Chapter 16: Greenhouse Gas Emissions and Climate Change

A. INTRODUCTION

This chapter evaluates the Proposed Actions' potential to result in greenhouse gas (GHG) emissions and their consistency with citywide GHG reduction goals. The 2020 *City Environmental Quality Review* (*CEQR) Technical Manual* recognizes that 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 are also 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.

In accordance with CEQR guidance, 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 conducted for any project conducting an environmental impact statement (EIS) and that would be expected to result in 350,000 square feet (sf) or more of development and/or consist of other energy-intense projects. The Proposed Actions would result in approximately 2.1 million sf of developed floor area on projected development sites under the With Action condition. Accordingly, a GHG consistency assessment was performed for the Proposed Actions.

PRINCIPAL CONCLUSIONS

The assessment of GHG emissions estimates that the building energy and vehicle use associated with the Proposed Actions would result in up to approximately 24 thousand metric tons of carbon dioxide equivalent (CO_2e) emissions per year. It also found that the Proposed Actions are consistent with the applicable citywide GHG emissions reduction and climate change goals, and that there would be no significant adverse GHG emission or climate change impacts.

The Proposed Actions involve zoning changes that would affect privately owned properties. Decisions regarding construction and building design for those sites, which would affect energy use and GHG emissions, would be made by the property developers in accordance with the City's building code requirements in effect at the time. The City is addressing citywide building energy efficiency and other GHG-related design questions through its ongoing long-term GHG policy development and implementation process.

The Proposed Actions would support other GHG goals by virtue of its density and location in an area well-served by transit, its proximity to the Downtown Manhattan and Lower Manhattan Central Business Districts, and through requirements to utilize natural gas in new developments (i.e., natural gas would be required to address the air quality [E] Designations). As compared to the No Action condition, the Proposed Actions would provide opportunities for increased residential density, including affordable housing, and space for new jobs in an area with very good

transit access. These changes could potentially result in less GHG emissions associated with auto use and suburban sprawl, and can also serve to lessen the pressure of rising rents in the area by increasing the supply of housing, including a substantial amount of affordable housing. Therefore, the Proposed Actions would align with the City's emissions reduction goals, as defined in the *CEQR Technical Manual*.

Regarding resilience to potential climate conditions, the City's long-term process for addressing coastal flooding risk in New York City may ultimately include large-scale projects providing coastal protection. The resilience of new development under the Proposed Actions, as described in greater detail in the Waterfront Revitalization Program (WRP) consistency assessment statement (see **Appendix B**), would be required to to meet the City's resiliency requirements of the City's Building Code through strategies such as elevating vulnerable uses within a building based on future projections of sea level rise and dry or wet flood-proofing. Therefore, the Proposed Actions would not adversely impact other resources (including ecological systems, public access, visual quality, water-dependent uses, infrastructure, and adjacent properties) due to climate change.

B. GREENHOUSE GAS EMISSIONS

POLLUTANTS OF CONCERN

GHGs are the 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. This phenomenon causes the general warming of the Earth's atmosphere, or 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 also 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 15, "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 in a variety of ways: 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 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, NF_3, 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 16-1**.

Table 16-1
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 CO2. 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 CO2 represent a very minor component of the emissions, these differences are negligible.

Source: 2020 *CEQR Technical Manual*.

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

Because of the growing consensus that human activity resulting in GHG emissions has the potential to profoundly impact the Earth's climate, countries around the world have undertaken efforts to reduce emissions by implementing both local and global 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

[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.

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

reducing emissions to between 26 and 28 percent lower than 2005 levels by 2025[3] to be implemented via existing laws and regulations with executive authority of the President of the United States. On June 1, 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 2022. 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 performance standards for existing, new, and modified and reconstructed electric utility generating units. On February 9, 2016, the Supreme Court stayed implementation of the Clean Power Plan pending judicial review. In October 2017, EPA proposed to repeal the Clean Power Plan and issued the Affordable Clean Energy rule June 19, 2019, replacing the Clean Power Plan. The Affordable Clean Energy rule establishes revised emissions reduction measures accepted as best technology and focusing on energy efficiency improvements in place of direct emissions reduction measures.

There are also local and regional efforts to reduce GHG emissions. In 2009, Governor Paterson issued Executive Order No. 24, which established a goal of reducing GHG emissions in New York State by 80 percent, compared with 1990 levels, by 2050, and created 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 has also 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.

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[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.

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

In 2019, New York State enacted the Climate Leadership and Community Protection Act to achieve the GHG reductions goals established in the New York State Energy Plan as well as establishing a new long-term goal to reduce statewide GHG by 100 percent, compared with 1990 levels by 2050. The legislation charges New York State Climate Action Council with establishing statewide GHG emission limits and agency regulations to reduce emissions, increase investments in renewable energy sources, and ensure that significant portions of investments are made in disadvantaged communities. Pursuant to these requirements, the Climate Action Council will prepare and approve a scoping plan outlining recommendations for attaining the GHG emission limits and reduction goals. A final scoping plan is anticipated to be approved by 2022.

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. The RGGI states and Pennsylvania have also announced plans to reduce GHG emissions from transportation, through the use of biofuel, alternative fuel, and efficient vehicles.

Many local governments worldwide, including New York City's, 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 as *PlaNYC* 2030 in 2007, 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 and is known as the New York City Climate Protection Act (the "GHG reduction goal").[6] The City has also 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 and achieving net-zero citywide GHG emissions by 2050.

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 buildings larger than 50,000 sf 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 sf will also 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 2020), requires equipment installed during a renovation to meet current efficiency standards.

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

To achieve the GHG reduction goals, 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 to building energy code and take other measures aimed at substantially reducing GHG emissions.

In May 2019, the New York City Council enacted Local Law 97 of 2019—the Climate Mobilization Act. For most buildings that exceed 25,000 gross square feet (gsf) (excluding electricity/steam generation facilities, rent-regulated accommodations, places of public worship, and City-owned properties), the City has established annual building emission limits beginning in 2024 and would require the owner of a covered building to submit annual reports demonstrating the building is in compliance with the current GHG emission limits. For buildings not covered under the GHG emissions limits, owners may either demonstrate compliance with the current limits or implement specified energy conservation measures where applicable.

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 projects' 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 have also been developed. 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, the Enterprise Green Communities (EGC) Program, a voluntary program for sustainable development of affordable housing, may be applied for some sites under the Proposed Actions. 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. Nonetheless, prudent planning dictates that all sectors address GHG emissions by identifying GHG sources and practicable means to reduce them. Therefore, this chapter assesses the total GHG emissions potentially associated with the Proposed Actions and identifies measures that would be implemented and measures that are still under consideration to limit emissions. Note that this differs from most other technical areas in that it does not account for the increment between the condition with and without the Proposed Actions. The reason for this different approach is that to account for the incremental emissions only would require speculation regarding where people may live in the future without the Proposed Actions if

residential units are not built at this location, what energy use and efficiency might be like for those alternatives and other related considerations, and similar assumptions regarding commercial and other uses. The focus is therefore on the total emissions associated with the uses, and on the effect of measures to reduce those emissions.

The potential GHG emissions associated with all projected development sites under the With Action condition have been estimated, including off-site emissions associated with electricity use, on-site emissions from heat and hot water systems, and emissions from vehicle use associated with the projected development. GHG emissions that would result from construction and solid-waste-related emissions are discussed qualitatively.

As per the guidance, analysis of building energy is based on the average citywide carbon intensity of buildings by use type in 2008. The carbon intensity of electricity is currently substantially lower than it was in 2008, and will likely be even lower in the 2031 analysis year and lower still in future years, as the fraction of electricity generated from renewable sources continues to increase as part of the City's goal for 100 percent renewable electricity. In addition, the City has introduced carbon intensity limits for most buildings over 25,000 sf that would reduce GHG emissions over time and result in much lower carbon intensities than in 2008.

Vehicular emission factors will also continue to decrease in future years as vehicle engine efficiency increases and emissions standards continue to decrease, resulting in lower emissions in future years. Emissions from transportation from development components completed earlier than 2031 would therefore have a higher intensity, but would be lower overall since the full level of activity would not occur until full build-out occurs. Overall, the emissions presented for the 2031 analysis year are conservatively high as compared with earlier years and subsequent operational 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. Furthermore, since detailed design information is not yet available, emissions reduction measures, described later in this chapter, are also not included in the quantified emissions. Overall, this analysis results in conservatively high estimates of potential GHG emissions.

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 CO_2e emissions per year (see "Pollutants of Concern," above).

The following sections describe the methodology used for quantifying GHG emissions associated with the development anticipated under the Proposed Actions.

BUILDING OPERATIONAL EMISSIONS

Estimates of emissions from 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 analysis year (2031). The intensity factors were multiplied by the building floor areas (gsf) by use type. Future emissions are expected to be lower as efficiency and renewable energy use continue to increase with the objective of meeting state and City GHG reduction goals.

MOBILE SOURCE EMISSIONS

The number of annual weekday and Saturday vehicle trips by mode (cars, taxis, and trucks) that would be generated by each land use was calculated using the transportation planning assumptions developed for the analysis and presented in Chapter 14, "Transportation." The assumptions used in the calculation include average daily weekday and Saturday person trips and delivery trips per dwelling unit, the percentage of vehicle trips by mode, and the average vehicle occupancy, and were applied to the number of dwelling units and floor areas (gsf) described above. To calculate annual totals, the number of trips on Sundays was assumed to be the same as on Saturday. Travel distances shown in Table 18-5 and 18-6 and associated text of the *CEQR Technical Manual* were used in the calculations of annual vehicle miles traveled by cars, taxis, and trucks. Table 18-7 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 with the manual was used to obtain estimate GHG emissions from car, taxi, and truck trips.

Based on the latest fuel lifecycle model from Argonne National Laboratory,[7] emissions from producing and delivering fuel ("well-to-pump") are estimated to add an additional 24 percent to the GHG emissions from gasoline and 22 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 Actions, 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 annual vehicle miles traveled associated with each use type, forming the basis for the GHG emissions calculations from mobile sources, are summarized in **Table 16-2**.

Table 16-2
Vehicle Miles Traveled per Year—RWCDS

Use Type	Passenger	Taxi	Truck
Residential	1,918,463	309,464	1,254,537
Office	660,710	17,814	516,583
Local Retail	2,869,112	184,898	442,367
Destination Retail	273,656	62,505	75,793
Supermarket	118,119	91,345	121,976
Community Facility (Medical Office)	17,238	19,996	47,737
Community Facility (Arts & Cultural)	43,622	0	35,839
Total	**5,900,920**	**686,023**	**2,494,831**

CONSTRUCTION EMISSIONS

A description of construction activities is provided in Chapter 20, "Construction." Consistent with CEQR practice, emissions associated with construction have not been estimated explicitly for the Proposed Actions, but analyses 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,

[7] Based on GREET1_2021 model from Argonne National Laboratory.

and cement used for construction) are equivalent to the total operational emissions over approximately 5 to 10 years.

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.

PROJECTED GHG EMISSIONS

The building floor area, emission intensity, and resulting GHG emissions from the projected development sites' potential land uses are presented in detail in **Table 16-3**. The mobile-source-related GHG emissions from all potential uses are presented in detail in **Table 16-4**.

Table 16-3
Annual Building Operational Emissions—RWCDS

Source Use	Building Area (gsf)	GHG Intensity (kg CO_2e/gsf/yr)	Annual GHG Emissions (metric tons CO_2e)
Residential	1,832,891	6.59	12,079
Office	160,765	9.43	1,516
Local Retail	121,885	9.43	1,149
Destination Retail	21,348	9.43	201
Supermarket	33,608	9.43	317
Community Facility (Medical Office)	11,868	11.42	136
Community Facility (Arts & Cultural)	8,910	11.42	102
		Total	**15,500**

Notes: Totals may not sum due to rounding.
Per *CEQR Technical Manual* guidance, electricity emissions are representative of existing conditions in 2012 and not the analysis year (2031). Future emissions are expected to be lower.
Representative emission intensity for existing buildings are higher than new and future construction, and do not include the specific energy efficiency measures.
Sources: 2020 *CEQR Technical Manual.*

Table 16-4
Annual Mobile Source Emissions—RWCDS
(metric tons CO_2e, 2031)

Use	Passenger Vehicle	Taxi	Truck	Total
Residential	1,001	145	2,595	3,741
Office	345	8	1,069	1,422
Local Retail	1,497	87	915	2,498
Destination Retail	143	29	157	329
Supermarket	62	43	252	357
Community Facility (Medical Office)	9	9	99	117
Community Facility (Arts & Cultural)	23	0	74	97
Total	**3,079**	**321**	**5,161**	**8,560**

In addition to the direct mobile-source emissions included in the analysis, an additional approximately 24 percent of emissions associated with fuel extraction, production, and delivery would be emitted upstream.

A summary of GHG emissions by source type is presented in **Table 16-5**. Note that if new buildings were to be constructed elsewhere to accommodate the same number of units and space for other uses (e.g., outside of New York City or in areas not as well served by transit or with

lower density), 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 Actions, depending on 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). 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 16-5
Summary of Annual GHG Emissions—RWCDS
(metric tons CO_2e)

Use	Building Operations	Mobile	*Total*
Residential	12,079	3,741	15,820
Office	1,516	1,422	2,938
Local Retail	1,149	2,498	3,648
Destination Retail	201	329	530
Supermarket	317	357	674
Community Facility (Medical Office)	136	117	253
Community Facility (Arts & Cultural)	102	97	199
Total	**15,500**	**8,560**	**24,060**

CONSISTENCY WITH THE CITYWIDE GHG REDUCTION GOALS

This section discusses the consistency of the Proposed Actions with the Citywide GHG reduction goals as defined in the *CEQR Technical Manual*. Since the Proposed Actions would not result in development under ongoing control of the City, specific decisions regarding construction and building design, which would affect energy use and GHG emissions, cannot be affected by the City within the scope of the Proposed Actions and would be made by developers under the building code requirements in effect at the time of development.

As part of its ongoing long-term GHG policy development and implementation process, the City has introduced citywide building energy efficiency requirements and limits on GHG emissions that would apply to the majority of existing and new buildings. However, some of the sites may require further specific energy efficiency measures beyond the code requirements if developers apply for U.S. Department of Housing and Urban Development (HUD) funding (described below). These sites would meet certain sustainable design requirements which would, among other benefits, result in lower GHG emissions—these features would be specified and required through the disposition and development contracts or other legally binding agreement between the City and the developer(s).

BUILD EFFICIENT BUILDINGS

For most of the sites, promotion of the GHG reduction goal through improved efficiency of site-specific building systems and similar measures cannot be achieved within the scope of the Proposed Actions since sites would be developed as a result of the Proposed Actions but would not otherwise be controlled by the City. In general, pursuing denser development, one of the objectives of the rezoning, would result in overall increased energy efficiency.

Some of the sites may require additional measures if developers apply for construction funding through the New York City Department of Housing Preservation and Development (HPD). These

sites would be developed under HPD's affordable housing requirements, including certification under the enterprise green communities (EGC) program per the HPD EGC Overlay. The EGC program certification for new buildings would require the implementation of a design aimed at reducing energy consumption and GHG emissions as compared with buildings designed to meet but not exceed the building code requirements; the program is currently designed to achieve a minimum of 15 percent reduction in energy expenditure relative to the requirements of the building code in effect at the time.

The EGC criteria also include mandatory and optional measures that would indirectly reduce GHG emissions such as water conservation.

USE CLEAN POWER

While details are not known at this time, it is likely, given the market and current common practice that buildings developed under the Proposed Actions would produce heat and hot water using natural gas-fired systems. Some sites would be required to use natural gas due to (E) Designations related to air quality (see Chapter 15, "Air Quality"). Natural gas has lower carbon content per unit of energy than other fuels, and thus reduces GHG emissions.

TRANSIT-ORIENTED DEVELOPMENT AND SUSTAINABLE TRANSPORTATION

The Project Area would be supported by many transit options. These include the Nos. 5 and 6 subway lines along Lafayette Street, the N/R/Q/W subway lines along Broadway, the A/C/E subway lines along Sixth Avenue, the No. 1 subway line along Varick Street, the 5/6/N/R/Q/W/J/Z subway lines located at the Canal Street Station, the 6/B/D/F/M subway lines located at the Broadway-Lafayette Station, and local and express buses throughout the Project Area. The Project Area also includes several Citi Bike stations, conventional bicycle paths, and protected bicycle paths throughout the Project Area.

REDUCE CONSTRUCTION OPERATION EMISSIONS

Promotion of the GHG reduction goal through construction specifications cannot be achieved within the scope of the Proposed Actions since sites would be developed as a result of the Proposed Actions, but would not otherwise be controlled by the City.

USE BUILDING MATERIALS WITH LOW CARBON INTENSITY

Promotion of the GHG reduction goal through design specifications cannot be achieved within the scope of the Proposed Actions since sites would be developed as a result of the Proposed Actions, but would not otherwise be controlled by the City. However, some of the sites may require additional measures if developers apply for HUD funding through HPD. In such cases, the sites would be developed under the HPD affordable housing requirements, including certification under the EGC program per the HPD EGC Overlay, which includes some requirements and additional options for the use of materials with low carbon intensity within the points-based system.

C. RESILIENCE TO CLIMATE CHANGE

Since portions of the Project Area are within current and future flood hazard zones, the potential effects of global climate change on the Proposed Actions have been considered.

Standards for analysis of the effects of climate change on a proposed project are still being developed and have not yet been defined in CEQR. However, the WRP[8] addresses climate change and sea-level rise. The WRP requires consideration of climate change and sea-level rise in planning and design of development within the defined Coastal Zone Boundary (a substantial portion of the Project Area is within that zone). As set forth in more detail in the *CEQR Technical Manual*, the provisions of the WRP are applied by the New York City Department of City Planning (DCP) and other City agencies when conducting environmental review. The Proposed Actions' consistency with WRP policies is described in Chapter 2, "Land Use, Zoning, and Public Policy," and **Appendix B**.

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.[9] The recommendations are to provide more protective standards for coastal development, wetlands protection, shoreline armoring, and post-storm recovery; implement adaptive measures for habitats; integrate climate change adaptation strategies into state environmental plans; and amend 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.

The New York State Climate Action Plan Interim Report identified a number of policy options and actions that could increase the climate change resilience of natural systems, the built environment, and key economic sectors—focusing on agriculture, vulnerable coastal zones, ecosystems, water resources, energy infrastructure, public health, telecommunications and information infrastructure, and transportation.[10] New York State's Community Risk and Resiliency Act (CRRA)[11] requires that applicants for certain state programs demonstrate that they have taken into account future physical climate risks from storm surges, sea-level rise and flooding, and required the New York State Department of Environmental Conservation (DEC) to establish official state sea-level rise projections by January 1, 2016. In February 2017, DEC adopted a revised draft rule (Part 490) defining the existing projections for use. These projections provide the basis for state decisions on climate change adaptation strategies and are available for use by all decision makers. CRRA applies to specific state permitting, funding and regulatory decisions, including smart growth assessments; funding for wastewater treatment plants; siting of hazardous waste facilities; design and construction of petroleum and chemical bulk storage facilities; oil and gas drilling, and state acquisition of open space. DEC published draft implementation guidance on June 20, 2018, addressing sea level rise and increased precipitation. For non-tidal areas, DEC recommends that applicants adjust designs to account for peak flows under future conditions by multiplying relevant peak flow parameters currently used in hydraulic analysis (e.g., Q50), by a factor of 1.2 (i.e., increasing capacity by 20 percent).

In New York City, the Climate Change Adaptation Task Force is tasked with securing the City's critical infrastructure against rising seas, higher temperatures, and fluctuating water supplies

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[8] City of New York Department of City Planning. *The New York City Waterfront Revitalization Program*. October 30, 2013. Approved by NY State Department of State, February 3, 2016.

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

[10] NYSERDA. *New York State Climate Action Plan Interim Report*. November, 2010.

[11] *Community Risk and Resiliency Act.* Chapter 355, NY Laws of 2014. April 9, 2013. Signed September 22, 2014.

projected to result from climate change. The Task Force is composed of over 35 New York City and State agencies, public authorities, and companies that operate, regulate, or maintain critical infrastructure in New York City. The approaches suggested for the City to create a citywide adaptation program include ways 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,[12] which was subsequently updated,[13] 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 previously published 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 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 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 1-in-100 annual probability ("100-year") 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 has also recommended strategies for addressing climate change resilience in buildings and for improving storm water management.[14] 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 require new developments within the projected future "100-year" floodplain (the area that would potentially be flooded in a severe coastal storm with a probability of 1-in-100 of occurring in any given year) to meet the same standards as buildings in the current 100-year flood hazard zone.

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. However, the recently approved revisions to the WRP require consideration of climate change and sea-level rise in planning and design of waterfront development. As set forth in more detail in the *CEQR Technical Manual*, the provisions of the WRP are applied by city agencies when conducting environmental review.

RESILIENCE OF THE PROPOSED PROJECT TO CLIMATE CHANGE

Regarding the impact of the Proposed Actions on resilience in the area and on other environmental effects as they may be affected by climate change, the Proposed Actions would include

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[12] 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.

[13] New York City Panel on Climate Change. *New York City Panel on Climate Change 2019 Report*. Ann. N.Y. Acad. Sci. 1439. 2019.

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

development within the floodplain, and therefore considerations identified in WRP Policy 6.2 such as providing protection to avoid coastal erosion, protecting other properties, and other design considerations for waterfront areas, were assessed.

In the existing condition, the projected flooding potential associated with a storm that has a probability of 1 in 100 of occurring in any given year ("100-year" storm) would extend beyond the southwestern portion of the Project Area—areas south of Spring Street and west of Greene Street. This would potentially affect only six projected development sites (Projected Development Sites 5, 6, 7, 20, 22, and 23) located within the Project Area. In the near future, as early as the 2050s, the potential flood hazard area would extend farther inland affecting additional areas—extending north to Spring Street and west to Lafayette Street. In the longer term, the area would potentially expand inland as far north as Prince Street and as far west as Baxter Street under the NPCC "High" scenario.

The current potential 100-year flood elevations in the Project Area are 10 feet North American Vertical Datum of 1988 (NAVD88). With sea-level rise this could potentially increase by 75 inches to approximately 16 and 17 feet NAVD88 by the end of the century under the NPCC "High" scenario.

New York City is aware of the potential current and future flooding potential in the Lower Manhattan area, and is considering long-term solutions. The City's long-term process for addressing coastal flooding risk in New York City may ultimately include large-scale projects providing coastal protection.[15] The City is actively pursuing projects in some areas of the City, which are likely to provide protection for severe storm surge at least out to the 2050s, and possibly later, based on the above NPCC projections. Since most sites would be developed as a result of the Proposed Actions, but would not otherwise be controlled by the City, and because implementing specific resilience measures for each site prior to design while considering local street and utility elevations and the effect on existing buildings is not practicable, addressing resilience for those sites through the Proposed Actions is not practicable. Resilience for the Project Area will be addressed in the future as part of the resilience process for the City overall. However, some of the sites may be subject to future discretionary city approvals, and would need to account for future sea-level rise projections. Any residential units at these sites should be above 17 feet NAVD88. Other uses and critical infrastructure such as generators, pumps, fuel storage, electrical and communications connections should be above 17 feet NAVD88 or otherwise sealed or protected. If solutions up to this elevation for specific components prove to be impracticable, the City could also consider protection up to 15 feet NAVD88, which would account for the upper end of NPCC's "Middle Range" scenario.

Stormwater management improvements (e.g., bioswales, greenstreets, ongoing separation of combined sewer overflows [CSO] and stormwater discharges) implemented irrespective of the Proposed Actions throughout the Project Area would improve street drainage during rain events, further reducing the risks of flood damage associated with local flooding (e.g., inland flooding due to short-term, high-intensity rain events coupled with inadequate drainage). The Proposed Actions would also not adversely affect other resources (including ecological systems, public access, visual quality, water-dependent uses, infrastructure, and adjacent properties) due to climate change. ✷

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