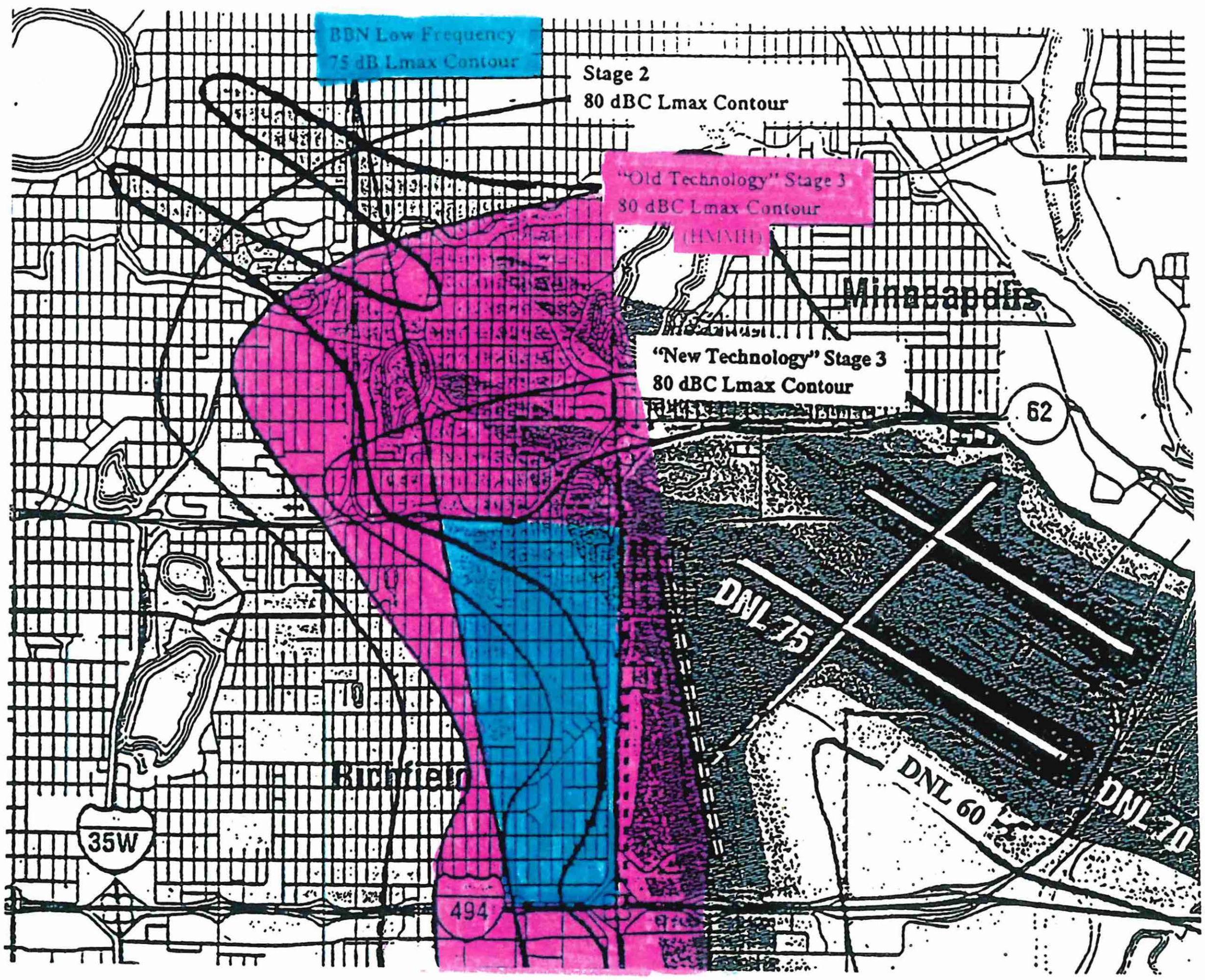
MINNESOTA ENVIRONMENTAL QUALITY BOARD

SUPPLEMENTAL MEMORANDUM OF RICHFIELD, MINNESOTA REGARDING THE ADEQUACY OF THE FINAL ENVIRONMENTAL IMPACT STATEMENT, DUAL TRACK AIRPORT PLANNING PROCESS



November 10, 1998

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INTRODUCTION

MAC's final EIS refuses to discuss low frequency noise effects focusing instead on A-weighted measurements of noise. A-weighted measurements are strongly biased against the low frequency range, precisely the frequency region of present interest. The stated rationale is that information about potential effects of low frequency noise and annoyance is "incomplete or unavailable,: and that there are no "standards or thresholds" nor any .basis for determining what types of mitigation would be appropriate."

However, since early 1988, MAC and the authors of the FEIS possessed but withheld from the public detailed data and information sufficient to prepare an adequate EIS on low frequency noise impacts and its mitigation. MAC failed to disclose that its consultant, HMMH, had recommended a criterion (80 dBC) as the standard or threshold for the onset of "disruptive" effects from low frequency noise and had predicted where such effects will occur.

Documents produced on November 5 and 6, 1998, in response to a Data Practices Act request, demonstrate that MAC's noise consultant, Harris, Miller, Miller & Hanson ("HMMH"), was hired in late 1997 at a cost of $67,000, to monitor low frequency noise on the C-scale from various types of aircraft at MSP, and to project the low frequency noise levels that will shake houses and rattle the windows in Richfield and other nearby areas as a result of the operation of Runway 17-35. Moreover, HMMH also recommended an 80 dBC criterion as the standard or threshold for the onset of disruptive effect of low frequency noise. HMMH, in its previous work for San Francisco and elsewhere, recognized that low frequency noise is a "hidden sound problem" which is "revealed when C-weighting is used to analyze low frequency sound" and had developed a criterion of 80 dBC (utilizing a C-weighted scale which gives more realistic weight to low frequency noise) as a basis for determining the level at which low frequency noise is "potentially disruptive." In January 1998, HMMH recommended that same criterion for use by MAC. **HMMH prepared low frequency noise contours showing projected noise contour lines for 80 dBC. The area of Richfield and other nearby communities, particularly South Minneapolis, encompassed within that line is <u>greater</u> than in the projections made by Richfield's consultant, Dr. Fidell.** (See Exhibits A, B and C hereto.)

Finally, MAC did have available substantial information on mitigation of low frequency noise. In fact, the purpose of projecting the 80 dBC contour line was to identify the areas over which mitigation measures will be required. Not only did MAC not use the information it had commissioned, it criticized the reports submitted by Richfield's consultant, BBN, which were more conservative than those of HMMH in predicting low frequency noise impacts.

MAC's rationale for aborting the work of its consultant and for withholding its low frequency noise measurements projections and 80 dBC criterion does not appear in the record. Whatever the reasons, in light of this new information, there can no longer be any dispute that low frequency noise from the new runway has the potential for significant environmental effect and that possible methods of mitigating the effects of such noise are adequately discussed in the FEIS.

The new information is discussed in this brief and presented in an appendix. Exhibit D hereto responds to the various unsupported assertions made by MAC in its memorandum of October 29, 1998.

I. THE UNDISCLOSED DATA AND UNDISCLOSED LOW FREQUENCY NOISE PROJECTIONS, PREPARED BY HMMH FOR MAC, DEMONSTRATE THAT LOW FREQUENCY NOISE FROM RUNWAY 17-35 HAS THE POTENTIAL FOR SIGNIFICANT ENVIRONMENTAL EFFECT.

A. MAC's Noise Consultant, HMMH, was Hired in Late 1997 by MAC to do Extensive Monitoring on Low Frequency Noise at MSP at a Cost of $67,000.

On July 15, 1997, MAC, Met Council, Richfield and their noise consultants held a meeting to discuss low frequency noise issues. Three days later, MAC's noise consultant, Harris, Miller, Miller & Hanson, prepared a proposal to study low frequency noise issues from the new runway. The existence of the HMMH proposal was not made public. The proposal, which was finalized in a presentation to MAC on October 27, 1998, provides:

> *Task 1: Determine Locations of Low Frequency Contours at MSP* - . . . We want to have at least 100 good measured values at each location for each stage of aircraft. Subsequent to the measurements, HMMH personnel will analyze the noise data measurements and develop contours of low frequency noise based on the measured data. The contour values will correspond to the values recommended during Task 2. . . .
>
> *Task 2: Recommended Impact Criteria for Low Frequency Noise* - As I said in the 9 October, 1997 memorandum, it appears that it is appropriate to consider the onset of potential impacts on residential properties as a C-weighted level of 80 dB. (This level, originally established for SFO, is confirmed by the BWI information.) [BWI is a study of low frequency noise and mitigation that HMMH did at Baltimore.] We propose that HMMH document fully the reasons for the proposed impact criterion. We have estimated the level of effort and cost to prepare detailed report. [The estimated cost for Task 2 was $8,500.]
>
> *Task 3: Identify Potential Measures to Mitigate Impacts of Low Frequency Noise on Residential Properties* - The purpose of this task is to identify potential measures to mitigate the impact of low frequency noise on residential properties. HMMH will evaluate a range of potential measures, ranging from modifications of sound insulation methods to use of barriers. <u>The area over which measures will be required will be identified during Tasks 1 and 2.</u> The product of this task will be a set of basic recommendations for consideration. It does not include detailed design recommendation, such as design of a barrier. (Emphasis added.)
>
> *Task 4: Assess Potential Noise Impacts on Properties on or Near the Extended Centerline of Runway 17-35.* (Appendix, Exhibit 13.)

A copy of the actual contract has not been provided. However, the record discloses that the monitoring work took place in November 1997 over a period of several days and analyzed hundreds of flights. The report of HMMH regarding Task 1, dated January 14, 1998, is attached hereto as Exhibit B. It demonstrates the location of the low frequency noise contours at 80 dBC and above far beyond the contours suggested by Richfield's consultant. It recommends using a criterion of 80 dBC for "older technology" stage 3 aircraft. This is exactly the type of information that should have been included in the final EIS. Exhibit C, a memo of January 21, 1998, updates the noise contours attached to the January 14, 1998 report, and extends those contours further from the runway.

In its comments attached to the Record of Decision, MAC and FAA criticize the studies by BBN and Dr. Fidell (commissioned by the City of Richfield) on the basis that Richfield's consultant did not perform "vibration measurements within those areas of Richfield exposed to airport-related noise," that the Richfield study does not apply to Minnesota because of differences in climate, and that "after reviewing the Richfield studies, the FAA and MAC are not able to conclude that a low frequency noise and perceptible vibration problem will occur in portions of the City of Richfield as a result of the proposed action at MSP." (Response to FEIS Comments, A.1-2.) Yet, MAC's own consultants had prepared exactly the type of low frequency studies and projections in Minnesota at MSP that FAA and MAC claimed are lacking. Although those studies were never mentioned in the EIS or otherwise, they conclusively demonstrate the low frequency noise from Runway 17-35 has the potential for significant environmental effects. They were withheld at a time when MAC knew that Richfield was preparing its own noise analysis and mitigation plan.

Note that on January 21, 1998, HMMH revised the noise contours to be even further from the runway. Figure 5, attached hereto as Exhibit C, prepared by HMMH for the Low Frequency Noise Report, shows the 80 dBC contour for "older technology" stage 3 aircraft to be 8 to 15 blocks further west than Dr. Fidell's recommended contour (75 dB not c-weighted).

B. MAC's Consultant, HMMH, Recommended to MAC the Use of the Criterion of 80 dBC (which HMMH had Previously Developed) for Determining the Onset of Potential Impacts of Low Frequency Noise and to identify areas for mitigation.

As noted, "Task 2" in HMMH's proposal of October 27 quoted above, is to develop a "recommended impact criteria for low frequency noise" based upon HMMH's previous work for San Francisco and Baltimore, proposing a C-weighted level of 80 dBC. In the January 14, 1998 report, it is clear that HMMH was engaged to perform "Task 2 Recommended Impact Criteria for Low Frequency Noise, and did recommend the 80 dBC contour resulting from noise generated by for older technology stage 3 aircraft as the point at which adverse impacts of low frequency noise begin to appear. At footnote 1, the report of January 14, 1998 (attached) states:

> During work on a separate task under this project, HMMH determined that it will recommend that the MAC consider a C-weighted level of 80 dBC as the threshold for low frequency noise impact on residential land use. This other work will be reported separately. (Emphasis supplied.)

Other quotes from the report of January 14, 1998 underscore this recommendation:

> HMMH recommends that the MAC base its analysis of potential low frequency impacts of Runway 17-35 at MSP on the 80 dBC contour from older technology stage 3 aircraft. (pg. 1)

> ... we are confident that the 80 dBC criterion is appropriate and that our noise contours accurately show the 80 dBC contour location . . . . (pg. 3)

Apparently, for reasons that have not been disclosed, HMMH was directed not to prepare a formal report on "Task 2".

The HMMH proposal of October 27, 1990 discloses that Tasks 1 and 2 were designed to identify the areas over which mitigation measures (to be identified in Task 3) "will be required." (Appendix) See "task" quoted above and discussion in Section II below. Thus, the criterion of 80 dBC was intended to identify areas where mitigation should be provided *viz.* where significant effects will occur.

The San Francisco Report (Appendix, Exhibit 1.)

HMMH had previously done the work for "Task 2" and only proposed to "document the reasons for the proposed criterion." MAC can be expected to argue that the 80 dBC criterion was not intended to be the measure of "potential for significant effect," but the words of HMMH prove that to be its purpose. Moreover, this task was being done while the EIS was in preparation. The purpose of developing the criterion of 80 dBC was to prevent or limit the adverse effects of "perceptible house vibrations." Report for the San Francisco Airport/Community Round Table of January 1996, "Development of Single Event Noise Metrics for Use in Identifying Aircraft Operations for Potential Mitigation," HMMH Report No. 294090 (hereinafter referred to as "San Francisco Report" at 12). (A copy of the voluminous report and other relevant documents are being submitted for the record in the Appendix.) The report states "low frequency sound levels produce vibrations of house windows, walls and floors, and the criterion [80 dBC] is intended to prevent these vibrations from being perceptible inside . . ." (Id. at pg. 1.) HMMH recommends "the use of 80 dBC . . . criteria for identification of aircraft events most likely to be disruptive for low frequency noise . . ." (id. at 1) and explains its rationale:

> Perhaps the most important consideration was to develop a reliable but not highly technical set of recommendations that would identify aircraft operations likely to produce the types of adverse effects that could result in citizen concerns and

> complaints. These recommendations are also based on the understanding that the ultimate Round Table objective is to develop a "local" single event noise metric(s) that will be non-regulatory in nature and that will be pursued in a cooperative effort as an additional tool to identify adverse noise effects and to pursue actions to alter practices or situations that tend to lead to adverse effects in citizen complaints. Thus, the recommendations presented here are designed to easily identify the operations most likely to cause adverse effects, and to provide the basis for a relatively non-technical analysis of those operations in pursuit of measures that may reduce the adverse effects. (Id. at 2, 3.)

HMMH focused on low frequency noise at the San Franciso airport because of complaints of neighboring communities about the low frequency "rumble" produced by departing jets. HMMH observes, contrary to MAC's claims, that "C-weighting is more suited to revealing the low frequency content of a sound than is A-weighting," (id. at pg. 8) and concludes that "a C-weighted maximum level of 80 dBC as a criterion that would correctly identify most of the events having vibration producing potential (80% correctly identified) while not including too many events that do not have such potential." (Id. at pg. 8, and concludes "We believe 80 dBC remains a valid criterion to identify low frequency noise events that have the potential for producing perceptible vibrations in homes near SFO." (Id.)

The HMMH report for San Francisco also utilizes the Hubbard criterion discussed by Dr. Fidell. Hubbard determined the level at which windows, walls and floors begin to vibrate from low frequency noise. Significantly, HMMH observed that the 80 dBC criterion will not include all events which will cause rattling, noting that even events between 70 and 80 dBC have the potential for causing perceptible window rattle. (Id. at p. A-8.) Of course, Hubbard's criteria was available to MAC as well, and the EIS could have simply identified those areas in Richfield where rattling of windows, walls and floors are likely to result from low frequency noise as a means of predicting potential low frequency noise impact.

Principals of HMMH have appeared at technical conferences, recommending use of 80 dBC as an appropriate criterion for "identifying operations likely to produce adverse effects due to low frequency noise from aircraft takeoffs as heard in the communities to the rear and side departures." See, e.g., *Low Frequency Noise Operation From Aircraft Ground Operations*, presented at UC Berkeley Noise Symposium, Stephen R. Alverson, Harris, Miller, Miller & Hanson, February 25, 1998. (Appendix) Mr. Alverson's presentation of February 25, 1998 made the following points which directly contradict many of MAC's statements to the MEQB:

- C-weighting is better suited to reveal the low frequency content of a sound than is A-weighting.
- A criterion of a C-weighted maximum level of 80 dBC would correctly identify most events having vibration potential.
- The "hidden" problem is revealed when C-weighting is used to analyze low frequency sound.
- Low frequency aircraft noise will continue to be a source of community concern well into the next century. (Id.) (Appendix, Exhibit 3)

It is important to distinguish between the MEPA concept of "potential for significant environmental effect," and the concept of "compatibility" of land uses adjacent to noisy runways. Minnesota law requires that potentially significant environmental effects be discussed in an EIS. MAC is likely to confuse the issue, however, by arguing that since there are no legal standards for compatibility requiring removal of residential uses or mitigation by sound insulation or other means, based upon low frequency noise contours, that they are "not obligated to assess such impacts in the EIS (ROD General Comments and Responses, General Comment 1 at A.1-1). The absence of a federally-recommended compatibility standard does not remove the environmental effect of rattling windows and houses.

II. MAC HAD AVAILABLE TO IT, THROUGH HMMH, INFORMATION REGARDING EFFECTIVENESS OF TRADITIONAL AND ENHANCED SOUND INSULATION TO MITIGATE LOW FREQUENCY NOISE.

One of MAC's principal excuses for not discussing the low frequency noise issue is that there is "no basis for determining what type of mitigation would be appropriate." (Dual Track FEIS at ix). The statement is contradicted by MAC's own files.

HMMH's original proposal identified mitigation as Task 3:

> *Task 3: Identify Potential Measures to Mitigate Impacts of Low Frequency Noise on Residential Properties* - The purpose of this task is to identify potential measures to mitigate the impact of low frequency noise on residential properties. To evaluate or arrange potential measures ranging from modifications of sound insulation methods to use of barriers. <u>The area over which measures will be required will be identified during tasks 1 and 2</u>. The product of this task will be a set of basic recommendations for consideration. (Appendix, Exhibit 13, HMMH proposal of October 27, 1997 at 2, 3.)

Note that Tasks 1 and 2 were specifically designed to identify the areas where <u>mitigation would be required</u>.

Thus, the 80 dBC contours identify areas where mitigation should occur, according to HMMH's own proposal. HMMH offered to MAC information adequate to address in an EIS mitigation of low frequency noise. In its report of January 14, 1998 concerning the results of its monitoring of low frequency noise and the projection of contours, HMMH states "We have information on sound insulation improvements relative to C-weighted noise." In fact, one of the reasons that HMMH recommends the use of an 80 dBC criterion rather than an unweighted measurement of low frequency noise is that, with that criterion, less mitigation would be required than by using an unweighted criterion: "while the 80 dBC criterion contour tends to cover a larger area than the low frequency 75 dB contour, it is probably easier to reduce the C-weighted level than it is to reduce levels at frequencies at or below 100 Hz." (January 14, 1998 HMMH report, Exhibit B, at pg. 3.)

It is not known whether "Task 3" was actually completed, but the ability to determine "appropriate mitigation" was certainly available, contrary to MAC's EIS excuse. In fact, on July 27, 1998 and again on October 4, 1998, HMMH submitted to MAC a work plan to deal with low frequency noise mitigation from Runway 17-35. Nevertheless, MAC apparently stands by its statement in the FEIS that there is "no basis for determining what type of mitigation would be appropriate." (Dual Track FEIS at ix.)

In fact, HMMH had previously studied low frequency noise mitigation in an extensive report in June 1996, Logan Low Frequency Noise Study, HMMH Report No. 293810.04 for Boston's Logan International Airport (hereinafter "Logan Report") (Appendix, Exhibit 2). One of the two purposes of that study was to determine "how much of a reduction in <u>low frequency</u> noise levels can be achieved in residences from the application of practical and available treatment measures." (Logan Report at p. 1). The report compares sound levels measured on the A-scale, the C-scale and unweighted sound levels below 100 Hz. Measurements were made outside residences, inside residences, both utilizing traditional noise treatment and a super-insulated single "room of preference." Conclusion: the magnitude of the reduction in sound levels depends "on the metric used to measure it," (Logan Report at 35) because "noise insulation treatment is more effective at higher frequencies than lower ones." Id. A-scale noise was reduced much more than C-scale or low frequency noise (100 Hz). "The average benefits for the basic program, excluding the room of preference, are 9 dBa, 6 dBC, and 4 dB < 100 Hz, meaning below 100 Hz. For the room of preference, the average benefits are 16 dBa, 12 dBC and 9 dB <100 Hz." (HMMH memo to MAC of October 7, 1998) (Appendix, Exhibit 14).

CONCLUSION

MAC and FAA have not been candid with the MEQB and the public. In light of all of the evidence in the record, including the noise measurements, projections and recommendations of MAC's own consultant, HMMH, it is impossible to avoid the factual conclusion that low frequency noise which will result from the operation of Runway 17-35 has "the potential for significant environmental effect." There is no evidence in the record which suggests that such low frequency noise does not have the potential for significant environmental effect. For the MEQB to make a finding that the FEIS is adequate would constitute a mockery of the environmental review process.

The delay, if any, which may result from a required revision of the EIS, is a problem of MAC's own making. It had the information available to it in January of 1998 to prepare an adequate Environmental Impact Statement, and it refused to do so. Meanwhile, it concealed the fact that its own consultant had projected low frequency noise contours for the areas which will be affected, and had made a recommendation of the use of 80 dBC as a criterion for identifying the level of potential significance.

There simply is no alternative for MAC at this point, other than to comply with the law. The EQB should find the EIS legally inadequate. Preparation for a revised EIS should not cause much delay, since MAC has had sufficient information to do so since at least January 1998.

Respectfully submitted,

Dated: 11/9/98

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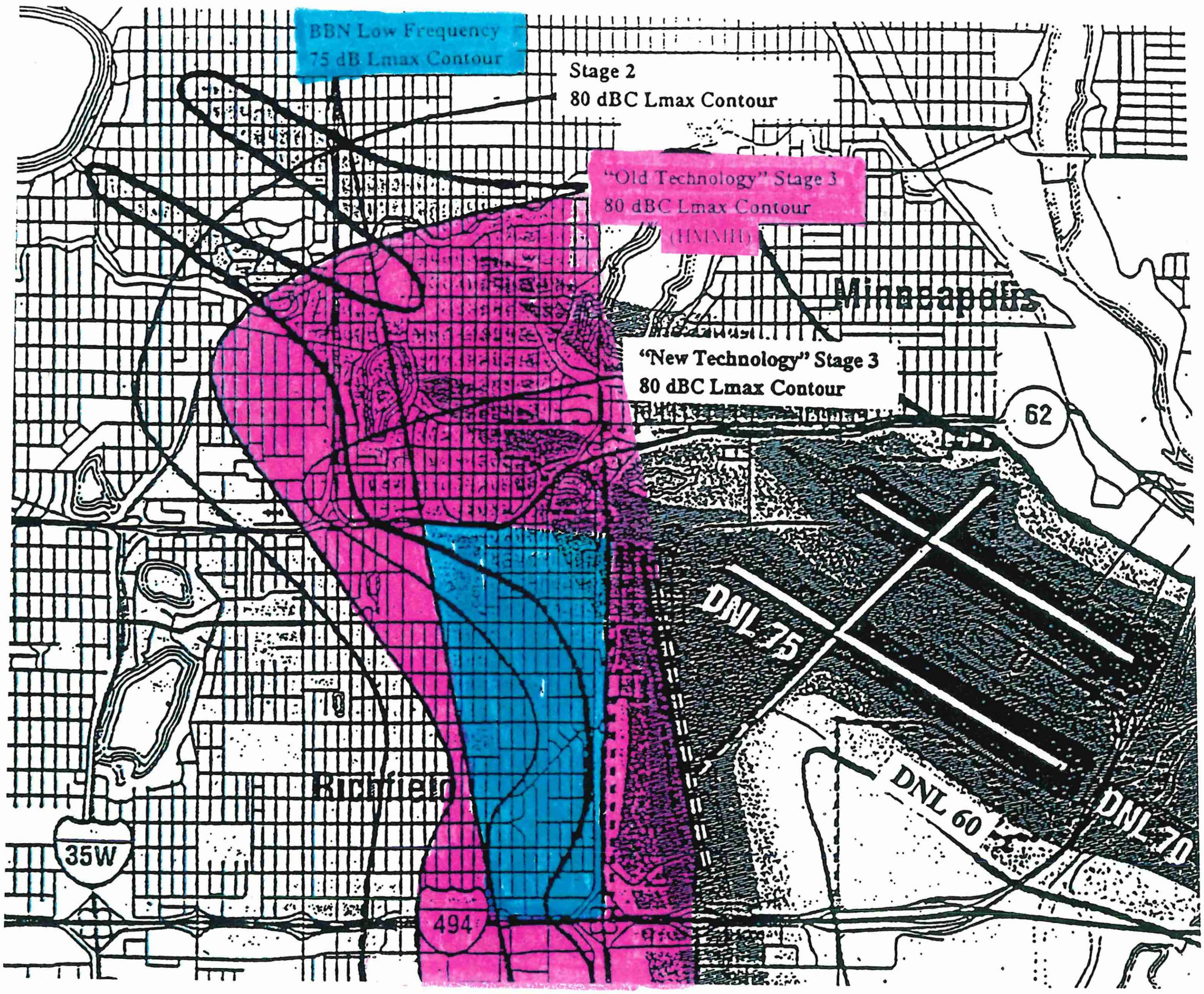
Projections From Figure 5
MSP Low Frequency Noise Study
Proposed North-South Runway - Criterion Contours
80dBC Lmax Contours and BBN 75 dB Low Freq. Contour



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MEMORANDUM

TO: Nigel Finney
cc: Roy Fuhrmann

FROM: Andrew S. Harris

SUBJECT: Initial Presentation of Low Frequency Noise contours
Minneapolis-St. Paul International Airport
Low Frequency Noise Study
HMMH No. 295340

DATE: 14 January 1998

Introduction

The MAC and Richfield have discussed potential impacts of low frequency noise from operation of a new runway, 17-35, at MSP. In the absence of adequate information on the levels of low frequency from MSP operations, HMMH proposed to measure noise from existing operations and develop noise contours based on those measurements. Because the level of low frequency noise is best represented by the "C" weighting network on a sound level meter, measurements were conducted with C weighting.[1] As proposed, HMMH began development of low frequency noise contours for operations at MSP by measuring levels of noise from operations on 12R-30L during the period from 5 November 1997 through 7 November 1997, three days. Two HMMH staff members were assisted during the measurement program by staff from the MSP noise office. After completion of the measurement task, HMMH evaluated the measured noise levels and developed contours showing C-weighted noise contours in the range from 80 dB to 95 dB. In this memorandum we present the contours developed during this study for your initial review. Contours are presented for three groups of aircraft: (1) stage 2 aircraft; (2) new-technology Stage 3 aircraft; and (3) older-technology Stage 3 aircraft. HMMH recommends that the MAC base its analysis of potential low frequency impacts of runway 17-35 at MSP on the 80-dBC contour from older-technology Stage 3 aircraft.

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1 During work on a separate task under this project, HMMH determined that it will recommend that the MAC consider a C-weighted level of 80 dB as the threshold for low frequency impact on residential land use. (This other work will be reported separately.)

Description of Measurements

HMMH measured noise from aircraft operations at seven locations. Figure 1 shows the measurement locations. The specific locations of measurements differ somewhat from the location initially anticipated. However, the measurement locations met the goals for a range of distances and an opportunity to determine wind effects on noise propagation. Another goal of the measurement program was to obtain 100 measurements of Stage 2 aircraft operations and 100 measurements of Stage 3 aircraft operations with data at all seven locations for each operation. Operations were on runway 12R for all measurements. The three-day measurement period yielded measurements at all seven locations and there were more than 100 operations by each stage of aircraft. However, a combination of interfering noise from operations on parallel runway 12L and temperature-related measurement problems at certain measurement sites reduced the numbers of good data points at some sites. The number of good data points was fully adequate to permit HMMH to draw noise contours and have confidence in the accuracy of the contours.

During the measurements, HMMH measured wind direction and velocity so that we could assess the influence of wind on the measurements. This was desirable since noise levels are higher during downwind conditions and airport neighborhoods tend to experience downwind conditions frequently. Measurements were available during downwind conditions at all locations.

Measurement Results

Based on the measurements, HMMH observed that the noise characteristics of aircraft departures at MSP fall into three groups. The first group is Stage 2 aircraft (i.e., B727 and DC9 aircraft). These are the noisiest aircraft at MSP. The second group is new-technology Stage 3 aircraft (i.e., B737-300 and B757 aircraft). These are the quietest aircraft at MSP. The third group is older-technology Stage 3 aircraft (i.e., hushkitted DC-9, DC10 and MD80 aircraft). This last group is quieter than the Stage 2 aircraft but not as quiet as the new-technology Stage 3 aircraft. While all three groups of aircraft are now present in large numbers at MSP, FAR Part 91 mandates that the Stage 2 aircraft will disappear by the year 2000, prior to construction and use of runway 17-35.

Noise Contours

Figures 2 through 4 show C-weighted noise contours from operation of runway 17-35 for the three groups of aircraft identified above. Note that the contours have shapes similar to other single-event noise contours. The distance from the runway to the contour depends on the noise produced by the aircraft and the aircraft elevation angle. The contours are not parallel to the runway. Since the Stage 2 aircraft should be out of the fleet when runway 17-35 becomes operational, we recommend that the MAC identify potential low frequency impacts on residential areas by using the 80 dBC contour for older-technology Stage 3 aircraft. Figure 5 shows the recommended older technology Stage 4 80 dBC contour in comparison with the 80 dBC contours for Stage 2 aircraft and new-technology Stage 3 aircraft. It also shows the BBN low frequency 75 dB maximum contour. While we are confident that the 80 dBC criterion is appropriate and that our noise contours accurately show the 80 dBC contour location, we are not able to evaluate the BBN recommendation or how BBN developed the low frequency 75 dB maximum contour.

BBN's report does not describe fully how they went from their measurements to the low frequency 75 dB maximum contour. From our knowledge of aircraft noise, we do not believe that a low frequency 75 dB contour would be parallel to the runway. As an aircraft accelerates, the level of low frequency noise generated by the engine decreases. Further, as an aircraft leaves the ground and begins flight, the noise propagation environment to distant locations improves. These two physical conditions cause contours to get closer to the runway as an aircraft accelerates and further from the runway as the plan begins actual flight. The contour eventually closes as the aircraft gets farther above the ground. We could probably get BBN to explain how they developed this particular contour. However, we would like to have you review this memo before we try.

A further point of consideration is potential differences in mitigation measures for the 80 dBC criterion and BBN's low frequency criterion. The BBN criterion is for frequencies at or below 100 Hz. The 80 dBC criterion covers a broader range of frequencies. While the 80 dBC criterion contour tends to cover a larger area than the low frequency 75 dB contour, it is probably easier to reduce the C-weighted level than it is to reduce levels at frequencies at or below 100 Hz. We have information on sound insulation improvements relative to C-weighted noise. We will need to see what information we can find on sound insulation improvements relative to noise levels at frequencies at or below 100 Hz.

Requested Action

Please review this memo and consider the implications of application of the two criteria for low frequency noise: 80 dBC and low frequency 75 dB maximum. I will plan to call you on Friday, 16 January 1998 to review this issue.

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Figure 1 MSP Low Frequency Noise Measurement Locations Departures on Runway 12R November 5-7, 1997

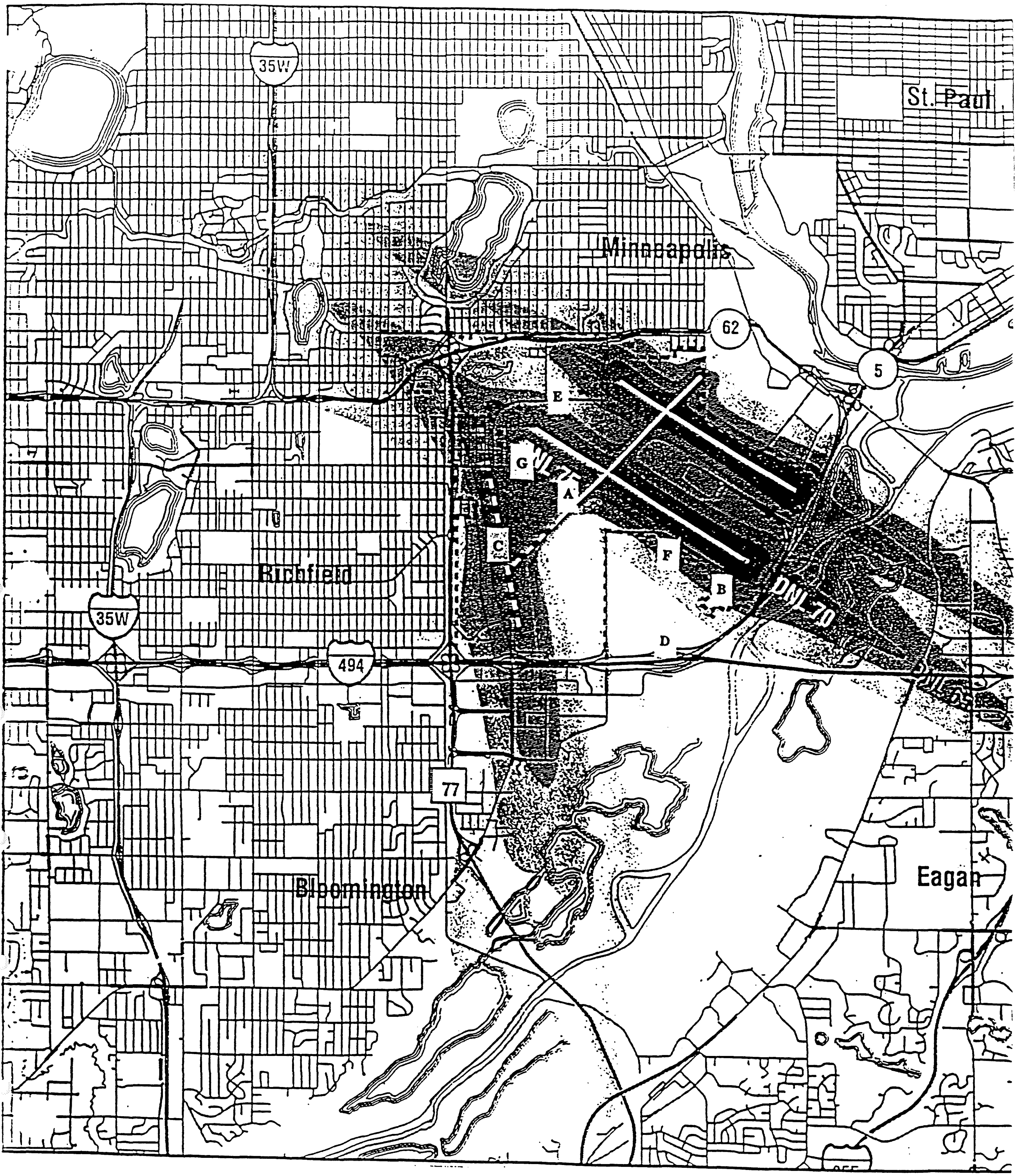


Figure 2
MSP Low Frequency Noise Study
Proposed North-South Runway - Lmax (dBC) Contours
Stage 2 Aircraft

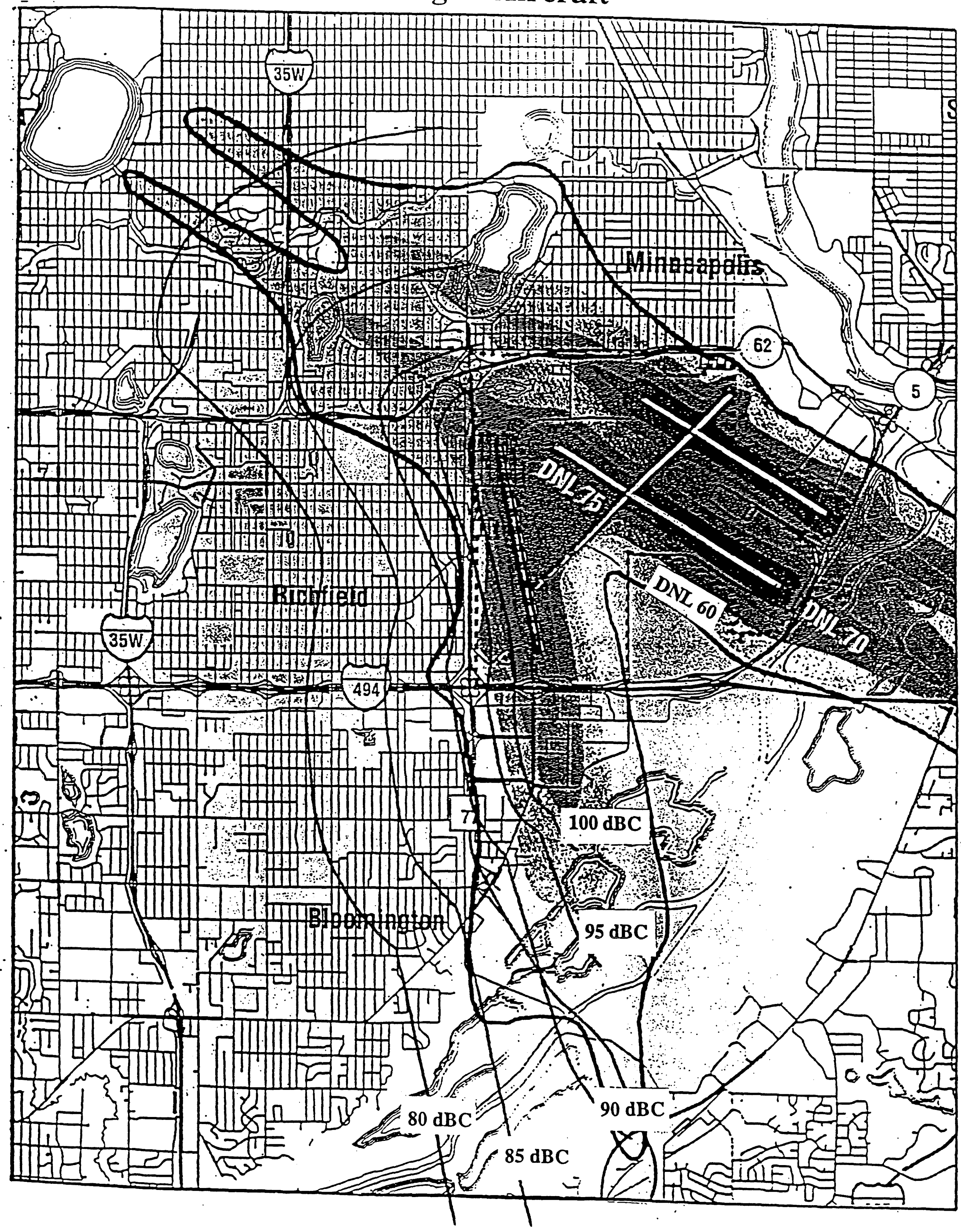


Figure 3

MSP Proposed North-South Runway
Lmax (dBC) Contours
"Older Technology" Stage 3 Aircraft

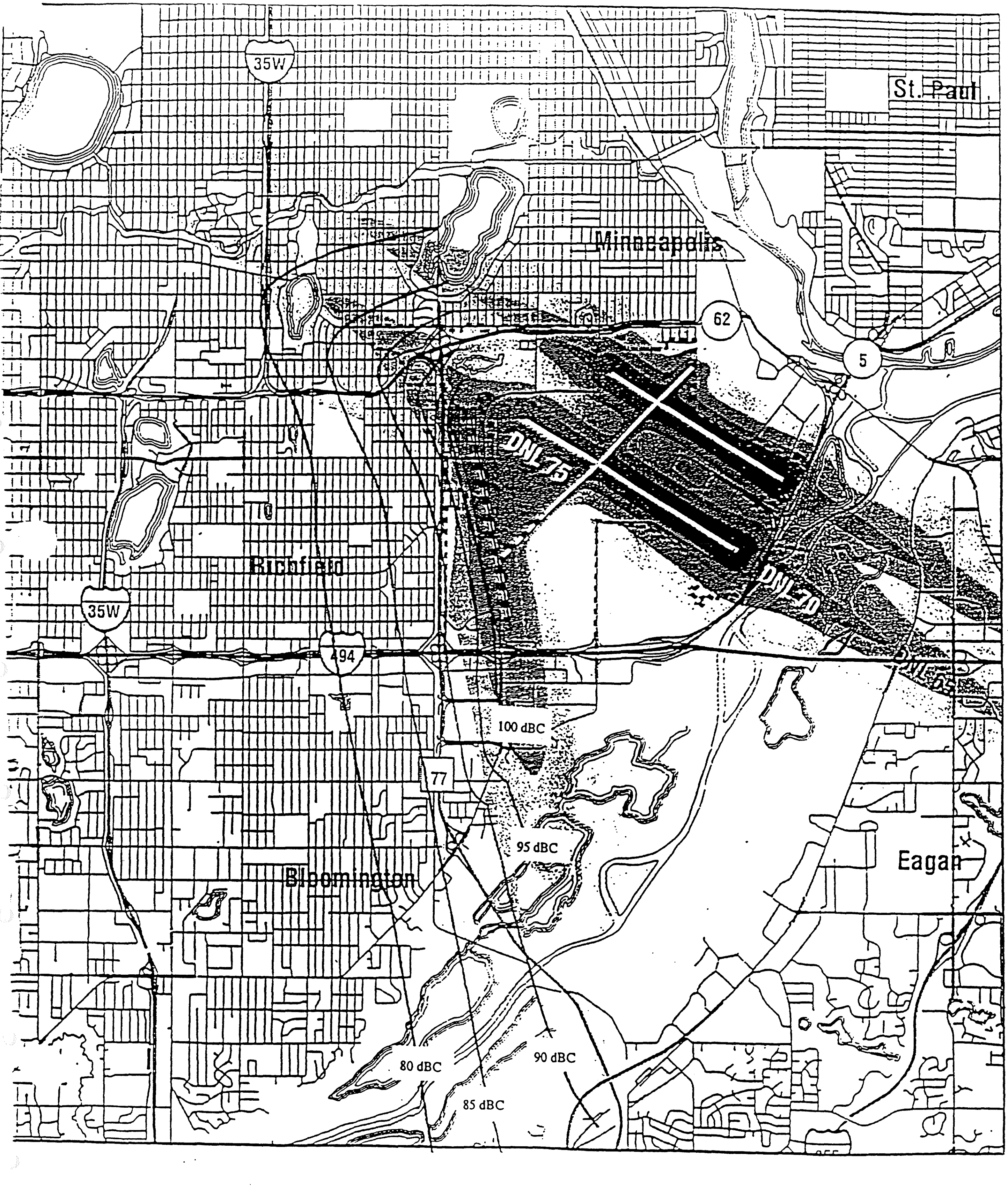


Figure 4

MSP Proposed North-South Runway
Lmax (dBC) Contours
"New Technology" Stage 3 Aircraft

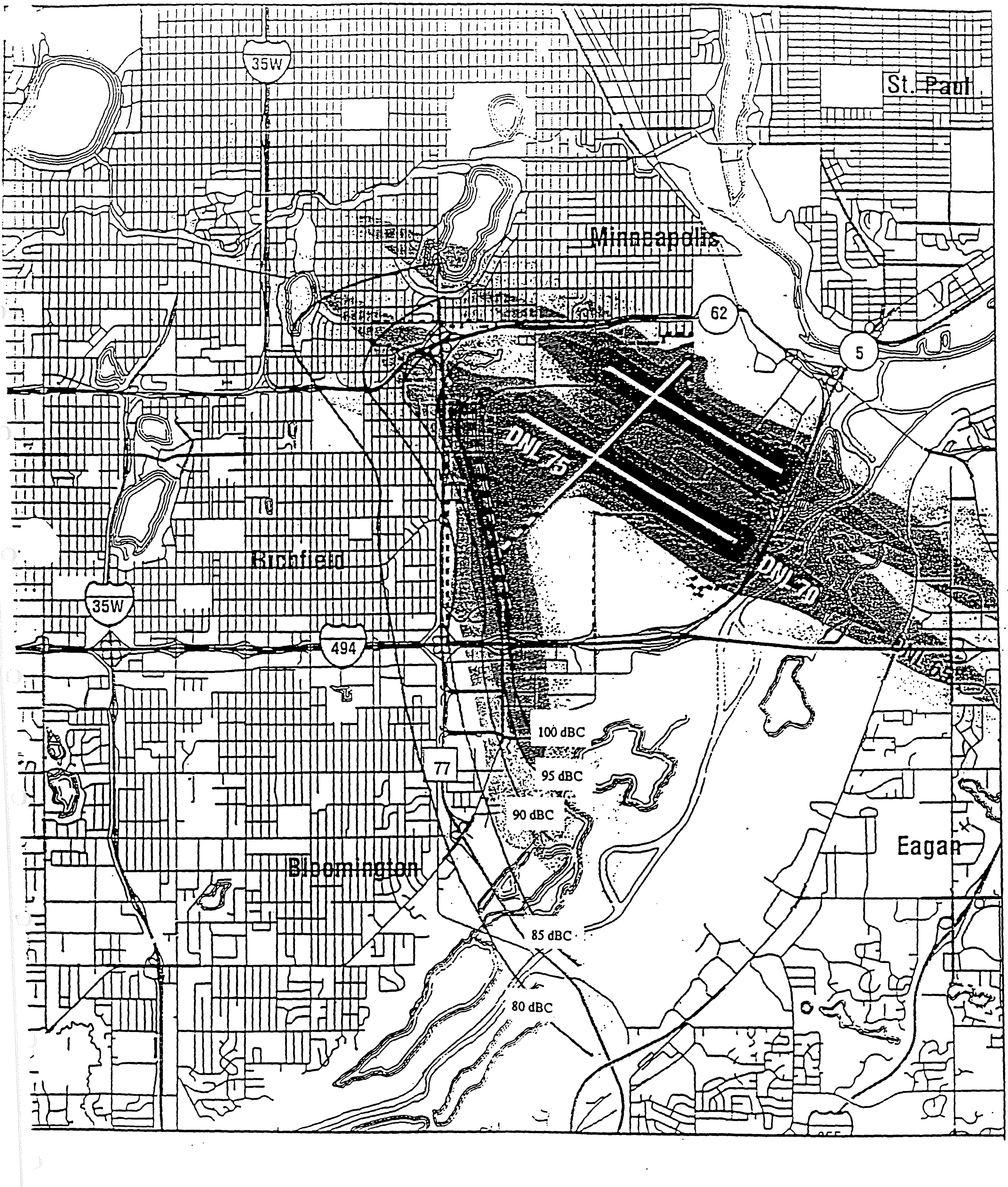
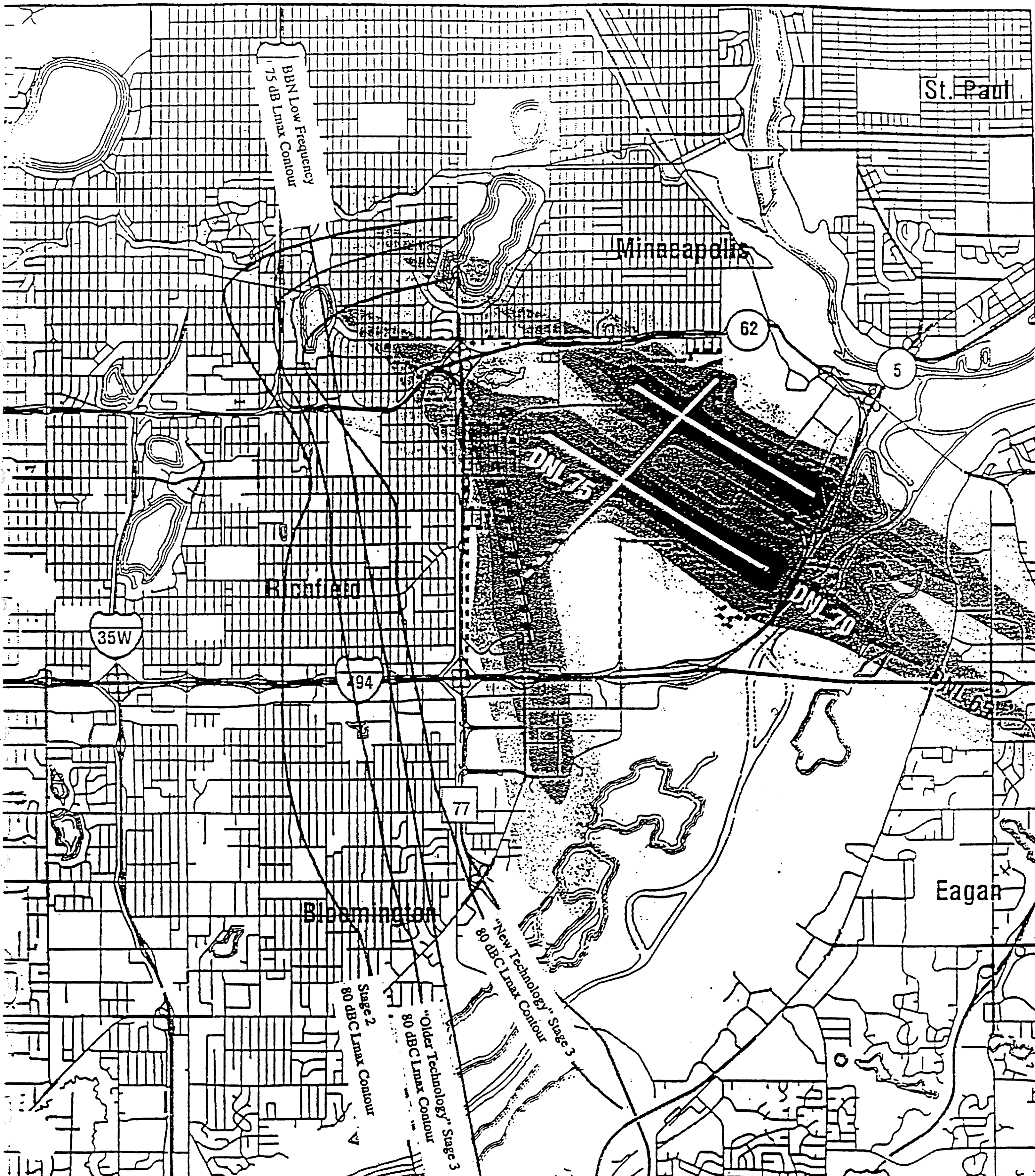


Figure 5 MSP Proposed North-South Runway
Criterion Contours



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MEMORANDUM

To:	Andy Harris HMMH
From:	Eugene M. Reindel
Date:	January 21, 1998
Subject:	Updated MSP Low Freq. Contours
Reference:	HMMH Job No. 295340.01

Andy,

Here is the package of exhibits you requested for the MSP Low Frequency Noise Report. Please notice that the five figures of the preliminary report are included and have been updated as I noticed a few errors when I was putting Table 2 together and describing the development of the contours. The errors found were: 1) The energy averaged values associated with the measurement sites were incorrect (some were average values, not energy average values), and 2) The directivity of the C-Lmax was not consistant in the database determining the contours (some calculations were for a directivity of 130 degrees and others were 140 degrees; 130 degrees is correct).

Number one above is obviously a major contributor to the contour definitions and therefore the contours changed. As you will notice, this correction had the effect of moving the 80 dBC contours out a bit and producing a larger disparity from the BBN criterion 75 dB low frequency contour.

I have plots that show how closely the contours match the measured data; even better than before with the corrected information. Take a close look at the figures and the other exhibits you requested and if any questions or concerns arise, please get together with me to discuss them.

I should have caught these errors earlier than now and feel bad that we almost gave the client bad information. I am confident in these new contours since they match with the measured data so closely.

Table 1. Summary of Downwind Measurements

Aircraft Noise Stage	Number of Downwind Measurements by Site					
	G/E	A	C	F	B	D
Stage 2	73	57	58	71	44	66
"Old Technology" Stage 3	17	15	15	19	16	18
"New Technology" Stage 3	28	31	17	39	20	28

Table 2. Summary of C-weighted Lmax Level Measurements

Aircraft Noise Stage	Aircraft	Energy Averaged C-weighted Lmax Levels by Site					
		G/E	A	C	F	B	D
Stage 2	DC9	98.9	94.7	88.5	96.7	99.8	86.8
	727	101.1	100.5	89.0	98.1	100.0	88.2
	737-200	97.5	95.2	85.7	92.8	93.7	83.4
	All Stage 2	99.4	98.5	88.6	96.9	99.6	87.1
"Old Technology" Stage 3	MD80	98.0	95.8	85.5	92.4	94.9	84.1
	DC10	96.2	93.0	83.0	89.9	92.2	82.3
	747	101.3	99.1	88.4	96.1	96.4	86.6
	All Stage 3 "OT"	96.8	96.4	86.1	93.2	94.7	84.5
"New Technology" Stage 3	757	90.1	88.1	80.0	88.2	89.9	83.3
	A300	92.7	87.1	80.8	86.5	89.9	79.4
	737-300	88.3	87.3	79.9	85.7	N/A	76.9
	F100	93.2	90.4	81.0	87.9	89.2	81.1
	BAE146	86.2	82.4	77.6	84.9	87.8	82.1
	All Stage 3 "NT"	94.3	88.0	80.0	86.9	89.3	81.4

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C-weighted Lmax Contour Determination for MSP Proposed North-South Runway

The contours were drawn using the energy average of the measured data in Table 2 for each aircraft type (noise stage). It was determined that the C-weighted Lmax level (C-Lmax) was measured when the aircraft was down the runway past the measurement site at an average directivity from the aircraft of 130 degrees during downwind conditions. The four measurement sites along the 1500 ft. sideline were utilized to determine the change in C-Lmax as the aircraft progressed down the runway. A third-order polynomial fit of the energy average C-Lmax at each site for each noise stage of aircraft was developed in order to produce an equation to describe the offset (from the level measured at site A; the reference level) measured along the runway.

The next step in developing the contours was to use the energy average measurements at the further out sites C and D (approximately 4500' sideline) compared to the measurements at sites A and B respectively to determine the propagation of the C-Lmax levels. Here we assumed that the level drops 3 dBC as the distance doubles or 20log(distance) along with some air absorption per 1000 feet of distance. Using the reference levels at sites A and B, the propagations at C and D were determined. This process showed that the air absorption coefficient changed as the aircraft became airborne; most aircraft were still on the ground when the C-Lmax level was measured at site C and airborne at site D. Therefore, the air absorption coefficients used for developing the contours depended on the distance down the runway of the aircraft.

The contours were generated by developing a spreadsheet with a matrix of locations sideline to the runway in a density of 100 ft square sections. The matrix started 500 ft. sideline to the runway and proceeded out to 10,000 ft and started 8500 ft behind the start of the runway and extended to 1000 ft beyond the runway. Each 100 ft square section of the matrix generated a C-Lmax level by determining the aircraft location when the C-Lmax would be measured at that section of the matrix (130 degree directivity assumed) which determined the distance from the aircraft (r) and the position of the aircraft along the distance vector r intersecting with the 1500' sideline, assigning an offset from the level measured at site A using the polynomial equation, assigning an air absorption coefficient (α), and solving the following equation:

$$C\text{-}Lmax_{x,y} = \text{Reference Level (Site A)} - \text{Offset Level}_{x,y} - 20*\log[r_{x,y}/1900'] - \alpha(x)_{x,y}*[r_{x,y}/1000']$$

where

1900 ft is the distance from Site A to the aircraft when the C-Lmax occurs and
1000 ft is required since the air absorption coefficients are per 1000 ft of distance.

The above process generated the curves sideline and offset by 130 degrees to the runway. This process also showed where the curves began to curve in toward the ruway centerline behind the runway. The 100 dBC Lmax curve was able to be closed on runway centerline since it was so close to the runway. The other curves were closed behind the runway by assuming a 3 dBC reduction in level per doubling of distance (20 log (r)). To extend the contours beyond the end of the runway, the INM5.1a program was utilized to produce A-weighted Lmax curves for four different aircraft types (DC9, MD80, 757, and 747-200). These A-weighted Lmax curves were then used to determine the shape of the contours beyond the end of the ruway to bring the curves in toward the runway centerline.

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Figure 1
MSP Low Frequency Noise Study
Measurement Locations - Departures on 12R 11/5-7/1997

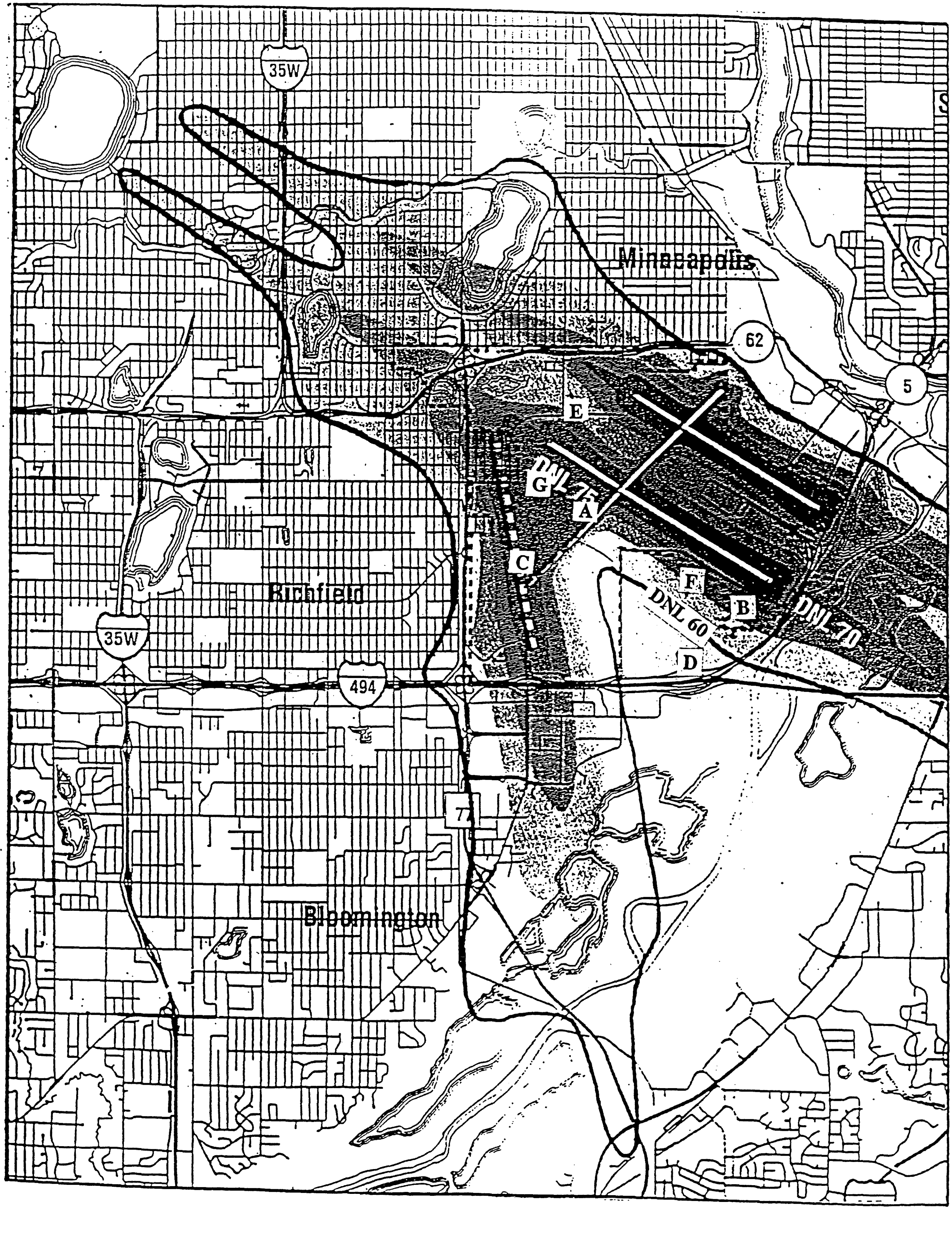


Figure 2
MSP Low Frequency Noise Study
Proposed North-South Runway - Lmax (dBC) Contours
Stage 2 Aircraft

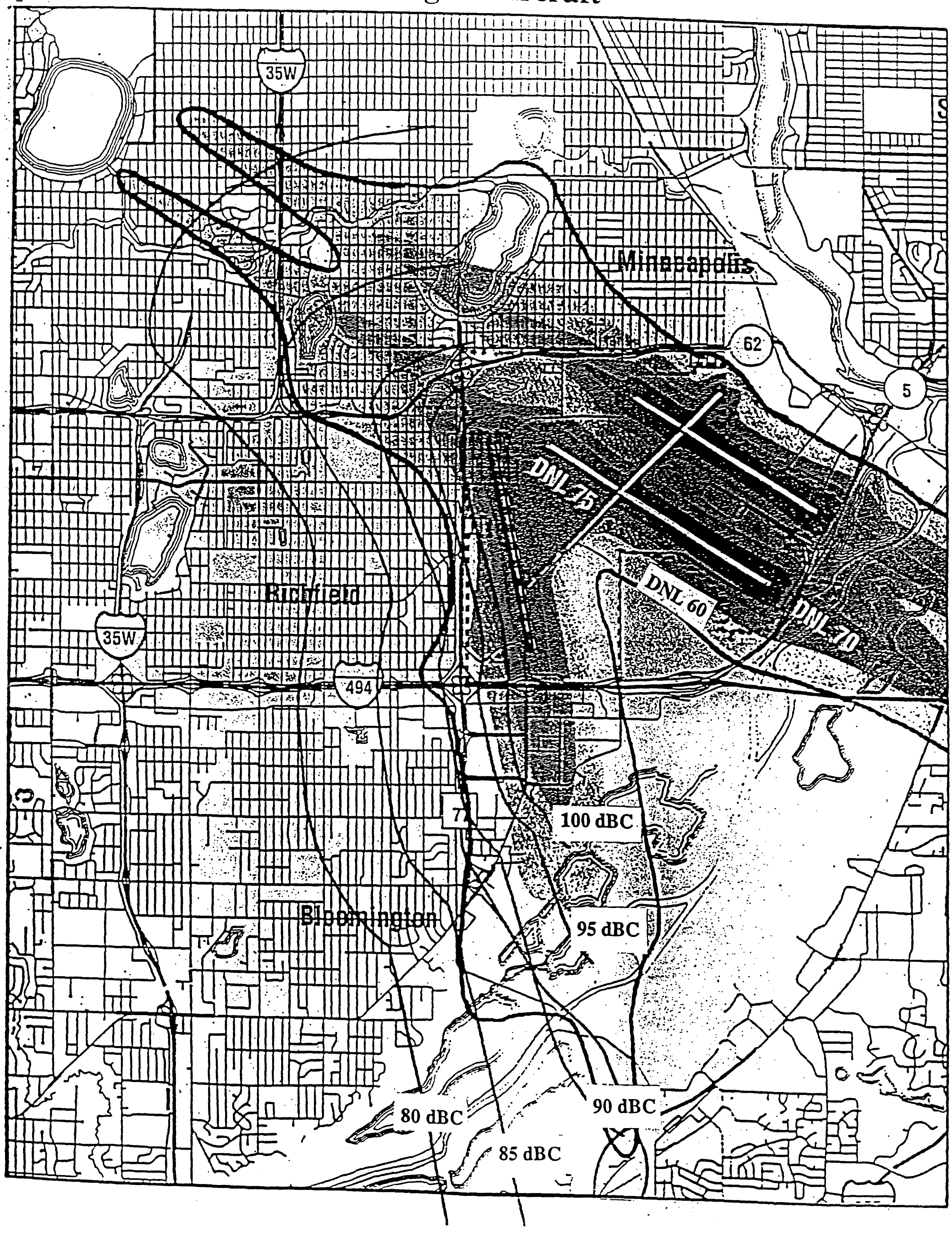


Figure 3
MSP Low Frequency Noise Study
Proposed North-South Runway - Lmax (dBC) Contours
"Old Technology" Stage 3 Aircraft

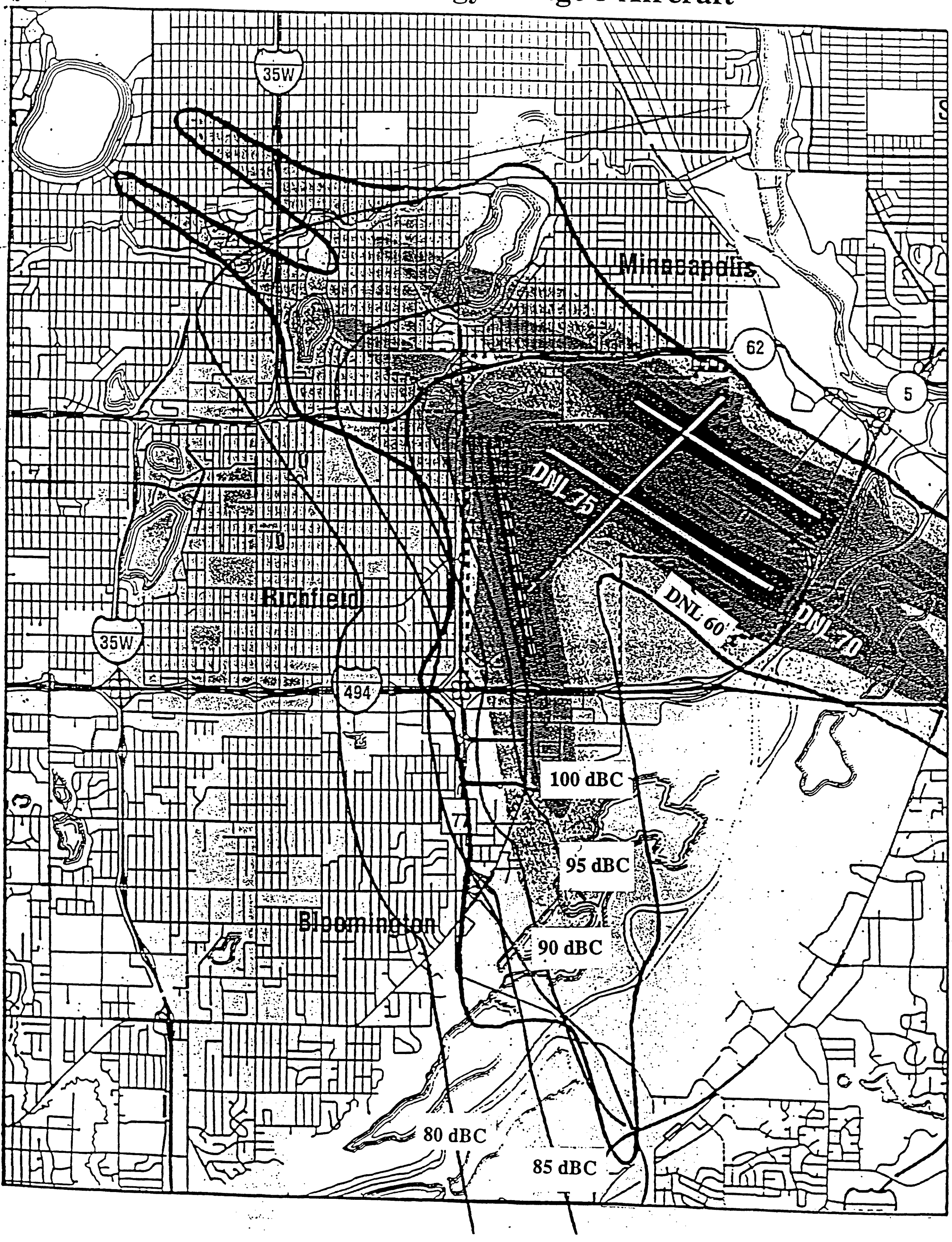


Figure 4
MSP Low Frequency Noise Study
Proposed North-South Runway - Lmax (dBC) Contours
"New Technology" Stage 3 Aircraft

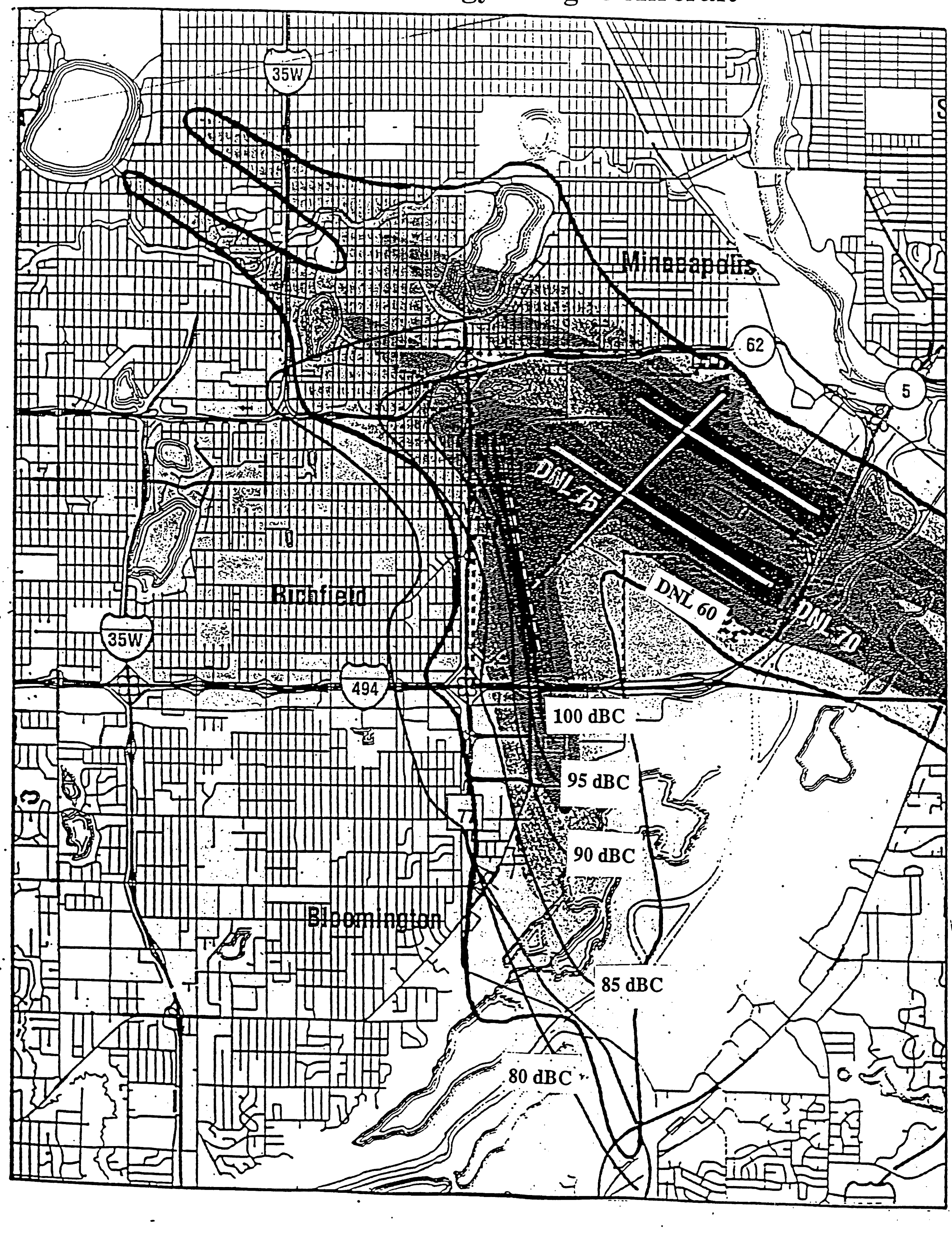
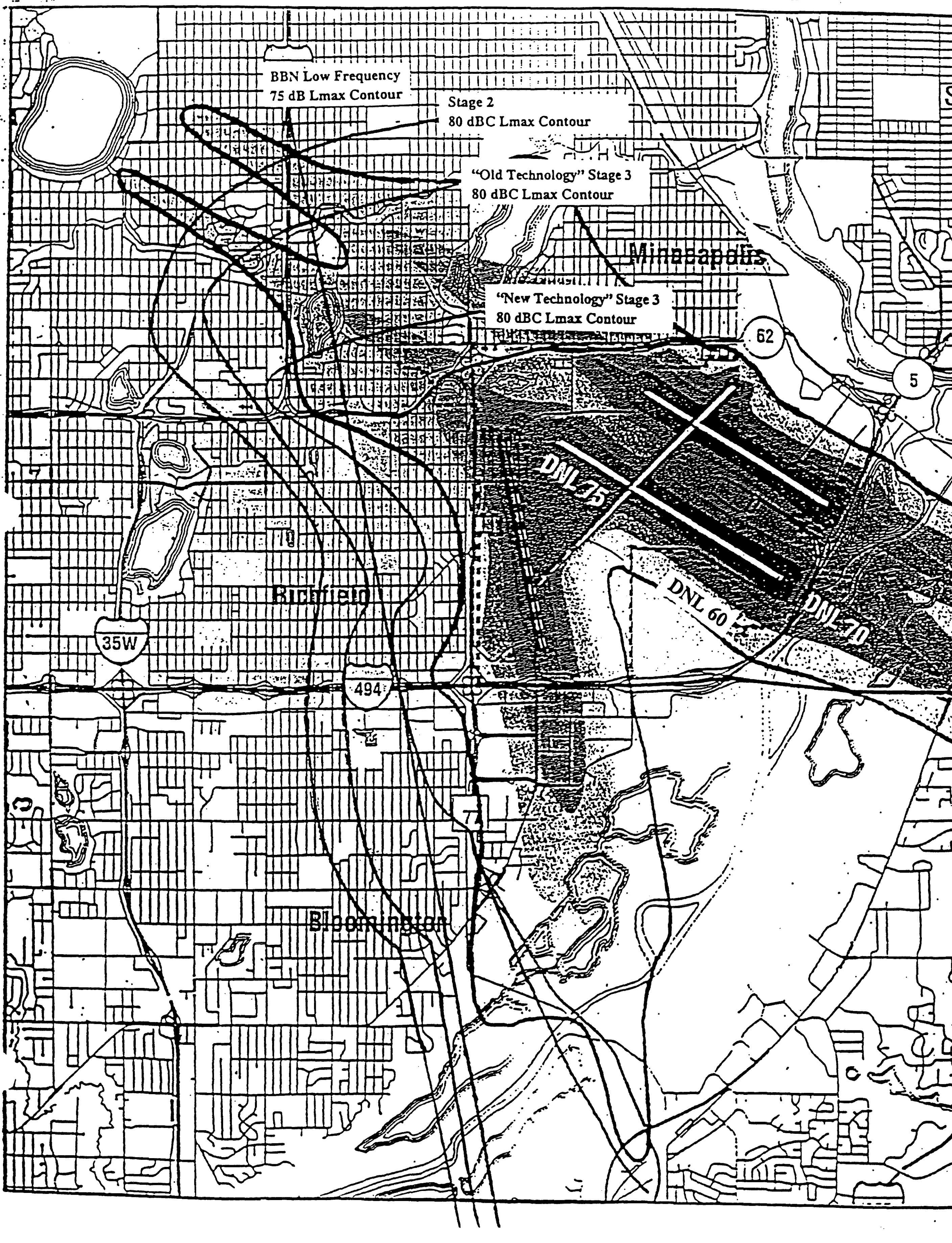


Figure 5
MSP Low Frequency Noise Study
Proposed North-South Runway - Critierion Contours
80 dBC Lmax Contours and BBN 75 dB Low Freq. Contour



RESPONSES TO VARIOUS ASSERTIONS IN MAC'S MEMORANDUM

The following assertions set forth in bold type are made in the MAC memorandum of October 29, 1998. The responses are set forth after each assertion.

MAC Assertion

"FAA uses DNL because the metric best reflects what the human ear actually hears. . . . A-weighted metrics are the most representative because they include all frequencies including the low or 'C' frequencies. There is no support for Richfield's assertion that A-weighted scales are defective in measuring low frequency noise." (MAC memorandum at 7.)

Richfield Response

MAC's consultants, HMMH, states in its memorandum of January 14, 1998 regarding its own measurements at MSP, "Because the level of low frequency noise is best represented by the 'C' weighting network on a sound level meter, measurements were conducted with C weighting. . . . HMMH determined that it will recommend that the MAC consider a C-weighted level of ADDB as the threshold for low frequency impact on residential land use." Exhibit A to Richfield Memorandum of November 10, 1998. (Emphasis supplied.)

In other words, it is now documented that MSC's noise consultant advised MAC in writing of the appropriateness and superiority of C-weighted noise measurements for characterizing the low frequency content of aircraft ground noise as early as January of 1998. MAC nonetheless subsequently maintained in its Final Environmental Impact Statement and even in its oral presentation to EQB of 26 October 1998:

1) that A-weighted sound level measurements suffice to disclose all environmental impacts of aircraft ground operations, and

2) that Richfield's concerns with the inadequacies of A-weighted measurements of aircraft ground noise may be dismissed as inappropriate.

Although MAC's deliberate misrepresentations to EQB might charitably be described as spurious, they are more accurately characterized as disingenuous.

MAC Assertion

"Federal agencies, including HUD, EPA and DOT have considered the effects of aircraft noise for over 30 years and consistently determined that the current FAA noise guidelines are the best means of assessing the effects of aircraft noise."

Richfield Response

The tacit allusion is to the FICON recommendations. "FAA noise guidelines" are merely the self-serving preferences of an agency, FAA, that has rarely encountered a runway that it hasn't liked. From FAA's documented perspective, land use compatibility is a one way street (land uses that do not compromise airport operations in any way). Moreover, FAA's "guidelines" have no compulsory effect. Finally, FAA explicitly defers to local judgment for definition of thresholds of noise impacts.

MAC Assertion

"Both the draft EIS and the final EIS found noise from ground operations to be insignificant." (DEIS at V-82; FEIS at V-80).

Richfield Response

This is an example of MAC's consistent attempt to mislead. The comments referred to are about "aircraft" taxiing to runways 11R and 17." They do not refer to low frequency noise generated on the ground by runway activity of aircraft taking off or landing, which is characterized as "an unresolved issue."

MAC Assertion

"Given that the Concorde did not produce any adverse low frequency noise effects, commercial aircraft operations on the proposed runway do not pose the potential for significant adverse impacts." (MAC brief at 8)

Richfield Response

As demonstrated by NASA Technical Memorandum 78736, a copy of which is provided in the Appendix, the noise measurements of the Concorde were made at distances varying from three to 10 kilometers away from the runway site, and do not constitute any evidence that low frequency noise from runway 17/35 would be insignificant.

In fact, the Environmental Impact Statement for the Concorde acknowledged that the planes' deep rumble would cause minor structural shaking, that its sound readily penetrates buildings, and that it would result in the rattling of dishes and other non-stationary objects within the homes. (See British Airways Board v. Port Authority of New York, 564 F.2d 1003, 1007 (2nd Cir. 1977), a copy of which is provided in the Appendix.)

MAC Assertion

"The Concorde study was the subject of litigation, and the court found the impact to be 'not more than minimal at most.' Based on a 16-month study of Concorde induced vibration at Dulles." (MAC brief at 9)

Richfield Response

The Concorde was anticipated to have four flights per day. (See British Airways Board v. Port Authority of New York, 437 F. Supp. 804, 811, (DCNY 1977) (a copy of which is provided in the Appendix.)

Of course, there will be hundreds of flights daily on Runway 17/35 which will produce low frequency noise and the resulting vibrations, shaking of houses and rattling of windows and other objects in the home. Four such incidents per day from the Concorde may be negligible, but several hundred simply cannot be termed insignificant.

<u>MAC Assertion</u>

"In an August 1993 report, FICON examined the question of low frequency noise measurement and concluded that the DNL metric remains the best approach. . . ."

<u>Richfield Response</u>

The statement confuses two issues (not to mention the date of publication of FICON report): use of DNL to predict annoyance, and low frequency noise measurement. The statement implies an explicit finding that DNL is adequate to predict low frequency noise effects. Such a finding does not appear in the FICON report.

<u>MAC Assertion</u>

"FAA analysis of recent evidence suggests that low frequency noise is likely to be of concern only in areas within a 65 DNL or greater contour. The evidence suggests that homes outside a DNL 65 contour are unlikely to experience levels of low frequency noise that could produce perceptible vibration. (MAC brief at 9)

<u>Richfield Response</u>

The statement (which is similar to one made in the ROD) is absolutely refuted by the report of MAC's consultant dated January 14, 1998, Exhibit A to Richfield Memorandum of November 10, 1998. How can the authors of the ROD make such an assertion, in the light of the low frequency noise measurements made by HMMH, and the advice of HMMH, showing that at a sound level of 80 dB (C-weighted) rattling and perceptible vibration are likely to occur?

<u>MAC Assertion</u>

"The BWI and Boston/Logan studies demonstrate that only homes in a DNL 65 or above noise contour experience perceptible low frequency vibration, and that standard sound insulation measures are effective in addressing such low frequency noise."

<u>Richfield Response</u>

Again, the first part of this statement is directly refuted by the studies and recommendations of low frequency noise done for MAC by HMMH and reported on January 14 and January 21, 1998. The second part of the statement regarding the effectiveness of standard sound insulation measures in addressing low frequency noise is discussed at length in the Boston/Logan study, referred to in Richfield's Supplementary Memorandum of November 10, 1998 at Section 2. In fact, much greater reductions were observed when the ametric was used to measure the reduction than when the symmetric was used or when unweighted low frequency sound was measured. The Boston/Logan study is provided in the Appendix. The BWI study is in the Appendix to the ROD.

MAC Assertion

"Richfield's studies in El Segundo do not apply in Minnesota because of the difference in the structural qualities of their residences." (MAC brief at 10)

Richfield Response

MAC's consultants, HMMH, discussed Dr. Fidel's findings in numerous memoranda to its client. HMMH advice was that an 80 dBC noise criterion, based upon a study that HMMH did in California, should be applied to determine the level at which low frequency noise in Minnesota would become "disruptive."

MAC Assertion

"FAA's DNL guideline is not based upon the percentage of people annoyed. Rather, FAA based its guideline on a 1980 report of the Federal Interagency Committee on Urban Noise (FICUN). The report does not mention annoyance as a primary consideration." (MAC brief at 10)

Richfield's Response

The FICOM report of August 1992, Volume 2: Technical Report, Section 3.2.2.1 Annoyance, pp. 3-3 et. seq. contains these quotes "The percent of the exposed population expected to be highly annoyed (% HA) [is] the most useful metric for characterizing or assessing noise impact on people."

"... the updated 'Schultz curve' remains the best available source of empirical dosage-effect information to predict community response to transportation noise."

MAC Assertion

"FAA determined that there is no evidence of adverse low frequency noise effects from the MSP alternative. (MAC brief at 11)

Richfield Response

Again, it is impossible to understand how the MAC and FAA can make such statements in light of the studies done by MAC's own consultants, showing the 80 dB (C-weighted) contours. In addition, MAC's statement is very carefully worded in the ROD at A.1-3. "Low frequency noise is not per se a potentially significant adverse impact. The FAA and MAC are not able to conclude that the proposed action at MSP would cause a low frequency noise and perceptible vibration problem in portions of the City of Richfield." This is a Clintonesque statement. What do they mean by "per se"? What do they mean by "a low frequency noise and perceptible vibration problem"? What do they mean by "vibration"? And, where is their analysis? How did they manage to ignore their own consultant's conclusions?