

Appendix E

Noise Abatement Alternatives

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This appendix presents the range of the noise abatement alternatives that were evaluated in this Part 150 Noise Compatibility Study (Part 150 Study) to mitigate noise impacts of aircraft operations at the Duluth International Airport (DLH or Airport).

E.1 Noise Abatement Alternatives

This section discusses the consideration and evaluation of potential abatement alternatives for possible inclusion in the DLH 2021 Noise Compatibility Program (NCP). The concept of noise abatement generally focuses on measures that may be able to affect the source of the noise such that the receivers of noise (residential areas etc.) are exposed to less noise. Thus, abatement measures generally are concerned with actions that would alter the use or configuration of air space, flight tracks, airport facilities, or aircraft operations, so as to reduce or shift the location of noise. The evaluation of a number of these alternatives is required under Title 14 of the Code of Federal Regulations (14 CFR) Part 150, even though they may have little utility for local application at DLH. These measures tend to fall into one of the five general categories listed below.

- Runway Use Modifications
- Flight Routing Modifications
- Aircraft Operational Procedure Modifications
- Airport Facility Modifications
- Airport Regulations and Facility Restrictions

The consideration of the various potential abatement techniques must be undertaken in the context of the current 2021 NCP at DLH as well as the policies of the Federal Aviation Administration (FAA) under 14 CFR Part 150. There were several measures recommended, and unofficially implemented, from the previous DLH NCP published in 1997. These are discussed further in **Section E.1.1**. Changes in operational levels and fleet mix that have occurred over the past twenty years, have resulted in reductions in noise exposure around the airport. As a result, measures in the previous DLH 1997 NCP would only reduce noise impacts outside of the 65 day-night average sound level (DNL) noise contour. They would not be recommended for further implementation since they don't mitigate impacts within the 65 DNL noise contour.

In order to evaluate each alternative, a set of evaluation criteria was established and used to identify the benefits and drawbacks of each alternative. The criteria include feasibility, safety, operational considerations, and noise reduction. After it was determined that an alternative was feasible, safe, and had no major operational drawbacks, an assessment of the benefits in terms of noise and land use compatibility was conducted. Because a decrease in one area may result in an increase in another area, priorities were developed to clarify the evaluation process. The noise impact priorities were as follows:

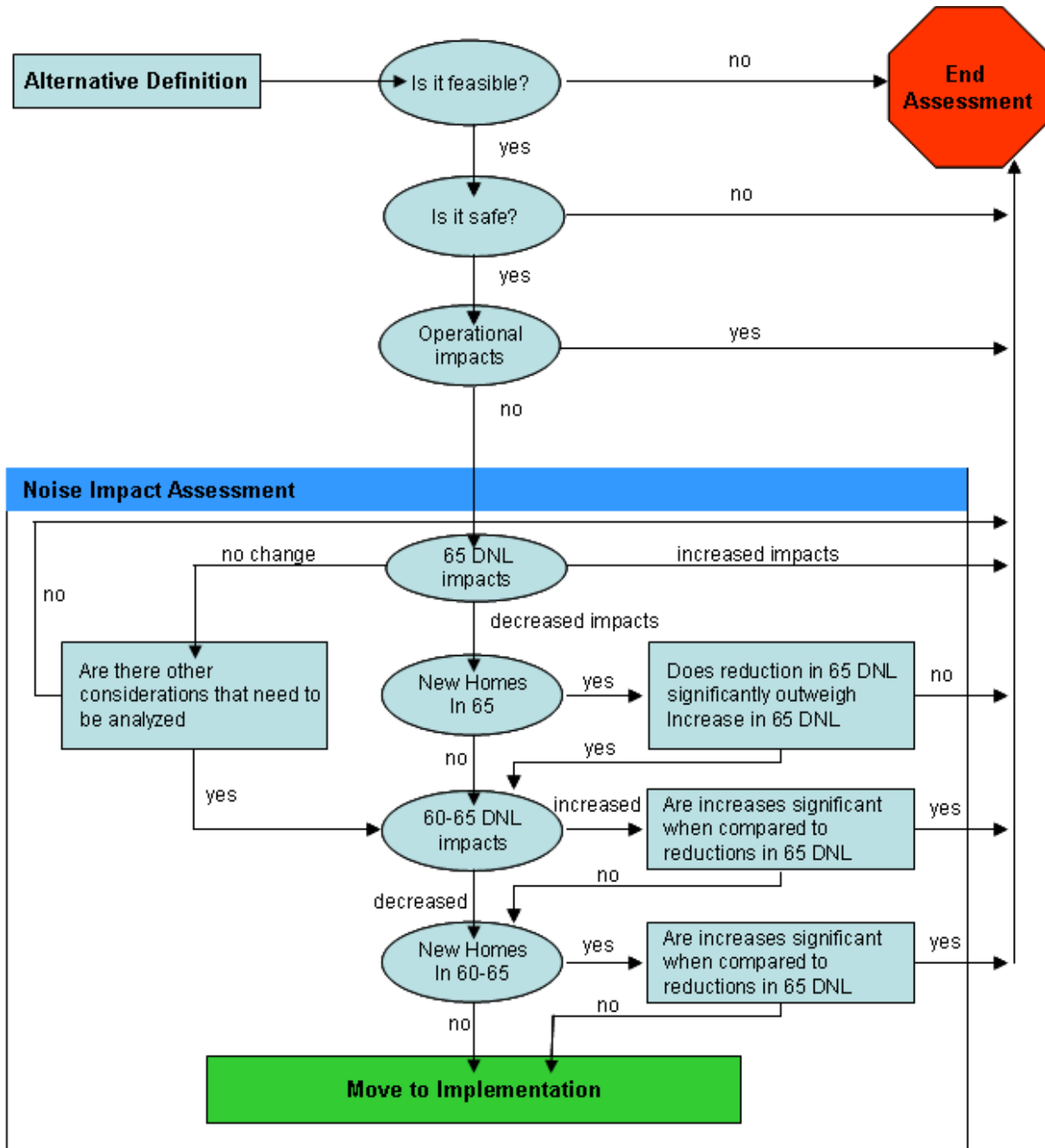
- Reductions in the 65+ DNL noise contours (most important)
- Sensitivity to shifting noise from one area to another (important)
- Ensuring that the tradeoffs of increased versus decreased noise are understood before making a decision

- Recognizing that an alternative may have a net reduction in noise impacts, but may be eliminated because those impacts are a result of decreases in one area with a similar level of increases in another

Exhibit E-1, *Abatement Alternatives Evaluation Process*, graphically depicts the steps of the evaluation process for abatement alternatives.

Within the aforementioned context, a two-step evaluation method was conducted for potential new abatement alternatives. First, a qualitative screening analysis was conducted on the full range of potential new abatement alternatives for DLH to determine whether or not they were feasible, and safe, and whether or not they would cause operational impacts. A summary of this screening analysis is provided in **Section E.1.2**. Secondly, those alternatives that were determined to be feasible were then subjected to a quantitative analysis, including, where applicable, an analysis of the benefits or drawbacks and potential implementation costs (see **Section E.1.3**).

Exhibit E-1 Abatement Alternatives Evaluation Process



Source: Landrum & Brown, 2021.

E.1.1 Previously Recommended Abatement Measures

This section provides a review of the abatement measures that were recommended in the 1997 DLH NCP. Provided for each measure is a description, the current status, and the recommendation for this NCP Update. Measures are either recommended to be continued, or recommended to be continued for further study.

Measure A-1

Description: An individual within Air Traffic Control (ATC), Minnesota air National Guard (MnANG) or the Airport management should continue to be designated with the responsibility for documenting and responding to all noise complaints. Quick response to public concerns may prevent future problems through the simple application of open communications. The current procedure should be reviewed, modified if necessary, and be continued. If circumstances create a significant number of noise complaints, as identified by keeping appropriate logs of complaints and the areas from which they are received, the following recommendation (Measure A-2) should be implemented as soon as practicable.

Status: Implemented per 1997 NCP

Recommendation: Recommended to be continued under Program Management Measures

Note: Although this Measure A-1 is listed as an abatement measure, it is actually a program management measure and is discussed further in **Chapter 4, Noise Compatibility Program**. Although previously approved, it is recommended that it be addressed under the program management measures.

Measure A-2

Description: The airport should develop a contingency plan for the rapid creation of a Community Noise Abatement Committee. Representation should include, but not necessarily be limited to; Duluth Airport Authority (DAA) staff, ATC, MnANG, airlines (including cargo operators), Fixed Base Operators (FBO), officials of neighboring governmental entities, and representatives from impacted neighborhoods. Meeting place, frequency of meetings, and meeting format should be established pending possible modifications as meetings actually begin.

Status: Not Implemented per 1997 NCP

Recommendation: Recommended for further study under Program Management Measures

Note: Although this Measure A-2 is listed as an abatement measure, it is actually a program management measure and is discussed further in **Chapter 4, Noise Compatibility Program**.

Measure A-3

Description: The existing Letter of Agreement between ATC and MnANG should be amended to preclude overflights of Pike Lake, whenever feasible. Although this area is outside of the 65 DNL contour, it is a particularly noise sensitive area and source of noise complaints.

Status: Implemented per 1997 NCP

Recommendation: Recommended to be continued but previously approved. It would only benefit areas outside the 65 DNL, no further analysis is required.

Measure A-4

Description: The existing policy of the local ATC personnel to disburse traffic to various areas should continue. The continuation of Measure A-1 will allow ATC to keep up to date on possible new areas of noise sensitivity.

Status: Implemented per 1997 NCP

Recommendation: Recommended to be continued but previously approved. It would only benefit areas outside the 65 DNL, no further analysis is required.

Measure A-5

Description: An Environmental Assessment (EA) should be commissioned as soon as possible to explore the feasibility of extending Runway 03/21 to a length adequate to accommodate F-16 operations. The final runway length is anticipated to be 8,000 feet, plus a possible paved or stabilized overrun. The MnANG has indicated their support in pursuing this approach as it may be possible to accomplish significant noise reductions.

Status: Not Implemented

Recommendation: Recommended to be continued for further analysis.

E.1.2 Screening of Potential Abatement Alternatives

This section summarizes the qualitative screening analysis of modified or potential new noise abatement measures. **Table E-1, Abatement Alternatives Screening Analysis Summary** presents a summary of the screening of the abatement alternatives. The "Evaluation and Recommendation" column provides a brief synopsis of the issues and findings associated with each alternative and notes whether the alternative was recommended for further analysis. Those alternatives that were determined to warrant further analysis are discussed in greater detail in **Section 1.1.3**.

The abatement alternatives that were evaluated for this NCP were as follows:

- Modification of arrival and departure flight routes
- Increase 03/21 runway utilization for commercial traffic
- Develop new approach and departure procedures
- Extension of Runway 03/21
- Construct sound barriers
- Implement airport operations restrictions

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Table E-1 Abatement Alternatives Screening Analysis Summary

DESCRIPTION	BENEFITS	DRAWBACKS	EVALUATION AND RECOMMENDATION
FLIGHT ROUTING MODIFICATIONS			
Modify arrival and departure flight tracks to reduce noise within the 65 DNL noise contour	Could reduce noise levels for the areas both inside and outside of the 65 DNL contour.	Due to the impacted homes location, modifying flight tracks would likely have little to no benefit for impacted homes within the 65 DNL.	This measure has the potential to provide benefits to the homes only outside the 65 DNL noise contour. These measures were previously approved in the 1997 NCP, but are NOT RECOMMENDED to be continued for further analysis. Measure A-3 and A-4 from the 1997 NCP outlines these previous recommendations.
RUNWAY USE MODIFICATIONS			
Increase usage of Runway 03/21 for commercial traffic	Could reduce noise levels for the areas outside of the 65 DNL noise contour.	Due to the impacted homes location, modifying the frequency Runway 03/21 is utilized for commercial traffic would likely have little to no benefit for impacted homes.	Due to the inability to provide benefits to the homes impacted within the 65 DNL noise contour this alternative is NOT RECOMMENDED for further analysis.
AIRCRAFT OPERATIONAL PROCEDURE MODIFICATIONS			
Develop and implement Optimized Profile Descent (OPD) Approach procedures	Implementing OPD procedures (previously known as continuous descent approach [CDA]) have been used at some airports to reduce approach noise at a distance from the airport. Generally, their most notable effect relates to reduced fuel burn and corresponding air emissions.	Potential noise reduction benefits would be limited to areas outside DNL 65 dBA. Due to the impacted homes location, implementing OPD's would likely have little to no benefit for impacted homes.	Due to the inability to provide benefits to the homes impacted within the 65 DNL noise contour this alternative is NOT RECOMMENDED for further analysis.
Develop and implement Distant Noise Abatement Departure Profiles (NADP)	Implementing Distant NADP's can potentially reduce noise for areas further away from the runway end (greater than three miles).	Distant NADP's can potentially increase noise for areas closer to the runway end. Due to the impacted homes location, implementing Distant NADP's would likely have little to no benefit for impacted homes.	Due to the inability to provide benefits to the homes impacted within the 65 DNL noise contour this alternative is NOT RECOMMENDED for further analysis.
Develop and implement Close-in Noise Abatement Departure Profiles (NADP)	Implementing Close-in NADP's can potentially reduce noise for areas in close proximity to the runway end (less than three miles).	Close-in NADPs can potentially increase noise for areas farther away from the runway end. Due to the impacted homes location, implementing Close-in NADP's would likely have little to no benefit for impacted homes.	Due to the inability to provide benefits to the homes impacted within the 65 DNL noise contour this alternative is NOT RECOMMENDED for further analysis.

DESCRIPTION	BENEFITS	DRAWBACKS	EVALUATION AND RECOMMENDATION
AIRPORT FACILITY MODIFICATIONS			
Extend Runway 03/21 length	Would reduce noise levels for impacted homes and mobile homes that are impacted from lateral noise originating from Runway 09/27 departure and arrival operations.	New residential areas to the South of Runway End 03 and North of Runway End 21 would experience increased noise exposure. There would be significant cost associated with the extension to Runway 03/21, however this cost could be offset by AIP funding if awarded.	This measure has the potential to provide benefits to the homes impacted in the 65 DNL noise contour. This measure was previously approved in the 1997 NCP, so this alternative is RECOMMENDED to be continued for further analysis. Measure A-5 from the 1997 NCP outlined the earlier recommendation.
Construct sound barrier along exterior of Airport property near impacted areas	Could attenuate some noise from operations on Runway 09/27 for homes directly adjacent to the sound barrier.	Depending on the parameters of the sound barrier (limited due to FAA height restrictions) there would be minimal reductions for impacted homes. There would be cost incurred to construct each sound barrier.	Due to the inability to provide benefits to the homes impacted within the 65 DNL noise contour this alternative is NOT RECOMMENDED for further analysis.
AIRPORT REGULATIONS AND FACILITY RESTRICTIONS			
Implement Airport Operational Restrictions (Part 161 Restrictions) such as: noise-/time-based landing fees, airport capacity restrictions based on relative "noisiness", aircraft type restrictions based on "noisiness"	Can resolve noise annoyance issues with certain loud aircraft events or aircraft types operating at DLH.	Such restrictions would be subject to the costly and time-consuming analytical requirements under 14 CFR Part 161. The FAA has never officially approved such measures.	Restrictions on access to an airport are measures of last resort for use in the most extreme cases of noise impact. This alternative is NOT RECOMMENDED for further analysis.

Source: Landrum & Brown analysis, 2021.

E.1.3 Analysis of Potential Abatement Alternatives

The qualitative analysis described in Section 1.1.2 identified one (1) potential new measure that is recommended for continued evaluation. The extension to Runway 03/21 was evaluated for benefits associated with impacted homes located within the 65+ DNL noise exposure contour and associated cost to implement.

The following information is provided for the alternative measure:

- **Title:** includes a brief descriptive title of the measure.
- **Category:** provides the category of each abatement alternative (runway use modification, flight routing modification, airport regulations and facility restrictions, aircraft operational procedure modification, or airport facility modification).
- **Background and Intent:** includes the intent of the measure as a means to abate noise impacts, and the background and setting to which the measure relates where applicable.
- **Benefits:** includes a statement of how the measure would provide noise mitigation benefits.
- **Drawbacks:** identifies any potential negative consequences of implementing the measure.
- **Cost to Implement:** identifies the potential cost to implement each measure.
- **Evaluation Method:** provides the method by which the measure was evaluated.
- **Findings and Recommendations:** provides a recommendation as to whether or not to carry forward the alternative for further analysis and consideration. In some cases, alternatives had drawbacks that made that alternative unfeasible or they did not provide measurable benefits and therefore no further consideration was warranted. Those alternatives that showed potential benefits were continued for further analysis, including further discussion with parties responsible for implementation (FAA, DAA, airport users) and presented to the public for input and comment. Alternatives that are recommended for inclusion in this NCP are included in **Chapter 4, Noise Compatibility Program**.

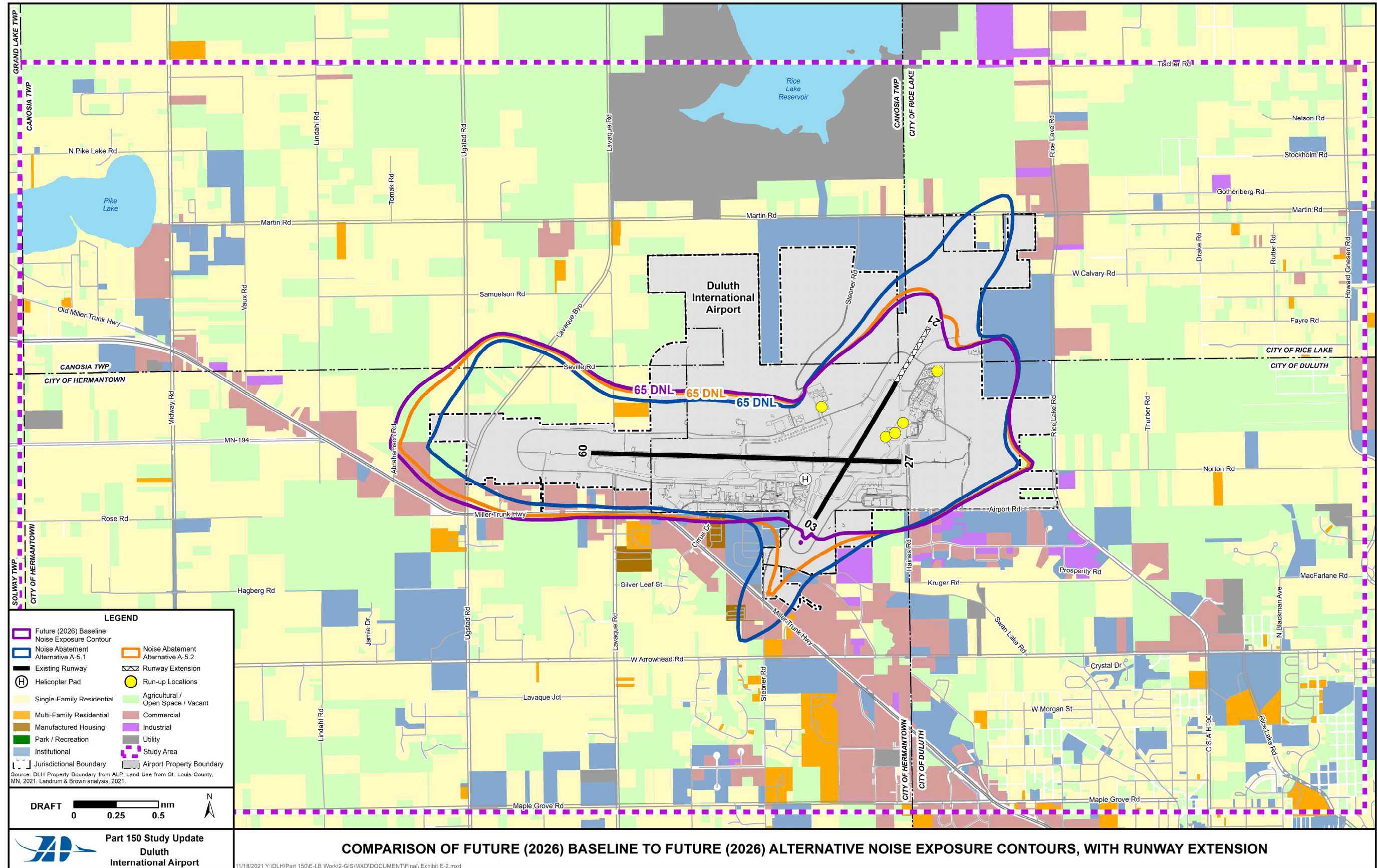
Noise Compatibility Program - Abatement Alternative A-5

TITLE:	Extension of Runway 03/21
CATEGORY:	Airport Facility Modifications
BACKGROUND AND INTENT:	Due to the current length of Runway 03/21 (5,719 ft.), the runway cannot accommodate arrivals or departures from aircraft that routinely operate at DLH. The final runway length is anticipated to be 8,000 ft., at this length all aircraft that currently operate at DLH could utilize the runway for arrival and departure operations when weather and operating conditions allow.
BENEFITS:	Allowing additional operations to utilize Runway 03/21 would reduce noise levels for impacted homes and mobile homes that are impacted from lateral noise originating from Runway 09/27 departure and arrival operations. Could provide additional abatement to homes located west of the Airport inside the 65 DNL noise exposure contour.
DRAWBACKS:	New residential areas to the south of Runway End 03 and north of Runway End 21 would experience increased noise exposure levels due to new arrival and departure traffic utilizing Runway 03/21. There would be significant cost associated with the extension to Runway 03/21, however this cost could be offset by AIP or DOD funding if awarded.
COST TO IMPLEMENT:	\$30,000,000

<p>EVALUATION METHOD:</p>	<p>Exhibit E-2, Comparison of Future (2026) Baseline to Future (2026) Alternative Noise Exposure Contours, with Runway Extension, shows the Future (2026) Alternative noise contour based on anticipated runway utilization if Runway 03/21 were extended to its final anticipated length of 8,000 ft. Two (2) Future (2026) Alternative noise exposure contours were modeled. The Future (2026) Baseline condition assumes 80% of F-16 arrival and departure operations utilize Runway 27 while 20% utilize Runway 09.</p> <ul style="list-style-type: none"> ▪ Alternative A-5.1: assumes a 20% shift in arrival and departure operations from Runway 27 (65%) and Runway 09 (15%) to Runways 03 (10%) and 21 (10%). Alternative A-5.1 assumes that no F-16 departure operations (0%) would occur on Runway 03/21 during nighttime hours (10:00 p.m. – 6:59 a.m.). ▪ Alternative A-5.2: assumes the use of arresting gear on the north end of Runway 03/21 only, limiting F-16 operations the ability to only utilize Runway End 21 for arrival and departure operations. Alternative A-5.2 assumes 10% operations on Runway 21 (0% at night). <p>The runway use changes are summarized in Table E-2, Future (2026) Baseline and Alternative Runway Use with Runway Extension (F-16 Runway Use Only) presents the assumed F-16 runway utilization for each of the previously described alternatives.</p> <p>Table E-3, Comparison of Future (2026) Baseline to Future (2026) Alternative Population and Housing Impacts, with Runway Extension, shows the comparison in housing and population impacts between the Future (2026) Baseline and the Future (2026) Alternative noise contours.</p>
<p>FINDINGS AND RECOMMENDATIONS:</p>	<p>This alternative would only provide limited relief to between 11 and 14 single-family or mobile home properties at a cost of \$30,000,000. As a result, this alternative is NOT RECOMMENDED for the purposes of noise abatement and inclusion in the NCP. While not a recommended measure for noise abatement a runway extension to 03/21 could be pursued by the DAA, MnANG or FAA in order to meet ongoing or future needs. An EA or EIS would be conducted to determine the environmental impacts, including noise, due to the extension of the runway.</p>

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Exhibit E-2 Comparison of Future (2026) Baseline to Future (2026) Alternative Noise Exposure Contours, with Runway Extension



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Table E-2 Future (2026) Baseline and Alternative F-16 Runway Use with Runway Extension

Runway End (Arrivals & Departures)	Baseline (%)	Alternative A-5.1 (%) ⁽¹⁾	Alternative A-5.2 (%) ⁽¹⁾
09	20	15	20
27	80	65	70
03	0	10	0
21	0	10	10

Notes: (1) Assumes 0% nighttime F-16 operations on Runway 03/21 (10:00 p.m. – 6:59 a.m.)
 Source: Landrum & Brown analysis, 2021.

Table E-3 Comparison of Future (2026) Baseline to Future (2026) Alternative Population and Housing Impacts, with Runway Extension

FUTURE (2026) DNL NOISE CONTOUR (65+)				
Housing Type	Units	Difference from Baseline	Population	Difference from Baseline
BASELINE (0% F-16 operations on Runway 03/21)				
Single-Family	45	--	93	--
Multi-Family	2	--	4	--
Mobile Homes	33	--	62	--
ALTERNATIVE A-5.1 (20% F-16 operations on Runway 03/21 & 0% night operations)				
Single-Family	30	-15	62	-31
Multi-Family	2	0	4	0
Mobile Homes	26	-7	49	-13
ALTERNATIVE A-5.2 (10% F-16 operations on Runway 21 only & 0% night operations)				
Single-Family	37	-8	77	-16
Multi-Family	2	0	4	0
Mobile Homes	31	-2	58	-4

Notes: Population numbers are estimated based on the housing counts multiplied by the average household size from the 2000 Census.

Housing counts are based on field verification and Saint Louis County Assessors data:
<https://www.stlouiscountymn.gov/departments-a-z/assessor/property-information>

Source: Landrum & Brown analysis, 2021.

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