Chapter 11: Air Quality

A. INTRODUCTION

This chapter examines the potential for direct and indirect air quality impacts associated with the proposed Staten Island Mall (the Mall) enlargement. The proposed actions would facilitate the development of approximately 426,576 gross square feet (gsf) of new uses at the project site, including 298,711 gsf of local and destination retail uses and 54,488 gsf of cinema. The additional space is anticipated to be occupied by: a supermarket; cinema; restaurant space; food court; enlargement of the existing Macy's department store; other non-department store retail uses; and Mall common area. In conjunction with the retail enlargement, the proposed project includes the development of a new parking structure.

Direct air quality impacts stem from emissions generated by stationary sources at a project site, such as emissions from on-site fuel combustion for heating and hot water systems. Indirect impacts include emissions from motor vehicle trips ("mobile sources") generated by the project or other changes to future traffic conditions due to a project.

With respect to mobile sources, the maximum hourly incremental traffic with the proposed development would exceed the 2014 *City Environmental Quality Review (CEQR) Technical Manual* carbon monoxide (CO) screening threshold of 170 peak hour trips at certain nearby intersections in the study area, and the fine particulate matter ($PM_{2.5}$) emission screening threshold discussed in Chapter 17, Sections 210 and 311 of the *CEQR Technical Manual*. Therefore, a mobile source analysis for these pollutants was performed.

The proposed development would include natural gas-fired boilers. Therefore, a stationary source screening assessment was conducted to evaluate the potential for an impact on air quality with the proposed heating and hot water systems.

No existing sources of concern with respect to air toxic emissions were identified. Therefore, a quantified analysis of industrial source emissions was not required.

PRINCIPAL CONCLUSIONS

The analysis finds that the proposed actions would not result in significant adverse air quality impacts.

Concentrations of carbon monoxide (CO) and fine particulate matter less than 10 microns in diameter (PM_{10}) due to project-generated traffic at intersections near the project site would not result in any violations of National Ambient Air Quality Standards (NAAQS). It was also determined that CO and $PM_{2.5}$ impacts from mobile sources associated with the proposed project would not exceed CEQR *de minimis* criteria. In addition, the proposed project's parking facility was found to result in no significant adverse air quality impacts.

Based on a screening analysis, using conservative assumptions regarding floor area served by a single heating and hot water system stack, there would be no potential for significant adverse air quality impacts from the proposed project's heating and hot water systems on neighboring

sensitive uses. Based on screening analyses, there would also be no potential for significant adverse impacts on air quality at proposed project uses from heating and hot water systems associated with other components of the proposed project (i.e., project-on-project impacts).

B. POLLUTANTS FOR ANALYSIS

Ambient air quality is affected by air pollutants produced by both motor vehicles and stationary sources. Emissions from motor vehicles are referred to as mobile source emissions, while emissions from fixed facilities are referred to as stationary source emissions. Ambient concentrations of CO are predominantly influenced by mobile source emissions. Particulate matter (PM), volatile organic compounds (VOCs), and nitrogen oxides (nitric oxide, or NO, and NO_2, collectively referred to as NO_x) are emitted from both mobile and stationary sources. Fine PM is also formed when emissions of NO_x, sulfur oxides (SO_x), ammonia, organic compounds, and other gases react or condense in the atmosphere. Emissions of sulfur dioxide (SO_2) are associated mainly with stationary sources, and some sources utilizing non-road diesel such as large international marine engines. On-road diesel vehicles currently contribute very little to SO_2 emissions since the sulfur content of on-road diesel fuel, which is federally regulated, is extremely low. Ozone is formed in the atmosphere by complex photochemical processes that include NO_x and VOCs. Ambient concentrations of CO, PM, NO_2, SO_2, and lead are regulated by the U.S. Environmental Protection Agency (EPA) under the Clean Air Act (CAA), and are referred to as 'criteria pollutants.' Emissions of VOCs, NO_x, and other precursors to criteria pollutants are also regulated by EPA.

CARBON MONOXIDE

CO, a colorless and odorless gas, is produced in the urban environment primarily by the incomplete combustion of gasoline and other fossil fuels. In urban areas, approximately 80 to 90 percent of CO emissions are from motor vehicles. CO concentrations can diminish rapidly over relatively short distances; elevated concentrations are usually limited to locations near crowded intersections, heavily traveled and congested roadways, parking lots, and garages. Consequently, CO concentrations must be predicted on a local, or microscale, basis.

The proposed actions would result in changes in traffic patterns and an increase in traffic volumes. Therefore, a mobile source analysis was conducted at critical intersections in the study area to evaluate future CO concentrations with and without the proposed project.

NITROGEN OXIDES, VOCS, AND OZONE

NO_x are of principal concern because of their role, together with VOCs, as precursors in the formation of ozone. Ozone is formed through a series of reactions that take place in the atmosphere in the presence of sunlight. Because the reactions are slow, and occur as the pollutants are advected downwind, elevated ozone levels are often found many miles from sources of the precursor pollutants. The effects of NO_x and VOC emissions from all sources are therefore generally examined on a regional basis. The contribution of any action or project to regional emissions of these pollutants would include any added stationary or mobile source emissions.

The proposed actions would not have a significant effect on the overall volume of vehicular travel in the metropolitan area; therefore, no measurable impact on regional NO_x emissions or on ozone levels is predicted. An analysis of emissions of these pollutants from mobile sources was therefore not warranted.

In addition to being a precursor to the formation of ozone, NO_2 (one component of NO_x) is also a regulated pollutant. Since NO_2 is mostly formed from the transformation of NO in the atmosphere, it has mostly been of concern further downwind from large stationary point sources, and not a local concern from mobile sources. (NO_x emissions from fuel combustion consist of approximately 90 percent NO and 10 percent NO_2 at the source.) However, with the promulgation of the 2010 1-hour average standard for NO_2, local sources such as vehicular emissions may become of greater concern for this pollutant.

In terms of emissions of NO_2 from mobile sources, the incremental increases in NO_2 concentrations are primarily due to relatively small increases in the number of vehicles (as compared to existing or No Build traffic in the study area). This increase would not be expected to significantly affect levels of NO_2 experienced near roadways without the proposed development.

Potential impacts from the fuel combustion for the proposed project heating and hot water systems were evaluated.

LEAD

Airborne lead emissions are currently associated principally with industrial sources. Lead in gasoline has been banned under the Clean Air Act, and therefore, lead is not a pollutant of concern for the proposed development. Therefore, an analysis of this pollutant was not warranted.

RESPIRABLE PARTICULATE MATTER—PM_{10} AND $PM_{2.5}$

PM is a broad class of air pollutants that includes discrete particles of a wide range of sizes and chemical compositions, as either liquid droplets (aerosols) or solids suspended in the atmosphere. The constituents of PM are both numerous and varied, and they are emitted from a wide variety of sources (both natural and anthropogenic). Natural sources include the condensed and reacted forms of naturally occurring VOCs; salt particles resulting from the evaporation of sea spray; wind-borne pollen, fungi, molds, algae, yeasts, rusts, bacteria, and material from live and decaying plant and animal life; particles eroded from beaches, soil, and rock; and particles emitted from volcanic and geothermal eruptions and from forest fires. Naturally occurring PM is generally greater than 2.5 micrometers in diameter. Major anthropogenic sources include the combustion of fossil fuels (e.g., vehicular exhaust, power generation, boilers, engines, and home heating), chemical and manufacturing processes, all types of construction, agricultural activities, as well as wood-burning stoves and fireplaces. PM also acts as a substrate for the adsorption (accumulation of gases, liquids, or solutes on the surface of a solid or liquid) of other pollutants, often toxic, and some likely carcinogenic compounds.

As described below, PM is regulated in two size categories: particles with an aerodynamic diameter of less than or equal to 2.5 micrometers ($PM_{2.5}$), and particles with an aerodynamic diameter of less than or equal to 10 micrometers (PM_{10}, which includes $PM_{2.5}$). $PM_{2.5}$ has the ability to reach the lower regions of the respiratory tract, delivering with it other compounds that adsorb to the surfaces of the particles, and is also extremely persistent in the atmosphere. $PM_{2.5}$ is mainly derived from combustion material that has volatilized and then condensed to form primary PM (often soon after the release from a source exhaust) or from precursor gases reacting in the atmosphere to form secondary PM.

Diesel-powered vehicles, especially heavy duty trucks and buses, are a significant source of respirable PM, most of which is $PM_{2.5}$; PM concentrations may, consequently, be locally elevated near roadways with high volumes of heavy diesel powered vehicles.

The boilers of the proposed project would be fueled by natural gas. PM is not the critical pollutant of concern with the combustion of natural gas. Therefore, PM emissions from stationary sources were not analyzed. However, an analysis was conducted to assess the worst case $PM_{2.5}$ impacts due to the increase in traffic associated with the proposed project.

SULFUR DIOXIDE

SO_2 emissions are primarily associated with the combustion of sulfur-containing fuels (oil and coal). SO_2 is also of concern as a precursor to $PM_{2.5}$ and is regulated as a $PM_{2.5}$ precursor under the New Source Review permitting program for large sources. Due to the federal restrictions on the sulfur content in diesel fuel for on-road and non-road vehicles, no significant quantities are emitted from vehicular sources. Vehicular sources of SO_2 are not significant and therefore, analysis of SO_2 from mobile sources was not warranted.

As part of the proposed project, natural gas would be combusted in the heating and hot water systems for the proposed project. The sulfur content of natural gas is negligible; therefore, an analysis of future levels of SO_2 with the proposed development was not warranted.

C. AIR QUALITY REGULATIONS, STANDARDS, AND BENCHMARKS

NATIONAL AND STATE AIR QUALITY STANDARDS

As required by the CAA, primary and secondary National Ambient Air Quality Standards (NAAQS) have been established for six major air pollutants: CO, NO_2, ozone, respirable PM (both $PM_{2.5}$ and PM_{10}), SO_2, and lead. The primary standards represent levels that are required to protect the public health, allowing an adequate margin of safety. The secondary standards are intended to protect the nation's welfare, and account for air pollutant effects on soil, water, visibility, materials, vegetation, and other aspects of the environment. The primary standards are generally either the same as the secondary standards or more restrictive. The NAAQS are presented in **Table 11-1**. The NAAQS for CO, annual NO_2, and 3-hour SO_2 have also been adopted as the ambient air quality standards for New York State, but are defined on a running 12-month basis rather than for calendar years only. New York State also has standards for total suspended PM, settleable particles, non-methane hydrocarbons, 24-hour and annual SO_2, and ozone which correspond to federal standards that have since been revoked or replaced, and for the noncriteria pollutants beryllium, fluoride, and hydrogen sulfide.

EPA has revised the NAAQS for PM, effective December 18, 2006. The revision included lowering the level of the 24-hour $PM_{2.5}$ standard from 65 micrograms per cubic meter ($\mu g/m^3$) to 35 $\mu g/m^3$ and retaining the level of the annual standard at 15 $\mu g/m^3$. The PM_{10} 24-hour average standard was retained and the annual average PM_{10} standard was revoked. EPA lowered the primary annual $PM_{2.5}$ average standard from 15 $\mu g/m^3$ to 12 $\mu g/m^3$, effective March 2013.

EPA has also revised the 8-hour ozone standard, lowering it from 0.08 to 0.075 parts per million (ppm), effective as of May 2008. On January 6, 2010, EPA proposed a change in the 2008 ozone NAAQS, lowering the primary NAAQS from the current 0.075 ppm level to within the range of 0.060 to 0.070 ppm and instituting a secondary ozone standard, measured as a cumulative concentration within the range of 7 to 15 ppm-hours aimed mainly at protecting sensitive vegetation; a final decision on these standards has been postponed and is currently in review.

Table 11-1
National Ambient Air Quality Standards (NAAQS)

Pollutant	Primary		Secondary	
	ppm	µg/m^3	ppm	µg/m^3
Carbon Monoxide (CO)				
8-Hour Average [1]	9	10,000	None	
1-Hour Average [1]	35	40,000		
Lead				
Rolling 3-Month Average [2]	NA	0.15	NA	0.15
Nitrogen Dioxide (NO_2)				
1-Hour Average [3]	0.100	189	None	
Annual Average	0.053	100	0.053	100
Ozone (O_3)				
8-Hour Average [4,5]	0.075	150	0.075	150
Respirable Particulate Matter (PM_{10})				
24-Hour Average [1]	NA	150	NA	150
Fine Respirable Particulate Matter ($PM_{2.5}$)				
Annual Mean [6]	NA	12	NA	15
24-Hour Average [7]	NA	35	NA	35
Sulfur Dioxide (SO_2) [8]				
1-Hour Average [9]	0.075	196	NA	NA
Maximum 3-Hour Average [1]	NA	NA	0.50	1,300

Notes:

ppm – parts per million (unit of measure for gases only)
µg/m^3 – micrograms per cubic meter (unit of measure for gases and particles, including lead)
NA – not applicable

All annual periods refer to calendar year.

Standards are defined in ppm. Approximately equivalent concentrations in µg/m^3 are presented.

(1) Not to be exceeded more than once a year.

(2) EPA has lowered the NAAQS down from 1.5 µg/m^3, effective January 12, 2009.

(3) 3-year average of the annual 98th percentile daily maximum 1-hr average concentration. Effective April 12, 2010.

(4) 3-year average of the annual fourth highest daily maximum 8-hr average concentration.

(5) EPA has proposed lowering the primary standard further to within the range 0.060-0.070 ppm, and adding a secondary standard measured as a cumulative concentration within the range of 7 to 15 ppm-hours aimed mainly at protecting sensitive vegetation. A final decision on these standards has been postponed and is currently in review.

(6) 3-year average of annual mean. EPA has lowered the primary standard from 15 µg/m^3, effective March 2013.

(7) Not to be exceeded by the annual 98th percentile when averaged over 3 years.

(8) EPA revoked the 24-hour and annual primary standards, replacing them with a 1-hour average standard. Effective August 23, 2010.

(9) 3-year average of the annual 99th percentile daily maximum 1-hr average concentration.

Source: 40 CFR Part 50: National Primary and Secondary Ambient Air Quality Standards.

EPA lowered the primary and secondary standards for lead to 0.15 µg/m^3, effective January 12, 2009. EPA revised the averaging time to a rolling 3-month average and the form of the standard to not-to-exceed across a 3-year span.

EPA established a 1-hour average NO_2 standard of 0.100 ppm, effective April 12, 2010, in addition to the annual standard. The statistical form is the 3-year average of the 98th percentile of daily maximum 1-hour average concentration in a year.

EPA also established a 1-hour average SO2 standard of 0.075 ppm, replacing the 24-hour and annual primary standards, effective August 23, 2010. The statistical form is the 3-year average of the 99th percentile of the annual distribution of daily maximum 1-hour concentrations (the 4th highest daily maximum corresponds approximately to 99th percentile for a year.)

NAAQS ATTAINMENT STATUS AND STATE IMPLEMENTATION PLANS

The CAA, as amended in 1990, defines non-attainment areas (NAA) as geographic regions that have been designated as not meeting one or more of the NAAQS. When an area is designated as non-attainment by EPA, the state is required to develop and implement a State Implementation Plan (SIP), which delineates how a state plans to achieve air quality that meets the NAAQS under the deadlines established by the Clean Air Act, followed by a plan for maintaining attainment status once the area is in attainment.

In 2002, EPA re-designated New York City as in attainment for CO. Under the resulting maintenance plans, New York City is committed to implementing site-specific control measures throughout the city to reduce CO levels, should unanticipated localized growth result in elevated CO levels during the maintenance period. The second CO maintenance plan for the region was approved by EPA on May 30, 2014.

Manhattan has been designated as a moderate NAA for PM_{10}. On December 2, 2013, EPA approved New York State's withdrawal of the 1995 SIP and redesignation request for the 1987 PM_{10} NAAQS, and made a clean data finding instead, based on data monitored from 2010-2012 indicating PM_{10} concentrations well below the 1987 NAAQS. Although not yet a redesignation to attainment status, this determination removes further requirements for related SIP submissions.

The five New York City counties and Nassau, Suffolk, Rockland, Westchester, and Orange Counties, which had been designated as a $PM_{2.5}$ non-attainment area since 2004 under the CAA due to exceedance of the 1997 annual average standard, were redesignated as in attainment for that standard on April 18, 2014, and are now under a maintenance plan. As stated above, EPA lowered the annual average primary standard to 12 $\mu g/m^3$ in December 2012. EPA designated the area as in attainment for the new 12 $\mu g/m^3$ NAAQS effective January 15, 2015. On April 18, 2014, EPA redesignated the New York City Metropolitan Area, which had been nonattainment with the 2006 24-hour $PM_{2.5}$ NAAQS since November 2009, as in attainment. The area, now under a maintenance plan for this standard, includes the same 10-county area as the maintenance area for the 1997 annual $PM_{2.5}$ NAAQS.

Nassau, Rockland, Suffolk, Westchester, Lower Orange County Metropolitan Area (LOCMA), and the five New York City counties had been designated as a severe non-attainment area for ozone under the 1-hour average standard of 0.12 ppm. In November 1998, New York State submitted its *Phase II Alternative Attainment Demonstration for Ozone*, which was finalized and approved by EPA effective March 6, 2002, addressing attainment of the 1-hour ozone NAAQS by 2007. The 1-hour standard was revoked in 2004 when it was replaced by the 8-hour ozone standard, but certain further requirements remained ('anti-backsliding'). On June 18, 2012, EPA determined that the New York–New Jersey–Long Island NAA has also attained the standard. Although not yet a redesignation to attainment status, this determination removes further requirements under the 1-hour standard.

Effective June 15, 2004, EPA designated these same counties as moderate non-attainment for the 1997 8-hour average ozone standard (0.08 ppm). Based on recent monitoring data (2007-2011), EPA determined that the NY-NJ-CT nonattainment area has attained the 1997 8-hour ozone NAAQS. Although not yet a redesignation to attainment status, this determination removes further requirements under the 1997 8-hour standard. In March 2008 EPA strengthened the 8-hour ozone standards. EPA designated the counties of Suffolk, Nassau, Bronx, Kings, New York, Queens, Richmond, Rockland, and Westchester as a marginal non-attainment area for the 2008 ozone NAAQS, effective July 20, 2012. SIPs will be due in 2015.

New York City is currently in attainment of the annual-average NO_2 standard. EPA has designated the entire state of New York as "unclassifiable/attainment" of the 1-hour NO_2 standard effective February 29, 2012. Since additional monitoring is required for the 1-hour standard, areas will be reclassified once three years of monitoring data are available (likely 2017).

EPA has established a 1-hour SO_2 standard, replacing the former 24-hour and annual standards, effective August 23, 2010. Based on the available monitoring data, all New York State counties currently meet the 1-hour standard. Additional monitoring will be required. Draft attainment designations were published by EPA in February 2013, indicating that EPA is deferring action to designate areas in New York State and expects to proceed with designations once additional data are gathered.

DETERMINING THE SIGNIFICANCE OF AIR QUALITY IMPACTS

The State Environmental Quality Review Act (SEQRA) regulations and *CEQR Technical Manual* indicate that the significance of a predicted consequence of a project (i.e., whether it is material, substantial, large or important) should be assessed in connection with its setting (e.g., urban or rural), its probability of occurrence, its duration, its irreversibility, its geographic scope, its magnitude, and the number of people affected.[1] In terms of the magnitude of air quality impacts, any action predicted to increase the concentration of a criteria air pollutant to a level that would exceed the concentrations defined by the NAAQS (see **Table 11-1**) would be deemed to have a potential significant adverse impact.

In addition, in order to maintain concentrations lower than the NAAQS in attainment areas, or to ensure that concentrations will not be significantly increased in non-attainment areas, threshold levels have been defined for certain pollutants; any action predicted to increase the concentrations of these pollutants above the thresholds would be deemed to have a potential significant adverse impact, even in cases where violations of the NAAQS are not predicted.

CO DE MINIMIS CRITERIA

New York City has developed *de minimis* criteria to assess the significance of the increase in CO concentrations that would result from the impact of proposed projects on mobile sources, as set forth in the *CEQR Technical Manual*. These criteria set the minimum change in CO concentration that defines a significant environmental impact. Significant increases of CO concentrations in New York City are defined as: (1) an increase of 0.5 ppm or more in the maximum 8-hour average CO concentration at a location where the predicted No Action 8-hour concentration is equal to or between 8 and 9 ppm; or (2) an increase of more than half the

[1] *CEQR Technical Manual*, Chapter 1, section 222, March 2014; and State Environmental Quality Review Regulations, 6 NYCRR § 617.7

difference between baseline (i.e., No Action) concentrations and the 8-hour standard, when No Action concentrations are below 8.0 ppm.

$PM_{2.5}$ DE MINIMIS CRITERIA

New York State Department of Environmental Conservation (DEC) has published a policy to provide interim direction for evaluating $PM_{2.5}$ impacts.[2] This policy applies only to facilities applying for permits or major permit modifications under SEQRA that emit 15 tons of PM_{10} or more annually. The policy states that such a project will be deemed to have a potentially significant adverse impact if the project's maximum impacts are predicted to increase $PM_{2.5}$ concentrations by more than 0.3 $\mu g/m^3$ averaged annually or more than 5 $\mu g/m^3$ on a 24-hour basis. Projects that exceed either the annual or 24-hour threshold will be required to prepare an environmental impact statement (EIS) to assess the severity of the impacts, to evaluate alternatives, and to employ reasonable and necessary mitigation measures to minimize the $PM_{2.5}$ impacts of the source to the maximum extent practicable.

In addition, New York City uses *de minimis* criteria to determine the potential for significant adverse $PM_{2.5}$ impacts under CEQR are as follows:

- Predicted increase of more than half the difference between the background concentration and the 24-hour standard;
- Annual average $PM_{2.5}$ concentration increments which are predicted to be greater than 0.1 $\mu g/m^3$ at ground level on a neighborhood scale (i.e., the annual increase in concentration representing the average over an area of approximately 1 square kilometer, centered on the location where the maximum ground-level impact is predicted for stationary sources; or at a distance from a roadway corridor similar to the minimum distance defined for locating neighborhood scale monitoring stations); or
- Annual average $PM_{2.5}$ concentration increments which are predicted to be greater than 0.3 $\mu g/m^3$ at a discrete receptor location (elevated or ground level).

Actions under CEQR predicted to increase $PM_{2.5}$ concentrations by more than the above *de minimis* criteria will be considered to have a potential significant adverse impact.

The *de minimis* criteria have been used to evaluate the significance of predicted impacts of the proposed project on $PM_{2.5}$ concentrations.

D. METHODOLOGY FOR PREDICTING POLLUTANT CONCENTRATIONS

MOBILE SOURCES

The prediction of vehicle-generated emissions and their dispersion in an urban environment incorporates meteorological phenomena, traffic conditions, and physical configuration. Air pollutant dispersion models mathematically simulate how traffic, meteorology, and physical configuration combine to affect pollutant concentrations. The mathematical expressions and formulations contained in the various models attempt to describe an extremely complex physical phenomenon as closely as possible. However, because all models contain simplifications and approximations of actual conditions and interactions, and since it is necessary to predict the

[2] CP33/Assessing and Mitigating Impacts of Fine Particulate Emissions, DEC 12/29/2003.

reasonable worst-case condition, most dispersion analyses predict conservatively high concentrations of pollutants, particularly under adverse meteorological conditions.

The mobile source analyses for the proposed project employ models approved by EPA that ~~has~~ have been widely used for evaluating air quality impacts of projects in New York City, other parts of New York State, and throughout the country. The modeling approach includes a series of conservative assumptions relating to meteorology, traffic, and background concentration levels resulting in a conservatively high estimate of expected pollutant concentrations that could ensue from the proposed development.

VEHICLE EMISSIONS

Engine Emissions

Vehicular CO and PM engine emission factors were computed using the EPA mobile source emissions model, Motor Vehicle Emission Simulator, or MOVES.[3] This emissions model is capable of calculating engine emission factors for various vehicle types, based on the fuel type (gasoline, diesel, or natural gas), meteorological conditions, vehicle speeds, vehicle age, roadway types, number of starts per day, engine soak time, and various other factors that influence emissions, such as inspection maintenance programs. The inputs and use of MOVES incorporate the most current guidance available from DEC.

Vehicle classification data were based on field studies. Appropriate credits were used to accurately reflect the inspection and maintenance program.[4] County-specific hourly temperature and relative humidity data obtained from DEC were used.

Road Dust

$PM_{2.5}$ emission rates were determined with fugitive road dust to account for their impacts in local microscale analyses. However, fugitive road dust was not included in the neighborhood scale $PM_{2.5}$ microscale analyses, since the New York City Department of Environmental Protection (DEP) considers it to have an insignificant contribution on that scale. Road dust emission factors were calculated according to the latest procedure delineated by EPA[5] and the *CEQR Technical Manual*.

TRAFFIC DATA

Traffic data for the air quality analysis were derived from existing traffic counts, projected future growth in traffic, and other information developed as part of the traffic analysis for the proposed project (see Chapter 10, "Transportation"). Traffic data for the future No Action and With Action conditions were used for the respective air quality modeling scenarios. For the PM microscale analysis, each of the peak periods analyzed in the Chapter 10, "Transportation," were used (weekday midday and PM, and Saturday midday and PM). For the CO microscale analysis, the Saturday PM (4:30 to 5:30 PM) peak period was analyzed. This time period was selected for

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[3] EPA, MOVES Model, User Guide for MOVES2014, July 2014.

[4] The inspection and maintenance programs require inspections of automobiles and light trucks to determine if pollutant emissions from each vehicle exhaust system are lower than emission standards. Vehicles failing the emissions test must undergo maintenance and pass a repeat test to be registered in New York State.

[5] EPA, Compilations of Air Pollutant Emission Factors AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources, Ch. 13.2.1, NC, http://www.epa.gov/ttn/chief/ap42, January 2011.

the CO mobile source analysis because it would produce the maximum anticipated project-generated traffic, and therefore have the greatest potential for significant air quality impacts.

For $PM_{2.5}$, the peak midday and PM period traffic volumes were used as a baseline for determining off-peak volumes. Off-peak traffic volumes in the No Action condition were determined by adjusting the peak period volumes by the 24-hour distributions of actual vehicle counts collected at appropriate locations. Off-peak increments from the proposed development were determined by adjusting the peak period volumes by weekday and weekend 24-hour distributions as applicable.

DISPERSION MODEL FOR MICROSCALE ANALYSES

Maximum CO concentrations adjacent to streets within the surrounding area, resulting from vehicle emissions were predicted using the Tier 1 CAL3QHC model Version 2.0.[6] The CAL3QHC model employs a Gaussian (normal distribution) dispersion assumption and includes an algorithm for estimating vehicular queue lengths at signalized intersections. CAL3QHC calculates emissions and dispersion of CO from idling and moving vehicles. The queuing algorithm includes site-specific traffic parameters, such as signal timing and delay (from the 2000 *Highway Capacity Manual* traffic forecasting model), saturation flow rate, vehicle arrival type, and signal actuation (i.e., pre-timed or actuated signal) characteristics to project the number of idling vehicles. The CAL3QHC model has been updated with an extended module, CAL3QHCR, which allows for the incorporation of hourly meteorological data into the modeling, instead of worst-case assumptions regarding meteorological parameters. This refined (Tier 2) version of the model, CAL3QHCR, is employed if maximum predicted future CO concentrations are greater than the applicable ambient air quality standards or when *de minimis* thresholds are exceeded using the first level of CAL3QHC modeling.

To determine motor vehicle generated $PM_{2.5}$ concentrations adjacent to streets within the traffic study area, the CAL3QHCR model was applied. This refined version of the model can use hourly traffic and meteorology data, and is therefore more appropriate for calculating 24-hour and annual average concentrations.

METEOROLOGY

In general, the transport and concentration of pollutants from vehicular sources are influenced by three principal meteorological factors: wind direction, wind speed, and atmospheric stability. Wind direction influences the direction in which pollutants are dispersed, and atmospheric stability accounts for the effects of vertical mixing in the atmosphere. These factors, therefore, influence the concentration at a particular prediction location (receptor).

Tier I CO Analysis—CAL3QHC

In applying the CAL3QHC model, the wind angle was varied to determine the wind direction resulting in the maximum concentrations at each receptor.

Following the EPA guidelines[7], CAL3QHC computations were performed using a wind speed of 1 meter per second, and the neutral stability class D. The 8-hour average CO concentrations

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[6] EPA, User's Guide to CAL3QHC, A Modeling Methodology for Predicted Pollutant Concentrations Near Roadway Intersections, Office of Air Quality, Planning Standards, Research Triangle Park, North Carolina, EPA-454/R-92-006.

[7] *Guidelines for Modeling Carbon Monoxide from Roadway Intersections*, EPA Office of Air Quality Planning and Standards, Publication EPA-454/R-92-005.

were estimated by multiplying the predicted 1-hour average CO concentrations by a factor of 0.7 to account for persistence of meteorological conditions and fluctuations in traffic volumes. A surface roughness of 3.21 meters was chosen. At each receptor location, concentrations were calculated for all wind directions, and the highest predicted concentration was reported, regardless of frequency of occurrence. These assumptions ensured that reasonable worst-case meteorology was used to estimate impacts.

Tier II $PM_{2.5}$ Analysis—CAL3QHCR

A Tier II analysis performed with the CAL3QHCR model includes the modeling of hourly concentrations based on hourly traffic data and five years of monitored hourly meteorological data. The data consist of surface data collected at LaGuardia Airport and upper air data collected at Brookhaven, New York for the period 2008–2012. All hours were modeled, and the highest resulting concentration for each averaging period is presented.

ANALYSIS YEAR

The microscale analyses were performed, based on the traffic data developed for the 2019 Full Build year. As described in Chapter 10, "Transportation", the analysis of the 2019 Full Build year is more conservative due to additional background traffic growth between 2017 and 2019. The future analysis was performed both without the proposed project (the No Action condition) and with the proposed project (the With Action condition).

BACKGROUND CONCENTRATIONS

Background concentrations are those pollutant concentrations originating from distant sources that are not directly included in the modeling analysis, which directly accounts for vehicular emissions on the streets within 1,000 feet and in the line of sight of the analysis site. Background concentrations are added to modeling results to obtain total pollutant concentrations at an analysis site.

The background concentrations for the project area are presented in **Table 11-2**. CO backgrounds are based on the latest available five years of monitored data (2009–2013). Consistent with the NAAQS for each pollutant, for averaging periods shorter than one year, the second highest value is used. These values were used as the background concentrations for the mobile source analysis. $PM_{2.5}$ impacts are assessed on an incremental basis and compared with the $PM_{2.5}$ *de minimis* criteria. $PM_{2.5}$ 24-hour average background concentration of 21.2 $\mu g/m^3$ (based on the 2011 to 2013 average of 98th percentile concentrations) was used to establish the *de minimis* value, consistent with the background concentration provided for the Port Richmond monitoring station on Staten Island.

Table 11-2
Maximum Background Pollutant Concentrations
For Mobile Source Sites ($\mu g/m^3$)

Pollutant	Average Period	Location	Concentration	NAAQS
CO	1-hour	CCNY, Manhattan	2.7	35 ppm
	8-hour		1.8	9 ppm
PM_{10}	24-hour	Division Street, Manhattan	48	150
$PM_{2.5}$	24-hour	Port Richmond, Staten Island	21.2	35

Note: Consistent with the NAAQS, CO concentrations are the 2nd highest of the latest 5 years.
Source: New York State Air Quality Report Ambient Air Monitoring System, DEC, 2009–2013.

ANALYSIS SITES

Intersections in the study area were reviewed for microscale analysis based on the *CEQR Technical Manual* guidance. The incremental traffic volumes were reviewed and intersections with increments exceeding the CO and PM volume thresholds were identified. Of those intersections, two were selected for microscale analysis (see **Table 11-3)**: These two sites were selected because they have the highest total traffic volumes and the largest incremental traffic volume in the traffic network studied.

Table 11-3
Mobile Source Analysis Intersection Locations

Analysis Site	Location
1	Richmond Avenue and Forest Hill Road
2	Richmond Avenue and Richmond Hill Road

RECEPTOR PLACEMENT

Multiple receptors (i.e., precise locations at which concentrations are predicted) were modeled at each of the selected sites; receptors were placed along the approach and departure links at spaced intervals. Ground-level receptors were placed at sidewalk or roadside locations near intersections with continuous public access, at a pedestrian height of 1.8 meters. Receptors in the analysis models for predicting annual average neighborhood-scale $PM_{2.5}$ concentrations were placed at a distance of 15 meters, from the nearest moving lane at each analysis location, based on the DEP guidance for neighborhood-scale corridor $PM_{2.5}$ modeling.

PARKING GARAGE

The proposed project would include structured parking – a naturally ventilated parking garage, with a capacity of 1,413 spaces. Emissions from vehicles using the parking facility could potentially affect ambient levels of pollutants at adjacent receptors. An analysis was performed using the methodology delineated in the 2014 *CEQR Technical Manual* to calculate levels for the pollutants of concern (CO and PM). To determine pollutant levels from naturally ventilated parking levels, the analysis was based on a correction factor for an elevated point source using the methodology in EPA's *Workbook of Atmospheric Dispersion Estimates, AP-26*. This methodology estimates concentrations by determining the appropriate height correction factor for each level, based on the difference between pedestrian height and the respective parking level elevation. Total ambient levels at each receptor site are then calculated by adding together contributions from each level of the facility and ambient background levels.

Potential impacts from the proposed parking facility on CO and PM concentrations were assessed at multiple receptor locations. The concentrations were determined for the time periods when overall usage would be the greatest – during the holiday weekday (6-7 PM) and holiday weekend peak hour (3-4 PM). The 24-hour average an annual average PM concentrations were conservatively based on the garage usage during the holiday peak hours. Emissions from vehicles entering, parking, and exiting the parking facility were estimated using the EPA MOVES mobile source emission model. All arriving and departing vehicles were conservatively assumed to travel at an average speed of 5 miles per hour within the parking facility. In addition, all departing vehicles were assumed to idle for 1 minute before exiting. The slope (grade) of the garage ramps was accounted for.

A "near" and "far" receptor was placed on the sidewalk adjacent to the proposed location of the parking garage to the south and on the sidewalk across the street from the proposed location of the parking facility. To determine compliance with the NAAQS, CO concentrations were determined for the maximum 1- and 8-hour average periods, and $PM_{2.5}$ concentrations were determined for the maximum 24-hour and annual average period. A persistence factor of 0.7 was used to convert the calculated 1-hour average maximum concentrations to 8-hour averages, accounting for meteorological variability over the average 8-hour period. A factor of 0.6 was used to obtain 24-hour average concentrations and a factor of 0.1 was used to obtain annual average concentrations from the peak one hour concentrations, following USEPA guidance.[8]

Background concentrations from the nearest NYSDEC monitoring station with available data were added to the modeling results to obtain the total ambient levels. The on-street pollutant concentrations were determined using the methodology in the Air Quality Appendix of the *CEQR Technical Manual*, utilizing traffic volumes derived from the traffic study conducted in the area.

STATIONARY SOURCES

HEATING AND HOT WATER SYSTEMS ANALYSIS

A screening analysis was performed to assess the potential for air quality impacts from natural gas-fired heating and hot water systems that would serve the proposed development. The methodology described in the *CEQR Technical Manual* was used for the analysis. The analysis is used to determine the threshold distance of a building of a similar or greater height to the heating and hot water system exhaust stack beyond which there would be no significant adverse impact. The screening procedure considers the type of fuel that would be used, the maximum development size, type of development, and the stack height, to evaluate whether a significant adverse impact is likely. Based on the development size, if the distance from the development to the nearest building of similar or greater height is less than the threshold distance in the *CEQR Technical Manual*, there is the potential for significant adverse air quality impacts, and a refined dispersion modeling analysis would be required. Otherwise, the source passes the screening analysis, and no further analysis is needed.

E. EXISTING CONDITIONS

Recent concentrations of all criteria pollutants at DEC air quality monitoring stations nearest the study area are presented in **Table 11-4**. All data statistical forms and averaging periods are consistent with the definitions of the NAAQS. It should be noted that these values are somewhat different than the background concentrations presented in **Table 11-2**.

These existing concentrations are based on recent published measurements, averaged according to the NAAQS (e.g., $PM_{2.5}$ concentrations are averaged over the three years); the background concentrations are the highest values in past years, and are used as a conservative estimate of the highest background concentrations for future conditions. There were no monitored violations of NAAQS at these monitoring sites, with the exception of the 8-hour ozone.

[8] U.S. Environmental Protection Agency, *AERSCREEN User's Guide*, March 2011.

Table 11-4
Representative Monitored Ambient Air Quality Data

Pollutant	Location	Units	Averaging Period	Concentration	NAAQS
CO	CCNY, Manhattan	ppm	8-hour	1.2	9
	CCNY, Manhattan		1-hour	1.8	35
SO_2	Queens College, Queens	$\mu g/m^3$	1-hour	53	196
PM_{10}	Division Street, Manhattan	$\mu g/m^3$	24-hour	39	150
$PM_{2.5}$	Port Richmond, Staten Island	$\mu g/m^3$	Annual	9	12
			24-hour	21	35
NO_2	Queens College, Queens	$\mu g/m^3$	Annual	33	100
	Queens College, Queens		1-hour	114	189
Lead	IS 52, Bronx	$\mu g/m^3$	3-month	0.005	0.15
Ozone	Susan Wagner, Staten Island	ppm	8-hour	0.078	0.075

Notes: Based on the NAAQS definitions, the CO and 3-hour SO_2 concentrations for short-term averages are the second-highest from the year (2013). $PM_{2.5}$ annual concentrations are the average of 2011–2013, and the 24-hour concentration is the average of the annual 98th percentiles in 2011-2013. 8-Hour average ozone concentrations are the average of the 4th highest-daily values from 2011 to 2013. SO_2 1-hour and NO_2 1-hour concentrations are the average of the 99th percentile and 98th percentile, respectively, of the highest daily 1-hour maximum from 2011 to 2013. The 3-hour SO_2 concentration is based on 2012 data, which is the most recent available data from DEC.
Source: DEC, New York State Ambient Air Quality Data.

F. FUTURE WITHOUT THE PROPOSED ACTIONS

MOBILE SOURCES

CO concentrations in the No Build condition were determined for future 2019 conditions[9] using the methodology previously described. **Table 11-5** shows future maximum predicted 8-hour average CO concentrations, including background concentrations, at the analysis intersections in the No Build condition. The values shown are the highest predicted concentrations for the receptor locations for any of the time periods analyzed.

Table 11-5
Maximum Predicted 8-Hour Average
CO No Build Concentrations

Analysis Site	Location	Time Period	8-Hour Concentration (ppm)
1	Richmond Avenue and Forest Hill Road	Saturday PM	2.2
2	Richmond Avenue and Richmond Hill Road	Saturday PM	2.4

Notes:
8-hour standard (NAAQS) is 9 ppm.
Concentration includes a background concentration of 1.8 ppm.

As shown in **Table 11-5**, 2019 No-Build values are predicted to be well below the 8-hour CO standard of 9 ppm.

PM_{10} concentrations for the No Build condition were also determined using the methodology previously described. **Table 11-6** presents the future maximum predicted PM_{10} 24-hour

[9] The 2019 full-build condition was considered in the analysis of transportation (as explained in Chapter 1 and Chapter 10) and for the purposes of the mobile source air quality analysis. The traffic volumes in 2019 and overall mobile source emissions would be greater than in the 2017 full-build condition. Therefore, the analysis of the later full-build condition is more conservative.

concentrations, including background concentrations, at the analyzed intersections in 2019 No Build condition. The values shown are the highest predicted concentrations for the receptor locations.

Table 11-6
Maximum Predicted 24-Hour Average
PM_{10} No Build Concentrations ($\mu g/m^3$)

Receptor Site	Location	Concentration
1	Richmond Avenue and Forest Hill Road	67.8
2	Richmond Avenue and Richmond Hill Road	66.4

Notes:
NAAQS—24-hour average 150 $\mu g/m^3$.
Concentration includes a background concentration of 48.0 $\mu g/m^3$.

$PM_{2.5}$ concentrations for the No Build condition are not presented, since impacts are assessed on an incremental basis.

STATIONARY SOURCES

In the future without the proposed project, it is assumed that the uses currently on the project site would remain. The emissions from heating and hot water systems would be lower than with the proposed project, as the existing systems would continue to serve a much smaller use.

G. FUTURE WITH THE PROPOSED ACTIONS

MOBILE SOURCES

INTERSECTION ANALYSIS

CO concentrations for future conditions in the 2019 analysis year were predicted using the methodology previously described. **Table 11-7** shows the future maximum predicted 8-hour average CO concentrations at the intersection studied. (No 1-hour values are shown, since no exceedances of the NAAQS would occur and the *de minimis* criteria are only applicable to 8-hour concentrations; therefore, the 8-hour values are the most critical for impact assessment.) The values shown are the highest predicted concentrations. The results indicate that the proposed actions would not result in any violations of the 8-hour CO standard. In addition, the incremental increases in 8-hour average CO concentrations are very small, and consequently would not result in a violation of the CEQR *de minimis* CO criteria. Therefore, mobile source CO emissions the proposed actions would not result in a significant adverse impact on air quality.

Table 11-7
Maximum Predicted 8-Hour
CO Build Concentrations (ppm)

Analysis Site	Location	Time Period	No Build	Build	*De Minimis*
1	Richmond Avenue and Forest Hill Road	Saturday PM	2.2	2.2	3.4
2	Richmond Avenue and Richmond Hill Road	Saturday PM	2.4	2.4	3.3

Notes:
8-hour standard is 9 ppm.
Concentration includes a background concentration of 1.8 ppm.

PM_{10} concentrations for the Build condition were also determined using the methodology previously described. **Table 11-8** presents the future maximum predicted PM_{10} 24-hour concentrations, including background concentrations, at the analyzed intersections in 2019 Build condition. The values shown are the highest predicted concentrations for the receptor locations.

Using the methodology previously described, maximum predicted 24-hour and annual average $PM_{2.5}$ concentration increments were calculated so that they could be compared with the *de minimis* criteria that would determine the potential significance of any impacts from the proposed actions. Based on this analysis, the maximum predicted localized 24-hour average and neighborhood-scale annual average incremental $PM_{2.5}$ concentrations are presented in **Table 11-9** and **Table 11-10**, respectively. Note that $PM_{2.5}$ concentrations in the No Build condition are not presented, since impacts are assessed on an incremental basis.

Table 11-8
Maximum Predicted 24-Hour Average
PM_{10} Build Concentrations ($\mu g/m^3$)

Analysis Site	Location	No Build	Build
1	Richmond Avenue and Forest Hill Road	67.8	69.9
2	Richmond Avenue and Richmond Hill Road	66.4	68.5

Notes:
NAAQS—24-hour average 150 $\mu g/m^3$.
Concentration includes a background concentration of 48.0 $\mu g/m^3$.

Table 11-9
2019 Maximum Predicted 24-Hour Average
$PM_{2.5}$ Incremental Concentrations

Analysis Site	Location	Increment ($\mu g/m^3$)	*De Minimis* ($\mu g/m^3$)
1	Richmond Avenue and Forest Hill Road	0.7	6.9
2	Richmond Avenue and Richmond Hill Road	1.0	6.9

Note:
$PM_{2.5}$ *de minimis* criteria — 24-hour average, not to exceed more than half the difference between the background concentration and the 24-hour standard of 35 $\mu g/m^3$.

Table 11-10
2019 Maximum Predicted Annual Average
$PM_{2.5}$ Incremental Concentrations ($\mu g/m^3$)

Analysis Site	Location	Increment
1	Richmond Avenue and Forest Hill Road	0.040
2	Richmond Avenue and Richmond Hill Road	0.095

Note: $PM_{2.5}$ *de minimis* criteria—annual (neighborhood scale), 0.1 $\mu g/m^3$.

The results show that the annual and daily (24-hour) $PM_{2.5}$ increments are predicted to be below the *de minimis* criteria. Therefore, there would be no potential for significant adverse impacts on air quality from vehicle trips generated by the proposed actions.

PARKING GARAGE

Based on the methodology previously described, the maximum predicted CO and PM concentrations from the proposed parking facility were analyzed, assuming a near side sidewalk receptor on the same side of the street (3 feet) as the parking facility and a far side sidewalk receptor on the opposite side of the street (56 feet) from the parking facility.

The maximum predicted 8-hour average CO concentration of all the receptors modeled is 2.1 ppm. This value includes a predicted concentration of 0.05 ppm from emissions within the parking garage, on-street contribution of 0.2 ppm, and a background level of 1.8 ppm. The maximum predicted concentration is substantially below the applicable standard of 9 ppm and the *de minimis* CO criteria.

The maximum predicted 24-hour and annual average $PM_{2.5}$ increments are 0.44 $\mu g/m^3$ and 0.07 $\mu g/m^3$, respectively. The maximum predicted $PM_{2.5}$ increments are well below the respective $PM_{2.5}$ *de minimis* criteria of 6.9 $\mu g/m^3$ for the 24-hour average concentration and 0.3 $\mu g/m^3$ for the annual concentration. Therefore, the proposed parking garage would not result in any significant adverse air quality impacts.

STATIONARY SOURCES

HEATING AND HOT WATER SYSTEMS ANALYSIS

A screening analysis was conducted to evaluate the potential for impacts on air quality from emissions from heating and hot water systems for the proposed project. The analysis was conservatively based on the floor area of the entire Mall with the proposed project, i.e. the existing mall and proposed development floor area of 1,655,390 gsf. The heating and hot water systems was conservatively analyzed as exhausting from a single stack, at the rooftop of the lowest portion of the proposed development, at 41 feet above street level. The closest taller building would be beyond 400 feet, therefore a distance of 400 feet was used in the analysis, per *CEQR Technical Manual Guidance*. Based on the use of natural gas, and Figure 17-8 in the *CEQR Technical Manual Air Quality Appendix*, the minimum distance beyond which there would be no potential for significant air quality impact would be 306 feet. Since there are no buildings of similar or greater height within that distance, the proposed development would not result in any significant adverse air quality impacts from heating and hot water systems.

Additional screening analyses were conducted to evaluate the potential for project-on-project impacts on air quality from emissions associated with the proposed heating and hot water systems. These analyses were based on the floor area for each of the components, stack height at three feet above the proposed building height (in accordance with the *CEQR Technical Manual* guidance), the use of natural gas, and the distance to the closest taller proposed project use. Based on Figure 17-8 in the *CEQR Technical Manual Air Quality Appendix*, there would be no potential for a significant adverse project-on-project heating and hot-water system impact on air quality. The potential effect of the heating and hot water systems exhaust for the proposed uses on air quality at the existing mall was also considered. The parapets for the proposed uses would extend 6 to 28 feet above the height of the existing mall parapet. Based on the difference in the exhaust height and parapet height for the proposed uses and the rooftop of the existing mall, which may include fresh air intakes, there would be no potential for a significant adverse impact on air quality.

H. FUTURE WITH 2017 COMPLETION DATE

As detailed in Chapter 1, "Project Description," there is the possibility that Macy's would elect to postpone commencement of construction of its proposed 75,000-gsf enlargement, in which case the Macy's enlargement and a portion of the proposed structured parking garage would be expected to be complete by 2019, rather than by 2017. The conclusions of the stationary source heating and hot water systems analysis would be unaffected by the project completion date. The mobile source analysis was based on the traffic analysis for the 2019 Full-Build scenario. As explained in Chapter 10, Transportation, compared to the 2017 full-build condition, the 2019 full-build scenario is more conservative for the purposes of the transportation analysis. While the per vehicle mobile source emissions in 2019 would be minimally lower in 2019 than in 2017, the overall emissions in the 2019 full-build condition would be greater because traffic volumes would be greater. The time of project completion (2017 or 2019) would not affect the overall conclusions of the air quality assessment. ✷