Appendix G
Helicopter Technical Memorandum

G.1 Introduction

This technical memorandum presents the results of a helicopter noise assessment prepared for the proposed California Northstate University (CNU) Medical Center project. The proposed project would include a new medical center and teaching hospital located on a 35-acre parcel in the southwestern portion of the Innovation Park Planned Unit Development (PUD) area. The parcel is bounded by A Street to the east, B Street to the north, and C Street and Sports Parkway to the west and south. The proposed CNU Medical Center includes the development of a helistop that would support helicopters transporting patients to and from the facility. The helicopter noise assessment describes the potential noise impacts on the surrounding community associated with these helicopter operations. The following sections describe the methodologies used in the noise analysis and the analysis results.

G.2 Background

G.2.1 Fundamentals of Noise

The decibel (dB) is a conventional unit for measuring the amplitude of sound. It accounts for large variations in sound pressure amplitude and reflects the way people perceive changes in sound. When describing sound and its effect on humans, A-weighted (dBA) sound levels are typically used to account for the response of the human ear. The term "A-weighted" refers to a filtering of the noise signal in a manner corresponding to the way the human ear perceives sound. Leq is the equivalent sound level over a specified period of time, typically, one hour (i.e., Leq(h)). Leq is also referred to as the average sound level.

People judge the relative magnitude of sound sensation by subjective terms such as "loudness" or "noisiness." A change in sound level of 3 dB is considered just perceptible, a change in sound level of 5 dB is considered clearly noticeable, and a change of 10 dB is recognized as twice as loud.

Because decibels are logarithmic values, they cannot be combined by normal algebraic addition. For example, when the decibel values of two sources differ by 0 to 1 dB, combining them would add 3 dB to the higher level for the combined sound level. When the decibel levels of two sources differ by more than 1 dB, combining them would add between 0 and 3 dBA to the higher level, depending on the relative difference. At a difference of 10 dB or more, the higher noise source dominates, and there is no addition to the higher level source (i.e., there is no effective change in the overall decibel value with or without the addition of the lower noise level source).

When noise propagates over a distance, the noise level reduces (i.e., attenuates) with distance. The degree to which it diminishes depends on the type of noise source and the propagation path. The Federal Aviation Administration's (FAA) Aviation Environmental Design Tool (AEDT) uses the atmospheric absorption standard included in SAE-ARP-5534.[1] It should be noted that AEDT does not take into account intervening objects, such as buildings.

1 SAE International. 2021. ARP5534 *Application of Pure-Tone Atmospheric Absorption Losses to One-Third Octave-Band Data.* May 2021.

Environmental noise levels are characterized using the following noise descriptors in the helicopter noise analysis for the proposed project:

SEL: The Sound Exposure Level (SEL) is the constant noise level that would deliver the same acoustic energy to the ear of a listener during a one-second exposure as the real and variable noise would deliver over its entire time of occurrence.

CNEL: The Community Noise Equivalent Level (CNEL) is a 24-hour, time-weighted energy average. The time-weighting refers to the fact that for the CNEL metric, each evening noise event occurring between the hours of 7:00:00 p.m. and 9:59:59 a.m. is multiplied by three, which results in an additional weight of 4.77 dB. Each nighttime noise event occurring between the hours of 10:00:00 p.m. and 6:59:59 a.m. is multiplied by ten, which results in an additional weight of 10 dB.

G.3 Regulatory Setting

G.3.1 Federal Aviation Administration

Title 14 Code of Federal Regulations (CFR) Part 150 describes the land use compatibility associated with aircraft-related noise. It states that a significant noise impact would occur if noise-sensitive land uses would be exposed to levels of 65 dBA CNEL or higher as a result of the project.

G.3.2 Sacramento City Code

Chapter 8.68.080 of the Sacramento City Code states that aircraft noise is preempted by state or federal law or regulation. Therefore, the Sacramento City Code is not applicable to determine the significance of noise impacts for this project.

G.3.3 Sleep Disturbance

For environmental noise screening purposes, the commonly accepted metric for assessing sleep disturbance is an outdoor Single Event Noise Exposure Level (SENEL) exceeding 89 dBA. The equivalent 89 dBA SEL is used for noise modeling purposes. This is based on achieving an indoor noise level of 65 dBA SENEL, which according to interim guidelines published by the Federal Interagency Committee on Aviation Noise (FICAN, issued June 1997) corresponds to a maximum 5 percent of the population potentially awakened, and assumes that the receiving building construction provides typical outdoor-to-indoor noise reduction of 24 dB.

G.3.4 Impact Thresholds

As the Sacramento City Code defers to state or federal law or regulations, the FAA’s impact threshold of 65 dBA CNEL is used to determine the impact significance from helicopter operations, and 89 dBA SEL is used as the threshold for sleep disturbance.

G.4 Noise Modeling Assumptions

G.4.1 Helicopter Type

The helicopter noise analysis prepared by the City of Elk Grove for the CNU Medical Center Project EIR (Elk Grove Project EIR) included three helicopter types: Airbus H-135, H-130, and H-145. The operational distribution for those three helicopter types would be 95 percent, 5 percent, and 5 percent, respectively. Of these three helicopter types, the FAA's AEDT model includes only the H-130. As was stated in the noise analysis prepared for the Elk Grove Project EIR, the H-130 would be louder than the H-135, which for purposes of the helicopter noise analysis is the predominant helicopter type. Therefore, it was decided that using the H-130 to characterize all helicopter operations associated with the proposed project would offer the most conservative basis for purposes of developing helicopter noise contours.

G.4.2 Helistop Description

The proposed helistop would be located on the roof of the eastern wing of the building at an elevation of 198.25 feet above ground level (AGL). The latitude and longitude coordinates used in AEDT are 38.649168, -121.519606.

G.4.3 Helicopter Operations

Two operational scenarios were assessed: normal and busy. Under the normal scenario, there would be four arrivals and four departures per month. Under the busy scenario, there would be six arrivals and six departures per month. Although helicopters could operate at any time of day, the helicopter noise analysis assumed that 80 percent of operations would occur during daytime hours (7:00 a.m. – 7:00 p.m.), 15 percent would occur during evening hours (7:00 p.m. – 10:00 p.m.), and 5 percent would occur during nighttime hours (10:00 p.m. – 7:00 a.m.). **Table 1** presents helicopter operation breakdown.

TABLE 1
ANNUAL AVERAGE DAY HELICOPTER OPERATIONS

Scenario	Direction	Helicopter Model	Substituted Model	Operations			Total
				Day	Evening	Night	
Normal	North	Airbus H-135 Airbus H-130 Airbus H-145	EC130	0.0631	0.0118	0.0039	0.0789
	South	Airbus H-135 Airbus H-130 Airbus H-145	EC130	0.1473	0.0276	0.0092	0.1841
Busy	North	Airbus H-135 Airbus H-130 Airbus H-145	EC130	0.0947	0.0178	0.0059	0.1184
	South	Airbus H-135 Airbus H-130 Airbus H-145	EC130	0.2209	0.0414	0.0138	0.2762

G.4.4 Helicopter Flight Profiles

AEDT includes standard arrival and departure flight profiles. The default climb and descend rate is approximately 2,000 feet per minute. The helicopter noise analysis assumed that because hospital helicopters would be carrying patients, the climb and descend rate would be slower than the default rates. The climb and descend rate used for the helicopter noise analysis is approximately 500 feet per minute. This is the same rate used for the noise analysis prepared for the Elk Grove Project EIR.

G.4.5 Helicopter Flight Tracks

To determine noise levels on the ground, it is not only important to know how many operations are occurring, but also where helicopters are flying as they arrive and depart the helistop. Identifying helicopter flight tracks and flight track use percentages are a key element in development of noise contours. **Exhibits 1** and **2** present north flow and south flow flight tracks, respectively. For purposes of the helicopter noise analysis, it was assumed that 70 percent of operations would be south flow and 30 percent of operations would be north flow. These percentages are based on historic runway use at Sacramento International Airport.

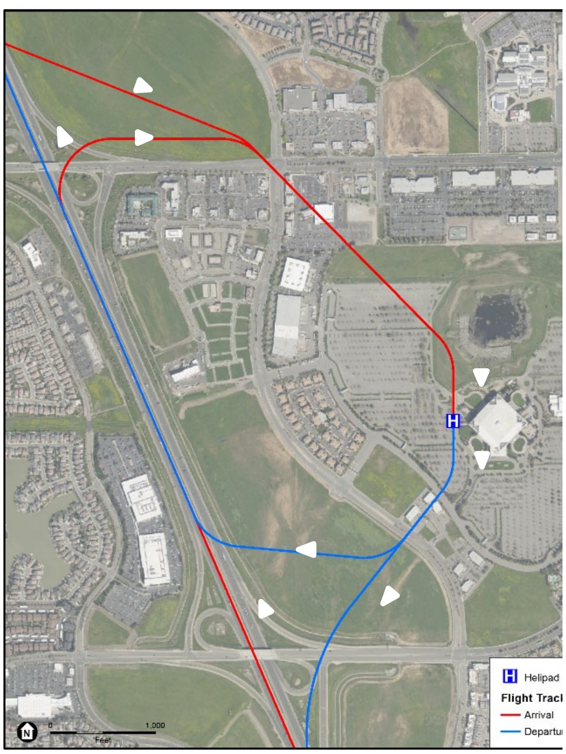

Exhibit 1
North Flow Flight Tracks

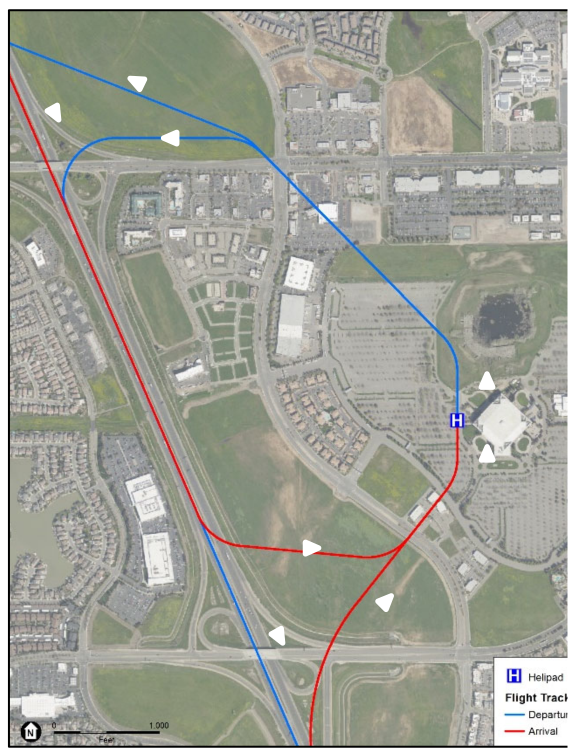

Exhibit 2
South Flow Flight Tracks

G.4.6 Terrain

Noise propagation can be affected by terrain. Noise receptors at higher ground elevations may be physically closer to helicopters in flight than receptors at lower ground elevations. When terrain data are not included, AEDT assumes the ground is flat at the user-specified receptor. The helicopter noise analysis for the proposed project did not include terrain data for two reasons. First, the terrain in the proposed project area and surrounding vicinity is largely flat. This means the modeled noise contours would not be affected by terrain. Second, the helistop would be located on the roof of a building approximately 198 feet AGL. The use of terrain data would cause a conflict in AEDT, and the model would not recognize the helistop elevation.

G.5 Noise Analysis Results

G.5.1 CNEL Noise Contours

As previously discussed, the CNEL metric represents a 24-hour, time-weighted energy average. The time-weighting means that each evening noise event occurring between the hours of 7:00:00 p.m. and 9:59:59 a.m. is multiplied by three, which results in an additional weight of 4.77 dB. Each nighttime noise event occurring between the hours of 10:00:00 p.m. and 6:59:59 a.m. is multiplied by 10, which results in an additional weight of 10 dB. The CNEL contours for the proposed project are shown in **Exhibits 3** and **4** for the normal and busy operational scenarios, respectively.

As shown on Exhibits 3 and 4, the CNEL contours would be limited to the proposed project site. Areas exposed to CNEL 65 dB and higher are too small in size to be depicted under either scenario.

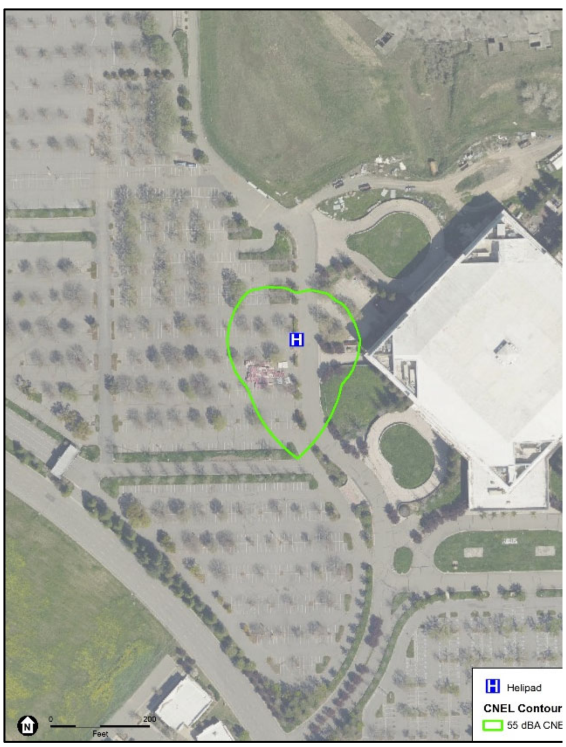

Exhibit 3
CNEL Contours – Normal Scenario

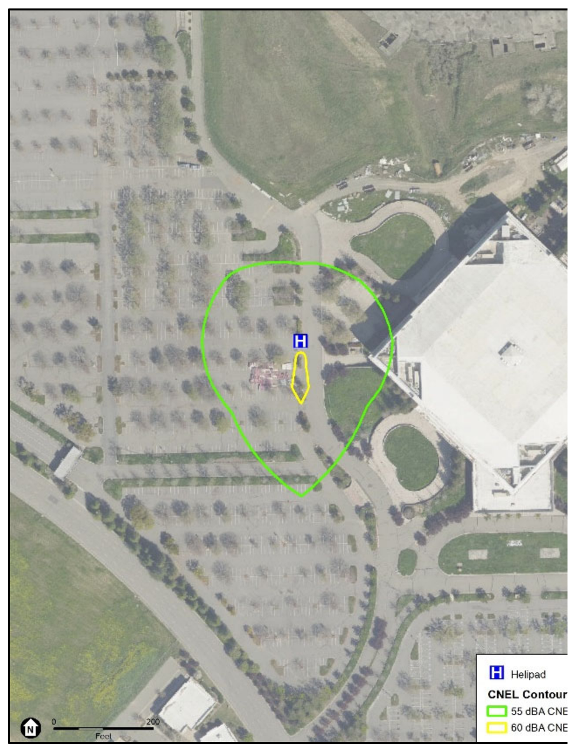

Exhibit 4
CNEL Contours – Busy Scenario

G.5.2 SEL Noise Contours

As previously discussed, SEL is the constant noise level that would deliver the same acoustic energy to the ear of a listener during a one-second exposure as the real and variable noise would deliver over its entire time of occurrence. **Exhibits 5** through **8** depict the SEL contours for arrivals on each modeled flight track. **Exhibits 9** through **12** depict the SEL contours for departures on each modeled flight track. The contours depict an SEL of 89 dBA, which represents the threshold for identifying sleep disturbance. Residential use areas are located to the west within the SEL contour.

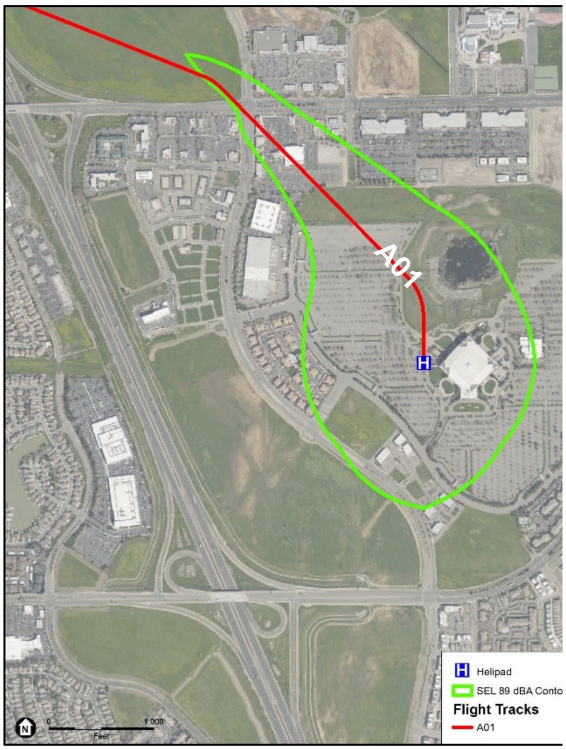

Exhibit 5
SEL Contour – Arrival on Flight Track A01

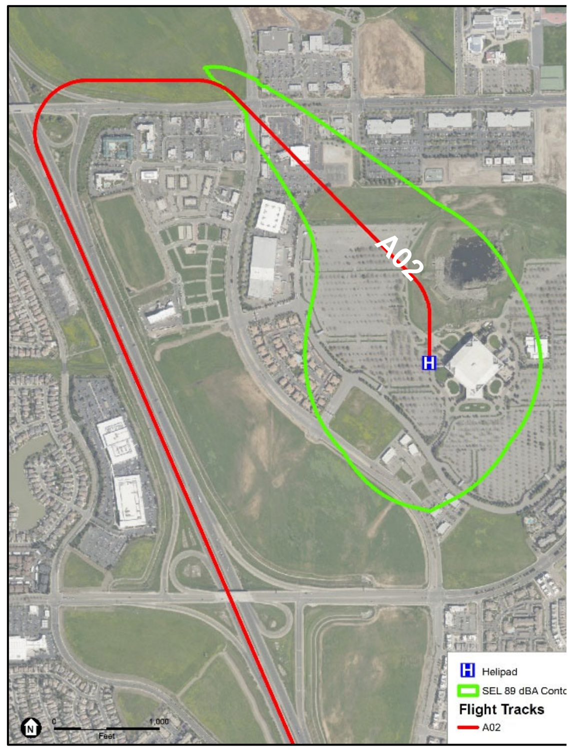

Exhibit 6
SEL Contour – Arrival on Flight Track A02

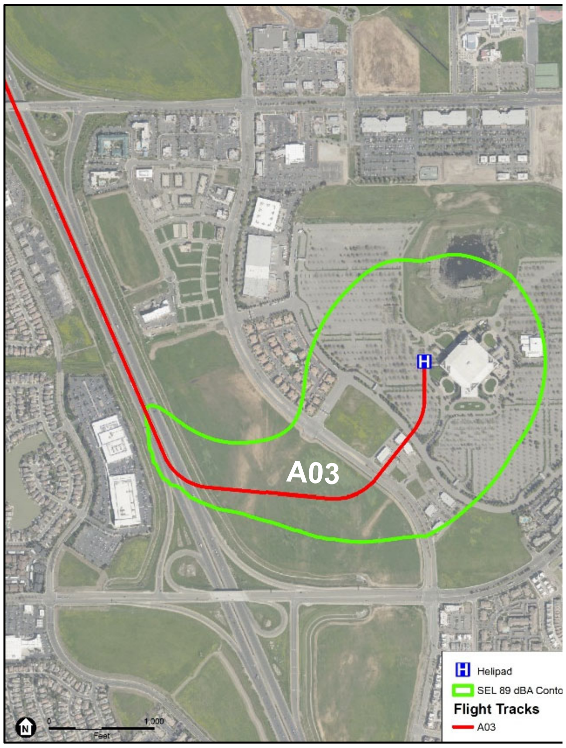

Exhibit 7
SEL Contour – Arrival on Flight Track A03

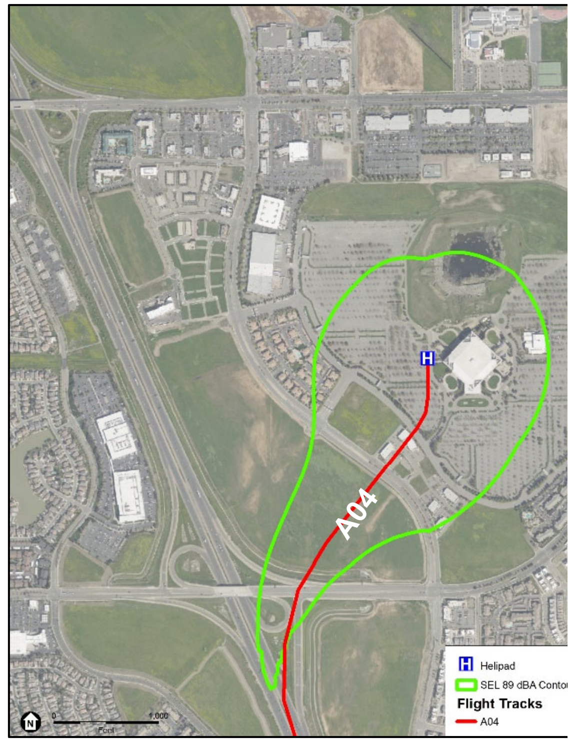

Exhibit 8
SEL Contour – Arrival on Flight Track A04

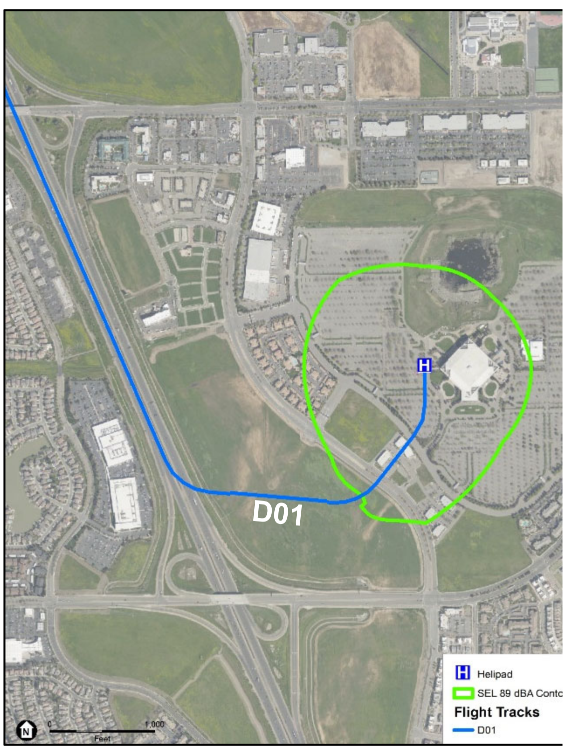

Exhibit 9
SEL Contour – Departure on Flight Track D01

Exhibit 10
SEL Contour – Departure on Flight Track D02

Preliminary – Subject to Revision

Exhibit 11
SEL Contour – Departure on Flight Track D03

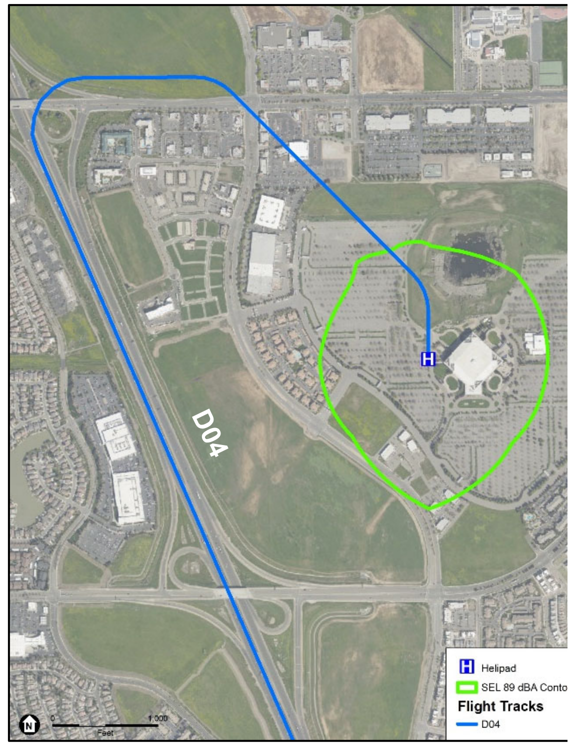

Exhibit 12
SEL Contour – Departure on Flight Track D04