Chapter 18: Noise

A. INTRODUCTION

This chapter assesses the potential for the proposed project to result in significant adverse noise impacts. As described in Chapter 1, "Project Description," the proposed project involves the redevelopment of several parcels on the Halletts Point peninsula in Queens with residential, retail, publicly accessible open space, and parking uses. The proposed project would also open a new connecting street segment between existing mapped portions of Astoria Boulevard through the New York City Housing Authority (NYCHA) Astoria Houses Campus.

The proposed project is expected to change traffic volumes in the general vicinity of the project site due to additional trips traveling to and from the proposed project as well as the addition of the new street segment connecting Astoria Boulevard between 1st Street and 8th Street. Since traffic on adjacent roadways is the main source of ambient noise, this could lead to changes in the ambient noise level.

The noise analysis presented in this chapter focuses on the operational noise effects of the proposed project and consists of three parts:

- A detailed analysis at locations where traffic generated by the proposed project would have the potential to result in significant adverse noise impacts to determine the magnitude of the increase in noise level;
- An analysis to determine the level of building attenuation necessary to ensure that interior noise levels throughout the study area satisfy City Environmental Quality Review (CEQR) requirements and the ~~City of New York Department of Housing Preservation and Development (HPD)~~ U.S. Department of Housing and Urban Development (HUD) noise abatement guidelines~~—which are based on U.S. Department of Housing and Urban Development (HUD) criteria—~~for interior noise levels; and
- An analysis to examine whether the newly created publicly accessible open space and waterfront esplanade would meet CEQR noise level guidelines for open space.

Noise effects during construction of the proposed project are analyzed and discussed separately in Chapter 20, "Construction."

PRINCIPAL CONCLUSIONS

The analysis finds that the proposed project would result in a noticeable increase in noise levels at locations immediately adjacent to the new roadway segment connecting Astoria Boulevard between 1st Street and 8th Street. The 2012 *CEQR Technical Manual* states that "it is reasonable to consider 65 dBA $L_{eq(1)}$ as an absolute noise level that should not be significantly exceeded" when determining a significant impact. The predicted $L_{eq(1)}$ at this location would be 62.4 dBA, which would be below the CEQR absolute noise impact guideline of 65 dBA. Additionally, since this increase would occur at a receptor site that represents a residential location, the L_{dn} noise level at this location in the future with the proposed project was considered and compared to HUD noise criteria. The L_{dn} for this receptor site was calculated to be 61.6 dBA. The minimum attenuation required to satisfy the HUD criteria of 45 dBA L_{dn} would be 17 dBA of attenuation. According to NYCHA, the nearest NYCHA residential building (and all other NYCHA buildings on the campus) has double glazed windows and window air conditioners. This combination would be expected to provide a minimum of 25 dBA of attenuation with an alternate means of ventilation under closed window conditions. Therefore, the interior L_{dn} noise levels at this receptor would be below 45 dBA, which is the HUD interior noise level guideline for residential use. Therefore, although this would be a noticeable increase in noise levels, it would not constitute a significant adverse noise impact requiring mitigation. Open space areas within the NYCHA Astoria Houses Campus adjacent to the proposed Astoria Boulevard connecting segment are predicted to experience $L_{10(1)}$ values of 62.5 dBA or less. These $L_{10(1)}$ values exceed the 55 dBA $L_{10(1)}$ CEQR guideline, but would be comparable to other parks around New York City. Overall, the proposed project would not have the potential to result in any significant adverse noise impacts as a result of increased traffic traveling to and from the project site.

The building attenuation analysis concludes that in order to meet *CEQR Technical Manual* interior noise level requirements, up to 28 dBA of building attenuation would be required for three of the building sites (certain facades of Buildings 3, 4, and 5). Because these specifications would be required by (E) designations, there would be no significant adverse noise impacts with respect to CEQR building attenuation requirements. Up to 22 dBA of building attenuation would be required to meet HUD criteria, where appropriate. This level of attenuation could be achieved with the use of standard windows, and therefore there would be no significant adverse noise impact with respect to building attenuation. No additional measures would be necessary to meet the required attenuation levels.

The analysis of noise levels in the proposed project's open space areas concludes that noise levels in the proposed open space and waterfront esplanade would be greater than the 55 dBA $L_{10(1)}$ CEQR guideline, but would be comparable to other parks around New York City. Therefore, the future projected noise levels would not constitute a significant adverse noise impact to the proposed project's open space areas.

B. ACOUSTICAL FUNDAMENTALS

Sound is a fluctuation in air pressure. Sound pressure levels are measured in units called "decibels" ("dB"). The particular character of the sound that we hear (a whistle compared with a French horn, for example) is determined by the speed, or "frequency," at which the air pressure fluctuates, or "oscillates." Frequency defines the oscillation of sound pressure in terms of cycles per second. One cycle per second is known as 1 Hertz ("Hz"). People can hear over a relatively limited range of sound frequencies, generally between 20 Hz and 20,000 Hz, and the human ear does not perceive all frequencies equally well. High frequencies (e.g., a whistle) are more easily discernible and therefore more intrusive than many of the lower frequencies (e.g., the lower notes on the French horn).

"A"-WEIGHTED SOUND LEVEL (DBA)

In order to establish a uniform noise measurement that simulates people's perception of loudness and annoyance, the decibel measurement is weighted to account for those frequencies most audible to the human ear. This is known as the A-weighted sound level, or "dBA," and it is the descriptor of noise levels most often used for community noise. As shown in **Table 18-1**, the threshold of human hearing is defined as 0 dBA; very quiet conditions (as in a library, for example) are approximately 40 dBA; levels between 50 dBA and 70 dBA define the range of noise levels generated by normal daily activity; levels above 70 dBA would be considered noisy, and then loud, intrusive, and deafening as the scale approaches 130 dBA.

Table 18-1
Common Noise Levels

Sound Source	(dBA)
Military jet, air raid siren	130
Amplified rock music	110
Jet takeoff at 500 meters	100
Freight train at 30 meters	95
Train horn at 30 meters	90
Heavy truck at 15 meters	80–90
Busy city street, loud shout	80
Busy traffic intersection	70–80
Highway traffic at 15 meters, train	70
Predominantly industrial area	60
Light car traffic at 15 meters, city or commercial areas, or residential areas close to industry	50–60
Background noise in an office	50
Suburban areas with medium-density transportation	40–50
Public library	40
Soft whisper at 5 meters	30
Threshold of hearing	0

Note: A 10 dBA increase in level appears to double the loudness, and a 10 dBA decrease halves the apparent loudness.

Sources: Cowan, James P. *Handbook of Environmental Acoustics,* Van Nostrand Reinhold, New York, 1994. Egan, M. David, Architectural Acoustics. McGraw-Hill Book Company, 1988.

In considering these values, it is important to note that the dBA scale is logarithmic, meaning that each increase of 10 dBA describes a doubling of perceived loudness. Thus, the background noise in an office, at 50 dBA, is perceived as twice as loud as a library at 40 dBA. For most people to perceive an increase in noise, it must be at least 3 dBA. At 5 dBA, the change will be readily noticeable. Generally, changes in noise levels less than 3 dBA are barely perceptible to most listeners.

SOUND LEVEL DESCRIPTORS

Because the sound pressure level unit of dBA describes a noise level at just one moment and very few noises are constant, other ways of describing noise over extended periods have been developed. One way of describing fluctuating sound is to describe the fluctuating noise heard over a specific time period as if it had been a steady, unchanging sound. For this condition, a descriptor called the “equivalent sound level,” L_{eq}, can be computed. L_{eq} is the constant sound level that, in a given situation and time period (e.g., 1 hour, denoted by $L_{eq(1)}$, or 24 hours, denoted as $L_{eq(24)}$), conveys the same sound energy as the actual time-varying sound. Statistical sound level descriptors such as L_1, L_{10}, L_{50}, L_{90}, and L_x, are used to indicate noise levels that are exceeded 1, 10, 50, 90 and x percent of the time, respectively.

The relationship between L_{eq} and levels of exceedance is worth noting. Because L_{eq} is defined in energy rather than straight numerical terms, it is not simply related to the levels of exceedance. If the noise fluctuates very little, L_{eq} will approximate L_{50} or the median level. If the noise fluctuates broadly, the L_{eq} will be approximately equal to the L_{10} value. If extreme fluctuations are present, the L_{eq} will exceed L_{90} or the background level by 10 or more decibels. Thus the relationship between

L_{eq} and the levels of exceedance will depend on the character of the noise. In community noise measurements, it has been observed that the L_{eq} is generally between L_{10} and L_{50}.

The day-night sound level (L_{dn}) refers to a 24-hour average noise level with a 10 dB penalty applied to the noise levels during the hours between 10 PM and 7 AM, due to increased sensitivity to noise levels during these hours.

For purposes of the proposed project, the L_{dn} and the 1-hour L_{10} descriptor ($L_{10(1)}$) have been selected as the noise descriptors to be used in this noise impact evaluation. The 1-hour L_{10} is the noise descriptor used in the *CEQR Technical Manual* (January 2012 edition) noise exposure guidelines for city environmental impact review classification, and the L_{dn} is the descriptor used to determine HUD noise abatement requirements.

C. NOISE STANDARDS AND CRITERIA

NEW YORK CEQR NOISE STANDARDS

The *CEQR Technical Manual* sets external noise exposure standards; these standards are shown in **Table 18-2**. Noise exposure is classified into four categories: acceptable, marginally acceptable, marginally unacceptable, and clearly unacceptable.

Table 18-2
Noise Exposure Guidelines For Use in City Environmental Impact Review

Receptor Type	Time Period	Acceptable General External Exposure	Airport[3] Exposure	Marginally Acceptable General External Exposure	Airport[3] Exposure	Marginally Unacceptable General External Exposure	Airport[3] Exposure	Clearly Unacceptable General External Exposure	Airport[3] Exposure
Outdoor area requiring serenity and quiet[2]		$L_{10} \le 55$ dBA	---------- Ldn ≤ 60 dBA ----------	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Hospital, nursing home		$L_{10} \le 55$ dBA		$55 < L_{10} \le 65$ dBA	---------- 60 < Ldn ≤ 65 dBA ----------	$65 < L_{10} \le 80$ dBA	(i) 65 < Ldn ≤ 70 dBA, (II) 70 ≤ Ldn	$L_{10} > 80$ dBA	---------- Ldn ≤ 75 dBA ----------
Residence, residential hotel, or motel	7 AM to 10 PM	$L_{10} \le 65$ dBA		$65 < L_{10} \le 70$ dBA		$70 < L_{10} \le 80$ dBA		$L_{10} > 80$ dBA	
	10 PM to 7 AM	$L_{10} \le 55$ dBA		$55 < L_{10} \le 70$ dBA		$70 < L_{10} \le 80$ dBA		$L_{10} > 80$ dBA	
School, museum, library, court, house of worship, transient hotel or motel, public meeting room, auditorium, outpatient public health facility		Same as Residential Day (7 AM-11 PM)		Same as Residential Day (7 AM-11 PM)		Same as Residential Day (7 AM-11 PM)		Same as Residential Day (7 AM-11 PM)	
Commercial or office		Same as Residential Day (7 AM-11 PM)		Same as Residential Day (7 AM-11 PM)		Same as Residential Day (7 AM-11 PM)		Same as Residential Day (7 AM-11 PM)	
Industrial, public areas only[4]	Note 4	Note 4		Note 4		Note 4		Note 4	

Notes:
(i) In addition, any new activity shall not increase the ambient noise level by 3 dBA or more; (ii) *CEQR Technical Manual* noise criteria for train noise are similar to the above aircraft noise standards: the noise category for train noise is found by taking the L_{dn} value for such train noise to be an L^{y}_{dn} (L_{dn} contour) value.
Table Notes:
1 Measurements and projections of noise exposures are to be made at appropriate heights above site boundaries as given by American National Standards Institute (ANSI) Standards; all values are for the worst hour in the time period.
2 Tracts of land where serenity and quiet are extraordinarily important and serve an important public need, and where the preservation of these qualities is essential for the area to serve its intended purpose. Such areas could include amphitheaters, particular parks or portions of parks, or open spaces dedicated or recognized by appropriate local officials for activities requiring special qualities of serenity and quiet. Examples are grounds for ambulatory hospital patients and patients and residents of sanitariums and nursing homes.
3 One may use FAA-approved L_{dn} contours supplied by the Port Authority, or the noise contours may be computed from the federally approved INM Computer Model using flight data supplied by the Port Authority of New York and New Jersey.
4 External Noise Exposure standards for industrial areas of sounds produced by industrial operations other than operating motor vehicles or other transportation facilities are spelled out in the New York City Zoning Resolution, Sections 42-20 and 42-21. The referenced standards apply to M1, M2, and M3 manufacturing districts and to adjoining residence districts (performance standards are octave band standards).
Source: New York City Department of Environmental Protection (adopted policy 1983).

The *CEQR Technical Manual* defines attenuation requirements for buildings based on exterior noise levels (see **Table 18-3**). Recommended noise attenuation values for buildings are designed to maintain interior noise levels of 45 dBA or lower for residential uses and 50 dBA or lower for commercial uses, and are determined based on exterior $L_{10(1)}$ noise levels.

Table 18-3
Required Attenuation Values to Achieve Acceptable Interior Noise Levels

	Marginally Acceptable				Clearly Unacceptable
Noise Level With Proposed Project	$70 < L_{10} \leq 73$	$73 < L_{10} \leq 76$	$76 < L_{10} \leq 78$	$78 < L_{10} \leq 80$	$L_{10} < 80$
Attenuation*	(I) 28 dBA	(II) 31 dBA	(III) 33 dBA	(IV) 35 dBA	$36 + (L_{10} - 80)^{B}$ dBA

Notes: [A] The above composite window-wall attenuation values are for residential dwellings. Commercial office spaces and meeting rooms would be 5 dB(A) less in each category. All the above categories require a closed window situation and hence an alternate means of ventilation.
[B] Required attenuation values increase by 1 dB(A) increments for L_{10} values greater than 80 dBA.
Source: New York City Department of Environmental Protection

HUD DEVELOPMENT GUIDELINES

HUD sets exterior noise standards for housing construction projects based on Day-Night Sound Level (i.e., L_{dn}) values (see **Table 18-4**). The L_{dn} refers to a 24-hour average noise level with a 10 dB penalty applied to the noise levels during the hours between 10 PM and 7 AM, due to increased sensitivity to noise levels during these hours. Noise attenuation values are designed to maintain an interior L_{dn} value of 45 dBA or lower for residential uses.

Table 18-4
HUD Exterior Noise Standards

	Acceptable	Normally Unacceptable	Unacceptable
Noise Level With Proposed Project	$L_{dn} \leq 65$	$65 < L_{dn} \leq 75$	$75 < L_{dn}$

Source: U.S. Department of Housing and Urban Development

For this analysis, L_{dn} levels were calculated using the following equation:

10*LOG[Energy sum of the 24 hourly equivalent sound levels with 10dB added between the hours of 10PM and 7AM] – 13.8

The equation listed above is used to calculate the L_{dn} when performing a continuous 24-hour measurement at the project site is feasible. First, 10 dB is added to the A-weighted sound levels measured between the hours of 10 PM and 7 AM (i.e., nighttime). The L_{dn} sound level is then computed from the adjusted nighttime sound levels along with the unadjusted daytime (i.e., 7 AM to 10 PM) values.

IMPACT DEFINITION

The determination of significant adverse noise impacts in this analysis is informed by the use of both absolute noise level limits and relative impact criteria. The 2012 *CEQR Technical Manual* states that "it is reasonable to consider 65 dBA $L_{eq(1)}$ as an absolute noise level that should not be significantly exceeded." Therefore, the determination of impacts first considers whether a projected noise increase would result in noise levels exceeding 65 dBA $L_{eq(1)}$. Where appropriate, this study also consults the following relative impact criteria to define a significant adverse noise impact, as recommended in the *CEQR Technical Manual*:

- An increase of 5 dBA, or more, in Build Leq(1) noise levels at sensitive receptors (including residences, play areas, parks, schools, libraries, and houses of worship) over those calculated for the No Build condition, if the No Build levels are less than 60 dBA Leq(1) and the analysis period is not a nighttime period.
- An increase of 4 dBA, or more, in Build $L_{eq(1)}$ noise levels at sensitive receptors over those calculated for the No Build condition, if the No Build levels are 61 dBA $L_{eq(1)}$ and the analysis period is not a nighttime period.
- An increase of 3 dBA, or more, in Build $L_{eq(1)}$ noise levels at sensitive receptors over those calculated for the No Build condition, if the No Build levels are greater than 62 dBA $L_{eq(1)}$ and the analysis period is not a nighttime period.
- An increase of 3 dBA, or more, in Build $L_{eq(1)}$ noise levels at sensitive receptors over those calculated for the No Build condition, if the analysis period is a nighttime period (defined by the *CEQR Technical Manual* criteria as being between 10 PM and 7 AM).

D. EXISTING NOISE LEVELS

SELECTION OF NOISE RECEPTOR LOCATIONS

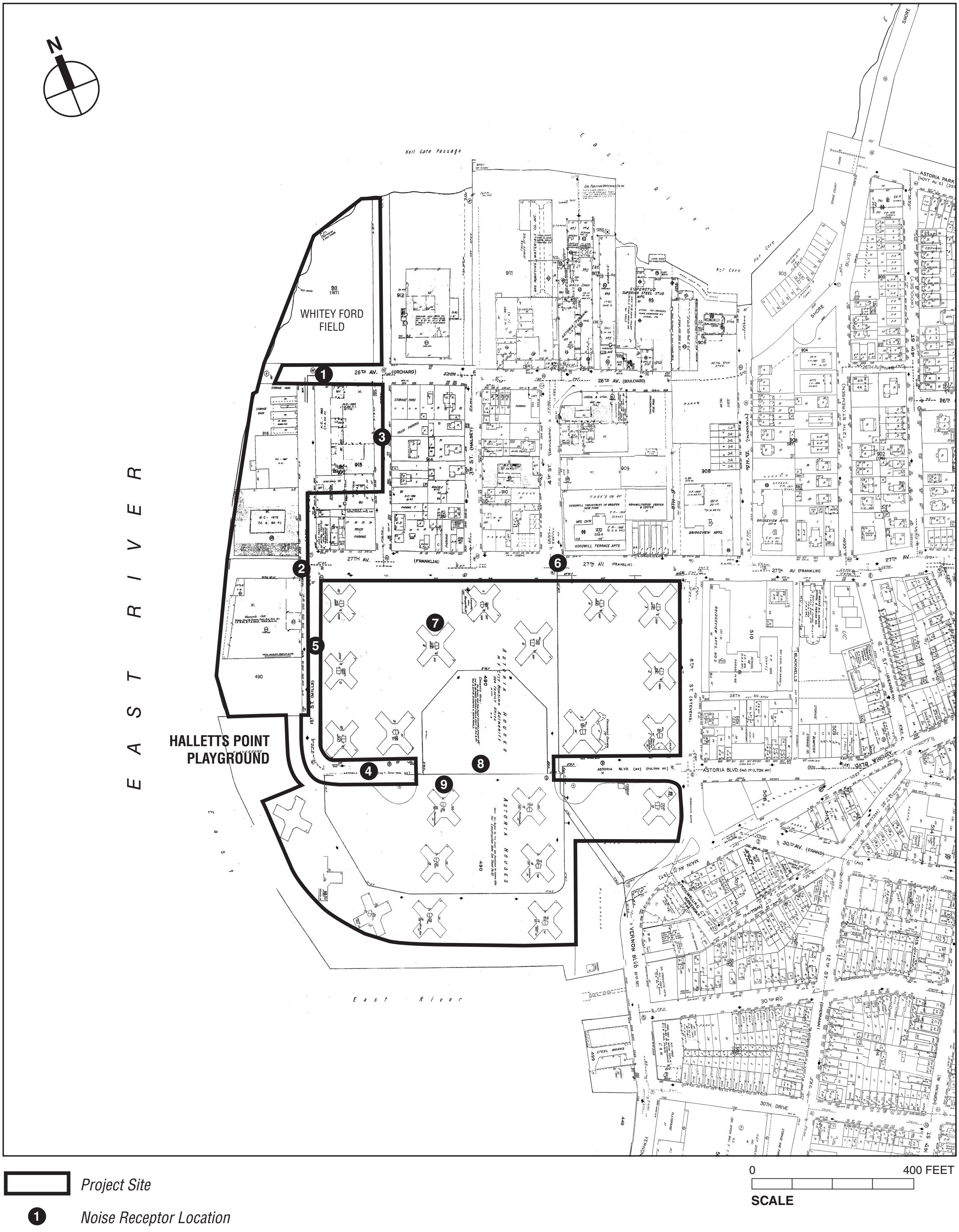
A total of nine receptor locations within the project area were selected for impact assessment, six of which were also used for evaluation of noise attenuation requirements, and three of which were used for evaluation of noise at publicly accessible open spaces generated by the proposed project. These locations are detailed below and shown in **Figure 18-1.**

Noise receptor locations were selected based on the following criteria: (1) locations near the project site; and (2) to provide comprehensive geographic coverage throughout the study area to get an accurate picture of the ambient noise environment.

- Receptor Location 1 is located on the corner of 1st Street and 26th Avenue.
- Receptor Location 2 is located on 1st Street at the western end of 27th Avenue.
- Receptor Location 3 is located on 2nd Street between 26th and 27th Avenues.
- Receptor Location 4 is located on Astoria Boulevard east of 1st Street.
- Receptor Location 5 is located on 1st Street between 27th Avenue and Astoria Boulevard.
- Receptor Location 6 is located on 27th Avenue at the southern end of 4th Street.
- Receptor Location 7 is located in the parking lot south of 27th Avenue between 2nd and 3rd Streets.
- Receptor Location 8 is located on the pedestrian walkway near the NYCHA basketball courts between the existing mapped portions of Astoria Boulevard.
- Receptor Location 9 is located adjacent to the north façade of 2-04 Astoria Boulevard (NYCHA Building 20)

Receptors sites 1 through 9 were used for impact assessment, receptor sites 1 through 6 were used for evaluation of noise attenuation requirements, and receptor sites 1, 2, and 5 were used to project noise levels at publicly accessible open space that would be created by the proposed project.

In the following analysis, receptor site 8 is used to project future noise levels within the open spaces in the Astoria Houses Campus alongside the proposed Astoria Boulevard connecting



Noise Receptor Locations
Figure 18-1

segment. Receptor site 9 is used to project future noise levels at the NYCHA residential buildings closest to the proposed Astoria Boulevard connector.

NOISE MONITORING

At receptor sites 1 through 8, existing noise levels were determined by field measurements. The measured existing noise levels at receptor site 8 were determined to be representative of existing levels at receptor site 9, because the locations are very close to each other and of comparable distance to nearby noise sources such as vehicular traffic Astoria Boulevard or helicopter traffic overhead. Noise monitoring was performed on October 10, 2012, October 11, 2012, and February 14, 2013. At sites 1 through 8, 20-minute spot measurements were taken. All measurements were performed during the weekday peak periods—AM (8:00 to 10:00 AM), midday (MD) (12:00 to 2:00 PM), and PM (4:30 to 6:30 PM). Receptors 1 through 8 were also measured during the late night period (10:00 PM to 2:00 AM).

EQUIPMENT USED DURING NOISE MONITORING

Measurements were performed using Brüel & Kjær Sound Level Meters (SLM) Type 2250 and 2260, Brüel & Kjær ½-inch microphones Type 4189, and Brüel & Kjær Sound Level Calibrators Type 4231. The Brüel & Kjær SLMs are Type 1 instruments according to ANSI Standard S1.4-1983 (R2006). The SLMs had a laboratory calibration date within one year of the time of use. The microphones were mounted at a height of approximately five feet above the ground surface on a tripod and approximately six feet or more away from any large sound-reflecting surface to avoid major interference with sound propagation. The SLMs were calibrated before and after readings with a Brüel & Kjær Type 4231 Sound Level Calibrator using the appropriate adaptor. The data were digitally recorded by the SLMs and displayed at the end of the measurement period in units of dBA. Measured quantities included the L_{eq}, L_1, L_{10}, L_{50}, and L_{90} values. A windscreen was used during all sound measurements except for calibration. All measurement procedures were based on the guidelines outlined in ANSI Standard S1.13-2005.

EXISTING NOISE LEVELS AT NOISE RECEPTOR LOCATIONS

MEASURED NOISE LEVELS

The results of the measurements of existing noise levels are summarized in **Table 18-5**. Traffic was the dominant noise source for all receptor sites. Noise levels are moderate to relatively high and reflect the level of vehicular activity present on the adjacent roadways.

At receptor sites 1 through 6, traffic noise from the immediately adjacent streets was the dominant noise source. At receptor site 7, traffic noise from 27th Avenue was the dominant noise source. At receptor sites 8 and 9, traffic noise from the mapped portions of Astoria Boulevard was the dominant noise source. At locations, including receptor site 1, where traffic volumes were very low, the measured L_{eq} values exceed the measured L_{10} values. This results from a condition where a large proportion of the noise energy during a measurement results from a small number of discrete events (such auto or bus pass-by events), thus increasing the L_{eq} descriptor, while not increasing the L_{10} descriptor because the duration of the events makes up less than 10 percent of the measurement period. At all receptor sites, helicopter traffic was included in the measurement but is not considered a dominant source. Measured noise levels are low to moderate and reflect the level of activity on the adjacent streets.

Table 18-5
Existing Noise Levels (in dBA)

Receptor #	Measurement Location	Time	L_{eq}	L_1	L_{10}	L_{50}	L_{90}	L_{dn}	CEQR Noise Exposure Category
1	Corner of 1st Street and 26th Avenue	AM	66.0	76.2	63.1	55.2	52.2	61.5	Acceptable
		MD	57.4	67.6	59.2	54.2	51.7		
		PM	63.9	75.0	62.5	57.2	51.0		
		LN	55.8	61.7	56.6	54.7	53.1		
2	1st Street at the eastern end of 27th Avenue	AM	65.5	76.8	70.1	57.8	59.3	64.7	Marginally Unacceptable
		MD	64.6	78.0	65.0	55.9	49.5		
		PM	62.0	72.3	65.8	58.1	54.4		
		LN	58.4	72.4	57.1	54.8	53.7		
3	2nd Street between 26th and 27th Avenues	AM	63.0	74.1	64.2	54.4	50.8	64.9	Acceptable
		MD	60.3	69.8	62.3	56.3	53.8		
		PM	59.7	72.4	61.2	52.7	48.2		
		LN	60.5	68.7	53.9	48.6	47.4		
4	Astoria Boulevard east of 1st Street	AM	56.0	63.0	58.5	54.4	51.9	61.4	Acceptable
		MD	55.2	61.4	57.4	54.0	52.4		
		PM	55.5	65.1	58.1	52.7	50.8		
		LN	57.2	63.1	58.6	56.5	55.3		
5	1st Street between 27th Avenue and Astoria Boulevard	AM	60.6	70.6	62.1	57.5	53.9	64.5	Acceptable
		MD	60.2	68.8	62.1	58.6	56.6		
		PM	57.4	65.9	60.3	54.9	53.4		
		LN	60.1	69.3	60.9	58.9	57.4		
6	27th Avenue at the southern end of 4th Street	AM	63.2	74.3	65.2	59.1	54.8	63.2	Marginally Acceptable
		MD	61.6	74.0	63.4	55.5	51.8		
		PM	63.3	73.9	65.9	57.8	54.0		
		LN	57.9	68.6	59.3	53.2	52.0		
7	Parking Lot south of 27th Avenue between 3rd and 4th Streets	AM	59.0	68.1	61.8	56.0	54.0	61.2	Acceptable
		MD	58.2	67.4	61.6	55.2	51.7		
		PM	57.3	67.4	59.7	54.4	51.7		
		LN	56.5	64.5	58.4	55.0	54.0		
8	Pedestrian Walkway Near the NYCHA Basketball Courts between Existing Mapped Portions of Astoria Boulevard	AM	54.1	63.1	56.6	51.6	49.6	58.5	Acceptable
		MD	54.4	64.9	55.0	51.3	49.7		
		PM	55.6	66.6	56.7	52.0	50.3		
		LN	54.0	59.1	55.4	53.6	52.0		
9	North Façade of 2-04 Astoria Boulevard (NYCHA Building 20)	AM	54.1	63.1	56.6	51.6	49.6	58.5	Acceptable
		MD	54.4	64.9	55.0	51.3	49.7		
		PM	55.6	66.6	56.7	52.0	50.3		
		LN	54.0	59.1	55.4	53.6	52.0		

In terms of *CEQR Technical Manual* criteria, existing noise levels at receptor sites 1, 3, 4, 5, 7, 8, and 9 would be in the "acceptable" category, existing noise levels at receptor site 6 would be in the "marginally acceptable" category, and existing noise levels at receptor site 2 would be in the "marginally unacceptable" category. According to HUD criteria, the existing noise levels at all receptor sites would be in the "acceptable" category.

E. NOISE PREDICTION METHODOLOGY

GENERAL METHODOLOGY

Future noise levels were calculated using either a proportional modeling technique or the Federal Highway Administration (FHWA) *Traffic Noise Model* (TNM) Version 2.5. The proportional modeling technique was used at receptor sites 1 through 7, where existing and future noise levels are primarily a result of the level of traffic on the immediately adjacent roadway segment. However, at receptor sites 8 and 9, adjacent to the new connecting segment of Astoria Boulevard between 1st Street and 8th Street, the TNM was used to account for noise associated with the additional traffic on the new roadway segment. Both the proportional modeling technique and the TNM are methodologies recommended for analysis purposes in the *CEQR Technical Manual*. The noise impact analysis examined the weekday AM, MD, and PM peak hours at receptor sites 1 through 9. The selected time periods are when the proposed project would be expected to produce the maximum traffic generation (based on the traffic studies presented in Chapter 15, “Transportation”) and therefore result in the maximum potential for significant adverse noise impacts. Traffic data was not available for the late night (LN) time period, but future late night noise levels were calculated as part of the building attenuation analysis by pro-rating future traffic during the PM peak period based on the difference between existing PM and late night traffic.

The proportional modeling and TNM procedures used for the noise analysis are described below.

PROPORTIONAL MODELING

Proportional modeling was used to determine locations with the potential for having significant noise impacts. Proportional modeling is one of the techniques recommended in the *CEQR Technical Manual* for mobile source analysis.

Using this technique, the prediction of future noise levels where traffic is the dominant noise source is based on a calculation using measured existing noise levels and predicted changes in traffic volumes to determine noise levels in the future without the proposed project (the No Build condition) and with the proposed project (the Build condition). Vehicular traffic volumes are converted into Passenger Car Equivalent (PCE) values, for which one medium-duty truck (having a gross weight between 9,900 and 26,400 pounds) is assumed to generate the noise equivalent of 13 cars, and one heavy-duty truck (having a gross weight of more than 26,400 pounds) is assumed to generate the noise equivalent of 47 cars, and one bus (vehicles designed to carry more than nine passengers) is assumed to generate the noise equivalent of 18 cars. Future noise levels are calculated using the following equation:

$$F\ NL - E\ NL = 10 * \log_{10} (F\ PCE / E\ PCE)$$

where:

F NL = Future Noise Level

E NL = Existing Noise Level

F PCE = Future PCEs

E PCE = Existing PCEs

Sound levels are measured in decibels and therefore increase logarithmically with sound source strength. In this case, the sound source is traffic volumes measured in PCEs. For example, assume that traffic is the dominant noise source at a particular location. If the existing traffic volume on a street is 100 PCE and if the future traffic volume were increased by 50 PCE to a total of 150 PCE, the noise level would increase by 1.8 dBA. Similarly, if the future traffic were increased by 100 PCE, or doubled to a total of 200 PCE, the noise level would increase by 3.0 dBA.

TRAFFIC NOISE MODEL (TNM)

At Site 8 and 9, preliminary modeling studies using the proportional modeling technique indicated that the future traffic may have the potential to cause noticeable increases in noise levels due to the new connecting street segment between existing mapped portions of Astoria Boulevard. Therefore, at this location, a refined analysis was performed using the TNM (described below).

The TNM is a computerized model developed for the FHWA that calculates the noise contribution of each roadway segment to a given noise receptor. The noise from each vehicle type is determined as a function of the reference energy-mean emission level, corrected for vehicle volume, speed, roadway grade, roadway segment length, and source-receptor distance. Further considerations included in modeling the propagation path include identifying the shielding provided by rows of buildings, analyzing the effects of different ground types, identifying source and receptor elevations, and analyzing the effects of any intervening noise barriers. The TNM provided more accurate results than proportional modeling for Sites 8 and 9 because there was no vehicular traffic present on the existing pedestrian walkway. The existing TNM noise levels were logarithmically subtracted from the measured existing noise levels and logarithmically added to the predicted TNM No Build and Build noise levels to account for background noise not attributable to vehicular traffic. The less refined proportional modeling technique could not account for the noise contributions from adjacent roadways, and thus, over predicts the project-generated traffic noise levels by attributing all of the noise due to traffic and traffic changes to the immediately adjacent street.

F. THE FUTURE WITHOUT THE PROPOSED PROJECT

Using the methodology previously described, noise levels in the No Build condition were calculated at the nine mobile source noise analysis receptors for the 2022 analysis year. These No Build values are shown in **Table 18-6**.

In 2022, the maximum increase in $L_{eq(1)}$ noise levels for the No Build condition would be 0.9 dBA or less at all of the mobile source noise analysis receptors. Changes of this magnitude would be imperceptible. In terms of CEQR noise exposure guidelines, noise levels at receptor sites 1, 3, 4, 5, 7, 8, and 9 would remain in the “acceptable” category, noise levels at receptor site 6 would remain in the “marginally acceptable” category, and noise levels at receptor site 2 would remain in the “marginally unacceptable” category.

Table 18-6
2022 No Build Condition Noise Levels (in dBA)

Receptor	Location	Time	Existing $L_{eq(1)}$	No Build $L_{eq(1)}$	$L_{eq(1)}$ Change	No Build $L_{10(1)}$	CEQR Noise Exposure Category
1	Corner of 1st Street and 26th Avenue	AM	66.0	66.2	0.2	69.2	Acceptable
		MD	57.4	57.6	0.2	59.4	
		PM	63.9	64.2	0.3	67.2	
2	1st Street at the eastern end of 27th Avenue	AM	65.5	65.7	0.2	70.3	Marginally Unacceptable
		MD	64.6	64.8	0.2	65.2	
		PM	62.0	62.2	0.2	66.0	
3	2nd Street between 26th and 27th Avenues	AM	63.0	63.3	0.3	64.5	Acceptable
		MD	60.3	60.5	0.2	62.5	
		PM	59.7	60.0	0.3	61.5	
4	Astoria Boulevard east of 1st Street	AM	56.0	56.2	0.2	58.7	Acceptable
		MD	55.2	55.4	0.2	57.6	
		PM	55.5	55.7	0.2	58.3	
5	1st Street between 27th Avenue and Astoria Boulevard	AM	60.6	60.8	0.2	62.3	Acceptable
		MD	60.2	60.4	0.2	62.3	
		PM	57.4	57.6	0.2	60.5	
6	27th Avenue at the southern end of 4th Street	AM	63.2	64.0	0.8	66.0	Marginally Acceptable
		MD	61.6	62.4	0.8	64.2	
		PM	63.3	64.2	0.9	66.8	
7	Parking Lot on 27th Avenue between 3rd and 4th Streets	AM	59.0	59.2	0.2	62.0	Acceptable
		MD	58.2	58.4	0.2	61.8	
		PM	57.3	57.5	0.2	59.9	
8	Pedestrian Walkway Near the NYCHA Basketball Courts between Existing Mapped Portions of Astoria Boulevard	AM	54.1	54.1	0.0	56.6	Acceptable
		MD	54.4	54.5	0.1	55.1	
		PM	55.6	55.6	0.0	56.7	
9	North Façade of 2-04 Astoria Boulevard (NYCHA Building 20)	AM	54.1	54.1	0.0	56.6	Acceptable
		MD	54.4	54.5	0.1	55.1	
		PM	55.6	55.6	0.0	56.7	

Notes:
1) Noise levels at Receptor Sites 1 through 7 were calculated using proportional modeling. Noise levels at Receptor Sites 8 and 9 were calculated using TNM.
2) $L_{10(1)}$ noise levels were calculated at Site 1 by adding 3 dBA to the No Build $L_{eq(1)}$ noise levels during the AM and PM time periods to be conservative. Measured $L_{eq(1)}$ noise exceeded the measured $L_{10(1)}$ noise levels during these times.

G. PROBABLE IMPACTS OF THE PROPOSED PROJECT

CALCULATED FUTURE NOISE LEVELS

Using the methodology previously described, Build condition noise levels were calculated at the 9 mobile source noise analysis receptors for the 2022 analysis year. These Build condition values are shown in **Table 18-7**.

MOBILE SOURCE NOISE ANALYSIS

In 2022, the maximum increase in $L_{eq(1)}$ noise levels for the Build condition would be 1.5 dBA or less at mobile source noise analysis receptors 1 through 7. Changes of this magnitude would be imperceptible and would fall below the CEQR threshold for a significant adverse noise impact. Consequently, the proposed project would not have the potential to result in a significant impact any of these receptor sites.

Table 18-7
2022 Build Condition Noise Levels (in dBA)

Receptor	Location	Time	No Build $L_{eq(1)}$	Build $L_{eq(1)}$	$L_{eq(1)}$ Change	Build $L_{10(1)}$	CEQR Noise Exposure Category
1	Corner of 1st Street and 26th Avenue	AM	66.2	67.0	0.8	70.0	Marginally Acceptable
		MD	57.6	58.6	1.0	60.4	
		PM	64.2	65.7	1.5	68.7	
2	1st Street at the eastern end of 27th Avenue	AM	65.7	66.4	0.7	71.0	Marginally Unacceptable
		MD	64.8	65.3	0.5	65.7	
		PM	62.2	63.5	1.3	67.3	
3	2nd Street between 26th and 27th Avenues	AM	63.3	64.7	1.4	65.9	Marginally Acceptable
		MD	60.5	61.6	1.1	63.6	
		PM	60.0	60.8	0.8	62.3	
4	Astoria Boulevard east of 1st Street	AM	56.2	57.2	1.0	59.7	Acceptable
		MD	55.4	56.0	0.6	58.2	
		PM	55.7	56.7	1.0	59.3	
5	1st Street between 27th Avenue and Astoria Boulevard	AM	60.8	61.8	1.0	63.3	Acceptable
		MD	60.4	61.0	0.6	62.9	
		PM	57.6	58.6	1.0	61.5	
6	27th Avenue at the southern end of 4th Street	AM	64.0	64.5	0.5	66.5	Marginally Acceptable
		MD	62.4	62.9	0.5	64.7	
		PM	64.2	64.9	0.7	67.5	
7	Parking Lot on 27th Avenue between 3rd and 4th Streets	AM	59.2	60.3	1.1	63.1	Acceptable
		MD	58.4	59.0	0.6	62.4	
		PM	57.5	58.8	1.3	61.2	
8	Pedestrian Walkway Near the NYCHA Basketball Courts between Existing Mapped Portions of Astoria Boulevard	AM	54.1	60.0	**5.9**	62.5	Acceptable
		MD	54.5	59.7	**5.2**	60.2	
		PM	55.6	59.2	3.6	60.3	
9	North Façade of 2-04 Astoria Boulevard (NYCHA Building 20)	AM	54.1	62.4	**8.3**	64.9	Acceptable
		MD	54.5	62.4	**8.0**	63.0	
		PM	55.6	60.4	4.7	61.4	

Notes:
Noise levels at Receptor Sites 1 through 7 were calculated using proportional modeling. Noise levels at Receptor Sites 8 and 9 were calculated using TNM.
$L_{10(1)}$ noise levels were calculated at Site 1 by adding 3 dBA to the Build $L_{eq(1)}$ noise levels during the AM and PM time periods to be conservative. Measured $L_{eq(1)}$ noise exceeded the measured $L_{10(1)}$ noise levels during these times.
CEQR Technical Manual noise level exceedances of relative impact criteria are marked in **bold**.

As noted above, receptor site 8 is used to project future noise levels within the open spaces in the Astoria Houses Campus alongside the proposed Astoria Boulevard connecting segment. The predicted increase in $L_{eq(1)}$ noise levels at receptor site 8 in the Build condition would range from 3.6 to 5.9 dBA. These increases would constitute a readily noticeable change in noise levels. In the future, traffic calming methods may be implemented along the re-opened segment of Astoria Boulevard, which could result in lower noise levels than predicted in this analysis. Absolute $L_{10(1)}$ noise levels at receptor site 8 in the Build condition would range from 60.2 to 62.5 dBA. These noise levels would exceed the recommended noise level for outdoor areas requiring serenity and quiet contained in the *CEQR Technical Manual* noise exposure guidelines (see **Table 18-2**), but would be comparable to noise levels in a number of existing open space areas that are located adjacent to roadways, including Hudson River Park, Riverside Park, Bryant Park, Fort Greene Park, and other urban open space areas and would therefore not constitute a significant adverse noise impact.

As discussed above, receptor site 9 is used to project future noise levels at the NYCHA residential buildings closest to the proposed Astoria Boulevard connector. The predicted increase in $L_{eq(1)}$ noise levels at receptor site 9 in the Build condition would range from 4.7 to 8.3 dBA. These increases would constitute a readily noticeable change in noise levels and a significant noise increase. In the future, traffic calming methods may be implemented along the re-opened segment of Astoria Boulevard, which could result in lower noise levels than predicted in this analysis. Noise level increases at this location are greater than those at receptor site 8 because receptor site 9 represents a location that is closer to the newly mapped portion of Astoria Boulevard. The 2012 *CEQR Technical Manual* states that "it is reasonable to consider 65 dBA $L_{eq(1)}$ as an absolute noise level that should not be significantly exceeded" when determining a significant impact. The predicted $L_{eq(1)}$ at this location is 62.4 dBA, below the CEQR absolute noise impact guideline of 65 dBA. Additionally, since receptor site 9 represents a residential location, the L_{dn} noise level at this location in the future with the proposed project was considered and compared to HUD noise criteria. The L_{dn} for receptor site 9 was calculated to be 61.6 dBA. The minimum attenuation required to satisfy the HUD criteria of 45 dBA L_{dn} would be 17 dBA of attenuation. 2-04 Astoria Boulevard (and all other NYCHA buildings on the campus) have double glazed windows and window air conditioners. This combination would be expected to provide a minimum of 25 dBA of attenuation. Therefore, the interior L_{dn} noise levels at this receptor would be below 45 dBA, which is the HUD interior noise level guideline for residential use.

Moreover, this increase in noise levels is due to the unique circumstances of the project site and the fact that the proposed project would reopen Astoria Boulevard to traffic through the NYCHA Astoria Houses Campus. Although the predicted increase in $L_{eq(1)}$ noise levels at this receptor exceed the 5 dBA CEQR impact threshold, noise levels in this area are very low in existing conditions and will continue to be low in the future with the proposed project. Even with the reopening of Astoria Boulevard through the NYCHA Astoria Houses Campus, the existing buildings in close proximity would be expected to have acceptable interior noise levels under both HUD and CEQR noise criteria. In addition, according to the *CEQR Technical Manual*, if any part of a proposed project would be financially assisted by HUD, such as is the case for the proposed project, analysis methodologies, significant impact thresholds, and reporting of noise information should be in accordance with HUD noise regulations. As noted above, interior L_{dn} noise levels at receptors along the reopened Astoria Boulevard would meet the HUD interior noise level guideline for residential use. Therefore, although this would be a noticeable increase in noise levels, it would not constitute a significant adverse noise impact requiring mitigation.

In terms of CEQR noise exposure guidelines, noise levels at receptor sites ~~1,~~ 4, 5, 7, 8, and 9 would remain in the "acceptable" category, noise levels at receptor sites 1 and 3 would change from the "acceptable" category to the "marginally acceptable" category, noise levels at receptor site 6 would remain in the "marginally acceptable" category, and noise levels at receptor site 2 would remain in the "marginally unacceptable" category.

Overall, the proposed project would not have the potential to result in any significant adverse noise impacts as a result of increased traffic traveling to and from the project site.

NOISE ATTENUATION MEASURES FOR THE PROPOSED PROJECT

CEQR BUILDING ATTENUATION REQUIREMENTS

The *CEQR Technical Manual* has set noise attenuation requirements for buildings based on exterior noise levels. Recommended noise attenuation values for buildings are designed to maintain interior noise levels of 45 dBA or lower for residential uses and 50 dBA or lower for commercial uses, and are determined based on exterior $L_{10(1)}$ noise levels. Based on measured exterior noise levels and CEQR criteria, the necessary attenuation for each façade of each proposed building has been calculated. The required attenuation levels at each of the receptor sites used for evaluation of noise attenuation requirements are shown in **Table 18-8**.

Attenuation would be required at one receptor location to achieve interior noise levels of 45 dBA or lower for residential uses and 50 dBA or lower for commercial uses. Based on the values shown in **Table 18-8**, required attenuation levels were determined for all building sites. These values are shown in **Table 18-9**.

Table 18-8
Required Attenuation at Noise Measurement Locations Under CEQR Criteria

Receptor #	Location	Highest Calculated Build $L_{10(1)}$ Value	Minimum Required Attenuation (dBA)
1	Corner of 1st Street and 26th Avenue	70.0	NA
2	1st Street at the western end of 27th Avenue	71.0	28
3	2nd Street between 26th and 27th Avenues	65.9	NA
4	Astoria Boulevard east of 1st Street	59.7	NA
5	1st Street between 27th Avenue and Astoria Boulevard	63.3	NA
6	27th Avenue at the southern end of 4th Street	67.5	NA

Note:
Attenuation values are shown for residential uses; commercial uses would be 5 dBA less.
(1) "NA" indicates that the highest calculated L_{10} is below 70 dBA. The *CEQR Technical Manual* does not specify minimum attenuation guidance for exterior L_{10} values below this level.

Table 18-9
Required Attenuation at the Building Sites Under CEQR Criteria

Building No.	Façade(s)	Representative Receptor Site	CEQR Minimum Required Attenuation[1] (in dBA)
Building 1	North / West	1	NA
	East / South	3	NA
Building 2	All	1	NA
Building 3	North / West	1	NA
	East / South	2	28[2]
Building 4	North / East	2	28[2]
	South / West	5	NA
Building 5	North / East	2	28[2]
	South / West	5	NA
Building 6	All	6	NA
Building 7	All	6	NA
Building 8	All	4	NA

Notes:
(1) Attenuation values are shown for residential uses; commercial uses would be 5 dBA less.
(2) Attenuation requirements would be enforced by a Noise (E) designation on Block 916, Lot 1 and a portion of Lot 10 and Block 490, Lots 1 and 11.

HUD BUILDING ATTENUATION REQUIREMENTS

HUD guidelines state that buildings must provide sufficient window/wall attenuation to result in L_{dn} values less than 45 dBA. Based on measured exterior noise levels and HUD criteria, the necessary attenuation for each façade of each proposed building has been calculated. The required attenuation levels at each of the receptor sites used for evaluation of noise attenuation requirements are shown in **Table 18-10**.

Table 18-10
Required Attenuation at Noise Measurement Locations Under HUD Criteria

		Calculated Build L_{dn} Value	Minimum Required Attenuation (dBA)
1	Corner of 1st Street and 26th Avenue	64.1	20
2	1st Street at the western end of 27th Avenue	67.2	23
3	2nd Street between 26th and 27th Avenues	66.2	22
4	Astoria Boulevard east of 1st Street	63.3	19
5	1st Street between 27th Avenue and Astoria Boulevard	66.4	22
6	27th Avenue at the southern end of 4th Street	64.3	20

Note: HUD attenuation requirements would not apply to commercial uses.

Based on the values shown in **Table 18-10**, required attenuation levels were determined for all building sites. These values are shown in **Table 18-11**.

Table 18-11
Required Attenuation at the Building Sites Under HUD Criteria

Building No.	Façade(s)	Representative Receptor Site	HUD Minimum Required Attenuation[1] (in dBA)
Building 1	North / West	1	20
	East / South	3	22
Building 2	All	1	20
Building 3	North / West	1	20
	East / South	2	23
Building 4	North / East	2	23
	South / West	5	22
Building 5	North / East	2	23
	South / West	5	22
Building 6	All	6	20
Building 7	All	6	20
Building 8	All	4	19

Note: [1] HUD attenuation requirements would not apply to commercial uses.

BUILDING ATTENUATION IMPLEMENTATION

The attenuation of a composite structure is a function of the attenuation provided by each of its component parts and how much of the area is made up of each part. Normally, a building façade is composed of the wall, glazing, and any vents or louvers for heating, ventilation, and air conditioning (HVAC) systems in various ratios of area. The proposed project buildings would be designed to provide a composite Outdoor-Indoor Transmission Class (OITC) rating greater than or equal to the attenuation requirements listed in **Table 18-9** and **Table 18-11**. The OITC classification is defined by ASTM International (ASTM E1332-10a) and provides a single-number rating that is used for designing a building façade including walls, doors, glazing, and combinations thereof. The OITC rating is designed to evaluate building elements by their ability to reduce the overall loudness of ground and air transportation noise.

The levels of attenuation specified in **Table 18-9** and **Table 18-11** could be achieved with the use of standard windows; no additional measures would be necessary to meet the required attenuation levels.

The required CEQR building attenuation levels for Buildings 3, 4, and 5 would be mandated by (E) designations on all affected building sites specifying the appropriate amount of window/wall attenuation. The text of the (E) designation for Buildings 3, 4, and 5 (located on Block 916, Lot 1 and a portion of Lot 10 and Block 490, Lots 1 and 11)[1] requiring 28 dBA of attenuation would be as follows:

"To ensure an acceptable interior noise environment, the building façade(s) of future residential uses must provide a minimum of 28 dBA composite building façade attenuation with windows closed, in order to maintain an interior noise level of 45 dBA. The minimum required composite building façade attenuation for future commercial uses would be 5 dBA less than that for residential uses. To maintain a closed-window condition, an alternate means of ventilation that brings outside air into the building without degrading the acoustical performance of the building façade(s) must also be provided."

Therefore, the proposed project would provide sufficient attenuation to achieve the *CEQR Technical Manual* interior noise level guidelines of 45 dBA L_{10} for residential uses and 50 dBA L_{10} for commercial uses and, if HUD project funding is used, to achieve the HUD interior noise level guideline of 45 dBA L_{dn} for residential use.

Therefore, the proposed project would not result in any significant adverse impacts related to building attenuation requirements.

NOISE LEVELS AT THE PROPOSED PROJECT'S OPEN SPACE AREAS

Based on predicted noise levels at receptors 1, 2, and 5, noise levels within the proposed project's publicly accessible open space and waterfront esplanade are expected to be above 55 dBA $L_{10(1)}$ and slightly above 65 dBA L_{dn}. This exceeds the recommended noise level for outdoor areas requiring serenity and quiet contained in the *CEQR Technical Manual* noise exposure guidelines (see **Table 18-2**) and falls in the "normally unacceptable" category according to HUD exterior noise exposure guidance. In the future with the proposed project, $L_{10(1)}$ values and L_{dn} values at the proposed open space and waterfront esplanade (located along the length of the site's waterfront with upland connections to 1st Street) would be in the mid-60s dBA. Because the dominant noise at the project site results from traffic noise, there are no practical and feasible mitigation measures that could be implemented to reduce noise levels to below the respective CEQR and HUD 55 dBA $L_{10(1)}$ and 65 dBA L_{dn} guidelines within the proposed open space and waterfront esplanade. Although noise levels in these areas would be above the guideline noise levels, they would be comparable to noise levels in a number of existing open space areas that are located adjacent to roadways, including Hudson River Park, Riverside Park, Bryant Park, Fort Greene Park, and other urban open space areas. The guidelines are a worthwhile goal for outdoor areas requiring serenity and quiet, such as passive open spaces. However, due to the mix of ~~level of~~recreational activity and activity on the surrounding streets present at most New York City open space areas and parks, a relatively low noise level is often not achieved. The proposed project's publicly accessible open space and waterfront esplanade are anticipated to provide both active and

[1] These are existing lot numbers for these building sites. ~~If~~ New lot numbers corresponding to the specific sites Buildings 3, 4, and 5 ~~are obtained~~ were not available between DEIS and FEIS~~, these numbers will be updated accordingly~~.

passive recreation opportunities. Therefore, the future projected noise levels would not constitute a significant adverse noise impact to the proposed project's open space areas.

MECHANICAL EQUIPMENT

It is assumed that the building mechanical systems (i.e., HVAC systems) would be designed to meet all applicable noise regulations (i.e., Subchapter 5, §24-227 of the New York City Noise Control Code, the New York City Department of Buildings Code) and to avoid producing levels that would result in any significant increase in ambient noise levels. Therefore, the proposed project would not result in any significant adverse noise impacts related to building mechanical equipment. ✷