Chapter 15: Greenhouse Gas Emissions and Climate Change

A. INTRODUCTION

This chapter evaluates the greenhouse gas (GHG) emissions that would be generated by the construction and operations which would result from the proposed project and its consistency with the city-wide GHG reduction goals, and evaluates the resilience of the buildings introduced by the proposed actions to climate conditions throughout the lifetime of the project.

As discussed in the 2014 *City Environmental Quality Review* (*CEQR) Technical Manual*, climate change is projected to have wide-ranging effects on the environment, including rising sea levels, increases in temperature, and changes in precipitation levels. Although this is occurring on a global scale, the environmental effects of climate change also are likely to be experienced at the local level. New York City's sustainable development policy, starting with PlaNYC, and continued and enhanced in OneNYC, established sustainability initiatives and goals for greatly reducing GHG emissions and for adapting to climate change in the City.

Per the *CEQR Technical Manual,* the citywide GHG reduction goal is currently the most appropriate standard by which to analyze a project under CEQR. The *CEQR Technical Manual* recommends that a GHG consistency assessment be undertaken for any project preparing an environmental impact statement expected to result in 350,000 square feet or more of development and other energy-intense projects. The proposed actions would result in approximately 1.8 million gross square feet (gsf) of developed floor area within the rezoning area, including parking garage space. Accordingly, a GHG consistency assessment is provided.

PRINCIPAL CONCLUSIONS

GREENHOUSE GAS EMISSIONS

The building energy use and vehicle use associated with the proposed project would result in up to approximately 16.5 thousand metric tons of carbon dioxide equivalent (CO_2e) emissions per year. Per the *CEQR Technical Manual* guidance, emissions from potential future development resulting from the proposed actions which are not under the applicant's operational control are discussed qualitatively.

The applicant and any potential developer of the projected future development site would be required, at a minimum, to achieve the energy efficiency requirements of New York City's building code. In 2016, as part of the implementation of strategies aimed at achieving the OneNYC GHG reduction goals, the City adopted a more stringent building energy code which substantially increased the energy efficiency required. Also in 2016, the City published a pathway to achieving the GHG reduction goals in the building sector. Should the measures identified in the City's pathway or other measures not yet implemented be adopted by the City in the future, they may apply to the proposed project or to the projected future development site. The proposed project and development on the projected future development site would implement any measures

required under such programs, as legally applicable. Therefore the proposed actions would support the goal identified in the *CEQR Technical Manual* of building efficient buildings.

The proposed actions also would support the other GHG reduction goals by virtue of the project's proximity to public transportation, commitment to construction air quality controls, and the fact that as a matter of course, construction in New York City uses recycled steel and includes cement replacements. All of these factors demonstrate that the proposed project supports the GHG reduction goal.

Therefore, based on the adherence to the City's energy efficiency requirements and by virtue of the project's location and nature, the proposed actions would be consistent with the City's emissions reduction goals, as defined in the *CEQR Technical Manual*.

RESILIENCE TO CLIMATE CHANGE

Most of the project area would remain outside of the one-percent annual chance flood area in the future. By the 2080s, the one-percent annual chance flood area could reach the northeast corner of the proposed development site, potentially affecting Proposed Building N, up to an elevation approximately 15.5 feet NAVD88, equivalent to approximately 2.5 feet depth at the West 135th Street sidewalk; and by the end of the century, up to approximately 17 feet NAVD88 at the proposed development site, potentially affecting Proposed Building NE with less than 1-foot flood depth at the West 135th Street sidewalk, and Proposed Building N at approximately 4 feet flood depth at the West 135th Street sidewalk. Residential units all would be located well above flood elevations out to 2100 and beyond.

The proposed project would not likely be affected by increasing flood elevations prior to the 2080s, or possibly later depending on future adjustments to end-of-century potential flood elevations estimates. Based on current estimates, existing and proposed residential units would all be located well above flood elevations out to 2100 and beyond. However, by the 2080s, without additional design measures, critical infrastructure lower than 17 feet NAVD88 located in the proposed new Buildings N and NE—which could include electrical and communications connections, elevators, fuel connections, boilers, water pumps, fire safety, emergency generators, and any other critical infrastructure if located below the above elevations—could be flooded in the event of a severe storm, similar to many residential buildings in the area. Non-critical uses such as sub-grade parking would also be flooded in such an event.

As noted above, the proposed project and any future development on the projected future development site would be constructed to meet the codes and any related resiliency requirements in effect at the time of construction. If determined to be necessary to supplement any flood-protection efforts undertaken by the City protect the proposed action's coastal area, enhancements such as the addition of temporary or built-in flood protection could be implemented in the future to further protect both existing and proposed uses on the proposed development site.

B. GREENHOUSE GAS EMISSIONS

POLLUTANTS OF CONCERN

GHGs are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere, and clouds. The general warming of the Earth's atmosphere

caused by this phenomenon is known as the "greenhouse effect." Water vapor, carbon dioxide (CO_2), nitrous oxide (N_2O), methane, and ozone are the primary GHGs in the Earth's atmosphere.

There are also a number of entirely anthropogenic GHGs in the atmosphere, such as halocarbons and other chlorine- and bromine-containing substances, which also damage the stratospheric ozone layer (and contribute to the "ozone hole"). Since these compounds are being replaced and phased out due to the 1987 Montreal Protocol, there is no need to address them in GHG assessments for most projects. Although ozone itself is a major GHG, it does not need to be assessed as such at the project level since it is a rapidly reacting chemical and efforts are ongoing to reduce ozone concentrations as a criteria pollutant (see Chapter 14, "Air Quality"). Similarly, water vapor is of great importance to global climate change, but is not directly of concern as an emitted pollutant since the negligible quantities emitted from anthropogenic sources are inconsequential.

CO_2 is the primary pollutant of concern from anthropogenic sources. Although not the GHG with the strongest effect per molecule, CO_2 is by far the most abundant and, therefore, the most influential GHG. CO_2 is emitted from any combustion process (both natural and anthropogenic); from some industrial processes such as the manufacture of cement, mineral production, metal production, and the use of petroleum-based products; from volcanic eruptions; and from the decay of organic matter. CO_2 is removed ("sequestered") from the lower atmosphere by natural processes such as photosynthesis and uptake by the oceans. CO_2 is included in any analysis of GHG emissions.

Methane and N_2O also play an important role since the removal processes for these compounds are limited and because they have a relatively high impact on global climate change as compared with an equal quantity of CO_2. Emissions of these compounds, therefore, are included in GHG emissions analyses when the potential for substantial emission of these gases exists.

The *CEQR Technical Manual* lists six GHGs that could potentially be included in the scope of a GHG analysis: CO_2, N_2O, methane, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). This analysis focuses mostly on CO_2, N_2O, and methane. There are no significant direct or indirect sources of HFCs, PFCs, or SF_6 associated with the proposed actions.

To present a complete inventory of all GHGs, component emissions are added together and presented as CO_2e emissions—a unit representing the quantity of each GHG weighted by its effectiveness using CO_2 as a reference. This is achieved by multiplying the quantity of each GHG emitted by a factor called global warming potential (GWP). GWPs account for the lifetime and the radiative forcing[1] of each chemical over a period of 100 years (e.g., CO_2 has a much shorter atmospheric lifetime than SF_6, and therefore has a much lower GWP). The GWPs for the main GHGs discussed here are presented in **Table 15-1**.

[1] *Radiative forcing* is a measure of the influence a gas has in altering the balance of incoming and outgoing energy in the Earth-atmosphere system and is an index of the importance of the gas as a GHG.

Table 15-1
Global Warming Potential (GWP) for Major GHGs

Greenhouse Gas	100-year Horizon GWP
Carbon Dioxide (CO_2)	1
Methane (CH_4)	21
Nitrous Oxide (N_2O)	310
Hydrofluorocarbons (HFCs)	140 to 11,700
Perfluorocarbons (PFCs)	6,500 to 9,200
Sulfur Hexafluoride (SF_6)	23,900

Note: The GWPs presented above are based on the Intergovernmental Panel on Climate Change's (IPCC) Second Assessment Report (SAR) to maintain consistency in GHG reporting. The IPCC has since published updated GWP values that reflect new information on atmospheric lifetimes of GHGs and an improved calculation of the radiative forcing of CO_2. In some instances, if combined emission factors were used from updated modeling tools, some slightly different GWP may have been used for this study. Since the emissions of GHGs other than CO_2 represent a very minor component of the emissions, these differences are negligible.

Source: 2014 *CEQR Technical Manual.*

POLICY, REGULATIONS, STANDARDS, AND BENCHMARKS FOR REDUCING GHG EMISSIONS

Because of the growing consensus that GHG emissions resulting from human activity have the potential to profoundly impact the Earth's climate, countries around the world have undertaken efforts to reduce emissions by implementing both global and local measures addressing energy consumption and production, land use, and other sectors. Although the U.S. has not ratified the international agreements that set emissions targets for GHGs, in December 2015, the U.S. signed the international Paris Agreement[2] that pledges deep cuts in emissions, with a stated goal of reducing annual emissions to a level that would be between 26 and 28 percent lower than 2005 emissions by 2025.[3] On June 1st, 2017, the President announced that "the United States will withdraw from the Paris Climate Accord."[4]

Regardless of the Paris Agreement, the U.S. Environmental Protection Agency (EPA) is required to regulate GHGs under the Clean Air Act and has begun preparing and implementing regulations. In coordination with the National Highway Traffic Safety Administration (NHTSA), EPA currently regulates GHG emissions from newly manufactured on-road vehicles. In addition, EPA regulates transportation fuels via the Renewable Fuel Standard program, which will phase in a requirement for the inclusion of renewable fuels increasing annually up to 36.0 billion gallons in 2023. In 2015, EPA also finalized rules to address GHG emissions from both new and existing power plants that would, for the first time, set national limits on the amount of carbon pollution that power plants can emit. The Clean Power Plan sets carbon pollution emission guidelines and

[2] Conference of the Parties, 21st Session. *Adoption of The Paris Agreement, decision -/CP.21*. Paris, December 12, 2015.

[3] United States of America. *Intended Nationally Determined Contributions (INDCs)* as submitted. March 31, 2015.

[4] Under the Agreement, countries are allowed to withdraw four years from the date the agreement entered into force—meaning the United States can officially withdraw on November 4, 2020. However, given the voluntary nature of the agreement, any action in the U.S. may or may not occur regardless of this status.

performance standards for existing, new, and modified and reconstructed electric utility generating units. In October 2017, EPA proposed to repeal the Clean Power Plan.

There are also regional and local efforts to reduce GHG emissions. In 2009, Governor Paterson issued Executive Order No. 24, establishing a goal of reducing GHG emissions in New York State by 80 percent by 2050, compared with 1990 levels, and creating a Climate Action Council tasked with preparing a climate action plan outlining the policies required to attain the GHG reduction goal; an interim draft plan has been published.[5] The State is now seeking to achieve some of the emission reduction goals via local and regional planning and projects through its Cleaner Greener Communities and Climate Smart Communities programs. The State also has adopted California's GHG vehicle standards, which are at least as strict as the federal standards.

The New York State Energy Plan outlines the State's energy goals and provides strategies and recommendations for meeting those goals. The latest version of the plan was published in June 2015. The new plan outlines a vision for transforming the state's energy sector that would result in increased energy efficiency (both demand and supply), increased carbon-free power production and cleaner transportation, in addition to achieving other goals not related to GHG emissions. The 2015 plan also establishes new targets: (1) reducing GHG emissions in New York State by 40 percent, compared with 1990 levels, by 2030; (2) providing 50 percent of electricity generation in the state from renewable sources by 2030; and (3) increasing building energy efficiency gains by 600 trillion British thermal units (Btu) by 2030.

New York State has also developed regulations to cap and reduce CO_2 emissions from power plants to meet its commitment to the Regional Greenhouse Gas Initiative (RGGI). Under the RGGI agreement, the governors of nine northeastern and Mid-Atlantic states have committed to regulate the amount of CO_2 that power plants are allowed to emit, gradually reducing annual emissions to half the 2009 levels by 2020, and reducing an additional 30 percent from 2020 to 2030. The RGGI states and Pennsylvania also have announced plans to reduce GHG emissions from transportation, through the use of biofuel, alternative fuel, and efficient vehicles.

Many local governments world-wide, including New York City, are participating in the Cities for Climate Protection campaign and have committed to adopting policies and implementing quantifiable measures to reduce local GHG emissions, improve air quality, and enhance urban livability and sustainability. New York City's long-term comprehensive plan for a sustainable and resilient New York City, which began in 2007 as PlaNYC 2030 and continues to evolve today as OneNYC, includes GHG emissions reduction goals, many specific initiatives that can result in emission reductions, and initiatives aimed at adapting to future climate change impacts. The goal to reduce citywide GHG emissions to 30 percent below 2005 levels by 2030 ("30 by 30") was codified by Local Law 22 of 2008, known as the New York City Climate Protection Act (the "GHG reduction goal").[6] The City also has announced a longer-term goal of reducing emissions to 80 percent below 2005 levels by 2050 ("80 by 50"), which was codified by Local Law 66 of 2014, and has published a study evaluating the potential for achieving that goal. More recently, as part of OneNYC, the City has announced a more aggressive goal for reducing emissions from building energy down to 30 percent below 2005 levels by 2025.

In December 2009, the New York City Council enacted four laws addressing energy efficiency in large new and existing buildings, in accordance with PlaNYC. The laws require owners of existing

[5] New York State Climate Action Council. *New York State Climate Action Plan Interim Report*. November 2010.

[6] Administrative Code of the City of New York, §24-803.

buildings larger than 50,000 square feet to conduct energy efficiency audits and retro-commissioning every 10 years, to optimize building energy efficiency, and to "benchmark" the building energy and water consumption annually, using an EPA online tool. By 2025, commercial buildings over 50,000 square feet will require lighting upgrades, including the installation of sensors and controls, more efficient light fixtures, and the installation of submeters, so that tenants can be provided with information on their electricity consumption. The legislation also creates a local New York City Energy Conservation Code, which along with the Energy Conservation Construction Code of New York State (as updated in 2016), requires equipment installed during a renovation to meet current efficiency standards.

To achieve the 80 by 50 goal, the City is convening Technical Working Groups to analyze the GHG reduction pathways from the building sector, power, transportation, and solid waste sectors to develop action plans for these sectors. The members of the Technical Working Groups will develop and recommend the data analysis, interim metrics and indicators, voluntary actions, and potential mandates to effectively achieve the City's emissions reduction goal. In 2016, the City published the building sector Technical Working Group report, which included commitments by the City to change the building energy code and take other measures aimed at substantially reducing GHG emissions.

As noted above, for certain projects subject to CEQR (e.g., projects with 350,000 gsf or more of development or other energy intense projects), an analysis of the project's contributions to GHG emissions is required to determine consistency with the City's reduction goal, which is currently the most appropriate standard by which to analyze a project under CEQR, and is therefore applied in this chapter.

A number of benchmarks for energy efficiency and green building design also have been developed (green building design considerations include factors such as material selection, which affects GHG emissions associated with materials extraction, production, delivery, and disposal). For example, the Leadership in Energy and Environmental Design (LEED) system is a benchmark for the design, construction, and operation of high-performance green buildings that includes energy efficiency components. Similarly, Envision is a voluntary system for benchmarking the performance and resiliency of physical infrastructure projects. EPA's Energy Star is a voluntary labeling program designed to identify and promote the construction of new energy efficient buildings, facilities, and homes and the purchase of energy-efficient appliances, heating and cooling systems, office equipment, lighting, home electronics, and building envelopes.

METHODOLOGY

Climate change is driven by the collective contributions of diverse individual sources of emissions to global atmospheric GHG concentrations. Identifying potential GHG emissions from a proposed action can help decision-makers identify practicable opportunities to reduce GHG emissions and ensure consistency with policies aimed at reducing overall emissions. While the increments of criteria pollutants and toxic air emissions are assessed in the context of health-based standards and local impacts, there are no established thresholds for assessing the significance of a project's contribution to climate change. As directed by the *CEQR Technical Manual*, this chapter presents the total GHG emissions potentially associated with the proposed project (the proposed development on the site controlled by the applicant, i.e., the proposed development site), evaluates the GHG emissions of the proposed actions overall qualitatively, and identifies measures that would be implemented and measures that are still under consideration to limit emissions.

Estimates of potential GHG emissions associated with the proposed project are based on the methodology presented in the *CEQR Technical Manual*. Estimates of emissions of GHGs from the proposed development have been quantified, including off-site emissions associated with use of electricity, on-site emissions from heat and hot water systems, emissions from vehicle use associated with the proposed development, and emissions that would result from construction. As per the guidance, analysis of building energy is based on the average carbon intensity of electricity in 2008, which will likely be lower in the 2026 build year and lower still in future years as the fraction of electricity generated from renewable sources continues to increase. Emissions from transportation conservatively apply the emission factors for the earlier 2023 build year, although the proposed project would not be fully developed by then and emissions would be lower due to the lower traffic generated. Vehicular emission factors also will continue to decrease in future years as vehicle engine efficiency increases and emissions standards continue to decrease, resulting in lower emissions in future years. Since the methodology does not account for future years and other changes described above, it also does not explicitly address potential changes in future consumption associated with climate change, such as increased electricity for cooling, or decreased on-site fuel for heating. Overall, this methodology results in conservatively high estimates of potential GHG emissions.

As detailed above, CO_2 is the primary pollutant of concern from anthropogenic emission sources and is accounted for in the analysis of emissions from all development projects. GHG emissions for gases other than CO_2 are included where practicable or in cases where they comprise a substantial portion of overall emissions. The various GHG emissions are added together and presented as metric tons of carbon dioxide equivalent (CO_2e) emissions per year (see "Pollutants of Concern," above).

BUILDING OPERATIONAL EMISSIONS

Estimates of emissions due to building electricity and fuel use were prepared using building carbon intensity by use type as detailed in the *CEQR Technical Manual*. Per *CEQR Technical Manual* guidance, the building carbon intensity data represents 2008 citywide averages by use type and not projections for the 2026 build year. Estimates of emissions due to parking facilities' electricity use were prepared using building carbon intensity data calculated from the 2014 local law 88 benchmark data for this use type,[7] representing a reasonable worst-case intensity for parking facilities (carbon intensity for parking is not available in the *CEQR Technical Manual*.) Future emissions are expected to be lower as efficiency and renewable energy use for grid-supplied electric power continue to increase with the objective of meeting State and City future GHG reduction goals.

Cogeneration is not under consideration for the proposed project. If cogeneration were to be included, it would likely result in higher GHG emissions and would need to be considered separately.

MOBILE SOURCE EMISSIONS

The number of annual weekday and Saturday vehicle trips by mode (cars, taxis, and trucks) that would be generated by the proposed project was calculated using the transportation planning assumptions developed for the analysis and presented in Chapter 13, "Transportation." The

[7] NYCMOS. 2015 LL84 Energy and Water Data Disclosure (Data for Calendar Year 2014). Latest version dated 12/8/15.

assumptions used in that calculation include average daily weekday and Saturday person trips and delivery trips by proposed use, the percentage of vehicle trips by mode, and the average vehicle occupancy. To calculate annual totals, the number of trips on Sundays was assumed to be the same as on Saturday. Travel distances shown in the *CEQR Technical Manual* (Table 18-6 and 18-7 and associated text) were used in the calculations of annual vehicle miles traveled by cars, taxis, and trucks. Table 18-8 of the *CEQR Technical Manual* was used to determine the percentage of vehicle miles traveled by road type, and the mobile GHG emissions calculator provided in the manual was used to estimate GHG emissions from all trips attributable to the proposed project.

Based on the latest fuel lifecycle model from Argonne National Laboratory,[8] emissions from producing and delivering fuel ("well-to-pump") are estimated to add an additional 25 percent to the GHG emissions from gasoline and 27 percent from diesel. Although upstream emissions (emissions associated with production, processing, and transportation) of all fuels can be substantial and are important to consider when comparing the emissions associated with the consumption of different fuels, fuel alternatives are not being considered for the proposed project, and as per the *CEQR Technical Manual* guidance, the well-to-pump emissions are not considered in the analysis. The assessment of tailpipe emissions only is in accordance with the *CEQR Technical Manual* guidance on assessing GHG emissions and the methodology used in developing the New York City GHG inventory, which is the basis of the GHG reduction goal.

The projected total annual vehicle miles traveled by roadway type, forming the basis for the GHG emissions calculations from mobile sources, are summarized in **Table 15-2**.

Table 15-2
Vehicle Miles Traveled per Year

Roadway Type	Passenger	Taxi	Truck
Local	594,676	110,488	361,754
Arterial	1,297,476	241,064	789,282
Interstate/Expressway	810,922	150,665	493,301
Total	**2,703,075**	**502,216**	**1,644,338**

CONSTRUCTION EMISSIONS

A description of construction activities is provided in Chapter 19, "Construction." Construction emissions include emissions from on-road trips, on-site non-road engines, and materials extraction, production, and transport.

The number of vehicle trips by mode (worker cars, delivery trucks) that would be generated by construction of the proposed project was calculated using the assumptions developed for the analysis and presented in Chapter 19, "Construction." The assumptions used in the calculation include average daily workers, the percentage of auto trips, and the average vehicle occupancy to develop annual vehicle miles traveled (VMT) associated with commuting workers. An average round-trip commute distance of 25.3 miles (based on the average trip to work distance for the New York Metropolitan Area)[9] for construction workers in the New York City Metropolitan Area was used. Similarly, the numbers of trucks (concrete trucks, dump trucks, and tractor trailers) for each

[8] Based on GREET1_2016 model from Argonne National Laboratory.
[9] NYSDOT. *2009 NHTS, New York State Add-On*. Key Tables. Table 3: Average Travel Day Person-Trip Length By Mode and Purpose, trip-to work distance for SOV in NYMTC 10-county area. 2011.

phase of construction activity were used to estimate truck VMT. Distances for truck deliveries were developed based on estimates of the origin and destination of materials for the proposed project. Table 18-8 of the *CEQR Technical Manual* was used to determine the percentage of vehicle miles traveled by road type and the most recent version of the EPA MOVES model was used to obtain an estimate of car and truck GHG emission factors used to produce the associated emissions attributable to the proposed actions.

The proposed project would result in construction worker travel of 0.3 million VMT. Additionally, the proposed project would result in construction truck trips totaling 1.5 million VMT. These data were used as the basis for the GHG emissions calculations from mobile sources, applying emission factors as described above for operational mobile source emissions.

On-site emissions from non-road construction engines have been estimated based on specific estimates of construction activity and fuel consumption data from EPA's NONROAD emissions model. A detailed schedule for the use of non-road construction engines was developed, as described in Chapter 19, "Construction." The detailed data, including the number, type, power rating, and hours of operation for all construction engines was coupled with fuel consumption rate data from EPA's NONROAD model to estimate total fuel consumption throughout the duration of the construction activities. Non-road construction engines are estimated to require approximately 356 thousand gallons of diesel equivalent throughout the duration of construction. The quantity of fuel was then multiplied by an emission factor of 10.30 kilograms CO_2e per gallon of diesel fuel.[10]

Upstream emissions related to the production of construction materials were estimated based on the expected quantity of iron or steel and cement. Although other materials will be used, cement and metals have the largest embodied energy and direct GHG emissions associated with their production, and substantial quantities would be used for the proposed project.

Construction of the proposed project is estimated to require 57,149 metric tons of cement. An emission factor of 0.928 metric tons of CO_2e per metric ton of cement produced was applied to estimate emissions associated with energy consumption and process emissions for cement production.[11] The precise origin of cement for the proposed project is unknown at this time.

Construction of the proposed project is estimated to require 39,825 metric tons of steel and other metals (e.g., structural, rebar, aluminum). An emission factor of 0.6 metric tons of CO_2e per metric ton of steel product produced was applied to estimate emissions associated with production energy consumption,[12] and 0.65 metric tons of CO_2e per metric ton of steel product produced for process emissions associated with steel production were applied.[13]

EMISSIONS FROM SOLID WASTE MANAGEMENT

The proposed actions would not fundamentally change the City's solid waste management system. Therefore, as per the *CEQR Technical Manual*, the GHG emissions from solid waste generation, transportation, treatment, and disposal are not quantified.

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[10] EPA. Emission Factors for Greenhouse Gas Inventories. 19 November 2015.
[11] The Portland Cement Association. Life Cycle Inventory of Portland Cement Manufacture. 2006.
[12] Arpad Horvath et al. Pavement Life-cycle Assessment Tool for Environmental and Economic Effects, Consortium on Green Design and Manufacturing. UC Berkeley. 2007.
[13] Based on 42.3 teragrams of CO_2e emitted and 65,460 thousand tons produced; USEPA. *Inventory of U.S. Climate Change and Sinks: 1990–2009*. April 15, 2011.

PROJECTED GHG EMISSIONS

A summary of total annual GHG emissions by emission source type and phase, and the total emissions from the proposed project, is presented below. Note that these results do not necessarily represent a net increase associated with the proposed actions; if buildings were to be constructed elsewhere to accommodate the same activity as the proposed actions, the emissions from the use of electricity, energy for heating and hot water, and vehicle use could be different than those of the proposed actions, depending on their location, access to transit, building type, and energy efficiency measures.

BUILDING OPERATIONAL EMISSIONS

The building floor area, emission intensity, and resulting GHG emissions from each of the uses are presented in detail in **Table 15-3**. Most of the emission are related to the residential use, since most of the proposed developed space would be residential.

Table 15-3
Annual Building Operational Emissions—Proposed Project, Full Build-Out

Proposed Use	Building Area (gsf)	GHG Intensity [1] (kg CO_2e / gsf / year)	Annual GHG Emissions (metric tons CO_2e)
Residential	1,430,258	6.59	9,425
Retail	135,500	9.43	1,278
Parking	192,601	1.24 [(2)]	239
Community Facility	15,055	9.43	142
		TOTAL	**11,084**

Notes: Totals may not sum due to rounding.
Per *CEQR Technical Manual* guidance, electricity emissions are representative of existing conditions in 2008 and not the future build year (2026). Future emissions are expected to be lower.
Representative emission intensity for existing buildings are higher than new and future construction meeting building code requirements.
Sources: 1. *CEQR Technical Manual*
2. AKRF, 2017, based on *Local Law 84 Benchmarking Data Disclosure* (for 2015 disclosure, 2014 data)

MOBILE SOURCE EMISSIONS

The mobile-source-related GHG emissions from the proposed project are presented in detail in **Table 15-4**. In addition to the direct emissions included in the analysis, an additional approximately 25 percent would be emitted upstream, associated with fuel extraction, production, and delivery.

Table 15-4
Annual Mobile Source Emissions—Proposed Project, Full Build-Out
(metric tons CO_2e)

Proposed Use	Passenger Vehicle	Taxi	Truck	Total
Residential	1,168	132	2,360	3,660
Retail	387	111	1,049	1,547
Community Facility	8	18	97	123
Total	**1,563**	**260**	**3,506**	**5,330**

Notes: This analysis conservatively applies the emission factors from the earlier 2023 build year to the trip generation projected for the full build-out in 2026, resulting in conservatively high emissions estimates.

CONSTRUCTION EMISSIONS

The estimated GHG emissions from construction of the proposed project are presented in **Table 15-5**.

Table 15-5
GHG Emissions from Construction—Proposed Project
(metric tons CO_2e)

	Total
Nonroad Construction Equipment	3,887
On-Road Vehicles	5,960
Construction Materials:	
Cement	49,613
Steel	53,034
Total	**112,493**

SUMMARY OF EMISSIONS

A summary of operational GHG emissions by source type is presented in **Table 15-6**. The operational emissions from building energy use include on-site emissions from fuel consumption as well as emissions associated with the production and delivery of the electricity to be used on-site. If new buildings were to be constructed elsewhere to accommodate the same number of units and space for other uses, the emissions from the use of electricity, energy for heating and hot water, and vehicle use would vary from those estimated for the proposed project, depending on their location, access to transit, building type, and energy efficiency measures. In addition, the total emissions associated with construction of the proposed project throughout the construction period, including both direct energy and emissions embedded in materials (extraction, production, and transport) would be approximately 112,493 metric tons CO_2e, equivalent to approximately 6 to 7 years of operational emissions. The proposed actions are not expected to fundamentally change the City's solid waste management system, and therefore emissions associated with solid waste are not presented.

Table 15-6
Summary of Annual GHG Emissions
(metric tons CO_2e)

Proposed Use	Building Operations	Mobile	Total
Residential	9,425	3,360	13,120
Indoor Parking	239	0	239
Retail	1,278	1,547	2,838
Community Facility	142	123	266
Total	**11,084**	**5,330**	**16,463**

Note: The mobile analysis conservatively applies the emission factors from the earlier 2023 build year to the trip generation projected for the full build-out in 2026, resulting in conservatively high emissions estimates.

ELEMENTS THAT WOULD REDUCE GHG EMISSIONS

In general, dense, mixed-use development with access to transit and existing roadways is consistent with sustainable land use planning and smart growth strategies to reduce the carbon footprint of new development. These features are discussed in this section, addressing the PlaNYC/OneNYC goals as outlined in the *CEQR Technical Manual*. Following the approach defined in the *CEQR Technical Manual*, the proposed actions would result in development that is consistent with the City's emissions reduction goal as implemented to date.

BUILD EFFICIENT BUILDINGS

The applicants and any developer who may redevelop the projected future development site would be required at a minimum to achieve the energy efficiency requirements of New York City's building code. In 2016, as part of the City's implementation of strategies aimed at achieving the OneNYC GHG reduction goals, the City adopted the 2016 New York City Energy Conservation Construction Code, which substantially increased the stringency of the building energy efficiency requirements and adopted the ASHRAE 90.1-2013 standard as a benchmark. In 2016, the City also published the findings of the Buildings Technical Working Group convened by the City to identify the pathway to achieving the GHG reduction goals in the building sector.[14] Should the measures identified by the Buildings Technical Working Group or other measures not yet implemented be adopted by the City in the future, they may apply to the proposed project or to the projected future development site, as would any changes to the building code adopted at a later date as applicable at the time of approval. The proposed project and any development in the projected future development site would implement any measures required under such programs as legally applicable. Therefore, the proposed actions would support the goal identified in the *CEQR Technical Manual* of building efficient buildings.

USE CLEAN POWER

The proposed project is likely to use natural gas, a lower carbon fuel, for the normal operation of the heat and hot water systems. However, the buildings would be able to utilize distillate fuel (the projected future development sites would be restricted to using natural gas for heat and hot water systems). No on-site renewable power is proposed. Fuel selection or the implementation of any other clean power for the projected future development sites is unknown.

TRANSIT-ORIENTED DEVELOPMENT AND SUSTAINABLE TRANSPORTATION

The proposed project and projected future development sites are located in an area heavily supported by many transit options, including existing bus and subway services immediately adjacent to the proposed development site and rezoning area. The current Community Board 10 Citi Bike expansion plan does not extend north of 130th Street. In addition, the proposed project would include multi-use paths throughout the site, and would reduce the requirement for accessory parking spaces normally applied through zoning requirements, thus further encouraging the use of public transportation.

[14] The City of New York. Technical Working Group Report: Transforming New York City Buildings for a Low-Carbon Future. 2016.

REDUCE CONSTRUCTION OPERATION EMISSIONS

Construction specifications would include an extensive diesel emissions reduction program, as described in detail in Chapter 19, "Construction," including diesel particle filters for large construction engines and other measures. These measures would reduce particulate matter emissions; while particulate matter is not included in the list of standard GHGs ("Kyoto gases"), recent studies have shown that black carbon—a constituent of particulate matter—may play an important role in climate change.

USE BUILDING MATERIALS WITH LOW CARBON INTENSITY

Recycled steel would most likely be used for most structural steel since the steel available in the region is mostly recycled. The proposed project intends to use recycled steel for 70 percent of its steel needs, and intends to divert 75 percent of its construction waste to be recycled. Some cement replacements such as fly ash and/or slag may also be used, and concrete content would be optimized to the extent feasible. The applicant is not proposing any other use of sustainable materials.

C. RESILIENCE TO CLIMATE CHANGE

The lifespan of residential buildings is 80 years or more. While mechanical, electrical, and plumbing equipment located within such buildings typically have a lifespan of 50 years, the location of equipment and connections does not generally change over time. The New York City Panel on Climate Change (NPCC) projected that sea levels are likely to increase by up to 10 inches by the 2020s, 30 inches by the 2050s, and 75 inches by 2100 under the "High Scenario."[15] The proposed development site is not located within the existing 1 percent annual-chance floodplain in the current flood hazard maps, which extends west of the Harlem River to approximately 400 feet east of the proposed development site; however, by the 2080s the 1 percent annual-chance floodplain could reach the northeast corner of the proposed development site. (Note that these flood areas and elevations are likely conservatively high, and may be revised in the future.)

Therefore, since the proposed development site would be partly located within the projected potential future (2080s and later) flood zone within the lifetime of the proposed project, the potential effects of global climate change on the proposed project are considered and measures that could be implemented as part of the project to improve its resilience to climate change are identified.

DEVELOPMENT OF POLICY TO IMPROVE CLIMATE CHANGE RESILIENCE

The New York State Sea Level Rise Task Force was created to assess potential impacts on the state's coastlines from rising seas and increased storm surge. The Task Force prepared a report of its findings and recommendations including protective and adaptive measures.[16] The recommendations are to provide more protective standards for coastal development, wetlands protection, shoreline armoring, and post-storm recovery; to implement adaptive measures for habitats; integrate climate change adaptation strategies into state environmental plans; and amend

[15] Note that the decadal projections represent 30-year averages, so the 2020s represents averages of 2010-2040, 2050s represents 2040-2070, and 2080s represents 2070-2100.

[16] New York State Sea Level Rise Task Force. *Report to the Legislature*. December 2010.

local and state regulations or statutes to respond to climate change. The Task Force also recommended the formal adoption of projections of sea-level rise.

In February 2017, the New York State Department of Environmental Conservation (DEC) adopted a rule (6 NYCRR Part 490) defining the existing projections for use. These projections provide the basis for State adaptation decisions and are available for use by all decision-makers. In New York City, the Climate Change Adaptation Task Force is tasked with fostering collaboration and cooperation between public and private organizations working to build the resilience of the city's critical infrastructure against rising seas, higher temperatures, and changing precipitation patterns. The Task Force is composed of over 57 City and State agencies, public authorities, and companies that operate, regulate, or maintain critical infrastructure in New York City. Led by the Mayor's Office of Resilience and Recovery, the Task Force works to assess risks, prioritize strategies, and examine how standards and regulations may need to be adjusted in response to a changing climate.

To assist the Task Force, the New York City Panel on Climate Change (NPCC) has prepared a set of climate change projections for the New York City region[17] which was subsequently updated,[18,19] and has suggested approaches to create an effective adaptation program for critical infrastructure. The NPCC includes leading climatologists, sea-level rise specialists, adaptation experts, and engineers, as well as representatives from the insurance and legal sectors. The climate change projections include a summary of baseline and projected climate conditions throughout the 21st century including heat waves and cold events, intense precipitation and droughts, sea-level rise, and coastal storm levels and frequency. NPCC has projected that sea levels are likely to increase by up to 30 inches by the 2050s and up to 75 inches by the end of the century (more detailed ranges and timescales are available). In general, the probability of increased sea levels is characterized as "extremely likely," but there is uncertainty regarding the probability of the various levels projected and timescale. Intense hurricanes are characterized as "more likely than not" to increase in intensity and/or frequency, and the likelihood of changes in other large storms ("Nor'easters") are characterized as unknown. Therefore, the projections for future coastal storm surge levels for New York City include only sea-level rise at this time, and do not account for changes in storm frequency.

The New York City Green Code Task Force also has recommended strategies for addressing climate change resilience in buildings and for improving storm water management.[20] Some of the recommendations call for further study, while others could serve as the basis for revisions to building code requirements. Notably, one recommendation was to amend the building code to expand floodplain requirements so as to include buildings in the projected future one-percent annual chance floodplain in the 2080s or later (the area that would potentially be flooded in a severe coastal storm with a probability of one percent of occurring in any given year) and to apply the standards up to future flood elevation levels.

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[17] New York City Panel on Climate Change. *Climate Change Adaptation in New York City: Building a Risk Management Response*. Annals of the New York Academy of Sciences, May 2010.

[18] New York City Panel on Climate Change. Climate Risk Information 2013: Observations, Climate Change Projections, and Maps. June 2013.

[19] New York City Panel on Climate Change. *New York City Panel on Climate Change 2015 Report*. Ann. N.Y. Acad. Sci. 1336. 2015.

[20] New York City Green Codes Task Force. *Recommendations to New York City Building Code*. February 2010.

While strategies and guidelines for addressing the effects of climate change are being developed on all levels of government, there are currently no specific requirements or accepted recommendations for development projects in New York City. As set forth in more detail in the *CEQR Technical Manual*, although significant climate change impacts are unlikely to occur in the analysis year for most projects, depending on a project's sensitivity, location, and useful life, it may be appropriate to provide a qualitative discussion of the potential effects of climate change on a proposed project in environmental review. Such a discussion should focus on early integration of climate change considerations into the project and may include proposals to increase climate resilience and adaptive management strategies to allow for uncertainties in environmental conditions resulting from climate change. Since the proposed project would include residential development located in the potential future (2080s and later) flood zone, climate change considerations and measures that would be implemented to increase climate resilience are discussed below. Additional climate change considerations may be incorporated into state and/or local laws prior to the development of the proposed project, and any development would be constructed to meet or exceed the codes in effect at the time of construction including any related resiliency requirements.

RESILIENCE OF THE PROPOSED PROJECT TO CLIMATE CHANGE

As detailed above, according to current flood hazard projections,[21] the current one-percent annual chance coastal storm surge could reach elevations of 11 feet NAVD88 and extends west of the Harlem River out to approximately 400 feet east of the proposed development site. Therefore, the New York City building code does not currently apply any resilience requirements at the proposed development site. In this evaluation, resilience considerations are accounted for throughout the lifetime of the use being evaluated. Residential buildings have a lifetime of 80 years or more, and therefore the furthest available projections (end of century) are considered here. According to the NPCC data cited above, by the 2050s, the one-percent annual chance flood levels could reach 30 inches higher due to sea-level rise (per NPCC "High" scenario), to approximately 13.5 feet NAVD88 immediately east and north of the proposed development site. By the 2080s the one-percent annual chance flood could reach the northeast corner of the proposed development site, potentially affecting Proposed Building N, up to an elevation approximately 15.5 feet NAVD88 (per NPCC "High" scenario), equivalent to approximately 2.5 feet depth at the West 135th Street sidewalk; and by the end of the century, up to approximately 17 feet NAVD88 at the proposed development site, potentially affecting Proposed Building NE with less than 1-foot flood depth at the West 135th Street sidewalk, and Building N at approximately 4 feet flood depth at the West 135th Street sidewalk.

Note that these flood areas and elevations are likely conservatively high, and may be revised in the future. On October 17, 2016, the Federal Emergency Management Agency (FEMA) and New York City Mayor De Blasio announced plans to revise the FEMA flood maps based on a 2015 New York City appeal of FEMA's flood risk calculations for New York City and the region. While revised flood maps have not yet been produced, the appeal generally identified potential reductions of 1.5 to 2.0 feet in the area of the proposed project. Therefore, it is possible that the revised FEMA current flood elevations would be lower, and the resulting future flood elevations, including sea-level rise, may also be lower than those presented here.

[21] FEMA. *Preliminary Flood Insurance Rate Map*. Panels 3604970083G and 3604970091G. Release Date: 1/30/2015.

New York City's initial resilience plan[22] did not yet identify an approach for protecting the proposed action's coastal area in its Phase 1 Initiatives.

The proposed project would not likely be affected by increasing flood elevations prior to the 2080s, or possibly later depending on future adjustments to end-of-century potential flood elevations estimates. Based on current estimates, existing and proposed residential units would all be located well above flood elevations out to 2100 and beyond. However, by the 2080s, without additional design measures, critical infrastructure lower than 17 feet NAVD88 located in the proposed new Buildings NE and N—which could include electrical and communications connections, elevators, fuel connections, boilers, water pumps, fire safety, emergency generators, and any other critical infrastructure if located below the above elevations—could be flooded in the event of a severe storm, similar to many residential buildings in the area. Non-critical uses such as sub-grade parking would also be flooded in such an event.

As noted above, the proposed project and any future development on the projected future development site would be constructed to meet the codes and any related resiliency requirements in effect at the time of construction. If determined to be necessary to supplement any flood-protection efforts undertaken by the City to protect the proposed action's coastal area, enhancements such as the addition of temporary or built-in flood protection could be implemented in the future to further protect both existing and proposed uses on the proposed development site. ✶

[22] The City of New York. *A Stronger, More Resilient New York*. June 11, 2013.