A. INTRODUCTION

This section assesses the potential noise effects of the proposed project at the Brooklyn Site at 275 Atlantic Avenue. According to the guidelines established in the *City Environmental Quality Review* (*CEQR) Technical Manual*, an initial noise impact screening considers whether a proposed action would generate any mobile or stationary source noise, or be located in an area with high ambient noise levels. A noise analysis examines an action for its potential effects on sensitive noise receptors, and the effects of noise exposure on newly introduced residential, commercial, and institutional uses.

In terms of mobile sources, the number of vehicle trips generated by the proposed project would not have the potential to cause a significant noise impact (i.e., it would not result in a doubling of noise passenger car equivalents [Noise PCEs] which would be necessary to cause a 3 dBA increase in noise levels, see **Appendix G**). Therefore, significant adverse mobile source noise impacts are unlikely, and further assessment is not warranted.

In terms of stationary sources, the proposed project would include recreation yards that would be partially open to the outdoors and arranged vertically on the exterior of the structure. These recreation yards were evaluated for the potential to result in significant adverse noise impacts on nearby sensitive receptors.

This section includes an analysis of the level of building attenuation necessary to ensure that interior noise levels within the proposed building would satisfy applicable interior noise criteria, as well as an analysis of noise from the recreations yards at the Brooklyn Site.

PRINCIPAL CONCULSIONS

The analysis finds that the proposed actions would not result in any significant adverse noise impacts at nearby noise receptors.

The recreation areas to be included in the proposed project would have the potential to generate noise. An analysis of noise from proposed recreation areas at the Brooklyn Site determined that any recreation yards along the proposed building's north façade would be recessed from the lot line at least 25 feet to avoid the potential for significant adverse noise impacts. With this setback, the proposed recreation yards would not have the potential to result in significant adverse noise impacts at any noise receptors.

To meet 2014 *CEQR Technical Manual* interior noise level requirements, the analysis prescribes up to 31 dBA of building attenuation for the proposed building, with an alternate means of ventilation to allow for the maintenance of a closed window condition. With these measures, interior noise levels would be within the range considered acceptable for the proposed uses, and there would be no significant adverse noise impact with respect to the proposed building.

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 (e.g., a whistle compared with a French horn) 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 the noise levels most often used for community noise. As shown in **Table 3.11-1**, the threshold of human hearing is defined as 0 dBA; very quiet conditions (e.g., a library) are approximately 40 dBA; normal daily activity levels are between 50 dBA and 70 dBA; noisy levels are above 70 dBA; and loud, intrusive, and deafening levels approach 130 dBA.

Table 3.11-1
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.

NOISE DESCRIPTORS USED IN IMPACT ASSESSMENT

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 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. 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 increases sensitivity to noise levels during these hours. 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}.

For purposes of the proposed actions, the 1-hour L_{eq} descriptor has been selected as the noise descriptor to be used in this noise impact evaluation, and the 1-hour L_{10} has been selected as the noise descriptor used to evaluate noise exposure at newly introduced noise receptors. These are the descriptors recommended by the *CEQR Technical Manual* for City environmental review.

C. NOISE STANDARDS AND CRITERIA

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 *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 utilizes the following relative impact criteria to define a significant adverse noise impact, as recommended in the *CEQR Technical Manual*:

- If the No Action noise level is less than 60 dBA $L_{eq(1)}$, a 5 dBA $L_{eq(1)}$ or greater increase would be considered significant.
- If the No Action noise level is between 60 dBA $L_{eq(1)}$ and 62 dBA $L_{eq(1)}$, a resultant $L_{eq(1)}$ of 65 dBA or greater would be considered a significant increase.
- If the No Action noise level is equal to or greater than 62 dBA $L_{eq(1)}$, or if the analysis period is a nighttime period (defined in the CEQR criteria as being between 10:00 PM and 7:00 AM), the incremental significant impact threshold would be 3 dBA $L_{eq(1)}$.

NEW YORK CEQR TECHNICAL MANUAL NOISE STANDARDS

The *CEQR Technical Manual* sets external noise exposure standards; these standards are shown in **Table 3.11-2**. Noise exposure is classified into four categories: acceptable, marginally acceptable, marginally unacceptable, and clearly unacceptable.

The *CEQR Technical Manual* defines attenuation requirements for buildings based on exterior noise level (see **Table 3.11-3**). Recommended noise attenuation values for buildings are designed to maintain interior noise levels of 45 dBA or lower for residential uses and interior noise levels of 50 dBA or lower for office/administrative use and are determined based on exterior $L_{10(1)}$ noise levels.

Table 3.11-2
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]		$L_{10} \leq 55$ dBA	---------- Ldn ≤ 60 dBA ----------	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Hospital, nursing home		$L_{10} \leq 55$ dBA		$55 < L_{10} \leq 65$ dBA	---------- 60 < Ldn ≤ 65 dBA ----------	$65 < L_{10} \leq 80$ 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	$L_{10} \leq 65$ dBA		$65 < L_{10} \leq 70$ dBA		$70 < L_{10} \leq 80$ dBA		$L_{10} > 80$ dBA	
	10 PM to 7 AM	$L_{10} \leq 55$ dBA		$55 < L_{10} \leq 70$ dBA		$70 < L_{10} \leq 80$ 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-10 PM)		Same as Residential Day (7 AM-10 PM)		Same as Residential Day (7 AM-10 PM)		Same as Residential Day (7 AM-10 PM)	
Commercial or office		Same as Residential Day (7 AM–10 PM)		Same as Residential Day (7 AM–10 PM)		Same as Residential Day (7 AM–10 PM)		Same as Residential Day (7 AM–10 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
[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.
[3] One may use FAA-approved L_{dn} contours supplied by the Port Authority of New York and New Jersey (PANYNJ), or the noise contours may be computed from the federally approved INM Computer Model using flight data supplied by the PANYNY.
[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).

Table 3.11-3
Required Attenuation Values to Achieve Acceptable Interior Noise Levels

	Marginally Unacceptable				Clearly Unacceptable
Noise Level with Proposed Actions	$70 < L_{10} \leq 73$	$73 < L_{10} \leq 76$	$76 < L_{10} \leq 78$	$78 < L_{10} \leq 80$	$80 < L_{10}$
Attenuation[A]	(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 dwelling units (DUs) or community facility uses. Office/administrative uses would be 5 dBA less in each category. All the above categories require a closed window condition and hence an alternate means of ventilation.
[B] Required attenuation values increase by 1 dBA increments for L_{10} values greater than 80 dBA.
Source: New York City Department of Environmental Protection.

D. NOISE PREDICTION METHODOLOGY

RECREATION YARD NOISE

The *CEQR Technical* Manual does not provide specific guidance for analysis of noise from recreation yards at detention facilities; however, a widely used and accepted method for screening noise impacts from playgrounds has been established. Due to the similar use of playgrounds and recreation yards

(e.g., sports/exercise, socialization, etc.), playground noise level estimates serve as a conservative way to determine the potential for noise impacts from the proposed detention facility recreation yards. **Table 3.11-4** shows maximum hourly playground boundary noise levels based upon measurements made at a series of New York City school playgrounds for the New York City School Construction Authority (SCA).[1]

Table 3.11-4
Reference Playground Boundary Noise $L_{eq(1)}$ Noise Levels (dBA)

Early Childhood	Elementary Schools	Intermediate Schools	High Schools
71.5	71.4	71.0	68.2
Source: SCA Playground Noise Study, AKRF, Inc., October 23, 1992.			

The detention facility recreation yards would be partially enclosed with up to six noise-reflecting interior surfaces (floor/ground, ceiling, and walls), whereas the playgrounds studied were outdoors with only one noise-reflecting surface (ground). Therefore, noise levels within the recreation yards would be expected to be higher than the playground noise levels due to the reverberant build-up of noise within the partially enclosed space. To account for this reverberant build-up of noise, 7 dBA[2] has been added to the playground boundary noise levels from **Table 3.11-4**. The high school playground was selected as most similar to the recreation yards; consequently, the maximum recreation yard boundary noise emission level was determined as follows:

$$High\ School\ Playground\ L_{eq(1)} + Reverberant\ Noise\ Buildup = Recreation\ Yard\ L_{eq}$$

$$68.2\ dBA + 7.0\ dBA = 75.2\ dBA$$

Geometric spreading and the consequent dissipation of sound energy with increasing distance from the recreation yard decreases noise levels at varying distances from the recreation yard boundary. Based upon measurements and acoustical principles, hourly noise levels were assumed to decrease by the following values at the specified distances from the recreation yard boundary: 4.8 dBA at 20 feet, 6.8 dBA at 30 feet, and 9.1 dBA at 40 feet. For all distances between 40 and 300 feet, a 4.5-dBA drop-off per doubling of distances from the recreation yard boundary was assumed.

Existing noise levels surrounding the proposed Brooklyn Site in each direction were determined by a program of noise level measurements. The measurements were conducted during the times of day that the recreation yards would potentially be in use (i.e., during daytime hours). Based on the above method and the minimum measured noise levels, the distance in each direction from the proposed Brooklyn Site at which recreation yard noise would result in noise level increases no greater than 3 dBA (i.e., "just noticeable" and not an impact per the *CEQR Technical Manual*) was determined.

The proposed Brooklyn Site would include recreation yards at housing unit floors, which would be at least 85 feet above grade based on preliminary conceptual designs. Sensitive receptors below the height of the proposed recreation yards would not have a line of sight to the yards and consequently were screened out due to anticipated building shielding.

The presence of any receptor(s) within the established screening distances and above the minimum height of the proposed recreation yards would indicate the need for further study of recreation area noise.

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[1] SCA Playground Noise Study, AKRF, Inc., October 23, 1992.

[2] 7 dBA is equivalent to a 5-fold increase in sound power resulting from the 5 additional reflective surfaces.

E. EXISTING NOISE LEVELS

SELECTION OF NOISE RECEPTOR LOCATIONS

Four receptor sites were selected for the noise analysis at the Brooklyn Site (see **Table 3.11-5**). These receptors, due to their proximity to the development sites, provide an effective and conservative representation of existing ambient noise levels in the Brooklyn Site.

Table 3.11-5
Noise Receptor Locations

Site	Receptor #	Measurement Location	Represented Newly-Introduced, Noise-Sensitive Receptor
Brooklyn Site	B-1	State Street, between Boerum Place and Smith Street	North Façade of Detention Facility
	B-2	Smith Street, between State Street and Atlantic Avenue	East Façade of Detention Facility
	B-3	Atlantic Avenue, between Boerum Place and Smith Street	South Façade of Detention Facility
	B-4	Boerum Place, between State Street and Atlantic Avenue	West Façade of Detention Facility
Note: Field noise measurements conducted by AKRF, Inc. on June 12, 2018			

Figure 3.11-1 shows the locations of the four noise receptors at the Brooklyn site and **Table 3.11-5** lists the noise receptor locations at the Brooklyn Site, and details which receptor represents each proposed building façade.

NOISE SURVEY PROCEDURES

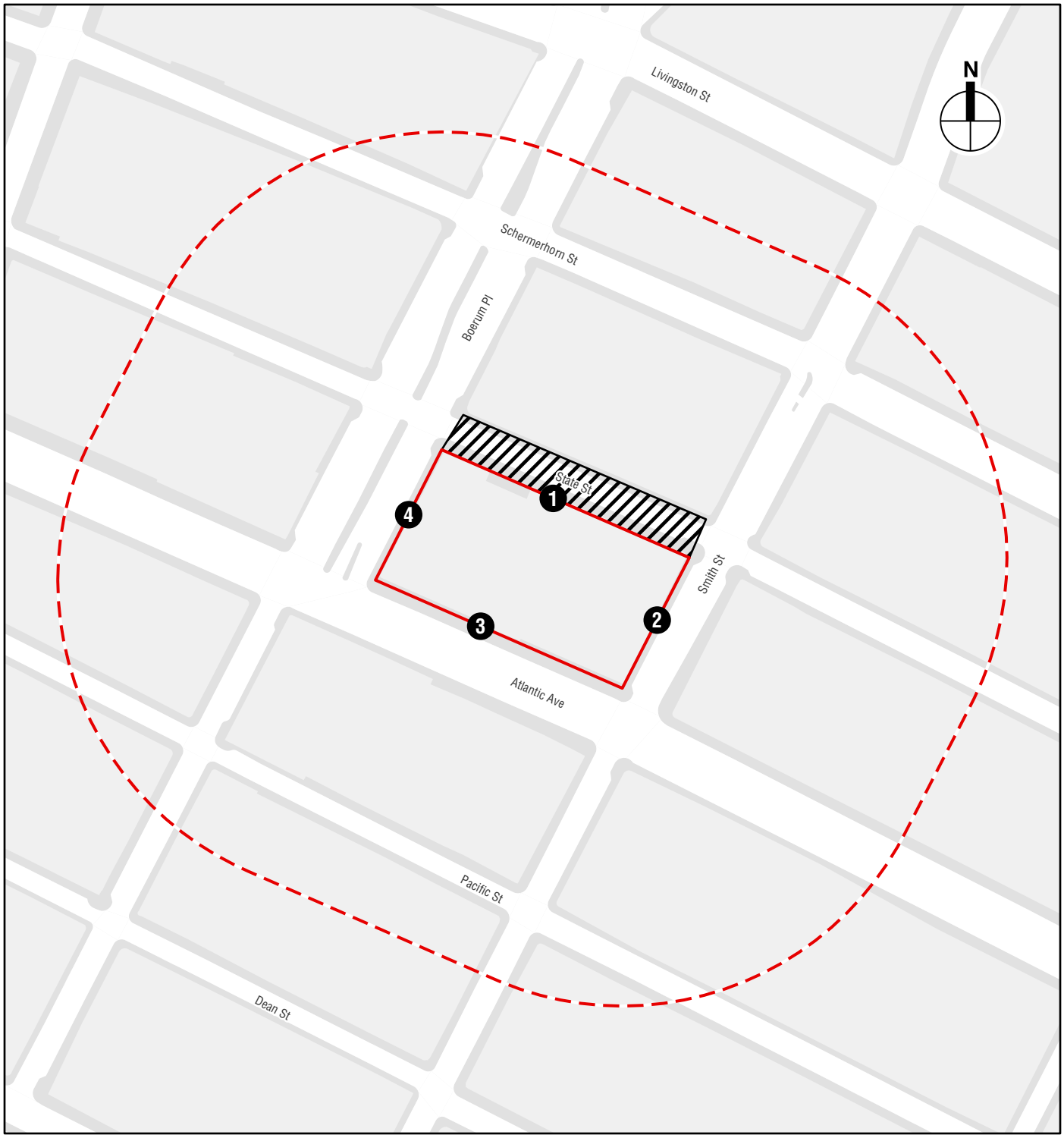
At each noise receptor location, a 20-minute spot measurements was taken during each of the weekday AM, midday, and PM peak periods (7:30 to 8:30 AM, 12:30 to 1:30 PM, 5:00 to 6:00 PM, respectively).

Measurements were performed using a Brüel & Kjær Sound Level Meter (SLM) Type 2250, Brüel & Kjær ½-inch microphone Type 4189, and a Brüel & Kjær Sound Level Calibrator Type 4231. The Brüel & Kjær SLM is a Type 1 instrument according to ANSI Standard S1.4-1983 (R2006). The SLM has a laboratory calibration date within 1 year of the date of the measurement, as is standard practice. The microphone was mounted at a height of approximately 4 feet above the ground and was mounted away from any large reflecting surfaces that could affect the sound level measurement. The SLM was calibrated before and after the reading with a Brüel & Kjær Type 4231 Sound Level Calibrator using the appropriate adaptor. Measurements at the location were made on the A-scale (dBA). The data were digitally recorded by the SLM and displayed at the end of the measurement period in units of dBA. Measured quantities included L_{eq}, L_1, L_{10}, L_{50}, and L_{90}. 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.

NOISE SURVEY RESULTS

The results of the noise measurement program are shown below in **Table 3.11-6**.

2/18/2019



Project Site

Study Area Boundary (400-foot boundary)

Proposed Demapped Area

1 *Noise Survey Locations*

0 400 FEET

Noise Survey Locations
Brooklyn Site - 275 Atlantic Avenue

BOROUGH-BASED NYC JAIL SYSTEM

Figure 3.11-1

Table 3.11-6
Existing Noise Levels at Brooklyn Site – 275 Atlantic Avenue in dBA

Receptor	Measurement Location	Time	L_{eq}	L_1	L_{10}	L_{50}	L_{90}
B-1	State Street between Boerum Place and Smith Street	AM	61.5	67.2	63.4	60.5	58.6
		MD	63.7	72.3	66.3	61.8	58.7
		PM	62.6	70.2	64.5	61.2	59.4
B-2	Smith Street between State Street and Atlantic Avenue	AM	67.9	76.2	70.4	64.6	61.7
		MD	68.8	79.5	71.2	64.3	61.0
		PM	67.2	76.8	69.7	65.0	61.7
B-3	Atlantic Avenue between Boerum Place and Smith Street	AM	70.7	80.1	73.5	67.6	63.1
		MD	72.0	81.3	73.5	68.0	64.3
		PM	70.5	79.6	73.3	68.4	62.4
B-4	Boerum Place between Atlanctic Avenue and State Street	AM	69.0	77.8	71.4	66.9	61.2
		MD	69.1	77.1	70.3	65.2	61.2
		PM	68.1	76.1	71.1	66.3	61.1

Notes: Field noise level measurements were performed by AKRF, Inc. on June 12, 2018.

In terms of *CEQR Technical Manual* noise exposure guidelines, Receptor B-1 is in the "marginally acceptable" category and Receptors B-2, B-3, B-4, are in the "marginally unacceptable" category.

F. THE FUTURE WITH THE PROPOSED PROJECT

NOISE FROM THE PROPOSED RECREATION YARDS

Screening distances for the proposed Brooklyn Site recreation areas were determined as previously described and are shown in **Table 3.11-7.** Noise level increases from the proposed recreation yards at any receptor outside of the screening distance would be less than 3 dBA (i.e., "just noticeable" and not an impact per *CEQR Technical Manual*).

As shown, there would be sensitive receptors within the screening distance to the north of the proposed detention facility. To avoid the potential for significant adverse noise impacts, any recreation yards along the proposed building's north façade would be recessed from the lot line at least 25 feet. With this setback the recreation yards would avoid being within the screening distance from north-adjacent receptor(s).

NOISE ATTENUATION MEASURES

As shown in **Table 3.11-3**, the *CEQR Technical Manual* has set noise attenuation quantities for buildings based on exterior $L_{10(1)}$ noise levels in order to maintain interior noise levels of 45 dBA or lower for residential uses and interior noise levels of 50 dBA or lower for office/administrative uses. The results of the building attenuation analysis are summarized in **Table 3.11-8**.

Table 3.11-7
Recreation Yard Noise Screening Analysis

Location	Direction From Proposed Building	Minimum Measured L_{eq} in dBA	Screening Distance[1] (feet)	Receptors within Screening Distance?
B-1	North	61.5	85	Yes
B-2	East	67.2	35	No
B-3	South	70.5	20	No
B-4	West	68.1	32	No

Notes: [1] Distance at which noise level increase would be less than 3 dBA, i.e., "just noticeable" per *CEQR Technical Manual*.

Table 3.11-8
Window/Wall Attenuation Requirements (dBA)

Building Façade	Applicable Noise Receptor	Maximum L_{10}	Attenuation Required[1]
North	B-1	66.3	N/A[2]
East	B-2	71.2	28
South	B-3	73.5	31
West	B-4	71.4	28

Notes:
(1) Attenuation values are shown for residential uses (e.g., detention facility housing units); office/administrative uses would require 5 dBA less attenuation.
(2) "N/A" indicates that the highest L_{10} is below 70 dBA. The *CEQR Technical Manual* does not specify minimum attenuation guidance for exterior L_{10} values below this level.

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 consists of wall, glazing, and any vents or louvers associated with the building mechanical systems in various ratios of area. The proposed design for the Brooklyn Site detention facility includes acoustically rated windows and air conditioning (an alternate means of ventilation). The proposed building's façades, including these elements, would be designed to provide window/wall attenuation greater than or equal to that listed in **Table 3.11-8**, along with an alternative means of ventilation in all habitable spaces of the building (i.e., spaces other than corridors, mechanical spaces, storage spaces, stairwells, lobby, etc.).

The window-wall attenuation measures, including an alternate means of ventilation, would be required to maintain interior noise levels of 45 dBA or lower for residential uses and interior noise levels of 50 dBA or lower for office/administrative use as follows:

> **To ensure an acceptable interior noise environment, the detention facility will provide minimum composite building façade attenuation as shown in Table 3.11-8 to ensure an interior $L_{10(1)}$ noise level not greater than 45 dBA for detention facility housing units or 50 dBA for commercial or office uses. To maintain a closed-window condition, an alternate means of ventilation will also be provided. Alternate means of ventilation includes, but is not limited to, central air conditioning.**

G. MECHANICAL SYSTEM

The building mechanical systems (i.e., heating, ventilation, and air conditioning systems) would be designed to meet all applicable noise regulations (i.e., Subchapter 5, §24-227 of the New York City Noise Control Code and the New York City Department of Buildings Code) and to avoid producing levels that would result in any significant increase in ambient noise levels. ✷