# 962-972 FRANKLIN AVENUE REZONING
# Chapter 4: Shadows

## A. INTRODUCTION

This chapter assesses the potential for the Proposed Project to result in incremental shadows long enough to reach any nearby publicly accessible open spaces or other sunlight-sensitive resources. According to the *City Environmental Quality Review* (CEQR) *Technical Manual*, a shadows assessment is required if a proposed project would result in structures (or additions to existing structures) of 50 feet in height or greater, or those that would be located adjacent to, or across the street from, a sunlight sensitive resource. As discussed in **Chapter 1, "Project Description,"** the Proposed Project would comprise one new mixed-use building greater than 50 feet in height compared to the No-Action condition. As such, a detailed shadows analysis was prepared to determine the potential for the Proposed Project to result in significant adverse impacts on sunlight-sensitive resources.

## B. PRINCIPAL CONCLUSIONS

The Proposed Project would result in incremental shadow coverage (i.e. additional, or new, shadow coverage) on portions of two sunlight-sensitive open space resources (Brooklyn Botanic Garden and the Jackie Robinson Playground). As the extent and duration of incremental shadows would (1) significantly reduce or completely eliminate direct sunlight exposure on one or more sunlight-sensitive features found within the garden; and (2) would potentially significantly alter the public's use or enjoyment of the gardens, or threaten the viability of vegetation or other elements located within the garden, incremental shadows from the Proposed Project on Brooklyn Botanic Garden would be considered a significant adverse impact, in accordance with *CEQR Technical Manual* methodology. Incremental shadows from the Proposed Project would be cast on several individual resources within the Brooklyn Botanic Garden. Greenhouses within the Brooklyn Botanic Garden are used to propagate plants for desert, tropical, and warm temperate climates that require full, year-round sun including sunlight during the winter months. Based on the detailed analysis presented in this chapter, the Department of City Planning (DCP), acting as Lead Agency, in consultation with the Department of Parks and Recreation (NYC Parks) finds that the Proposed Actions would result in significant adverse impacts to the Brooklyn Botanic Garden.

At Jackie Robinson Playground, incremental shadows from the Proposed Project are expected to cast shadow on a passive area for seating and an area for active uses such as a playground area and basketball court. Therefore, due to the size, duration, and time of day of incremental shadow on Jackie Robinson Playground, the Proposed Actions would cause a significant adverse impact on the open space.

## C. METHODOLOGY

According to the *CEQR Technical Manual*, the longest shadow a structure will cast in New York City, except for periods close to dawn or dusk, is 4.3 times its height. For projects or actions resulting in structures less than 50 feet tall, a shadow assessment is generally not necessary, unless the site is

adjacent to a park, historic resource, or important natural feature (if the feature that makes the structure significant depends on sunlight).

Also according to the *CEQR Technical Manual*, shadows occurring earlier than 1.5 hours after sunrise or later than 1.5 before sunset are long, move fast, and generally blend with shadows from existing structures. Consistent with this, the timeframe window of analysis for this analysis is the period between 1.5 hours after sunrise and 1.5 hours before sunset. At times outside the timeframe window of analysis, the sun is located near the horizon, and the sun's rays reach the Earth at close to tangential angles, diminishing the amount of energy delivered by the sun's rays and producing shadows that grow in length exponentially until the sun reaches the horizon and sets. Because of these conditions, the shadows occurring between 1.5 hours before sunset and 1.5 hours after sunrise are not considered significant pursuant to the guidance of the *CEQR Technical Manual,* which this environmental review follows, and their assessment is not warranted.

First, a preliminary screening assessment must be conducted to ascertain whether shadows resulting from a project could reach any sunlight-sensitive resource at any time of year. The *CEQR Technical Manual* defines sunlight-sensitive resources as those resources that depend on sunlight or for which direct sunlight is necessary to maintain the resource's usability or architectural integrity. The following are considered to be sunlight-sensitive resources[1]:

- *Public open space* (e.g., parks, playgrounds, plazas, schoolyards, greenways, and landscaped medians with seating). Planted areas within unused portions or roadbeds that are part of the Greenstreets program are also considered sunlight-sensitive resources. The use of vegetation in an open space establishes its sensitivity to shadows. This sensitivity is assessed for both (1) warm-weather dependent features, like wading pools and sandboxes, or vegetation that could be affected by loss of sunlight during the growing season (i.e., March through October); and (2) features, such as benches, that could be affected by a loss of winter sunlight. Uses that rely on sunlight include: passive use, such as sitting or sunning; active use, such as playfields or paved courts; and such activities as gardening, or children's wading pools and sprinklers. Vegetation requiring direct sunlight includes the tree canopy, flowering plants, and plots, particularly plots for food production in community gardens. The amount of sunlight typically considered to be the minimum that plantings and vegetation would need is six to eight hours of direct sunlight. However, certain plantings and vegetation can tolerate partial sun, with a reduced minimum requirement of four to six hours of direct sunlight. Examples of areas that can tolerate partial sun are established tree canopies, shrubs or perennials.
- *Features of historic architectural resources that depend on sunlight for their enjoyment by the public.* Only the sunlight-sensitive features of an architectural resource are considered in a shadows analysis. Sunlight-sensitive features include the following: design elements that are part of a recognized architectural style that depends on the contrast between light and dark (e.g., deep recesses or voids, such as open galleries, arcades, recessed balconies, deep window reveals, and prominent rustication); elaborate, highly carved ornamentation; stained glass windows; exterior building materials and color that depend on direct sunlight for visual character (e.g., the polychromy [multicolored] features found on Victorian Gothic Revival or Art Deco facades); historic landscapes, such as scenic landmarks, including vegetation recognized as an historic feature of the landscape; and structural features for which the effect of direct sunlight is described as playing a significant role in the structure's importance as an historic landmark.

[1] According to the *CEQR Technical Manual*, city streets, sidewalks, and private open spaces (such as private residential front and back yards, stoops, and vacant lots) are not considered to be sunlight-sensitive resources.

- *Natural resources where the introduction of shadows could alter the resource's condition or microclimate.* Such resources could include community gardens, surface water bodies, wetlands, or designated resources, such as coastal fish and wildlife habitats.

The preliminary screening assessment consists of three tiers of analysis. The first tier determines a simple radius around the proposed buildings representing the longest shadow that could be cast. If there are sunlight-sensitive resources within the radius, the analysis proceeds to the second tier, which reduces the area that could be affected by project-generated shadows by accounting for a specific range of angles that can never receive shade in New York City due to the path of the sun in the northern hemisphere. 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 new shadows by looking at specific representative days of the year 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 (i.e. the additional, or new, shadow) resulting from the project. The detailed shadow analysis establishes a baseline condition (the No-Action condition) that is compared to the future condition resulting from the Proposed Project (the With-Action condition) to illustrate the shadows cast by existing or future buildings and distinguish the additional (incremental) shadows cast by the Proposed Project. In accordance with the *CEQR Technical Manual*, shadows on sunlight-sensitive resources of concern were modeled for four representative days of the year. For the New York City area, the months of interest for an open space resource encompass the growing season (i.e., March through October) and one month between November and February representing a cold-weather month (usually December). Representative days for the growing season are generally the March 21 vernal equinox (or the September 21 autumnal equinox, which is approximately the same), the June 21 summer solstice, and a spring or summer day halfway between the summer solstice and equinoxes, such as May 6 or August 6 (which are approximately the same). For the cold- weather months, the December 21 winter solstice is included to demonstrate conditions when open space users rely most heavily on available sunlight warmth. As these months and days are representative of the full range of possible shadows, they are also used for assessing shadows on sunlight-sensitive historic and natural resources.

The *CEQR Technical Manual* defines the temporal limits of a shadow analysis period to fall from an hour and a half after sunrise to an hour and a half before sunset.

The detailed analysis provides the data needed to assess the shadow impacts. The effects of incremental shadows on the sunlight-sensitive resources are described, and their degree of significance is considered. The result of the analysis and assessment are documented with graphics, a table of incremental shadow durations, and narrative text. As described in the *CEQR Technical Manual*, an incremental shadow is generally not considered significant when its duration is no longer than ten minutes at any time of year and the resource continues to receive substantial direct sunlight. A significant shadow impact generally occurs when an incremental shadow of ten minutes or longer falls on a sunlight-sensitive resource and results in one of the following:

- *Vegetation:* a substantial reduction in sunlight duration available to sunlight-sensitive features of the resource to less than the time of its minimum sunlight needs (when there would be sufficient sunlight in the future without the project) or a reduction in direct sunlight exposure where the sensitive feature of the resource is already subject to substandard sunlight (i.e., less than the minimum sunlight needs).
- *Historic and cultural resources:* a substantial reduction in sunlight available for the enjoyment or

appreciation of the sunlight-sensitive features of an historic or cultural resource.

- *Open space utilization:* a substantial reduction in the usability of open space as a result of increased shadow, including information 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.

In general, 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 exposure, thereby significantly altering the public's use of the resource or threatening the viability of vegetation or other resources.

## D. PRELIMINARY SCREENING

### Tier 1 Screening Assessment

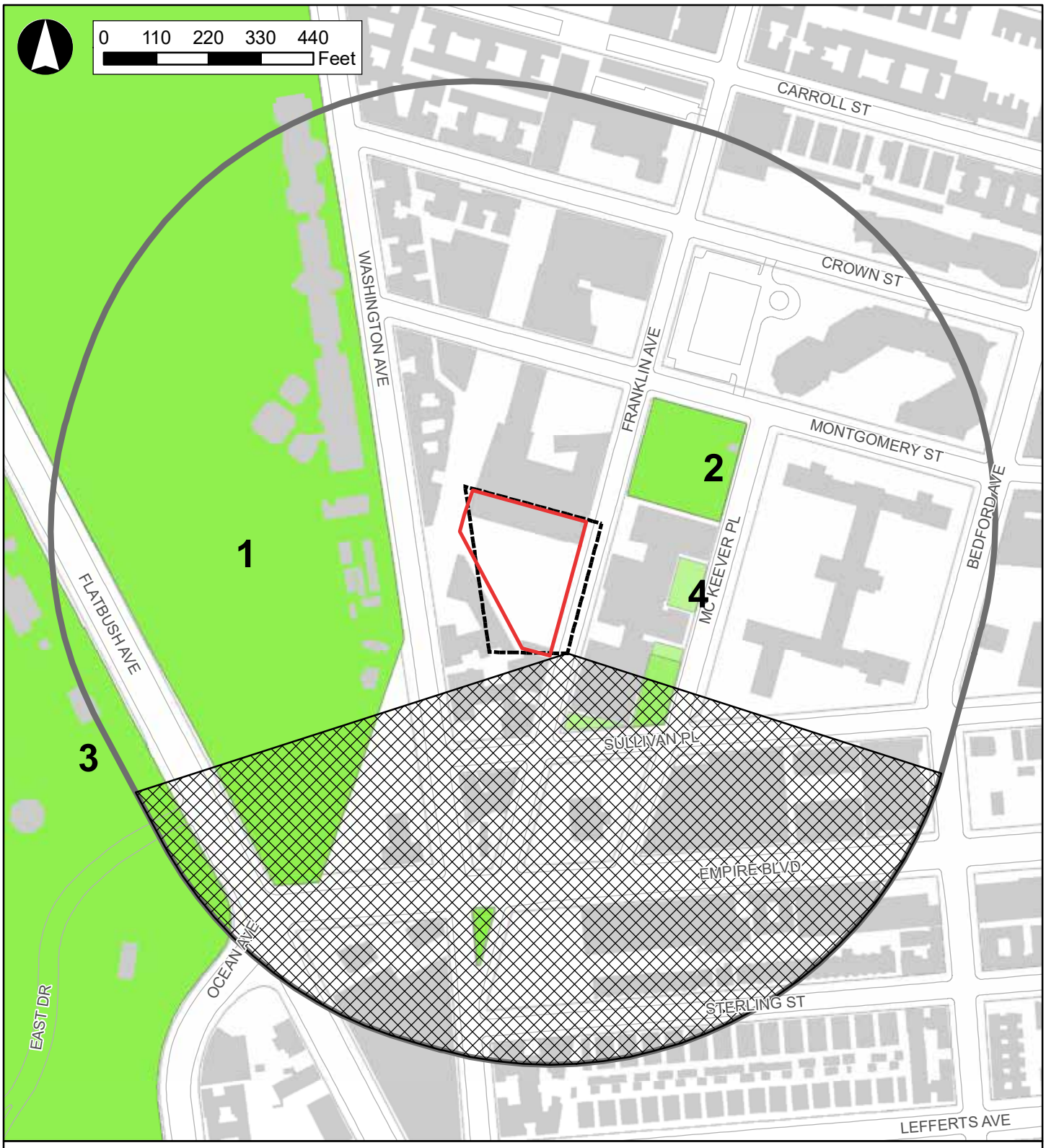
According to the *CEQR Technical Manual*, the longest shadow that a structure will cast in New York City, except for periods close to dawn or dusk, is 4.3 times its height. The maximum height of the Proposed Project is approximately 145 feet. On December 6, 2023, the City Council voted to approve the City of Yes for Carbon Neutrality text amendment. To help decarbonize our city, the text amendment removes existing zoning obstacles that limit how much rooftop space can be covered by solar panels and changes some of the zoning rules that govern the height of permitted rooftop obstructions such as solar panels. For the purposes of a conservative analysis, it is assumed that a 55-foot bulkhead would be utilized, which would be the maximum allowable permitted rooftop obstruction for the Proposed Project's height and zoning district under the City of Yes (COY) Carbon Neutrality Zoning text amendment. Based on a maximum height of 200 feet, the maximum shadow radius would be approximately 860 feet (refer to **Figure 4-1**). Within this longest shadow study area, there are four potentially sunlight-sensitive open spaces. Therefore, further screening was warranted in order to determine whether any resources could be affected by project-generated shadows.

### Tier 2 Screening Assessment

Due to the path of the sun across the sky in the northern hemisphere, no shadow can be cast in a triangular area south of any given site. In New York City, this area lies between -108 and +108 degrees from true north. The purpose of the Tier 2 screening is to determine whether the sunlight-sensitive resources identified in the Tier 1 screening are located within portions of the longest shadow study area that can receive shade from the Proposed Project.

**Figure 4-1** provides a base map illustrating the results of the Tier 1 and Tier 2 screening assessments (i.e., the portion of the longest shadow study area lying within -108 degrees from the true north and +108 degrees from true north as measured from the southernmost corner of the Proposed Project buildings). A total of four open space resources that could potentially be shaded as a result of the Proposed Actions were identified as sunlight-sensitive and are provided in **Table 4-1** below.

**Figure 4-1**
**Tier I and Tier II Shadow Assessment**




## Legend

- Development Site
- Project Area
- Tier I: Longest Shadow Study Area (860')
- Tier II: Area that Cannot be Shaded
- 1 Open Space (refer to Table 4-5)

**TABLE 4-1**
**Potentially Sunlight-Sensitive Resources Warranting Further Analysis Based on Tier 1 and 2 Screening**

| No.[1] | Open Space Resources |
|---|---|
| 1 | Brooklyn Botanic Garden |
| 2 | Jackie Robinson Playground |
| 3 | Prospect Park |
| 4 | P.S. 375K Community Playground |

**Notes:**
[1] Numbers keyed to **Figure 4-1.**

## Tier 3 Screening Assessment

According to the *CEQR Technical Manual*, a Tier 3 screening assessment should be performed to determine if, in the absence of intervening buildings, shadows resulting from a proposed project can reach a sunlight-sensitive resource, thereby warranting a detailed shadow analysis. The Tier 3 screening assessment is used to determine if shadows resulting from a proposed project can reach a sunlight-sensitive resource at any time between 1.5 hours after sunrise and 1.5 hours before sunset on representative analysis dates.

As project-generated shadows could reach a number of sunlight-sensitive resources, a Tier 3 assessment was performed using three dimensional (3D) computer mapping software. A 3D model of the Proposed Project was used to calculate and display project-generated shadows on individual representative analysis dates. The model contained 3D representations of the elements in the base map used in the preceding assessments and a 3D model of the Proposed Project. At this stage of the assessment, surrounding buildings within the study area were not included in the model so that it may be determined whether project-generated shadows would reach any sunlight sensitive resources.

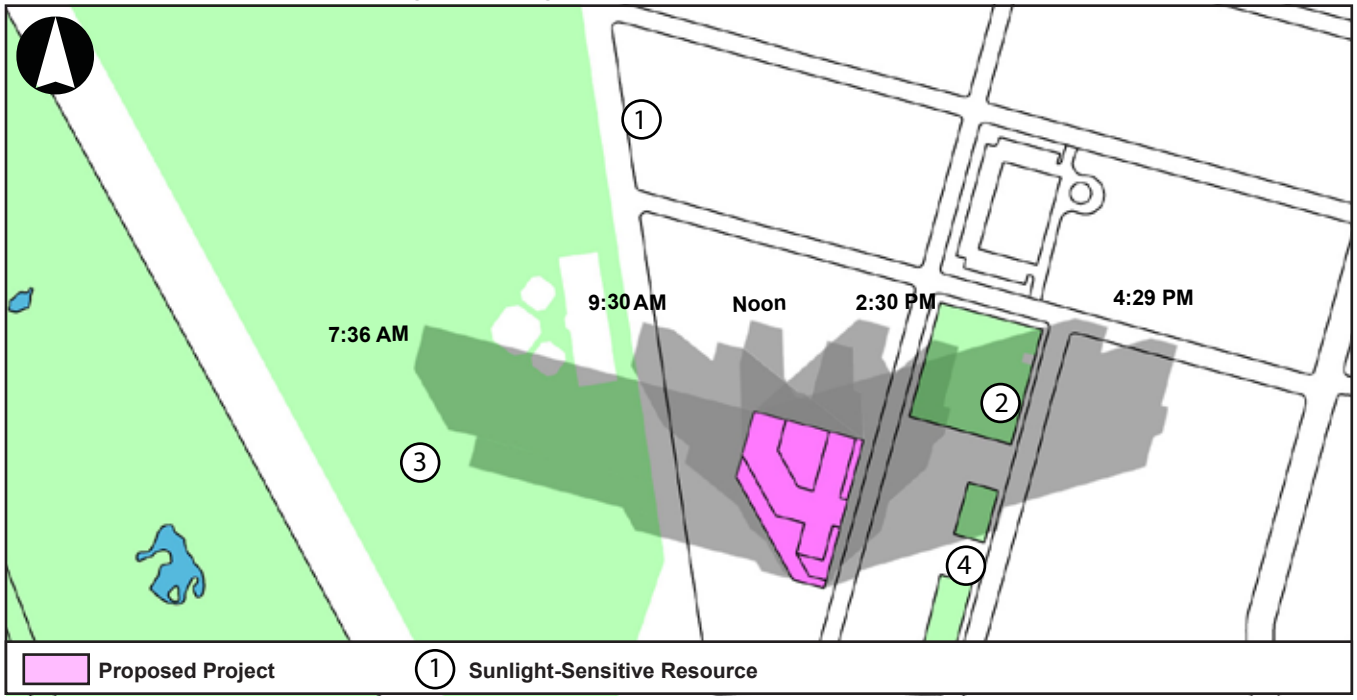
**TABLE 4-2**
**Potentially Sunlight-Sensitive Resources Warranting Further Analysis Based on Tier 3 Screening**

| No.[1] | Name | 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 | Number of Analysis Days |
|---|---|---|---|---|---|---|
| ***Open Space Resources*** | | | | | | |
| 1 | Brooklyn Botanic Garden | YES | YES | YES | YES | 4 |
| 2 | Jackie Robinson Playground | YES | YES | YES | YES | 4 |
| 3 | Prospect Park | NO | NO | NO | NO | 0 |
| 4 | P.S. 375K Community Playground | YES | YES | YES | NO | 3 |

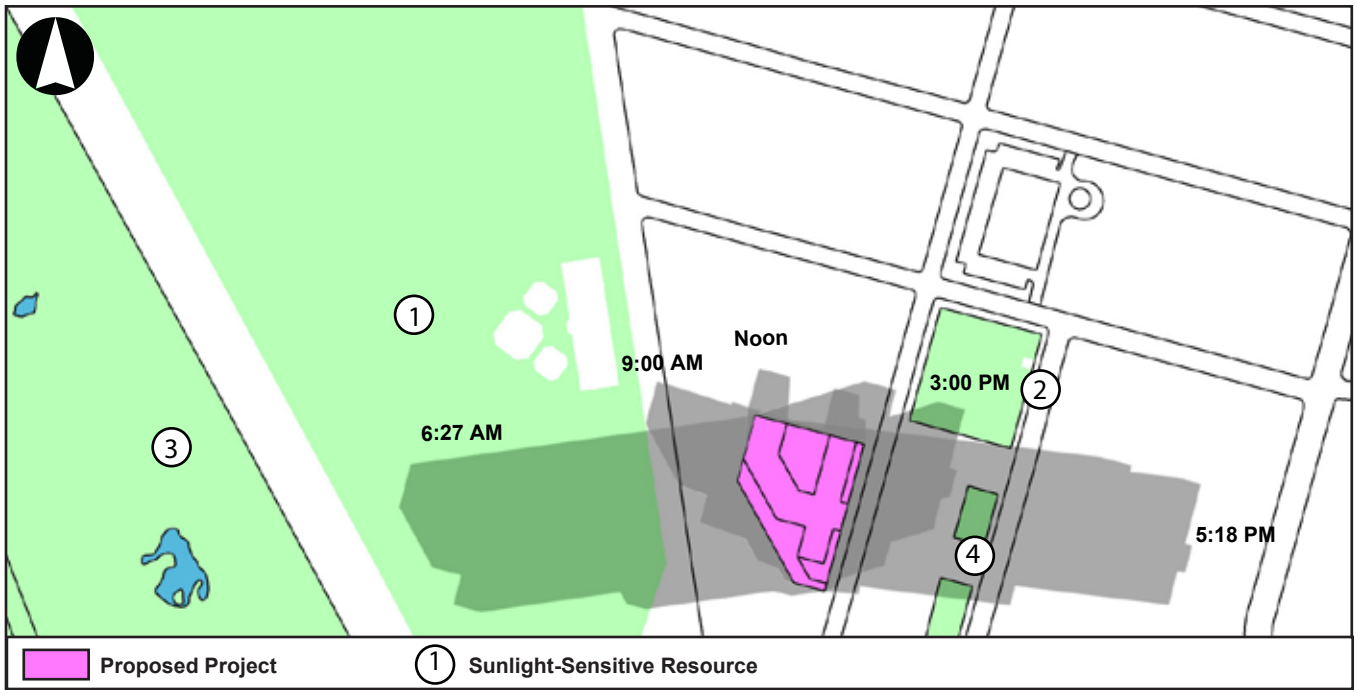
**Notes:**
[1] Numbers keyed to **Figure 4-1.**

As shown in **Table 4-2** above, the Tier 3 results determined that of the four sunlight-sensitive open space resources, Prospect Park (Resource #3 in **Figures 4-2a** and **4-2b**) would not receive project-generated shadows on any of the four analysis days and, therefore, did not require any further analysis. **Table 4-2** presents a summary of the Tier 3 assessment, showing the remaining three sunlight-sensitive open space resources that could, in the absence of intervening buildings, receive project-generated shadows, and on which analysis days the new shadows could occur. As presented in **Table 4-2**, the Proposed Project has the potential to cast new incremental shadows on the Brooklyn Botanic Garden on all four

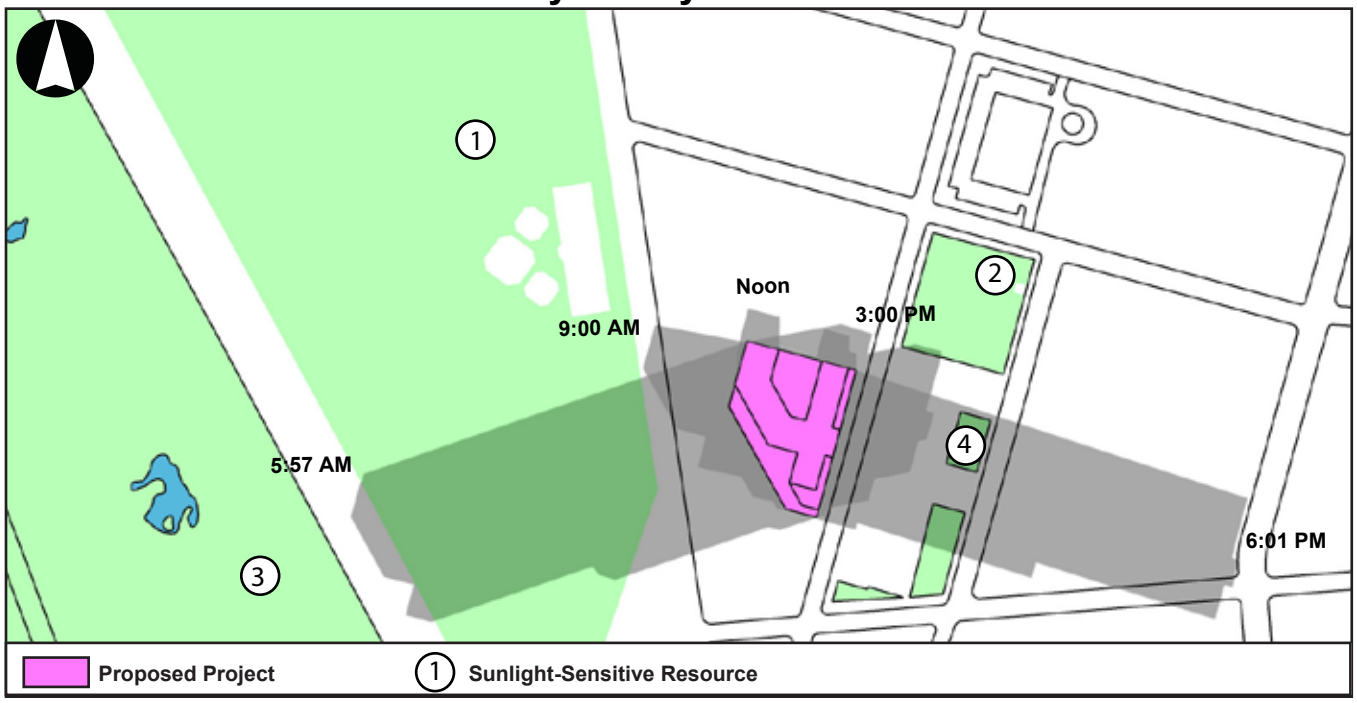
## Analysis Day: March 21 / September 21



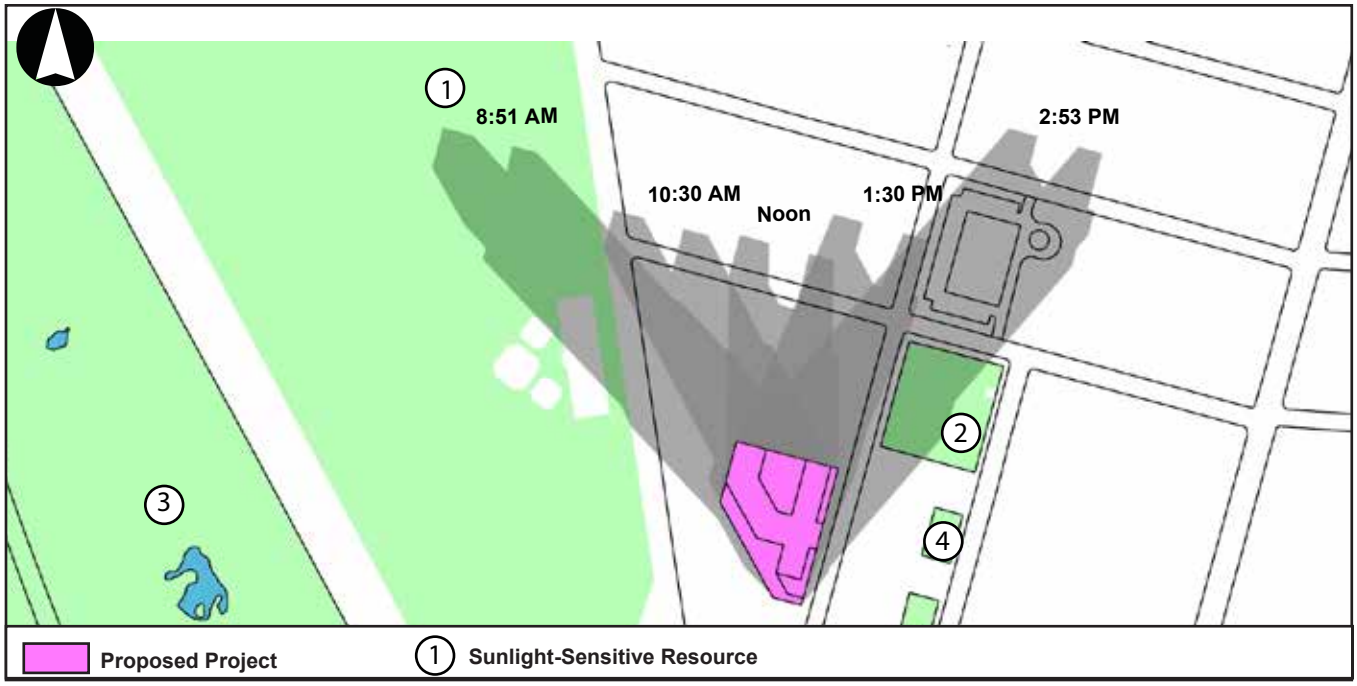

## Analysis Day: May 6 / August 6



## Analysis Day: June 21




## Analysis Day: December 21



analysis days, on Jackie Robinson Playground on four analysis days, and on the P.S. 375K Community Playground on three analysis days. Therefore, a detailed shadows analysis is warranted for these three resources and has been provided below.

# E. DETAILED ANALYSIS OF SHADOW IMPACTS

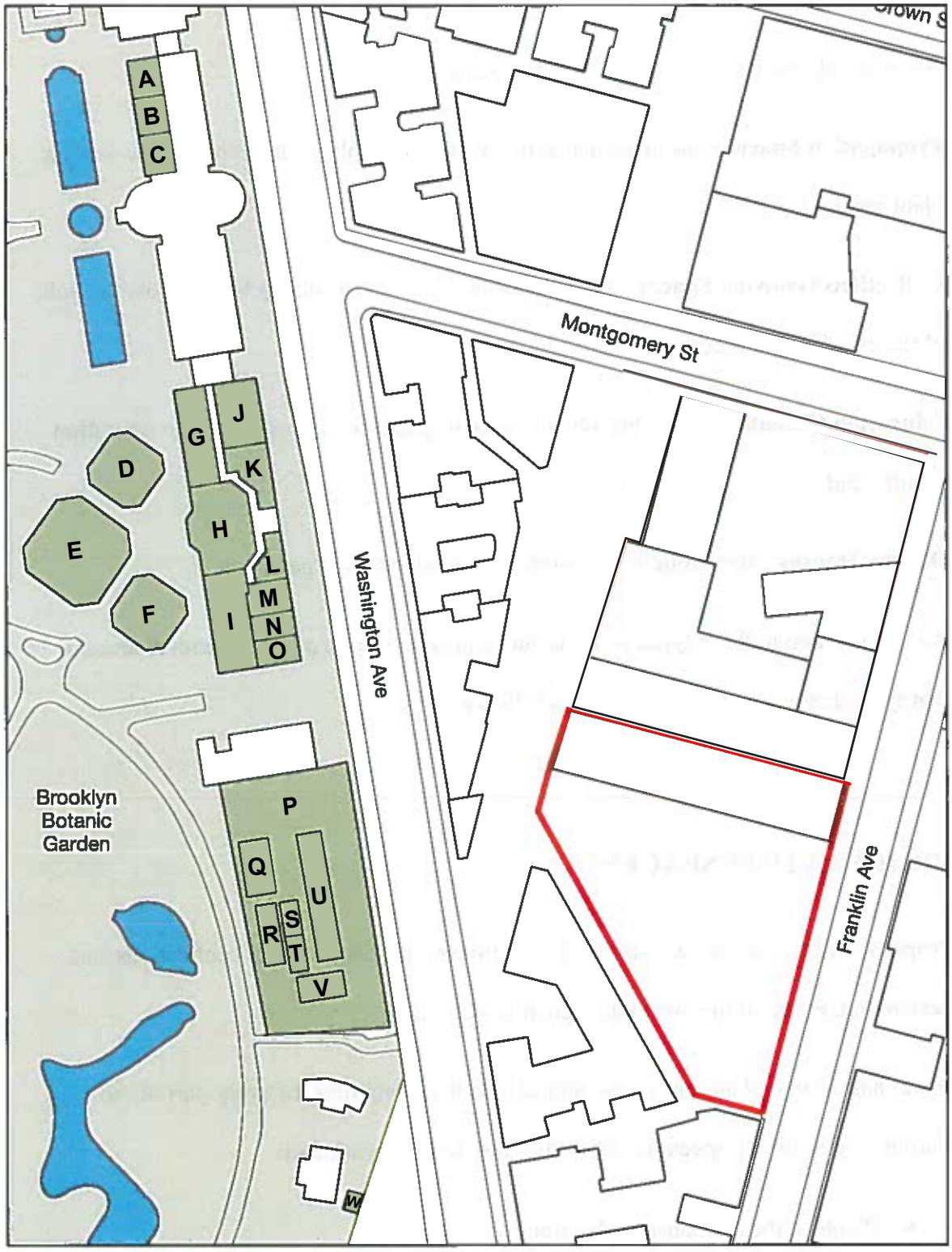
## Open Space Resources Affected by Project-Generated Shadows

### *Brooklyn Botanic Garden*

The Brooklyn Botanic Garden (also referred to in this chapter as "the Botanical Garden") is an approximately 52-acre passive open space resource extending along the west side of Washington Avenue between Empire Boulevard, Flatbush Avenue, and Eastern Parkway. The open space includes a number of unenclosed gardens, including the Cranford Rose Garden, the Children's Garden, the Discovery Garden, the Fragrance Garden, the Herb Garden, the Japanese Hill-and-Pond Garden, the Native Flora Garden, the Osborn Garden, the Rock Garden, the Shakespeare Garden, and the Shelby White and Leon Levy Water Garden. In addition, the open space contains a number of trees, ponds (such as the Lily Pool Terrace), grassy lawn areas, benches, plazas (such as the Magnolia Plaza, the Perennial Border, and the Annual Border), and walking paths (such as the Cherry Esplanade and the Celebrity Path). The Brooklyn Botanic Garden also contains the Steinhardt Conservatory, a 25,510-sf complex of display and support greenhouses built in 1988, made up of several pavilions, greenhouses, and propagation houses (described in greater detail below) containing plants that are staged in realistic environments that simulate a range of global habitats. The domed pavilions feature a diverse collection of plants native to the American Southwest, Central America, the deserts and scrublands of Africa, China, the Mediterranean, Australasia, southern Africa, the western United States, the Amazon Basin, the African rainforest, and tropical eastern Asia. Other collections held in the Steinhardt Conservatory, including orchids and bonsai, art exhibits, and historical displays, are presented in rotation during the year.

As presented in **Table 4-3** and **Figure 4-3** below, the Brooklyn Botanic Garden hosts 23 enclosed conservatories, greenhouses, propagation spaces, and nurseries that have each been designed to maximize natural sunlight due to the sensitivity of certain plants' growth and/or propagation needs. Each conservatory, greenhouse, propagation, and nursery facility is described in greater detail below in **Table 4-4**.

**Figure 4-3**
**Brooklyn Botanic Gardens Facilities**




A — Brooklyn Botanic Gardens Sunlight-Sensitive Facility

Project Site

**Keyed to Table 4-3*

**TABLE 4-3**
**Potentially Sunlight-Sensitive Resources Warranting Further Analysis Based on Tier 1 and 2 Screening**

| ID[1] | Brooklyn Botanic Gardens Facility | ID[1] | Brooklyn Botanic Gardens Facility |
|---|---|---|---|
| A | Education Greenhouse: Desert Plants | M | Highland Moist Tropical Orchid Workhouse |
| B | Education Greenhouse: Warm Temperate Plants | N | Tropical Plant Propagation House |
| C | Education Greenhouse: Tropical Plants | O | Tropical and Desert Plant Propagation House |
| D | Helen Mattin Warm Temperate Pavilion | P | Hardy Plant Nursery Yard |
| E | Tropical Pavilion | Q | Temperate Bonsai Tunnel |
| F | Desert Pavilion | R | Production House |
| G | C.V. Starr Bonsai Museum | S | Tropical Bonsai House |
| H | Conservatory Entry House | T | Auxiliary House |
| I | Aquatic House and Orchid Collection | U | New York-Native Flora and Temperate Plant Propagation Tunnel |
| J | Desert, Mediterranean, South African Bulb | V | Mediterranean Display Plants Tunnel |
| K | Humid Tropics Workhouse | W | Children's Garden Production House |
| L | Lowland Moist Tropical Orchid Workhouse | | |

**Notes:**
[1] Keyed to **Figure 4-3**

**TABLE ~~4F~~ 4-4**
**Potentially Sunlight-Sensitive Resources within the Brooklyn Botanic Garden**

| Brooklyn Botanic Garden Resource | Sunlight-Sensitive Resources/Plants |
|---|---|
| Plant Family Collection | Ferns, conifers, ginkgos, magnolias, shrubs, roses, legumes, honeysuckles, composites, monocots, elm trees, oak trees, walnut trees |
| Rock Garden | Woodland plants (e.g., maples, pines, spruces, and viburnums), acid-loving plants (e.g., heaths, azaleas, and rhododendrons), scree, drought-tolerant plants (e.g., succulents), evergreens (e.g., yew, juniper, spruce, fir, and false cypress), and shade-tolerant plants (e.g., azaleas, rhododendrons, bulbs, hostas, anemones, and hellebores) |
| Herb Garden | An assortment of herbs, vegetables, fruit trees, and grains |
| Lily Pool Terrace | Sacred Lotus (nelumbo nucifera), hardy water-lily, and tropical water-lily cultivars |
| Water Garden | Diverse water-based trees, shrubs, bulbs, and ferns |
| Discovery Garden | Planting beds for flowers, vegetables, and herbs, as well as meadow, woodland, and marsh areas that are utilized for youth educational programs |
| Rose Garden | Variety of roses |
| Cherry Esplanade | An assortment of scarlet oak trees, liberty oaks, and double-flowered *Prunus* 'Kazan' trees (aka 'Cherry Blossoms') |
| Japanese Hill-and-Pond Garden | An assortment of evergreen plants (e.g., white pine, American beech, and bald cypress), Japanese irises, wisteria, Japanese maples, and azaleas |
| Shakespeare Garden | A variety of plants referenced in William Shakespeare's work |

| | |
|---|---|
| Celebrity Path | An assortment of Austrian pines, rhododendrons, and daffodils |
| Fragrance Garden | An assortment apple geranium, Corsican mint, fumitory, Indian patchouli, lantana, lavender, lemon verbena, peppermint geranium, rose geranium, sage, southernwood, candytuft, garden verbena, heliotrope, marigold, Mexican evening primrose, ornamental flowering tobacco, petunia, red valerian, snow-in-summer, sweet alyssum, and wallflower |
| Daffodil Hill | Various species of daffodils |
| Magnolia Plaza | Various species of magnolias |
| Annual and Perennial Borders | Various species of annuals and perennials such as tulips |
| Desert Plants, Warm Temperate Plants, and Tropical Plants Education Greenhouses | Collection of cacti and succulents, warm temperate ornamental, culinary, and medicinal plants, and tropical ornamentals and crop plants |
| Hardy Plant Nursey Yard | Collection of hardy wood and herbaceous perennials |
| Temperate Bonsai Tunnel and Tropical Bonsai House | Plant collection of hardy wood perennials, broadleaf, conifers, and tropical, and woody perennials |
| Production House | Wide variety of annual and biennial plants |
| Auxiliary House | Plant collection of tender and tropical perennials |
| New York-Native Flora and Temperate Plant Propagation Tunnel | Plant collection of regional U.S. native plants, rare New York State flora, and temperate woody and herbaceous perennials |
| Mediterranean Display Plants Tunnel | Plant collection of citrus and olive plants |
| Compost Exhibit | Various trees and shrubs |
| Steinhardt Conservatory's Helen Mattin Warm Temperate Pavilion, Tropical Pavilion, Desert Pavilion, C.V. Starr Bonsai Museum, Aquatic House and Orchid Collection, Conservatory Entry House, Arid Workhouse, Humid Tropics Workhouse, Lowland and Highland Moist Tropical Orchid Workhouses, Tropical Plant Propagation House, and Tropical and Desert Plant Propagation House | An assortment of orchids, mangroves, papyrus, water hyacinth, aroids, carnivorous plants, pond-apple trees, cacti, succulents, wildflowers, vines, ground covers, and bonsai, as well as various trees and shrubs |

*EDUCATION GREENHOUSES (PALM HOUSE)*

The Education Greenhouses are where plants are propagated for school visits and other education groups (including children and adults with sensory and cognitive disabilities) and are the only spaces that house and display "touchable" plants in service of hands-on, experiential learning and experimentation.

Desert Plants Education Greenhouse

The Desert Plants Education Greenhouse is an approximately 900-sf glazed conservatory space open to school groups and other workshop participants. The growing environment is climate controlled between 70 and 80°F to simulate arid regions and is home to a plant collection of cacti and succulents. Its plant collection comprises approximately 400 individual plants. Additionally, approximately 3,000 seasonal

plants are produced in this space annually for educational use. Major plant families represented in this collection are the Cactaceae, Asphdelaceae, Asparagaceae, and Euphorbiaceae families.

Warm Temperate Plants Education Greenhouse

The Warm Temperate Plants Education Greenhouse is an approximately 900-sf glazed conservatory space adjacent to the Desert Plants Education Greenhouse that is also open to school groups and other workshop participants. The growing environment is climate controlled between 60 and 75°F to simulate warm temperate climates, and is home to a plant collection of warm temperate ornamental, culinary, and medicinal plants. Its plant collection comprises approximately 380 individual plants. Additionally, approximately 1,100 plants are produced in this space annually for educational use. Major plant families represented in this collection are the Geraniaceae, Lamiaceae, Fabaceae, Solanaceae, and Droseraceae families.

Tropical Plants Education Greenhouse

The Tropical Plants Education Greenhouse is an approximately 900-sf glazed conservatory space adjacent to the Warm Temperate Plants Education Greenhouse that is open to school groups and other workshop participants. The growing environment is climate controlled between 80 and 85°F to simulate tropical and sub-tropical climates and is home to a plant collection of tropical ornamentals and crop plants. The plant collection comprises approximately 400 individual plants. Additionally, approximately 150 seasonal plants are produced in this space annually for educational use. Major plant families represented in this collection are the Rutaceae, Zingiberaceae, Rubiaceae, Bromeliaceae, and Musaceae families.

*STEINHARDT CONSERVATORY*

The Steinhardt Conservatory is a 25,510-sf complex that supports several collections growing spaces, propagation spaces, and display houses. The facility's collections growing spaces contain rare and endangered species, are actively used for *ex-situ* plant conservation, and hold custody of rare plants protected by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) for the Federal Government. The facility's display houses include pavilions and conservatories intended to grow and exhibit long- and short-term plantings on rotation from the collections growing spaces. Long-term plantings may be planted directly into beds and are typically replaced at the end of their natural life or when they have outgrown their space, using plant material held in the collections growing and propagation spaces. Collections in these spaces are fully labelled, including education interpretation, and are included in educational tours and programming. The Steinhardt Conservatory's propagation spaces include the Tropical Plant and Tropical and Desert Plant Propagation houses, and are the areas within the conservatory that actively grow new plants and repropagate existing plant material.

Helen Mattin Warm Temperate Pavilion

The Helen Mattin Warm Temperate Pavilion is an approximately 2,890-sf glasshouse open to the public. The growing environment is climate controlled between 60 and 70°F to simulate warm temperate and Mediterranean regions of Africa, Australasia and Asia, and western coastal North and South America. The pavilion is home to a plant collection of warm temperate herbaceous and woody perennials, bulbs, and ferns. The plant collection comprises approximately 63 plant families, 181 taxa, 195 plant accessions, and 311 individual plants. Major plant families represented in this collection are the Lamiaceae, Amaryllidaceae, Dryopteridaceae, Asparagaceae, and Myrtaceae families. Nine of the taxa featured in this pavilion are at-risk protected species on the *International Union for Conservation of Nature (IUCN) Red*

*List of Threatened Species*. The current collection includes plant material introduced to the Brooklyn Botanic Garden over the last 104 years, from 71 individual sources.

Tropical Pavilion

The Tropical Pavilion is an approximately 5,840-sf nonpublic glasshouse pavilion. The growing environment is climate controlled between 80 and 86°F to simulate the tropical forests of the Amazon Basin, African Rainforest, and tropical Eastern Asia. The pavilion is home to a plant collection of palms, aroids, bromeliads, gingers, and economic crop plants. This plant collection comprises approximately 61 plant families, 245 taxa, 252 plant accessions, and 716 individual plants. Major plant families represented in this collection are the Araceae, Zingiberaceae, and Asparagaceae families. Of the taxa found within this pavilion, 14 are at-risk protected species on the *IUCN Red List of Threatened Species*. The current collection includes plant material introduced to the Brooklyn Botanic Garden over the last 105 years from 89 individual sources.

Desert Pavilion

The Desert Pavilion is an approximately 2,890-sf glasshouse open to the public. The growing environment is climate controlled between 65 and 85°F to simulate arid regions of the Europe, Asia, Africa, and the Americas, and is home to a plant collection of shrubs, cacti, succulents, wildflowers, and living stones. The desert plant collection comprises approximately 31 plant families, 275 taxa, 288 plant accessions, and 423 individual plants. Of the taxa found within the Desert Pavilion, 20 are at-risk protected species on the *IUCN Red List of Threatened Species*. Major plant families represented in this collection are the Cactaceae, Asphodelaceae, Crassulaceae, Aizoaceae, and Euphorbiaceae families. The current collection includes plant material introduced to the Brooklyn Botanic Garden over the last 103 years from 87 individual sources. It should be noted that the plant species featured in the Desert Pavilion generally require higher levels of direct sunlight; as such, any oversized plantings are frequently replaced to ensure high light levels reach down to the soil level.

C.V. Starr Bonsai Museum

The Bonsai Museum is an approximately 2,280-sf glazed conservatory open to the public. The growing environment is climate controlled between 36 and 42°F to simulate temperate Mediterranean to tropical and subtropical climates. The Bonsai Museum is home to a plant collection of tropical and temperate woody perennials. The space's plant collection comprises approximately 46 plant families, 261 taxa, 496 plant accessions, and 529 individual plants. Major plant families represented in this collection are the Cupressaceae, Rosaceae, Pinaceae, Sapindaceae, and Ulmaceae families. 19 of these taxa are at-risk protected species on the *IUCN Red List of Threatened Species*. The current collection includes plant material introduced to the Brooklyn Botanic Garden over the last 93 years from 55 individual sources, which feature some of the garden's oldest trees. The oldest specimen, a Rocky Mountain juniper, is 509 years old.

Conservatory Entry House

The Conservatory Entry House is an approximately 3,760-sf glazed conservatory open to the public. The growing environment is climate controlled between 77 and 83°F to simulate tropical and subtropical climates, and is home to a plant collection of aroids, cycads, and palms. The Conservatory Entry House plant collection comprises approximately 75 plant families, 274 taxa, 292 plant accessions, and 548 individual plants. Major plant families represented in this collection are the Araceae, Zamiaceae, and Arecaceae families. Of the taxa found in this display house, 35 are at-risk protected species on the *IUCN*

*Red List of Threatened Species*. The current collection includes plant material introduced to the Brooklyn Botanic Garden over the last 104 years from 92 individual sources.

Aquatic House and Orchid Collection

The Aquatic House is an approximately 2,960-sf glazed conservatory open to the public. The growing environment is climate controlled between 75 and 82°F to simulate tropical and subtropical aquatic and moist environments, and is home to a plant collection of aquatics, orchids, aroids, carnivorous plants, ferns, and mosses. The Aquatic House plant collection comprises approximately 28 plant families, 227 taxa, 308 plant accessions, and 616 individual plants. Major plant families represented in this collection are the Orchidaceae, Araceae, and Alismataceae families. One of these taxa is an at-risk protected species on the *IUCN Red List of Threatened Species*. The current collection includes plant material introduced to the Brooklyn Botanic Garden over the last 39 years from 54 individual sources. It should be noted that the plant species featured in the Aquatic House generally require higher levels of direct sunlight.

Desert, Mediterranean, South African Bulb (Arid) Workhouse

The Arid Workhouse is an approximately 2,080-sf nonpublic glazed conservatory space. The growing environment is climate controlled between 60 and 75°F to simulate arid regions of the New and Old World, and is home to a plant collection of cacti, succulents, living stones, and bulbs. This workhouse plant collection comprises approximately 61 plant families, 589 taxa, 633 plant accessions, and 946 individual plants. Major plant families represented in this collection are the Iridaceae, Asparagaceae, Asphodelaceae, Cactaceae, Amaryllidaceae, Euphorbiaceae, Ocalidaceae, and Crassulaceae families. Of the taxa in the Arid Workhouse, 33 are at-risk protected species on the *IUCN Red List of Threatened Species*. The current collection includes plant material introduced to the Brooklyn Botanic Garden over the last 52 years from 60 individual sources.

Humid Tropics Workhouse

The Humid Tropics Workhouse is an approximately 1,480-sf nonpublic glazed conservatory space. The growing environment is climate controlled between 72 and 80°F to simulate the moist tropics, and is home to a plant collection of tropical palms, bulbs, and ferns. This workhouse plant collection comprises approximately 55 plant families, 141 taxa, 147 plant accessions, and 284 individual plants. Major plant families represented in this collection are the Apocynaceae, Arecaceae, Euphorbiaceae, and Amaryllidaceae families. Seven of these taxa are at-risk protected species on the *IUCN Red List of Threatened Species*. The current collection includes plant material introduced to the Brooklyn Botanic Garden over the last 51 years from 94 individual sources.

Lowland Moist Tropical Orchid Workhouse

The Lowland Moist Tropical Orchid Workhouse is an approximately 860-sf nonpublic glazed conservatory space. The growing environment is climate controlled between 68 and 76°F to simulate lowland moist tropics, and is home to a plant collection of epiphytic orchids. This plant collection comprises approximately five plant families, 1,177 taxa, 2,000 plant accessions, and 2,038 individual plants. Of the taxa, 48 are at-risk protected species on the *IUCN Red List of Threatened Species*. The major plant family represented in this collection is the Orchidaceae family. The current collection includes plant material introduced to the Brooklyn Botanic Garden over the last 60 years from 100 individual sources.

Highland Moist Tropical Orchid Workhouse

The Highland Moist Tropical Orchid Workhouse is an approximately 1,020-sf nonpublic glazed conservatory space. The growing environment is climate controlled between 68 and 78°F to simulate highland moist tropics, and is home to a plant collection of epiphytic orchids. This plant collection comprises approximately 11 plant families, 2,483 taxa, 4,880 plant accessions, and 5,198 individual plants. The major plant family represented in this collection is the Orchidaceae family. Of the taxa found in the Highland Moist Tropical Orchid Workhouse, 61 are at-risk protected species on the *IUCN Red List of Threatened Species*. The current collection includes plant material introduced to the Brooklyn Botanic Garden over the last 63 years from 102 individual sources.

Tropical Plant Propagation House

The Tropical Plant Propagation House is an approximately 790-sf nonpublic glazed conservatory space. The growing environment is climate controlled between 75 and 85°F as an adaptable, specialist growing space, and is home to a plant collection of tropical perennials. This space is used to propagate plants for all the tropical glasshouse spaces within the Brooklyn Botanic Garden. This plant collection comprises approximately eight plant families, nine taxa, 20 plant accessions, and 30 individual plants. Major plant families represented in this collection are the Araceae and Araucariaceae families. Three of these taxa are at-risk protected species on the *IUCN Red List of Threatened Species*. The current collection includes plant material introduced to the Brooklyn Botanic Garden over the last 39 years, from eight individual sources. It should be noted that the propagation of the plant species found in the Tropical Plant Propagation House generally require higher levels of direct sunlight.

Tropical and Desert Plant Propagation House

The Tropical and Desert Plant Propagation House is an approximately 840-sf nonpublic glazed conservatory space. The growing environment is climate controlled between 70 and 85°F as an adaptable, specialist growing space, and is home to a plant collection of bromeliads, orchids, and carnivorous plants. Its plant collection comprises approximately 26 plant families, 127 taxa, 157 plant accessions, and 232 individual plants. Major plant families represented in this collection include the Bromeliaceae, Sarraceniaceae, Orchidaceae, and Apocyncaceae families. Of the taxa in the Tropical and Desert Plant Propagation House, 19 are at-risk protected species on the *IUCN Red List of Threatened Species*. The current collection includes plant material introduced to the Brooklyn Botanic Garden over the last 47 years, from 48 individual sources. It should be noted that the propagation of the plant species found in the Tropical and Desert Plant Propagation House generally require higher levels of direct sunlight.

*HARDY PLANT NURSERY YARD*

The Brooklyn Botanic Garden's Hardy Plant Nursery Yard is an approximately 17,960-sf nonpublic exterior growing space that is home to a plant collection of hardy wood and herbaceous perennials, as well as six propagation houses and collections growing spaces, including the Temperate Bonsai Tunnel, the Production House, the Tropical Bonsai House, the Auxiliary House, the New York-Native Flora and Temperate Plant Propagation Tunnel, and the Mediterranean Displace Plants Tunnel (which are described in greater detail below). The exterior nursery's plant collection comprises approximately 56 plant families, 202 taxa, 207 plant accessions, and 2,358 individual plants. Major plant families represented in the unenclosed portions of the nursery include the Asphodelaceae, Rosaceae, and Paeoniaceae families. Nine of these taxa are at-risk protected species on the *IUCN Red List of Threated Species*. The nursery's current collection includes plant material introduced to the Brooklyn Botanic Garden over the last 84 years, from 78 individual sources.

Temperate Bonsai Tunnel

The Temperate Bonsai Tunnel is an approximately 1,190-sf nonpublic growing tunnel. The growing environment is climate controlled between 38 and 45°F to simulate temperate regions, and is home to a plant collection of hardy wood perennials, broadleaf, and conifers. The Temperate Bonsai Tunnel serves as a nursery area for growing cold-hardy bonsai trees when they are not on display in the C.V. Starr Bonsai Museum.

Production House

The Production House is an approximately 930-sf nonpublic glasshouse. The growing environment is climate controlled between 60 and 80°F as an adaptable, specialist growing space. This house is used year-round to grow over 25,000 annual and biennial plants that are featured throughout the Brooklyn Botanic Garden. As the Production House serves as a greenhouse for propagating and growing collection and seasonal plants from seedlings, the facility generally requires higher levels of direct sunlight.

Tropical Bonsai House

The Tropical Bonsai House is an approximately 456-sf nonpublic glasshouse. The growing environment is climate controlled between 70 and 80°F to simulate tropical and subtropical climates, and is home to a plant collection of tropical, woody perennials. Similar to the Temperate Bonsai Tunnel described above, the Tropical Bonsai House serves as a nursery area for growing and housing tropical climate bonsai trees when they are not on display in the C.V. Starr Bonsai Museum.

Auxiliary House

The Auxiliary House is an approximately 465-sf nonpublic glasshouse. The growing environment is climate controlled between 60 and 80°F as an adaptable, specialist growing space, and is home to a plant collection of tender and tropical perennials. Its plant collection comprises approximately 10 plant families, 22 taxa, 22 plant accessions, and 49 individual plants. The major plant family represented in this collection is the Araceae family. The current collection includes plant material introduced to the Brooklyn Botanic Garden over the last 30 years from 10 individual sources. It should be noted that the plant species that grow in the Auxiliary House generally require higher levels of direct sunlight.

New York-Native Flora and Temperate Plant Propagation Tunnel

The New York-Native Flora and Temperate Plant Propagation Tunnel is an approximately 2,320-sf nonpublic growing tunnel. The growing environment is climate controlled between 55 and 80°F to simulate temperate regions and is home to a plant collection of regional U.S. native plants, rare New York State flora, and temperate woody and herbaceous perennials. This greenhouse tunnel serves as a temporary storage facility for plants that will eventually be planted throughout the Brooklyn Botanic Garden. The plant collection comprises approximately 84 plant families, 326 taxa, 348 accessions, and 3,820 individual plants. Major plant families represented in this collection include the Salicaceae, Asphodelaceae, and Oleaceae families. Of the taxa found within this greenhouse tunnel, 19 are at-risk protected species on the *IUCN Red List of Threatened Species*. The current collection includes plant material introduced to the Brooklyn Botanic Garden over the last 53 years from 96 individual sources.

Mediterranean Display Plants Tunnel

The Mediterranean Display Plants Tunnel is an approximately 870-sf nonpublic growing tunnel. The growing environment is climate controlled between 35 and 45°F to simulate the Mediterranean and is home to a plant collection of citrus and olive plants. This tunnel serves as a greenhouse for primarily growing citrus and olive trees when they are not on public display. This plant collection comprises approximately four plant families, 26 taxa, 28 plant accessions, and 30 individual plants. Major plant families represented in this collection include the Rutaceae and Oleaceae families. The current collection includes plant material introduced to the Brooklyn Botanic Garden over the last 29 years from 12 individual sources. It should be noted that the plant species that grow in the Mediterranean Display Plants Tunnel generally require higher levels of direct sunlight.

### *Jackie Robinson Playground*

Jackie Robinson Playground is a primarily active use park located on the northern half of the block bounded by Franklin Avenue to the west, McKeever Place to the east, and Montgomery Street to the north. The 1.0-acre playground includes basketball and handball courts, playgrounds, fitness equipment, spray showers, game tables, benches, and tree plantings (see **Figure 4~~F~~-4**).

### *P.S. 375K Community Playground*

P.S. 375K Community Playground is a 0.45-acre open space located on the block bounded by Franklin Avenue, McKeever Place, Montgomery Street, and Sullivan Place. The open space is generally divided into three separate open space areas. The southwestern portion of the open space fronting Franklin Avenue and Sullivan Place is a mostly paved area featuring bench seating and several tree plantings; the southeastern portion of the open space fronting Sullivan Place and McKeever Place is also paved and features a small running track and two basketball courts; and the northeastern portion of the open space fronting McKeever Place features raised garden beds, bench seating, tables, and trees.

## Detailed Shadows Analysis

Per *CEQR Technical Manual* guidelines, shadow analyses were performed for the three sunlight-sensitive resources identified above on four representative days of the year: March 21/September 21, the equinoxes; May 6, the midpoint between the summer solstice and the equinox (and equivalent to August 6); June 21, the summer solstice and the longest day of the year; and December 21, the winter solstice and shortest day of the year. These four representative days indicate the range of shadows over the course of the year. *CEQR Technical Manual* guidelines define the temporal limits of a shadow analysis period to fall from 1.5 hours after sunrise to 1.5 hours before sunset.

The City of Yes (COY) Carbon Neutrality Zoning Text Amendment, which was approved by the City Council on December 6, 2023, would increase the maximum permitted obstruction for bulkheads and other mechanical equipment for the proposed R8A zoning district by 15 feet, (55 feet total). The specific zoning text amendment states that equipment could cover up to 50 percent of the building to a height of 15 feet. Within this area, 30 percent could rise above 15 feet to account for larger equipment and elevator bulkheads the height would depend on the permitted height of the building -- 35 feet for buildings 120 feet or lower, fifty-five feet for taller buildings. For conservative analysis purposes, the entire building's maximum building height was increased by 55 feet to account for the maximum permitted obstruction for bulkheads and other mechanical equipment.

**Figure 4-4**
**Jackie Robinson Playground Aerial Site Map**



As discussed above, the results of the shadows analysis show the incremental difference in shadow impact between the No-Action and With-Action conditions, the results of which are summarized in **Table 4-4**. In addition, it should be noted that 23 of the Brooklyn Botanic Garden's conservatories, greenhouses, propagation spaces, and nurseries were analyzed separately in order to more accurately measure the incremental shadow impacts on the sunlight-sensitive features found within these structures, the results of which are summarized in **Table 4-5**.

As shown in **Table 4-4**, incremental project-generated shadows would reach two of the three sunlight-sensitive open space resources identified in the Tier 3 screening. Incremental shadows from the Proposed Project would not reach the P.S. 375K Playground. Of the 23 conservatories, greenhouses, propagation spaces, and nurseries studied separately within the Brooklyn Botanic Garden, the detailed shadows analysis determined that project-generated incremental shadows would reach 21 of these sunlight-sensitive resources located within the Brooklyn Botanic Garden (incremental project-generated shadows would not reach the Helen Mattin Warm Temperate Pavilion and the Children's Garden Production House) (refer to **Table 4-5**). Increases in shadow coverage would occur at the Brooklyn Botanic Garden and Jackie Robinson Playground on all four representative analysis days (March 21/September 21, May 6/August 6, June 21, and December 21).

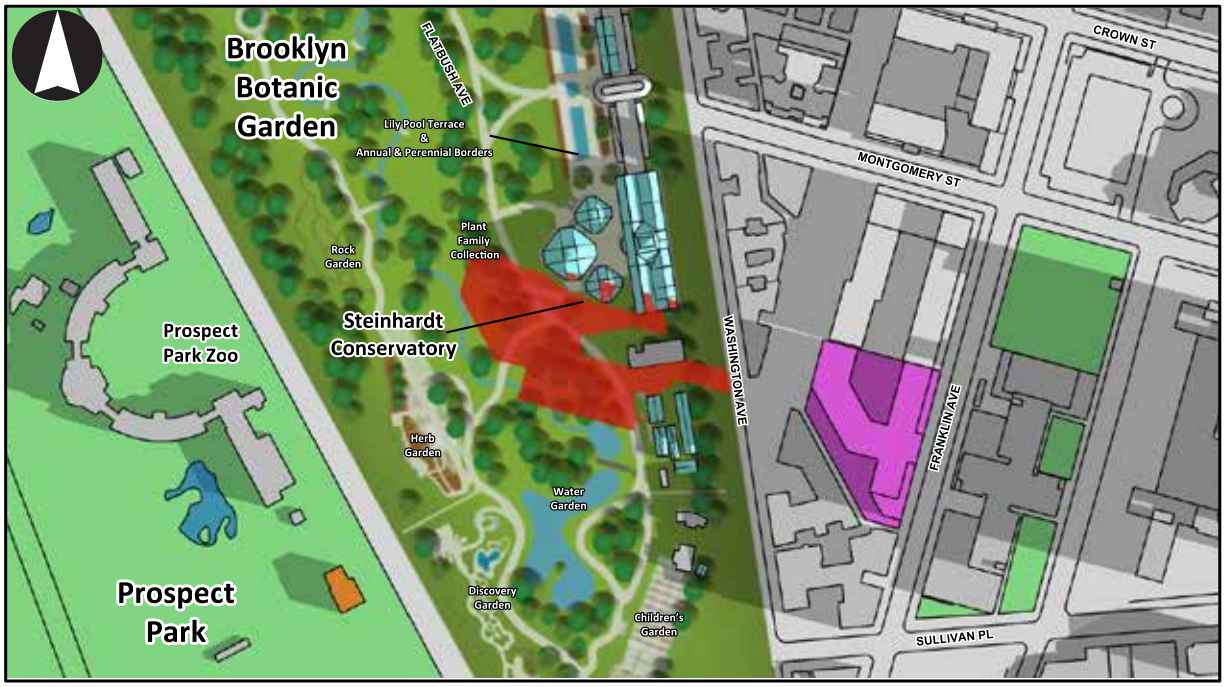
Within the Brooklyn Botanic Garden, incremental shadow coverage would occur at the Hardy Plant Nursery Yard, Temperate Bonsai Tunnel, Production House, Tropical Bonsai House, Auxiliary House, New York-Native Flora & Temperate Plant Propagation Tunnel, and Mediterranean Display Plants Tunnel on three of the four representative analysis days; increases in shadow coverage would occur at the Lowland Moist Tropical Orchid Workhouse, Highland Moist Tropical Orchid Workhouse on two of the four analysis days; and increases in shadow coverage would occur at the Education Greenhouse's Desert Plants, Warm Temperate Plants, and Tropical Plants, Tropical Pavilion, Desert Pavilion, C.V. Starr Bonsai Museum, Conservatory Entry House, Aquatic House & Orchid Collection, Desert Mediterranean South African Bulb (Arid) Workhouse, Tropical Plant Propagation House, and the Tropical & Desert Plant propagation House for one of the four analysis days. **Figures 4-5** through **4-8**, show representative shadow views for the two sunlight-sensitive resources (as well as the 20 sunlight-sensitive conservatories, greenhouses, propagation spaces, and nurseries within the Brooklyn Botanic Garden) of concern on each of the representative analysis days.

**TABLE 4-5**
**Duration of Shadows on Potentially Sunlight Sensitive Resources (Increment Compared to No-Action)**

| Resource | Analysis Day | March 21/Sept. 21<br>7:36 AM – 4:29 PM | May 6/August 6<br>6:27 AM – 5:18 PM | June 21<br>5:57 AM – 6:01 PM | December 21<br>8:51 AM – 2:53 PM |
|---|---|---|---|---|---|
| Brooklyn Botanic Garden | Shadow enter-exit time | 7:36 – 9:36 AM | 6:27 – 9:00 AM | 5:57 – 8:54 AM | 8:51 – 10:03 AM |
| | Incremental shadow duration | 2 hours | 2 hours 33 minutes | 2 hours 57 minutes | 1 hour 12 minutes |
| Jackie Robinson Playground | Shadow enter-exit time | 1:43 – 4:29 PM | 1:48 – 5:12 PM | 2:02 – 3:37 PM | 1:35 – 2:53 PM |
| | Incremental shadow duration | 2 hours 46 minutes | 3 hours 24 minutes | 1 hour 41 minutes | 1 hour 18 minutes |
| P.S. 375K Community Playground | Shadow enter-exit time | - | - | - | - |
| | Incremental shadow duration | - | - | - | - |

**Note:** All times are Eastern Standard Time; Daylight Savings Time was not accounted for per *CEQR Technical Manual* guidelines.
Table indicates the entry and exit times and total duration of incremental shadow for each sunlight-sensitive resource.

**Figure 4-5a**
**Brooklyn Botanic Gardens**
**Incremental Shadows on March 21/September 21**




**7:36 AM**




**8:15 AM**

Proposed Project
Open Space
Historic Resource
Greenhouse Facility
Incremental Shadow
Water Feature

**Figure 4-5b**
**Brooklyn Botanic Gardens**
**Incremental Shadows on March 21/September 21**




**8:45 AM**




**9:15 AM**

Proposed Project
Open Space
Historic Resource
Greenhouse Facility
Incremental Shadow
Water Feature

**Figure 4-5c**

**Brooklyn Botanic Garden - Steinhardt Conservatory**
**Incremental Shadows on March 21/September 21**




**7:36 AM**




**8:00 AM**

Proposed Project

Open Space

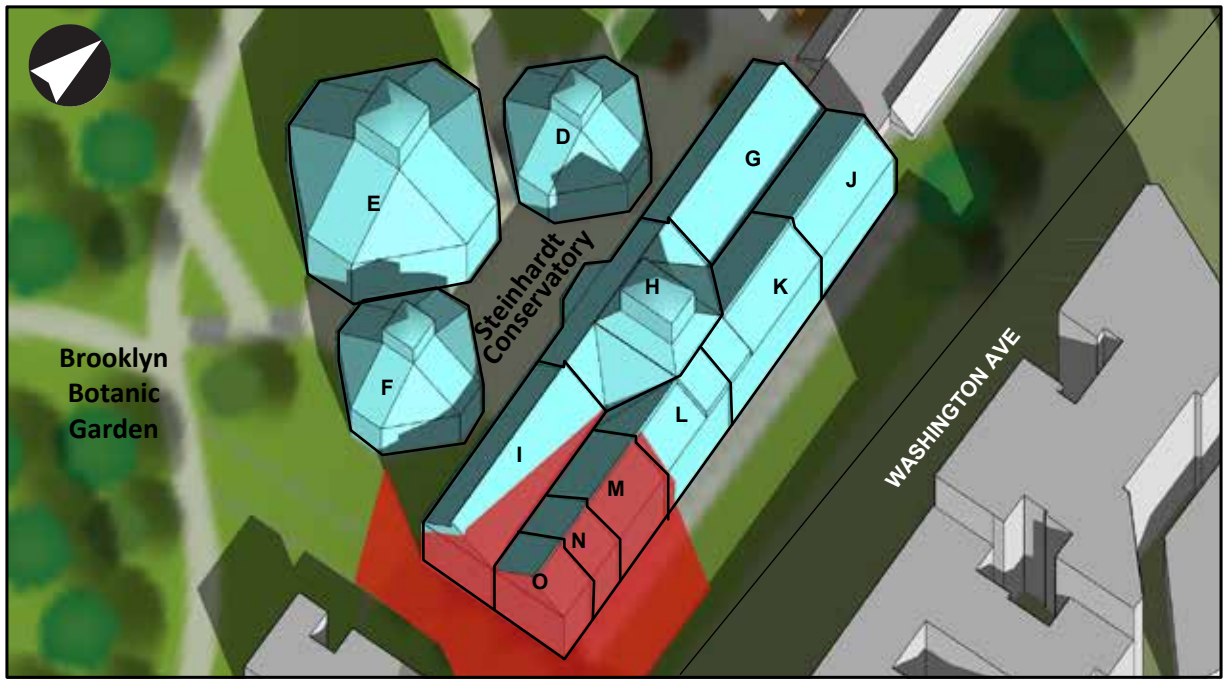
Historic Resource

D Greenhouse Facility
*Keyed to Table 4-6

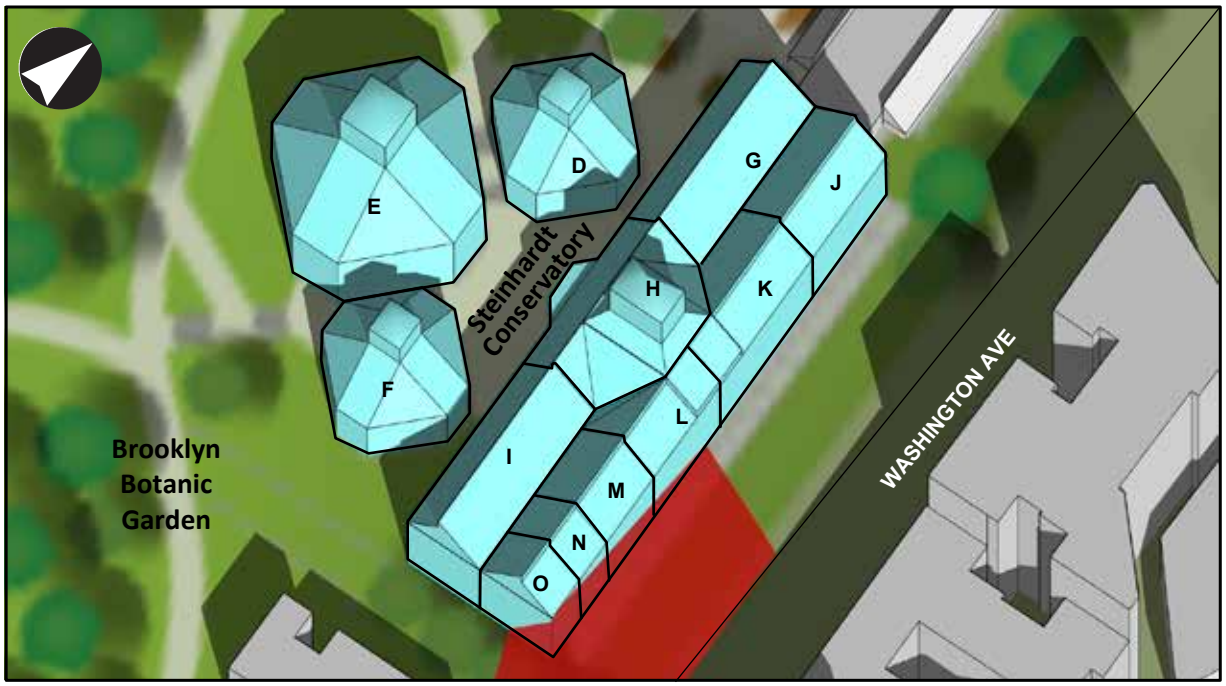
Incremental Shadow

**Figure 4-5d**

**Brooklyn Botanic Garden - Steinhardt Conservatory**
**Incremental Shadows on March 21/September 21**




**8:30 AM**




**9:00 AM**

**Proposed Project**

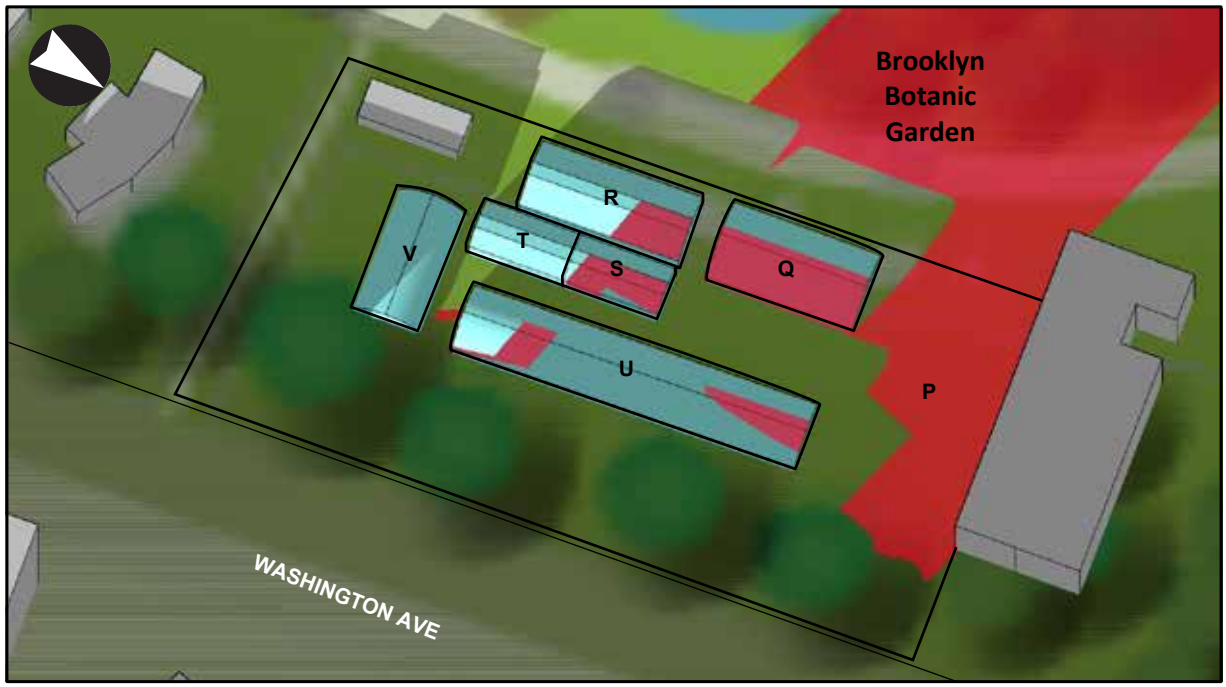
**Open Space**

**Historic Resource**

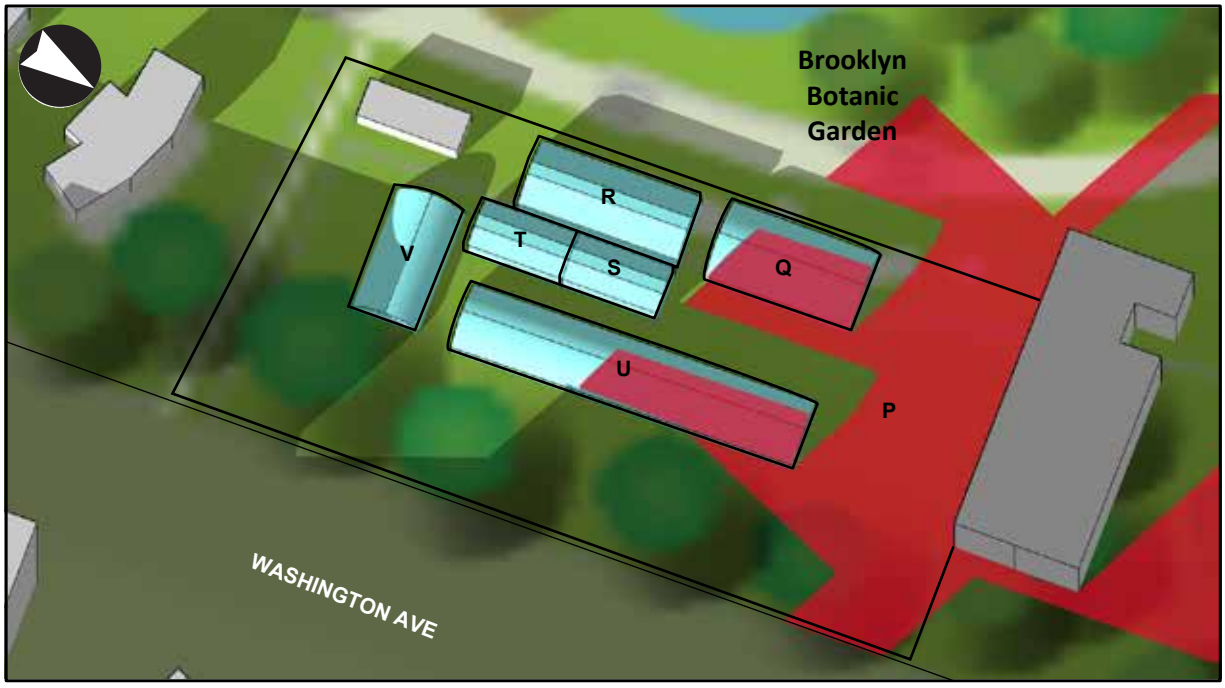
**D** **Greenhouse Facility**
**Keyed to Table 4-6*

**Incremental Shadow**

**Brooklyn Botanic Garden - Hardy Plant Nursery Yard**
**Incremental Shadows on March 21/September 21**



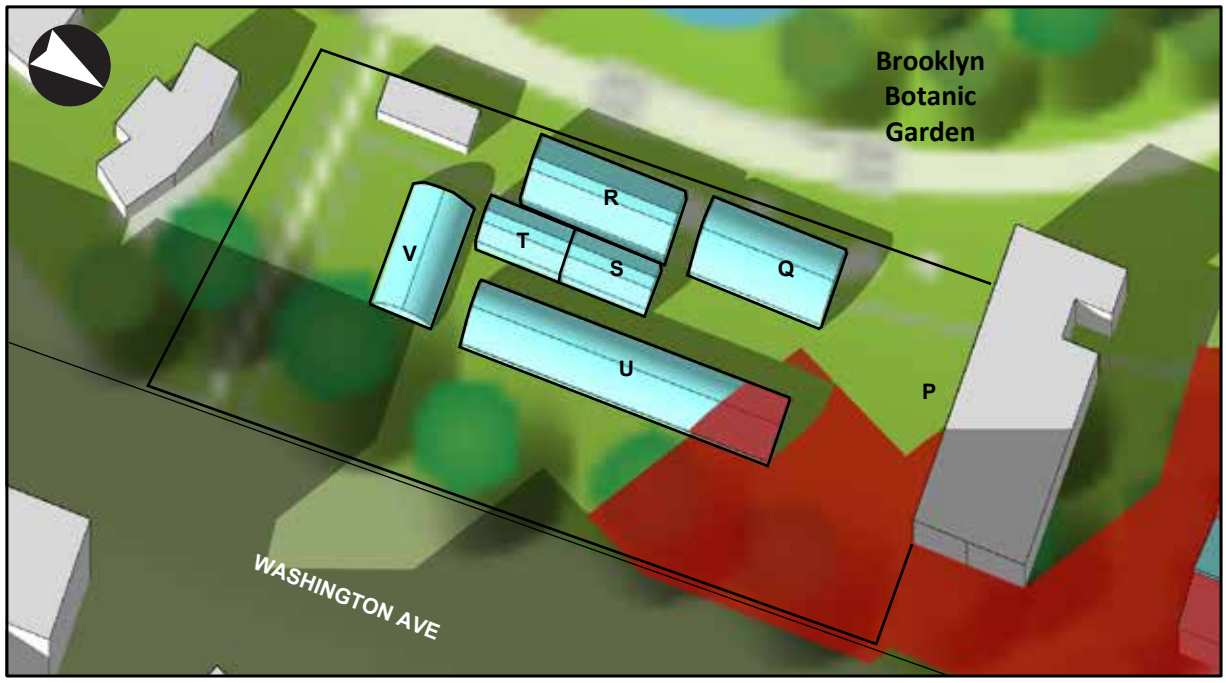

**7:36 AM**



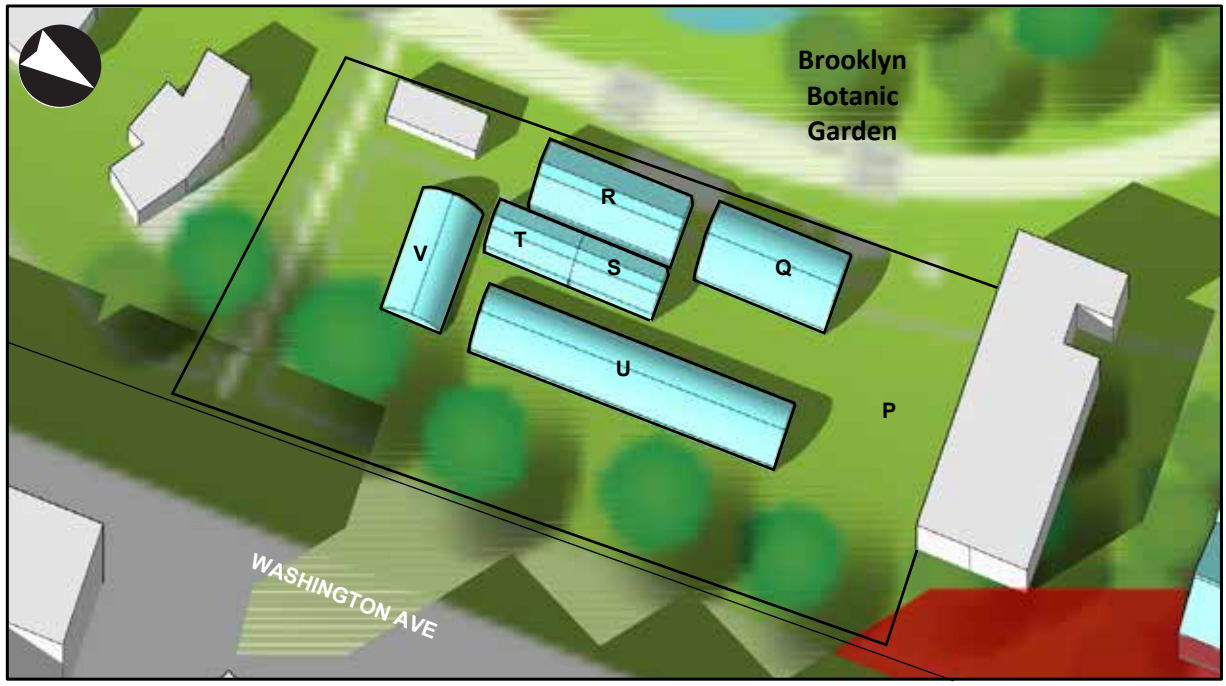

**8:00 AM**

**Proposed Project**
**Open Space**
**Historic Resource**
**P** **Greenhouse Facility**
**Keyed to Table 4-6*
**Incremental Shadow**

**Brooklyn Botanic Garden - Hardy Plant Nursery Yard**
**Incremental Shadows on March 21/September 21**




**8:30 AM**




**9:00 AM**

Proposed Project
Open Space
Historic Resource
P Greenhouse Facility
*Keyed to Table 4-6
Incremental Shadow

**Figure 4-6a**

**Brooklyn Botanic Gardens**
**Incremental Shadows on May 6/August 6**




**6:27 AM**




**7:00 AM**

| | | |
|---|---|---|
| Proposed Project | Open Space | Historic Resource |
| Greenhouse Facility | Incremental Shadow | Water Feature |

**Figure 4-6b**
**Brooklyn Botanic Gardens**
**Incremental Shadows on May 6/August 6**




**7:30 AM**




**8:00 AM**

Proposed Project
Open Space
Historic Resource
Greenhouse Facility
Incremental Shadow
Water Feature

**Figure 4-6c**

**Brooklyn Botanic Gardens**
**Incremental Shadows on May 6/August 6**

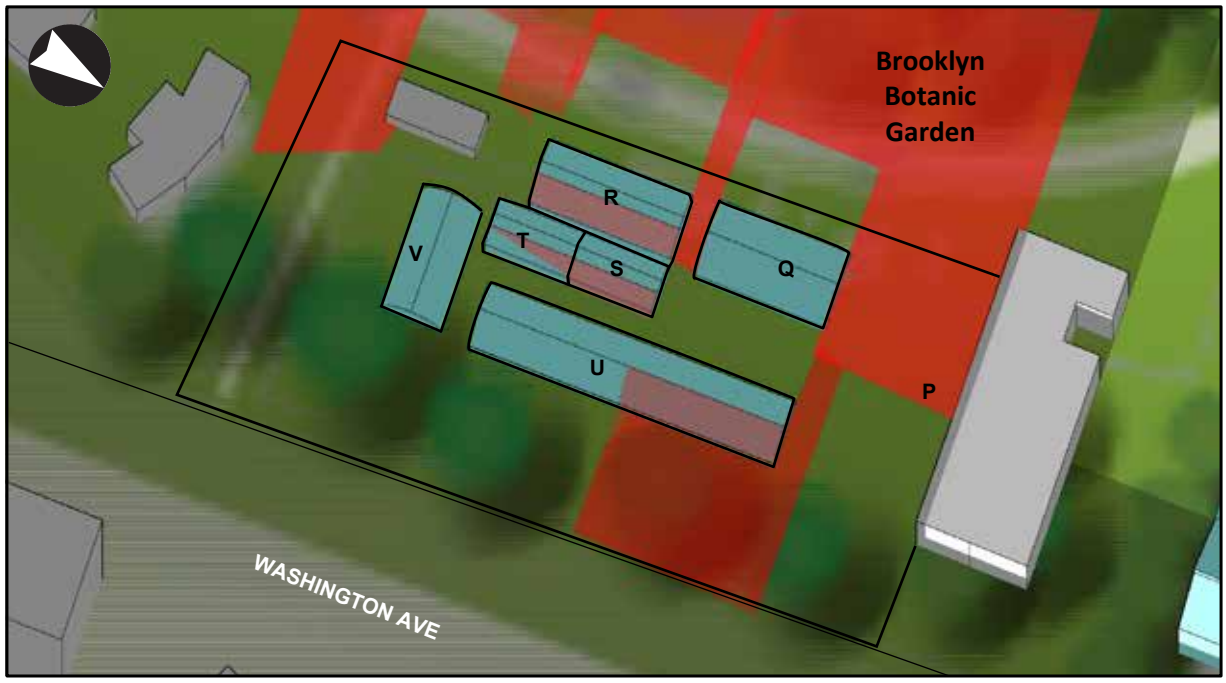



**8:30 AM**

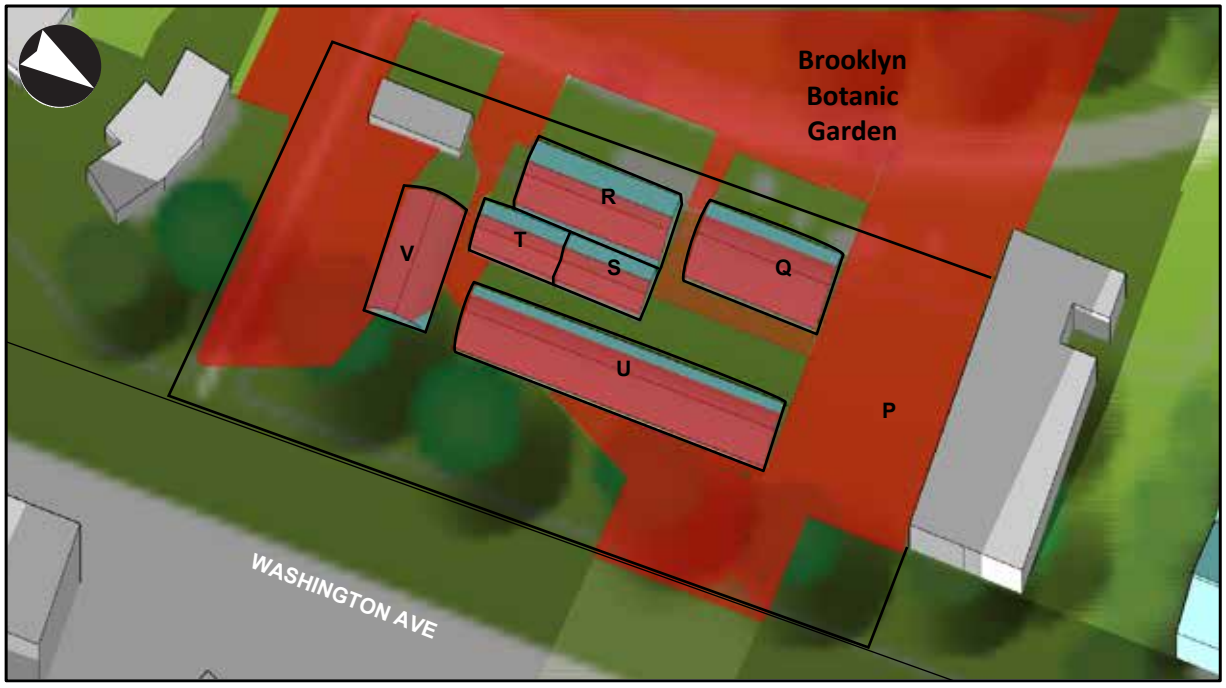
Proposed Project
Open Space
Historic Resource
Greenhouse Facility
Incremental Shadow
Water Feature

**Figure 4-6d**

**Brooklyn Botanic Garden - Hardy Plant Nursery Yard**
**Incremental Shadows on May 6/August 6**




**6:27 AM**




**7:00 AM**

**Proposed Project**

**Open Space**

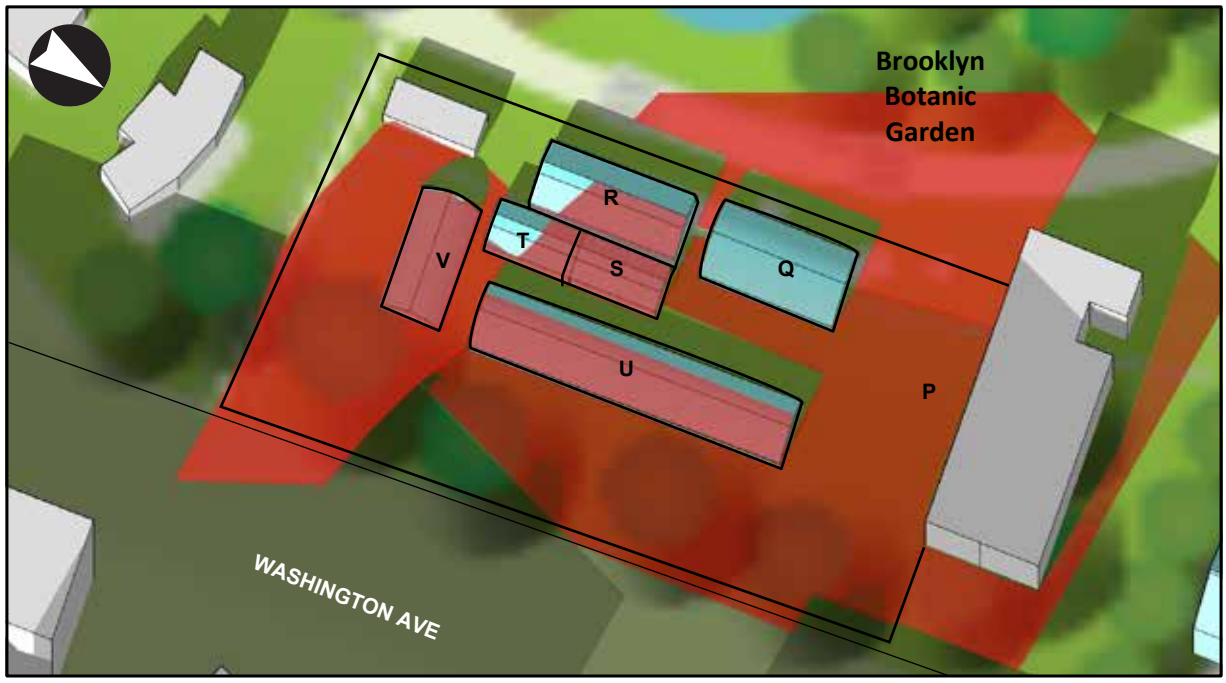
**Historic Resource**

**P** **Greenhouse Facility**
**Keyed to Table 4-6*

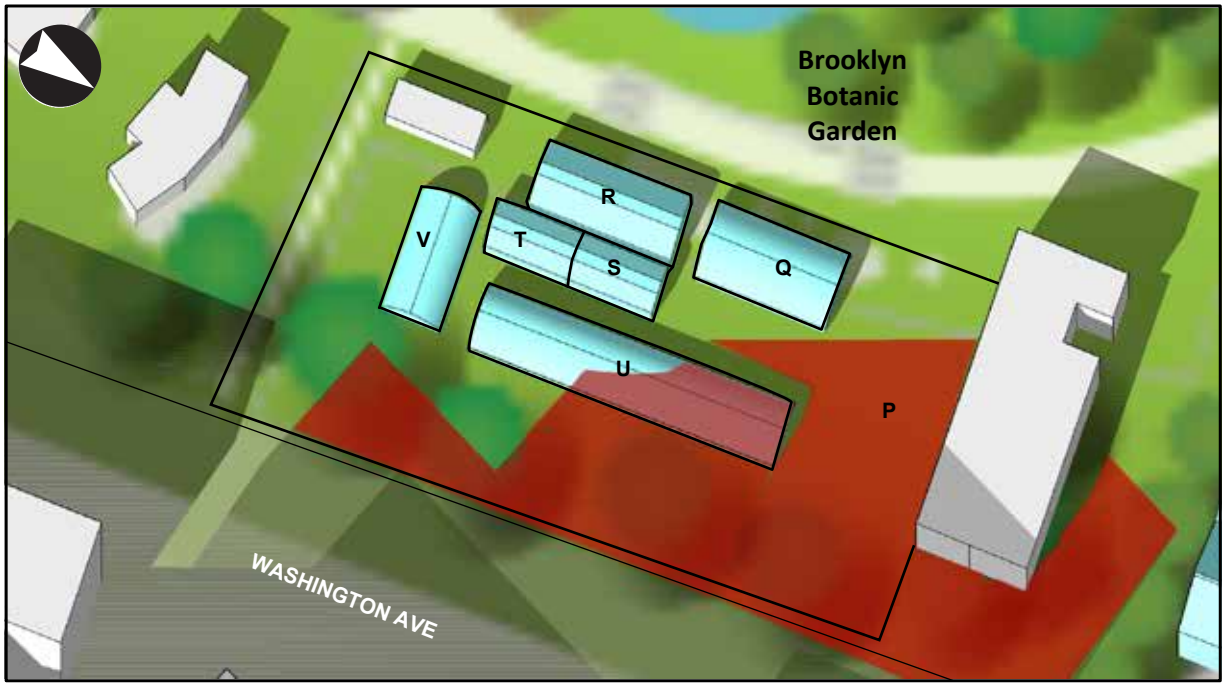
**Incremental Shadow**

**Figure 4-6e**

**Brooklyn Botanic Garden - Hardy Plant Nursery Yard**
**Incremental Shadows on May 6/August 6**




**7:30 AM**




**8:00 AM**

**Proposed Project**

**Open Space**

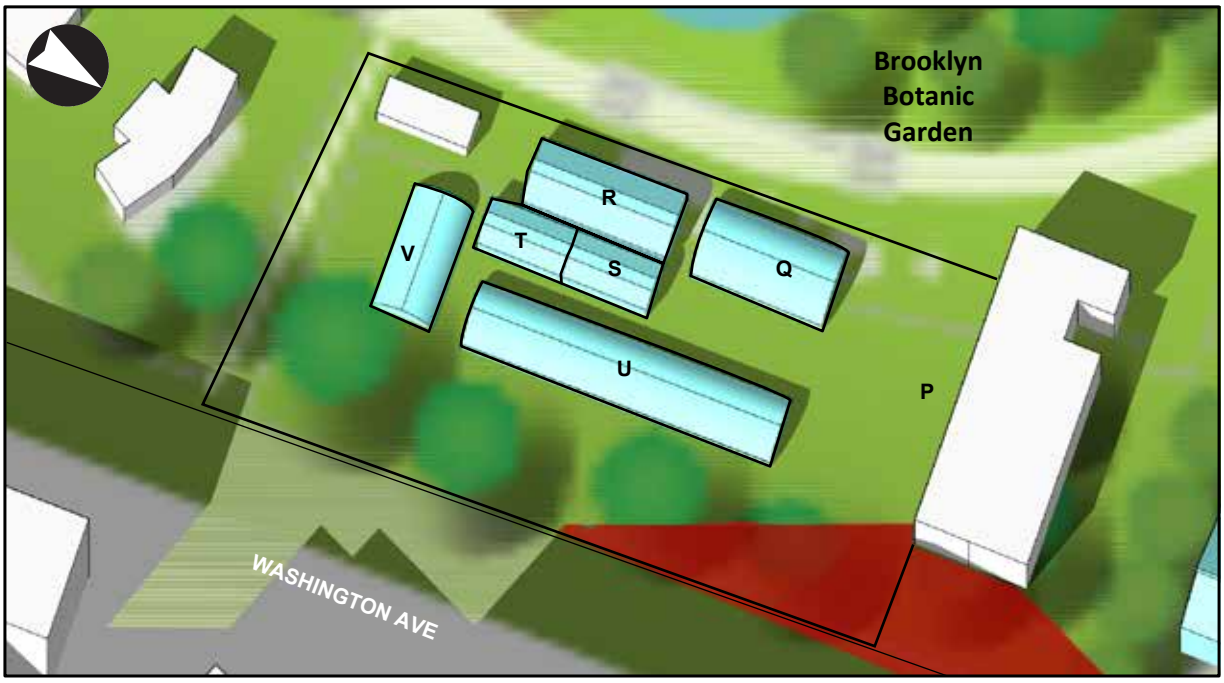
**Historic Resource**

P **Greenhouse Facility**
**Keyed to Table 4-6*

**Incremental Shadow**

**Figure 4-6f**

**Brooklyn Botanic Garden - Hardy Plant Nursery Yard**
**Incremental Shadows on May 6/August 6**




**8:30 AM**

**Proposed Project**

**Open Space**

**Historic Resource**

P **Greenhouse Facility**
**Keyed to Table 4-6*

**Incremental Shadow**

**Figure 4-7a**
**Brooklyn Botanic Gardens**
**Incremental Shadows on June 21**




**5:57 AM**




**6:30 AM**

Proposed Project
Open Space
Historic Resource
Greenhouse Facility
Incremental Shadow
Water Feature

**Figure 4-7b**
**Brooklyn Botanic Gardens**
**Incremental Shadows on June 21**




**7:00 AM**




**7:30 AM**

**Proposed Project**
**Open Space**
**Historic Resource**
**Greenhouse Facility**
**Incremental Shadow**
**Water Feature**

**Figure 4-7c**
**Brooklyn Botanic Gardens**
**Incremental Shadows on June 21**




**8:00 AM**

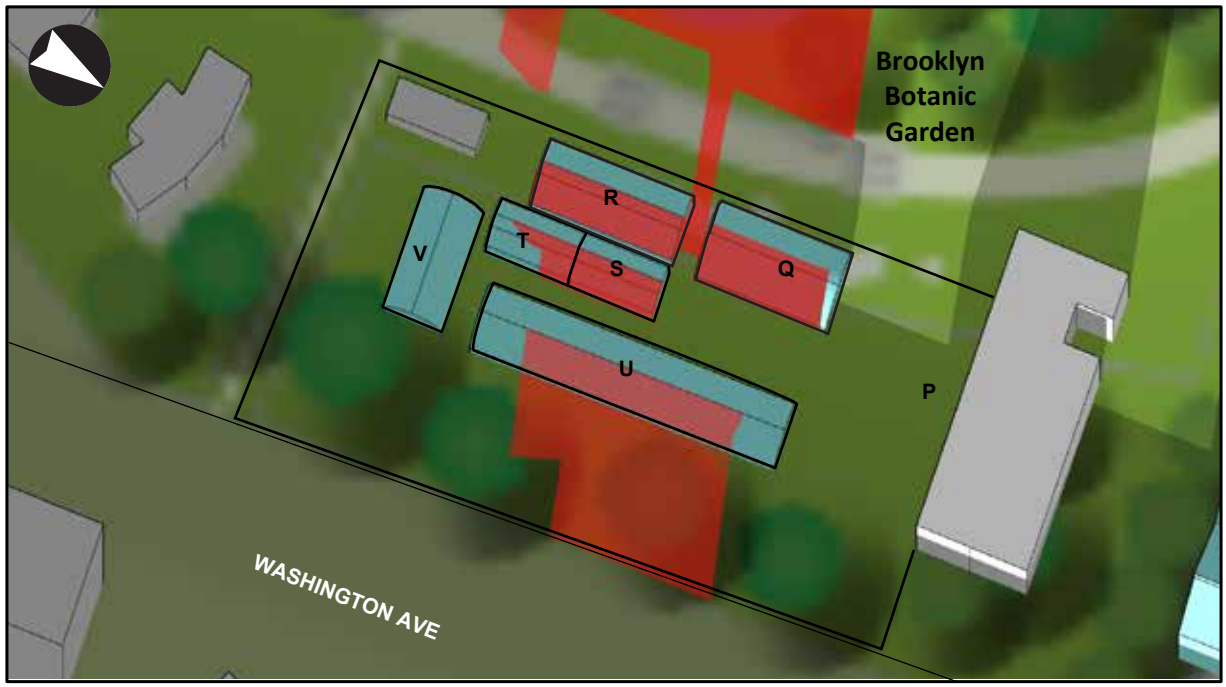



**8:30 AM**

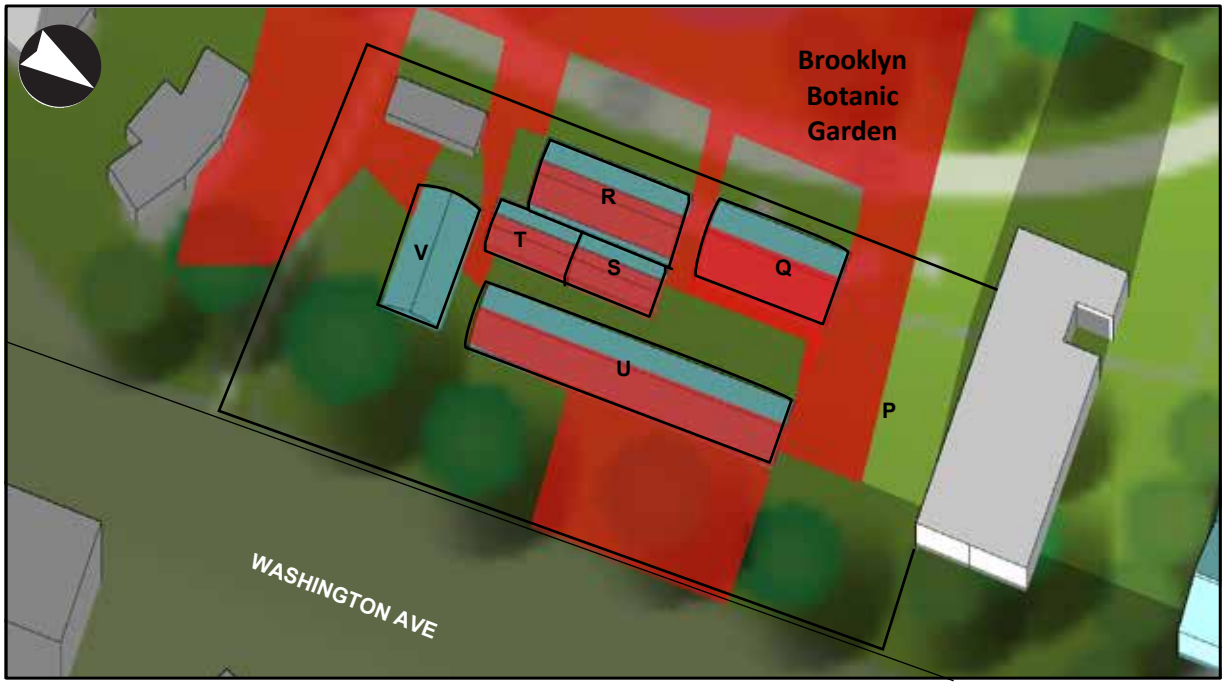
| | | |
|---|---|---|
| Proposed Project | Open Space | Historic Resource |
| Greenhouse Facility | Incremental Shadow | Water Feature |

**Figure 4-7d**

**Brooklyn Botanic Garden - Hardy Plant Nursery Yard**
**Incremental Shadows on June 21**




**5:57 AM**




**6:30 AM**

**Proposed Project**

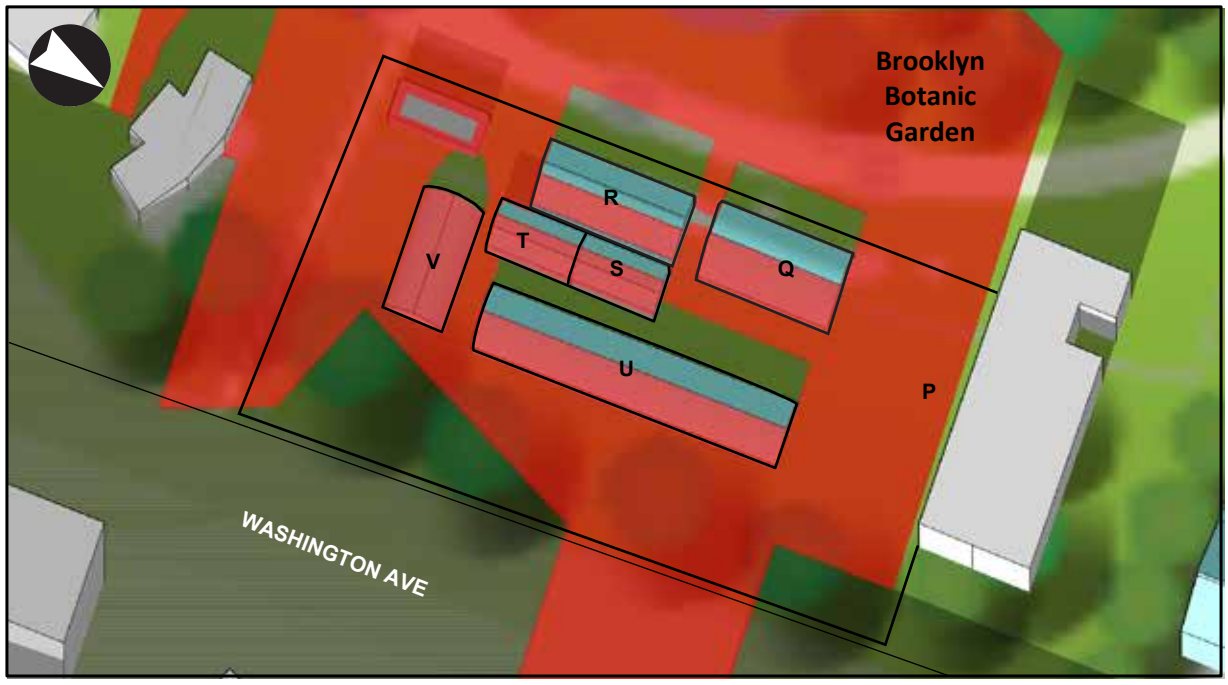
**Open Space**

**Historic Resource**

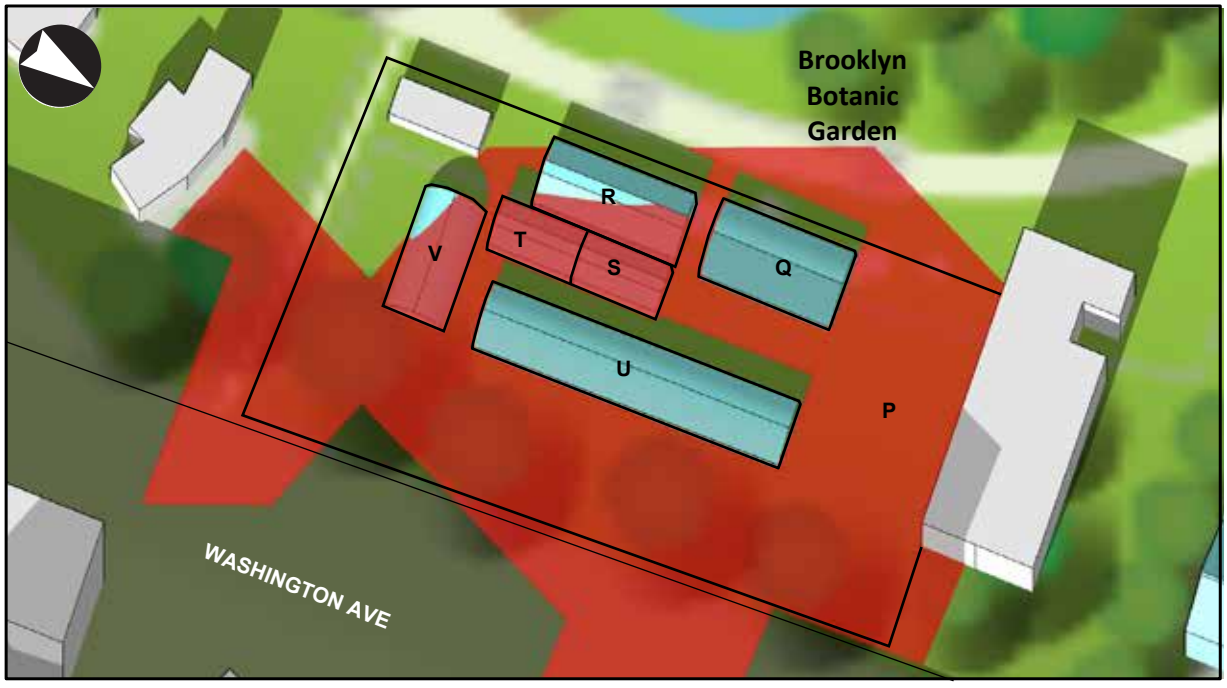
**P** **Greenhouse Facility**
**Keyed to Table 4-6*

**Incremental Shadow**

**Brooklyn Botanic Garden - Hardy Plant Nursery Yard**
**Incremental Shadows on June 21**




**7:00 AM**

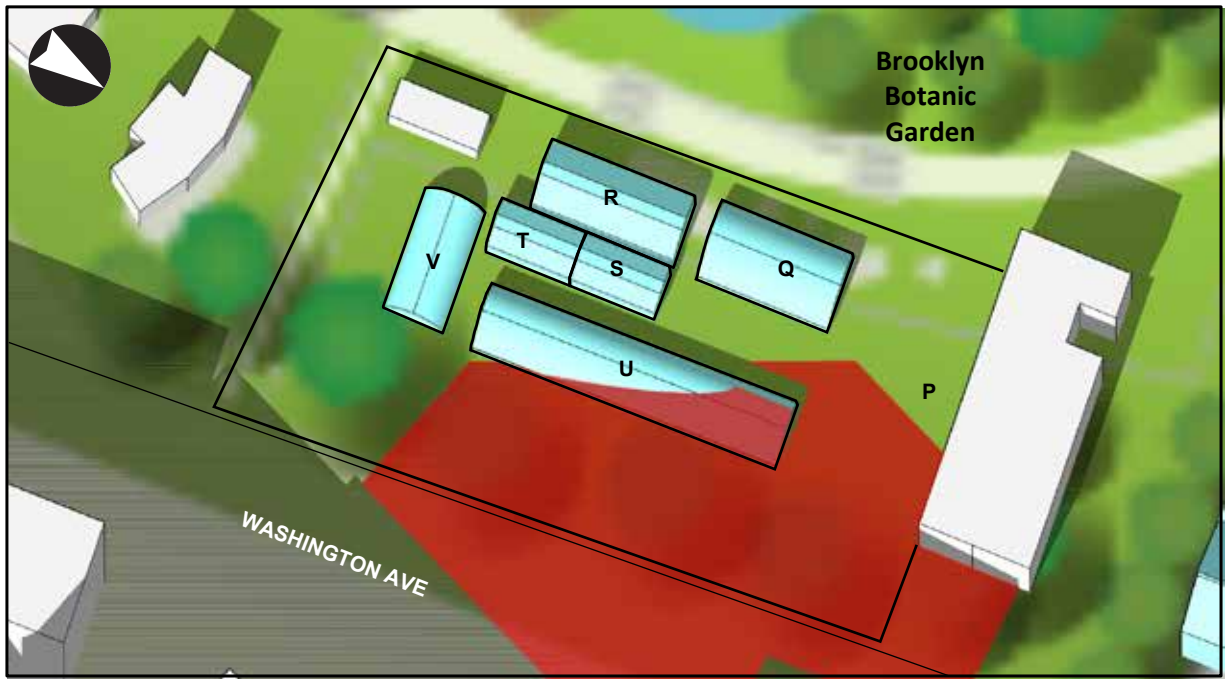



**7:30 AM**

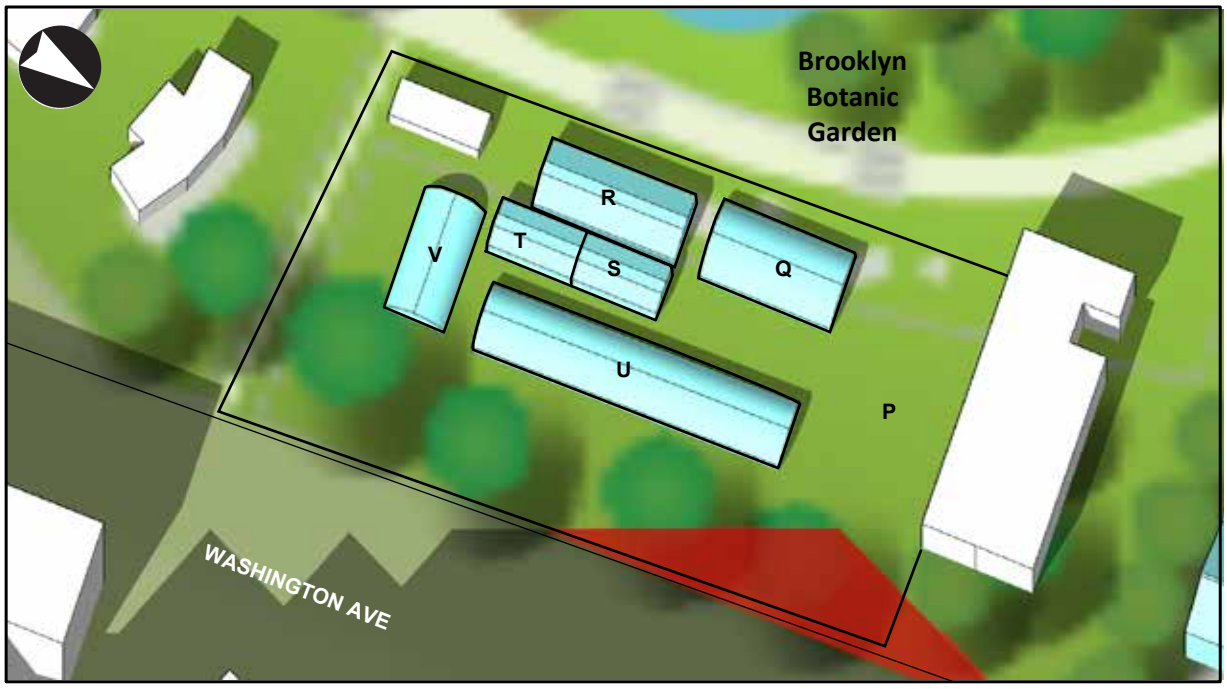
Proposed Project
Open Space
Historic Resource
P Greenhouse Facility
*Keyed to Table 4-6
Incremental Shadow

**Figure 4-7f**

**Brooklyn Botanic Garden - Hardy Plant Nursery Yard**
**Incremental Shadows on June 21**




**8:00 AM**




**8:30 AM**

**Proposed Project**

**Open Space**

**Historic Resource**

**P** **Greenhouse Facility**
**Keyed to Table 4-6*

**Incremental Shadow**

**Figure 4-8a**
**Brooklyn Botanic Gardens**
**Incremental Shadows on December 21**




**8:51 AM**




**9:45 AM**

Proposed Project
Open Space
Historic Resource
Greenhouse Facility
Incremental Shadow
Water Feature

**Figure 4-8b**

**Brooklyn Botanic Garden - Steinhardt Conservatory**
**Incremental Shadows on December 21**




**8:51 AM**




**9:20 AM**

**Proposed Project**

**Open Space**

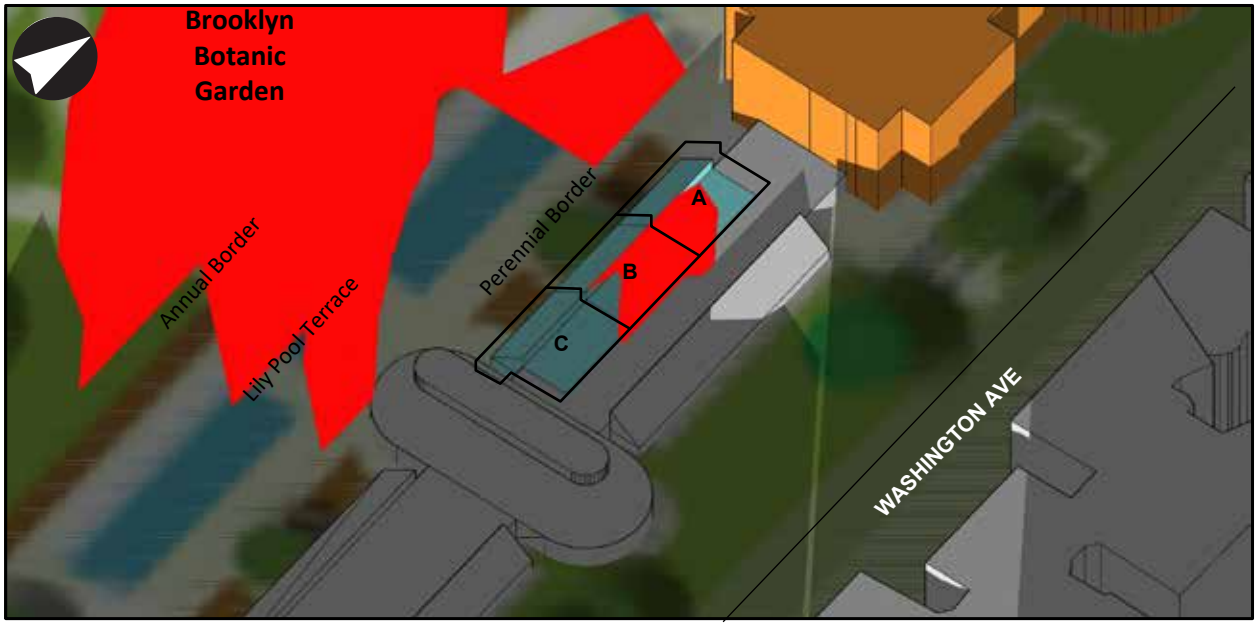
**Historic Resource**

**D** **Greenhouse Facility**
**Keyed to Table 4-6*

**Incremental Shadow**

**Figure 4-8c**

**Brooklyn Botanic Garden - Education Greenhouses**
**Incremental Shadows on December 21**




**8:51 AM**

**Proposed Project**

**Open Space**

**Historic Resource**

**A** **Greenhouse Facility**
**Keyed to Table 4-6*

**Incremental Shadow**

**TABLE 4-6**
**Duration of Shadows on Brooklyn Botanic Garden's Sunlight-Sensitive Conservatories, Greenhouses, Propagation Spaces, and Nurseries (Increment Compared to No-Action)**

| ID[1] | Resource | Analysis Day | March 21/Sept. 21<br>7:36 AM – 4:29 PM | May 6/August 6<br>6:27 AM – 5:18 PM | June 21<br>5:57 AM – 6:01 PM | December 21<br>8:51 AM – 2:53 PM |
|---|---|---|---|---|---|---|
| A | Education Greenhouse: Desert Plants | Shadow enter-exit time | - | - | - | 8:51 – 9:00 AM |
| | | Incremental shadow duration | - | - | - | 9 minutes |
| B | Education Greenhouse: Warm Temperate Plants | Shadow enter-exit time | - | - | - | 8:51 – 9:02 AM |
| | | Incremental shadow duration | - | - | - | 11 minutes |
| C | Education Greenhouse: Tropical Plants | Shadow enter-exit time | - | - | - | 8:51 – 9:04 AM |
| | | Incremental shadow duration | - | - | - | 13 minutes |
| D | Helen Mattin Warm Temperate Pavilion | Shadow enter-exit time | - | - | - | - |
| | | Incremental shadow duration | - | - | - | - |
| E | Tropical Pavilion | Shadow enter-exit time | 7:36 – 8:16 AM | - | - | - |
| | | Incremental shadow duration | 40 minutes | - | - | - |
| F | Desert Pavilion | Shadow enter-exit time | 7:36 – 8:28 AM | - | - | - |
| | | Incremental shadow duration | 52 minutes | - | - | - |
| G | C.V. Starr Bonsai Museum | Shadow enter-exit time | - | - | - | 8:51 - 9:18 AM |
| | | Incremental shadow duration | - | - | - | 27 minutes |
| H | Conservatory Entry House | Shadow enter-exit time | 8:16 – 8:30 AM | - | - | 8:51 - 9:07 AM |
| | | Incremental shadow duration | 14 minutes | - | - | 16 minutes |
| I | Aquatic House & Orchid Collection | Shadow enter-exit time | 7:36 – 8:53 AM | - | - | - |
| | | Incremental shadow duration | 1 hour 16 minutes | - | - | - |
| J | Desert, Mediterranean, South African Bulb (Arid) Workhouse | Shadow enter-exit time | - | - | - | 8:51 - 9:33 AM |
| | | Incremental shadow duration | - | - | - | 42 minutes |
| K | Humid Tropics Workhouse | Shadow enter-exit time | - | - | - | 8:51 - 9:28 AM |
| | | Incremental shadow duration | - | - | - | 37 minutes |
| L | Lowland Moist Tropical Orchid Workhouse | Shadow enter-exit time | 8:25 – 9:06 AM | - | - | 8:51 - 9:13 AM |
| | | Incremental shadow duration | 41 minutes | - | - | 22 minutes |
| M | Highland Moist Tropical Orchid Workhouse | Shadow enter-exit time | 7:53 - 9:14 AM | - | - | 8:51 – 9:00 AM |
| | | Incremental shadow duration | 1 hour 21 minutes | - | - | 9 minutes |
| N | Tropical Plant Propagation House | Shadow enter-exit time | 7:37 - 9:06 AM | - | - | - |
| | | Incremental shadow duration | 1 hour 29 minutes | - | - | - |
| O | Tropical & Desert Plant Propagation House | Shadow enter-exit time | 7:36 - 9:07 AM | - | - | - |
| | | Incremental shadow duration | 1 hour 31 minutes | - | - | - |

| | | | | | | |
|---|---|---|---|---|---|---|
| P | Hardy Plant Nursery Yard[2] | Shadow enter-exit time | 7:36 - 9:04 AM | 6:27 - 8:54 AM | 5:57 - 8:54 AM | - |
| | | Incremental shadow duration | 1 hour 28 minutes | 2 hours 27 minutes | 2 hours 57 minutes | - |
| Q | Temperate Bonsai Tunnel | Shadow enter-exit time | 7:36 - 8:27 AM | 6:27 - 7:58 AM | 5:57 - 7:55 AM | - |
| | | Incremental shadow duration | 51 minutes | 1 hour 31 minutes | 1 hour 58 minutes | - |
| R | Production House | Shadow enter-exit time | 7:36 - 7:51 AM | 6:27 - 7:45 AM | 5:57 - 7:41 AM | - |
| | | Incremental shadow duration | 15 minutes | 1 hour 18 minutes | 1 hour 44 minutes | - |
| S | Tropical Bonsai House | Shadow enter-exit time | 7:36 - 7:58 AM | 6:27 - 7:56 AM | 5:57 - 7:53 AM | - |
| | | Incremental shadow duration | 22 minutes | 1 hour 29 minutes | 1 hour 56 minutes | - |
| T | Auxiliary House | Shadow enter-exit time | - | 6:27 - 7:42 AM | 5:57 - 7:48 AM | - |
| | | Incremental shadow duration | - | 1 hour 15 minutes | 1 hour 51 minutes | - |
| U | New York-Native Flora & Temperate Plant Propagation Tunnel | Shadow enter-exit time | 7:36 - 8:42 AM | 6:27 - 8:19 AM | 5:57 - 8:18 AM | - |
| | | Incremental shadow duration | 1 hour 6 minutes | 1 hour 52 minutes | 2 hours 21 minutes | - |
| V | Mediterranean Display Plants Tunnel | Shadow enter-exit time | 7:36 - 7:37 AM | 6:32 - 7:54 AM | 6:06 - 7:49 AM | - |
| | | Incremental shadow duration | 1 minute | 1 hour 22 minutes | 1 hour 43 minutes | - |

**Note:** All times are Eastern Standard Time; Daylight Savings Time was not accounted for per *CEQR Technical Manual* guidance.
Table indicates the entry and exit times and total duration of incremental shadow for each sunlight-sensitive resource.
[1] Keyed to **Figure 4-3**.
[2] As noted above, this resource encompasses resources Q, R, S, T, U, and V. As a result, the incremental shadows durations noted for this resource are inclusive of all incremental shadows within the resources (i.e., Q through V). The actual duration of incremental shadows for each individual resource is also analyzed in this table.

It should be noted that, per the *CEQR Technical Manual*, all times reported herein are Eastern Standard Time and do not reflect adjustments for daylight savings time that is in effect from mid-March to early November. As such, the times reported in this chapter for March 21/September 21, May 6/August 6, and June 21 need to have one hour added to reflect the Eastern Daylight Savings Time.

## *BROOKLYN BOTANIC GARDEN*

*MARCH 21/SEPTEMBER 21*

On March 21/September 21, the time period for shadows analysis begins at 7:36 AM and continues until 4:29 PM. March is considered the beginning of the growing season in New York City, and September 21, which has the same shadow patterns as March 21, is also within the growing season.

The Proposed Project would cast incremental shadows on portions of the Brooklyn Botanic Garden for a total of two hours on the March 21/September 21 analysis day. Incremental shadows would enter the garden at 7:36 AM and continue until 9:36 AM. After 9:36 AM the Brooklyn Botanic Garden would not experience any incremental shadow coverage. As indicated in **Figures 4-5a, 4-5c, and 4-5e**, during the early morning hours, shadow coverage would be concentrated on the southern portion of the open space fronting Washington Avenue, which includes portions of the Plant Family Collection, the Shelby White and Leon Levy Water Garden, the Tropical Pavilion, the Desert Pavilion, the Aquatic House & Orchid Collection, the Tropical Plant Propagation House, the Tropical & Desert Plant Propagation House, the Hardy Plant Nursey Yard, the Production House, the Tropical Bonsai House, and the New York-Native Flora & Temperate Plant Propagation Tunnel.

As shown in **Figures 4-5b, 4-5d,** and **4-5f**, by 8:30 AM, incremental shadow coverage would continue to decrease, moving in an easterly direction and would cast incremental shadows on portions of the Aquatic House & Orchid Collection, Lowland Moist Tropical Orchid Workhouse, Highland Moist Tropical Orchid Workhouse, Tropical Plant Propagation House, Tropical & Desert Plant Propagation House, Hardy Plant Nursey Yard, and the New York-Native Flora & Temperate Plant Propagation Tunnel.

While these areas, combined, would experience incremental shadows for a total of two hours, no single feature of the Brooklyn Botanic Garden would be cast in incremental shadows for an extended period of time due to the speed and movement of these shadows across the open space. Specifically, the Brooklyn Botanic Garden's unenclosed sunlight-sensitive areas (i.e., the Plant Family Collection, the Water Garden and the Hardy Plant Nursery Yard) would experience incremental shadows ranging between 16 minutes (the Water Garden) and one hours and 28 minutes (the Hardy Plant Nursey Yard). The Brooklyn Botanic Garden's enclosed, climate-controlled facilities (i.e., the Tropical Pavilion, Desert Pavilion, the Steinhardt Conservatory's individual greenhouse facilities, the Temperate Bonsai Tunnel, the Production House; the Tropical Bonsai House, and the New York-Native Flora and Temperate Plant Propagation Tunnel), would experience incremental shadows ranging between 15 minutes (the Production House) and one hour and 37 minutes (the Tropical & Desert Plant Propagation House) (see **Table 4-5** and **Figures 4-5a** through **4-5f**). Incremental shadows would occur for one minute on the Mediterranean Display Plants Tunnel. No incremental shadow would occur on the three Educational Greenhouses, the Helen Mattin Temperate Pavilion, C.V. Starr Bonsai Museum, Desert, Mediterranean, South African Bulb (Arid) Workhouse, Humid Tropics Workhouse, or Auxiliary House.

*MAY 6/AUGUST 6*

On May 6/August 6 (the midpoint between the equinoxes and solstices), the time period for shadows analysis begins at 6:27 AM and continues until 5:18 PM.

The Proposed Project would cast incremental shadows on portions of the Brooklyn Botanic Garden for a total of two hours and 33 minutes on the May 6/August 6 analysis day. Incremental shadows would enter the garden at 6:27 AM (the beginning of the analysis day) and continue until 9:00 AM. After 9:00 AM the Brooklyn Botanic Garden would not experience any incremental shadow coverage. As indicated in **Figures 4-6a and 4-6d**, during the early morning hours, shadow coverage would be concentrated on the southern portion of the open space fronting Washington and Flatbush avenues, which includes portions of the Leon Levy Water Garden, the Hardy Plant Nursery Yard, the Temperate Bonsai Tunnel, the Production House, the Tropical Bonsai House, the Auxiliary House, the New York-Native Flora and Temperate Plant Propagation Tunnel, and the Mediterranean Display Plants Tunnel. As shown in **Figures 4-6b** and **4-6e**, by 8:00 AM, incremental shadow coverage would decrease, moving in a northeasterly direction and would continue to cast incremental shadows on portions of the Hardy Plant Nursery Yard and the New York-Native Flora and Temperate Plant Propagation Tunnel.

By 8:30 AM, incremental shadow coverage would be minimal, only affecting portions of the Hardy Plant Nursery Yard and the area to the north which includes a small portion of landscaping between the Steinhardt Conservatory and Washington Avenue. At 9:00 AM, incremental shadows would completely exit the Brooklyn Botanic Garden, and the majority of the open space would continue to receive direct sunlight for the remainder of the analysis day.

While these areas, combined, would experience incremental shadows for a total of two hours and 33 minutes, the duration of incremental shadows on individual resources in the Botanic Garden would range

between one hours and 15 minutes (the Auxiliary House) and two hours and 27 minutes (Hardy Plant Nursery Yard) (refer to **Table 4-6**).

*JUNE 21*

On June 21 (the summer solstice), the time period for shadows analysis begins at 5:57 AM and continues until 6:01 PM. On the summer solstice, which is the day of the year with the longest period of daylight, the sun is most directly overhead and generally shadows are shortest and move across the widest angular range from west to east.

The Proposed Project would cast incremental shadows on portions of the Brooklyn Botanic Garden for a total of two hours and 57 minutes on the June 21 analysis day. Incremental shadows would enter the garden at the beginning of the analysis day (5:57 AM) and continue until 8:54 AM. After 8:54 AM the Brooklyn Botanic Garden would not experience any incremental shadow coverage. As indicated in **Figures 4-7a and 4-7d**, during the early morning hours, shadow coverage would be concentrated on the southern portion of the open space fronting Washington Avenue, which includes portions of the Herb Garden, the Shelby White and Leon Levy Water Garden, the Discovery Garden, the Hardy Plant Nursery Yard, the Temperate Bonsai Tunnel, the Production House, the Tropical Bonsai House, the Auxiliary House, and the New York-Native Flora and Temperate Plant Propagation Tunnel. As shown in **Figures 4-7a and 4-7d**, by 6:30 AM, incremental shadow coverage would decrease, moving in a northeasterly direction, and would cast incremental shadows on the Shelby White and Leon Levy Water Garden, the Hardy Plant Nursery Yard, the Temperate Bonsai Tunnel, the Production House, the Tropical Bonsai House, the Auxiliary House, and the New York-Native Flora and Temperate Plant Propagation Tunnel.

As shown in **Figures 4-7b and 4-7e**, by 7:00 AM, incremental shadow coverage would continue to decrease, moving in a northeasterly direction, and would cast incremental shadows on the Shelby White and Leon Levy Water Garden, the Hardy Plant Nursery Yard, the Temperate Bonsai Tunnel, the Production House, the Tropical Bonsai House, the Auxiliary House, the New York-Native Flora and Temperate Plant Propagation Tunnel, and the Mediterranean Display Plants Tunnel. By 7:30 AM incremental shadow coverage would continue to decrease, moving in a northeasterly direction, and would cast incremental shadows on the Hardy Plant Nursery Yard, the Temperate Bonsai Tunnel, the Production House, the Tropical Bonsai House, the Auxiliary House, the New York-Native Flora and Temperate Plant Propagation Tunnel, and the Mediterranean Display Plants Tunnel (refer to **Figures 4-7b and 4-7e)**.

As shown in **Figures 4-7c and 4-7e**, by 8:00 AM, incremental shadows would continue to decrease, moving in a northeasterly direction, and would cast incremental shadows on the Hardy Plant Nursery Yard and the New York-Native Flora and Temperate Plant Propagation Tunnel. By 8:30 AM, incremental shadow coverage would continue to decrease and would only cast incremental shadows on a small portion of the Hardy Plant Nursery Yard (refer to **Figures 4-7c and 4-7e**). Incremental shadow would exit the Brooklyn Botanic Garden at 8:54 AM.

While these areas, combined, would experience incremental shadows for a total of two hours and 57 minutes, incremental shadow coverage on individual features of the Botanic Garden would range between 1 hour 44 minutes (Production House) and two hours 57 minutes (Hardy Plant Nursery Yard) (refer to **Table 4-5**).

*DECEMBER 21*

On the winter solstice (December 21), the day of the year with the shortest period of daylight, the sun is low in the sky and shadows are at their longest but move rapidly.

The Proposed Project would cast incremental shadows on portions of the Brooklyn Botanic Garden for a total of one hour and 12 minutes on the December 21 analysis day. Incremental shadows would enter the garden at the beginning of the analysis day (8:51 AM) and continue until 10:03 AM. After 10:03 AM the Brooklyn Botanic Garden would not experience any incremental shadow coverage. As indicated in **Figures 4-8a, 4-8b**, during the early morning hours, shadow coverage would be concentrated on portions of the Lily Pool Terrace, the Warm Temperate Plants and Tropical Plants Education Greenhouses, as well as portions of the Steinhardt Conservatory, including the Helen Mattin Warm Temperate Pavilion, the C.V. Starr Bonsai Museum, the Conservatory Entry House, the Aquatic House & Orchid Collection, the Arid Workhouse, the Humid Tropics Workhouse, and the Lowland and Highland Moist Tropical Orchid Workhouses. As shown in **Figure 4-8b,** by 9:20 AM incremental shadow coverage would decrease, moving in a southeasterly direction, and would cast incremental shadows on portions of the Arid Workhouse and the Humid Tropics House. By 9:45 AM, incremental shadow coverage would continue to decrease, moving in a southeasterly direction, and would cast incremental shadows on portions of the landscaped area along Washington Avenue (refer to **Figure 4-8a**). At 10:03 AM, incremental shadows would completely exit the Brooklyn Botanic Garden, and the majority of the open space would receive direct sunlight.

While these areas, combined, would experience incremental shadows for a total of one hour and 12 minutes, it should be noted that – though the December 21 analysis day is not considered to be part of the plant growing season –several individual facilities within the Botanic Garden provide enclosed habitats for vegetation to grow during the winter months. Therefore, vegetation within these enclosed facilities requires direct sunlight for their survival. The Brooklyn Botanic Garden's affected unenclosed sunlight-sensitive areas (i.e., the Lily Pool Terrace) would experience incremental shadow for approximately 30 minutes. The Brooklyn Botanic Garden's enclosed, climate-controlled facilities (i.e., the Steinhardt Conservatory's individual greenhouse facilities and the Education Greenhouses) would experience incremental shadows ranging from nine minutes (the Education Greenhouse: Desert Plants) and 42 minutes (the Arid Workhouse) (see **Table 4-5 and Figure 4-8a**). Though incremental shadow coverage would reach the open space's various plants, conservatories, greenhouses, propagation spaces, and nurseries for a total of one hour and 12 minutes on the December 21 analysis day, plants within the enclosed greenhouse facilities are expected to receive direct sunlight for at least five hours. As the December 21 analysis day is outside the growing season and only occurs for six hours and two minutes, these resources would continue to receive direct sunlight for a majority of the analysis day.

ASSESSMENT

The Proposed Project would cast incremental shadows on portions of the Brooklyn Botanic Garden on all four of the representative analysis days. Incremental shadow duration would range from one hour and 12 minutes on December 21 to two hours and 57 minutes on June 21 and would generally occur during the early morning hours. Incremental shadow coverage would generally be limited to southeastern and northeastern portions of the Botanic Garden depending on the analysis day. As shown in **Table 4-6,** incremental shadow coverage on individual resources within the Botanic Garden would vary (see **Figures 4-3** through **4-8**).

The areas affected by incremental shadows consist of gardens, including the Cranford Rose Garden, the Discovery Garden, the Fragrance Garden, the Herb Garden, the Japanese Hill-and-Pond Garden, the Rock Garden, the Shakespeare Garden, and the Shelby White and Leon Levy Water Garden; ponds such as the Lily Pool Terrace, the Japanese Hill-and-Pond Garden, and the Water Garden; plazas such as the Magnolia Plaza, the Perennial Border, and the Annual Border; conservatories and greenhouses, such as the Steinhardt Conservatory (which include the Tropical Pavilion, Desert Pavilion, C.V. Starr Bonsai Museum, Conservatory Entry House, Aquatic House and Orchid Collection, Desert, Mediterranean, South African

Bulb [Arid] Workhouse, Humid Tropics Workhouse, Lowland Moist Tropical Orchid Workhouse, Highland Moist Tropical Orchid Workhouse, Tropical Plant Propagation House, and Tropical and Desert Plant Propagation House), the Desert Plants, Warm Temperate Plants, and Tropical Plants Education Greenhouses, the Temperate Bonsai Tunnel, the Production House, the Tropical Bonsai House, the Auxiliary House, the New York-Native Flora and Temperate Plant Propagation Tunnel, and the Mediterranean Display Plants Tunnel; and walking paths such as the Cherry Esplanade and the Celebrity Path. The affected areas of the garden are predominantly used for passive recreation, with various walkways lined with benches, grassy lawns, and various plant exhibits. As outlined above, each section of the Botanic Garden would experience no more than two hours and 57 minutes (the Hardy Plant Nursery Yard on the June 21 representative analysis day) on any given feature; however, most sections of the Botanic Garden would experience incremental shadows ranging between 30 minutes and one hour and 30 minutes.

Furthermore, as shadows are not static and move from west to east throughout the day, all vegetation requiring direct sunlight – including those within enclosed conservatories, greenhouses, propagation spaces, and nurseries – would continue to receive the CEQR recommended minimum of generally six to eight hours of direct sunlight per day, which is generally the minimum requirement for vegetation requiring direct sunlight, per the *CEQR Technical Manual*. However, throughout the year, project-generated shadows would be cast on several Greenhouses used to propagate plants for desert, tropical, and warm temperate climates that require full, year-round sunlight including during the winter months. While the *CEQR Technical Manual* states that six to eight hours of sunlight is necessary for plant survival, the Brooklyn Botanic Garden contains over 18,500 kinds of plants, with globally rare species and native rare species. The six to eight hours of sunlight typically needed to constitute survival may not be enough to promote healthy growth of these rare plants. The Department of City Planning, acting as Lead Agency, in consultation with the Department of Parks and Recreation finds that the Proposed Actions would result in significant adverse impacts to the Brooklyn Botanic Garden due to the unique nature of the resource. Potential measures to mitigate, in full or part, this impact are discussed in **Chapter 11, "Mitigation."**

### *JACKIE ROBINSON PLAYGROUND*

*MARCH 21/SEPTEMBER 21*

The Proposed Project would also cast incremental shadows on portions of the Jackie Robinson Playground for a total of two hours and 46 minutes on the March 21/September 21 analysis day. Incremental shadows would enter the playground at 1:43 PM and continue until the end of the analysis day (4:29 PM). Prior to 1:43 PM the playground would not experience any incremental shadow coverage. As indicated in **Figures 4-9a** and **4-9b**, during the afternoon hours, incremental shadows would be limited to the southwestern portion of the playground fronting Franklin Avenue. By 3:15 PM, incremental shadow coverage would increase, moving in an easterly direction throughout the late afternoon up until the end of the analysis day (refer to **Figure 4-9a**). At 3:15, incremental shadow would be cast over the southwestern to central portions of the playground. Large portions of the playground would remain in direct sunlight. As shown in **Figure 4-9b**, incremental shadow would move easterly and grow in size throughout the afternoon.

The areas experiencing shadow coverage include basketball and handball courts, playgrounds, fitness equipment, spray showers, and trees; while these areas, combined, would experience incremental shadows for a total of two hours and 46 minutes. The full-court basketball courts located on the southeastern portion of the playground would experience incremental shadows for no longer than one and a half hours. Additionally, though incremental shadow coverage would reach the playground's trees

**Figure 4-9a**
**Jackie Robinson Playground**
**Incremental Shadows on March 21/September 21**



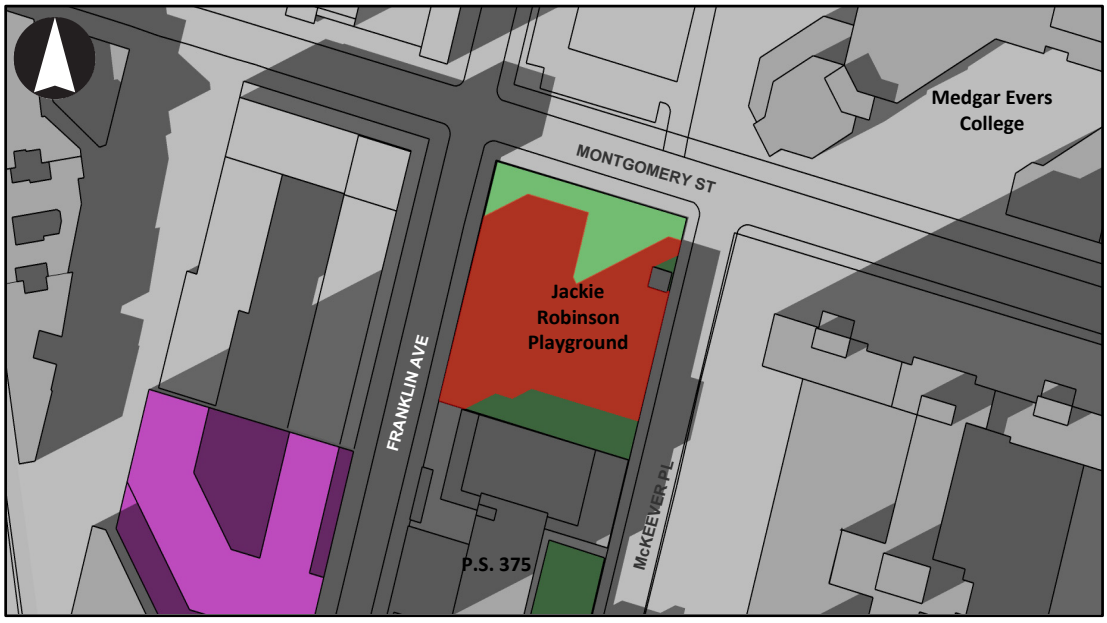

**2:30 PM**



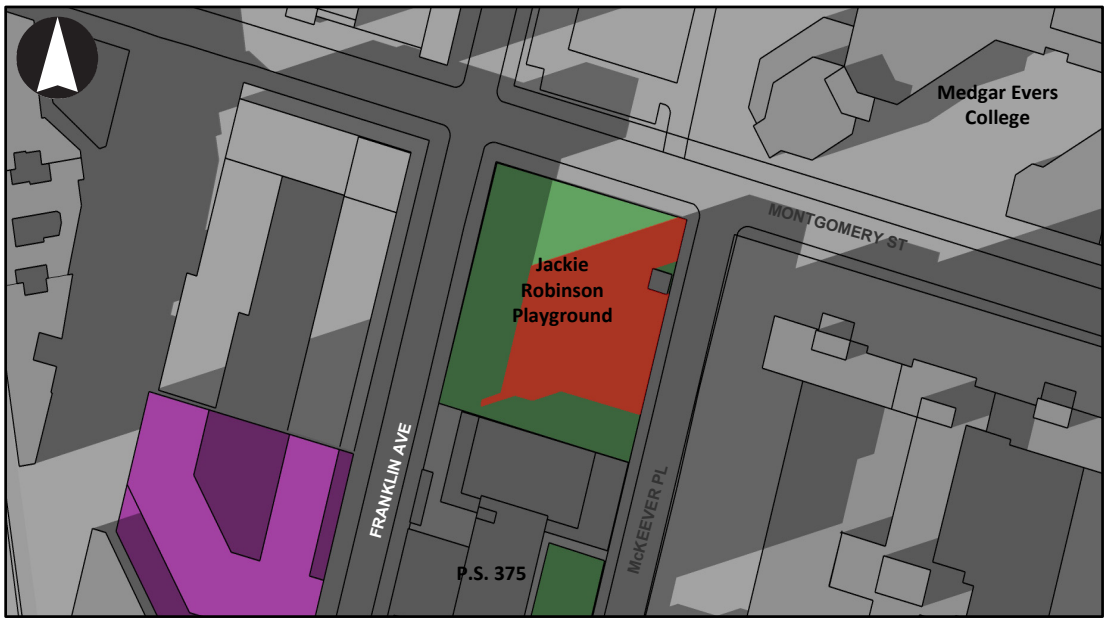

**3:15 PM**

**Proposed Project** **Open Space** **Incremental Shadow**

**Figure 4-9b**
**Jackie Robinson Playground**
**Incremental Shadows on March 21/September 21**




**3:45 PM**




**4:29 PM**

**Proposed Project** **Open Space** **Incremental Shadow**

in the northern portion of the playground on the March 21/September 21 analysis day, no single tree would receive direct sunlight for less than six hours, which, according to the CE*QR Technical Manual*, is the general minimum requirement for the survival of vegetation during the growing season.

*MAY 6/AUGUST 6*

The Proposed Project would also cast incremental shadows on portions of the Jackie Robinson Playground for a total of three hours and 24 minutes on the May 6/August 6 analysis day. Incremental shadows would enter the playground at 1:48 PM and continue until the end of the analysis day (5:12 PM). Prior to 1:48 PM the playground would not experience any incremental shadow coverage. As indicated in **Figure 4-10a**, during the early afternoon hours, incremental shadows would be limited to a very small portion of the southwestern portion of the playground fronting Franklin Avenue. By 3:00 PM, incremental shadow coverage would increase, moving in a northeasterly direction throughout the late afternoon. Incremental shadow would be located along the southwestern portion of the park on the handball courts (refer to **Figure 4-10a**). As shown in **Figure 4-10b**, incremental shadows would move easterly over the course of the afternoon and would be cast over portions of the handball and basketball courts.

The areas experiencing shadow coverage include basketball and handball courts; while these areas, combined, would experience incremental shadows for a total of three hours and 24 minutes. The handball and basketball courts would only receive partial incremental shadow coverage. Additionally, no single tree would receive direct sunlight for less than six hours, which, according to the CE*QR Technical Manual*, is the general minimum requirement for the survival of vegetation during the growing season.

*JUNE 21*

The Proposed Project would cast incremental shadows on portions of the Jackie Robinson Playground for a total of one hour and 41 minutes on the June 21 analysis day. Incremental shadows would enter the playground at 1:56 PM and continue until 3:37 PM. Prior to 1:56 PM the playground would not experience any incremental shadow coverage. As indicated in **Figure 4-11**, during the early afternoon hours, incremental shadows would be limited to the southern portion of the playground fronting Franklin Avenue (the handball courts). As shown in **Figure 4-11**, the size of the incremental shadow would be limited over the playground on this analysis day.

The areas experiencing shadow coverage include the handball and basketball courts. Additionally, no single tree would receive direct sunlight for less than six hours, which, according to the CE*QR Technical Manual*, is the general minimum requirement for the survival of vegetation during the growing season.

*DECEMBER 21*

The Proposed Project would cast incremental shadows on portions of Jackie Robinson Playground for a total of one hour and 18 minutes on the December 21 analysis day. Incremental shadows would enter the playground beginning at 1:35 PM and continue until the end of the analysis day (2:53 PM). As indicated in **Figure 4-12**, incremental shadows would be limited to the northwestern portions of the playground during the afternoon hours, moving very quickly in an easterly direction until the end of the analysis day (2:53 PM).

The areas of Jackie Robinson Playground experiencing shadow coverage feature basketball and handball courts, playgrounds, fitness equipment, spray showers, game tables, benches, and tree plantings; while these areas, combined, would experience incremental shadows for an accumulative total of one hour and 18 minutes, no single feature of the open space would be cast in incremental shadows for an extended

**Figure 4-10a**
**Jackie Robinson Playground**
**Incremental Shadows on May 6/ August 6**



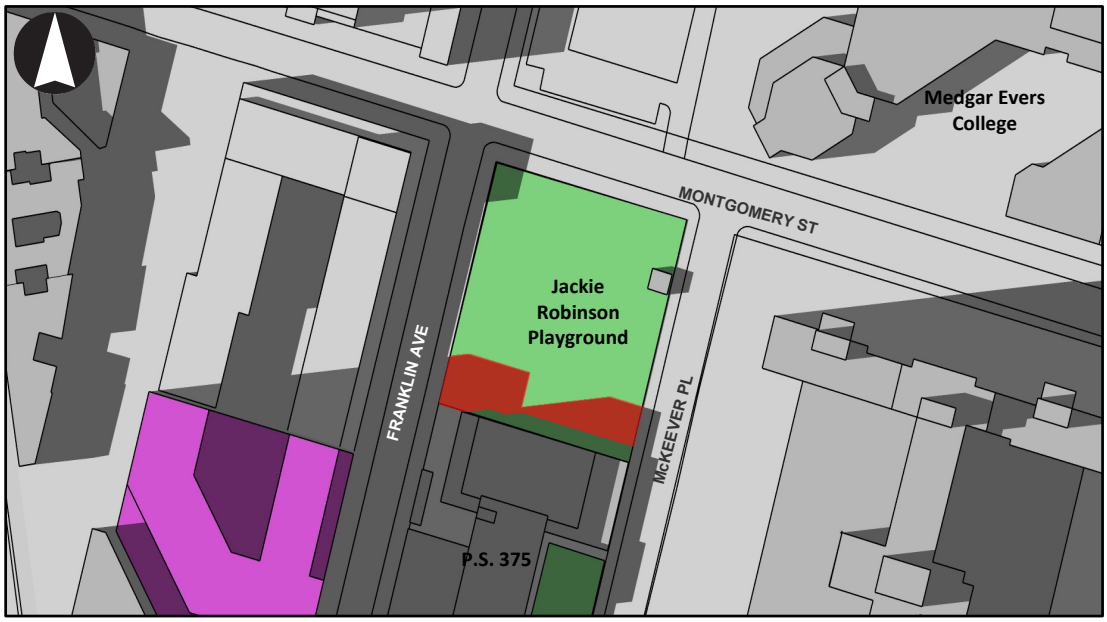

**2:00 PM**




**3:00 PM**

**Proposed Project** **Open Space** **Incremental Shadow**

**Figure 4-10b**
**Jackie Robinson Playground**
**Incremental Shadows on May 6/August 6**




**4:00 PM**



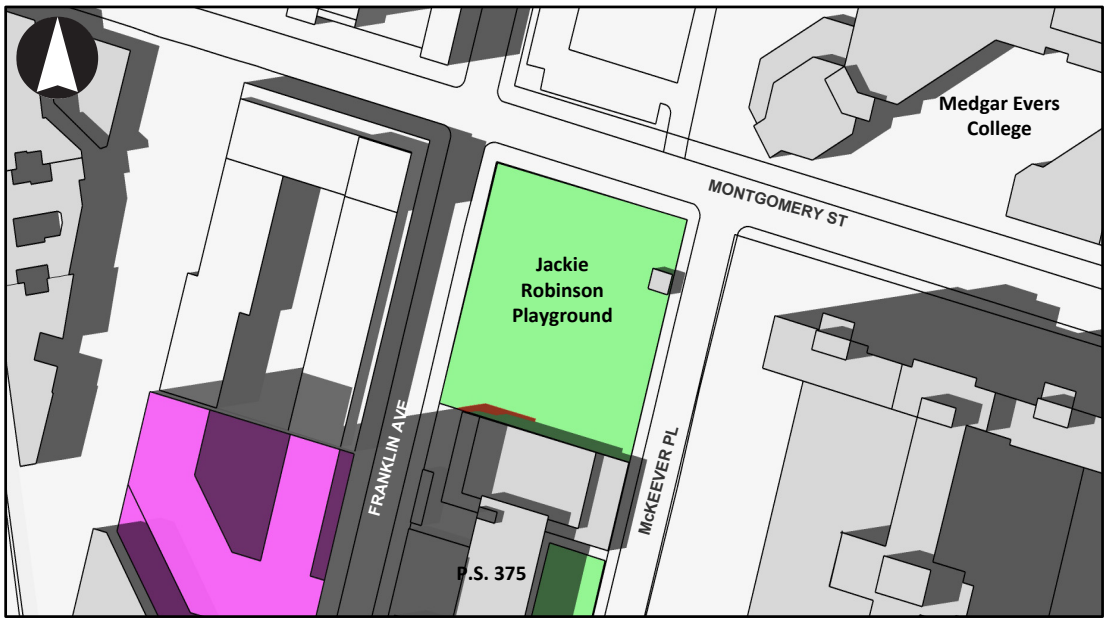

**5:00 PM**

**Proposed Project** **Open Space** **Incremental Shadow**

**Figure 4-11**
**Jackie Robinson Playground**
**Incremental Shadows on June 21**




**2:15 PM**




**3:15 PM**

**Proposed Project** **Open Space** **Incremental Shadow**

**Figure 4-12**
**Jackie Robinson Playground**
**Incremental Shadows on December 21**




**1:45 PM**




**2:53 PM**

**Proposed Project** **Open Space** **Incremental Shadow**

period of time due to the speed and movement of these shadows across the open space. In addition—though the December 21 analysis day is not considered to be part of the plant growing season—it should be noted that no single tree located in the northern portion of the playground would experience an incremental shadow of more than one hour and 18 minutes during this representative analysis day.

ASSESSMENT

The Proposed Project would cast incremental shadows on portions of the Jackie Robinson Playground on each of the four representative analysis days. Incremental shadow durations would range from one hour and 18 minutes on December 21 to three hours and 24 minutes on May 6/August 6. Shadow coverage would generally cover small portions of the playground and would enter the open space from the western sections of the playground during the growing season (which generally feature handball courts, playground equipment, benches, and tree plantings). On the December 21 analysis day, incremental shadow cast by the Proposed Project would be cast on large portions of this open space resource(see **Figures 4-9** through **4-12**). Therefore, as the extent, time of day and duration of the incremental shadows would (1) significantly reduce direct sunlight exposure on the sunlight-sensitive resources found within this open space; and (2) would alter the public's use of the park, incremental shadows from the Proposed Project on Jackie Robinson Playground would be considered a significant adverse impact, in accordance with *CEQR Technical Manual* methodology. Potential measures to mitigate, in full or part, this impact are discussed in **Chapter 11, "Mitigation."**