2303 GIANERA STREET
NOISE AND VIBRATION ASSESSMENT

Santa Clara, California

August 29, 2024

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Project: 24-042

INTRODUCTION

Eight three-story townhome units are proposed at 2303 Gianera Street in Santa Clara, California. The site is currently developed with a single-family residence and accessory structures, which would be demolished as part of the proposed project. Each proposed townhome unit would contain a two-car garage and rear yard.

This report evaluates the project's potential to result in significant noise and vibration impacts with respect to applicable California Environmental Quality Act (CEQA) guidelines. The report is divided into three sections: 1) the Setting Section provides a brief description of the fundamentals of environmental noise and groundborne vibration, summarizes applicable regulatory background, and describes the existing ambient noise environment at the project site; 2) the Plan Consistency Analysis Section discusses noise and land use compatibility utilizing applicable regulatory background; and, 3) the Impacts and Mitigation Measures Section describes the significance criteria used to evaluate project impacts, provides a discussion of each project impact, and presents measures, where necessary, to mitigate the impacts of the project on sensitive receptors in the vicinity.

SETTING

Fundamentals of Environmental Noise

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound could be caused by its *pitch* or its *loudness*. *Pitch* is the height or depth of a tone or sound, depending on the relative rapidity (frequency) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. *Loudness* is the intensity of sound waves combined with the reception characteristics of the ear. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave.

In addition to the concepts of pitch and loudness, there are several noise measurement scales which are used to describe noise in a particular location. A *decibel (dB)* is a unit of measurement which indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10 decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Technical terms are defined in Table 1.

There are several methods of characterizing sound. The most common in California is the *A-weighted sound level (dBA).* This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an

average level that has the same acoustical energy as the summation of all the time-varying events. This *energy-equivalent sound/noise descriptor* is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

The scientific instrument used to measure noise is the sound level meter. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends upon the distance the receptor is from the noise source. Close to the noise source, the models are accurate to within about plus or minus 1 to 2 dBA.

Since the sensitivity to noise increases during the evening and at night -- because excessive noise interferes with the ability to sleep -- 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The *Community Noise Equivalent Level* (*CNEL*) is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to evening (7:00 pm - 10:00 pm) and a 10 dB addition to nocturnal (10:00 pm - 7:00 am) noise levels. The *Day/Night Average Sound Level* (L_{dn} or *DNL*) is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.

Effects of Noise

Sleep and Speech Interference

The thresholds for speech interference indoors are about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating. Outdoors the thresholds are about 15 dBA higher. Steady noises of sufficient intensity (above 35 dBA) and fluctuating noise levels above about 45 dBA have been shown to affect sleep. Interior residential standards for multi-family dwellings are set by the State of California at 45 dBA L_{dn}. Typically, the highest steady traffic noise level during the daytime is about equal to the L_{dn} and nighttime levels are 10 dBA lower. The standard is designed for sleep and speech protection and most jurisdictions apply the same criterion for all residential uses. Typical structural attenuation is 12 to 17 dBA with open windows. With closed windows in good condition, the noise attenuation factor is around 20 dBA for an older structure and 25 dBA for a newer dwelling. Sleep and speech interference is therefore possible when exterior noise levels are about 57 to 62 dBA L_{dn} with open windows and 65 to 70 dBA L_{dn} if the windows are closed. Levels of 55 to 60 dBA are common along collector streets and secondary arterials, while 65 to 70 dBA is a typical value for a primary/major arterial. Levels of 75 to 80 dBA are normal noise levels at the first row of development outside a freeway right-of-way. In order to achieve an acceptable interior noise environment, bedrooms facing secondary roadways need to be able to have their windows closed; those facing major roadways and freeways typically need special glass windows.

Annoyance

Attitude surveys are used for measuring the annoyance felt in a community for noises intruding into homes or affecting outdoor activity areas. In these surveys, it was determined that the causes for annoyance include interference with speech, radio and television, house vibrations, and

interference with sleep and rest. The L_{dn} as a measure of noise has been found to provide a valid correlation of noise level and the percentage of people annoyed. People have been asked to judge the annoyance caused by aircraft noise and ground transportation noise. There continues to be disagreement about the relative annoyance of these different sources. When measuring the percentage of the population highly annoyed, the threshold for ground vehicle noise is about 50 dBA L_{dn}. At a L_{dn} of about 60 dBA, approximately 12 percent of the population is highly annoyed. When the L_{dn} increases to 70 dBA, the percentage of the population highly annoyed increases to about 25 to 30 percent of the population. There is, therefore, an increase of about 2 percent per dBA between a L_{dn} of 60 to 70 dBA. Between a L_{dn} of 70 to 80 dBA, each decibel increase increases by about 3 percent the percentage of the population highly annoyed. People appear to respond more adversely to aircraft noise. When the L_{dn} is 60 dBA, approximately 30 to 35 percent of the population is believed to be highly annoyed. Each decibel increase to 70 dBA adds about 3 percentage points to the number of people highly annoyed. Above 70 dBA, each decibel increase results in about a 4 percent increase in the percentage of the population highly annoyed.

TABLE 1 Definition of Acoustical Terms Used in this Report

Term	Definition
Decibel, dB	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20 micro Pascals.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e. g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sound are below 20 Hz and Ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level, L_{eq}	The average A-weighted noise level during the measurement period.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Day/Night Noise Level, L_{dn} or DNL	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 p.m. and 7:00 a.m.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 p.m.to 10:00 p.m. and after addition of 10 decibels to sound levels measured in the night between 10:00 p.m. and 7:00 a.m.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Source: Handbook of Acoustical Measurements and Noise Control, Harris, 1998.

TABLE 2 Typical Noise Levels in the Environment

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	110 dBA	Rock band
Jet fly-over at 1,000 feet		
	100 dBA	
Gas lawn mower at 3 feet		
	90 dBA	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	80 dBA	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawn mower, 100 feet	70 dBA	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	60 dBA	
		Large business office
Quiet urban daytime	50 dBA	Dishwasher in next room
Quiet urban nighttime	40 dBA	Theater, large conference room
Quiet suburban nighttime		
	30 dBA	Library
Quiet rural nighttime		Bedroom at night, concert hall (background)
	20 dBA	
		Broadcast/recording studio
	10 dBA	
	0 dBA	

Source: Technical Noise Supplement (TeNS), California Department of Transportation, September 2013.

Fundamentals of Groundborne Vibration

Ground vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One method is the Peak Particle Velocity (PPV). The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. In this report, a PPV descriptor with units of mm/sec or in/sec is used to evaluate construction generated vibration for building damage and human complaints. Table 3 displays the reactions of people and the effects on buildings that continuous or frequent intermittent vibration levels produce. The guidelines in Table 3 represent syntheses of vibration criteria for human response and potential damage to buildings resulting from construction vibration.

Construction activities can cause vibration that varies in intensity depending on several factors. The use of pile driving and vibratory compaction equipment typically generates the highest construction related groundborne vibration levels. Because of the impulsive nature of such activities, the use of the PPV descriptor has been routinely used to measure and assess groundborne vibration and almost exclusively to assess the potential of vibration to cause damage and the degree of annoyance for humans.

The two primary concerns with construction-induced vibration, the potential to damage a structure and the potential to interfere with the enjoyment of life, are evaluated against different vibration limits. Human perception to vibration varies with the individual and is a function of physical setting and the type of vibration. Persons exposed to elevated ambient vibration levels, such as people in an urban environment, may tolerate a higher vibration level.

Structural damage can be classified as cosmetic only, such as paint flaking or minimal extension of cracks in building surfaces; minor, including limited surface cracking; or major, that may threaten the structural integrity of the building. Safe vibration limits that can be applied to assess the potential for damaging a structure vary by researcher. The damage criteria presented in Table 3 include several categories for ancient, fragile, and historic structures, the types of structures most at risk to damage. Most buildings are included within the categories ranging from “Historic and some old buildings” to “Modern industrial/commercial buildings”. Construction-induced vibration that can be detrimental to the building is very rare and has only been observed in instances where the structure is at a high state of disrepair and the construction activity occurs immediately adjacent to the structure.

The annoyance levels shown in Table 3 should be interpreted with care since vibration may be found to be annoying at lower levels than those shown, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying. Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors, or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage.

TABLE 3 Reaction of People and Damage to Buildings from Continuous or Frequent Intermittent Vibration Levels

Velocity Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.01	Barely perceptible	No effect
0.04	Distinctly perceptible	Vibration unlikely to cause damage of any type to any structure
0.08	Distinctly perceptible to strongly perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
0.1	Strongly perceptible	Threshold at which there is a risk of damage to fragile buildings with no risk of damage to most buildings
0.25	Strongly perceptible to severe	Threshold at which there is a risk of damage to historic and some old buildings.
0.3	Strongly perceptible to severe	Threshold at which there is a risk of damage to older residential structures
0.5	Severe – Vibrations considered unpleasant	Threshold at which there is a risk of damage to new residential and modern commercial/industrial structures

Source: Transportation and Construction Vibration Guidance Manual, California Department of Transportation, April 2020.

Regulatory Background – Noise

The State of California Environmental Quality Act (CEQA) Guidelines, Appendix G, are used to assess the potential significance of impacts pursuant to local General Plan policies, Municipal Code standards, or the applicable standards of other agencies. A summary of the applicable regulatory criteria is provided below.

Federal

Federal Transit Administration. The Federal Transit Administration (FTA) has identified construction noise thresholds in the *Transit Noise and Vibration Impact Assessment Manual*,[1] which limit daytime construction noise to 80 dBA L_{eq} at residential land uses, to 85 dBA L_{eq} at commercial land uses, and to 90 dBA L_{eq} at industrial land uses.

State of California

State CEQA Guidelines. CEQA contains guidelines to evaluate the significance of effects of environmental noise attributable to a proposed project. Under CEQA, noise impacts would be considered significant if the project would result in:

(a) Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local General Plan or Noise Ordinance, or applicable standards of other agencies;

[1] Federal Transit Administration, *Transit Noise and Vibration Impact Assessment Manual*, FTA Report No. 0123, September 2018.

(b) Generation of excessive groundborne vibration or groundborne noise levels; or

(c) For a project located within the vicinity of a private airstrip or an airport land use plan or where such a plan has not been adopted within two miles of a public airport or public use airport, if the project would expose people residing or working in the project area to excessive noise levels.

2022 California Building Code, Title 24, Part 2. The current version of the California Building Code (CBC) requires interior noise levels in multi-family residential units attributable to exterior environmental noise sources to be limited to a level not exceeding 45 dBA L_{dn}/CNEL in any habitable room.

Santa Clara County

Santa Clara County Airport Land Use Commission Comprehensive Land Use Plan. The Comprehensive Land Use Plan (CLUP) adopted by the Santa Clara County Airport Land Use Commission contains standards for projects within the vicinity of San José International Airport which are relevant to this project:

4.3.2.1 Noise Compatibility Policies

N-1 The Community Noise Equivalent Level (CNEL) method of representing noise levels shall be used to determine if a specific land use is consistent with the CLUP.

N-2 In addition to the other policies herein, the Noise Compatibility Policies presented in Table 4-1 shall be used to determine if a specific land use is consistent with this CLUP.

N-3 Noise impacts shall be evaluated according to the Aircraft Noise Contours presented on Figure 5 (not shown in this report).

N-6 Noise level compatibility standards for other types of land uses shall be applied in the same manner as the above residential noise level criteria. Table 4-1 presents acceptable noise levels for other land uses in the vicinity of the Airport.

Table 4 - 1

NOISE COMPATIBILITY POLICIES

LAND USE CATEGORY	CNEL					
	55-60	60-65	65-70	70-75	75-80	80-85
Residential – low density Single-family, duplex, mobile homes	*	**	***	****	****	****
Residential – multi-family, condominiums, townhouses	*	**	***	****	****	****
Transient lodging - motels, hotels	*	*	**	****	****	****
Schools, libraries, indoor religious assemblies, hospitals, nursing homes	*	***	****	****	****	****
Auditoriums, concert halls, amphitheaters	*	***	***	****	****	****
Sports arena, outdoor spectator sports, parking	*	*	*	**	***	****
Playgrounds, neighborhood parks	*	*	***	****	****	****
Golf courses, riding stables, water recreation, cemeteries	*	*	*	**	***	****
Office buildings, business commercial and professional, retail	*	*	**	***	****	****
Industrial, manufacturing, utilities, agriculture	*	*	*	***	***	****
* Generally Acceptable	Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements. Mobile homes may not be acceptable in these areas. Some outdoor activities might be adversely affected.					
** Conditionally Acceptable	New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Outdoor activities may be adversely affected. Residential: Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.					
*** Generally Unacceptable	New construction or development should be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design. Outdoor activities are likely to be adversely affected.					
**** Unacceptable	New construction or development shall not be undertaken.					

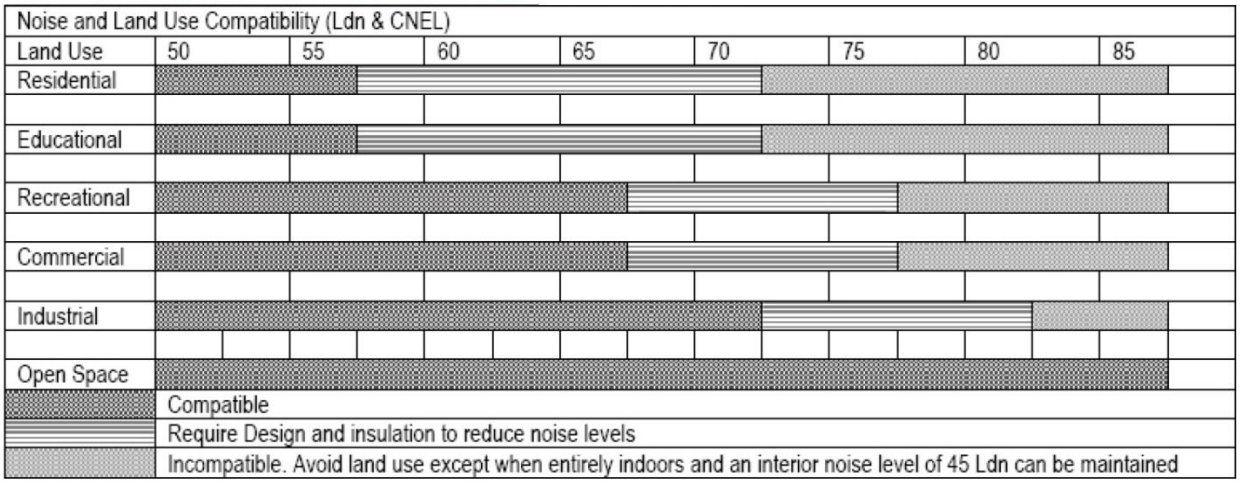
Source: Based on General Plan Guidelines, Appendix C (2003), Figure 2 and Santa Clara County ALUC 1992 Land Use Plan, Table 1

Source: Comprehensive Land Use Plan Santa Clara County, Norman Y Mineta San José International Airport, May 25, 2011, Amended May 23, 2019.

Local

City of Santa Clara General Plan. The City of Santa Clara's General Plan identifies noise and land use compatibility standards for various land uses and establishes policies to control noise within the community. Table 5.10-2 from the General Plan shows acceptable noise levels for various land uses. Residential land uses are considered compatible in noise environments of 55 dBA L_{dn}/CNEL or less. The guidelines state that where the exterior noise levels are greater than 55 dBA L_{dn}/CNEL and less than 70 dBA L_{dn}/CNEL, the design of the project should include measures to reduce noise levels to acceptable levels. Noise levels exceeding 70 dBA L_{dn}/CNEL at residential land uses are considered incompatible.

TABLE 5.10-2: GENERAL PLAN NOISE STANDARDS



Applicable goals and policies presented in the General Plan are as follows:

5.10.6-G1 Noise sources restricted to minimize impacts in the community.

5.10.6-G2 Sensitive uses protected from noise intrusion.

5.10.6-G3 Land use, development and design approvals that take noise levels into consideration.

5.10.6-P1 Review all land use and development proposals for consistency with the General Plan compatibility standards and acceptable noise exposure levels defined on Table 5.10-1.

5.10.6-P2 Incorporate noise attenuation measures for all projects that have noise exposure levels greater than General Plan "normally acceptable" levels, as defined on Table 5.10-1.

5.10.6-P3 New development should include noise control techniques to reduce noise to acceptable levels, including site layout (setbacks, separation and shielding), building treatments (mechanical ventilation system, sound-rated windows, solid core doors and baffling) and structural measures (earthen berms and sound walls).

5.10.6-P4 Encourage the control of noise at the source through site design, building design, landscaping, hours of operation and other techniques.

5.10.6-P5 Require noise-generating uses near residential neighborhoods to include solid walls and heavy landscaping along common property lines, and to place compressors and mechanical equipment in sound-proof enclosures.

5.10.6-P6 Discourage noise sensitive uses, such as residences, hospitals, schools, libraries and rest homes, from areas with high noise levels, and discourage high noise generating uses from areas adjacent to sensitive uses.

5.10.6-P7 Implement measures to reduce interior noise levels and restrict outdoor activities in areas subject to aircraft noise in order to make Office/Research and Development uses compatible with the Norman Y. Mineta International Airport land use restrictions.

City of Santa Clara Municipal Code. The City's Municipal Code establishes noise level performance standards for fixed sources of noise. Section 9.10.40 of the Municipal Code limits noise levels at receiving single- and multi-family residences to 55 dBA during daytime hours (7:00 a.m. to 10:00 p.m.) and 50 dBA at night (10:00 p.m. to 7:00 a.m.); at receiving commercial and office buildings to 65 dBA during daytime hours and 60 dBA at night; and at receiving light industrial uses to 70 dBA anytime. The noise limits are not applicable to emergency work, licensed outdoor events, City-owned electric, water, and sewer utility system facilities, construction activities occurring within allowable hours, permitted fireworks displays, or permitted heliports.

Construction activities are not permitted within 300 feet of residentially zoned property except within the hours of 7:00 a.m. and 6:00 p.m. on weekdays and 9:00 a.m. and 6:00 p.m. on Saturdays. No construction is permitted on Sundays or holidays.

The City Code does not define the acoustical time descriptor such as L_{eq} (the average noise level) or L_{max} (the maximum instantaneous noise level) that is associated with the above limits. A reasonable interpretation of the City Code would identify the ambient base noise level criteria as an average or median noise level (L_{eq}/L_{50}).

Regulatory Background – Vibration

California Department of Transportation. The California Department of Transportation recommends a vibration limit of 0.5 in/sec PPV for buildings structurally sound and designed to modern engineering standards, which typically consist of buildings constructed since the 1990s. Conservative vibration limits of 0.3 in/sec PPV is used for buildings that are found to be structurally sound but where structural damage is a major concern (see Table 3 above for further explanation). For historical buildings or some older buildings, a vibration limit of 0.25 in/sec PPV would apply.

Existing Noise Environment

The project site is located at 2303 Gianera Street in the City of Santa Clara, and is bound by residential land uses to the east, south, and to the west, and the Northern Receiving Station electrical substation to the north. Levi's Stadium is located about 690 feet north of the project site.

The noise environment at the site and in the surrounding areas results primarily from aircraft associated with San José Mineta International Airport. On days when events, such as football games and concerts, are held at Levi's Stadium, noise associated with those events also contributes to the ambient noise environment. Traffic noise from Lafayette Street and train noise from the Union Pacific Railroad (UPRR) tracks would also contribute to the noise environment in the project vicinity.

The City of Santa Clara has installed noise monitors in the neighborhood containing the project site and the neighborhood to the east of Levi's Stadium. *Wilson Ihrig* provides public access to noise levels recorded at these locations.[2] One of the monitoring locations is at the Cheeney Street/Lenox Place intersection, which is about 300 feet south of the project site. This meter would represent the ambient noise levels at the project site and the surrounding area. The meter is installed on a utility pole approximately 30 feet above the ground. The measurement location (identified in Figure 1 as LT-1) is shown in Figure 1.

Long-term noise measurement data was reviewed to summarize ambient noise levels in the site vicinity. Data from Monday, April 15, 2024, through Sunday, April 21, 2024 was used to represent typical daily activities. No events occurred at Levi's Stadium in this time period. Recorded data was also reviewed during a weekend in the fall of 2023 when a regular season National Football League (NFL) game between the Dallas Cowboys and the San Francisco 49ers was scheduled to play (from Friday, October 6, 2023, through Monday, October 9, 2023). This game is expected to be on the louder side compared to other regular season games due to the spirited fanbase of the Dallas Cowboys. Additionally, two weekends in January 2024, when NFL playoff games occurred, were used to represent noise levels during special sporting events (i.e., Friday, January 19, 2024, through Monday, January 22, 2024, when the 49ers hosted the Green Bay Packers and Friday, January 26, 2024, through Monday, January 29, 2024, for the NFC Championship Game against the Detroit Lions). Other events, including the Mexico-Colombia soccer match (Wednesday, September 27, 2023), Taylor Swift Eras Tour concert (Friday, July 28, 2023, and Saturday, July 29, 2023), and the Ed Sheeran concert (Friday, September 16, 2023), which broke the attendance record at Levi's Stadium, were reviewed since each of these large fanbases are also very spirited. Table 4 summarizes the range in hourly average noise levels for each of these scenarios. Note, the recorded data includes noise levels with and without jets. Table 4 provides both data with and without jet noise.

The daily trends in noise levels on days summarized in Table 4 are shown in Figures A1 through A23 in the Appendix of this report.

[2] https://seti-media.com/infopopulation/levis_stadium/station/G4V2USCASantaClara4

TABLE 4 Summary of L_{eq} Noise Levels Recorded at LT-1

Event Scenario	Date (Hours)	Measured Noise Levels with Jets, dBA		Measured Noise Levels without Jets, dBA	
		L_{eq}	CNEL	L_{eq}	CNEL
Typical Weekdays (No Events)	4/15/2024 to 4/19/2024 (7:00 a.m. to 10:00 p.m.)	51 to 67	64 to 65	47 to 65	56 to 58
	4/15/2024 to 4/19/2024 (10:00 p.m. to 7:00 a.m.)	42 to 66		42 to 56	
Typical Weekends (No Events)	4/20/2024 to 4/21/2024 (7:00 a.m. to 10:00 p.m.)	52 to 66	62 to 63	49 to 62	56 to 57
	4/20/2024 to 4/21/2024 (10:00 p.m. to 7:00 a.m.)	42 to 63		42 to 55	
Typical NFL Game (non-game weekdays)	10/6/2023 and 10/9/2023 (7:00 a.m. to 10:00 p.m.)	57 to 65	62 to 65	50 to 61	56 to 59
	10/6/2023 and 10/9/2023 (10:00 p.m. to 7:00 a.m.)	42 to 66		45 to 56	
Typical NFL Game (non-game weekend)	10/7/2023 (7:00 a.m. to 10:00 p.m.)	54 to 63	63	49 to 56	57
	10/7/2023 (10:00 p.m. to 7:00 a.m.)	48 to 62		47 to 53	
Typical NFL Game (gameday)	10/8/2023 (7:00 a.m. to 10:00 p.m.)	60 to 66	66	52 to 62	60
	10/8/2023 (10:00 p.m. to 7:00 a.m.)	48 to 63		48 to 55	
NFL Playoff Game (non-game weekdays)	1/19/2024 and 1/22/2024 (7:00 a.m. to 10:00 p.m.)	56 to 64	63 to 65	49 to 63	59 to 60
	1/19/2024 and 1/22/2024 (10:00 p.m. to 7:00 a.m.)	48 to 66		47 to 56	
NFL Playoff Game (non-game weekend)	1/21/2024 (7:00 a.m. to 10:00 p.m.)	58 to 63	63	53 to 57	59
	1/21/2024 (10:00 p.m. to 7:00 a.m.)	46 to 62		45 to 55	
NFL Playoff Game (gameday)	1/20/2024 (7:00 a.m. to 10:00 p.m.)	55 to 61	62	54 to 60	59
	1/20/2024 (10:00 p.m. to 7:00 a.m.)	48 to 58		46 to 53	
NFC Champ. Game (non-game weekdays)	1/26/2024 and 1/29/2024 (7:00 a.m. to 10:00 p.m.)	54 to 70	65	50 to 68	59 to 60
	1/26/2024 and 1/29/2024 (10:00 p.m. to 7:00 a.m.)	47 to 65		47 to 58	

Event Scenario	Date (Hours)	Measured Noise Levels with Jets, dBA		Measured Noise Levels without Jets, dBA	
		L_{eq}	CNEL	L_{eq}	CNEL
NFC Champ. Game (non-game weekend)	1/27/2024 (7:00 a.m. to 10:00 p.m.)	54 to 66	64	48 to 62	58
	1/27/2024 (10:00 p.m. to 7:00 a.m.)	49 to 65		49 to 53	
NFC Champ. Game (gameday)	1/28/2024 (7:00 a.m. to 10:00 p.m.)	60 to 65	66	52 to 63	60
	1/28/2024 (10:00 p.m. to 7:00 a.m.)	46 to 63		46 to 53	
Soccer match	9/27/2023 (7:00 a.m. to 10:00 p.m.)	56 to 64	64	51 to 61	58
	9/27/2023 (10:00 p.m. to 7:00 a.m.)	45 to 64		44 to 53	
Taylor Swift Concerts	7/28/2023 (7:00 a.m. to 10:00 p.m.)	61 to 66	67	55 to 66	63
	7/28/2023 (10:00 p.m. to 7:00 a.m.)	45 to 64		45 to 59	
	7/29/2023 (7:00 a.m. to 10:00 p.m.)	60 to 64	66	52 to 63	62
	7/29/2023 (10:00 p.m. to 7:00 a.m.)	46 to 65		46 to 61	
Ed Sheeran Concert	9/16/2023 (7:00 a.m. to 10:00 p.m.)	60 to 64	64	50 to 60	60
	9/16/2023 (10:00 p.m. to 7:00 a.m.)	41 to 63		41 to 57	

FIGURE 1 Aerial Image of the Project Site and Vicinity Showing the Long-Term Noise Measurement Location

Source: Google Earth, 2024.

PLAN CONSISTENCY ANALYSIS

Noise and Land Use Compatibility

Noise levels at outdoor use areas that are affected by transportation noise are required to be maintained at or below 55 dBA CNEL to be considered normally acceptable for residential land uses, according to the City's General Plan. According to the Santa Clara County Airport Land Use Commission CLUP, the normally acceptable threshold for multi-family residential land uses when aircraft is the dominant noise source would be 60 dBA CNEL, and the conditionally acceptable threshold would be 65 dBA CNEL, assuming new residential buildings would be constructed of conventional materials with fresh air supply systems or air conditioning. Additionally, residential interior noise levels are required to meet the performance standard of 45 dBA CNEL.

The future noise environment at the project site would continue to be dominated by aircraft associated with San José Mineta International Airport, with events occurring at Levi's Stadium, vehicular traffic noise associated with Lafayette Street, and train traffic from the UPRR tracks also contributing to the noise environment. It is assumed that the occurrence of aircraft, events at Levi's Stadium, and train traffic would remain the same under future conditions.

A traffic study was not completed for the proposed project; however, project trips generated by the proposed eight townhomes would be insignificant compared to existing peak hour traffic volumes in the project vicinity (i.e., 0 dBA CNEL increase over existing volumes). To estimate a traffic noise increase under future conditions, a conservative 1% to 2% increase in traffic volumes each year for the next 20 years was assumed for standard traffic volume increase in a developed area. Under this assumption, the traffic noise increase by the year 2044 would be about 2 dBA CNEL, which would be applied to the CNEL without jets in Table 4. When added back into the noise level data with jets, the total increase would be up to 1 dBA CNEL during typical daily activities and during events.

Future Exterior Noise Environment

Each of the proposed townhomes would have backyards, with the centers of the backyards set back approximately 45 to 150 feet from the centerline of Gianera Street. Future exterior noise levels would range from 63 to 66 dBA CNEL on typical days and days of soccer matches. On days of NFL games and concerts, future noise levels would range from 67 to 68 dBA CNEL.

Future exterior noise levels would not meet the City's exterior thresholds, and conventional attenuation methods, such as a noise barrier, would not reduce noise levels since the dominant noise source at the project site is aircraft. Future exterior noise levels would fall within the generally unacceptable category, according to the Santa Clara County Airport Land Use Commission CLUP. The CLUP would require new construction to conduct a detailed noise and land use compatibility study to analyze noise reduction requirements and required noise insulation features to reduce interior noise levels to 45 dBA CNEL or less. However, exterior noise levels would not be affected by these measures.

Future Interior Noise Environment

Standard residential construction provides approximately 15 dBA of exterior-to-interior noise reduction, assuming the windows are partially open for ventilation. Standard construction with the windows closed provides approximately 20 to 25 dBA of noise reduction in interior spaces. Where exterior noise levels range from 60 to 65 dBA CNEL, the inclusion of adequate forced-air mechanical ventilation is often the method selected to reduce interior noise levels to acceptable levels by closing the windows to control noise. Where noise levels exceed 65 dBA CNEL, forced-air mechanical ventilation systems and sound-rated construction methods are normally required. Such methods or materials may include a combination of smaller window and door sizes as a percentage of the total building façade facing the noise source, sound-rated windows and doors, sound rated exterior wall assemblies, and mechanical ventilation so windows may be kept closed at the occupant's discretion.

Residential units located along Gianera Street would be set back approximately 40 feet from the centerline. Residential units on the project site would be exposed to future exterior noise levels ranging from 63 to 66 dBA CNEL on typical days and on days with soccer games and from 67 to 68 dBA CNEL on days of NFL games and concerts. Assuming windows to be partially open, future interior noise levels in these units would be up to 53 dBA CNEL.

To meet the interior noise requirements set forth by the State of California of 45 dBA CNEL, implementation of noise insulation features would be required.

Noise Insulation Features to Reduce Future Interior Noise Levels

The following noise insulation features shall be incorporated into the proposed project to reduce interior noise levels to 45 dBA CNEL or less at residential interiors:

- Provide a suitable form of forced-air mechanical ventilation, as determined by the local building official, for all residential units on the project site, so that windows can be kept closed at the occupant's discretion to control interior noise and achieve the interior noise standards.

- Preliminary calculations indicate that the townhome units would require windows and doors with a minimum rating of 31 STC with adequate forced-air mechanical ventilation to meet the interior noise threshold of 45 dBA CNEL.

The implementation of these noise insulation features would reduce interior noise levels to 45 dBA CNEL or less at residential uses.

Conditions of Approval

Interior Noise Standard for Residential Development. The project applicant shall prepare final design plans that incorporate building design and acoustical treatments to ensure compliance with State Building Codes and City noise standards. A project-specific acoustical analysis shall be prepared to ensure that the design incorporates controls to reduce interior noise levels to 45 dBA CNEL or lower within the residential units. The project applicant shall conform with any special

building construction techniques requested by the City's Building Department, which may include sound-rated windows and doors, sound-rated wall constructions, and acoustical caulking.

NOISE IMPACTS AND MITIGATION MEASURES

Significance Criteria

The following criteria were used to evaluate the significance of environmental noise resulting from the project:

(a) Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local General Plan or Noise Ordinance, or applicable standards of other agencies;

(b) Generation of excessive groundborne vibration or groundborne noise levels; or

(c) For a project located within the vicinity of a private airstrip or an airport land use plan or where such a plan has not been adopted within two miles of a public airport or public use airport, if the project would expose people residing or working in the project area to excessive noise levels.

Impact 1a: **Temporary Construction Noise.** Existing noise-sensitive land uses would be exposed to a temporary increase in ambient noise levels due to project construction activities. The incorporation of construction best management practices would result in a **less-than-significant** temporary noise impact.

The project applicant proposes to demolish the existing structures on the project site. Total project construction is expected to last approximately 11 months, and project construction is planned between 8:00 a.m. and 6:00 p.m. on weekdays. Construction phases would include demolition, site preparation, grading, trenching, building construction, architectural coating, and paving. During each phase of construction, there would be a different mix of equipment operating, and noise levels would vary by phase and vary within phases, based on the amount of equipment in operation and the location at which the equipment is operating.

Noise impacts resulting from construction depend upon the noise generated by various pieces of construction equipment, the timing and duration of noise-generating activities, and the distance between construction noise sources and noise-sensitive areas. Construction noise impacts primarily result when construction activities occur during noise-sensitive times of the day (e.g., early morning, evening, or nighttime hours), the construction occurs in areas immediately adjoining noise-sensitive land uses, or when construction lasts over extended periods of time.

The City's Municipal Code limits construction activities (including the loading and unloading of materials and truck movements) within 300 feet of residentially zoned property to the hours of 7:00 a.m. to 6:00 p.m. on weekdays and between the hours of 9:00 a.m. and 6:00 p.m. on Saturdays. No construction is permitted on Sundays or holidays.

While noise thresholds for temporary construction are not provided in the City's General Plan or Municipal Code, this analysis uses the noise limits established by the Federal Transit Administration (FTA) to identify the potential for impacts due to substantial temporary construction noise. The FTA identifies construction noise limits in the *Transit Noise and Vibration Impact Assessment Manual*.[1] During daytime hours, an exterior threshold of 80 dBA L_{eq} shall be applied at residential land uses, 85 dBA L_{eq} shall be applied at commercial land uses, and 90 dBA L_{eq} shall be applied at industrial land uses.

Construction activities generate considerable amounts of noise, especially during earth-moving activities when heavy equipment is used. The typical range of maximum instantaneous noise levels for the proposed project would be 70 to 90 dBA L_{max} at a distance of 50 feet (see Table 5). Table 6 shows typical hourly average construction-generated noise levels measured at a distance of 50 feet from the center of the site during busy construction periods (e.g., earth moving equipment, impact tools, etc.). As shown in Table 6, typical residential buildings generate construction noise levels ranging from 72 to 88 dBA L_{eq} at a distance of 50 feet from the center of the busy site. Construction-generated noise levels drop off at a rate of about 6 dBA per doubling of the distance between the source and receptor. Shielding by buildings or terrain often result in lower construction noise levels at distant receptors; however, for purposes of assessing a worst-case scenario, construction noise levels in this report are estimated assuming no attenuation due to intervening buildings or structures.

Equipment expected to be used in each construction stage are summarized in Table 7, along with the quantity of each type of equipment and the reference noise level at 50 feet, assuming the operation of the two loudest pieces of construction equipment for each construction phase.

Federal Highway Administration's (FHWA's) Roadway Construction Noise Model (RCNM) was used to calculate the hourly average noise levels for each phase of construction, assuming the two loudest pieces of equipment would operate simultaneously, as recommended by the FTA for construction noise evaluations. This construction noise model includes representative sound levels for the most common types of construction equipment and the approximate usage factors of such equipment that were developed based on an extensive database of information gathered during the construction of the Central Artery/Tunnel Project in Boston, Massachusetts (CA/T Project or "Big Dig"). The usage factors represent the percentage of time that the equipment would be operating at full power. Table 7 also summarizes the construction noise levels for the two loudest pieces of equipment propagated to the surrounding receiving land uses.

To assess construction noise impacts at the receiving property lines of existing noise-sensitive receptors, the worst-case hourly average noise level, which is calculated by combining all pieces of equipment per phase, was propagated from the geometrical center of the project site to the nearest property lines of the surrounding land uses. These noise level estimates are shown in Table 8. Noise levels in Table 8 do not assume reductions due to intervening buildings or existing barriers.

TABLE 5 Construction Equipment, 50-foot Noise Emission Limits

Equipment Category	L_{max} Level (dBA)[1,2]	Impact/Continuous
Arc Welder	73	Continuous
Auger Drill Rig	85	Continuous
Backhoe	80	Continuous
Bar Bender	80	Continuous
Boring Jack Power Unit	80	Continuous
Chain Saw	85	Continuous
Compressor[3]	70	Continuous
Compressor (other)	80	Continuous
Concrete Mixer	85	Continuous
Concrete Pump	82	Continuous
Concrete Saw	90	Continuous
Concrete Vibrator	80	Continuous
Crane	85	Continuous
Dozer	85	Continuous
Excavator	85	Continuous
Front End Loader	80	Continuous
Generator	82	Continuous
Generator (25 KVA or less)	70	Continuous
Gradall	85	Continuous
Grader	85	Continuous
Grinder Saw	85	Continuous
Horizontal Boring Hydro Jack	80	Continuous
Hydra Break Ram	90	Impact
Impact Pile Driver	105	Impact
Insitu Soil Sampling Rig	84	Continuous
Jackhammer	85	Impact
Mounted Impact Hammer (hoe ram)	90	Impact
Paver	85	Continuous
Pneumatic Tools	85	Continuous
Pumps	77	Continuous
Rock Drill	85	Continuous
Scraper	85	Continuous
Slurry Trenching Machine	82	Continuous
Soil Mix Drill Rig	80	Continuous
Street Sweeper	80	Continuous
Tractor	84	Continuous
Truck (dump, delivery)	84	Continuous
Vacuum Excavator Truck (vac-truck)	85	Continuous
Vibratory Compactor	80	Continuous
Vibratory Pile Driver	95	Continuous
All other equipment with engines larger than 5 HP	85	Continuous

Notes: [1] Measured at 50 feet from the construction equipment, with a "slow" (1 sec.) time constant.

[2] Noise limits apply to total noise emitted from equipment and associated components operating at full power while engaged in its intended operation.

[3]Portable Air Compressor rated at 75 cfm or greater and that operates at greater than 50 psi.

TABLE 6 Typical Ranges of Construction Noise Levels at 50 Feet, L_{eq} (dBA)

	Domestic Housing		Office Building, Hotel, Hospital, School, Public Works		Industrial Parking Garage, Religious Amusement & Recreations, Store, Service Station		Public Works Roads & Highways, Sewers, and Trenches	
	I	II	I	II	I	II	I	II
Ground Clearing	83	83	84	84	84	83	84	84
Excavation	88	75	89	79	89	71	88	78
Foundations	81	81	78	78	77	77	88	88
Erection	81	65	87	75	84	72	79	78
Finishing	88	72	89	75	89	74	84	84

I – All pertinent equipment present at site.
II – Minimum required equipment present at site.

Source: U.S.E.P.A., Legal Compilation on Noise, Vol. 1, p. 2-104, 1973.

TABLE 7 Estimated Construction Noise Levels for the Proposed Mixed-Use Building at a Distance of 50 feet

Phase of Construction	Total Workdays	Construction Equipment (Quantity)	Estimated Construction Noise Level at 50 feet, dBA L_{eq}
Demolition	17	Concrete/Industrial Saw (1)[a] Excavator (1) Rubber-Tired Dozer (1) Tractor/Loader/Backhoe (2)[a]	85
Site Preparation	5	Grader (1)[a] Rubber-Tired Dozer (1) Tractor/Loader/Backhoe (1)[a]	84
Grading/Excavation	25	Excavator (1) Grader (1)[a] Rubber-Tired Dozer (1) Concrete/Industrial Saw (1)[a] Tractor/Loader/Backhoe (1)	85
Trenching/Foundations	40	Tractor/Loader/Backhoe (1)[a] Excavator (1)[a]	82
Building – Exterior	100	Forklift (2)[a] Air Compressor (1)[a]	75
Building – Interior/ Architectural Coating	20	Air Compressor (1)[a]	74
Paving	5	Cement & Mortar Mixer (4) Paver (1) Paving Equipment (1)[a] Roller (1) Tractor/Loader/Backhoe (1)[a]	84

[a] Denotes two loudest pieces of construction equipment per phase.

TABLE 8 Estimated Construction Noise Levels at Nearby Land Uses

Phase of Construction	Calculated Hourly Average Noise Levels, dBA L_{eq}		
	South Residences (125ft)	East & West Residences (60ft)	North Substation (160ft)
Demolition	79	85[a]	77
Site Preparation	77	83[a]	74
Grading/Excavation	79	86[a]	77
Trenching/Foundations	74	80[a]	72
Building – Exterior	68	74[a]	65
Building – Interior/ Architectural Coating	66	72[a]	64
Paving	79	85[a]	76

[a] Construction noise levels in this table represent all equipment per phase operating simultaneously. Noise levels at the east and west residences are higher than those shown in Table 7, which represent the two loudest pieces of equipment only.

As shown in Table 8, construction noise levels would intermittently range from 66 to 86 dBA L_{eq} at existing residences and from 64 to 77 dBA L_{eq} at the existing substation surrounding the project site when activities are focused near the center of the project site. While the 90 dBA L_{eq} threshold for industrial uses would not be exceeded at the north substation, construction noise levels would potentially exceed the exterior threshold of 80 dBA L_{eq} at residential land uses adjoining the site to the east and west by up to 6 dBA. This would be considered a significant impact.

Mitigation Measure 1a:

Reasonable regulation of the hours of construction, as well as regulation of the arrival and operation of heavy equipment and the delivery of construction material, are necessary to protect the health and safety of persons, promote the general welfare of the community, and maintain the quality of life. The construction crew shall adhere to the following construction best management practices to reduce construction noise levels emanating from the site and minimize disruption and annoyance at existing noise-sensitive receptors in the project vicinity. The incorporation of construction best management practices would reduce temporary construction noise levels as much as possible.

Construction Best Management Practices

Develop a construction noise control plan, including, but not limited to, the following available controls:

- Ensure that excavating, grading and filling activities, and other construction activities (including the loading and unloading of materials and truck movements) within 300 feet of residentially zoned property, including hotel properties, are limited to the hours of 7:00 a.m. to 6:00 p.m. on weekdays and between the hours of 9:00 a.m. and 6:00 p.m. on Saturdays. No construction is permitted on Sundays or holidays.

- Construct a solid plywood fence along the eastern and western property lines, where feasible, to shield the adjoining residential receptors from construction work. A temporary 8-foot-tall noise barrier would be tall enough to block direct line-of-sight with ground-level receptors;

- Equip all internal combustion engine-driven equipment with intake and exhaust mufflers that are in good condition and appropriate for the equipment.

- Unnecessary idling of internal combustion engines should be strictly prohibited.

- Locate stationary noise-generating equipment, such as air compressors or portable power generators, as far as possible from sensitive receptors as feasible. If they must be located near receptors, adequate muffling (with enclosures where feasible and appropriate) shall be used to reduce noise levels at the adjacent sensitive receptors. Any enclosure openings or venting shall face away from sensitive receptors.

- Construction staging areas shall be established at locations that will create the greatest distance between the construction-related noise sources and noise-sensitive receptors nearest the project site during all project construction.

- Locate material stockpiles, as well as maintenance/equipment staging and parking areas, as far as feasible from residential receptors.

- Control noise from construction workers' radios to a point where they are not audible at existing residences bordering the project site.

- The contractor shall prepare a detailed construction schedule for major noise-generating construction activities. The construction plan shall identify a procedure for coordination with adjacent residential land uses so that construction activities can be scheduled to minimize noise disturbance.

- Designate a "disturbance coordinator" who would be responsible for responding to any complaints about construction noise. The disturbance coordinator will determine the cause of the noise complaint (e.g., bad muffler, etc.) and will require that reasonable measures be implemented to correct the problem. Conspicuously post a telephone number for the disturbance coordinator at the construction site and include in it the notice sent to neighbors regarding the construction schedule.

Implementation of the above measures would reduce construction noise levels emanating from the site, limit construction hours, and minimize disruption and annoyance. With the implementation of these measures and recognizing that noise generated by construction activities would occur over a temporary period, the temporary increase in ambient noise levels would reduce to a less-than-significant level.

Impact 1b: **Permanent Noise Level Increase/Exceed Applicable Standards.** The proposed project would not result in a substantial permanent noise level increase at receptors in the project vicinity. Operational noise levels generated by the proposed project could potentially exceed applicable standards at the future noise-sensitive receptors west of the project site. This is a **less-than-significant** impact with the incorporation of the City's standard conditions of approval for mechanical equipment.

A significant impact would occur if the permanent noise level increase due to project-generated traffic was 3 dBA CNEL or greater for future ambient noise levels exceeding 60 dBA CNEL or was 5 dBA CNEL or greater for future ambient noise levels at or below 60 dBA CNEL. Existing ambient measurements made in the project site vicinity indicate that existing and future ambient noise levels at the noise-sensitive receptors in the project site vicinity would result in noise levels over 60 dBA CNEL. Therefore, a significant impact would occur if project-generated traffic increased levels by 3 dBA CNEL or more.

Under the City of Santa Clara Municipal Code, noise generated by fixed sources of noise would be restricted to 55 dBA during daytime hours (7:00 a.m. to 10:00 p.m.) and to 50 dBA during nighttime hours (10:00 p.m. to 7:00 a.m.) at residentially zoned land uses. At existing industrial land uses, noise would be restricted to 70 dBA anytime.

Project Traffic Increase

A traffic study was not required for the proposed project; however, peak hour trips generated by a total of eight townhome units would be fewer than 10 during both peak AM and peak PM hours. Compared to the existing volumes along Lafayette Street and within the residential neighborhood, these peak hour trips would not result in a measurable or detectable noise level increase (0 dBA CNEL increase). This impact is a less-than-significant impact.

Mechanical Equipment

The site plan for the proposed building does not show heating, ventilation, and air conditioning (HVAC) units; however, these types of units are typically located on the ground level along the exterior building façades. The most likely location for these units would be in the corner of the backyards of each townhome. The site plan does show a solid six-foot privacy fence surrounding each of the backyards. Due to the height of typical HVAC units (maximum of 3 feet), the minimum attenuation of the privacy fence would be 10 dBA at the surrounding receptors.

Typical noise levels produced by residential HVAC units would range from 53 to 63 dBA at 3 feet during operation. These types of units typically cycle on and off continuously during daytime and nighttime hours. Since each unit would be located outside each individual townhome unit, the most combined HVAC noise would be from up to two units clustered together. Assuming up to two units would operate simultaneously at any given time, the estimated combined noise level at 3 feet would be up to 66 dBA.

Table 9 shows the estimated mechanical equipment noise propagated to the surrounding land uses.

TABLE 9 Estimated Operational Noise Levels for the HVAC Equipment

Receptor	Distance from Nearest HVAC Equipment, feet	Hourly L_{eq}, dBA	CNEL, dBA	Noise Level Increase, dBA CNEL
South Residences	65	29[a]	36[a]	0
East Residences	5	52[a]	58[a]	2
West Residences	5	52[a]	58[a]	2
North Substation	100	26[a]	32[a]	0

[a] Minimum attenuation of 10 dBA is applied to these noise levels due to six-foot privacy fence.

Based on the estimated noise levels in Table 9, mechanical equipment noise levels would be expected to exceed the City's nighttime thresholds at the adjacent residential land uses to the east and west. This would be considered a significant impact.

For the east and west residences, the noise level increase would be up to 2 dBA CNEL. For all other surrounding receptors, the noise level increase due to mechanical equipment noise would not be measurable or detectable (0 dBA CNEL increase). This would not exceed the conservative 3 dBA CNEL threshold. This would be considered a less-than-significant impact.

Total Combined Project-Generated Noise

The operational noise levels produced by the proposed project combined (i.e., traffic and mechanical equipment) would not result in a noise level increase of 3 dBA CNEL or more. Operational noise levels due to mechanical equipment would potentially exceed the City's nighttime thresholds at residential receptors adjoining the project site to the east and west. This would be a potentially significant impact.

Mitigation Measure 1b:

A detailed acoustical study shall be prepared during final design to evaluate the potential noise generated by mechanical equipment and demonstrate the necessary noise control to meet the City's 50 dBA nighttime noise threshold at the receiving property lines. Noise control features, such as selection of quiet units, sound attenuators, enclosures, and barriers shall be identified and evaluated to demonstrate that mechanical equipment noise would not exceed 50 dBA at the receiving property lines. The noise control features identified by the study shall be incorporated into the project prior to issuance of a building permit.

Impact 2: **Exposure to Excessive Groundborne Vibration due to Construction.** Construction-related vibration levels resulting from activities at the project site would potentially exceed 0.3 in/sec PPV at the existing structures to the west and to the north the project site. **This is a potentially significant impact.**

The construction of the project may generate vibration when heavy equipment or impact tools (e.g., jackhammers, hoe rams) are used. Construction activities would include grading, foundation work, paving, and new building framing and finishing. According to the equipment list provided

at the time of this study, impact or vibratory pile driving activities, which can cause excessive vibration, are not expected for the proposed project.

The California Department of Transportation (Caltrans) recommends a vibration limit of 0.5 in/sec PPV for buildings structurally sound and designed to modern engineering standards, which typically consist of buildings constructed since the 1990s. Conservative vibration limit of 0.3 in/sec PPV is used for buildings that are found to be structurally sound but where structural damage is a major concern (see Table 3 above for further explanation). For historical buildings or some older buildings, a vibration limit of 0.25 in/sec PPV would apply.

Most of the neighborhood consists of residences built in the 1990s; the conservative 0.3 in/sec PPV threshold would apply to the surrounding residential buildings, as well as the substation. According to the City's website,[3] no historical buildings are located within 200 feet of the project site.

Table 10 presents typical vibration levels that could be expected from construction equipment, as measured at a distance of 25 feet. Project construction activities, such as drilling, the use of jackhammers, rock drills and other high-power or vibratory tools, and rolling stock equipment (tracked vehicles, compactors, etc.), may generate substantial vibration in the immediate vicinity. Jackhammers typically generate vibration levels of 0.035 in/sec PPV, and drilling typically generates vibration levels of 0.09 in/sec PPV at a distance of 25 feet. Vibration levels would vary depending on soil conditions, construction methods, and equipment used.

Vibration levels are highest close to the source and then attenuate with increasing distance at the rate $\left({}^{D_{ref}}/_{D}\right)^{1.1}$, where D is the distance from the source in feet and D_{ref} is the reference distance of 25 feet. While construction noise levels increase based on the cumulative equipment in use simultaneously, construction vibration levels would be dependent on the location of individual pieces of equipment. That is, equipment scattered throughout the site would not generate a collective vibration level, but a vibratory roller, for instance, operating near the project site boundary would generate the worst-case vibration levels for the receptor sharing that property line. Further, construction vibration impacts are assessed based on the potential for damage to buildings on receiving land uses, not at receptors at the nearest property lines.

Table 10 also summarizes the vibration levels generated by construction equipment at the site propagated to the structures surrounding the project site. The nearest buildings would be the adjoining residences to the east and west, which would be about 10 feet from the shared property line. At this distance, vibration levels would be up to 0.57 in/sec PPV. A study completed by the US Bureau of Mines analyzed the effects of blast-induced vibration on buildings in USBM RI 8507.[4] The findings of this study have been applied to buildings affected by construction-generated vibrations.[5] As reported in USBM RI 8507[4] and reproduced by Dowding,[5] Figure 2 presents the

[3] https://www.santaclaraca.gov/our-city/about-santa-clara/maps/santa-clara-s-historic-properties-story-map/historic-properties

[4] Siskind, D.E., M.S. Stagg, J.W. Kopp, and C.H. Dowding, Structure Response and Damage Produced by Ground Vibration form Surface Mine Blasting, RI 8507, Bureau of Mines Report of Investigations, U.S. Department of the Interior Bureau of Mines, Washington, D.C., 1980.

[5] Dowding, C.H., Construction Vibrations, Prentice Hall, Upper Saddle River, 1996.

damage probability, in terms of "threshold damage" (described above as cosmetic damage), "minor damage," and "major damage," at varying vibration levels. As shown in Figure 2, maximum vibration levels of 0.3 in/sec PPV or lower would result in virtually no measurable damage, while maximum vibration levels of 0.6 in/sec PPV would result in less than 8% chance of cosmetic damage. No minor or major damage would be expected at the buildings immediately adjoining the project site.

Neither cosmetic, minor, or major damage would occur at historical, old sensitive, or structurally sound buildings located 25 feet or more from the project site. At these locations, and in other surrounding areas where vibration would not be expected to cause cosmetic damage, vibration levels may still be perceptible. However, as with any type of construction, this would be anticipated and would not be considered significant, given the intermittent and short duration of the phases that have the highest potential of producing vibration (use of jackhammers and other high-power tools). By use of administrative controls, such as notifying neighbors of scheduled construction activities and scheduling construction activities with the highest potential to produce perceptible vibration during hours with the least potential to affect nearby businesses, perceptible vibration can be kept to a minimum.

In summary, the construction of the project would potentially generate vibration levels exceeding 0.3 in/sec PPV at the nearest structurally sound buildings adjoining the project site. This would be a potentially significant impact.

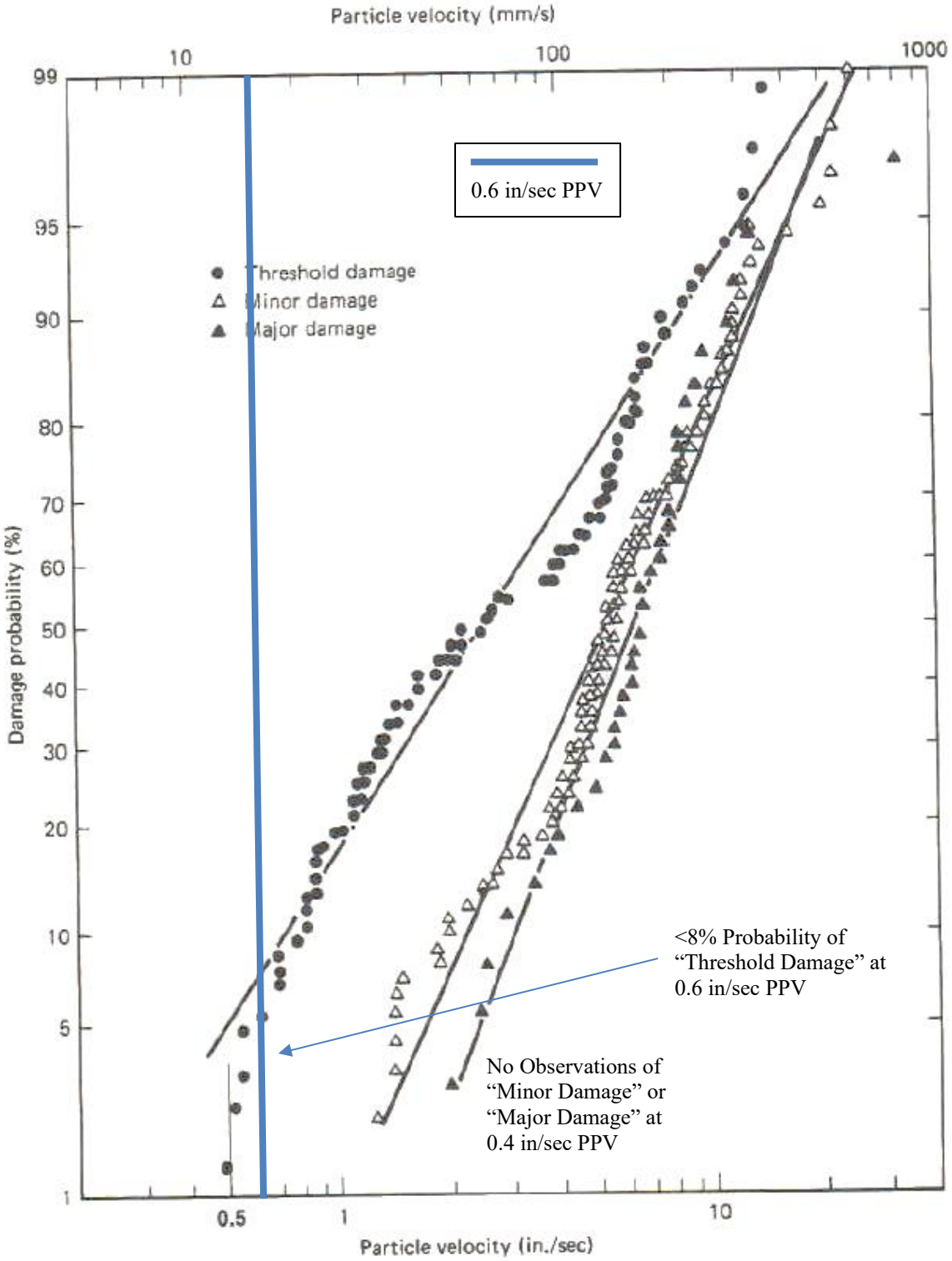
TABLE 10 Estimated Vibration Levels Propagated to the Buildings Surrounding the Project Site

Equipment		Estimated Vibration Levels at Structures Surrounding the Project Site, in/sec PPV		
		South Residences[a] (60 feet)	East & West Residences[a] (10 feet)	North Substation[a] (525 feet)
Clam shovel drop		0.077	**0.553**	0.007
Hydromill (slurry wall)	in soil	0.003	0.022	0.000
	in rock	0.006	0.047	0.001
Vibratory Roller		0.080	**0.575**	0.007
Hoe Ram		0.034	0.244	0.003
Large bulldozer		0.034	0.244	0.003
Caisson drilling		0.034	0.244	0.003
Loaded trucks		0.029	0.208	0.003
Jackhammer		0.013	0.096	0.001
Small bulldozer		0.001	0.008	0.000

Source: Transit Noise and Vibration Impact Assessment Manual, Federal Transit Administration, Office of Planning and Environment, U.S. Department of Transportation, September 2018, as modified by Illingworth & Rodkin, Inc., April 2024.

[a] All surrounding residences and substation buildings would conservatively be subject to the 0.3 in/sec PPV threshold.

FIGURE 2 Probability of Cracking and Fatigue from Repetitive Loading



Source: Dowding, C.H., Construction Vibrations, Prentice Hall, Upper Saddle River, 1996, as modified by Illingworth & Rodkin, Inc., April 2024.

Mitigation Measure 2:

The following measures are recommended to reduce vibration impacts from construction activities to a less-than-significant level:

- Avoid using vibratory rollers and clam shovel drops within 25 feet of the adjacent buildings to the east and west.

- Select demolition methods that do not involve large impact tools such as hoe-rams within 25 feet of the adjoining residences to the east and west. Portable jackhammers, saws, or grinders shall be used to minimize impacts to the ground.

- Avoid dropping heavy equipment and use alternative methods for breaking up existing pavement, such as a pavement grinder, instead of dropping heavy objects, within 25 feet of the adjacent buildings to the east and west.

- Smaller equipment (less than 18,000 pounds) shall be used near the property lines adjacent to buildings to minimize vibration levels. For example, a smaller vibratory roller similar to a Caterpillar model CP433E vibratory compactor could be used when compacting materials within 25 feet of the adjacent buildings.

- Hoe rams, large bulldozers, drill rigs, loaded trucks, and other similar equipment shall not be used within 25 feet of adjacent buildings to the east and west.

Implementation of these measures would reduce the vibration activities during construction by limiting the use of heavy vibration-generating equipment and requiring alternative approaches to ground disturbing activities. Accordingly, the project would have a less-than-significant impact from generation of groundborne vibration.

Impact 3: **Excessive Aircraft Noise.** The project site is located about 2.5 miles from San José Mineta International Airport, and the noise environment attributable to aircraft is considered conditionally acceptable under the ALUC. With the incorporation of forced-air mechanical ventilation and sound-rated construction materials, this would be a **less-than-significant** impact.

San José Mineta International Airport is a public-use airport located approximately 2.5 miles southeast of the project site. According to the Airport Land Use Compatibility Plan for Santa Clara County,[6] the project site lies outside the 65 dBA CNEL contour line (see Figure 3). According to the Noise Compatibility Policies shown above in the Regulatory Criteria section of this report, the project site falls within the conditionally acceptable category, which requires new construction to conduct a detailed noise analysis to demonstrate the recommended noise insulation features included in the design of the townhomes reduce interior noise levels to 45 dBA CNEL. Further, the proposed residences require forced-air mechanical ventilation systems to be incorporated into the project.

[6] Walter B. Windus, PE, "Airport Land Use Compatibility Plan Santa Clara County San José Mineta International Airport," March 2024.

Ambient noise levels measured in the project vicinity exceeded 65 dBA CNEL with the inclusion of aircraft. Therefore, sound-rated windows and doors with the inclusion of adequate forced-air mechanical ventilation would be required for future interior noise levels to be at or below 45 dBA CNEL with the inclusion of aircraft. Assuming this would be incorporated into the project as a condition of approval, this would be considered a less-than-significant impact.

Mitigation Measure 3: **No further mitigation required.**

FIGURE 3 2037 CNEL Noise Contours for ALUC Plan in Santa Clara County Relative to Project Site

Cumulative Impacts

Cumulative noise impacts would include either cumulative traffic noise increases under future conditions or temporary construction noise from cumulative construction projects.

A significant cumulative traffic noise increase would occur if two criteria are met: 1) if the cumulative traffic noise level increase was 3 dBA CNEL or greater for future levels exceeding 60 dBA CNEL or was 5 dBA CNEL or greater for future levels at or below 60 dBA CNEL; and 2) if the project would make a "cumulatively considerable" contribution to the overall traffic noise increase. A "cumulatively considerable" contribution would be defined as an increase of 1 dBA CNEL or more attributable solely to the proposed project.

A traffic study was not required for this project; therefore, the project would not be expected to result in a cumulatively considerable contribution along any roadway segments with noise-sensitive receptors. Therefore, the project would not result in a cumulative noise increase due to traffic.

From the City's website,[7] the nearest planned or approved project would be located more than 1,800 feet north of the proposed project. The two project sites would not share noise-sensitive receptors. Therefore, the noise-sensitive receptors surrounding the project site would not be subject to cumulative construction impacts.

[7] https://missioncity.maps.arcgis.com/apps/MapTour/index.html?appid=5afdbed13fad458cb6288c46a0bad060

APPENDIX

FIGURE A1 Daily Trend in Noise Levels at LT-1 During Typical Days, Monday, April 15, 2024

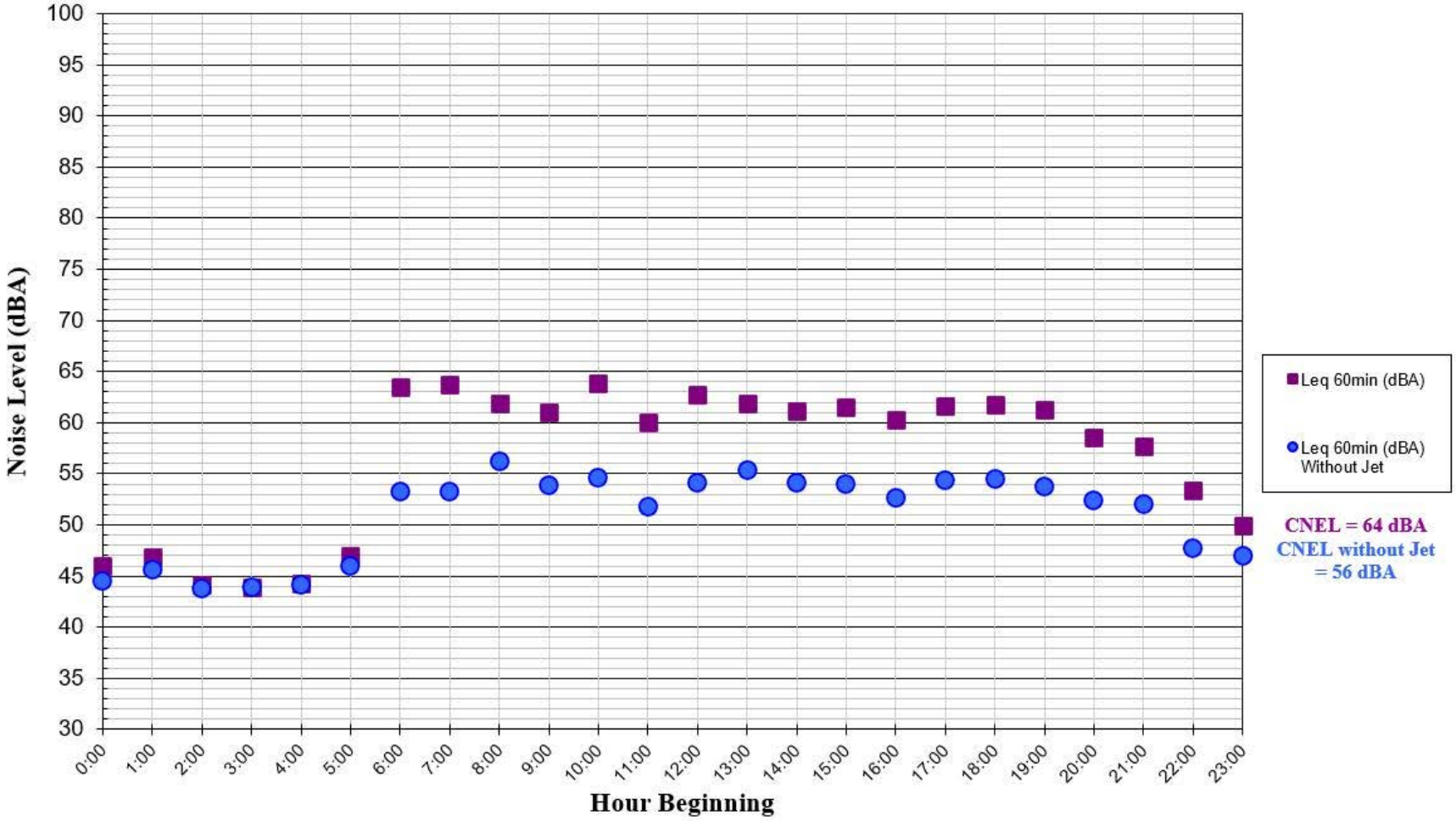


FIGURE A2 Daily Trend in Noise Levels at LT-1 During Typical Days, Tuesday, April 16, 2024

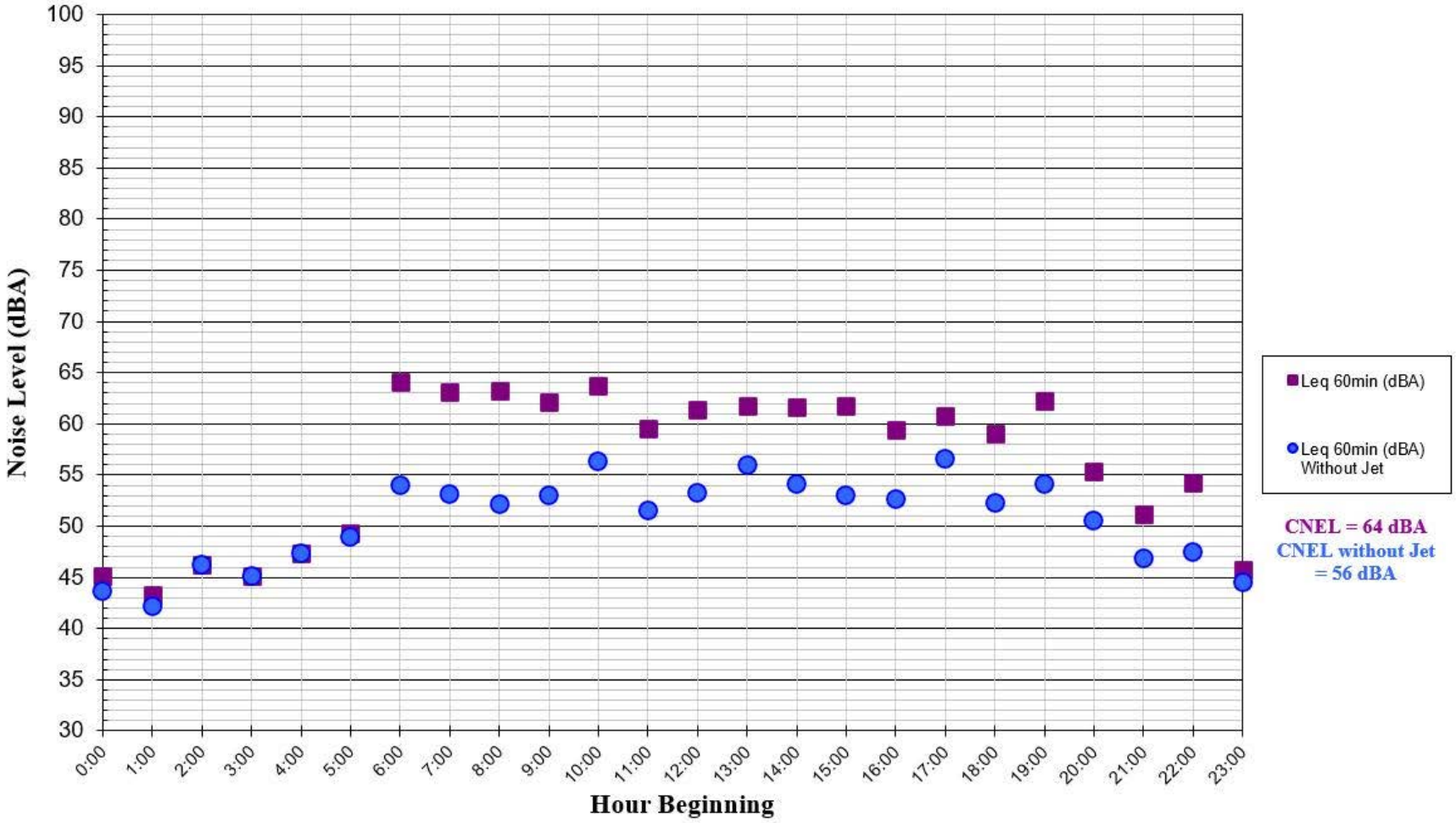


FIGURE A3 Daily Trend in Noise Levels at LT-1 During Typical Days, Wednesday, April 17, 2024

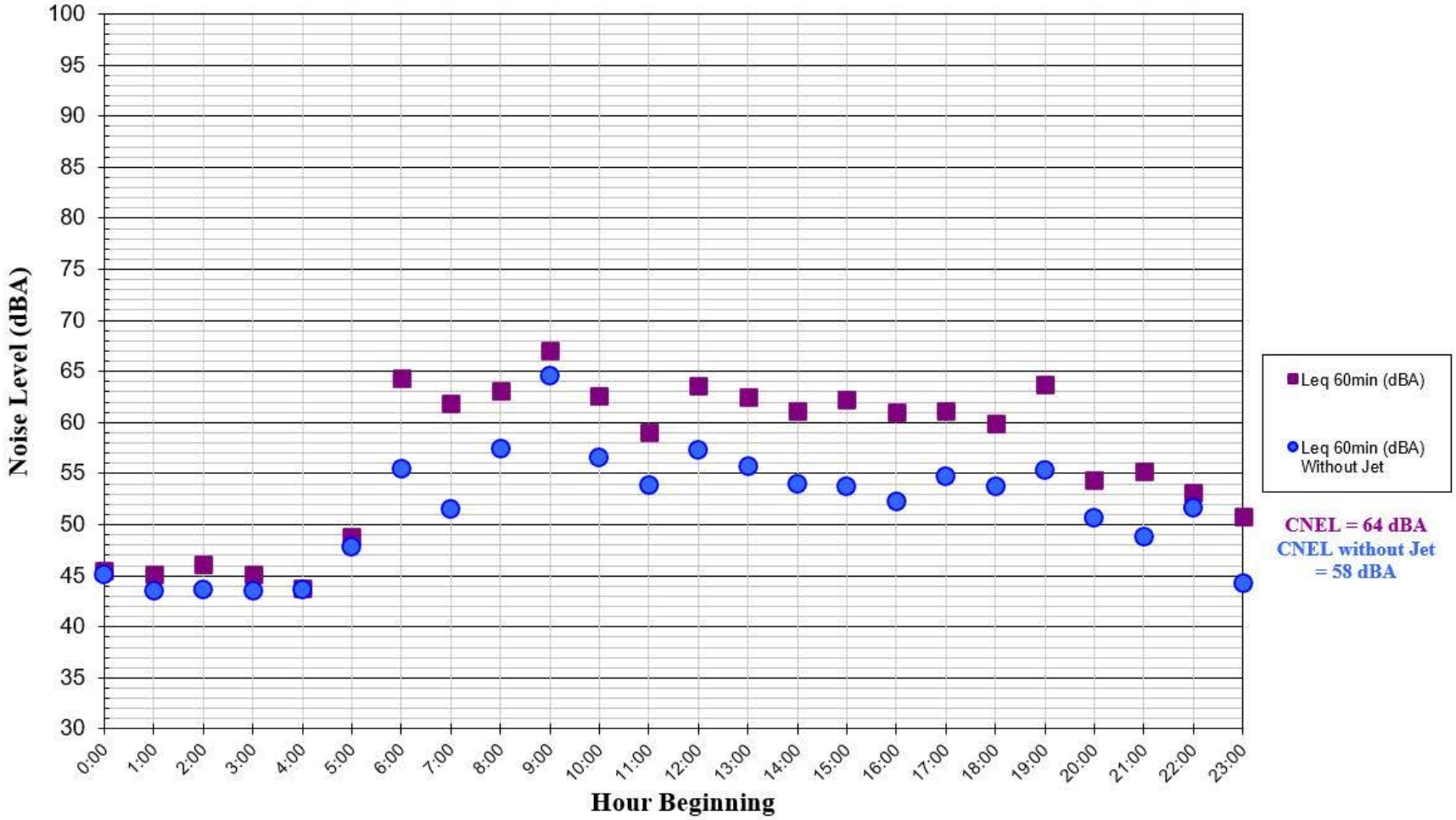


FIGURE A4 Daily Trend in Noise Levels at LT-1 During Typical Days, Thursday, April 18, 2024

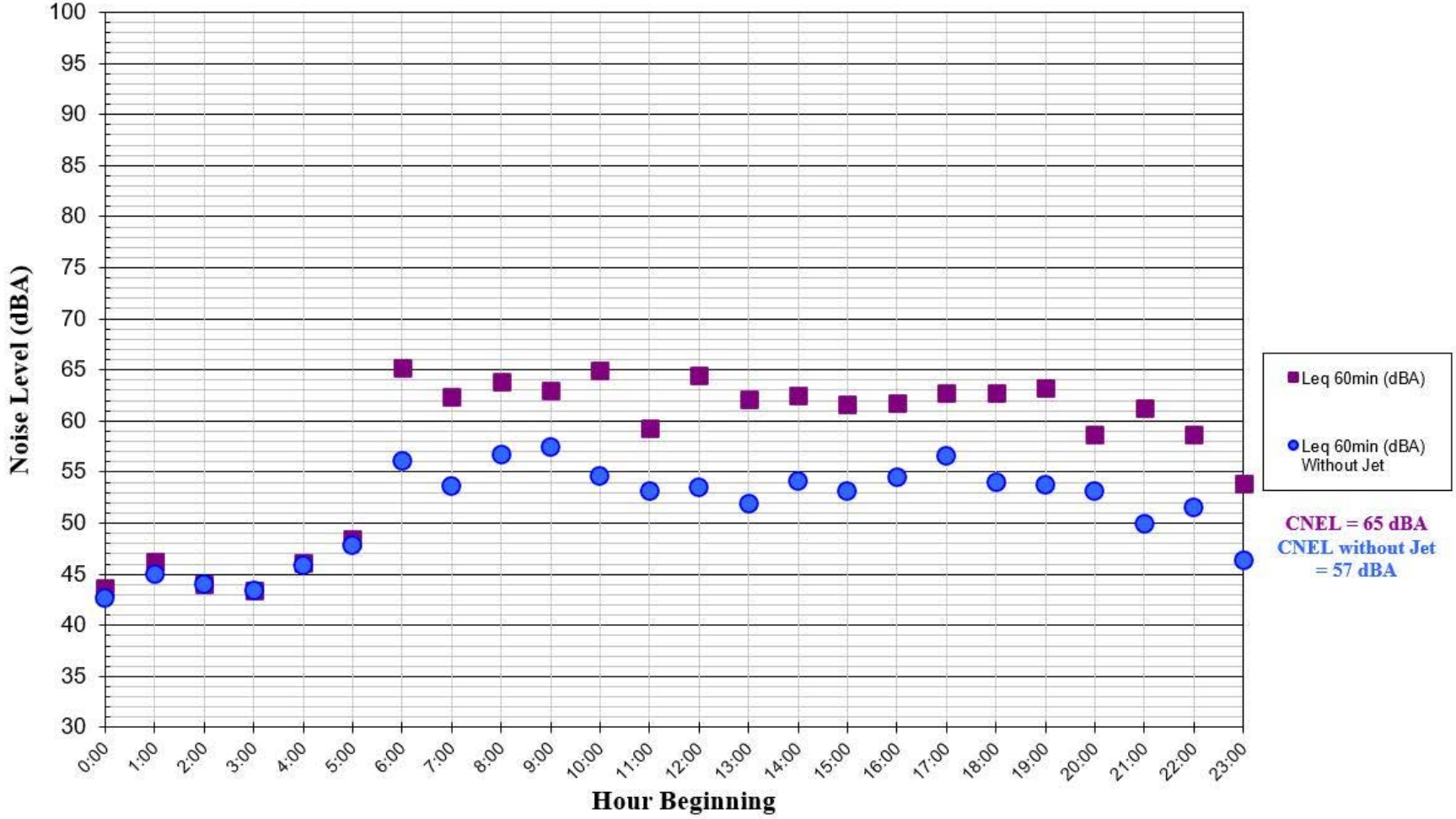


FIGURE A5 Daily Trend in Noise Levels at LT-1 During Typical Days, Friday, April 19, 2024

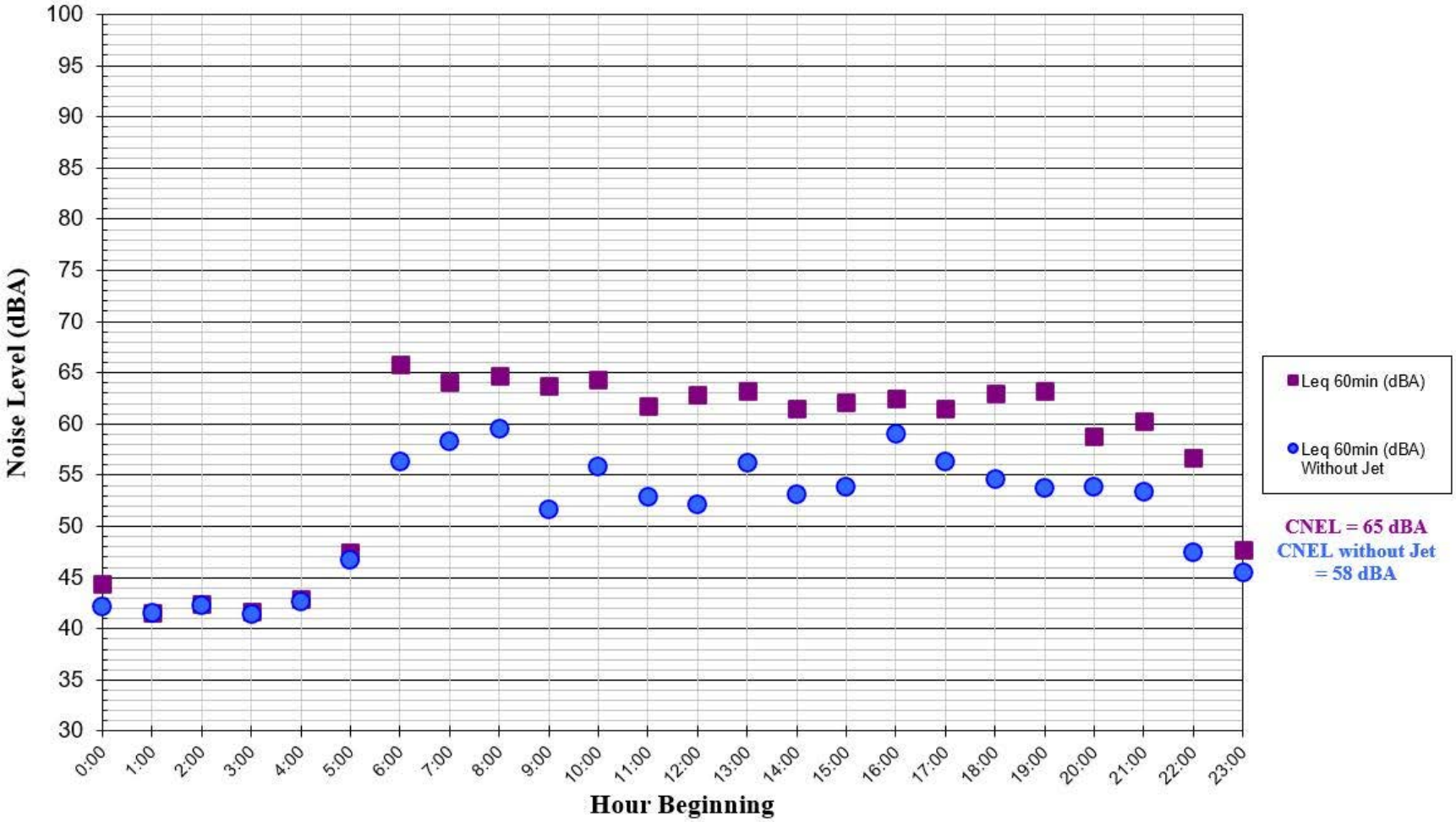


FIGURE A6 Daily Trend in Noise Levels at LT-1 During Typical Days, Saturday, April 20, 2024

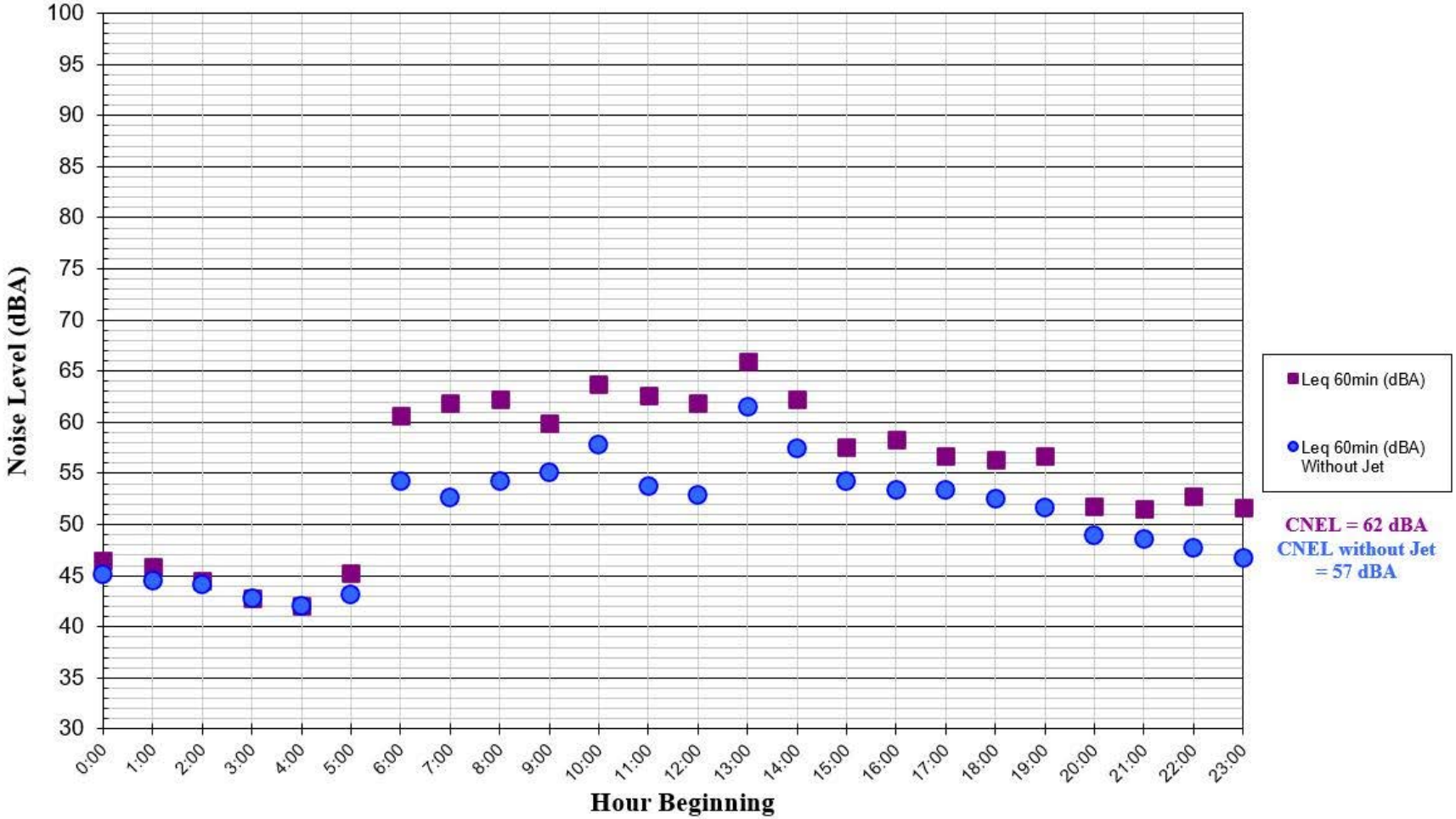


FIGURE A7 Daily Trend in Noise Levels at LT-1 During Typical Days, Sunday, April 21, 2024

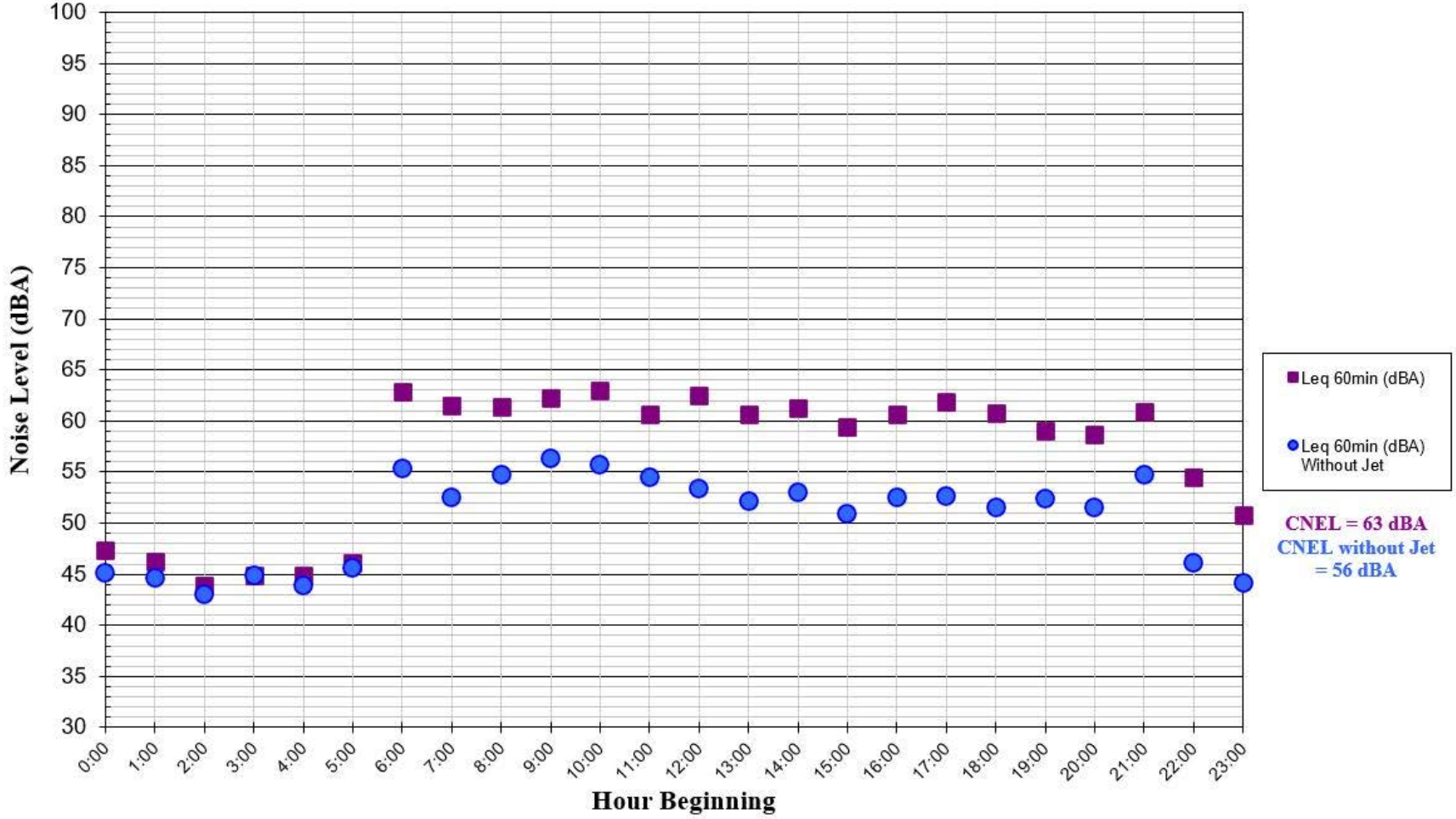


FIGURE A8 Daily Trend in Noise Levels at LT-1 During an NFL Weekend, Friday, October 6, 2023

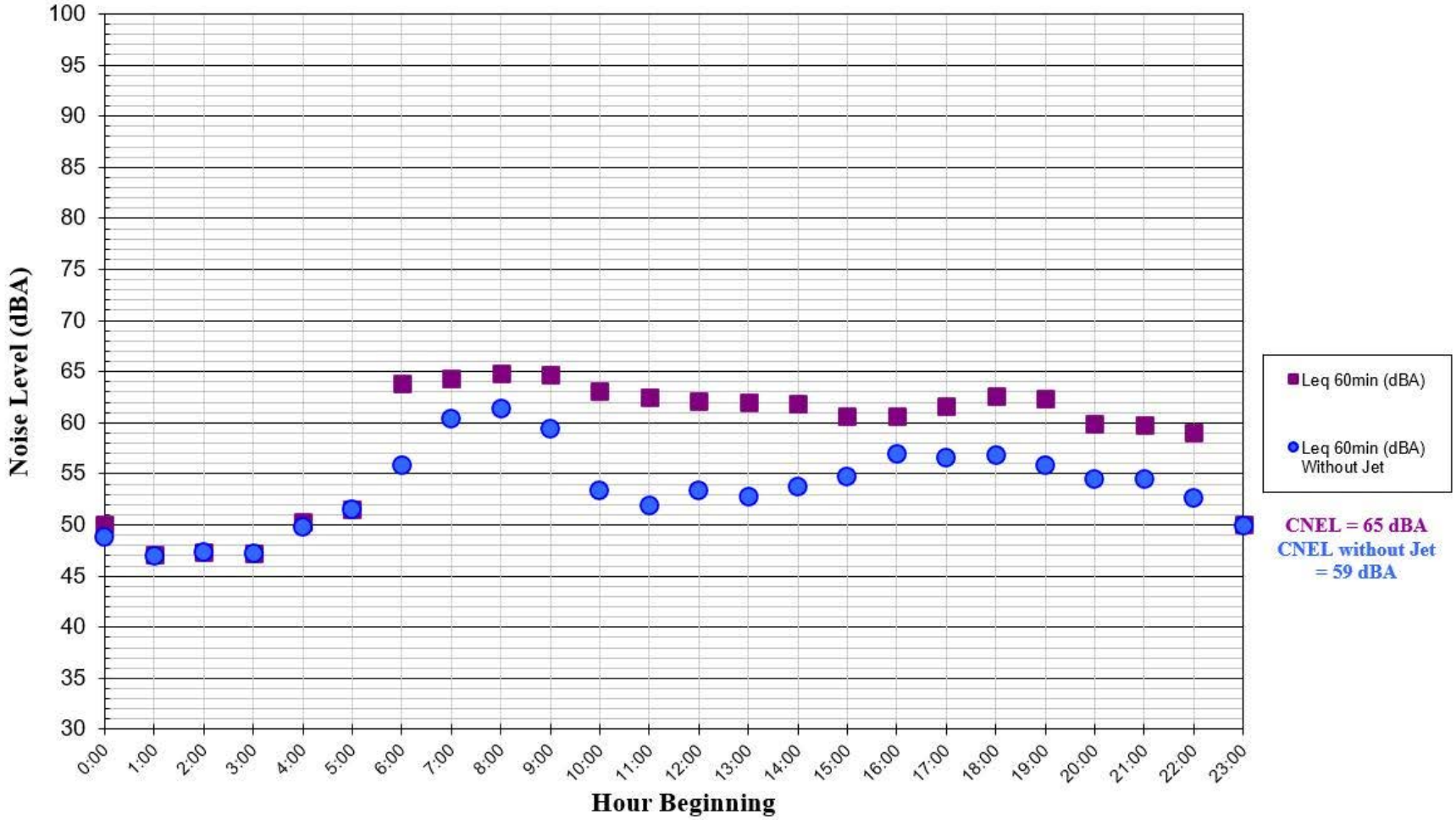


FIGURE A9 Daily Trend in Noise Levels at LT-1 During an NFL Weekend, Saturday, October 7, 2023

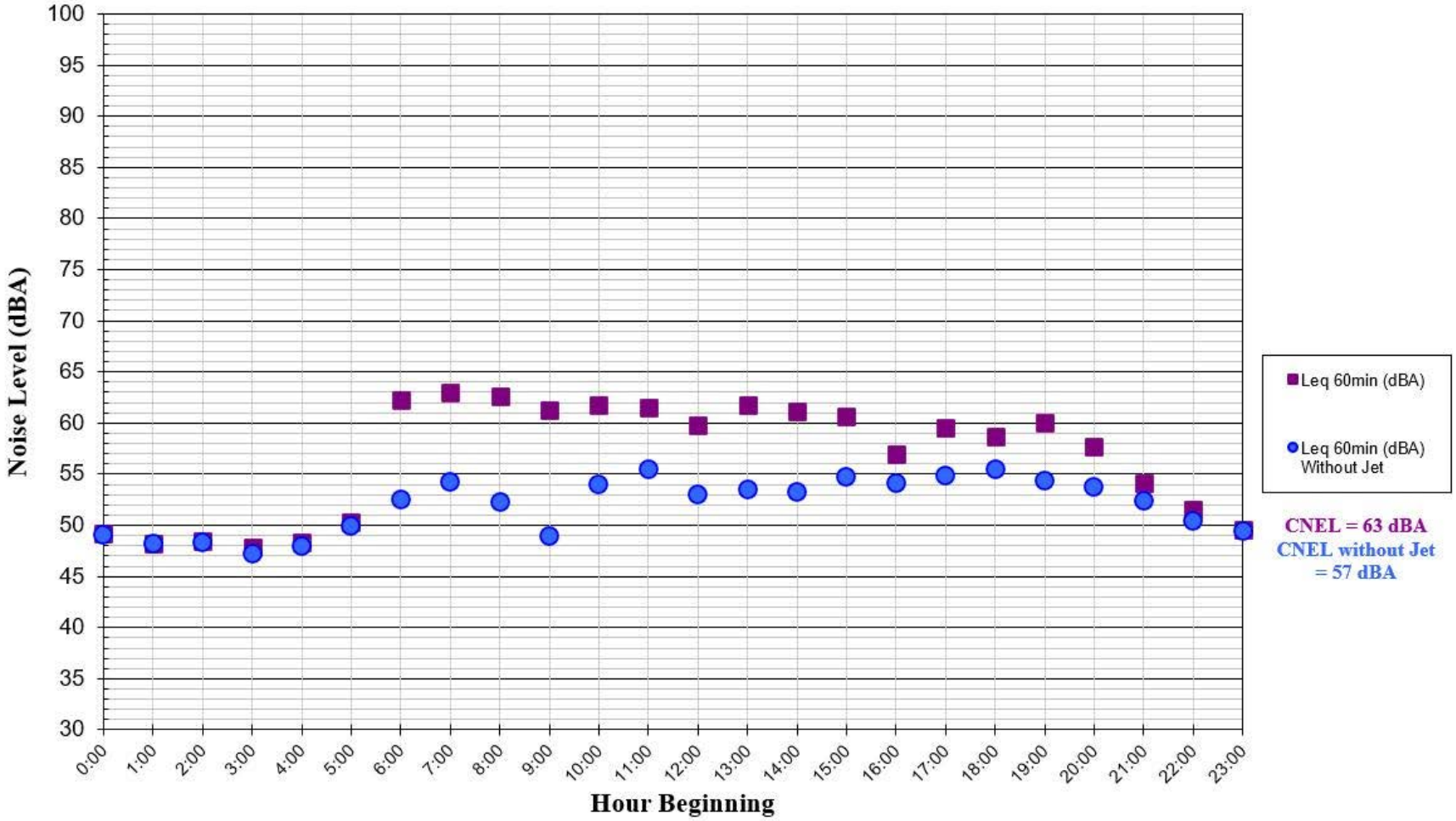


FIGURE A10 Daily Trend in Noise Levels at LT-1 During an NFL Weekend, Sunday, October 8, 2023

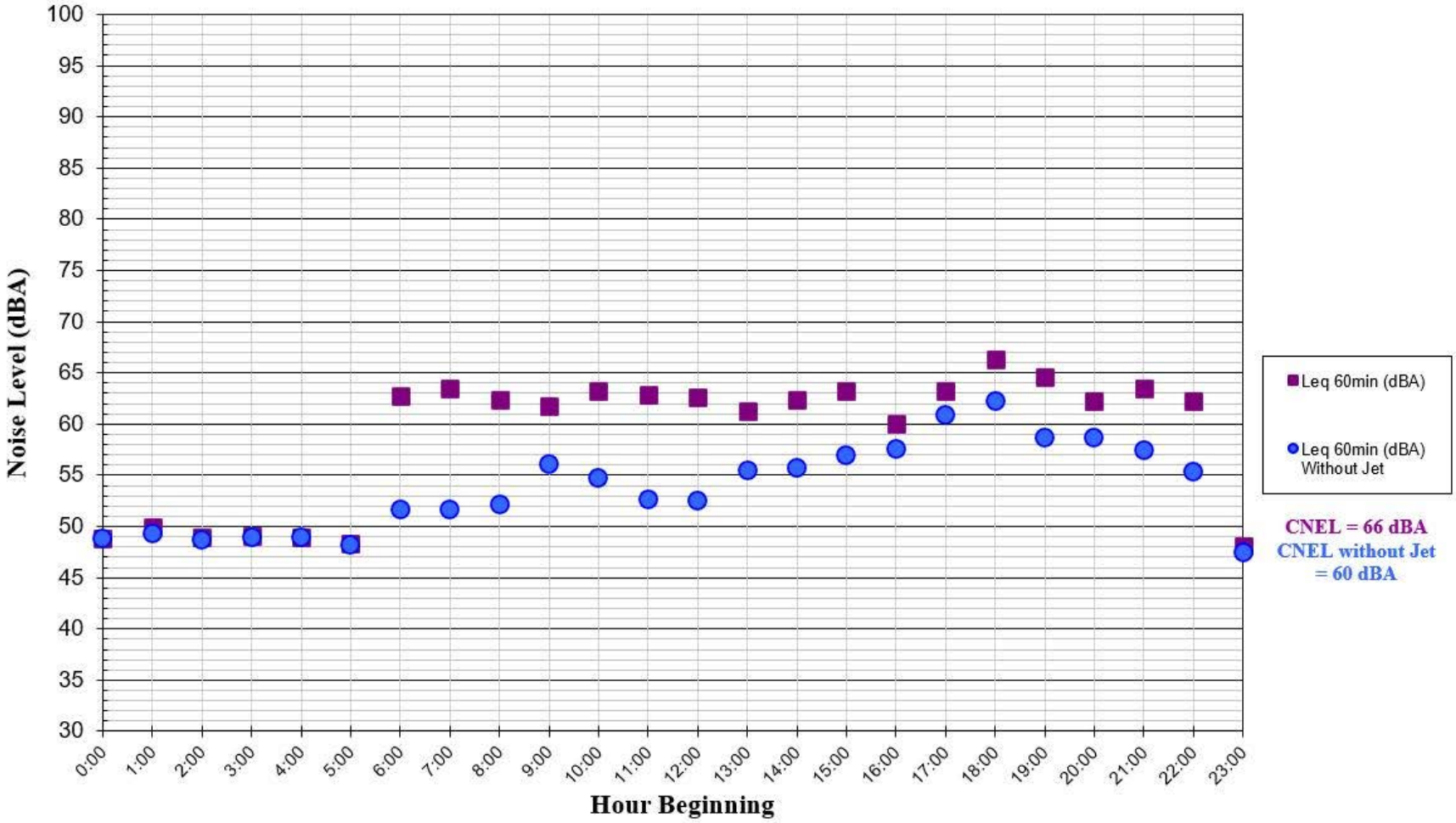


FIGURE A11 Daily Trend in Noise Levels at LT-1 During an NFL Weekend, Monday, October 9, 2023

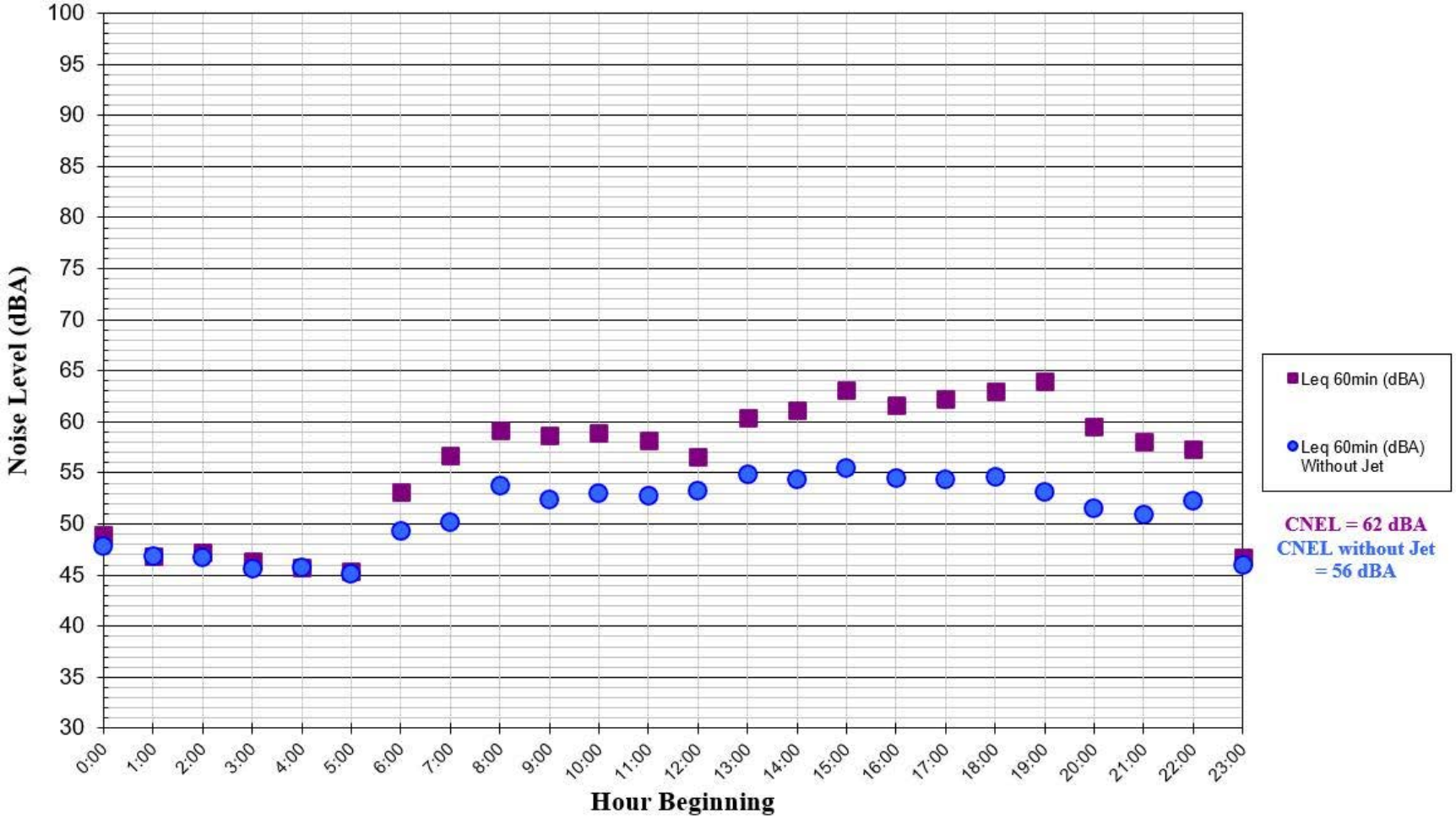


FIGURE A12 Daily Trend in Noise Levels at LT-1 During an NFL Playoff Weekend, Friday, January 19, 2024

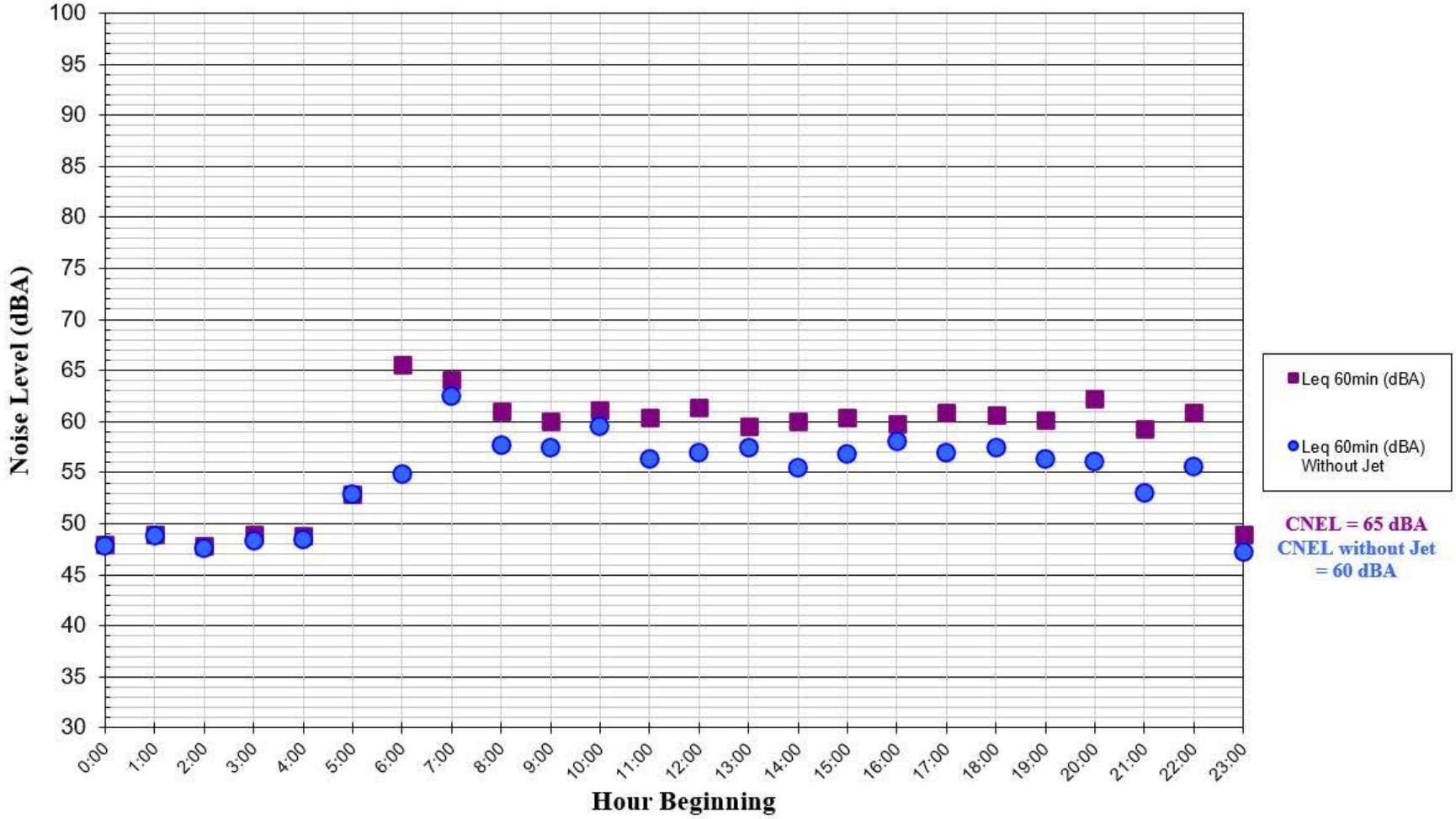


FIGURE A13 Daily Trend in Noise Levels at LT-1 During an NFL Playoff Weekend, Saturday, January 20, 2024

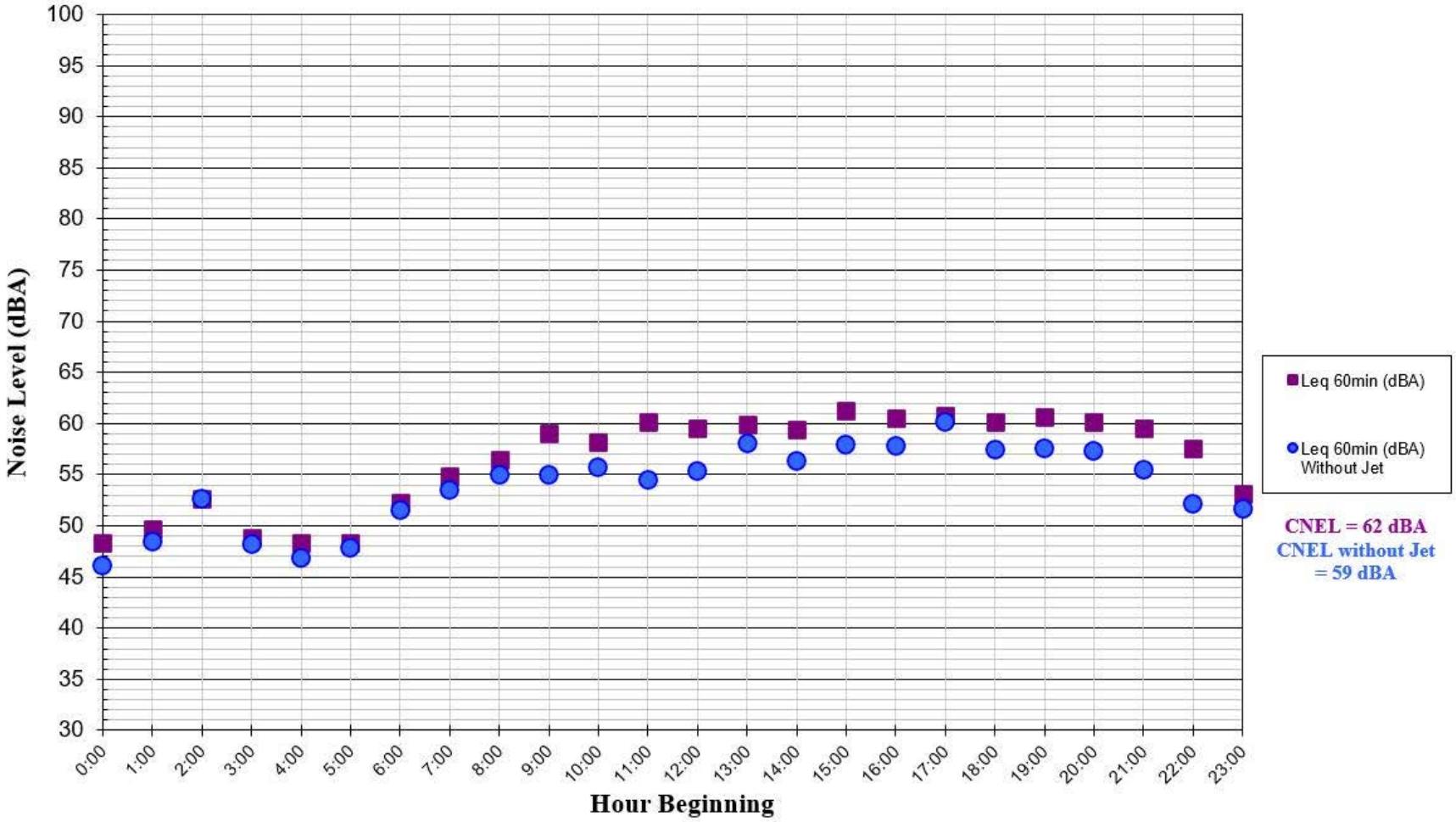


FIGURE A14 Daily Trend in Noise Levels at LT-1 During an NFL Playoff Weekend, Sunday, January 21, 2024

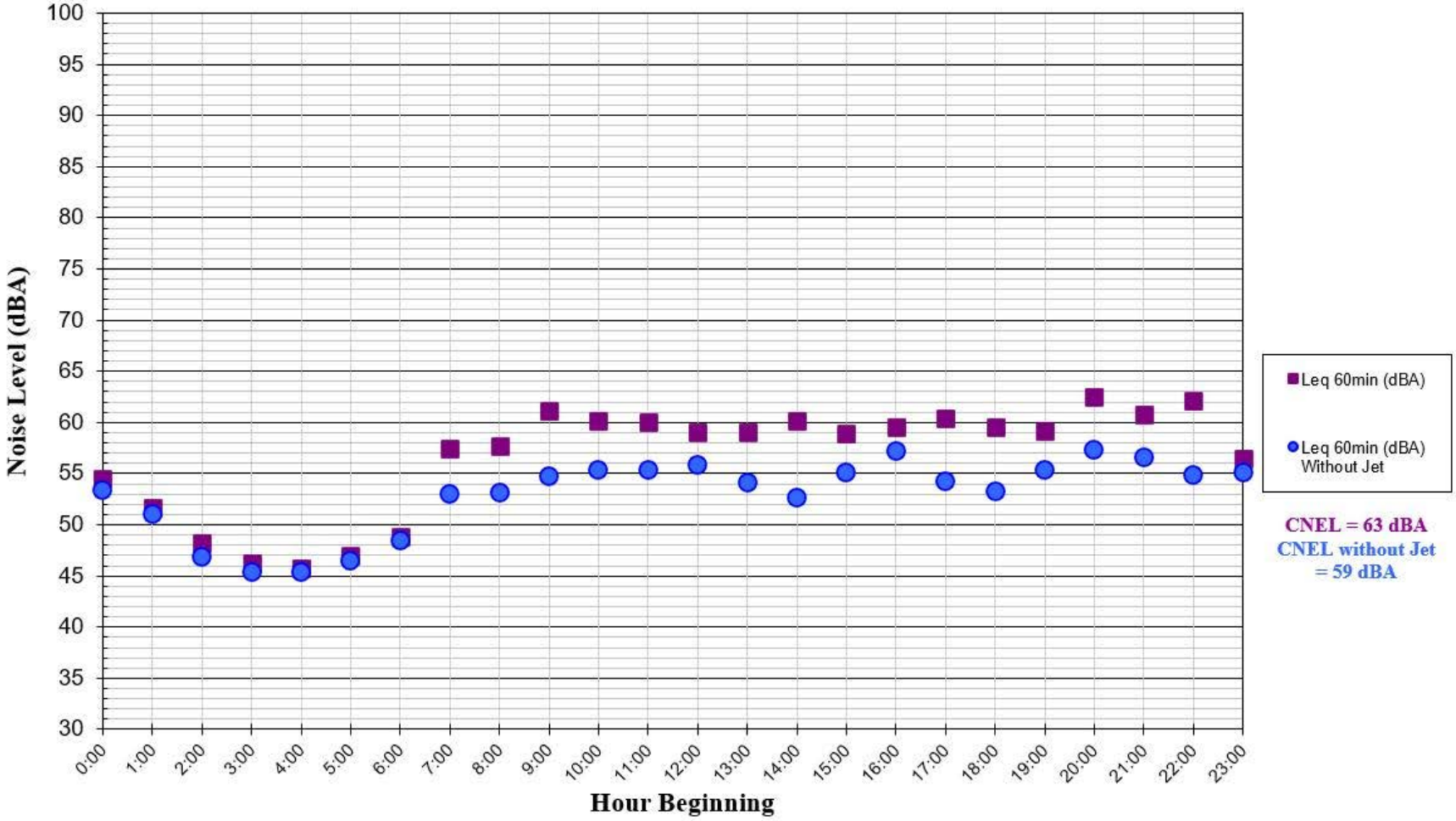


FIGURE A15 Daily Trend in Noise Levels at LT-1 During an NFL Playoff Weekend, Monday, January 22, 2024

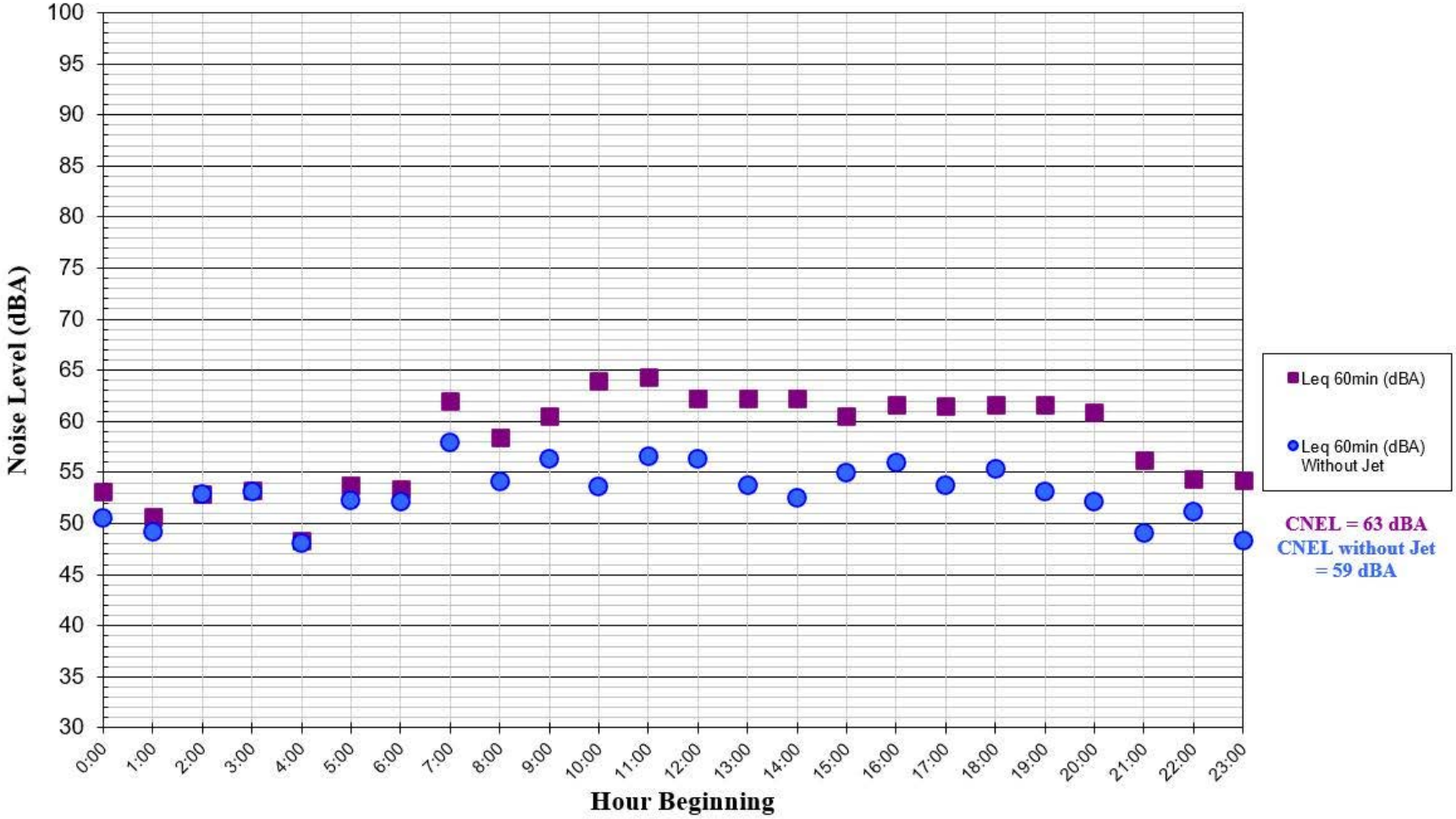


FIGURE A16 Daily Trend in Noise Levels at LT-1 During the NFC Championship Weekend, Friday, January 26, 2024

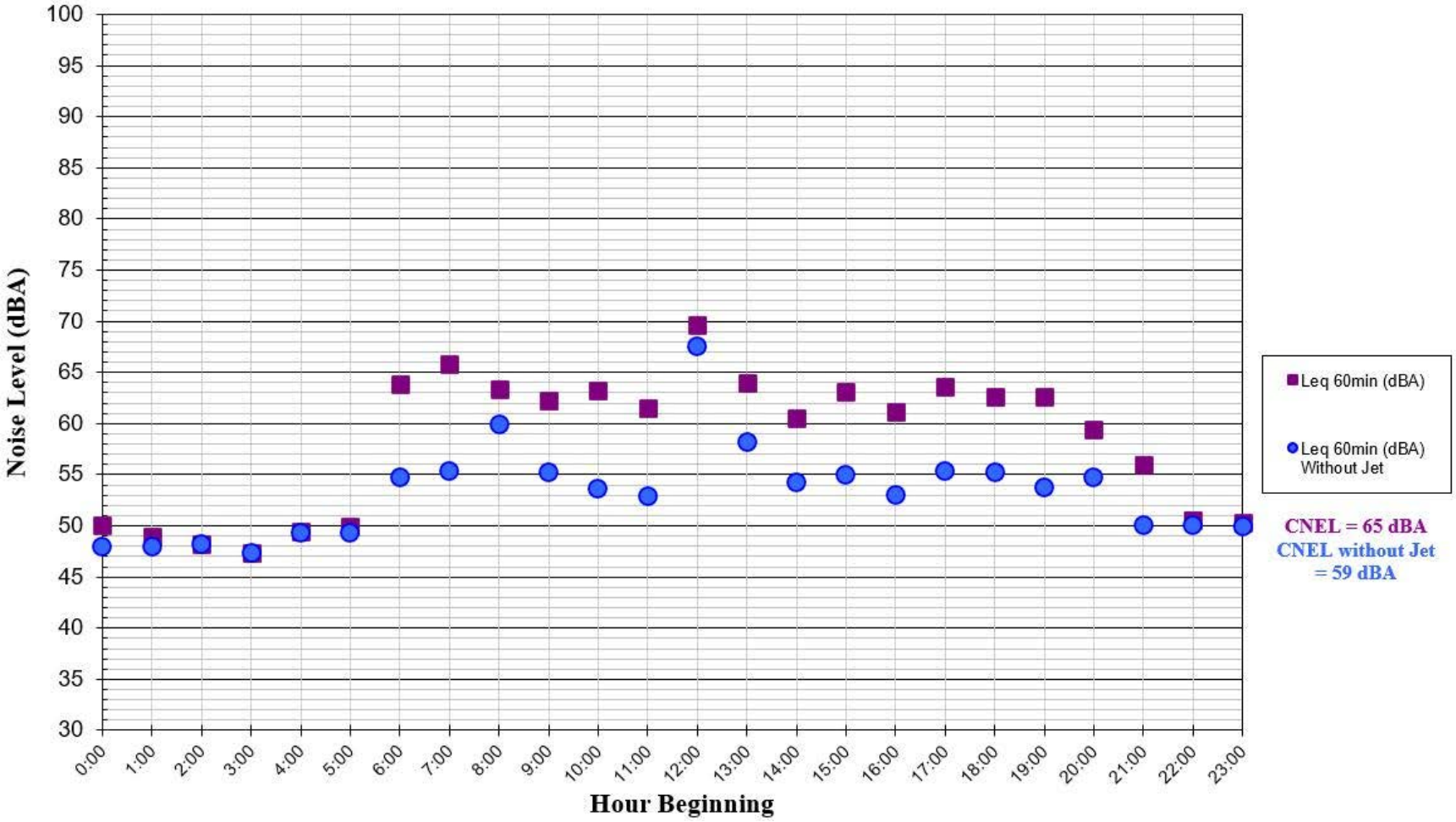


FIGURE A17 Daily Trend in Noise Levels at LT-1 During the NFC Championship Weekend, Saturday, January 27, 2024

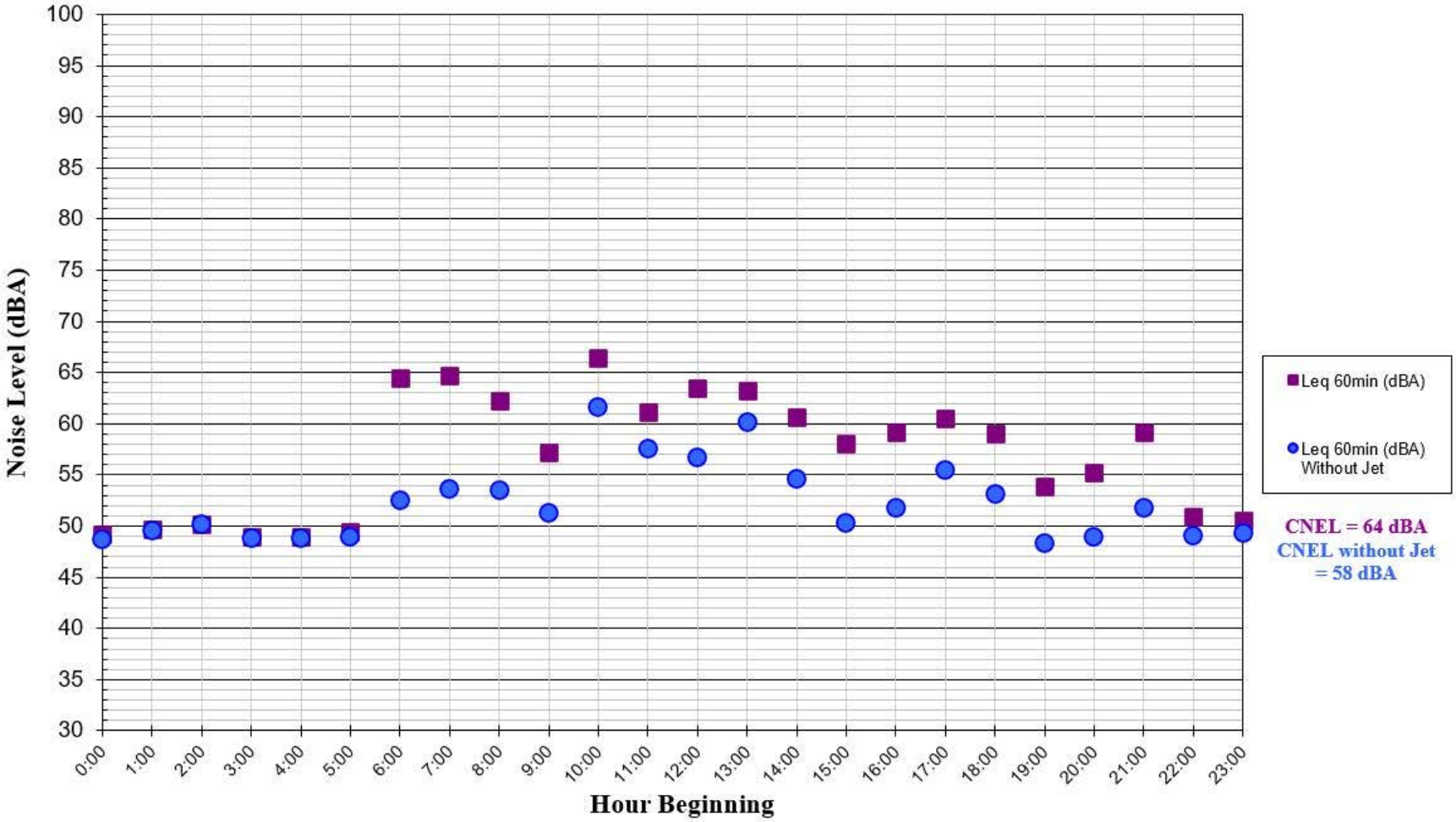


FIGURE A18 Daily Trend in Noise Levels at LT-1 During the NFC Championship Weekend, Sunday, January 28, 2024

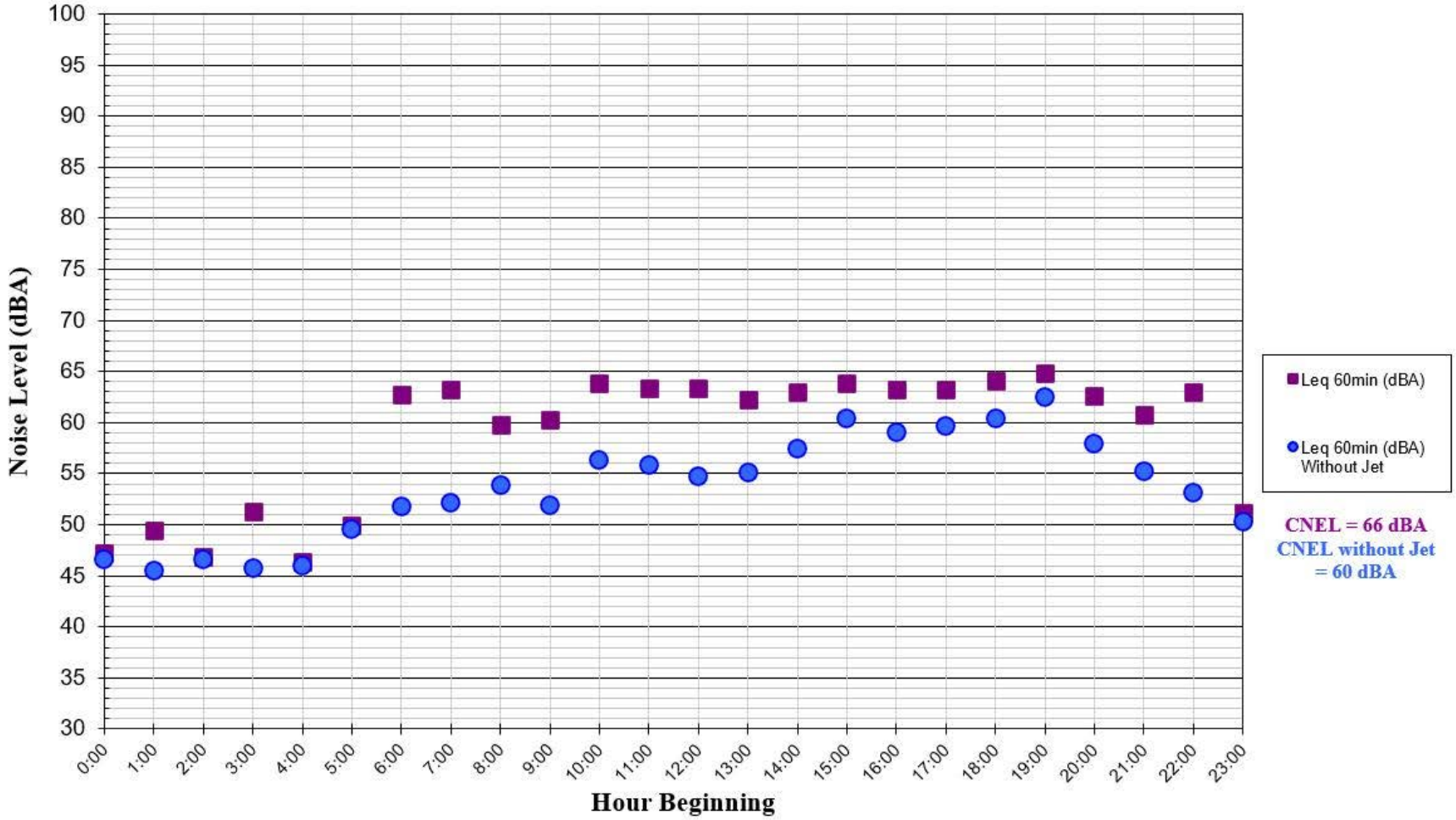


FIGURE A19 Daily Trend in Noise Levels at LT-1 During the NFC Championship Weekend, Monday, January 29, 2024

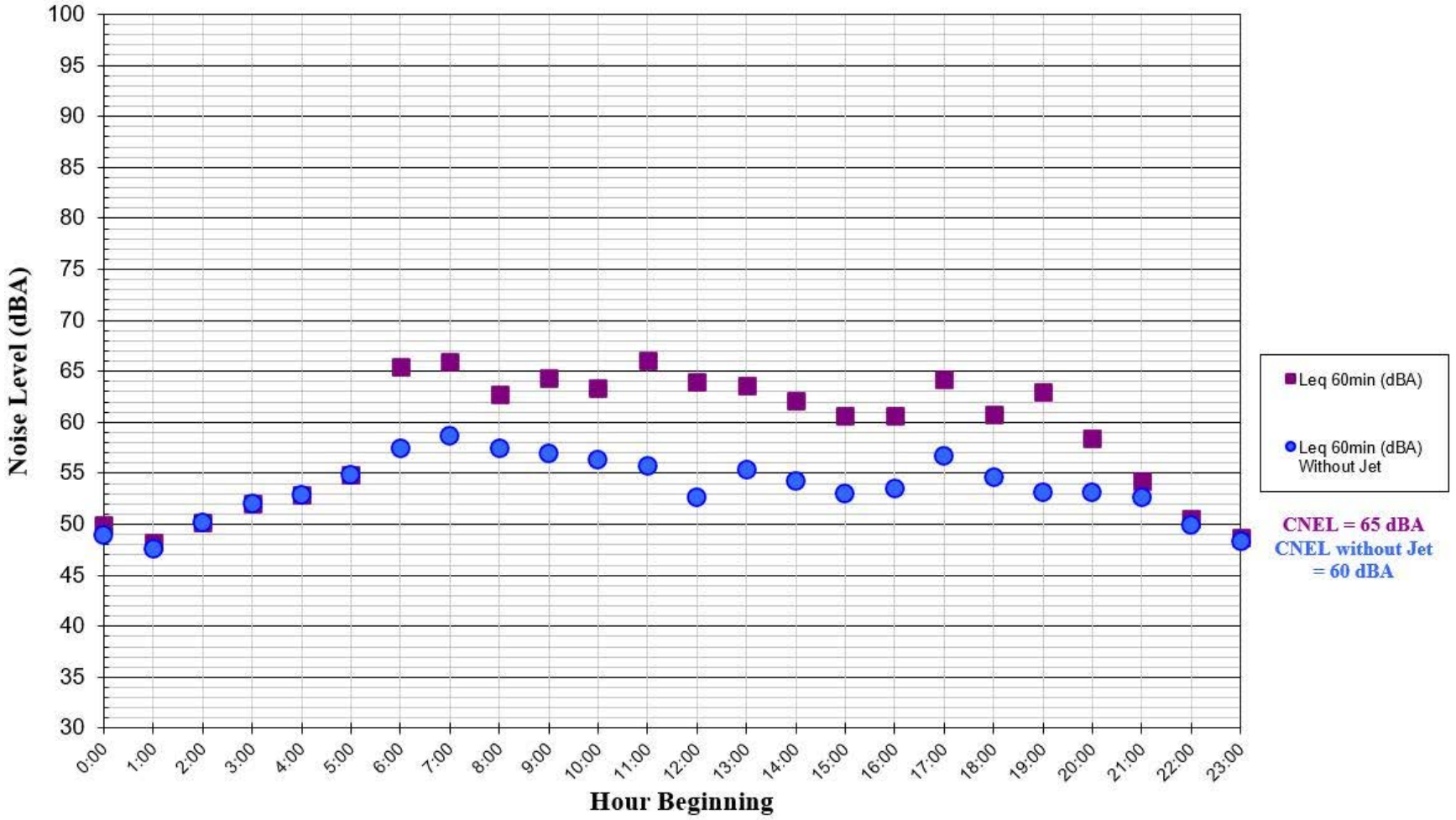


FIGURE A20 Daily Trend in Noise Levels at LT-1 During a Soccer Match, Wednesday, September 27, 2023

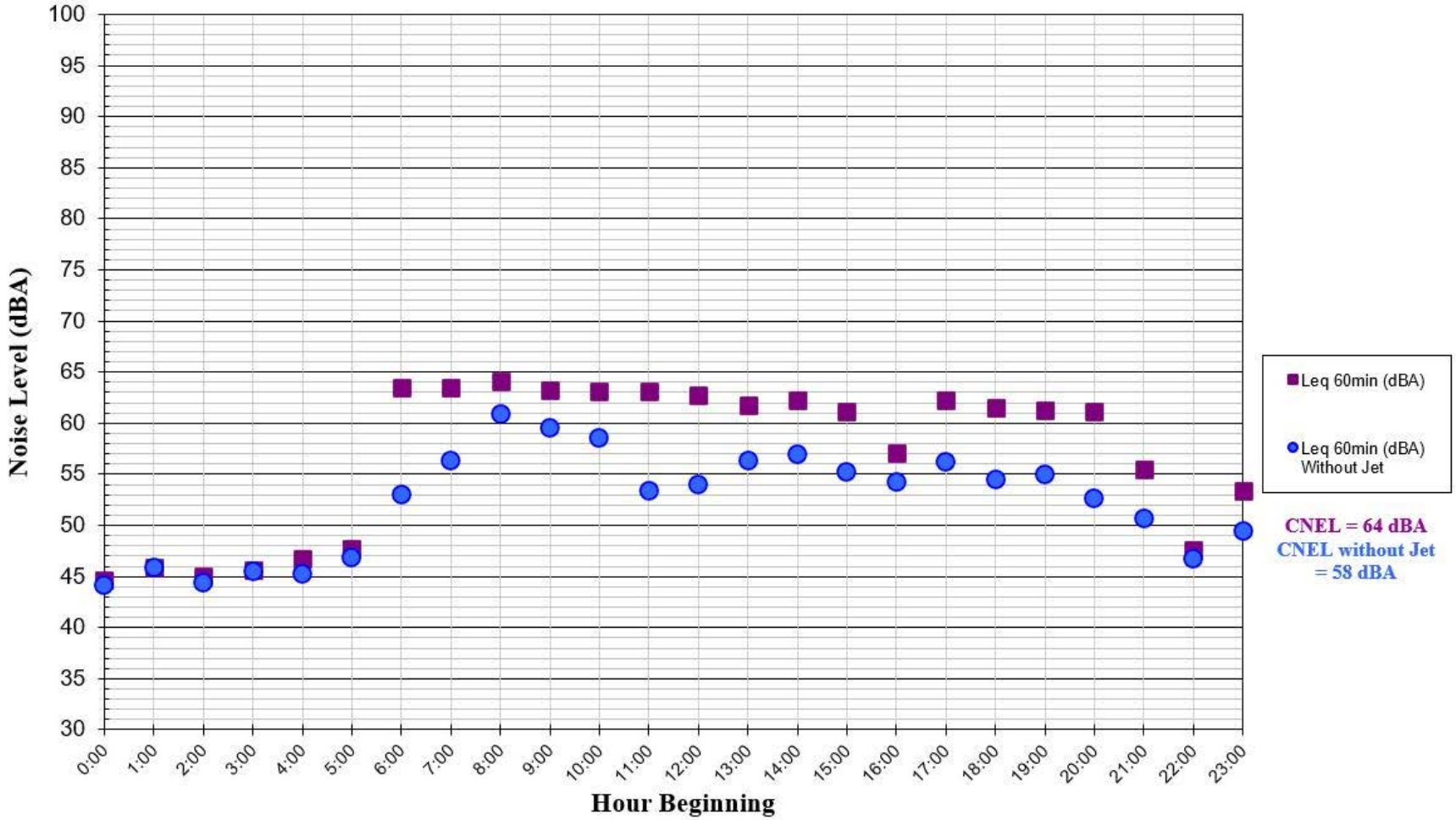


FIGURE A21 Daily Trend in Noise Levels at LT-1 During a Taylor Swift Concert, Friday, July 28, 2023

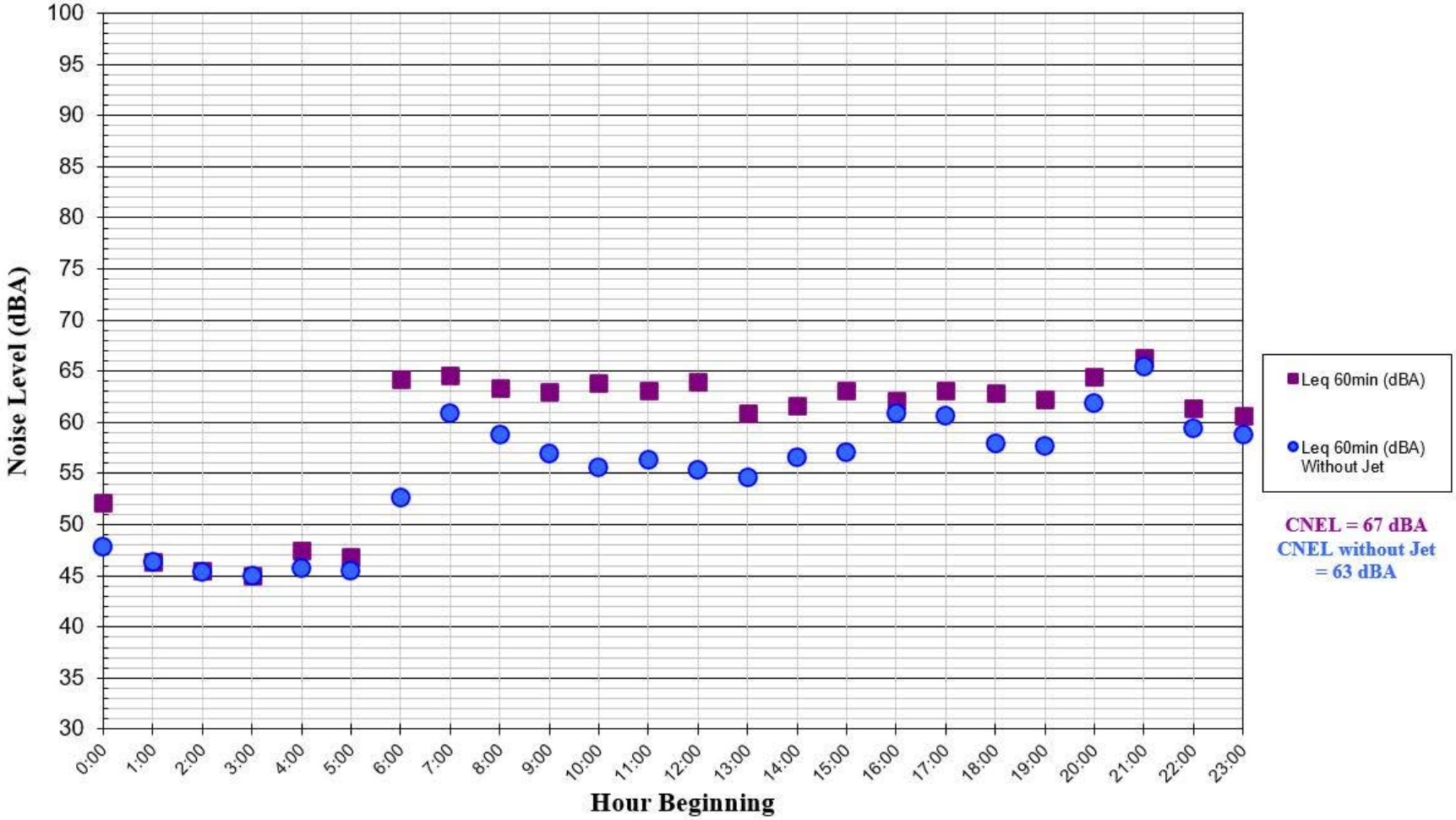


FIGURE A22 Daily Trend in Noise Levels at LT-1 During a Taylor Swift Concert, Saturday, July 29, 2023

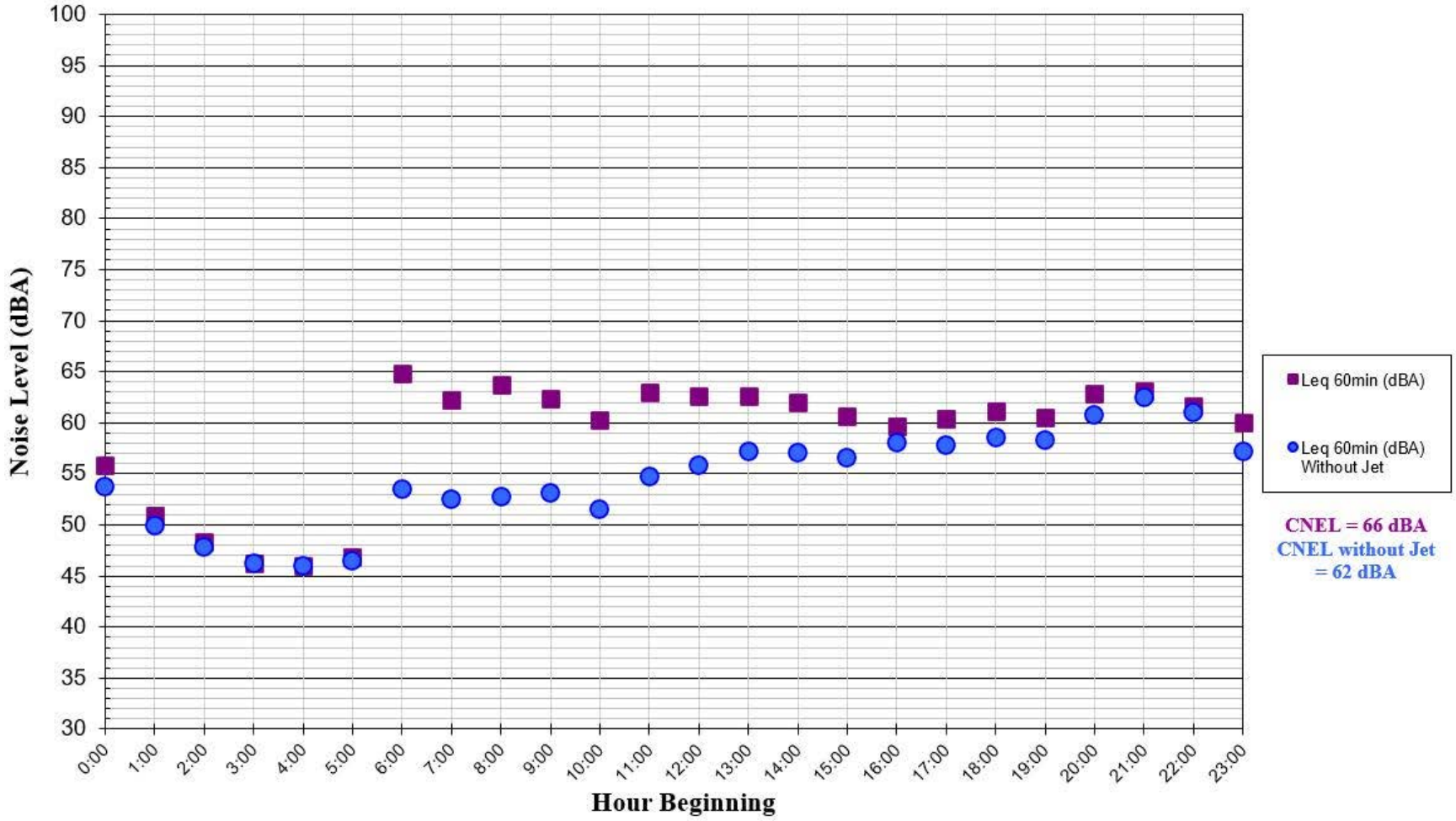


FIGURE A23 Daily Trend in Noise Levels at LT-1 During a Ed Sheeran Concert, Friday, September 16, 2023