FAR PART 150 NOISE COMPATIBILITY STUDY

MILWAUKEE COUNTY'S

GENERAL

MITCHELL

INTERNATIONAL AIRPORT

G. ABATEMENT ALTERNATIVES EVALUATION (PART ONE)

Abatement Alternatives Evaluation (Part One)

Introduction

From the range of potential operational and facility alternatives presented in the previous chapter, and from suggestions made by the public, the following preliminarily operational alternatives have been determined to be appropriate for review when developing noise abatement measures for General Mitchell International Airport. It is recommended that these operational alternatives be evaluated for the contribution each would make to noise abatement. These "Part One" alternatives are the first set to be evaluated in the FAR Part 150 Noise Compatibility Study. As additional alternatives are developed, they will be evaluated in subsequent chapters. Some alternatives may be similar in nature and design to alternatives presented in this chapter, but, through the Committee process, they may be changed or combined.

After these Part One alternatives have been reviewed by and discussed with the Study Advisory Committee, it is anticipated that additional alternatives will be recommended by the Committee for further analysis and evaluation. The Part One alternatives are all similar in nature; as such, the methodology and analysis for these alternatives are similar. Additional alternatives for review will consist of suggestions from Airport staff and the Committee. The ground-based noise alternatives analysis incorporates additional noise monitoring data acquired during a supplemental noise monitoring survey. Land use and administrative alternatives will be evaluated after the operational and facility alternatives have been refined.

Listed below are the Part One Aircraft Operation Alternatives that have been selected for initial review and analysis. These alternatives consist of modifications to existing flight tracks, as well as an on-airport operational modification. The alternatives are not listed in terms of priority and are only to be considered as initial feasible alternatives that will be further refined and combined, which will result in final recommendations. It is anticipated and encouraged that additional alternatives be recommended by the Committee for evaluation. The term Flight Management System (FMS) will be used generically to include a wide variety of satellite based navigation systems.

Aircraft Operational Alternatives - Flight Track Changes

Alternative 1	Develop FMS departure procedures for Runway 19R (South departures).
Alternative 2	Develop FMS departure procedures for Runway 7R (East departures, no jet aircraft turns until reaching shore).
Alternative 3	Develop FMS departure procedures for Runway 1L (North departures).
Alternative 4	Develop FMS departure procedures for Runway 25L (West departures).
Alternative 5	Evaluate altitudes of turbo-prop departures.
Alternative 6	Develop procedures to reduce early turns on approach for turbo-prop aircraft.
Alternative 7	Evaluate close-in and distant departure procedures.

Aircraft Operational Alternatives - On-Airport Changes

Alternative 8	Evaluate intersection departures for south-bound aircraft at night.
Alternative 9	Develop ground-based noise alternatives.
Alternative 10	Provide additional high-speed taxiways to reduce use of reverse thrust on landing.

Noise Analysis Methodology

In order to evaluate and differentiate the noise abatement alternatives, multiple noise metrics are presented for each. These metrics include the FAA mandated DNL, as well as supplemental noise metrics to better understand the character of the noise and how that noise may change with the implementation of a specific alternative. The DNL metric information is presented in graphic and tabular format and the supplemental metrics are presented in tabular format. As discussed previously, all of the analysis is based upon year 2009 future conditions (five years in the future from existing base year conditions). The noise metrics analyzed within this study include:

DNL Noise Contour Analysis. DNL noise contours have been developed for selected alternatives to graphically depict areas exposed to specific DNL noise levels. The comparison of noise contours for various alternatives illustrates how the contour may change in size and area relative to each other. The DNL noise contours are presented in terms of the 65, 70, and 75 DNL noise value. These contours are the average annual DNL noise level.

Representative Receptor Analysis. This allows for a direct comparison of how noise levels may change in different neighborhoods. The Representative Receptor locations are a grid of points on the ground surrounding each quadrant around the Airport where noise levels may experience a change. The effectiveness of the alternatives is not always measurable by DNL standards; therefore, Time Above, Number of Events Above, and Single Event analysis are included for noise receptor locations around the Airport.

The representative receptor grid locations are presented in Figure G17. The grid results tables are in Tables G5 through G10. Grids were drawn on the four quadrants of the Airport covering areas where aircraft fly. Each alternative has an associated table that shows how the noise changes at each of the chosen grid points. Existing and future noise levels for any location can be approximated by plotting a location within the grid.

The following noise metrics will be determined at each grid point for each alternative under consideration:

> DNL Analysis. Tables and graphics present the DNL, which is the annual average noise level, at the representative locations.
>
> Time Above Analysis. Tables presenting the Time Above noise level depict the number of minutes per day that the noise is greater than 65 dBA at each of the representative locations.
>
> Number of Events Above Analysis. Tables present the Number of Events Above noise level, which is the number of events per day that the noise is greater than 65 dBA at each of the representative locations.
>
> Single Event Analysis. For Alternative 7, a table presenting the Single Event noise level (SEL) at the representative locations, using the departure of an MD83 aircraft as a representative loud aircraft.

Alternatives Analysis

The following sections of this chapter provide a detailed analysis for each Part One alternative. The analysis describes the noise goal of the alternative, a description of the alternative, how it varies from existing procedures, and what potential change in noise may result from implementation of the alternative.

Alternative 1
Develop Satellite Based Departure Procedures for Runway 19R
(South Flow Departures)

Goal:

The goal of this alternative is to provide for more precise flight paths for aircraft departing to the south on Runway 19R. There are two procedures under consideration in this alternative: one for south departures that turn to the east (Alternative 1A) and the second for south departures that turn to the west (Alternative 1B). This alternative is designed to reduce drift and early turns at lower altitudes. The intent of the alternative is to take advantage of compatible land uses and to concentrate aircraft close-in to the Airport over the compatible land use and then disperse them farther out from the Airport.

Description:

Alternatives 1A and 1B use FMS technology, which allows aircraft to fly a more precise path than is possible with current vectoring procedures. With FMS, flight paths are more concentrated and deviate less from the procedure. This allows aircraft flight paths close-in to the Airport to be concentrated and then fan out, or disperse, as they fly farther from the Airport.

An FMS procedure typically consists of a series of three guides: *way points, altitudes,* and *flight heading information*. Way points are known positions on the ground that provide references for aircraft flight. Two types of way points can be part of FMS-based procedures: fly-over and fly-by. The two procedures are described below:

- A fly-over way point is a point on the ground that the aircraft actually flies directly over.
- A fly-by way point is a point on the ground that the FMS computer onboard the aircraft uses as a reference in flying the aircraft through a turn. The aircraft typically flies an equal distance inside that point, both entering and exiting the turn. The turn is not equal for all aircraft and varies with speed.

Alternative 1A— Satellite Based Departure Procedure for Runway 19R, East Destinations.

Existing Procedure:

Commercial jet aircraft departing to the south on Runway 19R, heading to eastern or southeastern destinations, fly runway heading until roughly crossing the departure end of the runway. After the aircraft has passed the departure end of Runway 19R, south and east-bound aircraft are turned approximately 15 degrees to the left (east) of the extended centerline until reaching 3,000 feet above Mean Sea Level (MSL); eastern destinations then turn to the east, while southern destinations continue on this heading. With current navigation technology, aircraft will often turn early and some aircraft will drift more to the east due to weather or natural spread associated with existing navigation technology.

New Procedure:

The FMS computer would direct jet aircraft to fly runway heading until it reaches approximately one-half mile past the runway end. Then, the computer would change the aircraft heading to approximately 15 degrees left (east) of the extended runway centerline. The FMS flight path would have way points to guide the aircraft more precisely on the flight track. The FMS flight path would essentially be the same flight path that is flown today, but with new technology providing a more precise departure path with less spread and drift. Once the aircraft has cleared 3,000 feet above MSL, it would turn on course as is done today. Figure G1, *Alternatives 1A & 1B Runway 19R Jet Departure Flight Tracks*, shows the new FMS flight path overlaid on the existing flight tracks.

New Procedure Noise Analysis:

Figure G2, *Comparison of Alternative 1A, FMS South DNL Contour and 2009 Base Case DNL Contour*, shows the 65, 70, and 75 DNL noise contours associated with this alternative compared with the 2009 Base Case DNL noise contours. The Base Case contours are shown with a solid line; changes to the Base Case 2009 contour due to the alternative are shown as a dashed line. The land use and population changes associated with this alternative, compared to the future Base Case contour, are shown in Table G4, at the end of this chapter.

Alternative 1A could be used by 80 percent of the existing commercial jet aircraft fleet operating at General Mitchell International Airport. Military aircraft, older hush-kit aircraft, turbo-prop, and general aviation aircraft are not equipped to fly FMS procedures; as such, these aircraft would continue to fly their existing flight procedures. This alternative would reduce the eastern drift and the number of early turns by turbojet aircraft, thus reducing DNL noise levels by up to 2.9 DNL southeast of the Airport. The number of people in the 65 DNL that have not previously received sound insulation would be reduced by one. The Number of Events above 65 dBA metric would be reduced by 10.9 per day in the area southeast of the Airport and increased by 18.8 per day in the area directly south of the Airport. The Time Above 65 dBA would be decreased by 2.5 minutes per day in areas southeast of the Airport.

Alternative 1B— Satellite Based Departure Procedure for Runway 19R, West Destinations.

Existing Procedure:

Aircraft departing to the south on Runway 19R, heading to western or southwestern destinations, fly runway heading until roughly crossing the departure end of the runway. After the aircraft has passed the departure end of Runway 19R, it is turned approximately 15 degrees to the right (west) of the extended centerline until reaching 3,000 feet above MSL; northwest and west destinations then turn to the west at this point, while southwest destinations continue on this heading. With current navigation technology, aircraft often turn early. Additionally, some aircraft drift more to the west due to weather or natural spread associated with current navigation technology.

New Procedure:

The FMS flight path would be the same flight path that is flown today, but with new technology that provides for a more precise departure path. The FMS computer would direct the aircraft to fly runway heading until it reaches the runway end. Then, the computer would change the aircraft heading to approximately 15 degrees right (west) of the extended runway centerline. The FMS flight path would have way points to guide the aircraft more precisely on the flight track. The way points would be located at positions of change in direction so that they would not be too closely spaced. Figure G1, *Alternatives 1A and 1B Runway 19R Jet Departure Flight Tracks*, shows the new FMS flight path overlaid on the existing flight tracks.

New Procedure Noise Analysis:

Figure G3, *Comparison of Alternative 1B, FMS South DNL Contour and 2009 Base Case DNL Contours*, shows the 65, 70, and 75 DNL noise contours associated with this alternative compared with the 2009 Base Case DNL noise contours. The Base Case contours are shown with a solid line; changes to the Base Case 2009 contour due to the alternative are shown as a dashed line. The land use and population changes associated with this alternative, compared to the future Base Case contour, are shown in Table G4, at the end of this chapter.

Alternative 1B could be used by 80 percent of the existing commercial jet aircraft fleet operating at General Mitchell International Airport. Military aircraft, older hush-kit aircraft, turbo-prop, and general aviation aircraft are not equipped to fly FMS procedures; as such, these aircraft would continue to fly their existing flight procedures. This alternative would reduce the westerly drift and the number of early turns by turbojet aircraft, thereby reducing DNL noise levels by 1.5 DNL close to the Airport with a corresponding increase of 1.5 DNL farther from the Airport. Alternative 1B would not result in a change to the total number of housing units in the 65 DNL; however, this alternative would increase the number of non-compatible housing units in the 65 DNL by seven. Non-compatible housing units include those that have not been previously sound insulated because the houses were either outside the previous program boundaries or inside the previous program boundary and refused sound insulation. The Events Above 65 dBA is decreased by 2.3 events a day in the areas south of the Airport and increased by 9.9 events a day in the areas southwest of the Airport. The Time Above 65 dBA metric is increased by 3.1 minutes per day in the southwest and decreased by 1.6 minutes closer to the Airport.

Difference Compared to Base Case Contour:

Alternative 1A would result in the 65 DNL noise contour expanding south of the Airport, east of Clement Avenue, which is not within the 2009 Base Case 65 DNL noise contour. The 65 DNL associated with Alternative 1A is the same as the 2009 Base Case 65 DNL in all other areas. Alternative 1B would result in the 65 DNL noise contour expanding to just south of Rawson Avenue and east of Howell Avenue. The 65 DNL noise contour is essentially the same as the 65 DNL Base Case contour in all other areas.

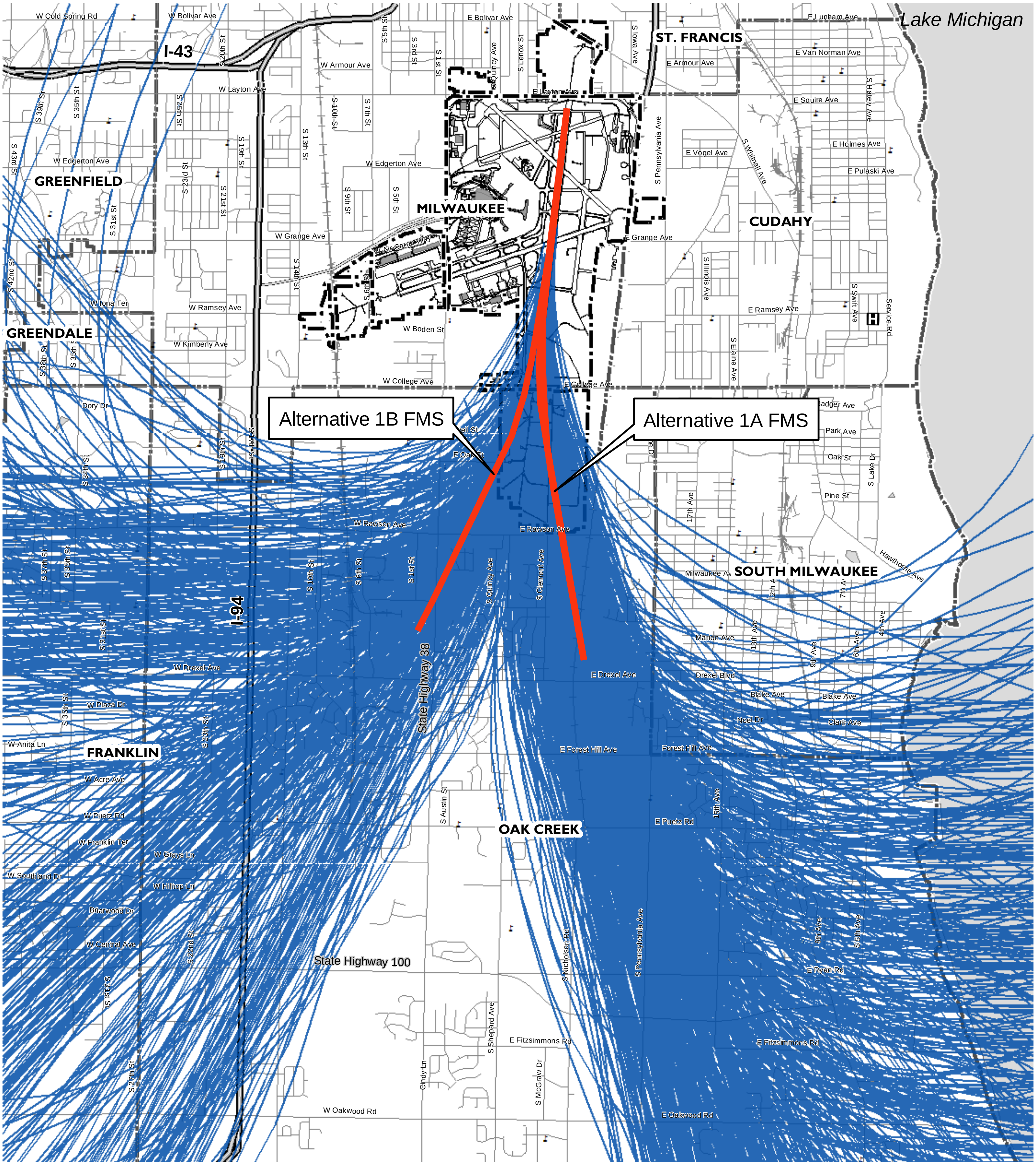

Figure G1 Alt 1A & 1B INM Jet Departure Flight Tracks
Overlaid on Existing Radar Jet Departure Flight Tracks for Runway 19R
(Representative sample of 1,100 jet departures during June 2003)

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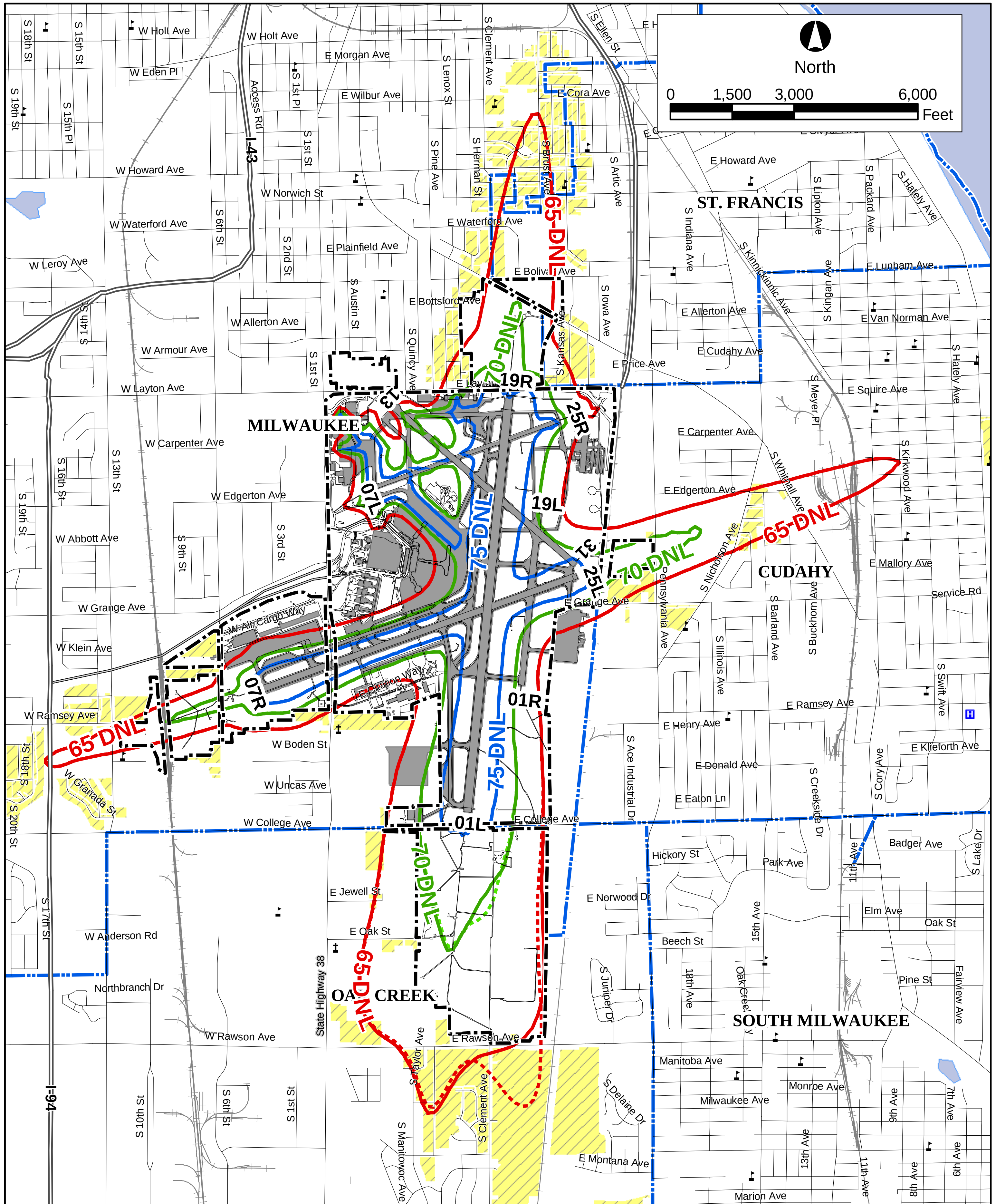
Figure G2
Comparison of
Alternative 1A FMS South DNL Contour &
2009 Base Case DNL Contour



Legend

2009 Base Case

- 65 DNL Contour
- 70 DNL Contour
- 75 DNL Contour

Alternative 1A

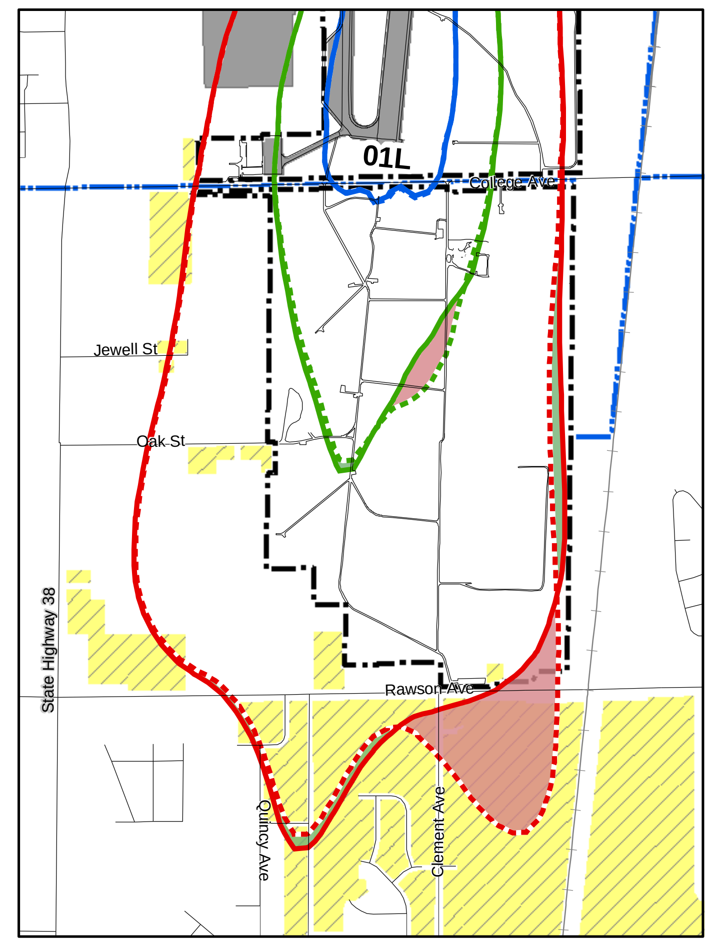
- 65 DNL Contour
- 70 DNL Contour
- 75 DNL Contour
- Phase 1 Program Boundries
- MUNICIPAL BOUNDARY
- AIRPORT BOUNDARY
- hospitals
- schools
- churches

Source: Milwaukee County, 2003

Comparative Analysis

Areas within the limits of this alternative but not within the limits of the 2009 Base Case are shown in red.
65 DNL - Approx. 40 Acres
70 DNL - Approx. 6 Acres

Areas within the limits of the 2009 Base Case but not within the limits this alternative are shown in green.
65 DNL - Approx. 18 Acres
70 DNL - Approx. 3 Acres



Runway End 01L Detail

North

0 1,000 2,000 4,000
Feet

Legend

- Newly affected
- No longer affected

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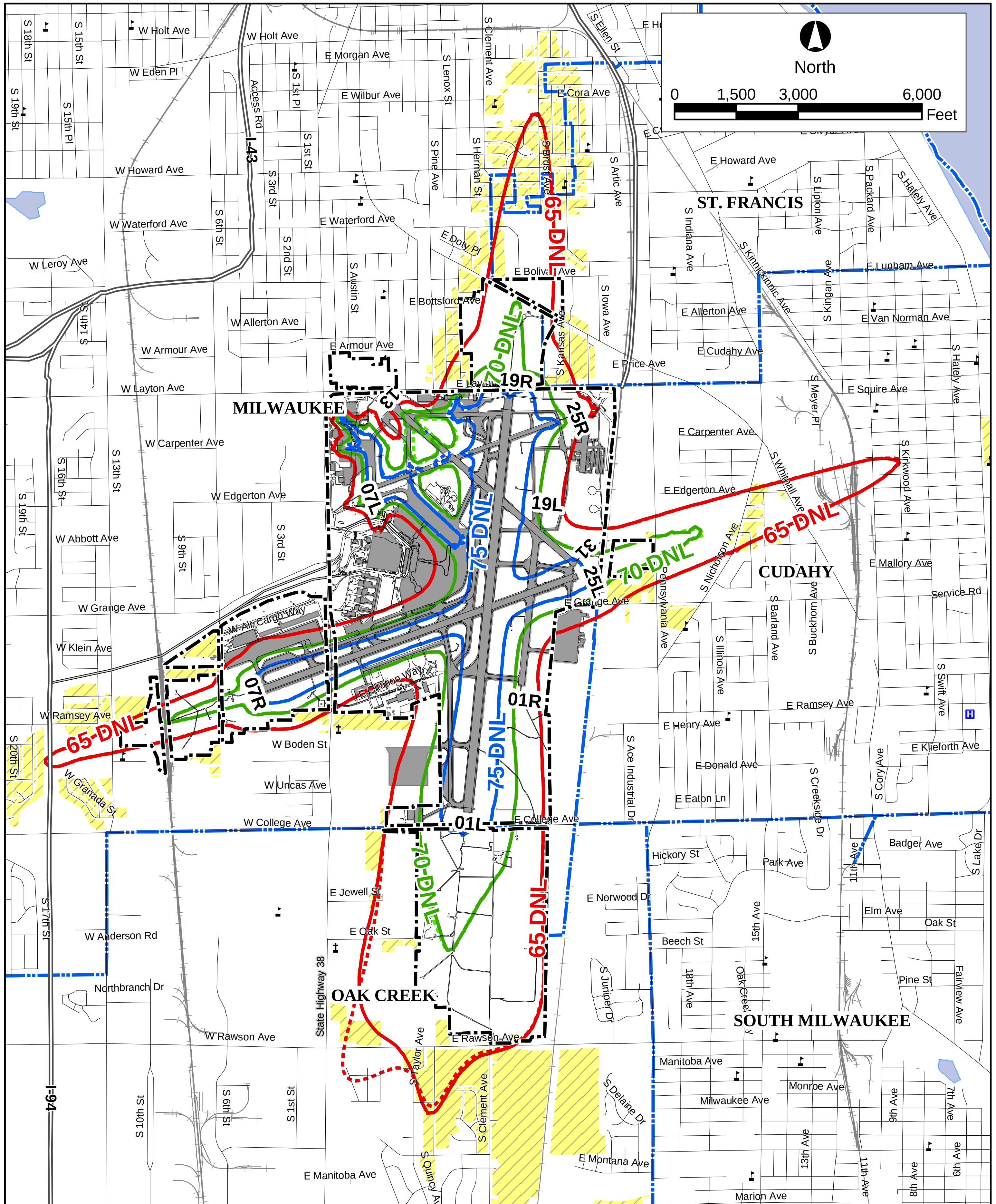


Figure G3

Comparison of Alternative 1B FMS South DNL Contour & 2009 Base Case DNL Contour

Legend

2009 Base Case

- CONTOUR_65-0
- CONTOUR_70-0
- CONTOUR_75-0
- Phase 1 Program Boundries

Alternative 1B

- 65 DNL Contour
- 70 DNL Contour
- 75 DNL Contour

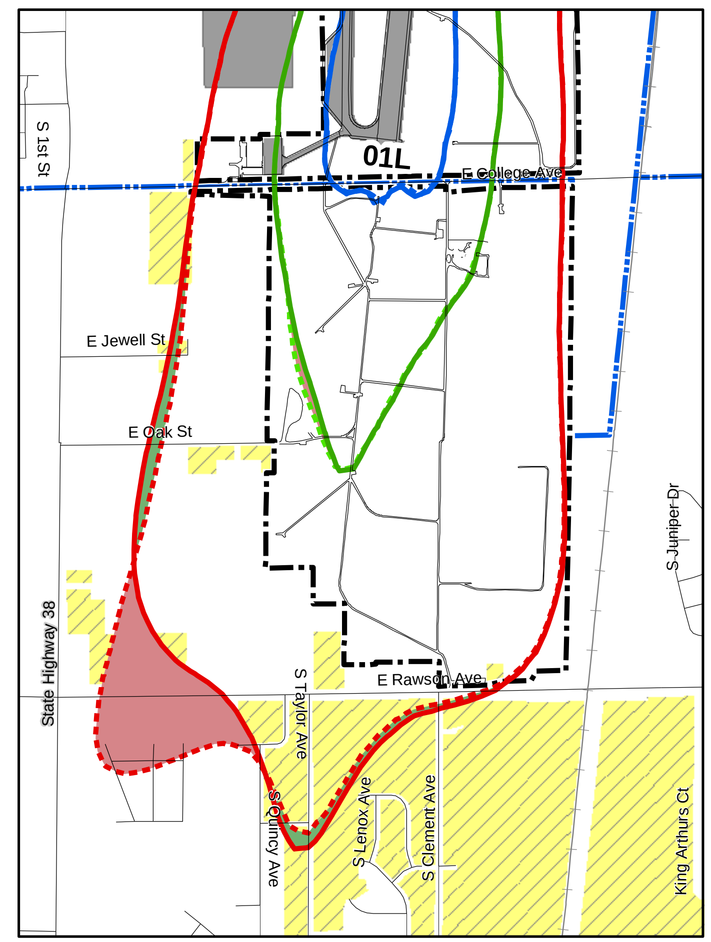
- MUNICIPAL BOUNDARY
- AIRPORT BOUNDARY
- hospitals
- schools
- churches

Source: Milwaukee County, 2003

Comparative Analysis

Areas within the limits of this alternative but not within the limits of the 2009 Base Case are shown in red.
65 DNL - Approx. 38 Acres
70 DNL - Approx. 2 Acres

Areas within the limits of the 2009 Base Case but not within the limits this alternative are shown in green.
65 DNL - Approx. 13 Acres



Runway End 01L Detail

North

0 1,000 2,000 4,000 Feet

Legend

- Newly affected
- No longer affected

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Alternative 2
Develop Satellite Based Departure Procedures for Runway 7R
(East Departures, No Jet Aircraft Turns until Reaching Lake Michigan)

Goal:

This alternative was developed with the goal of reducing early departure turns by jet aircraft before reaching Lake Michigan. The goal of this alternative is to concentrate departures over a small area of compatible land use along the runway centerline, with no jet aircraft turning until reaching Lake Michigan.

Description:

This procedure would create a more defined and narrow flight path using FMS technology to concentrate aircraft flight tracks under the runway centerline. Aircraft would use the existing east-bound flight paths, but would utilize FMS technology to reduce dispersion over non-compatible use areas, such as residential.

Existing Procedures:

Aircraft depart Runway 7R and fly runway heading until reaching 2,000 feet above MSL. At this point, aircraft continue on course or turn left or right to the heading assigned by Air Traffic Control based upon destination.

New Procedure:

Aircraft would depart Runway 7R and fly runway heading using FMS way points until reaching the shoreline. After passing the shoreline, aircraft would continue on course or turn depending upon destination. With this procedure, aircraft would fly a narrower path than possible with the existing procedure. In addition, fewer jet aircraft would turn north or south before reaching the shoreline. Figure G4, *Alternative 2 Runway 7R Jet Departure Flight Tracks*, shows the new FMS flight path overlaid on the existing flight tracks.

New Procedure Noise Analysis:

Figure G5, *Comparison of Alternative 2, FMS East and 2009 Base Case DNL Contours*, shows the 65, 70, and 75 DNL noise contours associated with this alternative compared with the 2009 Base Case DNL noise contours. The Base Case contours are shown with a solid line; changes to the Base Case 2009 contour due to the alternative are shown as a dashed line. The land use and population changes associated with this alternative, compared to the future Base Case contour, are shown in Table G4, at the end of this chapter.

Alternative 2 could be used by 80 percent of the existing commercial jet aircraft fleet operating at General Mitchell International Airport. Military aircraft, older hush-kit aircraft, turbo-prop, and general aviation aircraft are not equipped to fly FMS procedures; as such, these aircraft would continue to fly their existing flight procedures. This alternative reduces the dispersion of the aircraft from the center flight path and reduces the number of early turns by turbojet aircraft. However, the alternative increases the size of the 65 DNL noise contour and the number of housing units and people in the 65 DNL noise contour. The Time Above 65 dBA metric is reduced by 2.4 minutes per day and the Number of Events above 65 dBA is reduced by 7.7 events per day east of the Airport.

Difference Compared to Base Case Contour:

Alternative 2 would result in the 65 DNL noise contour expanding to the east beyond Kirkwood Avenue to just about Somers Avenue, east of the Airport beyond the 2009 Base Case 65 DNL noise contour. The 65 DNL associated with Alternative 2 is the same as the 2009 Base Case 65 DNL in all other areas.

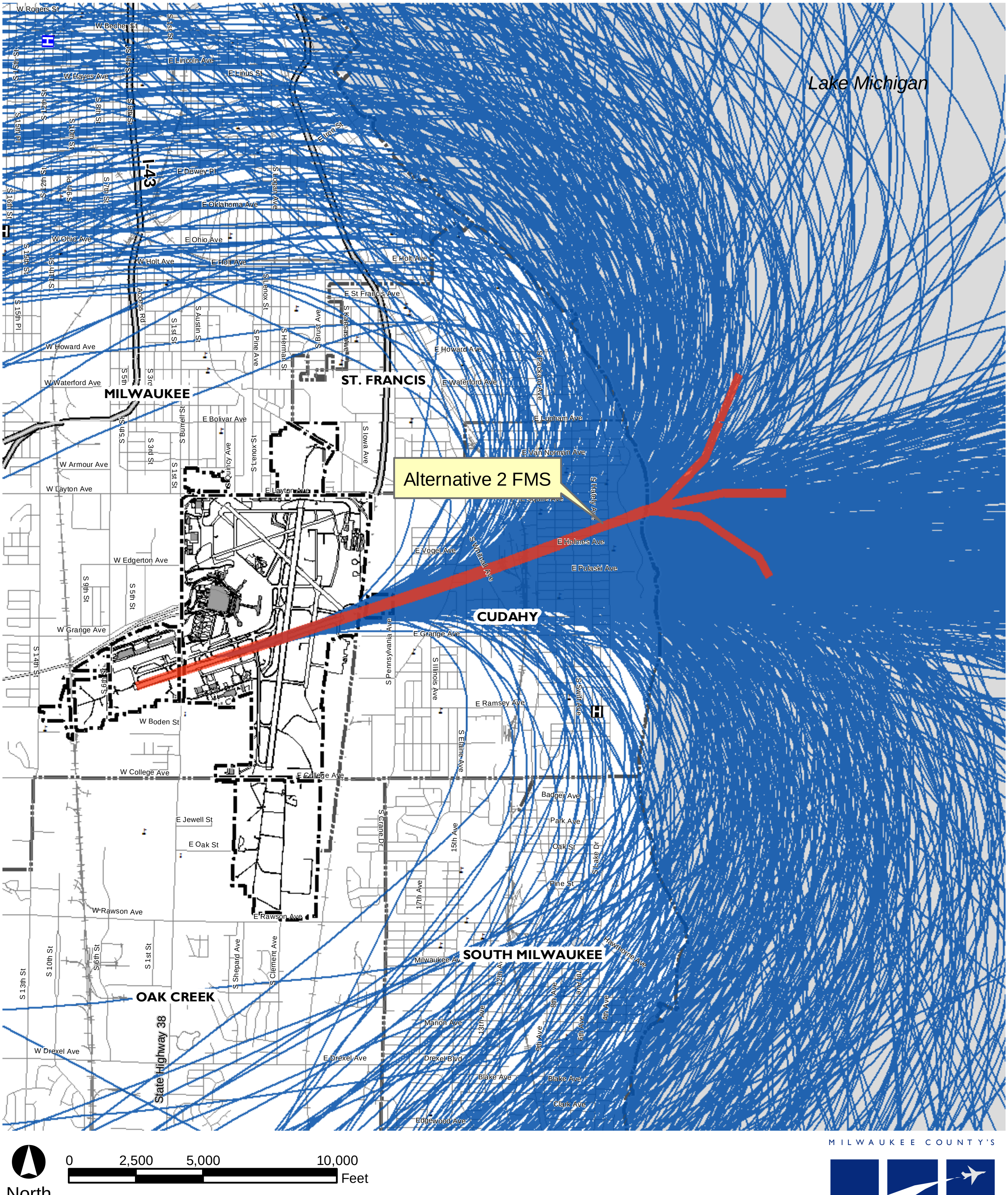

Figure G4 Alternative 2 INM Jet Departure Flight Tracks
Overlaid on Existing Runway 7R Radar Jet Departure Flight Tracks
(Representative sample of 1,200 jet departures during June 2003)

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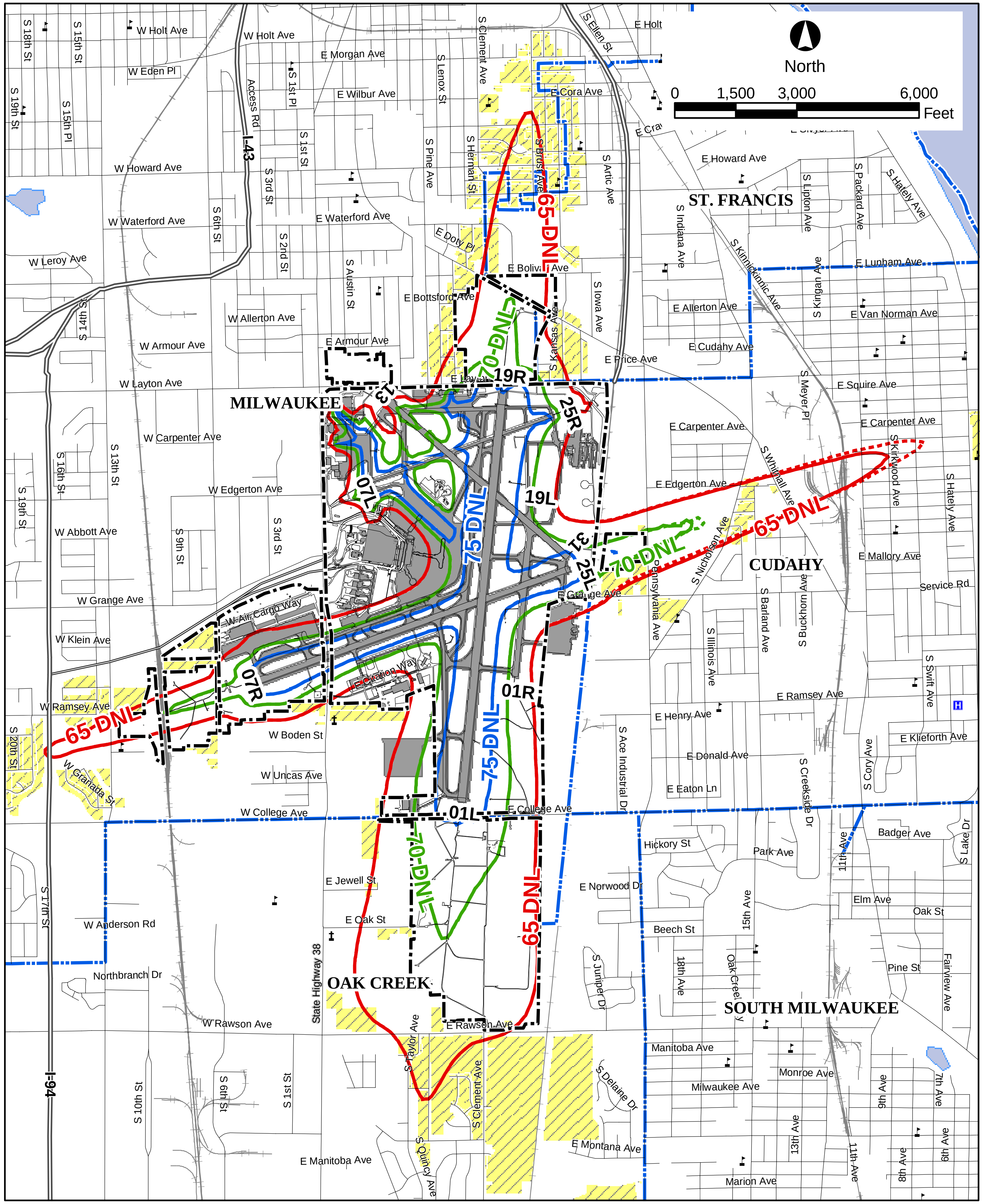


Figure G5

Comparison of
Alternative 2 FMS East DNL Contour &
2009 Base Case DNL Contour

Legend

2009 Base Case

- 65 DNL Contour
- 70 DNL Contour
- 75 DNL Contour

Alternative 2

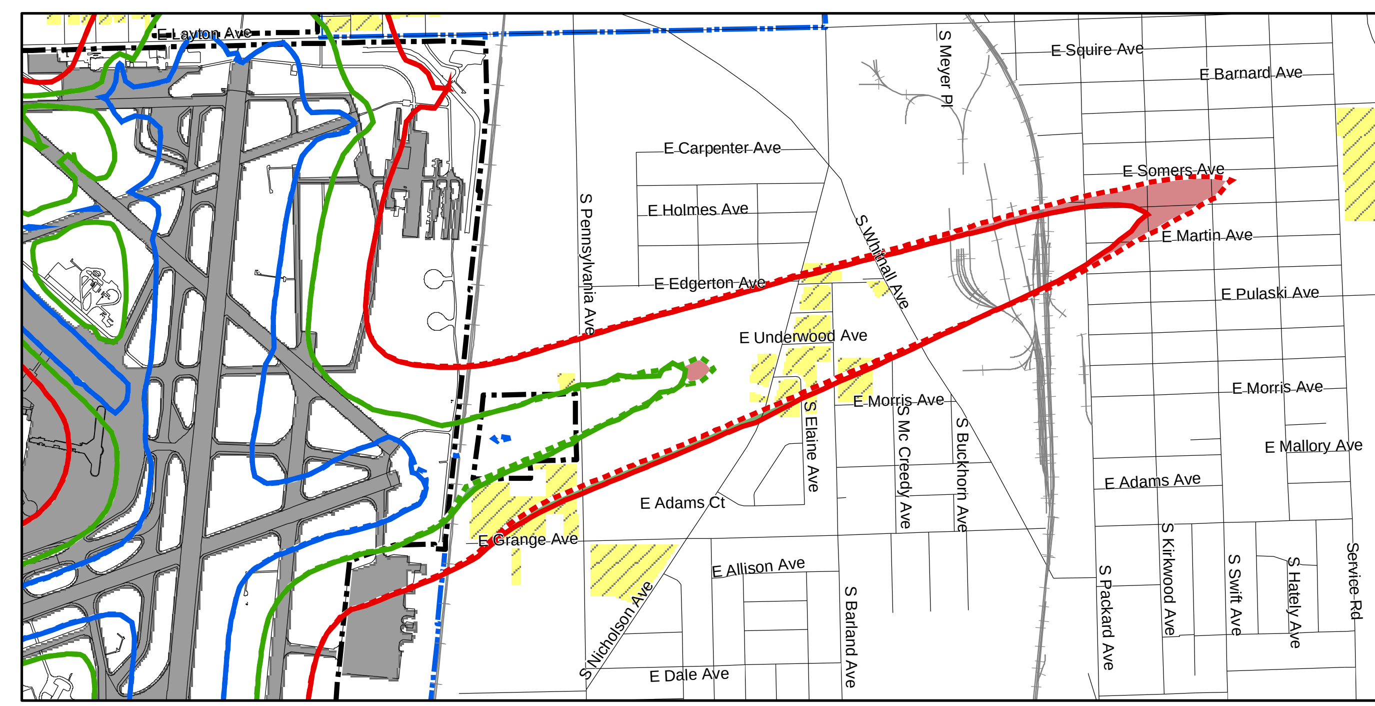
- 65 DNL Contour
- 70 DNL Contour
- 75 DNL Contour
- Phase 1 Program Boundries
- MUNICIPAL BOUNDARY
- AIRPORT BOUNDARY
- hospitals
- schools
- churches

Source: Milwaukee County, 2003

Comparative Analysis

Areas within the limits of this alternative but not within the limits of the 2009 Base Case are shown in red.
65 DNL - Approx. 18 Acres
70 DNL - Approx. 4 Acres

Areas within the limits of the 2009 Base Case but not within the limits this alternative are shown in green.
65 DNL - Approx. 9 Acres
70 DNL - Approx. 3 Acres



Runway End 25 Detail

North

Legend

- Newly affected
- No longer affected

0 1,000 2,000 4,000 Feet

Alternative 3
Develop Satellite Based Departure Procedures for Runway 1L
(North Jet Departures)

Goal:

This alternative was developed with the goal to eliminate "drift" for aircraft departing initially to the north, but then turning east or west. The intent of the alternative is to take advantage of compatible land uses directly north of the Airport. The alternative would concentrate aircraft over the compatible land use close to the Airport and then disperse aircraft flight paths farther out from the Airport.

Description:

This procedure would create a more defined flight path using FMS technology to concentrate aircraft flight tracks over compatible land uses near the Airport. Aircraft would use the existing north-bound flight paths, but would use FMS technology to reduce dispersion over non-compatible use areas. Military aircraft, older hush-kit aircraft, smaller (non-commercial service) turbo-prop, and general aviation aircraft are not equipped with the necessary instruments to fly FMS procedures, and, as such, these aircraft would continue to fly their existing flight paths.

Existing Procedures:

Aircraft depart Runway 1L and fly runway heading until reaching 2,000 feet above MSL. At this point, aircraft continue on course or turn to the heading assigned by Air Traffic Control based upon destination.

New Procedure:

Aircraft would depart Runway 1L and fly runway heading using FMS technology until reaching 2,000 feet above MSL. At this point, aircraft would continue on course or turn left or right, depending upon destination. With this procedure, aircraft would fly a narrower path than what occurs with the existing procedure. In addition, fewer jet aircraft would turn east or west before reaching the minimum altitude goals. The minimum altitude goal before turning on course for the new procedure would be 2,000 feet above MSL. This is similar to the current procedure; but, with the new technology, there is less dispersion, and early turns at altitudes lower than 2,000 feet above MSL are minimized. Figure G6, *Alternative 3 Runway 1L Jet Departure Flight Tracks*, shows the new FMS flight path overlaid on the existing flight tracks.

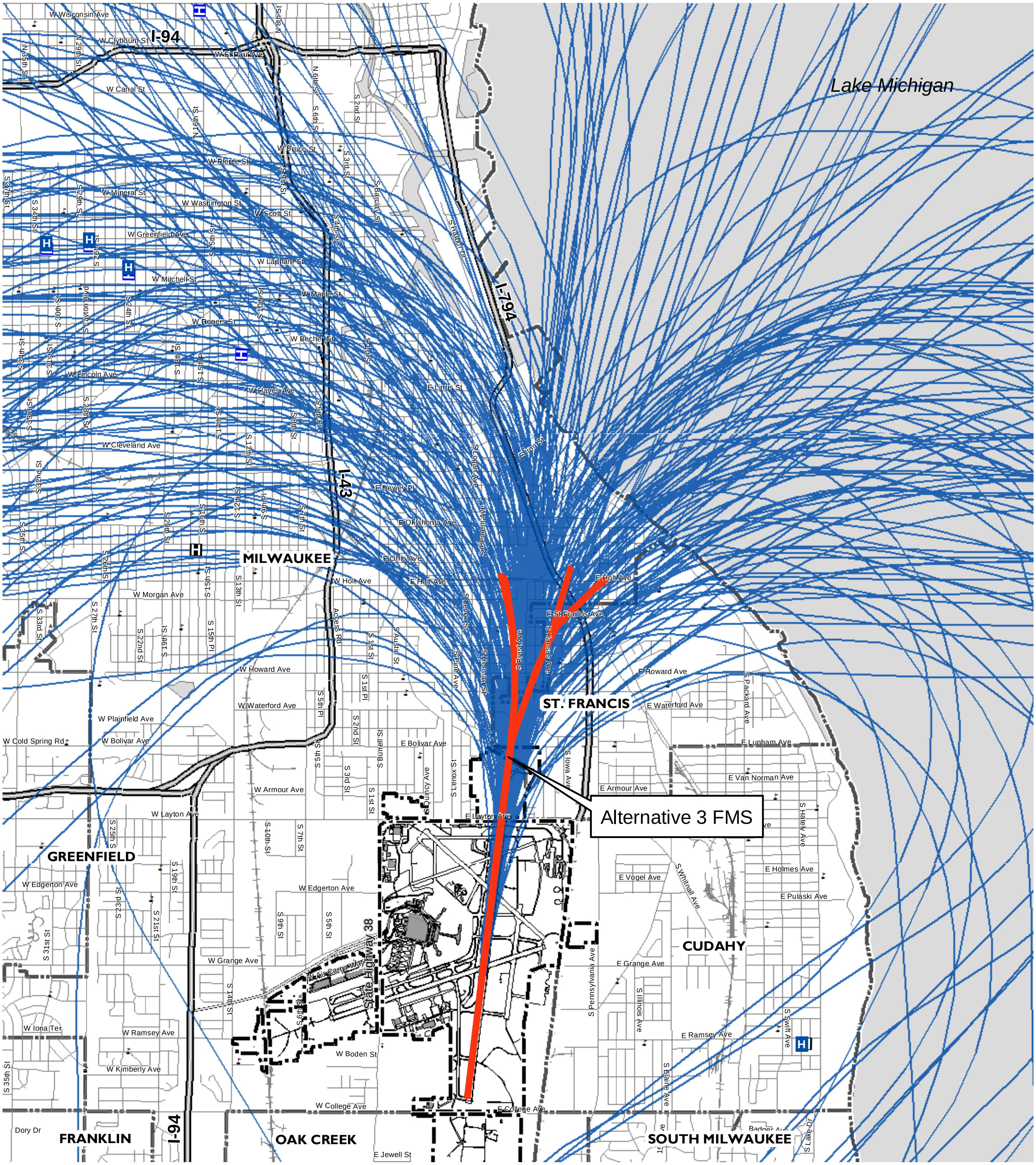
New Procedure Noise Analysis:

Figure G7, *Comparison of Alternative 3, FMS North DNL and 2009 Base Case DNL Contours*, shows the 65, 70, and 75 DNL noise contours associated with this alternative compared with the 2009 Base Case DNL noise contours. The Base Case contours are shown with a solid line; changes to the Base Case 2009 contour due to the alternative are shown as a dashed line. The land use and population changes associated with this alternative, compared to the future Base Case contour, are shown in Table G4, at the end of this chapter.

Alternative 3 could be used by 80 percent of the existing commercial jet aircraft fleet operating at General Mitchell International Airport. Military aircraft, older hush-kit aircraft, turbo-prop, and general aviation aircraft are not equipped to fly FMS procedures; as such, these aircraft would continue to fly their existing flight procedures. This alternative would increase the total number of housing units within the 65 DNL noise contour by 39 when compared to the 2009 Future Base Case contour; however, there would be no increase in non-compatible housing units (i.e. those that have not been sound attenuated). The Time Above metric increases by less than 1 minute per day; the Events Above 65 dBA metric shows an increase of 3.7 events per day northeast of the Airport and a decrease of 4.9 events per day northwest of the Airport.

Difference Compared to Base Case Contour:

Alternative 3 would result in the 65 DNL noise contour expanding north of the Airport beyond Saveland Avenue when compared against the 2009 Base Case 65 DNL noise contour. The 65 DNL associated with Alternative 3 is the same as the 2009 Base Case 65 DNL in all other areas.



0 2,500 5,000 10,000
Feet

North

Figure G6 Alternative 3 INM Jet Departure Flight Tracks
Overlaid on Existing Runway 1L Radar Jet Departure Flight Tracks
(Representative sample of 300 jet departures during June 2003)

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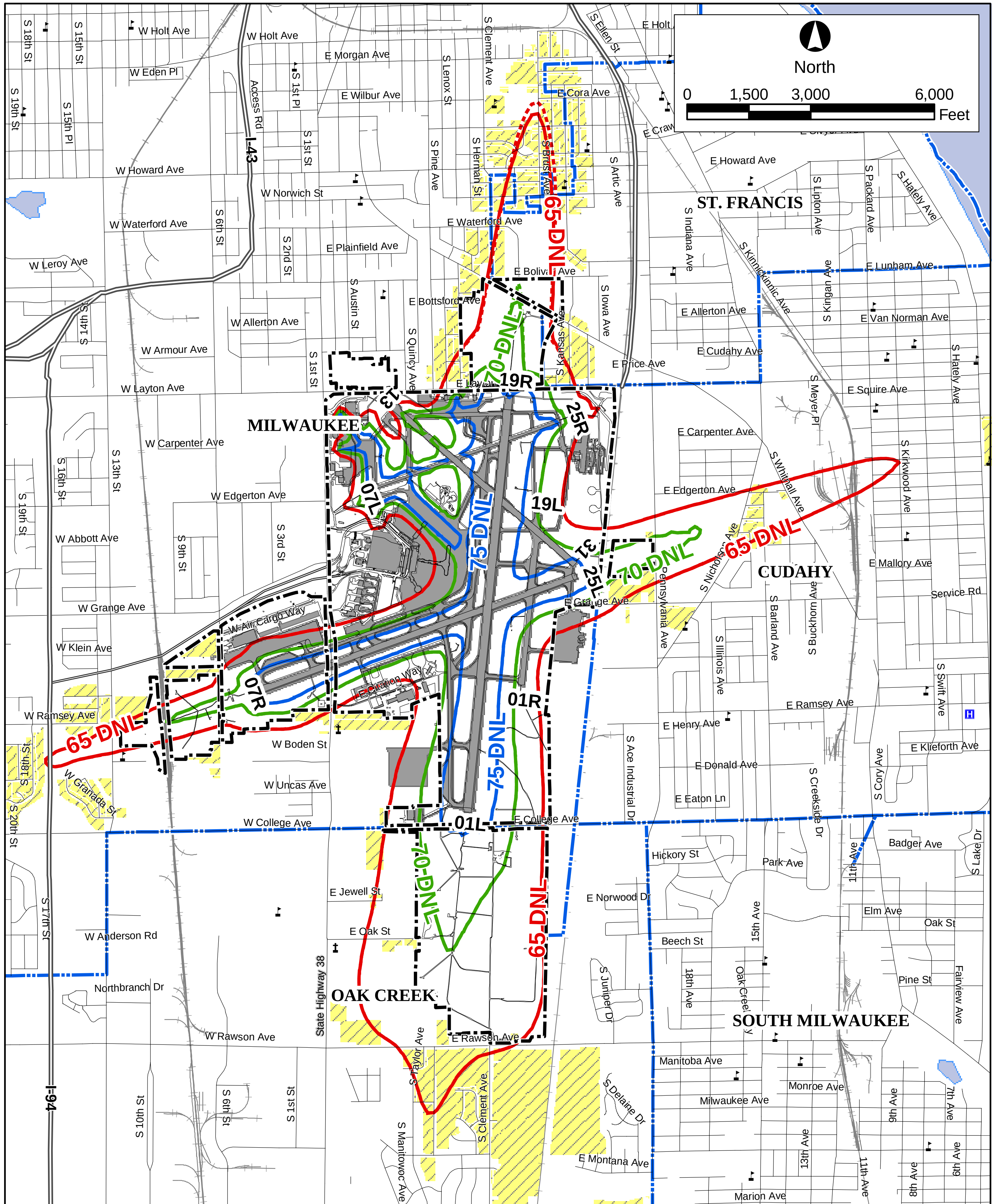

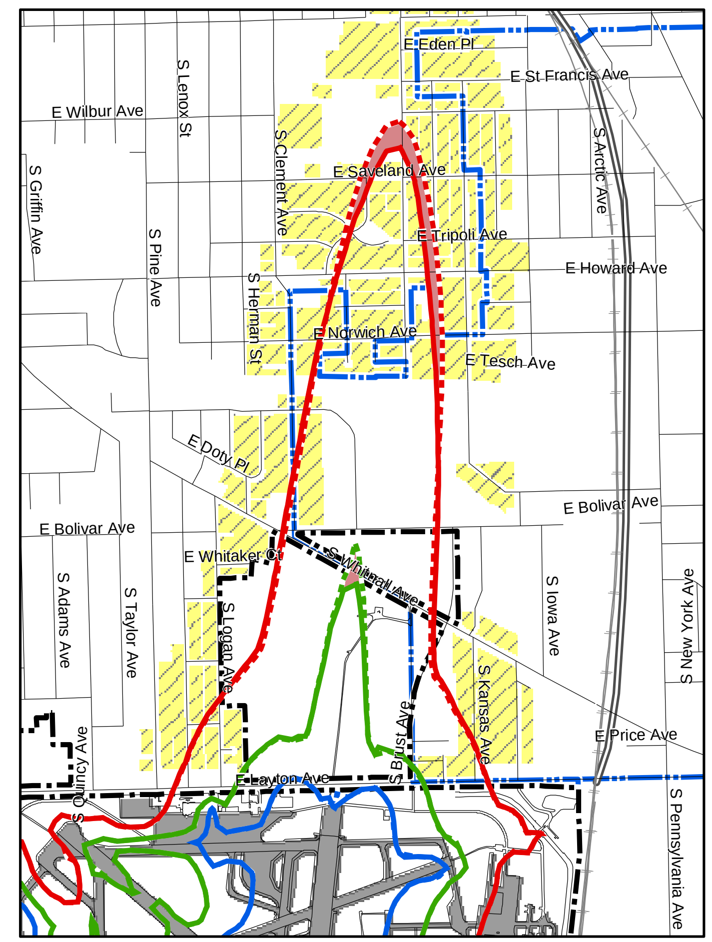

Runway End 19R Detail

North

0 1,000 2,000 4,000 Feet

Legend

Newly affected

No longer affected

Comparative Analysis

Areas within the limits of this alternative but not within the limits of the 2009 Base Case are shown in red.
65 DNL - Approx. 11 Acres
70 DNL - Approx. 2 Acres

Areas within the limits of the 2009 Base Case but not within the limits this alternative are shown in green.
65 DNL - Approx. 4 Acres

Figure G7
Comparison of
Alternative 3 FMS North DNL Contour &
2009 Base Case DNL Contour

Legend

2009 Base Case

65 DNL Contour
70 DNL Contour
75 DNL Contour

Alternative 3

65 DNL Contour
70 DNL Contour
75 DNL Contour

Phase 1 Program Boundries

CORPORATE BOUNDARY

AIRPORT BOUNDARY

hospitals

schools

churches

Source: Milwaukee County, 2003

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Alternative 4
Develop Satellite Based Departure Procedures for Runway 25L
(South Jet Departures)

Goal:

This alternative was developed with the goal to eliminate "drift" from jet departures on Runway 25L. The goal of this alternative is to concentrate turbojet aircraft over a small area along the runway centerline and other compatible land uses southwest of the Airport. The flight paths under consideration are west departures on Runway 25L that turn to the south. West departures that head west or turn north would not be modified, because no large compatible land use corridors are present.

Description:

This procedure would create a more defined and narrow flight path using FMS technology to concentrate aircraft flight tracks along the extended runway centerline and to the south. Aircraft would use the existing west departure and then turn southbound while using FMS technology to reduce dispersion over non-compatible use areas. Military aircraft, older hush-kit aircraft, turbo-prop, and general aviation aircraft are not equipped with the necessary instruments to fly FMS procedures; as such, these aircraft would continue to fly their existing flight paths. West departures not turning south would continue to use existing departure procedures after reaching 2,000 feet MSL.

Existing Procedures:

Aircraft depart Runway 25L and fly runway heading until reaching 2,000 feet MSL. At this point, aircraft continue on course or turn left or right to the heading assigned by Air Traffic Control based upon destination. A new procedure would be developed for those aircraft turning to the south.

New Procedure:

Aircraft would depart Runway 25L and fly runway heading using FMS way points. The flight procedure would be written such that aircraft flying to southern destinations would then turn southward using FMS way points at about 2 ½ miles from the start of takeoff, as shown in Figure G8. Aircraft turning south would fly a narrower path following a concentration of compatible land uses. Aircraft with a western or northern destination would continue to fly the existing departure procedure. Figure G8, *Alternative 4 Runway 25L Jet Departure Flight Tracks, South Turn*, shows the new FMS flight path overlaid on the existing flight tracks.

New Procedure Analysis:

Figure G9, *Comparison of Alternative 4, FMS West DNL Contour and 2009 Base Case DNL Contours*, shows the 65, 70, and 75 DNL noise contours associated with this alternative compared with the 2009 Base Case DNL noise contours. The Base Case contours are shown with a solid line; changes to the Base Case 2009 contour due to the alternative are shown as a dashed line. The land use and population changes associated with this alternative, compared to the future Base Case contour, are shown in Table G4, at the end of this chapter.

Alternative 4 could be used by 80 percent of the existing commercial jet aircraft fleet operating at General Mitchell International Airport; exceptions are the older hush-kit jet aircraft that do not have the necessary navigation instruments. This alternative would reduce the number of early turns by turbojet aircraft. The number of total housing units and people in the 65 DNL noise contour would be slightly reduced; however, the number of non-compatible housing units would remain the same. The Time Above metric ranges from an increase of 1.1 minutes per day above 65 dBA to a decrease of 0.4 minutes per day. The Number of Events metric ranges from an increase of 4.1 events per day and a decrease of 1.9 events per day.

Difference Compared to Base Case Contour:

Alternative 4 is essentially identical to the 2009 Base Case noise contour. There are no perceivable differences in the 65 DNL associated with either Alternative 4 or the 2009 Base Case noise contour.

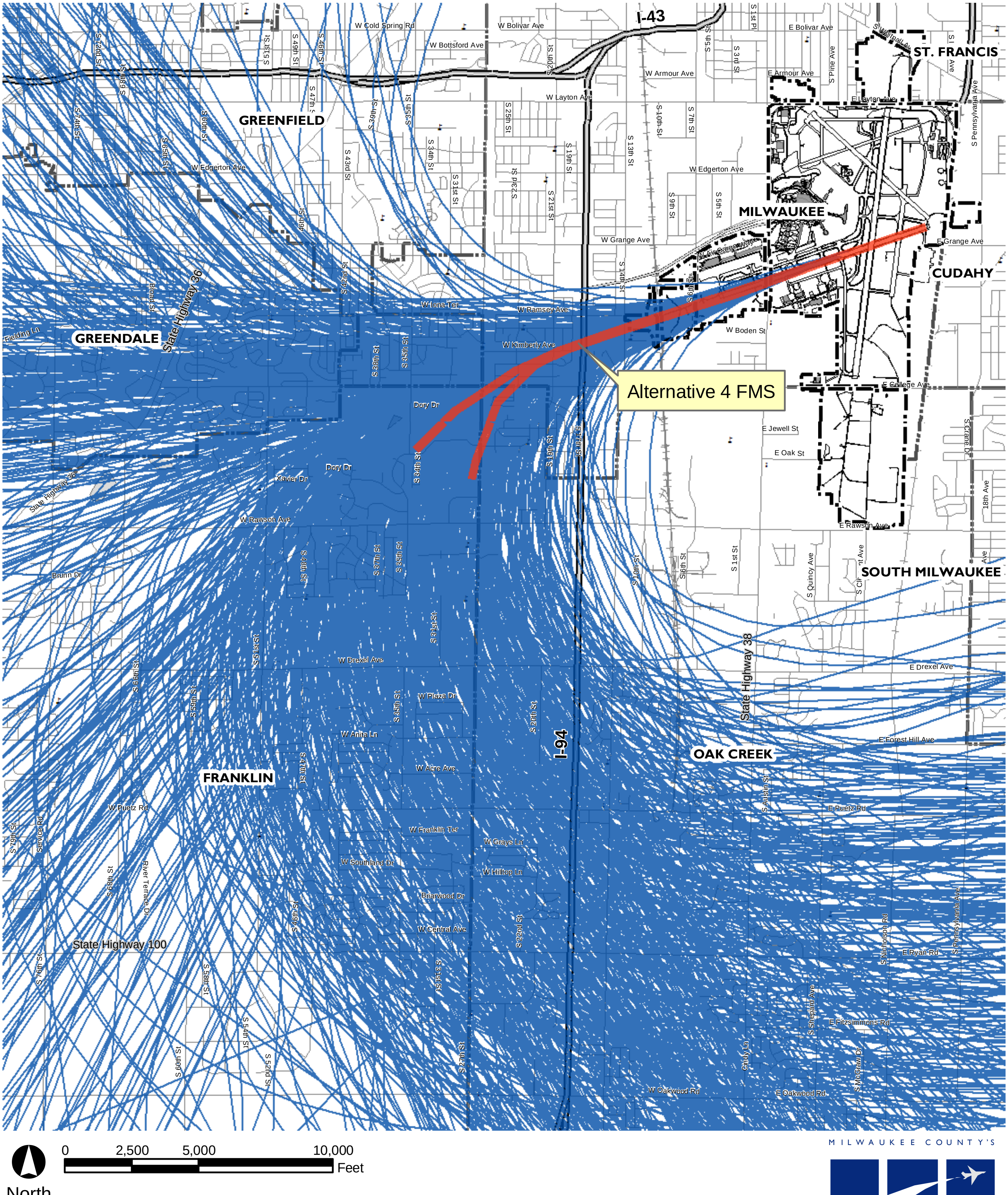


Figure G8 Alternative 4 Runway 25L INM Jet Departure Flight Tracks, South Turn Overlaid on Existing Radar Flight Tracks for Runway 25L Jet Departures (Representative sample of 1000 jet departures during June 2003)

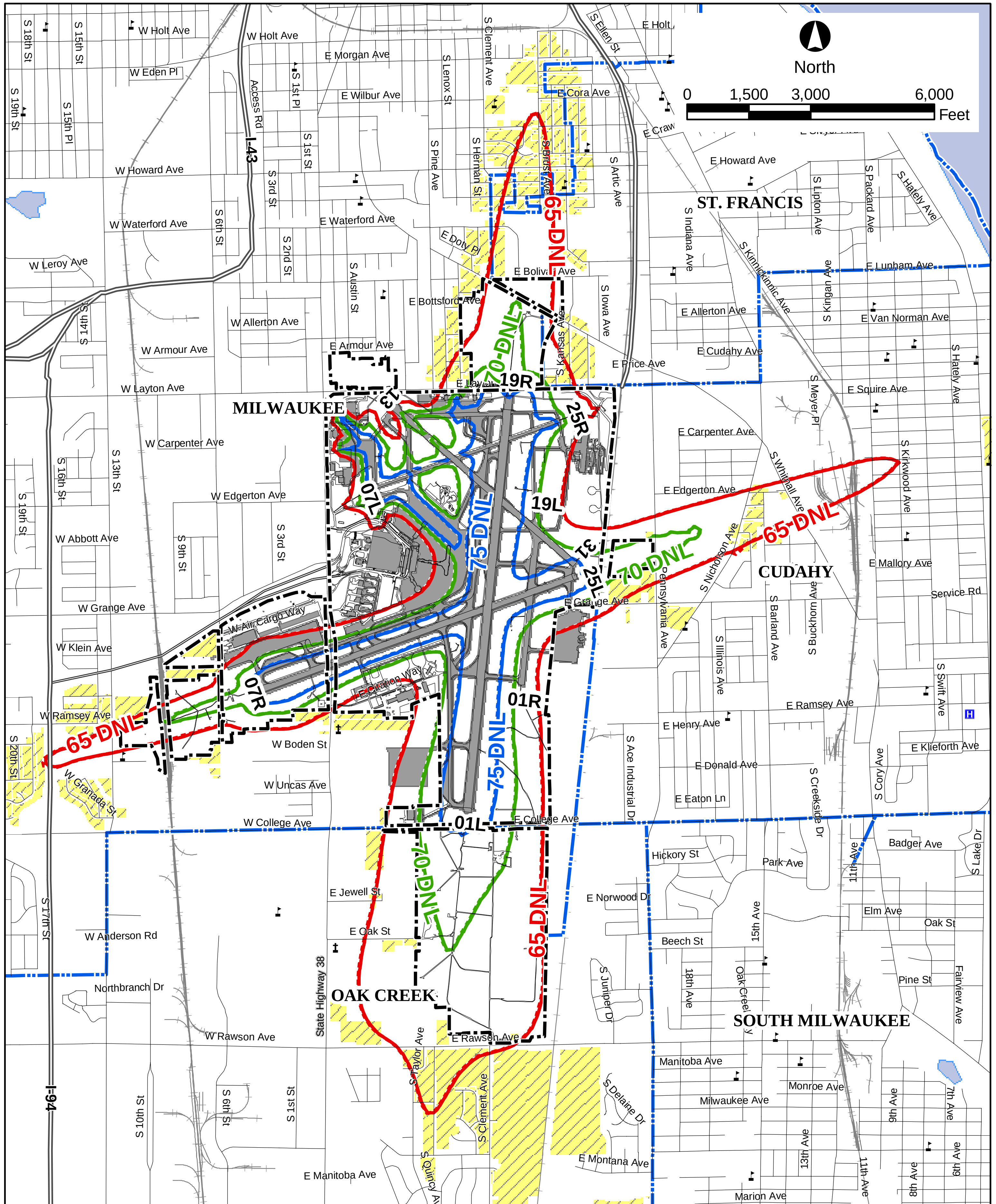


Figure G9

Comparison of Alternative 4 FMS West DNL Contour & 2009 Base Case DNL Contour

Legend

2009 Base Case

- 65 DNL Contour
- 70 DNL Contour
- 75 DNL Contour

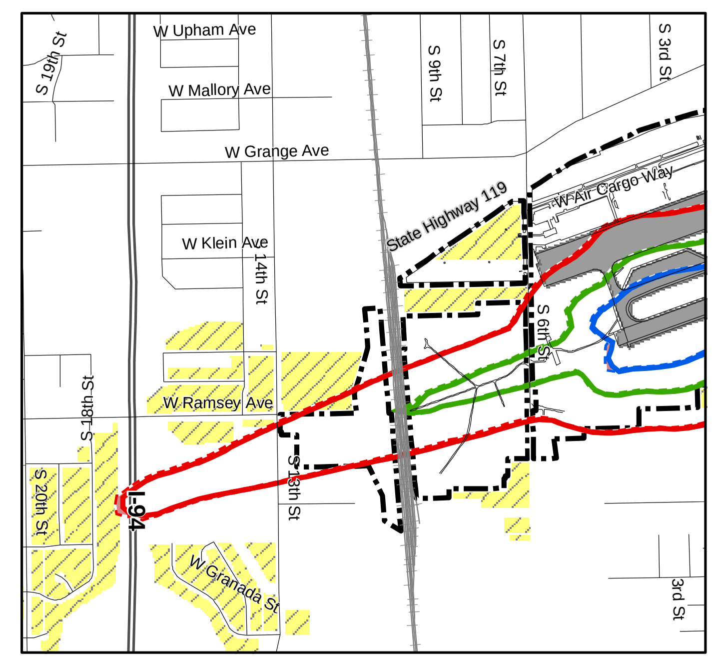
Alternative 4

- 65 DNL Contour
- 70 DNL Contour
- 75 DNL Contour
- Phase 1 Program Boundries
- CORPORATE BOUNDARY
- AIRPORT BOUNDARY
- hospitals
- schools
- churches

Source: Milwaukee County, 2003

Comparative Analysis

Areas within the limits of this alternative but not within the 2009 Base Case are shown in red.
65 DNL - Approx. 5 Acres
70 DNL - Approx. 3 Acres
75 DNL - Approx. 4 Acres



Runway End 07R Detail

North

Legend

Newly affected

0 1,000 2,000 4,000 Feet

MILWAUKEE COUNTY'S GENERAL MITCHELL INTERNATIONAL AIRPORT

Alternative 5
Evaluate Altitude of Small Propeller Aircraft Departures

Goal:

The goal of this alternative is to increase the altitude over residential neighborhoods of small propeller aircraft departing from the Airport. Increasing the altitude would likely result in reduced single event sound exposure noise levels from these aircraft operations.

Description:

This alternative evaluates methods of how to increase the departure altitude of small propeller aircraft departing the Airport. While the majority of these aircraft are at, or above, 500 feet above field elevation (AFE), some slow-climbing aircraft turn before reaching this altitude. In addition to increasing the altitude at which these propeller aircraft turn, it would also reduce the early turns by defining a specific altitude where the turn should occur.

Existing Procedure:

Small propeller aircraft generally depart the Airport at various altitudes; however, at times, they execute early turns during slow climb outs over residential neighborhoods. Propeller aircraft, during busy times, do not always depart and fly runway heading until reaching 500 feet AFE. Figure G10, *Alternative 5 Existing Flight Tracks, Small Propeller Departures Runway 7L*, shows the dispersion of these aircraft on departure from Runway 7L.

New Procedure:

Small propeller aircraft would fly runway heading until reaching at least 500 feet AFE, or until reaching a designated landmark assigned through coordination with FAA air traffic control. At that point, the aircraft would turn towards its destination. This procedure would be used during periods of lower activity levels, for operations on the smaller runways during visual meteorological conditions, or when aircraft are able to make visual contact with the designated landmark. Since the majority of these operations are from aircraft operators that regularly fly in and out of General Mitchell International Airport, a pilot awareness brochure could be developed through a fly quiet program to work with the chief pilots to educate them on this noise issue.

New Procedure Noise Analysis:

This alternative would not alter the DNL noise contours, but could have a beneficial effect by reducing annoyance from single event flyovers.

This alternative could potentially reduce the single event noise levels from 2 to 4 dBA. While many aircraft are already at, or above, 500 feet AFE, the alternative is designed to increase the altitude of the lowest aircraft. Typically, these aircraft generate the highest single event noise levels associated with these operations. Alternative 5 is dependent on Air Traffic Control workload and availability to have aircraft fly runway heading until 500 feet AFE. If an aircraft needs to expedite its departure, the aircraft might need to be turned early in order to keep them in the proper sequence.

Difference Compared to Base Case Contour:

No DNL contours were developed for this alternative.

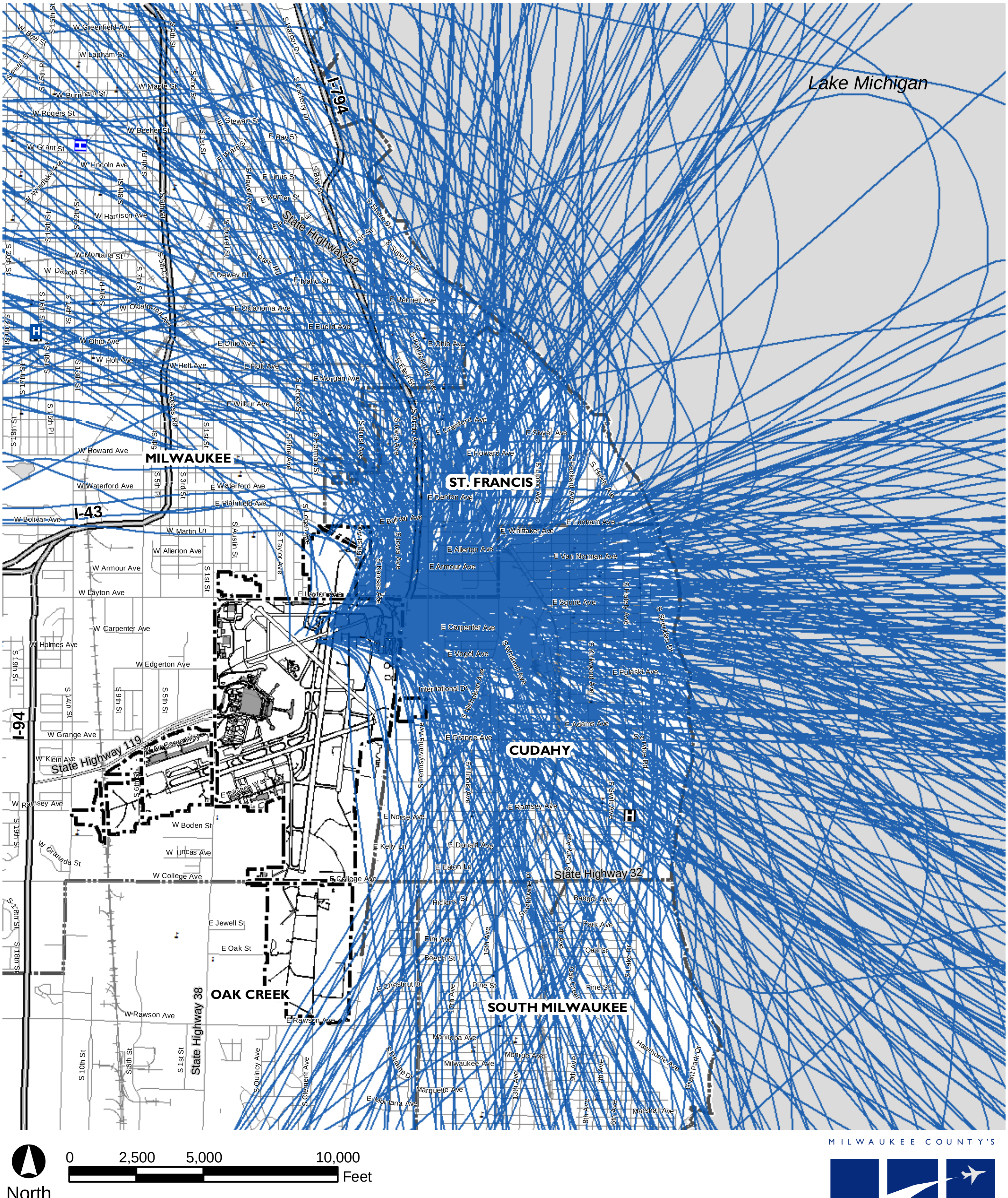


Figure G10 Alternative 5 Existing Radar Flight Tracks,
Small Propeller Departures Runway 7L

(Representative sample of 500 propeller aircraft departures during Second Quarter 2003)

MILWAUKEE COUNTY'S GENERAL MITCHELL INTERNATIONAL AIRPORT

Alternative 6
Develop Procedures to Reduce Early Turns on Approach for Small Propeller Aircraft.

Goal:

The goal of this alternative is to avoid flying over residential areas by reducing early turns by small propeller aircraft on approach. This occurs when propeller aircraft "cut the corner" for a short approach and fly low over non-compatible land uses. These early turns are done for a variety of reasons including weather minimums, pilot convenience, and to assist in the sequencing of landing aircraft during high activity periods.

Description:

This alternative evaluates procedures to reduce the number of early turns by small propeller aircraft on arrival. At times, these aircraft are flying level at 500 feet AFE for long periods to intercept the glide slope. This alternative is designed to minimize the time these aircraft are flying low when approaching to land.

Existing Procedures:

Small propeller aircraft fly at relatively low altitudes (500 to 1,000 feet AFE) when approaching the Airport so that they are easily sequenced in with landing jet or other high performance aircraft. Figure G11, *Alternative 6 Existing Flight Tracks, Small Propeller Arrivals Runway 25R*, shows the dispersion and occasional early turns of the small propeller aircraft arriving on Runway 25R.

New Procedure:

Aircraft would not begin a turn to the final approach leg until crossing a designated location (shoreline, way point, intersection, or landmark) at, or above, 500 feet AFE. When small propeller aircraft are approaching the Airport, they would not descend early to this altitude and over-fly for long distances at level altitude. Instead, these aircraft would fly the three (3) degree glide slope to descend at a constant rate. Since the majority of these operations are from aircraft operators that regularly fly in and out of General Mitchell International Airport, a pilot awareness brochure could be developed to work with the chief pilots to educate them regarding this specific measure.

New Procedure Noise Analysis:

This alternative would not alter the DNL noise contours, but could have beneficial effects by reducing annoyance from single event flyovers.

This alternative would potentially reduce the single event noise levels from 2 to 4 dBA. While many aircraft are already at, or above, this altitude, the alternative is designed to increase the altitude of the lowest aircraft. Typically, these aircraft generate the highest single event noise levels associated with these low-level operations. Alternative 6 is dependent on Air Traffic Control workload, and, if Air Traffic Control needs to expedite an arrival, the aircraft might need to be brought to a lower altitude in order to keep aircraft in the proper sequence.

Difference Compared to Base Case Contour:

No DNL contours were developed for this alternative.

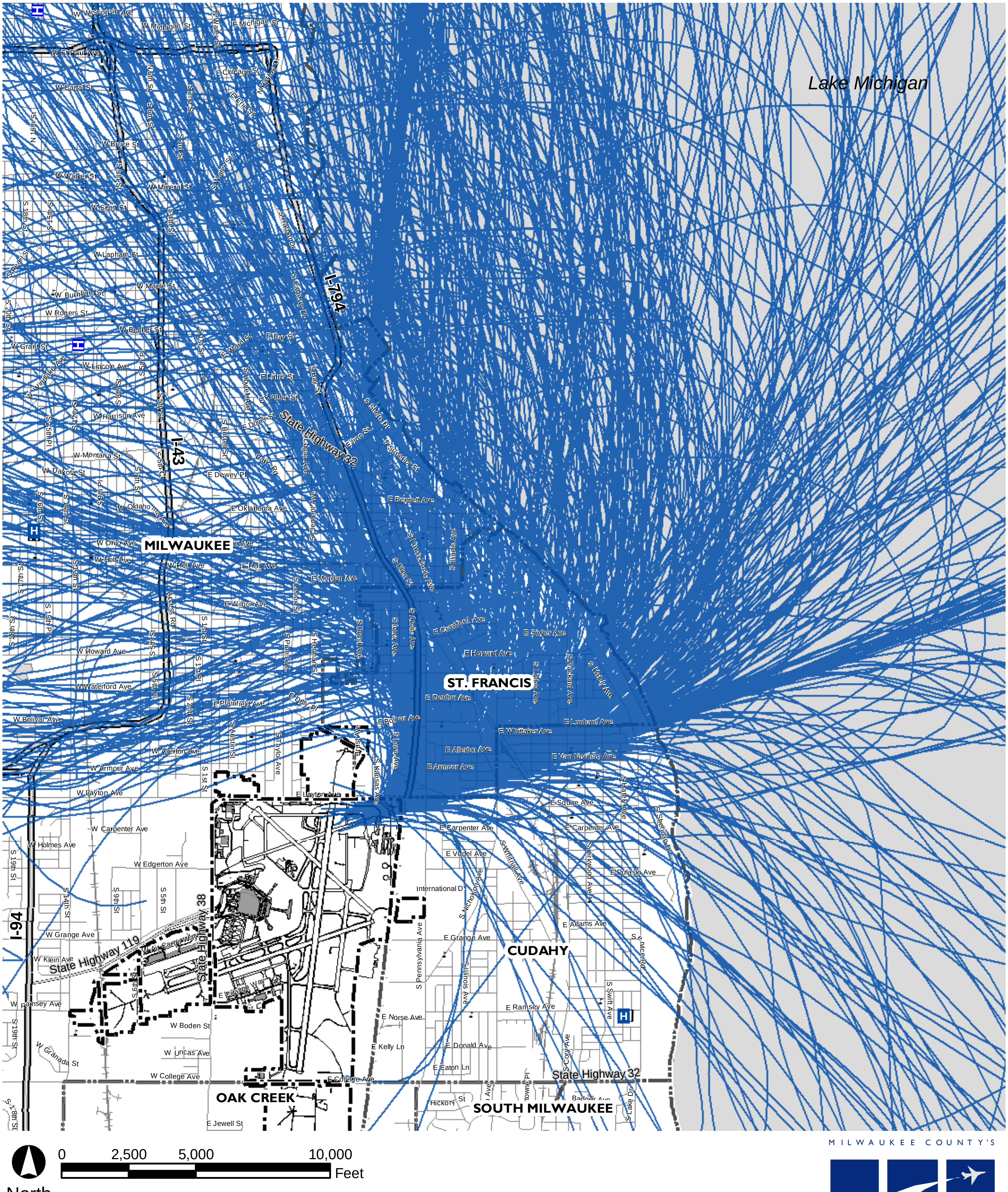


Figure G11 Alternative 6 Existing Radar Flight Tracks, Small Propeller Arrivals Runway 25R

(Representative sample of 800 propeller aircraft arrivals during Second Quarter 2003)

MILWAUKEE COUNTY'S GENERAL MITCHELL INTERNATIONAL AIRPORT

Alternative 7
Evaluate Close-in and Distant Departure Procedures

Goal:

The goal of this alternative is to reduce single event noise levels from commercial jet departures over residential land uses by utilizing the appropriate thrust cutback departure procedure, which would result in the lowest noise levels in the community. The departure procedure is based upon FAA Noise Abatement Departure Profile (NADP), as detailed in FAA Advisory Circular (AC) 91-53A.

Description:

In 1993, the Federal Aviation Administration revised AC 91-53 (1978) to describe two standard departure profiles for turbojet aircraft over 75,000 lbs. These departure profiles described as "close-in" and "distant" have the potential to minimize airplane noise impact on communities surrounding airports by modifying distance and altitude for application of full takeoff power, engine thrust cutback, and re-application of normal climb thrust.

The close-in departure typically reduces noise closer to an airport, but may increase noise farther from an airport (8 to 10 miles away). Conversely, the distant procedure concentrates noise closer to an airport (within 3 to 6 miles), but reduces noise farther away.

Existing Procedures:

Radar data obtained for General Mitchell International Airport indicates that aircraft thrust cutback typically occurs at 1,000 to 1,200 feet above field elevation (AFE). The current departure climb procedure is applicable to most commercial jet aircraft that operate at the Airport. Takeoff power (full power) is applied until reaching about 1,000 feet above airfield elevation (AFE), at which point the power is cut back to a reduced climb power. Regular climb power is re-applied when reaching an altitude of 3,000 feet AFE.

New Procedure:

Alternative 7 examines two departure scenarios, a close-in departure and a distant departure. The departure procedures would be determined for the Airport by each airline for every aircraft type operated, within the limits determined in the Advisory Circular.

FAA AC 91-53A specifies that normal climb power be re-applied at an altitude of 3,000 feet above field elevation (AFE), or above, or when the airplane has been fully transitioned to the en-route configuration (whichever occurs first). At General Mitchell International Airport, the re-application of normal climb thrust would occur in the vicinity of 3 to 6 statute miles from the beginning of takeoff. Locations where normal climb thrust is re-applied may experience an increase in noise above what would be experienced during a typical departure, due to lower aircraft altitude and the re-application of normal climb thrust.

<u>Close-In Departure Procedure:</u> Full power is applied until reaching an altitude of 800 feet, and then the thrust is cut back until reaching 3,000 feet, where climb power would be re-applied. Figure G12 shows the points where a typical MD83 reaches 800 feet AFE, and then 3,000 feet AFE when using the close-in procedure.

<u>Distant Departure Procedure:</u> The "distant" departure procedure is a variant on the current Airport departure - the difference being that the initial full power would remain until aircraft reach an altitude of 1,500 feet AFE before thrust cut back. Similar to the previous procedures, full power would again resume at an altitude of 3,000 feet AFE. Figure G12 shows the points where a typical MD83 reaches 1,500 feet, and then 3,000 feet AFE when flying this procedure.

Following is a summary of each Noise Abatement Departure Profile variant:

1. Current Airport Departure Procedure: At present, pilots apply takeoff power until reaching about 1,000 to 1,200 feet AFE, when they cut back power to reduce noise levels on the ground. Regular climb power is re-applied when reaching an altitude of 3,000 feet AFE.

2. Close-In Departure Procedure: Using this procedure, aircraft would apply full power until reaching an altitude of 800 feet AFE when they cut back and re-apply regular power at 3,000 feet AFE.

3. Distant Departure Procedure: This procedure is a variant on the current Airport departure - the only difference being that full power would remain until aircraft reach an altitude of 1,500 feet AFE before the cutting back. Regular power would again resume at an altitude of 3,000 feet AFE.

New Procedure Noise Analysis:

The noise analysis for Alternative 7 is conducted by comparing the single event noise levels for each procedure, and a determination of the population within the 85 SEL noise contour, shown in Table G1. The change in the single event noise levels, as expressed in SEL between the existing procedure and both the close-in and distant procedures, was determined. Annual DNL noise contours were not developed for this alternative because the potential changes in noise are best illustrated using a single event noise analysis. The analysis was based upon a heavy MD83 aircraft departing north on Runway 1L. Figure G12*, Alternative 7, Typical MD 83 Close-in and Distant Departure Procedure Points,* graphically depicts the close-in and distant points. The MD83 is one of the loudest aircraft operating at the Airport, and is also a relatively slow-climbing aircraft as compared to new-generation aircraft. Newer generation aircraft climb much quicker, and there is less difference between procedures.

Table G1
EXISTING, CLOSE-IN, AND DISTANT DEPARTURE PROCEDURES
POPULATION COUNT COMPARISONS
(MD83 Departure Northward on Runway 1L)
General Mitchell International Airport FAR Part 150 Noise Compatibility Study

Departure Procedure	Population within 85 SEL Contour	Population within 90 SEL Contour	Population within 95 SEL Contour	Population within 100 SEL contour	Population within 105 SEL contour
Existing	26,089	15,837	4,865	338	0
Close-In	24,949	15,393	6,123	227	0
Distant	28,024	16,806	4,971	428	0

The above population numbers are cumulative. In other words, the population within the 85 SEL contains the population in the 90, 95, 100, and 105 SEL contours.

For the close-in departure procedure, there is a noise decrease in the areas close to the Airport, where the SEL noise levels would decline by -0.1 to -1.4 dBA. The areas more distant to the Airport would experience an increase in the SEL noise of +0.0 to +0.8 dBA.

For the distant departure procedure, there is a noise decrease in the areas more distant from the Airport where the SEL noise levels would decline by -0.1 to -0.9 dBA. The areas close to the Airport would experience an increase in SEL noise of +0.1 to +2.1 dBA. These results are presented in Table G2 for the north Representative Grid Locations that are presented in Figure G17.

Table G2

CHANGE IN NOISE GRIDS (ALTERNATIVE 7)
EXISTING PROCEDURE SEL VS. CHANGE IN SEL WITH ALTERNATIVE PROCEDURES
(MD83 Departure Northward on Runway 1L)
General Mitchell International Airport FAR Part 150 Noise Compatibility Study

Grid ID	Existing Procedure SEL	Change in SEL with Close In Procedure	Change in SEL with Distant Procedure
N11	81.9	-0.1	0.0
N12	83.8	-1.0	0.2
N13	83.7	-0.8	2.1
N14	85.8	-0.5	0.9
N15	89.9	0.0	-0.1
N21	97.6	0.0	0.0
N22	95.9	-1.1	0.1
N23	94.2	-0.3	1.9
N24	95.7	0.5	-0.3
N25	95.0	0.8	-0.9
N31	91.8	0.0	-0.1
N32	94.0	-1.4	0.0
N33	91.8	-0.4	1.9
N34	88.9	-0.2	1.1
N35	85.1	-0.3	0.5
N41	80.2	-0.1	0.0
N42	82.2	-1.3	0.3
N43	81.1	-0.9	2.0
N44	79.5	-0.5	2.1
N45	77.5	-0.6	1.2

Difference Compared to Base Case Contour:

No DNL noise contours were developed for this alternative because the potential differences are best illustrated using SEL analysis described above.

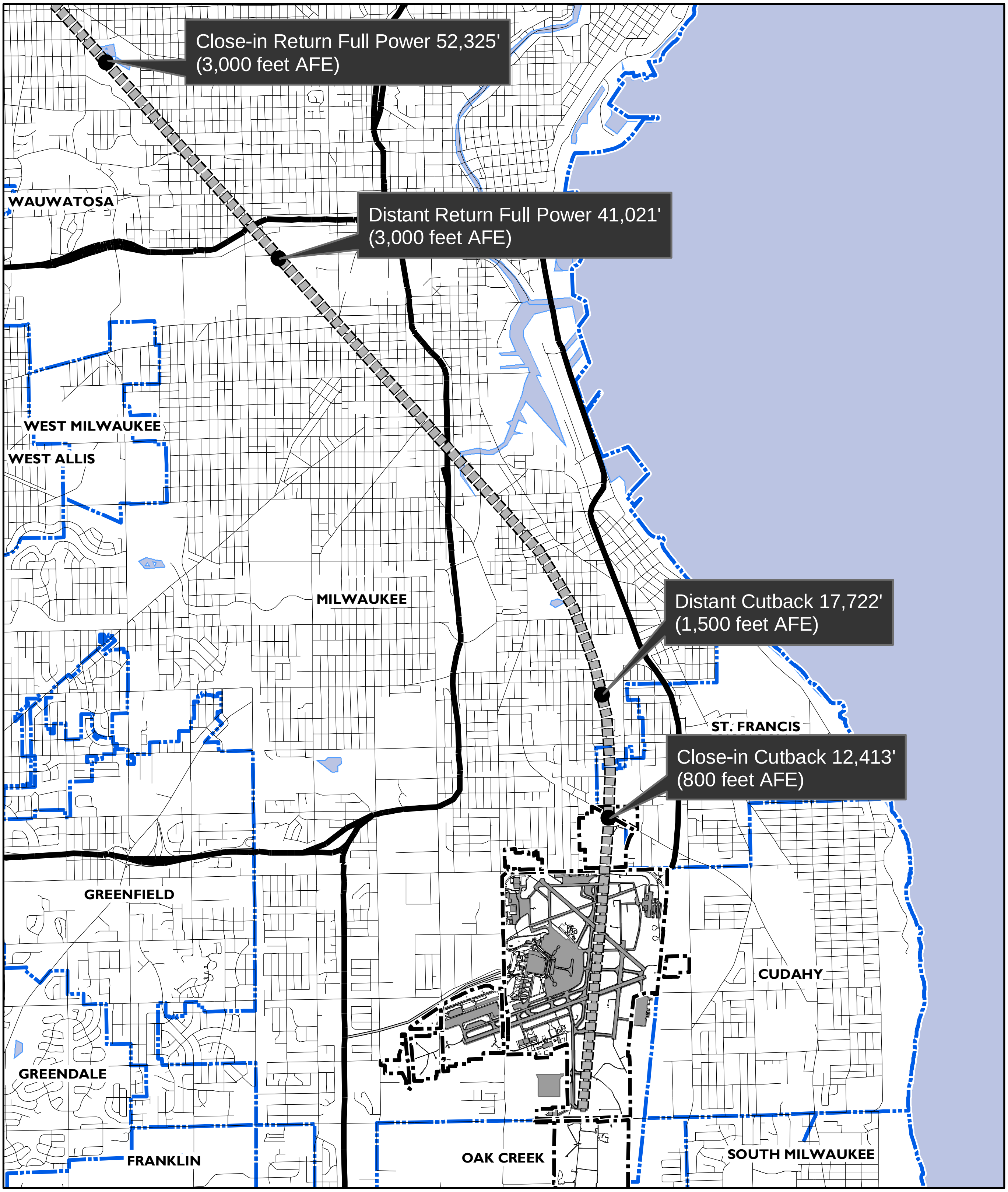


Figure G12
Alternative 7
Typical MD83 Close-in and Distant Departure Procedure Points (Departure 1L)

Legend

INM Jet Departure AD330

AFE Above Field Elevation

THE BARNARD DUNKELBERG & COMPANY TEAM

MILWAUKEE COUNTY'S GENERAL MITCHELL INTERNATIONAL AIRPORT

Alternative 8
Intersection Departures for South-Bound Departures at Night

Goal:

The goal of this alternative is to reduce jet takeoff and taxi noise in the neighborhood north of the Airport, especially during the night hours of 10 p.m. to 6 a.m., by having aircraft depart at the intersection of Runway 19R and taxiway Victor.

Description:

Airports can use intersection departures during hours of low activity as a noise abatement option. When weather and runway conditions are appropriate, some jets may be able to start their takeoff roll at a point south of the northern runway end, as opposed to the normal location at the north threshold of the runway.

Existing Procedure:

Aircraft that depart on Runway 19R typically depart at the end of Runway 19R, using the full length of the runway for the departure. Per FAA Order 7110.22T, there are no intersection departures permitted at General Mitchell International Airport by jet aircraft between the hours of 10 p.m. to 6 a.m. Intersection departures are allowed during the daytime hours to allow for use of Runway 7L/25R, which is restricted if the full length of Runway 01L/19R is used.

New Procedure:

Aircraft would start the departure roll at the taxiway Victor, or "V" intersection, approximately 1,090 feet south of the Runway 19R threshold. Figure G13*, Victor Departure Point,* presents an aerial photo that illustrates the runway end and the taxiway Victor departure point. This procedure would result in less aircraft noise in communities north of the Airport. This would apply only to aircraft that are able to depart on the resulting shorter runway. Aircraft using the intersection Victor departure would have 8,600 feet of useful runway for departures. It is estimated that 70 percent of the aircraft that operate at the Airport would be able to use the intersection departure procedure. While an aircraft is capable of executing an intersection departure, use of the procedure would depend on pilot discretion, as well as wind, weather conditions, and aircraft loading.

New Noise Procedure Analysis:

Figure G14, *Comparison of Alternative 8, Intersection Departures South DNL Contours and 2009 Base Case DNL Contour,* shows the 65 and greater DNL noise contours associated with this alternative. The land use and population changes associated with this alternative, compared to the future Base Case contour, are shown in Table G4. Alternative 8 would not appreciably affect the 65 DNL; however, there is a slight reduction to the north area and a slight increase to the south. Alternative 8 results in one less non-compatible housing unit within the 65 DNL noise contour and 49 fewer total housing units within the contour when compared to the 2009 Future Base Case.

The back blast (low frequency) noise levels to the north would be reduced by more than 2.0 DNL when using the intersection departure rather than a full runway length departure. To the south, there is a corresponding 0.5 DNL increase. The Number of Events per day above 65 dBA decreases by 11 events north of the Airport with a corresponding increase of one event per day to the south.

Difference Compared to Base Case Contour:

Alternative 8 would result in the 65 DNL noise contour generally changing in width. To the south, the contour would expand slightly to the east and west basically around Rawson Avenue. To the north, the 65 DNL noise contour associated with Alternative 8 would reduce in width just north of Layton Avenue. The 70 DNL would also reduce in width north of the Airport, when compared to the 2009 Base Case noise contours.

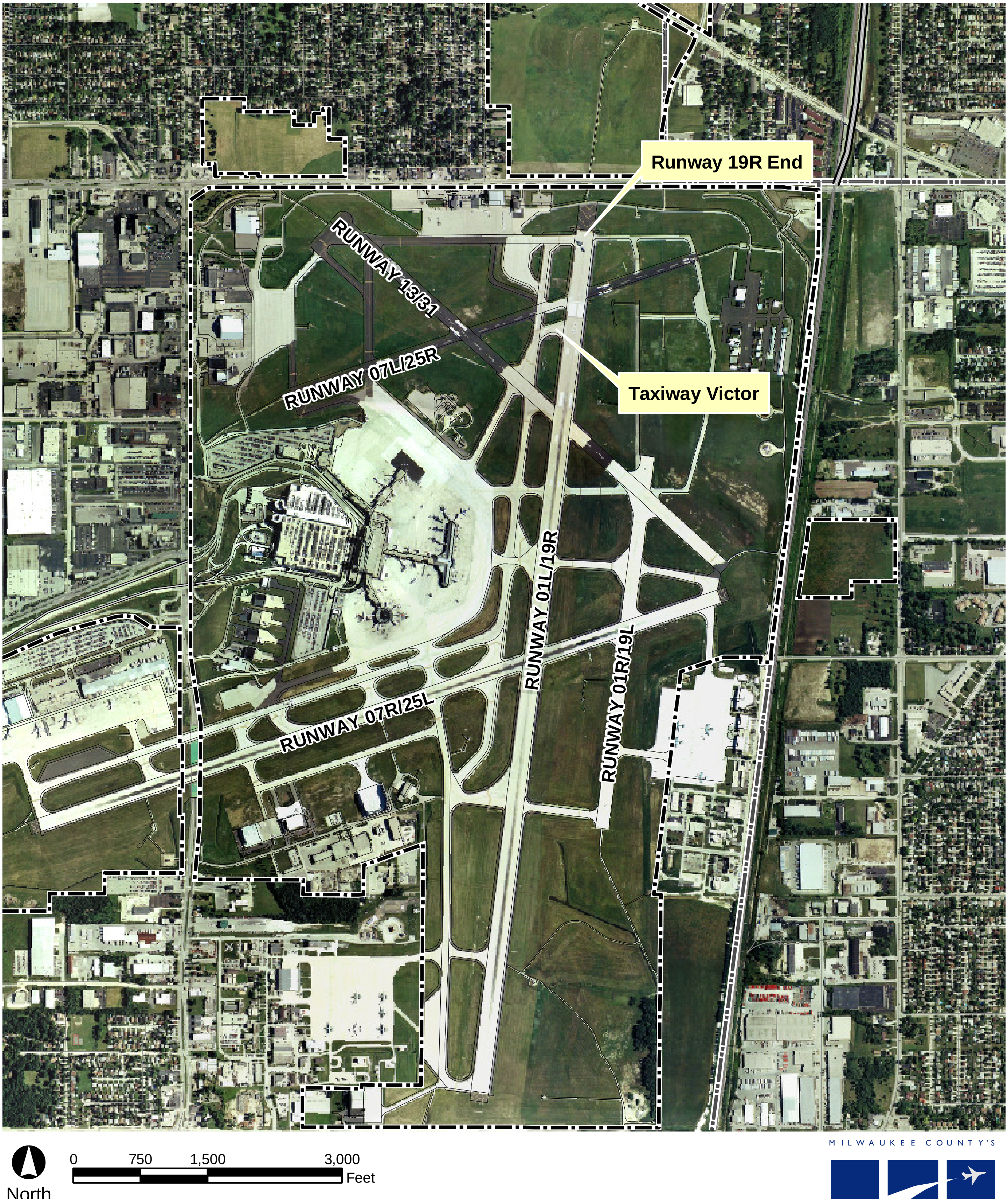
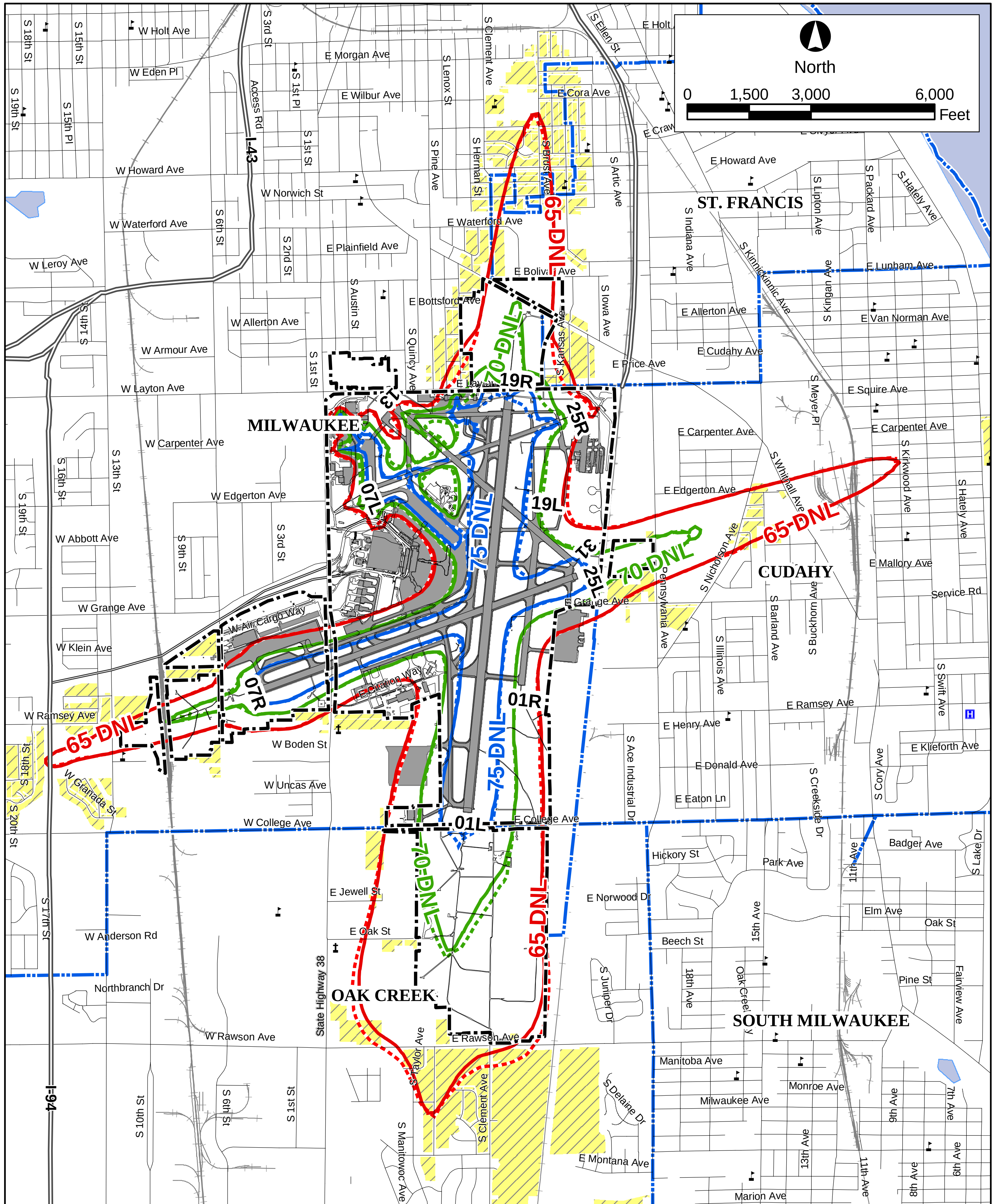
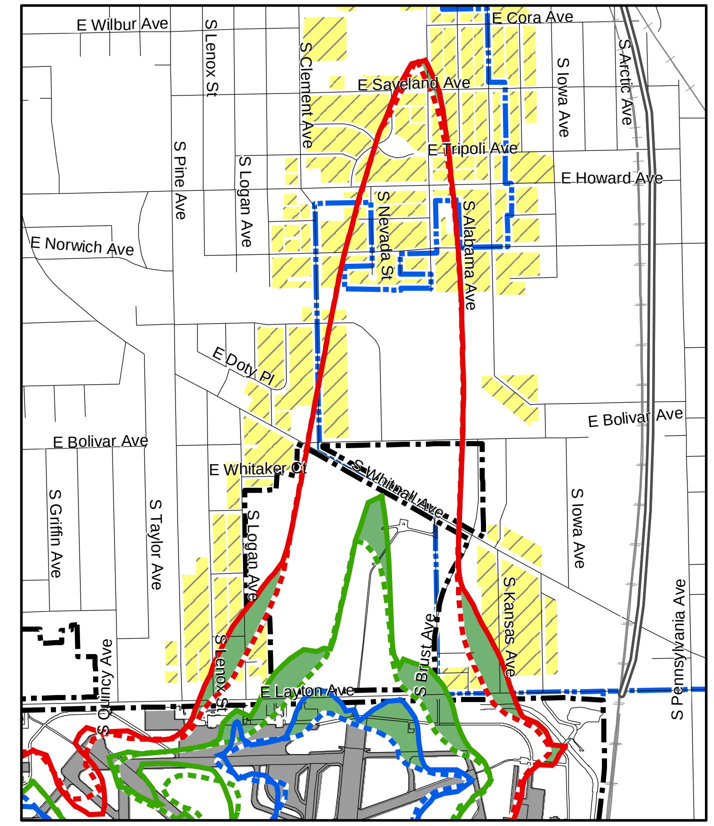


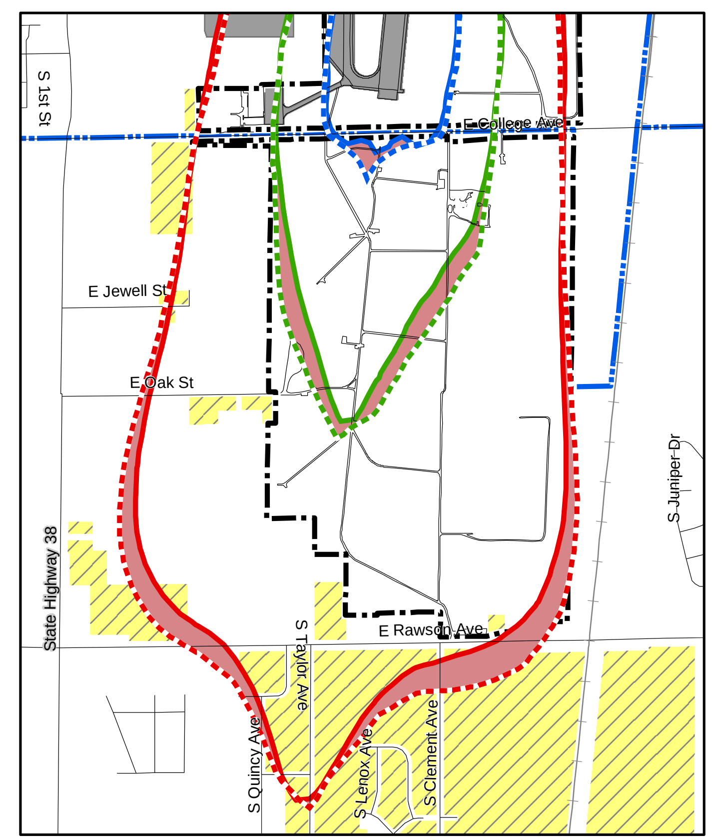
Figure G13 Aerial Photo of Victor Intersection

MILWAUKEE COUNTY'S GENERAL MITCHELL INTERNATIONAL AIRPORT





Runway End 19R Detail



Runway End 01L Detail

North

0 1,000 2,000 4,000 Feet

Legend

- Newly affected
- No longer affected

Figure G14

Comparison of
Alternative 8 Intersection Departures to
South DNL Contour &
2009 Base Case DNL Contour

Legend

2009 Base Case

- 65 DNL Contour
- 70 DNL Contour
- 75 DNL Contour

Alternative 8

- 65 DNL Contour
- 70 DNL Contour
- 75 DNL Contour
- Phase 1 Program Boundries
- CORPORATE BOUNDARY
- AIRPORT BOUNDARY
- hospitals
- schools
- churches

Source: Milwaukee County, 2003

Comparative Analysis

Areas within the limits of this alternative but not within the limits of the 2009 Base Case are shown in red.
65 DNL - Approx. 45 Acres
70 DNL - Approx. 21 Acres
75 DNL - Approx. 4 Acres

Areas within the limits of the 2009 Base Case but not within the limits this alternative are shown in green.
65 DNL - Approx. 20 Acres
70 DNL - Approx. 19 Acres
75 DNL - Approx. 9 Acres

MILWAUKEE COUNTY'S GENERAL MITCHELL INTERNATIONAL AIRPORT

Alternative 9
Ground-Based Noise Alternatives

Goal:

The goal of this alternative is to reduce noise in surrounding communities resulting from aircraft operations on the ground at General Mitchell International Airport. This alternative was developed to explore available options that will minimize ground noise intrusion, especially in areas north of the Airport.

Description:

Alternative 9 addresses aircraft noise from ground operations, which is defined as all aircraft movement while an aircraft is on the ground, including operations on the taxiways, runways, apron areas, terminal area, and ground run-up enclosure. The term "remote facilities" is an umbrella term that encompasses all facilities away from the passenger terminal, including maintenance hangars, general aviation areas, military areas, and fixed based operators (FBO). Types of ground noise include the following:

- Run-up procedures by all aircraft categories at the remote facilities
- Taxi
    - To and from remote facilities
    - To and from terminal gates
- Idle
    - At the terminal gates
    - At the remote facilities
- Takeoff roll prior to lift off
- Engine start and auxiliary power unit (APU) use at remote facilities
- APU use at terminal gates

The following lists the type of general mitigation measures available for ground noise:

- Sound barriers such as sound walls, earthen berms, and any solid material that acts to shield the noise, including existing or proposed structures such as buildings and hangars.
- Parking plans to determine aircraft placement on aprons and at terminal gates that minimize the impact of the noise in the adjacent communities.
- Use of ground power for aircraft to minimize use of aircraft engines and auxiliary power units.
- Voluntary Airport Regulations for reducing aircraft ground noise.

Ground Mitigation Measures:

Sound Barriers

Ground noise irritation comes from the run-ups and taxiing of aircraft, especially at night. Sometimes, barriers can be effective in reducing ground noise exposure in adjoining neighborhoods. A noise barrier is an obstruction to the path of the sound transmission from ground-based aircraft operations. Once an aircraft becomes airborne, barriers have no further effect. Barriers include walls (those used along highways), earth mounds (berms), wall and berm combinations, or placement of buildings and landscaping. In the case of barriers, neighbors would be shielded from the noise source as long as the barrier is solid and sufficiently breaks the line-of-sight from the noise source to the listener. Barriers can potentially provide noise reduction benefits for communities near an airport from aircraft ground operations. The closer a barrier is to the noise source, the more effective it is (i.e. the reason the Ground Run-Up Enclosure works so well is the close proximity between the noise source and the barrier).

The placement of structures, barriers or berms is dictated by airport design guidelines and regulations, one of which is Federal Aviation Regulation (FAR) Part 77, which defines certain height restrictions at specified distances from runways. To ensure the safe operation of aircraft on the Airport, these restrictions should not be exceeded, thereby making berms unfeasible in specific locations.

Noise Barrier Design Overview

Noise barriers are structures designed to block the propagation of noise at the source. An overview of the acoustic principles behind noise barrier design is summarized below. An understanding of these acoustical principles is essential in the design of effective noise barriers. When there are no obstacles between the source and adjoining areas, sound travels by a direct path of "source" to "receiver." This straight line is referred to as the "line-of-sight."

Introducing a barrier between the source and the receiver, which interrupts the line of sight, redistributes the sound energy into several paths: a diffracted path over the top of the barrier; a transmitted path through the barrier; and a reflected path directed away from the receiver. The noise reflected off the sound barrier is usually directed away from the receiver, and can be ignored unless large buildings or other reflecting surfaces are present. Absorptive barriers are often used if there are receivers located on the other side of the noise source as well. The noise path of primary concern is the diffracted path.

All receivers located in the shadow zone (the area between the barrier and the diffracted noise path) will experience some sound attenuation; the amount of that attenuation is directly related to the degree that the sound must bend or diffract. That is, the barrier attenuation is a function of the geometrical relationship between the source, receiver, and barrier. (The closer the receiver is to the barrier, the more attenuation it will receive.)

The location of barriers is dependent on its distance from the noise source, the orientation of the noise source, FAR Part 77 surface requirements, and time of day. Noise propagation is louder in certain directions and during times of low ambient noise levels (generally nighttime hours). It is usually advantageous to locate a noise barrier as close to the noise source as possible; if this is not possible, aircraft should then be located as far away from non-compatible land uses as possible while still taking advantage of the noise barrier. In addition to locating an aircraft as far away as possible, the aircraft should be oriented so that noise will dissipate away from the sensitive land use. For example, an idling jet should be parked with its tail pointed towards the community, because noise from an idling jet is louder at the front of the aircraft due to noise from the engine fans.

Types of Barriers

- Earthen berm:
  Earthen berms are generally composed of dirt with a ground cover such as grass, low-profile plants, small bushes, or trees. The height of the berm is dependent on its location on the airfield, its intended use and proximity to airfield activities. Berms are generally located on airport property boundaries.

- Earthen berm and wall combination:
  Earthen berms can be combined with a wall to create a higher structure. Walls can be placed on top of an earthen berm to create a more aesthetically-pleasing noise barrier.

- Landscape:
  The placement of trees can be effective in breaking the line of sight between a noise source and the community. The density of the trees affects the dissipation of noise. At locations where aircraft noise levels are not substantially higher than the ambient neighborhood noise, landscaping can be a good alternative to reduce the line of sight. Landscaping is generally located on airport property boundaries.

- Building placement:
  Airports can take advantage of existing buildings to shield communities from aircraft noise. If ground noise is an issue at an airport, the siting of new buildings can take into account how they can be used for noise reduction.

- Hay bales:
  Hay bales (or other straw-like material) have been found to be an economical way to reduce ground noise propagation. Unlike standard construction materials, hay bales can be easily and quickly formed into the specific shape needed to mitigate noise.

- Blast fence:
  Blast fences are used to deflect noise from engine start-up, run-up, and taxi. Blast fences are located on apron areas, terminal areas, and airport property lines. Blast fences can vary in height and length depending on intended use.

Parking and Taxi Plan

As detailed in the *Inventory* Chapter, residential and other noise sensitive land uses border Airport property or are close to Airport facilities and the location and orientation of parked aircraft on the airfield can greatly influence noise levels in these adjoining areas. Similarly, the route aircraft taxi on the airfield can influence noise exposure in the vicinity. Typically aircraft taxi to and from either the terminal area or remote facilities and the runway ends.

Terminal Area

The use of terminal gates by commercial aircraft is determined by a combination of the following:

- Airline
- Aircraft size
- Schedule – aircraft arrival and departure
- Location relative to preferred runway
- Aircraft position relative to the surrounding community

Airlines lease gate space from the airport operator; depending on the level of activity at certain airports, more than one airline can use the same gate. The use of gates is generally covered by a gate usage plan monitored by the airport operator. Aircraft generally taxi to the terminal from the runways and hangars, if the aircraft was parked overnight or needed maintenance.

Remote Areas

Most airports have numerous aprons, ramp areas, and leased facilities that are used for aircraft parking, maintenance, and run-up. Each of these apron areas has unique characteristics that are analyzed independently of each other. As stated earlier, parking and taxiing of aircraft in remote areas in relation to a noise barrier are determined by distance from the noise barrier, orientation of the aircraft, time of day usage, and location of existing structures.

The use of parking aprons by commercial and general aviation aircraft is determined by a combination of the following:

- Apron load capabilities
- Aircraft size
- Schedule
- Location relative to sound barriers
- Orientation of aircraft

Electrification of Ground Power

Ground-based aircraft noise occurs when aircraft are operating on the airfield after arrival, before takeoff, or during maintenance operations. The majority of aircraft use auxiliary power units (APUs) to power the aircraft while parked, both at terminal gates and remote facilities. An APU is a small jet engine that powers the heating, air conditioning, and electrical units in the aircraft, and because APUs are jet engines, there are generally high noise levels associated with their use. A small number of aircraft do not have on-board APUs. In this case, the aircraft typically either use gas or diesel ground power unit (GPU), which also generates ground noise, or receive an engine start from the ground crew and operate the aircraft at idle engine power while on the ramp.

Airports have the capacity to electrify passenger boarding gates with the type of power that an aircraft needs to run the cooling and heating system and the onboard computer systems. Airports install 400Hz power, which can be converted for use by all aircraft types, both turbojet and turbo propeller, as is being done at General Mitchell International Airport. The same type of power could potentially be installed at remote areas such as fixed-base operators and parking aprons where electricity would be installed in the pavement based on typical parking patterns of aircraft.

General Mitchell Ground-Based Aircraft Noise:

Alternative 9 analyzes the above-ground noise issues by type of noise. There are three ground-based options as described above and five distinct areas on the airfield that have ground noise that are proposed for evaluation. The five areas of the airfield that are used for aircraft parking and taxiing are: the Signature Ramp, Skyway Ramp, West Ramp, Northeast Ramp, and Terminal Facilities. Table G3 provides a listing of the areas being studied as well as recommended noise abatement measures for each. Figure G15, *Alternative 9 Airfield Locations*, graphically shows each location.

Table G3
ALTERNATIVE 9 BY AIRFIELD LOCATION
General Mitchell International Airport FAR Part 150 Noise Compatibility Study

Area	Issue	Applicable Measure
Signature Ramp	Business jet and large corporate aircraft start up, taxi, and idle noise	Noise Barrier, Parking Plan, Electrification
Skyway Ramp	Turbo propeller aircraft start up, aircraft remaining overnight	Noise Barrier, Electrification, Parking Plan
West Ramp	Large Aircraft Parking, APU usage	Noise Barrier, Electrification
Northeast Ramp	Piston and turbo propeller aircraft run-up and taxi	Noise Barrier
Terminal Facilities	Turbojet aircraft APU use and parking orientation	Parking Plan, Electrification

Figure G15 Alternative 9 Airfield Locations

MILWAUKEE COUNTY'S GENERAL MITCHELL INTERNATIONAL AIRPORT

Signature Flight Support Ramp

Signature Flight Support (Signature) is a Fixed Base Operator (FBO) located on the north end of the Airport, north of Taxiway "F." Signature provides aviation services such as fuel, maintenance, crew support, and hangar facilities to business jets, narrow- and wide-body charter aircraft, as well as turboprop aircraft. Among the services offered is a large aircraft parking apron where corporate jets and narrow-body charter aircraft are parked. Because of Signature's location, it can expose nearby communities north of the Airport to aircraft noise from aircraft start up, APU use, and taxi.

Mitigation Options

For the Signature Ramp, a noise barrier on the Airport property line would be effective for the homes due north and directly across Layton Street. For the homes to the northwest, along East Armour Avenue, a barrier along the Airport property line would not have much of an effect due to the elevated terrain at these homes. A barrier located at the highest point on the ground between the noise source and receiver may be more effective in reducing the ground noise. The location and height of potential noise barriers will be evaluated.

In addition to noise barriers, noise reductions could be achieved by providing electrical connections in the ramp area in conjunction with an updated parking plan that takes advantage of the existing buildings, potential noise barriers, and the directional characteristics of the aircraft noise. As part of the supplemental noise monitoring that was completed in September 2005, ground noise monitoring was done in this area. Based upon this additional data, a recommend parking plan is being developed for this area.

Skyway Ramp

The Skyway Airlines Ramp is on the northwest side of the airfield. Activities on the Skyway Ramp include turbo-prop and regional jet maintenance, turbo-prop run-ups, APU use, and taxi. The apron area in front of the Skyway Ramp is used for parking of commercial aircraft that remain overnight. Typically, 4 to 12 aircraft will remain overnight. Aircraft are taxied to the apron area from the terminal at night and taxied back to the terminal when the aircraft is scheduled to depart the next day. The Skyway hanger serves as a barrier for local communities from much of the ground-based aircraft activity noise.

Mitigation Options

A noise barrier would be an effective option with the specific location, size, and material evaluated through ongoing analysis. The barrier would need to be located close to the Skyway building to effectively shield noise from the homes to the north that are at a higher elevation than the airfield. A noise barrier located at the highest point of ground elevation for the homes along East Armour (described for the Signature Ramp option) will also be evaluated.

The Skyway Ramp could also benefit from electrification of the ramp, a parking plan, and an agreement with the airlines on APU use. A parking plan can be effective in orienting aircraft so the majority of noise stays on the Airport. Aircraft currently park in an east-west orientation at the request of the noise abatement office. The parking plan and preferred aircraft parking orientation will be further evaluated to assess possible improvements.

West Ramp

Commercial aircraft are often parked on the West Ramp overnight (east of the Air Wisconsin hangar). These aircraft are parked on the ramp overnight and then taxied to the terminal gates early in the morning. While on the West Ramp, these aircraft use their APUs for startup before taxi to the terminal gates or during cleaning and minor maintenance during the night.

Mitigation Options

The West Ramp could benefit from electrification of the ramp.. Each of these options will be evaluated for the West Ramp.

Northeast Ramp

The Northeast Ramp is located in the northeast section of the Airport. Activities on the Northeast Ramp include turbo-prop maintenance, turbo-prop run-ups, APU use, and taxi. The orientation of the Northeast Ramp exposes local communities to the ground-based aircraft activity noise.

Mitigation Options

The Northeast Ramp can benefit from a noise barrier such as a blast fence, hay bales, or using the existing buildings for shielding. Initial review of the area indicates that a noise barrier could be effective if located next to the hanger area. If a noise barrier is found to be ineffective, the Airport could request that Northeast Ramp operators use the ground run-up enclosure. While the ground run-up enclosure is an effective noise mitigation tool, aircraft located on the Northeast Ramp must taxi across active runways to the ground run-up enclosure, which could result in decreased airfield capacity and increase Air Traffic Control Tower staff workload. This additional taxiing could also create new noise from the taxiing aircraft.

Terminal Facilities

The Terminal Facilities are comprised of the three concourses attached to the main terminal building and the International Arrivals Building (IAB) used for commercial aircraft operations. Activities at the terminal include aircraft parking, taxiing, and APU use. General Mitchell International Airport is currently in the process of providing electrification at each of the aircraft gates to reduce APU use and noise.

Mitigation Options

Because of the central location of the terminal facility relative to the airfield, ground noise from the terminal complex contributes a relatively small amount to community noise exposure. Nonetheless, the terminal facilities, including the International Arrivals Building, will be evaluated to assess possible aircraft noise reductions through electrification.

New Procedure Noise Analysis:

The mitigation measures presented in Alternative 9 will not affect the 65 DNL, but will affect single event noise levels. Additional noise monitoring for this study was conducted in September 2005. The results of the additional noise monitoring as applicable to this alternative showed that noise from APU use could be reduced to near nighttime ambient levels, an approximate 10dB reduction of the continuous background noise.

Alternative 10
Provide Additional High-Speed Taxiways to Reduce Use of Reverse Thrust on Landing

Goal:

The goal of this alternative is to reduce the noise from reverse thrust when aircraft land at the Airport. Thrust reversers redirect the flow of the jet engine thrust toward the front of the aircraft. Reversing the power in this way assists in slowing the aircraft when landing.

Description:

This alternative would minimize the use of reverse thrust as a means of reducing noise to residents in close proximity to the Airport through two specific possible actions:

1. Pilot awareness program concerning the impact of reverse thrust.
2. Installation of additional high-speed exits that would facilitate less use of reverse thrust.

The use of reverse thrust is at the pilot's control and is based on stability and safety. It is based on runway conditions, landing conditions, and weather conditions, once the aircraft are on the runway. This alternative evaluated how noise would be reduced by the installation of additional high-speed taxiway exits that could facilitate a decrease in the use of reverse thrust. A typical landing procedure involves the pilot deploying the thrust reversers shortly after the main landing gear has touched down. The appropriate placement of multiple-angled (high-speed) taxiways can also help reduce the need for applying reverse thrust, as the aircraft has more options for exiting the runway and does not necessarily have to slow down the same amount to turn off the runway. A standard perpendicular connecting taxiway requires the aircraft to slow to a greater extent than an angled taxiway.

Existing Procedure:

The Airport has appropriately placed high-speed taxiways, and additional taxiways would not contribute significantly to the reduction in the use of reverse thrust, unless new aircraft types are accommodated or additional landside facilities are programmed. The placement of such taxiway exits is dependent upon the aircraft's desired destination, such as a gate, apron, or landside facility. In future airfield planning efforts, it is appropriate to plan and design high-speed taxiways where appropriate and feasible. This alternative is dependent on the possible shift of the runway thresholds and runway safety area; thus, further study is recommended once the location of the thresholds is determined. Figure

G16, *Alternative 10, High-Speed Taxiway Locations*, shows the location of the high-speed taxiways.

New Procedure:

Alternative 10 would involve establishing a pilot education program, possibly coupled with new high-speed taxiway exits to reduce the use of reverse thrust. As part of the noise abatement programs at General Mitchell International Airport, it would educate pilots on the noise impact associated with the use of reverse thrust and encourage reduced use where safe and operationally feasible.

New Noise Procedure:

This procedure does not have a DNL noise contour to model. However, reduced use of reverse thrust should be part of the pilot awareness program and should continue to be evaluated. It is appropriate to include such an awareness program in the Fly Quiet Program.

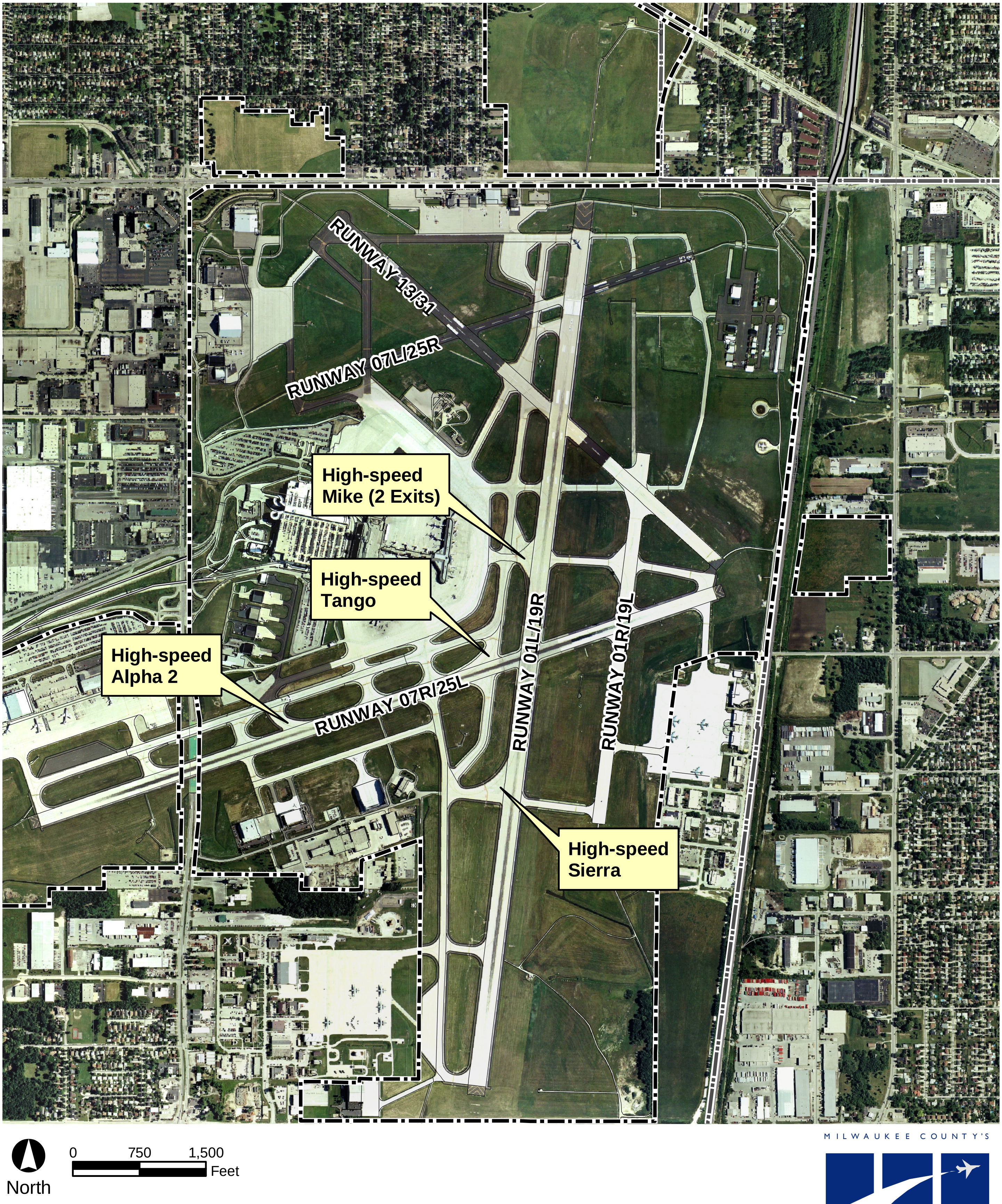


Figure G16 Alternative 10 High-Speed Taxiway Locations

MILWAUKEE COUNTY'S GENERAL MITCHELL INTERNATIONAL AIRPORT

Contour Evaluation

Land Use Comparison

Population and housing units, along with other noise sensitive uses for each modeled alternative, are evaluated and compared to the Future Base Case noise contours in the following table. The evaluation compares the number of residents, housing units, and other noise sensitive uses within the 65 DNL and greater noise contour, which is the federally recognized contour for identifying land use compatibility. As seen, Alternatives 1A, 1B, 4 and 8 result in the same or slightly less total population within the 65 DNL noise contour as the 2009 Future Base Case contour. The other alternatives increase, although not dramatically in some cases, the number of non-compatible housing units and people within the 65 DNL noise contour compared to the 2009 Future Base Case.

Table G4

2009 DNL CONTOUR COMPARISON FOR EACH MODELED ALTERNATIVE

General Mitchell International Airport FAR Part 150 Noise Compatibility Study

	2009 Future Base Case		Alt 1A		Alt 1B		Alt 2		Alt 3		Alt 4		Alt 8	
	Total	Non-Compat-ible[1]	Total	Non-Compat-ible[1]	Total	Non-Compat-ible[1]	Total	Non-Compat-ible[1]	Total	Non-Compat-ible[1]	Total	Non-Compat-ible[1]	Total	Non-Compat-ible[1]
DNL 65														
Housing Units	463	77	460	76	463	84	529	147	502	77	462	77	414	76
Population	1,090	180	1,080	180	1,090	195	1,240	345	1,180	180	1,085	180	970	180
Schools	1	0	1	0	1	0	1	0	2	0	1	0	1	0
Churches	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DNL 70														
Housing Units	8	7	7	6	7	6	6	5	8	7	9	8	5	4
Population	20	15	15	15	15	15	15	10	20	15	20	20	10	10
Schools	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Churches	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DNL 75														
Housing Units	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Population	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Schools	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Churches	0	0	0	0	0	0	0	0	0	0	0	0	0	0

A1a FMS Departure Procedure, Runway 19R, East Destinations
A1bFMS Departure Procedure, Runway 19R, West Destinations
A2 FMS Procedures for East Departures, No Turns until Reaching Lake Michigan, Runway 7R
A3 FMS Procedures, North-Bound Departures, Runway 1L
A4 FMS Procedures, South-Bound Departures, Runway 25L
A8Intersection Departures for South-Bound Departures at Night

1 Housing units that have not been sound attenuated because they are either outside of the 1997 68.5 DNL contour or units eligible for sound insulation that refused assistance
2 Note: Population numbers derived from the average number of persons per household per census tract times the number of housing units, rounded to the nearest five.
Note: Numbers are cumulative between contours; the 65 DNL contains the 70 and 75 DNL numbers.

Grid Analysis

Tables G5 through G10 present the results of the representative grid analysis completed for each of the alternatives for which DNL noise contours were generated. These grids can be used to identify the potential change in noise that may occur in a neighborhood as a result of each of the alternatives. Only the grids in the quadrant for which a change may potentially occur as a result of that alternative are presented. The location of each of the grids is presented in Figure G17.

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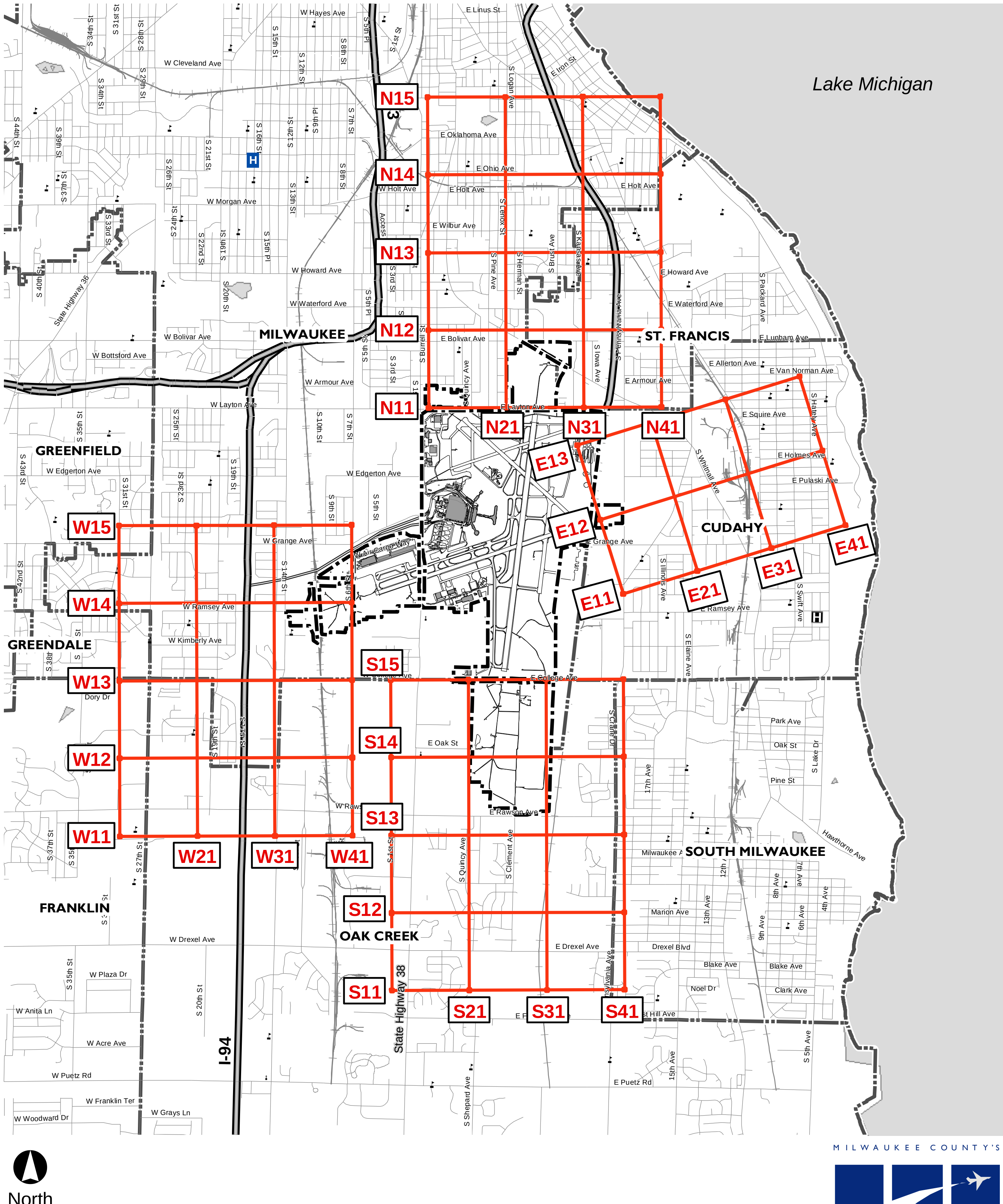

Figure G17 Representative Receptor Grid

MILWAUKEE COUNTY'S GENERAL MITCHELL INTERNATIONAL AIRPORT

Table G5

CHANGE IN NOISE GRIDS (ALTERNATIVE 1A - SATELLITE BASED DEPARTURE PROCEDURE FOR RUNWAY 19R - EAST), BASE CASE 2009 NOISE LEVELS AND ALTERNATIVE 1A CHANGE

General Mitchell International Airport FAR Part 150 Noise Compatibility Study

Grid ID	**2009 Base Case DNL**	**DNL Change**	**2009 Base Case Time Above 65 DNL** (Minutes)	**Time Above 65 DNL Change** (Minutes)	**2009 Base Case Number of Events Above 65 DNL**	**Number of Events Above 65 DNL Change** (Events)
S11	56.2	0.0	6.7	0.1	33.2	1.3
S12	59.3	0.1	10.9	0.2	46.7	0.0
S13	61.9	0.0	17.6	0.1	62.1	-1.1
S14	60.9	0.0	19.6	-0.1	65.4	-0.4
S15	58.0	0.0	17.4	0.0	68.5	-0.3
S21	59.9	-0.1	21.0	-0.3	91.2	0.3
S22	62.9	-0.1	28.4	0.5	120.2	1.1
S23	65.2	-0.1	39.7	-0.1	164.7	2.5
S24	67.9	-0.1	52.6	1.0	203.0	4.6
S25	68.6	0.0	82.5	0.2	223.7	0.5
S31	59.0	1.6	13.9	4.1	61.5	18.8
S32	61.8	1.7	20.5	1.9	82.9	4.4
S33	64.0	0.9	26.8	0.4	106.1	1.5
S34	65.4	-0.5	37.8	0.3	143.5	1.0
S35	66.0	-0.1	69.8	0.2	203.7	0.0
S41	58.3	-1.3	13.1	0.0	57.0	8.1
S42	58.7	-2.9	12.0	-2.5	53.6	-10.9
S43	56.8	-1.6	10.8	-2.1	50.5	-6.2
S44	55.4	-0.4	8.9	-0.9	37.3	-2.6
S45	54.6	-0.1	6.9	-0.2	33.2	0.4

Table G6

CHANGE IN NOISE GRIDS (ALTERNATIVE 1B - SATELLITE BASED DEPARTURE PROCEDURE FOR RUNWAY 19R - WEST), BASE CASE 2009 NOISE LEVELS AND ALTERNATIVE 1B CHANGE

General Mitchell International Airport FAR Part 150 Noise Compatibility Study

Grid ID	**2009 Base Case DNL**	**DNL Change**	**2009 Base Case Time Above 65** (Minutes)	**Time Above 65 Change** (Minutes)	**2009 Base Case Number of Events Above 65 DNL**	**Number of Events Above 65 DNL Change** (Events)
S11	56.2	0.2	6.7	1.0	33.2	4.7
S12	59.3	1.5	10.9	3.1	46.7	9.9
S13	61.9	1.3	17.6	2.0	62.1	3.9
S14	60.9	-1.5	19.6	-1.6	65.4	-1.3
S15	58.0	-0.2	17.4	-0.8	68.5	-0.9
S21	59.9	-0.1	21.0	-0.2	91.2	-2.3
S22	62.9	-0.2	28.4	-0.3	120.2	-1.1
S23	65.2	-0.2	39.7	1.3	164.7	2.5
S24	67.9	0.5	52.6	0.0	203.0	0.0
S25	68.6	0.0	82.5	-0.1	223.7	0.0
S31	59.0	0.0	13.9	-0.1	61.5	0.0
S32	61.8	0.0	20.5	0.1	82.9	0.3
S33	64.0	0.0	26.8	-0.1	106.1	-2.3
S34	65.4	0.0	37.8	-0.2	143.5	-0.7
S35	66.0	0.0	69.8	0.1	203.7	0.0
S41	58.3	0.0	13.1	0.0	57.0	0.0
S42	58.7	0.0	12.0	0.0	53.6	-0.6
S43	56.8	0.0	10.8	-0.1	50.5	0.4
S44	55.4	0.0	8.9	-0.1	37.3	0.4
S45	54.6	0.0	6.9	-0.1	33.2	-0.2

Table G7

CHANGE IN NOISE GRIDS (ALTERNATIVE 2 - SATELLITE BASED DEPARTURE PROCEDURE FOR RUNWAY 7R), BASE CASE 2009 NOISE LEVELS AND ALTERNATIVE 2 CHANGE

General Mitchell International Airport FAR Part 150 Noise Compatibility Study

Grid ID	**2009 Base Case DNL**	**DNL Change**	**2009 Base Case Time Above 65** (Minutes)	**Time Above 65 Change** (Minutes)	**2009 Base Case Number of Events Above 65 DNL**	**Number of Events Above 65 DNL Change** (Events)
E11	55.7	0.0	13.0	-0.6	66.1	-7.2
E12	73.6	-0.1	55.4	-0.1	236.2	0.0
E13	64.3	0.0	71.2	-0.2	228.5	-0.5
E21	54.4	-0.3	9.2	-0.6	41.9	-4.9
E22	68.4	0.2	50.6	-0.2	195.9	0.0
E23	57.2	0.0	16.6	0.3	81.7	-3.6
E31	53.8	-1.1	8.2	-1.6	35.1	-5.4
E32	65.9	0.3	47.6	0.0	186.5	0.0
E33	55.5	-0.1	10.9	-0.2	49.7	-4.8
E41	55.0	-3.2	8.0	-2.4	33.0	-7.7
E42	63.4	0.7	45.6	2.3	175.4	1.2
E43	55.5	-1.3	8.7	0.7	41.3	-3.0

Table G8

CHANGE IN NOISE GRIDS (ALTERNATIVE 3 - SATELLITE BASED DEPARTURE PROCEDURE FOR RUNWAY 1L), BASE CASE 2009 NOISE LEVELS AND ALTERNATIVE 3 CHANGE

General Mitchell International Airport FAR Part 150 Noise Compatibility Study

Grid ID	**2009 Base Case DNL**	**DNL Change**	**2009 Base Case Time Above 65** (Minutes)	**Time Above 65 Change** (Minutes)	**2009 Base Case Number of Events Above 65 DNL**	**Number of Events Above 65 DNL Change** (Events)
N11	56.9	0.0	11.0	0.0	43.8	0.0
N12	53.5	-0.1	3.8	0.0	14.1	-0.1
N13	52.5	-0.4	3.1	-0.3	11.8	-1.1
N14	53.3	-1.7	4.0	-1.1	15.8	-4.9
N15	54.9	-1.7	5.0	0.1	19.7	-1.7
N21	68.8	-0.1	114.0	0.1	251.0	0.0
N22	61.2	-0.3	15.3	-0.1	58.1	0.0
N23	60.0	-1.1	10.4	-0.5	40.8	-1.7
N24	59.6	-0.3	8.0	0.3	31.0	-0.2
N25	56.8	2.2	6.3	0.8	26.9	0.1
N31	63.3	0.0	50.2	0.0	191.3	0.1
N32	61.4	-0.3	16.1	0.3	62.0	0.0
N33	61.9	0.5	17.6	0.6	75.7	0.2
N34	60.3	-0.5	17.2	0.7	73.4	3.4
N35	58.5	-0.4	14.3	-0.2	60.7	-0.1
N41	57.4	0.0	13.9	0.0	70.5	0.2
N42	53.8	-0.1	6.7	-0.1	28.0	-0.4
N43	54.4	-0.6	5.8	-0.3	24.4	-2.8
N44	55.4	1.5	5.7	0.6	25.3	1.5
N45	53.1	-0.9	4.3	-0.3	21.4	3.7

Table G9

CHANGE IN NOISE GRIDS (ALTERNATIVE 4 - SATELLITE BASED DEPARTURE PROCEDURE FOR RUNWAY 25L), BASE CASE 2009 NOISE LEVELS AND ALTERNATIVE 4 CHANGE

General Mitchell International Airport FAR Part 150 Noise Compatibility Study

Grid ID	2009 Base Case DNL	DNL Change	2009 Base Case Time Above 65 (Minutes)	Time Above 65 Change (Minutes)	2009 Base Case Number of Events Above 65 DNL	Number of Events Above 65 DNL Change (Events)
W11	54.4	0.9	7.8	1.1	33.5	4.0
W12	55.2	0.5	8.5	0.9	39.6	2.4
W13	59.3	-0.2	24.8	0.2	102.7	3.5
W14	53.4	-0.1	5.8	-0.2	31.7	-1.6
W15	49.5	0.0	2.2	0.0	13.6	0.0
W21	55.8	-0.3	8.9	-0.1	37.9	-1.1
W22	56.0	-0.3	9.9	0.4	41.9	4.1
W23	58.8	0.4	24.5	0.4	110.2	0.0
W24	55.9	-0.2	12.5	0.2	67.2	1.5
W25	50.8	0.0	3.6	-0.1	21.5	0.2
W31	57.6	-0.1	10.3	-0.4	41.6	-1.9
W32	56.9	-0.1	10.0	-0.3	40.3	-1.9
W33	56.9	-0.2	13.7	-0.1	58.1	0.0
W34	60.9	-0.1	26.5	0.1	111.2	0.0
W35	52.9	0.0	5.1	-0.1	29.8	-1.9
W41	60.3	0.0	14.6	-0.1	52.4	-0.5
W42	59.0	0.0	13.8	-0.1	50.4	0.0
W43	56.6	0.0	14.4	0.0	60.8	2.7
W44	71.8	0.2	24.2	-0.1	129.8	0.0
W45	54.4	0.0	10.8	0.0	42.6	-0.7

Table G10

CHANGE IN NOISE GRIDS (ALTERNATIVE 8 - INTERSECTION DEPARTURES FOR SOUTH-BOUND DEPARTURES AT NIGHT), BASE CASE 2009 NOISE LEVELS AND ALTERNATIVE 4 CHANGE

General Mitchell International Airport FAR Part 150 Noise Compatibility Study

Grid ID	2009 Base Case DNL	DNL Change	2009 Base Case Time Above 65 (Minutes)	Time Above 65 Change (Minutes)	2009 Base Case Number of Events Above 65 DNL	Number of Events Above 65 DNL Change
N11	56.9	-0.1	11.0	-0.2	43.8	0.0
N12	53.5	-0.3	3.8	-0.1	14.1	0.0
N13	52.5	-0.1	3.1	0.0	11.8	0.0
N14	53.3	-0.1	4.0	0.0	15.8	0.0
N15	54.9	-0.1	5.0	0.0	19.7	0.0
N21	68.8	-2.0	114.0	-9.0	251.0	-0.7
N22	61.2	0.0	15.3	-0.2	58.1	-0.7
N23	60.0	0.0	10.4	-0.1	40.8	0.0
N24	59.6	0.0	8.0	0.0	31.0	0.0
N25	56.8	0.0	6.3	0.0	26.9	0.0
N31	63.3	-1.0	50.2	-2.5	191.3	-11.0
N32	61.4	-0.1	16.1	-0.2	62.0	-0.9
N33	61.9	0.0	17.6	0.0	75.7	0.0
N34	60.3	0.0	17.2	0.0	73.4	0.0
N35	58.5	0.0	14.3	0.0	60.7	0.0
N41	57.4	-0.2	13.9	-0.1	70.5	-0.9
N42	53.8	-0.2	6.7	-0.1	28.0	0.0
N43	54.4	-0.1	5.8	0.0	24.4	0.0
N44	55.4	0.0	5.7	0.0	25.3	0.0
N45	53.1	0.0	4.3	0.0	21.4	0.0
S11	56.2	0.4	6.7	0.0	33.2	0.1
S12	59.3	0.4	10.9	0.0	46.7	-0.1
S13	61.9	0.3	17.6	0.1	62.1	0.1
S14	60.9	0.2	19.6	0.0	65.4	0.2
S15	58.0	0.0	17.4	0.0	68.5	-0.3
S21	59.9	0.0	21.0	0.0	91.2	0.1
S22	62.9	0.1	28.4	0.1	120.2	0.2
S23	65.2	0.2	39.7	0.1	164.7	0.5
S24	67.9	0.5	52.6	0.3	203.0	0.7
S25	68.6	0.1	82.5	-0.1	223.7	0.0
S31	59.0	0.3	13.9	0.1	61.5	0.6
S32	61.8	0.3	20.5	0.1	82.9	0.8
S33	64.0	0.4	26.8	0.1	106.1	0.2
S34	65.4	0.4	37.8	0.3	143.5	1.0
S35	66.0	-0.2	69.8	-0.2	203.7	0.4
S41	58.3	0.5	13.1	0.1	57.0	0.4
S42	58.7	0.3	12.0	0.1	53.6	0.3
S43	56.8	0.1	10.8	0.0	50.5	0.2
S44	55.4	0.0	8.9	-0.1	37.3	0.1
S45	54.6	-0.3	6.9	-0.2	33.2	-0.2