A. INTRODUCTION

As described in Chapter 1, "Project Description," the Proposed Development facilitated by the Proposed Action would include 124 residential units, a children's museum of art and storytelling, a day care facility, an office space and an up to 114-space below-grade accessory garage in the Harlem Heights North neighborhood of West Harlem in Manhattan Community District 9.

An analysis was performed to evaluate the potential effect of the Proposed Action on noise levels at existing and potential future noise sensitive locations, including areas that may be redeveloped for residential and other noise sensitive uses. The predicted increases in noise levels would potentially affect the proposed introduction of sensitive receptors into an area with existing ambient noise levels classified as "Marginally Unacceptable", as defined in the *CEQR Technical Manual and* in the *HUD noise guidelines.* The noise analysis addresses the following two factors:

- The change in noise levels from future No-Action conditions in the area as a result of the Proposed Action; and
- The location of new sensitive receptors and the degree to which window/wall attenuation would provide acceptable interior noise levels at these receptors.

B. NOISE FUNDAMENTALS

Introduction

Noise is "unwanted sound" and, by this definition, the perception of noise is a subjective process. Noise in our environment can be characterized by three distinguishing characteristics: loudness, pitch, and time variation.

- The loudness or magnitude of noise is a measure of its intensity, and it is measured in units called decibels (dB). The decibel unit is based on a logarithmic scale, and it compresses a large range of sound pressures into manageable numbers. For example, on the decibel scale, environmental noise ranges from 40 dB from the rustling of leaves to over 80 dB from a truck passage and up to 100 dB at the front rows of a rock concert. The louder the sound, the greater is its decibel value.
- Pitch describes the character and frequency content of noise. Measured in Hertz (Hz), the pitch is used to identify annoying characteristics of noise and help in determining appropriate mitigation to minimize annoyance. The human ear is sensitive to noise frequencies between 20 Hz (low-pitched noise) and 20,000 Hz (high-pitched noise). For

example, a noise may be characterized as a low-pitched "rumble" from stereo sub-woofers or a high-pitched "whine" from a train whistle or a train wheel squeal.

- Time variation describes the pattern of the sound over the observation period. Time variation of environmental noise can be characterized as: 1) continuous, such as noise from a building ventilation fan; 2) intermittent, such as noise from a train passage; or 3) impulsive, like noise from a car backfire. Time variation is used in combination with loudness and pitch to determine the sound energy exposure from a particular noise during a period of time, such as a 24-hour day.

Human Perception of Noise and Noise Descriptors

Since the human ear does not respond equally to all frequencies, measured sound levels (in decibel units at standard frequency bands) are often adjusted or weighted to correspond to the frequency response of human hearing. The weighted sound level is expressed in units called "A"-weighted decibels (dBA) and is measured with a calibrated noise meter. A 10 dBA increase in noise level is generally perceived as a doubling of loudness, while a 3 dBA increase in noise is just barely perceptible to the human ear. Except in carefully controlled laboratory experiments, a change of 1 dBA cannot be perceived. A change in sound level of 5 dBA is subjectively noticeable. Typical A-weighted noise levels in the environment lie in the range of 0 dBA (approximate threshold of hearing) to 120 dBA (jet aircraft at 500 feet).

The following A-weighted noise descriptors (noise metrics) are typically used to determine impacts from noise sources.

- L_{eq} represents the level of a constant noise containing the same acoustical energy as a fluctuating noise (e.g., highway traffic) observed during a given interval, typically one hour. The L_{eq} is commonly used to describe energy average levels at places with primarily daytime uses such as offices, schools, and churches. L_{eq} (1 h) represents the cumulative noise exposure from all events averaged over one hour.
- L_{90}: Noise level in dBA exceeded 90 percent of the observation time. L_{90} is often considered to represent the "background" noise in a community.
- L_{10}: Noise level in dBA exceeded 10 percent of the observation time. This unit is used in CEQR regulations and establishes threshold levels for acceptable noise exposure.
- L_1: Noise level in dBA exceeded 1 percent of the observation time. This unit is often taken to approximate the "maximum" noise level in the community over a period of time, since it is likely to be more representative than a singe, instantaneous maximum level.
- L_{dn} : Day-night average sound level that describes a receiver's cumulative noise exposure from all events over a full 24 hours, with events between 10 pm and 7 am increased by 10 decibels to account for greater nighttime sensitivity to noise. This unit is used in the Federal Department of Housing and Urban Development's (HUD) noise guidelines and establishes threshold for acceptable noise exposure.

Outdoor A-weighted sound levels were used in the measurements and analysis of the noise effects from the proposed action, as dBA correlates well with the human perception of noise. The one-hour equivalent continuous noise level ($L_{eq\ (1h)}$ in dBA), the tenth percentile level L_{10} and the day-night average sound level L_{dn} were selected as the noise descriptors for this analysis.

Criteria

The NYCDEP, Division of Noise Abatement, sets standards for external noise exposure. These standards are classified into four main categories: "Acceptable"; "Marginally Acceptable"; "Marginally Unacceptable"; and "Clearly Unacceptable" (see Table 10-1). The 2010 *CEQR Technical Manual* provides guidance for assessing project-generated noise impacts at sensitive receptors based on the category of external noise exposure at these receptor sites. These guidelines are used in this analysis to determine the applicable interior noise levels of sensitive uses, including potential future residential sites based on external noise exposure. For example, at proposed residential sites located within areas with "Marginally Unacceptable" external noise levels, a minimum of 28 to 35 dBA reduction below daytime external noise level would be required according to *CEQR Technical Manual* guidelines to satisfy the interior noise level criteria.

Under the *CEQR Technical Manual*, increases in daytime noise levels as a result of the proposed action are not considered significant unless the resulting noise levels exceed 65 dBA. At night and during the day where No Build noise levels exceed 65 dBA, a 3dBA increase from the No Build condition is considered a significant adverse impact. In addition, the introduction of sensitive uses such as residences into an area with noise levels above 70 dBA constitutes a significant adverse impact unless interior noise levels for the buildings are attenuated to 45 dBA.

While HUD has no specific responsibility to reduce the noise levels at the source the way the U.S. Environmental Protection Agency (EPA) and the federal Aviation Administration (FAA) do, it does have the responsibility to be aware of the noise problem and its impact on the housing environment. In general, HUD requirements establish three zones: an acceptable zone where all projects could be approved, a normally acceptable zone where mitigation measures would be required and where each project would have to be individually evaluated, and an unacceptable zone in which projects would not, as a rule, be approved. It is HUD's goal that the interior auditory environment at the residences shall not exceed a day-night average sound level of 45 L_{dn}. For housing developments in high noise areas, HUD noise guidance specifies an exterior day-night average sound level of L_{dn} 65 and below are acceptable and are allowable for residential development.

C. EXISTING CONDITIONS

Noise Monitoring Locations

Information about land uses in the rezoning area and trip assignment for potential future uses was reviewed to select monitoring sites and for assessing the future noise impacts on sensitive sites. The four monitoring sites depicted in Figure 10-1 are representative of the future sensitive land uses in the area and of locations where additional new vehicle trips are expected, which could result in an increase in noise. Measured noise levels at the four monitoring sites represent the existing noise exposure conditions at these locations. Noise monitoring was performed during March 2009 during different daytime periods. Time periods chosen for sampling included AM peak, Midday peak, and PM peak. In addition to $L_{eq(h)}$ and L_{10} noise levels, other statistical noise

TABLE 10-1
Noise Exposure Standards for Use in City Environmental Impact Reviews

Receptor Type	Time Period	Acceptable General External Exposure	Airport[3] Environs	Marginally Acceptable General External Exposure	Airport[3] Environs	Marginally Unacceptable General External Exposure	Airport[3] Environs	Clearly Unacceptable General External Exposure	Airport[3] Environs
1. Outdoor area requiring serenity and quiet [2]		L_{10} less or equal 55 dBA	L_{dn} less than or equal to 60 dBA	--	L_{dn} less than or equal to 65 dBA	--	(I)L_{dn} less than or equal to 70 dBA (II) L_{dn} less than or equal to 75 dBA	--	L_{dn} >75 dBA
2. Hospital, Nursing Home		L_{10} less or equal55 dBA		55<L_{10} but less or equal 65 dBA		65<L_{10} but less or equal80 dBA		L_{10}> 80 dBA	
3. Residence, Residential Hotel or Motel	7 AM to 11 PM	L_{10} Less or equal 65 dBA		65<L_{10} but less or equal 70 dBA		70<L_{10} but less or equal 80 dBA		L_{10}> 80 dBA	
	11 PM to 7 AM	L_{10} Less or equal 55 dBA		55<L_{10} but less or equal 70 dBA		70<L_{10} but less or equal 80 dBA		L_{10}> 80 dBA	
4. School, Museum, Library, Court, House of Worship, Transient Hotel or Motel, Public Meeting Room, Auditorium, Out- Patient Public Health Facility		Same as Residential Day (7AM-11PM)		Same as Residential Day (7AM-11PM)		Same as Residential Day (7AM-11PM)		Same as Residential Day (7AM-11PM)	
5. Commercial or Office		Same as Residential Day (7AM-11PM)		Same as Residential Day (7AM-11PM)		Same as Residential Day (7AM-11PM)		Same as Residential Day (7AM-11PM)	
6. Industrial, Public Areas Only [4]	Note [4]	Note [4]		Note [4]		Note [4]		Note [4]	

Source: CEQR Technical Manual (NYCDEP, adopted policy 1983).

(I) In addition, any new activity shall not increase the ambient noise level by 3 dBA or more.

(II) Noise standards for train noise are similar to the aircraft noise standards: the category for train noise is derived by taking the L_{dn} value for such train noise to be an L_{dn} (L_{dn} contour) value.

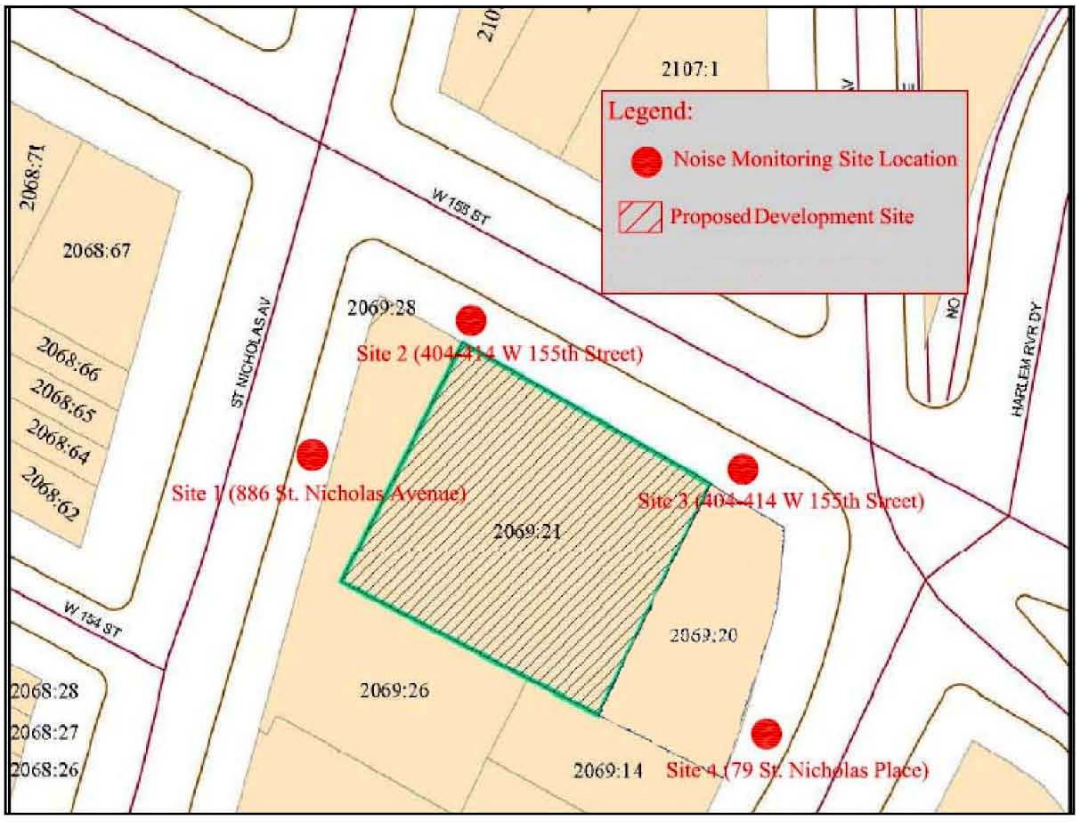
[1] Measurements and projections of noise exposures are to be made at appropriate heights above site boundaries as given by American National Standards Institute (ANSI) Standards. All values are for the worst hour in the time period.

[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 requiring special qualities of serenity and quiet, such as at sanitariums and old-age homes.

[3] Either the 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 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).

Figure 10-1
Noise Monitoring Sites



descriptors (L_1, L_{50}, and L_{90}) were also sampled at all locations for all time periods. Ldn noise levels, as required by HUD guidance, were calculated. The monitored noise levels are summarized in Table 10-2. For noise assessment purposes, L_{10} and L_{dn} values were used in this report, consistent with guidelines contained in the *CEQR Technical Manu*al and HUD guidance.

Equipment Used in Noise Monitoring

A calibrated Bruel and Kjaer Type 2231 sound level meter with a Type 4165 condenser microphone and windshield was used at the noise-monitoring sites. The noise meter was calibrated before and after each reading. The sound level meter was mounted on a tripod at a height of approximately 5.5 feet above ground level. At the end of the preset time period of twenty minutes, the statistical levels and the L_{eq} noise levels were read on the digital display of the meter. (For traffic noise measurements 20 minute readings at the monitoring sites are adequate and they are representative of one hour statistical and L_{eq} noise levels). Noise monitoring was performed under acceptable weather and road surface conditions: low wind speed (less than 20 mph) and dry road surface.

Results of Baseline Noise Measurements

The results of baseline noise measurements are presented in Table 10-2. Daytime noise levels at all of the receptor sites (see Figure 10-1) are fairly typical of noise levels in the study area. A steady background noise exists at all locations due to constant traffic on nearby streets. The background noise level L_{90} (lowest average minimum level) is in the range of 58 to 68 dBA. The highest L_{10} monitored noise level was measured during the PM peak period at Site 3 (404-414 West 155th Street Receptor in front of parking garage) and it is represented by an L_{10} noise level of 76 dBA. Noise level, in terms of twenty minutes L_{eq} at the same location during the same time period, was 73.2 dBA. This level of exposure places this site under CEQR defined "Marginally Unacceptable" category. Sites 1 (886 St. Nicholas Avenue), 2 (404-414 West 155th Street Receptor west end of West 155th Street), and 4 (79 St. Nicholas Place) also fall under the "Marginally Unacceptable" category. The categorization of these monitoring sites is based on the results of baseline noise monitoring and *CEQR Technical Manual* Attenuation Level Exposure Guidelines (Table 3.6-1 and Table 3.6-6).

Following HUD guidelines, all of the noise monitoring sites would fall under the unacceptable category since the existing exterior L_{dn} levels are higher than the HUD threshold of 65 -- Sites 1 and 4 would register an estimated L_{dn} of 67, and sites 2 and 4 would register an estimated L_{dn} of 71.

D. THE FUTURE WITHOUT THE PROPOSED ACTION (NO-ACTION)

As indicated in Table 10-2, the existing noise levels are in the "Marginally Unacceptable" category at the Proposed Development Site. Future No-Action noise levels at the four monitoring sites would be higher than the existing noise levels. CEQR noise analysis impacts account only for changes from No-Action to With-Action noise levels.

Under the future No-Action conditions, 300 public parking spaces would continue to be available on the Proposed Development Site. It was determined that parking noise levels would not contribute to significant increases in No-Action L_{eq}, L_{10} or L_{dn} noise levels at the Proposed Development Site.

TABLE 10-2
Existing Short-Term Noise Levels at Monitoring Sites 1 through 4
(March 19 through March 31, 2009)

Site #	Location	Measurement Times	Existing Noise Level					Estimated L_{dn} (CEQR noise exposure Classification)
			Leq	L1	L10	L50	L90	
1	886 St. Nicholas Avenue	AM	69.3	79.2	71.7	66.7	62.2	67 (Marginally unacceptable)
		Midday	68.1	79	70.5	64.5	59	
		PM	84.1*	69.8	72.5	67	62	
2	404-414 W. 155 St. Receptor west end of W. 155 Street	AM	70.9	81.2	74.2	67.7	63.2	71 (Marginally unacceptable)
		Midday	72.8	84.5	75	67	62	
		PM	72.6	81	75.5	69	65	
3	404-414 W. 155 St. Receptor in front of parking garage	AM	72.4	80.7	74.2	70.2	66.2	71 (Marginally unacceptable)
		Midday	72.4	80	74.5	70.5	68	
		PM	73.2	82.5	76	70	65.5	
4	79 St. Nicholas Place	AM	67.4	75.2	71.7	64.2	59.7	67 (Marginally unacceptable)
		Midday	66.3	74.5	68.5	65.5	57.5	
		PM	69	77.5	72.5	66	60	

Note:
[1] Noise Exposure Category Classification (Table 10-1) is based on the highest L10 noise level measured during any of the four time periods. The highest L10 noise levels monitored during the noted time periods are underlined.

*some unusual activity during this time period resulted in higher Leq levels and this measurement was rejected.

Future No-Action noise levels at the other monitoring sites are also not expected to be very different from the existing noise levels and, therefore, any change in noise level from the existing conditions would likely be insignificant and imperceptible under the No-Action conditions.

E. PROBABLE IMPACTS OF THE PROPOSED ACTION

There would be no perceptible increases in traffic noise levels at the Proposed Development Site as a result of increases in traffic associated with the Proposed Action. Also, the addition of an up to 114-space below grade accessory parking garage would not result in any increase in noise levels. Any change in the noise levels from the No-Action conditions would be insignificant and imperceptible.

F. SENSITIVE RECEPTOR ASSESSMENT

Existing L_{10} noise levels at the four monitoring sites and the future noise levels at the proposed residential site would exceed 70 dBA and existing L_{dn} levels at the proposed residential site are estimated to range between 67 and 71. The procedure for estimating the L_{dn} from measured hourly L_{eq} noise levels is provided in the FTA's "Transit Noise and Vibration Impact Assessment" Manual (May 2006) Appendix D Option 4.

Following both CEQR (Table 10-1) and HUD guidelines, existing noise levels are in the "Marginally Unacceptable" range at the proposed residential site. The Proposed Action would introduce new sensitive receptors into an area with high existing ambient noise levels.

According to the CEQR guidance, the Proposed Development Site would be suitable for residential uses with window-wall attenuation of 28 dBA for the exterior facades of the affected residences on St. Nicholas Avenue and 31 dBA for the exterior faces of the affected building on West 155th Street. Wall attenuation required to satisfy the requirements of HUD guidance would be lower -- 25 dBA for the exterior facades of the affected residences on St. Nicholas Aveneue and 30 dBA for the exterior facades of the affected buildings facing West 155th Street. Window attenuation as indicated in Table 10-3 would be required to achieve a 45 dBA interior noise level. As such, an (E) designation for the Proposed Development Site was developed to preclude the potential for significant adverse noise impacts.

TABLE 10-3
Required Attenuation Values to Achieve Acceptable Interior Noise Levels

	Marginally Acceptable	**Marginally Unacceptable**				**Clearly Unacceptable**
Noise level with the Proposed Action	$65<L_{10}\leq70$	$70<L_{10}\leq73$	$73<L_{10}\leq76$	$76<L_{10}\leq78$	$78<L_{10}\leq80$	$80<L_{10}$
Attenuation[A]	25 dB(A)	(I) 28 dB(A)	(II) 31 dB(A)	(III) 33 dB(A)	(IV) 35 dB(A)	$36 + (L_{10} - 80)$[B] dB(A)

Note: [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

Source: 2010 CEQR Technical Manual.

Window attenuation requirements for the four noise monitoring sites are shown in the following bulleted items. The required closed window condition at these sites can be maintained by providing an alternate means of ventilation for the interior spaces.

- To satisfy the requirements of the HUD guidelines sound attenuation of 25 dBA would be needed for sites in the area of noise monitoring sites 1 and 4, where future L_{dn} levels are estimated to be 67 $L_{dn.}$ The required window attenuation can be achieved through installing standard ¼ inch thick single glazed window.

- To satisfy the requirements of the HUD guidelines sound attenuation of 30 dBA would be needed for sites in the area of noise monitoring sites 2 and 3, where future L_{dn} levels are estimated to be 71 $L_{dn.}$ The required window attenuation can be achieved through installing ¼ inch laminated single glazed window or double-glazed windows with 1/8 inch glass panes with ¼ inch air space between them mounted in a heavy frame.
- To satisfy the CEQR requirements sound attenuation of 28 dBA would be needed for sites in the area of noise monitoring Sites 1 and 4, where the future maximum L_{10} noise levels would be between 70 and 73 dBA. The required window attenuation can be achieved through installing ¼ inch laminated single glazed window or double-glazed windows with 1/8 inch glass panes with ¼ inch air space between them mounted in a heavy frame.
- To satisfy the CEQR requirements sound attenuation of 31 dBA would be required for sites in the area of noise monitoring Sites 2 and 3, where the future maximum L_{10} noise levels would be between 73 and 76 dBA. This can be achieved through installing double glazed windows on a heavy frame in masonry structures or windows consisting of laminated glass

Therefore, the proposed zoning map change would be accompanied by the mapping of an (E) designation on the Proposed Development Site, which following the CEQR requirements would mandate that required noise attenuation of up to 31 dBA be incorporated into the Proposed Development. The (E) designation would require that windows on the front facade of the Proposed Development facing West 155th Street should be provided with window attenuation of 31 dBA; whereas windows on the facade of the Proposed Development facing St. Nicholas Avenue should be provided with window attenuation of 28 dBA. The (E) designations would also state that if any portion of the Proposed Development on this site is federally assisted with funding from HUD, the attenuation requirements would be reduced to 25 dBA on the facade facing St. Nicholas Avenue, and 30 dBA on the façade facing West 155th Street.

The text for the (E) designation for sites requiring 31 dBA is as follows:

> **In order to ensure an acceptable interior noise environment, future residential/ community facility uses must provide a closed window condition with a minimum of 31 dB window/wall attenuation on the West 155th Street façade in order to maintain an interior noise level of 45 dBA. In order to maintain a closed-window condition, an alternate means of ventilation must also be provided. If any portion of the project is federally assisted with funding from the U.S. Department of Housing and Urban Development (made available through HPD) the attenuation requirements for the West 155th Street façade would be 30 dBA in order to satisfy HUD guidelines. If any portion of the project is federally assisted with funding from HUD (made available through HPD), an alternate means of ventilation found acceptable to HPD should be incorporated into the proposed project.**

The text for the (E) designation for sites requiring 28 dBA is as follows:

> **In order to ensure an acceptable interior noise environment, future residential/ community facility uses must provide a closed window condition with a minimum of 28 dBA window/wall attenuation on all remaining façades in order to maintain an interior noise level of 45 dBA. In order to maintain a closed-window condition, an alternate means of ventilation must also be provided. If any portion of the project is federally assisted with funding from the U.S. Department of Housing and Urban Development (made available through HPD) the attenuation requirements on all**

remaining façades would be 25 dBA in order to satisfy HUD guidelines. If any portion of the project is federally assisted with funding from HUD (made available through HPD), an alternate means of ventilation would be considered for the proposed project in accordance with HUD's noise guidelines.

With the attenuation measures specified above and summarized in Tables 10-4 and 10-5, the proposed rezoning would not result in any significant adverse noise impacts, and would meet *CEQR Technical Manual* guidelines.

TABLE 10-4
CEQR Required Attenuation Values for the Proposed Development Site

Address (Monitoring Site Number)	Block Number	Lot Number	Build L_{10} (dBA)	Attenuation Required
Proposed Development Site				
886 St. Nicholas Avenue (1)	2069	21	72.5	28 dBA
North Side of 414 West 155th Street (western end) (2)	2069	21	76.0	31 dBA

TABLE 10-5
HUD Required Attenuation Values for the Proposed Development Site

Address (Monitoring Site Number)	Block Number	Lot Number	Build L_{dn} (dBA)	Attenuation Required
Proposed Development Site				
886 St. Nicholas Avenue (1)	2069	21	67	25 dBA
North Side of 414 West 155th Street (western end) (2)	2069	21	71	30 dBA

G. CONCLUSION

There would be no perceptible increases in traffic noise levels at the Proposed Development Site as a result of increases in traffic associated with the Proposed Action. Also, the addition of an up to 114-space below grade accessory parking garage would not result in any increase in noise levels. Any change in the noise levels from the No-Action conditions would be insignificant and imperceptible.

Based on the measured existing noise levels and judged by the CEQR internal noise level requirements, the Proposed Development planned within the proposed rezoning area would require 28 to 31 dBA attenuation of external noise exposure on all facades facing the adjacent roadways to maintain interior noise levels of 45 dBA (Table 10-4). Based on the estimated existing noise levels and judged by the HUD external and internal noise level requirements, the Proposed Development planned within the proposed rezoning area would require 25 to 30 dBA attenuation of external noise exposure on all facades facing the adjacent roadways to maintain interior noise levels of L_{dn} 45 (Table 10-5). As such, the window attenuation required to satisfy CEQR will be more than sufficient to satisfy HUD requirements.

Therefore, the proposed zoning map change would be accompanied by the mapping of an (E) designation on the Proposed Development Site, which would mandate that required noise attenuation of up to 31 dBA be incorporated into the Proposed Development. The noise attenuation required under the Proposed Action would provide the needed attenuation under both CEQR and HUD guidelines, and preclude the potential for significant adverse noise impacts.