A. INTRODUCTION

This section assesses the potential for the proposed facility at the Bronx Site to cast new shadows that would adversely impact any nearby sunlight-sensitive resources. Following the guidelines of the *City Environmental Quality Review (CEQR) Technical Manual*, sunlight-sensitive open spaces include publicly accessible parks and open space, features of historic resources that depend on sunlight, and natural resources that depend on sunlight. Therefore, this section is closely linked to the data and assessments presented in Bronx Site Sections 2.4, "Open Space" and 2.6, "Historic and Cultural Resources."

Per CEQR guidelines, an assessment of shadows is required if the proposed project would result in structures 50 feet or greater in height, or of any height if the project site is located adjacent to, or across the street from, a sunlight-sensitive resource. As discussed in Chapter 1, "Project Description," the proposed detention facility that would be constructed on the eastern portion of the Bronx Site would rise to a maximum envelope height of 245 feet above the ground floor project base level. The western portion of the site would be rezoned to permit a maximum zoning height of 145 feet. In addition, there are two planted medians with Greenstreets signage adjacent to the project site, which are sunlight-sensitive resources. Therefore, an analysis was conducted to assess potential shading effects on these and any other sunlight-sensitive resources.

PRINCIPAL CONCLUSIONS

The proposed project would result in incremental shadow on St. Mary's Park in winter and on two Greenstreets traffic medians in certain seasons, but in no case would the incremental shadow result in significant adverse impacts to either the use or the vegetation of those resources.

B. DEFINITIONS AND METHODOLOGY

This analysis has been prepared in accordance with New York City CEQR procedures and follows the guidelines of the 2014 *CEQR Technical Manual*.

DEFINITIONS

Incremental shadow is the additional, or new, shadow that a structure resulting from a proposed project would cast on a sunlight-sensitive resource.

Sunlight-sensitive resources are those that depend on sunlight or for which direct sunlight is necessary to maintain the resource's usability or architectural integrity. Such resources generally include:

- *Public open space* such as parks, beaches, playgrounds, plazas, schoolyards (if open to the public during non-school hours), greenways, and landscaped medians with seating. Planted areas within unused portions of roadbeds that are part of the Greenstreets program are also considered sunlight-sensitive resources.

- *Features of architectural resources that depend on sunlight for their enjoyment by the public.* Only the sunlight-sensitive features need be considered, as opposed to the entire resource. Such sunlight-sensitive features might include: design elements that depend on the contrast between light and dark (e.g., recessed balconies, arcades, deep window reveals); elaborate, highly carved ornamentation; stained-glass windows; historic landscapes and scenic landmarks; and features for which the effect of direct sunlight is described as playing a significant role in the structure's importance as a historic landmark.
- *Natural resources* where the introduction of shadows could alter the resource's condition or microclimate. Such resources could include surface water bodies, wetlands, or designated resources such as coastal fish and wildlife habitats.

Non-sunlight-sensitive resources include, for the purposes of CEQR:

- *City streets and sidewalks* (except Greenstreets);
- *Private open space* (e.g., front and back yards, stoops, vacant lots, and any private, non-publicly accessible open space);
- *Project-generated open space* cannot experience a significant adverse shadow impact from the project, according to CEQR, because without the project the open space would not exist. However, if the condition of project-generated open space is included in the qualitative analysis presented in the Open Space chapter of the EIS, a discussion of how shadows would affect the new space may be warranted.

A significant adverse shadow impact occurs when the incremental shadow added by a proposed project falls on a sunlight-sensitive resource and substantially reduces or completely eliminates direct sunlight, thereby significantly altering the public's use of the resource or threatening the viability of vegetation or other resources. Each case must be considered on its own merits based on the extent and duration of new shadow and an analysis of the resource's sensitivity to reduced sunlight.

METHODOLOGY

Following the guidelines of the *CEQR Technical Manual*, a preliminary screening assessment must first be conducted to ascertain whether a project's shadow could reach any sunlight-sensitive resources at any time of year. The preliminary screening assessment consists of three tiers of analysis. The first tier determines a simple radius around the proposed building representing the longest shadow that could be cast. If there are sunlight-sensitive resources within this radius, the analysis proceeds to the second tier, which reduces the area that could be affected by project shadow by accounting for the fact that shadows can never be cast between a certain range of angles south of the project site due to the path of the sun through the sky at the latitude of New York City.

If the second tier of analysis does not eliminate the possibility of new shadows on sunlight-sensitive resources, a third tier of screening analysis further refines the area that could be reached by project shadow by looking at specific representative days in each season and determining the maximum extent of shadow over the course of each representative day.

If the third tier of analysis does not eliminate the possibility of new shadows on sunlight-sensitive resources, a detailed shadow analysis is required to determine the extent and duration of the incremental shadow resulting from the project. The detailed analysis provides the data needed to assess the shadow impacts. The effects of the new shadows on the sunlight-sensitive resources are described, and their degree of significance is considered. The results of the analysis and

assessment are documented with graphics, a table of incremental shadow durations, and narrative text.

C. PRELIMINARY SCREENING ASSESSMENT

A base map was developed using Geographic Information Systems (GIS)[1] showing the location of the proposed project and the surrounding street layout (see **Figure 2.5-1**). In coordination with the open space, historic and cultural resources, and other assessments presented in other sections of this EIS, potential sunlight-sensitive resources were identified and shown on the map.

TIER 1 SCREENING ASSESSMENT

For the Tier 1 assessment, the longest shadow that the proposed structure(s) could cast is calculated, and, using this length as the radius, a perimeter is drawn around the project site. Anything outside this perimeter representing the longest possible shadow could never be affected by project-generated shadow, while anything inside the perimeter needs additional assessment.

According to the *CEQR Technical Manual*, the longest shadow that a structure can cast at the latitude of New York City occurs on December 21, the winter solstice, at the start of the analysis day at 8:51 AM, and is equal to 4.3 times the height of the structure.

Therefore, at a maximum envelope height of 245 feet above the ground floor project base level~~curb level~~, plus an additional 40 feet to conservatively allow for rooftop mechanical structures, the proposed project could cast a shadow up to approximately 1,226 feet in length (285 x 4.3). Using this length as the radius, a perimeter was drawn around the project site (see **Figure 2.5-1**).

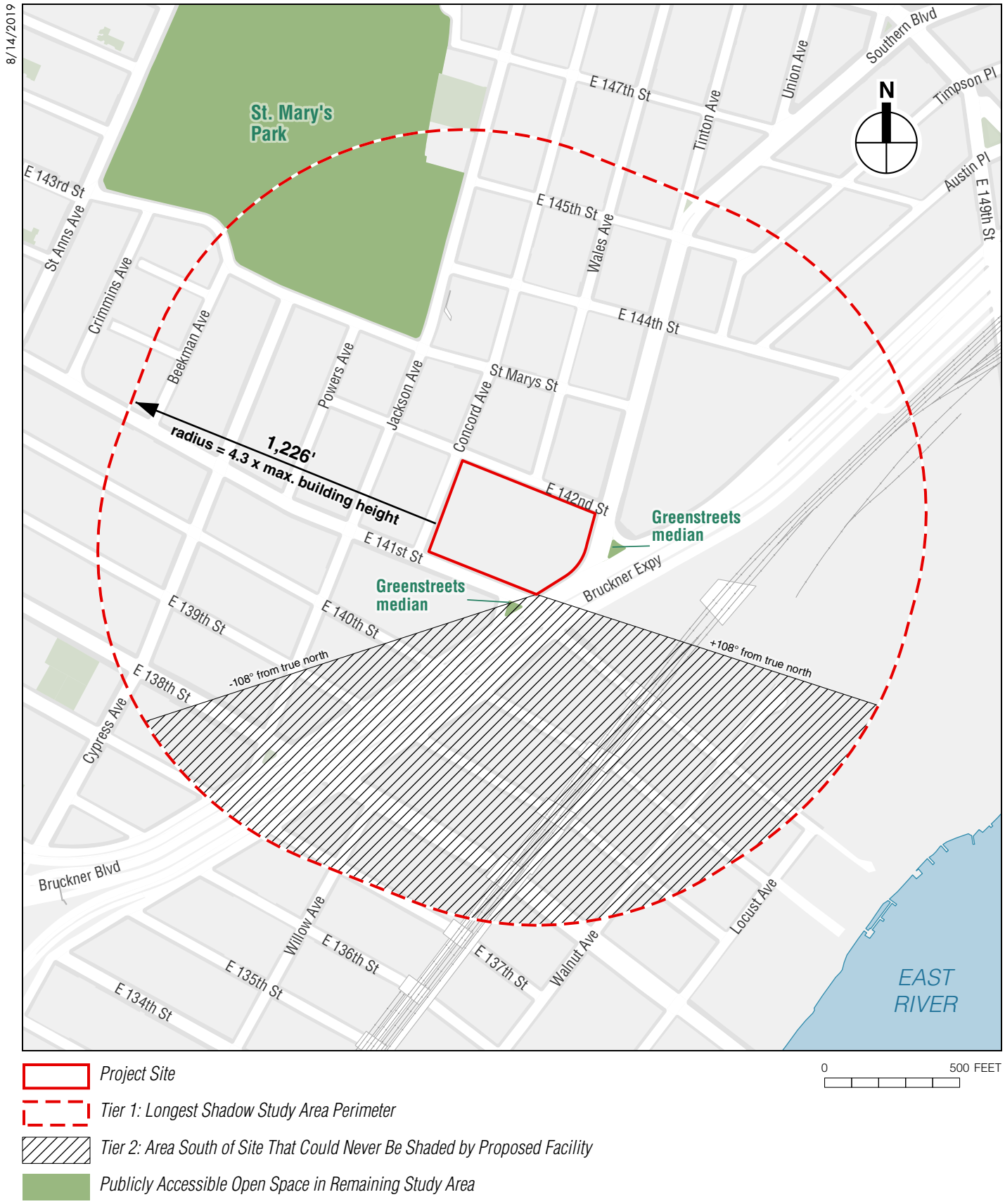
The Tier 1 assessment showed that four open space resources were located within the longest shadow study area: a portion of St. Mary's Park to the north, a Greenstreets median directly across Tinton Avenue to the east, and two Greenstreets medians to the south, one directly across East 141st Street and the other one, named Gouverneur Morris Triangle, located several blocks to the southwest at the intersection of East 138th Street, Jackson Avenue, and Bruckner Boulevard. Therefore, the next tier of assessment was required. No historic resources with sunlight-sensitive features were located in the longest shadow study area.

TIER 2 SCREENING ASSESSMENT

Because of the path that the sun travels across the sky in the northern hemisphere, no shadow can be cast in a triangular area south of any given project site. In New York City this area lies between -108 and +108 degrees from true north. **Figure 2.5-1** illustrates this triangular area south of the project site. The complementary area to the north within the longest shadow study area represents the remaining area that could potentially experience new project generated shadow.

The Tier 2 assessment showed that a portion of St. Mary's Park, the Greenstreets median to the east, and a very small portion of the Greenstreets median across East 141st Street to the south were located in the remaining longest shadow study area, and the next tier of assessment was required for those remaining three resources.

[1] Software: Esri ArcGIS Pro; Data: New York City Department of Information Technology and Telecommunications (DoITT) and other City agencies, and AKRF site visits.



Tier 1 and Tier 2 Assessments
Bronx Site - 745 East 141st Street

BOROUGH-BASED NYC JAIL SYSTEM

Figure 2.5-1

TIER 3 SCREENING ASSESSMENT

The direction and length of shadows vary throughout the course of the day and differ depending on the season. In order to determine whether project-generated shadow could fall on a sunlight-sensitive resource, three-dimensional (3D) computer modeling software[1] is used in the Tier 3 assessment to calculate and display the proposed project's shadows on individual representative days of the year. A computer model was developed containing three-dimensional representations of the elements in the base map used in the preceding assessments, the topographic information of the study area, and a reasonable worst-case three-dimensional representation of the proposed project.[2]

REPRESENTATIVE DAYS FOR ANALYSIS

Following the guidance of the *CEQR Technical Manual*, shadows on the summer solstice (June 21), winter solstice (December 21) and spring and fall equinoxes (March 21 and September 21), which are approximately the same in terms of shadow patterns) are modeled, to represent the range of shadows over the course of the year (see **Figures 2.5-2** and **2.5-3)**. An additional representative day during the growing season is also modeled, generally the day halfway between the summer solstice and the equinoxes, i.e., May 6 or August 6, which have approximately the same shadow patterns.

TIMEFRAME WINDOW OF ANALYSIS

The shadow assessment considers shadows occurring between one and a half hours after sunrise and one and a half hours before sunset. At times earlier or later than this timeframe window of analysis, the sun is down near the horizon and the sun's rays reach the Earth at very tangential angles, diminishing the amount of solar energy and producing shadows that are very long, move fast, and generally blend with shadows from existing structures until the sun reaches the horizon and sets. Consequently, shadows occurring outside the timeframe window of analysis are not considered significant under CEQR, and their assessment is not required.

TIER 3 SCREENING ASSESSMENT RESULTS

The Tier 3 assessment showed that on the morning of the December 21 analysis day, project-generated shadow would be long enough to move across a limited portion of St. Mary's Park, on its southern side, which is adjacent to St. Mary's Street approximately between Cypress Avenue and Jackson Avenue. No other sunlight-sensitive resources would be affected on this analysis day.

On the March 21/September 21 and the May 6/August 6 analysis days, project-generated shadow could fall on the Greenstreets traffic median directly east of the project site in the afternoon. No other sunlight-sensitive resources would be affected on this analysis day.

On the June 21 analysis day, project-generated shadow could fall on the Greenstreets traffic median directly east of the project site in the afternoon. In the early morning of this analysis day, project-generated shadow could briefly fall on a very small portion of the Greenstreets median

[1] Bentley MicroStation.

[2] Since issuance of the Draft EIS, the design for each proposed detention facility has been refined to include setbacks, as discussed in Chapter 1, "Project Description." This analysis does not account for the proposed setbacks, which provides for a conservative assessment of potential shadow impacts.

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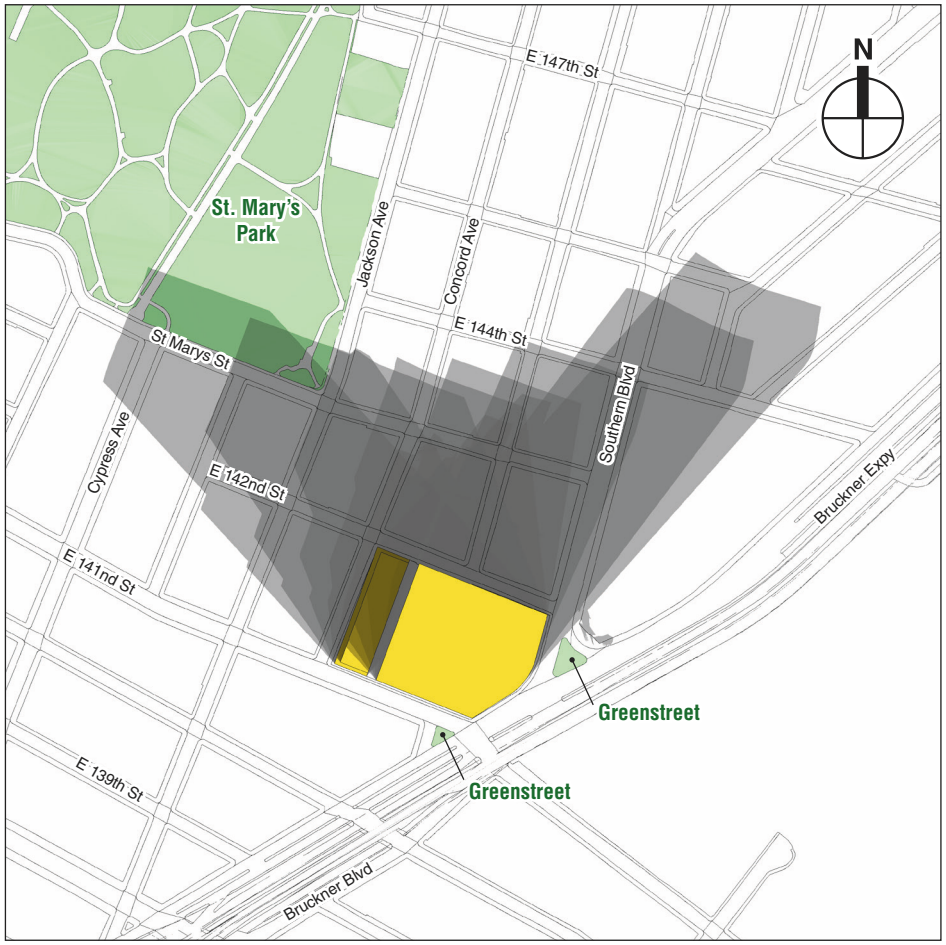
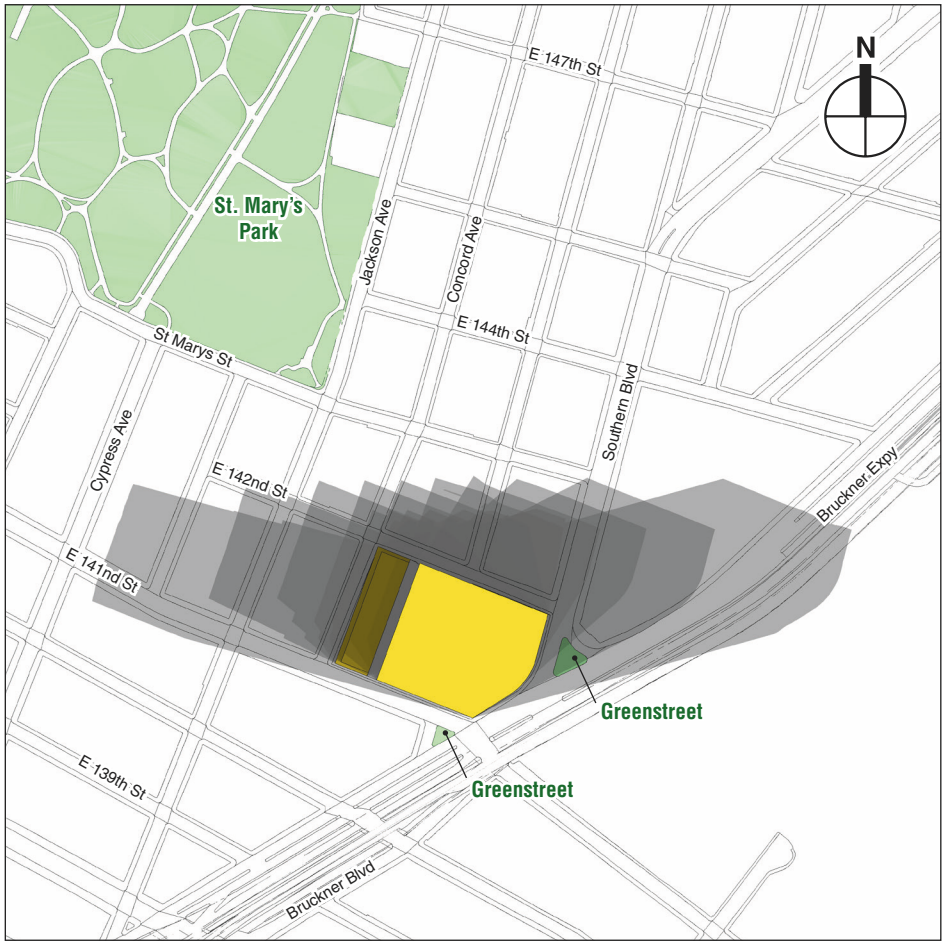


December 21



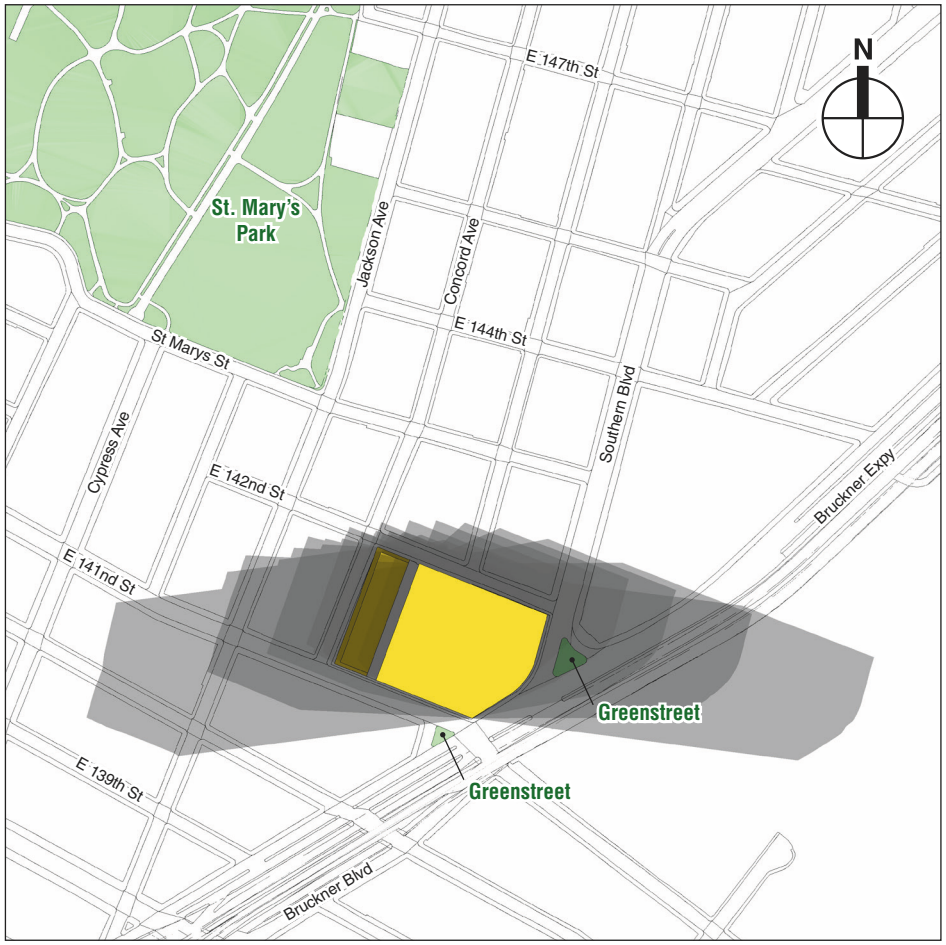
March 21 / Sept. 21

Publicly Accessible Open Space

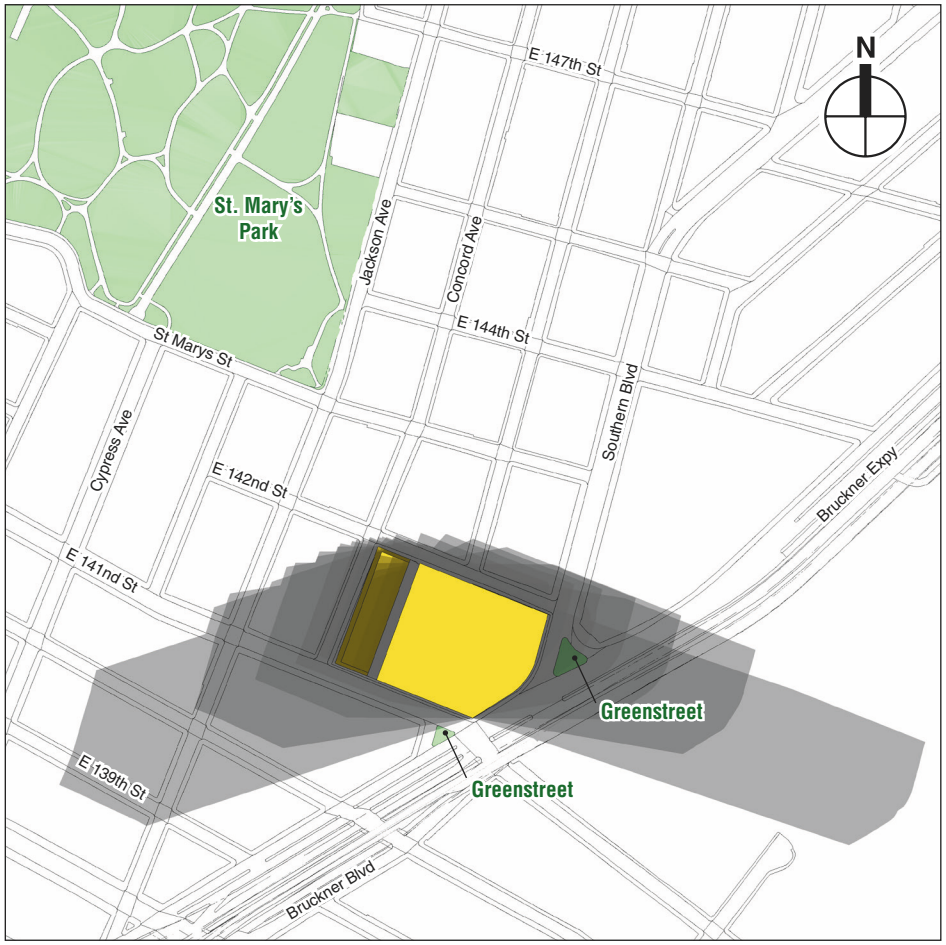
This figure illustrates the range of shadows that would occur, absent intervening structures, from the proposed building on the winter solstice and spring/fall equinox analysis days. The shadows are shown occurring approximately every 60 minutes from the start of the analysis day (one and a half hours after sunrise) to the end of the analysis day (one and a half hours before sunset). The Tier 3 assessment serves to illustrate the daily path or "sweep" of the proposed building's shadows across the landscape, indicating which resources could potentially be affected on that analysis day, absent intervening buildings, by project-generated shadow. Daylight Saving Time was not used, per CEQR Technical Manual guidelines.

Tier 3 Assessment

8.14.19



May 6 / August 6



June 21

Publicly Accessible Open Space

This figure illustrates the range of shadows that would occur, absent intervening structures, from the proposed building on the May 6/August 6 and summer solstice analysis days. The shadows are shown occurring approximately every 60 minutes from the start of the analysis day (one and a half hours after sunrise) to the end of the analysis day (one and a half hours before sunset). The Tier 3 assessment serves to illustrate the daily path or "sweep" of the proposed building's shadows across the landscape, indicating which resources could potentially be affected on that analysis day, absent intervening buildings, by project-generated shadow. Daylight Saving Time was not used, per CEQR Technical Manual guidelines.

Tier 3 Assessment

south-adjacent to the project site. No other sunlight-sensitive resources would be affected on this analysis day.

In summary, a portion of St. Mary's Park could be affected in the morning on the winter analysis day, the Greenstreets median directly east of the project site could be affected in the afternoon on the spring, summer, and fall analysis days, and the Greenstreets median directly south of the project site could be affected in a very limited way in the morning of the June 21 analysis day. Therefore, a more detailed analysis was warranted for these resources on the relevant analysis days.

D. DETAILED SHADOW ANALYSIS

The purpose of the detailed analysis is to determine the extent and duration of new incremental shadows that fall on sunlight-sensitive resources as a result of the project, and to assess their potential effects. The baseline or future No Action condition is established, containing existing buildings and any future developments planned in the area, to illustrate the baseline shadows. The future condition with the proposed project and its shadows can then be compared with the baseline condition to determine the incremental shadows that would result with the proposed project.

Following the analysis framework described in Chapter 1, "Project Description," the shadows assessment was performed for the analysis year of ~~2027~~2026, comparing the proposed project with No Action condition in which the site would remain as in the existing condition.

Three-dimensional representations of the existing buildings in the study area were developed using data obtained from the New York City Department of Information Technology and Telecommunications (NYC DoITT), building plans on file with the City, and photos taken during project site visits, and were added to the three-dimensional model used in the Tier 3 assessment.

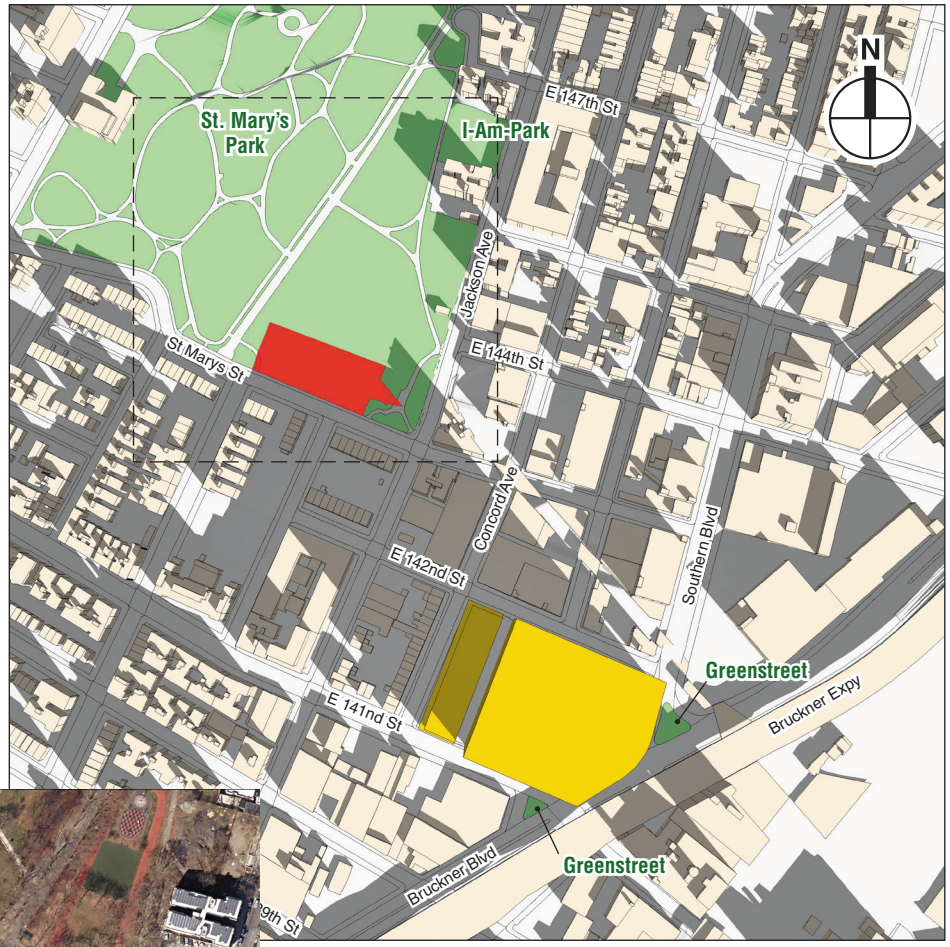
Shadows are in constant movement. The computer simulation software produces an animation showing the movement of shadows over the course of each analysis period. The analysis determines the time when incremental shadow would enter each resource, and the time it would exit.

Shadow analyses were performed for each of the representative days and analysis periods indicated in the Tier 3 assessment.

Table 2.5-1 summarizes the entry and exit times and total duration of incremental shadows on each affected sun-sensitive resource. **Figures 2.5-4** through **2.5-10** document the results of the analysis by providing graphic representations from the computer animation of times when incremental shadow would fall on a sun-sensitive resource. The figures illustrate the extent of additional, incremental shadow at that moment in time, highlighted in red, and show existing shadow and remaining areas of sunlight.

8.14.19

No Action



Proposed Building Envelope

Publicly Accessible Open Space

Incremental Shadow on Sunlight-Sensitive Resource

Existing Building

Proposed Building

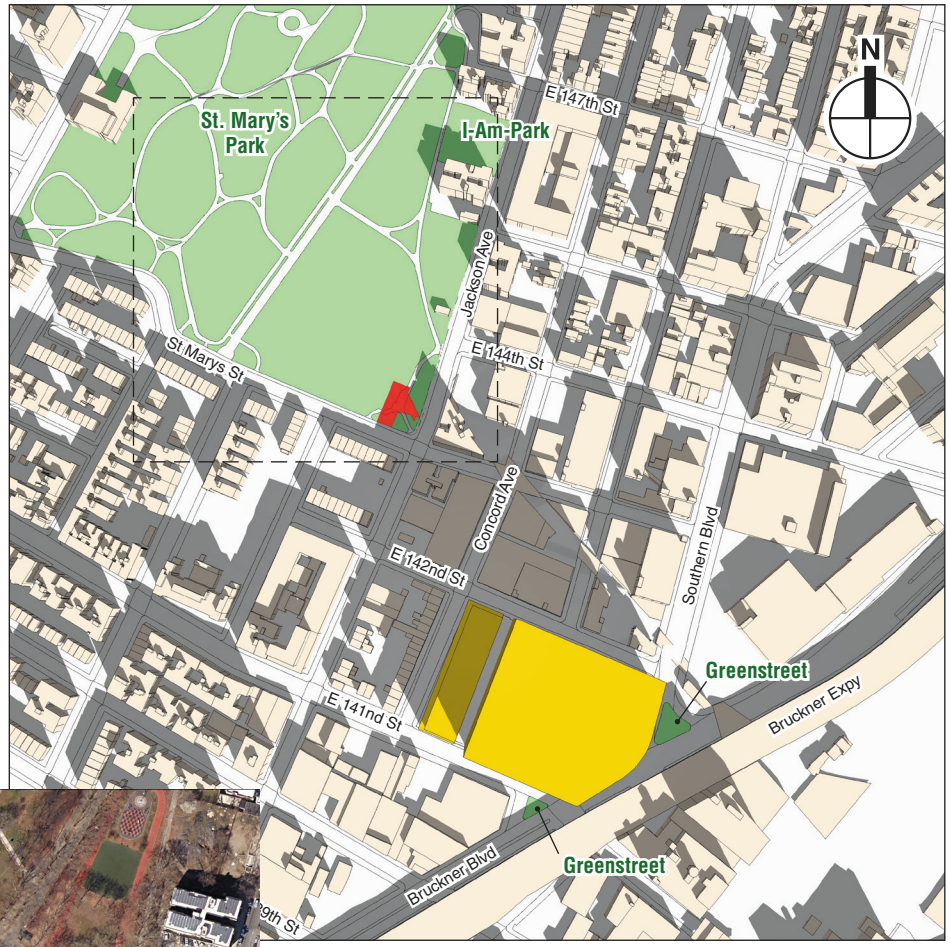
December 21 – 9:00 AM

BOROUGH-BASED NYC JAIL SYSTEM

Figure 2.5-4

8.14.19

No Action



Proposed Building Envelope

Publicly Accessible Open Space

Incremental Shadow on Sunlight-Sensitive Resource

Existing Building

Proposed Building

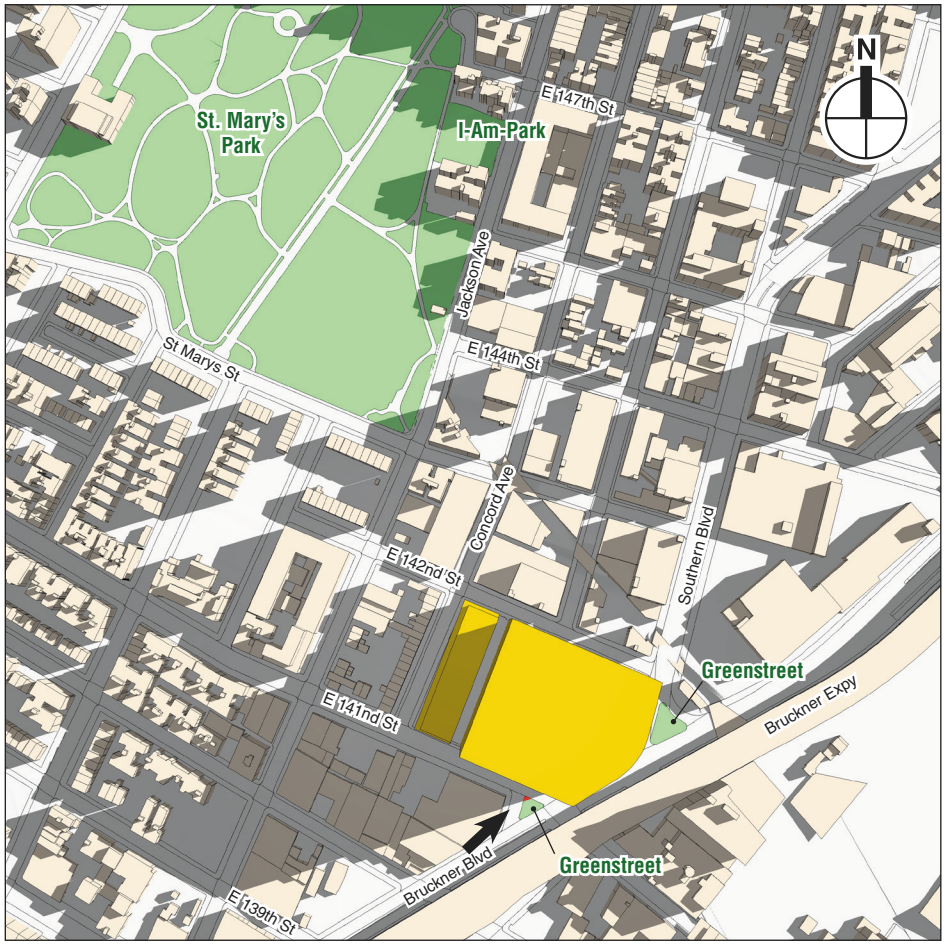
December 21 – 10:00 AM

BOROUGH-BASED NYC JAIL SYSTEM

Figure 2.5-5

8.14.19

No Action



Proposed Building Envelope

Publicly Accessible Open Space

Incremental Shadow on Sunlight-Sensitive Resource

Existing Building

Proposed Building

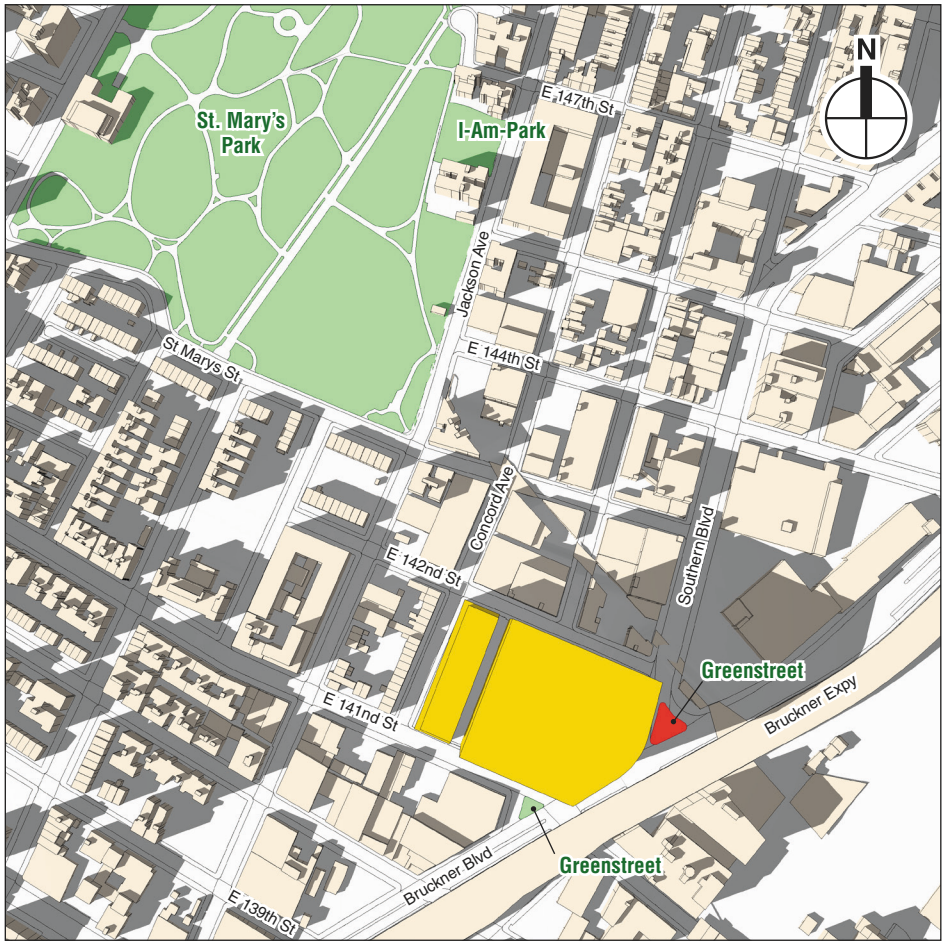
June 21 – 6:00 AM

BOROUGH-BASED NYC JAIL SYSTEM

Figure 2.5-6

8.14.19

No Action



Proposed Building Envelope

Publicly Accessible Open Space

Incremental Shadow on Sunlight-Sensitive Resource

Existing Building

Proposed Building

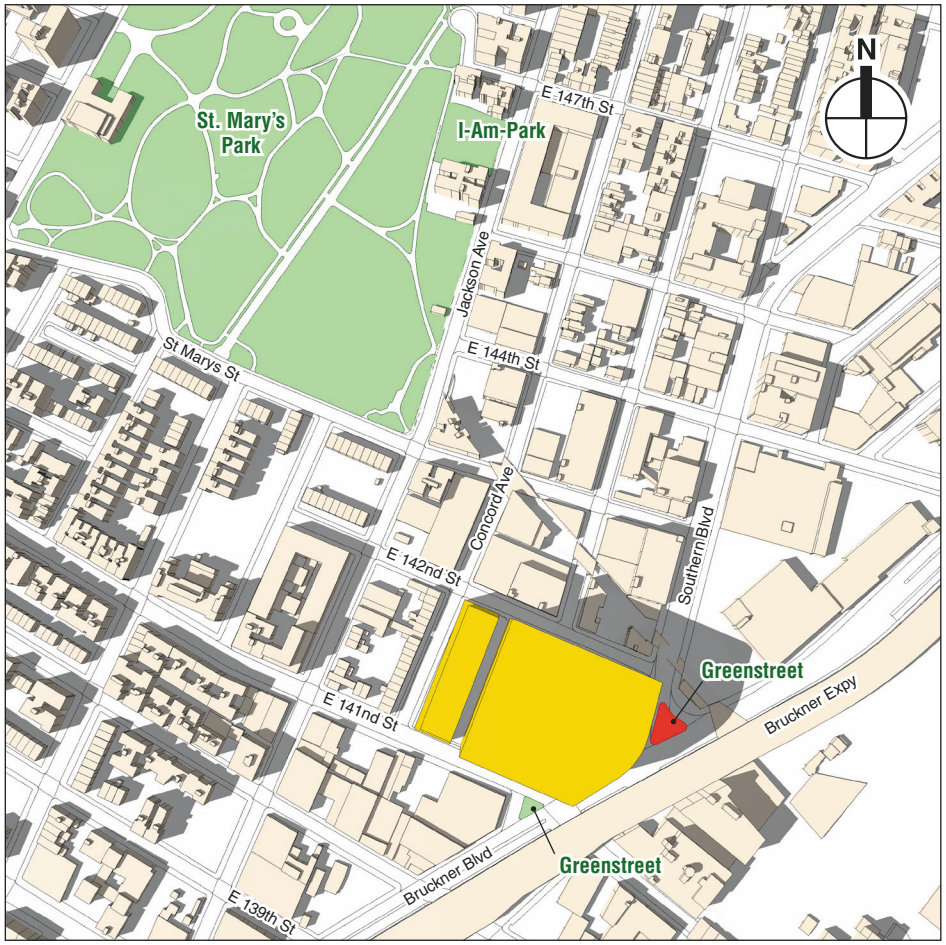
March 21 / Sept. 21 – 4:00 PM

BOROUGH-BASED NYC JAIL SYSTEM

Figure 2.5-7

8.14.19

No Action



Proposed Building Envelope

Publicly Accessible Open Space

Incremental Shadow on Sunlight-Sensitive Resource

Existing Building

Proposed Building

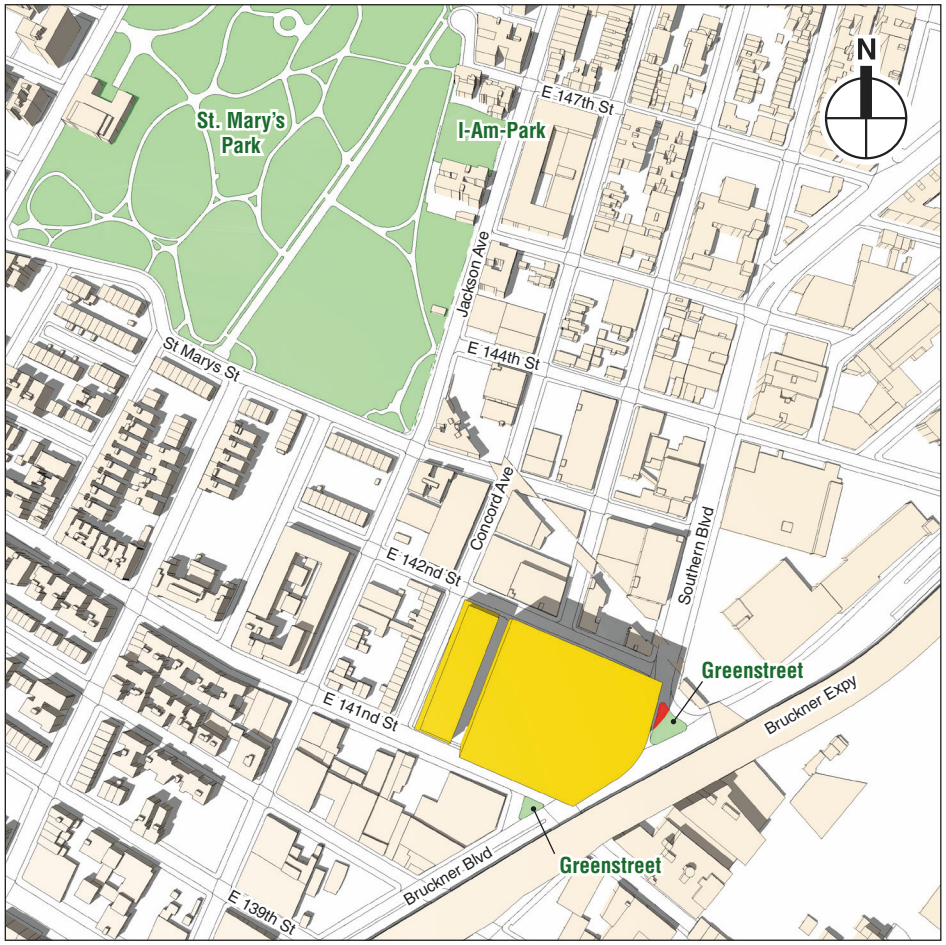
May 6 / August 6 – 3:00 PM

BOROUGH-BASED NYC JAIL SYSTEM

Figure 2.5-8

8.14.19

No Action



Proposed Building Envelope

Publicly Accessible Open Space

Incremental Shadow on Sunlight-Sensitive Resource

Existing Building

Proposed Building

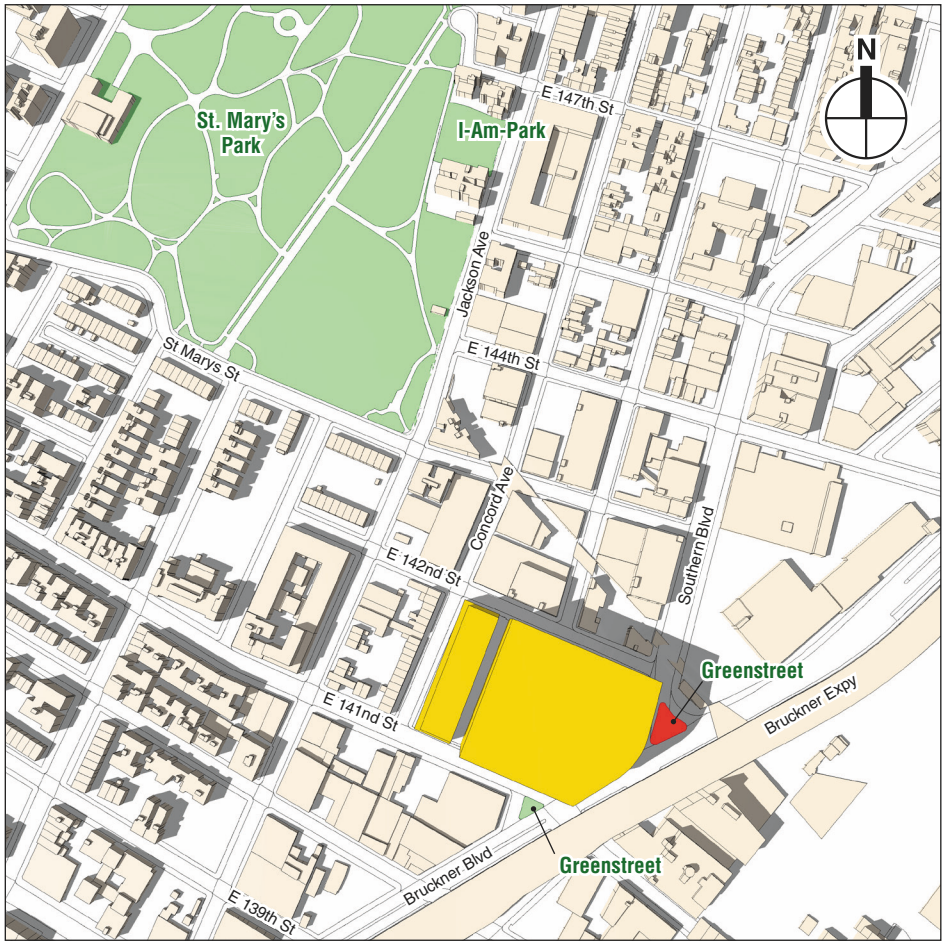
June 21 – 1:30PM

BOROUGH-BASED NYC JAIL SYSTEM

Figure 2.5-9

8.14.19

No Action



Proposed Building Envelope

Publicly Accessible Open Space

Incremental Shadow on Sunlight-Sensitive Resource

Existing Building

Proposed Building

June 21 – 2:30PM

BOROUGH-BASED NYC JAIL SYSTEM

Figure 2.5-10

Table 2.5-1
Incremental Shadow Durations on Sunlight-Sensitive Resources

Analysis day and timeframe window	December 21 8:51 AM–2:53 PM	March 21/Sept. 21 7:36 AM–4:29 PM	May 6/August 6 6:27 AM–5:18 PM	June 21 5:57 AM–6:01 PM
St. Mary's Park	8:51 AM–10:25 AM Duration: 1 hr 34 min	—	—	—
Greenstreets median, East 141st Street and Bruckner Boulevard	—	—	—	5:57 AM–6:20 AM Duration: 23 min
Greenstreets median, Southern Boulevard and Bruckner Boulevard	—	2:10 PM–4:29 PM Duration: 2hr 19 min	1:20 PM–5:18 PM Duration: 3 hr 58 min	1:15 PM–6:01 PM Duration: 4 hr 46 min

Notes:

Table indicates entry and exit times and total duration of incremental shadow for each sunlight-sensitive resource.

Daylight saving time is not used—times are Eastern Standard Time, per *CEQR Technical Manual* guidelines. However, as Eastern Daylight Time is in effect for the March/September, May/August, and June analysis periods, add 1 hour to the given times to determine the actual clock time.

DETERMINATION OF IMPACT SIGNIFICANCE

The determination of significance of shadow impacts on a sunlight-sensitive resource is based on (1) the information resulting from the detailed shadow analysis describing the extent and duration of incremental shadows, and (2) an analysis of the resource's sensitivity to reduced sunlight. The goal of the assessment is to determine whether the effects of incremental shadows on a sunlight-sensitive resource are significant under CEQR.

A shadow impact occurs when the incremental shadow from a proposed project falls on a sunlight-sensitive resource or feature and reduces its direct sunlight exposure. Determining whether this impact is significant or not depends on the extent and duration of the incremental shadow and the specific context in which the impact occurs.

Per CEQR, a significant shadow impact generally occurs when an incremental shadow of 10 minutes or longer falls on a sunlight sensitive resource and results in one of the following:

VEGETATION

- A substantial reduction in sunlight available to a sunlight-sensitive feature of the resource to less than the minimum time necessary for its survival (when there was sufficient sunlight in the future without the proposed actions). In the growing season, four to six hours a day of sunlight is a minimum requirement.
- A reduction in direct sunlight exposure where the sensitive feature of the resource is already subject to substandard sunlight (i.e., less than minimum time necessary for its survival).

HISTORIC AND CULTURAL RESOURCES

- A substantial reduction in sunlight available for the enjoyment or appreciation of the sunlight-sensitive features of a historic or cultural resource.

OPEN SPACE UTILIZATION

- A substantial reduction in the usability of open space as a result of increased shadows.

FOR ANY SUNLIGHT-SENSITIVE FEATURE OF A RESOURCE

- Complete elimination of all direct sunlight on the sunlight-sensitive feature of the resource, when the complete elimination results in substantial effects on the survival, enjoyment, or, in the case of open space or natural resources, the use of the resource.

SHADOW EFFECTS BY RESOURCE

ST. MARY'S PARK

St. Mary's Park is a large park spanning several blocks. The park includes lawn areas, various sports fields, playgrounds, a dog park, and barbeque areas. The park would receive incremental shadow in the morning on the December 21 analysis day from 8:51 AM to 10:25 AM (see **Figures 2.5-4** and **2.5-5**). The incremental shadow would pass over the southern corner of St. Mary's Park where the dog park and the baseball fields are located. Only a portion of the dog park and the southern baseball field would be in shadow during this time. This limited extent and duration of shadow would not affect the use of the space, because portions of the dog park and baseball fields would remain in sun and large areas of the park in general would be in sun during this time for users seeking sunlight. Further, the incremental shadow would not substantially affect trees and other vegetation during the winter months, which are outside of the growing season. The proposed project would therefore not result in significant adverse shadow impacts to this resource in winter or in any other season.

GREENSTREETS MEDIAN, EAST 141ST STREET AND BRUCKNER BOULEVARD

This Greenstreets median is located south of the project site on East 141st Street and Bruckner Boulevard. It is primarily grass with a few trees. This space would receive a very small incremental shadow on the June 21 analysis day from 5:57 AM to 6:20 AM. The incremental shadow would be limited to the northern corner of the median (see **Figure 2.5-6**). The incremental shadow would be brief in duration and very small in extent and therefore would not result in any significant impacts to the vegetation in the median. The proposed project would not result in significant adverse shadow impacts to this resource.

GREENSTREETS MEDIAN, SOUTHERN BOULEVARD AND BRUCKNER BOULEVARD

This Greenstreets median is located east of the project site on Southern Boulevard and Bruckner Boulevard. This resource contains landscaped areas with young trees and other plantings and a sidewalk running through it. There are no benches or other amenities; it is used for pedestrian circulation. The median would receive incremental shadow on three of the analysis days.

On the March 21 analysis day, the median would receive incremental shadow from 2:10 PM to 4:29 PM. From 3:35 PM to the end of the analysis day, the incremental shadow would eliminate the sunlight on the space (see **Figure 2.5-7** showing 4:00 PM). The planted areas would continue to receive over six hours of direct sunlight throughout the morning and early afternoon and therefore this resource would not be significantly impacted by the project on this analysis day.

On the May 6/August 6 analysis day, the incremental shadow would enter the median at 1:20 PM. At 2:30 PM, the incremental shadow would eliminate the sunlight on the median until the end of the analysis day at 5:18 PM (see Figure **2.5-8** showing 3:00 PM). The approximately two and a half hours of project-generated incremental shadow would be the only shadow on the median throughout the day. The planted areas would receive over seven hours of direct sunlight with the proposed project and therefore the resource would not be significantly impacted on this analysis day.

On the June 21 analysis day the incremental shadow would enter the median at 1:15 PM (see **Figure 2.5-9** showing 1:30 PM). At 2:20 PM, the incremental shadow would eliminate all the sunlight on the median (see **Figure 2.5-10** showing 2:30 PM) and would continue to do so until the end of the analysis day at 6:01 PM. The incremental shadow would be the only shadow on the median throughout the day. The planted areas would receive over seven hours of direct sunlight with the proposed project and therefore the resource would not be significantly impacted on this analysis day.

In conclusion, the proposed project would not cause significant adverse shadow impacts to this resource.

E. CONCLUSIONS

The proposed project would result in incremental shadow on St. Mary's Park in winter and on two Greenstreets traffic medians in certain seasons but in no case would the incremental shadow result in significant adverse impacts to either the use or the vegetation of those resources. ✷