

**Anoka Open Air Theater**  
**Anoka, Minnesota**

**ASSESSMENT OF OFF-SITE NOISE**

Prepared for the

Windego Park Society

by

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## 1.0 INTRODUCTION AND PURPOSE OF STUDY

The Anoka Open Air Theater is located in Windego Park in the City of Anoka, Minnesota, just east of Minnesota Trunk Highway 169 (TH 169) or Ferry Street on the west bank of the Rum River. Reconditioning and renewal of activities at the theater are being explored by the Windego Park Society.

Since the theater was built in 1915, significant development has occurred in the community, including the introduction of the automobile and numerous building mechanical systems. While a noise barrier will be erected along TH 169 to minimize traffic noise impacts on the open air theater, the use of sound amplification may be required for some of the activities and performances at the theater. Recorded or amplified music may also be used at the theater, also it is assumed that no high-energy musical events will take place at the theater. A temporary sound system will be used that will be directed at the audience in the theater and will be controlled to minimize off-site impacts.

In addition, both commercial and residential development has occurred along both sides of the Rum River that could potentially be impacted by amplified sound from the theater.

The purpose of this study is to assess the potential impact of sound levels on land uses adjacent to the open air theater with the sound amplification system in use.

## 2.0 ASSUMPTIONS AND ASSESSMENT METHODOLOGY

For purposes of this assessment, it is assumed that the maximum design sound level at the back seat in the theater is 85 dBA, which should provide sufficient intelligibility of speech or singing. It is assumed that a portable sound system will be used with speakers directed toward the seating area from either side of the stage.

The sound barrier along TH 169 is assumed to be 15 feet above ground level along the roadway. The sound barrier is assumed to be approximately 200 feet long along TH 169 and wrap around on both the north and south sides of the theater.

Information on the surrounding buildings provided by Bjorn Skogquist has been used to classify buildings as commercial or residential land uses in accordance with Minnesota noise standard land use classifications. Maximum sound levels have been estimated at each of nineteen buildings in the vicinity of the open air theater, taking into account some directivity of the sound system and shielding provided by the noise barrier. These buildings or "receptor" sites are identified by number below in TABLE 1 and shown by location in FIGURE 1.

TABLE 1

## SOUND LEVEL RECEPTOR SITES

Rec #	Description of Land Use or Building	Est. Distance from Stage (ft)
1	Apartment (seniors)	396
2	Cul-de-Sac	404
3	Park	305
4	Walker Senior Center	355
5	Multifamily rental	238
6	Riverplace Treatment Center	80
7	Riverplace Meeting Bldg	139
8	Riverplace Meeting Bldg	168
9	Riverplace Offices	219
10	Riverplace Facility	331
11	Walgreen's	406
12	Residential	468
13	Residential	418
14	Residential	373
15	Franklin Lane Apts	153
16	Franklin Lane Apts	182
17	Residential	319
18	Residential	483
19	Residential	522

Receptor Site #1 (apartment building) across the Rum River is approximately 80 feet high. Receptor Site #4 (Walker Senior Center) is approximately 60 feet high. Receptor Sites #15 and #16 (Franklin Apartments) are approximately 30 feet high and could be exposed to sound from the stage area without the sound barrier which is needed to reduce sound levels within the theater area itself.

The level of noise impact is determined using the Minnesota noise standards, which specify levels in terms of L10 (noise level exceeded 10% of the time or 6 minutes of an hour) and L50 (noise level exceeded 50% of the time or 30 minutes of an hour). The maximum predicted level (which will normally occur for less than a total of 60 seconds in an hour) is well above the L10 level which is the level exceeded 6 minute or 360 seconds of an hour. For normal speech, the L10 level will be 5 to 10 dBA below the maximum level. However, the maximum level is used here to determine the potential for impact and provide a basis for estimating the L10 level to compare with the state noise standards.

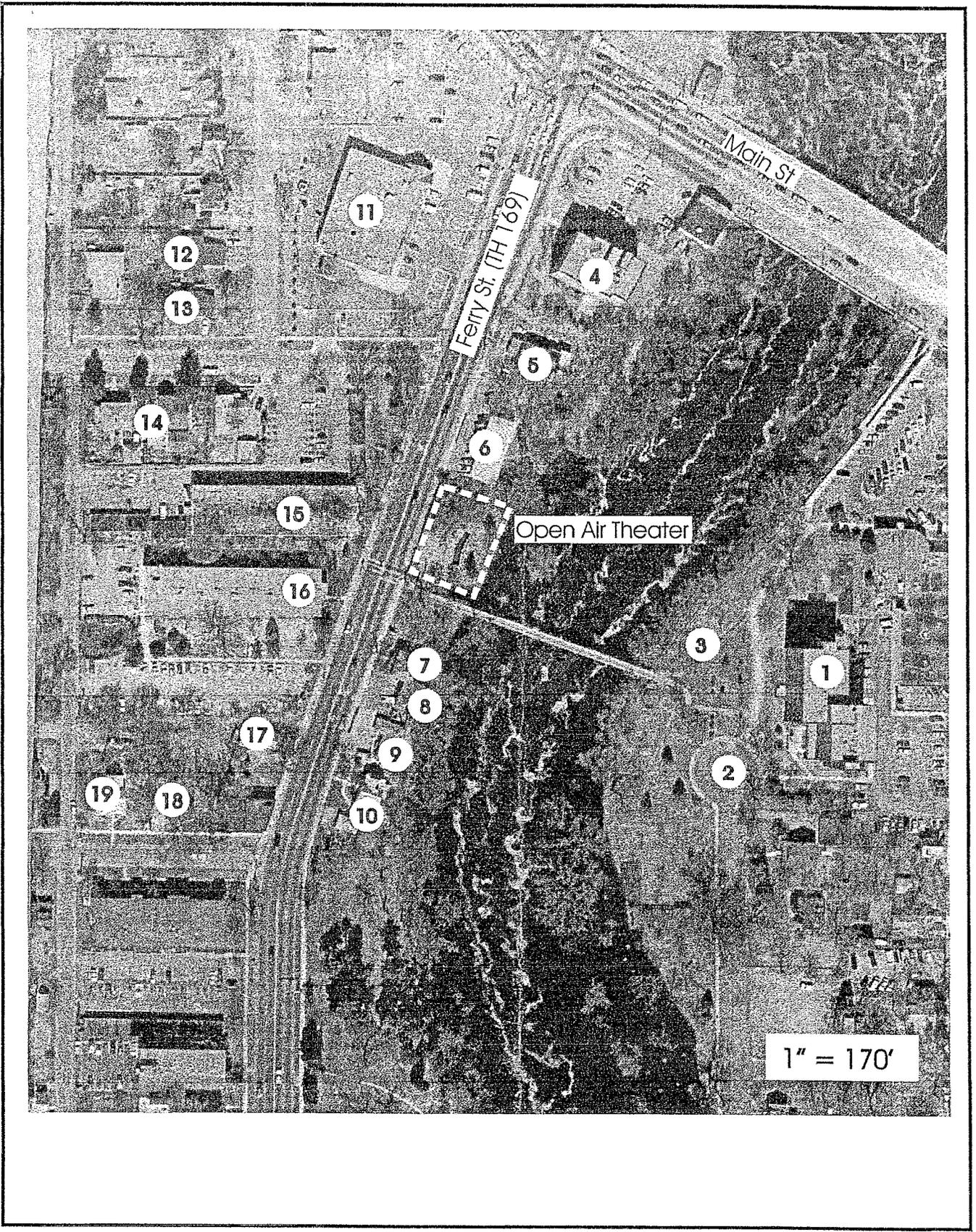


FIGURE 1  
Receptor Sites

### 3.0 SOUND ASSESSMENT RESULTS

Predicted maximum sound levels are shown for each receptor site in **FIGURE 2**. They are also shown graphically in **FIGURE 3**. These levels assume a maximum barrier attenuation of 15 dBA although theoretically, a reduction of almost 20 dBA is predicted for the top floor of the Franklin Apartments east of the theater.

From both figures, it can be seen that the highest sound levels are expected in the immediate vicinity of the theater, with considerably lower levels at the other receptor sites. Both Receptor Site 6 (Riverplace Treatment Center) and Site 7 (Meeting facility) fall under the commercial land use classification with an L10 standard of 70 dBA. Since the predicted maximum level is well below 70 dBA, no exceedances of the state standards are expected at these adjacent commercial land uses.

In the park (receptor site #3), the maximum predicted level (behind the loudspeakers) is 52 dBA which is well below the daytime L10 (65 dBA) for a park. The only other receptors predicted to have a maximum sound level greater than 50 dBA are the two Franklin Apartment buildings immediately to the east of the theater. These estimates are for the top floor which is less shielded by the sound barrier. The maximum sound level on lower floors will be lower than for the top floor. As noted above, the L10 level associated with a play or musical at the theater will be from 5 to 10 dBA lower than the maximum level, suggesting a maximum L10 of 53 dBA at the top floor of the Franklin Apartments. This is below the L10 55 nighttime standard (applicable after 10 pm) and thus exceedance of the Minnesota noise standards is not anticipated with amplified sound from the theater. It should be noted that sound from the theater could be audible but may be below ambient sound levels due to traffic on TH 169 and other mechanical equipment in the study area.

While the predicted sound level at the top floor of the adjacent Franklin Apartments is just below the L10 standard, it may be prudent to establish a maximum level of approximately 85 dBA at the back of the theater to ensure that the L10 will not be exceeded at this location. However, any limit on sound level should be established based upon refined calculations after the noise barrier height is determined, and the design and placement of loudspeakers have been developed.

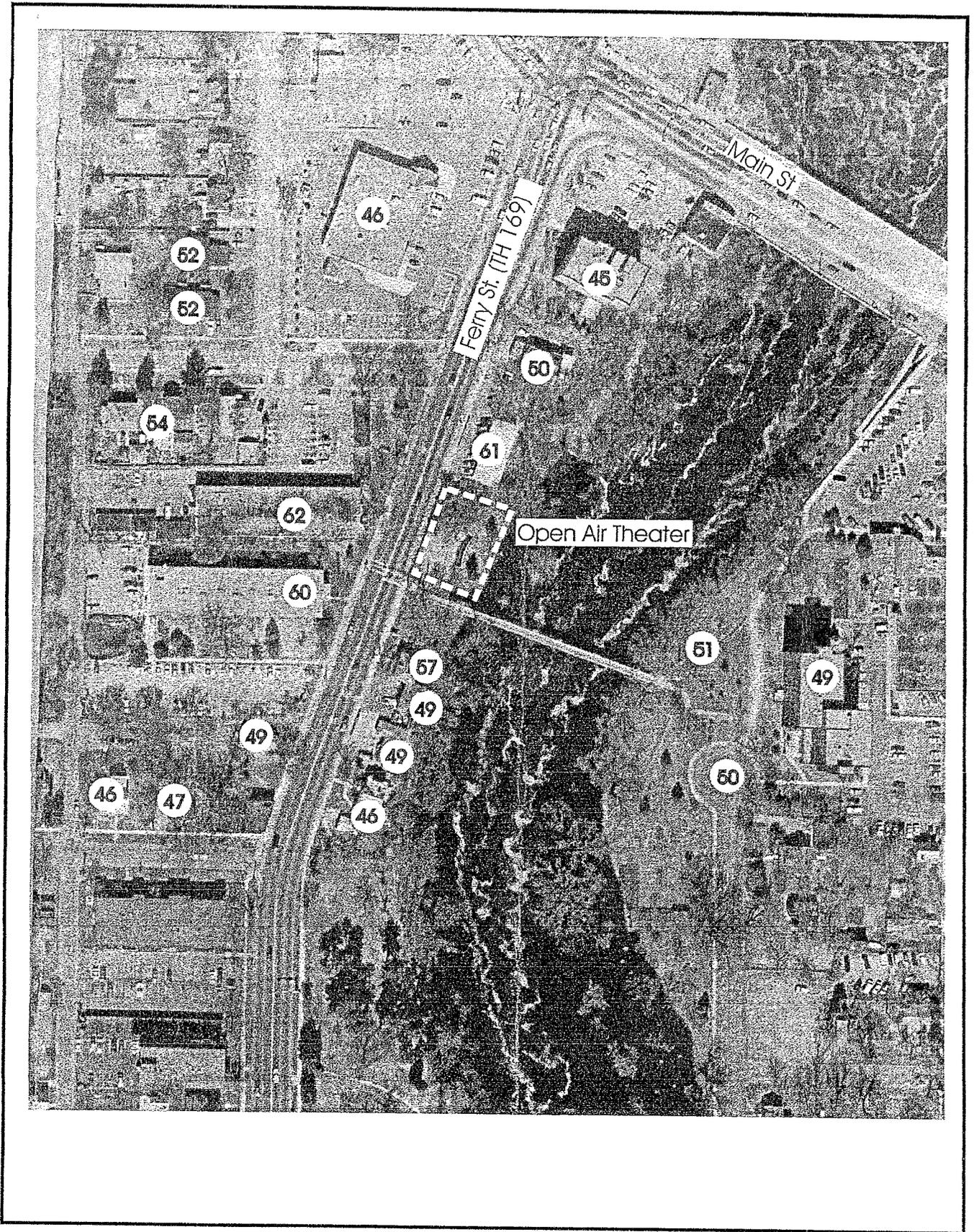


FIGURE 2

Maximum Sound Levels (dBA)

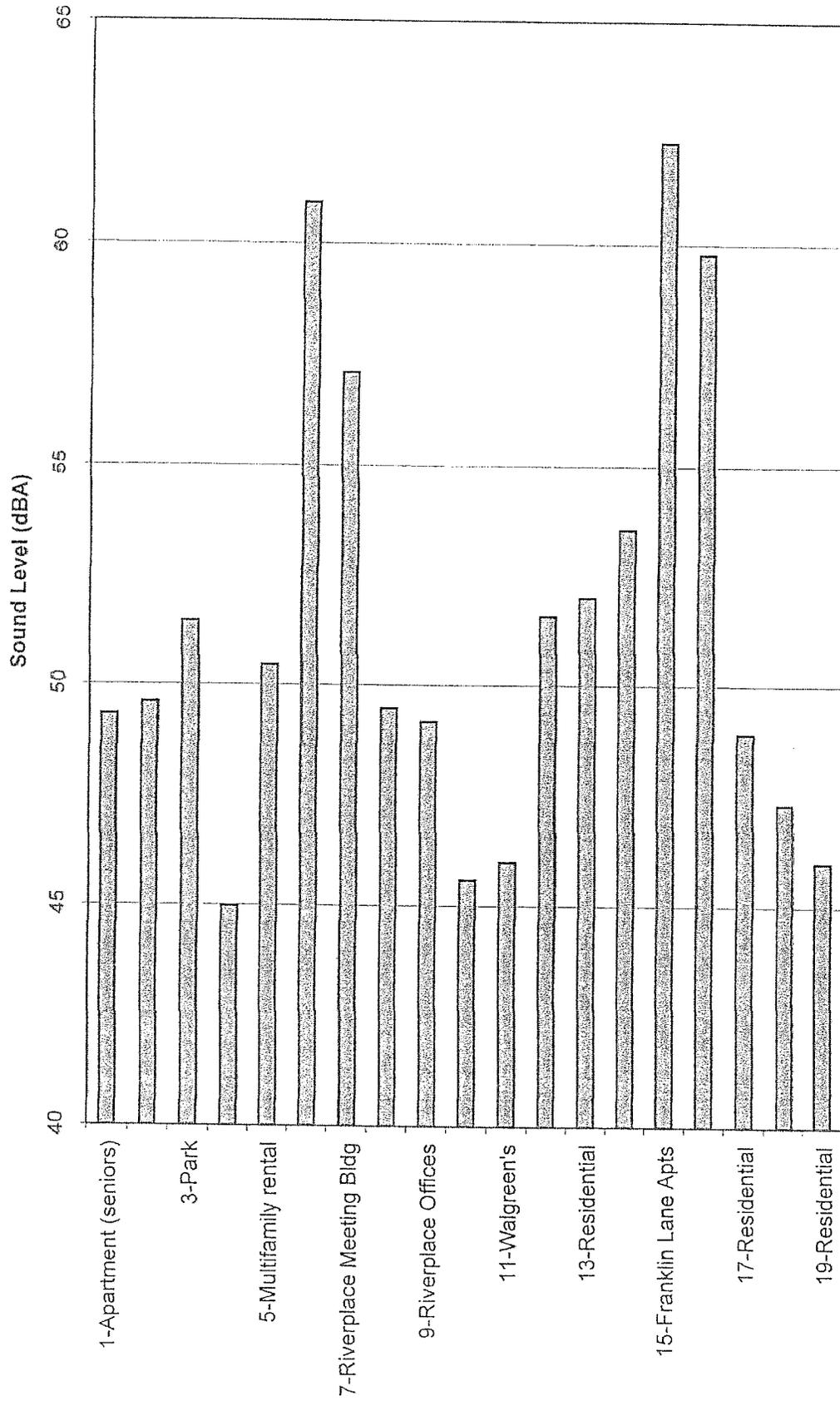


FIGURE 3  
 Projected Maximum Sound Levels  
 (shielding limited to 15 dBA)

#### 4.0 DISCUSSION OF PROPOSED NOISE BARRIER

For the purpose of sound level predictions in this report, a noise barrier 15 feet in height has been assumed along TH 169 and wrapping to the north and south of the theater. The exact wall height should be determined based upon future traffic volumes on TH 169. The wall should be high enough to reduce traffic noise to acceptable ambient levels in the stage area as well as at the last row of the theater closest to the roadway. Due to the closeness of the two Riverplace buildings north and south of the open air theater, it is recommended that the noise barrier also wrap around to the north and south of the theater. The barrier height could be stepped down towards the Rum River, although the final barrier heights will depend upon the theater seating and adjacent ground elevations. The location of the assumed noise barrier is shown in **FIGURE 4**.

Several cross sections are included to provide the reader with some idea as to the effectiveness of the noise barrier for the nearest potentially impacted buildings. **FIGURE 5** shows a cross section between the theater stage and Receptor 5 (multifamily apartments) south of the theater. It can be seen that significant shielding will be provided by the natural terrain and that a barrier may not be needed for this receptor. However, for Receptor 6 immediately south of the theater (**FIGURE 6**), the noise barrier is needed to bring the level down to 61 dBA from an unshielded level of 76 dBA. The third cross section (**FIGURE 7**) (Receptor 15 - Franklin Apartments) shows the importance of a noise barrier since the natural terrain will provide only minimal shielding of the loudspeakers at the top floor of the apartment building.

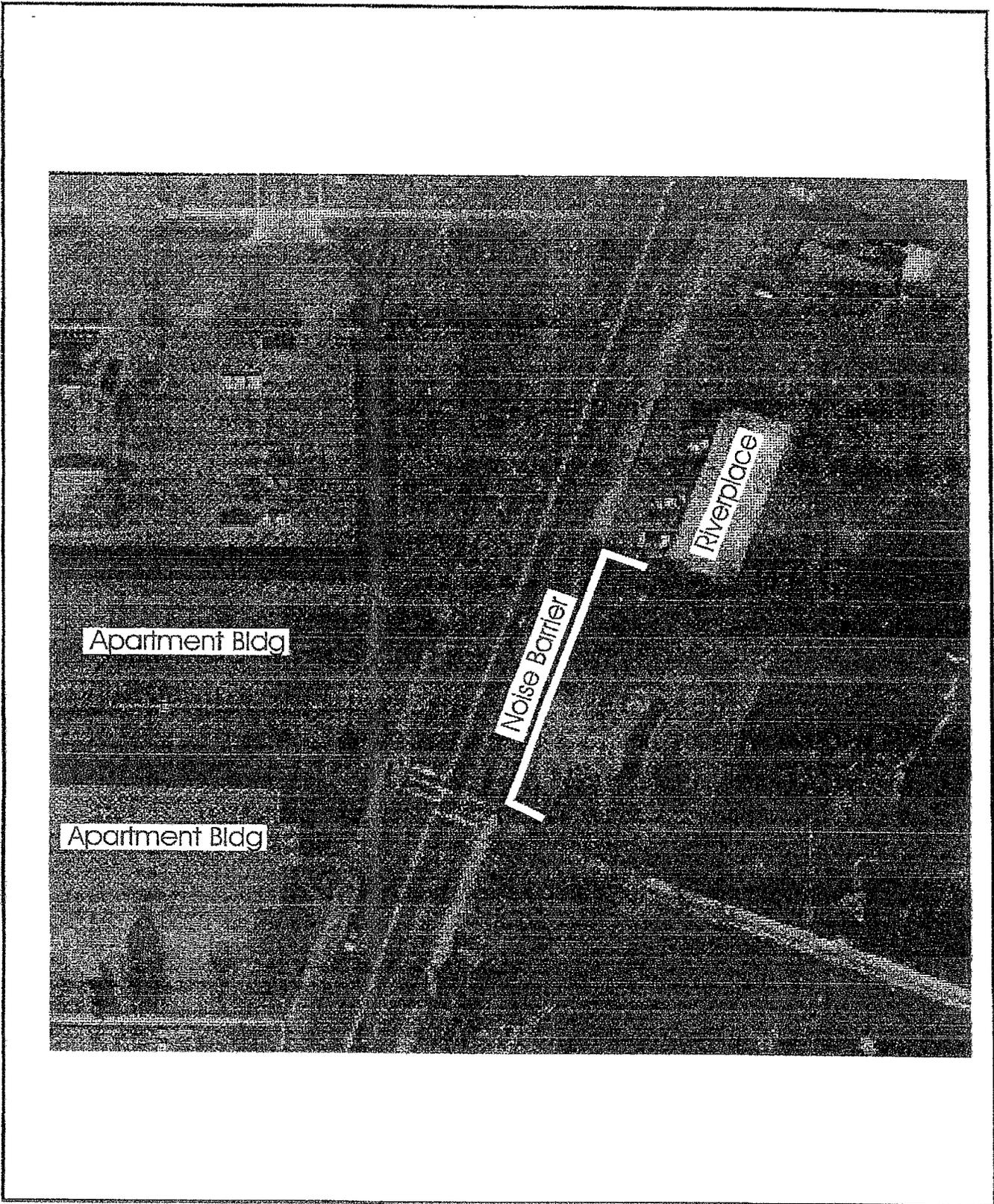


FIGURE 4

Schematic Noise Barrier Layout

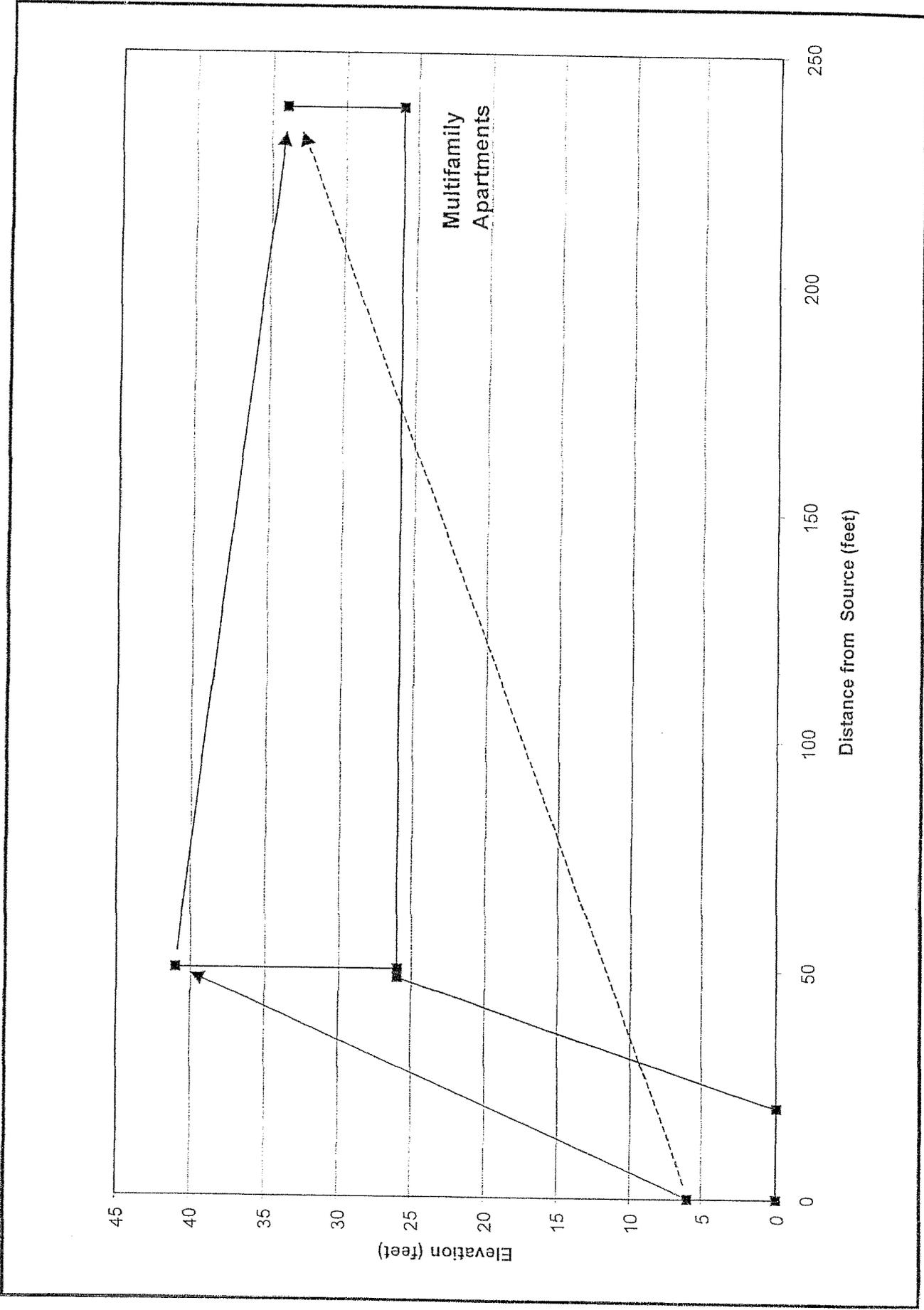


FIGURE 5  
Site 5 Cross Section

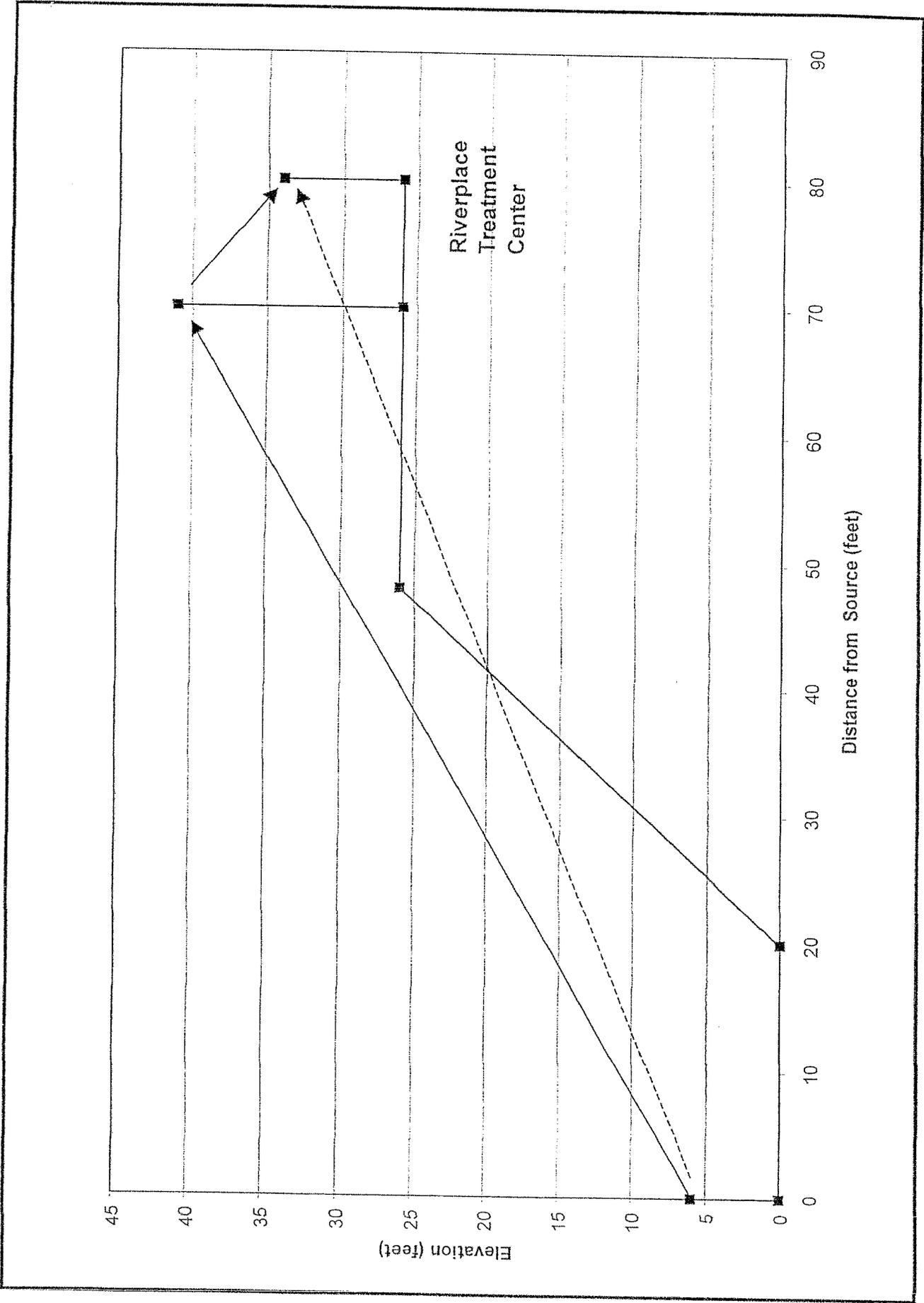


FIGURE 6

Site 6 Cross Section

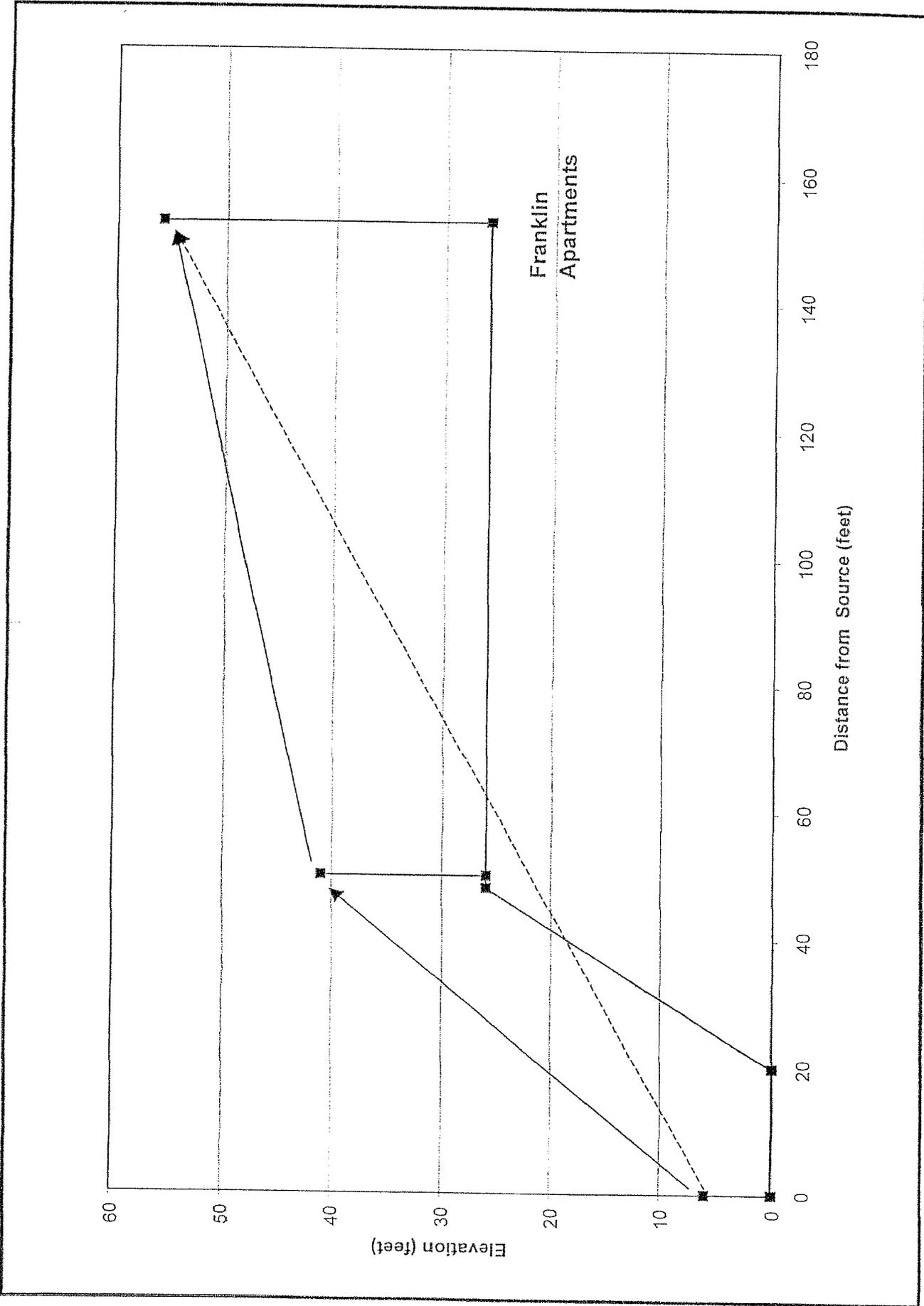


FIGURE 7

Site 15 Cross Section

## 5.0 SUMMARY AND CONCLUSIONS

This study has examined the potential impacts of amplified sound from the open air theater on the west bank of the Rum River in Anoka, Minnesota. The use of amplified sound will likely be needed for some presentations to ensure adequate audibility of speech and singing from the stage. A sound system may also be needed for recorded or amplified music. With a temporary sound system and loudspeakers facing to the west and directed at the audience, it is important to determine whether off-site sound levels could impact adjacent land uses and buildings.

Sound levels from loudspeakers near the stage area have been estimated taking into account the distance of buildings from the loudspeakers and intervening shielding provided by natural terrain and the proposed sound barrier that will be needed to shield the theater from traffic noise along TH 169. A maximum of 85 dBA at the back of the theater has been assumed sufficient to provide the necessary audibility and intelligibility of sound.

Maximum predicted sound levels are expected to occur at the Riverplace Treatment Center immediately north of the theater, the Riverplace meeting building south of the theater, and the Franklin Apartments west of the theater across TH 169. The Riverplace buildings fall under the Noise Area Classification 2 (commercial) land use contained in the Minnesota noise standards, and are not expected to experience sound levels over these standards. The Franklin Apartments fall under the Noise Area Classification 1 (residential) land use, and are expected to experience sound levels just below the nighttime L10 standard of 55 dBA at the top floor of the building.

The proposed sound barrier is an important element in reducing sound levels at the adjacent commercial and apartment buildings as well as reducing traffic noise within the theater itself. However, the barrier should be constructed so as to minimize reflections back to the stage area and across the Rum River.

It may be prudent to establish a maximum level of approximately 85 dBA at the back of the theater to ensure that the L10 will not be exceeded at this location, although any limit on sound level should be established after the noise barrier height is determined, and the design and placement of loudspeakers have been developed.

With appropriate layout and design of the theater and sound barrier, noise impacts on adjacent buildings can be minimized. While sound from the amphitheater may be audible at some of the adjacent buildings and park areas, it is predicted to remain below state noise standards and not create a significant adverse impact on nearby buildings or the adjacent park.

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