Akron-Canton Airport (CAK) Part 150 Update Study
PROJECT MEMORANDUM

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To:	Part 150 Advisory Committee
From:	Ted Baldwin and Justin Divens, HMMH
Subject:	Background for the Fourth Advisory Committee Meeting
Date:	January 9, 2014
Reference:	HMMH Project Number 305231.003/4

1. PURPOSE

This memorandum presents noise contours, analyses, and other material for discussion at the fourth CAK Part 150 Advisory Committee meeting, planned for February 5, 2014, to address the following major purposes:

- Presenting draft 2014 and 2019 Noise Exposure Map contours and land-use analyses
- Addressing noise issues raised in the committee meetings and first workshop
- Providing bases for initiating the first-round noise abatement contours
- Responding to a question about the 2004 Environmental Assessment forecast

2. DRAFT 2014 AND 2019 NOISE EXPOSURE MAP CONTOURS AND LAND-USE ANALYSES

Table 1 on the following page presents an excerpt from the FAA's Part 150 Noise Exposure Map Checklist that identifies the FAA's graphical requirements for a Noise Exposure Map submission.[1]

Figures 1 and 2 present draft 2014 and 2019 Noise Exposure Map figures that contain all required elements, with the exception of flight tracks, which (as item IV.E of the checklist notes) Part 150 permits airports to submit in supplemental graphics.[2]

As noted in item IV.D of the checklist, Part 150 requires that Noise Exposure Maps depict the 65, 70, and 75 DNL noise contours. For informational purposes only at this time, the figures also include the 60 DNL noise contour, using a dashed line.

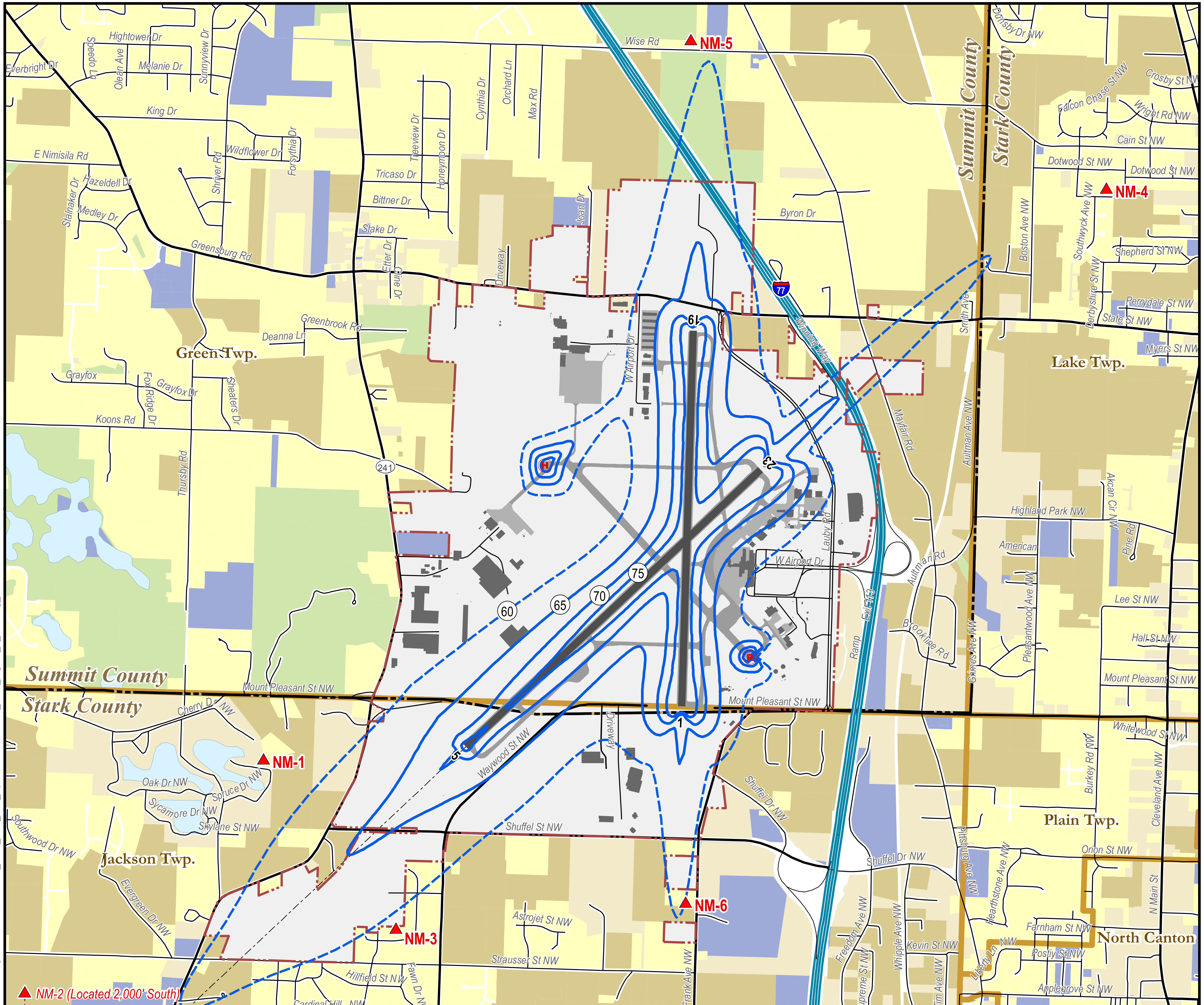
Under Part 150 land use compatibility guidelines, which CAK and local land use control jurisdictions have adopted in prior Part 150 processes, FAA considers all land uses compatible outside of 65 DNL. As noted on the figures and in Table 1, there is no noncompatible land use within the Noise Exposure Map contours for either 2014 or 2019, including consideration of actual current land use and zoning for undeveloped land use. There are no discrete "sensitive receptors" within the 65 DNL contour for either year (e.g., schools, health care places of worship, facilities, etc.).

[1] The full checklist is presented in Table 1 of the September 2013 "Project Introduction and Inventory Report."

[2] These supplemental graphics were presented for Advisory Committee review in Figures 33 – 35 of the "Project Introduction and Inventory Report."

Table 1 Excerpt from Part 150 Noise Exposure Map Checklist

FAR PART 150 NOISE EXPOSURE MAP CHECKLIST-PART I (Excerpt presenting graphical requirements only)			
Airport Name: Akron-Canton Airport	Reviewer:		
	Yes/No/ NA	Page/Other Reference	Notes/ Comments
IV. MAP SCALE, GRAPHICS, AND DATA REQUIREMENTS: [A150.101, A150.103, A150.105, 150.21(A)]			
A. Are the maps of sufficient scale to be clear and readable (they must be not be less than 1" to 2,000'), and is the scale indicated on the maps?	Yes	On figures	1” to 2,000’
B. Is the quality of the graphics such that required information is clear and readable?	Yes	On figures	
C. Depiction of the airport and its environs.			
1. Is the following graphically depicted to scale on both the existing condition and 5-year maps:	Yes	On figures	
a. airport boundaries	Yes	On figures	
b. runway configurations with runway and numbers	Yes	On figures	
2. Does the depiction of the off-airport data include:			
a. a land use base map depicting streets and other identifiable geographic features	Yes	On figures	
b. area within 65 DNL (or beyond, at local discretion.)	Yes	On figures	
c. clear delineation of geographic boundaries and the names of all jurisdictions with planning and land use control authority within the 65 DNL (or beyond, at local discretion).	Yes	On figures	
D. 1. Continuous contours for at least DNL 65, 70, and 75?	Yes	On figures	
2. Based on current airport and operational data for the existing condition year Noise Exposure Map, and forecast data for the 5-year Noise Exposure Map?	Yes	On figures	
E. Flight tracks for the existing condition and 5-year forecast time frames (these may be on supplemental graphics which must use the same land use base map as the existing condition and 5-year Noise Exposure Map), which are numbered to correspond to accompanying narrative?	Flight tracks are presented on supplemental graphics, in Figures 33 – 35 of the September 2013 “Project Introduction and Inventory Report.”		
F. Locations of any noise monitoring sites (these may be on supplemental graphics which must use the same land use base map as the official Noise Exposure Maps)	Yes	On figures	Not used for any modeling purposes.
G. Noncompatible land use identification:			
1. Are noncompatible land uses within at least the 65 DNL depicted on the maps?	There is no noncompatible land use within the Noise Exposure Map contours for either 2014 or 2019, including consideration of actual current land use and zoning for undeveloped land use. There are no discrete “sensitive receptors” within the 65 DNL contour for either year (e.g., schools, health care places of worship, facilities, etc.).		
2. Are noise sensitive public buildings identified?			
3. Are the noncompatible uses and noise sensitive public buildings readily identifiable and explained on the map legend?			
4. Are compatible land uses, which would normally be considered noncompatible, explained in the accompanying narrative?			



![Akron-Canton Airport logo]

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Figure 1
Draft 2014 Existing Conditions Noise Exposure Map
14 CFR Part 150 Update

- 2014 DNL Contour (65-75 dB)
- 2014 DNL Contour (60 dB)
- Airport Property Boundary
- Airport Runway
- NM-# Portable Noise Monitoring Sites
- OANG Helipad
- Designated Runup Location
- County Boundary
- Township Boundary

Land Use (Actual or zoned. Draft subject to verification.)

- Residential Use
- Public Use
- Commercial Use
- Manufacturing and Production
- Recreational and Open Space
- Interstate Highways
- Primary Roads
- Local Roads
- Water Bodies

Notes:
Part 150 Sec. A150.101, Table 1 presents FAA land use compatibility guidelines as a function of yearly DNL. Under those guidelines, all land uses are considered compatible with noise exposure outside 65 DNL.

Portable Noise Monitoring Site NM-2 (Not Shown) is located southwest 11,327' along runway 5 extended centerline, offset northwest 1,031'

North

0 2,000 4,000 Feet

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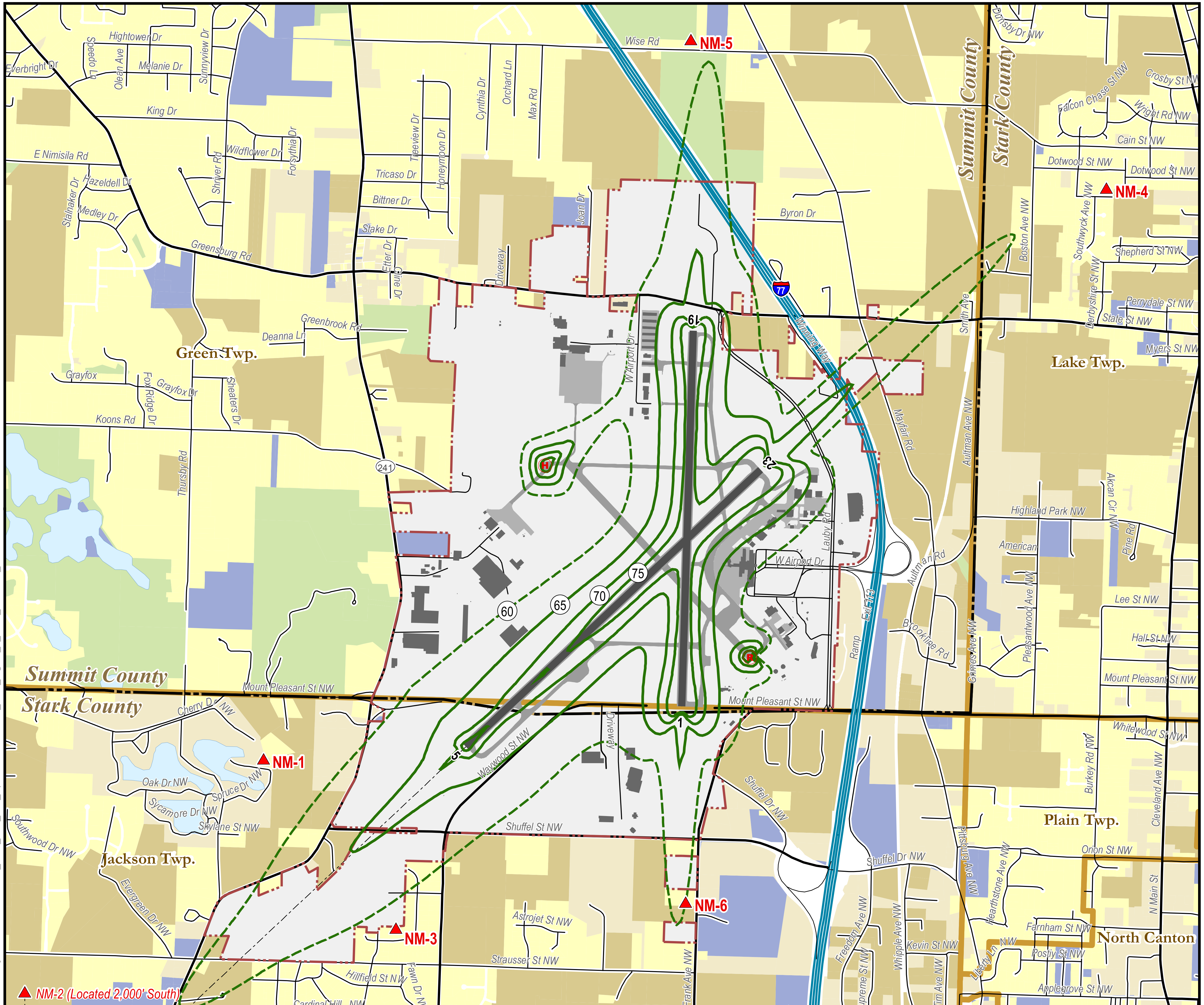

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Figure 2
2019 Five-Year Forecast Conditions
Noise Exposure Map
14 CFR Part 150 Update

- 2019 DNL Contour (65-75 dB)
- 2019 DNL Contour (60 dB)
- Airport Property Boundary
- Airport Runway
- NM-# Portable Noise Monitoring Sites
- OANG Helipad
- Designated Runup Location
- County Boundary
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3. ADDRESSING ISSUES RAISED IN THE COMMITTEE MEETINGS AND FIRST WORKSHOP

At Advisory Committee meetings and the first workshop, and in other communications, stakeholders have requested information on the following issues:

- Comparison of measured and modeled noise exposure
- Day versus night exposure
- Corporate jet exposure
- Commercial jet exposure
- Ohio Army National Guard (OANG) helicopter exposure

These matters are addressed in that order below.

3.1 Comparison of Measured and Modeled Noise Exposure

Table 2 presents the overall DNL measured at the six monitoring locations visited during the June 2013 portable noise measurement program, compared to the modeled DNL forecast for annual average day activity in 2014 and 2019. The table also identifies the numbers of hours of measurements conducted at each location, to assist in placing the measured and modeled values in perspective, and reports the difference between the 2014 measured and modeled results.[3] The DNL figures presented in this report depict the measurement locations.

Table 2 Comparison of 2014 and 2019 Modeled DNL to Measurements at Six Portable Monitoring Sites
Source: HMMH, June 2013 (Measured) and January 2014 (Modeled)

Site	Overall DNL Measured at Site	Hours of Measurements at Site	Annual Average Day Modeled DNL		2014 Difference (Measured Minus Modeled)
			2014	2019	
1	57	159	56	56	1 dB
2	52	66	56	56	-4 dB
3	54	141	59	59	-5 dB
4	54	74	55	56	-1 dB
5	64	26	59	59	5 dB
6	59	27	60	60	-1 dB

The measured and modeled results agree very well within expected and commonly observed tolerances, particularly taking into consideration factors such as:

- Measurement durations were relatively short compared to the annual time frames of the modeled estimates.
- The modeling was for forecast annual 2014 and 2019 operations, not the operations that occurred during the measurement periods at each site.
- The measurements do not reflect annual average day runway use, fleet mix, and other operating conditions.
- The measurements include non-aircraft noise exposure.
- Both the measurements and noise model involve some inherent technical accuracy tolerances.[4]

More specific site-by-site comparisons are summarized below.

[3] The measurement program and results are presented and discussed in full in Section 3 of the “Project Introduction and Inventory Report.”

[4] The measurements were conducted using noise monitors that meet American National Standards Institute (ANSI) S1.4-1983 standards for Type I “precision” sound level meters (SLMs), which must meet a ± 1.5 dB end-to-end accuracy tolerance requirement. These monitors exceed the Part 150 requirement for the use of Type 2 “survey” SLMs, for which the end-to-end accuracy tolerance is ± 2.3 dB. However, even the higher accuracy monitors used in the measurements may contribute as much as 1.5 dB to the differences between measured and modeled results. The FAA does not provide an official statement of the accuracy of the Integrated Noise Model, which it requires airports to use in preparing noise contours. However, long-term studies show that when it is applied carefully, DNL estimates generally differ from measurements by two decibels or less.

3.1.1 Site 1: 95 Spruce Dr. NW

The excellent (one-decibel) agreement between the measured DNL (57 dB) and that modeled for 2014 (56 dB) can be attributed to a number of factors, principally including: (1) the site had the longest measurement duration, (2) measurements included periods of activity on Runway 1, 5, and 23, providing a diverse range of aircraft exposure, and (3) operations on Runways 5 and 23, which have the most effect at the site, occurred on five of the six days of measurement (with the most important Runway 23 operations on all or part of four days). It is not surprising that the measured level is slightly higher than the modeled level, given that the site was deliberately visited during a period when Runway 23 operations were expected, that it rained for some time during the measurements, and that the measurements included at least a modest amount of non-aircraft noise.

3.1.2 Site 2: 7601 Pine Ridge St. NW

The measured DNL at Site 2 (52 dB) is approximately four decibels below the 2014 modeled level (56 dB). This is a reasonable difference, particularly given that the measured DNL reflects only the operations that occurred during the two-plus day site visit, whereas the modeled DNL reflects annual average day conditions. The site is affected primarily by Runway 23 departures and Runway 5 arrivals. While the former activity occurred during slightly more than two days of the measurements, the only other activity was approximately a half day of Runway 1 operations, which have a negligible effect at the site. It is not surprising that the modeled exposure is higher, in particular because the modeling reflects the effect of Runway 5 arrivals directly over the site, which did not occur during the measurements.

3.1.3 Site 3: 6167 Redford Rd. NW

The measured DNL at this site (54 dB) is approximately five decibels below the 2014 modeled level (59 dB), While the measurement duration was the second longest after Site 1, the runway use during the measurements differed from the annual average; that was likely a major factor contributing to the difference. For example, Runway 5 operations occurred for less than one day over the six days of measurements. These operations are important at this site because it is close to the Runway 5 landing threshold, where landings are low and concentrated. Normal day-to-day variation in flight track geometry, aircraft fleet mix, and the day-night split of operations were likely contributing factors as well.

3.1.4 Site 4: 3527 Northgate St. NW

The measured DNL at this site (54 dB) is one decibel less than the 2014 modeled level (55 dB). Factors contributing to this excellent level of agreement are likely to include the relatively long three-day measurement session and the fact the operations occurring during the session included use of Runways 1, 5, and 23, with approximately two full days of Runway 23 arrivals and one full day of Runway 5 departures, which are the first and second most important types of activity affecting the site.

3.1.5 Site 5: 2475 Wise Rd. NW

The measured DNL at this site (64 dB) is five decibels more than the modeled level (59 dB). The major factor leading to this difference is the fact that the monitor was deliberately installed at the site starting on a day when Runway 1 was the primary runway in use, since Runway 1 departures pass close to or directly over the site. Operations shifted to primarily Runway 23 on the second day of monitoring. As shown on Figure 6, contours for a hypothetical day when all operations are on Runway 1 result in an estimated DNL of approximately 63 dB, essentially identical to the 64 dB DNL measured at the site.

As discussed in the detailed measurement summary for this site presented in the September 2013 “Project Introduction and Inventory Report,” an MD-88 departure on Runway 1 during the hour starting at 5 p.m. on June 3rd resulted in the highest aircraft noise level measured at any site during the measurements. That single operation was loud enough that it would have created an overall DNL on the day of measurements of approximately 56 dB, even if it had been the only aircraft noise on the entire day. A Runway 1 departure in that unusually noisy aircraft type is forecast to occur in 2014 less than once every eight days.

When the effects of the unusual operation, runway use, and non-aircraft sources are taken into account, the difference between measured and modeled levels are reasonable. However, given the relatively short measurement duration at this site (26 hours) this agreement should not be given a high level degree of significance. The primary value of this site is the information on single event and hourly levels.

3.1.6 Site 6: 7979 Frank Ave., NW

The measured DNL (59 dB) at this site agrees well with that modeled for 2014 (60 dB). However, given the relatively short measurement duration at this site (27 hours) this agreement should not be given a high level degree of significance.

3.2 Day versus Night Exposure

Advisory Committee members and other stakeholders have noted that nighttime aircraft noise is particularly intrusive. The September 2013 “Project Introduction and Inventory Report” presented detailed information on hourly levels measured at each site, in terms of the hourly “equivalent level” (L_{eq}). To further respond to this area of interest, Table 3 presents the L_{eq} values calculated for average daily operations in 2014 for the time periods considered “day” and “night” in the calculation of DNL (i.e., the 15 “daytime” hours from 7 a.m. to 10 p.m., and the nine “nighttime” hours from 10 p.m. to 7 a.m.).

Table 3 Comparison of 2014 and 2019 Modeled DNL to Measurements at Six Portable Monitoring Sites
Source: HMMH, June 2013 (Measured) and January 2014 (Modeled)

Site	Levels Modeled for Forecast 2014 Annual Average Day Operations				
	Overall (24-hour) Modeled DNL	Daytime (7 a.m. - 10 p.m.) L_{eq}	Daytime L_{eq} Difference from DNL	Nighttime (10 p.m. - 7 a.m.) L_{eq}	Nighttime L_{eq} Difference from DNL
1	56	54	-2	48	-8
2	56	53	-3	48	-8
3	59	57	-2	51	-8
4	55	52	-3	48	-7
5	59	57	-2	51	-8
6	60	58	-2	52	-8

As the table shows, average aircraft noise exposure during the nighttime is seven or eight decibels lower than total DNL. This result is not an unexpected, given that only 16% of all aircraft activity is forecast to occur at night. However, it is reasonable for citizens to note the effect of nighttime noise, given the lower non-aircraft levels at night, again as shown in the hourly L_{eq} figures presented in the September 2013 “Project Introduction and Inventory Report.” As discussed in the introduction to noise metrics in Section 2.1.6 of that report, a 10-dB weighting is added to nighttime noise levels when calculating DNL, to reflect increased the generally increased sensitivity to noise at night. The nighttime L_{eq} values presented in Table 3 do not include that weighting, since it is only added when calculating DNL.

The roughly equivalent contribution of day and night activity to overall DNL means that noise abatement measures focused on nighttime activity will provide more benefit with lower impact on operations. Measures such as preferential runway or flight track use at night can have a benefit that is relatively large compared to the numbers of operations affected. Noise abatement measures also may be more feasible to implement at night when winds tend to be lighter and potential traffic conflicts are minimized. These considerations suggest it would be most practical to focus noise abatement efforts on nighttime matters.

3.3 Contributions of Specific Aircraft and Operator Categories

Stakeholders also observe that some aircraft type and operator categories tend to be of particular concern. Those concerns vary with location around the airport, due to the differing flight paths commonly used by those aircraft and operator groupings. Stakeholders specifically cite the following categories:

- All jet operations
- Commercial jet operations
- Corporate jet operations
- OANG helicopter operations

3.3.1 Contributions of Jet Operations

Figures 3, 4, and 5 present DNL contours for forecast 2014 operations in the first three of these categories; i.e., the annual average day noise exposure that would occur if these different categories of jet operations were the *only* activity that occurred during the year. These figures are presented for Advisory Committee consideration, in preparation for discussion at the 4th meeting. However, three general observations might be made:

- The total jet operations contours are roughly the same size and shape as the contours for all operations, reflecting the dominant contribution of this overall category.
- Commercial jet and corporate operations are roughly the same size as each other, indicating they contribute roughly similar amounts of noise to overall exposure, despite the fact that there are approximately four times as many commercial jet operations as corporate jet operations. This difference is a reflection of the fact that most commercial jet operations are in modern, quiet types, in particular regional jets. The representative single event contours presented in Section 4.3 illustrate these differences.
- Commercial jet operations show more noise effect associated with arrivals, indicated by the relatively extended narrow contours off the runway ends, whereas corporate jet operations show more effect associated with departures, as indicated by the relatively broad and blunt contours off the runway ends. The representative single event contours presented in Section 4.3 also illustrate these differences.

3.3.2 Contributions of OANG Helicopter Operations

No figure is presented for OANG helicopter operations, because those contours do not leave the airport property. In fact, the 2014 and 2019 Noise Exposure Map graphics (Figures 1 and 2) depict the annual average day exposure associated with all OANG helicopter operations quite clearly. That effect is shown by the small "teardrop-shaped" contour centered on the "H" in the northwestern area of the airfield. That H is the location of an airfield facility called the "turnaround button." OANG helicopter pilots generally operate to and from that location when conducting departures, arrivals, and training patterns.[5]

The small size of the OANG-related DNL contour is a result of the relatively small number of operations that occur. However, it is not unreasonable for citizens to cite the noise associated with these operations, for several reasons, including: (1) the pattern activity tends to occur on a repeated basis in concentrated time frames, (2) helicopters use flight paths that are separate from fixed-wing aircraft, so they affect different areas, and (3) helicopters have a distinctive sound character, in particular low-frequency noise and the "whop-whop" sound associated with "blade slap."

Both the limited DNL exposure of OANG operations and their military purpose make it infeasible to consider any formal measures to address their associated noise exposure.

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[5] While maintenance runup operations have not been cited as a specific concern to date in this study, the similarly small contour centered on the "R" on the southeast side of the airfield reflects the noise contribution of those operations. Based on analyses conducted in the previous Part 150 study, CAK designated that site (at the end of a decommissioned runway) as the preferred location for maintenance runups and prohibited those runups from 5 p.m. to 8 a.m. The lack of concerns expressed regarding those runups suggests that the measures have effectively addressed related noise issues.

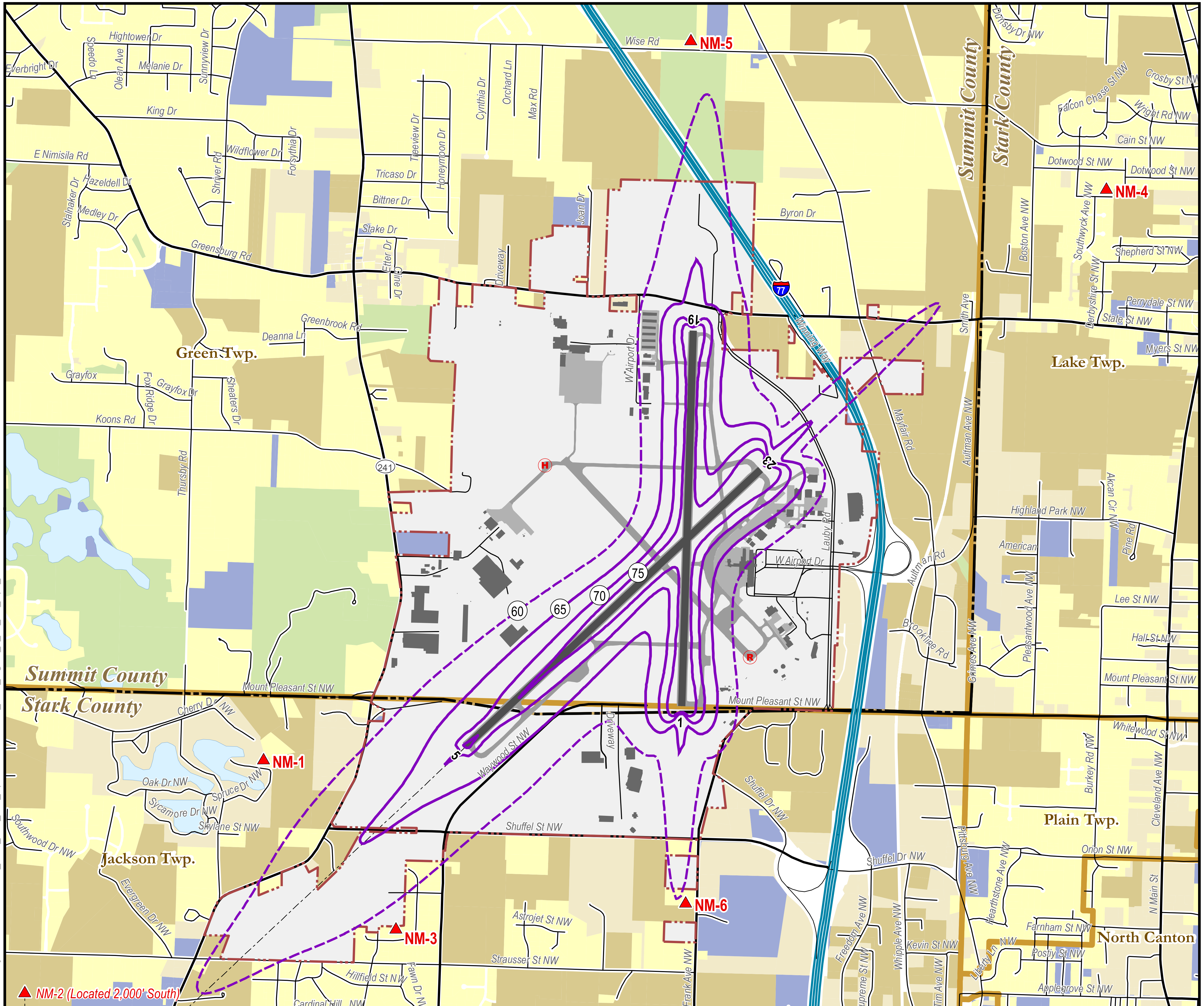

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Figure 3
2014 DNL Contours for All Jet Operations Only
14 CFR Part 150 Update

DNL Contour (65-75 dB)
DNL Contour (60 dB)

Airport Property Boundary
Airport Runway

NM-# Portable Noise Monitoring Sites
OANG Helipad
Designated Runup Location

County Boundary
Township Boundary

Land Use (Actual or zoned. Draft subject to verification.)

Residential Use
Public Use
Commercial Use
Manufacturing and Production
Recreational and Open Space

Interstate Highways
Primary Roads
Local Roads
Water Bodies

Notes:
Part 150 Sec. A150.101, Table 1 presents FAA land use compatibility guidelines as a function of yearly DNL. Under those guidelines, all land uses are considered compatible with noise exposure outside 65 DNL.

Portable Noise Monitoring Site NM-2 (Not Shown) is located southwest 11,327' along runway 5 extended centerline, offset northwest 1,031'

North

0 2,000 4,000 Feet

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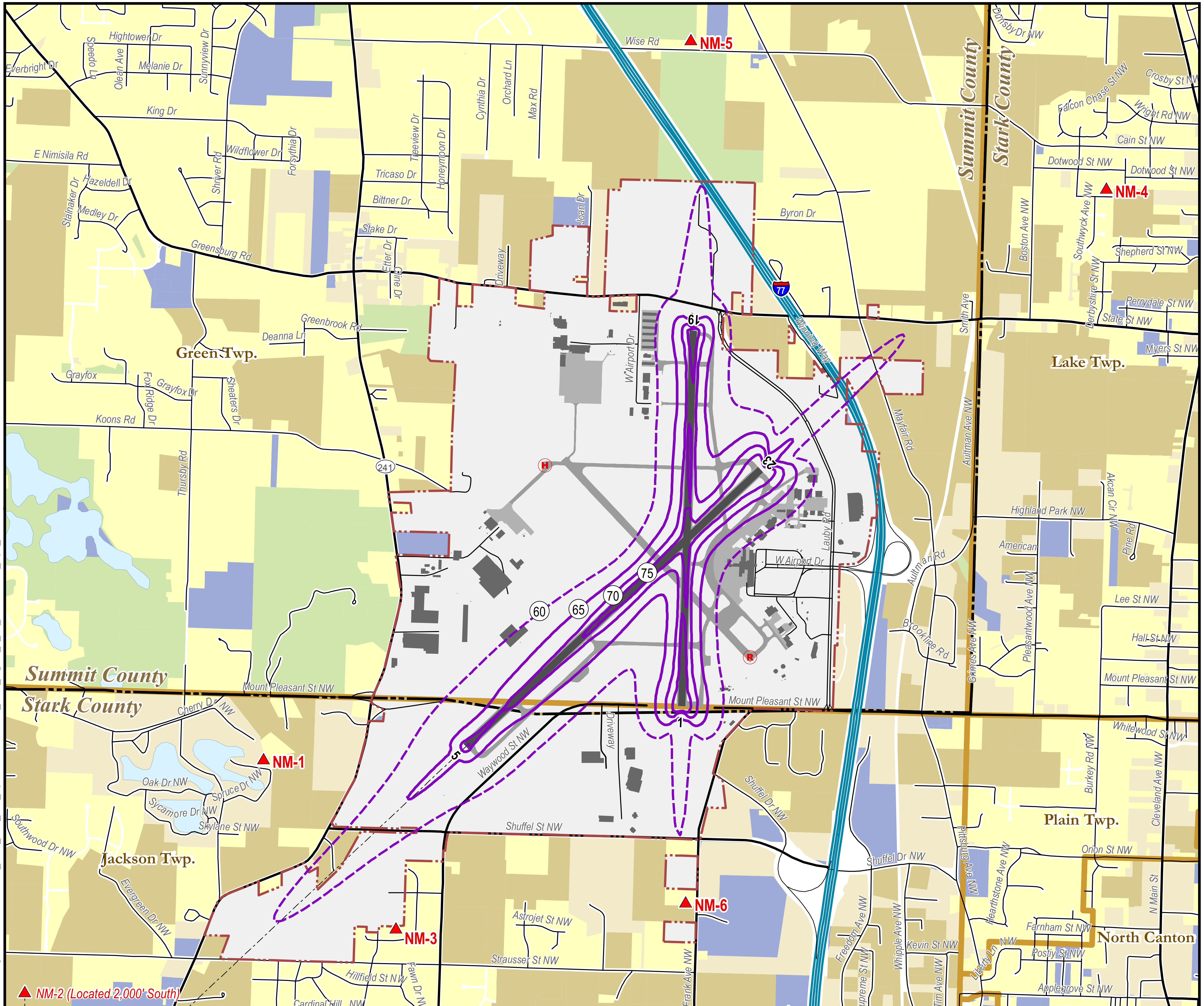

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Figure 4
2014 DNL Contours for Commercial Jet Operations Only
14 CFR Part 150 Update

DNL Contour (65-75 dB)

DNL Contour (60 dB)

Airport Property Boundary

Airport Runway

NM-# Portable Noise Monitoring Sites

OANG Helipad

Designated Runup Location

County Boundary

Township Boundary

Land Use (Actual or zoned. Draft subject to verification.)

Residential Use

Public Use

Commercial Use

Manufacturing and Production

Recreational and Open Space

Interstate Highways

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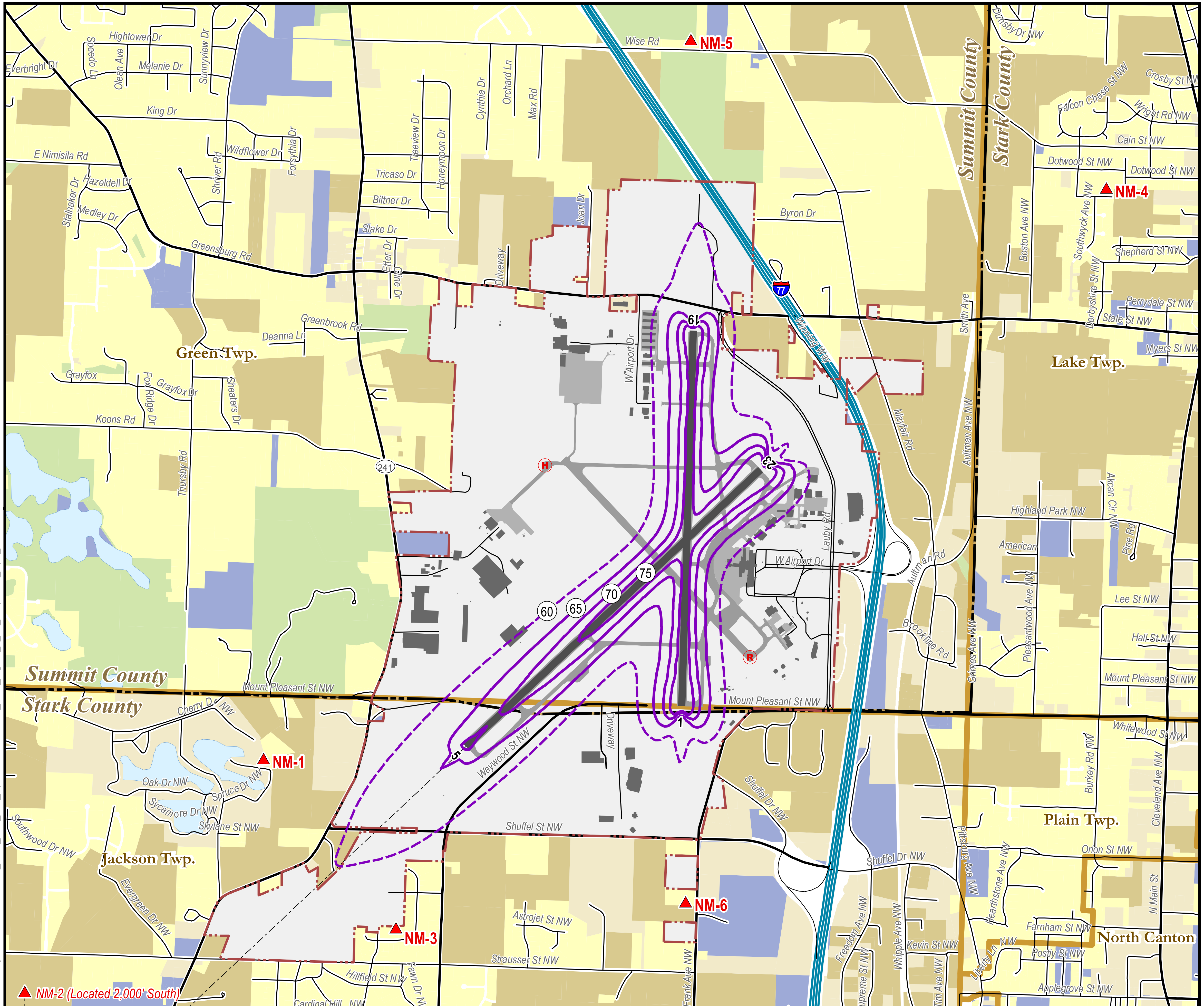

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Figure 5
2014 DNL Contours for Corporate Jet Operations Only
14 CFR Part 150 Update

- DNL Contour (65-75 dB)
- DNL Contour (60 dB)
- Airport Property Boundary
- Airport Runway
- NM-# Portable Noise Monitoring Sites
- OANG Helipad
- Designated Runup Location
- County Boundary
- Township Boundary

Land Use (Actual or zoned. Draft subject to verification.)

- Residential Use
- Public Use
- Commercial Use
- Manufacturing and Production
- Recreational and Open Space
- Interstate Highways
- Primary Roads
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4. PROVIDING BASES FOR INITIATING THE FIRST-ROUND NOISE ABATEMENT CONTOURS

The additional DNL contours presented in Section 3 provide a partial basis for initiating noise abatement discussion. Based on stakeholder discussions to date, two other bases for initiating first-round noise abatement discussion are presented for initial consideration:

- Comparisons of runway-specific *cumulative* (DNL) noise exposure
- Comparisons of the relative “noisiness” of representative jet aircraft types, using single event contours

A primary objective of the upcoming Advisory committee meeting will be to use these contours and other information assembled to date to identify specific noise abatement alternatives to investigate further using either DNL or single event contours.

4.1 Comparisons of Runway-Specific Cumulative Noise Exposure

The Advisory Committee has raised questions regarding preferential runway use. To provide a starting point for further discussion on this topic, Figures 6, 7, 8, and 9 present DNL contours for hypothetical annual average days when all operations at the airport are on each individual runway, to permit a runway-specific “sensitivity analysis:”

- Figure 6: 2014 DNL contours for a hypothetical day when all operations on Runway 1
- Figure 7: 2014 DNL contours for a hypothetical day when all operations on Runway 5
- Figure 8: 2014 DNL contours for a hypothetical day when all operations on Runway 19
- Figure 9: 2014 DNL contours for a hypothetical day when all operations on Runway 23

In later analyses, we might consider pursuing a preferential runway use program, with the goal of adjusting annual use as permitted consistent with wind, weather, aircraft performance, and other operational conditions.

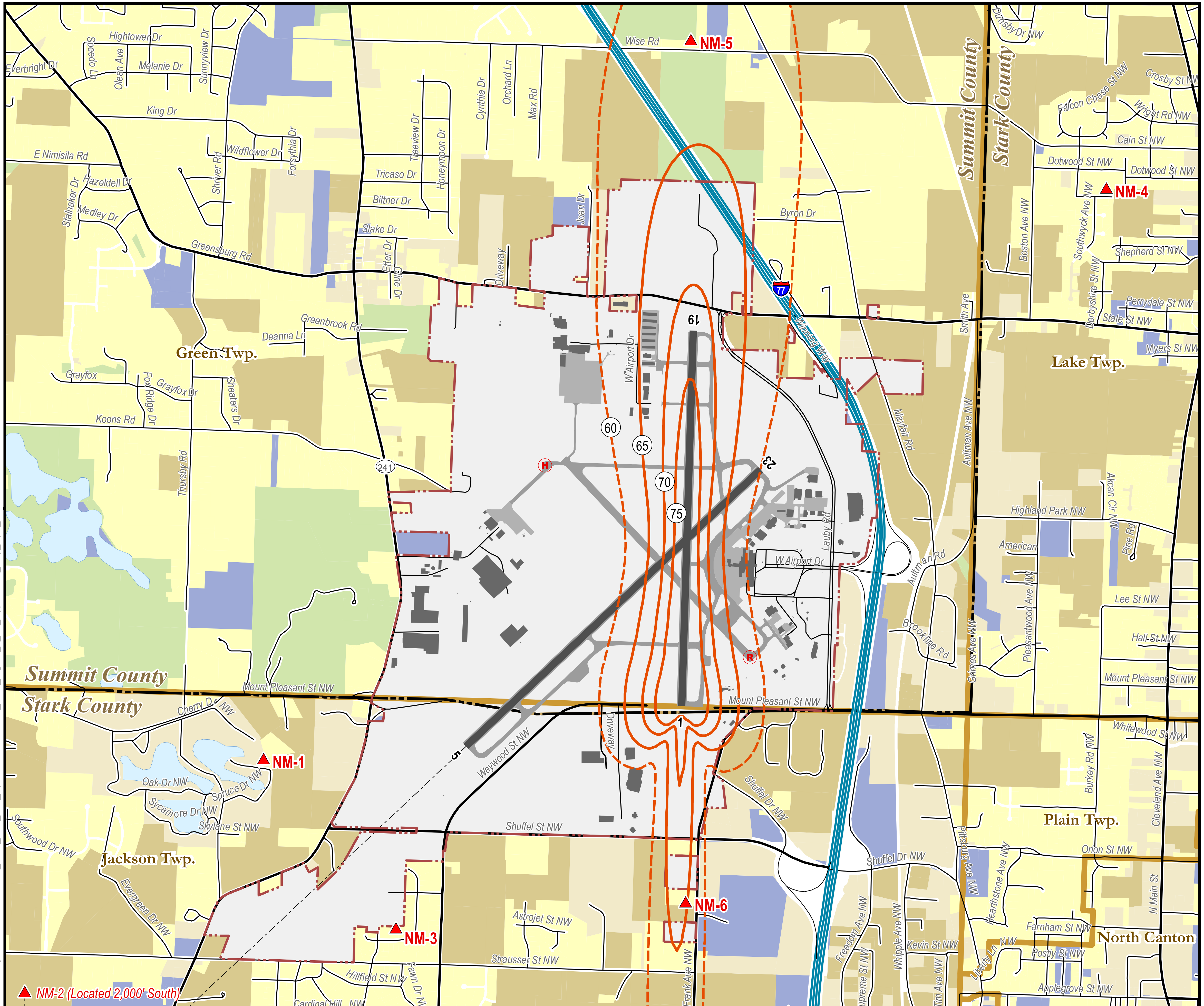

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Figure 6
2014 DNL Contours for a Hypothetical Day with All Operations on Runway 1
14 CFR Part 150 Update

- DNL Contour (65-75 dB)
- DNL Contour (60 dB)
- Airport Property Boundary
- Airport Runway
- NM-# Portable Noise Monitoring Sites
- OANG Helipad
- Designated Runup Location
- County Boundary
- Township Boundary

Land Use (Actual or zoned. Draft subject to verification.)

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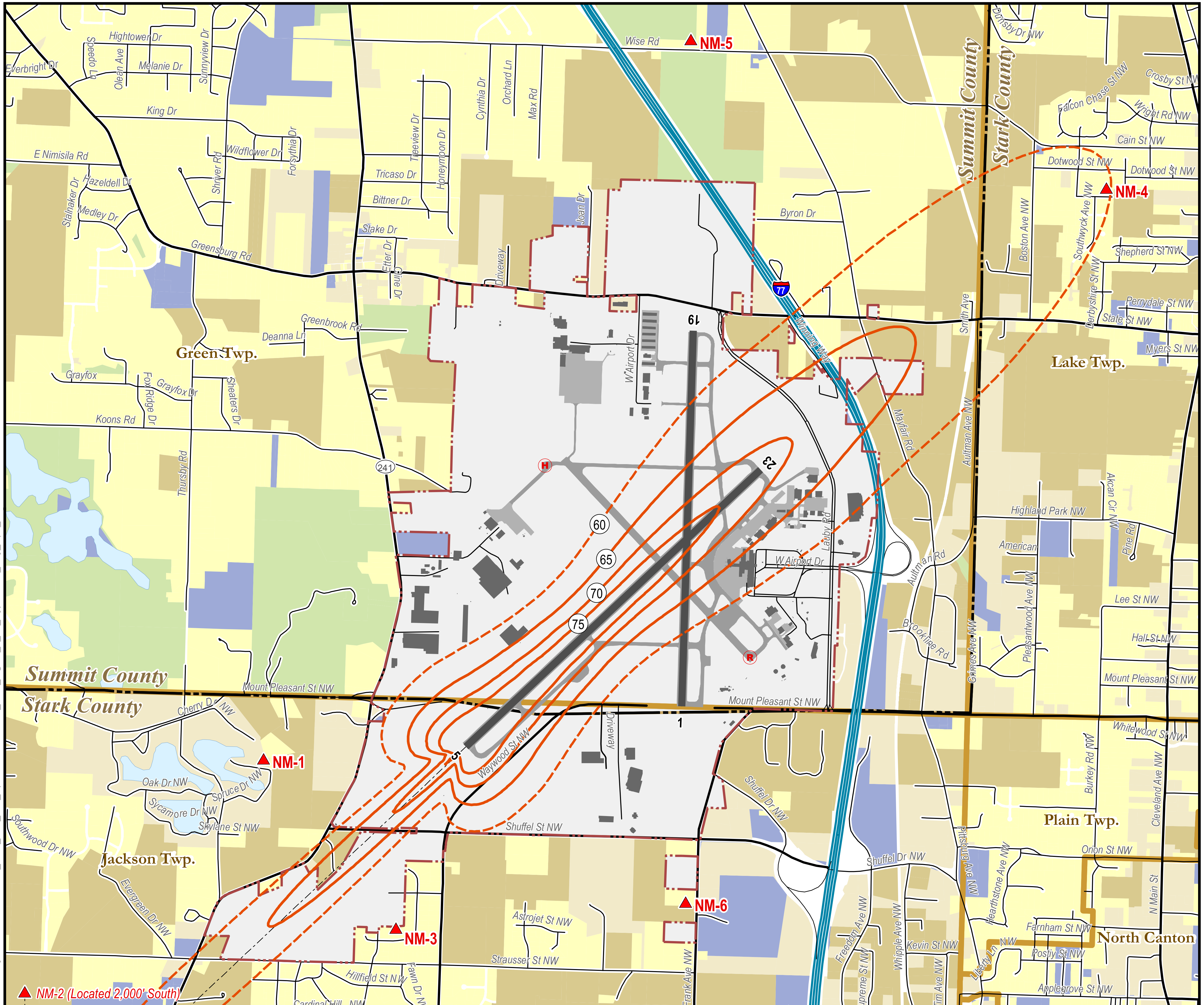

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Figure 7
2014 DNL Contours for a Hypothetical Day with All Operations on Runway 5
14 CFR Part 150 Update

- DNL Contour (65-75 dB)
- DNL Contour (60 dB)
- Airport Property Boundary
- Airport Runway
- NM-# Portable Noise Monitoring Sites
- OANG Helipad
- Designated Runup Location
- County Boundary
- Township Boundary

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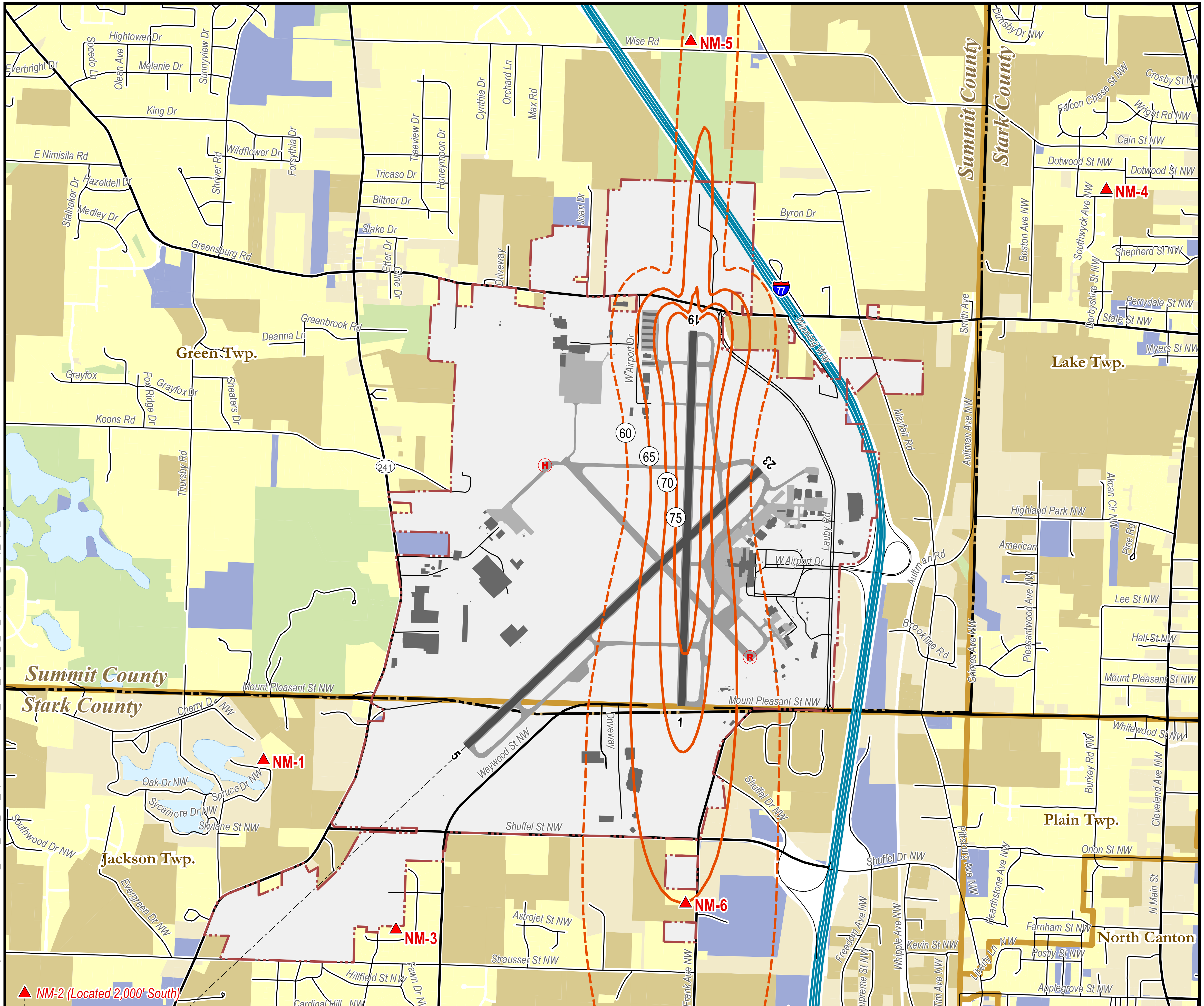

Figure 8
2014 DNL Contours for a Hypothetical Day with All Operations on Runway 19
14 CFR Part 150 Update

- DNL Contour (65-75 dB)
- DNL Contour (60 dB)
- Airport Property Boundary
- Airport Runway
- NM-# Portable Noise Monitoring Sites
- OANG Helipad
- Designated Runup Location
- County Boundary
- Township Boundary

Land Use (Actual or zoned. Draft subject to verification.)

- Residential Use
- Public Use
- Commercial Use
- Manufacturing and Production
- Recreational and Open Space
- Interstate Highways
- Primary Roads
- Local Roads
- Water Bodies

Notes:
Part 150 Sec. A150.101, Table 1 presents FAA land use compatibility guidelines as a function of yearly DNL. Under those guidelines, all land uses are considered compatible with noise exposure outside 65 DNL.

Portable Noise Monitoring Site NM-2 (Not Shown) is located southwest 11,327' along runway 5 extended centerline, offset northwest 1,031'

North

0 2,000 4,000 Feet

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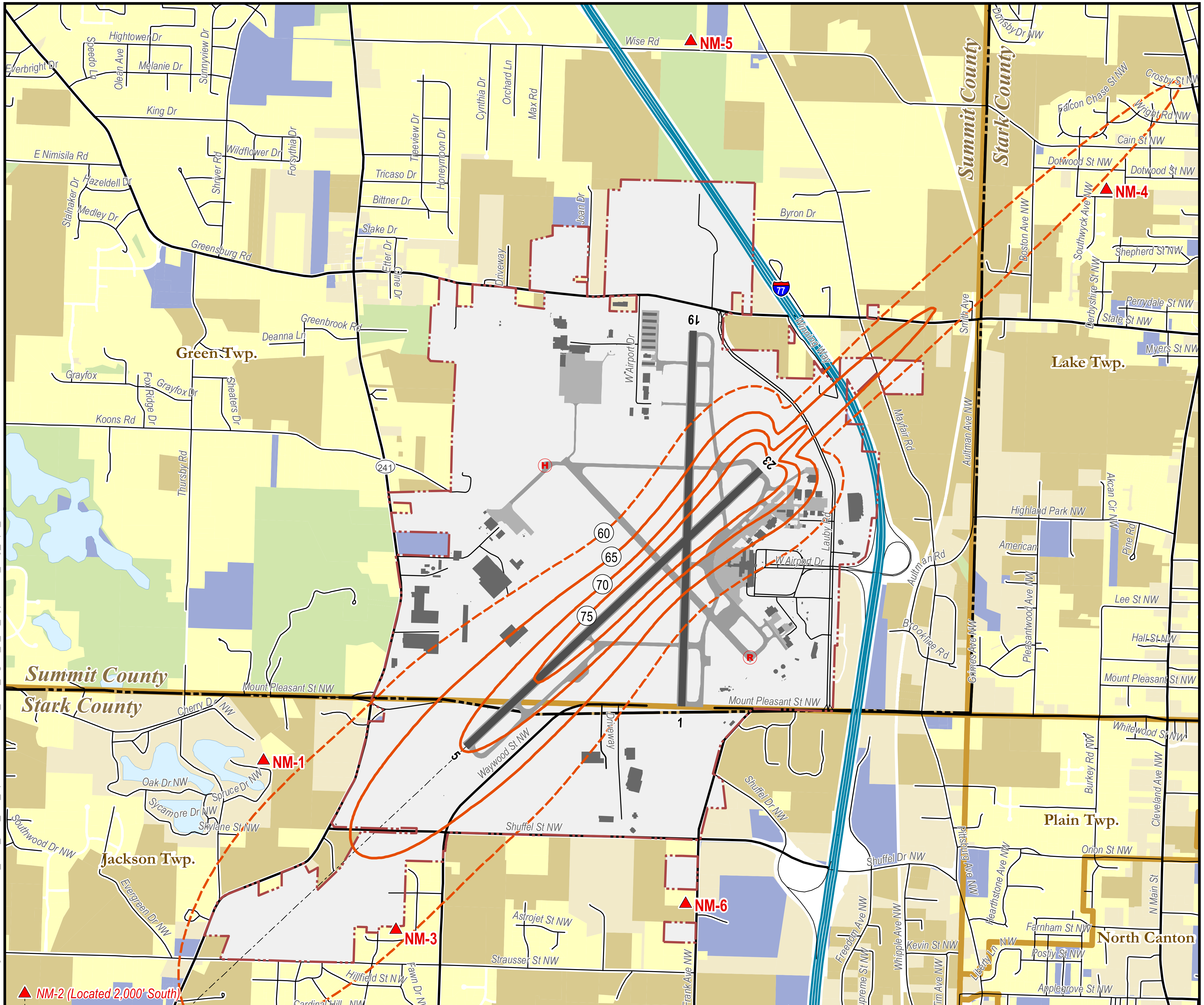

AKRON-CANTON AIRPORT

Figure 9
2014 DNL Contours for a Hypothetical Day with All Operations on Runway 23
14 CFR Part 150 Update

- DNL Contour (65-75 dB)
- DNL Contour (60 dB)
- Airport Property Boundary
- Airport Runway
- NM-# Portable Noise Monitoring Sites
- OANG Helipad
- Designated Runup Location
- County Boundary
- Township Boundary

Land Use (Actual or zoned. Draft subject to verification.)

- Residential Use
- Public Use
- Commercial Use
- Manufacturing and Production
- Recreational and Open Space
- Interstate Highways
- Primary Roads
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Portable Noise Monitoring Site NM-2 (Not Shown) is located southwest 11,327' along runway 5 extended centerline, offset northwest 1,031'

North

0 2,000 4,000 Feet

HARRIS MILLER MILLER & HANSON INC.

4.2 Comparisons of the Relative "Noisiness" of Representative Jet Aircraft Types

The Advisory Committee has asked that we assess "single event" noise exposure. One of the most valuable uses of single event contours will be to assess potential noise abatement flight tracks. To start this process, Figure 10 presents comparisons of landing-takeoff cycles, following straight-in and straight-out flight tracks, for aircraft reflecting the spectrum of relatively "noisy" to relatively "quiet" air carrier, regional, and corporate jet types at CAK. In later analyses, we might investigate potentially effective and practical noise abatement flight tracks, by preparing single event contours for specific CAK runway ends, and specific aircraft types operating at CAK, along existing or modified flight tracks.

First, three "air carrier" type jets:

- **McDonnell-Douglas DC-9-50:** This aircraft type is the noisiest airliner operated at CAK in recent years. Airlines stopped using these aircraft at CAK in 2013, and they are unlikely to be reintroduced for regular service in the future, because airlines have been disposing of them. The DC-9-50 is an example of an airliner that was originally manufactured to meet the earliest – and most lenient – "Stage 2" federal noise standards that the FAA adopted in 1969, and that were later modified ("retrofitted" or "hushkitted") to meet the more stringent "Stage 3" standards.[6] Its maximum gross takeoff weight is on the order of 120,000 pounds.
- **Boeing 737-700:** This aircraft type is the second most common air carrier aircraft model forecast to operate at CAK in 2014 and 2015. Overall, the Boeing 737 is the best-selling series of jet airliners in the history of aviation. The -700 model is representative of the most modern generation of 737s, and meets at least Stage 3 noise standards (which all aircraft with maximum gross takeoff weights over 75,000 pounds must meet to operating in the U.S., as discussed in Appendix A). Its maximum gross takeoff weight typically ranges from 135,000 to 155,000 pounds.
- **Boeing 717-200:** This aircraft is the most common air carrier model forecast to operate at CAK in 2014 and 2015. It is the most modern derivative of the DC-9 series of airliners. Boeing took over production of the DC-9 series when it purchased McDonnell-Douglas in the late 1990s. Like the Boeing 737-700, the 717-200 is representative of the most modern generation of the series, and meets at least Stage 3 noise standards. Like the DC-9-50, its maximum gross takeoff weight is on the order of 120,000 pounds. The difference in the noise contours produced by these two similarly sized aircraft show how much noise reduction has been achieved in aircraft and powerplant design over the past three or four decades.

Second, two "regional jet" types:

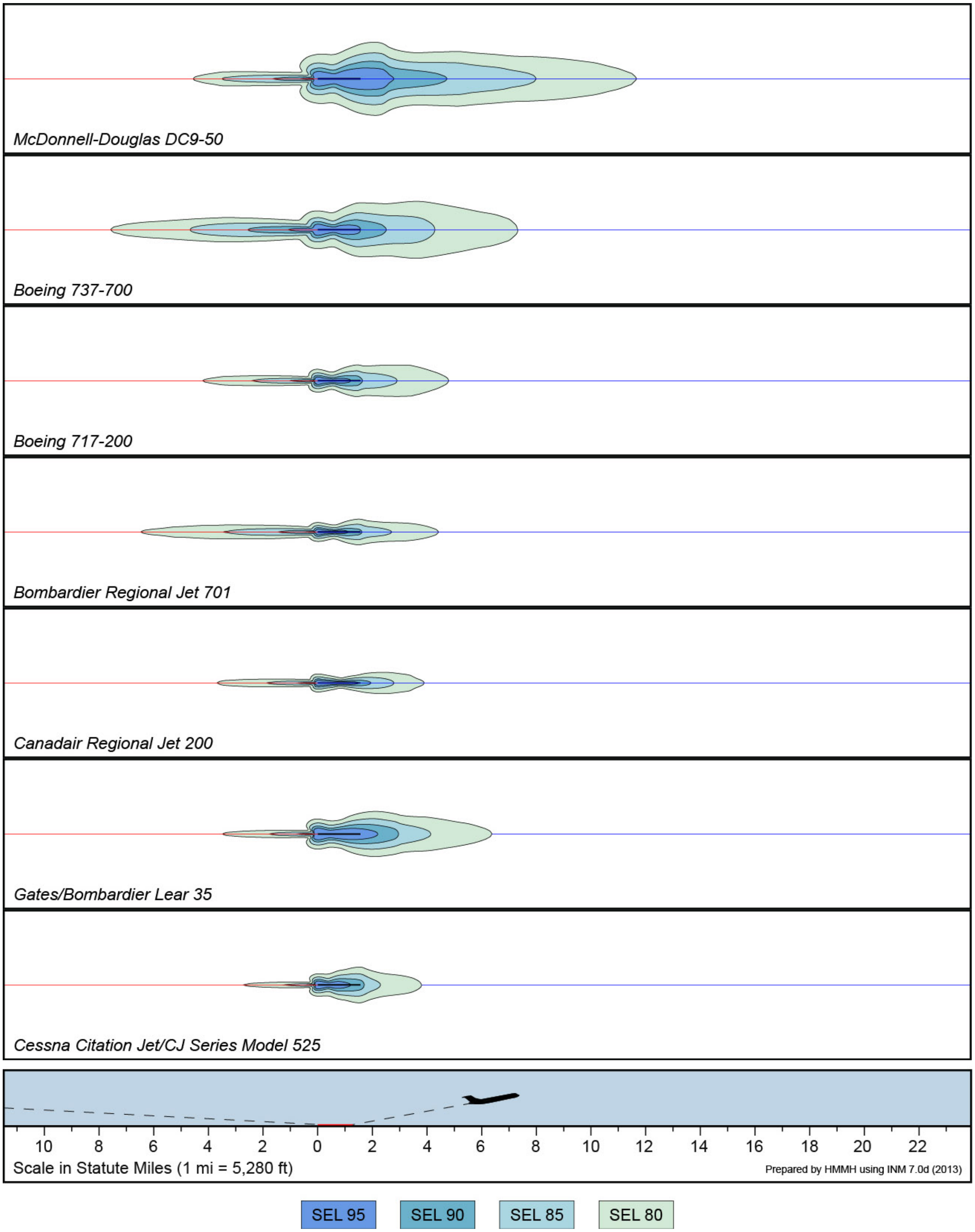
- **Bombardier Regional Jet 701:** The Bombardier Regional Jet 701 is sometimes referred to as the CRJ701, since it is a derivative of the Canadair Regional Jet, stretched to seat ±70 passengers**.** It is the second most common regional jet model forecast to operate at CAK in 2014 and 2019. Its maximum gross takeoff weight typically ranges from 75,000 to 85,000 pounds.
- **Canadair Regional Jet 200:** The CRJ-200 is the most common regional jet model forecast to operate at CAK in 2014 and 2019. It typically seats 45-50 passengers. Its maximum gross takeoff weight is typically on the order of 53,000 pounds.

Third, two "corporate jet" types:

- **Gates / Bombardier Lear 35:** The Lear 35 is one of the highest-selling corporate jets in history. It was one of the first corporate jets designed to meet Stage 3 noise standards. Its maximum gross takeoff weight typically ranges from 15,000 to 18,000 pounds.
- **Cessna CitationJet/CJ Model 525:** The CJ525 is representative of a modern light-weight corporate jet. Its maximum gross takeoff weight is on the order of 10,000 pounds.

[6] 14 CFR Part 36, "Noise Standards: Aircraft Type and Airworthiness Certification." Appendix A to this memorandum provides an overview of Part 36 certification standards, for readers who seek more background.

Figure 10 Sound Exposure Level Contours for Arrival-Departure "Cycles" of Representative Aircraft Types
Source: HMMH, 2013



5. RESPONSE TO QUESTIONS ABOUT THE 2015 FORECAST FROM THE 2004 EA

An Advisory Committee member requested a comparison of the Part 150 forecast to the forecast that was prepared for the December 2004 "Environmental Assessment for Improvements of Runway 5/23 at Akron-Canton Airport." Table 4 provides that comparison. It shows that the EA predicted there would be substantially higher levels of activity in 2015 than actually occurred in 2011, or that are forecast for 2014 and 2019. The EA forecast was higher overall and in all generalized aircraft type categories, except for regional jet operations, where 2014 and 2019 forecast operations are essentially identical to the EA forecast for 2015.

Table 4 Comparison of 2004 EA Forecast Operations to 2011 Actual Operations, and 2014 and 2019 Forecast Operations
Sources: Landrum & Brown (2004), FAA and CAK (2011), CHA (2014 and 2019)

Generalized Aircraft Type	2015 Forecast from 2004 EA	2011 Actual (Part 150 Baseline)	2014 Forecast for Part 150	2019 Forecast for Part 150
Narrow-Body Airline Jet	21,170	13,473	11,151	13,096
Regional Jet	20,440	17,673	20,172	21,008
Single Engine Propeller	35,770	10,936	11,039	11,229
Multi-Engine Propeller	35,040	13,525	13,716	14,029
Business Jet	32,120	23,204	23,554	24,144
Military Jet	n.a.	24	24	24
Rotor	4,380	2,570	2,570	2,570
Total Operations	**148,920**	**81,405**	**82,225**	**86,100**

The much higher forecast presented in the EA appears to have been the result of higher baseline levels at the time. For example, the EA reported actual annual operations totaled over 130,000 in 1993, declining to a low of approximately 104,000 in 1996, and then returning to over 125,000 in 2003. As noted in the Part 150 forecast appendix of the September 2013 "Project Introduction and Inventory Report," annual operations declined after that year, to approximately 81,000 in 2011, the forecasting baseline for this study.

APPENDIX A: OVERVIEW OF PART 36 STAGE CLASSIFICATION

The Federal Aviation Administration (FAA) has established limits on allowable levels of aircraft noise emissions, under 14 CFR Part 36, " Noise Standards: Aircraft Type and Airworthiness Certification," that sets noise standards airplanes must meet to receive new or revised "type" or “airworthiness” certificates, to operate in the U.S. The standards, measurement locations, procedures, and noise limits vary according to combinations of aircraft “design” criteria, including, but not limited to, factors such as subsonic versus supersonic speed capabilities, type of propulsion (e.g. turbojet- or propeller-driven), weight categories (e.g., “small” aircraft with maximum gross takeoff weights less than 12,500 pounds, and “large” aircraft with maximum takeoff weights of 12,500 pounds or more), helicopter versus fixed-wing aircraft, operating category (e.g., “agricultural,” “transport,” and “commuter”), date of initial fight, and, in limited cases, even specific engine manufacturer and model or specific characteristics of turbojet engines. In general, permissible noise levels, in terms of Effective Perceived Noise decibels (EPNdB), increase with maximum gross takeoff weight.

Initial Rule: 1969 - Establishment of Initial Certification Standards

When first promulgated in 1969, Part 36 only applied to “transport-category” large aircraft and all turbojet-powered aircraft. Transport category includes all jets with 10 or more seats or greater than 12,500 pounds maximum takeoff weights, and all propeller-driven airplanes with greater than 19 seats or greater than 19,000 pounds maximum takeoff weight. The regulation set separate measurement requirements and limits for takeoff, sideline, and approach locations. The 1969 regulation categorized aircraft as “certificated” or “uncertificated,” to reflect whether the aircraft type had passed testing or not.

1974 Amendment - Application of Part 36 to Propeller-Driven Aircraft

The FAA added noise standards for “propeller driven small aircraft” in 1974, prior to the creation of the “stage” terminology. They continue to be termed either “certificated” or “uncertificated,” with no stage references.

1977 Amendment - Introduction of Stage Classifications

In 1977, the FAA amended Part 36 to define more stringent noise limits for transport-category large aircraft and all turbojet-powered aircraft types, and introduced the concept of certification “stages,” to provide terminology to differentiate between the original and revised standards. For “transport category” large airplanes and all turbojet-powered airplanes, this amendment created three stages:

- “Stage 1” aircraft have never been shown to meet any noise standards, either because they have never been tested, or because they have been tested and failed.
- “Stage 2” aircraft meet original noise limits, set in 1969.
- “Stage 3” aircraft meet more stringent limits, established in 1977.

1988 Amendment - Addition of Certification Standards for Helicopters

The FAA amended Part 36 to incorporate standards for helicopters in 1988, after the creation of stage terminology. Part 36 uses two stage classifications for helicopters. Stage 1 helicopters are uncertificated, either because they have never been tested for compliance with noise standards, or because they have been tested and failed to meet the standards. Stage 2 helicopters are certificated, because they have passed the prescribed tests. The segregation of helicopters into only two Part 36 classifications is equivalent to the manner in which the regulation treats “propeller driven small aircraft.” Stage 2 does not have the same meaning for helicopters as for transport-category large aircraft and turbojet-powered aircraft, since for helicopters it reflects compliance with the highest standards the FAA has issued to date. Measurement locations and testing requirements differ significantly for helicopters and proper-driven small airplanes, compared to each other, and to transport-category large aircraft and turbojet-powered aircraft.

2005 Amendment - Addition of Stage 4 Certification Standards

In 2005, FAA amended Part 36 to adopt a Stage 4 classification. The Stage 4 noise limits are a cumulative 10 EPNdB less than those for Stage 3. All subsonic turbojet-powered and transport-category airplanes with maximum gross takeoff weights of 12,500 pounds or more for which application of a new type design is submitted on or after January 1, 2006, must meet new noise certification levels.

It should be noted that the new Stage 4 standard applies only to application for a new airplane type design on and after January 1, 2006. It does not initiate any FAA process to phase out the production or operation of current aircraft models. As discussed in the following "phaseout" discussion, Stage 1, 2, and 3 aircraft under 75,000 pounds and Stage 3 aircraft of 75,000 pounds or more may continue to operate in the U.S.

Phaseout of Stage 1 and 2 Operations

In response to detection of the U.S. Congress, the FAA has adopted regulations that ban U.S. operations of Stage 1 and 2 civil jet operations, with limited exemptions for emergency operations, individual flights for the purpose of permanently flying the aircraft out of the U.S., or flying them in for modification to meet noise standards, etc. Specifically:

- In 1976, the FAA adopted regulations that banned essentially all U.S. civil operations in Stage 1 jet aircraft with maximum gross takeoff weights over 75,000 pounds after 1988.
- In 1991, the FAA strengthened these regulations to ban essentially all U.S. civil operations in Stage 2 jet aircraft with maximum gross takeoff weights over 75,000 pounds after 1999.
- In 2013, the FAA adopted regulations that banned essentially all U.S. civil operations in Stage and 2 jets with maximum gross takeoff weights under 75,000 pounds after 2015.

Therefore, as of January 1, 2016, essentially all civil jet aircraft operating in the U.S. will be required to meet Stage 3 standards and essentially all newly manufactured jet aircraft will be required to meet Stage 4 standards.