

A. INTRODUCTION

As described in Chapter 1, “Project Description,” the Proposed Actions include the construction of new buildings, the tallest of which would rise to 31 stories (approximately 315 feet above the curb level at the corner of 11th Avenue and West 45th Street). This chapter assesses whether the proposed buildings would result in new shadows that would adversely impact any nearby sun-sensitive resources, including publicly accessible open spaces, historic resources with sunlight-dependent architectural features, or important natural features.

PRINCIPAL CONCLUSIONS

The analysis concludes that incremental shadows would fall on portions of Hudson River Park and the adjacent Route 9A Bikeway early in the morning during the fall, winter and early spring, and on a small area of the Hudson River in the winter. The new shadows would be quite limited in extent and duration and would not result in significant adverse impacts to these resources.

B. METHODOLOGY

Shadows vary according to time of day and season. Morning and evening shadows are long, while midday shadows are shorter. Shadows in winter, when the sun arcs low across the southern sky, are longer throughout the day than at corresponding times in spring and fall, and in summer the high arc of the sun casts shorter shadows than at any other time of year. Early and late shadows in summer fall much further to the south than early and late shadows in winter.

The first step in the assessment of a project’s shadow impacts is to determine whether project shadows would be long enough to reach any sunlight-sensitive open spaces, natural features, or architectural resources at any time of year. If this preliminary or screening assessment indicates they might, then a detailed shadow analysis is warranted. The detailed analysis determines the extent and duration of project-generated incremental shadows on any sun-sensitive uses and vegetation of open spaces, or sunlight-sensitive features of architectural resources, and assesses the effects of new shadows on such resources.

Following the guidelines of the *CEQR Technical Manual*, this analysis considers shadows on four representative days of the year: March 21 (equivalent to September 21, the equinoxes); June 21, the summer solstice; May 6 (equivalent to August 6, the midpoints between the equinoxes and summer solstice); and December 21, the winter solstice.

The CEQR methodology does not consider shadows and incremental increases in shadows within 1½ hours of sunrise or sunset to be significant. Therefore, the analysis period on each of the four representative days is between 1½ hours after sunrise and 1½ hours before sunset. Additionally, CEQR does not consider shadows on city streets, sidewalks, and other buildings to be significant.

ANALYSIS FRAMEWORK

The study area for the shadow analysis is derived from the screening assessment, when the full extent of the area that could be reached by project shadow is calculated for each of the analysis days and delineated on a street map.

The analysis compares project shadows to a baseline condition representing the future build year of 2013 without the Proposed Actions. The baseline condition assumes that none of the proposed discretionary actions are approved, and that all the existing structures on the project site would remain. The analysis compares shadows that would be cast by the Proposed Project to those that would be cast by the existing structures in 2013 without the Proposed Actions. The analysis takes into account shadows cast by other existing buildings, as well as those cast by additional developments in the study area expected to be completed by the 2013 build year.

The Proposed Actions would include the relocation of P.S. 51 from the north to the south side of the project block and the construction of a new playground for the school to replace the one that currently exists. This playground is not included in the quantitative analysis, because it is not publicly-accessible open space, and in any case, according to City Environmental Quality Review (CEQR) methodology, shadows cast on open spaces that are part of a proposed project are not considered impacts of an action because without the action, the open space would not exist. However, a qualitative assessment of shadows on the proposed playground is included in this analysis.

For the detailed analysis, shadows were modeled using the solar rendering capabilities of MicroStation V8 software. A three-dimensional model of existing buildings and topography around the project site was provided by Fugro EarthData Inc. and augmented by AKRF. A three-dimensional model of the Proposed Project was provided by the project sponsor and integrated into the existing conditions model. Other known development projects in the study area were added to the existing conditions model, as accurately as available information allowed, to correctly modeling the future baseline conditions.

DETERMINATION OF IMPACT SIGNIFICANCE

According to the CEQR Technical Manual, a significant shadow impact may occur when there is substantial reduction in sunlight to a sun-sensitive use or feature, threatening the survival of vegetation or significantly reducing the usability of the open space, or in the case of an architectural feature, obscuring the elements or details that make that resource significant. The determination of impact significance is based on an assessment of how a project's incremental shadows specifically would affect sun-sensitive features of individual resources.

SCREENING ASSESSMENT

A screening assessment was performed to determine which open spaces, sunlight-sensitive historic resources, or important natural features could be affected by project shadows at any time of year. To identify resources of concern, the maximum shadow length was calculated for the proposed buildings on the four analysis days, taking into account time of day as well as season. For example, on the December 21 analysis day a building has a maximum shadow length factor equal to 4.3 times its height at the beginning and end of the analysis period when shadows are cast to the northwest and northeast, respectively. Toward midday, as the sun rises in the sky, the shadow length factor is reduced to 2.07 times the height of the building. Shadow length factors for the other analysis days throughout the calendar year are shorter than they are in December. However, the daylight hours are longer during the rest of the year, resulting in longer analysis periods and

shadows that fall farther to the southwest and southeast at the beginning and end of the day. During the December analysis day, shadows are cast up to 43 degrees east and west of true north, but in June shadows are cast up to 108 degrees east and west. Open spaces in the southern portion of the area that could be reached by project shadow in June would not be affected in December.

Using the heights and forms of the proposed buildings, the full extent of the area that could be reached by project shadow was calculated for each of the analysis days and delineated on a street map. In coordination with the open space and historic resource analyses presented in other chapters of this EIS, open spaces and historic resources were also denoted on the map. All sun-sensitive resources that would fall fully or partially within the perimeter representing the maximum shadow length from the Proposed Project on the four analysis days were included in the more detailed analysis below (see **Figure 6-1**).

C. EXISTING CONDITIONS

The Project Site currently contains three structures—a two-story, vacant warehouse building, a two-story stable, and the five-story P.S. 51. Shadows from the existing buildings on the Project Site do not reach the sunlight sensitive resources in the study area.

D. THE FUTURE WITHOUT THE PROPOSED ACTIONS

Absent the Proposed Actions, there would be no changes in existing structures on the Project Site. Therefore, shadows from the Project Site would not be changed, and shadows from these buildings would not reach the sunlight sensitive resources in the study area.

E. PROBABLE IMPACTS OF THE PROPOSED ACTIONS

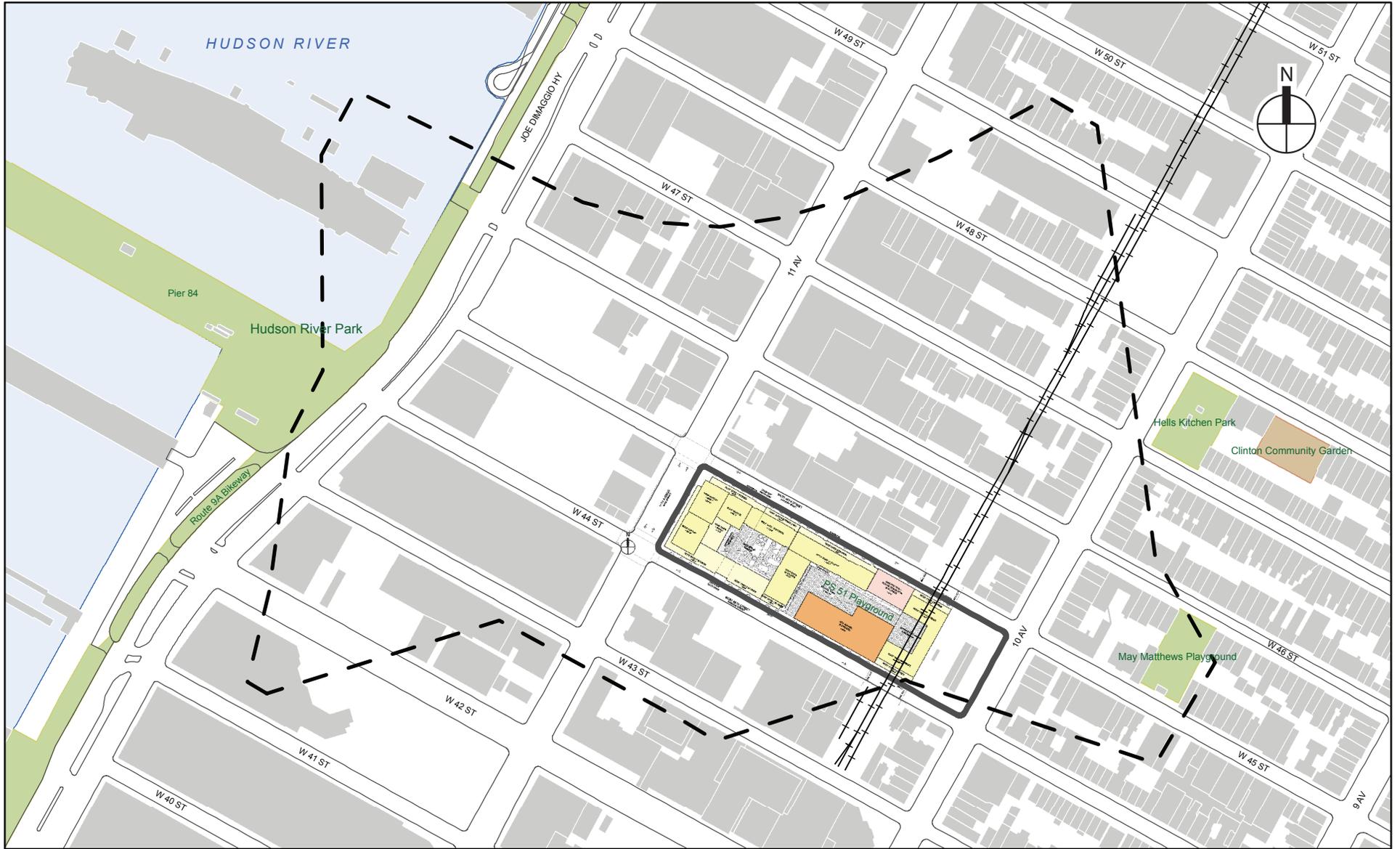
MicroStation V8 software was used to compare the shadows cast by the proposed buildings with those cast by the project site's existing buildings on each of the four analysis days. The analysis showed that the tower portion on the western side of the project site would cast a small area of incremental shadow on a portion of Hudson River Park and the adjacent Route 9A Bikeway early in the mornings of the fall, winter and early spring analysis days. In the late spring and summer these open space resources would not be affected by project shadow at any time.

Additionally, the analysis showed that incremental shadow from the tower portion on the western side of the project site would reach a very small area of the Hudson River, an important natural resource, for about 45 minutes on the December analysis day only.

The other three open spaces in the analysis study area, May Matthews Playground, Hell's Kitchen Park, and Clinton Community Garden, were all located too far east of the project site to be reached by incremental shadow on any analysis day. In the case of May Matthews Playground, project shadow would be long enough to reach a part of the playground for about five minutes at the end of the June 21 analysis day, but the playground would already be in existing shadows at that time.

No historic resources with sunlight-dependent features were located near enough to the project site to experience incremental shadow from the Proposed Project.

Table 6-1 shows the duration of incremental shadows on the two affected sun-sensitive resources. The extent, duration, and effects of these incremental shadows are discussed below for each resource.



- Project Site Boundary
- - - Perimeter Showing Longest Possible Shadow Length



**Table 6-1
Incremental Shadow Durations**

Resource	March 21 8:36 AM-5:29 PM EDT	May 6 7:27 AM-6:18 PM EDT	June 21 6:57 AM-7:01 PM EDT	December 21 8:51 AM-2:53 PM EST
Hudson River Park (portion)	8:36 AM-8:45 AM Total: 9m	—	—	8:51 AM-9:25 AM Total: 34m
Hudson River (portion)	—	—	—	8:51 AM-9:35 AM Total: 44m
Route 9A Bikeway (portion)	8:36 AM-8:50 AM Total: 14m	—	—	8:51 AM-9:45 AM Total: 54m
Notes: EST—Eastern Standard Time; EDT—Eastern Daylight Time March 21 is the equivalent of September 21. May 6 is the equivalent of August 6.				

Figure 6-2 shows shadows on the spring and fall equinox mornings (March 21/September 21); **Figures 6-3** and **6-4** show shadows on the winter solstice (December 21) morning; and **Figure 6-5** shows shadows on the summer solstice (June 21) morning, when project shadows would not be long enough to reach the Hudson River Park, the Route 9A Bikeway or the River.

HUDSON RIVER PARK

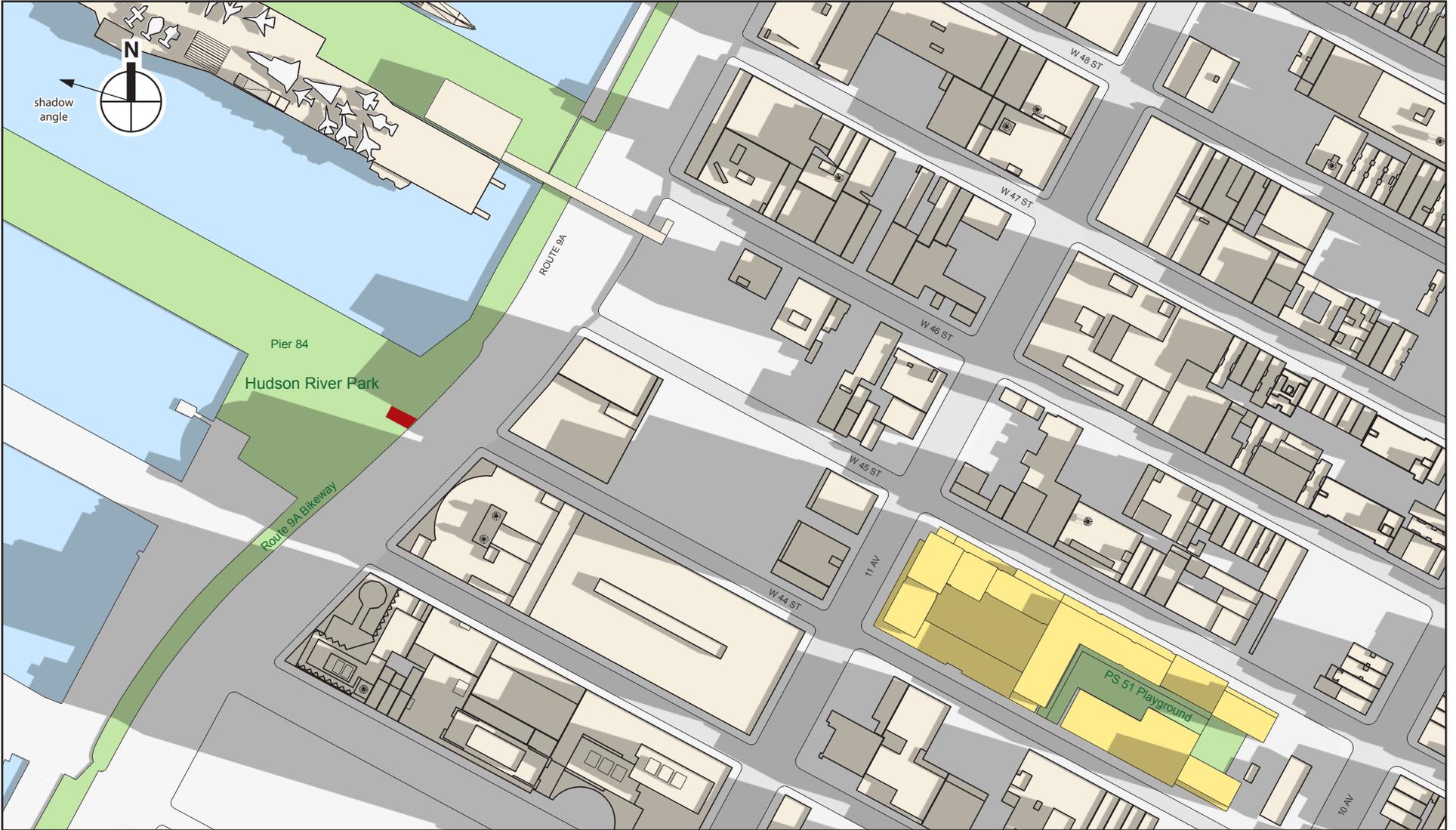
Hudson River Park stretches from Battery Park to the south to West 59th Street to the north. On the morning of the March 21/September 21 analysis day project shadow would reach a small area at the base of Pier 84, a large public pier within Hudson River Park at West 44th Street, between 8:36 AM and 8:45 AM, for a total duration of nine minutes (see **Figure 6-2**). On the morning of December 21, incremental shadow would reach a small area of the park a little further north, on a section of a walkway south of West 46th Street, between 8:51 AM and 9:10 AM (see **Figure 6-3**). The shadow would also fall on portions of Pier 86, which is part of the Intrepid Sea, Air & Space Museum, from 8:51 AM to 9:25 AM. Areas affected by this short duration of new shadow include the entrance plaza in front of the main museum building, and the area beyond the entrance gates, near the Growler Submarine, and the Growler itself. These areas are paved and do not contain any features that are sunlight-sensitive. These brief durations of incremental shadow would not cause an adverse impact to these areas of the park.

HUDSON RIVER

Incremental shadow would fall across an area of the river next to the shore for about 45 minutes on the morning of December 21 (see **Figure 6-3**). This limited extent and duration of additional shadow would not result in a significant adverse impact to the biota of the river.

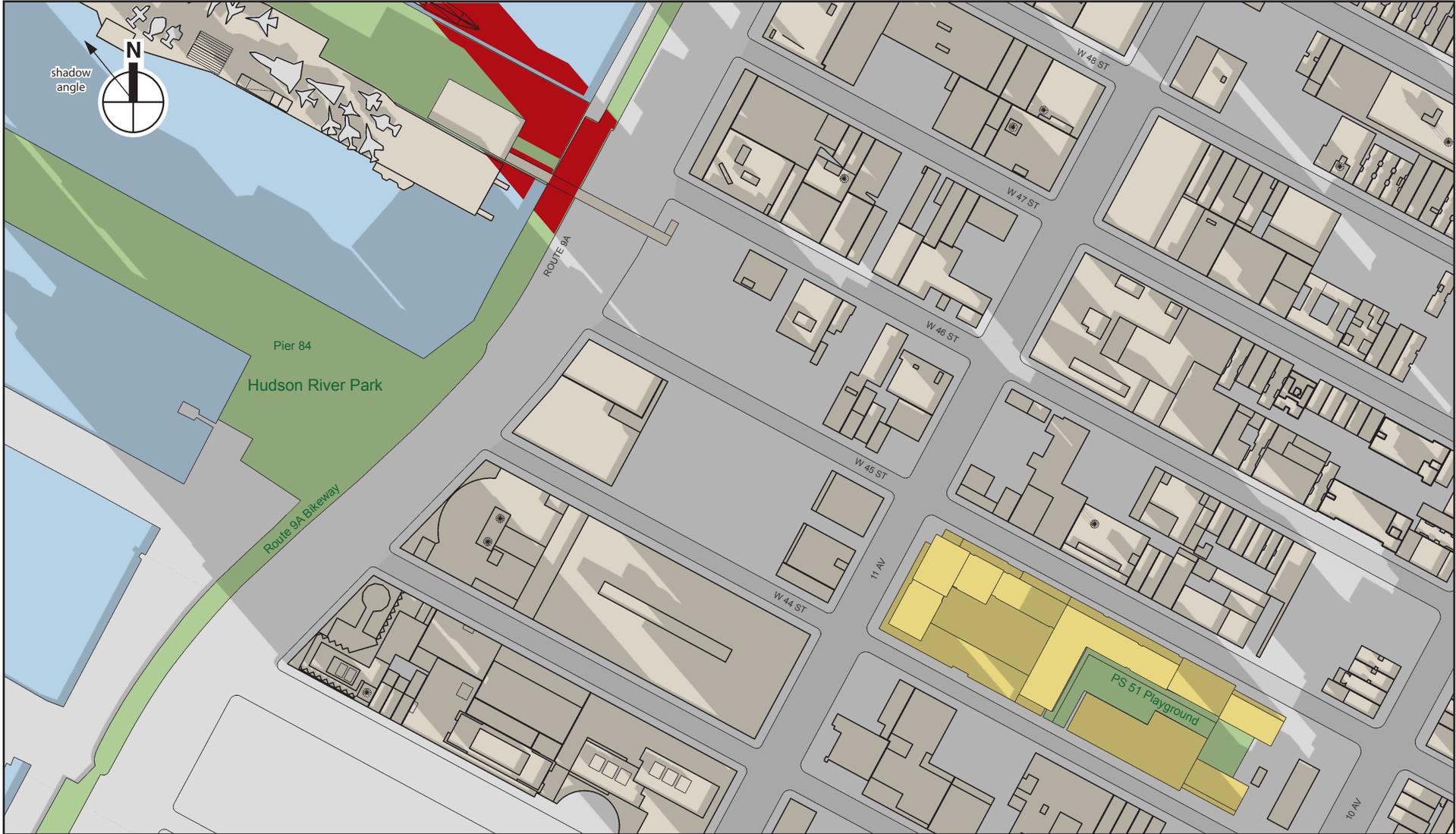
ROUTE 9A BIKEWAY

The Route 9A bikeway provides off-street paths for active recreational activities such as running, biking, and rollerblading. Project shadow would fall across portions of this resource for about 15 minutes early on the March 21/September 21 morning, and for just under an hour on the December 21 morning (see **Figures 6-2, 6-3 and 6-4**). The bikeway is devoted to active recreation, and as such would not be substantially impacted by these incremental shadows. In any case, the bikeway would continue to experience a great deal of sunlight for nearly the entire day throughout the year, situated as it is next to the river and its open vistas.



- Proposed Buildings
- Incremental Shadow on Sun-Sensitive Resource





- Proposed Buildings
- Incremental Shadow on Sun-Sensitive Resource





- Proposed Buildings
- Incremental Shadow on Sun-Sensitive Resource





 Proposed Buildings



PROPOSED P.S. 51 PLAYGROUND

The above sections consider the potential for significant adverse shadow impacts from the Proposed Project on publicly-accessible open space with sunlight-sensitive features. While the new P.S. 51 playground is not currently contemplated to be publicly-accessible and shadow impacts on project-generated open spaces are not typically assessed under CEQR, this section describes shadows on the existing and future P.S. 51 playground for informational purposes.

Just east of the proposed playground, a private open space for residents of the surrounding development would provide eastern exposure, and consequently the playground would be mostly sunny during spring, summer and fall mornings. In the late spring and summer, the playground would remain mostly sunny until the early afternoon, when shadows begin covering more than half the space. Fall and early spring shadows are longer, and the new playground would be half in shadow by late morning rather than early afternoon, and mostly in shade through the early afternoon. In the winter, long shadows would keep the playground shaded from late morning through the afternoon. **Table 6-2** characterizes the shadows on the proposed P.S. 51 playground.

**Table 6-2
Shadows on Existing P.S. 51 Playground**

Time Period	March 21 8:36 AM-5:29 PM EDT	May 6 7:27 AM-6:18 PM EDT	June 21 6:57 AM-7:01 PM EDT	December 21 8:51 AM-2:53 PM EST
Morning	Partial shadow on east side	Partial shadow on east and north sides	Partial shadow on east and north sides	Shadow on east and south sides
Midday	Minimal shadow on east side	Sunny	Sunny	Mostly in shadow
Afternoon	Partial shadow on south and west sides	Minimal shadow on west side in late afternoon	Minimal shadow on west side in late afternoon	Mostly in shadow
Notes: EST—Eastern Standard Time; EDT—Eastern Daylight Time March 21 is the equivalent of September 21. May 6 is the equivalent of August 6.				

By comparison, the current playground gets morning shadow throughout the year on its eastern side where the play equipment is located, cast by the wall along the rail cut. The current playground is sunny through the middle of the day in the spring, summer and fall, and begins to get shadow from buildings to the west and south west later in the afternoon. In winter the current playground is mostly shady throughout the day, except for about a half-hour around 1:00 PM when it is mostly in sun (see **Table 6-3**).

Table 6-3
Shadows on Proposed P.S. 51 Playground

Time Period	March 21 8:36 AM-5:29 PM EDT	May 6 7:27 AM-6:18 PM EDT	June 21 6:57 AM-7:01 PM EDT	December 21 8:51 AM-2:53 PM EST
Morning	Mostly sunny, some shadow on west side	Mostly shaded early, mostly sunny after 9:00 AM	Mostly shaded early, mostly sunny after 9:45 AM	Mostly in shadow; area of sun on northwest portion
Midday	Mostly in shadow	Sunny on northern half; shaded on southern half	Mostly sunny, some shadow on southern half	In shadow
Afternoon	Mostly in shadow	Mostly in shadow after 2:00 PM	More than half in shadow; areas of sun on north and west sides	In shadow
Notes: EST—Eastern Standard Time; EDT—Eastern Daylight Time March 21 is the equivalent of September 21. May 6 is the equivalent of August 6.				

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