Appendix J

California Northstate University Medical Center Helicopter Noise Report



CALIFORNIA NORTHSTATE UNIVERSITY MEDICAL CENTER

SM&W Project #19028AS

Helicopter Noise Report

Prepared for:

Fong & Chan Architects 1361 Bush Street San Francisco, CA 94109

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INTEGRATED COMMUNICATIONS TECHNOLOGY AND ACOUSTIC CONSULTING ¬

SHEN MILSOM WILKE

EXECUTIVE SUMMARY

- 1. This report describes the potential noise impacts on the surrounding community due to helicopter operations at the proposed project at 9700 West Taron Drive in Elk Grove, CA.
- 2. The project site is located at the intersection of Interstate 5 (I-5) and Elk Grove Blvd at the existing shopping center and California Northstate University buildings. The new helipad would be located on the roof of the proposed new hospital tower.
- 3. The site is surrounded by a mix of commercial uses, residential (mostly single-family homes), and the Stone Lakes National Wildlife Refuge. The surrounding neighborhoods include community uses such as local schools and outdoor recreation areas.
- 4. The existing primary sources of noise in the area are traffic on I-5 as well as local traffic on Elk Grove Blvd and smaller collector streets. According to the Elk Grove General Plan, noise levels in this area range from 60 to 70+ dBA Ldn.
- 5. Noise from proposed helicopter operations was assessed against Federal, State, and Local regulations and policies. A secondary assessment for sleep disturbance, not required by these regulations, was also carried out at the nearby residences.
- 6. According to information provided to SM&W, helicopter operations are expected to occur on average 4 times per month, and as many as 6 times per month.
- 7. Helicopter noise was first assessed through a field test of proposed flight paths using an older and generally louder helicopter (A-109) than expected to be used for emergency transport for the hospital. Noise measurements were taken remotely at 11 locations within a 1.5-mile radius of the proposed helipad, representing the range of noise-sensitive uses in the area.
- 8. The sleep disturbance threshold for single event noise was not exceeded at any of the noise monitoring locations.
- Helicopter noise during field testing was clearly audible above the background noise at most positions near the flight path, but in many cases was comparable to or less than the noise from existing local sources, including garbage trucks, lawn care equipment, local traffic, and others in the residential neighborhoods.
- 10. A computer noise model of the proposed helicopter flight paths, helicopter models, and anticipated flight frequency was constructed using the Aviation Environmental Design Tool (AEDT) which is issued and approved by the Federal Aviation Administration (FAA) for aircraft noise analysis in the US.
- 11. The AEDT model was calibrated to the field measured data. The resulting predictions are considered conservative and therefore appropriate for impact screening purposes.
- 12. The AEDT model was used to predict annualized long-term noise metrics (Ldn, CNEL) used to assess helicopter noise against Federal, State, and Local thresholds, as well as single-event criteria for sleep disturbance. No exceedances of any of these thresholds were detected.
- 13. A secondary computer noise model was constructed using the Soundplan environmental noise model to compare and estimate the combined annualized noise of traffic and helicopter operations. This model was calibrated to the AEDT model (for helicopter noise) and traffic noise levels provided in the Elk Grove General Plan.
- 14. As shown in the secondary model, annualized helicopter noise is predicted to be well below the existing noise exposure due to nearby traffic.
- 15. In summary, measurements and modeling show that the proposed helicopter operations would be within Federal, State, and Local noise thresholds.
- 16. To further reduce perceived noise exposure, the project proposes to minimize flights over and near residential areas and, where flights must take place near residential areas, the flight path is positioned over a major noise source (Interstate 5) to minimize the perceived noise exposure.

INTRODUCTION

This report describes the potential noise impacts on the surrounding community due to helicopter operations at the proposed project at 9700 West Taron Drive in Elk Grove, CA. The project includes a new medical center and teaching hospital on the existing campus of California Northstate University (CNU). At

5 the time of this report, buildout of Phase 1, the project as proposed will consist of approximately 596,790 square feet of facility space and include 250 patient beds. The helipad is proposed for development as part of Phase 1.

EXISTING NOISE ENVIRONMENT

SITE DESCRIPTION

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- 10 The project site is located at the intersection of Interstate 5 (I-5) and Elk Grove Blvd at the existing shopping center and California Northstate University buildings. The new helipad is proposed on the roof of the new hospital tower (currently proposed at 221 ft MSL). The existing sources of noise in the area are traffic on I-5 as well as local traffic on Elk Grove Blvd and smaller collector streets. The site is surrounded by a mix of commercial uses, residential (mostly single family homes), and the Stone Lakes National Wildlife Refuge.
- 15 The surrounding neighborhoods include community uses such as local schools and outdoor recreation areas. An overview map of the area is provided in Figure 1 below and each area is described in the sections below.

(A) EXISTING CNU CAMPUS

This is a commercial area bordered by I-5, Elk Grove Blvd, and W Taron Drive and includes the existing CNU College of Medicine, the Stone Lake Landing shopping center, and other commercial uses. All buildings are considered low-rise (3 stories or less). This area is considered relatively noisy due to traffic on I-5 and Elk Grove Blvd as well as local traffic accessing the parking lots and continuing into the adjacent residential areas. A solid sound wall is installed between the highway and most of the CNU college buildings. This area includes some noise from commercial equipment but is generally only noticeable in the innermost areas, as the highway is the predominant source of noise.

(B) COMMERCIAL ON ELK GROVE BLVD

This is a small commercial area along Elk Grove Blvd and split across Harbour Point Drive. Besides typical commercial restaurants retail and gas, this area includes some noise sensitive uses such as the Holiday Inn Express and Merryhill Preschool both located along Maritime Drive. All buildings are considered low-rise (3 stories or less). Noise sources are similar to area A above, such as local traffic and noise associated with commercial uses. No sound walls are installed in this area.

(C) MARITIME OFFICE PLAZA

This area includes an office park and a self-storage facility located directly against I-5 and provides a buffer from this primary noise source to the adjacent residential neighborhoods. All buildings are considered low-rise (3 stories or less) and most are only a single story. No sound walls are installed in this area. Station 75 of the Cosumnes Fire Department is also located in this area, along the border of the nearby residential neighborhoods.

(D) RESIDENTIAL LAGUNA WEST (NEAR I-5)

40 This residential development includes a mix of 1 and 2 story single-family homes. A solid soundwall is installed between I-5 and the immediately adjacent residences, however the 2nd stories still have a clear line of sight to the highway traffic due to the limited wall height. Highway traffic is clearly audible in this neighborhood.

(E) RESIDENTIAL LAGUNA WEST (INTERIOR)

45 This is a collection of neighborhoods located mostly away from the highway and primary arterial roads; it is relatively quiet due to limited local traffic. These neighborhoods are mostly comprised of 1 and 2 story single-family homes but include some multi-family buildings closer to Elk Grove

Blvd. Joseph Sims and Stone Lake elementary schools, and River City Early Learning Center are located in this area, as well as multiple outdoor recreation areas.

50 (F) RESIDENTIAL STONE LAKE COMMUNITY

Similar to Laguna West, this residential neighborhood contains a mix of 1 and 2 story single family homes with some multi-family buildings. Highway noise is clearly audible within a few blocks of the border with I-5, while the inner areas have lower ambient noise levels. A solid sound-wall is installed between I-5 and the immediately adjacent residences, however the 2nd stories still have clear line of sight to the highway traffic due to the limited wall height. Community uses in this area include Elliott Ranch Elementary, Stonelake Clubhouse and multiple outdoor recreation areas.

(G) STONE LAKES NATIONAL WILDLIFE REFUGE

This is an undeveloped and protected wildlife area managed by the U.S. Fish and Wildlife Service reaching over 6,000 acres. Near the project site, this area abuts I-5 as well as the Stone Lake Community neighborhood.

The study area¹ is currently exposed to noise levels in the range of 60 to 70+ dBA Ldn (as defined in Appendix A) due to Interstate 5 and local streets. A map of current noise exposure in the area, extracted from the City of Elk Grove General Plan, is provided in Figure 2 below and is based on measurements and predictions of local traffic noise in the area.

65 **Figure 1:** Area Map (Source: Google Earth)

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¹ Study area refers to the area where helicopter noise levels are either measured or predicted in this analysis. The study area includes all acoustically sensitive receivers within approximately 1.5 miles of the proposed helipad.



Figure 2: Existing Noise Levels (Source: City of Elk Grove, General Plan Update DEIR, July 2018)

NOISE CRITERIA

- 70 The noise criteria used to assess noise from future helicopter operations are summarized here and described in detail in the sections below.
 - Federal Standards

65 dBA Ldn

- California Standards
 65 dBA CNEL
 Elk Grove General Plan
 60 dBA Ldn
- Elk Grove General Plan
 60 dBA Ldn
- Wildlife 60 dBA Ldn or CNEL
 Sleep Disturbance 95 dBA SEL (SENEL)
- Sleep Disturbance 95 dBA SEL/SENEL

Refer to Appendix A for definitions of common acoustical terms.

FEDERAL STANDARDS

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The Federal Aviation Administration (FAA) is responsible for regulating aircraft noise at the federal level. 80 According to their standards (Code of Federal Regulations, Part 150 Title 14), annualized (i.e. average over a typical year) aircraft noise is considered compatible with all land uses, provided it is less than 65 dBA Ldn.

CALIFORNIA STANDARDS

The Aeronautics Division of the California Department of Transportation (CALTRANS) is responsible for regulating aircraft noise at the state level. According to their standards (California Code of Regulations, Title 21, Division 2.5, Chapter 6), annualized aircraft noise is considered compatible with all land uses, provided it is less than 65 dBA CNEL.

CITY OF ELK GROVE GENERAL PLAN

Chapter 8 of the City's general plan includes criteria for transportation noise impacts on various land uses.
 According to the guidelines in Table 8-3, transportation noise would be considered compatible with occupied land uses if levels are below 60 dBA Ldn.

Policy N-2-2 also outlines acceptable increases in noise level depending on the existing noise exposure:

- Where existing ambient noise levels are less than 60 dB Ldn at the outdoor activity areas of noise-sensitive uses, a +5 dB Ldn increase in noise levels shall be considered significant; and
- Where existing ambient noise levels range between 60 and 65 dB Ldn at the outdoor activity areas of noise-sensitive uses, a +3 dB Ldn increase in noise levels shall be considered significant; and
- Where existing ambient noise levels are greater than 65 dB Ldn at the outdoor activity areas of noise-sensitive uses, a +1.5 dB Ldn increase in noise levels shall be considered significant. Public roadway improvements to alleviate traffic congestion and safety hazards shall utilize FHWA noise standards to allow a reasonable dollar threshold per dwelling to be used in the evaluation and abatement of impacts.

According to the Elk Grove General Plan (General Plan Update DEIR, Figure 5.10-2, July 2018) the existing noise exposure near the project area ranges from as low as 60 dBA Ldn to 70+ dBA Ldn. Based on the most conservative interpretation of the general plan requirements, helicopter noise alone should be limited to the levels shown in the table below. Noise levels are expressed on a logarithmic scale (decibel), where adding two 60 dB sound sources to an existing 60 dB source would create a 63-dB noise level (not 150 dB). Hence, if the existing noise level is 66 dB, the maximum additional noise level would be 62 dB to limit the increase below 1.5 dB.

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 Table 1
 Maximum Allowable Helicopter Noise Based on the Elk Grove General Plan

Existing Ambient Noise Level	Allowable Increase	Maximum Allowable Helicopter Noise
60 to 65 dBA Ldn	3 dB	60 dBA Ldn
66 dBA Ldn	1.5 dB	62 dBA Ldn

The most restrictive criterion (60 dBA Ldn) has been used for assessment against the city's requirements.

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 95 dBA. The equivalent 95 dBA SEL is used for noise modeling purposes. This is based on achieving an indoor noise level of 80 dBA SENEL, which according to interim guidelines published by the Federal Interagency Committee on Aviation Noise (FICAN, issued June 1997) corresponds to a maximum 10% of the population potentially awakened, and assuming the receiving building construction provides typical outdoor-to-indoor noise reduction of 15 dB.

110 IMPACTS TO WILDLIFE

There is currently limited research and no widely accepted thresholds of significance for assessing the impact of helicopter noise on wildlife. In the interim, environmental analysis in California typically uses 60 dBA continuous noise as a threshold (Caltrans Report, The Effects of Highway Noise on Birds dated

9/30/2007) and therefore a 24-hour average noise level (Ldn or CNEL) inclusive of the associated penalties represents a conservative assessment.

HELICOPTER NOISE MEASUREMENTS

PROCEDURE

Mock-up testing of helicopter flights was carried out on 11/1/2019 between 1:00 to 1:20 PM and included flight paths in both the north and south directions (each direction is included in a single "Profile"), using two different approach/departure profiles. Profile 1 included a generally longer approach/departure path and utilized a normal rate of descent/climb out starting or terminating two (2) miles out from the future helistop site. Profile 2 utilized a shorter approach/departure path and a steeper flight profile that commenced or concluded approximately one (1) mile from the proposed helistop site. All flights were completed once, except Flight N-1 (northern approach, Profile 1), which was repeated a second time (designated N-1').

- 125 During each flight, the helicopter hovered above the approximate location of the future helipad at a height of approximately 150 ft MSL. Flight information was provided by the Flight Safety Institute (10/3/2019) and relevant excerpts are attached in Appendix B. The helicopter utilized for the testing was a multi-engine Agusta-109 helicopter (with turbo-shaft power-plants) which is now considered an older and louder aircraft than the newer, quieter models anticipated for use at the new hospital.
- 130 Noise levels were monitored at 11 pre-determined locations using calibrated unattended sound level meters (Larson Davis 831C) as shown in Figure 3 below. Photos of the monitoring locations are provided in Appendix C attached. Each microphone was secured to available surfaces (typically street light poles or trees in the public right-of-way) approximately 10 feet above the ground. The sound level meters recorded continuously before during and after the helicopter flights and relevant noise metrics were subsequently 135

Figure 3: Helicopter Mock-Up Testing Map



MEASUREMENT RESULTS

140 Single Event Noise (SENEL)

The only applicable criterion that can be directly assessed using the measured data is the single event criteria for sleep disturbance (SENEL) since this can be analyzed for each individual helicopter test flight. Helicopter events were determined through analysis of spectral data, review of sound recordings taken on the unattended sound level meters, and time-synchronized data from other positions and results are summarized in the table below. It should be noted that long term noise metrics (Ldn and CNEL) have been assessed using computer noise models in accordance with industry standards in the sections below.

The SENEL could not be calculated at some of the more remote monitoring positions since the helicopter noise level was near or below the local ambient noise (i.e. poor signal to noise ratio) and are shown as

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empty cells in the table below. The "Sleep Disturbance" of 95 dBA SENEL was not exceeded at any of the noise monitoring locations. The maximum noise level (LSMax) is provided for informational purposes.

	Single Event Noise Level (dBA SENEL)			Maximum Noise Level (dBA LSMax)						
Location	N1	S 1	N2	S2	N1'	N1	S 1	N2	S2	N1'
Position 1	70 E	77.0	70.7	70.2	70.0	60.2	65.6	70.2	67.0	60.0
(Elliott Ranch Elementary)	76.5	11.2	19.1	19.2	79.0	09.5	05.0	70.2	07.2	00.0
Position 2	85.2	85.3	8/1 3	86.1	83.0	75 7	73 5	75.2	76.4	73.2
(Snowy Egret Ct. & Night Heron Way)	00.2	00.0	04.5	00.1	03.9	15.1	75.5	15.2	70.4	73.2
Position 3	87.6	89.6	86.9	90.2	86.2	79.0	79.6	77 9	78 7	75.6
(Ruddy Duck Way & Migration Dr.)	01.0	00.0	00.0	50.2	00.2	75.0	10.0	11.0	10.1	75.0
Position 4	90.3	88.8	91.2	90.2	90.6	78.8	75 5	79.9	76.9	77 9
(CNU Near W. Taron Drive)	00.0	00.0	01.2	00.2	00.0	70.0	70.0 75.5	10.0	10.0	11.5
Position 5	87.8	85 9	85.7	86.9	86.6	76.2	73.6	73.6	73 7	75 4
(Holiday Inn Express)	07.0 00	00.0	00.1	00.0	00.0	10.2	10.0	10.0	10.1	10.1
Position 6	87.8	87.8	87 /	83.0	86.8	76.1	70.3	77 1	73 5	78 /
(Heger Way & Yarnell Way)	07.0 07.0	07.4	00.0	00.0	70.1	75.5	77.1	75.5	70.4	
Position 7	75 1	72 5	68 5	68.8		63.6	65.2	57.6	58.8	50.2
(Joseph Sims Elementary)	75.1	72.5	00.0	00.0	-	03.0	05.2	57.0	50.0	09.Z
Position 8	_	_	_	_		10.2	10.0	50 /	50 5	_
(Stone Lake Elementary)	-	-	-	-	-	49.2	49.0	50.4	50.5	-
Position 9	97.2	97.9	96.9	99 F	99.2	74.0	75 7	72.5	747	747
(Stone Lake Wildlife Refuge)	07.2	07.0	00.0	00.0	00.2	74.0	/5./	73.5	74.7	74.7
Position 10	80.7	99.0	80.2	97 /	02.1	70.4	70.4	916	77.9	Q1 Q
(Maritime Drive Commercial Park)	09.7	08.0	09.2	07.4	92.1	79.4	79.4	01.0	11.8	01.8
Position 11	911	95.9	94.2	95.1	85.0	74.4	72.4	72.6	72.2	70.0
(Stone Lake Wildlife Refuge)	84.4	8.68	84.3	00.1	03.0	/4.4	72.4	/3.6	12.3	72.2

Table 2 Measured Noise Levels During the Helicopter Testing at 11 Positions

Other Data and Observations

The 1-second time record, as well as a spectrogram (shows noise level over time as well as frequency) from 12:50 to 1:30 PM is provided in the attached charts within Appendix D; these charts include the helicopter testing as well as local ambient noise not due to the helicopter during this time. A full record of measured noise levels (in 5-minute intervals) at each monitoring position is provided in Appendix E to show typical ambient noise alongside the helicopter testing.

As shown in the attached charts, helicopter noise is clearly audible above the background noise at most positions near the flight path, but in many cases is comparable to or less than the noise from local sources as further illustrated in the table below. During meter setup and removal, SM&W staff noticed many sources

160 as further illustrated in the table below. During meter setup and removal, SM&W staff noticed many sources of intermittent noise in these areas. The residential neighborhoods specifically included noise from garbage trucks, lawncare equipment, local traffic and others.

An SMW consultant was present at the furthest monitoring position (8, near Stone Lake Elementary School) during the flights and noted that helicopter noise was barely audible when there were no cars or other noise sources. Helicopter noise was inaudible when cars passed by or when nearby landscaping equipment was in use.

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	Highest Measured 5-minute Noise Levels							
	Without	Helicopter	During Helicopter Testing					
Position	Average (Leq)	Maximum (LSmax)	Average (Leq)	Maximum (LSmax)				
Position 1 (Elliott Ranch Elementary)	69 dBA	89 dBA	60 dBA	73 dBA				
Position 2 (Snowy Egret Ct. & Night Heron Way)	66 dBA	84 dBA	64 dBA	76 dBA				
Position 3 (Ruddy Duck Way & Migration Dr.)	64 dBA	79 dBA	67 dBA	79 dBA				
Position 4 (CNU Near W. Taron Drive)	59 dBA	75 dBA	69 dBA	79 dBA				
Position 5 (Holiday Inn Express)	64 dBA	84 dBA	65 dBA	75 dBA				
Position 6 (Heger Way & Yarnell Way)	66 dBA	81 dBA	65 dBA	79 dBA				
Position 7 (Joseph Sims Elementary)	73 dBA	91 dBA	57 dBA	72 dBA				
Position 8 (Stone Lake Elementary)	74 dBA	86 dBA	60 dBA	74 dBA				
Position 9 (Stone Lake Wildlife Refuge)	60 dBA	72 dBA	65 dBA	76 dBA				
Position 10 (Maritime Drive Commercial Park)	68 dBA	81 dBA	69 dBA	82 dBA				
Position 11 (Stone Lake Wildlife Refuge)	57 dBA	72 dBA	64 dBA	75 dBA				

Table 3 Comparison of Noise Levels without Helicopter and During Helicopter Testing

AEDT NOISE MODELING

- 170 A computer noise model of the proposed helicopter flight paths, helicopter models, and anticipated flight frequency was constructed using the Aviation Environmental Design Tool (AEDT) which is issued and approved by the Federal Aviation Administration (FAA) for aircraft noise analysis in the US. This software creates a 3D model of the surrounding area and outputs noise contours based on annualized helicopter flight operations. Please note that AEDT is considered a conservative and basic noise model as it does not
- 175 take into account acoustic shielding provided by buildings in the area or other ambient noise sources (traffic, etc.). AEDT noise modeling was performed by KB Environmental Sciences, Inc. based on the information noted below and results were provided to SM&W for inclusion in this report.

MODEL CALIBRATION

First, a model of a single test flight (see noise measurements section above) was created for comparison to the measured noise levels using the AEDT data for the Model A-109 helicopter and test flight paths. As indicated in Table 4, the AEDT data predicted noise levels that varied from the field measured data as follows:

- The modeled noise levels were greater than the field measured noise levels for 34 of the 44 total events (~75%) by as much as 9 dB but typically between 2 and 7 dB. In general, an increase of 10 dBA is perceived as a "doubling" of sound intensity.
- The modeled noise levels were less than the field measured noise levels for 8 of the 44 total events (~20%) by as much as 7 dBA, but typically 2 dBA or less. In general, 3 dBA is considered the just noticeable difference (i.e. minimum perceivable) in noise levels for the average person.

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 Since the AEDT model predictions are conservative (i.e. model generally predicts higher noise levels than were actually measured), the model is considered suitable for impact screening purposes.

		Maximum Helicopter Noise Level (LAMax) at Position										
Profile	Description	1	2	3	4	5	6	7	8	9	10	11
N-1	Measured	69	76	79	79	76	76	64	49	74	79	74
	Modeled	70	78	80	78	76	82	60	54	79	85	76
	Difference	1	2	1	-1	0	6	-4	5	5	6	2
S-1	Measured	66	74	80	76	74	79	65	49	76	79	72
	Modeled	74	83	87	83	76	82	58	57	74	88	71
	Difference	8	9	7	7	2	3	-7	8	-2	9	-1
N-2	Measured	70	75	78	80	74	77	58	50	73	82	74
	Modeled	70	76	80	78	76	80	61	55	80	84	77
	Difference	0	1	2	-2	2	3	3	5	7	2	3
S-2	Measured	67	76	79	77	74	74	59	51	75	78	72
	Modeled	74	80	84	83	76	78	60	58	74	83	71
	Difference	7	4	5	6	2	4	1	7	-1	5	-1

Table 4 Measured vs. Modeled Comparison of Maximum Helicopter Noise Level at all the Positions

FUTURE NOISE MODEL INPUTS

A separate model of the proposed future helicopter flight conditions from the new hospital was constructed. The helipad was located at the following approximate location:

- Latitude: N 38 24' 28.60520
- Longitude: W 121 28' 49.92944
- Height: 221 ft AMSL

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The following flight scenarios were provided to SM&W to model a range of possible flight operations spanning from a "normal" month to the worst case ("busy") month. Flights were distributed evenly between the north and south approaches.

- Normal: 4 landings per month
- Busy: 6 landings per month

The following helicopter models and flight distributions were provided to SM&W for modeling noise from the new helipad.

Airbus H-135:	~90%
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- Airbus H-130: ~5%
- Airbus H-145: ~5%

Out of these models, AEDT only includes the EC-130 (now re-named the H-130), however this is considered an appropriate approximation of overall helicopter noise exposure given the H-135 is considered quieter than the H-130, and the H-135 accounts for almost all anticipated flights.

It should be noted that all the proposed helicopter models are significantly quieter than the older Model A-109 used for the mock-up testing described in the sections above. A helicopter other than those listed above may on a special occasion request approval to utilize the CNUMC helistop, but such operations are expected to be few and far between.

AEDT requires helicopter operations to be input separately for day, evening and nighttime in order to appropriately calculate annualized noise metrics consistent with FAA, state, and local criteria. The following anticipated flight distribution was provided to SM&W for modeling purposes:

- Day (7am-7pm): 80%
- Evening (7pm-10pm): 15%
- Night (10pm-7am): 5%

Based on the anticipated flight operations described above, the following annualized operations were used for the noise model, consistent with FAA requirements.

		Holiooptor	Cultertituted	Operations						
Condition	Direction	Model	Model	Day	Evening	Night	TOTAL			
		Airbus H-135				0.0033	0.0658			
	North	Airbus H-130	EC 130	0.0526	0.0099					
Normal		Airbus H-145								
Normai	South	Airbus H-135	EC 130	0.0526	0.0099	0.0033	0.0658			
		Airbus H-130								
		Airbus H-145								
	North	Airbus H-135	EC 130	0.0789	0.0148	0.0049	0.0986			
		Airbus H-130								
Ruov		Airbus H-145								
Busy	South	Airbus H-135	EC 130		0.0148	0.0049	0.0986			
		Airbus H-130		0.0789						
		Airbus H-145								

Table 5 Annualized Helicopter Operations used in the Model

A separate modeling scenario was created for each flight profile (N-1/S-1 vs N-2/S-2) and each operational condition (normal vs busy) for a total of 4 scenarios.

MODELING RESULTS

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The resulting noise contours for each of these scenarios for both 24-hour average noise (Ldn, CNEL) and single event noise (SEL) are provided in the following contours.

- 230 No exceedances of the screening criteria were found.
 - Helicopter noise is predicted to be at or below 60 dBA Ldn/CNEL in all areas and would, therefore, be compatible with Federal, State, and local requirements (60 or 65 Ldn or CNEL, see Criteria section above).
 - Single event levels marginally exceeding 95 dBA SEL (criteria for sleep disturbance) were limited to the future hospital area only. Residential uses nearest the new hospital are located marginally within the 85 dBA SEL contour, and levels were noticeably lower at all other residential uses.

Ldn Contour 1 Normal, Flight Profile 1



Ldn Contour 2 Busy, Flight Profile 1



Ldn Contour 3 Normal, Flight Profile 2



Ldn Contour 4 Busy, Flight Profile 2



CNEL Contour 1 Normal, Flight Profile 1



CNEL Contour 2 Busy, Flight Profile 1



CNEL Contour 3 Normal, Flight Profile 2



CNEL Contour 4 Busy, Flight Profile 2



SEL Contour 1 Normal, Flight Profile 1



SEL Contour 2 Busy, Flight Profile 1



SEL Contour 3 Normal, Flight Profile 2



SEL Contour 4 Busy, Flight Profile 2



SOUNDPLAN NOISE MODELING

- 230 A secondary computer noise model was constructed using the Soundplan (v 7.3) noise modeling software. This model uses ray tracing methods to calculate individual noise paths including reflections, shielding from buildings, and can accommodate a range of noise source types. Please note AEDT only considers aircraft noise and standard noise propagation calculations.
- The purpose of this secondary computer model was to show graphically the individual contributions of the existing traffic noise and future helicopter flights, as well as the combined noise level. Individual roads, buildings (existing and future), and helicopter paths were input into the model using available area satellite imagery, hospital architectural drawings, and flight path information provided to SM&W. In the residential neighborhoods, individual houses were modeled in areas near noise sources (helicopter flight paths or roadways). At the inner blocks of these neighborhoods, houses were grouped to simplify model run-time. This simplification does not noticeably impact the overall model accuracy as the primary acoustic shielding (if any) is provided by buildings nearest the noise source. A representative image of the Soundplan 3D wire-frame model is provided in Figure 4 below for informational purposes.

Figure 4: Soundplan 3D Wire-Frame Model



245 MODEL CALIBRATION

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Helicopter Noise

A model comparable to the AEDT model was first constructed including only the local terrain conditions and helicopter flight paths and without buildings, roads, etc. for comparison of the two modeling methods. Helicopter noise levels were calculated at each of the monitoring positions using flight path N-1/S-1 and the "Busy" operational condition. As shown in the table below, there were some discrepancies at certain positions between the two models, however for all the positions the levels predicted by the Soundplan model were comparable or louder than those predicted by the AEDT model. Therefore, the Soundplan model is considered an even more cautious estimate of helicopter noise, especially considering the generally conservative predictions provided by the AEDT model.

Table 6 Results of Predicted Helicopter Noise Levels from AEDT and SoundPlan

	Modeled Helicopter Noise Levels (Ldn dBA)						
Position	AEDT	Soundplan	Difference				
Position 1	23.1	26.4	3.3				
(Elliott Ranch Elementary)							
Snowy Egret Ct. & Night Heron Way)	27.5	30.7	3.2				
Position 3 (Ruddy Duck Way & Migration Dr.)	32.9	34.4	1.5				
Position 4 (CNU Near W. Taron Drive)	41.8	41.3	-0.5				
Position 5 (Holiday Inn Express)	36.9	36.7	-0.2				
Position 6 (Heger Way & Yarnell Way)	28.7	33.1	4.4				
Position 7 (Joseph Sims Elementary)	16.5	22.1	5.6				
Position 8 (Stone Lake Elementary)	17.3	21.6	4.3				
Position 9 (Stone Lake Wildlife Refuge)	30.4	34.4	4.0				
Position 10 (Maritime Drive Commercial Park)	33.0	39.4	6.4				
Position 11 (Stone Lake Wildlife Refuge)	28.0	32.5	4.5				

Traffic Noise

A separate model was constructed to calibrate predictions for traffic noise against the City of Elk Grove General Plan. This model contained only the modeled roads and terrain, no buildings or helicopters were included. Existing traffic noise levels were extracted from the tables in Appendix E (Noise Modeling Data) of the City of Elk Grove, General Plan Update DEIR, dated July 2018. As shown in the table below, the traffic noises predicted by the Soundplan model are in good agreement with the General Plan.

260

265

270

	1 5					
		Elk Grove G	eneral Plan	Soundpla		
Road	Segment	Published Noise Level (dBA Ldn)	Distance from Centerline	Modeled Noise Level dBA Ldn	Distance from Centerline	Difference
I-5	Elk Grove Blvd to Hood Franklin Rd.	70	592 feet	70.3	592 feet	0.3
Elk Grove	I-5 Ramp to Harbour Point Dr.	70	91 feet	70.7	91 feet	0.7
Blvd	Harbour Point Dr. to Four Winds Dr.	70	138 feet	69.7	138 feet	-0.3
Harbour Point Drive	Elk Grove Blvd. to Laguna Blvd.	70	40 feet	69.3	40 feet	-0.7

Table 7 Comparing Noise Levels of Elk Grove General Plan with SoundPlan Model

The existing sound walls along residential sections of I-5 were included in the later models of traffic noise since these were not accounted for in the General Plan predictions. Including sound walls would lower the ground level noise in these areas due to traffic, but not helicopter noise.

MODELING RESULTS

The resulting noise contours for each of these scenarios are provided in Figures 5 through 7 below. As shown in these maps, the annual noise contributions from future helicopter operations at the proposed hospital are expected to be below the existing traffic noise in the area. In general, noise levels expressed in decibels from multiple sources are controlled by the loudest source (in this case, traffic noise) and other noise sources would need to be within 10 dB of the traffic noise to result in a measurable increase in annual noise levels. Helicopter operations are not predicted to increase these levels.

255



Figure 5: Existing Traffic Noise Only

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Figure 6: Future Helicopter Noise Only (Profile N-1/S-1, Busy)



Figure 7: Combined future noise (existing traffic + future helicopter)

280 CONCLUSIONS

The measurements and modeling of helicopter noise described in the sections above show that the proposed helicopter operations would be within Federal, State and Local thresholds. No additional mitigation is necessary.

285 Despite these conclusions, the helicopter procedures and policies currently proposed by California 285 Northstate University will reduce perceived noise exposure by minimizing flights over and near residential areas, and, where flights must take place near residential areas, the flight path is positioned over a major noise source (Interstate 5) to minimize the perceived noise exposure. APPENDIX A

DEFINITIONS OF COMMON ACOUSTICAL TERMS

A WEIGHTING is the decibel scale for sound level measurements using the "A" weighted network of a sound level meter and is denoted as "dBA." The A-weighted network is shaped to correspond to the response of the human ear so that the results correlate approximately with human perception. It is the accepted standard for environmental noise measurements.

AMBIENT NOISE (see also Background Noise) is the sound pressure level associated with a given environment. It is a composite of sounds from near and far. For the purpose of measuring a specific noise source, it is the sound pressure level of all sources excluding the specific sound source being measured.

BACKGROUND NOISE (also Ambient Noise) is the sound pressure level associated with given environment. For the purpose of measuring indoor ambient noise, the dominant component of the noise is caused by the HVAC system.

COMMUNITY NOISE EQUIVALENT LEVEL (CNEL) similar to the DNL (see below) except that an additional penalty of 5 dB is added during evening hours (7 PM to 10 PM) and is typically, but not exclusively used by the State of California to report general environmental noise rather than DNL.

DAY-NIGHT LEVEL (L_{dn} or DNL) is the A-weighted equivalent continuous sound exposure level for a 24hour period with a 10 dB adjustment added to the sound levels occurring during nighttime hours (10 PM to 7 AM). Ldn is typically used by regulating agencies to report general environmental noise.

$$\begin{split} L_{dn} &= \left[(L_d + 10 \ \text{Log}_{10} \ 15) \ \& \ (L_n + 10 + 10 \ \text{Log}_{10} \ 9) \right] - 10 \ \text{log}_{10} 24 \\ & \text{Where} \quad L_d = \text{Leq for the daytime} \\ & L_n = \text{Leq for the nighttime} \\ & \& = \text{decibel addition} \end{split}$$

DECIBEL or properly decibel scale is the scale that measures sound level pressure (or other quality of interest) defined as 20 times the logarithm of the ratio of the sound level pressure (or other quality) to a standard reference level that by convention has been selected to approximate the threshold of hearing The standard reference in the U.S. is 0 decibel equals a pressure of 0.0002 Micro bar. The abbreviation for decibel is dB.

ENVIRONMENTAL NOISE, contrary to its original meaning referring to natural noise, has become known as the noise in the outdoor environment from transportation systems, machinery or other manmade sources.

FREQUENCY is the pitch of sound and refers to the cyclical variations per unit time. Noise can be composed of sound from the entire spectrum of frequencies. Frequency is expressed in cycles per second or Hertz. This is abbreviated Hz.

INTEGRATED OR EQUIVALENT SOUND LEVEL is the A-weighted equivalent continuous sound exposure level for a defined time. This is abbreviated $L_{eq (time)}$.

OCTAVE BAND is the range of sound frequencies whose lower limit frequency is half the upper limit frequency (one octave). Octave bands are identified by the geometric mean frequency or center between the lower limit and the upper limit.

OUTDOOR INDOOR TRANSMISSION CLASS (OITC) is the single number rating system to classify the transmission loss of materials used for environmental noise isolation rather than reporting the levels at separate frequency bands. For environmental noise, this rating system is preferred over STC because it was specifically designed to address transportation noise using an average transportation noise spectrum. OITC ratings are calculated from measured values of transmission loss in 1/3 octave bands, according to ASTM Standard E 1332.

SOUND EXPOSURE LEVEL (SEL) is the perceived loudness of a single noise event and is dependent on the noise level as well as the duration. This is calculated by adding all the noise energy over the duration

of the event, expressed in decibels referenced to a time period of 1-second. SEL can only be field measured if the start and end times of a specific noise event are known.

SINGLE EVENT NOISE EXPOSURE LEVEL (SENEL) is similar to the SEL metric in that it illustrates the perceived loudness of a single noise event using level and duration. However, the duration is not the full event time, but the time period where the noise level is within 10 dB of the maximum level which is then expressed in decibels referenced to a time period of 1-second. SENEL is easily field measured by sound level meters with an SENEL function or manually calculated during post-processing if the noise level time record is retained.

SOUND LEVEL METER is an instrument to measure sound pressure levels in dB. Various features are incorporated into an instrument to select specific sound frequency bands, integrate pressure over time and display minimum, mean, and peak levels.

SOUND PRESSURE LEVEL (SPL) is the ratio, expressed in decibels, of the mean-square sound pressure level to a reference mean-square sound pressure level that by convention has been selected to approximate the threshold of hearing (0.0002 Microbar in the U.S.)

SOUND TRANSMISSION CLASS (STC) is the established single number rating system to classify the transmission loss of materials rather than reporting the levels at separate frequency bands. The rating system was originally designed to address speech isolation and is derived from measured values of transmission loss, according to ASTM E 413. It is not appropriate for use in environmental noise isolation applications because the STC rating does not sufficiently take into account the low frequencies that predominate in transportation noise. Two materials with the same STC rating may achieve very different levels of transportation noise isolation.

TRANSMISSION LOSS is a measure of the sound insulation of a material stated in decibels. Generally, the transmission losses of materials are given in standard 1/3 octave band intervals.

APPENDIX B

HELICOPTER MOCK-UP FLIGHT INFORMATION

EXCERPTS FROM FLIGHT SAFETY INSTITUTE LETTER DATED 10/3/2019

SEQUENCE OF EVENTS

- 1. Monitoring units tested, calibrated and positioned between 9:00 AM and 12:00 Noon.
- 2. Monitoring units recording ambient sound pressure levels <u>and</u> helicopter arrival and departure sound levels from 12:00 Noon to 3:00 PM.
- 3. Establish air-to-ground communications (129.45 VHF) between helicopter and acoustic's site manager (ASM) at 1:00 PM.
 - a. ASM confirms all monitoring sites are operational and Test Site "A" is <u>Clear of ALL Non-Essential Personnel</u> at 1:00 PM.
- 4. Helicopter reports "2 miles out" and <u>initiates N-1 Approach Profile</u> to Site "A" at 1:05 PM *unless* ASM requests "Time Out".
- 5. Simulated Landing (Hover) at Site "A" between 1:07 1:08 PM.
- 6. Helicopter reports and <u>initiates N-2 Takeoff and Climb-Out Profile</u> from Site "A" at 1:08 PM.
- Helicopter reports "1 mile out" and <u>initiates N-3 Approach Profile</u> ("Noise Abatement" procedure) to Site "A" at 1:12.
- 8. Simulated Landing (Hover) at Site "A" between 1:14 1:15 PM.
- 9. Helicopter reports and <u>initiates N-4 Takeoff and Climb-Out Profile</u> ("Noise Abatement procedure) from Site "A" at 1:15 1:17 PM.
- Helicopter reports "2 miles out" and <u>initiates S-1 Approach Profile</u> to Site"A" at 1:20 PM.
- 11. Simulated Landing (Hover) at Site "A" between 1:22 1:23 PM.
- 12. Helicopter reports and <u>initiates S-2 Takeoff and Climb-Out Profile</u> from Site "A" at 1:23- 1:25 PM.
- 13. Helicopter reports "1 mile out" and <u>initiates S-3 Approach Profile</u> ("Noise Abatement procedure) to Site "A" at 1:27 PM.
- 14. Simulated Landing (Hover) at Site "A" between 1:28 1:29 PM.
- 15. Helicopter reports and <u>initiates S-4 Takeoff and Climb-Out Profile</u> ("Noise Abatement procedure) from Site "A" at 1:29 1:31 PM.
- 16. Helicopter reports to ASM that all flight profiles are completed.
- 17. ASM advises if necessary to re-fly any Flight Profiles and identifies profiles that require "re-fly", i.e., N-3 and N-4, etc.
- 18. Helicopter departs area and returns to base.





FLIGHT SAFETY INSTITUTE RANCHO CORDOVA, CALIFORNIA

FIELD ASSESSMENT OF HELICOPTER "NOISE" ON ALTERNATIVE FLIGHT-TRACKS									
CNU Medical Center - Site "A" (Elevated Helistop Site)									
<u>October 29, 2019</u>									
Elight Profile Number	Direction of Helicopter Arrival (Aircraft Heading)	<u>En Route</u> <u>Altitude</u> <u>(MSL)</u>	Elight Track Over Ground During Arrival and Initial Descent	<u>Descent</u> Point for Approach	Rate of Descent (fpm) During Approach	<u>Minimum.</u> Descent Altitude	Rate of Climb Out During Departure	<u>Flight Track Over</u> <u>Ground During</u> <u>Departure</u>	<u>Miscellaneous</u> <u>Notes/Comments</u>
N-1	From North (160° <u>+</u>)	1.000 ft. MSL	Parallel to and Immediately West of I-5	2 Miles North of CNUMC Site "A"	500 fpm	150 ft. msl <u>+</u>	500 fpm	Depart Heading 180° <u>+</u> Until Intercepting West Side of I-5; then Paralleling I-5 Until 1,000 ft. MSL	"Normal" Approach and Takeoff/Departure.
N-2	From North (160° <u>+</u>)	1.000 ft. MSL	Parallel to and Immediately West of I-5	1 Mile North of CNUMC Site "A"	1,000 fpm	150 ft. msl <u>+</u>	1,000 fpm	Depart Heading 180°± Until Intercepting West Side of I-5; then Paralleling I-5 Until 1,000 ft. MSL	"Noise Abatement" Approach and Takeoff/Departure
S-1	From South (340° <u>+</u>)	1.000 ft. MSL	Parallel to and Immediately East of I-5	2 Miles South of CNUMC Site "A"	500 fpm	150 ft. msl <u>+</u>	500 fpm	Depart Heading 305°± Until Immediately East of I-5 then Fly Northbound Parallel to and East of I-5.	"Normal" Approach and Takeoff/Departure.
\$-2	From South (340°±)	1.000 ft. MSL	Parallel to and Immediately East of I-5	1 Mile South of CNUMC Site "A"	1,000 fpm	150 ft. msl±	1,000 fpm	Depart Heading 305° <u>+</u> Until Immediately East of I-5 then Fly Northbound Parallel to and East of I-5.	"Noise Abatement" Approach and Takeoff/Departure

APPENDIX C

PHOTOS OF NOISE MONITORING LOCATIONS



Position 1: Elliott Ranch Elementary School (E. Taron Dr. and Bobbell Dr.)



Position 2: Snowy Egret Way and Night Heron Way



Position 3: Migration Drive and Ruddy Duck Way

Position 4: CNUMC (W. Taron Drive)



CNU Medical Center – Helicopter Noise Report



Position 5: Holiday Inn Express (Maritime Dr.)

Position 6: Heger Way and Yarnell Way





Position 7: Joseph Sims Elementary School (Buckminster Dr. and Bay Head Ct.)



Position 8: Johnson Park Rec Center Stone Lake Elementary







Position 10: Maritime Dr. - Commercial Park

APPENDIX D 1-SECOND TIME RECORDS & SPECTROGRAMS HELICOPTER TESTING (12:50 TO 1:30 PM)

CNU Medical Center – Helicopter Noise Report



Position 1:





Position 2:





Position 3:





Position 4:





Position 5:





Position 6:





Position 7:





Position 8:

1 Second Noise Levels, Spectrum over Time

20kHz Reset Zoom 8kHz 1kHz Frequency 100Hz 6.3Hz 12:58 13:00 13:02 13:04 13:06 13:08 13:10 13:12 13:14 13:16 13:18 25 dB 0 dB 50 dB 75 dB

OBA 1/3 SPL



Position 9:





Position 10:




APPENDIX E 5-MINUTE INTERVAL TIME RECORDS COMPLETE DATA FOR EACH LOCATION























Time of Day, hour





