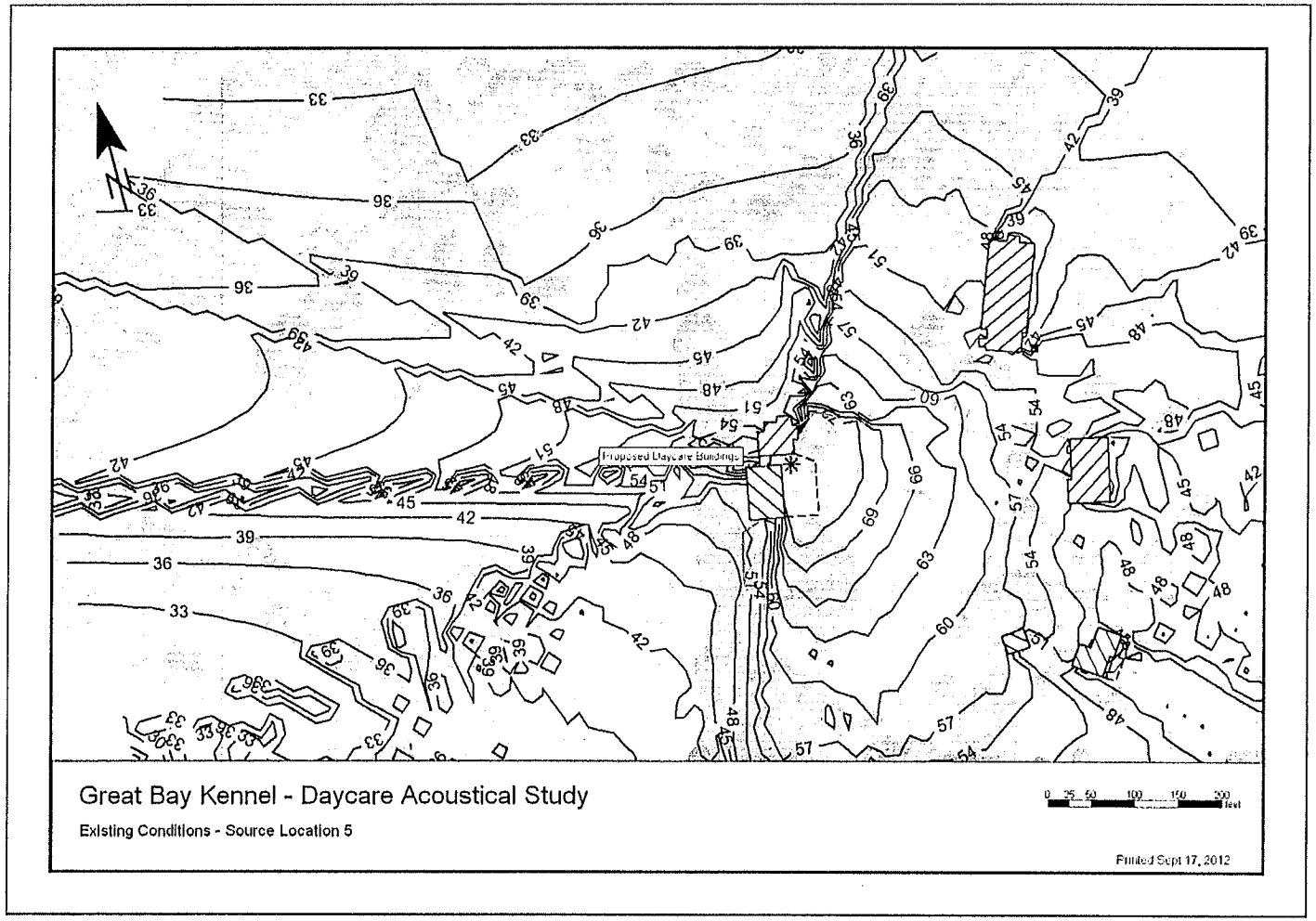
Proposed Daycare Buildings
Great Bay Kennel - Daycare Acoustical Study
Existing Conditions - Source Location 5
Printed Sept 17, 2012

Figure 3b

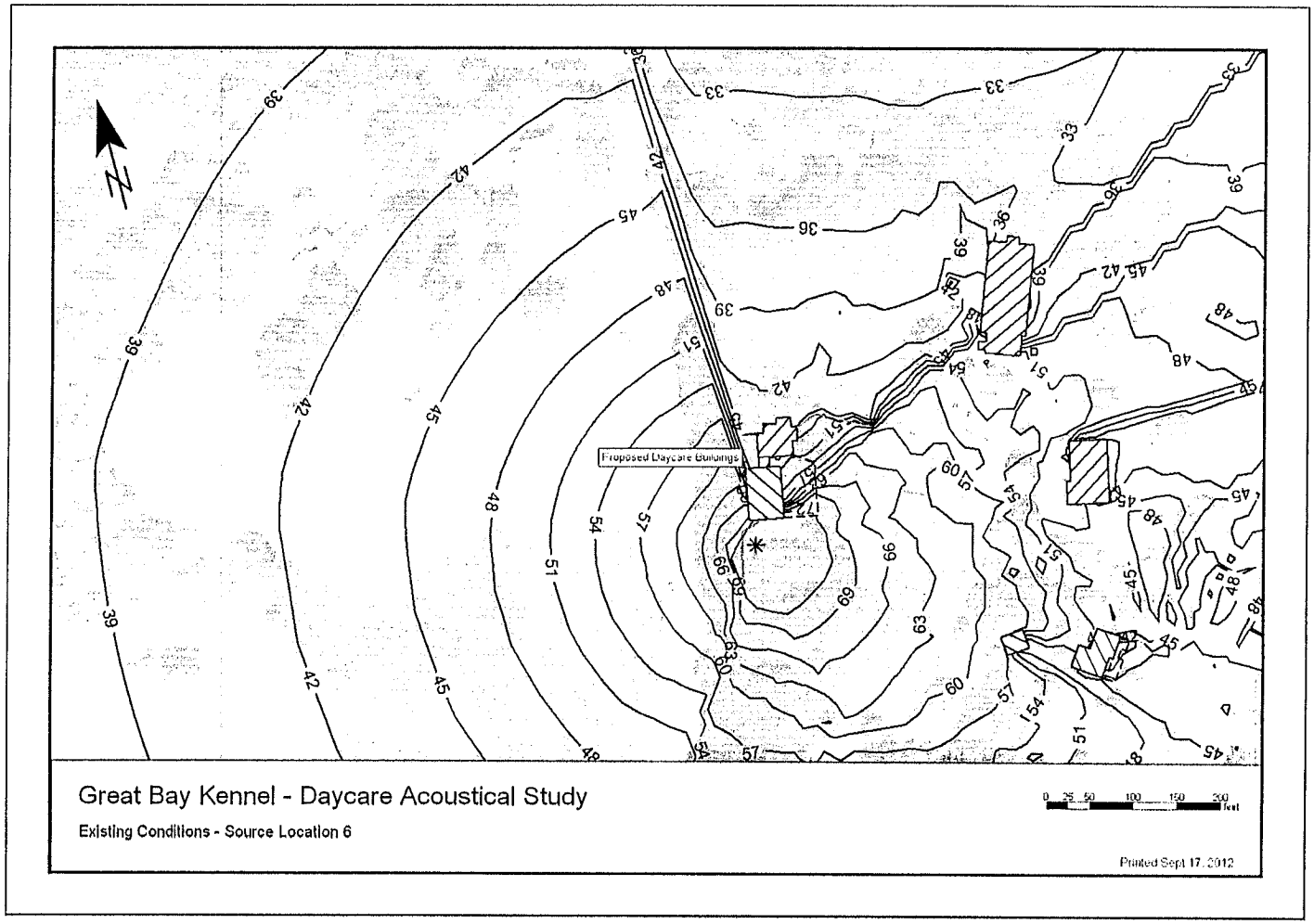
Proposed Daycare Buildings
Great Bay Kennel - Daycare Acoustical Study
Existing Conditions - Source Location 6
Printed Sept 17, 2012

Figure 3c

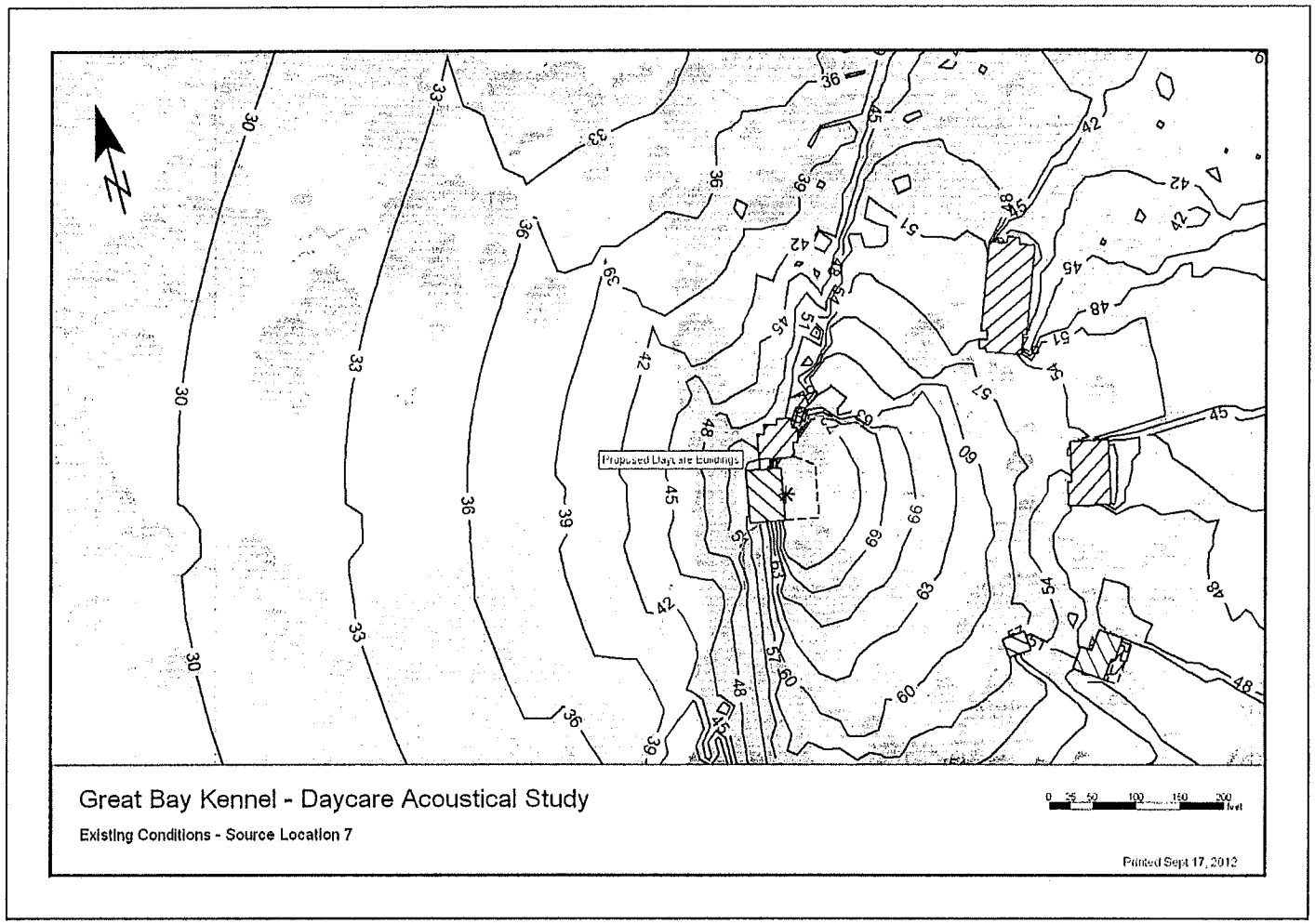
Great Bay Kennel - Daycare Acoustical Study
Existing Conditions - Source Location 7
Printed Sept 17, 2012

Figure 3d

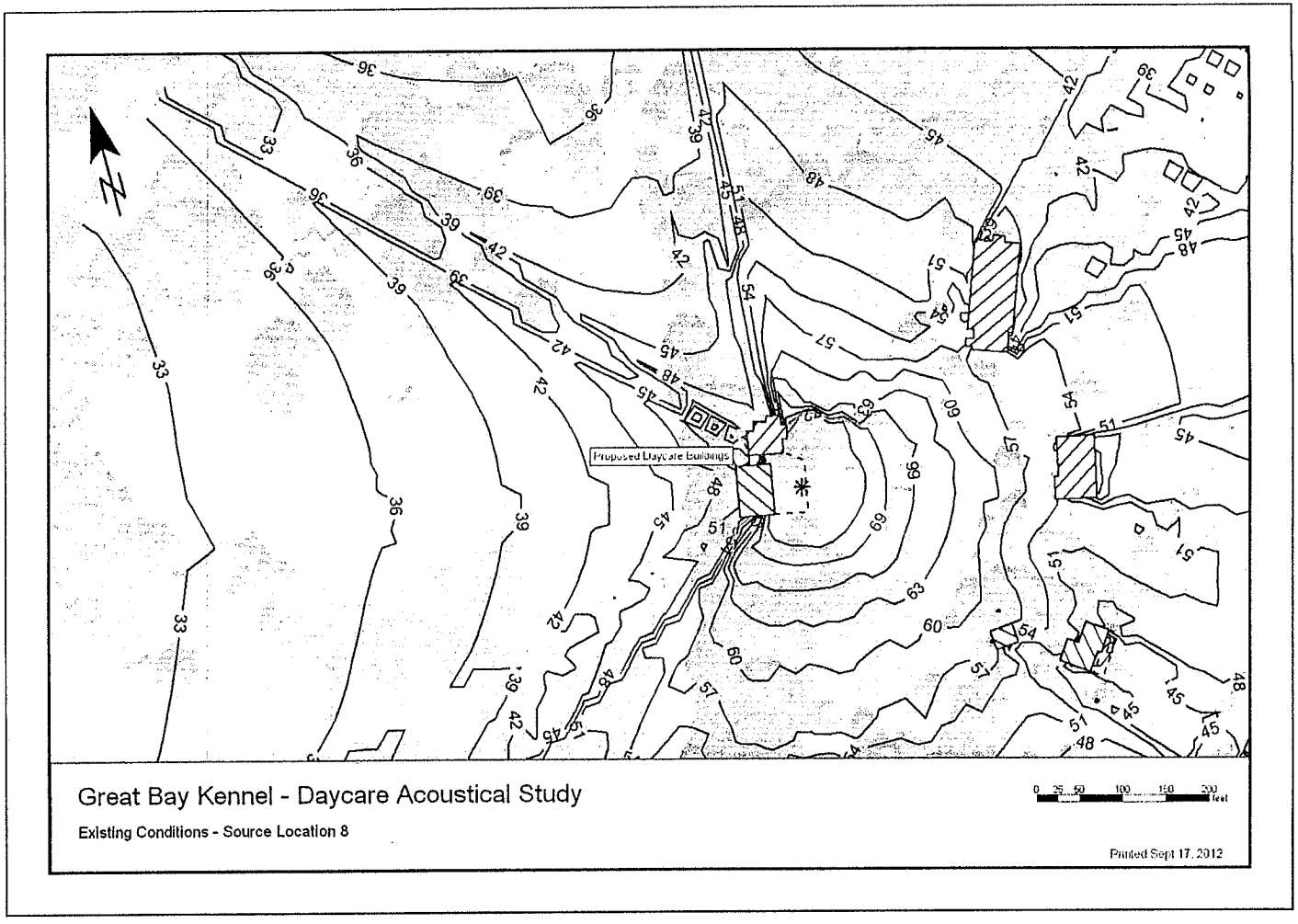
N
Proposed Daycare Buildings
Great Bay Kennel - Daycare Acoustical Study
Existing Conditions - Source Location 8
Printed Sept 17, 2012

Figure 3e