A. INTRODUCTION

As discussed in the June 2012 *City Environmental Quality Review (CEQR) Technical Manual*, increased concentrations of greenhouse gases (GHGs) in the atmosphere are changing the global climate, resulting in 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 greatly reducing GHG emissions and adapting to climate change in the city. The goal to reduce citywide GHG emissions to 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").[1] The city is also engaged in several initiatives to assess potential local effects of global climate change and develop strategies to make existing and proposed infrastructure and development citywide more resilient to the effects of climate change. The *CEQR Technical Manual* recommends that a project resulting in 350,000 square feet of development or more and other energy-intense projects quantify project-related GHG emissions and assess the project's consistency with the citywide GHG reduction goal.

The proposed Cornell NYC Tech project would result in the development of approximately 790,000 gross square feet (gsf) by 2018, the analysis year for Phase 1, and a total of approximately 2.13 million gsf by 2038, the analysis year for Full Build. Accordingly, a GHG consistency assessment is provided. The GHG emissions that would be generated as a result of the proposed project—and measures that would be implemented to limit those emissions—are presented in this chapter, along with an assessment of the proposed project's consistency with the citywide GHG reduction goal. The chapter also identifies measures that would be taken to increase the resilience of the proposed project to the potential effects of climate change.

The proposed project would be consistent with the citywide GHG reduction goal and would incorporated measures that would make the project resilient to the projected effects of climate change.

B. 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 that address energy consumption and production, land use, and other sectors. 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

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

lower than 2005 levels by 2050 (pending legislation) via the Copenhagen Accord.[2] 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 already begun issuing regulations. The U.S. Department of Transportation (USDOT) and USEPA have established GHG emissions standards for vehicles that will reduce vehicular GHG emissions over time.

There are also regional, state, and local efforts to reduce GHG emissions. In 2009, Governor David Paterson issued Executive Order No. 24, establishing a goal of reducing GHG emissions in New York State 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[3]).

New York State also has regulations to cap and reduce CO_2 emissions from power plants, as part of the commitment to the Regional Greenhouse Gas Initiative (RGGI), a multistate agreement to reduce the amount of CO_2 from power plants.

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 and identifies specific initiatives that can result in emission reductions and initiatives targeted at adaptation to climate change impacts. As mentioned, the PlaNYC 2030 goal to reduce citywide GHG emissions to 30 percent below 2005 levels by 2030 was codified by Local Law 22 of 2008. Projects that require a GHG assessment under CEQR are evaluated with this goal as the benchmark.

A number of benchmarks for energy efficiency and green building design have also been developed. For example, the LEED® system is a benchmark for the design, construction, and operation of high performance green buildings that includes energy efficiency components.

USEPA'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.

C. METHODOLOGY

Although the contribution of any single project to 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. As required by the *CEQR Technical Manual*, this chapter presents the total GHG emissions potentially associated with the proposed Cornell NYC Tech project and identifies the measures that would be implemented and measures that are still under consideration to limit the emissions.

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

[3] http://www.nyclimatechange.us/

The analysis of GHG emissions that would be generated by the proposed project is based on the methodology presented in the *CEQR Technical Manual*. Emissions of GHGs associated with the proposed project have been quantified and include the following:

- Off-site emissions associated with on-site use of electricity,
- On-site emissions from heat and hot water systems and production of electricity, and
- Emissions from vehicle use attributable to the proposed project

GHG emissions that would result from construction of the proposed project are discussed as well.

POLLUTANTS OF CONCERN

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

The *CEQR Technical Manual* lists six GHGs that could potentially be included in the scope of an EIS: CO_2, nitrous oxide (N_2O), methane, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). This analysis focuses on CO_2, N_2O, and methane. HFCs, PFCs, and SF_6 emissions are associated with industrial processes and would not be emitted in significant amounts from the proposed project.

To present a complete inventory of all GHGs, component emissions are added together and presented as CO_2 equivalent (CO_2e) emissions—a unit representing the quantity of each GHG weighted by its effectiveness using CO_2 as a reference. This is achieved by multiplying the quantity of each GHG emitted by a factor called global warming potential (GWP). GWPs account for the lifetime and the radiative forcing of each chemical over a period of 100 years (e.g., CO_2 has a much shorter atmospheric lifetime than 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
Global Warming Potential (GWP) for Major GHGs

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

Source: IPCC, Climate Change 1995—Second Assessment Report.

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

Methane and nitrous oxide also play an important role since the removal processes for these compounds are limited and they have a relatively high impact on global climate change as compared to an equal quantity of CO_2. These compounds are emitted during combustion of fuels, in vehicles, heating systems, and power plants, and are therefore included in the analysis.

BUILDING OPERATIONAL EMISSIONS

Emissions associated with electricity and natural gas use for the proposed project were estimated using projections of energy consumption developed using energy modeling and data specific to the Cornell NYC Tech project. The emissions were estimated using an emission factor of 696.1 pounds of CO_2e per megawatt-hour for grid electricity in New York City (as referenced in the 2011 inventory of GHG emissions for New York City)[4] and 53.2 kg per million Btu for natural gas combustion, from *CEQR Technical Manual* Table 18-2. For quantifying the potential benefits of on-site electricity generation with microturbines, the non-baseload emission factors from eGRID2012 were used.[5] The use of non-baseload factors for quantifying the benefits of energy efficiency and renewable energy projects is consistent with EPA guidance.[5]

The energy consumption data include some energy efficient design measures aimed at achieving LEED® Silver certification, at a minimum. However, since not all detailed energy efficiency measures could be accounted for at this time, this estimate may be conservatively high.

A summary of the projected energy consumption for the proposed project is presented in **Table 16-2**, assuming no electricity generation on-site.

Table 16-2
Annual Building Energy Consumption

Use	Phase 1		Full Build	
	Electricity (MWh/year)	Natural Gas (MMBTU/year)	Electricity (MWh/year)	Natural Gas (MMBTU/year)
Academic	3,656	975	11,334	5,970
Corporate Co-location	2,133	1,189	10,667	5,947
Residential	3,650	13,082	9,733	34,885
Executive Education Center	2,196	7,814	2,196	7,814
Central Utility Plant	427	238	853	476
Total	**12,062**	**23,298**	**34,783**	**55,092**

The proposed project's total combined energy intensity would be 81,542 Btu per square foot, which is substantially lower than the average intensities in New York City.[6] These efficiencies result from building design.

Operational building emissions were also quantified assuming that at least 20 percent of the needed electricity would be generated on-site. Emissions from the use of additional natural gas that would be required, as discussed in Chapter 13, "Energy," were accounted for.

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[4] *Inventory of New York City Greenhouse Gas Emissions*, Mayor's Office of Long-Term Planning and Sustainability, PlaNYC2030, September 2011.

[5] USEPA, eGRID2012 Version 1, April 2012.

[6] *CEQR Technical Manual* Table 15-1.

MOBILE SOURCE EMISSIONS

The number of annual weekday motorized vehicle trips by mode (cars, taxis, trucks) that would be generated by the proposed project was calculated using the transportation planning assumptions developed for the analysis presented in Chapter 14, "Transportation." The assumptions used in the calculation include average daily weekday person trips and delivery trips, the percentage of vehicle trips by mode, and the average vehicle occupancy. Travel distances for locations other than Manhattan shown in Table 18-4 and Table 18-5 of the *CEQR Technical Manual* were used in the calculations of annual vehicle miles traveled by cars and taxis. The average one-way truck trip was assumed to be 38 miles, as per the *CEQR Technical Manual*. Table 18-6 of the *CEQR Technical Manual* was used to determine the percentage of vehicle miles traveled by road type and the mobile GHG emissions calculator was used to obtain an estimate of car, taxi, and truck GHG emissions attributable to the proposed project.

USEPA estimates that the well-to-pump GHG emissions of gasoline and diesel are approximately 22 percent of the tailpipe emissions.[7] 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, as per the *CEQR Technical Manual* guidance, the well-to-pump emissions are not considered in the analysis for the proposed project.

The projected annual vehicle miles traveled, forming the basis for the GHG emissions calculations from mobile sources, are presented in **Table 16-3**.

Table 16-3
Estimated Total Annual Vehicle Miles Traveled for the Proposed Project

Road Type	Phase 1			Full Build		
	Passenger Vehicle	Taxi	Truck	Passenger Vehicle	Taxi	Truck
Local	461,149	134,246	208,681	1,208,642	192,755	551,358
Arterial	945,355	275,204	427,797	2,477,717	395,147	1,130,284
Interstate/Expressway	899,240	261,779	406,929	2,356,853	375,872	1,075,148
Total	**2,305,743**	**671,228**	**1,043,407**	**6,043,212**	**963,773**	**2,756,789**

CONSTRUCTION EMISSIONS

Emissions associated with construction have not been estimated explicitly for the proposed project, but other similar analyses have shown that construction emissions (both direct and emissions embedded in the production of materials, including on-site construction equipment, delivery trucks, and upstream emissions from the production of steel, rebar, aluminum, and cement used for construction) would be equivalent to the total emissions from the operation of the buildings over approximately 3 to 10 years.

EMISSIONS FROM SOLID WASTE MANAGEMENT

The proposed project would not change the city's solid waste management system. The proposed project would be built to LEED® Silver certification specifications, which contain provisions regarding recyclables and construction waste management. Therefore, as per the *CEQR*

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

Technical Manual, the GHG emissions from solid waste generation, transportation, treatment, and disposal are not quantified.

D. PROJECTED GHG EMISSIONS FROM THE PROPOSED PROJECT

A summary of total annual GHG emissions by emission source type is presented in this section for Phase 1 and Full Build. The emissions are shown for a baseline scenario, in which all of the electricity for the campus is assumed to be supplied by the grid. The benefits of on-site electricity generation are quantified and discussed.

2018 ANALYSIS YEAR (PHASE 1)

Projected GHG emissions from Phase 1 are presented in **Table 16-4** in metric tons of CO_2e. Without the on-site production of electricity, the proposed project would emit 7,962 metric tons of CO_2e per year in Phase 1, or approximately 10 kilograms (kg) of CO_2e per gsf of development. On-site electricity generation using microturbines would reduce the total emissions from operational electricity and natural gas use shown in Table 16-4 by approximately 3 percent, not accounting for the benefits associated with the reduction in transmission and distribution losses. Grid losses in the region are estimated at 5.82 percent of the generated electricity.[8] The use of electricity generated using on-site solar panels would further reduce GHG emissions. With or without on-site electricity generation, the GHG emission intensity from the proposed project would be substantially lower than the emission intensity for comparable projects.[9]

Table 16-4
GHG Emissions, Phase 1 (2018)
(Metric Tons CO_2e)

Scenarios	Emissions from Operational Electricity Use	Emissions from Operational Natural Gas Use	Mobile Source Emissions	***Total Emissions***
With all Electricity from the Grid	3,808	1,239	2,914	7,962
Sources: Cornell and AKRF, Inc.				

2038 ANALYSIS YEAR (FULL BUILD)

Projected GHG emissions from Full Build are presented in **Table 16-5** in metric tons of CO_2e.

Table 16-5
GHG Emissions, Full Build (2038)
(Metric Tons CO_2e)

Scenarios	Emissions from Operational Electricity Use	Emissions from Operational Natural Gas Use	Mobile Source Emissions	***Total Emissions***
With all Electricity from the Grid	10,982	2,931	6,140	20,053
Sources: Cornell and AKRF, Inc.				

[8] USEPA, eGRID2012 Version 1, April 2012.

[9] American College & University Presidents' Climate Commitment, GHG Reports. Scopes 1 + 2 gross emissions per 1,000 square feet for similar universities in the region, including SUNY Stony Brook, New York University, University of Connecticut, and University of Pennsylvania.

Without the on-site production of electricity, the proposed project would emit 20,053 metric tons of CO_2e per year in Full Build, or approximately 9 kg of CO_2e per gsf of development. On-site electricity generation using microturbines would reduce the total emissions from operational electricity and natural gas use presented in Table 16-5 by more than 3 percent. Additional reductions in GHG emissions would be achieved through electricity generated on-site using solar energy. With or without on-site electricity generation, the GHG emission intensity from the proposed project would be substantially lower than the emission intensity for comparable projects.[10]

Cornell has agreed to achieve, at a minimum, the energy efficiency level required for LEED® Silver certification under the New Construction and Major Renovations Rating System. To attain LEED® certification under current LEED® requirements, the proposed project buildings would need to exceed energy efficiency required by code by at least 10 percent. The proposed project building design would be aimed at attaining an energy efficiency of 30 percent better than the ASHRAE 90.1 standard, which is well above the minimum, LEED® requirement. Furthermore, the Phase 1 academic building would be designed to an even higher level of energy efficiency, representing the approximate limit of readily-available technology to limit loads, a better building envelope, better controls, and geothermal heat pumps providing all heating and cooling needs, except for a small gas-fired hot water unit.

Cornell NYC Tech would develop and operate the proposed project in a manner that maximizes energy efficiency and on-site renewable energy generation. These energy measures would ensure that Cornell NYC Tech's operations consume less fossil-fuel derived energy than comparable New York City institutions. The energy conservation and other sustainable measures to be incorporated in the proposed project design, and the proposed on-site generation systems are described in the following section.

E. ELEMENTS OF THE PROPOSED PROJECT THAT WOULD REDUCE GHG EMISSIONS

The proposed project would include many sustainable design features that would lower GHG emissions. These features are discussed in this section, assessing the consistency of the proposed project with the GHG reduction goal as outlined in the *CEQR Technical Manual*.

Cornell is committed to addressing environmental and sustainability issues on its Cornell NYC Tech campus. As a signatory to the American College and University Presidents Climate Commitment, Cornell University has a Climate Action Plan to reduce GHG emissions from its Ithaca campus to net zero by 2050. The proposed Phase 1 academic building would also be designed as a net zero energy building, while the design for all proposed buildings would attain LEED® Silver certification, at a minimum. The features and other measures currently under consideration that would address GHG emissions are discussed in this section.

BUILD EFFICIENT BUILDINGS

Cornell has committed to achieving at least LEED® Silver certification for each building constructed as part of the proposed project. LEED® certification requires building energy efficiency that results in energy expenditure at least 10 percent lower than the baseline building

[10] American College & University Presidents' Climate Commitment, GHG Reports. Scopes 1 + 2 gross emissions per 1,000 square feet for similar universities in the region, including SUNY Stony Brook, New York University, University of Connecticut, and University of Pennsylvania.

designed to meet minimum code requirements. As mentioned above, Cornell plans to exceed this minimum energy efficiency requirement for LEED® and design buildings to be 30 percent more energy efficient than buildings meeting the ASHRAE 90.1 standard.[11] Some energy efficiency measures were included in the energy modeling and are reflected in the results presented above; however, additional efficiency may be achieved due to sustainable project elements not yet designed and additional measures still under consideration. To attain the LEED® certification, the designs for the proposed project will include:

- Energy efficient building envelopes to reduce cooling/heating requirements
- High-efficiency heating, ventilation, and air conditioning (HVAC) systems or generators
- Green roofs or rooftop gardens, that would provide shade and remove heat from the air through evapotranspiration, reducing the building energy needs and providing other environmental benefits
- Features to optimize interior daylighting and minimize heat loss and solar gain (e.g., window glazing, superinsulation, building orientation)
- Motion sensors, lighting control, and climate control
- Efficient, directed exterior lighting
- A commitment to conduct third party building commissioning to ensure energy performance
- Building orientation that minimizes energy use
- Water conserving fixtures that exceed building code requirements
- Low impact development for stormwater design
- Water efficient landscaping

Other measures likely to be part of the design include high-albedo roofing materials except on roofs with solar panels or green roofs, peak shaving or load shifting strategies, subject to acceptable life-cycle cost evaluation, efficient lighting and elevators, and Energy Star appliances, gray water reuse and/or collection and reuse of rainwater, and other sustainable design features.

USE CLEAN POWER

Cornell has also set a goal to achieve net-zero energy consumption for its Phase 1 academic building. This means that the campus collectively would generate enough renewable electricity to offset the cumulative electrical power, heating, and cooling energy use of the Phase 1 academic building on an annual basis.

The systems that are being considered to generate energy on-site are briefly described below:

- A below-grade closed-loop geothermal well field would be developed to serve the academic building. Approximately 140 geothermal wells may be constructed during Phase 1. These wells would likely meet the cooling demand for the academic building. A feasibility study is underway to determine whether other heat rejection means (such as cooling towers) could be used to reduce the peak cooling needs and to determine the actual geothermal well capacity

[11] The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 90.1 – Energy Standards for Buildings, is the guidance standard used by LEED® to define energy standards for rating.

from drill data. Cornell may expand the geothermal system as practical for the Full Build, depending on the success of the Phase 1 system.

- The utility plants would provide space for in-coming utility services and may also include equipment to supply power, chilled water, and heat to portions of the campus. As the campus develops, it may also evolve to contain (in this structure or added facilities) distributed energy generation units that would operate on natural gas (fuel cells, micro-turbines, or novel engine-generators) to support the campus energy demand while reducing fossil fuel needs (and thus reducing the campus carbon footprint).
- An array of photovoltaic (PV) panels would be constructed above the roof of the academic building; PV panels may also extend over a portion of the central spine (creating a canopy), and possibly continue over the roof of the corporate co-location building. PV panels may also be integrated into the landscape to form pavilions, covered rest areas, and similar ground-mounted structures as needed to achieve the renewable electricity goals of the campus.

ENHANCE AND USE TRANSIT-ORIENTED DEVELOPMENT AND SUSTAINABLE TRANSPORTATION

The proposed project strongly supports the city's transit-oriented development and sustainable transportation objective. The proposed project would be designed to support walking and bicycling. Much of the population served by the proposed project would both live and work on campus, minimizing the need for vehicle commutes and the associated GHG emissions. Mass transit options would include the "F" subway line, the Q102 bus, the Roosevelt Island Red Bus, and the Tramway. The proposed project will also consider the following actions for inclusion:

- Develop multi-use paths to and through the proposed site.
- Develop a parking management program to minimize parking requirements, such as parking cash-out, parking charges, preferential carpool or vanpool parking, and limiting parking available to employees.
- Develop and implement a marketing/information program that includes posting and distribution of ride sharing transit information.
- Reduce employee trips during peak periods through alternative work schedules, telecommuting, and/or flex-time.
- Provide bicycle storage and showers/changing rooms.
- Implement roadway improvements to improve traffic flow.
- Implement traffic signalization and coordination to improve traffic flow and support pedestrian and bicycle safety.

An additional measure that may be further investigated is the provision of charging stations for electric vehicles.

REDUCE CONSTRUCTION OPERATION EMISSIONS

Construction would include a diesel emissions reduction program including diesel particulate filters for large construction engines and other measures (see Chapter 20, "Construction"). These measures would reduce 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

The following would be included to minimize GHG emissions associated with the production and transport of construction materials:

- Building materials with recycled content.
- Building materials that are extracted and/or manufactured within the region.
- Efforts to divert construction waste from landfill.

In addition, building materials and products that are not contaminated would be reused to the extent practicable. 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 likely be used. The use of cement replacements (slag, fly-ash, silica fume, calcined clay, interground limestone) would also be likely.

F. ADAPTATION 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, because a portion of the proposed site is located within the current 500-year floodplain and the likely future 100-year floodplain, the DEIS does consider potential effects of global climate change on the proposed project.

In New York City, the New York City Panel on Climate Change (NPCC) has prepared a set of climate change projections for the New York City region and has suggested approaches to create an effective adaptation program for critical infrastructure.[12] The NPCC includes leading climatologists, sea-level rise specialists, adaptation experts, and engineers, as well as representatives from the insurance and legal sectors. The NPCC projects that sea levels are likely to increase by 12 to 23 inches by the end of the century, with possible increase up to 55 inches in the event of rapid ice melt. The New York City Green Code Task force has also recommended strategies for addressing climate change resilience in buildings and for improving stormwater management.[13] 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 is currently working with the Federal Emergency Management Agency (FEMA) to revise the Flood Insurance Rate Maps (FIRMs) using the recently acquired detailed Light Detection and Ranging (LiDAR) data.

As stated above, standards and a framework for analysis of the effects of climate change on a proposed project currently 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. Cornell is voluntarily evaluating and implementing measures that would make the proposed project resilient to the projected effects of climate change. In addition, climate change considerations may be incorporated into

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

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.

RESILIENCE TO CLIMATE CHANGE

The current FEMA 100-year floodplain is the only regulatory standard relating to elevation of new development. As stated above, since a portion of the proposed site is located within the current 500-year floodplain and likely within the future 100-year floodplain, climate change considerations and measures that would be implemented to increase climate resilience are discussed.

On the eastern and western sides of the study area, the current 100-year floodplain (i.e., the area with a 1 percent chance of flooding each year) reaches beyond the seawall and covers portions of West Road and East Road. The project site, however, is almost entirely outside of the 100-year floodplain zone. The 500-year floodplain zone (i.e., the area with a 0.2 percent chance of flooding each year) extends into the project site towards its midpoint where the elevation is lowest (see Figure 9-2). The FEMA Advisory Base Flood Elevations (ABFE) maps [14] indicate that the eastern and western portions of the project site are within the Advisory 1% Base Flood Elevation (i.e., 100 year flood elevation, 13 feet North American Vertical Datum of 1988 (NAVD88, which converts to 14.1 feet National Geodetic Vertical Datum of 1929 [NGVD29] and 16.4 feet Belmont Island Datum[15]), and much of the project site's center is below the Advisory 0.2%. Base Flood Elevation (i.e., 500-year flood elevation). The ABFE for the 100-year flood elevation is approximately 4 feet higher than the currently applicable 100-year flood elevation at the western and eastern edges of the study area.

~~By the 2050s, the NPCC projects that sea level rise would be in the range of approximately 1 foot under median conditions (not accounting for the rapid ice-melt scenario). By the 2080s, the projected sea level rise under median conditions is approximately 2 feet.~~

~~Currently, the 100-year floodplain is the only regulatory standard relating to elevation of new development. As stated above, since a portion of the proposed site is located within the current 500-year floodplain and likely within the future 100-year floodplain, climate change considerations and measures that would be implemented to increase climate resilience are discussed.~~

The project proposes to set the minimum building finished floor elevation (FFE) for the main entry level to ~~16.3~~ 17.4 feet, referenced to the Belmont Island Datum, used for Roosevelt Island (basement and service entries could be lower).[16] ~~This would exceed the elevation needed to make the project resilient to a rise in sea level projected for 2050, while allowing for reasonable connections to the perimeter road.~~ In select locations where existing elevations are higher, Cornell is considering FFE of ~~18~~ 21 feet, referenced to the Belmont Island Datum~~, are recommended if possible based upon building configuration and entrance locations~~. By designing the FFE to be at least one to five feet above the ABFE 100-year flood elevation, the project would be resilient to sea level rise within the likely range of rise projected by the NPCC by end of century.

[14] The FEMA Advisory Base Flood Elevation (ABFE) for the portion of New York City that includes the project site was released for review on February 25, 2013.

[15] Belmont Island Datum is the datum used for Roosevelt Island.

[16] Philip Habib & Associates, Memorandum, Cornell NYC Considerations for Determination of First Floor Elevation, March 7, 2012.

It is important to note that these elevation recommendations are based on preliminary considerations and that the final elevations may not conform to these elevations, since the elevations currently anticipated exceed code requirements. The factors contributing to ongoing decision making regarding where to set the project's FFE hinges on the New York City Department of Buildings requirement of being above the current FEMA 100-year flood elevation and further review of studies of the effect of climate change and storm surge. If the recommended elevations were implemented, sensitive uses and critical infrastructure would be more resilient to the likely future 1-in-100 flood levels when accounting for this potential additional flood elevation. In addition, any potentially hazardous materials, such as fuels would be stored in areas that would not be subject to flooding with the projected effects of climate change.

G. CONCLUSIONS

The building energy use and vehicle use associated with the proposed project would result in up to approximately 8 thousand metric tons of CO_2e emissions per year in Phase 1 and up to approximately 20 thousand metric tons of CO_2e in Full Build. The GHG emissions intensity of 9 to 10 kg CO_2e per gsf, would be substantially lower than the emissions intensity for similar uses.[17] The proposed project would result in the development of a high-technology, sustainable campus that is energy efficient and uses low-carbon and renewable power sources, which would further reduce the emissions from the proposed project, quoted above. The proposed site would be walkable and supportive of transit and non-motorized commuting and would strive to minimize GHG emissions from construction activity and emissions associated with the production and transport of construction materials. The proposed project's design includes many features aimed at reducing energy consumption and GHG emissions, and would be consistent with the city's citywide GHG reduction goal.

By designing the FFE to be at least one to five feet above the ABFE 100-year flood elevation, the project would be resilient to sea level rise within the likely range of rise projected by the NPCC by end of century. ~~The proposed project's design would also accommodate the potential sea level rise to 2050. Sensitive uses and critical infrastructure would be resilient to the likely future 1-in-100 flood levels when accounting for this potential additional flood elevation.~~ ✷

[17] American College & University Presidents' Climate Commitment, GHG Reports. Scopes 1 + 2 gross emissions per 1,000 square feet for similar universities in the region, including SUNY Stony Brook, New York University, University of Connecticut, and University of Pennsylvania.