



Minneapolis St. Paul International Airport (MSP) 2017 Annual Noise Contour Report

**Comparison of the 2017 Actual and the 2007 Forecast Noise Contours
February 2018**

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ES EXECUTIVE SUMMARY

ES.1 BACKGROUND

The issue of aircraft noise at Minneapolis-St. Paul International Airport (MSP) includes a long history of local efforts to quantify and mitigate noise impacts in a manner responsive to concerns raised by communities around the airport and consistent with federal policy. In 1992, the Metropolitan Airports Commission (MAC) embarked on a 14 CFR Part 150 Program at MSP (Program), which included a noise mitigation program for single-family and multi-family residences and schools, as well as property acquisition and relocation based on mitigation eligibility defined by the 1996 forecast 65 decibel Day-Night Average Sound Level (dB DNL) noise contour. When the original Part 150 Program was completed in 2006, noise mitigation had been provided to 7,846 single-family homes, 1,327 multi-family units, 18 schools and 437 residential properties were acquired around MSP at a cost of approximately \$385.6 million.

In 1999 the MAC began an update its Program and published a draft Part 150 Update document in October 2000, which included a 2005 forecast noise contour. In May 2002, after further consideration of the effects of September 11, 2001, the MAC withdrew the draft Part 150 Update to ensure the operational impacts and MSP fleet mix changes were considered in the noise contours.

One of the largest discussion items in the Part 150 Update process focused on the mitigation program. Expansion of noise mitigation efforts beyond the federally-recognized level of 65 dB DNL was outlined as part of the Dual-Track Airport Planning Process (a process directed by the State Legislature that began in 1989 and concluded in 1998 that examined moving MSP versus expanding it in its current location). Through the Part 150 Update, the MAC detailed a specific mitigation package to be offered to homes located in the 60-64 dB DNL noise contour area, which proposed providing central air conditioning to single-family homes that did not have it, with a homeowner co-pay based on the degree of noise impact.

ES.2 AIRPORT NOISE LITIGATION AND CONSENT DECREE

The cities located around MSP expressed dissatisfaction with the Part 150 Update associated with the expanded noise mitigation proposal in the context of the Dual-Track Airport Planning Process discussions. Contention grew and in early 2005, the Cities of Minneapolis, Eagan, and Richfield and the Minneapolis Public Housing Authority filed a lawsuit in Hennepin County District Court against the MAC on the grounds that the MAC violated environmental quality standards and the Minnesota Environmental Rights Act by failing to provide a Full 5-decibel Noise Reduction Package (as was provided in the 1996 65 dB DNL noise contour) to single-family homes in the 60-64 dB DNL noise contour areas. In September 2005, plaintiffs seeking class action certification filed a separate action against the MAC alleging breach of contract claims associated with mitigation in the 60-64 dB DNL noise contours.

In 2007, the MAC and the Cities of Minneapolis, Eagan, and Richfield and the Minneapolis Public Housing Authority entered into a Consent Decree that settled the litigation. The 2007 Consent Decree provided the Full 5-decibel Reduction Package to single-family homes within the 2007 forecast 63 dB DNL noise contour and a Partial Noise Reduction Package to single-family homes

located in the 2007 forecast 60-62 dB DNL noise contours. A Homeowner Reimbursement Program was also offered to single-family homes located in areas between the 2005 forecast 60 dB DNL noise contour and the 2007 forecast 60 dB DNL noise contour. Multi-family structures within the 2007 forecast 60 dB DNL noise contour were offered a uniform Multi-Family Reduction Package.

Upon the completion of the 2007 Consent Decree noise mitigation program in 2014, more than 15,000 single-family homes and 3,303 multi-family units were provided noise mitigation around MSP. The MAC's expenditures related to its noise mitigation program efforts extend to over \$482 million.

ES.3 MSP 2020 IMPROVEMENTS EA/EAW

In January 2013, the MAC published the Final MSP 2020 Improvements Environmental Assessment/Environmental Assessment Worksheet (EA/EAW), which reviewed the potential and cumulative environmental impacts of MSP terminal and landside developments needed through the year 2020. In response to new concerns expressed by MSP Noise Oversight Committee membership, a new noise mitigation plan was proposed in the EA/EAW leading to an amendment to the 2007 Consent Decree.

ES.4 THE AMENDED CONSENT DECREE

The first amendment to the 2007 Consent Decree was initiated in 2013 and establishes Residential Noise Mitigation Program eligibility based on annual assessments of actual MSP aircraft activity rather than projections. To be eligible, a home must be located within the actual 60 dB DNL noise contour and exposed to a higher noise mitigation eligibility area when compared the previous noise mitigation program area for three consecutive years. The first of the three years must occur by 2020. The Full 5-decibel Reduction Package is offered to single-family homes meeting these criteria inside the actual 63 dB DNL noise contour while the Partial Noise Reduction Package is offered to single-family homes in the actual 60-62 dB DNL noise contours. A uniform Multi-Family Noise Reduction Package is offered to multi-family units within the actual 60 dB DNL noise contour. Homes will be mitigated in the year following their eligibility determination. The 2013 actual noise contour marked the first year in assessing this new mitigation program.

A second amendment was made to the 2007 Consent Decree in 2017. This amendment allows the use of the Aviation Environmental Design Tool (AEDT) to develop the actual noise contours each year, beginning with the 2016 actual noise contour. In 2015, AEDT became the federally-approved computer model for determining and analyzing noise exposure and land use compatibility issues around airports in the United States. The second amendment also provided clarity on the Opt-Out Eligibility criteria. Specifically, single-family homes that previously opted out of the Partial Noise Reduction Package may participate in the Full 5-decibel Reduction Package, provided the home meets the eligibility requirements.

ES.5 2017 NOISE CONTOUR

Based on the 415,703¹ total operations at MSP in 2017, the actual 60 dB DNL contour is approximately 27 percent smaller than the 2007 forecast contour and the 65 dB DNL contour is approximately 38 percent smaller than the 2007 forecast contour. The predominant contraction in the contours from the 2007 forecast to the 2017 actual noise contour scenario is driven largely by a reduction in total aircraft operations by 28.6 percent, 274.9 fewer average daily flights in Hushkit Stage 3 aircraft, and a daily average of 3.2 fewer flights during the nighttime. However, there continues to be a small area in South Minneapolis where the 2017 actual noise contours extend beyond the 2007 forecast noise contours establishing First-, Second-, and Third-year Candidate Eligibility under the terms of the amended Consent Decree. This expansion of noise impacts can largely be attributed to nighttime runway use variances between what was forecasted for 2007 and what actually occurred in 2017, particularly an increase of the nighttime arrival operations on Runway 12R. This same trend existed in 2016.

ES.6 NOISE MITIGATION PROGRAM ELIGIBILITY UNDER THE AMENDED CONSENT DECREE

First-Year Candidate Eligibility

The 2017 actual noise contour includes 63 single-family homes within the First-Year eligibility area for the Partial Noise Reduction Package. These homes were previously eligible for homeowner reimbursements. Of these homes, 33 are located in Eagan, 25 are in Minneapolis and 5 are located in Inver Grove Heights. There are no multi-family units within the First-Year eligibility area. If these 63 single-family homes remain in a higher noise impact area compared to the previous noise mitigation program for two consecutive years more, they will be eligible for mitigation in 2021.

Second-Year Candidate Eligibility

The 2017 actual noise contour includes 243 homes within the Second-Year eligibility area. It is important to note that a reduction in aircraft noise exposure in 2017 compared to 2016 resulted in the 2017 actual noise contour shrinking in Minneapolis along the arrival lobe for Runway 12R. Based on this analysis, 200 single-family homes and 149 multi-family units that met the First-Year Candidate Eligibility criteria in the 2016 analysis no longer meet the noise level criteria required for Second-Year Candidate Eligibility.

Of the 243 homes within the 2017 Second-Year eligibility area, 140 were previously outside the program area and 24 were previously eligible for homeowner reimbursements. The 2017 actual noise contour includes another 79 single-family homes within the Second-Year eligibility area for the Full 5-decibel Reduction Package. There are no multi-family units within the Second-Year eligibility area. If these 243 total single-family homes remain in a higher noise impact area

¹ Based on airport operations counts documented by the Federal Aviation Administration for MSP in 2017.

compared to the previous noise mitigation program by virtue of the 2018 actual noise contour, they will be eligible for mitigation in 2020.

Third-Year Candidate Eligibility

The 2017 actual noise contour includes 430 homes within the Third-Year eligibility area and will be invited into the mitigation program in 2019. Again, it is important to note that a reduction in aircraft noise exposure in 2017 compared to 2016 resulted in the 2017 actual noise contour shrinking in Minneapolis along the arrival lobe for Runway 12R. Based on this analysis, 53 homes that met the Second-year Candidate Eligibility criteria in the 2016 analysis no longer meet the noise level criteria required for Third-year Candidate Eligibility.

Of the 430 homes that meet the Third-year Candidate Eligibility, 249 homes are eligible for the Partial Noise Reduction Package. Of these, 177 homes were previously located outside the eligibility area and 72 homes were previously eligible for homeowner reimbursements. These single-family homes are entered into the 2019 mitigation program to receive one of two mitigation options, as detailed in Section 9.5(b) of the first amendment to the 2007 Consent Decree. The remaining 181 single-family homes are eligible for the Full 5-decibel Reduction Package.

There are no multi-family units that meet the criteria for Third-Year Candidate Eligibility. Homeowners of eligible properties will be notified by the MAC in writing by mid-2018.

In cases where homes have received previous reimbursements or mitigation from the MAC, those improvements will be deducted from the efforts required to increase the home mitigation relative to the actual noise level, per the amended Consent Decree.

The blocks meeting the first, second and third consecutive year(s) of noise mitigation eligibility by virtue of the 2017 actual noise contours are shown in Figures ES-1, ES-2 and ES-3.

2017 Mitigation Program

In 2017 the MAC began the project to provide mitigation to 138 single-family homes that became eligible by virtue of the 2015 actual noise contour. As of February 12, 2018, 92 homes have been completed, 37 homes have begun the construction or pre-construction phases, and nine homes declined participation.

Two multi-family structures were also eligible to participate in the Multi-Family Mitigation Program in 2017; one property is in pre-construction, and one property declined to participate. The year-to-date construction cost for the 2017 Mitigation Program is \$1,795,957.

2018 Mitigation Program

In late 2017 the MAC began contacting the homeowners of 283 single-family homes that achieved eligibility by virtue of the 2016 actual noise contour. As of February 12, 2018, five homes have been completed, 271 homes have begun the construction or pre-construction phases, and seven homes declined participation. The 2018 Mitigation Program does not include any multi-family properties. To date, \$90,252 has been spent on the 2018 Mitigation Program.

Figure ES-1: 2017 Contours and Mitigation Program Eligibility

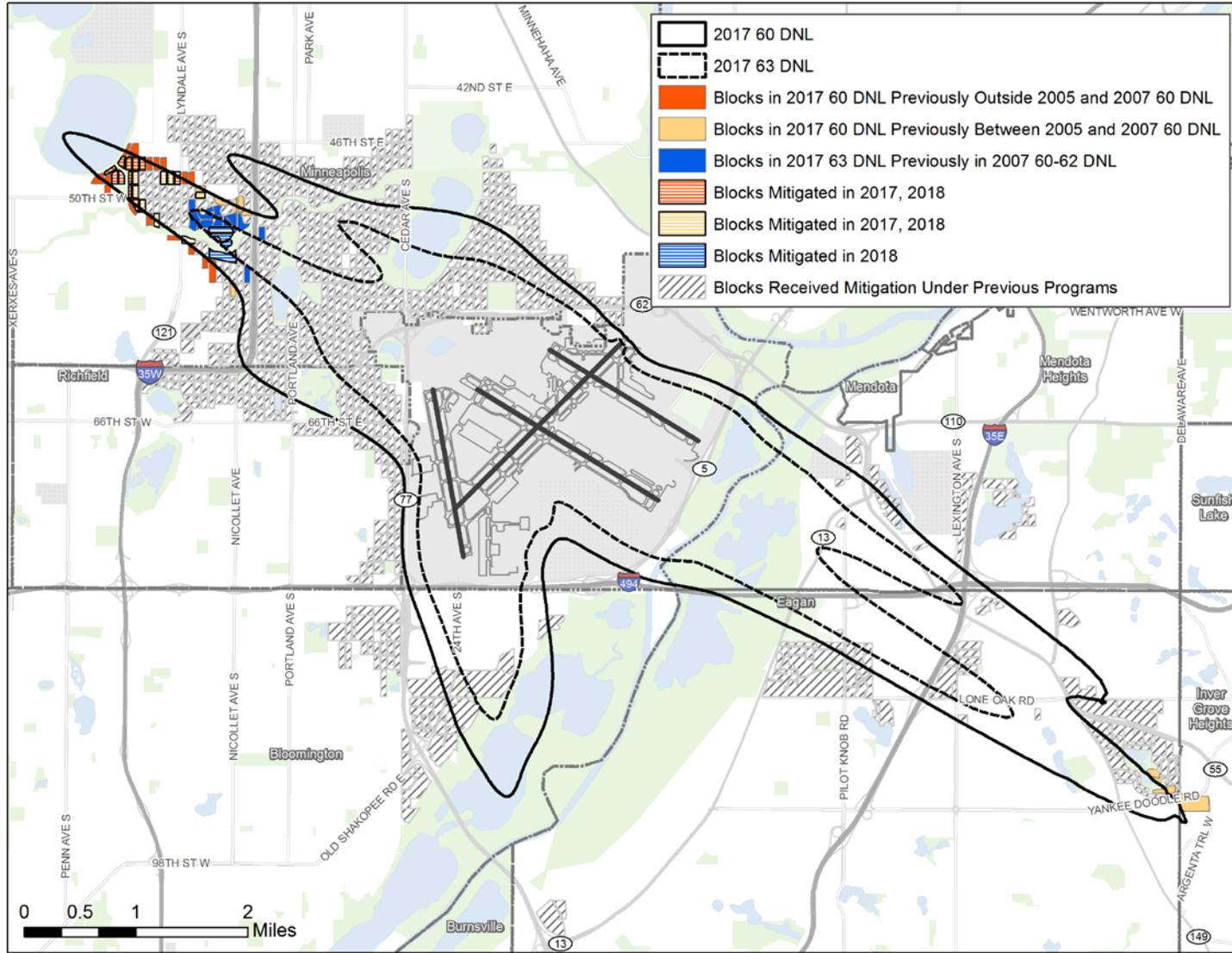


Figure ES-2: 2017 Contours and Mitigation Program Eligibility – City of Minneapolis

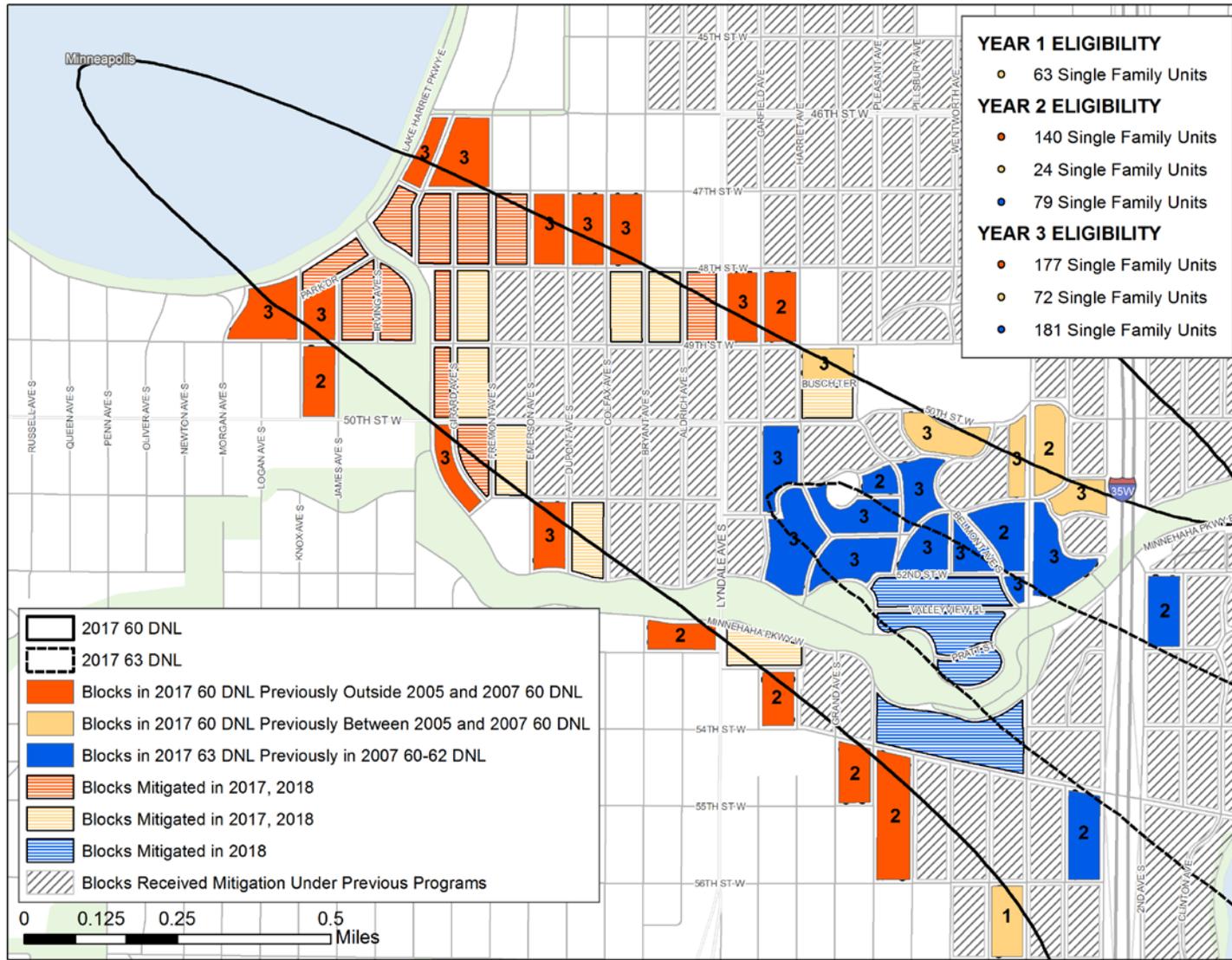
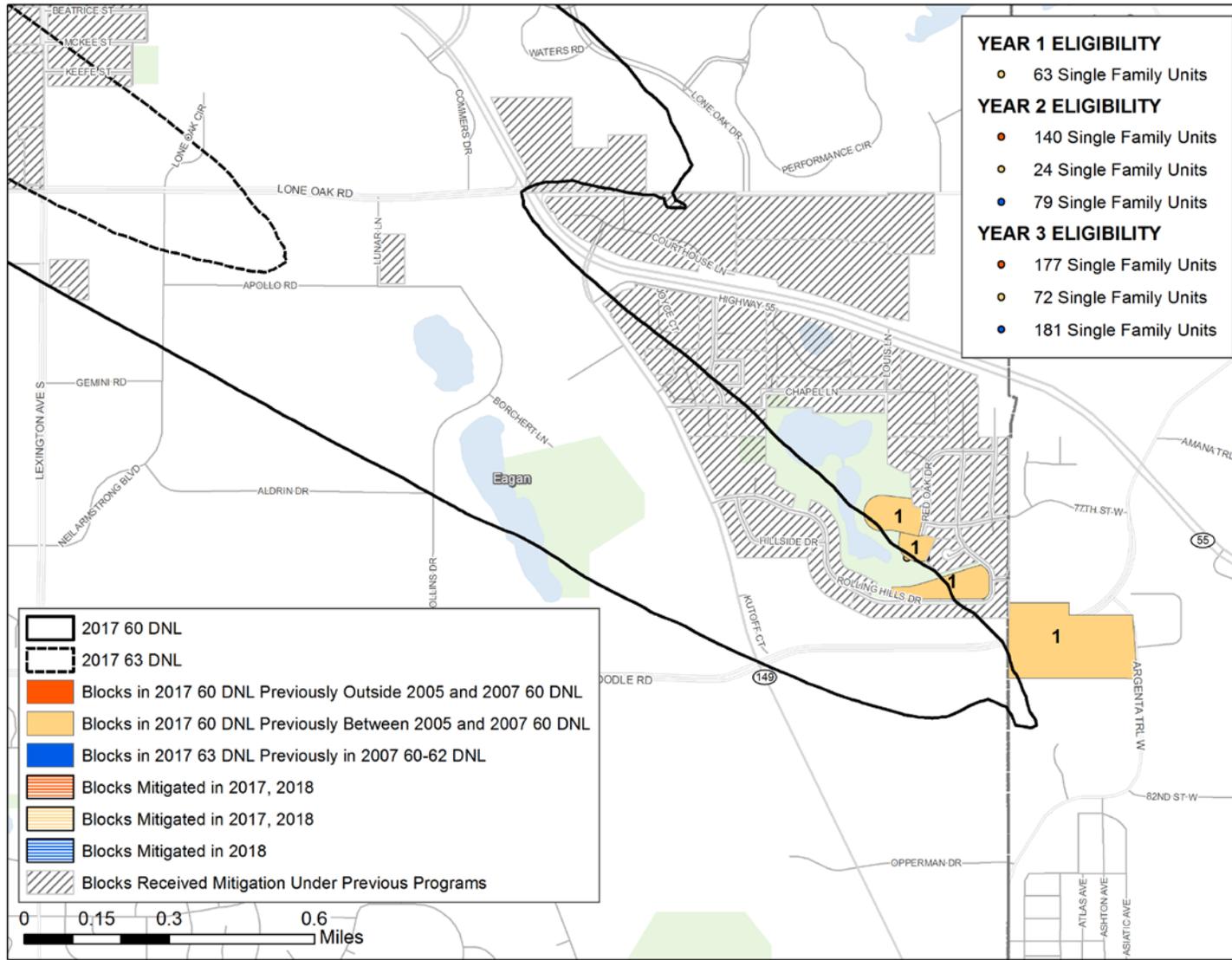


Figure ES-3: 2017 Contours and Mitigation Program Eligibility – Cities of Eagan and Inver Grove Heights



1. INTRODUCTION AND BACKGROUND

The issue of aircraft noise at Minneapolis-St. Paul International Airport (MSP) includes a long history of local efforts to quantify and mitigate noise impacts in a manner responsive to concerns raised by the communities around the airport and consistent with federal policy. These efforts have resulted in the conceptualization and implementation of many initiatives to reduce noise impacts around MSP. One of the most notable of these initiatives has been the sound insulation program originally implemented under 14 Code of Federal Regulations Part 150 (Part 150).

Part 150 provides a framework for airport operators to develop a comprehensive noise plan for an airport in the form of a Noise Compatibility Program (NCP). An NCP is comprised of two fundamental approaches to addressing noise impacts around an airport: (1) Land Use Measures, and (2) Noise Abatement (NA) Measures (operational measures to reduce noise). A key component of Part 150 program planning is the development of a Base Case Noise Exposure Map (NEM) and a five-year forecast NEM without (unmitigated forecast scenario) and with (forecast mitigated scenario) the recommended operational noise abatement measures. Including operational noise abatement measures is important because how an airport is operated and how aircraft procedures are executed have a direct effect on an airport's noise impact. NEMs are commonly referred to as noise contours. Forecast mitigated noise contours depict the areas that may be eligible for Land Use Measures (compatible land use plans, property acquisition, residential relocation, and sound mitigation) around an airport.

Recognizing the need for increased infrastructure and the emerging importance of noise issues as operations at MSP increased, the Metropolitan Airports Commission (MAC) submitted its first MSP Part 150 Study to the Federal Aviation Administration (FAA) in October 1987. NEMs were accepted by the FAA in October 1989, and portions of the NCP were approved in April 1990. The NCP included Corrective Land Use Measures which called for the soundproofing of residences, schools and other public buildings. A 1992 update to the NCP and NEM marked the beginning of corrective mitigation measures within the forecast 1996 NEM 65 dB Day-Night Average Sound Level (DNL) noise contours.

1.1 CORRECTIVE LAND USE EFFORTS TO ADDRESS AIRCRAFT NOISE

From 1992 to 2006, the Residential Noise Mitigation Program was a large and visible part of the Part 150 program at MSP. The MAC designed the MSP Residential Noise Mitigation Program using FAA structural Noise Level Reduction (NLR) documentation to establish product-specific Sound Transmission Class (STC) ratings and associated NLR goals, creative bidding practices, and cooperative prioritization and funding efforts. Through innovative approaches to enhancing the program as new information and technologies became available, the MSP Residential Noise Mitigation Program quickly became a national model.

Because testing and evaluation of single-family homes near MSP indicated that the majority of such homes provided an average 30 dB of exterior to interior sound attenuation, the MAC developed a "Full 5-decibel Reduction Package" for single-family homes within the 65 dB DNL and greater noise contours. This package provided an average exterior-to-interior noise reduction level of 5 dB, ensuring a noticeable level of reduction designed to meet the FAA's target of a 45 dB DNL interior noise level in each home. The Full 5-decibel Reduction Package offered a menu

of mitigation measures that the MAC might install to achieve an average 5 dB noise reduction and meet the 45 dB DNL interior noise level in an individual home. The menu of mitigation measures included: windows; prime doors; attic insulation; baffling of attic vents, mail slots and chimneys; and the addition of central air-conditioning. The MAC determined which specific mitigation measures were necessary for a particular home after assessing the home's existing condition.

As a result of detailed and extensive project management and quality control, the program achieved an excellent record of homeowner satisfaction. Throughout the duration of the program, when homeowners were asked if the improvements were effective at reducing aircraft noise, at least 95 percent responded yes. When asked if the modifications improved interior home comfort, at least 95 percent responded yes.

In 2004, the MAC awarded the final bids for the remaining unmitigated homes in the 1996 65 dB DNL noise contour. In early 2006, the MAC completed the mitigation of an additional 165 single-family homes in the 2007 forecast mitigated 65 dB DNL noise contour. With the completion of the 165 single-family homes, all eligible and participating homes within the 2007 forecast mitigated 65 dB DNL contour have been mitigated. This represented a significant accomplishment for an industry-leading aircraft noise mitigation program. The program resulted in the mitigation of over 7,800 single-family homes in communities around MSP.

The financial investment in the MSP Residential Noise Mitigation Program was among the largest in the nation for such programs. Throughout the 14-year project (1992-2006) several variables had an impact on the project's annual financial profile. Year-to-year variations in housing stock and material costs caused fluctuations in the unit, or per-house, costs. This, combined with variations in annual budgets as a result of challenges such as the terrorist attacks of September 11, 2001, resulted in a fluctuating rate of annual home completions.

Annual average mitigation costs per single-family home ranged from a low of \$17,300 in 1994 to a high of \$45,000 in 2001. The MAC spent a total of approximately \$229.5 million on the single-family home mitigation program during its 14-year lifespan.

In addition to the single-family mitigation program, the MAC also mitigated multi-family units and schools, and engaged in property acquisition and relocation. The multi-family component of the Residential Noise Mitigation Program began in 2001, and was significantly smaller in both the number of structures mitigated and the associated costs. With completion of multi-family structures in the 1996 65 dB DNL noise contour, the MAC mitigated approximately 1,327 multi-family units at a total cost of approximately \$11.1 million. There were no additional multi-family structures inside the 2007 forecast mitigated 65 dB DNL noise contour. All eligible and participating multi-family structures within the 2007 forecast mitigated 65 dB DNL noise contour have been mitigated.

Also, since 1981, the MAC has mitigated 18 schools located around MSP. This total represents all of the schools located within the 1996 65 dB DNL noise contour. In response to the Minnesota State Legislature's directives, the MAC also provided mitigation to certain schools located outside the 1996 65 dB DNL noise contour. The costs of insulating individual schools varied from \$850,000 to \$8 million. A total of approximately \$52 million was spent on the school sound insulation program.

In addition to the residential and school noise mitigation programs, the MAC implemented a residential property acquisition program that facilitated the relocation of sensitive land uses, such as residential buildings, in noise impact areas. The intent of the residential acquisition program was to address impacted properties in the 1996 65 dB DNL noise contour, with the property owners and the city in which the respective property resided agreeing that acquisition was the desirable means of mitigating the homes. As a result, the MAC acquired approximately 437 residential properties. In total, the MAC expended approximately \$93 million on the residential property acquisition program.

1.2 2007 FORECAST MITIGATED NOISE CONTOUR

In late 1998, the MAC authorized an update to the Part 150 program at MSP. The update process began in 1999 with the development of noise contours and noise abatement and land use measures. The MAC published a draft Part 150 Update document in October 2000 and submitted the study, including a 2005 forecast NEM and revised NCP, to the FAA for review. In May 2002, after further consideration of the events of September 11, 2001, the MAC withdrew the study to update the forecast and associated noise contours.

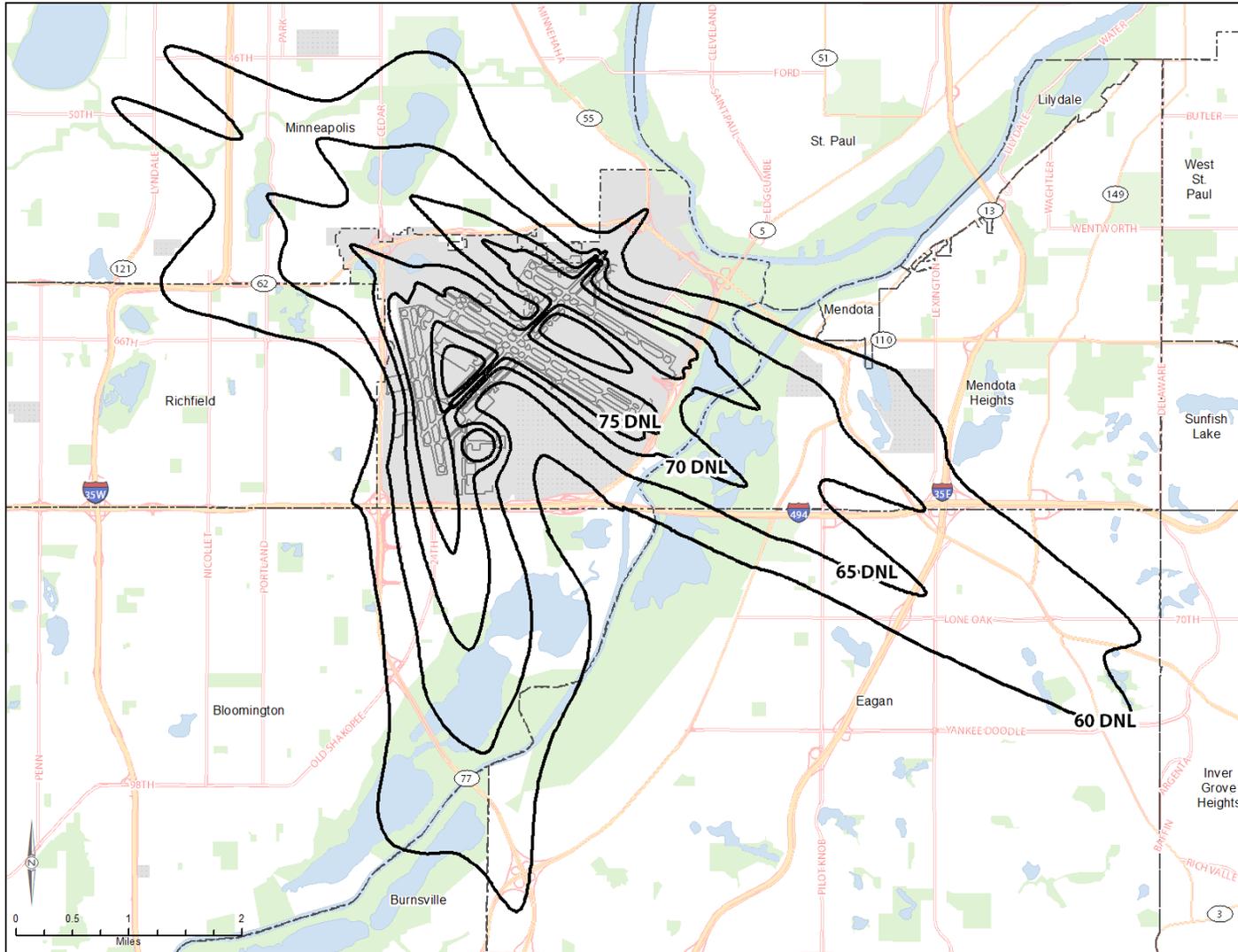
The forecast update process began in February 2003. This effort focused on updating the Base Case year from a 2000 scenario to a 2002 Base Case, and updating the forecast year from 2005 to 2007. The purpose of the forecast update was to ensure that the noise contours considered the impacts of the events of September 11, 2001 and ongoing changes in the MSP aircraft fleet. In addition to updating the forecast, the MAC and the MSP Noise Oversight Committee (NOC) conducted a review of the Integrated Noise Model (INM) input methodology and data to ensure continued consensus with the previous contour (i.e., November 2001) development process.

On November 17, 2003, the MAC approved the revised forecast and fleet mix numbers and INM input methodology and data for use in developing the 2002 and 2007 NEMs. In March 2004, the MAC revised the forecast to incorporate certain corrections in general aviation numbers and to reflect Northwest Airlines' announcement that it would resume service of five aircraft that had been taken out of service previously.

The 2004 Part 150 Update resulted in a comprehensive NCP recommendation. In addition to several land use measures around MSP, the NCP included provisions for a number of operational NA measures. The aircraft and airport operational noise abatement initiatives in the 2004 Part 150 Update focused on aircraft operational procedures, runway use, departure and arrival flight tracks, voluntary operational agreements with the airlines, and provisions for further evaluation of technology. The MAC has implemented the operational NA Measures outlined in the November 2004 Part 150 Update NCP that are reflected in the 2007 forecast mitigated noise contour included in the 2004 MSP Part 150 Update.

Based on the estimate of 582,366 total operations in the 2007 forecast mitigated scenario, approximately 7,234.4 acres are in the 65 dB DNL noise contour and approximately 15,708.3 acres are in the 60 dB DNL noise contour. Since 2014 all eligible and participating homes within the 2007 forecast mitigated 60 dB DNL noise contour have been mitigated. A depiction of the 2007 forecast noise contours is provided in Figure 1.

Figure 1: 2007 Forecast Noise Contour



1.3 AIRCRAFT NOISE LITIGATION

One of the largest discussion items in the Part 150 Update process that began in 1999 focused on the mitigation program that the MAC would offer in the 60-64 dB DNL noise contour area. The FAA recognizes sensitive land uses, such as residential land uses eligible for noise mitigation under Part 150, only within the 65 dB DNL noise contour or greater. However, as part of the Dual-Track Airport Planning Process (a process that examined moving MSP versus expanding it in its current location, undertaken at the direction of the Minnesota State Legislature), the MAC made a policy decision to provide some level of noise mitigation out to the 60 dB DNL noise contour at MSP. During the Dual-Track Airport Planning Process, an MSP Noise Mitigation Committee was developed and tasked with proposing a noise mitigation plan to be considered in conjunction with the expansion of MSP at its present location.

Throughout the Part 150 Update process, the intent of the MSP Noise Mitigation Committee's recommendation regarding mitigation outside the 65 dB DNL contour was a topic of detailed discussion and debate. During the course of the Part 150 Update process the MAC formulated a number of mitigation proposals, culminating in a final MAC position on mitigation outside the 65 dB DNL contour. In the November 2004 Part 150 Update, the MAC's recommendation for mitigation in the 60-64 dB DNL contours called for providing central air-conditioning to single-family homes that did not have it, with a homeowner co-pay based on the degree of noise impact.

The MAC based eligibility for the mitigation proposal on the 2007 forecast mitigated noise contour using the block intersect methodology. The cities located around MSP expressed dissatisfaction with the MAC proposal, asserting that the MSP Noise Mitigation Committee recommended that the Full 5-decibel Reduction Package was to be expanded to all properties in the 60-64 dB DNL noise contours. The MAC countered that the MSP Noise Mitigation Committee's recommendations did not specify the mitigation package elements to be offered in the 60-64dB DNL noise contour area and that, because homes in Minnesota have higher than the national average pre-existing noise attenuation characteristics, the Full 5-decibel Reduction Package was not necessary outside the 65 dB DNL contour.

In early 2005, the Cities of Minneapolis, Eagan, and Richfield and the Minneapolis Public Housing Authority filed suit in Hennepin County District Court claiming, among other things, the MAC violated environmental quality standards and the Minnesota Environmental Rights Act (MERA) by failing to provide the Full 5-decibel Reduction Package to single-family homes in the 60-64 dB DNL contours. In September 2005, plaintiffs seeking class action certification filed a separate action against the MAC alleging breach of contract claims associated with mitigation in the 60-64 dB DNL contours. In January 2007, Hennepin County District Judge Stephen Aldrich granted the cities partial summary judgment. The court found, among other things, that the MAC, by virtue of implementing the Full 5-decibel Reduction Package, created an environmental standard that the MAC violated by recommending different mitigation in the 64 to 60 DNL noise contour area. In February 2007, the court held a trial on the cities' MERA and mandamus claims. Before the court entered final judgment post-trial, however, the parties negotiated a global settlement resolving the cities' case and the class action suit.

1.4 NOISE MITIGATION SETTLEMENT AND ANNUAL NOISE CONTOUR

On October 19, 2007, Judge Stephen Aldrich approved a Consent Decree entered into by the MAC and the Cities of Minneapolis, Eagan, and Richfield and the Minneapolis Public Housing Authority that settled the litigation. The Consent Decree provided that it became effective only if: (1) the FAA advised the MAC in writing by November 15, 2007 that the Decree was an appropriate use of airport revenue and was consistent with the MAC's federal grant obligations; and (2) that the court approved a settlement in the class action case by January 17, 2008. Both of these conditions were satisfied, and in 2008 the MAC began implementing single-family and multi-family mitigation out to the 2007 60 dB DNL noise contours and mitigation reimbursement funds out to the 2005 60 dB DNL noise contours, as the Consent Decree required. Under the Decree, mitigation activities would vary based on noise contour. Homes in the most noise-impacted contours were eligible for more extensive mitigation than those in less-impacted areas.

The 2007 Consent Decree provided that approximately 457 homes in the 2007 63-64 dB DNL forecast noise contours were eligible to receive the Full 5-decibel Reduction Package, which was the same level of noise mitigation that the MAC provided in the 1996 65 dB DNL and greater contours. The 2007 63-64 dB DNL noise contour mitigation program was designed to achieve 5 dB of noise reduction on average, with mitigation measures that might include the following, depending upon the home's existing condition: central air-conditioning; exterior and storm window repair or replacement; prime door and storm door repair or replacement; wall and attic insulation; baffling of roof vents and chimney treatment. As required by the Consent Decree, the MAC completed construction of mitigation in the 2007 63-64 dB DNL noise contours by December 31, 2009. A total of 404 homes participated in the program.

In addition, under the Decree, owners of the approximately 5,428 single-family homes in the 2007 60-62 dB DNL noise contours were eligible for one of two mitigation packages: 1) homes that did not have central air-conditioning as of September 1, 2007 would receive it and up to \$4,000 (including installation costs) in other noise mitigation products and services they could choose from a menu provided by the MAC; or 2) owners of homes that already had central air-conditioning installed as of September 1, 2007 or who chose not to receive central air-conditioning were eligible for up to \$14,000 (including installation costs) in noise mitigation products and services they could choose from a menu provided by the MAC. The mitigation menu included acoustical modifications such as: exterior and storm window repair or replacement; prime door and storm door repair or replacement; wall and attic insulation; and baffling of roof vents and chimney treatment. These packages collectively became known as the Partial Noise Reduction Program. As required by the Consent Decree, the MAC completed the Partial Noise Reduction Program by December 1, 2012. A total of 5,055 homes participated in the program.

According to the provisions in the Consent Decree, single-family homes in the 2007 63-64 dB DNL contours and in the 2007 60-62 dB DNL contours whose earlier owners opted out of the previously-completed MAC noise mitigation program for the 1996 65 dB DNL noise contours and greater, but that had new owners on September 1, 2007, were eligible to "opt in" and receive noise mitigation. If the total cost to the MAC of the opt-in mitigation is less than \$7 million, any remaining funds were used to reimburse owners of single-family homes between the 2005 mitigated 60 dB DNL contour and the 2007 forecast mitigated 60 dB DNL contour for purchase and installation of products included on a menu provided by the MAC. The amount each

homeowner received was determined by subtracting dollars spent for the opt-in program from the total \$7 million budget, and then by dividing the remainder of funds among the total number of single-family homes within the 2005 60 dB DNL and 2007 dB 60 DNL contours. This program became known as the Homeowner Reimbursement Program.

In September 2014, the MAC completed the Homeowner Reimbursement Program for a total of 1,773 participating single-family homes between the 2005 mitigated 60 dB DNL contour and the 2007 forecast mitigated 60 dB DNL contour. The total cost of the “opt-in” mitigation and the 2005 mitigated 60 dB DNL contour reimbursement mitigation program was capped at \$7 million.

The MAC completed the Multi-Family Noise Reduction Package in 2010 by installing acoustical covers on air-conditioners or installing new air-conditioners in 1,976 living units.

With the final payments in September 2014 for noise mitigation reimbursements, all of the phases of the Residential Noise Mitigation Program required under the original Consent Decree have been completed. The total cost to implement mitigation under the original Consent Decree was approximately \$95 million, (which is inclusive of the \$7 million for opt-in mitigation and single-family mitigation reimbursement).

In addition to the MAC’s mitigation obligations, the Consent Decree releases legal claims that the cities and homeowners have against the MAC in exchange for the actions that the MAC would perform under the Decree. The releases cease to be effective for a certain location if the average annual aircraft noise level in DNL at that location is at or above DNL 60 dB and is at least 2 dB in DNL higher than the Base Case DNL Noise Level. The Base Case DNL Noise Level is established by the actual DNL noise level for that location during the year the home becomes eligible for noise mitigation under the amended Consent Decree. The Base Case DNL Noise Level for homes that are not eligible for mitigation under the amended Consent Decree is established using the 2007 forecast DNL level for that location. The MAC determines DNL values by using the FAA’s AEDT noise modeling software and actual MSP operations data to generate a noise contour reflecting noise conditions at MSP for the prior calendar year. The MAC must develop a noise contour reflecting noise conditions for the prior calendar year by March 1 of each year. The MAC has prepared this report to satisfy Section 8.1(d) of the Consent Decree. MAC staff and representatives from the Cities of Minneapolis, Eagan, and Richfield met on February 11 and 20, 2008 to discuss and finalize the annual report format. The actual contour that the MAC must develop under Section 8.1(d) of the Consent Decree is relevant to the release provisions in Section 8.1 as well as the determination of mitigation eligibility as defined by an amendment to the Consent Decree, described in Chapter 4 of this report.

1.5 FINAL MSP 2020 IMPROVEMENTS EA/EAW AND AMENDED CONSENT DECREE

In January 2013, the MAC published the Final MSP 2020 Improvements Environmental Assessment/Environmental Assessment Worksheet (EA/EAW), which reviewed the potential and cumulative environmental impacts of MSP terminal and landside developments needed through the year 2020.

As is detailed in the EA/EAW, the Federal Aviation Administration's (FAA) Finding of No Significant Impact/Record of Decision (FONSI/ROD) and summarized in the MAC's related Findings of Fact, Conclusions of Law, and Order, the Preferred Alternative scenario does not have the potential for significant environmental effects. The forecasted noise contours around MSP are driven by natural traffic growth that is anticipated to occur with or without implementation of the 2020 Improvements.

However, given past noise mitigation activities surrounding MSP, the terms of the 2007 Consent Decree in *City of Minneapolis, et. al. v. Metropolitan Airports Commission*, and local land use compatibility guidelines defined by the Metropolitan Council, many of the public comments on the EA/EAW focused on future noise mitigation efforts. Additionally, the anticipated completion of the Consent Decree Residential Noise Mitigation Program in 2014 raised community interest regarding the future of noise mitigation at MSP.

In response, MAC staff, in consultation with the MSP NOC, began the process of developing a noise mitigation plan to be included in the EA/EAW. The resulting recommended noise mitigation program established that eligibility be based upon actual noise contours that the MAC would prepare for MSP on an annual basis. To be eligible for noise mitigation, a home would need to be located for three consecutive years in a higher noise mitigation impact area when compared to the home's status under the terms of the 2007 Consent Decree.

The Final MSP 2020 Improvements EA/EAW detailed the following mitigation program elements:

- Mitigation eligibility would be assessed annually based on the actual noise contours for the previous year.
- The annual mitigation assessment would begin with the actual noise contour for the year in which the FAA FONSI/ROD for the EA/EAW was issued.
- For a home to be considered eligible for mitigation it must be located within the actual 60 dB DNL noise contour, within a higher noise impact mitigation area when compared to its status relative to the original Consent Decree noise mitigation program, for a total of three consecutive years, with the first of the three years beginning no later than 2020.
- The noise contour boundary would be based on the block intersect methodology.
- Homes would be mitigated in the year following their eligibility determination.

On January 7, 2013, the FAA published the Final MSP 2020 Improvements EA/EAW and the Draft Finding of No Significant Impact/Record of Decision (FONSI/ROD), which included the following position regarding the proposed noise mitigation program:

"The FAA is reviewing MAC's proposal for noise mitigation of homes for consistency with the 1999 FAA Policy and Procedures concerning the use of airport revenue and other applicable policy guidance."

During the public comment period on the FAA's Draft FONSI/ROD many communities submitted comments urging the FAA to approve the MAC's revised noise mitigation proposal.

On March 5, 2013, the FAA approved the FONSI/ROD for the Final MSP 2020 Improvements EA/EAW. Specifically, the FAA stated that noise mitigation would not be a condition of FAA approval of the MSP 2020 Improvements project because "[n]o areas of sensitive land uses would

experience a 1.5 dB or greater increase in the 65 dB DNL noise contour when comparing the No Action Alternative for 2020 and 2025 with the Proposed Action for the respective years.” However, the FAA included a letter dated March 5, 2013, as an attachment to the FONSI/ROD that addresses the conditions under which airport revenue may be used for off-airport noise mitigation. In that letter, the FAA stated:

“As a matter of general principle mitigation measures imposed by a state court as part of a consent decree are eligible for use of airport revenue. Conceptually MAC could use airport revenues if it were to amend the 2007 consent decree to include the proposed mitigation.”

Based on the FAA guidance, the MAC initiated discussions with the other parties to the Consent Decree (Cities of Minneapolis, Richfield and Eagan and the Minneapolis Public Housing Authority) to begin the amendment process. Additionally, at the March 20, 2013, NOC meeting, the Committee was updated on the progress of this issue and voted unanimously, supporting the following position:

“NOC supports the noise mitigation program as detailed in the final EA/EAW in principal and supports follow-up negotiations between the parties to the Consent Decree to establish mutually agreeable terms for the modification of the Consent Decree consistent with the March 5th FAA letter in Appendix D of the FONSI ROD, for consideration by the Court.”

The first amendment to the 2007 Consent Decree was initiated in 2014 with the 2013 actual noise contours establishing the first year of candidate eligibility based on the criteria detailed in the Final MSP 2020 Improvements EA/EAW. The Full 5-decibel Reduction Package is offered to single-family homes meeting the eligibility criteria inside the actual 63 dB DNL noise contour while the Partial Noise Reduction Package is offered to single-family homes in the actual 60-62 dB DNL noise contours. A uniform Multi-Family Noise Reduction Package is offered to multi-family units within the actual 60 dB DNL noise contour. Homes will be mitigated in the year following their eligibility determination. The 2013 actual contour marked the first year in assessing this amended mitigation program.

In 2017 MAC began construction on homes meeting the eligibility requirements, which includes 138 single-family homes and 88 multi-family units as part of the 2017 program and 283 single-family homes in the 2018 program. As of February 2018, \$1,886,209 has been spent on mitigating homes pursuant to the amended Consent Decree.

A second amendment was made to the 2007 Consent Decree in 2017. This amendment allows the use of the new federally approved noise model, the Aviation Environmental Design Tool (AEDT) to run the actual noise contours each year, beginning with the 2016 actual noise contour. The second amendment also provides clarity on two points with regard to the Opt-Out Eligibility criteria: (1) homeowners who failed to participate in the reimbursement program are not considered “Opt-Outs” and may participate in future programs provided the home meets the eligibility requirements; and (2) single-family homes that previously opted out of the Partial Noise Reduction Package may participate in the Full 5-decibel Reduction Package provided the home meets the eligibility requirements.

2. 2017 ACTUAL NOISE CONTOURS

2.1 DEVELOPMENT OF THE 2017 ACTUAL NOISE CONTOURS

2.1.1 Noise Modeling

By March 1 of each year, the MAC is required to prepare actual noise contours reflecting the noise exposure from MSP aircraft operations that took place during the previous calendar year. The availability of federal or airport-generated funds for the purpose of noise mitigation is contingent upon the development of noise contours in a manner consistent with FAA requirements. One of these requirements is the use of the DNL noise assessment metric to determine and analyze aircraft noise exposure. The DNL metric is calculated by cumulatively averaging sound levels over a 24-hour period. This average cumulative sound exposure includes the application of a 10-decibel penalty to sound exposures occurring during the nighttime (10:00 PM to 7:00 AM). The night sound exposures are increased by 10 decibels to account for relatively low nighttime ambient noise levels and because most people are asleep during these hours.

In 2015, the FAA began evaluating its methods for measuring aircraft noise. According to the FAA, the results of the evaluation will be used to determine whether an update to policies regarding the DNL metric is warranted, along with the parameters under which a home is eligible to receive funding for mitigation. The FAA has not made any updates to these policies at the time of this report development.

The most recent version of the Aviation Environmental Design Tool (AEDT), version 2d, was used to develop the 2017 actual noise contours. In May 2015, the AEDT version 2b was released by the FAA to replace a series of legacy tools, including the Integrated Noise Model (INM), which was previously used for modeling noise pursuant to the terms of the Consent Decree. According to the FAA, there is overlap in functionality and underlying methodologies between AEDT and the legacy tools, however updates were made in AEDT which result in differences when comparing outputs from AEDT and the legacy tools. The updates related to noise modeling include: smaller flight segments to more accurately model aircraft noise levels for a larger number of aircraft positions and states along a flight path; a new standard (SAE-ARP-5534) for computing the effects of weather on noise; correcting misidentified aircraft engine mounted locations for three aircraft types; and moving from recursive grids to dynamic grids for noise contour generation. The AEDT 2d release includes new features, updates, and a series of bug fixes and usability improvements. Highlights include dynamic grid support for time-based noise metrics, track dispersion enhancements, updates to the study database and fleet database, including new noise profiles for the Boeing 737 MAX8.

Noise contours depict an annualized average day of aircraft noise impacts using model inputs, such as runway use, flight track use, aircraft fleet mix, aircraft performance and thrust settings, topography information, and atmospheric conditions. Quantifying aircraft-specific noise characteristics in AEDT is accomplished through the use of a comprehensive noise database that has been developed under 14 CFR Part 36. As part of the airworthiness certification process, aircraft manufacturers are required to subject aircraft to a battery of noise tests. Through the use of federally adopted and endorsed algorithms, this aircraft-specific noise information is used in

the generation of DNL contours. Justification for such an approach is rooted in national standardization of noise quantification at airports.

2.1.2 2017 Aircraft Operations and Fleet Mix

The past 17 years have presented many challenges to the aviation industry. From a local perspective, operational levels and the aircraft fleet mix at MSP have been subject to effects related to the terrorist attacks on September 11, 2001, high fuel prices, a flurry of bankruptcy filings by several legacy airlines including the former Northwest Airlines, and an economic recession. Additionally, overall market forces appear to be favoring consolidation, as indicated by major airline acquisitions and mergers, beginning with Delta Air Lines' acquisition of Northwest Airlines in 2008, followed by United Airlines' acquisition of Continental Airlines in 2012, the merger of American Airlines and US Airways in 2013 and the merger of Southwest Airlines and AirTran in 2014. These developments have had an effect on airline and aircraft operations. For example, the actual 2017 operations level at MSP, while slightly up from 2016, is still below the operational level documented at the airport over 25 years ago.

The MAC used its Noise and Operations Monitoring System (MACNOMS) for the 2017 fleet mix data used in the assessment. The MACNOMS total operations number was 0.5 percent lower than the operations number reported in the FAA's Operations Network (OPSNET). To rectify the numbers, MACNOMS data was adjusted upward to equal the OPSNET number. In 2017, the total operations at MSP was 415,703², or an average of 1,138.9 daily flights. This represents an increase of less than one percent from the 2016 annual operations level reported by the FAA. A summary of the 2017 fleet mix is provided in Table 2.1. A more detailed presentation of the 2017 aircraft fleet mix is provided in Appendix 1.

On average, one Hushkit Stage 3 Jet operated every ten days in 2017, which is similar to 2015 and 2016. In 2017, the average daily number of total nighttime operations was 119.7, up from the 118.8 in 2016. Stage 2 jet aircraft below 75,000 pounds were required to meet Stage 3 noise regulations by January 1, 2016. The operators of these aircraft achieved this by retrofitting their aircraft with hush kits. These operations are reflected in the "Retrofitted Stage 2 Jets <75,000 lbs" category.

Table 2.1: Summary of 2017 Average Daily Flight Operations

Average Daily Flight Operations	Day	Night	Total	% of Total Operations
Manufactured to be Stage 3+	973.6	115.8	1,089.4	95.65%
Hushkit Stage 3 Jets	0.1	0.0	0.1	0.01%
Retrofitted Stage 2 Jets <75,000 lbs	0.4	1.5	1.9	0.16%
Microjet	0.4	0.0	0.4	0.03%

² Based on airport operations counts documented by the Federal Aviation Administration for MSP in 2017.

Propeller	43.1	2.4	45.5	4.00%
Helicopter	0.0	0.0	0.0	0.00%
Military	1.6	0.0	1.7	0.15%
<i>Total</i>	<i>1,019.2</i>	<i>119.7</i>	<i>1,138.9</i>	<i>100.00%</i>
<i>% of Total Operations</i>	<i>89.49%</i>	<i>10.51%</i>	<i>100.00%</i>	

Note: Totals may differ due to rounding.

Source: MAC-provided MACNOMS data, HNTB 2018

The use of newer and quieter aircraft is on the rise. In 2017, there were 920 Airbus A320neo (or “new engine option”) operations, which according to Airbus are 50 percent quieter than the current engine option. The current version of AEDT does not have a noise profile for the A320neo, therefore a conservative approach was taken, consistent with FAA guidance, to input the current engine option for the 2017 annual noise contour. All nonstandard aircraft substitutions in AEDT were approved by the FAA Office of Energy and Environment. There were 42 operations in the Boeing 737 MAX8, which Boeing says are 40 percent quieter than today’s B737. Meanwhile use of older and louder aircraft is declining. All scheduled flights in DC-9 aircraft were eliminated in January 2014. The MD-80s saw a 31 percent drop in operations in 2017 and within the next two years, the airlines plan to completely retire their MD-80 fleet.

2.1.3 2017 Runway Use

FAA control of runway use throughout the year for arrival and departure operations at MSP has a notable effect on the noise impact around the airport. The number of people and dwellings impacted by noise is a direct result of the number of operations on a given runway and the land uses off the end of the runway as well as areas underlying the flight paths aircraft follow to get to and from the airport.

Historically, prior to the opening of Runway 17/35, arrival and departure operations occurred on the parallel runways at MSP (12L/30R and 12R/30L) in a manner that resulted in approximately 50 percent of the arrival and departure operations occurring to the northwest over South Minneapolis and 50 percent to the southeast over Mendota Heights and Eagan. As a result of the dense residential land uses to the northwest and the predominantly industrial/commercial land uses to the southeast of MSP, focusing departure operations to the southeast has long been the preferred operational configuration from a noise reduction perspective.

Since the introduction of Runway 17/35 at MSP in 2005, another opportunity exists to route aircraft over an unpopulated area – the Minnesota River Valley. With use of the Runway 17 Departure Procedure, westbound departing aircraft are routed such that they avoid close-in residential areas southwest of Runway 17. Thus, use of Runway 17 for departing aircraft is the second preferred operational configuration (after Runways 12L and 12R) for noise reduction purposes.

In 2013, the National Transportation Safety Board (NTSB) recommended modifications to arrival and departure procedures for airports with Converging Runway Operations (CRO). CRO exists when the extended centerline of two runways intersect within one nautical mile of the two runway departure ends. This poses a potential risk for aircraft converging at the intersection point. At MSP, the extended centerline of Runway 35 intersects within one mile with the extended centerlines of both Runway 30L and 30R. Since Runway 35 is only used for arrivals from the

south, potential convergence in flight paths would only occur if an aircraft executes an aborted landing (“go around”) on Runway 35.

The FAA used a phase-in approach to introduce new safety requirements at United States airports identified by the NTSB. Beginning in July 2015, the FAA worked to introduce the requirements at MSP. At the end of 2015 and throughout 2016, the airport saw notable changes in runway use resulting from increased southerly winds plus the added complexity for controllers when the airport was in a CRO condition (landing and departing in a northerly direction). In response, the MSP NOC unanimously passed a resolution requesting the FAA evaluate the current and future environmental and capacity impacts from the new CRO rules and to communicate the findings back to the NOC. The MAC Board of Commissioners took unanimous action supporting the NOC resolution and forwarded it to the FAA.

During 2017, the FAA made substantial progress in designing and employing technological tools within its air traffic control system to revert changes in runway use, regain some capacity loss, and reduce air traffic controller work load at MSP during CRO. In January 2017, the FAA began using two Arrival Departure Windows (ADWs) for each of the parallel runways. In order to use two ADWs at the same time, a thorough risk assessment and approval process was required. These windows help alternate flights departing Runways 30L and 30R with flights arriving to Runway 35. Use of the two ADWs increased MSP’s northerly arrival rate from 64 to 75 aircraft per hour. Further, in June 2017, the FAA implemented a Converging Runway Display Aid (CRDA) which aligns aircraft arriving to Runways 30L with 35 to offer efficiency gains in sequencing departures to the northwest. The CRDA tool helps arrivals on Runway 35 line up with arrivals on Runway 30L to create a predictable departure gap for Runway 30L. This has allowed the FAA to flex arrival rates up to 84 aircraft per hour during three peak arrival demand periods throughout the day which reduces arrival delays. Similarly, in August 2017 the FAA began flexing departure rates up during periods of peak departure demand by routing Runway 35 arrivals to either parallel runway (30L or 30R), thus eliminating the dependency on ADWs for aircraft departing to the northwest. The FAA’s implementation of this layered mitigation has moved runway use trends to closer to pre-CRO conditions. The FAA continues to evaluate the use of other tools, such as the Airport Surface Detection Equipment, Model X (ASDE-X) to further refine traffic management, which could result in operation patterns that revert almost entirely to pre-CRO conditions.

A summary of notable changes in runway use from 2016 to 2017 is provided below. Areas where the 2017 actual noise contour extended beyond the 2016 noise contour are within previously mitigated neighborhoods, with the exception of the Runway 12R arrival lobe near Lake Harriet in Minneapolis. Chapter 4 details the Residential Noise Mitigation eligibility impacts.

- Runway 35 arrivals rebounded with daytime arrivals increasing by a third and nighttime arrivals doubling for a total increase of 37.9 percent from 2016. However, daytime arrivals on Runway 35 were still below levels experienced prior to the implementation of the new CRO rules.
- Arrivals to Runway 30L and Runway 30R continued to increase in 2017 as a result of the reduced number of arrivals on Runway 35 compared to pre-CRO conditions. In total, Runway 30L arrivals accounted for 27.7 percent of MSP arrivals; daytime arrivals on Runway 30L increased 9.6 percent and nighttime increased 15 percent. Runway 30R was used for a total of 22.7 percent of MSP arrivals; daytime arrivals on Runway 30R increased

13.4 percent and nighttime increased 13.4 percent. This resulted in growth of the contour near the border of Egan and Inver Grove Heights.

- The arrival percentages on Runways 12L and 12R returned to pre-CRO levels. In total, Runway 12R arrivals accounted for 23.5 percent of MSP arrivals; daytime arrivals on Runway 12R decreased 11.7 percent and nighttime decreased 10.5 percent. Runway 12L was used for a total of 19.5 percent of MSP arrivals; daytime arrivals on Runway 12L decreased 13.3 percent and nighttime decreased 28.9 percent. The reduced arrivals to both runways contributed to the contraction of the contour near Lake Harriet in South Minneapolis.
- Runway 30L and 30R departures rebounded closer to pre-CRO levels with Runway 30L used for 27 percent of the MSP departures; daytime departures on Runway 30L increased 30 percent and nighttime increased 19.8 percent. Runway 30R was used for 23.1 percent of the MSP departures; daytime departures on Runway 30R increased 4.2 percent and nighttime increased 15.5 percent. This contributed to growth of the contours near Lake Nokomis in South Minneapolis and Highway 62 near the border of Minneapolis and Richfield.
- Overall, Runway 17 was used for 31 percent of MSP departures, which was a 6.4 percent decrease from 2016. One third of daytime departures used Runway 17. This is 6.8 percent lower than 2016, but higher than 2014 and 2015. The increase compared to 2014 and 2015 is partly driven by increased use of mixed-flow operations. Runway 17 was used for 9.2 percent of nighttime departures in 2017, which is an increase of 10.8 percent from 2016, but lower than 2014 and 2015.
- Runway 12L and 12R departures decreased with Runway 12L being used for 13 percent of the MSP departures; daytime departures on Runway 12L decreased 16.7 percent and nighttime decreased 17.1 percent. Runway 12R was used for 5.8 percent of departures; daytime departures on Runway 12R decreased 26.5 percent and nighttime decreased 15.3 percent. Due to the lower number of departures on these runways, this change only led to slight changes in the noise contour.

Table 2.2 provides the average annual runway use distribution for 2017.

Table 2.2: Summary of 2017 Average Annual Runway Use

Operation	Runway	Day	Night	Total
Arrivals	4	0.0%	0.0%	0.0%
	12L	20.4%	12.4%	19.5%
	12R	23.1%	26.1%	23.5%
	17	0.0%	0.0%	0.0%
	22	0.1%	0.1%	0.1%
	30L	26.3%	39.1%	27.7%
	30R	23.2%	18.8%	22.7%
Departures	35	6.8%	3.4%	6.4%
	4	0.0%	0.0%	0.0%
	12L	12.5%	17.7%	13.0%
	12R	3.8%	23.6%	5.8%

17	33.4%	9.2%	31.0%
22	0.1%	0.0%	0.1%
30L	26.8%	28.3%	27.0%
30R	23.3%	21.3%	23.1%
35	0.0%	0.0%	0.0%

Note: Total may not add up due to rounding. Helicopters are excluded.

Source: MAC-provided MACNOMS Data, HNTB 2018

2.1.4 2017 Flight Tracks

Modeled departure and arrival flight tracks were developed using actual flight track data. The model tracks used in the 2017 actual noise contour were identical to those used for the 2016 actual noise contour. Sub-tracks are added to each of the backbone arrival and departure model tracks. The distribution of operations among the backbone and sub-tracks in AEDT use a standard “bell curve” distribution, based on the number of sub-tracks developed. The methodology in AEDT is consistent with the way INM distributed operations on sub-tracks in the modeling process.

The same methodology as in previous annual reports was used to assign actual 2017 flight tracks to the modeled tracks. The correlation process employs a best-fit analysis of the actual flight track data based on linear trends. This approach provides the ability to match each actual flight track directly to the appropriate model track.

Graphics of model flight tracks and the percent that each was used in 2017 are provided in Appendix 2.

2.1.5 2017 Atmospheric Conditions

The weather data used in the 2017 actual noise contour were acquired from the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center. As per FAA guidance, the following default weather parameters from the MSP weather station were applied:

- Temperature – 45.0 degrees Fahrenheit
- Dew point – 35.9 degrees Fahrenheit
- Wind speed – 8.4 knots
- Pressure – 985.4 Millibars
- Relative humidity – 67.7 percent

2.2 2017 MODELED VERSUS MEASURED DNL VALUES

As part of the 2017 actual noise contour evaluation, a comparison was conducted on the actual 2017 measured aircraft noise levels at the MAC’s 39 sound monitoring sites around MSP to the modeled DNL noise values from AEDT. The latitude and longitude coordinates for each sound monitoring site was used to calculate modeled DNL values in AEDT.

Table 2.3 provides a comparison of the AEDT modeled DNL noise values and the actual measured aircraft DNLs at those locations in 2017.

Table 2.3: 2017 Measured vs. Modeled DNL Values

Sound Monitoring Site	2017 Measured DNL (a)	2017 Modeled DNL	Difference	Absolute Difference
1	56.2	57.3	1.1	1.1
2	58.0	57.8	-0.2	0.2
3	62.8	63.4	0.6	0.6
4	59.7	60.8	1.1	1.1
5	68.0	68.2	0.2	0.2
6	67.8	66.3	-1.5	1.5
7	60.1	58.7	-1.4	1.4
8	56.5	56.5	0.0	0.0
9	41.1	44.2	3.1	3.1
10	43.2	49.9	6.7	6.7
11	29.6	45.4	15.8	15.8
12	38.0	47.9	9.9	9.9
13	53.7	54.8	1.1	1.1
14	60.7	61.0	0.3	0.3
15	55.7	55.5	-0.2	0.2
16	64.6	63.8	-0.8	0.8
17	41.4	48.8	7.4	7.4
18	52.4	59.2	6.8	6.8
19	48.4	54.1	5.7	5.7
20	41.4	51.1	9.7	9.7
21	45.6	49.8	4.2	4.2
22	56.2	57.9	1.7	1.7
23	60.5	59.9	-0.6	0.6
24	59.3	60.1	0.8	0.8
25	50.8	54.6	3.8	3.8
26	51.7	52.7	1.0	1.0
27	55.0	56.3	1.3	1.3
28	56.2	61.1	4.9	4.9
29	52.6	53.6	1.0	1.0
30	60.6	60.2	-0.4	0.4
31	45.4	50.5	5.1	5.1
32	40.0	48.2	8.2	8.2
33	46.9	50.2	3.3	3.3
34	44.7	48.2	3.5	3.5
35	50.9	52.7	1.8	1.8
36	51.1	50.5	-0.6	0.6
37	46.9	48.8	1.9	1.9
38	50.1	51.0	0.9	0.9
39	50.9	51.9	1.0	1.0
			Average	3.1
			Median	1.4

Notes:

All units in dB DNL

(a) Computed from daily DNLs

Source: MAC sound monitoring data and HNTB, 2018

The use of absolute values provides a perspective of total difference between the modeled values and the measured values. The average absolute difference between modeled and measured DNLs is approximately 3.1 dB, compared with 2.3 dB in 2016 and 2.1 dB in 2015. The absolute median difference is 1.4 dB, compared with 1.1 dB in 2016 and 1.4 dB in 2015 indicating that the 2017 actual noise contours generated through modeling in AEDT are similar in absolute difference to actual measured noise levels. The absolute median difference is considered the most reliable indicator of correlation when considering the data variability across modeled and measured data. There were eight RMTs that reported slightly higher DNL values than the model generated. The MAC believes that this is due in part to the inclusive approach MAC staff has taken in its noise-to-track matching parameters. This inclusive approach, along with the increasing number of quieter jets operating at the airport, results in some instances of community-driven noise events being attributed to aircraft operations. RMT Site 11 was inoperable for the first quarter of the year due to equipment relocation. This contributed to the greatest difference with the modeled DNL level exceeding the measured DNL level by 15.8 dB DNL. Additionally, there are some new aircraft types in the actual 2017 operations data that are not available to model in AEDT. In these cases, a conservative approach was taken to model these aircraft using similar, but older models, contributing to a slightly higher absolute median difference in the 2017 modeled DNL. Overall, the small variation between the actual measured aircraft noise levels and the AEDT modeled noise levels provides additional external system verification that AEDT is providing an accurate assessment of the actual aircraft noise impacts around MSP.

2.3 2017 NOISE CONTOUR IMPACTS

Based on the 415,703 total operations in 2017, approximately 4,474 acres are in the 65 dB DNL noise contour (an increase of 60 acres, or 1.4 percent, from the 2016 actual noise contour) and approximately 11,469 acres are in the 60 dB DNL noise contour (an increase of 321 acres, or 2.9 percent, from the 2016 actual noise contour). The increase is due to the contribution of various factors, particularly a higher number of total operations and a higher number of operations at night.

Table 2.5 contains the count of single-family (one to three units per structure) and multi-family (more than three units per structure) dwelling units in the 2017 actual noise contours. The counts are based off the block intersect methodology where all structures on a block that are within or touched by the noise contour are counted. The spatial analysis was performed in Universal Transverse Mercator (UTM Zone 15).

Table 2.5 Summary of 2017 Actual DNL Noise Contour Unit Counts

City		Dwelling Units Within dB DNL Interval									
		Single Family				Total	Multi-Family				Total
		60-64	65-69	70-74	75+		60-64	65-69	70-74	75+	
Bloomington	Completed	16	1	-	-	17	513	-	-	-	513
	Additional	-	-	-	-	-	-	-	-	-	-
	Total	16	1	-	-	17	513	-	-	-	513
Eagan	Completed	331	14	-	-	345	38	-	-	-	38
	Additional	33	-	-	-	33	-	-	-	-	-
	Total	364	14	-	-	378	-	-	-	-	-
Inver Grove Heights	Completed	-	-	-	-	-	-	-	-	-	-
	Additional	5	-	-	-	5	-	-	-	-	-
	Total	5	-	-	-	5	-	-	-	-	-
Minneapolis	Completed	7650	1751	-	-	9401	901	507	-	-	1408
	Additional	268	-	-	-	268	-	-	-	-	-
	Total	7918	1751	-	-	9669	901	507	-	-	1408
Richfield	Completed	841	98	-	-	939	144	-	-	-	144
	Additional	-	-	-	-	-	-	-	-	-	-
	Total	841	98	-	-	939	144	-	-	-	144
Mendota Heights	Completed	41	1	-	-	42	-	-	-	-	-
	Additional	-	-	-	-	-	-	-	-	-	-
	Total	41	1	-	-	42	-	-	-	-	-
All Cities	Completed	8879	1865	-	-	10744	1596	507	-	-	2103
	Additional	306	-	-	-	306	-	-	-	-	-
	Total	9185	1865	-	-	11050	1596	507	-	-	2103

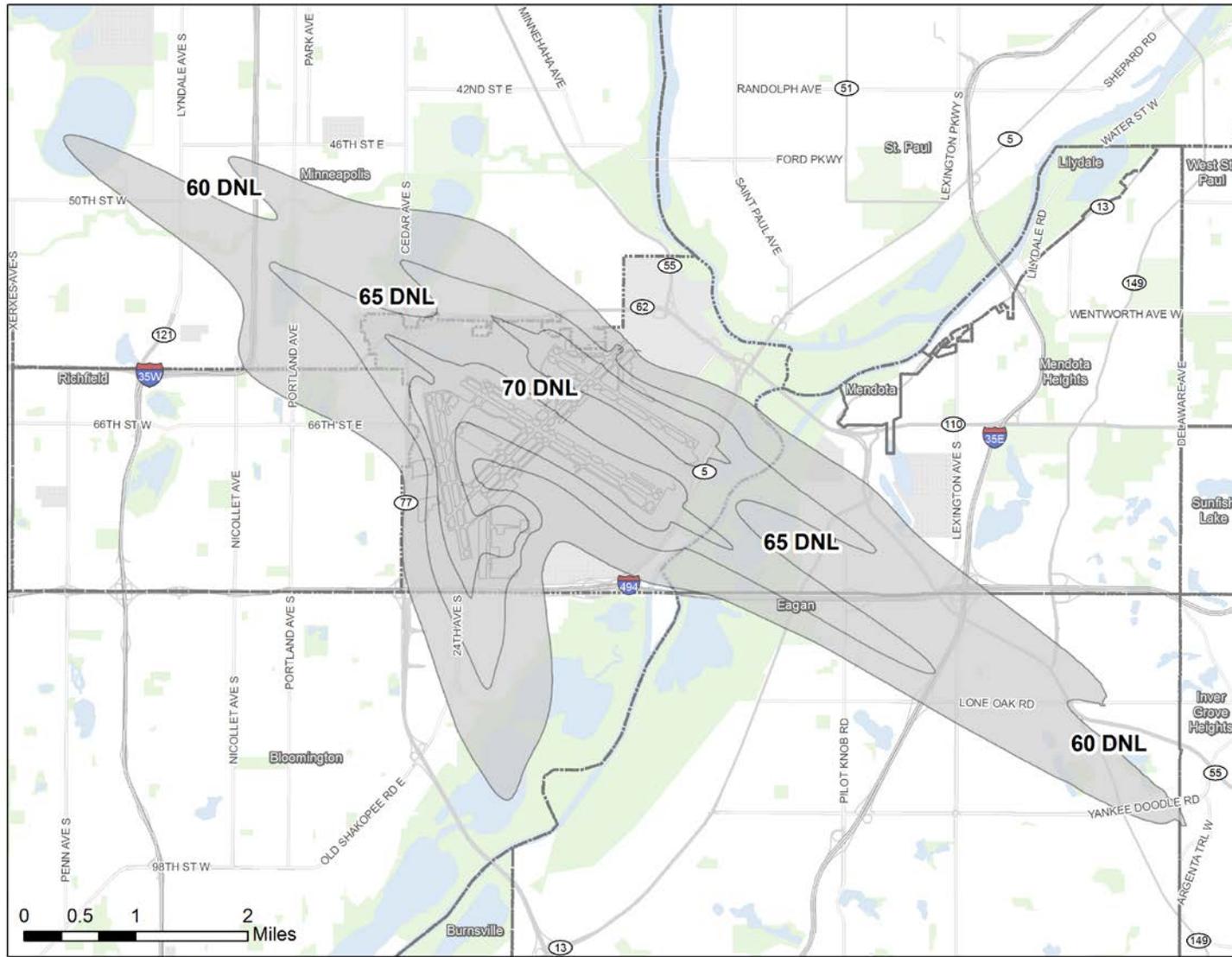
Notes: Block intersect methodology; Multi-family units = 4 or more units; As a result of parcel information updated in January 2018, unit counts may differ from previous reports. Completed counts include residences that are eligible for the 2017, 2018 and 2019 Mitigation Programs.

Source: HNTB provided AEDT contours, MAC analysis, 2018

A total of 424 single-family residences and 88 multi-family units within the 60 dB DNL noise contour in the City of Minneapolis were entered into the 2017 and 2018 Mitigation Programs. An additional 430 single-family residences within the 60 dB DNL noise contour in the City of Minneapolis received mitigation eligibility for the 2019 Mitigation Program by virtue of the 2017 actual noise contour. The 2017 count of residential units within the actual 60 dB DNL noise contour that have not received noise mitigation around MSP and are not part of the 2017, 2018, or 2019 programs is 306, an overall decrease from the 1,589 based on the 2016 actual noise contours. While there was an overall decrease – primarily driven by a reduction in the arrival lobe to Runway 12R and the inclusion of some homes in the current mitigation program – there are individual cities with an increase in residences inside the 2017 actual 60 dB DNL noise contour. The City of Eagan had 33 and Inver Grove Heights had 5 residential units added to the 60 dB DNL noise contour. It should be noted, that these 38 units were eligible to receive mitigation reimbursement funds in previous programs. The increase in these areas is primarily due to runway use in 2017, particularly nighttime arrival operations on Runway 30L. All homes within the 2017 actual 65 dB DNL contour have received the 5 dB noise reduction mitigation package.

A thorough evaluation of the 2017 actual noise contour and resulting changes to residential noise mitigation is provided in Chapter 4. A depiction of the 2017 actual noise contour is provided in Figure 2.

Figure 2: 2017 Actual Noise Contours



3. COMPARISON OF THE 2017 ACTUAL AND THE 2007 FORECAST NOISE CONTOURS

3.1 COMPARISON OF NOISE CONTOUR INPUTS

3.1.1 Noise Model Considerations

The 2017 actual noise contour was modeled in AEDT 2d, which incorporates updates to flight segments, atmospheric computing standards, grids used for noise contour generation and other issues that carried over from the Integrated Noise Model (INM). The AEDT 2d release includes new features, updates, and a series of bug fixes and usability improvements. Highlights include dynamic grid support for time-based noise metrics, track dispersion enhancements, updates to the study database and fleet database, including new noise profiles for the Boeing 737 MAX8. The 2007 forecast noise contour was developed using INM Version 6.1.

It is important to note that modeling modifications over time can change the size and shape of a noise contour. For example, a range of case study airports revealed that improvements to lateral attenuation adjustment algorithms and flight path segmentation in INM version 7.0 were found by the FAA to increase the size of a DNL contour for a range of case study airports between 3 and 10 percent over what previous versions of INM would have modeled. Additionally, some updates incorporated into AEDT, had the effect of reducing the 60 dB DNL noise contour by 0.6 percent at MSP compared to the last version of INM.

3.1.2 Aircraft Operations and Fleet Mix Comparison

The forecasted level of operations in the 2007 noise contour was 582,366 annual flights, or an average of 1,595.9 flights per day. In 2017, the actual number of operations was 415,703, or 1,138.9 flights per day. This represents a 28.6 percent reduction from the 2007 forecast number. Nighttime operations decreased by 3.2 average daily flights from the 2007 forecast to 2017 actual. Table 3.1 provides a summary comparison of the 2017 actual and the 2007 forecast average daily operations. A more detailed comparison of the 2007 forecast fleet mix and the 2017 actual aircraft fleet mix is provided in Appendix 1.

In general, many of the aircraft groups operating at MSP showed a reduction in the number of average daily operations from the 2007 forecast to 2017. On average, one Hushkit Stage 3 Jet operated every ten days in 2017, this is down from the 2007 forecast average of 274.9 flights per day. Manufactured Stage 3+ average daily operations in 2017 were down six percent from the 2007 forecast. The number of propeller-driven and military aircraft operations decreased 69.8 and 80.3 percent, respectively.

Stage 2 jet aircraft below 75,000 pounds were required to meet Stage 3 noise regulations by January 1, 2016. The operators of these aircraft achieved this by retrofitting their aircraft with hush kits, therefore a new category was added for "Retrofitted Stage 2 Jets <75,000 lbs".

Table 3.1: Summary of 2017 and 2007 Average Daily Flight Operations

Average Daily Flight Operations	Day	Night	Total	% of Total Operations
2017				
Manufactured to be Stage 3+	973.6	115.8	1089.4	95.7%
Hushkit Stage 3 Jet	0.1	0.0	0.1	0.0%
Retrofitted Stage 2 Jet	0.4	1.5	1.9	0.2%
Stage 2 Jets under 75,000 lbs	0.0	0.0	0.0	0.0%
Microjet	0.4	0.0	0.4	0.0%
Propeller	43.1	2.4	45.5	4.0%
Helicopter	0.0	0.0	0.0	0.0%
Military	1.6	0.0	1.7	0.1%
<i>Total</i>	<i>1019.2</i>	<i>119.7</i>	<i>1138.9</i>	<i>100.0%</i>
<i>% of Total Operations</i>	<i>89.5%</i>	<i>10.5%</i>	<i>100.0%</i>	
2007				
Manufactured to be Stage 3+	1071.5	85	1156.7	72.6%
Hushkit Stage 3 Jet	253.3	21.7	274.9	17.3%
Retrofitted Stage 2 Jet	0	0	0	0.0%
Stage 2 Jets under 75,000 lbs	4.2	0.2	2.3	0.1%
Microjet	0	0	0	0.0%
Propeller	135.2	15.8	151	9.5%
Helicopter	0	0	0	0.0%
Military	8.2	0.2	8.5	0.5%
<i>Total</i>	<i>1472.4</i>	<i>122.9</i>	<i>1593.4</i>	<i>100.0%</i>
<i>% of Total Operations</i>	<i>92.4%</i>	<i>7.7%</i>	<i>100.0%</i>	

Notes:

Totals may differ due to rounding

As of January 1, 2016, Stage 2 aircraft below 75,000 lbs are required to be compliant with Stage 3 noise regulations.

Source: MAC-provided MACNOMS data, HNTB 2018

3.1.3 Runway Use Comparison

Table 3.2 provides the runway use percentages for 2017 and a comparison to the 2007 forecast runway use percentages. A general evaluation of the runway use percentages in Table 3.2 shows that the use of Runway 12R for nighttime arrivals in 2017 is 13.7 percent higher than what was forecasted in the 2007 noise contour. The use of Runway 30L for nighttime arrivals is also up 14 percent from what was forecasted in the 2007 noise contour. The use of Runway 35 for total arrivals is 10.1 percent lower than the 2007 forecast. The daytime departure percentage on Runway 12R in 2017 is well below the 2007 forecast, while the nighttime percentage on this runway was higher than the 2007 forecast. The departure difference on Runway 17 at night is over 25 percent below the 2007 forecast. Lastly, the Runway 30L departure percentage at night is 15.5 percent above the 2007 forecast.

Table 3.2: Summary of Average Annual Runway Use 2017, 2007

Operation	Runway	Day		Night		Total	
		2017 Actual	2007 Forecast	2017 Actual	2007 Forecast	2017 Actual	2007 Forecast
Arrivals	4	0.0%	0.0%	0.0%	3.8%	0.0%	0.3%
	12L	20.4%	21.8%	12.4%	17.2%	19.5%	21.4%
	12R	23.1%	14.7%	26.1%	12.4%	23.5%	14.5%
	17	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	22	0.1%	0.5%	0.1%	2.4%	0.1%	0.6%
	30L	26.3%	21.1%	39.1%	25.1%	27.7%	21.4%
	30R	23.2%	25.1%	18.8%	26.4%	22.7%	25.2%
	35	6.8%	16.9%	3.4%	12.7%	6.4%	16.5%
Departures	4	0.0%	0.2%	0.0%	0.4%	0.0%	0.2%
	12L	12.5%	8.9%	17.7%	14.1%	13.0%	9.3%
	12R	3.8%	15.9%	23.6%	18.3%	5.8%	16.1%
	17	33.4%	37.2%	9.2%	34.6%	31.0%	37.0%
	22	0.1%	0.1%	0.0%	0.8%	0.1%	0.1%
	30L	26.8%	15.0%	28.3%	12.8%	27.0%	14.8%
	30R	23.3%	22.7%	21.3%	19.2%	23.1%	22.4%
	35	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Note: Total may not add up due to rounding.

Source: MAC-provided MACNOMS data, HNTB 2018. Annual runway use for 2007 Forecast was obtained from the November 2004 Part 150 document.

3.1.4 Flight Track Considerations

Modeled departure and arrival flight tracks were developed using actual flight track data from 2017. These flight tracks differ from those used to develop the 2007 forecast noise contour due to enhanced modeling methods and improved technologies. Sub-tracks were also added to each of the backbone tracks. Standard distribution in both INM and AEDT were used to distribute the flights to the sub-tracks.

The same methodology as in previous annual reports was used to assign actual 2017 flight tracks to the modeled tracks. The correlation process employs a best-fit analysis of the actual flight track data based on linear trends. This approach provides the ability to match each actual flight track directly to the appropriate model track.

3.1.5 Atmospheric Conditions Comparison

The atmospheric condition inputs vary slightly between INM and AEDT. INM takes pressure values in inches of Mercury, where standard atmospheric pressure is 29.92. AEDT takes pressure in millibars, where standard is 1013.25. AEDT takes an additional input value for dew point temperature in degrees Fahrenheit. As stated in Section 2.1.5, the weather data used in the 2017 actual noise contour were acquired from the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center. As per FAA guidance, the following default weather parameters from the MSP weather station were applied:

- Temperature – 45.0 degrees Fahrenheit
- Dew point – 35.9 degrees Fahrenheit
- Wind speed – 8.4 knots
- Pressure – 985.4 Millibars
- Relative humidity – 67.7 percent

The following annual average atmospheric conditions were used in the 2007 forecast noise contour:

- Temperature – 47.7 degrees Fahrenheit
- Wind speed – 5.3 knots
- Pressure – 29.90 inches of Mercury
- Relative humidity – 64.0 percent

3.2 COMPARATIVE NOISE MODEL GRID POINT ANALYSIS

AEDT was used to calculate DNL values for the center points of each city block included in the mitigation programs outlined in the amended Consent Decree. Graphics showing the actual 2017 DNL levels calculated for each block, Base Case DNL Noise Levels calculated for each block and the block-by-block difference in DNL levels between the Base Case and the 2017 actual noise contours are contained in Appendix 3.

The Base Case DNL is established using the actual DNL noise level for that location during the year the home becomes eligible for noise mitigation under the amended Consent Decree. The Base Case DNL for homes that are not eligible for mitigation under the amended Consent Decree is established using the 2007 forecast DNL for that location.

It is important to note that the 2007 forecast DNL was developed in INM Version 6.2a because this was the oldest version of INM available to MAC staff to conduct the analysis in early 2008 when the MSP annual noise contour reporting efforts began. When comparing the DNL values generated for the MACNOMS sound monitoring sites with INM 6.1 in the November 2004 Part 150 Update document to the DNL generated for those same locations with INM 6.2a, the differences were insignificant.

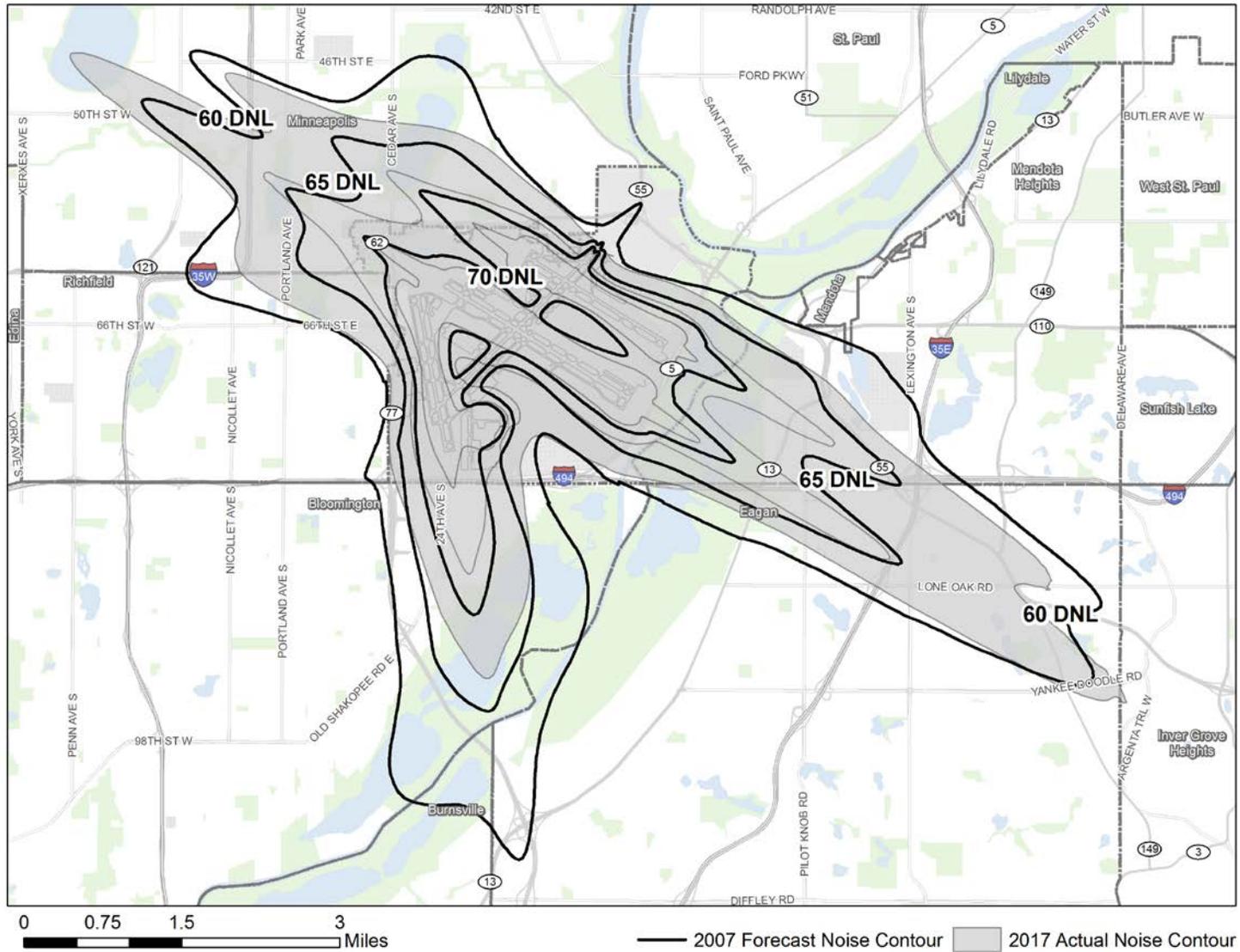
3.3 CONTOUR COMPARISON SUMMARY

The 2017 actual noise contour is smaller than the 2007 forecast mitigated contour by 4,239 acres (27 percent reduction) in the 60 dB DNL contour and by 2,761 acres (38 percent reduction) in the 65 dB DNL contour. As depicted in Figure 3, there is an area in Minneapolis as well as an area in Eagan/Inver Grove Heights where the 2017 actual noise contours extend beyond the 2007 forecast noise contours. The increase in these areas is primarily due to runway use in 2017, particularly arrival operations on Runways 12R and 30L. All homes within the 2017 actual 65 dB DNL contour have received the 5 dB noise reduction mitigation package. Chapter 4 provides an analysis of mitigation eligibility relative to the 2017 actual contour consistent with the requirements of the amended Consent Decree.

The predominant contraction in the contours from the 2007 forecast to the 2017 actual noise contour scenarios is driven largely by fleet mix changes, including a significant reduction in Hushkit Stage 3 aircraft operations, and a reduction of 454.5 average daily operations. The extension of the 2017 actual noise contour beyond the 2007 forecast mitigated noise contour can largely be attributed to nighttime runway use variances between what was forecasted for 2007 and what occurred in 2017, particularly an increase in nighttime arrival operations on Runway 12R.

In summary, in addition to modeling changes and updates, the primary factors to consider when comparing the 2007 forecast mitigated noise contours to the 2017 actual noise contours are total operation numbers, fleet mix, nighttime operations, and runway use.

Figure 3: 2017 Actual and 2007 Forecast Noise Contour Comparison



4. 2017 ANNUAL NOISE CONTOUR AND THE AMENDED CONSENT DECREE

4.1 FIRST AMENDMENT TO THE NOISE MITIGATION CONSENT DECREE

As discussed previously, the first amendment to the Consent Decree requires the MAC to determine eligibility for noise mitigation on an annual basis using actual noise contours, developed under Section 8.1(d) of the Consent Decree. This chapter provides detailed information about noise mitigation impacts from the 2017 actual noise contour at MSP.

On July 31, 2013, the Cities of Minneapolis, Richfield and Eagan, and the Minneapolis Public Housing Authority and the MAC jointly filed the first amendment to the Consent Decree to Hennepin County Court. On September 25, 2013, Hennepin County Court Judge Ivy S. Bernardson approved the first amendment to the 2007 Consent Decree. The first amendment contains language that binds the MAC to provide noise mitigation services consistent with the noise mitigation terms described in the Final MSP 2020 Improvements Environmental Assessment/Environmental Assessment Worksheet (EA/EAW).

In 2014 the Annual Noise Contour Report format was updated in consultation and agreement with the parties to the Consent Decree to address the mitigation program requirements detailed in the first amendment. The report was updated to provide maps analyzing changes that occur in noise mitigation eligibility as compared to the 2007 Consent Decree, and associated trends relative to consecutive yearly impacts.

4.2 SECOND AMENDMENT TO THE CONSENT DECREE

In 2016, the Cities of Minneapolis, Richfield and Eagan, and the Minneapolis Public Housing Authority and the MAC began drafting a second amendment to the 2007 consent decree. This amendment (1) allows the use of the Aviation Environmental Design Tool (AEDT) to run the actual noise contours each year; (2) provided clarity on the Opt-Out Eligibility criteria; and (3) provided a safeguard for homes that may fall out of consecutive year mitigation eligibility by virtue of a change in the model used to generate the noise contours. By November 2016, the parties to the Consent Decree signed off on the second amendment. On December 23, 2016, the FAA sent a letter to MAC Executive Director/CEO declaring the provisions included in the drafted second amendment “constitute a proper use of airport revenue” and “is consistent with MAC’s grant obligations.” On January 31, 2017 Judge Bernardson approved the second amendment to the 2007 Consent Decree.

Due to the increase in total in operations in 2016 as well as the increase in nighttime operations, there were no blocks that failed to qualify for a second or third consecutive year of mitigation eligibility in the 2016 actual noise contour. Therefore, there was no need to run the 2016 actual contour inputs in the Integrated Noise Model (INM) version 7.0d to determine whether these blocks would have advanced in consecutive year eligibility in the INM-generated 2016 actual noise contour, as stipulated in agreement with the parties to the Consent Decree.

4.2 2017 ACTUAL CONTOUR NOISE MITIGATION IMPACT

Under the provisions of the first and second amendments to the Consent Decree, properties must meet certain criteria to be considered eligible for participation in the MAC noise mitigation program.

First, as stated in the first amendment:

“The community in which the home is located has adopted local land use controls and building performance standards applicable to the home for which mitigation is sought that prohibit new residential construction, unless the construction materials and practices are consistent with the local land use controls and heightened building performance standards for homes within the 60 dB DNL Contour within the community in which the home is located.”

This criterion has been met by all of the communities contiguous to MSP.

Second, as stated in the first amendment:

“The home is located, for a period of three consecutive years, with the first of the three years beginning no later than calendar year 2020 (i) in the actual 60-64 dB DNL noise contour prepared by the MAC under Section 8.1(d) of this Consent Decree and (ii) within a higher noise impact mitigation area when compared to the Single-Family home's status under the noise mitigation programs for Single-Family homes provided in Sections 5.1 through 5.3 of this Consent Decree or when compared to the Multi-Family home's status under the noise mitigation programs for Multi-Family homes provided in Section 5.4 of this Consent Decree. The noise contour boundary will be based on the block intersect methodology. The MAC will offer noise mitigation under Section IX of this Consent Decree to owners of eligible Single-Family homes and Multi-Family homes in the year following the MAC's determination that a Single-Family or Multi-Family home is eligible for noise mitigation under this Section.”

Table 4.1 provides a summary of the number of single-family living units within the 2017 60 dB DNL noise contour, as well as changes in mitigation and the number of years of eligibility achieved by virtue of the 2017 actual noise contour.

Table 4.2 provides the number of multi-family living units within the 2017 60 dB DNL noise contour, as well as changes in mitigation and the number of years of eligibility achieved by virtue of the 2017 actual noise contour. The spatial analysis was performed in Universal Transverse Mercator (UTM Zone 15).

Table 4.1: Summary of 2017 Actual Noise Contour Single-Family Unit Counts

Year of Eligibility	City	Mitigation	DNL Contours					Total
			60-62	63-64	65-69	70-74	75+	
No Change in Eligibility	Bloomington	In 2017 Actual Contours previously mitigated	9	7	1	-	-	17
1	Eagan	In 2017 Actual 60 dB DNL previously between 2005 and 2007 60 dB DNL <i>(Eligible for additional mitigation, less previous reimbursements after 3 consecutive years)</i>	33	-	-	-	-	33
No Change in Eligibility	Eagan	In 2017 Actual Contours previously mitigated	239	92	14	-	-	345
1	Inver Grove Heights	In 2017 Actual 60 dB DNL previously between 2005 and 2007 60 dB DNL <i>(Eligible for additional mitigation, less previous reimbursements after 3 consecutive years)</i>	5	-	-	-	-	5
No Change in Eligibility	Mendota Heights	In 2017 Actual Contours previously mitigated	41	-	1	-	-	42
1	Minneapolis	In 2017 Actual 60 dB DNL previously between 2005 and 2007 60 dB DNL <i>(Eligible for additional mitigation, less previous reimbursements after 3 consecutive years)</i>	25	-	-	-	-	25
2	Minneapolis	In 2017 Actual 60 dB DNL previously outside 2005 and 2007 60 dB DNL <i>(Eligible for mitigation after 3 consecutive years)</i>	140	-	-	-	-	140
		In 2017 Actual 60 dB DNL previously between 2005 and 2007 60 dB DNL <i>(Eligible for additional mitigation, less previous reimbursements after 3 consecutive years)</i>	24	-	-	-	-	24
		In 2017 Actual 63 dB DNL previously outside 2005 and 2007 60 dB DNL <i>(Eligible for the "five decibel package" after 3 consecutive years)</i>	-	79	-	-	-	79
Entered into the 2019 Mitigation Program	Minneapolis	In 2017 Actual 60 dB DNL previously outside 2005 and 2007 60 dB DNL <i>(Eligible for mitigation)</i>	177	-	-	-	-	177
		In 2017 Actual 60 dB DNL previously between 2005 and 2007 60 dB DNL <i>(Eligible for additional mitigation, less previous reimbursements)</i>	72	-	-	-	-	72
		In 2017 Actual 63 dB DNL previously in 2007 60-62 dB DNL <i>(Eligible for the "five decibel package")</i>	-	181	-	-	-	181
Entered into the 2018 Mitigation Program	Minneapolis	In 2017 Actual 60 dB DNL previously outside 2005 and 2007 60 dB DNL <i>(Eligible for mitigation)</i>	126	-	-	-	-	126
		In 2017 Actual 60 dB DNL previously between 2005 and 2007 60 dB DNL <i>(Eligible for additional mitigation, less previous reimbursements)</i>	39	-	-	-	-	39
		In 2017 Actual 63 dB DNL previously in 2007 60-62 dB DNL <i>(Eligible for the "five decibel package")</i>	-	118	-	-	-	118
No Change in Eligibility	Minneapolis	In 2017 Actual Contours previously mitigated	4,804	2,133	1,751	-	-	8,688
No Change in Eligibility	Richfield	In 2017 Actual Contours previously mitigated	619	222	98	-	-	939
Grand Total			6,353	2,832	1,865	-	-	11,050

Notes: Block Intersect Methodology; Multi-Family = 4 or more units; As a result of parcel information updated in January 2018, unit counts may differ from previous reports.

Source: HNTB provided AEDT Contours, MAC analysis 2018

Table 4.2 Summary of 2017 Actual Noise Contour Multi-Family Unit Counts

Year of Eligibility	City	Mitigation	DNL Contours				Total
			60-64	65-69	70-74	75+	
No Change in Eligibility	Bloomington	In 2017 Actual Contours previously mitigated	513	-	-	-	513
No Change in Eligibility	Eagan	In 2017 Actual Contours previously mitigated	38	-	-	-	38
No Change in Eligibility	Inver Grove Heights	No multi-family units in 2017 Actual Contours	-	-	-	-	-
No Change in Eligibility	Mendota Heights	No multi-family units in 2017 Actual Contours	-	-	-	-	-
No Change in Eligibility	Minneapolis	In 2017 Actual Contours previously mitigated	901	507	-	-	1,408
No Change in Eligibility	Richfield	In 2017 Actual Contours previously mitigated	144	-	-	-	144
Grand Total			1,596	507	-	-	2,103

Notes: Block Intersect Methodology; Multi-Family = 4 or more units; As a result of parcel information updated in January 2018, unit counts may differ from previous reports.

Source: HNTB provided AEDT Contours, MAC analysis 2018

First-Year Candidate Eligibility

The 2017 actual noise contour includes 63 single-family homes within the First-Year eligibility area for the Partial Noise Reduction Package. These homes were previously eligible for homeowner reimbursements. Of these homes, 33 are located in Eagan, 25 are in Minneapolis and 5 are located in Inver Grove Heights. There are no multi-family units within the First-Year eligibility area. If these 63 single-family homes remain in a higher noise impact area compared to the previous noise mitigation program for two consecutive years more, they will be eligible for mitigation in 2021.

Second-Year Candidate Eligibility

The 2017 actual noise contour includes 243 homes within the Second-Year eligibility area. It is important to note that a reduction in aircraft noise exposure in 2017 compared to 2016 resulted in the 2017 actual noise contour shrinking in Minneapolis along the arrival lobe for Runway 12R. Based on this analysis, 200 single-family homes and 149 multi-family units that met the First-Year Candidate Eligibility criteria in the 2016 analysis no longer meet the noise level criteria required for Second-Year Candidate Eligibility.

Of the 243 homes within the 2017 Second-Year eligibility area, 140 were previously outside the program area and 24 were previously eligible for homeowner reimbursements. The 2017 actual noise contour includes another 79 single-family homes within the Second-Year eligibility area for the Full 5-decibel Reduction Package. There are no multi-family units within the Second-Year eligibility area. If these 243 total single-family homes remain in a higher noise impact area compared to the previous noise mitigation program by virtue of the 2018 actual noise contour, they will be eligible for mitigation in 2020.

Third-Year Candidate Eligibility

The 2017 actual noise contour includes 430 homes within the Third-Year eligibility area and will be invited into the mitigation program in 2019. Again, it is important to note that a reduction in aircraft noise exposure in 2017 compared to 2016 resulted in the 2017 actual noise contour shrinking in Minneapolis along the arrival lobe for Runway 12R. Based on this analysis, 53 homes that met the Second-year Candidate Eligibility criteria in the 2016 analysis no longer meet the noise level criteria required for Third-year Candidate Eligibility.

Of the 430 homes that meet the Third-year Candidate Eligibility, 249 homes are eligible for the Partial Noise Reduction Package. Of these, 177 homes were previously located outside the eligibility area and 72 homes were previously eligible for homeowner reimbursements. These single-family homes are entered into the 2019 mitigation program to receive one of two mitigation options, as detailed in Section 9.5(b) of the first amendment to the 2007 Consent Decree. The remaining 181 single-family homes are eligible for the Full 5-decibel Reduction Package.

There are no multi-family units that meet the criteria for Third-year Candidate Eligibility. Homeowners of eligible properties will be notified by the MAC in writing in mid-2018.

In cases where homes have received previous reimbursements or mitigation from the MAC, those improvements will be deducted from the efforts required to increase the home mitigation relative to the actual noise level, per the amended Consent Decree.

The blocks meeting the first, second and third consecutive year(s) of noise mitigation eligibility by virtue of the 2017 actual noise contours are shown in Figures 4.1, 4.2, and 4.3.

2017 Mitigation Program

In 2017 the MAC began the project to provide mitigation to 138 single-family homes that became eligible by virtue of the 2015 actual noise contour. As of February 12, 2018, 92 homes have been completed, 37 homes have begun the construction or pre-construction phases, and nine homes have declined participation.

Two multi-family structures were also eligible to participate in the Multi-Family Mitigation Program in 2017; one property is in pre-construction, and one property declined to participate. The year-to-date construction cost for the 2017 Mitigation Program is \$1,795,957.

2018 Mitigation Program

In late 2017 the MAC began contacting the homeowners of the 283 single-family homes that achieved eligibility by virtue of the 2016 actual noise contour. As of February 12, 2018, five homes have been completed, 271 homes have begun the construction or pre-construction phases, and seven homes declined participation. The 2018 Mitigation Program does not include any multi-family properties. To date, \$90,252 has been spent on the 2018 Mitigation Program.

Figure 4.1: 2017 Contours and Mitigation Program Eligibility

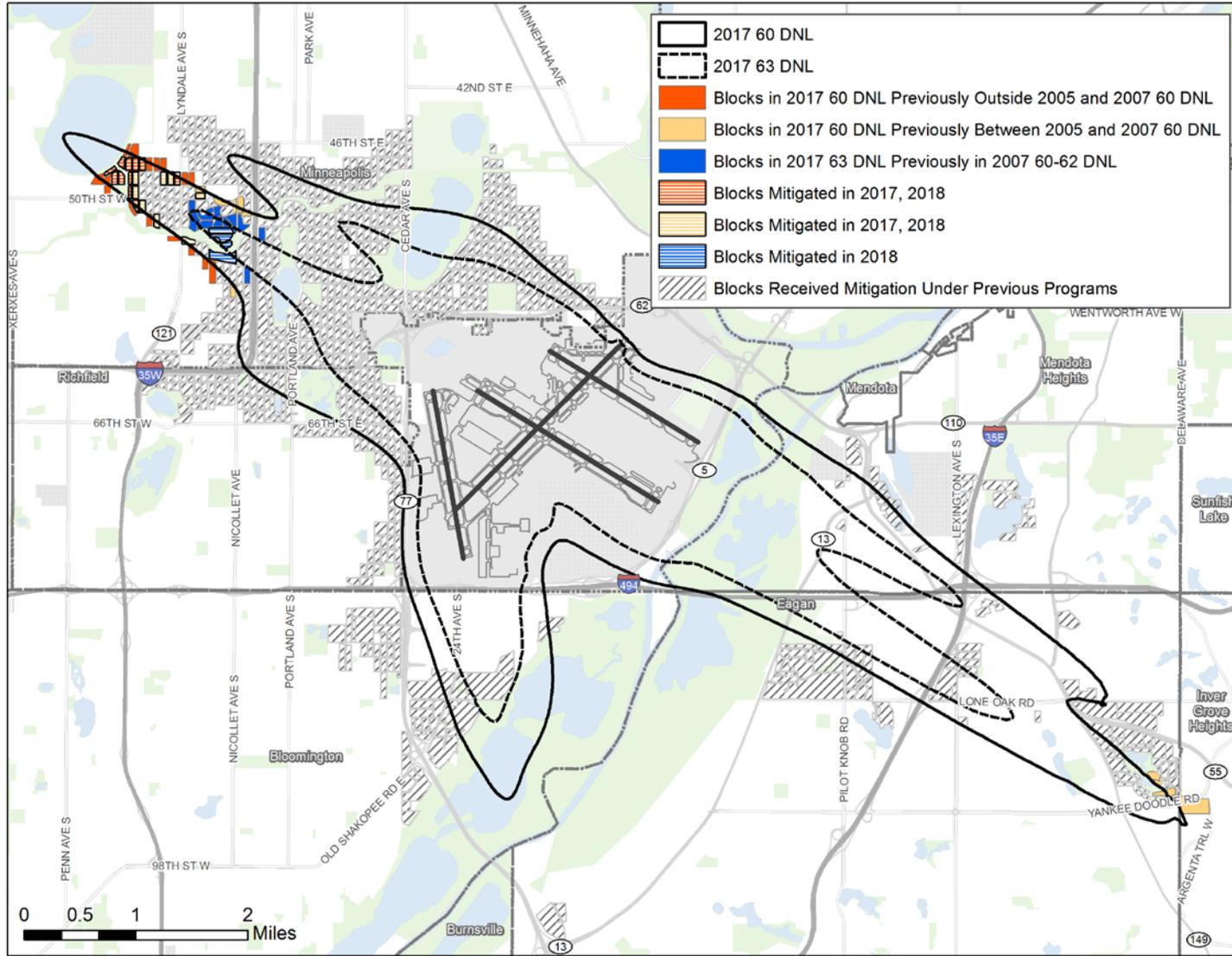


Figure 4.2: 2017 Contours and Mitigation Program Eligibility – City of Minneapolis

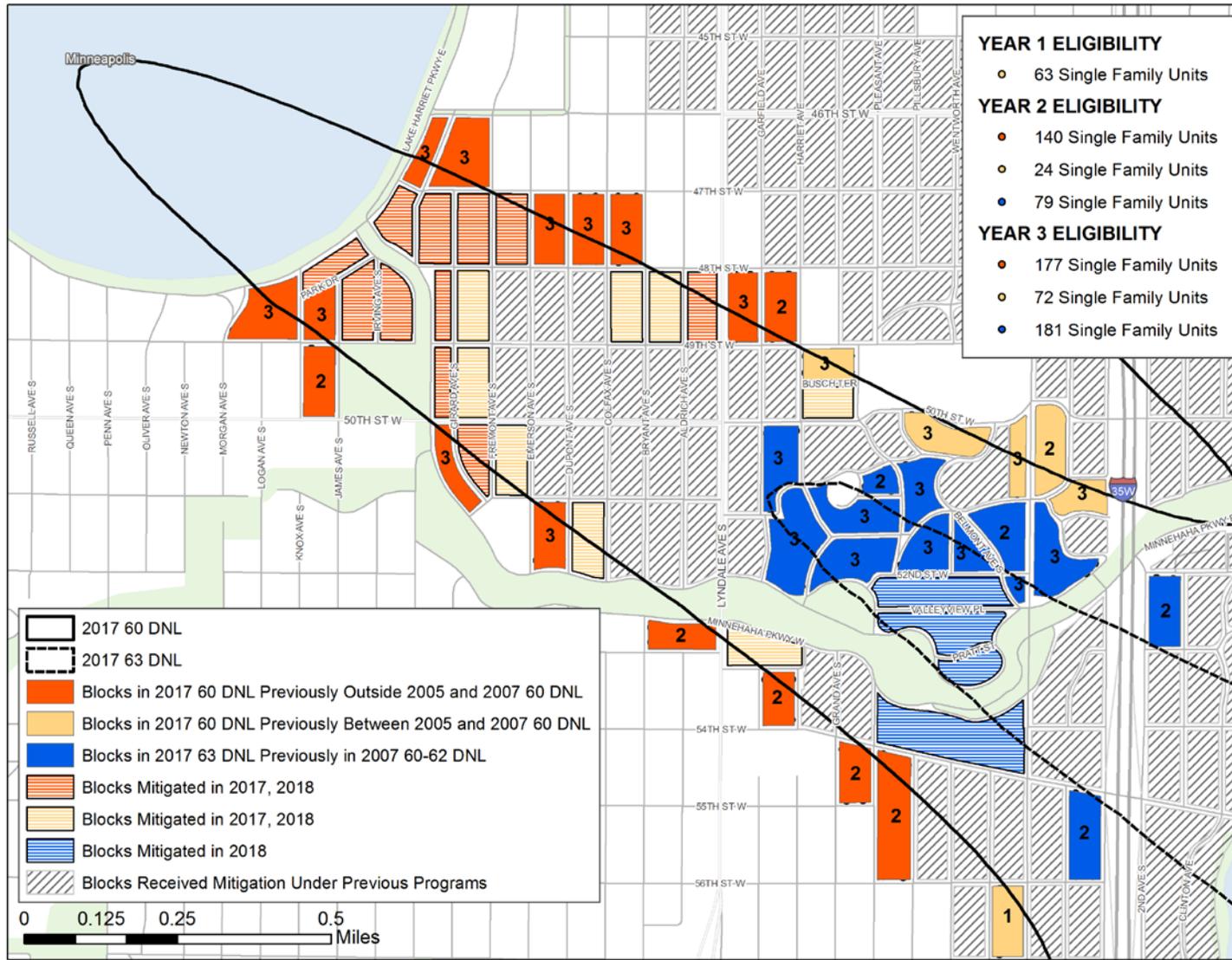
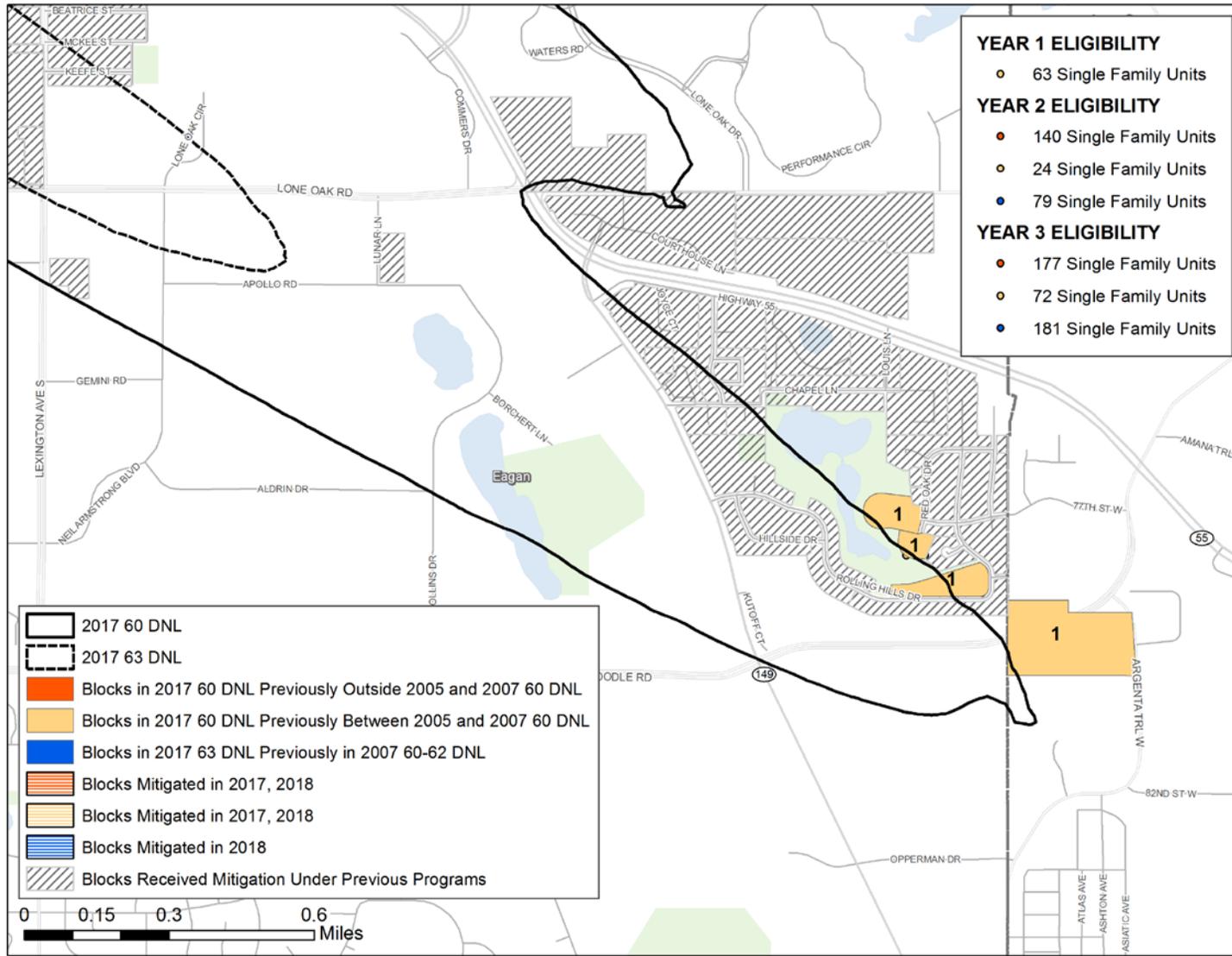


Figure 4.2: 2017 Contours and Mitigation Program Eligibility – Cities of Eagan and Inver Grove Heights



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Appendix 1: Detailed Aircraft Fleet Mix Average Daily Operations

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Table A1-1: 2017 Aircraft Fleet Mix Average Daily Operations

Group	Aircraft Type	2017 Day	2017 Night	2017 Total
	A306	0.0	0.0	0.1
	A306	0.1	0.1	0.3
	A310	0.0	-	0.0
	A319	64.9	6.0	70.9
	A320	67.3	7.4	74.7
	A320-251N	0.4	0.5	1.0
	A320-271N	1.5	0.1	1.6
	A321	2.6	2.9	5.6
	A332	0.7	0.0	0.7
	A333	6.5	1.3	7.8
	A343	0.7	0.0	0.7
	A346	0.0	0.0	0.0
	A359	0.0	-	0.0
	ASTR	0.1	0.0	0.1
	B712	51.4	3.7	55.2
	B733	3.2	0.4	3.7
	B734	0.2	0.1	0.3
	B735	0.0	0.0	0.0
	B737	42.5	10.5	53.0
	B737-8	0.1	0.0	0.1
	B738	78.6	24.1	102.7
	B739	44.5	8.5	53.0
	B744	0.1	0.0	0.1
	B748	0.0	0.0	0.0
Manufactured to be Stage 3+	B752	37.5	9.7	47.1
	B753	13.4	1.4	14.9
	B757	0.0	0.0	0.0
	B762	0.6	0.1	0.7
	B762	0.7	0.2	0.8
	B763	4.2	1.0	5.2
	B764	0.1	0.0	0.1
	B772	3.6	0.0	3.6
	B77L	0.4	-	0.4
	B789	0.1	0.0	0.1
	BE40	0.8	0.0	0.8
	C25A	0.3	0.0	0.3
	C25B	0.4	0.0	0.5
	C25C	0.2	0.0	0.2
	C25M	0.0	-	0.0
	C501	0.0	-	0.0
	C525	0.2	0.0	0.2
	C550	0.4	0.0	0.4
	C560	0.7	0.1	0.8
	C56X	3.1	0.2	3.3
C650	0.3	0.0	0.3	
C680	3.4	0.1	3.6	
C68A	0.5	0.0	0.5	
C750	2.8	0.2	3.0	
CL30	3.4	0.4	3.7	
CL35	1.7	0.1	1.8	
CL60	1.4	0.1	1.4	

Group	Aircraft Type	2017 Day	2017 Night	2017 Total
	CRJ1	0.5	0.2	0.6
	CRJ2	162.8	7.4	170.2
	CRJ7	48.2	2.6	50.8
	CRJ9	112.0	6.9	118.9
	DC10	1.3	0.5	1.9
	DC10	0.0	-	0.0
	DC10	0.7	0.3	1.0
	E135	0.3	0.0	0.3
	E145	0.2	0.0	0.2
	E170	10.3	0.9	11.2
	E190	4.3	0.6	5.0
	E35L	0.0	0.0	0.0
	E45X	0.4	0.0	0.4
	E545	0.1	0.0	0.1
	E550	0.1	0.0	0.1
	E55P	1.2	0.1	1.3
	E75L	27.5	6.2	33.7
	E75S	27.3	2.0	29.3
	F2TH	1.4	0.1	1.5
	F900	1.3	0.1	1.4
	FA10	0.0	-	0.0
	FA50	1.2	0.1	1.2
	FA7X	0.1	-	0.1
	FA7X	0.1	-	0.1
	G150	0.3	0.0	0.4
	G280	0.3	0.0	0.3
	GALX	1.3	0.2	1.5
	GL5T	0.2	0.0	0.2
	GLEX	0.2	0.0	0.2
	GLF4	1.5	0.1	1.6
	GLF5	1.5	0.2	1.7
	GLF6	0.2	0.0	0.2
	H25B	1.4	0.1	1.5
	H25C	0.2	0.0	0.2
	HA4T	0.1	0.0	0.1
	HAWK	0.0	-	0.0
	J328	0.0	0.0	0.1
	LJ31	0.1	-	0.1
	LJ35	0.4	0.1	0.5
	LJ40	0.1	0.0	0.1
	LJ45	1.1	0.1	1.1
	LJ55	0.0	0.0	0.1
	LJ60	0.6	0.0	0.6
	LJ70	0.4	-	0.4
	MD11	3.2	1.7	4.9
	MD81	0.0	0.0	0.0
	MD82	2.1	0.0	2.1
	MD83	5.9	0.0	5.9
	MD88	17.3	0.7	18.0
	MD90	88.2	4.8	93.0
	PRM1	0.0	0.0	0.0
	PRM1	0.0	0.0	0.0

Group	Aircraft Type	2017 Day	2017 Night	2017 Total
	PRM1	0.0	0.0	0.0
	WW24	0.0	0.0	0.0
<i>Manufactured to be Stage 3+ Total</i>		<i>973.6</i>	<i>115.8</i>	<i>1,089.4</i>
Microjet	C510	0.1	0.0	0.1
	E50P	0.1	0.0	0.1
	EA50	0.0	-	0.0
	HDJT	0.0	-	0.0
	SF50	0.1	0.0	0.1
<i>Microjet Total</i>		<i>0.4</i>	<i>0.0</i>	<i>0.4</i>
Hushkit Stage 3 Jet	B722	0.0	0.0	0.0
	B732	0.0	0.0	0.0
	DC91	0.0	0.0	0.0
<i>Hushkit Stage 3 Jet Total</i>		<i>0.1</i>	<i>0.0</i>	<i>0.1</i>
Retrofitted Stage 2 Jets <75,000 lbs	FA20	0.3	1.4	1.8
	GLF3	0.1	0.0	0.1
<i>Retrofitted Stage 2 Jets <75,000 lbs</i>		<i>0.4</i>	<i>1.5</i>	<i>1.9</i>
Military	A400	0.0	-	0.0
	C130	1.5	0.0	1.5
	C30J	0.0	-	0.0
	F18S	0.0	-	0.0
	K35R	0.0	-	0.0
	T38	0.0	-	0.0
	TEX2	0.1	-	0.1
<i>Military Total</i>		<i>1.6</i>	<i>0.0</i>	<i>1.7</i>
Propeller	AC90	0.0	0.0	0.0
	AEST	0.1	0.0	0.1
	AT43	1.2	0.2	1.4
	B190	4.8	0.7	5.4
	B350	0.5	0.0	0.5
	BE20	0.5	0.1	0.6
	BE30	0.3	0.0	0.4
	BE35	0.0	-	0.0
	BE36	0.1	0.0	0.1
	BE58	0.1	0.0	0.1
	BE65	6.3	0.4	6.7
	BE80	3.5	0.1	3.7
	BE90	0.0	-	0.0
	BE99	5.2	0.2	5.3
	BE9L	0.3	0.1	0.4
	C172	0.2	0.0	0.2
	C177	0.0	-	0.0
	C182	0.0	0.0	0.0
	C206	0.0	-	0.0
	C208	8.9	0.0	8.9
	C310	0.0	0.0	0.1
	C340	0.0	-	0.0
	C402	0.0	-	0.0
	C414	0.2	-	0.2
	C421	0.0	0.0	0.0
	C425	0.0	-	0.0
	C441	0.1	0.0	0.1
D328	0.0	-	0.0	

Group	Aircraft Type	2017 Day	2017 Night	2017 Total
	DA42	0.0	-	0.0
	E120	0.0	0.0	0.0
	M20P	0.1	-	0.1
	MU2	0.0	-	0.0
	P180	0.1	0.0	0.1
	P28A	0.0	0.0	0.0
	P28A	0.0	0.0	0.0
	P28B	0.0	-	0.0
	P28R	0.0	0.0	0.0
	P46T	0.0	0.0	0.0
	PA31	0.0	0.0	0.0
	PA32	0.0	-	0.0
	PA34	0.0	-	0.0
	PA44	0.0	-	0.0
	PA46	0.0	0.0	0.0
	PAY1	0.0	0.0	0.0
	PAY2	0.0	-	0.0
	PAY3	0.0	0.0	0.0
	PC12	5.4	0.1	5.5
	S22T	0.0	-	0.0
	SR22	0.3	0.0	0.3
	SW3	0.0	0.0	0.0
	SW4	4.2	0.3	4.5
	TBM7	0.0	-	0.0
	TBM8	0.2	0.0	0.2
	TBM9	0.0	-	0.0
	TBM9	0.0	-	0.0
<i>Propeller Total</i>		43.1	2.4	45.5
Helicopter	HELO	0.0	-	0.0
	R44	0.0	-	0.0
<i>Helicopter Total</i>		0.0	-	0.0
Grand Total		1,019.2	119.7	1,138.9

Note: Totals may differ due to rounding.

Sources: MAC-provided ANOMS data, HNTB 2018

**Table A1-2: Comparison of 2007 Forecast Fleet Mix and 2017 Actual Fleet Mix
Average Daily Operations**

Group	Aircraft Type	Day		Night		Total		Difference
		2007 Forecast	2017 Actual	2007 Forecast	2017 Actual	2007 Forecast	2017 Actual	
Manufactured to be Stage 3+	717200	7.3	51.4	1.0	3.7	8.3	55.2	46.9
	737300	48.2	3.2	3.5	0.4	51.7	3.7	(48.0)
	737400	0.1	0.2	-	0.1	0.1	0.3	0.2
	737500	5.7	0.0	0.5	0.0	6.2	0.0	(6.2)
	737700	7.8	42.5	0.5	10.5	8.3	53.0	44.7
	737800	65.5	78.6	12.6	24.1	78.1	102.7	24.6
	737900	5.7	44.5	0.5	8.5	6.2	53.0	46.8
	747400	1.9	-	0.2	-	2.1	-	(2.1)
	757300	34.1	-	1.1	-	35.2	-	(35.2)
	767200	1.2	1.3	0.5	0.3	1.7	1.5	(0.2)
	757PW	88.4	-	8.6	-	97.0	-	(97.0)
	A300-622R	4.8	-	4.2	-	9.0	-	(9.0)
	A306	-	0.2	-	0.1	-	0.3	0.3
	A310	-	0.0	-	-	-	0.0	0.0
	A310-304	1.4	-	1.3	-	2.7	-	(2.7)
	A318	5.7	-	0.5	-	6.2	-	(6.2)
	A319	-	64.9	-	6.0	-	70.9	70.9
	A319-131	149.1	-	3.9	-	153.0	-	(153.0)
	A320	-	67.3	-	7.4	-	74.7	74.7
	A320-211	173.4	-	16.5	-	189.9	-	(189.9)
	A320-251N	-	0.4	-	0.5	-	1.0	1.0
	A320-271N	-	1.5	-	0.1	-	1.6	1.6
	A321	-	2.6	-	2.9	-	5.6	5.6
	A330-301	6.2	-	-	-	6.2	-	(6.2)
	A332	-	0.7	-	0.0	-	0.7	0.7
	A333	-	6.5	-	1.3	-	7.8	7.8
	A340-642	2.1	-	-	-	2.1	-	(2.1)
	A343	-	0.7	-	0.0	-	0.7	0.7
	A346	-	0.0	-	0.0	-	0.0	0.0
	A359	-	0.0	-	-	-	0.0	0.0
	ASTR	2.3	0.1	0.2	0.0	2.5	0.1	(2.4)
	B737-8	-	0.1	-	0.0	-	0.1	0.1
	B744	-	0.1	-	0.0	-	0.1	0.1
	B748	-	0.0	-	0.0	-	0.0	0.0
	B752	-	37.5	-	9.7	-	47.1	47.1
	B753	-	13.4	-	1.4	-	14.9	14.9
	B757	-	0.0	-	0.0	-	0.0	0.0
	B763	-	4.2	-	1.0	-	5.2	5.2
	B764	-	0.1	-	0.0	-	0.1	0.1
	B772	-	3.6	-	0.0	-	3.6	3.6
	B77L	-	0.4	-	-	-	0.4	0.4
	B789	-	0.1	-	0.0	-	0.1	0.1
	BAE146	74.3	-	2.2	-	76.5	-	(76.5)
	BE40	-	0.8	-	0.0	-	0.8	0.8
	C25A	-	0.3	-	0.0	-	0.3	0.3
	C25B	-	0.4	-	0.0	-	0.5	0.5
	C25C	-	0.2	-	0.0	-	0.2	0.2
	C25M	-	0.0	-	-	-	0.0	0.0
	C501	-	0.0	-	-	-	0.0	0.0
	C525	-	0.2	-	0.0	-	0.2	0.2
C550	-	0.4	-	0.0	-	0.4	0.4	
C560	-	0.7	-	0.1	-	0.8	0.8	
C56X	-	3.1	-	0.2	-	3.3	3.3	
C650	-	0.3	-	0.0	-	0.3	0.3	
C680	-	3.4	-	0.1	-	3.6	3.6	
C68A	-	0.5	-	0.0	-	0.5	0.5	
C750	-	2.8	-	0.2	-	3.0	3.0	
CL30	-	3.4	-	0.4	-	3.7	3.7	
CL35	-	1.7	-	0.1	-	1.8	1.8	
CL60	-	1.4	-	0.1	-	1.4	1.4	

Group	Aircraft Type	Day		Night		Total		Difference
		2007 Forecast	2017 Actual	2007 Forecast	2017 Actual	2007 Forecast	2017 Actual	
	CL601	264.1	-	14.7	-	278.8	-	(278.8)
	CNA500	1.4	-	0.1	-	1.5	-	(1.5)
	CNA650	4.9	-	0.6	-	5.5	-	(5.5)
	CNA750	4.6	-	0.3	-	4.9	-	(4.9)
	CRJ1	-	0.5	-	0.2	-	0.6	0.6
	CRJ2	-	162.8	-	7.4	-	170.2	170.2
	CRJ7	-	48.2	-	2.6	-	50.8	50.8
	CRJ9	-	112.0	-	6.9	-	118.9	118.9
	DC10	-	2.0	-	0.8	-	2.9	2.9
	DC1010	9.6	-	3.8	-	13.4	-	(13.4)
	DC870	-	-	1.4	-	1.4	-	(1.4)
	E135	-	0.3	-	0.0	-	0.3	0.3
	E145	-	0.2	-	0.0	-	0.2	0.2
	E170	-	10.3	-	0.9	-	11.2	11.2
	E190	-	4.3	-	0.6	-	5.0	5.0
	E35L	-	0.0	-	0.0	-	0.0	0.0
	E45X	-	0.4	-	0.0	-	0.4	0.4
	E545	-	0.1	-	0.0	-	0.1	0.1
	E550	-	0.1	-	0.0	-	0.1	0.1
	E55P	-	1.2	-	0.1	-	1.3	1.3
	E75L	-	27.5	-	6.2	-	33.7	33.7
	E75S	-	27.3	-	2.0	-	29.3	29.3
	EMB145	45.3	-	0.2	-	45.5	-	(45.5)
	F2TH	-	1.4	-	0.1	-	1.5	1.5
	F900	-	1.3	-	0.1	-	1.4	1.4
	FA10	-	0.0	-	-	-	0.0	0.0
	FA50	-	1.2	-	0.1	-	1.2	1.2
	FA7X	-	0.2	-	-	-	0.2	0.2
	FAL20A	1.0	-	0.7	-	1.7	-	(1.7)
	G150	-	0.3	-	0.0	-	0.4	0.4
	G280	-	0.3	-	0.0	-	0.3	0.3
	GALX	-	1.3	-	0.2	-	1.5	1.5
	GIV	2.6	1.5	0.2	0.1	2.8	1.6	(1.2)
	GL5T	-	0.2	-	0.0	-	0.2	0.2
	GLEX	-	0.2	-	0.0	-	0.2	0.2
	GLF6	-	0.2	-	0.0	-	0.2	0.2
	GV	0.8	1.5	0.1	0.2	0.9	1.7	0.8
	H25B	-	1.4	-	0.1	-	1.5	1.5
	H25C	-	0.2	-	0.0	-	0.2	0.2
	HA4T	-	0.1	-	0.0	-	0.1	0.1
	HAWK	-	0.0	-	-	-	0.0	0.0
	J328	-	0.0	-	0.0	-	0.1	0.1
	L101	0.6	-	0.2	-	0.8	-	(0.8)
	LEAR35	26.0	0.4	2.3	0.1	28.3	0.5	(27.8)
	LJ31	-	0.1	-	-	-	0.1	0.1
	LJ40	-	0.1	-	0.0	-	0.1	0.1
	LJ45	-	1.1	-	0.1	-	1.1	1.1
	LJ55	-	0.0	-	0.0	-	0.1	0.1
	LJ60	-	0.6	-	0.0	-	0.6	0.6
	LJ70	-	0.4	-	-	-	0.4	0.4
	MD11	-	3.2	-	1.7	-	4.9	4.9
	MD11GE	0.3	-	0.4	-	0.7	-	(0.7)
	MD81	0.5	0.0	-	0.0	0.5	0.0	(0.5)
	MD82	-	2.1	-	0.0	-	2.1	2.1
	MD83	17.0	5.9	1.6	0.0	18.6	5.9	(12.7)
	MD88	-	17.3	-	0.7	-	18.0	18.0
	MD90	-	88.2	-	4.8	-	93.0	93.0
	MU300	7.2	-	0.6	-	7.8	-	(7.8)
	PRM1	-	0.1	-	0.0	-	0.1	0.1
	SBR2	0.4	-	-	-	0.4	-	(0.4)
	WW24	-	0.0	-	0.0	-	0.0	0.0
<i>Manufactured to be Stage 3+ Total</i>		1,071.5	973.6	85.0	115.8	1,156.5	1,089.4	(67.1)

Group	Aircraft Type	Day		Night		Total		Difference
		2007 Forecast	2017 Actual	2007 Forecast	2017 Actual	2007 Forecast	2017 Actual	
Hushkit Stage 3 Jet	727EM2	8.0	-	6.4	0.0	14.4	0.0	(14.4)
	B722	-	0.0	-	0.0	-	0.0	0.0
	B732	-	0.0	-	0.0	-	0.0	0.0
	DC91	-	0.0	-	0.0	-	0.0	0.0
	DC9Q	245.3	-	15.3	-	260.6	-	(260.6)
Hushkit Stage 3 Jet Total		253.3	0.1	21.7	0.0	275.0	0.1	(274.9)
Retrofitted Stage 2 Jet	FAL20	-	0.3	-	1.4	-	1.8	1.8
	GIIB	-	0.1	-	0.0	-	0.1	0.1
Retrofitted Stage 2 Jet Total		-	0.4	-	1.5	-	1.9	1.9
Stage 2 Jets under 75,000 lbs	GIIB	2.1	-	0.2	-	2.3	-	(2.3)
	LEAR25	2.1	-	0.4	-	2.5	-	(2.5)
Stage 2 Jets Under 75,000 lbs Total		4.2	-	0.6	-	4.8	-	(4.8)
Microjet	C510	-	0.1	-	0.0	-	0.1	0.1
	E50P	-	0.1	-	0.0	-	0.1	0.1
	EA50	-	0.0	-	-	-	0.0	0.0
	HDJT	-	0.0	-	-	-	0.0	0.0
	SF50	-	0.1	-	0.0	-	0.1	0.1
Microjet Total		-	0.4	-	0.0	-	0.4	0.4
Propeller	AC90	-	0.0	-	0.0	-	0.0	0.0
	AEST	-	0.1	-	0.0	-	0.1	0.1
	AT43	-	1.2	-	0.2	-	1.4	1.4
	B190	-	4.8	-	0.7	-	5.4	5.4
	B350	-	0.5	-	0.0	-	0.5	0.5
	BE20	-	0.5	-	0.1	-	0.6	0.6
	BE30	-	0.3	-	0.0	-	0.4	0.4
	BE35	-	0.0	-	-	-	0.0	0.0
	BE36	-	0.1	-	0.0	-	0.1	0.1
	BE58	-	0.1	-	0.0	-	0.1	0.1
	BE65	-	6.3	-	0.4	-	6.7	6.7
	BE80	-	3.5	-	0.1	-	3.7	3.7
	BE90	-	0.0	-	-	-	0.0	0.0
	BE99	-	5.2	-	0.2	-	5.3	5.3
	BE9L	-	0.3	-	0.1	-	0.4	0.4
	BEC58	14.3	-	4.7	-	19.0	-	(19.0)
	C172	-	0.2	-	0.0	-	0.2	0.2
	C177	-	0.0	-	-	-	0.0	0.0
	C182	-	0.0	-	0.0	-	0.0	0.0
	C206	-	0.0	-	-	-	0.0	0.0
	C208	-	8.9	-	0.0	-	8.9	8.9
	C310	-	0.0	-	0.0	-	0.1	0.1
	C340	-	0.0	-	-	-	0.0	0.0
	C402	-	0.0	-	-	-	0.0	0.0
	C414	-	0.2	-	-	-	0.2	0.2
	C421	-	0.0	-	0.0	-	0.0	0.0
	C425	-	0.0	-	-	-	0.0	0.0
	C441	-	0.1	-	0.0	-	0.1	0.1
	D328	-	0.0	-	-	-	0.0	0.0
	DA42	-	0.0	-	-	-	0.0	0.0
	DHC6	22.5	-	4.4	-	26.9	-	(26.9)
	E120	-	0.0	-	0.0	-	0.0	0.0
	FK27	0.1	-	-	-	0.1	-	(0.1)
	GASEPF	1.3	-	0.3	-	1.6	-	(1.6)
	GASEPV	3.7	-	0.5	-	4.2	-	(4.2)
	M20P	-	0.1	-	-	-	0.1	0.1
	MU2	-	0.0	-	-	-	0.0	0.0
P180	-	0.1	-	0.0	-	0.1	0.1	
P28A	-	0.0	-	0.0	-	0.0	0.0	
P28A	-	0.0	-	0.0	-	0.0	0.0	
P28B	-	0.0	-	-	-	0.0	0.0	
P28R	-	0.0	-	0.0	-	0.0	0.0	
P46T	-	0.0	-	0.0	-	0.0	0.0	
PA31	-	0.0	-	0.0	-	0.0	0.0	
PA32	-	0.0	-	-	-	0.0	0.0	

Group	Aircraft Type	Day		Night		Total		Difference
		2007 Forecast	2017 Actual	2007 Forecast	2017 Actual	2007 Forecast	2017 Actual	
	PA34	-	0.0	-	-	-	0.0	0.0
	PA44	-	0.0	-	-	-	0.0	0.0
	PA46	-	0.0	-	0.0	-	0.0	0.0
	PAY1	-	0.0	-	0.0	-	0.0	0.0
	PAY2	-	0.0	-	-	-	0.0	0.0
	PAY3	-	0.0	-	0.0	-	0.0	0.0
	PC12	-	5.4	-	0.1	-	5.5	5.5
	S22T	-	0.0	-	-	-	0.0	0.0
	SF340	93.3	-	5.9	-	99.2	-	(99.2)
	SR22	-	0.3	-	0.0	-	0.3	0.3
	SW3	-	0.0	-	0.0	-	0.0	0.0
	SW4	-	4.2	-	0.3	-	4.5	4.5
	TBM7	-	0.0	-	-	-	0.0	0.0
	TBM8	-	0.2	-	0.0	-	0.2	0.2
	TBM9	-	0.0	-	-	-	0.0	0.0
	TBM9	-	0.0	-	-	-	0.0	0.0
Propeller Total		135.2	43.1	15.8	2.4	151.0	45.5	(105.5)
Helicopter	HELO	-	0.0	-	-	-	0.0	0.0
	R44	-	0.0	-	-	-	0.0	0.0
Helicopter Total		-	0.0	-	-	-	0.0	0.0
Military	A400	-	0.0	-	-	-	0.0	0.0
	C130E	-	-	-	-	-	-	-
	C-130E	7.8	1.5	0.2	0.0	8.0	1.5	(6.5)
	C17	-	-	-	-	-	-	-
	C30J	-	0.0	-	-	-	0.0	0.0
	C5	0.1	-	-	-	0.1	-	(0.1)
	F16GE	0.1	-	-	-	0.1	-	(0.1)
	F-18	-	0.0	-	-	-	0.0	0.0
	KC-135	-	0.0	-	-	-	0.0	0.0
	T37	0.1	-	-	-	0.1	-	(0.1)
	T38	0.1	0.0	-	-	0.1	0.0	(0.1)
	T-38A	-	-	-	-	-	-	-
	TEX2	-	0.1	-	-	-	0.1	0.1
Military Total		8.2	1.6	0.2	0.0	8.4	1.7	(6.7)
Grand Total		1,472.4	1,019.2	123.3	119.7	1,595.9	1,138.9	(456.8)

Notes:

Total may differ due to rounding.

As of January 1, 2016, all Stage 2 aircraft types are required to meet Stage 3 noise standards.

Source: MAC-provided INM Input Data, HNTB 2017. Average Daily Operations for 2007 Forecast were obtained from the November 2004 Part 150 document.

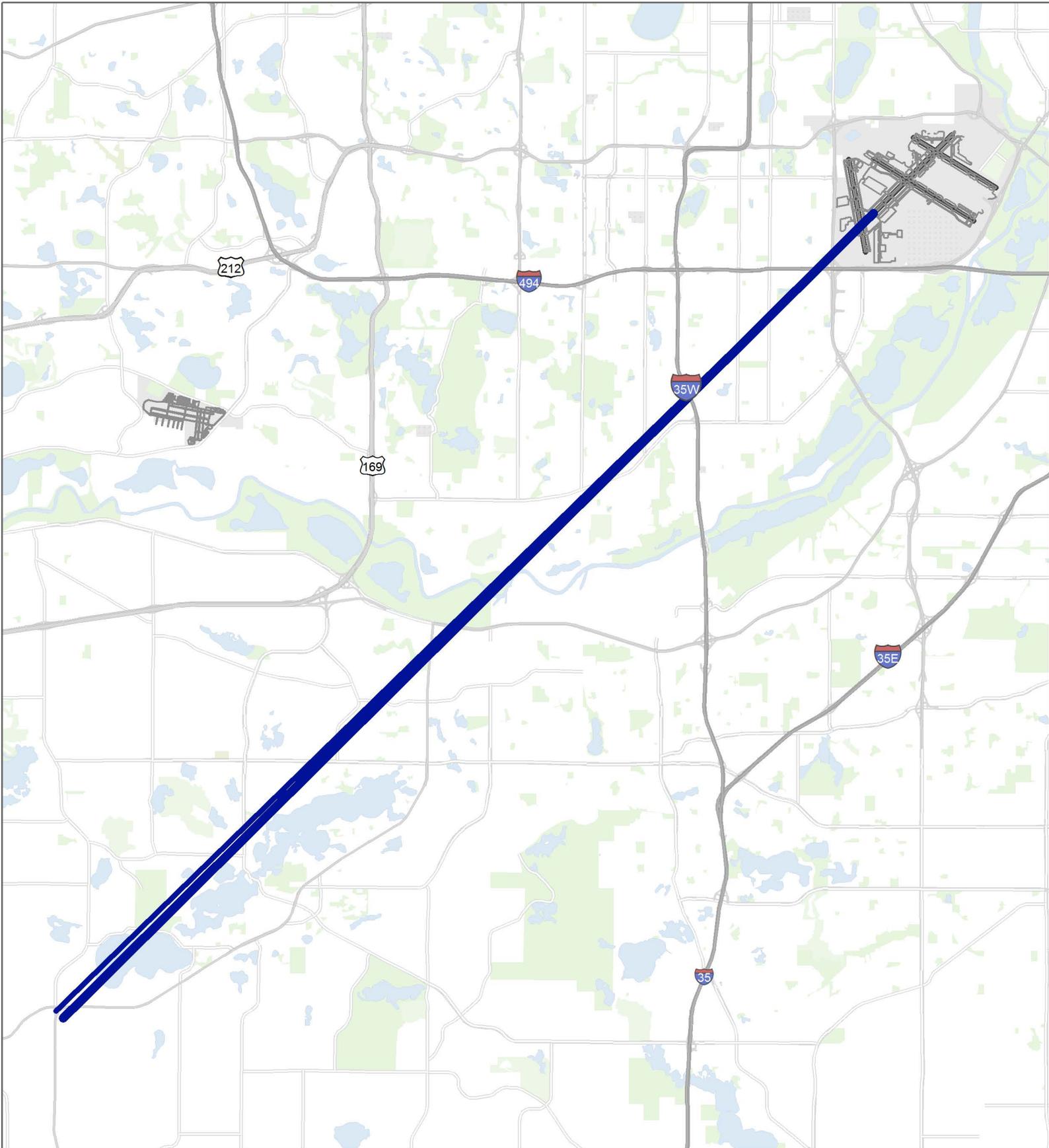
Appendix 2: 2017 Model Flight Tracks and Use

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Runway 4 Arrivals	2-1
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Runway 12R Arrivals	2-3
Runway 17 Arrivals	2-4
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Runway 35 Departures	2-16

2017 AEDT TRACKS - ARRIVAL RUNWAY 4

Overall Use Percentage

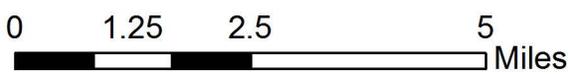
Figure 2.1



AEDT Track Use Percentage



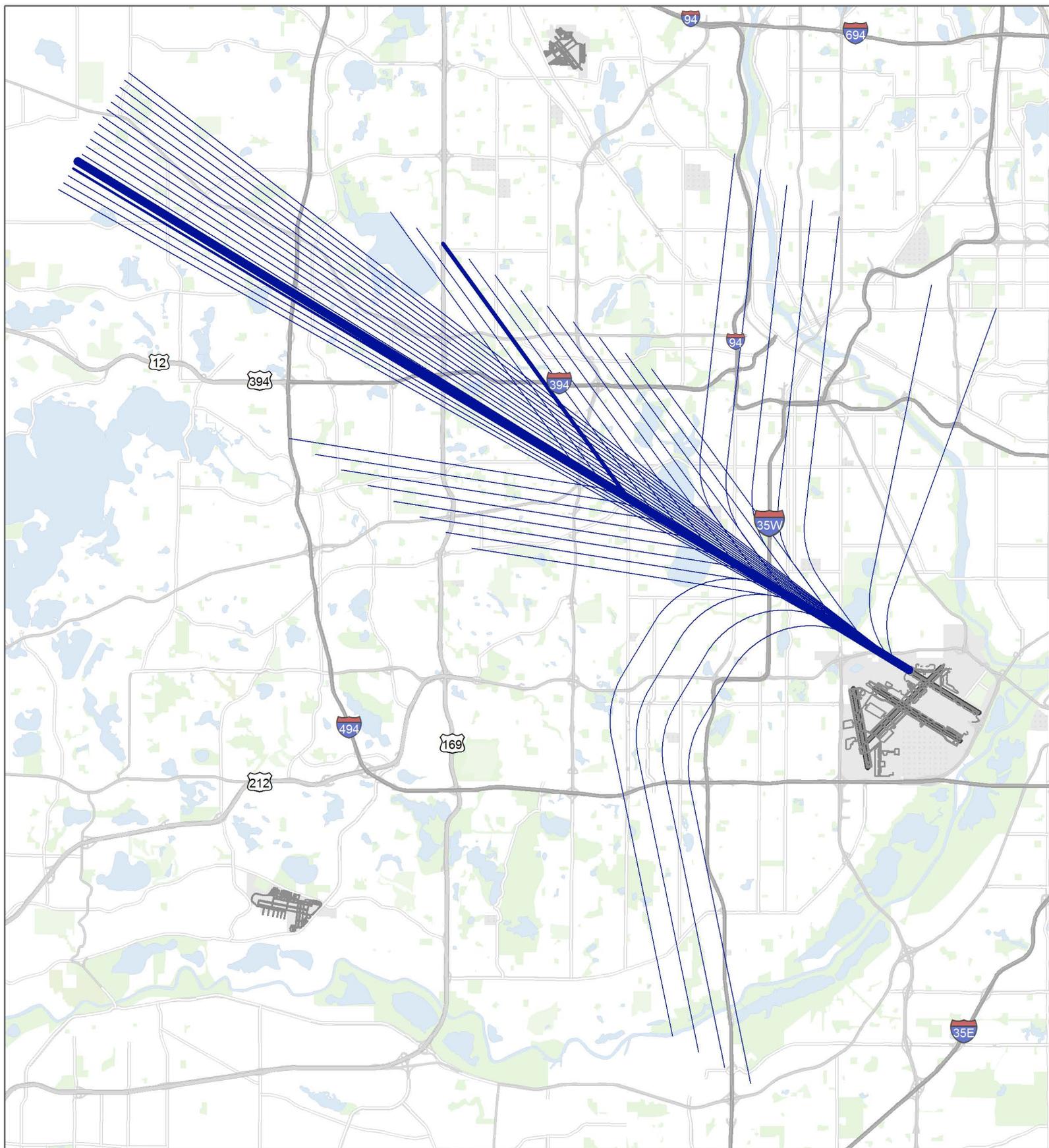
2-1



2017 AEDT TRACKS - ARRIVAL RUNWAY 12L

Overall Use Percentage

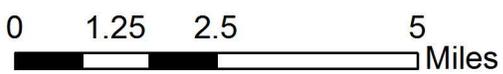
Figure 2.2



AEDT Track Use Percentage



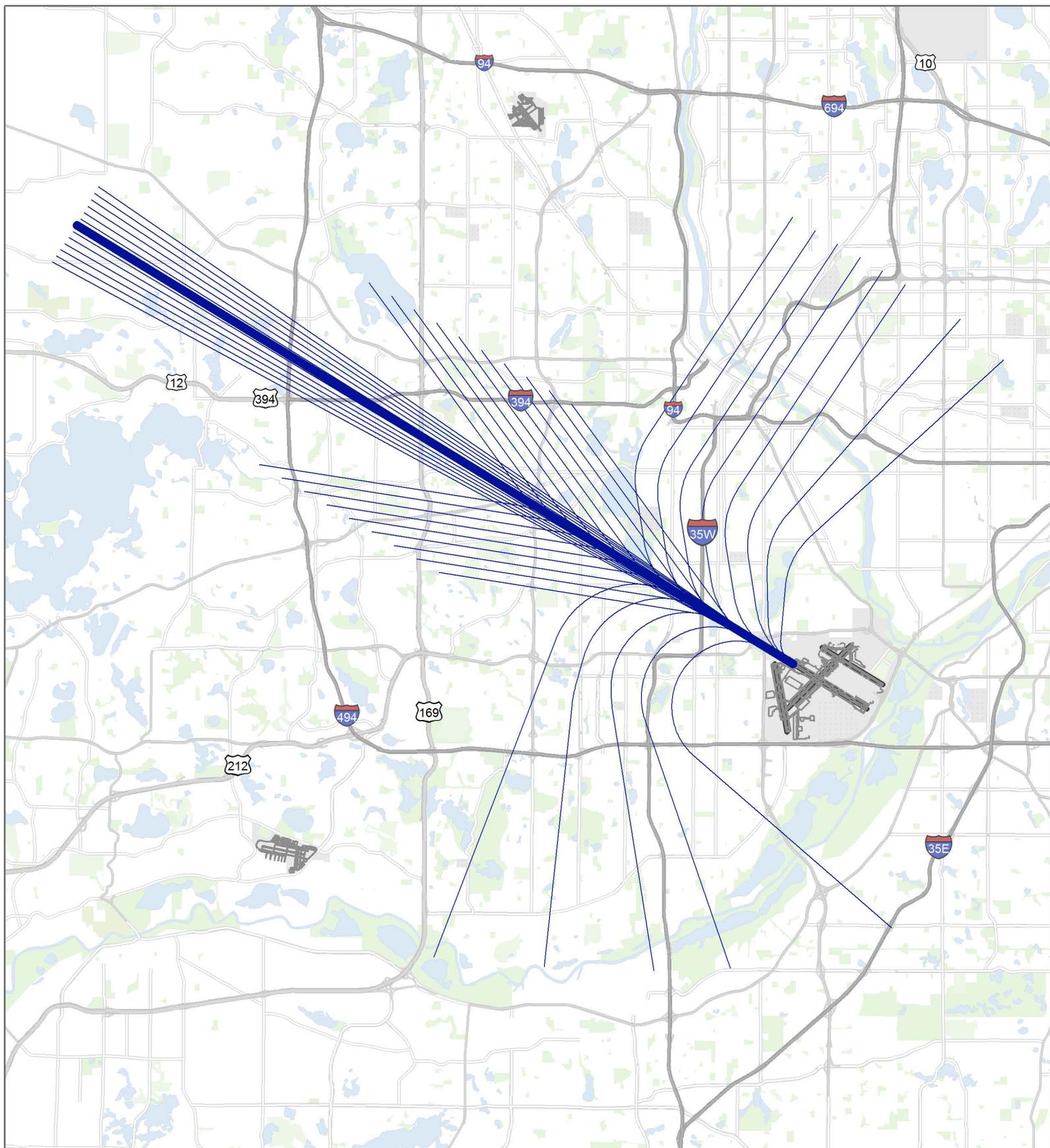
2-2



2017 AEDT TRACKS - ARRIVAL RUNWAY 12R

Overall Use Percentage

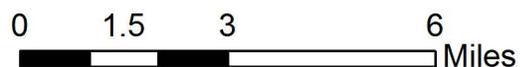
Figure 2.3



AEDT Track Use Percentage



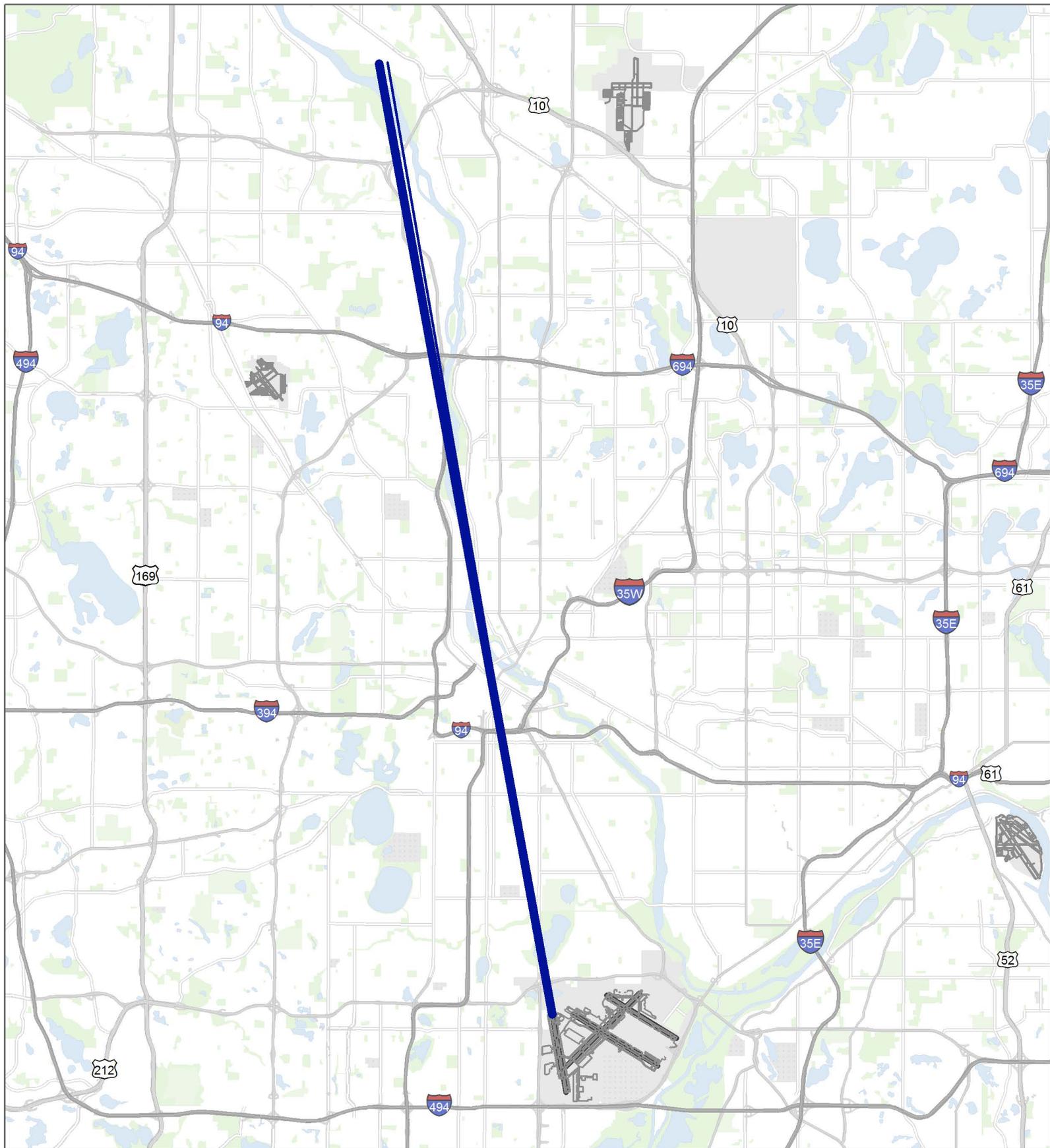
2-3



2017 AEDT TRACKS - ARRIVAL RUNWAY 17

Overall Use Percentage

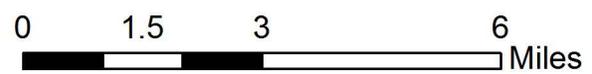
Figure 2.4



AEDT Track Use Percentage



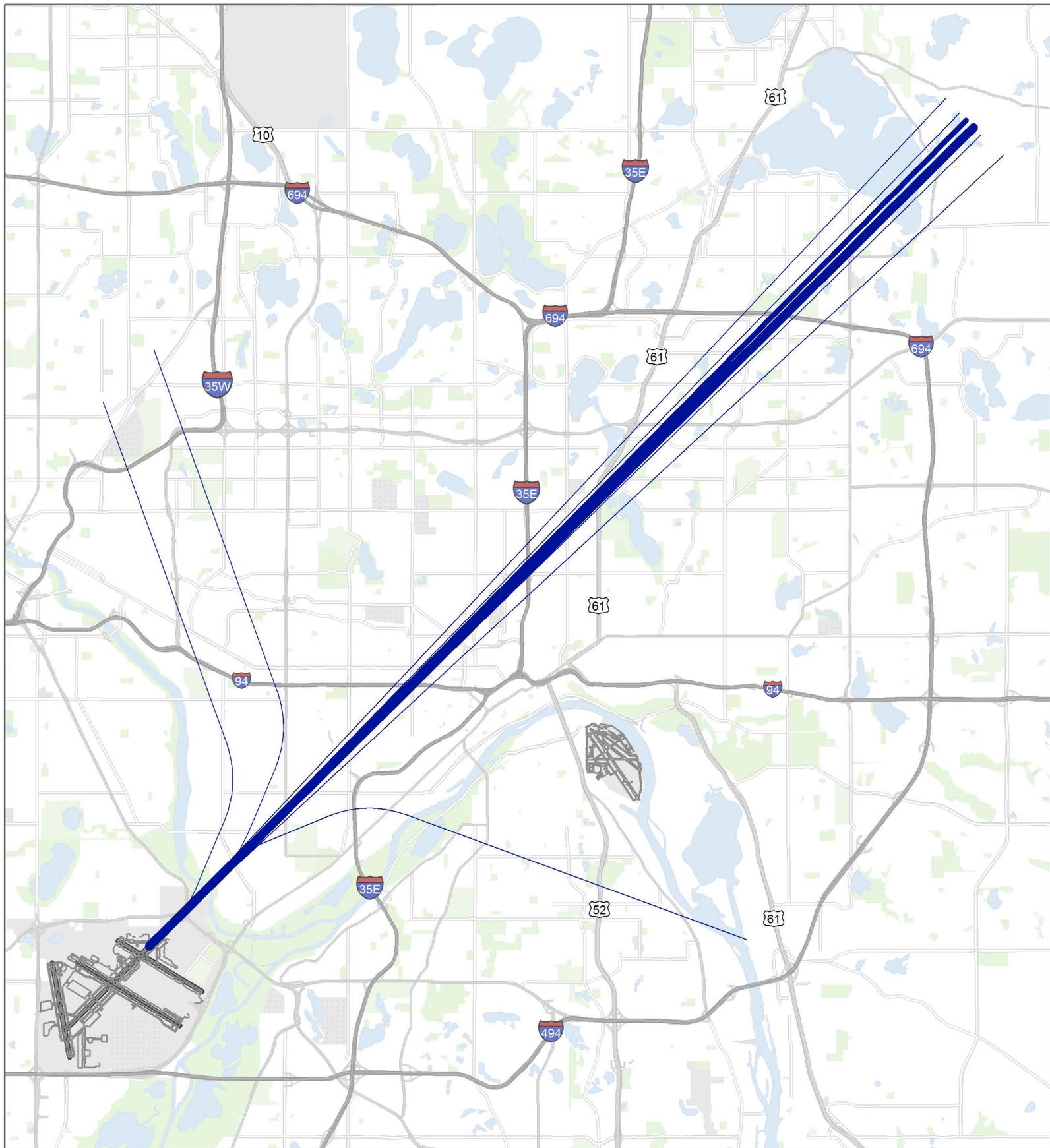
2-4



2017 AEDT TRACKS - ARRIVAL RUNWAY 22

Overall Use Percentage

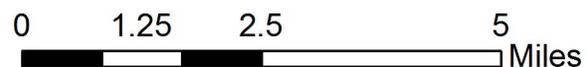
Figure 2.5



AEDT Track Use Percentage



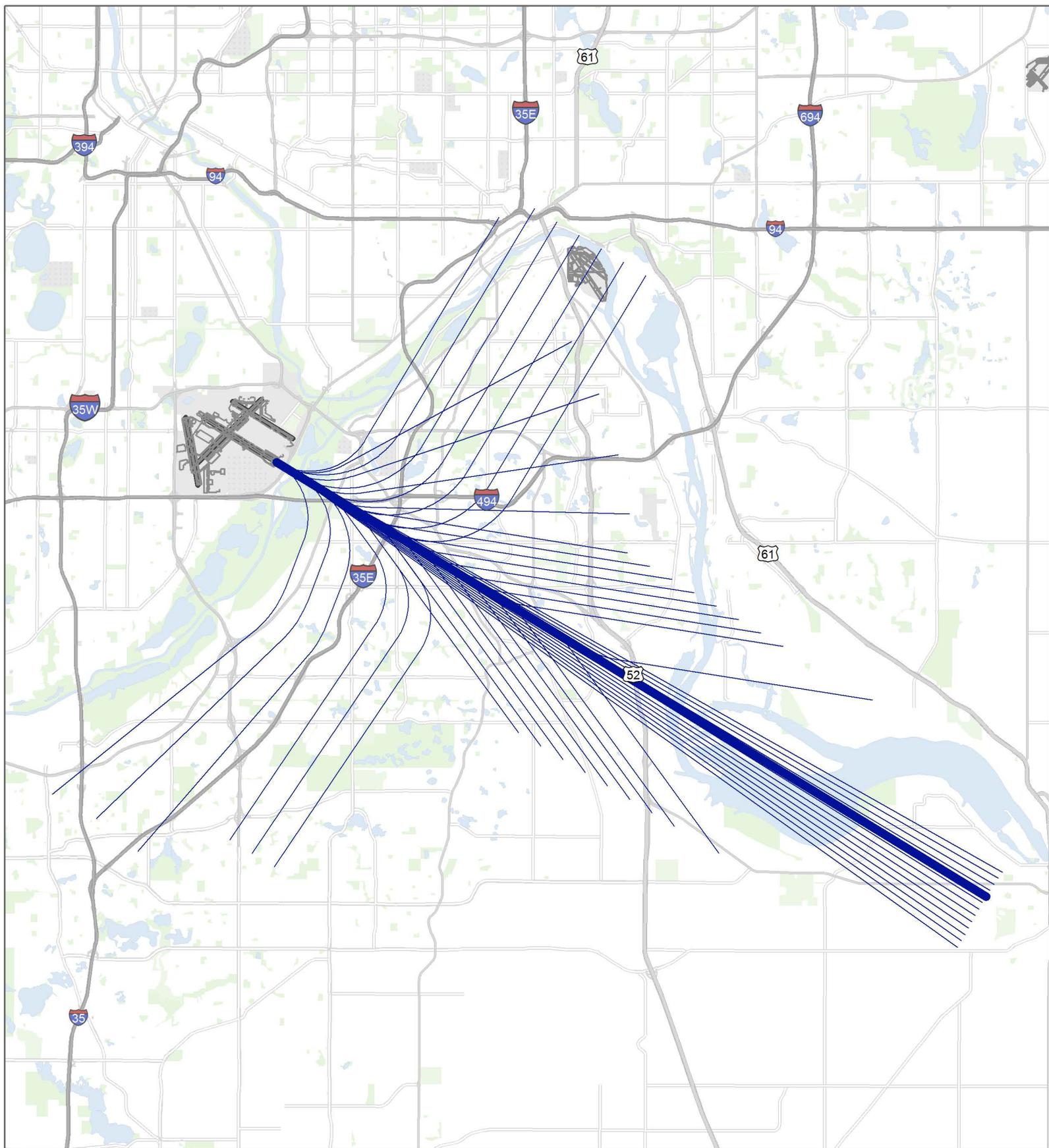
2-5



2017 AEDT TRACKS - ARRIVAL RUNWAY 30L

Overall Use Percentage

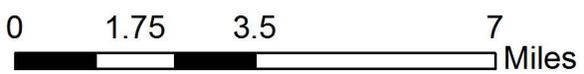
Figure 2.6



AEDT Track Use Percentage

- < 5%
- 5 - 10%
- 10 - 20%
- 20 - 30%
- 30 - 50%
- > 50%

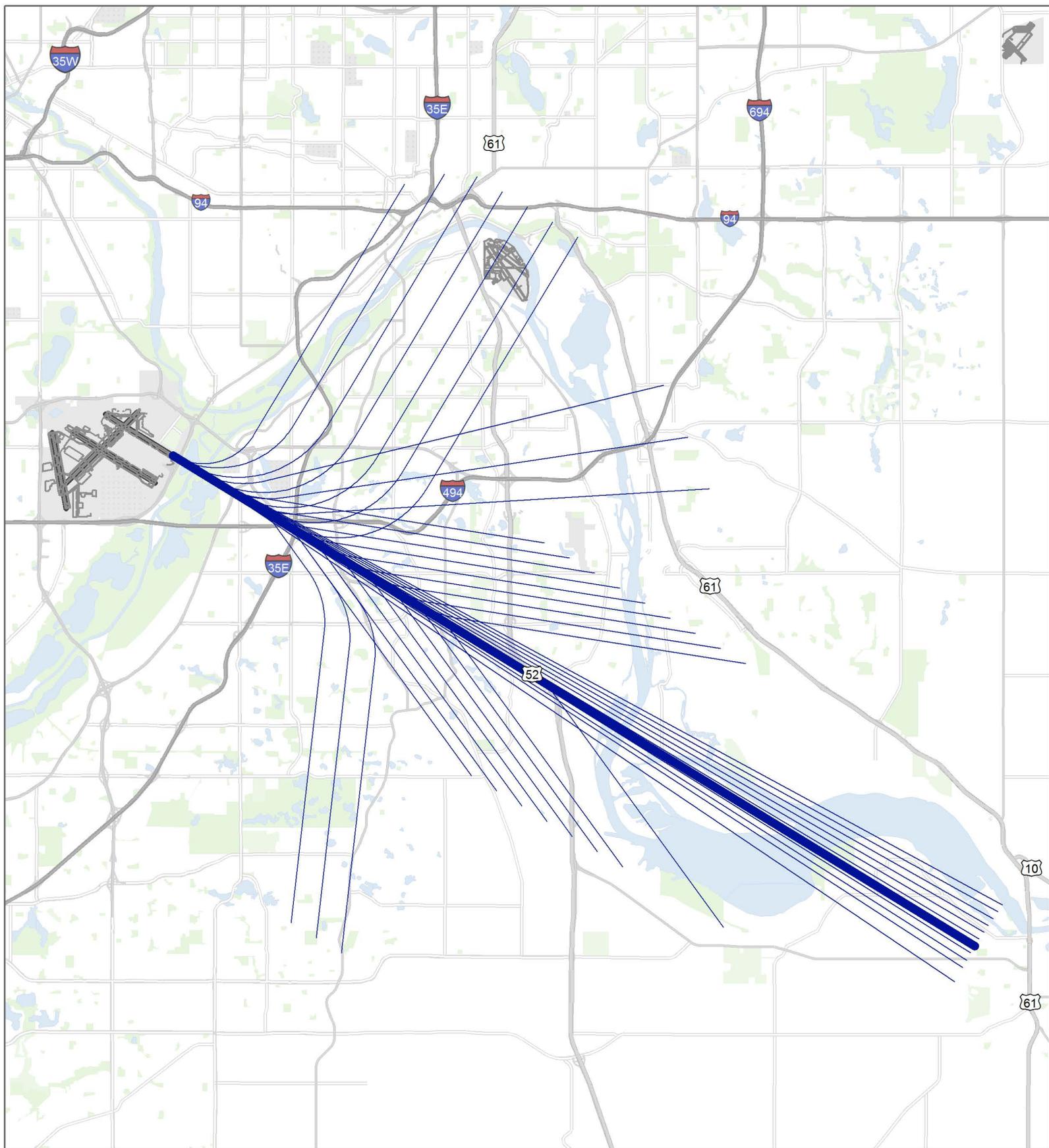
2-6



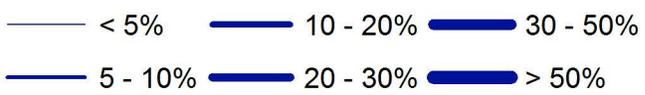
2017 AEDT TRACKS - ARRIVAL RUNWAY 30R

Overall Use Percentage

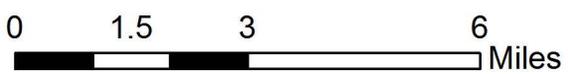
Figure 2.7



AEDT Track Use Percentage



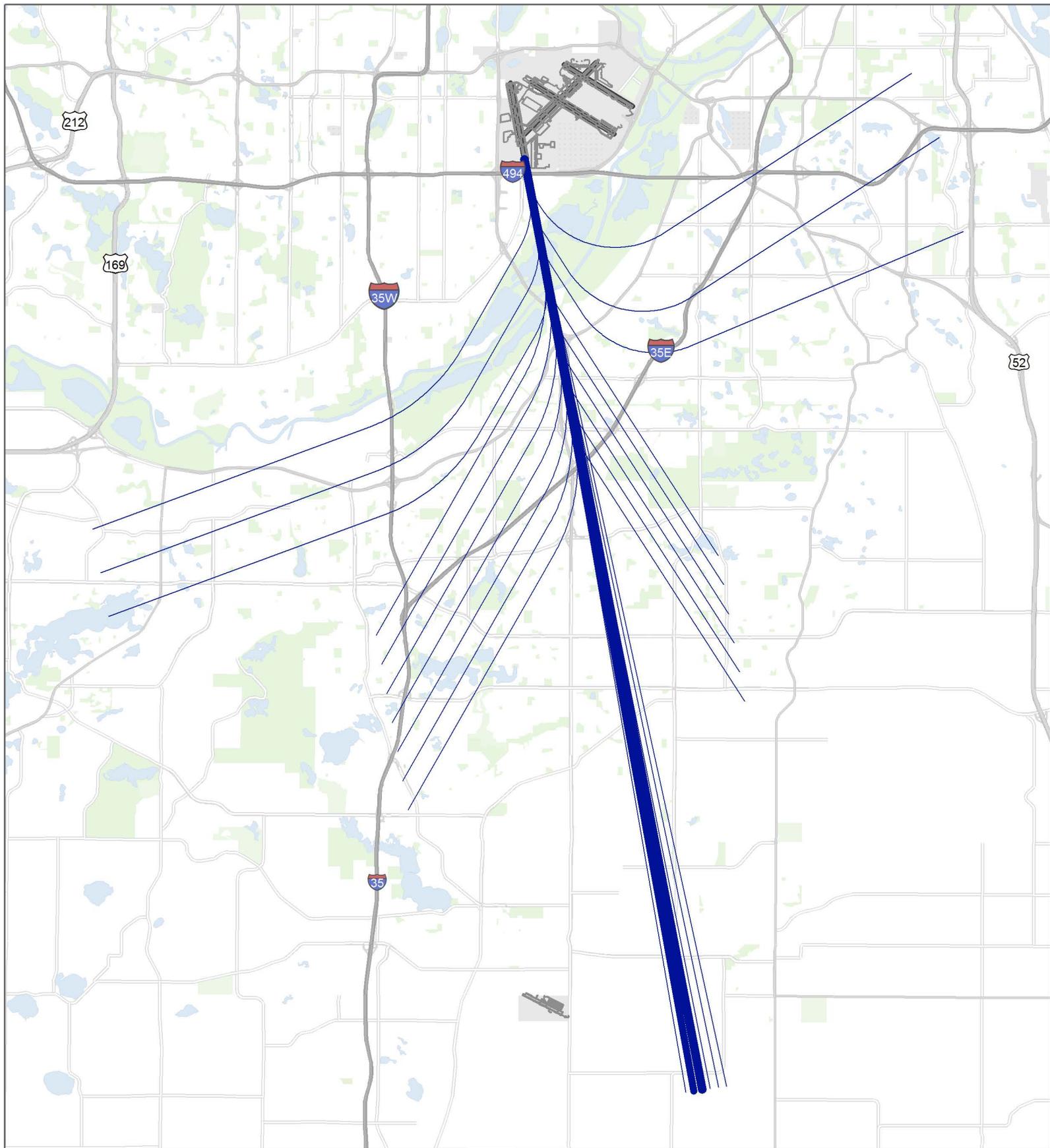
2-7



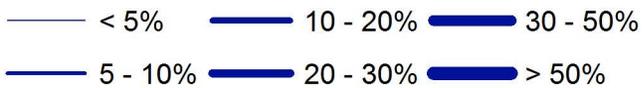
2017 AEDT TRACKS - ARRIVAL RUNWAY 35

Overall Use Percentage

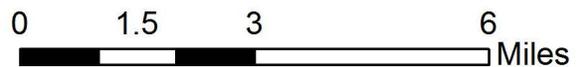
Figure 2.8



AEDT Track Use Percentage



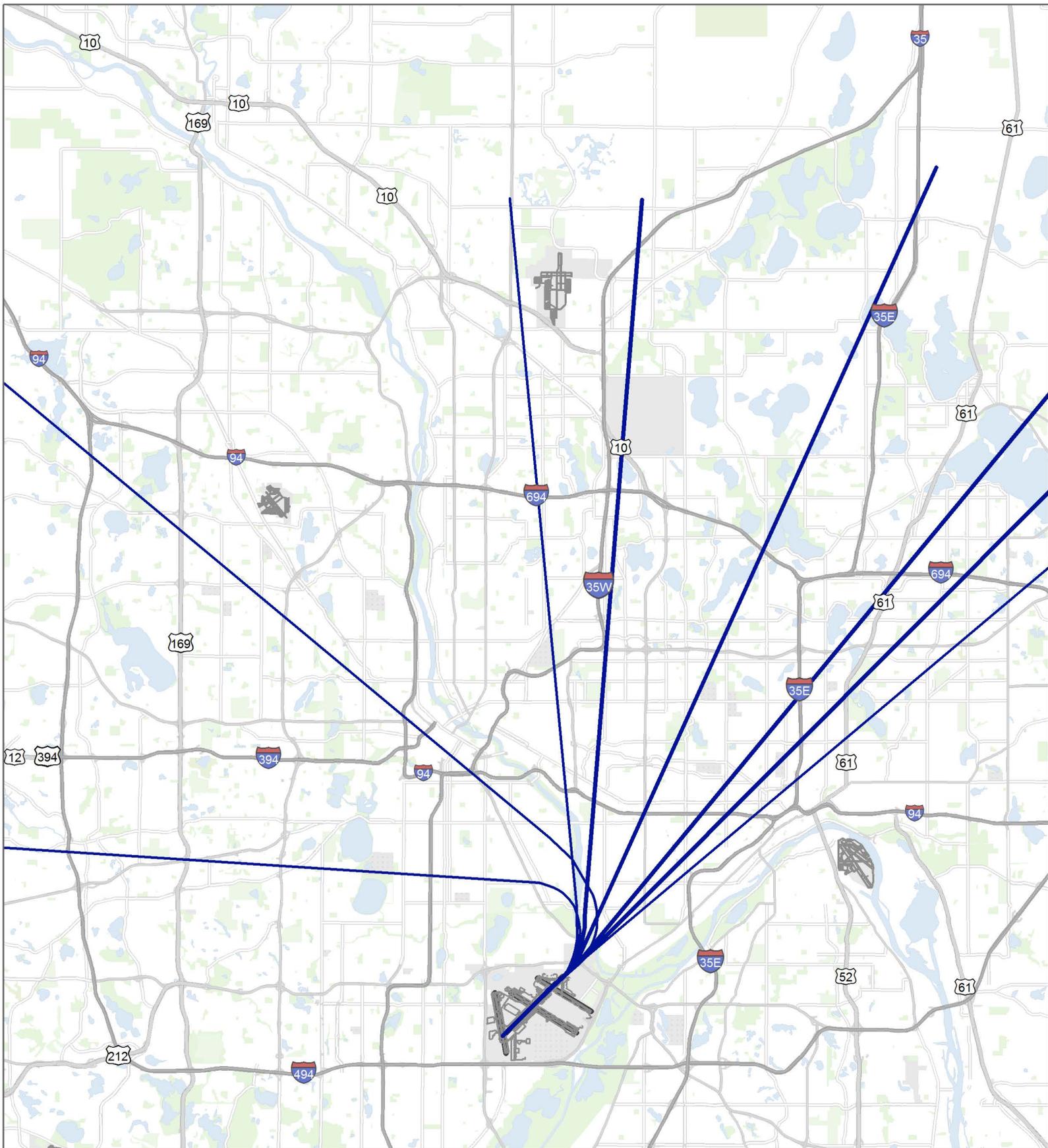
2-8



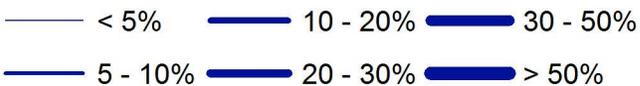
2017 AEDT TRACKS - DEPARTURE RUNWAY 4

Overall Use Percentage

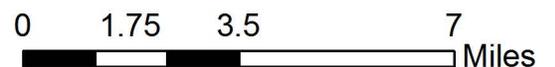
Figure 2.9



AEDT Track Use Percentage



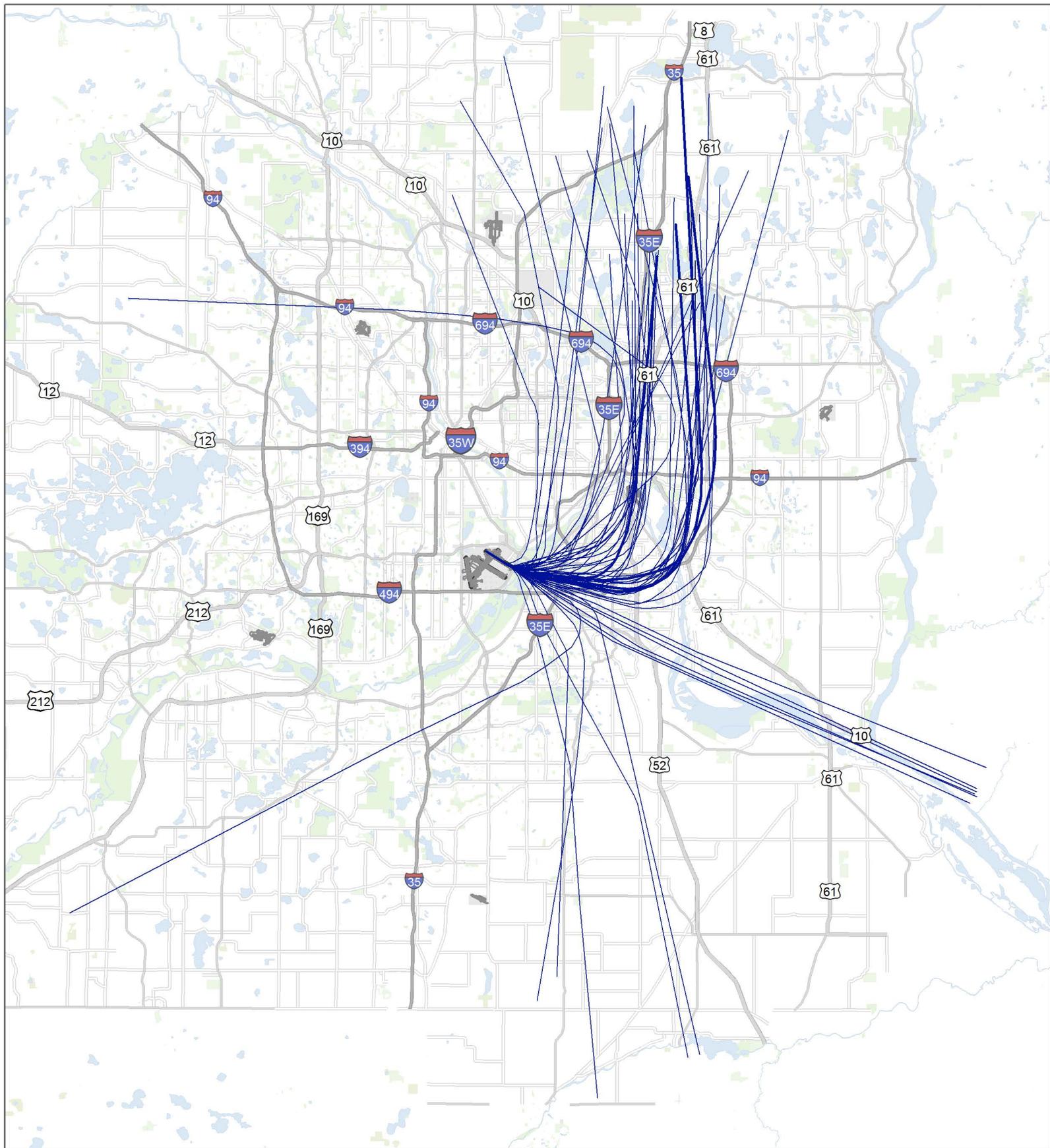
2-9



2017 AEDT TRACKS - DEPARTURE RUNWAY 12L

Overall Use Percentage

Figure 2.10



AEDT Track Use Percentage

— < 5% — 10 - 20% — 30 - 50%

— 5 - 10% — 20 - 30% — > 50%

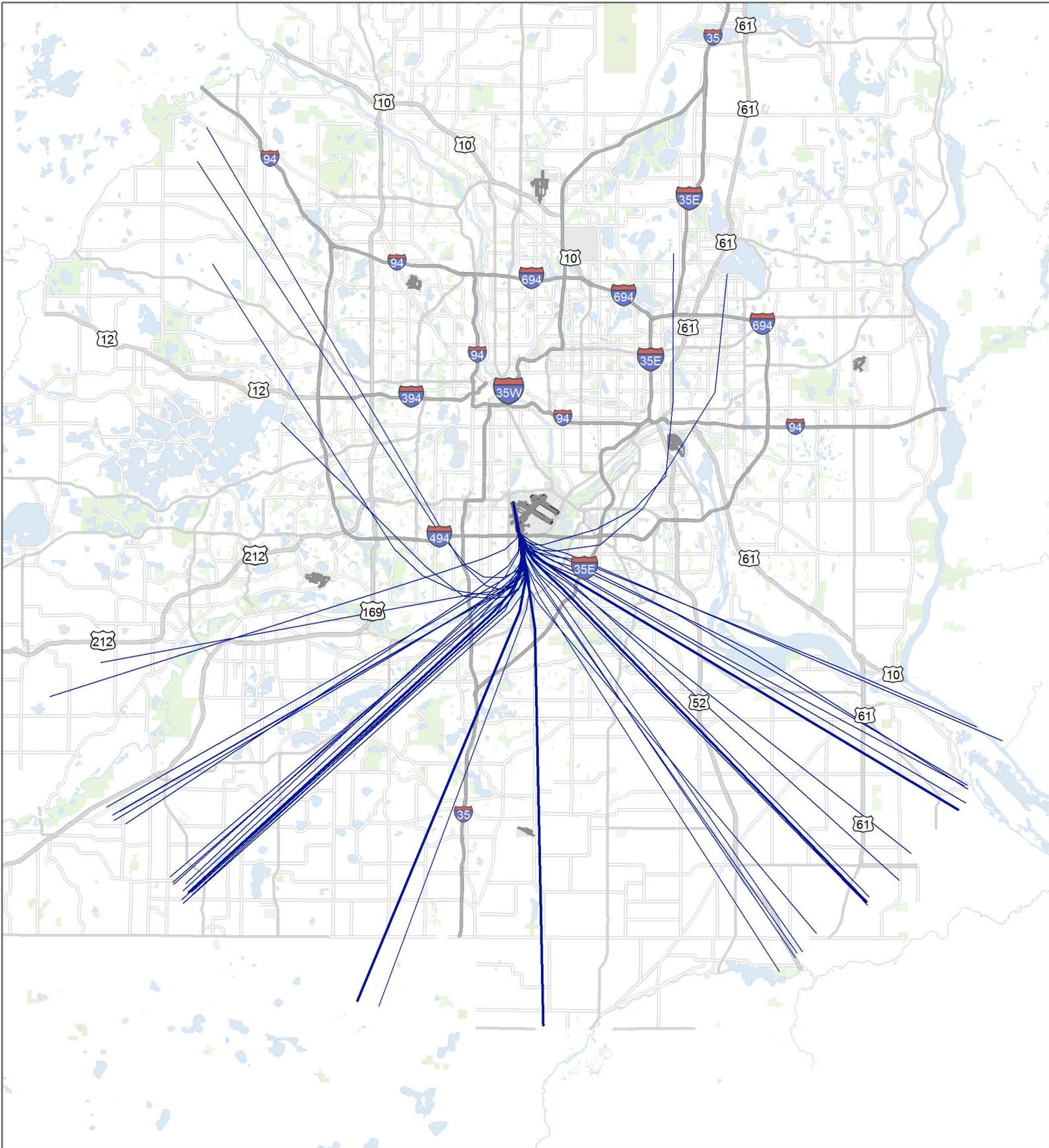
2-10



2017 AEDT TRACKS - DEPARTURE RUNWAY 17

Overall Use Percentage

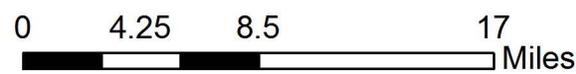
Figure 2.12



AEDT Track Use Percentage

- < 5%
- 5 - 10%
- 10 - 20%
- 20 - 30%
- 30 - 50%
- > 50%

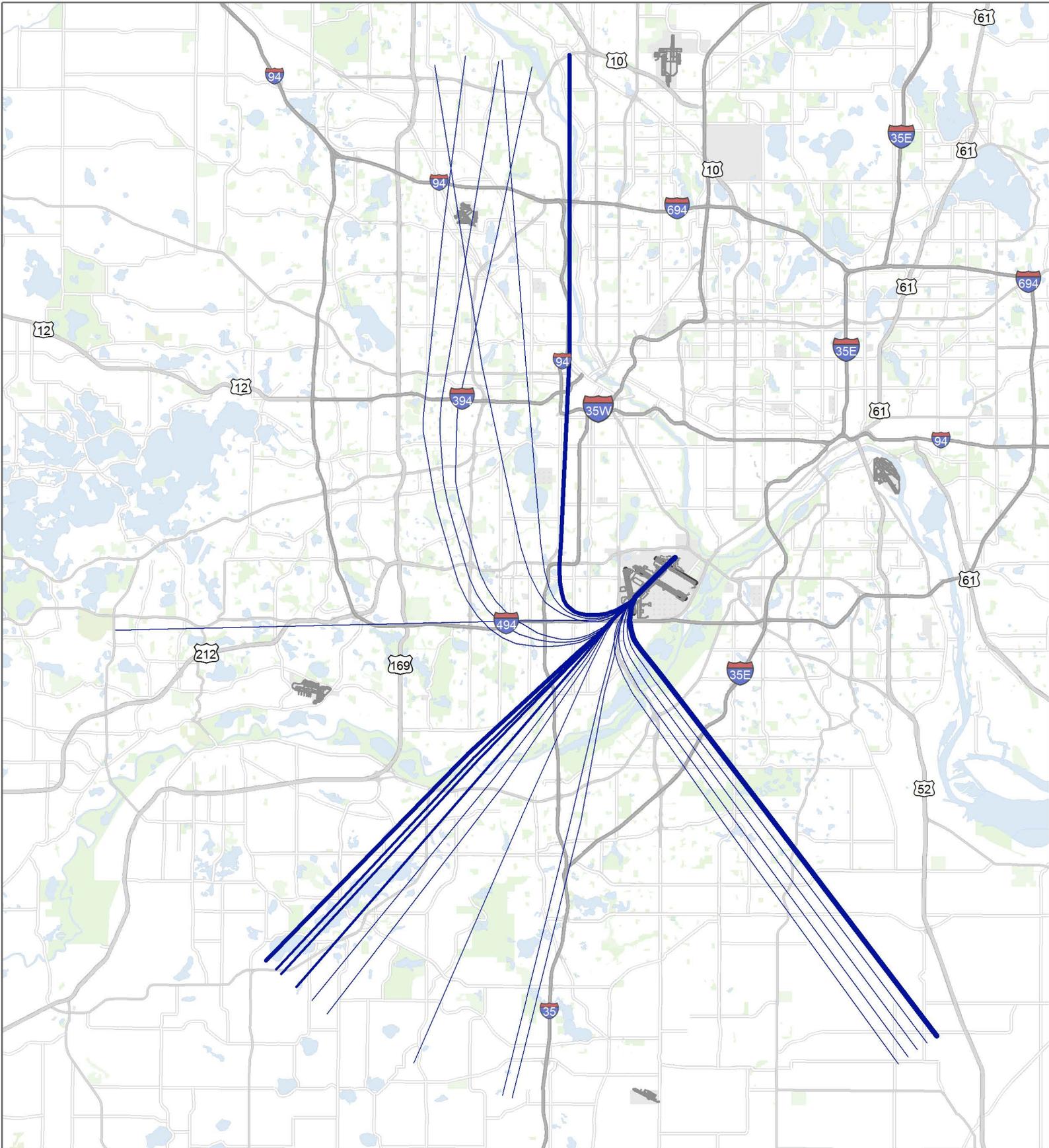
2-12



2017 AEDT TRACKS - DEPARTURE RUNWAY 22

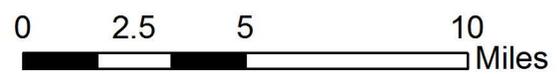
Overall Use Percentage

Figure 2.13



AEDT Track Use Percentage

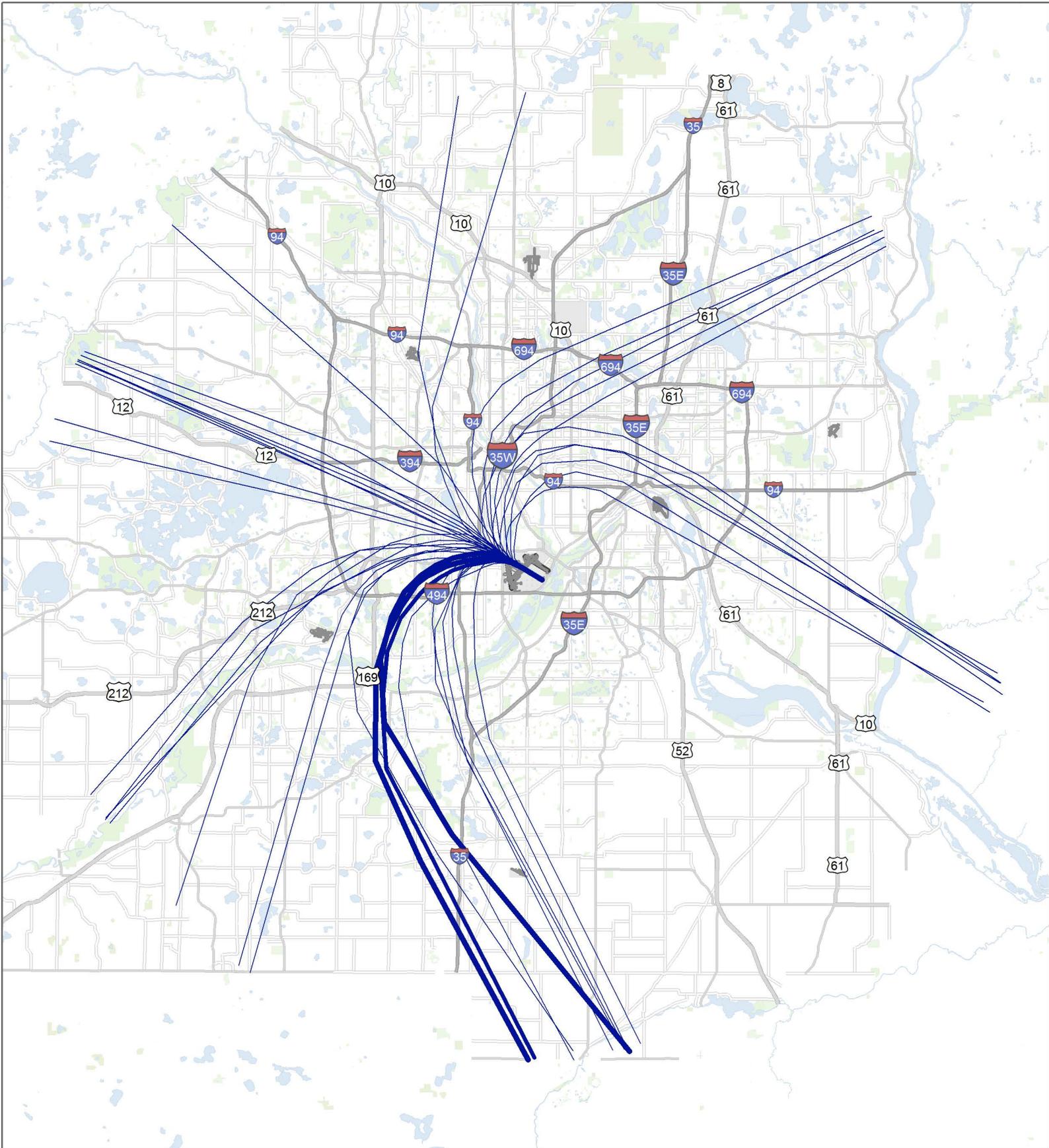
- < 5%
- 5 - 10%
- 10 - 20%
- 20 - 30%
- 30 - 50%
- > 50%



2017 AEDT TRACKS - DEPARTURE RUNWAY 30L

Overall Use Percentage

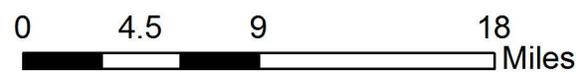
Figure 2.14



AEDT Track Use Percentage



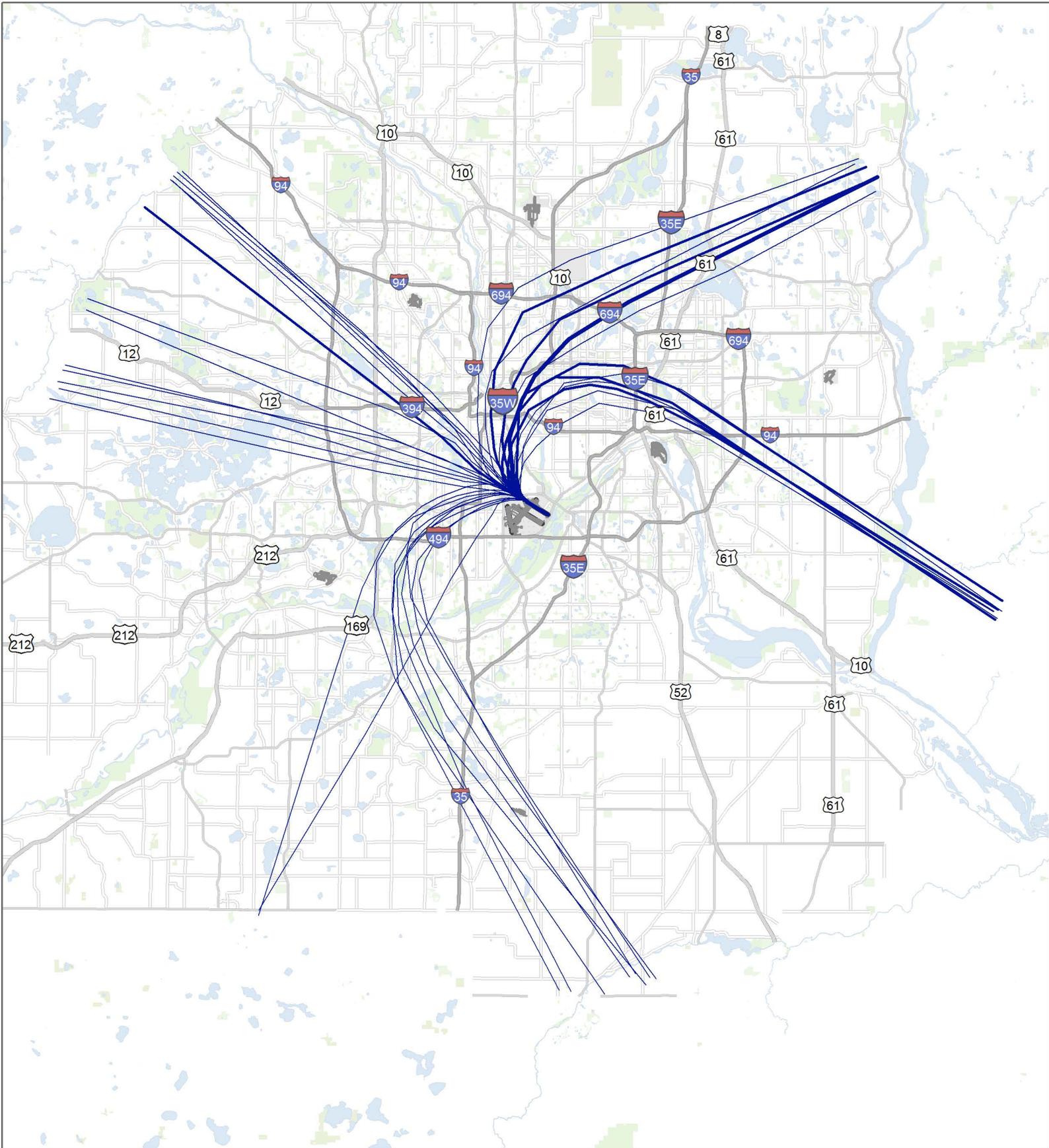
2-14



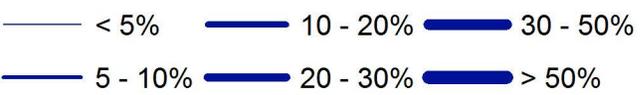
2017 AEDT TRACKS - DEPARTURE RUNWAY 30R

Overall Use Percentage

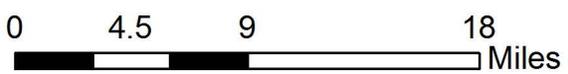
Figure 2.15



AEDT Track Use Percentage



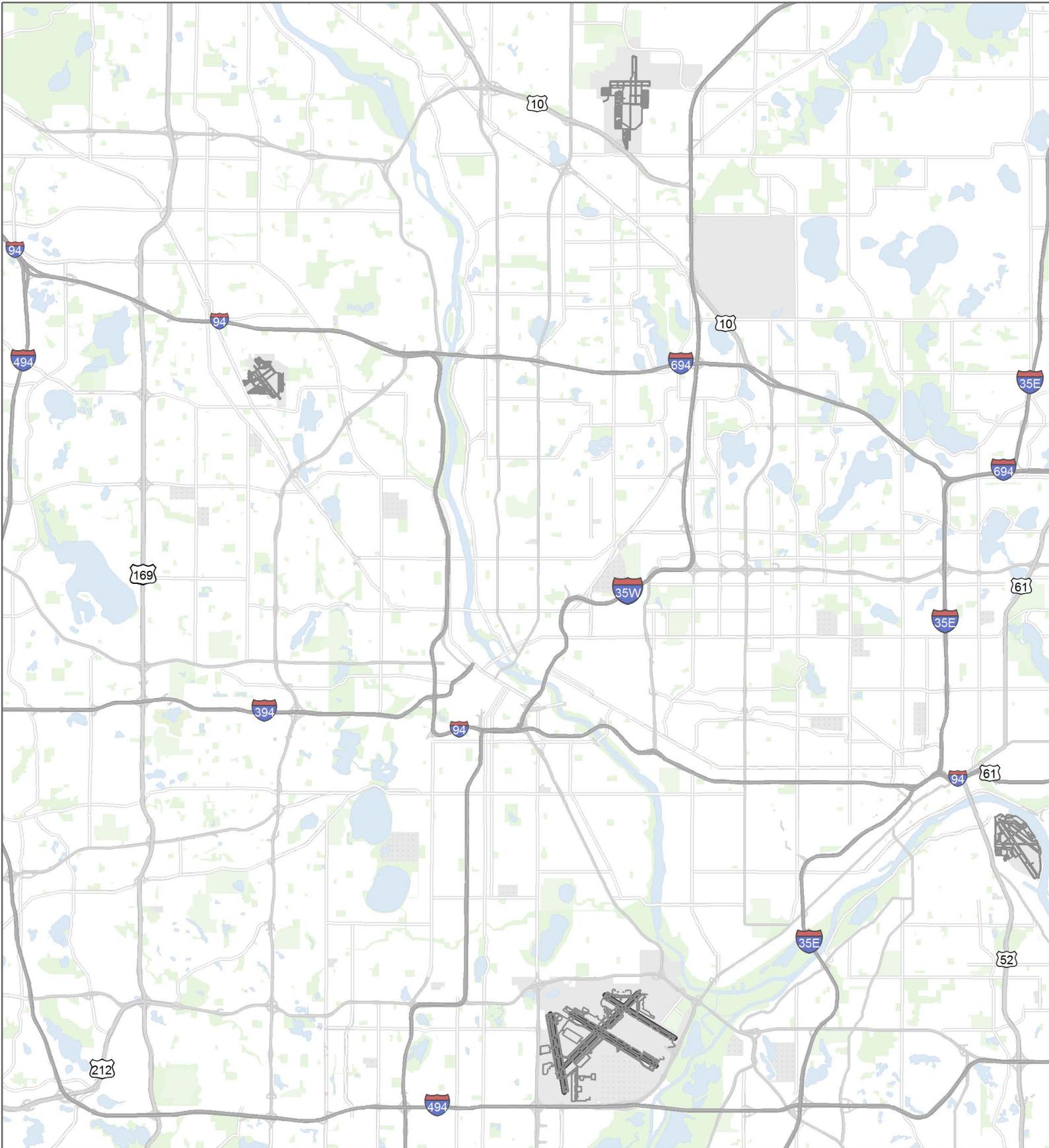
2-15



2017 AEDT TRACKS - DEPARTURE RUNWAY 35

Overall Use Percentage

Figure 2.16



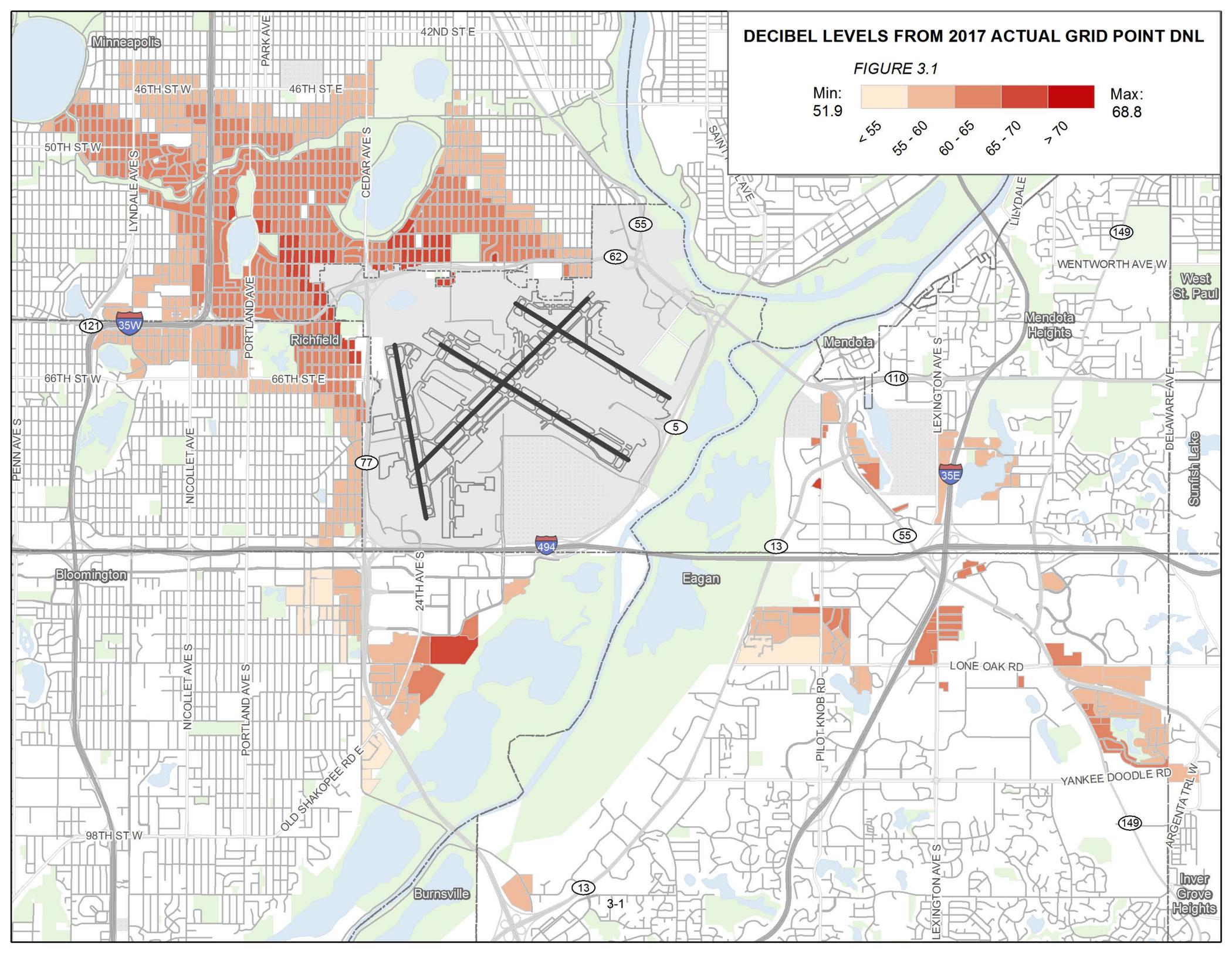
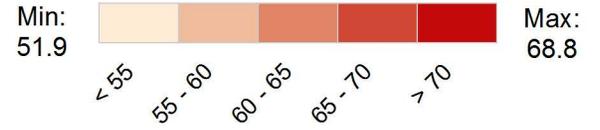
Note: No departures recorded on Runway 35 in 2017.

Appendix 3: Noise Model Grid Point Maps

Content	Page
Decibel Levels from 2017 Actual Grid Point DNLs	3-1
Decibel Levels from Base Case Year Grid Point DNLs	3-6
Difference in dB Level Between Block Base Case Year and 2017 Actual Grid Point DNLs for Blocks Included in the Noise Mitigation Settlement	3-11

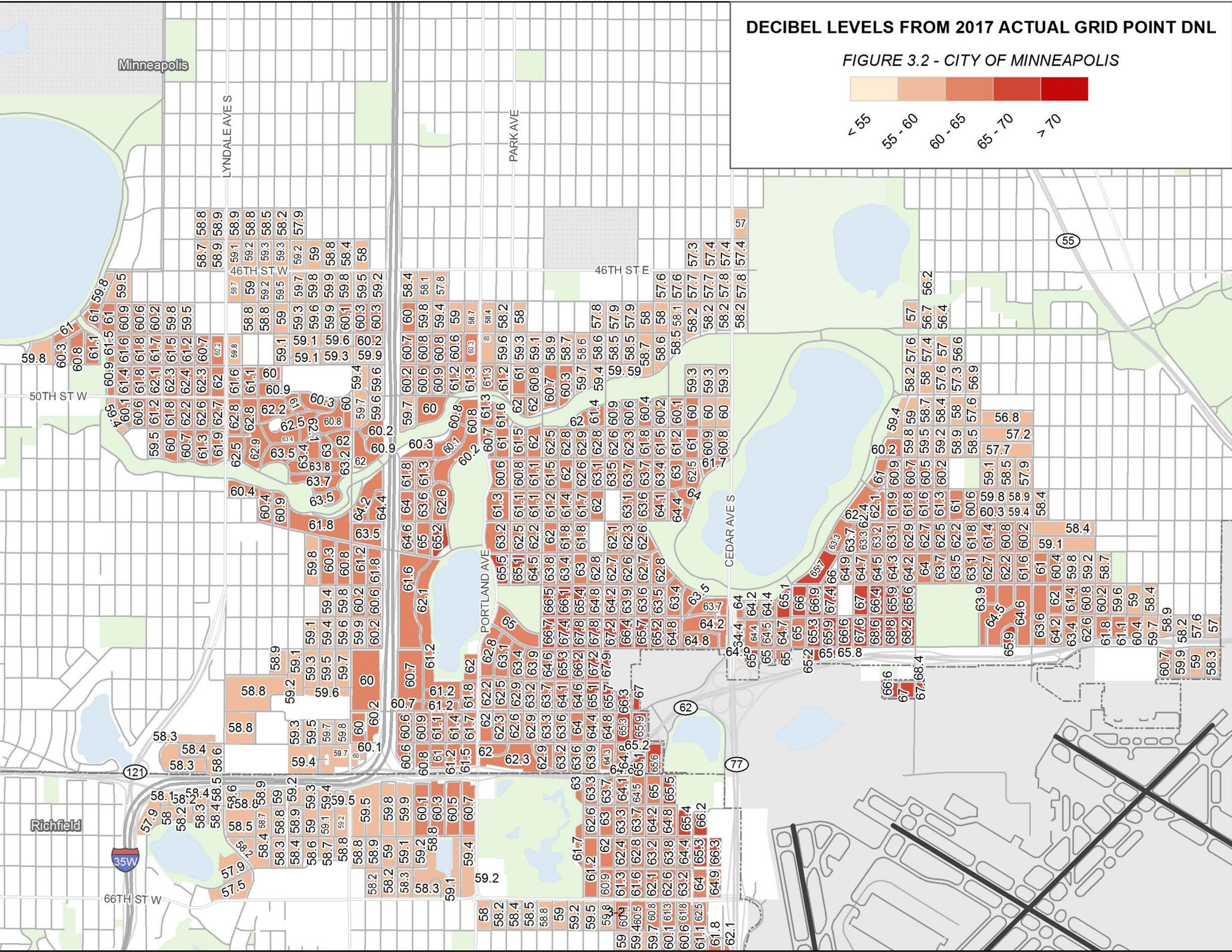
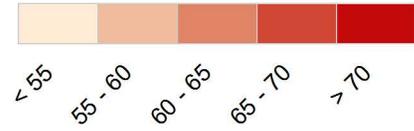
DECIBEL LEVELS FROM 2017 ACTUAL GRID POINT DNL

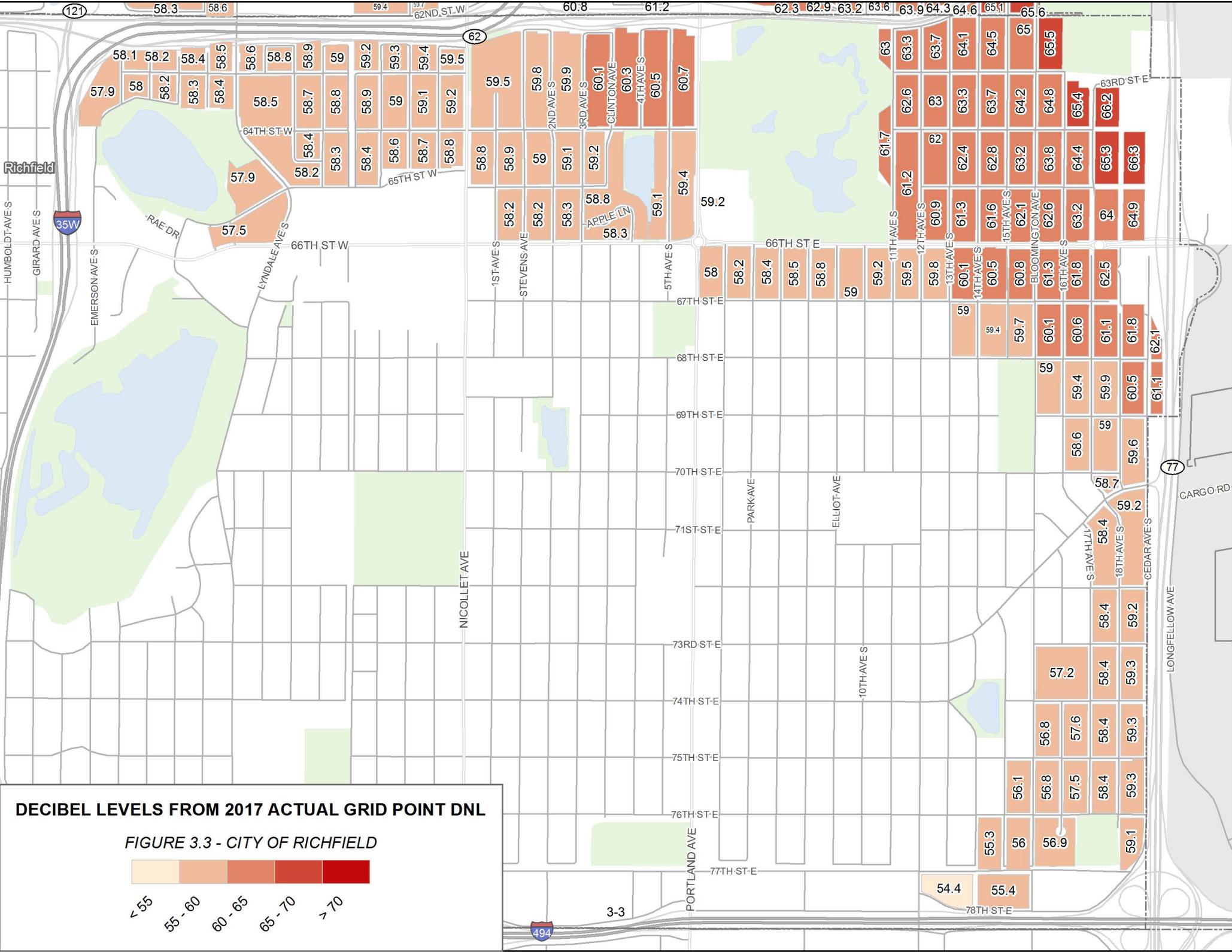
FIGURE 3.1

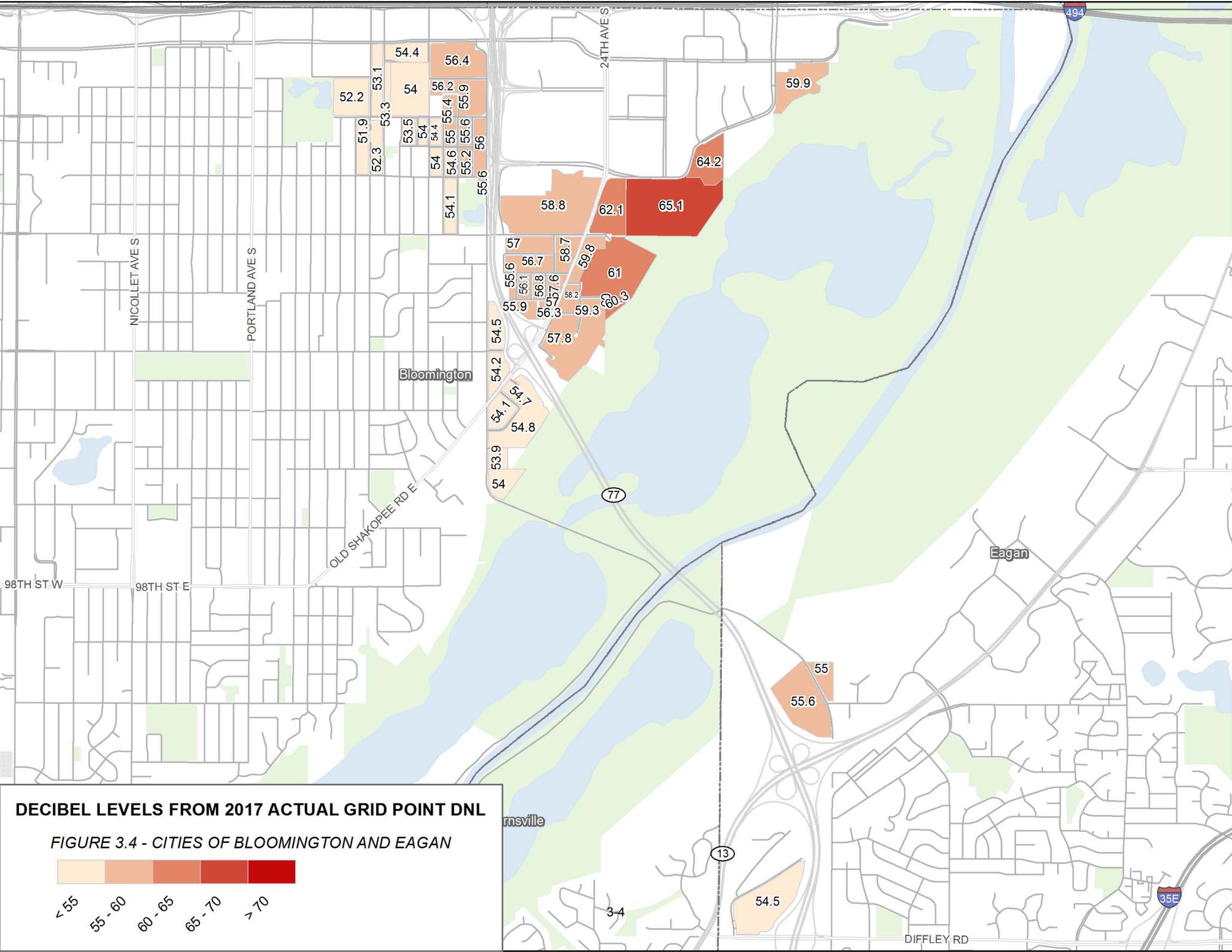


DECIBEL LEVELS FROM 2017 ACTUAL GRID POINT DNL

FIGURE 3.2 - CITY OF MINNEAPOLIS

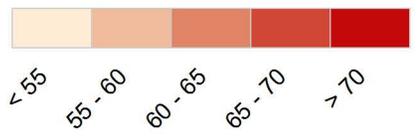






DECIBEL LEVELS FROM 2017 ACTUAL GRID POINT DNL

FIGURE 3.4 - CITIES OF BLOOMINGTON AND EAGAN



Bloomington

Eagan

msville

DIFFLEY RD

77

13

35E

494

24TH AVE S

NICOLLET AVE S

PORTLAND AVE S

OLD SHAKOPEE RD E

98TH ST W

98TH ST E

55

55.6

54.5

3-4

59.9

64.2

58.8

62.1

65.1

57

55.6

55.9

54

53.9

54.2

54.1

54.7

54.8

54

54.5

54.2

54.1

54.7

54.8

54

53.9

54

54

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54

54

54

54

54

54

54

54

54

57

55.6

55.9

54

53.9

54.2

54.1

54.7

54.8

54

54.5

54.2

54.1

54.7

54.8

54

54.5

54.2

54.1

54.7

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54

54

54

54

57

55.6

55.9

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53.9

54.2

54.1

54.7

54.8

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54.7

54.8

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54.5

54.2

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54

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57

55.6

55.9

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53.9

54.2

54.1

54.7

54.8

54

54.5

54.2

54.1

54.7

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54.5

54.2

54.1

54.7

54.8

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54

54

57

55.6

55.9

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53.9

54.2

54.1

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53.9

54.2

54.1

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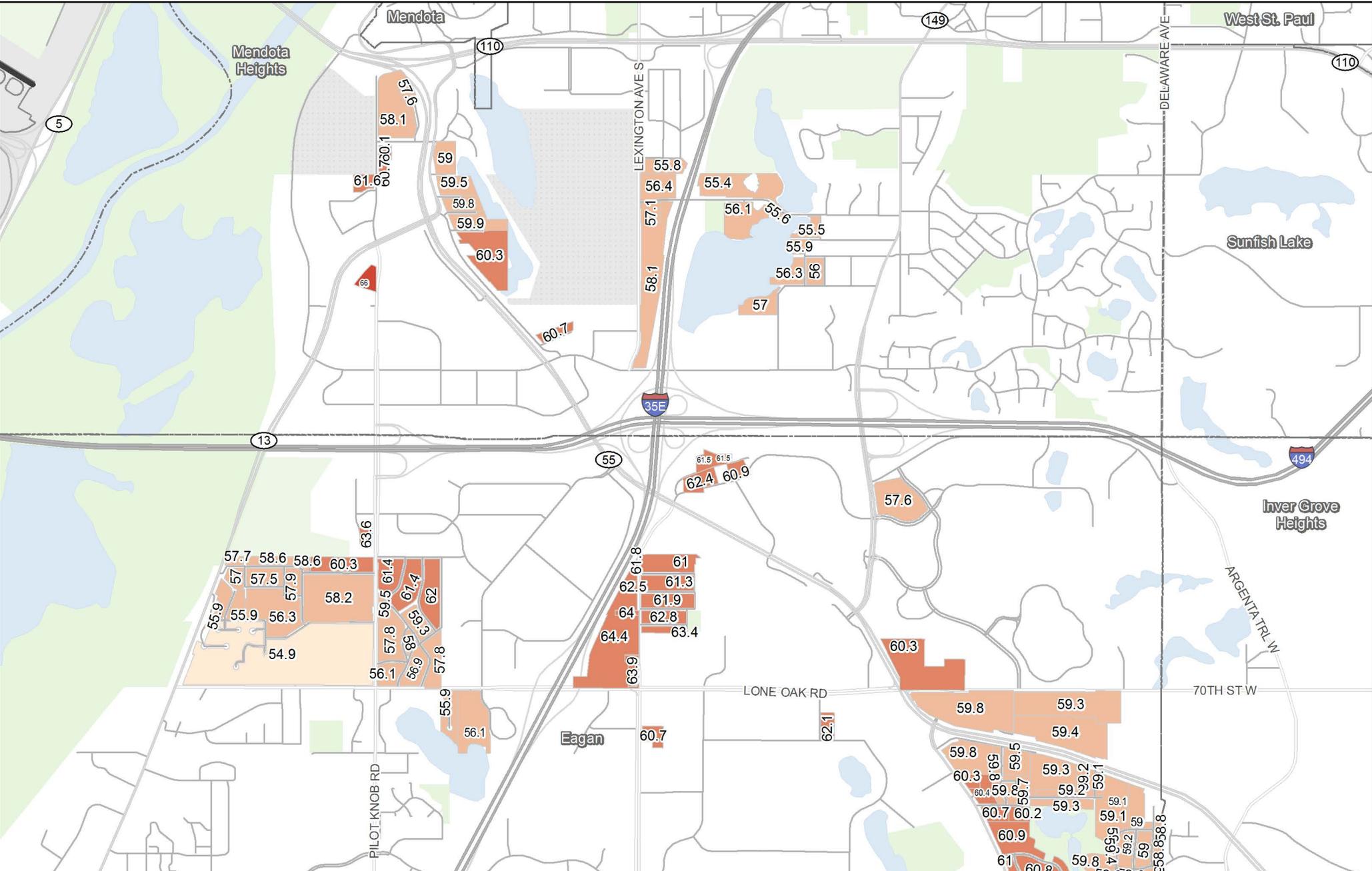
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57

55.6

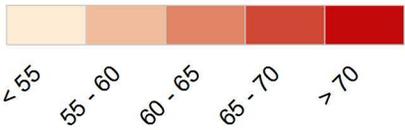
55.9

54



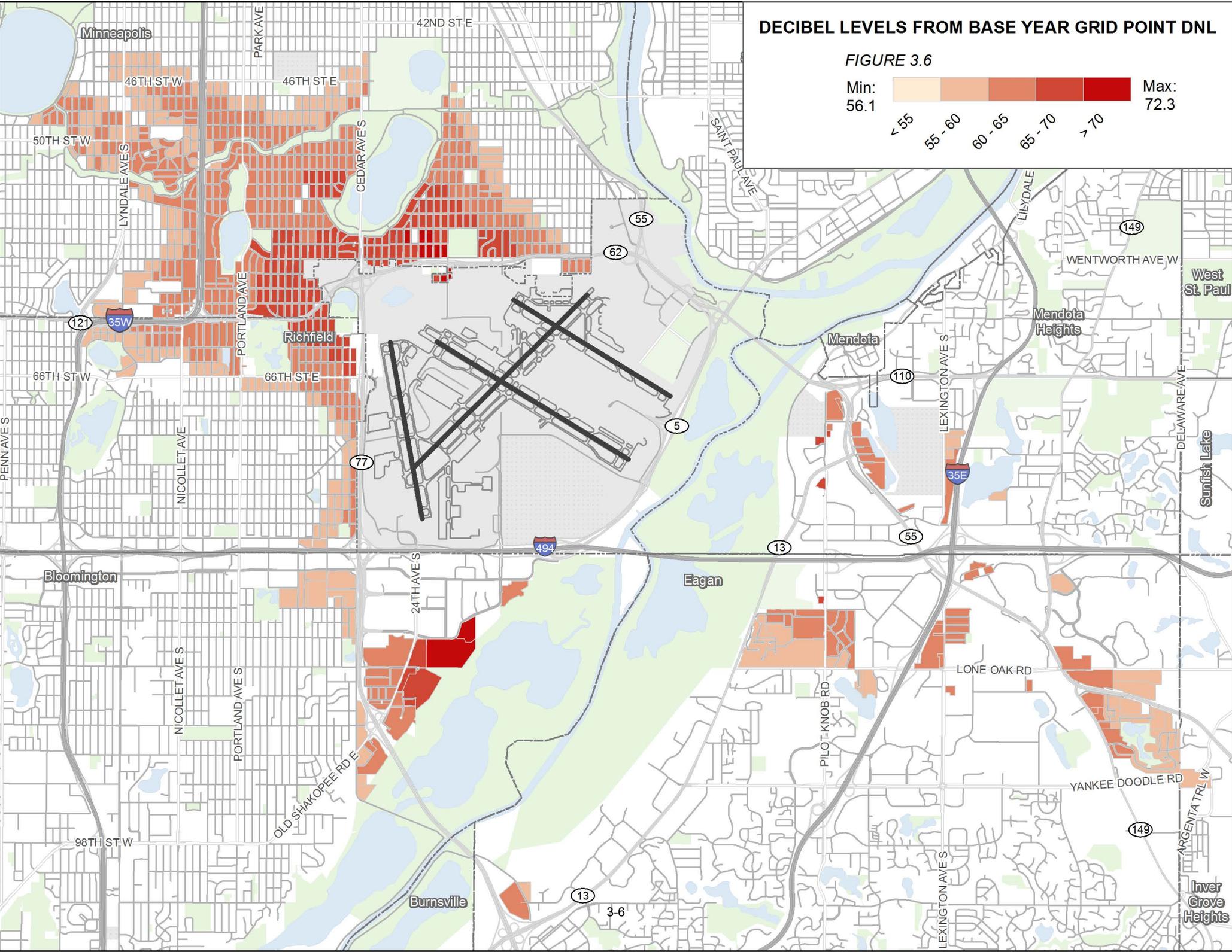
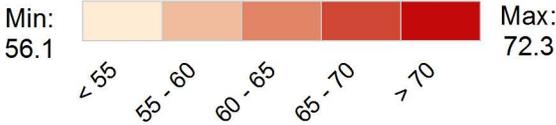
DECIBEL LEVELS FROM 2017 ACTUAL GRID POINT DNL

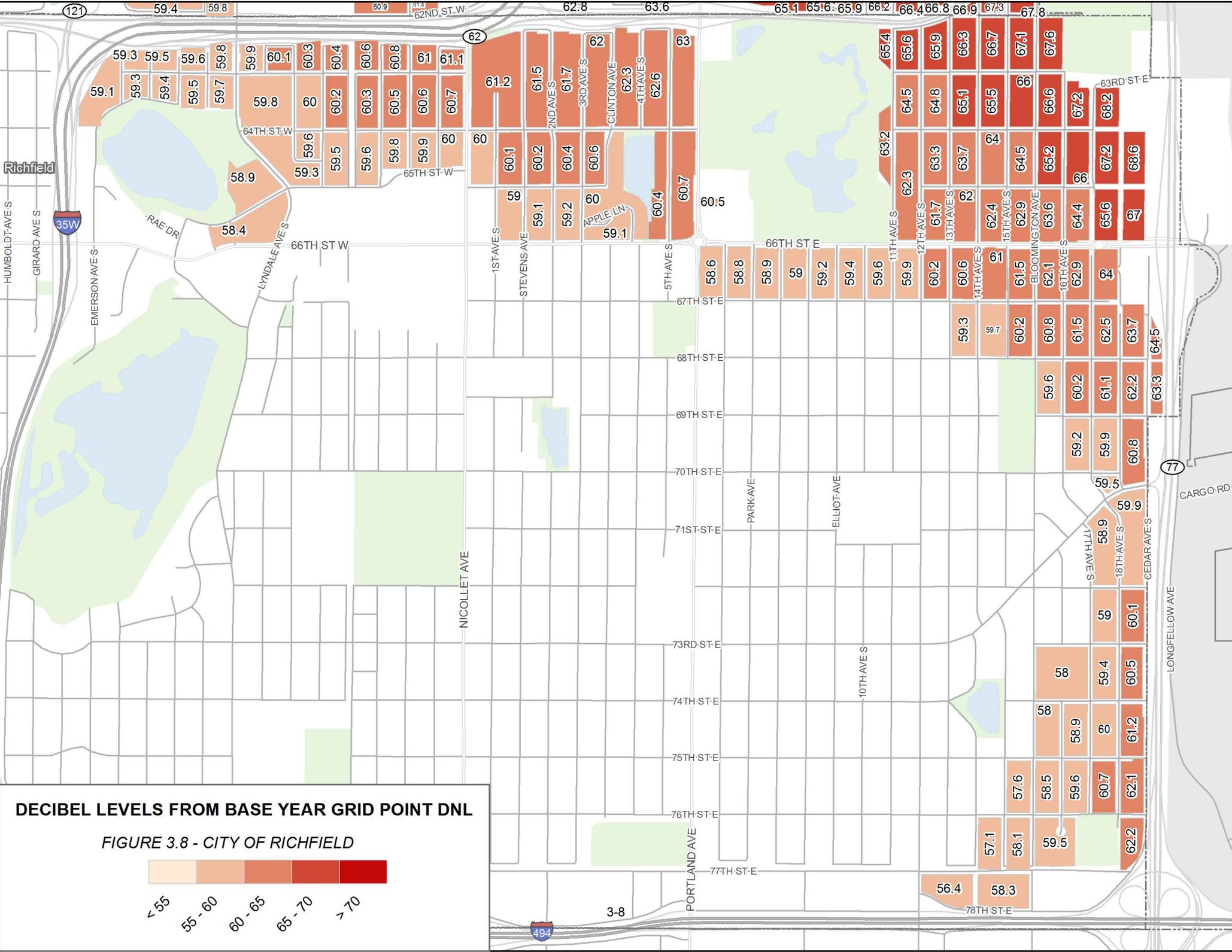
FIGURE 3.5 - CITIES OF EAGAN, MENDOTA HEIGHTS AND INVER GROVE HEIGHTS



DECIBEL LEVELS FROM BASE YEAR GRID POINT DNL

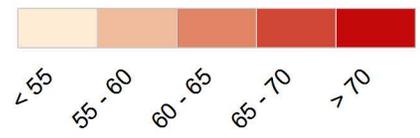
FIGURE 3.6

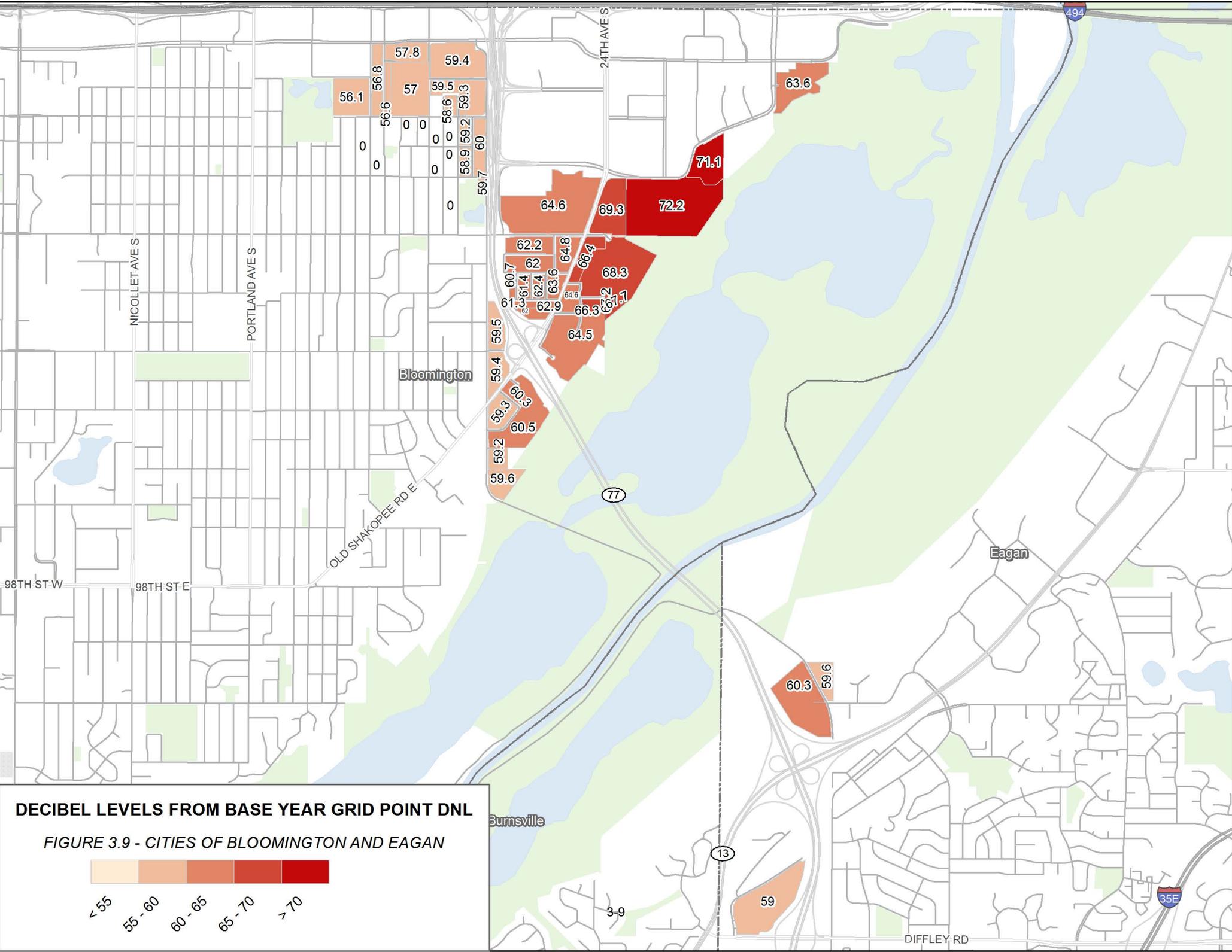




DECIBEL LEVELS FROM BASE YEAR GRID POINT DNL

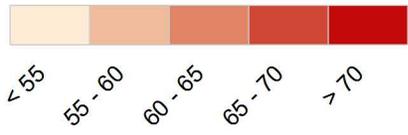
FIGURE 3.8 - CITY OF RICHFIELD





DECIBEL LEVELS FROM BASE YEAR GRID POINT DNL

FIGURE 3.9 - CITIES OF BLOOMINGTON AND EAGAN



Bloomington

Eagan

Burnsville

DIFFLEY RD

77

13

35E

494

24TH AVE S

NICOLLET AVE S

PORTLAND AVE S

OLD SHAKOPEE RD E

98TH ST W

98TH ST E

3-9

59

60.3

59.6

71.1

72.2

64.6

69.3

63.6

62.2

64.8

66.4

68.3

60.7

62

62.4

63.6

64.6

66.3

67.2

68.1

61.3

62.9

64.5

66.3

59.5

59.4

59.3

60.3

59.2

60.5

59.6

56.1

56.8

57.8

59.4

57

59.5

58.6

59.3

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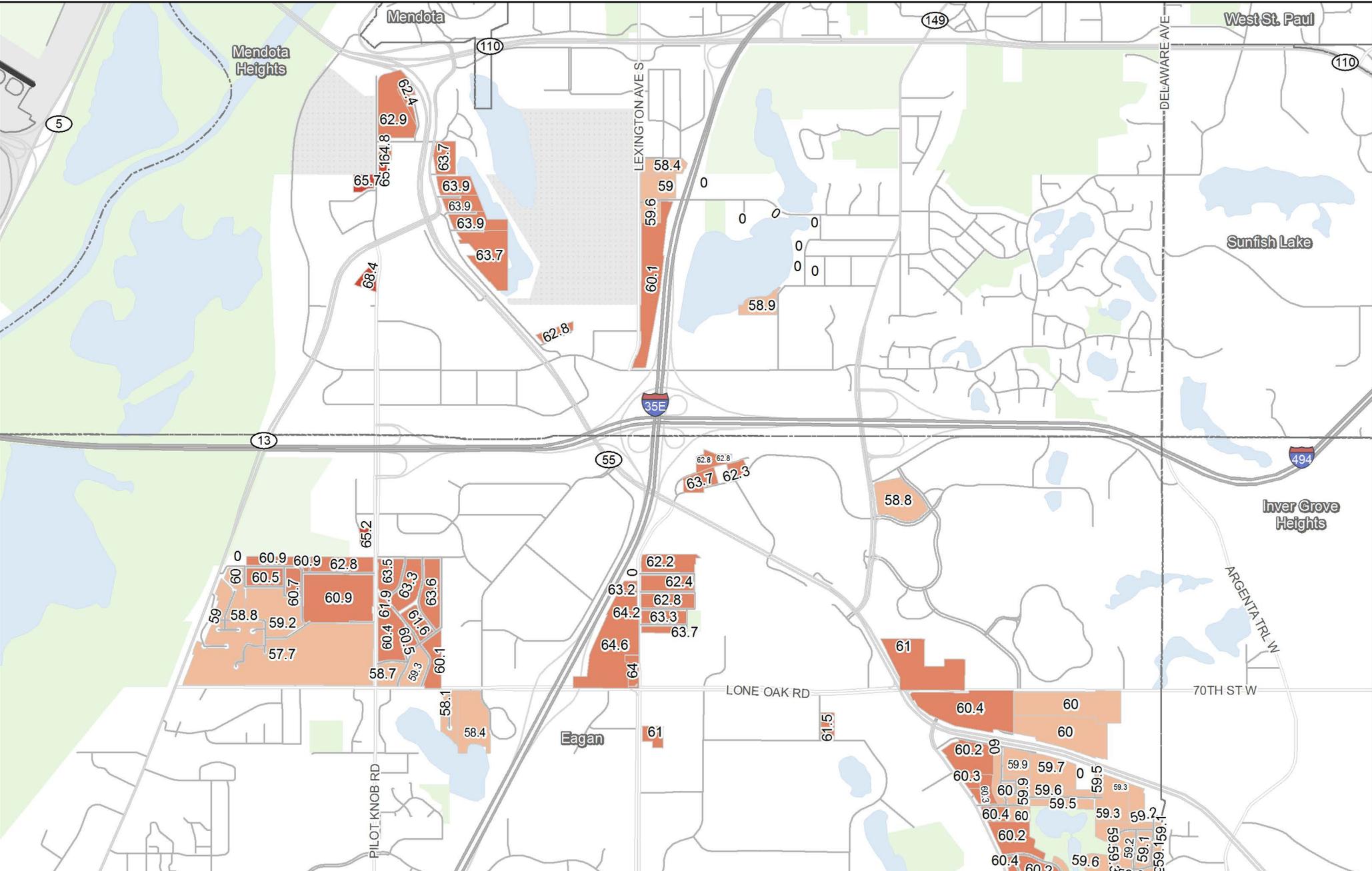
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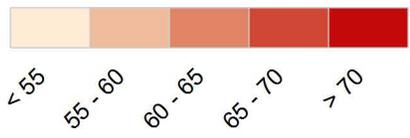
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DECIBEL LEVELS FROM BASE YEAR GRID POINT DNL

FIGURE 3.10 - CITIES OF EAGAN, MENDOTA HEIGHTS AND INVER GROVE HEIGHTS



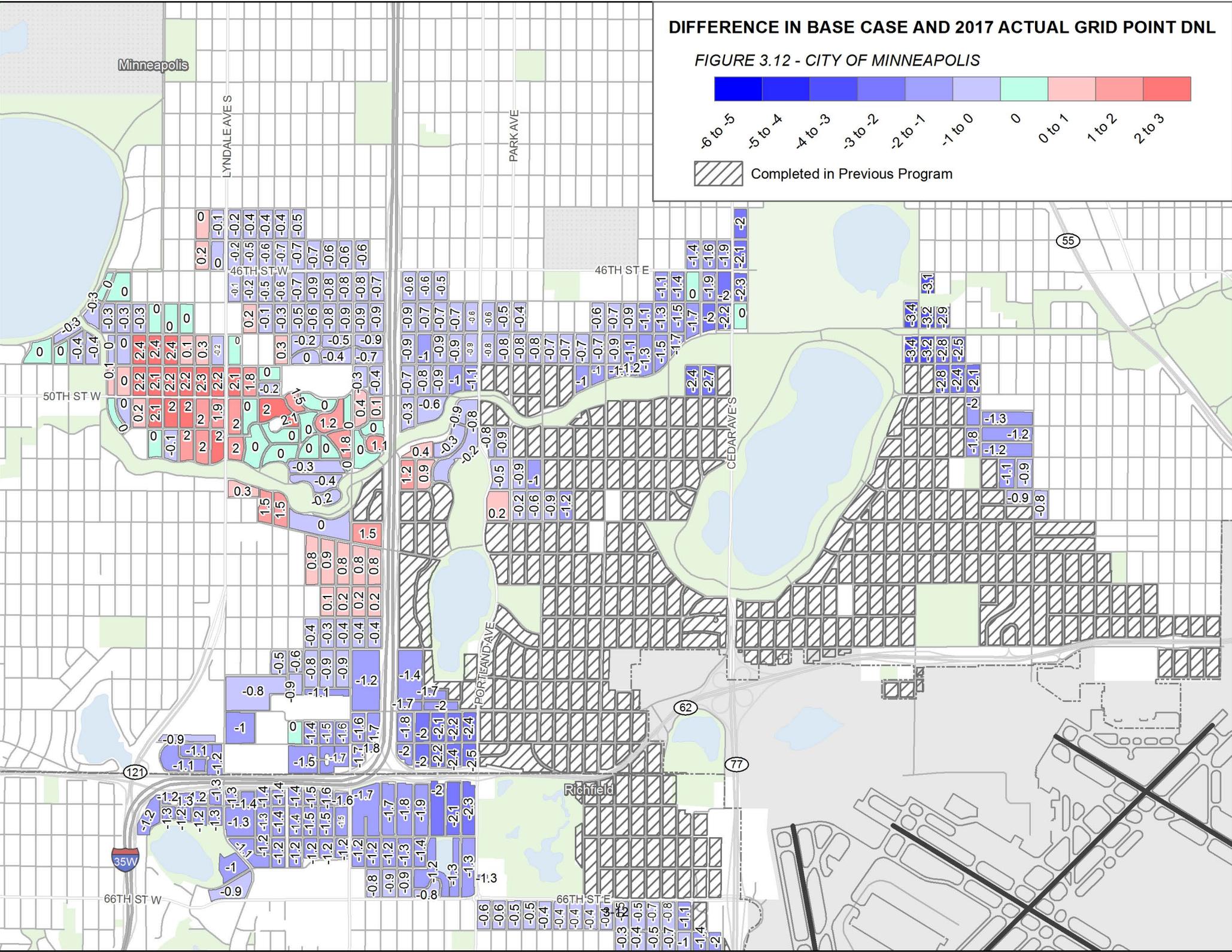
DIFFERENCE IN BASE CASE AND 2017 ACTUAL GRID POINT DNL

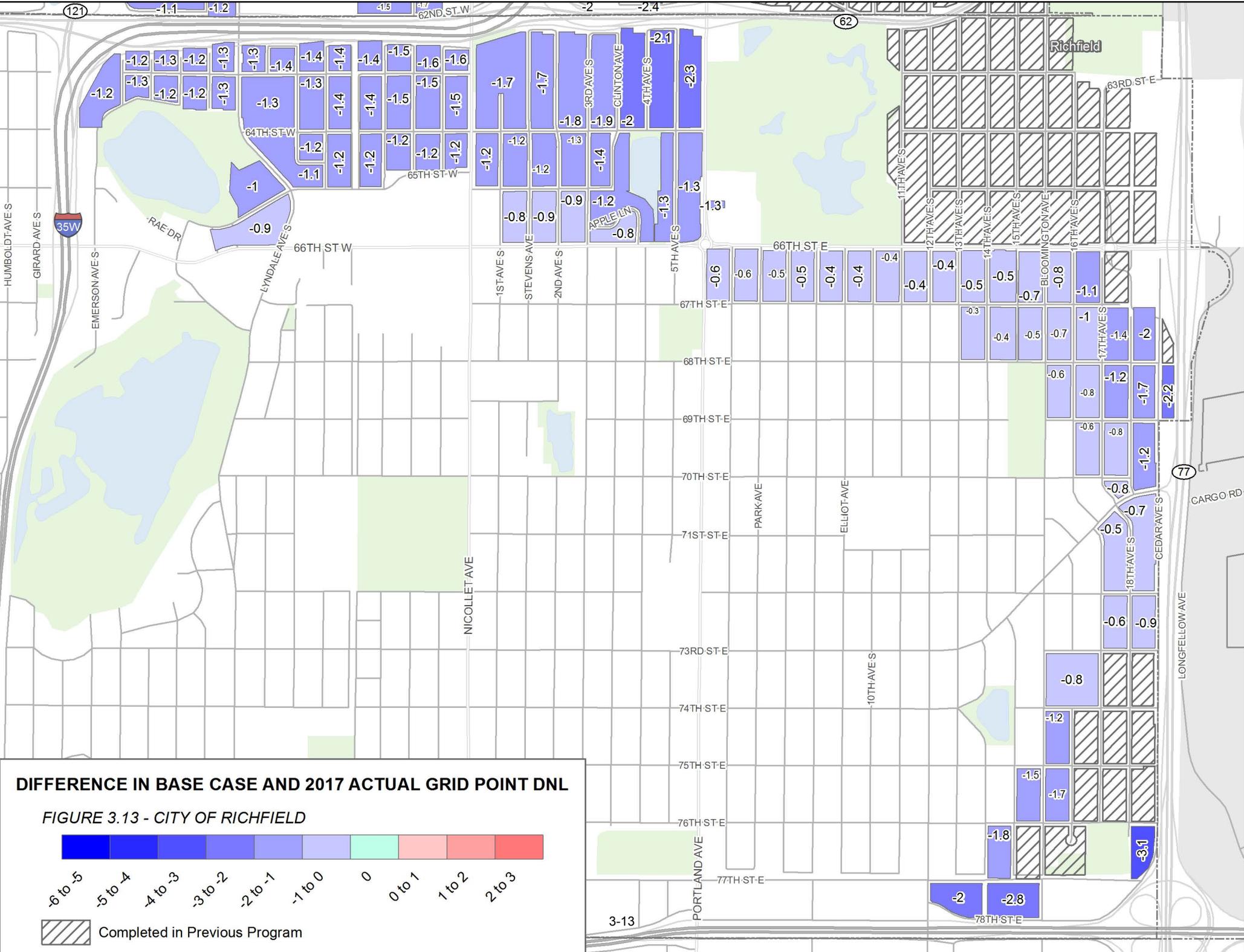
FIGURE 3.12 - CITY OF MINNEAPOLIS



-6 to -5
-5 to -4
-4 to -3
-3 to -2
-2 to -1
-1 to 0
0
0 to 1
1 to 2
2 to 3

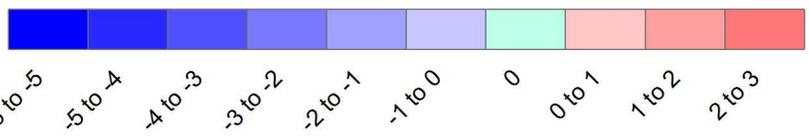
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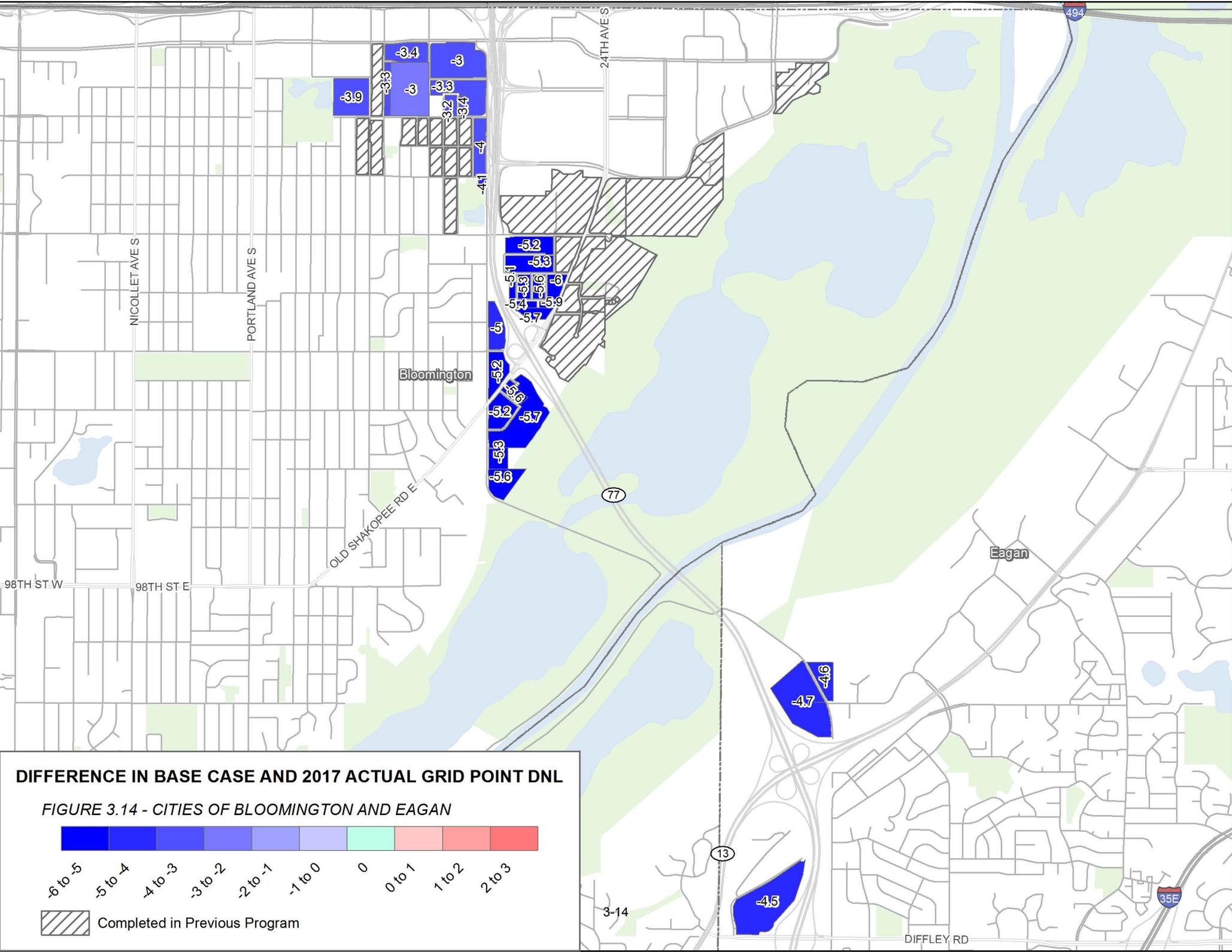
DIFFERENCE IN BASE CASE AND 2017 ACTUAL GRID POINT DNL

FIGURE 3.13 - CITY OF RICHFIELD



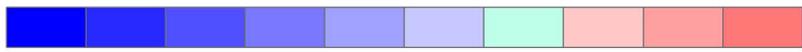
 Completed in Previous Program

3-13



DIFFERENCE IN BASE CASE AND 2017 ACTUAL GRID POINT DNL

FIGURE 3.14 - CITIES OF BLOOMINGTON AND EAGAN



-6 to -5 -5 to -4 -4 to -3 -3 to -2 -2 to -1 -1 to 0 0 0 to 1 1 to 2 2 to 3

 Completed in Previous Program

3-14

DIFFLEY RD

