Chapter 14 : Greenhouse Gas Emissions and Climate Change

I. INTRODUCTION

As described in the *City Environmental Quality Review (CEQR) Technical Manual,* increased greenhouse gas (GHG) emissions are changing the global climate, which is predicted to lead to wide-ranging effects on the environment, including rising sea levels, increases in temperature, and changes in precipitation levels and intensity. Although this is occurring on a global scale, the environmental effects of climate change are also likely to be felt at the local level. New York City's long-term sustainability plan (*OneNYC, The Plan for a Strong and Just City*) built on initiatives included in the former *PlaNYC* and includes several initiatives to reduce GHG emissions and increase the City's resilience to the effects of climate change. This chapter provides an estimate of the GHG emissions that would be generated during the construction and operation of the Proposed Project and assesses the consistency of the Proposed Project with citywide GHG emissions reduction goals.

As described in Chapter 1, "Project Description," the Applicant is seeking a set of Proposed Actions in the form of discretionary approvals to include zoning map and text amendments, a large-scale general development (LSGD) special permit, a City Map Amendment to re-establish a portion of Beach 52nd Street south of Rockaway Beach Boulevard to reconnect with Rockaway Freeway, and public funding and/or financing from various City and New York State agencies and/or programs related to affordable housing development on the Project Site. The Project Site is situated in Queens Community District 14 (CD 14).The Proposed Actions would facilitate the Proposed Project to consist of an approximately 2,371,000 gross square feet (gsf) development on the Project Site, comprised of 11 buildings with approximately 2,200 income-restricted dwelling units (DUs), of which 1,927 DUs would be income-restricted up to 80% of Area Median Income (AMI), to include approximately 201 DUs set aside for Affordable Independent Residences for Seniors (AIRS) senior housing, with the remaining 273 DUs restricted to income levels not exceeding 130% of AMI. In addition to the residential DUs, the Proposed Project would include approximately 72,000 gsf of retail space, including a fitness center and a supermarket; approximately 77,000 gsf of community facility space, approximately 24,000 square feet (sf) of publicly-accessible open space, and approximately 973 accessory parking spaces.

As stated in the *CEQR Technical Manual*, a GHG assessment is typically conducted only for larger projects undergoing review in the form of an Environmental Impact Statement (EIS), since these projects have a greater potential to be inconsistent with the City's GHG emissions reduction goal to a degree considered significant. The *CEQR Technical Manual* further states that a GHG emissions and climate change assessment is appropriate for a project conducting an EIS and that would result in the development of 350,000 square feet (sf) or greater. Since the Proposed Project would result in an approximately 2,371,000 gsf mixed-use development, a GHG consistency assessment has been conducted. In addition, a qualitative discussion is provided of the potential effects of the Proposed Project on climate change.

II. PRINCIPAL CONCLUSIONS

The Proposed Project would not result in significant adverse impacts related to greenhouse gas as it would be consistent with the City's GHG emissions reduction goals, as defined in the *CEQR Technical Manual.* Furthermore, the Proposed Project would be consistent with policies regarding adaptation to climate change as identified in *OneNYC*.

The direct (building operation) energy use and indirect (motor vehicle) energy use associated with the Proposed Project would result in approximately 26,430 metric tons of carbon dioxide equivalent (CO_2e) emissions per year, including approximately 15,980 metric tons/year from building operations and approximately 10,450 metric tons/year from on-road motor vehicle emissions. GHG emissions related to the construction phase or the extraction or production of materials or fuels would not be a significant part of total project emissions and were therefore not quantified. Consistent with guidance in the *CEQR Technical Manual,* GHGs from solid waste management were not quantified since the Proposed Project would not fundamentally change the City's solid waste management system.

In addition, the Proposed Project would support the attainment of a 30% reduction in GHG emissions below 2005 levels by 2030 based on goals stated in the *CEQR Technical Manual*, including the promotion of transit-oriented development, generation of clean, renewable energy, construction of a resource- and energy-efficient building, and encouragement of sustainable transportation. The Proposed Project would be well-served by public transit including a subway station, several bus lines, and ferry service.

Since the Project Site is located within the 100-year coastal floodplain, the potential effects of global climate change have been considered and are presented in Chapter 2, "Land Use, Zoning, and Public Policy". That assessment considers the effects of climate change on rising sea levels, storm surge, and coastal flooding resulting from the Proposed Project. As detailed in Chapter 2, it was determined that the Proposed Project would support Policy 6.2 of the New York City Waterfront Revitalization Program (WRP).

III. GREENHOUSE GAS EMISSIONS

Pollutants of Concern

GHGs are those gaseous constituents of the atmosphere, both natural and manufactured, that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere, and clouds. This causes the general warming of the Earth's atmosphere, or the "greenhouse effect." Some GHGs, such as carbon dioxide (CO_2), occur naturally and are emitted into the atmosphere through natural processes and human activities. There are six internationally-recognized greenhouse gases regulated under the Kyoto Protocol (an international agreement adopted in 1997 that is linked to the United Nations Framework Convention on Climate Change): CO_2, nitrous oxide (N_2O), methane (CH_4), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). The *CEQR Technical Manual* identifies these gases as those that should potentially be included in the scope of an EIS.

To present a complete inventory of all GHGs, component emissions are added together and presented as carbon dioxide equivalent (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 of each chemical over a period of 100 years (e.g., CO_2 has a much shorter atmospheric lifetime than SF6, and therefore has a much lower GWP). The GWPs for the main GHGs are discussed here[1] and presented in **Table 14-1: Global Warming Potential for Primary Greenhouse Gases**.

Carbon Dioxide (CO_2)

Carbon dioxide (CO_2) enters the atmosphere via the combustion of fossil fuels (oil, natural gas, and coal), solid waste, trees, and wood products. It also results from other chemical reactions (e.g., manufacture of cement). CO_2 is removed from the atmosphere (or "sequestered") when it is absorbed as part of the

[1] Definitions are from the US Environmental Protection Agency: https://www.epa.gov/ghgemissions/overview-greenhouse-gases, accessed 11/10/16

biological carbon cycle. Although not the GHG with the strongest effect per molecule, CO_2 is by far the most abundant and, consequently, the most influential GHG.

Nitrous Oxide (N_2O)

Nitrous oxide (N_2O) is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste.

Methane (CH_4)

Methane (CH_4) is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste landfills.

Fluorinated Gases

Hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are synthetic, powerful greenhouse gases that are emitted from a variety of industrial processes. Fluorinated gases are sometimes used as substitutes for stratospheric, ozone-depleting substances (e.g., chlorofluorocarbons, hydro chlorofluorocarbons, and halons). These gases are typically emitted in smaller quantities, but because they are potent greenhouse gases, they are sometimes referred to as High Global Warming Potential gases ("High GWP gases").

Table 14-1: Global Warming Potential for Primary Greenhouse Gases

Greenhouse Gas	Common sources	Global Warming Potential (GWP)
Co_2 – Carbon Dioxide	Fossil fuel combustion, forest clearing, cement production	1
CH_4 – Methane	Landfills, production and distribution of natural gas a petroleum, anaerobic digestion, rice cultivation, fossil fuel combustion	21
N_2O – Nitrous Oxide	Fossil fuel combustion, fertilizers, nylon production	310
HFCs – Hydrofluorocarbons	Refrigeration gases, aluminum smelting, semiconductor manufacturing	140-11,700*
PFCs – Perfluorocarbons	Aluminum production, semiconductor manufacturing	6,500-9,200*
SF_6 – Sulfur Hexafluoride	Electrical transmissions and distribution systems, circuit breakers, magnesium production	23,900

Source: *2014 CEQR Technical Manual*

Note: Since the Second Assessment Report (SAR) was published in 1995, the IPCC has published updated GWP values in its Third Assessment Report (TAR) and Fourth Assessment Report (AR4) that reflect new information on atmospheric lifetimes of greenhouse gases and an improved calculation of the radiative forcing of CO_2. However, GWP values from the SAR are still used by international convention to maintain consistency in GHG reporting, including by the United States when reporting under the Union Nations Framework Convention on Climate Change.

* The GWP of HFCs and PFCs vary depending on the specific compound emitted. A full list of these GWPs is available in Table ES-1 of the U.S. Environmental Protection Agency's Inventory of Greenhouse Gas Emissions and Sinks: 1990-2008, available at: http://epa.gov/climatechange/emissions/usinventoryreportin.html.

IV. METHODOLOGY

Greenhouse Gas Emissions

New York City has determined the need to consider the effect of GHG emissions under *CEQR* for several reasons: (1) greenhouse gas emission levels may be directly affected by a project's effect on energy use; (2) the U.S. Supreme Court has upheld the determination that CO_2, one of the main greenhouse gases, is an air pollutant, subject to regulation as defined by the Clean Air Act; and (3) Local Law 22 of 2008 codified *PlaNYC's* Citywide GHG emissions reduction goal of 30% below 2005 levels by 2030 (the "GHG reduction goal"). In addition, the City has adopted a longer-term goal of reducing emissions to 80% below 2005 levels by 2050, which was codified by Local Law 66 of 2014. More recently, in *One City: Built to Last*, the City has announced a more aggressive goal for reducing emissions from building energy down to 30% below 2005 levels by 2025. As mentioned previously in accordance with the *CEQR Technical Manual*, the GHG consistency assessment generally focuses on proposed actions that would result in 350,000 sf or more of new development and other energy-intense projects. A project's GHG emissions may generally be assessed in two steps:

1. Estimate the emissions for the sources discussed below, and
2. Examine the project against qualitative goals identified in the *CEQR Technical Manual* for reducing GHG emissions.

The *CEQR Technical Manual* recommends that the project's emissions be estimated from the following emissions sources: operations emissions (direct and indirect); mobile source emissions (direct and indirect) and, when applicable, construction emissions and emissions from solid waste management. After the emissions are estimated, the source of GHG emissions are qualitatively examined against City-established goals for reducing GHG emissions.

Operational emissions and mobile source emissions were considered for this analysis. Pursuant to guidance in the *CEQR Technical Manual,* the GHG assessment is based on the total GHG emissions associated with the Proposed Actions, rather than the net change in GHG emissions between the With-Action and No-Action conditions.

Construction Emissions

A description of construction activities is provided in Chapter 18, "Construction." Consistent with *CEQR* practice, emissions associated with construction have not been estimated explicitly for the Proposed Project. Assessments of similar projects have shown that construction emissions (both direct and emissions embedded in the production of materials, including on-site construction equipment, delivery trucks, and upstream emissions from the production of steel, rebar, aluminum, and cement used for construction) are equivalent to the total operational emissions over approximately 5 to 10 years.[2] Construction emissions, based on the annual operational emissions estimated in **Table 14-3** over a five- to 10-year period, would range from approximately 77.1 million to 154.3 million kg CO_2e. Therefore, the construction phase would not be a significant part of total GHG emissions, and a quantification of construction-related emissions is not needed. Also, as presented in *CEQR* Chapter 17, "Air Quality", the Applicant would be required to implement several measures during the construction of the Proposed Project that would minimize pollutant emissions to the greatest extent practicable.

[2] Examples include GHG analyses prepared for the EISs for Riverside Center, the Domino Sugar Rezoning, and Western Rail Yard.

Emissions from Solid Waste Management

The Proposed Actions would not fundamentally change the City's solid waste management system. Therefore, pursuant to *CEQR Technical Manual* guidelines, an estimate of GHGs from solid waste management is not warranted.

Climate Change

Guidance in the *CEQR Technical Manual* indicates that, 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 the environmental review. Rising sea levels and increases in storm surge and coastal flooding are the most immediate threats in NYC for which site-specific conditions can be assessed, and an analysis of climate change may be warranted for projects located within 100- or 500-year flood zone. Based on the Federal Emergency Management Agency (FEMA) revised Preliminary Flood Insurance Rate Maps (FIRMs) issued January 2015, the Project Site is located within the 100- and 500-year flood zones and is also located in the NPCC 100- and 500-year projections for the 2020s and 2050s. Consequently, the Project Site is susceptible to storm surge and coastal flooding, and an assessment of climate change is warranted.

V. PROJECTED GHG EMISSIONS FROM THE PROPOSED ACTIONS

Building Operational Emissions

GHG emissions due to building operations would mainly result from energy use, including direct emissions from natural gas-fired on-site boilers. Energy use for the Proposed Project was estimated based on average energy consumption in NYC for each building type provided in Table 15-1 of the *CEQR Technical Manual*. Though the Proposed Project would include residential and commercial uses, a large residential building type was conservatively considered for purposes of this assessment. GHG emissions were estimated using Table 18-4 of the *CEQR Technical Manual* and presented in **Table 14-2: Projected Annual Energy Use** and **Table 14-3: Projected Annual Building Operational Emissions**.

Table 14-2: Projected Annual Energy Use

Building Type	Source Energy (Thousand Btu (MBtu/sq ft)) *	Square Feet	Total Energy Use (MBtu)
Commercial	0	0	0
Industrial	0	0	0
Institutional	0	0	0
Large Residential (>4 family)	126.7	2,289,000	300,405,700
Small Residential (1-4 family)	0	0	0
			300,405,700

Source: Table 15-1: Average Annual Whole-Building Energy Use in New York City, *2014 CEQR Technical Manual*

Table 14-3: Projected Annual Building Operational Emissions

Total Energy use (MBtu)	Natural Gas CO_2e Conversion Factor (kg CO_2e/MMBtu)**	GHG Generation (kg CO_2e)
300,405,700	53.196	**15,980,382**

***Source**: Table 18-4: CO_2e Conversion Factors ,*2014 CEQR Technical Manual*

The Proposed Project would generate approximately 15,980,382 kg or 15,980 metric tons of CO_2e annually for building operations.

Mobile Source Emissions

Estimates of GHG emissions due to mobile source trips generated by the Proposed Project were completed pursuant to guidance in the *CEQR Technical Manual,* GHG emissions due to mobile source activity associated with the Proposed Project were estimated based on:

- An estimate of the number of annual weekday and Saturday vehicle trips by mode (cars, taxis, and trucks) that would be generated by the Proposed Project calculated using the transportation planning assumptions presented in Chapter 12, "Transportation." The assumptions used in the calculations include average daily weekday and Saturday person trips and delivery trips by 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 the number of trips on Saturdays.
- Estimates of the average one-way trip distances travelled by cars and taxis in Tables 18-6 and 18-7 of the *CEQR Technical Manual* were used to estimate the vehicle miles traveled (VMT) by cars and taxis with the Proposed Project. Consistent with guidance in the *CEQR Technical Manual*, the average truck trip length was assumed to be 38 miles. Table 18-8 of the *CEQR Technical Manual* was used to determine the percentage of vehicle miles traveled by road type.
- The projected annual VMT with the Proposed Actions, which formed the basis for the GHG emissions estimates from mobile sources, are summarized in **Table 14-4: Proposed Actions' Annual Vehicle Miles Traveled**.
- The "mobile GHG emissions calculator" appended to Chapter 18 of the *CEQR Technical Manual* was then used to estimate the GHG emissions from car, taxi, and truck travel generated by the Proposed Actions.

As shown in **Table 14-5: Annual Mobile Source Emissions,** it is estimated that approximately 10,450 metric tons/year of CO_2e emissions would be generated from mobile sources resulting from the Proposed Project in the 2034 analysis year.

Table 14-4: Proposed Actions' Annual Vehicle Miles Traveled (miles per year)

Use	Passenger Vehicles	Taxis	Trucks	Total
Residential	11,508,640	1,155,996	1,095,920	13,760,556
Retail	1,800,620	582,253	217,360	2,600,233
Community Facility (Medical Office)	6,811,800	1,745,420	305,140	8,862,360
Recreational Open Space	50,520	0	0	50,520
Total Increase in VMT	**20,171,580**	**3,483,669**	**1,618,420**	**25,273,669**

Table 14-5: Annual Mobile Source Emissions for 2034

Carbon Dioxide Equivalent (CO_2e) Emissions (metric tons/year)				
Road Type	**Passenger Vehicles**	**Taxis**	**Trucks**	**Total**
Local	2,862.85	444.02	1,168.17	4,475.04
Arterial	2,943.66	455.00	1,056.76	4,455.42
Interstate/Expressway	1,014.11	154.06	351.41	1,519.58
Total	**6,820.62**	**1,053.08**	**2,576.34**	**10,450.04**

Summary

A summary of the GHG emissions that would be generated with the Proposed Project by source type is presented in **Table 14-6: Summary of Proposed Project's Annual GHG Emissions, 2034**. Note that if the 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 could equal or exceed those estimated for the Proposed Project, depending on their location, access to transit, building type, and energy efficiency measures. As described in the "Methodology," section above, construction emissions were not modeled explicitly, but are estimated to be equivalent to approximately 5 to 10 years of operational emissions, including both direct energy and emissions embedded in materials (extraction, production, and transport). Since the Proposed Project would not fundamentally change the City's solid waste management system, an estimate of emissions associated with solid waste management are not presented.

Table 14-6: Summary of Proposed Project's Annual GHG Emissions, 2034

Source	CO_2e Emissions (metric tons/ year)
Building Operations	15,980
Mobile	10,450
Total	**26,430**

The Proposed Project would result in total annual GHG emissions of approximately 26,430 metric tons/year of CO_2e from building operations and mobile sources. This level of emissions would not represent a significant adverse impact related to GHG emissions.

VI. CONSISTENCY WITH THE GHG REDUCTION GOAL

As indicated in the *CEQR Technical Manual*, the assessment of the consistency with the City GHG reduction goal should answer the following question: Is the project consistent with the goal of reducing GHG emissions, specifically the attainment of the City's established GHG reduction goal of reducing citywide GHG emissions by 30% below 2005 levels by 2030. The *CEQR Technical Manual* identifies four major goals that should be considered when determining whether a proposed project would support the attainment of a 30% reduction in GHG emissions below 2005 levels by 2030:

- Is the proposed project a transit-oriented development;
- Would the proposed project generate clean, renewable power through the replacement of inefficient power plants with state-of-the-art technology and expanding the use of clean distributed generation;
- Would the proposed project result in the construction of new resources- and energy-efficient buildings (including the use of sustainable construction materials and practices) and improve the efficiency of existing buildings; and
- Would the proposed project encourage sustainable transportation through improving public transit, improving the efficiency of private vehicles, and decreasing the carbon intensity of fuels?

The Proposed Actions are consistent with these goals in that:

- The Project Site is well-served by public transit. Nearby public transit access includes the Q22 (Rockaway Beach Boulevard – Beach Channel Drive) bus route, and the QM17 (Far Rockaway – Midtown) express but route. The closest Q22 stop to the Project Site is located at the intersection of Beach Channel Drive and Beach 51st Street, and the closest Q17 stop to the Project Site is located at the intersection of Beach Channel Drive and Beach 54th Street (one block west of the Project Site), which is also a Q22 bus stop. Elevated tracks of the MTA-New York City Transit (NYCT) Rockaway (A train) Line run along Rockaway Freeway, with subway stops at Beach 44th Street (approximately five blocks east of the Project Site) and Beach 60th Street (approximately four blocks west of the Project Site). Additionally, the NYC Ferry Service operated by Hornblower on the Rockaway Route stops just one block west of the Project Site at Beach Channel Drive and Beach 54th Street and provides access to the ferry landing located at Beach Channel Drive and Beach 108th Street. The Rockaway ferry route is a new key connection between the Rockaways and Sunset Park Brooklyn, and Lower Manhattan.
- Utilization of energy-efficient package terminal air conditioning (PTAC) units for residential units would reduce GHG emissions related to space heating. GHG emissions from fossil fuel-fired burners to heat residential units would be avoided.
- The Proposed Actions would utilize the existing urban infrastructure, which through *CEQR* analyses has been determined to possess the capacity to manage growth.
- The Proposed Actions would not substantially involve energy-intensive uses such as data centers or web hosting facilities, nor would they remove a source of energy generation.

Consequently, the Proposed Actions would support the attainment of a 30% reduction in GHG emissions below 2005 levels by 2030 and is consistent with City policy concerning the reduction of GHG emissions and climate change.

VII. RESILIENCE TO CLIMATE CHANGE

As described in Chapter 1, "Project Description," based on a review of the Preliminary Flood Insurance Rate Maps (FIRM) for New York City dated 1/30/2015, which are issued by the Federal Emergency Management Agency (FEMA) and considered the best available flood hazard data, the Project Site is located in a flood hazard Zone AE (Elevation 10) on the Federal Emergency Management Agency (FEMA) 2015 Preliminary Flood Insurance Rate Map (FIRM), indicating an area of moderate to high flood hazard with an annual probability of flooding 1 percent or greater. The 1-percent annual chance flood is also referred to as the base flood or 100-year flood.

Since the Proposed Project would be constructed and operated within a 100-year coastal floodplain, the potential effects of global climate change have been considered. As stated in the *CEQR Technical Manual*, an analysis of consistency with Policy 6.2 of the WRP may provide sufficient information to assess the potential effects of sea level rise, storm surge, and coastal sea flooding. Policy 6.2 of the WRP states that consideration of the latest New York City projections of climate change and sea level rise (as published by the NPCC, or any successor thereof) should be integrated into the planning and design of projects in the City's Coastal Zone.

WRP Policy 6.2 requires waterfront developments reviewed under CEQR to:

- Consider potential risks related to coastal flooding to features specific to the project, including, but not limited to, critical electrical and mechanical systems, residential living areas, and public access areas;
- Minimize losses from flooding and erosion by employing non-structural and structural management measures appropriate to the condition and site, the use of the property to be protected, and the surrounding area; * Integrate consideration of the latest New York City projections of climate change and sea level rise into the planning and design of projects in the City's Coastal Zone;
- Incorporate design techniques in projects that address the potential risks identified and/or that enhance the capacity to incorporate adaptive techniques in the future. Climate resilience techniques should aim to protect lives, minimize damage to systems and natural resources, prevent loss of property, and, if practical, promote economic growth and provide additional benefits, such as provision of public space and intertidal habitat;
- Provide a qualitative analysis of potential adverse impacts on existing resources (including ecological systems, public access, visual quality, water-dependent uses, infrastructure, and adjacent properties) as a result of the anticipated effects of climate change;
- Projects that involve construction of new structures directly in the water or at the water line should be designed to protect inland structures and uses from flooding and storm surge when appropriate and practicable;
- As appropriate and to the extent practicable:
    - Promote the greening of the waterfront with a variety of plant material for aesthetic and ecological benefit;
    - Use water- and salt-tolerant plantings in areas subject to flooding and salt spray;
    - Maximize water-absorption functions of planted areas;
    - Preserve and enhance natural shoreline edges;

- Design shoreline edges that foster a rich marine habitat; and o Design sites that anticipate the effects of climate change, such as sea level rise and storm surges.

As detailed in Chapter 2, “Land Use, Zoning, and Public Policy,” the Proposed Project would support Policy 6.2 of the WRP. Since coastal floodplains are influenced by astronomic tide and meteorological forces and not by fluvial (river) flooding, they are not affected by the placement of obstructions within the floodplain. Consequently, construction and operation of the Proposed Project would not exacerbate future projected flooding conditions.

Based on these considerations, the Proposed Project would not result in significant adverse climate change impacts.