

A. INTRODUCTION

Under *City Environmental Quality Review (CEQR) Technical Manual* guidelines, a shadows assessment is required if a 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. Sunlight-sensitive resources of concern include public open space, sunlight-dependent features of historic architectural resources, and natural resources that depend on sunlight.

As described in greater detail in Chapter 1, “Projection Description,” the Proposed Project is a commercial center with the associated parking, open space, and street and infrastructure improvements. Since portions of the Proposed Project would include be more than 50 feet in maximum height, and further since the proposed Project Site is located adjacent to tidal and freshwater wetland areas, a shadows assessment was conducted.

PRINCIPAL CONCLUSIONS

The shadows from the Proposed Project would briefly and minimally impact the proposed vegetation and aquatic resources along the immediate western shoreline, but would not affect these resources located along the southern shoreline of the Proposed Project site. The enhanced tidal wetland and freshwater wetland creation areas along the western shoreline and within the preserved northern portion of the Project Site would receive minimal shading from the Proposed Project. Proposed vegetation within the building vicinity would have a moderate amount of tolerance to the anticipated building shadows. Therefore, the Proposed Project is not anticipated to result in any significant adverse impacts on vegetation or aquatic resources due to shadows.

B. DEFINITIONS AND METHODOLOGY

This analysis has been prepared in accordance with the guidelines of the *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 resources 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* (e.g., parks, beaches, playgrounds, plazas, schoolyards, greenways, 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, a qualitative discussion of shadows on the project-generated publicly-accessible open space should be included in the analysis.

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 accounts for existing shadows cast by intervening and surrounding buildings, and 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. In coordination with the open space, historic resources and natural resources assessments presented in other chapters of this Environmental Impact Statement (EIS), potential sunlight-sensitive resources were identified and shown on the map.

TIER 1 SCREENING 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 (412.8 feet).

The Proposed Project is comprised of multiple commercial spaces that would range in height up to a maximum of 96 feet. In order to ensure a conservative analysis, the maximum height of the tallest portion of the Proposed Project was used for the entire Project Site.

At a maximum height of approximately 96.0 feet above grade, the Proposed Project could cast a shadow up to 412.8 feet in length (96.0 x 4.3). Using this length as the radius, a perimeter was drawn around the entire proposed Project Site. Portions of wetland areas were located within the perimeter or longest shadow study area, and therefore the next tier of screening assessment was conducted.

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. The complementing area to the north within the longest shadow study area represents the remaining area that could potentially experience new project generated shadow.

Portions of wetland were located within the remaining longest shadow study area, and therefore the next tier of screening assessment was conducted for these resources.

TIER 3 SCREENING ASSESSMENT

According to the *CEQR Technical Manual* guidelines, a Tier 3 screening assessment should be performed to determine whether a proposed building's shadow could potentially, absent intervening and surrounding buildings, fall on a sunlight-sensitive resource. The analysis is performed utilizing a three-dimensional (3D) computer model, and shadows are modeled on four representative days of the year to represent the annual variation in shadow patterns in each of the four seasons. If the Tier 3 assessment shows that project-generated shadow could reach one or more sunlight-sensitive resources, a more rigorous detailed analysis is conducted utilizing a 3D

¹ Software: Esri ArcGIS 10.3; Data: New York City Department of Information Technology and Telecommunications (DoITT) and other City agencies, and AKRF site visits.

model including existing structures in the study area, and the extent and duration of incremental shadows are reported.

Given that the Project Site contains wetlands and is on the waterfront, and there are no intervening buildings that would affect project-generated shadows, it was determined that any project-generated shadow would directly fall on these resources on at least one, and likely all, of the representative analysis days. Therefore, a Tier 3 assessment was not necessary, and a detailed shadow analysis was performed as required under the *CEQR Technical Manual*.

D. DETAILED SHADOW ANALYSIS

The direction and length of shadows vary throughout the course of the day and also differ depending on the season. In order to determine whether project-generated shadow could fall on a sunlight-sensitive resource, three-dimensional (3D) computer mapping software² 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.

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. 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.

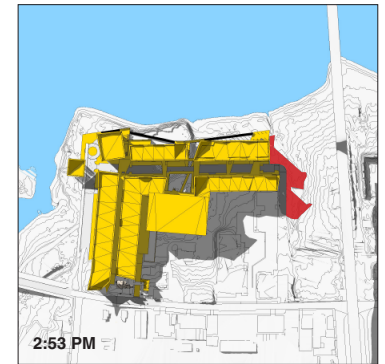
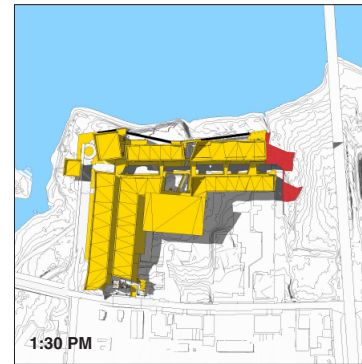
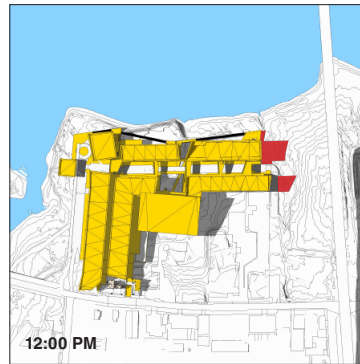
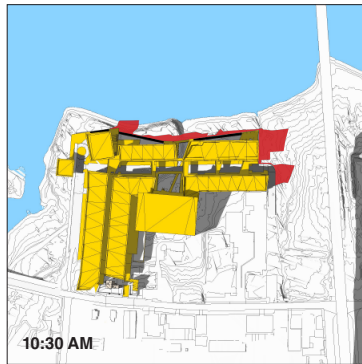
ANALYSIS RESULTS

Table 5-1 summarizes the entry and exit times and total duration of incremental shadows on each affected sun-sensitive area.

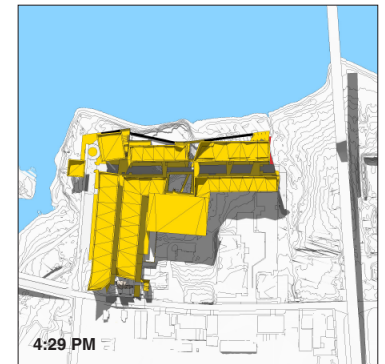
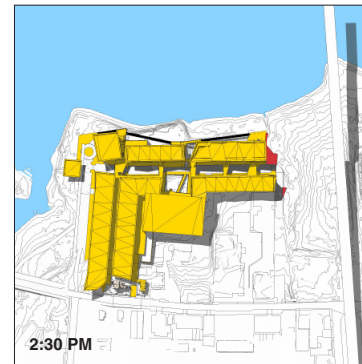
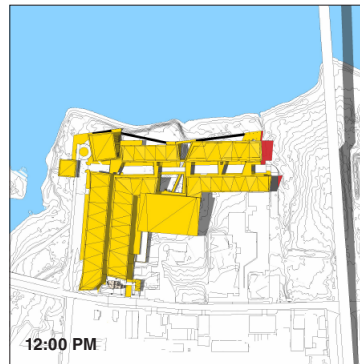
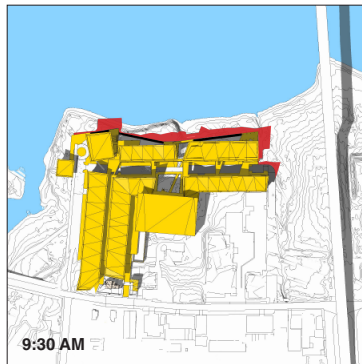
Figures 5-1 and 5-2 document the results of the analysis by providing graphic representations from the computer animation of times when incremental shadow would fall on a sun-sensitive resource on each of the four representative analysis days. The figures illustrate the extent of

² MicroStation V8i (SELECTSeries 3).

D e c e m b e r 2 1

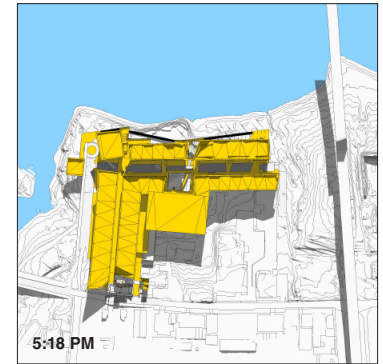
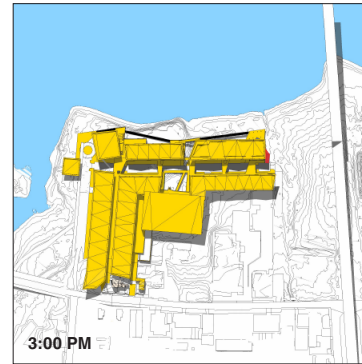
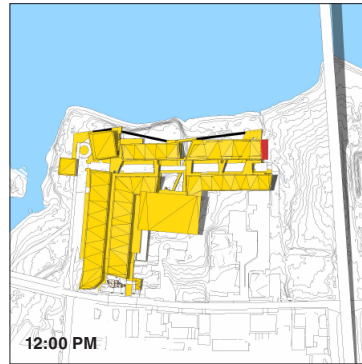
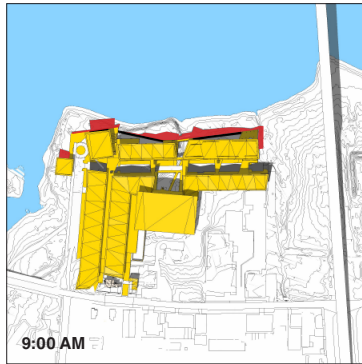
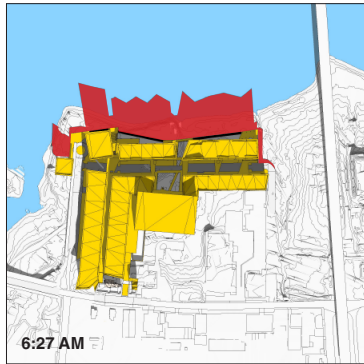


M a r c h 2 1 / S e p t e m b e r 2 1

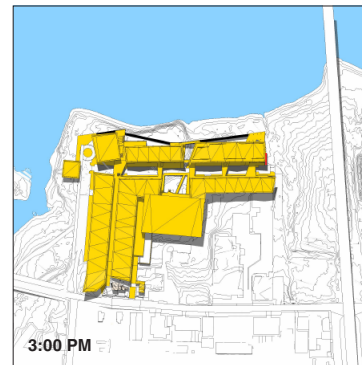
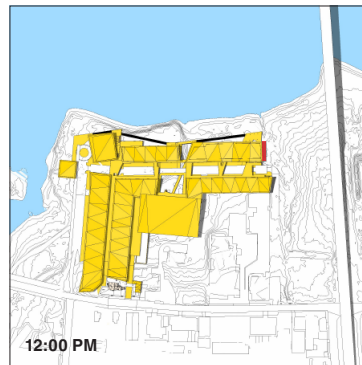
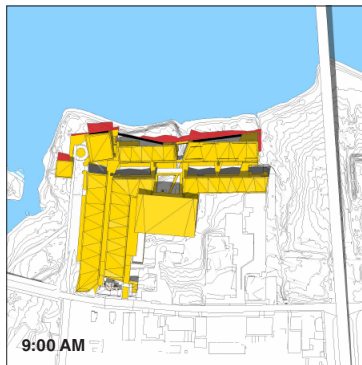


Note: All times are Eastern Standard Time

May 6 / August 6



June 21



Note: All times are Eastern Standard Time

Table 5-1
Incremental Shadow Durations

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
Arthur Kill	8:51 AM–10:45 AM Total: 1 hr 54 min	7:36 AM–9:45 PM Total: 2 hr 9 min	6:27 AM–8:45 AM Total: 2 hr 18 min	5:57 AM–8:15 AM Total: 2 hr 18 min
Waterfront Open Space west of Proposed Project	8:51 AM–11:45 AM Total: 2 hr 54 min	8:30 AM–10:45 PM Total: 2 hr 15 min	6:27 AM–10:30 AM Total: 4 hr 3 min	5:57 AM–10:45 AM Total: 4 hr 48 min
Preserved/restored wetland area north of Proposed Project	8:51 AM–2:53 PM Total: 6 hr 2 min	7:36 AM–4:29 PM Total: 8 hr 53 min	6:27 AM–4:00 PM* Total: 9 hr 33 min	5:57 AM–3:00 PM* Total: 9 hr 3 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 <i>CEQR Technical Manual</i> guidelines. However, as Eastern Daylight Time is in effect for the March/September, May/August and June analysis periods, add one hour to the given times to determine the actual clock time. *For much of the incremental shadow duration on the May 6/August 6 and June 21 analysis days, the size of the incremental shadow coverage on this preserved wetland area would be very small, as shown in Figure 5-2 and discussed in greater detail below.				

additional, incremental shadow at representative moments in time, highlighted in red, and also show existing shadows and remaining areas of sunlight.

December 21

On December 21st, the early morning (8:51 AM) project-generated incremental shadow would reach the Arthur Kill and the immediate western shoreline of the Project Site. By 10:30 AM incremental shadow would have nearly completely retreated from the Arthur Kill and by 12:00 PM would have completely retreated from both the Arthur Kill and the waterfront open space. Small areas of new shadow would fall on the preserved areas west and north of the Proposed Project throughout the analysis day.

March 21/September 21

On March/September 21, the early morning (7:36 AM) shadow would reach the Arthur Kill and the immediate western shoreline of the Project Site and by 9:30 AM would have nearly completely retreated from the Arthur Kill, and by 12:00 PM would have completely retreated from both the Arthur Kill and the waterfront open space. Only small areas of new shadow would fall on the preserved areas west and north of the Proposed Project throughout the analysis day. The area of shadow would be largest at the start of the analysis day at 7:36 AM, covering approximately 12,400 square feet (see Figure 5-2). But it would decrease in size from that time to approximately 6,250 square feet, covering about half that size two hours later at 9:30 AM (see Figure 5-2). The shadow coverage area would be about 5,500 square feet at noon, down to 3,200 square feet at 2:30 PM, and by the end of the analysis day at 4:29 PM would be only about 350 square feet in area (see Figure 5-2). Given the sweep of this shadow, the limited duration of the shadow and the diminishing shadow extent through the course the day, it is not expected that the Proposed Project would result in any significant impacts on the ecology of these habitats or the functionality of the preservation areas on the western and northern portion of the Project Site.

May 6/August 6

On May/August 6, the early morning (6:27 AM) shadow would reach the immediate western shoreline of the Project Site and by 9:00 AM would have completely retreated from the Arthur Kill and by 12:00 PM would have completely retreated from the waterfront open space. New shadow would fall on the restored wetland area north-adjacent to the Proposed Project for much of the day but would be minimal, affecting only very small areas adjacent to the Proposed Project. At 9:00 AM, the new shadow would cover only approximately 1,200 square feet of the north-adjacent preserved wetland area (see Figure 5-2). The new shadow would increase in coverage area to approximately 1,800 square feet at 10:30 AM, and approximately 2,000 square feet from 11:30 AM to 12:30 PM (see Figure 5-2). By 2:00 PM the coverage would decrease to approximately 1,000 square feet, at 3:00 PM down to approximately 340 square feet (see Figure 5-2), and by 3:30 PM down to less than 100 square feet. The incremental shadow would exit the area completely at 4:00 PM. As stated above, given the sweep of this shadow, the limited duration of the shadow and the diminishing shadow extent through the course the day, it is not expected that the Proposed Project would result in any shadow impacts on the ecology of these habitats or the functionality of the preservation areas on the western and northern portion of the Project Site.

June 21

On June 21, the early morning (5:57 AM) shadow would reach the immediate western shoreline of the Project Site and would move off the Arthur Kill by 8:15 AM and off the waterfront open space by 10:45 AM. New shadow would fall on the restored wetland area north-adjacent to the Proposed Project for much of the day but would be minimal, affecting only very small areas adjacent to the Proposed Project. June 21 shadows are shorter than at any other time of year. At 9:00 AM, the new shadow would cover only approximately 200 square feet of the north-adjacent preserved wetland area (see Figure 5-2). The new shadow would increase in coverage area to approximately 800 square feet at 10:30 AM, and approximately 1,000 square feet from 11:30 AM to 12:30 PM (see Figure 5-2). By 2:00 PM the coverage area would decrease to approximately 400 square feet, and shadow would exit completely at 3:00 PM. As with the areas above, given the sweep of this shadow, the limited duration of the shadow and the diminishing shadow extent through the course the day, it is not expected that the Proposed Project would result in any shadow impacts on the ecology of these habitats or the functionality of the preservation areas on the western and northern portion of the Project Site.

CONCLUSION

The above shadow assessment has disclosed that the Proposed Project would not significantly impact any public open space or natural habitats. The enhanced tidal wetland along the western shoreline and the and freshwater wetland creation areas the preserved northern portion of the Project Site would be subject to limited shading in both area and duration from the Proposed Project. For example, in early spring and in the fall, incremental shadow coverages would range from a quarter-acre, briefly at the start of the analysis day; they would decrease to about 0.13 acres at noon and decrease gradually down to 350 square feet. Through the middle of the growing season, the area of new shadows on the northern portion of the preservation area would be limited to 0.04 acres or less on the May 6/August 6 analysis day and 0.02 acres on the June 21 analysis day. These incremental shadows would move across areas adjacent to the Proposed Project would not result in any significant adverse impacts to the habitats along the shoreline or in the preservation area. Further, the proposed wetland mitigation plantings would be tolerant of

the shadows that are projected from the Proposed Project. Therefore, it is concluded that the Proposed Project would not result in any significant adverse impacts due to shadows. *