Chapter 5. Environmental Considerations

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Chapter 5 Environmental Considerations

This chapter presents an overview of the environmental considerations for development of the 2040 MSP Long-Term Plan (LTP). These considerations include the effects that development may have on noise, air quality, and water quality within the region surrounding the Airport. The analysis for noise conditions was developed using an Aviation Environmental Design Tool (AEDT) and is based on updated forecasts discussed in **Chapter 2**. The remaining environmental considerations are based on Chapter 5 of Appendix A, which presents the 2030 LTCP update for aviation demand, and Appendix B, which presents the 2020 Improvements Final EA/EAW.

The Metropolitan Airports Commission (MAC) has a longstanding commitment to creating a sustainable future. The MAC furthered this commitment in 2020 by setting the following 2030 goals:

- Reduce MSP's greenhouse gas emissions by 80%.
- Reduce MSP's water usage per passenger by 15%.
- Divert 75% of MSP's waste away from landfills.
- Achieve a MAC employee engagement sustainability score of 85.

The MAC and airport stakeholders are working toward reaching these goals through a variety of means, such as reducing energy and CO2 emissions, achieving Level 2 in the Airport Carbon Accreditation program, diverting airport waste, reducing water consumption, and planning for climate resiliency.

5.1 BACKGROUND

The **Appendix A** analysis was based on the 2008 aviation forecast, with demand extending to 2030. The baseline condition for **Appendix B** was based on 2010 data, with aviation demand extending to 2020. The total aircraft operations calculated for the 2040 LTP is lower in 2040 than what was determined for 2030 in **Appendix A** and 2025 in **Appendix B**. As presented on **Exhibit 2-39** in Chapter 2 of this report, total operations for 2040, in relation to the revised baseline forecast, are anticipated to be approximately 517,000 operations. Total operations forecast for 2030 in **Appendix A** were approximately 630,800. This is approximately 113,800 more operations 10 years earlier based on data derived in 2008. Total operations forecast for 2025 in **Appendix B** were approximately 526,000. This is approximately 9,000 more operations 15 years earlier based on data derived in 2010.

The 2040 LTP forecast operations in 2040 were noticeably less than the operations forecast in prior studies, consequently the environmental results from these studies are applicable in relation to the LTP 2040 peak demand. In addition, the alternatives that were assessed in prior studies require similar alterations to the preferred development alternative presented in **Chapter 4**; therefore, the extent of the study area is still appropriate. The environmental consequences within the study areas, defined in **Appendix B**, were completed in accordance with FAA Orders 1050.1E, *Environmental Impacts: Policies and Procedures*, and 5050.4B, *National Environmental Policy Act* (*NEPA) Implementing Instructions for Airport Actions*, and the FHWA NEPA regulations. An environmental consequences summary can be found in **Appendix B**.

Development projects included in the 2030 LTCP which are also in the 2040 LTP include:

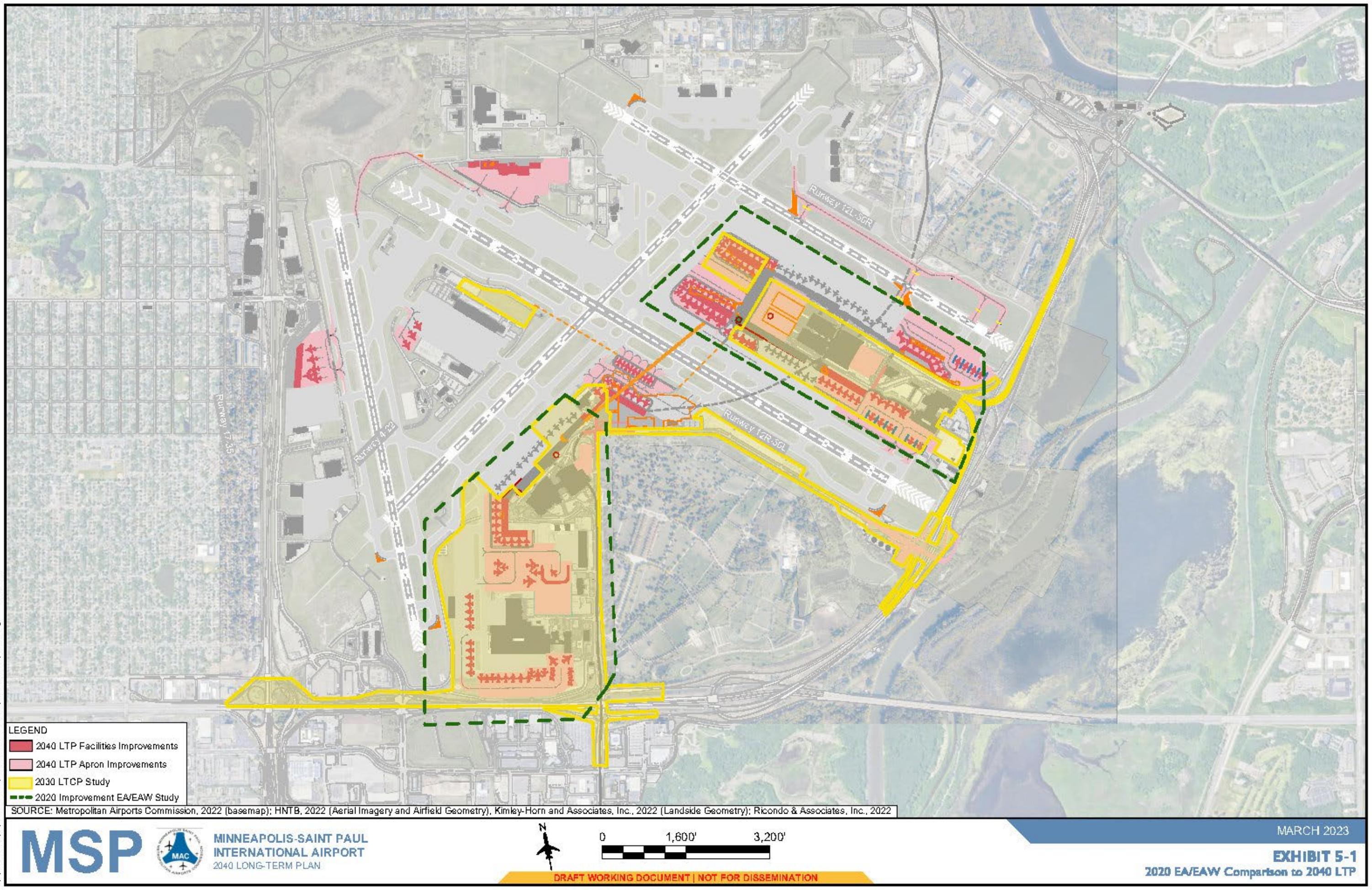
- North and south extensions of T2
- South extension of the G Concourse
- Improvements to the T1 and T2 Terminal for ticketing, baggage, security, and Federal Inspection Services (FIS)
- Redevelopment and expansion of arrivals curbs for both T1 and T2
- Redevelopment of the Green/Gold Ramps
- Redevelopment of the U.S. Postal Service area
- Additional multi-level parking garages at both T1 and T2
- Interchange improvements at I-494 and 34th Avenue South
- Interchange improvements at John A. Johnson Memorial Highway and Post Road
- Improvements at the intersection at 34th Avenue and 70th Street

Additional development projects beyond the 2030 LTCP that are were in the 2020 EA/EAW Preferred Development which are in the 2040 LTP include:

- Relocation of the 30L deicing pad
- Redevelopment of Concourse E
- Reconfiguration of the 34th Avenue. South/East 70 Street and Humphrey Drive/East 70th Street intersections
- Relocation of the Ground Runup Enclosure (GRE)/Construct Remain Overnight (RON) Aircraft Apron

Though these projects from the 2030 LTCP and the 2040 LTP do differ in some respects, the study area envelope for the projects in each study are consistent. The comparison between the 2030 LTCP study area and the 2040 LTP is depicted in **Exhibit 5-1**.

Exhibit 5-1: 2020 EA/EAW and Preferred Development Comparison



SOURCE: Metropolitan Airports Commission, 2022 (basemap); HNTB, 2022 (Aerial Imagery and Airfield Geometry), Kimley-Horn and Associates, Inc., 2022 (Landside Geometry); Ricondo & Associates, Inc., 2022

5.2 AIRCRAFT NOISE

5.2.1 Quantifying Aircraft Noise

Sound is energy transferred through the air that our ears detect as small changes in air pressure. A sound source vibrates or otherwise disturbs the air immediately surrounding the source, causing variations in pressure above and below the static (at-rest) value of atmospheric pressure. These disturbances force air to compress and expand setting up a wavelike movement of air particles that move away from the source. Sound waves, or fluctuations in pressure, vibrate the eardrum creating audible sound.

Noise is sound that is unwanted. Noise has both a measurable, physical component as well as a subjective component that takes account of an individual's reaction to a sound. For example, the same sound can be pleasant for one person and annoying to another. Even sounds that are pleasant at one volume can become annoying as they get louder.

Sound levels are measured in decibels (dB), which is a logarithmic scale of energy referenced to human hearing. The dB scale accounts for the range of hearing with values from 0 dB to around 200 dB. Most human hearing of sound experience falls into the 30 dB to 120 dB range.

Decibels are logarithmic, and thus cannot be added directly. Two identical noise sources each producing 70 dB do not add to a total of 140 dB, but to 73 dB. Each time the number of sources is doubled, the sound pressure level increases 3 dB.

- 2 sources: 70 dB + 70 dB = 73 dB
- 4 sources: 70 dB + 70 dB + 70 dB + 70 dB = 76 dB
- 8 sources: 70 dB + 70 dB + 70 dB + 70 dB + 70 dB + 70 dB + 70 dB + 70 dB = 79 dB

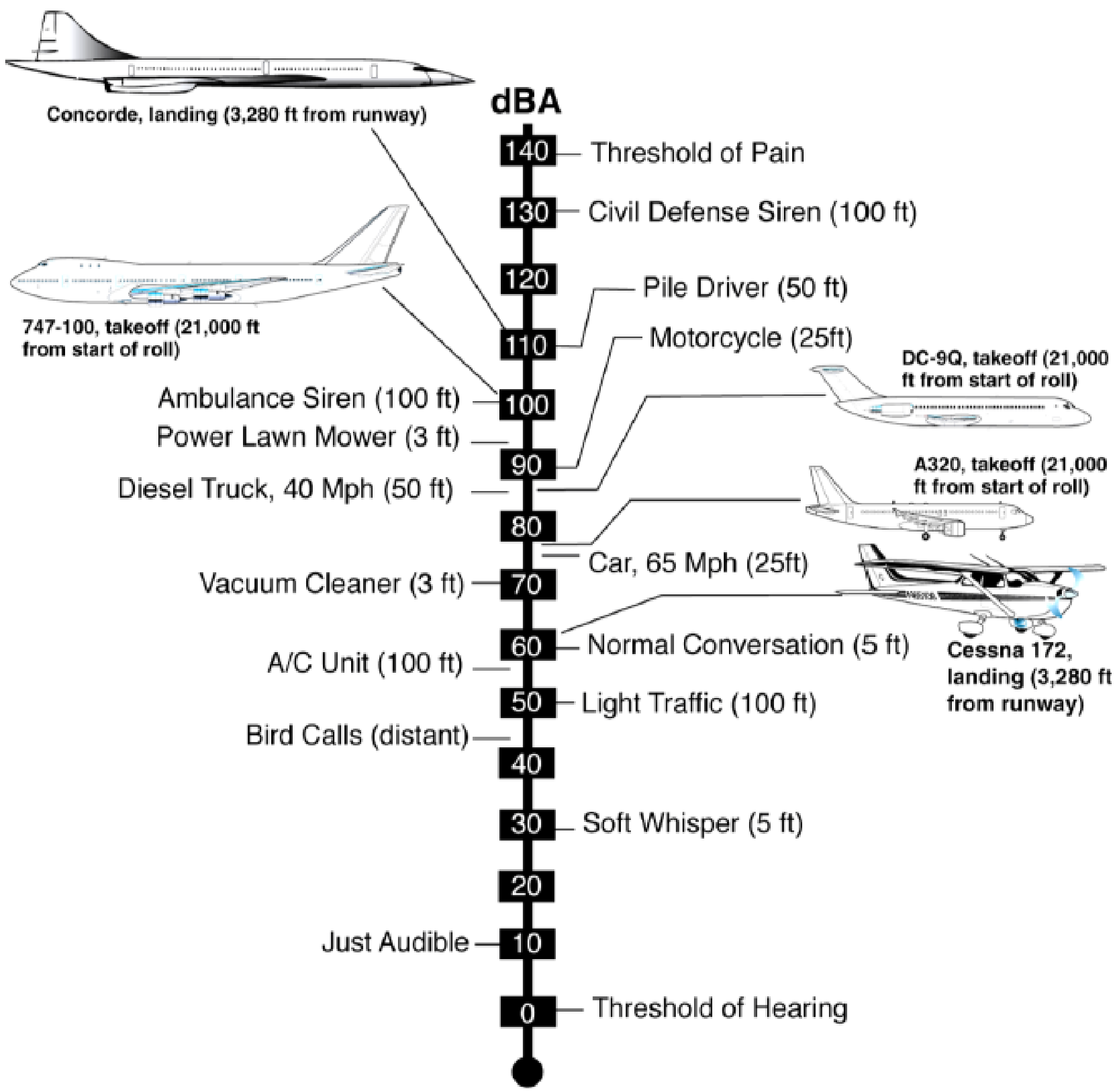
The just-noticeable change in loudness for normal hearing adults is about 3 dB. That is, changes in sound level of 3 dB or less are difficult to notice. A doubling of loudness for the average listener of A-weighted sound is about 10 dB[1]. Measured, A-weighted sound levels changing by 10 dBA result in a subjective perception of being "twice as loud."[2]

Exhibit 5-2 provides the noise levels for various common sources.

[1] A-weighted decibels represent noise levels that are adjusted relative to the frequencies that are most audible to the human ear.

[2] Peppin and Rodman, Community Noise, p. 47-48; additionally, Harris, Handbook, Beranek and Vér, Noise and Vibration Control Engineering, among others.

Exhibit 5-2: Sound Levels of Typical Noise Sources



SOURCE: Metropolitan Airports Commission, 2022

5.2.1 Day-Night Average Sound Level (DNL)

Through the Aviation Safety and Noise Abatement Act (ANSA) of 1979, Congress directed the Federal Aviation Administration (FAA) to establish a single metric for assessing land use compatibility with respect to noise from aircraft operations and to establish standards and methods for assessing the noise environment associated with ongoing aircraft operations near airports. In 1981, the FAA implemented the ANSA provisions. These are published at 14 Code of Federal Regulations (CFR), Part 150 (“Part 150”).

This regulation adopted the Day-Night Average Sound Level (DNL) metric. The DNL metric reflects a person's cumulative exposure to sound over a 24-hour period. The metric uses aircraft operations over the course of the year to calculate noise exposure for an average annual day. To account for a higher sensitivity to noise exposure at night (10:00 PM to 7:00 AM), DNL calculations add 10 times weighting for each nighttime flight. This equates to each nighttime flight being measured as if 10 daytime flights had occurred. Due to the logarithmic scale of decibels, this is equivalent to adding 10 decibels to nighttime flights.

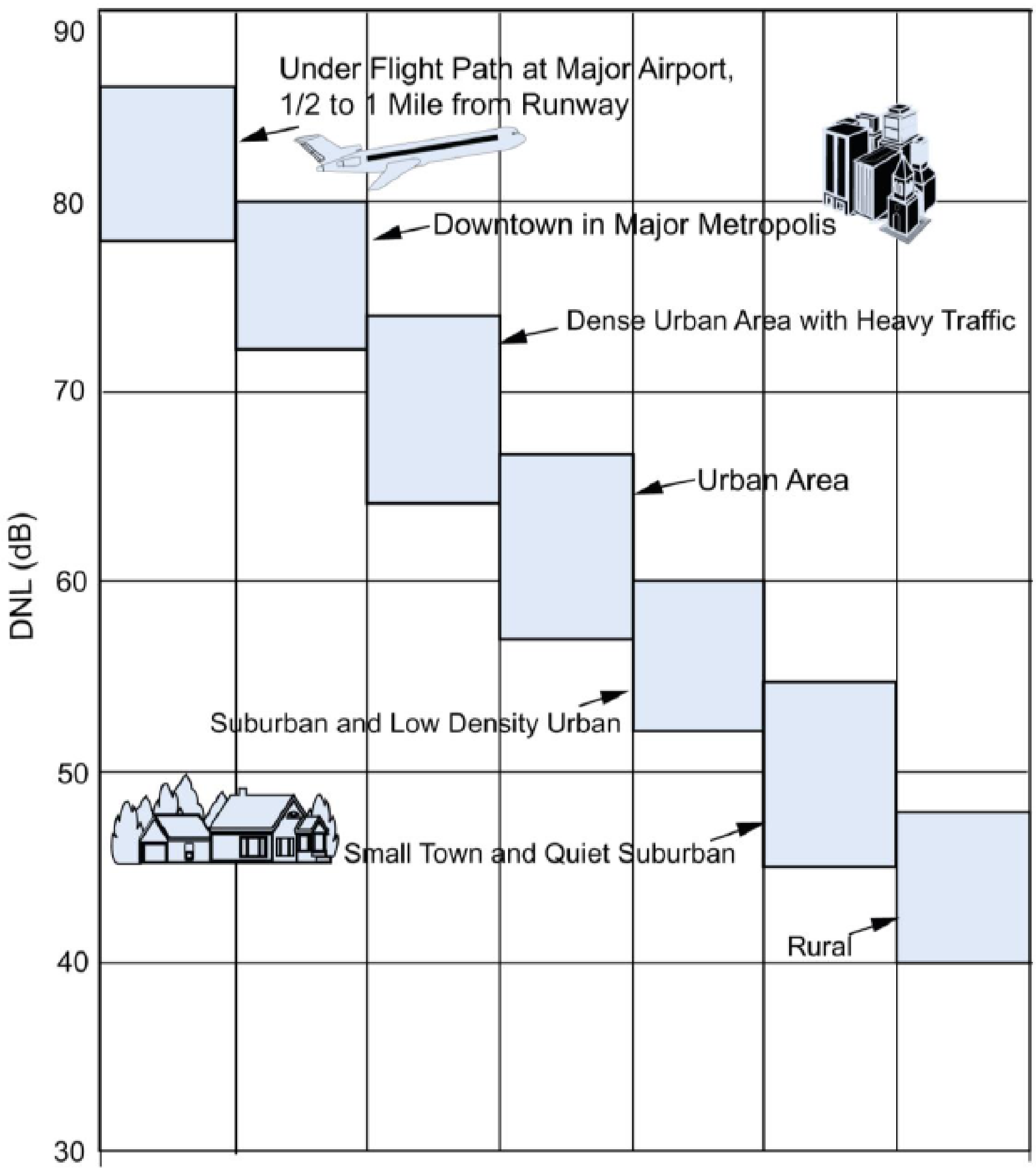
The FAA also established land use compatibility guidelines for aircraft noise, determining 65 A-weighted decibels (dB) DNL is the threshold of significant noise exposure, and thus would be incompatible with residential and other noise-sensitive land uses.

Exhibit 5-3 provides examples of typical DNL levels in various environments.

Currently, the FAA requires the DNL metric be used in a variety of policy objectives, including assessment, identification, and mitigation of incompatible land uses in the vicinity of civil airports, and evaluation of environmental consequences that would occur if changes to aircraft operations or airfield infrastructure near an airport were implemented. DNL has also been formally adopted by most federal agencies dealing with noise exposure, such as the U.S. Environmental Protection Agency (EPA), U.S. Department of Defense, U.S. Department of Housing and Urban Development, and Veterans Administration.

MSP is unique relative to noise mitigation provided to incompatible residential land uses around the airport. This is due to the conditions of a consent decree that settled noise mitigation litigation in 2007. Since this settlement, the MAC has provided noise relief to eligible homes within the 60 dB DNL contour (five dB beyond the federal requirement). The MSP Noise Mitigation Program has been amended three times and is currently in place until 2032.

Exhibit 5-3: Typical Outdoor Community Day-Night Average Sound Levels



SOURCE: U.S. Department of Defense. Departments of the Air Force, the Army, and the Navy, 1978. *Planning the Noise Environment*. AFM 19-10. TM 5-803-2, and NAVFAC P-970.

5.2.1 MSP Noise Reduction Efforts

The MAC has a long history of working with community stakeholders, airport users, the FAA, and other government entities to address aircraft noise issues. These efforts date back to before 1970 and include operational noise abatement and land use measures.

Noise abatement measures are those that affect the shape and size of the noise contours. A voluntary Noise Abatement Plan is in place to promote aircraft operating procedures that help reduce aircraft noise and overflights for residents living near MSP. There are a total of 12 voluntary noise abatement procedures in place at MSP. A description of these procedures is available at metroairports.org/msp-noise-abatement-efforts.

Beginning in 1992, the MAC's efforts included land use management measures, which are measures that address incompatible land use that remains after the implementation of noise abatement measures. The MAC's most notable land use measure is the delivery of noise reducing modifications to homes, apartment buildings and schools around MSP. The MAC's work in this area is the most expansive in the country and represents the most direct form of tangible relief to neighbors most affected by aircraft noise from MSP air traffic.

Between 1992 through January 2023, the MAC's noise mitigation program has provided noise relief to almost 20,000 single- and multi-family homes and 19 schools around MSP at a total cost of over $513 million.

In 2021, the MAC committed to continue providing noise relief to qualifying homes through 2032. For a home to qualify, it must be located, for a period of three consecutive years in the actual 60 DNL aircraft noise contour published in an annual noise contour report, and, be located within a higher noise impact area when compared to the home's status under a previous phase of the program.

The 2040 Forecast scenarios noise contours and analysis contained in this report do not qualify homes for the MAC's noise mitigation program. Eligibility for noise relief provided by the MAC is determined annually, based upon actual MSP noise contours developed for the preceding calendar year.

5.3 NOISE CONTOUR DEVELOPMENT

5.3.1 Aviation Environmental Design Tool

The noise contours presented in this document were developed using the FAA's AEDT.

The AEDT model produces DNL noise contours depicting an annualized average day of aircraft noise impacts. The model uses operational information such as runway use, flight track use, aircraft type, aircraft performance and thrust settings and operation time of day as inputs. The model also considers environmental variables, such as topography and atmospheric conditions. Quantifying aircraft-specific noise characteristics in AEDT is accomplished using 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. Using federally adopted and endorsed methodology, this aircraft-specific noise information is used in the generation of DNL contours. Justification for this approach is rooted in national standardization of noise quantification at airports.

The 2040 Forecast scenarios noise contours were developed using AEDT version 3e, which is the most current version released by the FAA. The noise contours developed for the 2018 Base Year, as developed in the MAC's 2018 Annual Noise Contour Report, were developed using AEDT version 2d, which was the most current version at the time of its development (January 2019).

Updates made to the aircraft fleet database are the primary change between these versions. AEDT 3e includes the following aircraft types, which were not available in AEDT 2d:

- Gulfstream 650ER
- Boeing 737 MAX 8
- Airbus A320-271N
- Airbus A320-272N
- Falcon 900EX
- ATR72-212A
- Boeing 767-300ER
- Boeing 747-400RN
- Boeing 787-900

The number of operations by new or updated noise aircraft types account for approximately 18.4% of the 2018 Base Year operations and 26.7% of the projected 2040 operations. Noise aircraft types are one of the most critical components in AEDT as they represent aircraft performance and associated noise levels. It is expected that the new and updated noise aircraft types would introduce the most significant change from AEDT 2d to AEDT 3e. However, their impacts are expected to be relatively minor as the noise aircraft types they replace have similar performance and noise characteristics.

Another change between the AEDT versions include weather inputs. Default weather parameters were applied in both the 2018 Base Year and 2040 Forecast scenarios noise analyses. The default weather parameters in AEDT 2d (used in the 2018 Base Year) represent 30-year average weather readings at the MSP weather station. The default weather parameters in AEDT 3e represent a 10-year average at the same weather station. The resultant weather inputs are similar and would have minimal impacts on the noise contour results.

5.3.2 Aircraft Activity Levels

The MAC owns and operates a Noise and Operations Monitoring System (MACOMS). In addition to monitoring noise levels at 39 remote sound monitoring stations located around MSP, the system collects flight track data to approximately 40 miles around the Airport up to 20,000 feet. MACNOMS flight track data in the vicinity of MSP was used in the AEDT modeling for both the 2018 Base Year and to aid in the development process of the AEDT input file for the 2040 Forecast scenarios noise contours.

Activity forecasts were developed to identify a potential range of demand scenarios for aviation services to the year 2040. Chapter 2 discusses the forecasts and the inherent uncertainty in predicting the level of air traffic demand for the next 20 years. Three scenarios were developed in the forecast, which consider this uncertainty and promote efficiency and flexibility.

The 2040 Revised Forecast is the expected outcome and is the forecast contour that is used in the noise impact analysis. A 2040 high scenario was developed, which reflects demand growth driven by the most optimistic socioeconomic drivers. Lastly, a 2040 low scenario was developed, which is informed by more conservative forecasts used for the financial planning process. This generally reflects lower demand, due to an assumption of reduced hub connectivity. The forecast operations range from 460,600 in the low scenario to 554,900 in the high scenario. All three forecast scenarios were used to develop DNL contours to display a range potential of noise impact levels 20 years into the future.

As summarized in **Table 2-11** in **Chapter 2**, the total number of MSP operations in the 2018 Base Year is 406,913 (1,115 average daily flights) and the 2040 Forecast scenarios total operations ranges from 460,600 (1,262 average daily flights) in the low scenario to 554,900 (1,520 average daily flights) in the high scenario. The baseline forecast number of total operations is 509,700 (1,396 average daily flights).

5.3.3 Fleet Mix

The 2018 Base Year fleet mix was based on 2018 annual MACNOMS data. MACNOMS annual operations were 0.4% 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.

The Baseline Forecast High scenario, and Low scenario operations were based on the 2040 Long-Term Plan activity forecast3 (2040 LTP Forecast). Details about the forecast are provided in Chapter 2 of this document.

A summary of the 2018 Base Year and 2040 Forecast scenario fleet mixes are provided in **Table 5-1**. A more detailed presentation of the 2018 Base Year aircraft fleet mix is provided in **Chapter 2**.

The use of newer and quieter aircraft is expected to increase over the 20-year forecast. In 2018, there were 283 operations in the Boeing 737 MAX 8. According to Boeing, the 737 MAX aircraft variants are 40% quieter than the B737-800 jets. The 2040 baseline forecast includes 10,950 operations in the B737 MAX family of aircraft.

Additionally, 1,400 Airbus A320neo ("new engine option") operations occurred in 2018. According to Airbus, the A320neo is 50% quieter than the current engine option. By 2040, MSP is anticipated to have approximately 95,600 operations in A319, A320 and A321 NEOs.

The AEDT model includes a group of representative aircraft and helicopter types with noise parameters. For this analysis, aircraft types were assigned to the AEDT model aircraft. The model also provides pre-approved aircraft substitutions for instances where an aircraft type does not have a direct match with the model aircraft types. AEDT version 3e, which was used to develop the 2040 Forecast scenarios, does not have a noise profile for the B737 MAX 10. A conservative approach was taken consistent with FAA guidance, to input the B737 MAX 8 noise parameters in place of the B737 MAX 10. All nonstandard aircraft substitutions in AEDT were approved by the FAA Office of Energy and Environment.

[3] Minneapolis-Saint Paul International Airport, 2040 Long-Term Plan: Activity Forecast Summary Technical Memorandum, Ricondo, November 2021.

5.3.4 Day/Night Split of Operations

The DNL metric adds a 10 decibel (dB) penalty to noise events occurring at night (between 10 p.m. and 7 a.m.). It is important to separate aircraft operations over the course of a year into daytime or nighttime operations, creating a day/night split.

The split of daytime and nighttime operations for the 2018 Base Year was determined from MACNOMS flight track data for MSP. A summary of the day/night splits for the 2018 Base Year Condition and the 2040 Forecast scenarios are provided in **Table 5-1**. A more detailed report of the 2018 Base Year and 2040 Forecast scenario day/night splits are provided in **Appendix D**.

The percentage of nighttime operations is expected to increase slightly from 11% in 2018 to approximately 12% in 2040 as a result of increased nighttime operations projected in the design day flight schedule.

Table 5-1: Summary of Average Daily Flight Operations

Average Daily Flight Operations	Day	Night	Total	% of Total Operations
2018 Base Year Condition				
Manufactured to be Stage 3+	953	117	1,071	96%
Hushkit Stage 3 Jets	0	1	1	0%
Microjet	1	0	1	0%
Propeller	38	2	40	4%
Helicopter	0	0	0	0%
Military	2	0	2	0%
Total	*995*	*120*	*1115*	*100%*
% of Total Operations	*89%*	*11%*	*100%*	
2040 Baseline Forecast Scenario				
Manufactured to be Stage 3+	1,194	157	1,351	97%
Hushkit Stage 3 Jets	0	0	0	0%
Microjet	1	0	1	0%
Propeller	34	3	37	3%
Helicopter	0	0	0	0%
Military	7	1	7	1%
Total	*1,236*	*161*	*1,396*	*100%*
% of Total Operations	*88%*	*12%*	*100%*	
2040 High Forecast Scenario				
Manufactured to be Stage 3+	1,301	171	1,472	97%
Hushkit Stage 3 Jets	0	0	0	0%
Microjet	1	0	1	0%
Propeller	36	43	39	3%
Helicopter	0	0	0	0%
Military	7	1	8	1%
Total	*1,345*	*175*	*1,520*	*100%*
% of Total Operations	*88%*	*12%*	*100%*	
2040 Low Forecast Scenario				
Manufactured to be Stage 3+	1,075	142	1,218	96%
Hushkit Stage 3 Jets	0	0	0	0%
Microjet	1	0	1	0%
Propeller	33	43	35	3%
Helicopter	0	0	0	0%
Military	7	1	8	1%
Total	*1,116*	*146*	*1,262*	*100%*
% of Total Operations	*88%*	*12%*	*100%*	

NOTES:
Number is shown as 0 when less than 0.5. Totals may differ due to rounding.
SOURCES: MACNOMS Flight Track Data (2018 Base Year); 2040 Long-Term Plan: Activity Forecast Summary Technical Memorandum, Ricondo, Nov. 2021 and HNTB analysis, 2022 (2040 Forecast scenarios).

5.3.5 Runway Use

Runway use represents how aircraft utilize the runway(s) and helipad(s) at an airport and is a primary factor determining noise exposure. FAA Air Traffic Control determines the runway use throughout the year for arrival and departure operations.

Prior to 2005 when Runway 17/35 opened, arrival and departure operations at MSP occurred on the parallel runways (12L/30R and 12R/30L) in a manner that resulted in approximately 50% of the arrival and departure operations occurring to the northwest over south Minneapolis and 50% to the southeast over Mendota Heights and Eagan. Because of the dense residential land uses to the northwest and the predominantly industrial/commercial land uses southeast of MSP, there was a concerted effort to focus departure operations over areas to the southeast as the preferred operational configuration. This tactic proved to affect fewer sensitive land uses and people from an aircraft noise perspective.

Runway 17/35 opened at MSP in October 2005 and provided FAA with new runway use options. The use of the runways has changed over time as a natural result of weather and operational variables.

One noise abatement procedure in place at MSP is the Runway Use System (RUS). The RUS prioritizes arrival and departure runways to promote flight activity over less-populated residential areas as much as possible.

The RUS was updated in 2005 to coincide with the opening of Runway 17/35. For departures, Runways 12L and 12R are the first priority (Priority 1) since aircraft are directed over non-residential (industrial use) areas to the southeast immediately after takeoff. Runway 17 is the second priority (Priority 2) departure runway and is used for departures to the south to augment the flow of air traffic using the parallel runways. The Minnesota River Valley and commercial land uses in Bloomington provide another opportunity to route aircraft over an unpopulated area. There are, however, residential areas to the south, impacted by Runway 17 departures turning eastbound after crossing the Minnesota River.

Runway uses in 2040 Forecast scenarios by airlines and aircraft were assumed to be consistent with the 2018 Base Year runway use. For aircraft not included in the 2018 Base Year fleet mix, it was assumed that their runway use would be the same as the aircraft they are expected to replace or similar aircraft types.

Table 5-2 compares the runway use in 2018 Base Year and 2040 Forecast scenarios. In general, the projected 2040 Forecast scenarios runway use is consistent with the 2018 Base Year runway use with minor variances. Compared with the 2018 Base Year runway use, the 2040 Forecast scenarios departures from Runway 12L decrease by approximately 1.7% and, from Runway 30L, increase by approximately 1.5%-1.6%. The 2040 Forecast arrivals to Runway 30L increase by approximately 1.4%-1.6%. Changes in other runways are less than 1%.

A more detailed presentation of the 2018 Base Year condition and 2040 Forecast scenarios runway use are provided in **Appendix D**.

Table 5-2: Summary of Average Annual Runway Use

Average Annual Runway Use %	Arrivals			Departures		
	Day	Night	Total	Day	Night	Total
2018 Base Year Condition						
Runway 4	0.1%	0.3%	0.1%	0.5%	1.0%	0.5%
Runway 12L	22.2%	14.2%	21.3%	14.2%	18.6%	14.7%
Runway 12R	25.6%	27.5%	25.8%	4.1%	24.9%	6.2%
Runway 17	0.0%	0.6%	0.1%	36.3%	11.7%	33.8%
Runway 22	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Runway 30L	24.8%	34.7%	25.9%	23.2%	25.0%	23.4%
Runway 30R	21.9%	16.6%	21.3%	21.6%	18.5%	21.3%
Runway 35	5.4%	6.1%	5.5%	0.0%	0.2%	0.0%
2040 Baseline Forecast Scenario						
Runway 4	0.0%	0.2%	0.1%	0.5%	0.9%	0.5%
Runway 12L	21.2%	15.4%	20.5%	12.3%	18.3%	13.0%
Runway 12R	26.7%	25.2%	26.5%	4.8%	22.0%	6.7%
Runway 17	0.0%	0.5%	0.1%	37.3%	11.0%	34.4%
Runway 22	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Runway 30L	26.6%	33.4%	27.4%	24.7%	27.7%	25.0%
Runway 30R	20.8%	17.2%	20.3%	20.4%	19.9%	20.4%
Runway 35	4.7%	8.2%	5.1%	0.0%	0.2%	0.0%
2040 High Forecast Scenario						
Runway 4	0.0%	0.2%	0.1%	0.5%	0.9%	0.5%
Runway 12L	21.2%	15.4%	20.5%	12.3%	18.4%	13.0%
Runway 12R	26.7%	25.2%	26.5%	4.8%	22.0%	6.7%
Runway 17	0.0%	0.5%	0.1%	37.3%	11.0%	34.4%
Runway 22	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Runway 30L	26.5%	33.3%	27.3%	24.6%	27.7%	25.0%
Runway 30R	20.8%	17.2%	20.4%	20.4%	19.9%	20.4%
Runway 35	4.7%	8.2%	5.1%	0.0%	0.2%	0.0%
2040 Low Forecast Scenario						
Runway 4	0.0%	0.2%	0.1%	0.5%	0.9%	0.5%
Runway 12L	21.2%	15.2%	20.4%	12.3%	18.2%	12.9%
Runway 12R	26.7%	25.2%	26.5%	4.9%	21.9%	6.7%
Runway 17	0.0%	0.5%	0.1%	37.2%	11.1%	34.3%
Runway 22	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Runway 30L	26.6%	33.7%	27.5%	24.7%	27.8%	25.1%
Runway 30R	20.7%	17.0%	20.3%	20.4%	19.9%	20.3%
Runway 35	4.7%	8.1%	5.1%	0.0%	0.2%	0.0%

NOTES: Total may not add up due to rounding. Helicopters are excluded.
SOURCES: MAC Data and HNTB Analysis, 2022.

5.3.6 Flight Tracks

To determine projected noise levels on the ground, it is necessary to determine not only the frequency of aircraft operations, but also their altitudes and locations. Flight tracks to and from an airport are generally a function of the geometry of the airport's runways and the surrounding airspace structure near the airfield.

Actual flight track data is used to develop AEDT model tracks. The 2018 Base Year actual flight tracks are assigned to the model tracks using a geospatial best-fit analysis of the actual flight track geometry based on linear trends. This method provides the ability to match each actual flight track directly to the appropriate model track. Arrival and departure sub-tracks are added to distribute operations among the backbone and sub-tracks using a standard "bell curve" distribution based on the number of sub-tracks developed.

Flight track layout and associated use for all three 2040 Forecast scenarios were derived from the 2018 Base Year noise contour analysis. The AEDT model flight tracks used for the 2040 Forecast scenarios are the same as those used for the 2018 Base Year noise contour. The 2040 Forecast scenarios operations were then assigned to the model flight tracks based on aircraft type and airline.

Figures depicting flight track locations and additional detail related to flight track use for the 2018 Base Year and 2040 Forecast scenarios are provided in **Appendix D.**

The flight tracks used for this noise analysis did not change based on Area Navigation (RNAV) departure procedures being developed as part of the FAA's Very-High Frequency Omnidirectional Radial (VOR) Minimum Operational Network program. In January 2023, the FAA, along with representatives from airlines, air traffic control, support contractors, and the MAC, began the process of developing new satellite-based departure procedures to replace the published procedures that use the MSP VOR. The goal is to develop procedures that replicate existing flight patterns to the extent possible; therefore, differences in flight tracks are expected to be negligible in the noise contour area. These procedures will be evaluated in a separate environmental review conducted by the FAA.

5.3.7 2018 Base Year Modeled Versus Measured DNL Levels

As part of the 2018 Base Year actual noise contour evaluation, a comparison was conducted on the actual 2018 Base Year measured aircraft noise levels at the MAC's 39 sound monitoring sites 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 5-3 provides a comparison of the AEDT modeled DNL noise values and the actual measured aircraft DNLs at those locations in 2018.

There is an inherent difference between modeled noise results and measured noise results. AEDT modeled data only reports on aircraft noise. It cannot replicate the various other sources of community noise that exist and contribute to ambient conditions. AEDT cannot replicate the exact operating characteristics of each aircraft that is input into the model. AEDT uses average weather conditions instead of actual weather conditions at the time of the flight. AEDT also uses conservative aircraft substitutions when new aircraft are not yet available in the model. Conversely, RMT measured data is highly impacted by community sound. The MACNOMS system must set thresholds for events to attempt to eliminate occurrences of community sound events being assigned to aircraft noise. While some of the data is evaluated by staff, most events are assumed to be aircraft if a flight track existed during the time of the event. The factors that may contribute to differences include site terrain, building reflection, foliage and ground cover, ambient noise level, and atmospheric conditions. There variables will impact the propagation of sound differently.

The use of absolute values provides a perspective of total difference between the modeled values and the measured DNL values provided by MACNOMS in 2018. The median is considered the most reliable indicator of correlation when considering the data variability across modeled and measured data.

Table 5-3: 2018 Measured vs. Modeled DNL Values

Sound Monitoring Site	2018 Measured DNL (a)	2018 Modeled DNL	Difference	Absolute Difference
1	55.9	57.6	1.7	1.7
2	58.1	58.2	0.1	0.1
3	62.6	63.6	1.0	1.0
4	59.2	59.7	0.5	0.5
5	67.5	68.2	0.7	0.7
6	67.1	66.0	-1.1	1.1
7	58.8	58.1	-0.7	0.7
8	55.3	55.6	0.3	0.3
9	36.9	43.5	6.6	6.6
10	44.1	50.2	6.1	6.1
11	38.3	45.1	6.8	6.8
12	39.2	47.7	8.5	8.5
13	53.9	55.3	1.4	1.4
14	59.8	61.2	1.4	1.4
15	55.7	55.9	0.2	0.2
16	64.0	63.6	-0.4	0.4
17	44.0	49.7	5.7	5.7
18	52.4	58.9	6.5	6.5
19	48.0	54.5	6.5	6.5
20	40.8	51.3	10.5	10.5
21	44.5	50.1	5.6	5.6
22	54.9	57.6	2.7	2.7
23	60.6	60.2	-0.4	0.4
24	58.1	59.9	1.8	1.8
25	50.0	52.8	2.8	2.8
26	51.0	54.8	3.8	3.8
27	52.1	55.3	3.2	3.2
28	54.9	61.1	6.2	6.2
29	51.5	53.1	1.6	1.6
30	60.6	60.6	0	0
31	46.1	50.9	4.8	4.8
32	40.4	48.2	7.8	7.8
33	46.0	50.6	4.6	4.6
34	42.8	48.5	5.7	5.7
35	50.8	53.2	2.4	2.4
36	50.8	51.4	0.6	0.6
37	46.0	48.8	2.8	2.8
38	49.1	50.9	1.8	1.8
39	49.9	51.6	1.7	1.7
			Average	*3.3*
			Median	2.4

NOTES: All units in dB DNL
(a) Computed from daily DNLs
SOURCE: MAC sound monitoring data and HNTB, 2019

More differences between measured and modeled data occur at sites that have less events overall. When more data is available, that variance begins to decrease. Overall, the small variation between actual measured aircraft noise levels and the AEDT modeled noise levels provides additional system verification that AEDT is providing an accurate assessment of the aircraft noise impacts around MSP.

5.3.8 2018 Base Year Condition Noise Impacts

In the 2018 Base Year noise contours there are 638 acres within the 75 DNL contour, which is entirely contained on airport property. The 70 DNL contour contains approximately 1,588 acres. The 65 DNL contour contains approximately 4,444 acres. The 60 DNL contour contains approximately 11,323 acres.

While the FAA considers residential structures incompatible within the 65 DNL noise contour, the MAC's noise mitigation program at MSP Airport offers residential noise mitigation to the 60 DNL level.

A depiction of the 2018 Base Year noise contour is provided in **Exhibit 5-4.**

Table 5-4 contains the count of residential units in the 2018 Base Year noise contours. The analysis is based on parcels intersect methodology where all parcels that are within or touched by the noise contour are counted.

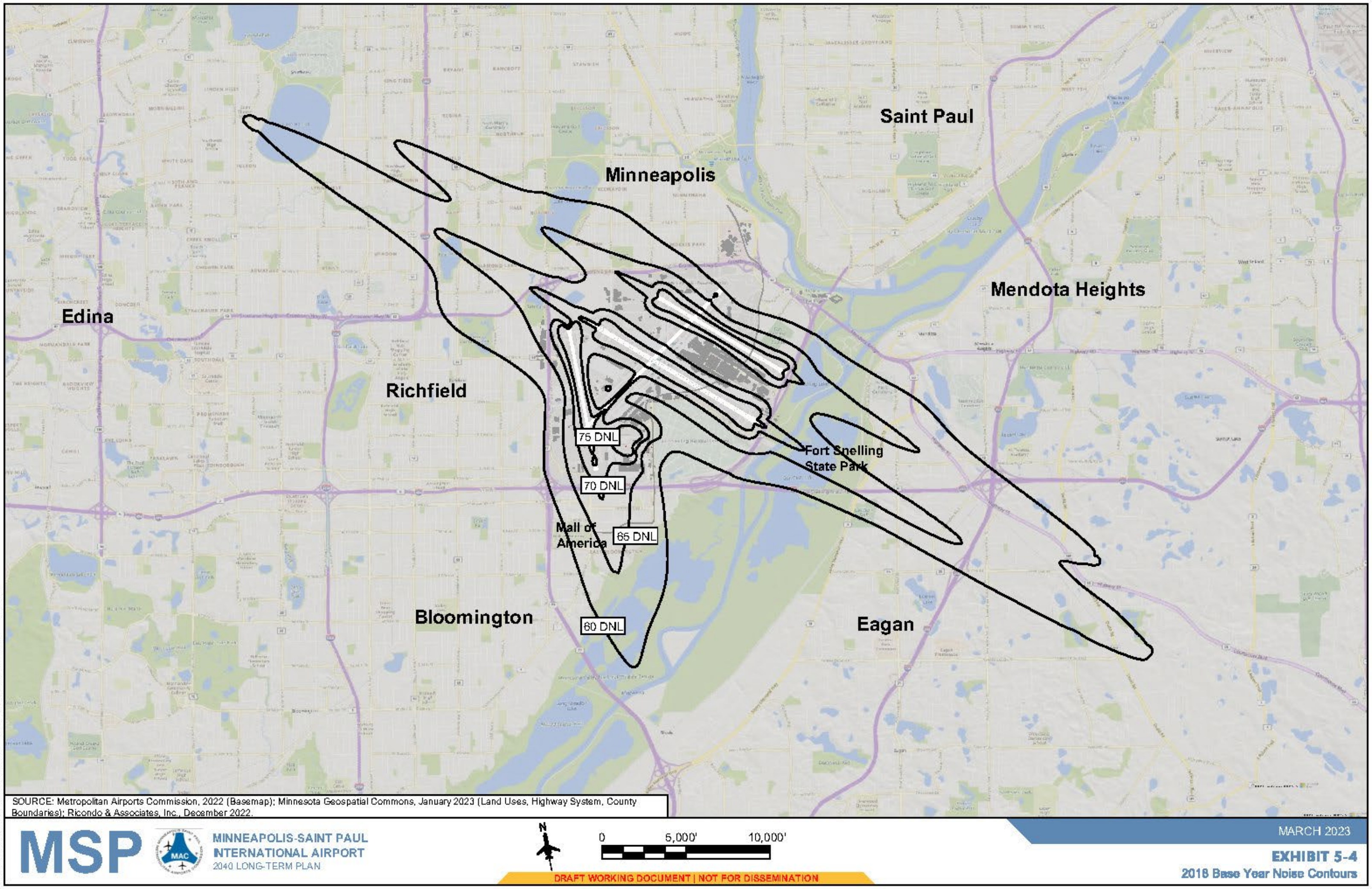
Table 5-4: 2018 Base Year Noise Impact Summary

	Single-Family					Multi-Family				
City	60-64	65-69	70-74	75+	Total	60-64	65-69	70-74	75+	Total
Bloomington	13	-	-	-	13	1,377	-	-	-	1,377
Eagan	258	1	-	-	259	-	-	-	-	-
Mendota Heights	46	1			47					-
Minneapolis	6,703	957	-	-	7,660	1,540	256	-	-	1,796
Richfield	582	4			586	184				184
Total	***7,602***	***963***	**-**	**-**	***8,565***	***3,101***	***256***	**-**	**-**	***3,357***

NOTES: Parcel intersect method. Single-family units defined as one unit per structure. Multi-family units defined as greater than one unit per structure. The spatial analysis was performed in Universal Transverse Mercator (UTM Zone 15).
SOURCE: HNTB provided AEDT contours; Metropolitan Council parcel data, Jan 2023; MAC analysis, 2023

The 2018 Base Year contour qualified 243 residences to become eligible for the MAC's noise mitigation program. Another 313 residences were within the 2018 Base Year 60 DNL contour and at a higher noise impact area for one year; however, these homes did not stay in higher noise impact areas in 2019 and were not eligible to receive noise relief from the MAC.

Exhibit 5-4: 2018 Base Year Noise Contours



5.3.9 2040 Forecast Scenarios Noise Impacts

All three forecast scenarios (2040 Baseline, High and Low) were used to develop DNL contours to display a range potential of noise impact levels 20 years into the future.

A depiction of the three 2040 forecast scenarios is provided in **Exhibit 5-5**.

In the 2040 Baseline Forecast noise contours there are 826 acres within the 75 DNL contour, which is entirely contained on airport property. The 70 DNL contour contains approximately 2,212 acres. The 65 DNL contour contains approximately 5,933 acres. The 60 DNL contour contains approximately 15,775 acres.

A depiction of the 2040 Baseline Forecast noise contour is provided in **Exhibit 5-6.**

Table 5-5 contains a summary of the 2040 Baseline Forecast noise impact. The analysis followed the same methodology and definitions as the 2018 Base Year analysis described above.

Table 5-5: 2040 Baseline Forecast Noise Impact Summary

	Single-Family					Multi-Family				
City	60-64	65-69	70-74	75+	Total	60-64	65-69	70-74	75+	Total
Bloomington	94				94	1,895				1,895
Eagan	586	4			590					
Inver Grove Heights	63				63					
Mendota Heights	48	1			49					
Minneapolis	9,752	2,251	49		12,052	2,745	743	4		3,492
Richfield	1,506	116			1,622	585				585
Total	***12,049***	***2,372***	***49***	***-***	***14,470***	***5,225***	***743***	***4***	***-***	***5,972***

Notes: Parcel intersect method. Single-family units defined as one unit per structure. Multi-family units defined as greater than one unit per structure. The spatial analysis was performed in Universal Transverse Mercator (UTM Zone 15).

Source: HNTB provided AEDT contours; Metropolitan Council parcel data, Jan 2023; MAC analysis, 2023

Of the 14,470 single-family homes within the 2040 Baseline Forecast 60 DNL contour, there are 1,388 that are outside the area mitigated by the MAC's noise mitigation program. All single-family homes within the 2040 Baseline Forecast 65 DNL contour have been eligible for the MAC's 5 dB noise reduction package. Of the 5,972 multi-family units within the 2040 Baseline Forecast 60 DNL contour, there are 649 that are outside the area mitigated by the MAC's noise mitigation program.

A comparison of the 2018 Base Year and 2040 Baseline Forecast noise contours is shown in **Exhibit 5-7**.

Exhibit 5-5: 2040 Forecast Scenarios Noise Contours

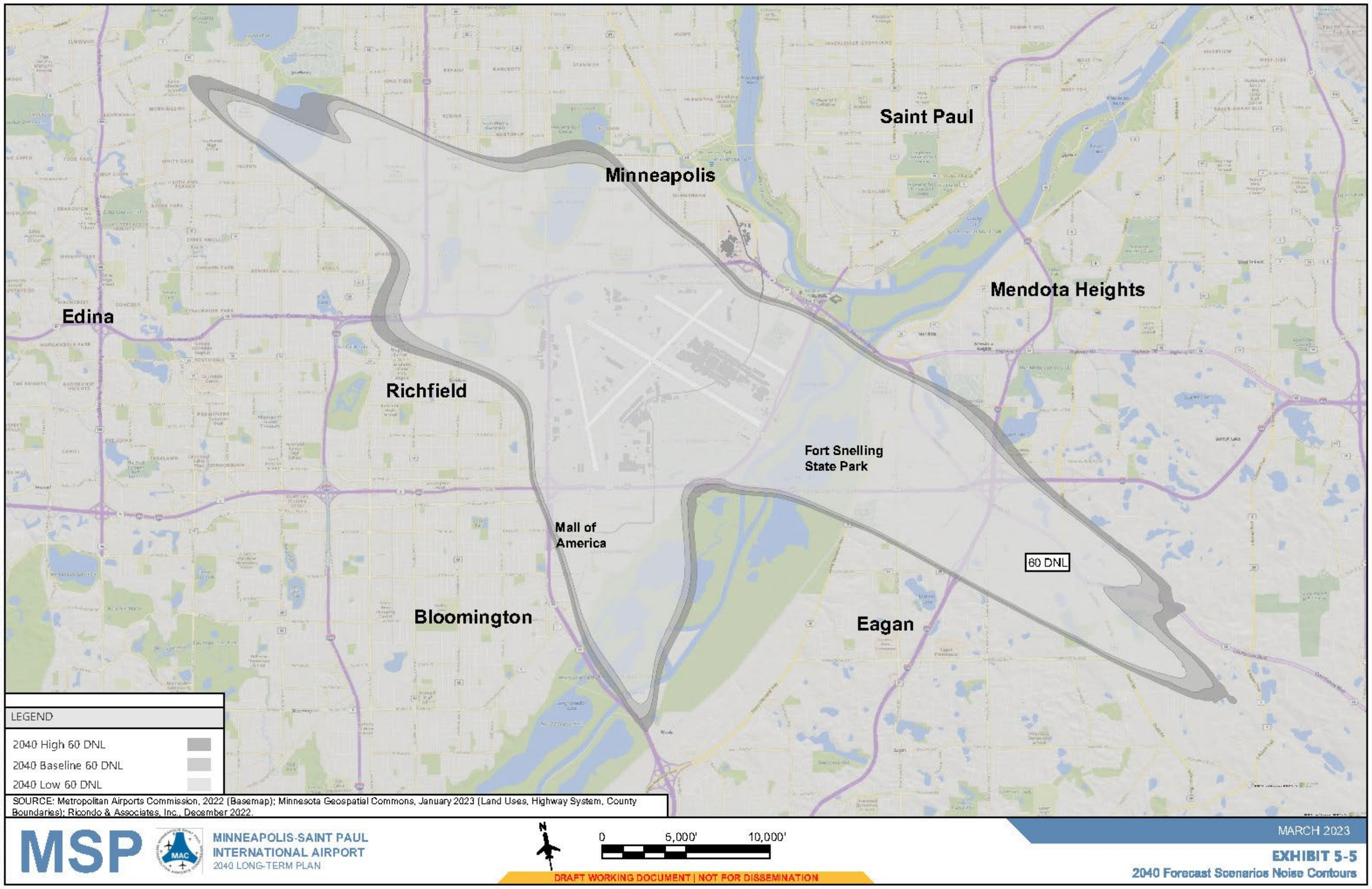


Exhibit 5-6: 2040 Baseline Forecast Noise Contours

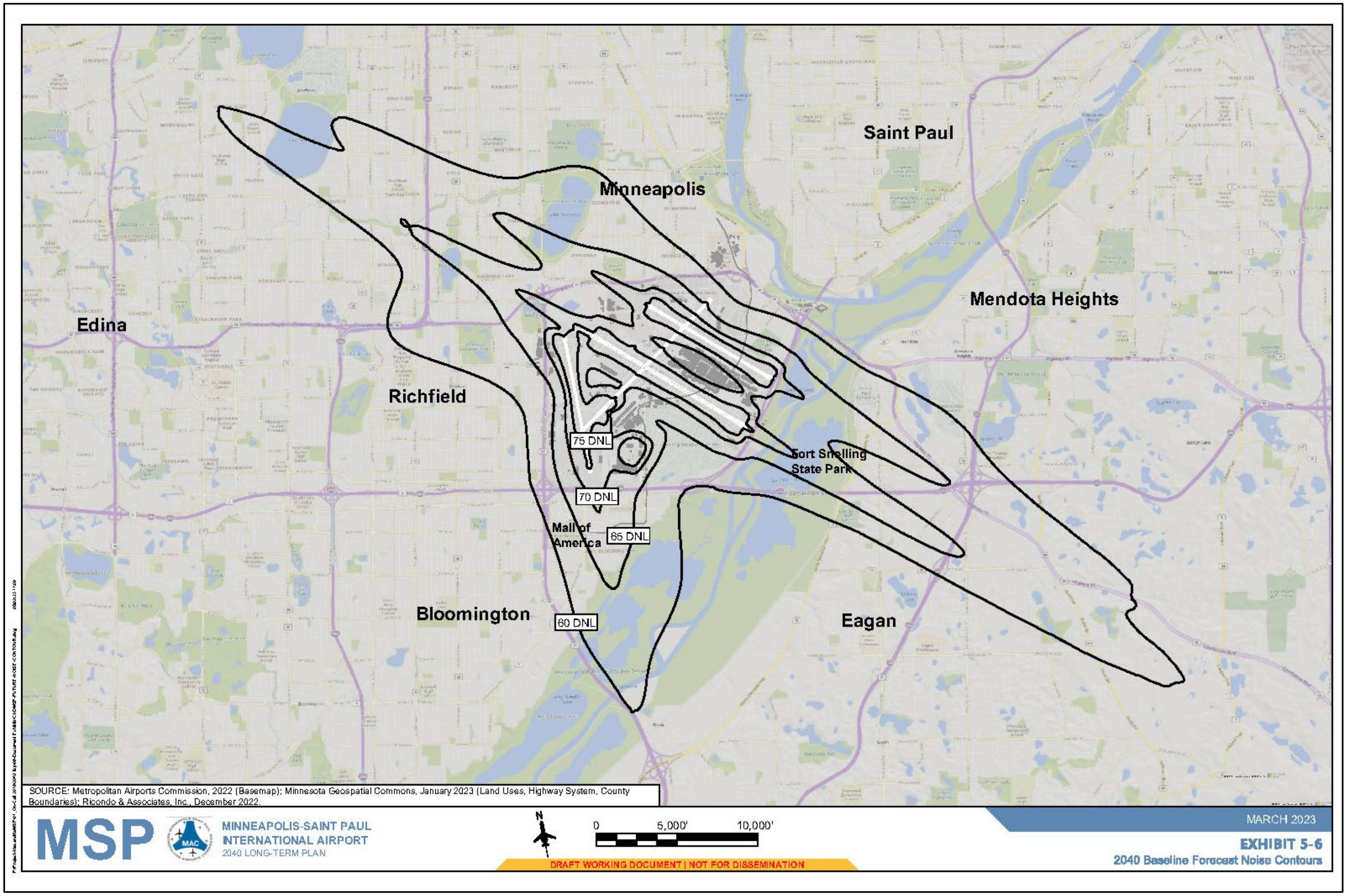
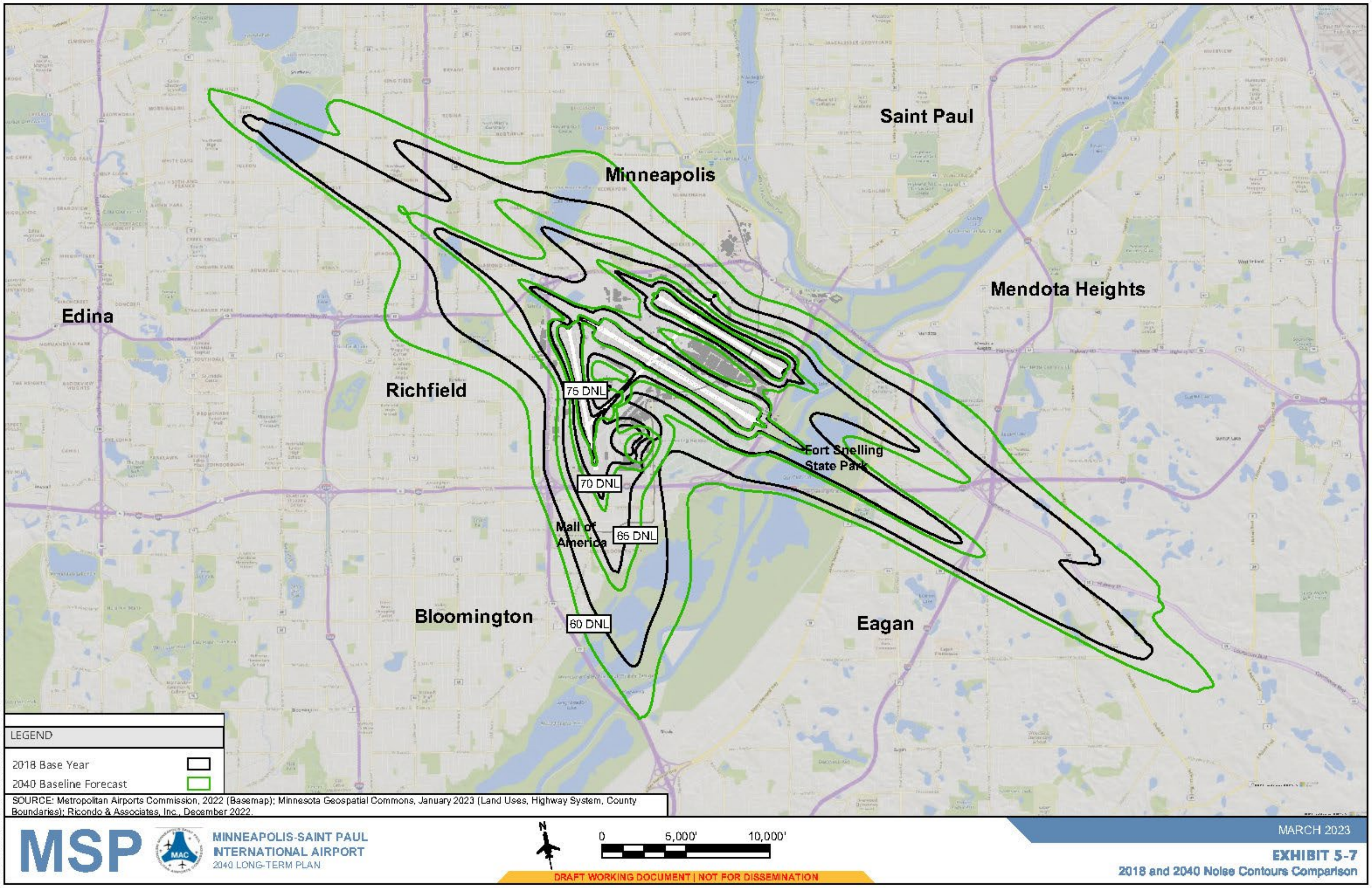


Exhibit 5-7: 2018 Base Year and 2040 Forecast Noise Contours Comparison



5.4 AIR QUALITY

This section reviews the methodologies and results of the air quality impact analyses that are presented in Section 5.1 of **Appendix B**, which was published in January 2013 (for additional details reference the appendix). Regarding the regulatory background, the main regulating rulings include NEPA and the Clean Air Act of 1970 (CAA). National Ambient Air Quality Standards (NAAQS) were used to establish criteria for pollutants. A criteria pollutant emissions inventory, including operational emissions and construction emissions, was used to evaluate the alternatives reviewed in this report (referred to as Action Alternatives).[4] Air quality thresholds of significance are based on the NAAQS / Minnesota Ambient Air Quality Standards (MAAQS) and the General Conformity Rule, as they relate to carbon monoxide (CO) and other pollutants. The Minnesota Pollution Control Agency (MPCA) operates ambient monitoring stations as part of the statewide air monitoring program.

At the time of the publication of **Appendix B**, the MAC functioned under an Option D Registration Permit, and based on forecast emissions, the MAC was not forecast to exceed permit thresholds. As explained earlier in this chapter, because 2040 operations were forecast as less than the operations forecasts used for **Appendix B**, the thresholds should not be exceeded (as long as the regulations used remain valid).

5.4.1 Aircraft, Ground Service Equipment, and On-Site Roadway Emissions

As part of its statewide air monitoring program, the MPCA runs ambient (outdoor) air quality monitoring stations. The closest monitoring stations to MSP are at the Hans Christian Andersen School and Ramsey Health Center. These stations document levels of U.S. Environmental Protection Agency (EPA) criteria air pollutants. All concentrations of pollutants are within the NAAQS. In May 2006, the MPCA published a study of ambient monitoring conditions near MSP. This study measured air toxins and criteria pollutants. The locations of the study included Wenonah School, Richfield Middle School, and two areas within the Airport property. The median and average concentrations of pollutants observed near MSP were comparable to other monitored locations in the Twin Cities metropolitan area.

The air quality study area differs by emission source (i.e., aircraft, ground service equipment [GSE], motor vehicles) and pollutant. Aircraft emissions during the modes of a landing/takeoff cycle reach the atmospheric mixing height of approximately 3,000 feet. This altitude stretches approximately 1.5 miles past the runway ends, depending on the aircraft type. GSE emissions are mainly restricted to the main terminal aprons and cargo facilities, whereas on-site motor vehicle emissions are mostly constricted to the on-site roadways, terminal curbsides, and parking facilities.

Because Airport-related motor traffic can potentially impact off-site intersections, the air quality study included several regional roadways near MSP: I-494, TH 77, TH 62, and TH 5. The following information summarizes the 2010 baseline conditions within the study area.

The total baseline (2010) emissions were measured as follows: 5,818 tons per year of CO; 407 tons per year of volatile organic compounds (VOCs); 2,027 tons per year of nitrogen oxide (NO_x);

[4] Action Alternative 1 represented a plan where airlines remained in their existing locations. Action Alternative 2 (the preferred alternative) represented a plan where the airlines relocated, as necessary. These action alternatives are similar to both the 2030 and 2040 preferred alternatives.

177 tons per year of sulfur dioxide (SO_2); 38.8 tons per year of particulate matter with a diameter of 10 microns or less (PM_{10}); 36.2 tons per year of particulate matter with a diameter of 2.5 microns or less ($PM_{2.5}$), and 0.04 tons per year of lead (Pb).

Table 5-6 summarizes the baseline condition for the macroscale dispersion analysis. The maximum concentration of 28.4 parts per million (ppm) of CO occurs southeast of T1. Here, GSE activity is the main contributor to CO concentration. The maximum-predicted concentration is less than the 1-hour CO standard of 30.0 ppm. The maximum 8-hour CO concentration of 8.0 ppm occurs in the same location because of the same activities. This concentration does not exceed the 8-hour CO standard of 9.0 ppm.

Table 5-7 summarizes the baseline condition for the roadway intersection analysis. The highest 1-hour CO concentration predicted at the Fort Snelling National Cemetery near the 34th Avenue South and I-494 interchange is estimated to be 6.2 ppm. The maximum 8-hour concentration of 4.4 ppm occurs at the same location. The 1-hour concentration at the Crowne Plaza Hotel at the 34th Avenue South and American Boulevard intersection is estimated to be 5.8 ppm, with an 8-hour concentration of 3.7 ppm. All the estimated maximum 1-hour and 8-hour CO concentrations are within the applicable standards of 35/30 and 9.0 ppm.

Table 5-6: Dispersion Modeling Results

2010 Baseline Condition – Carbon Monoxide Macroscale Dispersion Modeling Results (ppm)					
Averaging Time	**Maximum Modeled Concentration**	**Background Concentration**	**Total Predicted Concentration**	**NAAQS/ MAAQS**	**Exceeds NAAQS/MAAQS**
1-hour	24.0	4.4	28.4	35/30	No
8-hour	5.4	2.6	8.0	9/9	No

NOTES:
ppm – Parts per Million
NAAQS – National Ambient Air Quality Standards
MAAQS – Minnesota Ambient Air Quality Standards
SOURCE: Metropolitan Airports Commission, *Minneapolis–St. Paul International Airport 2020 Improvements Final Environmental Assessment Worksheet*, January 2013.

Table 5-7: Roadway Intersection Analysis Results

2010 Baseline Condition – Carbon Monoxide Roadway Intersection Analysis Results (ppm)						
Intersection	Averaging Time	Maximum Modeled Concentration	Background Concentration	Total Predicted Concentration	NAAQS/ MAAQS	Exceeds NAAQS/ MAAQS
34th Avenue South and I-494 Interchange	1-hour	1.8	4.4	6.2	35/30	No
	8-hour	1.8	2.6	4.4	9/9	No
34th Avenue South and American Boulevard	1-hour	1.4	4.4	5.8	35/30	No
	8-hour	1.1	2.6	3.7	9/9	No

NOTES:
ppm – Parts per Million
NAAQS – National Ambient Air Quality Standards
MAAQS – Minnesota Ambient Air Quality Standards
SOURCE: Metropolitan Airports Commission, *Minneapolis-St. Paul International Airport 2020 Improvements Final Environmental Assessment Worksheet*, January 2013.

5.4.2 Regional Roadway Emissions

The ozone levels within the Twin Cities metropolitan area currently meet both state and federal standards, and overall reductions in ozone levels were observed between 2007 and 2010. The EPA has classified the State of Minnesota as an “ozone attainment area,” which implies Minnesota has been identified as a geographic area that meets the national health-based standards for ozone levels. Due to these factors, a quantitative ozone analysis was not conducted for this study.

Recently, the State of Minnesota was designated as an unclassifiable/attainment area for particulate matter (PM), meaning Minnesota has been established as a geographic area that meets the national health-based standards for PM levels; therefore, the state is exempt from qualitative hotspot analyses for PM.

Within the specified project area, the possibility of nitrogen dioxide (NO_2) standards being approached or exceeded is low based on the limited ambient concentrations of NO_2 in Minnesota and the long-term trend toward a reduction of NOx emissions. Due to these factors, a specific analysis of NO_2 was not conducted for this study.

Transportation sources produce emissions of SO_2, which are a small component of the overall production of emissions that continue to decline due to the desulphurization of fuels. The EPA has classified the State of Minnesota as a “SO_2 attainment area,” which implies Minnesota has been identified as a geographic area that meets the national health-based standards for SO_2 levels. Due to these factors, a quantitative analysis for SO_2 was not conducted for this study.

Projects included in the Transportation Improvement Plan (TIP)[5] and evaluated for Transportation Conformity only include those that are funded and approved prior.

5.5 SANITARY SEWER AND WATER

Using information from **Appendices A** and **B**, which were published in 2008 and 2010, respectively, this section reviews the key information regarding sanitary sewer (also known as wastewater) and stormwater, water supply, solid waste, and wetlands.

During the development of the 2040 LTP, additional review and studies for sanitary sewer and water will be completed as necessary. These studies will be in collaboration with adjacent communities to ensure the most up-to-date information on capacity and other related factors are available prior to advancing project construction.

5.5.1 Sanitary Sewer

According to Section 5.18.4 in **Appendix B**, generated wastewater discharged from the MSP campus is conveyed and treated by the Metropolitan Council Environmental Services (MCES) at the Metro Wastewater Treatment Plant (Metro Plant). The Metro Plant has an operating and design capacity of 251 million gallons per day (MGD). Based on Chapter 5 of **Appendix B**, the proposed projects are expected to increase passenger loads by approximately 50% between 2008 and 2030, which will coincide with similar increases in wastewater discharge.

The wastewater is discharged to the Metro Plant per the MCES sewer interceptor system. MSP discharged wastewater is conveyed to the interceptor system through three different sewer systems. The majority of the discharged wastewater from the Airport is then transported to a tunnel near the Mississippi River and then discharged into the interceptor system. The City of Minneapolis sewer system discharges a small volume of wastewater prior to reaching the MCES interceptors. The southwest portion of the MSP campus wastewater is discharged to the City of Richfield sewer system before reaching the MCES inceptors.

Based on the passenger loads determined in **Appendix A** (completed in 2008), the estimated 50% increase in passenger loads would increase the daily discharge volume by approximately 0.35 MGD. The increase would be conveyed through the tunnel and Richfield systems. Assuming a 2.5 peak loading factor, this would amount to a peak addition of approximately 37,000 gallons per hour. The increase in loading would not be expected to be an issue with the Metro Plant's total capacity, because the increase would amount to less than 0.2% of the plant's daily treatment capacity. However, there could be issues with the wet-weather conveyance capacity of the interceptor system from other municipal sources. According to the MCES, there is sufficient dry-weather capacity in the MCES interceptor system to handle the proposed increase in flow. Additionally, the City of Bloomington has the option to divert its discharges through the Richfield oversized system to the Metro Plant if Bloomington's conveyance system to the Seneca Wastewater Treatment Plant is obstructed. However, this is unlikely as Bloomington's conveyance system was upgraded around 2008. Therefore, the Richfield system should have adequate capacity.

[5] Regionally significant projects are part of the 4-year TIP.

The MAC-owned sanitary sewer infrastructure, regardless of whether the proposed CIP projects for MSP are implemented, may require upgrades to convey both terminals' higher volumes of wastewater (upstream of the tunnel and Richfield systems). As development decisions are being made, the MAC will evaluate the existing capacity of the MAC-owned sanitary sewer system to identify when and where the limitations of wastewater capacity may be encountered.

The MAC has taken measures to reduce the municipality-supplied potable water through a reduction in water usage and wastewater volumes, such as through the use of high-efficiency fixtures/valves, like automatic sensors. The measures have resulted in the reduction of the sanitary sewer flow; therefore, capacity exists for the projects planned in the LTP.

5.5.2 Water Supply

As noted in **Appendix A**, the MSP campus uses an approximate 1 million gallons of potable water per day (as of 2008). The potable water is used for several Airport facilities and activities, such as concession facilities, restroom facilities, facility cleaning, tenant facilities, cargo facilities, irrigation, and rental car wash facilities. The proposed projects include expansions at both terminals' concourses. The expansions will include additions to both concession and restroom facilities, along with other water-using facilities. In addition, the plan also includes a hotel that would be another significant user of potable water.

The proposed projects would increase the water demand at the MSP campus. Both water and fire flow demand will be incorporated as projects are reviewed for preliminary engineering and design. However, the added water demand from the proposed projects is not expected to exceed the 1.5 MGD.

All the water used on the MSP campus is provided by the City of Minneapolis. At the time **Appendix A** was created, the city had a maximum capacity of 180 MGD, in which the city reached a maximum peak of approximately 145 MGD in 2007. Furthermore, capacity enhancements will not be required in Minneapolis for the increased water usage. An option to obtain additional water from the City of Richfield was studied. If this option is pursued, construction would occur at locations that are within a down gradient of public wells and outside the City of Richfield wellhead protection area limits.

Reducing the amount of water use on the campus is one of the key goals of the MAC's overall sustainability efforts. Upcoming projects to replace high-flow toilets and/or incorporate rainwater reuse for landscaping will help MAC attain its water reduction goal.

5.5.3 Water Resources

5.5.3.1 Surface Water

Based on Section 5.18 of **Appendix B**, the surface water study area includes the storm sewer collection, the MSP stormwater ponds, the Minnesota Department of Transportation (MnDOT) Almaz Pond, the I-494 bypass pond, and the Minnesota River. These ponds on the MSP site cover approximately 2,840 acres, where impervious surfaces cover 1,880 acres. The majority of stormwater drains to retention ponds to discharge to the Minnesota River via storm sewers from MSP. A smaller portion of the stormwater drains to Mother Lake from MSP.

Almost all Airport activity on the west side of MSP, including T2, the cargo facilities, and Runway 17-35, discharges stormwater to the MSP Pond 1 drainage area. The majority of Airport activity that includes most of T1 discharges stormwater to the MSP Pond 2 discharge area. MSP Ponds 1 and 2 were designed to determine total suspended solids to the Minnesota River by an approximate factor of 80%, and they can contain any fuel spills that may happen.

MSP Ponds 3 and 4 work together in which they receive stormwater discharge from portions of T1 that serve regional aircraft, parts of Runways 12L-30R and 4-22 and their associated taxiways, inbound and outbound roadways, the post office, Air Force Reserve, and the MNANG airside operations. The two ponds also diminish the total suspended solids (TSS) discharge to the Minnesota River by 80%, and they can contain fuel spills.

Additionally, portions of I-494, TH 77, and other related roadways discharge stormwater to the MnDOT Almaz Pond. The MnDOT Almaz Pond was also designed with the same standards as Ponds 1 and 2 to diminish the annual TSS discharge by approximately 80%.

5.5.3.2 Groundwater

The MSP groundwater flows toward the Minnesota River in an east/southeasterly direction, where all groundwater eventually flows into the Minnesota River basin. The MSP groundwater flows into the downstream receptors of the Minnesota River and Fort Snelling State Park.

The Twin Cities basin, where the MSP campus is located, is underlain by a complete section of Paleozoic bedrock, which is mantled with a variety of glacial sediments. The bedrock units (from youngest to oldest) include Decorah shale, Platteville limestone, Glenwood shale, St. Peter sandstone, Prairie du Chien formation, Jordan sandstone, and the St. Lawrence formation. Both the Glenwood shale and the St. Peters sandstone serve as confining layers to prevent the vertical migration of groundwater to the Prairie du Chien-Jordan aquifer system.

The MAC created a comprehensive well network at MSP and has been regularly sampling and reporting the groundwater since 2005. Petroleum-related impacts and residuals from the aircraft deicing fluid (ADF) are the primary contaminates in groundwater at MSP.

The groundwater monitoring data that have been collected have shown that free product or petroleum contamination does not exist at the MSP campus, outside the petroleum release sites that are historically known. Additionally, demand testing for propylene glycol and chemical oxygen has indicated Airport-wide subsurface glycol impacts are not present.

The site has two factors that make MSP a suitable hydrogeological setting for the natural protection of deeper aquifers. First, the confining layers of the St. Peter sandstone and Glenwood shale inhibit the downward flow of fuel or other contaminants obtained from the surface into the water sources below. Secondly, the regional groundwater discharge location is believed to be the Minnesota River system, and the zone between MSP and the river system is the area of potential impact.

The MAC and its tenants have established active programs to help protect against groundwater contamination at the MSP campus, in addition to the natural protection features. The programs include fueling system and tank tightness testing, tanks and fueling systems in compliance with current regulations for secondary containment, corrosion protection and spill/overfill protection, an integrated spill plan (ISP), glycol collection systems at locations where ADF is applied, and an extensive groundwater monitoring network.

Based on **Appendix B**, when groundwater impacts occur, mitigation should be in accordance with MPCA permits and regulations.

5.5.3.3 Drinking Water

There are no drinking water wells located on the MSP campus or on the down gradient that is between MSP and the Minnesota River location for the groundwater discharge. The Minnesota River is not a resource for drinking water.

5.5.4 Solid Waste

Based on **Appendix B**, all Action Alternatives would produce the same quantity of solid waste. The number of passengers is proportional to the amount of solid waste. With the same number of passengers in each alternative, the amount of solid waste would be consistent; therefore, the Action Alternatives would not impact post-construction solid waste.

Reducing the amount of solid waste sent to landfill is a key goal of the MAC's overall sustainability goals. MAC is already incorporating waste reduction strategies into concession programs, including paper towel compactors in restrooms, compactors in trash cans within terminal spaces, expanding organics and recycling opportunities, and implementing compostable-only employee events.

A project's contractor typically oversees waste materials produced from construction. The reuse and salvaging of building materials is exercised whenever possible. Maximizing the recovery of recyclable construction and demolition waste, like metal and concrete, is a standard practice. When appropriate, high volumes of concrete are crushed and reused on-site. Non-recyclable materials are transported to a landfill. Hazardous waste is managed and regulated at local disposal facilities in accordance with applicable procedures. Waste generated from the Action Alternatives can be accommodated by the processing facilities and disposal sites.

5.5.5 Wetlands

Wetland activity is addressed in Executive Order 11990, *Protection of Wetlands*, U.S. Department of Transportation Order 5660.1A, *Preservation of the Nation's Wetlands,* the Rivers and Harbors Act of 1899, and the Clean Water Act. Additionally, the Minnesota Wetland Conservation Act (WCA) serves as the regulation for wetlands.

According to **Appendix B**, a location between the north- and south-bound lanes of TH 5 is the only study area with wetland characteristics, and it is not shown on the National Wetland Inventory map. The Hennepin County Soil Survey identifies non-hydric soils at this location. Based on old aerial photos and highway construction drawings, this area was previously an upland with a gravel roadway and maple trees. Because this area's wetland characteristics are not natural, the area is exempt from the WCA. Therefore, the study area does not include jurisdictional wetlands protected by the Minnesota Department of Natural Resources or WCA. Based on the same criteria, the area does not qualify as a U.S. Army Corps of Engineers wetland.

Because the study area is free of wetlands, it would not be impacted by any of the alternatives.

Potential impacts were also measured outside the study area. It was concluded that none of the alternatives would substantially alter the drainage areas or runoff volumes. Minor changes in impervious surfaces occur in areas where stormwater runoff is collected by storm sewers. These storm sewers discharge into stormwater ponds for control before being released into the Minnesota River. Thus, none of the alternatives would impact wetlands outside the study area.

5.6 OTHER ENVIRONMENTAL CONSIDERATIONS

It is anticipated that most of the projects in the preferred development plan will require an environmental review process per federal NEPA and Minnesota Environmental Policy Act (MEPA) requirements to identify the environmental footprint of the improvements more specifically before construction can begin. During that process, alternatives must be reviewed and any potential impacts must be avoided if possible. If impacts cannot be avoided, they must be minimized to the extent possible and mitigated in full compliance with federal and state requirements.

Please note that a few projects that are currently or soon to be implemented were covered in the previous environmental review process and will continue their implementation schedule ahead of new projects proposed in this LTP.

The following impact categories will be assessed during the environmental review:

- Air quality
- Biological resources (including fish, wildlife, and plants)
- Climate
- Department of Transportation Section 4(f) properties (park and recreational lands, wildlife and waterfowl refuges, and historic sites)
- Farmlands
- Hazardous materials, solid waste, and pollution prevention
- Historical, architectural, archeological, and cultural resources
- Land use
- Natural resources and energy supply
- Noise and compatible land use
- Socioeconomics, environmental justice, and children's environmental health and safety risks
- Visual effects (including light emissions)
- Water resources (including wetlands, floodplains, surface waters, groundwater, and wild and scenic rivers)
- Construction impacts
- Cumulative effects

The environmental review process cannot begin until a sufficiently detailed plan is available to evaluate. The MAC will initiate the environmental review for the preferred development plan following the review by Metropolitan Council and formal adoption by the MAC Board. A full study of these environmental impact items currently falls outside the scope of this document.