Chapter 16: Greenhouse Gas Emissions and Climate Change

A. INTRODUCTION

There is general consensus in the scientific community that the global climate is changing as a result of increased concentrations of greenhouse gases (GHGs) in the atmosphere. GHGs are those gaseous constituents of the atmosphere, from both natural and anthropogenic (i.e., resulting from the influence of human beings) emission sources, that absorb infrared radiation (heat) emitted from the earth's surface, the atmosphere, and clouds. This property causes the general warming of the earth's atmosphere, or the "greenhouse effect."

As discussed in the 2012 *CEQR Technical Manual*, climate change could 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 felt at the local level. Through PlaNYC, the City has established sustainability initiatives and goals for both greatly reducing GHG emissions and adapting to climate change in the City. The goal to reduce citywide GHG emissions 30 percent below 2005 levels by 2030 was codified by Local Law 22 of 2008, known as the New York City Climate Protection Act (the "GHG reduction goal"). See §24-803 of the Administrative Code of the City of New York. Per the 2012 *CEQR Technical Manual*, the City's citywide GHG reduction goal is currently the most appropriate standard by which to analyze a project under CEQR. The City is also engaged in several initiatives related to assessing potential local impacts of global climate change and developing strategies to make existing and proposed infrastructure and development more resilient to potential effects of climate change.

This chapter discusses the projected GHG emissions from the proposed project and the reasonable worst-case development scenario (RWCDS). To achieve the Leadership in Energy and Environmental Design (LEED®) rating by the United State Green Building Council (USGBC), as described in Chapter 13, "Energy" and in more detail in this chapter, a range of sustainable design and energy efficiency measures that would reduce GHG emissions would be considered. Those measures are discussed in this chapter in the context of the GHG reduction goal. Planned improvements, which would increase the resilience of the project to current weather conditions and to ~~some of the~~ potential effects of climate change through the 2050s, are described. Also described are additional strategies for protecting the project infrastructure, which would be implemented if needed based on future regulations and guidance, as well as future efforts that the City may undertake on a larger scale to make coastal areas more resilient to longer-term increases in sea levels, for which projections have not yet been updated.

PRINCIPAL CONCLUSIONS

As discussed in the following sections, the building energy use and vehicle use associated with the full build-out of the proposed project would result in approximately 150,000 metric tons of carbon dioxide equivalent (CO_2e) emissions per year. The RWCDS, which includes the potential future development on Lot B, would result in approximately 161,000 metric tons of CO_2e emissions from building energy consumption and vehicle use. The overall RWCDS emissions

are lower than those presented in Technical Memorandum #4 (TM4), despite the increase in the floor area proposed for development, due to the expected improvement in vehicle efficiency from 2022, the final build year analyzed in TM4; and 2032, the anticipated year of proposed project completion.

The proximity of the proposed development to public transportation, its mixed-use nature, and dense design are all factors that contribute to the energy efficiency. To meet the requirements of LEED® certification, the energy cost reduction requirements of Local Law 86 of 2005, and to comply with the regulations of the Special Willets Point District, specific measures would be incorporated into the proposed project design, which would decrease the potential GHG emissions and further the GHG reduction goal.

As additional detailed local climate change projections become available and are adopted into the City's infrastructure design criteria, such criteria would be incorporated into the development program. In addition, an engineering study would be prepared prior to commencement of construction that would assess the feasibility of implementing strategies to improve resilience to climate change impacts into the design of the development program, in light of the most current climate change projections. Based on that engineering study, practicable strategies to improve resilience to climate change would be implemented.

B. SUMMARY OF FINDINGS, 2008 FGEIS AND SUBSEQUENT TECHNICAL MEMORANDA

The 2008 FGEIS did not include an analysis of GHG emissions, as the analysis was not required under CEQR at the time. The 2008 FGEIS did, however, address the potential effects of climate change, in Chapter 14, "Water and Sewer Infrastructure," as well as in Chapter 29, "Response to Comments on the DGEIS." Accounting for the 2010 revisions of the *CEQR Technical Manual*, which included guidance on addressing GHG emissions, TM4 included Appendix E, which disclosed the GHG emissions from the full build-out of the Updated Plan, No Convention Center Scenario, and the anticipated development on Lots B and D. The TM4 Appendix also discussed measures to reduce GHG emissions and measures to make the project more resilient to the potential effects of sea level rise.

C. GHG EMISSIONS

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

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 which set emissions targets for GHGs, in a step toward the development of national climate change regulation, the U.S. has committed to reducing emissions to 17 percent lower than 2005 levels by 2020 and to 83 percent lower than 2005 levels by 2050 (pending legislation) via the Copenhagen Accord.[1] Without legislation focused on this goal, the U.S. Environmental Protection Agency (USEPA) is required to regulate GHGs under the Clean Air Act (CAA), and has begun preparing regulations addressing newly manufactured vehicles and permitted large stationary sources. In addition, the

[1] Todd Stern, U.S. Special Envoy for Climate Change, letter to Mr. Yvo de Boer, UNFCCC, January 28, 2010.

American Recovery and Reinvestment Act of 2009 (ARRA, "economic stimulus package") funded actions and research that can lead to reduced GHG emissions, and the Energy Independence and Security Act of 2007 includes provisions for increasing the production of clean renewable fuels, increasing the efficiency of products, buildings, and vehicles, and for promoting research on GHG capture and storage options.

U.S. Department of Transportation (USDOT) and USEPA have also established GHG emission standards and more stringent combined corporate average fuel economy (CAFE) standards for vehicles. These regulations will all serve to reduce vehicular GHG emissions over time.

There are also regional, state, 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 by 80 percent, compared to 1990 levels, by 2050, and creating a Climate Action Council tasked with preparing a climate action plan outlining the policies required to attain the GHG reduction goal (that effort is currently under way[1]). The 2009 New York State Energy Plan[2] outlines the state's energy goals and provides strategies and recommendations for meeting those goals. The state's goals include:

- Implementing programs to reduce electricity use by 15 percent below 2015 forecasts;
- Updating the energy code and enacting product efficiency standards;
- Reducing vehicle miles traveled by expanding alternative transportation options; and
- Implementing programs to increase the proportion of electricity generated from renewable resources to 30 percent of electricity demand by 2015.

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 10 Northeast and Mid-Atlantic states have committed to regulate the amount of CO_2 that power plants are allowed to emit. The regional emissions cap for power plants will be held constant through 2014, and then gradually reduced to 10 percent below the initial cap through 2018. 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, 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 sustainability program, PlaNYC 2030, includes GHG emissions reduction goals, specific initiatives that can result in emission reductions and initiatives targeted at adaptation to climate change impacts. For certain projects subject to CEQR, an analysis of the project's GHG emissions and an assessment of the project's consistency with the City's citywide emission reduction goal are required.

In 2005, the New York City Council enacted one of the nation's first green building laws (Local Law 86 of 2005). Local Law 86 of 2005 requires new buildings, additions, and substantial building reconstruction work in capital projects that receive city funds to be built in accordance with the rigorous standards of the Leadership in Energy and Environmental Design (LEED®) green building rating systems developed by the U.S. Green Building Council (USGBC). It also

[1] http://www.dec.ny.gov/energy/80930.html

[2] New York State, 2009 New York State Energy Plan, December 2009.

requires that most of this work, as well as larger lighting, boiler, HVAC controls, and plumbing upgrade work, be designed to reduce the use of both energy and potable water well beyond that required by the current NYC building code.

In December 2009, the New York City Council enacted four laws addressing energy efficiency in new and existing buildings, in accordance with PlaNYC. The laws require owners of existing buildings larger than 50,000 square feet to conduct energy efficiency audits every 10 years, to optimize building energy efficiency, and to "benchmark" the building energy and water consumption annually, using a USEPA online tool. By 2025, commercial buildings over 50,000 square feet will also require lighting upgrades, including the installation of sensors and controls, more efficient light fixtures, and the installation of sub-meters, so that tenants can be provided with information on their electricity consumption. The legislation also created a New York City Energy Code, which along with the New York State Energy Conservation Code (as revised in 2010), requires equipment installed during a renovation to meet energy efficiency standards.

A number of voluntary rating systems for energy efficiency and green building design have also been developed. For example, LEED® system is a benchmark for the design, construction, and operation of high performance green buildings that includes energy efficiency components. It is noteworthy that the proposed project would seek certification under LEED®, as described in more detail in Chapter 13, "Energy," and subsequent sections of this chapter.

Another voluntary rating system is USEPA's *Energy Star*—a 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

Although the contribution of any single project to global climate change is infinitesimal, the combined GHG emissions from all human activity are believed to have a severe adverse impact on global climate. 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 presents an estimate of the total GHG emissions that would be generated with the proposed project and the RWCDS and identifies the measures that would be implemented and measures that are under consideration to limit the emissions from the proposed project.

The analysis of GHG emissions that would be generated by the proposed project and the RWCDS is based on the methodology presented in the *CEQR Technical Manual*. Emissions of GHGs from the proposed project and the RWCDS have been quantified, including off-site emissions associated with use of electricity on-site, on-site emissions from heat and hot water systems, and emissions from vehicle use attributable to the proposed project and RWCDS. GHG emissions that would result from construction of the proposed project are discussed as well.

It should be noted that the analysis conservatively overestimates the net increase in GHG emissions, as it takes no credit for existing emissions at the project site, or emissions that would be generated if the uses that would be accommodated by the proposed project were to be developed elsewhere. For example, without the development of the District, the demand for residential space would be met elsewhere, generating similar demand for heating, hot water, electricity, and transportation, potentially without the energy efficient building design that would be implemented with the proposed

project. The analysis also does not account for the potential reduction in vehicle miles traveled (VMT) associated with the proposed retail at Willets West, which would provide opportunities for commerce closer to the surrounding community than currently available.

Carbon dioxide (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, consistent with the New York City annual inventory.[1] CO_2e is a sum that includes the quantity of each GHG weighted by a factor of its effectiveness as a GHG 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). The GWP accounts for the lifetime and the radiative forcing of each gas 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 are presented in **Table 16-1**.[2]

Table 16-1
Global Warming Potential (GWP) for Major GHGs

Compound	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
Sources: IPCC, Climate Change 1995—The Science of Climate Change: Contribution of Working Group I to the Second Assessment of the Intergovernmental Panel on Climate Change, 1996.	

BUILDING OPERATIONAL EMISSIONS

Emissions due to energy use were developed using carbon intensity factors by building type presented in Table 18-3 of the *CEQR Technical Manual* and the floor area by use. The residential building carbon intensity factor was used to calculate the CO_2 emissions associated with the residential floor area, the institutional building carbon intensity factor was used to calculate the CO_2 emissions associated with the school and community facility floor area, and the commercial building carbon intensity factor was used for all other uses.

MOBILE SOURCE EMISSIONS

The number of annual weekday and weekend vehicle trips by mode (cars, taxis, and trucks) that would be generated by the proposed project and RWCDS was calculated for each analysis year (2018, 2028, and 2032) using the transportation planning assumptions discussed in Chapter 15, "Transportation." The assumptions used in the calculation include average daily weekday and

[1] City of New York, *Inventory of New York City Greenhouse Gas Emissions*, December 2012, by Jonathan Dickinson, Jamil Khan, Douglas Price, Steven A. Caputo, Jr., and Sergej Mahnovski. Mayor's Office of Long-Term Planning and Sustainability, New York, 2012.

[2] Following standard protocol for greenhouse gas inventories, and consistent with New York City's GHG inventory, the GWP factors from IPCC's Second Assessment Report (1996) are used. These GWP factors are specified for use for national GHG inventories under the Kyoto Protocol.

weekend person trips and delivery trips by proposed use (residential, office, retail, etc.), the percentage of vehicle trips by mode, and the average vehicle occupancy. Travel distances shown in Table 18-4 of the *CEQR Technical Manual* were used in the calculations of annual vehicle miles traveled by cars. The average one way taxi trip distance of 7.88 miles was obtained from Table 18-5 of the *CEQR Technical Manual*. The average truck trip was assumed to be 38 miles, as per the *CEQR Technical Manual*. Table 18-6 was used to determine the percentage of vehicle miles traveled by road type and the mobile GHG emissions calculator was used to obtain the total estimated mobile source GHG emissions attributable to the proposed project.

EPA estimates that the well-to-pump GHG emissions of gasoline and diesel are approximately 22 percent of the tailpipe emissions.[1] 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, they are not considered in the analysis of the proposed project. Accounting for tailpipe emissions but not well-to-pump emissions is in accordance with the *CEQR Technical Manual* guidance 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, which form the basis for the GHG emissions calculations from mobile sources, are presented in **Table 16-2**.

CONSTRUCTION EMISSIONS

Emissions associated with construction of the proposed project and RWCDS have not been estimated explicitly. GHG emissions from building construction (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 typically in the range of the total emissions from the operation of the project over approximately 5 to 10 years. As the proposed project would also involve remedial work and construction of new infrastructure, the overall GHG emissions during construction would likely be greater.

EMISSIONS FROM SOLID WASTE MANAGEMENT

As discussed in Chapter 12, "Solid Waste and Sanitation," the proposed project 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. Space for storage and collection of recyclables (including paper, corrugated cardboard, glass, plastic, and metals) will be provided.

PROJECTED GHG EMISSIONS WITH THE PROPOSED PROJECT

A summary of GHG emissions by emission source type, along with total annual emissions from the proposed project and the RWCDS is presented in **Table 16-3**. Note that much of these emissions would be associated with similar activity outside of the proposed project area. For

[1] Environmental Protection Agency, *MOVES2004 Energy and Emission Inputs*, Draft Report, EPA420-P-05-003, March 2005.

Table 16-2
Annual Vehicle Miles Traveled (miles per year)

Use	Project Area	2018—Phase 1A			2028—Phase 1B (Cumulative w/Phase 1A)			2032—Phase 2 (Cumulative w/Phases 1A and 1B)		
		Car	Taxi	Truck	Car	Taxi	Truck	Car	Taxi	Truck
Retail	WW	35,178,541	4,986,180	4,114,323	35,178,541	4,986,180	4,114,323	35,178,541	4,986,180	4,114,323
Retail	SWPD	529,639	0	108,881	24,778,254	2,280,160	3,284,589	31,896,835	2,546,430	4,536,725
Hotel	SWPD	1,200,850	579,349	110,838	2,942,083	1,419,405	271,554	4,202,975	2,027,721	387,934
Residential	SWPD	0	0	0	10,285,276	438,439	1,678,559	24,164,204	1,030,066	3,943,602
School	SWPD	0	0	0	140,009	0	174,294	328,267	0	406,948
Community Facility	SWPD	0	0	0	107,553	8,149	94,221	645,320	48,895	565,326
Office	SWPD	0	0	0	9,132,758	2,611,930	1,606,640	9,132,758	2,611,930	1,606,640
Convention Center	SWPD	0	0	0	0	0	0	7,773,813	2,223,740	2,840,272
Recreation Space[1]	SWPD	582,408	68,485	415,234	0	0	0	0	0	0
Retail[2]	Lot B	0	0	0	0	0	0	6,017,352	715,093	669,621
Office[2]	Lot B	0	0	0	0	0	0	5,114,344	1,462,681	899,718

Notes: While the creation of new public open space is planned for Phase 1B and Phase 2, it would be ancillary to other proposed uses. Therefore, the Recreation Space vehicle miles traveled in Phase 1B and Phase 2 are captured in the VMT for other uses, and are accounted for separately only for Phase 1A.
SWPD = Special Willets Point District
WW = Willets West

[1]The annual vehicle miles traveled for the recreation space reflect the use of the space for recreation for 183 days a year.

[2]As discussed in Chapter 1, "Project Description," the RWCDS includes the potential future development on Lot B as analyzed in the 2008 FGEIS.

Table 16-3
Projected Annual GHG Emissions (metric tons CO_{2e})

Use	Project Area	2018-Phase 1A			2028-Phase 1B (Cumulative w/Phase 1A)			2032-Phase 2 (Cumulative w/Phases 1A and 1B)		
		Buildings	Mobile	Total	Buildings	Mobile	Total	Buildings	Mobile	Total
Retail	WW	13,202	23,658	36,860	13,202	19,633	32,835	13,202	18,827	32,029
Retail	SWPD	283	402	685	8,534	14,024	22,558	11,788	17,673	29,461
Hotel	SWPD	1,509	918	2,427	3,725	1,841	5,566	5,281	2,512	7,793
Residential	SWPD	0	0	0	16,409	6,131	22,540	38,552	13,867	52,418
School	SWPD	0	0	0	1,199	304	1,503	2,627	698	3,325
Community Facility	SWPD	0	0	0	286	178	464	1,713	1,046	2,759
Office	SWPD	0	0	0	4,715	6,294	11,009	4,715	6,052	10,767
Convention Center	SWPD	0	0	0	0	0	0	3,772	7,294	11,066
Recreation Space[1]	SWPD	0	939	939	0	0	0	0	0	0
Proposed Project Total	**ALL**	**14,994**	**25,916**	**40,910**	**48,070**	**48,405**	**96,475**	**81,648**	**67,969**	**149,617**
Retail	Lot B	0	0	0	0	0	0	1,740	3,131	4,871
Office	Lot B	0	0	0	0	0	0	2,640	3,389	6,029
RWCDS[2] Total	**ALL**	**14,994**	**25,916**	**40,910**	**48,070**	**48,405**	**96,475**	**86,029**	**74,489**	**160,518**

Notes: All figures above shown are in metric tons of CO_2e.
SWPD = Special Willets Point District
WW = Willets West
[1]The annual GHG emissions for the recreation space reflect the use of the space for recreation for 183 days a year.
[2]As discussed in Chapter 1, "Project Description," the RWCDS includes the potential future development on Lot B as analyzed in the 2008 FGEIS.

example, if buildings were to be constructed elsewhere to accommodate the same number of people as the proposed project, the emissions from the use of electricity, energy for heating and hot water, and vehicle use could exceed those of the proposed project, depending on the location, access to transit, building type, and energy efficiency measures.

As presented above, the estimated energy-related emissions are conservatively high since default rates for city-wide energy consumption by existing buildings from the *CEQR Technical Manual* were applied; new buildings would likely have lower energy demand. Furthermore, to attain the LEED® for Neighborhood Development (LEED®-ND) rating, 90 percent of the floor area to be developed within the District would have to meet an energy efficiency requirement that substantially reduces energy costs compared to the referenced ASHRAE 90.1-2007 standard (equivalent to current New York City energy code). In order to attain LEED® Silver certification and comply with the requirements of Local Law 86, Phases 1A and 1B, including the Willets West portion of the proposed project would include energy efficiency measures that exceed building code requirements. As plans for LEED attainment and energy efficiency measures are at this time not sufficiently specific to quantify the resulting GHG emission reductions, the estimates of emissions from buildings presented in **Table 16-3** are conservatively high.

ELEMENTS OF THE PROPOSED PROJECT THAT WOULD REDUCE GHG EMISSIONS

As described in the 2008 FGEIS, the Willets Point Development Plan had been accepted as a pilot LEED®-ND project by USGBC. Phase 1A and 1B are subject to Local Law 86 of 2005 (see New York City Charter section 224.1) and the project sponsor would comply with the requirements thereof. To the extent Local Law 86 of 2005 applies to any portion of Phase 2, the City would further ensure that the sponsor for Phase 2 complies with the requirements thereof. Accordingly, in Phase 1A, the retail buildings, including the proposed development on the Willets West site, will be designed and constructed to achieve LEED silver certification for core and shell (LEED-CS), and the hotel building will be designed and constructed to achieve LEED silver certification for new construction (LEED-NC). In Phases 1B and 2, as set forth in the FGEIS and reiterated in Technical Memorandum #4, all portions of the project within the Willets Point Special District will be required to achieve LEED-ND certification. Phase 1B buildings will also comply with all the applicable requirements of Local Law 86 of 2005. Specifically, retail, hotel, community facility, and office buildings will be designed and constructed to achieve LEED silver certification pursuant to the LEED rating system that is most appropriate under Local Law 86 (see Section 10-02 of Chapter 10 of Title 43 of the Rules of the City of New York). To meet the requirements of LEED and the energy cost reduction requirements of Local Law 86 of 2005 that are applicable to the project under NYC Charter section 224.1(b)(2)(ii), energy efficiency measures would be incorporated into building designs, as described in this chapter. The requirements of Local Law 86 of 2005 and the commitments set forth in this chapter would be incorporated into the development agreements and/or amended lease agreements. The provisions of the development agreements and/or amended lease agreements, relating to the substance and enforceability of these commitments, would be subject to approval by the Mayor's Office of Environmental Coordination.

The proposed project's dense, mixed-use development and reuse of developed land with access to transit and existing roadways are consistent with sustainable land use planning and smart growth strategies to reduce the carbon footprint of new development. A number of sustainable features that would reduce GHG emissions would be considered in achieving LEED certification and the project's sustainability goals. In addition, the proposed school in the District would be built according to the *New York City Green Schools Guide*,[1] which addresses the sustainable design, construction, and operation of new schools, modernizing projects, and school renovations in New York City. The *Green Schools Guide* and Rating System include strategies that substantially reduce energy costs and water use as compared with buildings constructed to meet code, and require the use of recycled content, and regional materials in construction.

The following text outlines features of the proposed project and measures that would be required by the Special Willets Point District regulations or considered in achieving LEED® certification. The features listed would most directly reduce GHG emissions, addressing the GHG reduction goals as outlined in the *CEQR Technical Manual*.

BUILD EFFICIENT BUILDINGS

- 90 percent of the floor area developed within the District would exceed energy code requirements by at least 10 percent.

[1] New York City School Construction Authority, *New York City Green Schools Guide*, revised May 2009

- Phase 1A and 1B are subject to Local Law 86 of 2005, which requires non-residential structures to be designed and constructed to exceed energy code requirements.
- Energy efficient building envelopes would be designed to reduce cooling/heating requirements.
- To the extent feasible, towers within the District would be oriented to create favorable conditions for use of passive and active solar energy strategies.
- High efficiency heating, ventilation and air conditioning (HVAC) systems would be specified, as well as high efficiency domestic hot water systems.
- Highly reflecting roofing material would reduce air conditioning needs in the summer and help mitigate the urban heat island effect.[1]
- Spectrally-selective window glazing would optimize daylighting, heat loss and solar heat gain.
- Efficient lighting (including high efficacy fluorescent and LED) with advanced controls such as motion sensors and daylight dimming would reduce energy consumption.
- State-of-the-art Building Management Systems would be incorporated to provide comprehensive control over building HVAC and lighting, and to minimize unnecessary energy use.
- Efficient elevators and escalators would be specified where practicable.
- Efficient appliances and equipment (e.g., Energy Star) would be specified where practicable.
- Efficient, directed exterior lighting would be specified.
- Third party building commissioning would be conducted to ensure proper energy performance of the building energy systems.
- Construction and design guidelines to facilitate sustainable design for build-out by tenants.
- Measures to reduce stormwater runoff would be implemented as discussed in Chapter 11, "Water and Sewer Infrastructure."
- Low-flow plumbing fixtures would be used to reduce hot water consumption and water pumping energy.
- The landscape would be designed for water efficiency.

USE CLEAN POWER

The District's zoning regulations allow for the provision of a new cogeneration facility within that portion of the project site, provided that it would primarily serve the District. Cogeneration is not currently proposed as part of Phases 1A and 1B. It is possible that a cogeneration facility could be included as part of Phase 2; however, a developer for Phase 2 has not yet been selected. A cogeneration facility, if proposed or needed at a future time, would require further study and additional approvals. Such studies would require information on the facility location, size, and design that is not presently available. The heating and hot water systems would likely use natural

[1] The urban heat island effect refers to the temperature difference between urban areas and surrounding suburban or rural areas. Much of this temperature difference is attributed to the prevalence of dark roofs and dark colored pavement, which absorb more heat than lighter surfaces, as well as the declining presence of vegetation in cities.

gas, which has a lower carbon content per unit of energy than other fuels, and thus its use generates lower GHG emissions.

The use of solar photovoltaic panels will also be considered on a dedicated area of Willets West, as part of Phase 1A. While further study is needed, early assessments indicate that a considerable amount of electricity may be generated using the solar panels.

TRANSIT-ORIENTED DEVELOPMENT AND SUSTAINABLE TRANSPORTATION

The proximity of the proposed project to transit and the diversity of uses proposed would reduce automobile dependence, and therefore GHG emissions from travel. The proposed project's dense development and reuse of developed land with access to transit and existing roadways are consistent with sustainable land use planning and smart growth strategies to reduce the carbon footprint of new development. In addition, the proposed project would feature the following elements:

- Parking within the District would be sized to meet, but not exceed, parking required by zoning.
- A network of bike lanes and bicycle racks would be available within the District. Provision of changing rooms or showers would be considered.
- Design of streets, sidewalks and street planting within the District would encourage walking.
- Roadway improvements would be made to improve traffic flow.
- Traffic signalization and coordination would aim to improve traffic flow and support pedestrian and bicycle safety.

In addition, a marketing/information program that would include posting and distribution of ride sharing and transit information would likely be developed. Although the proposed project already has excellent access to transit, it is anticipated that service may be extended or expanded, in response to the proposed development and other growth, as discussed in the 2008 FGEIS. These potential improvements include provision of regular Long Island Railroad (LIRR) service to the existing Mets-Willets Point station, which is currently serviced only during game events; additional 7 train service; and extension of bus routes to the District. Preferred on-site parking for alternative vehicles (such as hybrids and electric vehicles) would likely be provided to the extent practicable, and the practicability of including on-site charging stations for electric vehicles will be explored. Dedicated carpool spaces for Willets West employees will also be provided. Options for encouraging carpooling and car sharing in the District will be explored.

REDUCE CONSTRUCTION OPERATION EMISSIONS

As described in Chapter 20, "Construction," an extensive diesel emission reduction program will be implemented during project construction. The program will minimize particulate matter emissions; while particulate matter is not included in the list of standard greenhouse gasses ('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

In meeting the requirements for the appropriate LEED® rating, the use of recycled content in infrastructure would be considered. In addition, for individual buildings throughout the project

site to achieve the required LEED® rating, a number of GHG reducing strategies would be considered, including:

- Use of materials with recycled content.
- Use of building materials that are extracted and/or manufactured within the region.
- Wood that is locally produced and/or certified in accordance with the Sustainable Forestry Initiative or the Forestry Stewardship Council's Principles and Criteria would be used for commercial buildings and considered for residential buildings.
- Ultra low sulfur diesel would be used for project construction.
- Cement replacements, such as slag, would be used to the extent practicable.
- Construction waste would be diverted from landfill through reuse and recycle efforts.

In addition, the use of cement produced using lower-GHG fuel, concrete produced with optimized cement content, and design that would reduce the need for concrete and steel would be considered.

CONCLUSIONS

As detailed above in **Table 16-3**, the potential GHG emissions associated with the proposed project in 2032 upon completion of Phase 2 (cumulative with Phases 1A and 1B) are projected to be approximately 150,000 metric tons of CO_2e. The GHG emissions resulting from the RWCDS in 2032 would be approximately 161,000 metric tons of CO_2e. The GHG emissions from Phase 1A (2018) and Phase 1B (2028, cumulative with Phase 1A) would be 41,000 metric tons of CO_2e and 96,000 metric tons of CO_2e, respectively.

Measures for reducing GHG emissions that are included in the District's regulations, or would be considered in achieving the LEED® ratings have been identified. Overall, the project site's location, the project's dense, mixed-use design, the commitments to achieve energy efficiency, and other measures incorporated in the proposed project would result in lower GHG emissions than would otherwise be achieved by similar residential and commercial uses, and thus would be consistent with the GHG reduction goal. The greenhouse gas reduction measures, LEED rating requirements, and requirements of Local Law 86 of 2005 would be incorporated into the development agreements and/or amended lease agreements.

D. RESILIENCE TO CLIMATE CHANGE

Currently, standards and a framework for analysis of the effects of climate change on a proposed project are not included in CEQR. However, the recently proposed revisions to the Waterfront Revitalization Program (WRP)[1] address climate change and sea level rise. If finalized, the revisions to the WRP would 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 the Department of City Planning and other city agencies when conducting environmental review. Since the project site is in the floodplain, the potential effects of global climate change on the proposed project are considered below, and strategies to increase climate resilience and adaptive management are discussed.

[1] City of New York Department of City Planning, The NYC Waterfront Revitalization Program: Proposed Revisions for Public Review, March 2012, http://www.nyc.gov/html/dcp/html/wrp/wrp_revisions.shtml

DEVELOPMENT OF POLICY TO IMPROVE CLIMATE CHANGE RESILIENCE

In recognition of the important role that the federal government has to play to address adaptation to climate change, a federal executive order signed October 5, 2009, charged the Interagency Climate Change Adaptation Task Force, composed of representatives from more than 20 federal agencies, with recommending policies and practices that can reinforce a national climate change adaptation strategy. The 2011 progress report by the Task Force included recommendations to build resilience to climate change in communities by integrating adaptation considerations into national programs that affect communities, facilitating the incorporation of climate change risks into insurance mechanisms, and addressing additional cross-cutting issues, such as strengthening resilience of coastal, ocean, and Great Lakes communities.[1]

The New York State Sea Level Rise Task Force was created to assess potential impacts to the state's coastlines from rising seas and increased storm surge. The Task Force has prepared a final report of its findings and recommendations including protective and adaptive measures.[2] 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 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 will also include strategies for adapting to climate change. The 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.[3]

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 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 city-wide 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,[4] updated in June 2013,[5] and has suggested approaches to create an effective adaptation program for critical infrastructure.[6] 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

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[1] The White House Council on Environmental Quality, Progress Report of the Interagency Climate Change Adaptation Task Force: Federal Actions for a Climate Resilient Nation, October 28, 2011.

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

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

[4] New York City Panel on Climate Change, *Climate Risk Information*, February 2009.

[5] New York City Panel on Climate Change, *Climate Risk Information 2013*, June 2013.

[6] 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.

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. The NPCC projects that sea levels are likely to increase by ~~12~~11 to ~~23~~24 inches by the ~~end~~ middle of the century (2050s middle range, 25th to 75th percentile), with possible increase up to ~~55~~31 inches (high estimate, 90th percentile) ~~in the event of rapid ice melt~~. While the 2013 update did not include 2080s data, based on 2009 NPCC report, sea levels could rise by up to 59 inches by 2080s. Local Law 42 of 2012 requires updates to climate projections at least every three years. In general, the probability of ~~higher~~ sea level~~s~~ rise is characterized as "extremely likely" (>95 percent probability of occurrence). ~~, but there is high uncertainty regarding the probability of a rapid ice melt scenario.~~ 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 coastal storm surge levels for New York City include only sea level rise at this time ~~(excluding the rapid ice melt scenario)~~ , and do not account for changes in storm frequency. Regardless of the frequency of the storms, the frequency of flooding events would increase because the sea level rise would result in flooding due to lesser storms, such that the current flood with 1 percent chance of occurring in any given year would have a 5 percent chance of occurring in any given year by mid-century, and higher by the end of the century.

In the wake of Hurricane Sandy, Mayor Bloomberg convened the Special Initiative for Rebuilding and Resiliency (SIRR) and charged it with analyzing the impacts of the storm on the City's buildings, infrastructure, and people; assessing the risks the City faces from climate change; and outlining ambitious, comprehensive, but achievable strategies for increasing resiliency citywide. The Mayor also asked SIRR to develop proposals for rebuilding the areas hardest hit by Sandy—the Brooklyn-Queens Waterfront, the eastern and southern shores of Staten Island, Southern Queens, Southern Brooklyn, and Southern Manhattan. SIRR published the City's resiliency policy, entitled *A Stronger, More Resilient New York*, in June 2013. Although the plan outlines a general approach for coastal protection throughout the City, the plan does not yet outline specific measures in the area of the proposed project.

~~The New York City Green Code Task force has also recommended strategies for addressing climate change resilience in buildings and for improving stormwater management.[1] 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 develop flood maps that reflect projected sea level rise and increases in coastal flooding through 2080 and to require new developments within the projected future 100-year floodplain to meet the same standards as buildings in the current 100-year flood zone. The City has been working with the Federal Emergency Management Agency (FEMA) to revise the Flood Insurance Rate Maps (FIRMs) using the detailed Light Detection and Ranging (LiDAR) data.~~

The New York City Department of Environmental Protection is evaluating adaptive strategies for City water and wastewater infrastructure. The City has already developed a *New York City Green Infrastructure Plan*[2], and a *Sustainable Stormwater Management Plan.*[1] Many of the strategies discussed in these plans would improve the City's resilience to climate change.

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

[2] New York City, New York City Green Infrastructure Plan, September 2010.

Overall, strategies and guidelines for addressing the effects of climate change are rapidly being developed on all levels of government. Currently, standards and a framework for analysis of the effects of climate change on a proposed project are not included in the *CEQR Technical Manual*. While qualitative guidance on addressing the effect of climate change is in the process of being developed at the national, state, and local levels, no specific requirements for development projects are available at this time. Climate change considerations may be incorporated into state and local laws prior to the construction of the proposed project, and any future development would be constructed to meet or exceed the codes in effect at the time of construction. ~~The requirements of Local Law 86 of 2005, which include LEED rating requirements and measures that would reduce greenhouse gas emissions, would be incorporated as applicable into the development agreements and/or amended lease agreements.~~

RESILIENCE OF THE PROPOSED PROJECT TO CLIMATE CHANGE

As presented in Figure 9-1, based on the currently in effect Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs), Willets West, the South Lot, and Lots B and D are within the ~~100-year~~ 1-in-100 floodplain, with a flood elevation of 13 feet NAVD88[2] ~~14 feet NGVD29~~(All elevations in this chapter are presented relative to the NAVD88 datum.) Most of the District is also within the ~~100-year~~ 1-in-100 floodplain (with flood elevation of 13 feet ~~14 feet NGVD29~~) (with the exception of three small areas located in the northwest area of the proposed project, along the eastern border and along Roosevelt Avenue that are within the ~~500-year~~ 1-in-500 floodplain—these are likely mapping anomalies, and in one case this is an area that is elevated with material stockpiling.) ~~The existing FIRM 100-year floodplain is currently the only regulatory standard relating to elevation of new development. The City has been working with FEMA to revise the FIRMs. On February 25, 2013, FEMA released Advisory Base Flood Elevation maps for areas in New York City, including the project site. The 100-year flood ABFE for Willets West, and portions of the project site to the south of 37th Avenue, is 12 feet NAVD88. Within the District, for most of the area to the North of 37th Avenue, the 100-year ABFE is 13 feet NAVD88, with the exception of an area mostly to the north of 34th Avenue, which is outside of the advisory 100-year floodplain. Although the ABFE is subject to further review, if it is adopted as part of a future updated Flood Insurance Rate Map, the proposed project would comply with these flood elevations as required by the New York City Building Code~~.

On July 2, 2013, FEMA released the latest version of the Best Available Flood Hazard Data (BAFHD)—a draft product preceding the publication of new FIRMs. FEMA encourages communities to use the BAFHD when making decisions about floodplain management and post-Sandy recovery efforts, and these levels have been adopted by New York City for zoning purposes, allowing projects to account for higher base flood elevations for height and other zoning requirements. The 1-in-100 levels are the same as the current FIRM in the northern portion of the District, north of 37th Avenue, and are one foot lower in all other areas of the proposed project.

Given the proposed project location within the 100-year floodplain, the potential effects of global climate change on the proposed project have been considered. As described above, NPCC

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[1] New York City, Sustainable Stormwater Management Plan, December 2008.

[2] Elevations in the in effect map are calculated from the NGVD29 datum; current maps use the NAVD88 datum which is 1.1 feet higher. To transform elevations from the old map, Elevation (NAVD88) = Elevation (NGVD29) – 1.1 feet. Note that all FIRM elevations are rounded to the nearest whole foot.

has published projections for sea level rise and the associated flood elevations throughout the current century, and recently updated projections for 2020s and 2050s. In the proposed project area, based on the BAFHD and NPCC projections, it is expected that the 1-in-100 flood level would range up to an elevation of approximately 18 feet north of 37th Avenue in the District, and 17 feet in other proposed project areas by the end of the century. Under the current plan, the District portion of the project site and Willets West would be graded and elevated one foot above the current FIRM ~~floodplain~~ (which is two feet above the BAFHD for all project areas except a portion of the District north of 37th Avenue) such that the occupiable floors would be at an elevation of 14 feet ~~15 feet NGVD29~~ and would meet the requirements of the New York City Building Code. ~~It is anticipated that the ABFE maps would be adopted in the near future. The occupiable floors of the proposed buildings are designed to be at an elevation of one to two feet above the ABFE~~. Therefore, the proposed design would reduce the vulnerability to flood damage as compared to existing conditions, as well as offer resilience in the event of 1 to 2 feet of future sea level rise ~~(above the ABFE)~~, which is expected to occur by mid-century (2050s). ~~within the likely range of sea level rise projections made by NPCC. To achieve the LEED® ND rating, the District would comply with all LEED® ND prerequisites, including Floodplain Avoidance (Smart Location & Linkage, Prerequisite 6). Therefore, as appropriate, development within the District would reflect any changes to the floodplain elevations.~~

Given that the projections for sea level rise are changing, further measures will be investigated and implemented within the proposed project site to the extent practicable. Prior to commencement of construction for each phase of the project, the project sponsor will work with the Mayor's Office of Environmental Coordination (MOEC) to develop a plan for resilience of the proposed area to be developed in that phase from future flood levels, considering the types of uses proposed; the plan will be designed with the goal of making the project area resilient to end-of-century flood levels in residential areas, and mid-century in other areas. This may be achieved via a combination of practicable measures within the project, potentially including grade change, protection of critical infrastructure, and design elevations, and storm surge protection measures if those are practicable and relevant within the area to be developed in that phase, along with area-wide or waterfront measures to be undertaken by the City outside of the project area, as appropriate. While the plan for each phase may not identify all details necessary for the long-term implementation, it will identify the practicable measures needed for that phase of the project and conceptual measures being considered or undertaken by the City beyond the project site. The plan will be consistent with the City's citywide coastal protection policy as described in *A Stronger, More Resilient New York* through the 2050s.

For sea level rise beyond the 1 to 2 feet projected for mid-century, the most practicable solutions to increase resiliency may include area-wide and/or waterfront solutions, which may need to be implemented off-site by the City. While the City has not yet undertaken the studies needed to select the most effective measure to offer flood protection to the area of Queens that includes Willets Point, some measures that may be undertaken by City agencies in the future include:

- Coastal edge elevation measures;
- The City's tide gate repair study at Flushing Meadows, if relevant;
- Integrated flood protection and storm surge barriers.

The City would also have the authority to require an increase in the proposed grade of the District at the time of such future development via changes to the New York City Building Code, by incorporating changes to the flood level provisions, ~~application of FEMA Flood~~

~~Insurance Rate Map data~~, or ~~such~~ via other New York City Executive Orders, rules, or regulations, as may be issued at that time.

The proposed project would incorporate the most recent building code requirements available at the time of construction and consider any prudent guidance and information available. As described in Chapter 11, "Water and Sewer Infrastructure," the proposed project would include a number of features, in addition to the requirements of the building code and current Department of Environmental Protection (DEP) drainage standards, designed to absorb or retain stormwater and reduce the potential for flooding. These features would form part of a site stormwater management plan that would be reviewed by DEP in light of the developing understanding of the effects of climate change on infrastructure.

Potential risks related to flooding would be considered in locating critical electrical and mechanical systems, residential living areas, waste storage areas, fuel storage tanks, and other vulnerable features. Other measures to increase resilience to climate change would be considered on a case-by-case basis, accounting for site specific vulnerabilities, as well as costs and benefits. The following potential techniques would be considered and incorporated into project design, as appropriate:

- Opportunities to elevate, encase, or design electrical and mechanical equipment to be submersible.
- Use of flood- and salt-water-resistant materials.
- Elevation of structures and usable space to an appropriate design flood elevation that reduces risk with minimal impacts on public space and urban design. The selection of an appropriate design flood elevation would consider projections of likely flood levels, as may be legally required in the future, as well as the lifespan of the project and other project specific information.
- The raising of land or the placement of fill to elevate the proposed project uses above projected future flood levels, if such levels become legally defined in the future.
- Selection of plantings suited to the current and projected future climate including selection of salt-water-tolerant species.
- Securing hazardous materials from the impacts of flooding and wave action due to storm surge.
- Incorporation of design features that would allow the proposed project to be adapted on an ongoing basis in response to changing climate projections and conditions .

As part of the plan, ~~prior to the placement of fill,~~ the project sponsor would submit to ~~the Mayor's Office of Environmental Coordination (~~MOEC~~)~~ an assessment of the appropriate grade for the District in light of all available information concerning potential sea level rise and other ~~changes due to~~ likely effects of climate change, while considering the practicability of making such grade changes and other measures available for flood protection.

By striving to incorporate reasonable strategies that would increase resilience to the likely projected effects of climate change through 2050s, the proposed project would go beyond the ~~existing *CEQR* and other~~ legal requirements to address the potential effects of climate change on a project and would be consistent with the City's SIRR policy. As part of citywide efforts to improve coastal resiliency, it is anticipated that solutions for protecting the area over a longer time horizon will be developed before sea levels rise beyond 1 to 2 feet. ✶