Chapter 6: Shadows

A. INTRODUCTION

This chapter examines whether the proposed actions would result in new shadows on any sunlight-sensitive publicly accessible resources or other resources of concern, and assesses the potential for the proposed actions to result in significant adverse shadows.

According to the 2012 *CEQR Technical Manual*, a shadows assessment is required if a project would result in structures (or additions to existing structures) of 50 feet or more, or be located adjacent to or across the street from a sunlight-sensitive resource. The proposed actions would result in the construction of a new mixed-use high-rise development along West 57th Street (the proposed project site, or development site 1), as well as a potential new hotel building at the corner of West 56th Street and Eleventh Avenue (development site 2). Development resulting from the proposed actions would reach a maximum height of approximately 450 feet above curb level including the rooftop mechanical structures and screenwall. Therefore, a shadows analysis is appropriate.

Public open spaces and historic and natural resources are all considered potentially sunlight-sensitive and, therefore, this chapter has been prepared in coordination with the information presented in other sections of this document such as Chapter 5, "Open Space." As described in Chapter 1, "Project Description," the bulk and size of the structures assumed to be constructed under either RWCDS 1 or RWCDS 2 are substantially the same; therefore this analysis does not make a distinction between the two.

PRINCIPAL CONCLUSIONS

The analysis shows that project-generated incremental shadow would fall on portions of the Hudson River, and existing or future sections of Hudson River Park in the mornings of all seasons. Three other resources would experience incremental shadow: The plaza at 555 West 57th Street would receive approximately 1 to 3 hours of new shadow at the end of the March 21/September 21, May 6/August 6, and June 21 analysis days, the John Jay College Seating Area Plaza would experience incremental shadow during the final 28 minutes of the December 21 analysis day and the future Riverside Center Open Space would experience new shadow for an hour in the middle of the December 21 analysis day.

The analysis concludes that with the proposed actions the affected resources would still receive adequate direct sunlight, and that the incremental shadow would not adversely impact the usability of the publicly accessible open spaces or the vegetation that grows within them. Overall, the proposed actions would not result in any significant adverse shadow impacts.

B. DEFINITIONS AND METHODOLOGY

This analysis has been prepared in accordance with New York City Environmental Quality Review (CEQR) procedures and follows the guidelines of the 2012 *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.* 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. Only the sunlight-sensitive features need be considered, as opposed to the entire resource.
- *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 open space should be included in the analysis.

A significant adverse shadow impact (according to the 2012 *CEQR Technical Manual*) generally 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 development 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, taking into account existing buildings and their shadows. 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.

According to the *CEQR Technical Manual*, 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 project).
- 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 shadow (should cross reference with information provided in the open space analysis, regarding anticipated new users and the open space's utilization rates throughout the affected time periods).

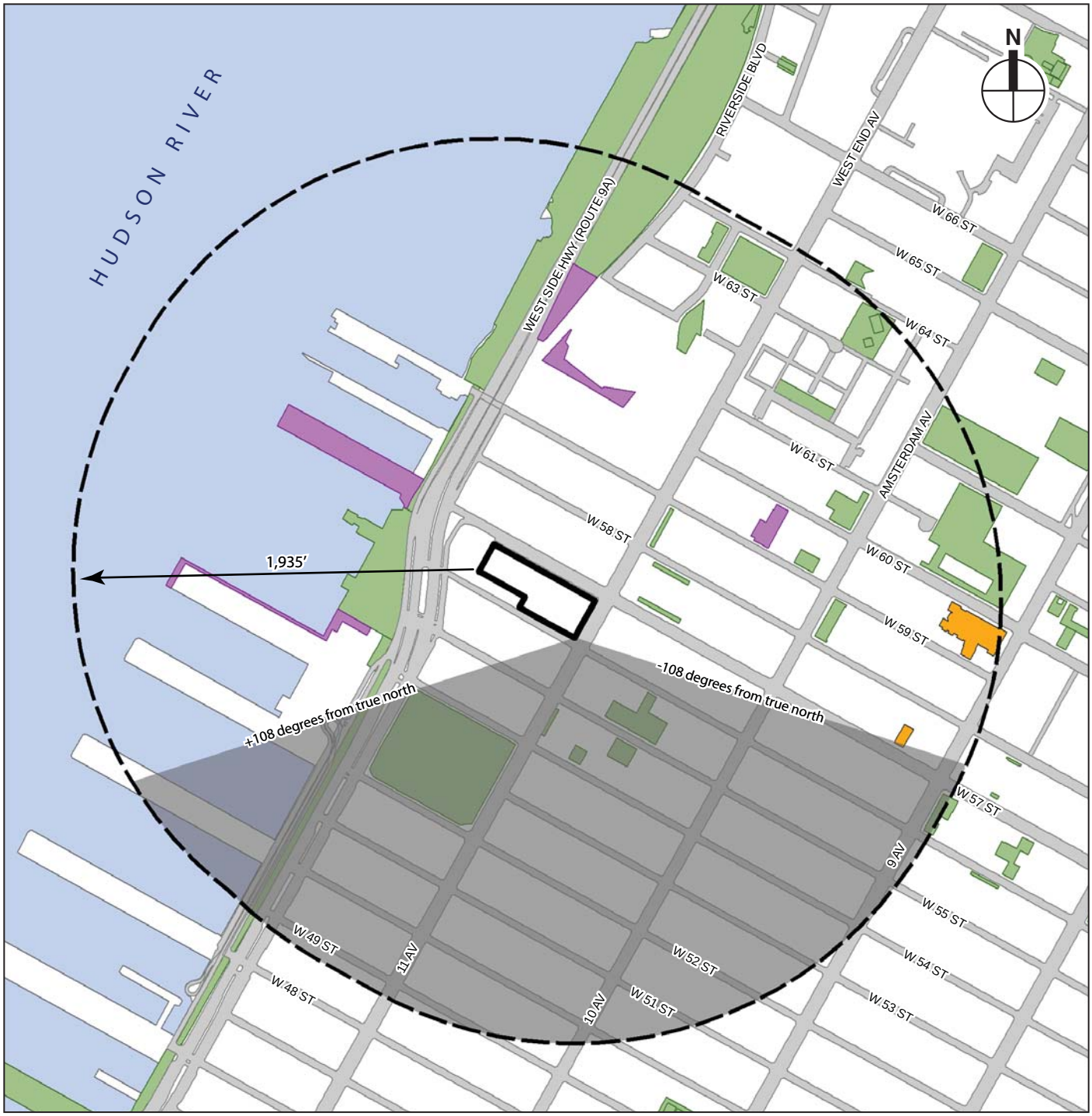
FOR ANY SUNLIGHT-SENSITIVE FEATURE OF A RESOURCE

- 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.

C. PRELIMINARY ASSESSMENT

A base map was developed showing the location of the rezoning area and the surrounding street layout (see **Figure 6-1**). In coordination with the information regarding open space and historic and cultural resources presented in other sections of this EIS, potentially sunlight-sensitive resources were identified and shown on the map. In addition, the analysis accounts for the Hudson River, which is considered a natural resource.

6.3.13



Lots within Proposed Rezoning Area

Longest Shadow Study Area Boundary

Existing Publicly-Accessible Sun-Sensitive Open Space

Future Publicly-Accessible Sun-Sensitive Open Space

Historic Resource with Sun-Sensitive Feature

Area Too Far South to Ever Be Shaded by Project

Tier 1 & Tier 2 Screening Assessment

606 WEST 57TH STREET

Figure 6-1

TIER 1 SCREENING ASSESSMENT

For the Tier 1 assessment, the longest shadow that would be cast by new buildings resulting from the proposed actions is calculated, and, using this length as the radius, a perimeter is drawn around the proposed footprint. 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 2012 *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 very 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 height of 450 feet above curb level, including rooftop mechanical structures, the proposed actions could be expected to cast a maximum shadow up to 1,935 feet in length (450 x 4.3). Using this length as the radius, a perimeter was drawn around the rezoning area (see **Figure 6-1**). Since a number of sun-sensitive resources lay within the perimeter or longest shadow study area, 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. **Figure 6-1** illustrates this triangular area south of the project site. The complementing area to the north within the longest shadow study area represents the remaining area that could potentially experience new project-generated shadow.

A number of publicly-accessible open spaces are located within the remaining shadow study area, and the analysis therefore proceeded to the Tier 3 screening assessment.

TIER 3 SCREENING ASSESSMENT

The direction and length of shadows vary throughout the course of the day, and also differ depending on the season. In order to determine when project-generated shadow could fall on a sunlight-sensitive resource, three-dimensional computer mapping software is used in the Tier 3 assessment to calculate and display shadows resulting from the proposed actions on individual representative days of the year.

REPRESENTATIVE DAYS FOR ANALYSIS

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 1.5 hours after sunrise and 1.5 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

Figure 6-2 illustrates the range of shadows that would occur from the proposed actions in the absence of intervening buildings on the four representative days for analysis. As they move east and clockwise over the landscape, the shadows are shown occurring approximately every two hours 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 indicate which resources could be reached by project-generated shadow and require further analysis; existing shadows cast by intervening buildings are not considered.

On March 21 and September 21, in the absence of intervening buildings, shadow from the proposed actions would fall on portions of the existing Hudson River Park at the start of the analysis day. In the afternoon shadow from the proposed actions could fall on the open space at 555 West 57th Street, the John Jay College Seating Area, and the West 59th Street Recreation Center. At the very end of the analysis day shadow from the proposed actions could reach the public plaza at 200 West 60th Street, although it is likely that intervening buildings would already be casting shadows on that space at that time.

On May 6 and August 6, existing and future portions of Hudson River Park could be affected by project-generated shadow in the morning. At the end of the analysis day, shadows from the proposed actions would be long enough to reach the plaza at 555 West 57th Street and the plaza at St. Luke's-Roosevelt Hospital.

On June 21, the proposed building's shadow could fall across existing and future portions of Hudson River Park in the morning and the plaza at 555 West 57th Street in the afternoon.

On December 21, in the absence of intervening buildings, project-generated shadow would fall to the northwest in the morning on existing and future sections of Hudson River Park. In the afternoon, shadow resulting from the proposed actions would fall toward the northeast and would be long enough to reach the John Jay College Seating Area and row of benches in the Amsterdam Houses open space.

Project-generated shadow would also be long enough to reach a small area of the Hudson River on all four analysis days.

No other sun-sensitive resources could be affected by project-generated shadow. As described below, a detailed analysis was conducted to determine the extent and duration of project-generated incremental shadow on existing and future sections of Hudson River Park, the plazas at 555 West 57th Street, 200 West 60th Street and St. Luke's-Roosevelt Hospital Center, the John Jay College Seating Area, the West 59th Street Recreation Center, the Amsterdam Houses open space and the Hudson River.

D. DETAILED ANALYSIS

The purpose of the detailed analysis is to determine the extent and duration of incremental shadows on sunlight-sensitive resources and to assess their effects. A three-dimensional computer model of the baseline condition was developed, containing existing buildings and future developments in the area expected to be completed by the 2017 Build year. In the future

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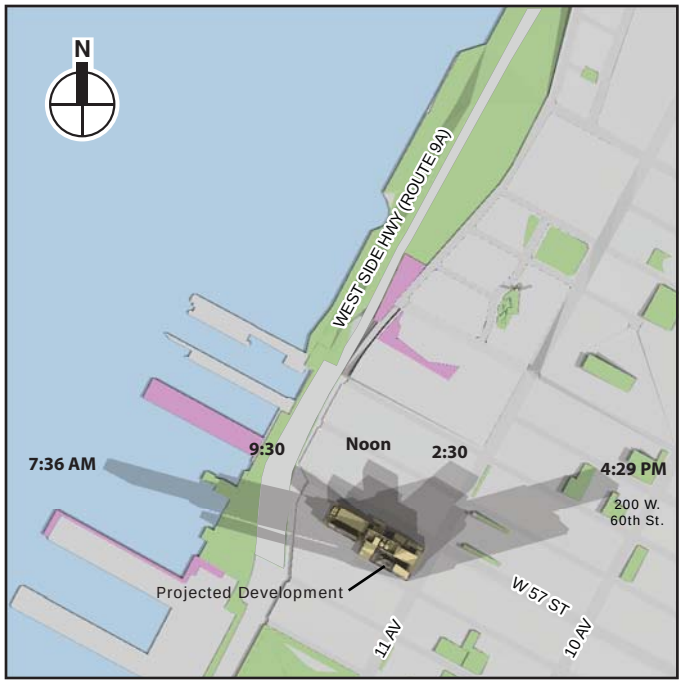


March 21/Sept. 21



May 6/August 6



June 21



December 21

Note: Daylight Saving Time not used.

Exisiting Publicly-Accessible Open Space

Future Publicly-Accessible Open Space

Hudson River

Shadow

Tier 3 Screening Assessment

606 WEST 57TH STREET **Figure 6-2**

without the proposed actions, the existing buildings in the rezoning area are assumed to remain the same. The future condition with the proposed actions are compared to the baseline shadows to determine the incremental shadows that would result from the proposed actions. **Figure 6-3** shows views of the computer model, with conditions in the future with and without the proposed actions.

Shadow analyses were performed for each of the representative days and analysis periods indicated in the Tier 3 assessment. The analysis showed that project-generated incremental shadow would fall on portions of the Hudson River, and on either existing or future sections of Hudson River Park in the mornings of all four analysis days. Additionally, the John Jay College Seating Area would receive new shadow at the end of the March 21/September 21 and December 21 analysis days. The plaza at 555 West 57th Street would receive new shadow in the afternoon of all analysis days except December 21. **Table 6-1** summarizes the results of the detailed analysis. It shows the entry and exit times and total duration of incremental shadow on each affected resource. The results of the detailed analysis are illustrated in **Figures 6-4** through **6-11**.

Table 6-1
Incremental Shadow Durations

Analysis day and timeframe window	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	December 21 8:51 AM-2:53 PM
OPEN SPACES				
Hudson River Park/Rt. 9A Bikeway/Walkway	7:36 AM–9:20 AM Total: 1 hr 44 min	6:37 AM–8:30 AM Total: 1 hr 53 min	5:57 AM–8:15 AM Total: 2 hr 18 min	8:51 AM–10:45 AM Total: 1 hr 54 min
555 West 57th Street plaza	3:15 PM–4:29 AM Total: 1 hr 14 min	3:00 PM–5:18 PM Total: 2 hr 18 min	3:10 PM–6:00 PM Total: 2 hr 50 min	—
Riverside Center Open Space	—	—	—	12:45 pm – 1:45 pm Total: 1 hr
John Jay College Seating Area	—	—	—	2:25 PM–2:53 PM Total: 28 min
NATURAL FEATURES				
Hudson River	7:36 AM–9:00 AM Total: 1 hr 24 min	6:27 AM–7:30 AM Total: 1 hr 3 min	5:57 AM–7:00 AM Total: 1 hr 3 min	8:51 AM–10:45 AM Total: 1 hr 54 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.

Project-generated shadow did not fall on the plazas at 200 West 60th Street and St. Luke's-Roosevelt Hospital Center, the West 59th Street Recreation Center, and the Amsterdam Houses open space and the Hudson River.

NATURAL RESOURCES OF CONCERN

The Hudson River is an important natural feature, as it provides habitat for an array of aquatic flora and fauna.



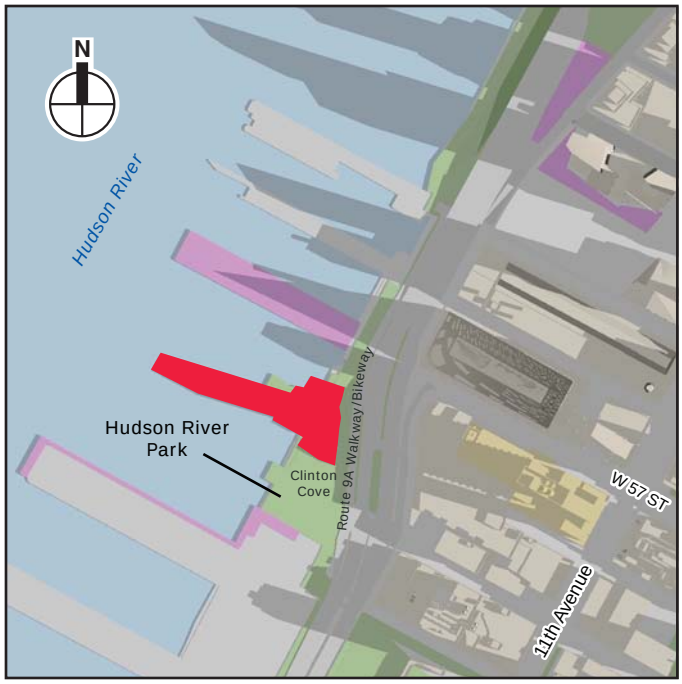
No Build Condition



Build Condition

Three-Dimensional Computer Model

6.3.13



7:45 AM



8:15 AM



8:45 AM



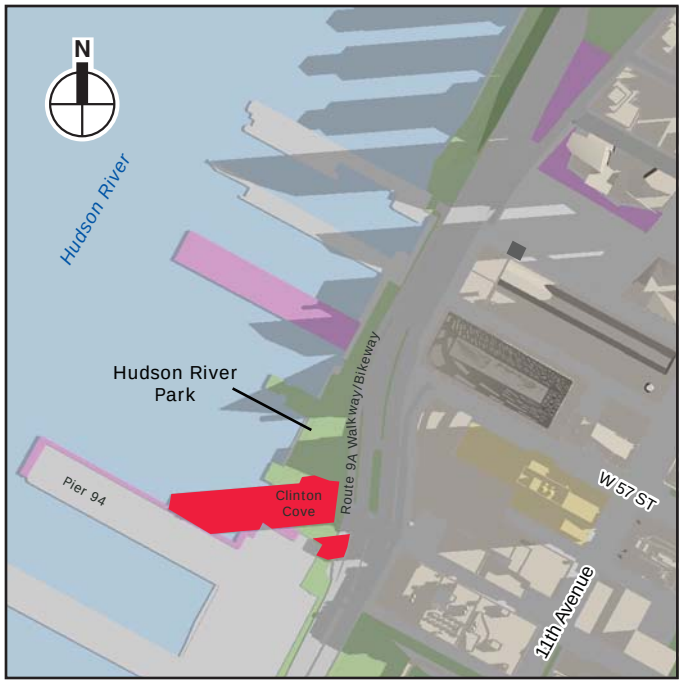
9:15 AM

Note: Daylight Saving Time not used.

- *Projected Development*
- *Existing Publicly-Accessible Open Space*
- *Future Publicly-Accessible Open Space*
- *Incremental Shadow on Sunlight-Sensitive Feature*

Detailed Analysis
March 21/September 21
Figure 6-4

6.3.13



6:45 AM



7:15 AM



7:45 AM



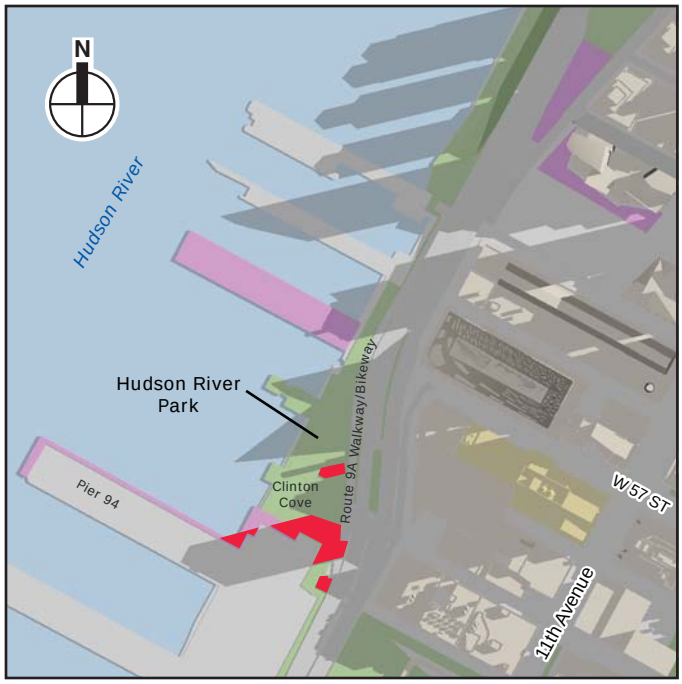
8:15 AM

Note: Daylight Saving Time not used.

- *Projected Development*
- *Existing Publicly-Accessible Open Space*
- *Future Publicly-Accessible Open Space*
- *Incremental Shadow on Sunlight-Sensitive Feature*

Detailed Analysis
May 6/August 6
Figure 6-5

6.3.13



6:30 AM



7:00 AM



7:30 AM



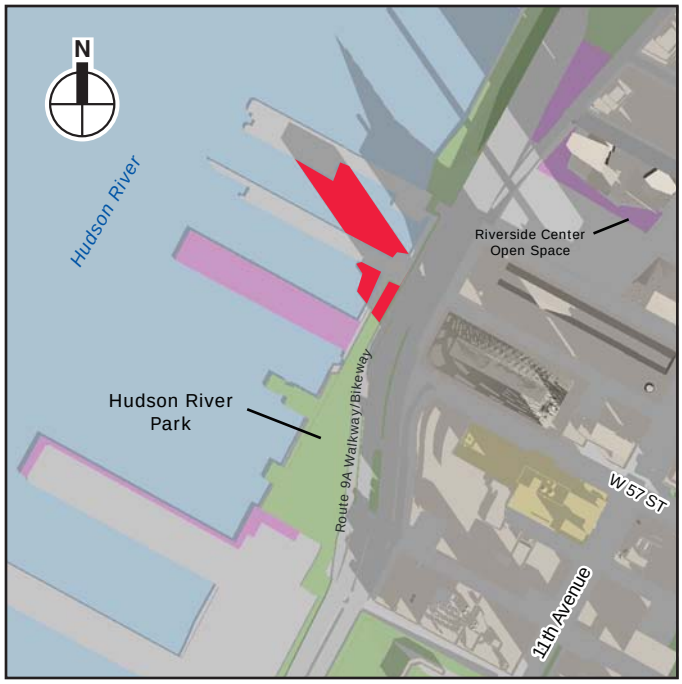
8:00 AM

Note: Daylight Saving Time not used.

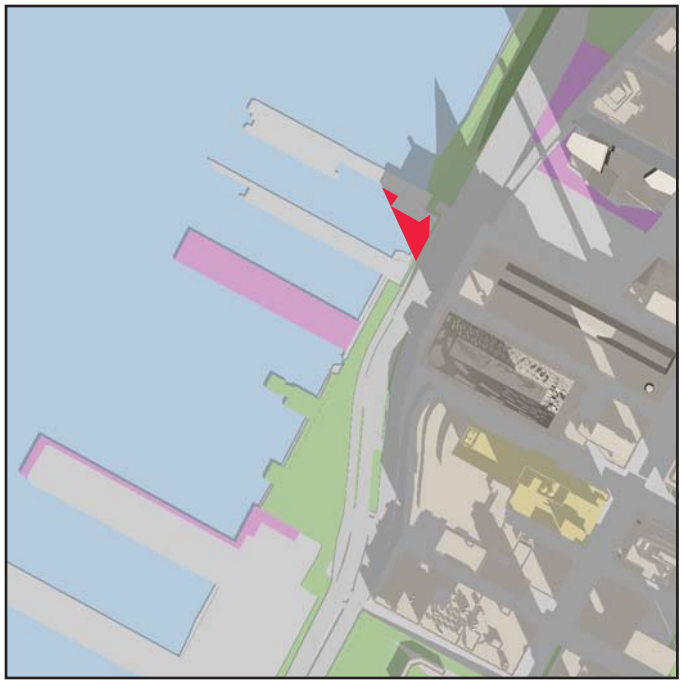
- *Projected Development*
- *Existing Publicly-Accessible Open Space*
- *Future Publicly-Accessible Open Space*
- *Incremental Shadow on Sunlight-Sensitive Feature*

Detailed Analysis
June 21
Figure 6-6

6.3.13



9:30 AM



10:15 AM



1:00 PM



1:30 PM

Note: Daylight Saving Time not used.

Projected Development

Existing Publicly-Accessible Open Space

Future Publicly-Accessible Open Space

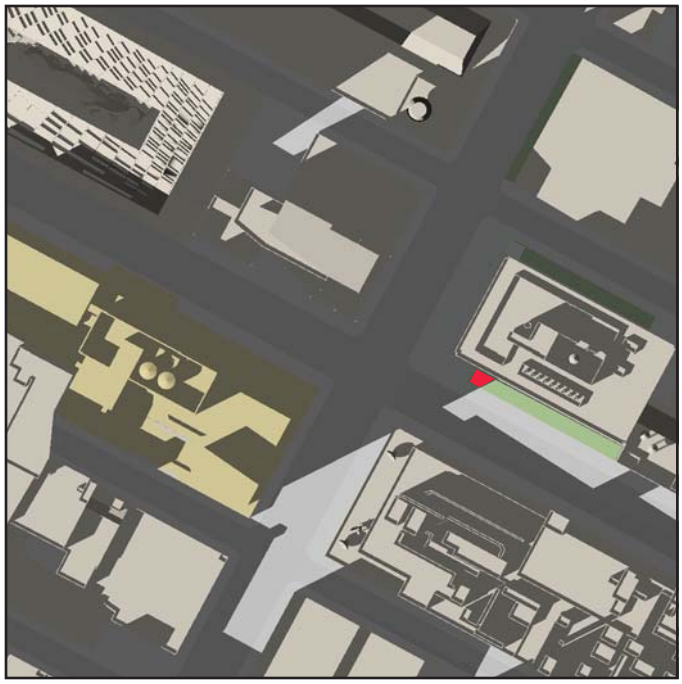
Incremental Shadow on Sunlight-Sensitive Feature

Detailed Analysis
December 21
Figure 6-7

6.3.13



3:00 PM



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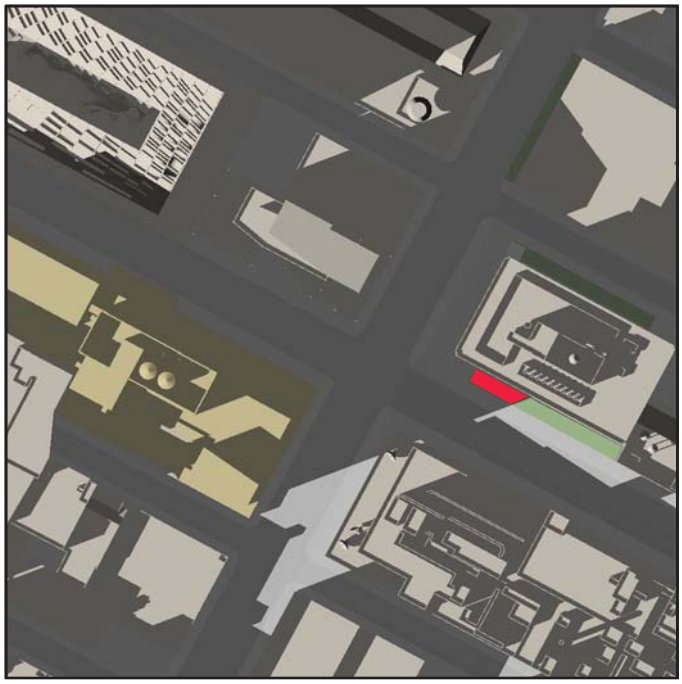
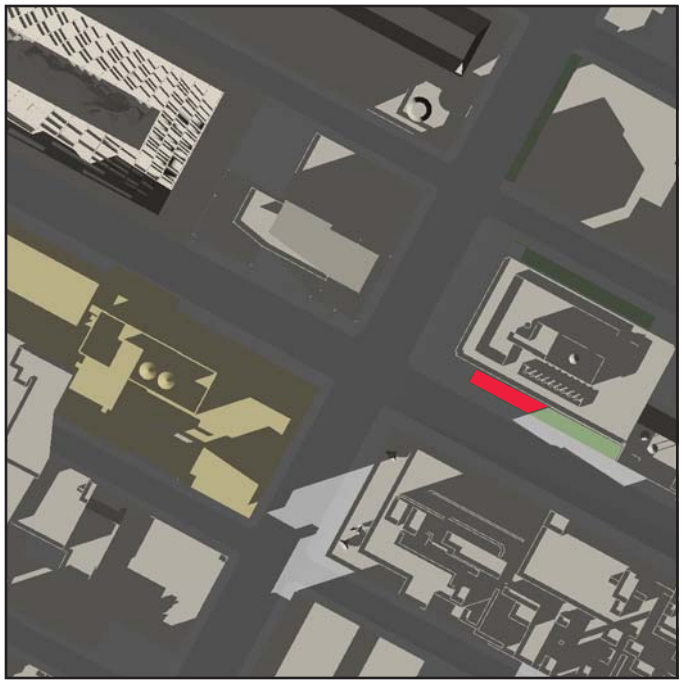


4:00 PM



4:30 PM

Note: Daylight Saving Time not used.

Projected Development

Publicly-Accessible Open Space

Incremental Shadow on Sunlight-Sensitive Feature

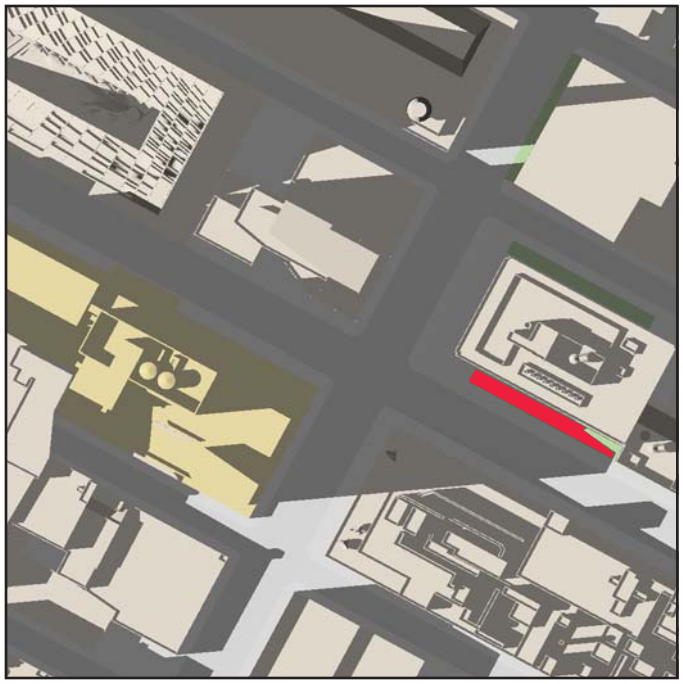
Detailed Analysis
March 21/September 21
Figure 6-8

606 WEST 57TH STREET

6.3.13



3:15 PM



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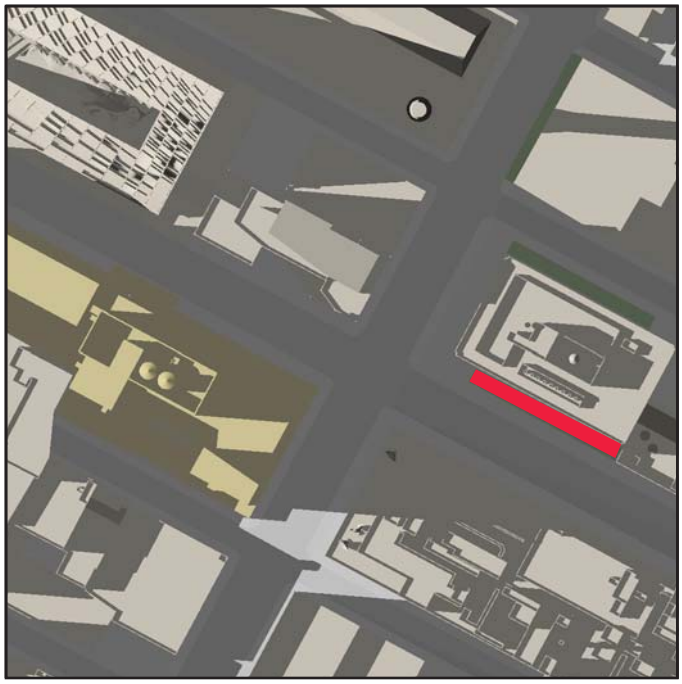
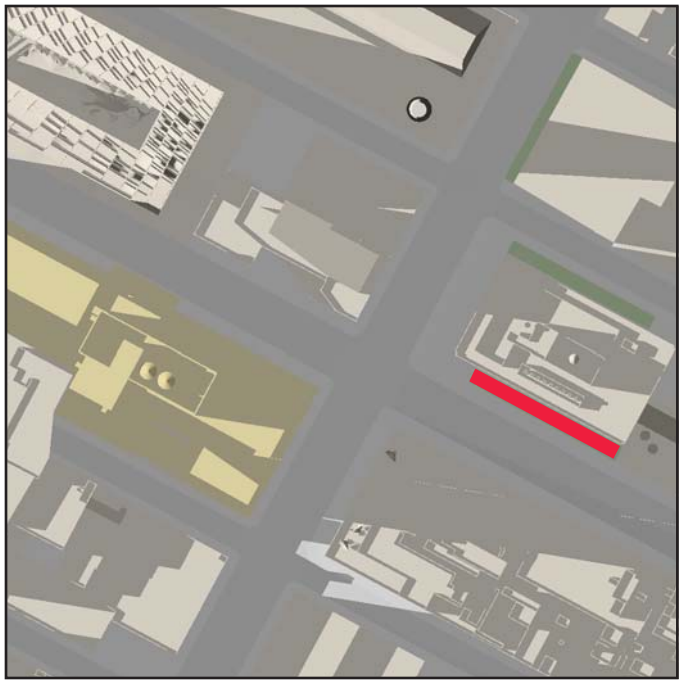


5:00 PM



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Note: Daylight Saving Time not used.

Projected Development

Publicly-Accessible Open Space

Incremental Shadow on SUnlight-Sensitive Feature

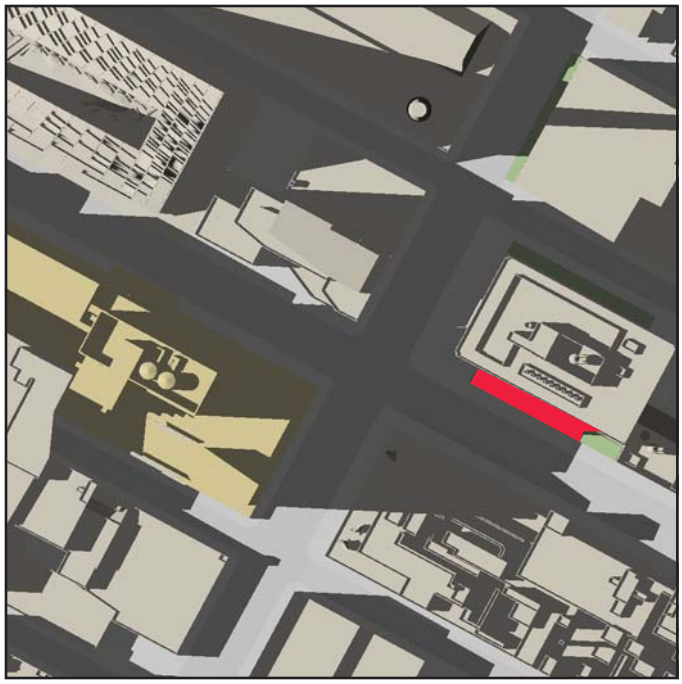
606 WEST 57TH STREET

Detailed Analysis
May 6 / August 6
Figure 6-9

6.3.13



3:15 PM



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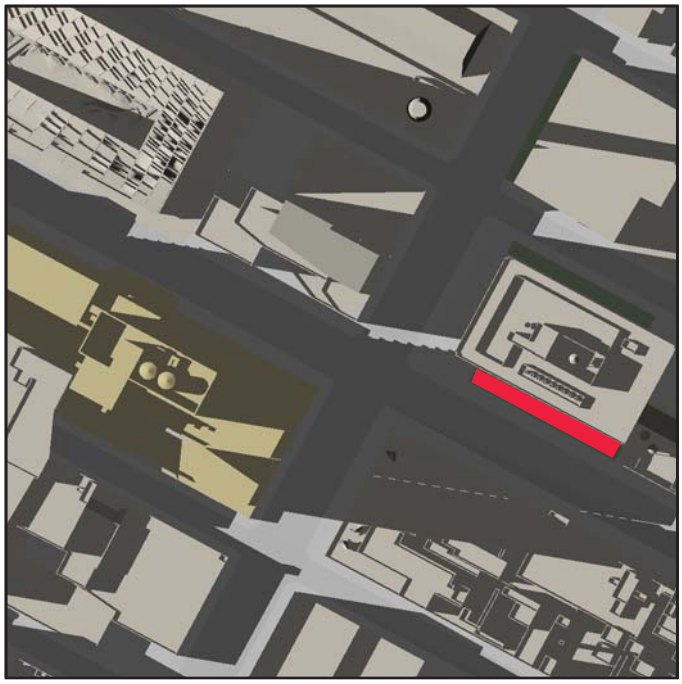

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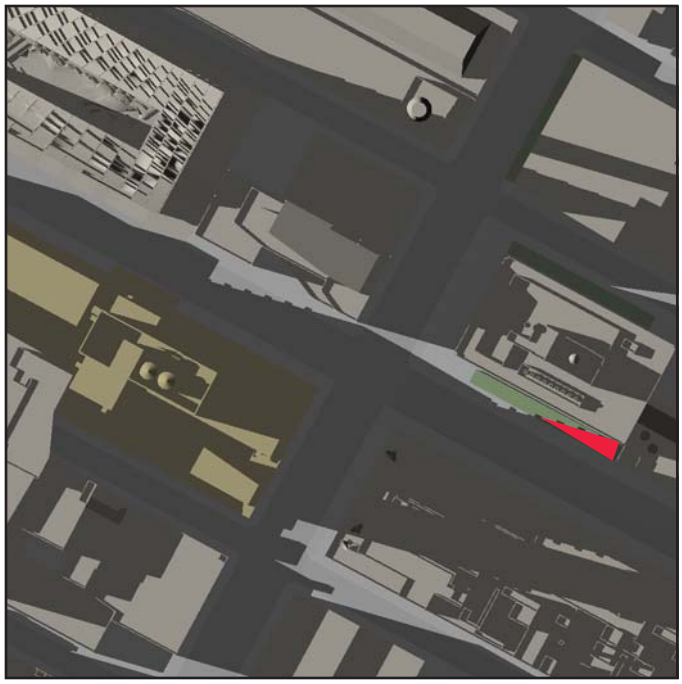


5:30 PM

Note: Daylight Saving Time not used.

Projected Development

Publicly-Accessible Open Space

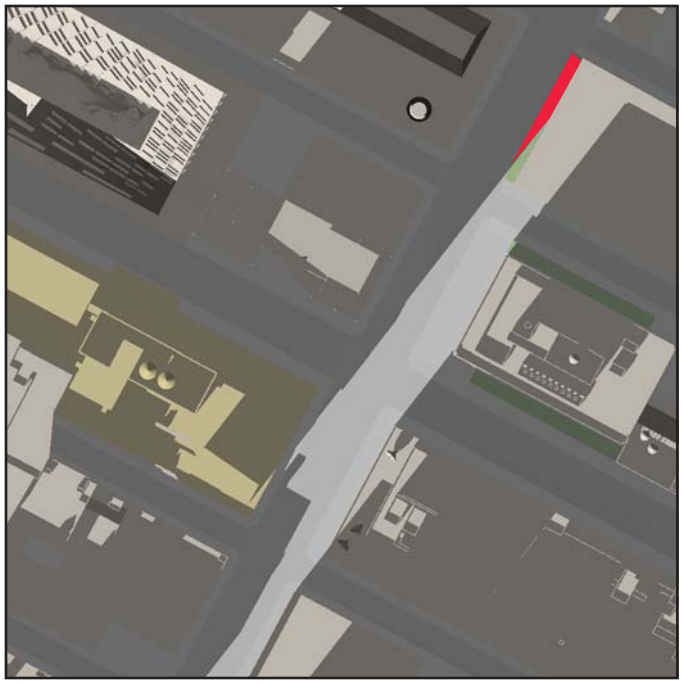
Incremental Shadow on SUnlight-Sensitive Feature

Detailed Analysis
June 21
Figure 6-10

6.3.13



2:30 PM



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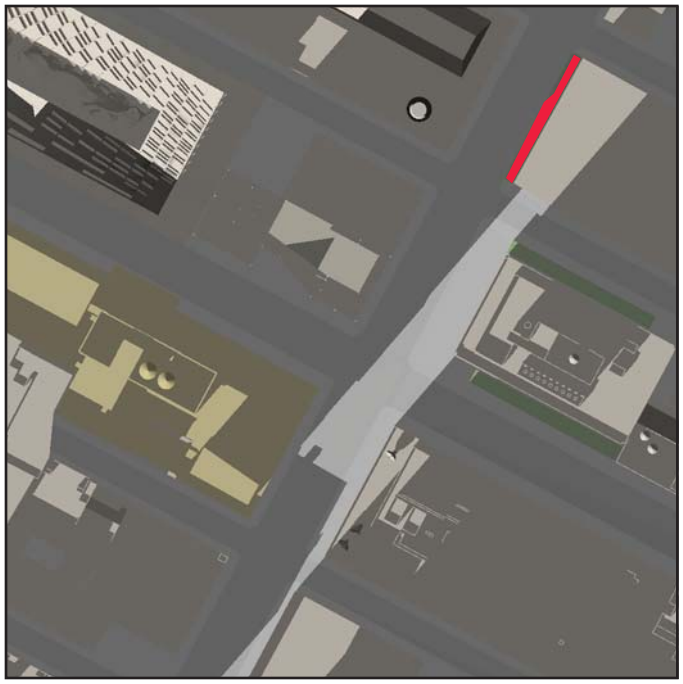
2:40 PM



2:50 PM

Note: Daylight Saving Time not used.

Projected Development

Publicly-Accessible Open Space

Incremental Shadow on SUnlight-Sensitive Feature

Detailed Analysis
December 21
Figure 6-11

606 WEST 57TH STREET

Incremental shadow would fall on the Hudson River at the beginning of all four analysis days. The duration of new shadow would last from just under 1 hour to nearly 2 hours (see **Figures 6-4** through **6-8**).

OPEN SPACE RESOURCES OF CONCERN

Existing and future sections of **Hudson River Park** and the **Route 9A Walkway/Bikeway** would be affected by project-generated shadow. The Clinton Cove section of Hudson River Park opened in 2005 and is located along the waterfront between Pier 94 (near West 54th Street) and Pier 97 (near West 57th Street). This area includes an esplanade with benches, lawns, shade trees, and a public boat house at the waterfront. The Route 9A Walkway/Bikeway, stretching from Battery Park to West 59th Street between Route 9A and Hudson River Park, provides off-street paved paths for active recreational activities such as running, biking, and rollerblading. The walkway/bikeway continues northward through Riverside Park South.

Future sections of Hudson River Park that would be affected by new shadow from the project include Piers 94. As discussed in Chapter 5, "Open Space", Piers 92 and 94, located in the area of West 52nd Street and West 54th Street, currently contain an enclosed event space used for conventions and trade shows; a planned expansion of the event space includes the addition of an esplanade, viewing platform, and public plaza, totaling 0.41 acres of passive open space.

Incremental shadow would fall on the existing Clinton Cove and Route 9A Walkway/Bikeway on the morning of all four analysis days, ranging in duration from 2 to 3 hours. On the very early morning of the May 6/August 6 and June 21 analysis days, new shadow from the proposed actions would also be cast on future open space improvements to Pier 94 (see **Figures 6-4** through **6-8**).

The River Side Center Open Space is a future publicly accessible passive open space to be built in conjunction with Riverside Center Building 1. The open space will feature seating, landscaping and a lawn. The open space will be located directly to the south and west of Building 1. Incremental shadow from the proposed actions would fall on the eastern portion of this future open space for just 1 hour between 12:45 PM and 1:45 PM on the December 21 analysis day (see **Figure 6-7**).

555 West 57th Street is a through-block office building with a BMW automobile showroom on the ground floor. Narrow, rectangular outcroppings of elevated terrace-like plaza flank the West 58th and 57th Street entrances. A few wood benches and small planters are the only amenities in these spaces, which are paved. Currently, the park is off limits as 555 West 57th Street undergoes construction. This analysis assumes that the associated plaza would return to its original state once construction is completed.

The plaza at the 57th Street entrance would be affected by incremental shadow in the afternoon on all analysis days with the exception of the December 21 analysis day. Incremental shadow duration would last from 1 hour and 14 minutes on the March 21/September 21 analysis day to nearly 3 hours on the June 21 analysis day. From approximately 4:15 PM to 5:18 PM on the May 6/ August 6 analysis day and from 4:30 PM to 5:15 PM on the June 21 analysis day the entire plaza would be cast in incremental shadow (see **Figures 6-8** through **6-10**).

John Jay College Open Space is a block-long strip of basic planters and seating on the east side of 11th Avenue between 58th and 59th Streets. The proposed actions would result in new shadow on the open space for only 28 minutes at the end of the December 21 analysis day. For the last 8 minutes the open space would be completely in shadow (see **Figure 6-11**).

E. CONCLUSION

According to the 2012 *CEQR Technical Manual*, a significant shadow impact generally occurs when the incremental shadow added by a proposed project falls on a sunlight sensitive resource and substantially reduces direct sunlight exposure, reduces direct sunlight to unacceptable levels, or completely eliminates all direct sunlight for longer than 10 minutes at any time of the year.

The new morning shadows that would fall on the Hudson River, and existing and future sections of the Hudson River Park would be limited in extent and duration, as shown in the figures and **Table 6-1**. These sunlight-sensitive resources are very large in size and the incremental shadows affect very small portions, relative to the whole. In addition, due to the lack of structures to the west, these resources experience direct sunlight throughout the mid-day and afternoon periods throughout the year. Therefore, the incremental shadows would not result in significant adverse shadow impacts on these resources.

The plaza on the south side of 555 West 57th Street would experience new shadow in the afternoon of all analysis days with the exception of December 21 analysis day. The new shadow would last from 1 hour and 14 minutes on the March 21/September 21 analysis day to nearly 3 hours on the June 21 analysis day. For roughly an hour on the May 6/August 6 and June 21 the small plaza would be cast completely in new shadow from the proposed project. Although the shadow impacts would last several hours, the plaza would receive direct sunlight for hours from mid-morning to mid-afternoon on all analysis days. Incremental shadow would fall on this resource later in the day and well after lunch times, when urban plazas are often most utilized. In addition, the plaza is paved and vegetation is very limited, with several small shrubs in planters. Therefore, the new shadow is not expected to adversely impact either the plaza's vegetation or usability.

The future Riverside Center Open Space would experience incremental shadow for an hour in the middle of the December 21 analysis day. This limited duration of incremental shadow would not adversely impact the usability or vegetation of the open space.

Similarly, the John Jay College Seating Area would receive less than 30 minutes of new shadow from the proposed actions at the end of the December 21 analysis day. Given the limited extent and seasonality of the incremental shadow, this would not be a significant adverse shadow impact. ✷