

## A. INTRODUCTION

This chapter examines whether the proposed Cornell NYC Tech project would cast new shadows on any sunlight-sensitive publicly accessible resources or other resources of concern, and assesses the potential effects of any such new shadows. Sunlight-sensitive resources of concern potentially include publicly accessible open spaces, important natural features such as water bodies, and sunlight-dependent features of historic and cultural resources.

According to the June 2012 *City Environmental Quality Review (CEQR) Technical Manual*, a shadows assessment is required if the proposed project would result in structures (or additions to existing structures) of 50 feet or more, or if the project site is located adjacent to, or across the street from, a sunlight-sensitive resource. The proposed campus is located adjacent to Roosevelt Island's waterfront promenade. South Point Park, and the East River, an important natural resource, lie just beyond these open spaces. Therefore, a shadow analysis is warranted.

The analysis concluded that with the full build-out of the proposed Cornell NYC Tech project, the waterfront promenade to the east and west of the project site would receive incremental shadows in all seasons; the outdoor basketball court associated with Sportspark north of the project site would receive incremental shadows in all seasons; the east channel and west channel of the East River would receive incremental shadows in all seasons; South Point Park would receive incremental shadows in the late spring, and summer ~~and fall~~, and Firefighter Field and one section of Sutton Place Park in Manhattan would receive brief incremental shadows on the winter analysis day only. The analysis further concluded that the incremental shadows would not result in significant adverse shadow impacts on any of these resources.

## B. DEFINITIONS AND METHODOLOGY

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

### DEFINITIONS

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

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

- *Public open space* (e.g., parks, beaches, playgrounds, plazas, schoolyards, greenways, landscaped medians with seating). Planted areas within unused portions of roadbeds that are part of the Greenstreets program are also considered sunlight-sensitive resources.

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

**Non-sunlight-sensitive resources** include, as set forth in the *CEQR Technical Manual*:

- *City streets and sidewalks* (except Greenstreets);
- *Private open space* (e.g., front and back yards, stoops, vacant lots, and any private, non-publicly-accessible open space);
- *Project-generated open space* cannot experience a significant adverse shadow impact from the project, according to the *CEQR Technical Manual*, because without the project the open space would not exist. However, a qualitative discussion of shadows on the project-generated open space should be included in the analysis.

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

## METHODOLOGY

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

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

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

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

### **ANALYSIS FRAMEWORK**

As described in Chapter 1, “Project Description,” the maximum likely development program, or reasonable worst case development scenario (RWCDS), as currently contemplated, would comprise ~~nine~~ 40 buildings ranging in height from ~~four~~ eight to ~~31~~ 30 stories, as well as publicly accessible open space. The RWCDS would comprise two phases: Phase 1, which would include the northern portion of the site, expected to be completed by 2018, and Phase 2, the remaining southern portion of the site, expected to be completed by 2038. The analysis assumes that absent the proposed project, in both 2018 and in 2038, the No-Action condition would include the vacant but still standing Goldwater Hospital structures.

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

### **DETERMINING IMPACT SIGNIFICANCE**

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

#### **For vegetation:**

- A substantial reduction in sunlight available to a sunlight-sensitive feature of the resource to less than the minimum time necessary for its survival (when there was sufficient sunlight in the future without the project).
- A reduction in direct sunlight exposure where the sensitive feature of the resource is already subject to substandard sunlight (i.e., less than minimum time necessary for its survival).

#### **For open space utilization:**

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

#### **For any sunlight-sensitive feature of a resource:**

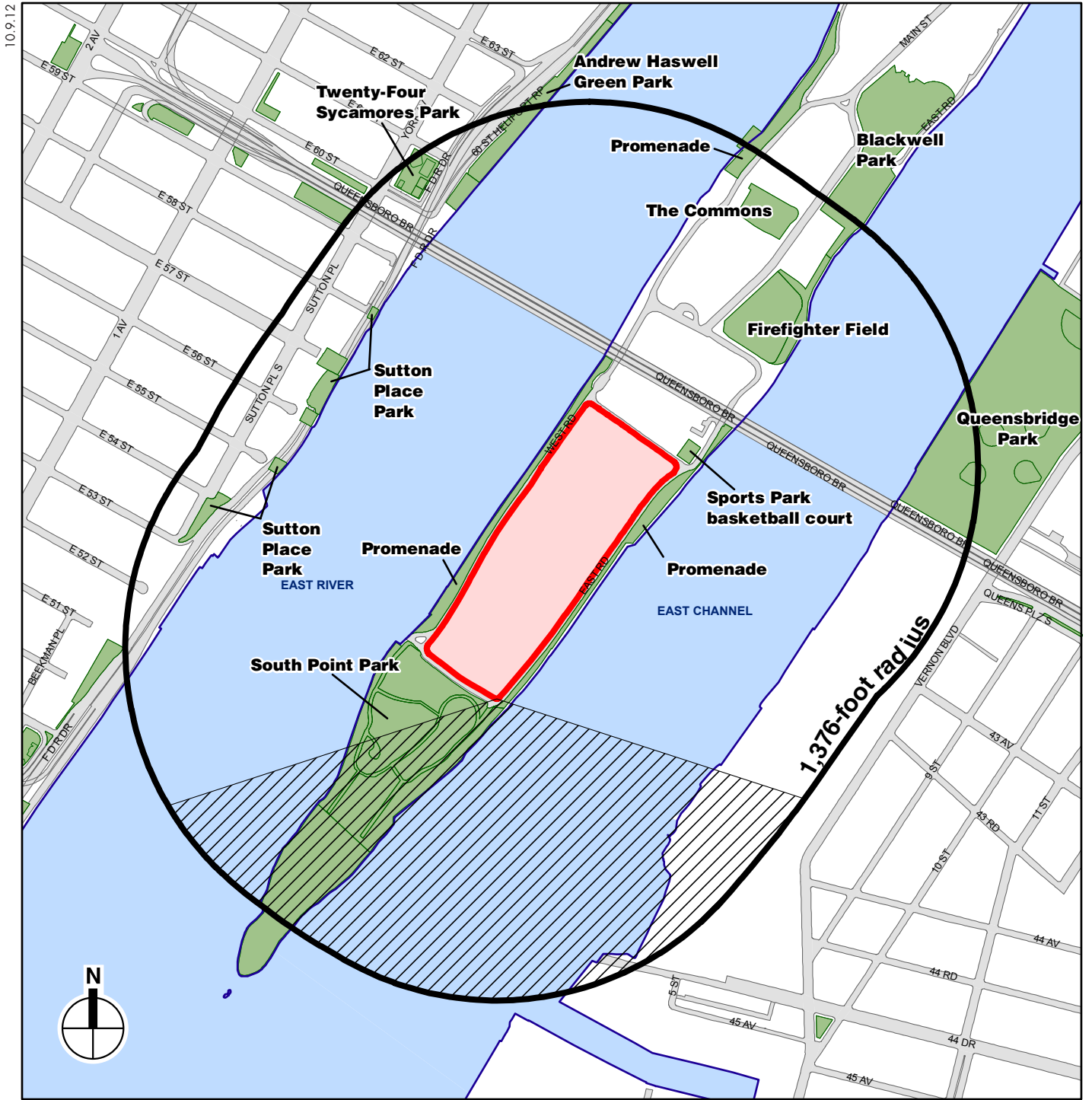
- Complete elimination of all direct sunlight on the sunlight-sensitive feature of the resource, when the complete elimination results in substantial effects on the survival, enjoyment, or, in the case of open space or natural resources, the use of the resource.

## **C. PRELIMINARY SCREENING ASSESSMENT**

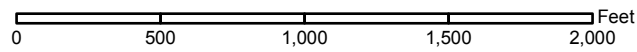
A base map was developed using Geographic Information Systems (GIS)<sup>1</sup> showing the location of the proposed project and the surrounding street layout (see **Figure 6-1**). In coordination with the open space, historic and cultural resources, and natural resources assessments presented in other chapters of this EIS, potentially sunlight-sensitive resources were identified and shown on the map.

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<sup>1</sup> Software: Esri ArcGIS 10; Data: New York City Department of Information Technology and Telecommunications (DoITT) and other city agencies, and AKRF.



- Project site
- Publicly accessible open space
- Tier 1: Perimeter representing longest shadow study area
- Tier 2: Area to south that can never be shaded by project



Tier 1 and Tier 2 Assessment  
**Figure 6-1**

### **TIER 1 SCREENING ASSESSMENT**

Following *CEQR Technical Manual* methodology, for the Tier 1 assessment, the longest shadow that the proposed project could cast is calculated, and, using this length as the radius, a perimeter is drawn around the project site. Anything outside this perimeter representing the longest possible shadow could never be affected by project generated shadow, while anything inside the perimeter needs additional assessment.

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

The tallest structure in the RWCDS would be a 320-foot-tall (including mechanical space) residential building. However, to ensure the most conservative assessment, the Tier 1 assessment accounted for a maximum building height of 320 feet across the project site, since 320 feet is the maximum allowable height for a portion of the site as set forth in the proposed Special Southern Roosevelt Island Special District.

Therefore, at a maximum height of 320 feet the proposed project could cast a shadow up to 1,376 feet in length (320 x 4.3). Using this length as the radius, a perimeter was drawn around the entire project site (see Figure 6-1). Since a number of sun-sensitive resources are located within this perimeter or longest shadow study area, the next tier of screening assessment was conducted.

### **TIER 2 SCREENING ASSESSMENT**

Because of the path that the sun travels across the sky in the northern hemisphere, no shadow can be cast in a triangular area south of any given project site. In New York City this area lies between -108 and +108 degrees from true north. Figure 6-1 illustrates this triangular area south of the project site. The area to the north within the longest shadow study area represents the remaining area that could potentially experience new project generated shadow.

A number of sunlight-sensitive resources are located in the remaining longest shadow study area, and the next tier of assessment was therefore conducted.

### **TIER 3 SCREENING ASSESSMENT**

The direction and length of shadows vary throughout the course of the day and also differ depending on the season. In order to determine whether project-generated shadow could fall on a sunlight-sensitive resource, three-dimensional (3D) computer mapping software<sup>2</sup> is used in the Tier 3 assessment to calculate and display the proposed project's shadows on individual representative days of the year.

A 3D computer model was developed containing three-dimensional representations of the elements in the base map used in the preceding assessments, the topographic information of the study area, and a reasonable worst-case three-dimensional representation of the proposed project.

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<sup>2</sup> MicroStation V8i (SELECTSeries 2)

### *REPRESENTATIVE DAYS FOR ANALYSIS*

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

### *TIMEFRAME WINDOW OF ANALYSIS*

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

### *TIER 3 SCREENING ASSESSMENT RESULTS*

**Figure 6-2** illustrates the range of shadows that would occur, in the absence of intervening buildings, from the RWCDS on the four representative days for analysis. As they move east and clockwise over the landscape, the shadows from the RWCDS building envelopes are shown occurring approximately every two hours from the start of the analysis day (one and a half hours after sunrise) to the end of the analysis day (one and a half hours before sunset).

The Tier 3 assessment showed that several sunlight-sensitive resources are located in the sweep of project generated shadow on one or more analysis days.

Sections of the **Promenade** east and west of the project site could be affected by project-generated shadow on all four analysis days. (Note: all references to the promenade in the following sections refer to the portions of the promenade south of the Ed Koch Queensboro Bridge, east and west of the project site.)

Project-generated shadow would fall on areas of the **East River**, to the east and the west, on all four analysis days.

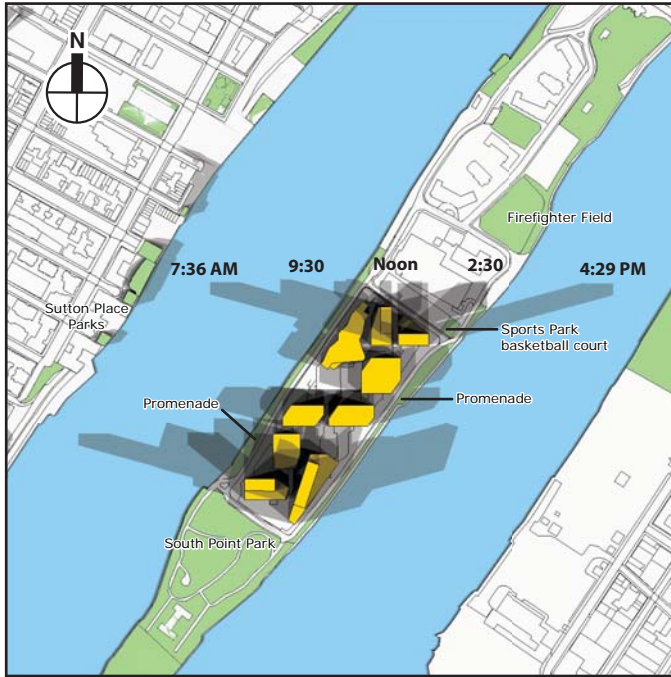
Project-generated shadow would also be long enough to reach the **basketball court** associated with the Sportspark club on all four analysis days.

The area of **South Point Park** southwest of the project site could be affected by project-generated shadow in the mornings of the May 6/August 6 and June 21 analysis days.

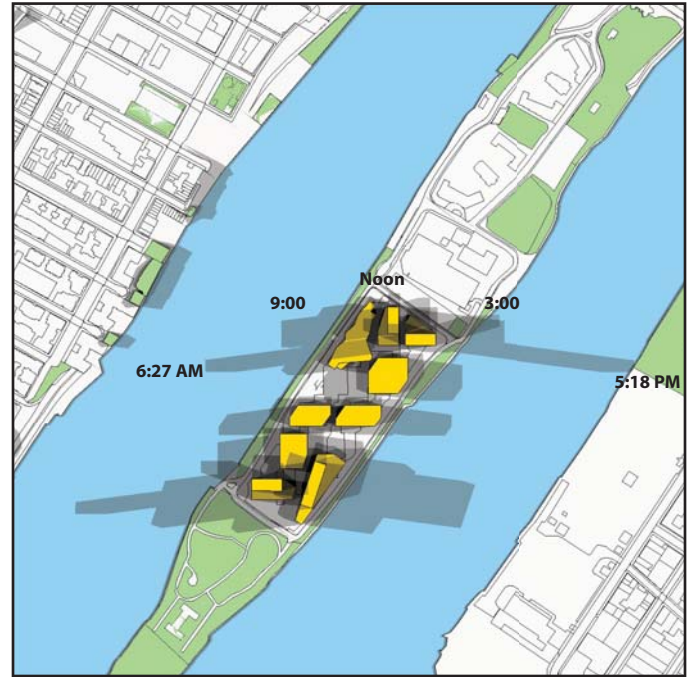
Finally, on the December 21 analysis day only, project shadow could reach a very small portion of one of the **Sutton Place Parks**, at the east ends of East 55th Street and ~~East 66th Street~~, and **Firefighter Field** and an adjacent portion of the promenade near the end of the analysis day.

In summary, the Tier 3 screening assessment concluded that, in the absence of intervening buildings, shadows from the proposed RWCDS envelopes would reach two open space resources and the East River on all four analysis days, another open space resource on three of

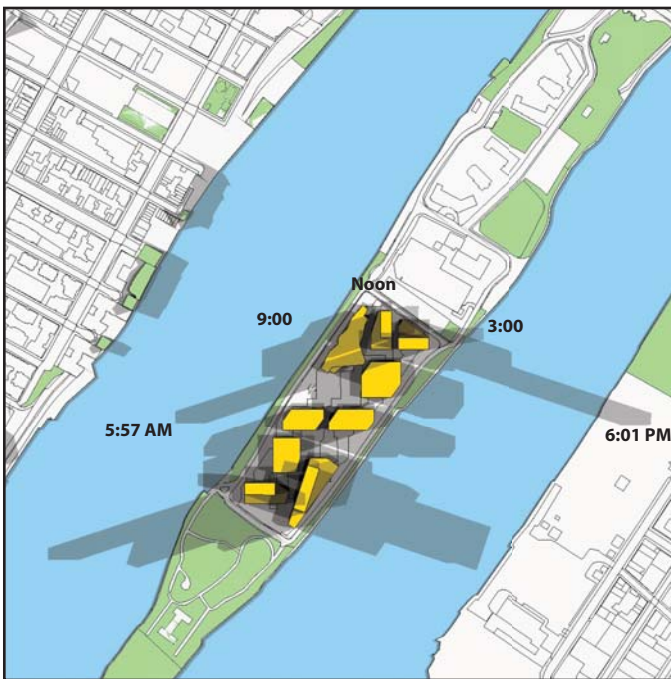
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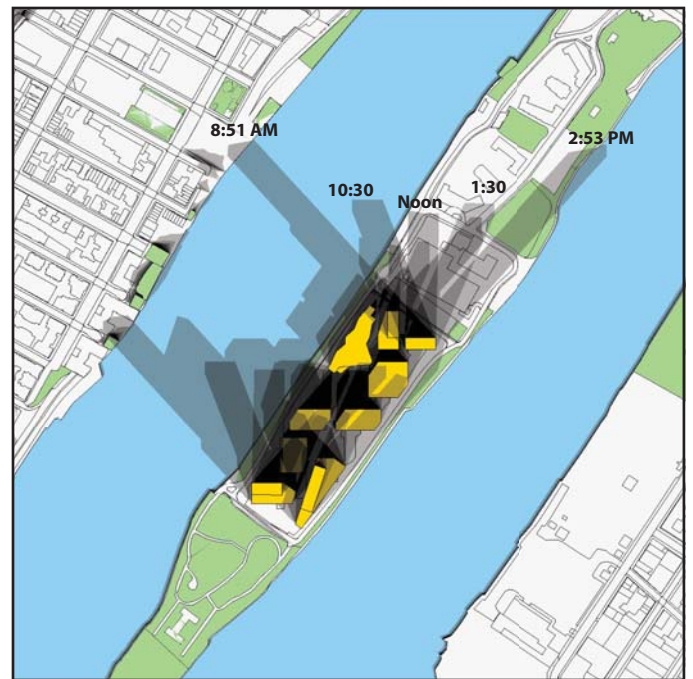
March 21/Sept. 21



May 6/August 6



June 21



December 21

 Reasonable Worst-Case Development Scenario Building Envelopes

 Publicly-Accessible Open Space

 East River

 Daily Sweep of Project-Generated Shadow

Note: Daylight Saving Time not used.

the four analysis days, and two additional open spaces on the December 21 day only. Therefore, a detailed analysis is warranted for those resources on the relevant analysis periods.

## **RESOURCES OF CONCERN**

### *WATERFRONT PROMENADE—WEST SIDE*

The waterfront promenade on the western side provides a walkway for pedestrians with sweeping views of Manhattan. It contains benches overlooking the river and Manhattan fairly continuously from the northern end of the project site to the southern, as well as opportunities for active uses like running and bicycling (see **Figure 6-3**). Vegetation includes cherry trees and other tree species, and lawn.

### *WATERFRONT PROMENADE—EAST SIDE*

The eastern promenade is narrower for most of its length and contains fewer and smaller trees, and fewer seating areas (see **Figure 6-4**). It is wider near the northern end of the project site, and this area consists mainly of lawn. There are three benches at wide intervals in the northern part, and three other benches at even wider intervals along the longer southern section of the promenade.

### *SPORTSPARK*

Figure 6-4 shows this hard-surface, fenced basketball court. Bordering the court on the west is the Sportspark building. This resource has no vegetation and, being an active recreational use, its users are only minimally sensitive to shadows.

### *SOUTH POINT PARK*

Located south of the project site, South Point Park is a passive open space resource. The north and northwest sections that could potentially be reached by incremental shadow contain natural areas, pathways, benches, and a restroom facility.

### *FIREFIGHTER FIELD*

Located north of the project site, Firefighter Field is an active open space containing both a baseball diamond and goalposts for soccer. As an active resource, its users are less sensitive to shadows.

### *SUTTON PLACE PARK*

The Sutton Parks are a series of five vest-pocket parks along the East River waterfront near Sutton Place. The Sutton Place Parks include a sandbox and playground equipment, and views of the East River and the Queensboro Bridge.

## **D. DETAILED SHADOW ANALYSIS**

The purpose of the detailed analysis is to determine the extent and duration of new incremental shadows that fall on sunlight-sensitive resources as a result of the project, and to assess their effects. A baseline or future No Action condition is established, containing existing buildings and sunlight-sensitive resources and any future developments planned in the area, to illustrate the baseline shadows from buildings and other structures in the study area defined in the





Looking south



Looking north



Basketball court

Northern section of eastern promenade looking north



Southern section of eastern promenade looking north

Photos of Waterfront Promenade - Eastern Side and Basketball Court

**Figure 6-4**

preliminary assessment. The future condition with the proposed project and its shadows can then be compared to the baseline condition with shadows from the No Action condition, to determine the incremental shadows that would result with the proposed project.

Three-dimensional representations of the existing buildings in the study area were developed using data obtained from NYC DoITT, Sanborn maps, and photos taken during project site visits, and were added to the three-dimensional model used in the Tier 3 assessment. Other developments in the area expected to be completed by the build years were also added to the model: specifically, the three towers that constitute the planned Southtown expansion north of Firefighter Field. **Figure 6-5** shows a view of the computer model used in the analysis.

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

Following the analysis framework described in Chapter 1, “Project Description,” the shadows assessment was performed for Phase 1, with an analysis year of 2018, comparing the proposed development on the northern portion of the site with the future No Action condition in which the Goldwater Hospital would remain (vacant). Then, for the Full Build or 2038 analysis year, shadows with the full build out of the proposed project were compared to shadows in the same No Action condition (the vacant hospital complex).

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

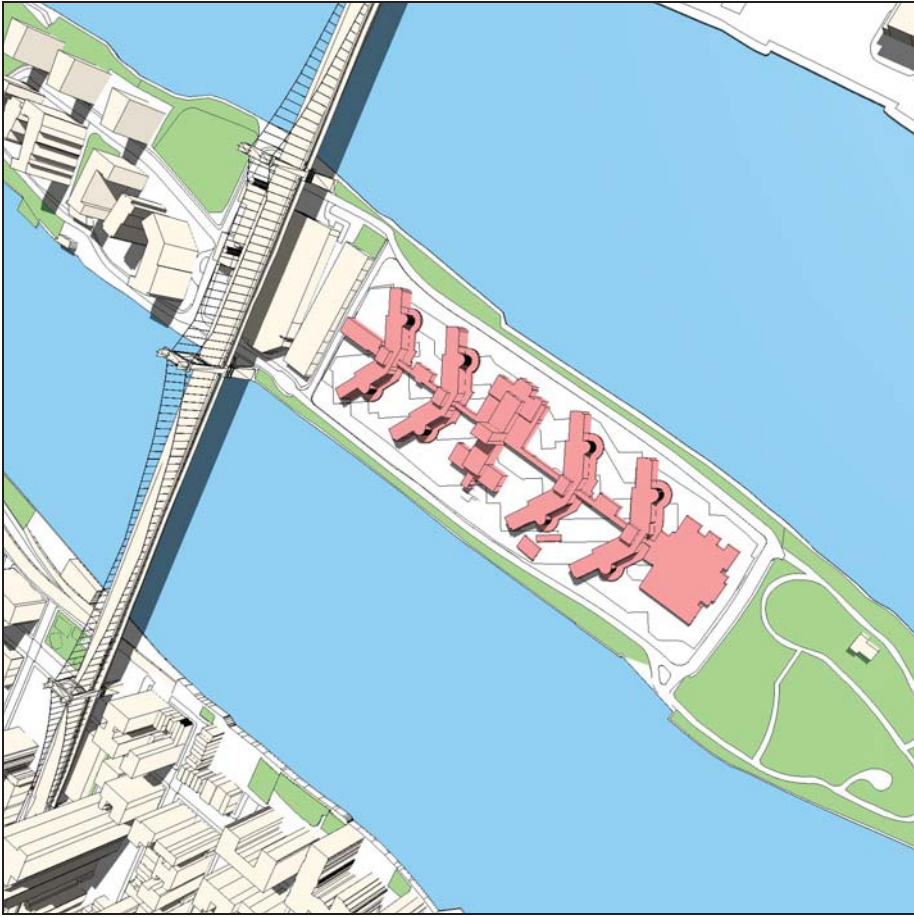
### PHASE 1 (2018)

**Table 6-1** summarizes the entry and exit times and total duration of incremental shadows on each affected sun-sensitive resource for the Phase 1 analysis year. **Figures 6-6 to 6-42** document the results of the Phase 1 analysis by providing graphic representations from the computer animation of times when incremental shadow would fall on a sun-sensitive resource. The figures illustrate the extent of additional, incremental shadow at that moment in time, highlighted in red, and also show existing shadow and remaining areas of sunlight.

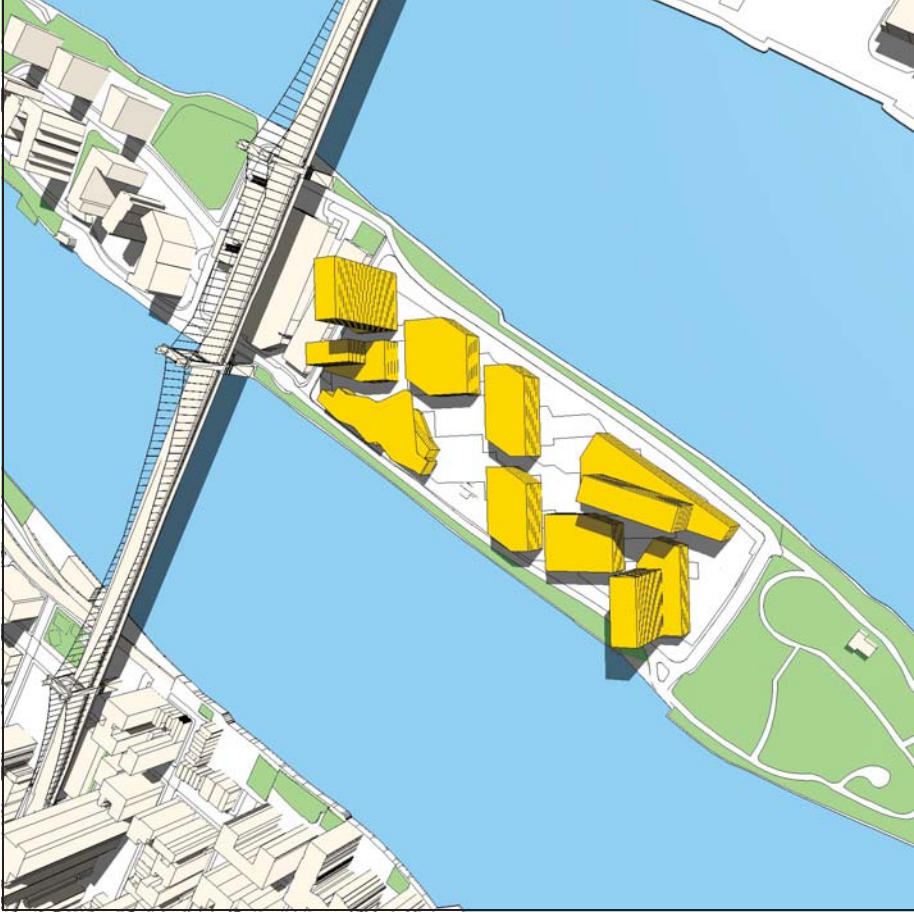
#### *MARCH 21/SEPTEMBER 21 (FIGURES 6-6 TO 6-13)*

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. Shadows on March 21 and September 21 are of moderate length.

In the morning, shadows from the Phase 1 development would fall to the west across portions of the promenade and the west channel of the East River. One area of the promenade adjacent to the proposed Phase 1 academic building and photovoltaic (PV) canopy would receive approximately ~~four and a half~~three hours of incremental shadows between the start of the analysis day and ~~12:30 PM~~10:40 AM (see Figures 6-6 to 6-~~10~~8); other small areas west and north of the proposed Phase 1 development would receive between one and ~~four~~three hours of new shadows. The area of the promenade adjacent to the southern half of the project site would be completely in sun throughout the morning, which would represent a reduction in shadow compared to the No Action condition, in which the Goldwater Hospital would continue to cast shadows in that area of the promenade. An area of the west channel adjacent to the shore would receive up to approximately ~~three and a three-quarters~~hours an hour and a half of new shadow; other areas of the channel further west and northwest would receive less new shadow.

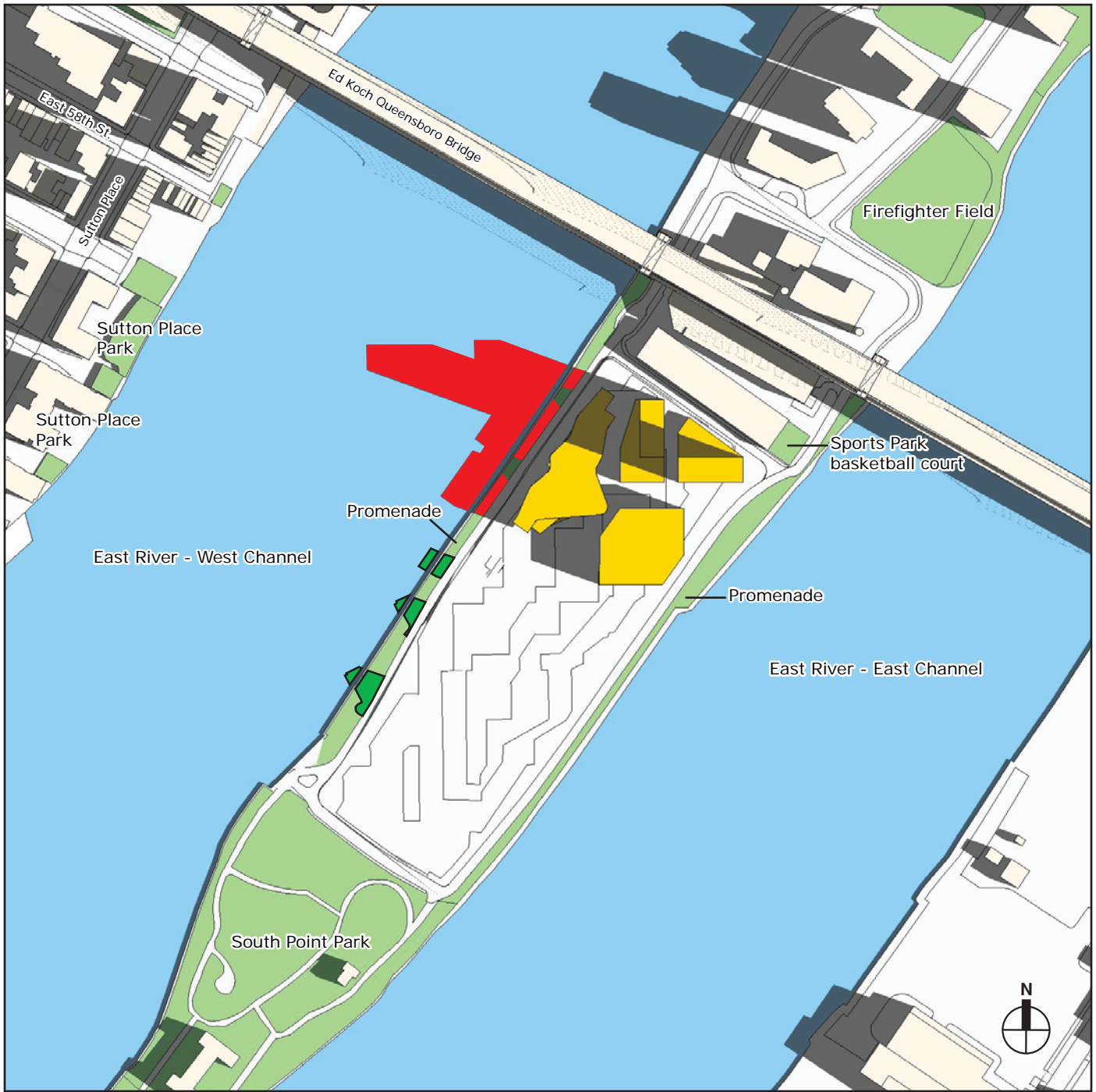


Future No-Action



Reasonable Worst-Case Development Scenario - full build-out

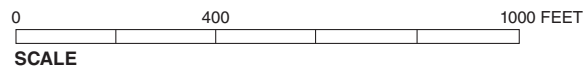
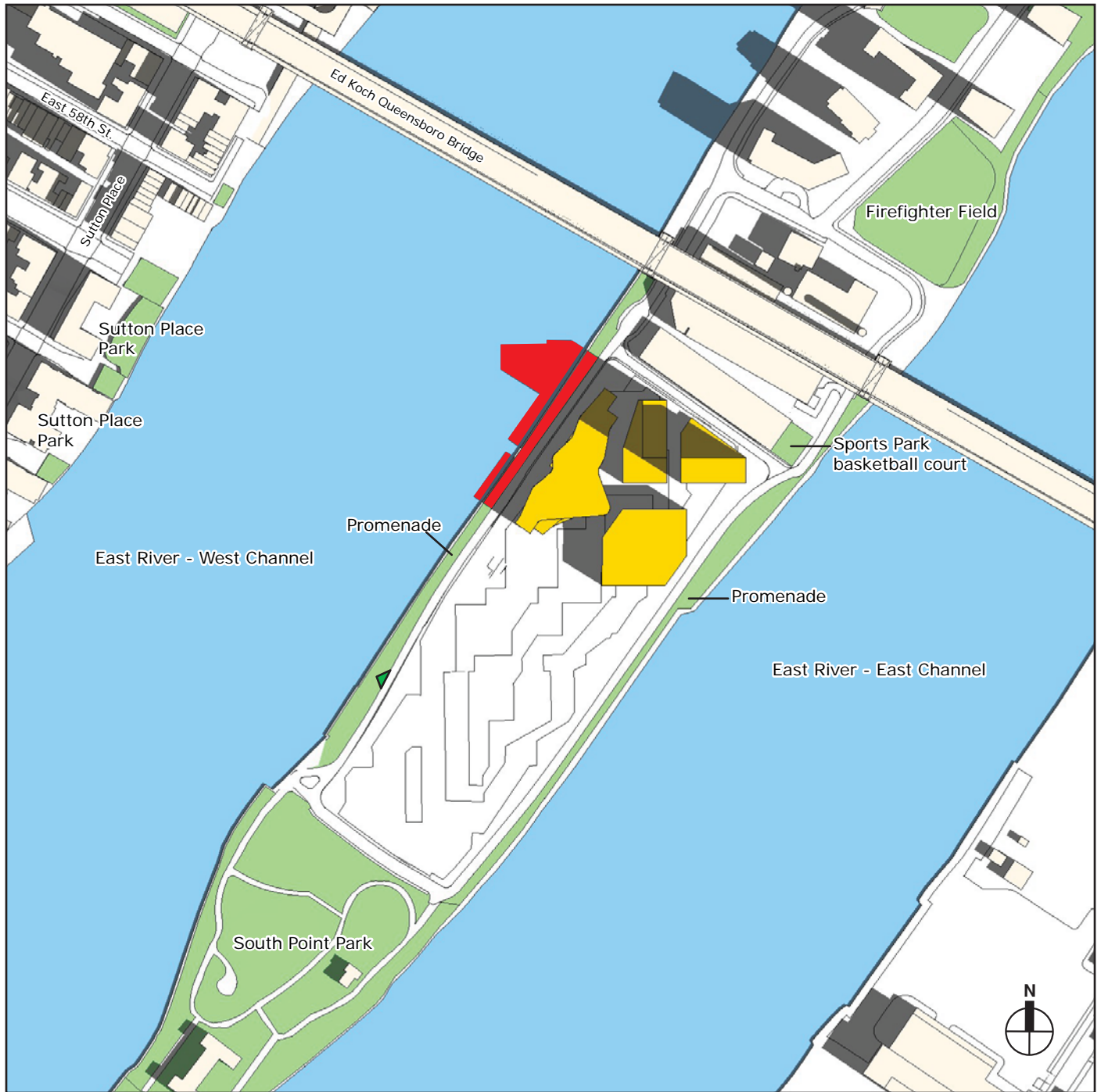
Three-Dimensional Computer Model - View North  
Figure 6-5



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River
- Incremental Shadow
- Reduced Shadow (i.e. cast in Future No-Action but not with Proposed Project)

Note: Daylight Saving Time not used.

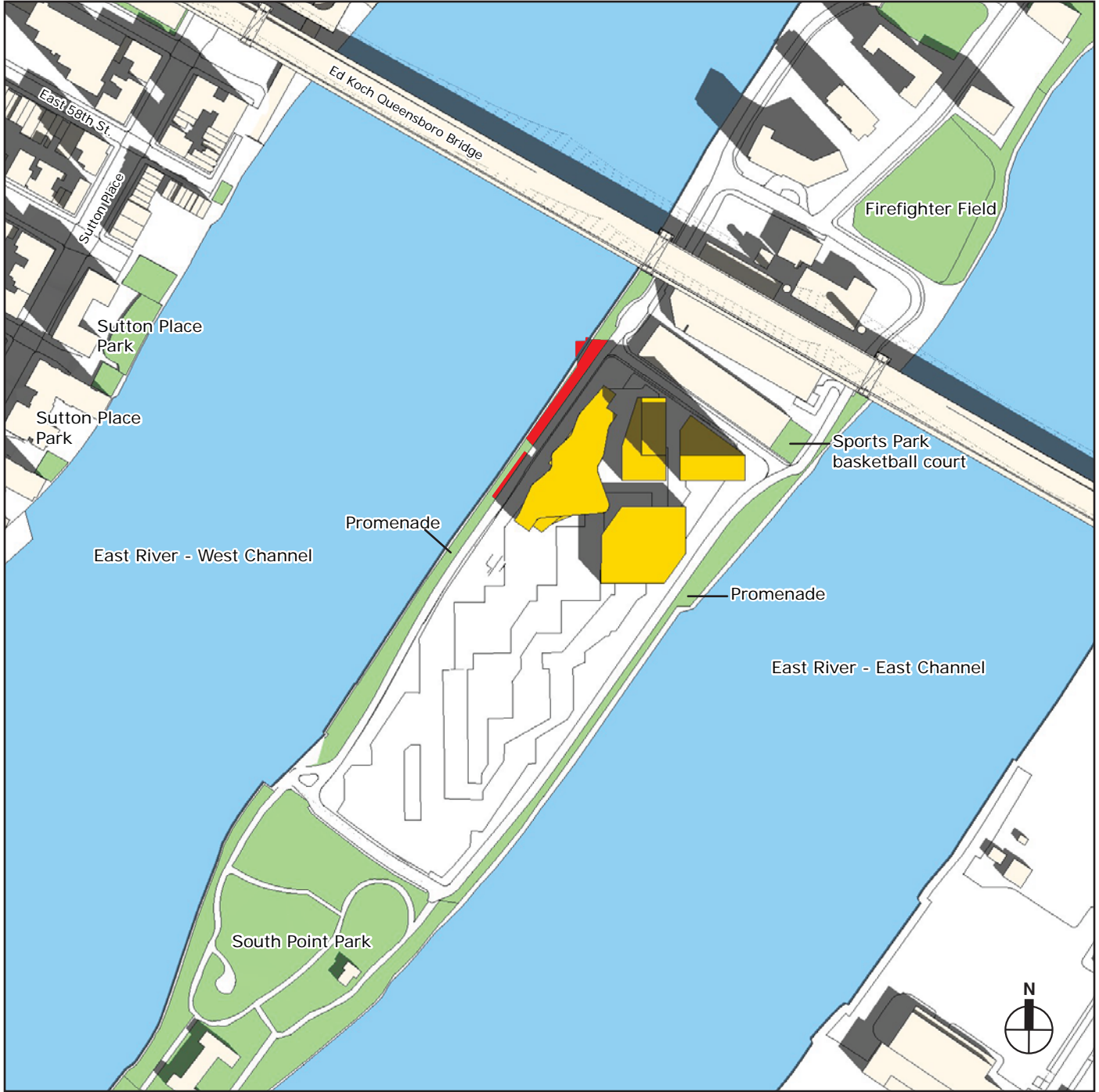
Phase 1  
 March 21/Sept. 21 - 8:00 AM  
**Figure 6-6**



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River
- Incremental Shadow
- Reduced Shadow (i.e. cast in Future No-Action but not with Proposed Project)

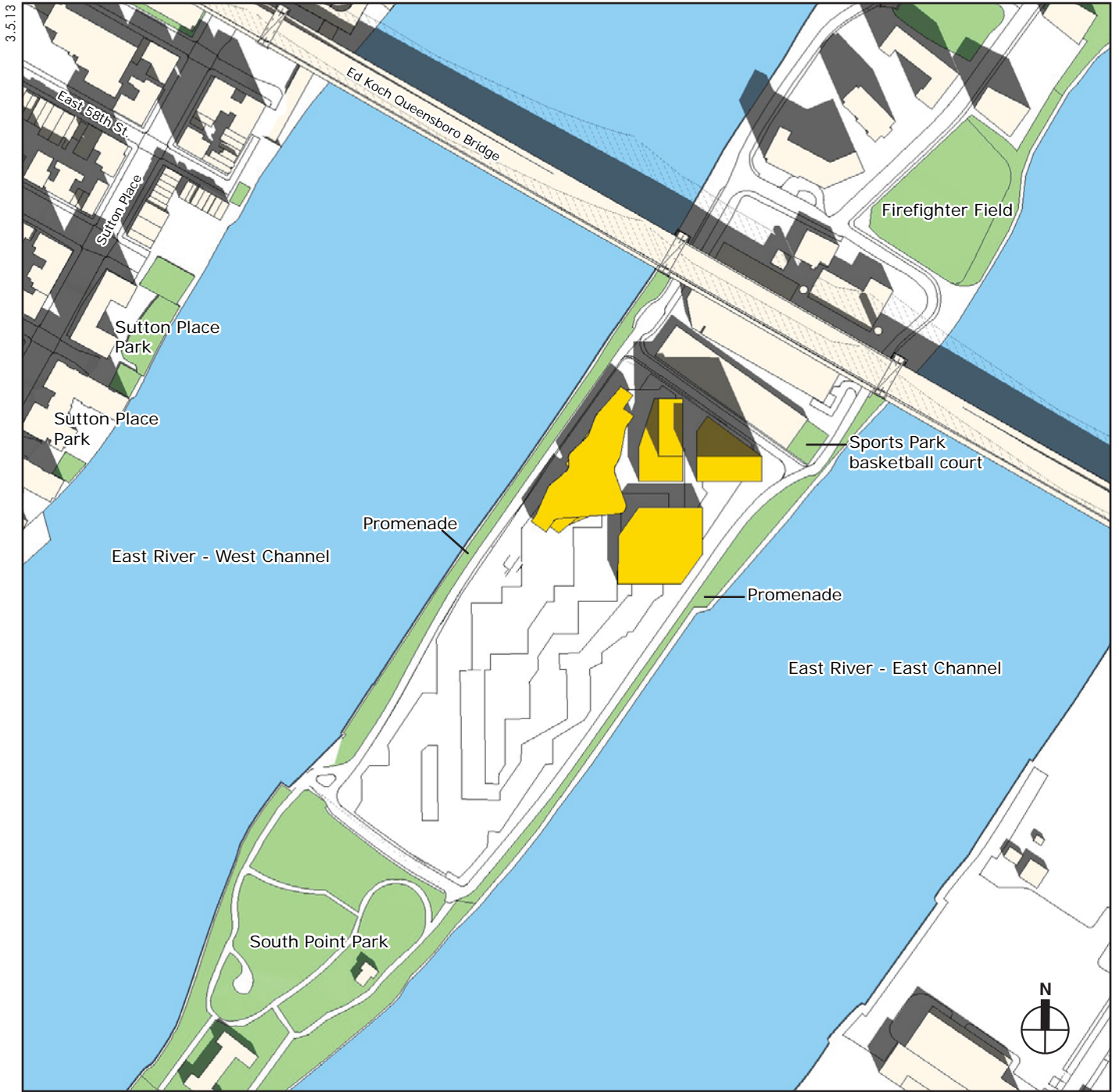
Note: Daylight Saving Time not used.

Phase 1  
March 21/Sept. 21 - 9:00 AM  
**Figure 6-7**

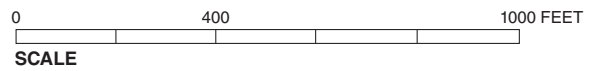


- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.



3.5.13

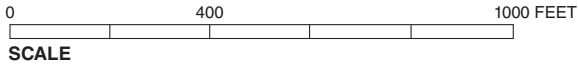
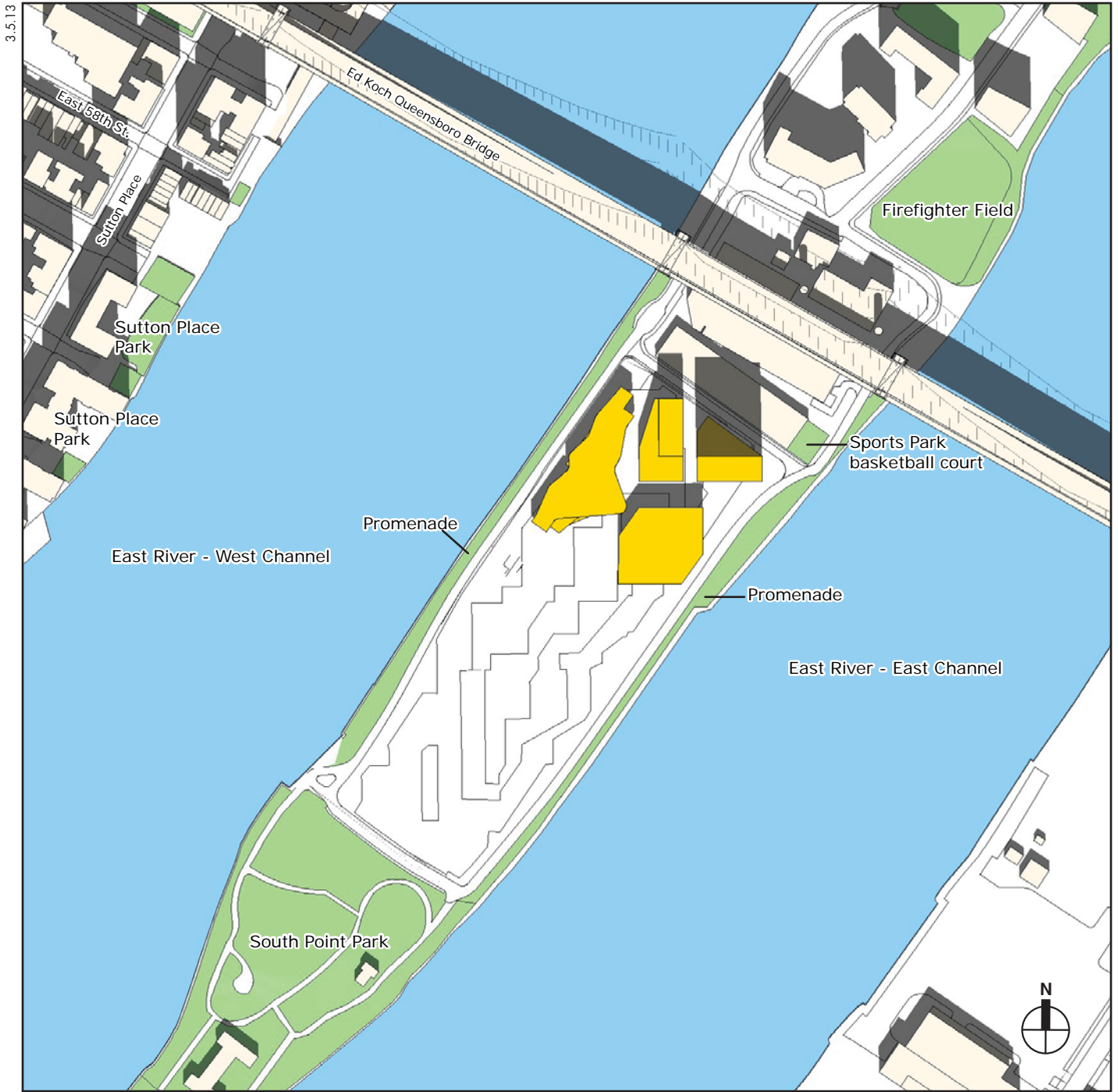


- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River

Notes: No incremental shadow on sun-sensitive resources would occur at this time.  
Daylight Saving Time not used.

Phase 1  
March 21/Sept. 21 - 11:00 AM  
**Figure 6-9**

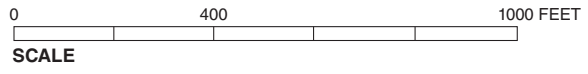
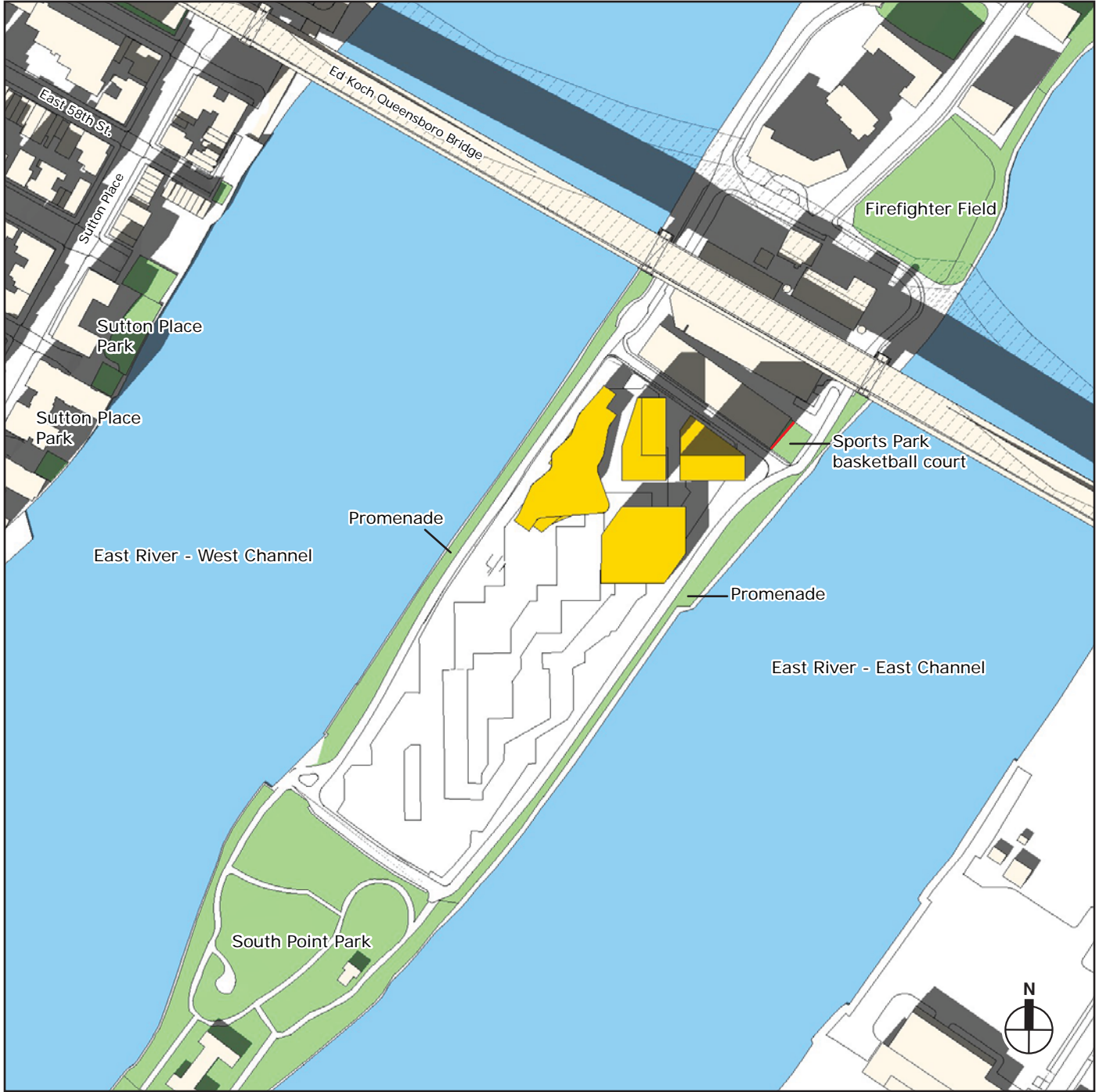




- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River

Notes: No incremental shadow on sun-sensitive resources would occur at this time.  
Daylight Saving Time not used.

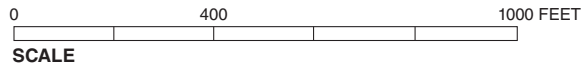
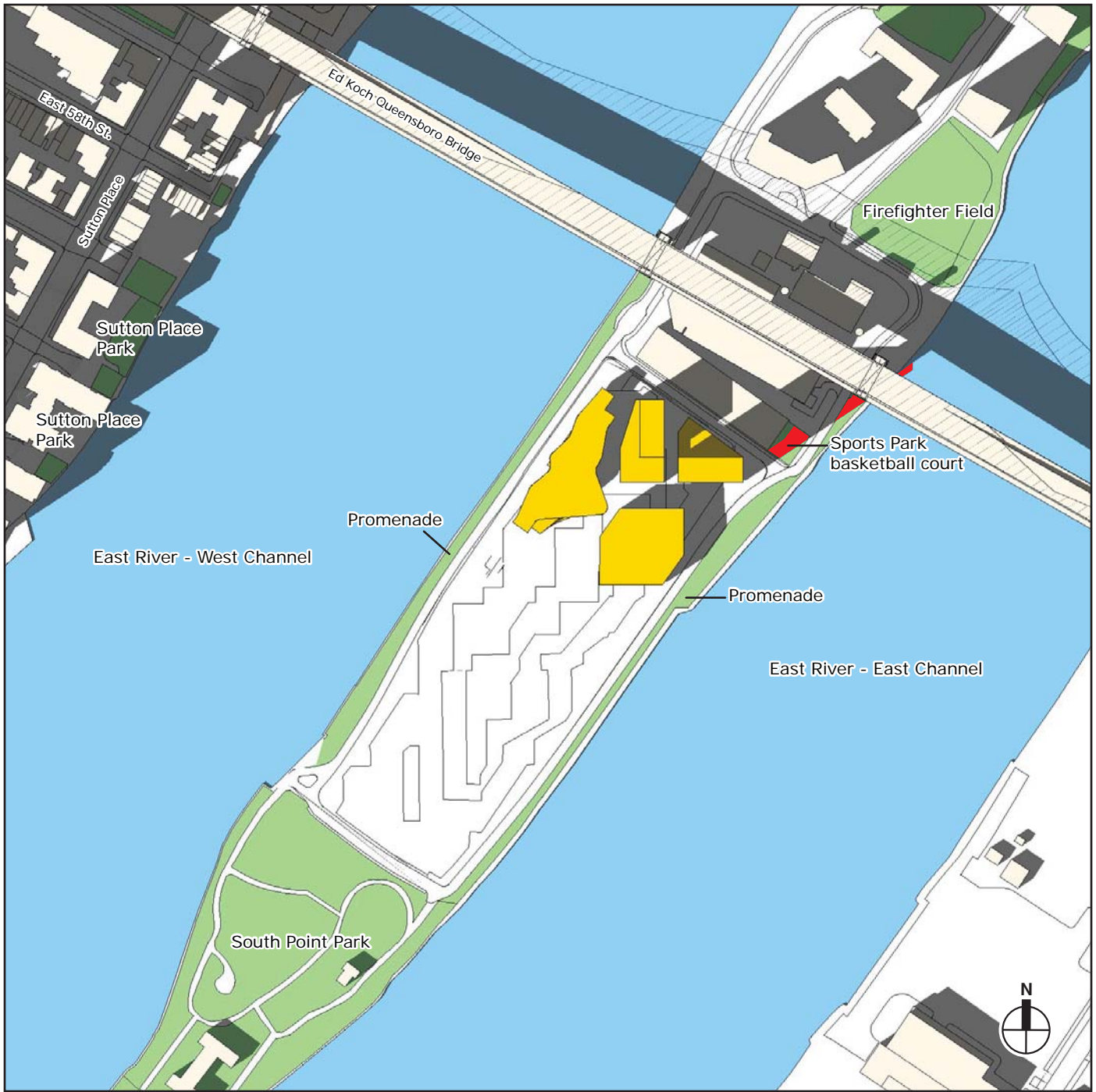
Phase 1  
March 21/Sept. 21 - 12:00 PM  
**Figure 6-10**



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.

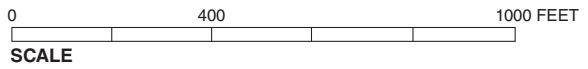
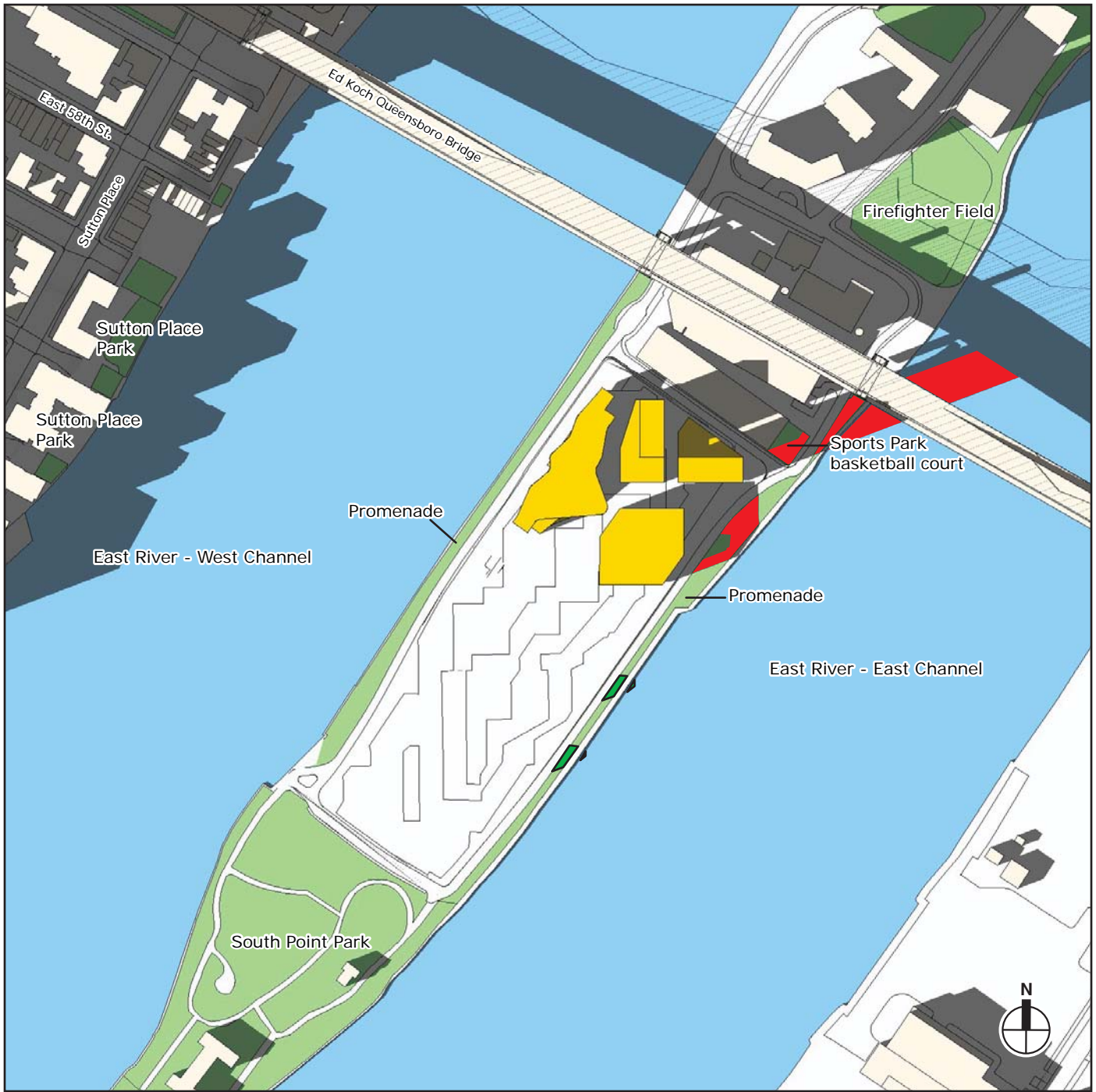
Phase 1  
March 21/Sept. 21 - 2:00 PM  
**Figure 6-11**



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.

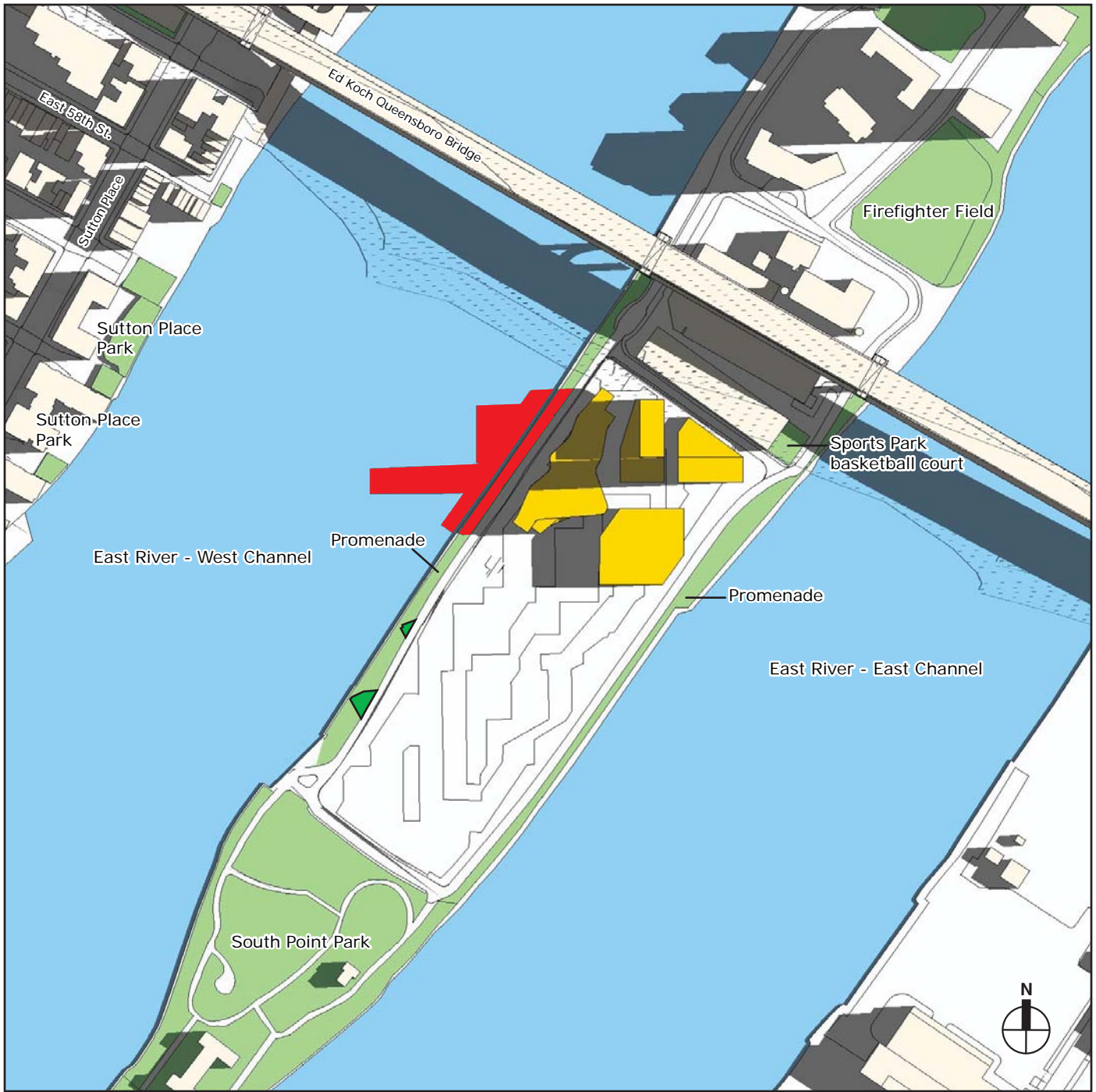
Phase 1  
 March 21/Sept. 21 - 3:00 PM  
**Figure 6-12**



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River
- Incremental Shadow
- Reduced Shadow (i.e. cast in Future No-Action but not with Proposed Project)

Note: Daylight Saving Time not used.

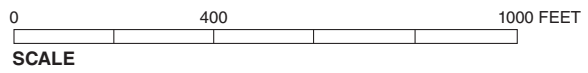
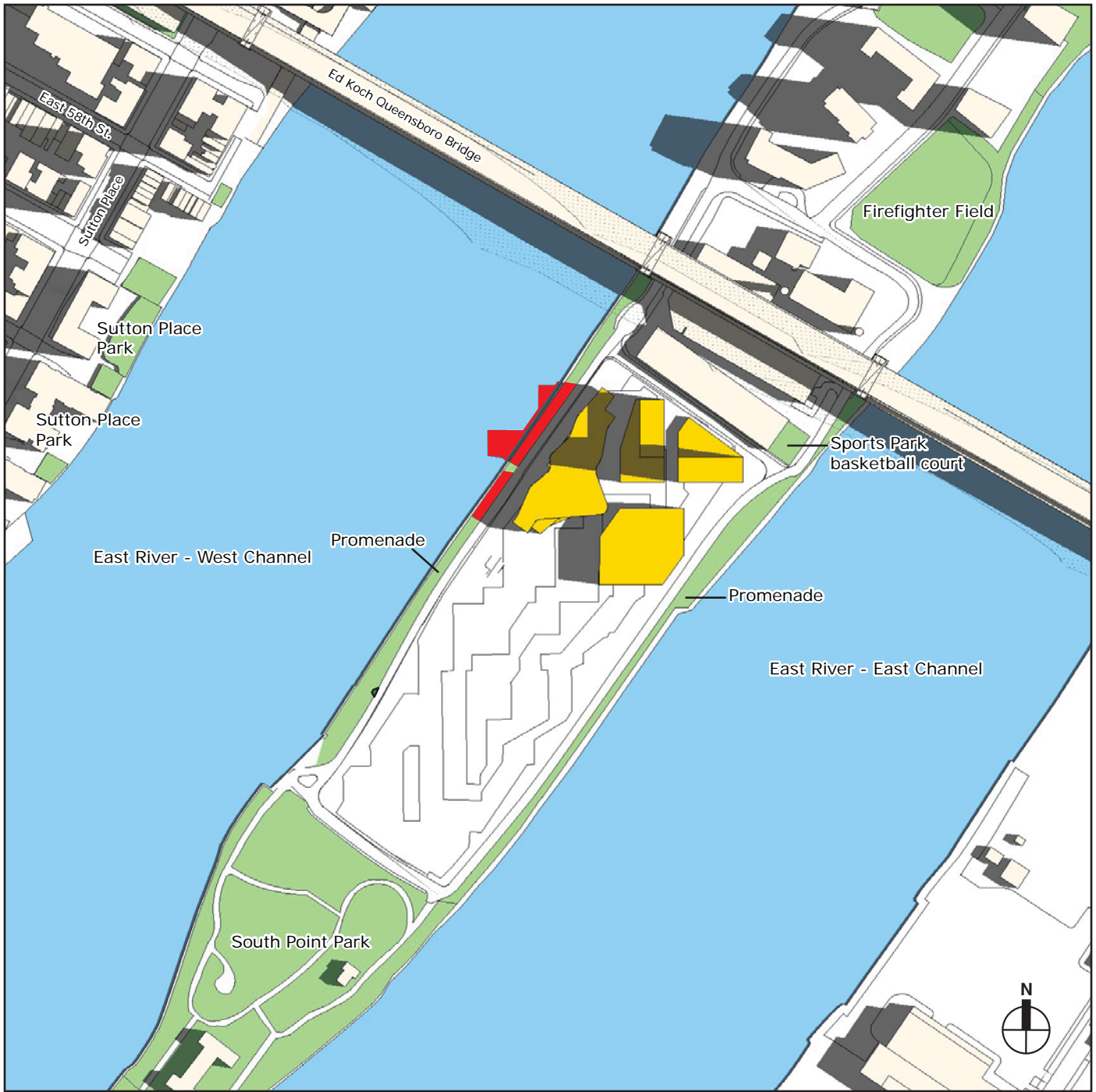
Phase 1  
 March 21/Sept. 21 - 4:00 PM  
**Figure 6-13**



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River
- Incremental Shadow
- Reduced Shadow (i.e. cast in Future No-Action but not with Proposed Project)

Note: Daylight Saving Time not used.

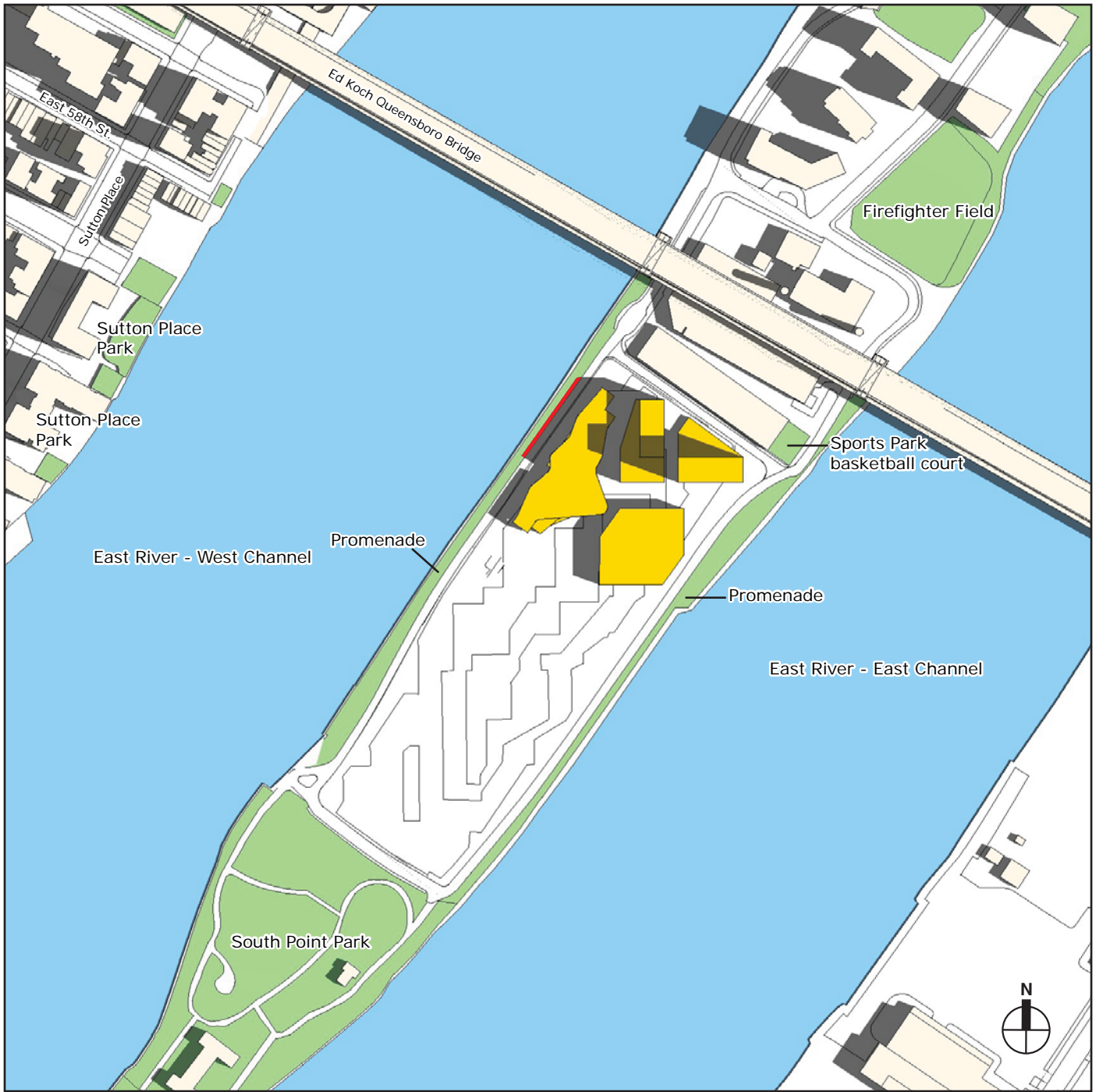
Phase 1  
 May 6/August 6 - 7:00 AM  
**Figure 6-14**



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River
- Incremental Shadow
- Reduced Shadow (i.e. cast in Future No-Action but not with Proposed Project)

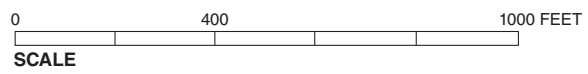
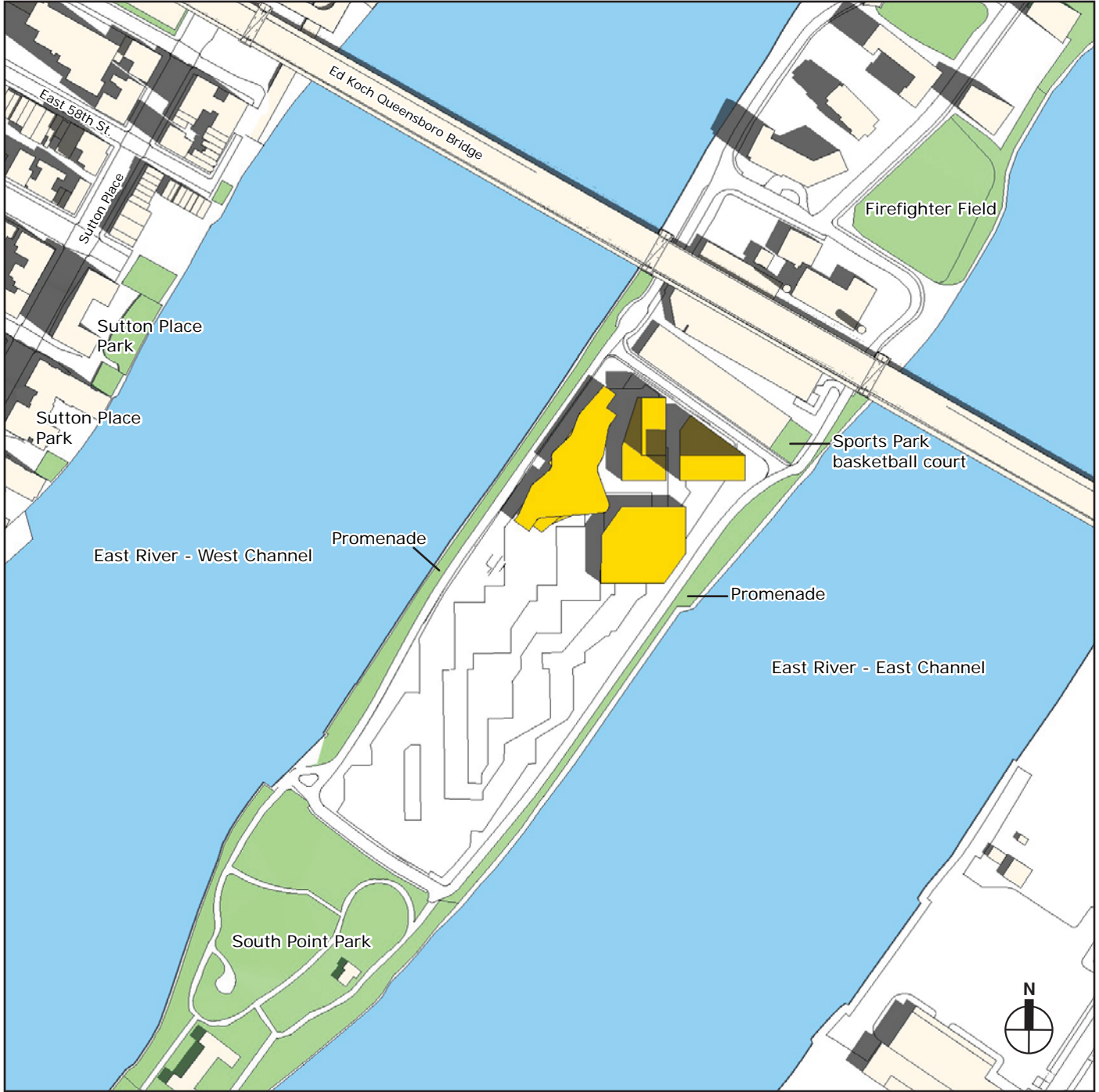
Note: Daylight Saving Time not used.

Phase 1  
 May 6/August 6 - 8:00 AM  
**Figure 6-15**



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.

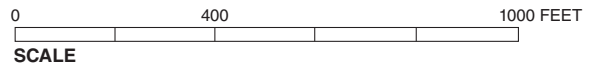
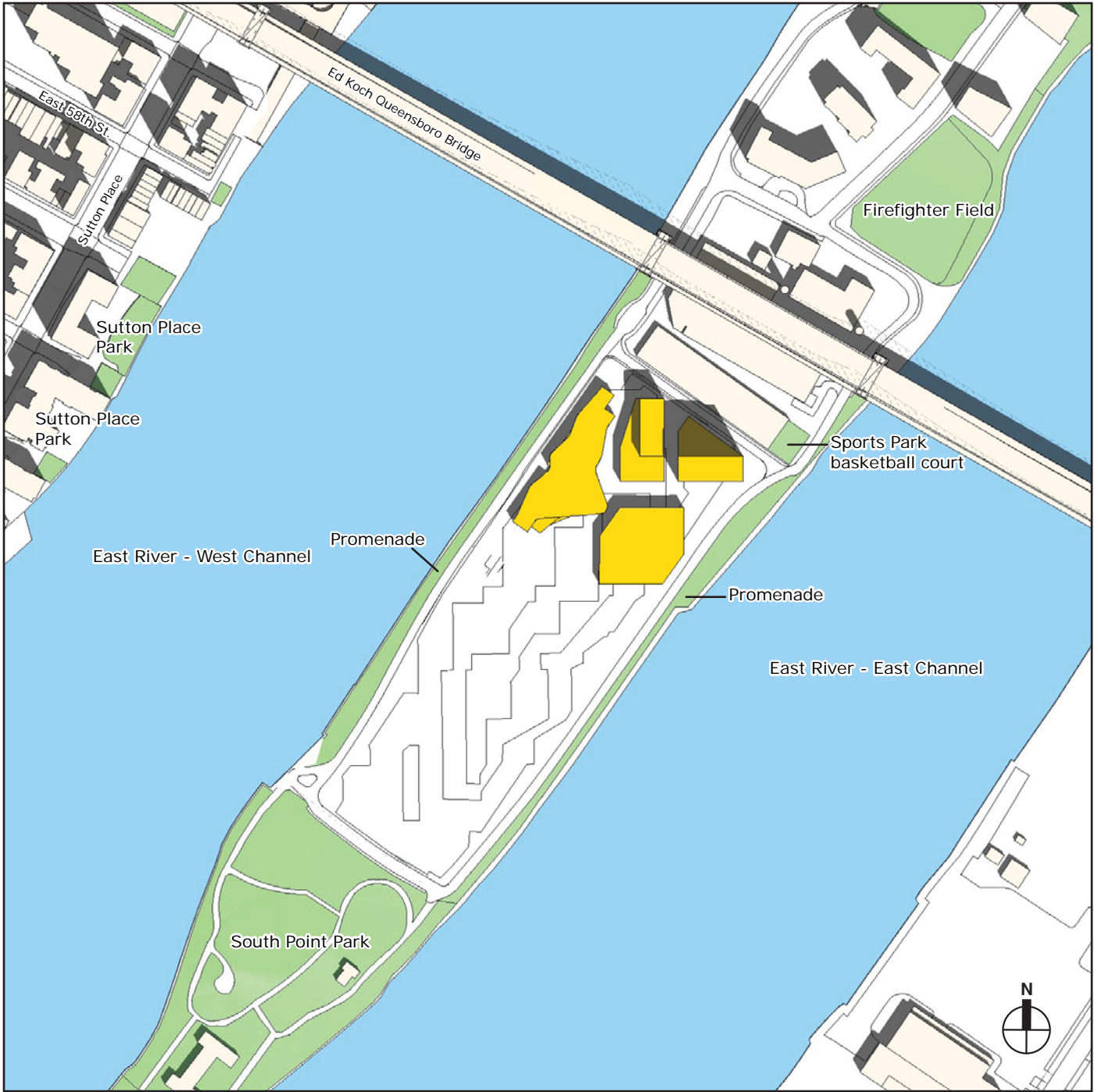


- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River

Notes: No incremental shadow on sun-sensitive resources would occur at this time.  
Daylight Saving Time not used.

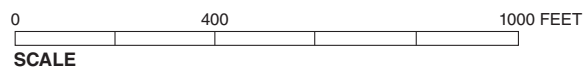
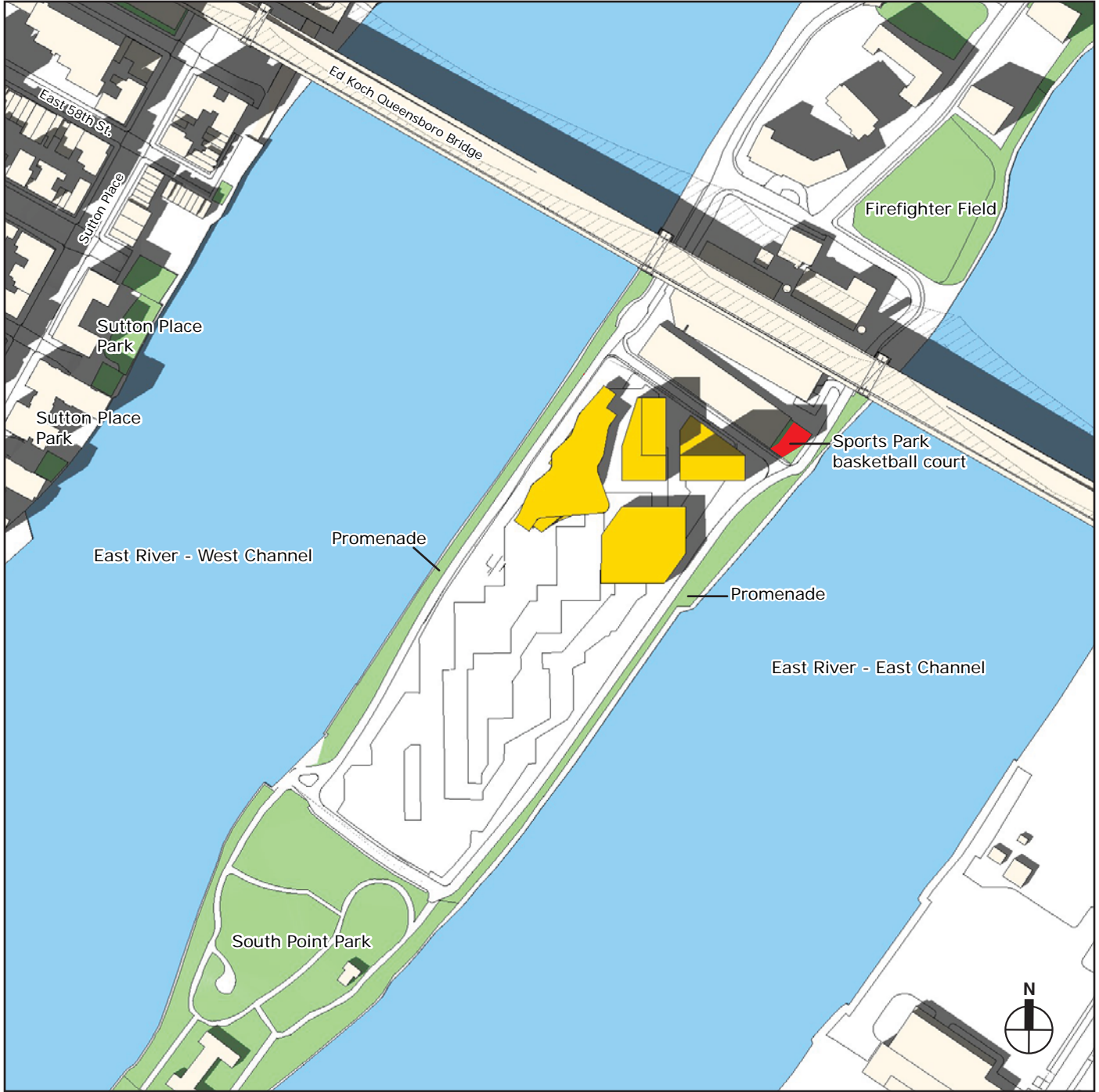
Phase 1  
May 6/August 6 - 10:00 AM  
**Figure 6-17**





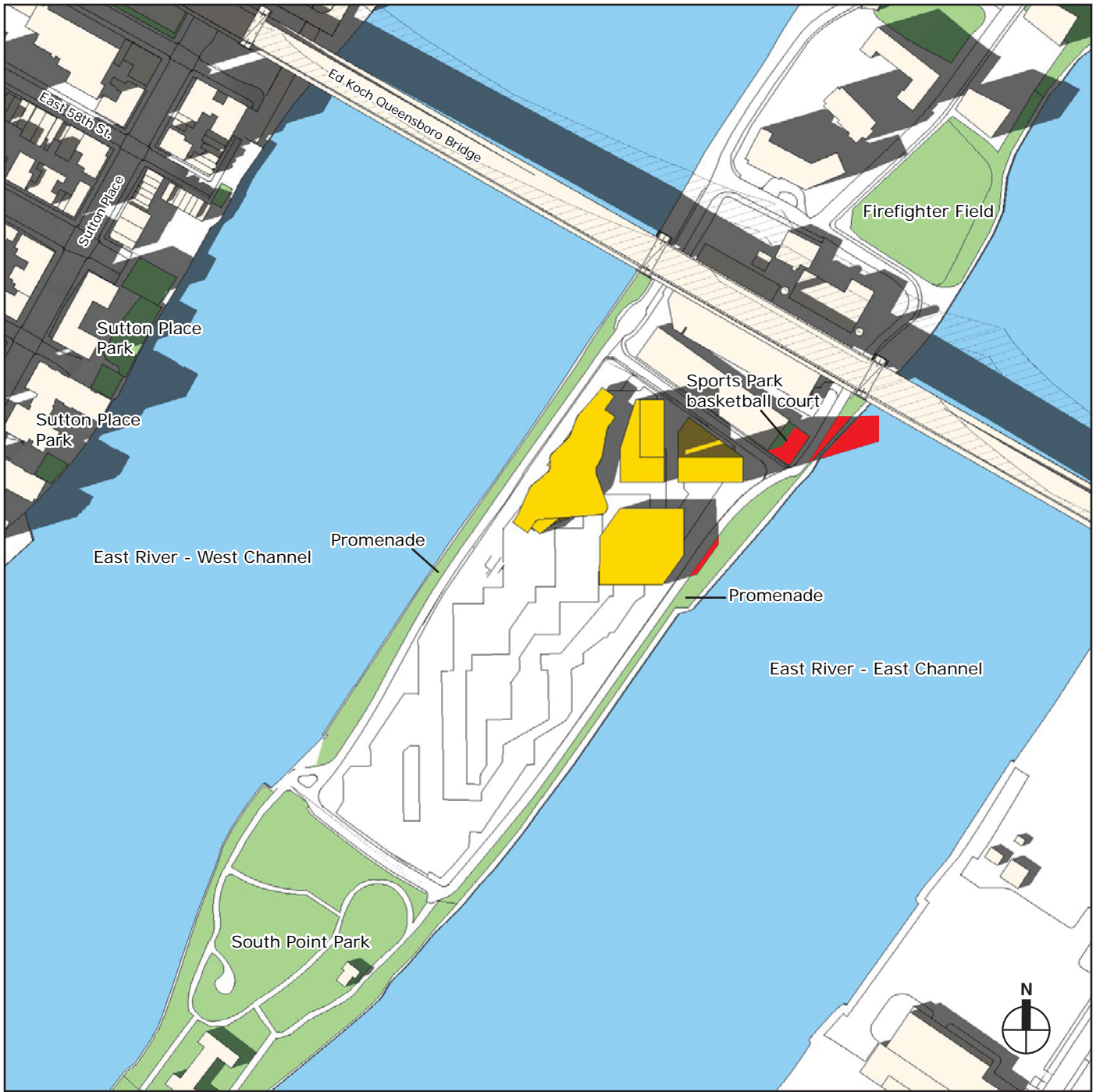
- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River

Notes: No incremental shadow on sun-sensitive resources would occur at this time.  
Daylight Saving Time not used.



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

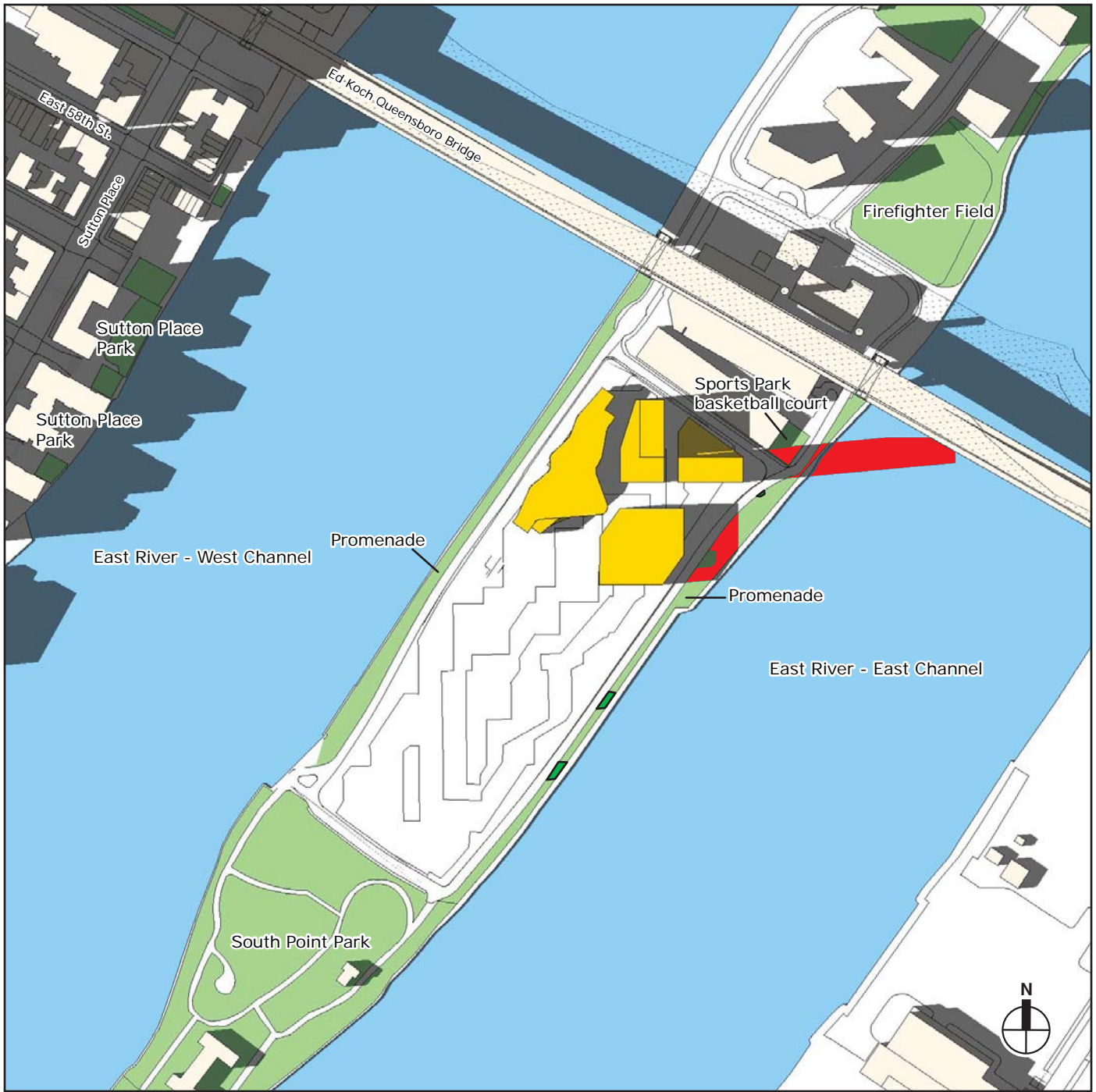
Note: Daylight Saving Time not used.



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.

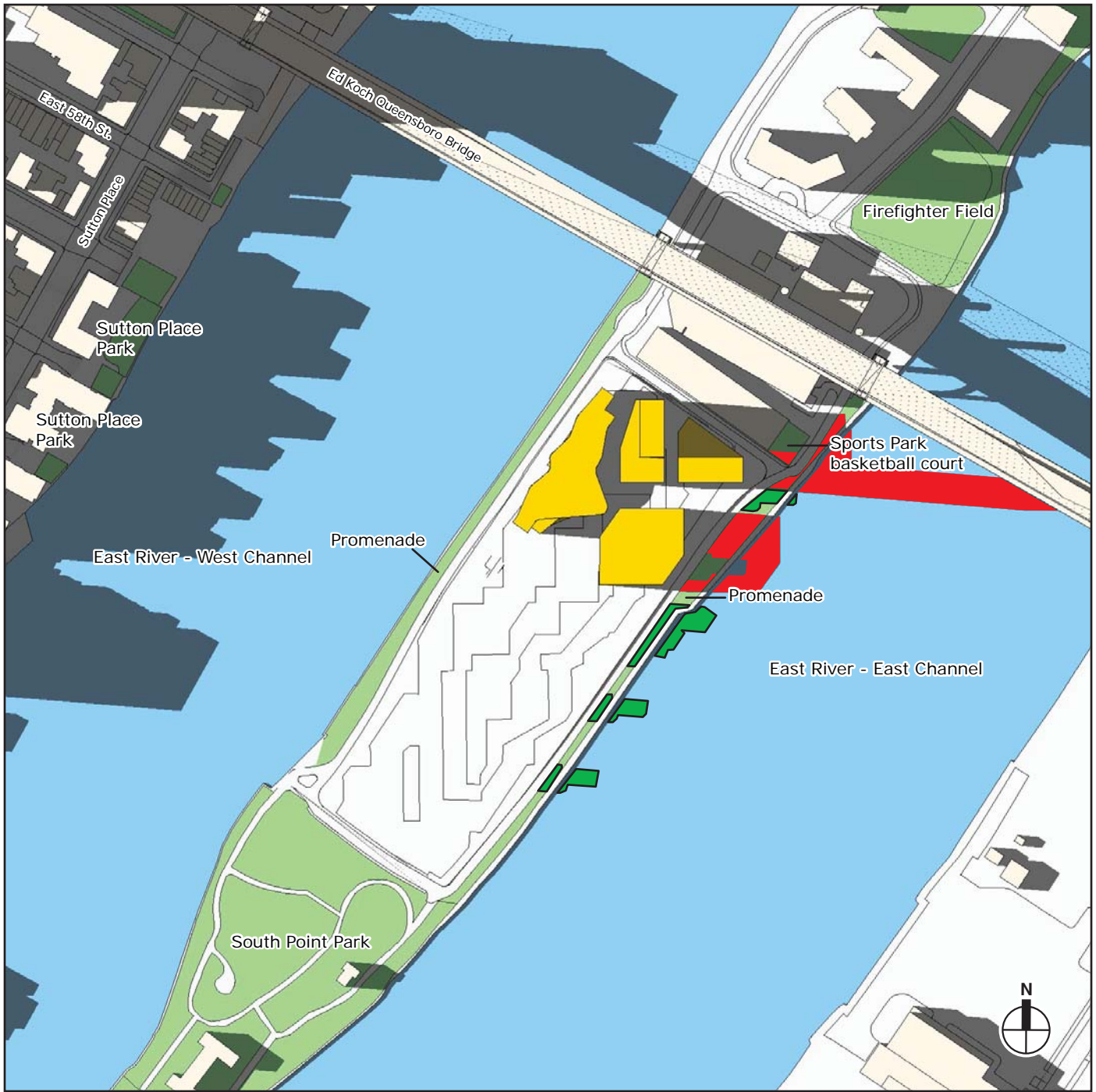
Phase 1  
May 6/August 6 - 3:00 PM  
**Figure 6-20**



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River
- Incremental Shadow
- Reduced Shadow (i.e. cast in Future No-Action but not with Proposed Project)

Note: Daylight Saving Time not used.

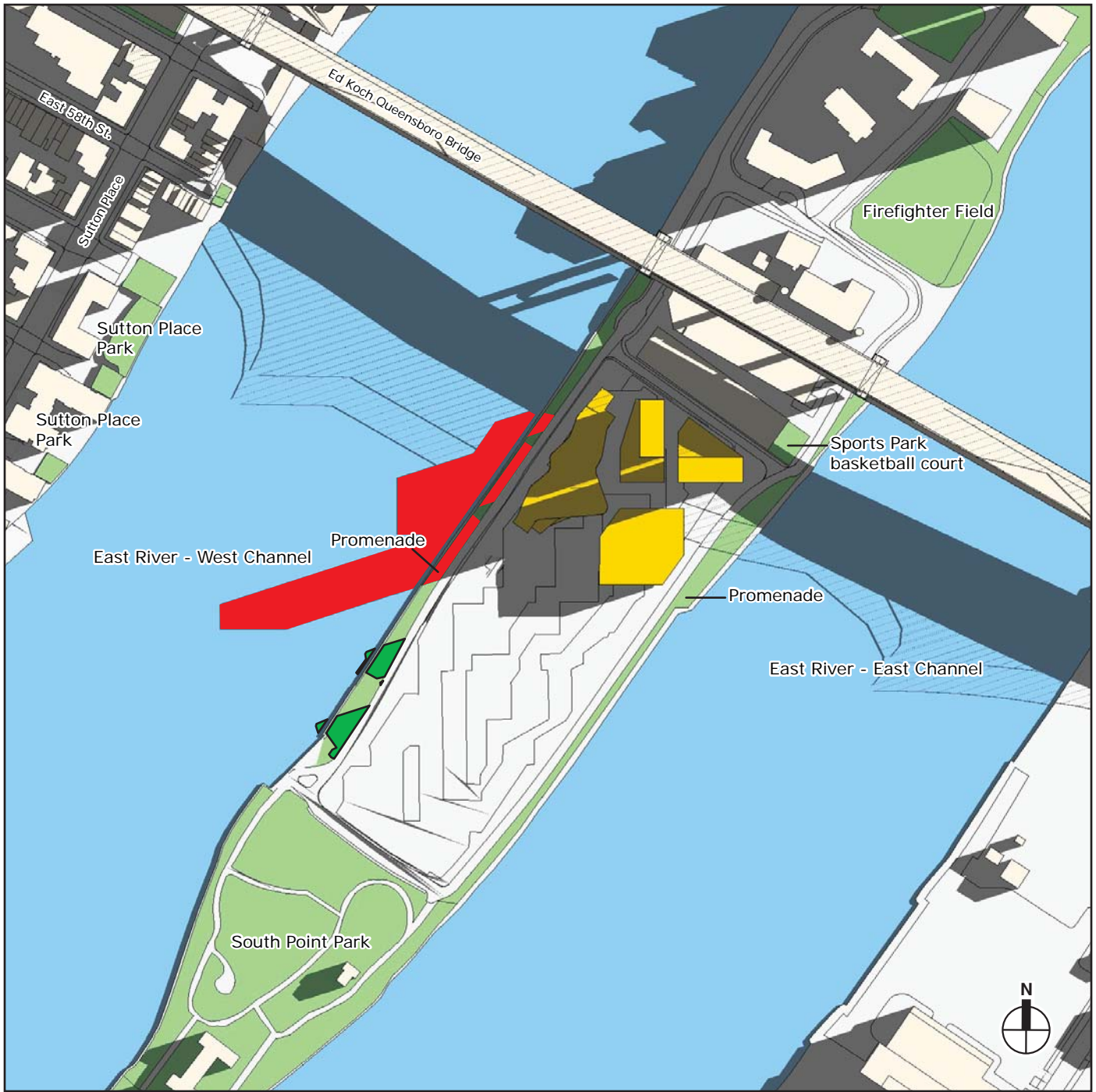
Phase 1  
May 6/August 6 - 4:00 PM  
**Figure 6-21**



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River
- Incremental Shadow
- Reduced Shadow (i.e. cast in Future No-Action but not with Proposed Project)

Note: Daylight Saving Time not used.

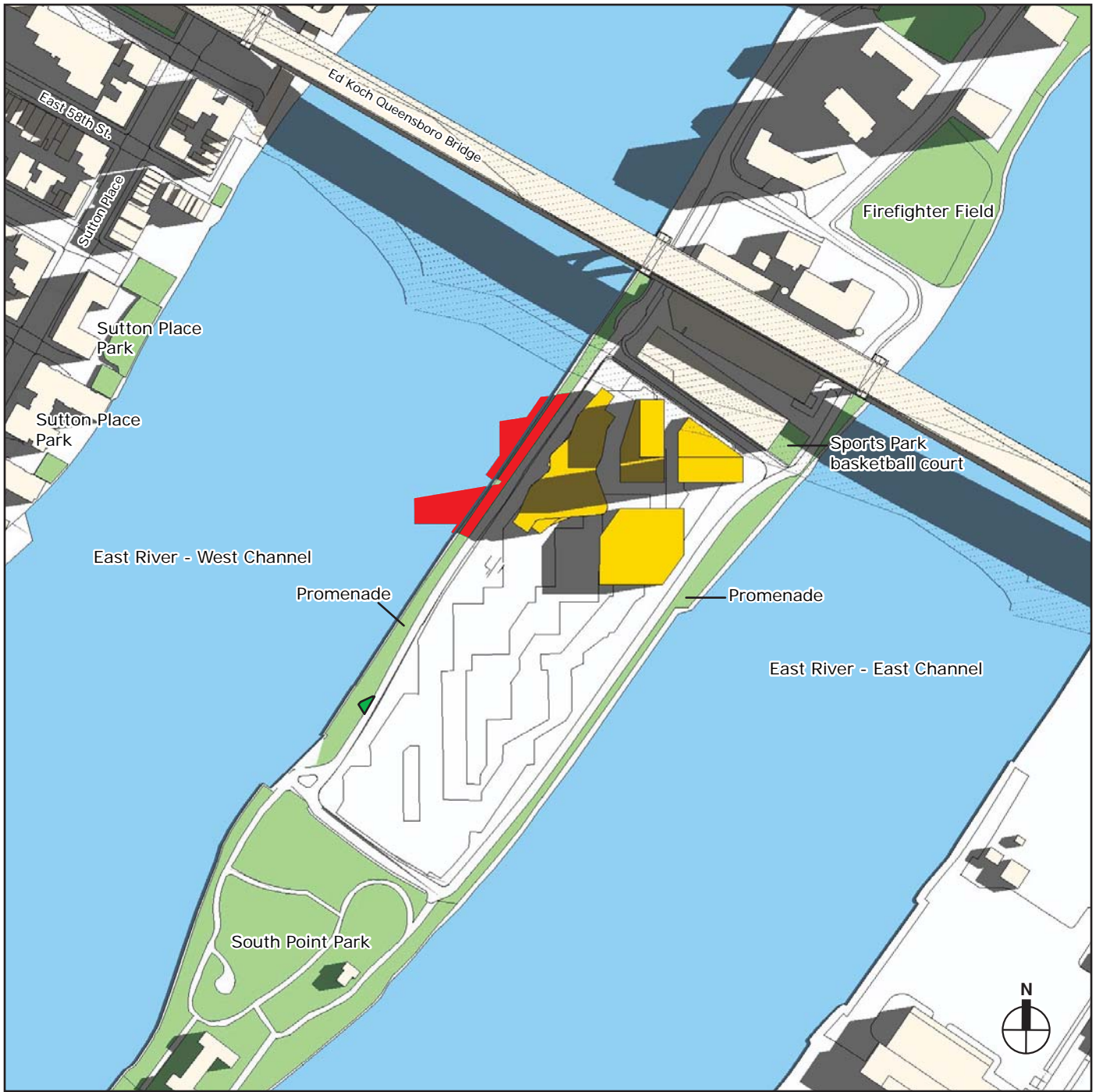
Phase 1  
 May 6/August 6 - 5:00 PM  
**Figure 6-22**



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River
- Incremental Shadow
- Reduced Shadow (i.e. cast in Future No-Action but not with Proposed Project)

Note: Daylight Saving Time not used.

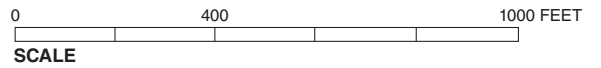
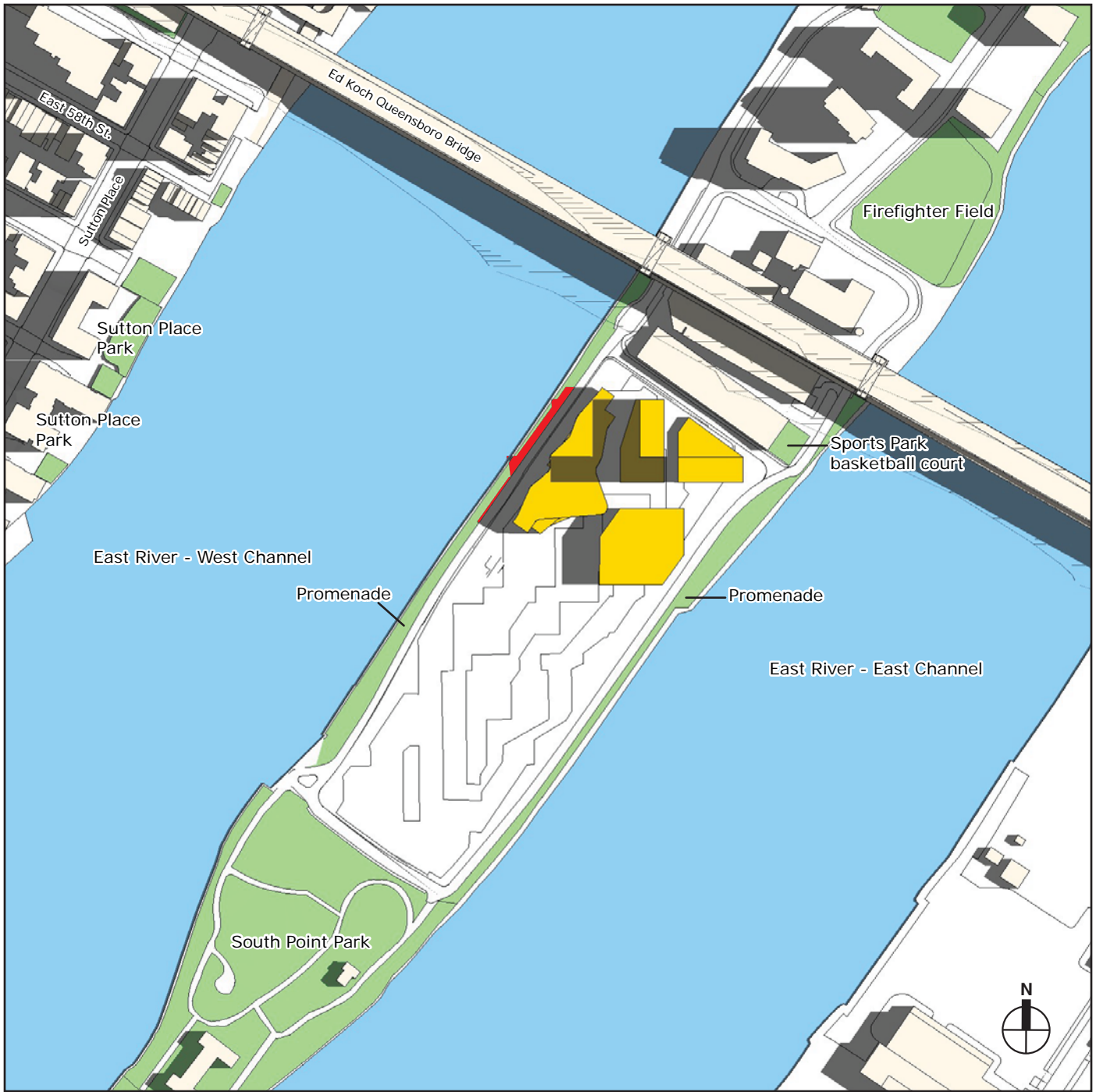
Phase 1  
 June 21 - 6:00 AM  
**Figure 6-23**



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River
- Incremental Shadow
- Reduced Shadow (i.e. cast in Future No-Action but not with Proposed Project)

Note: Daylight Saving Time not used.

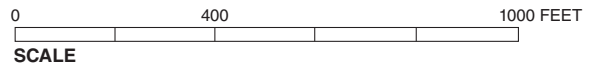
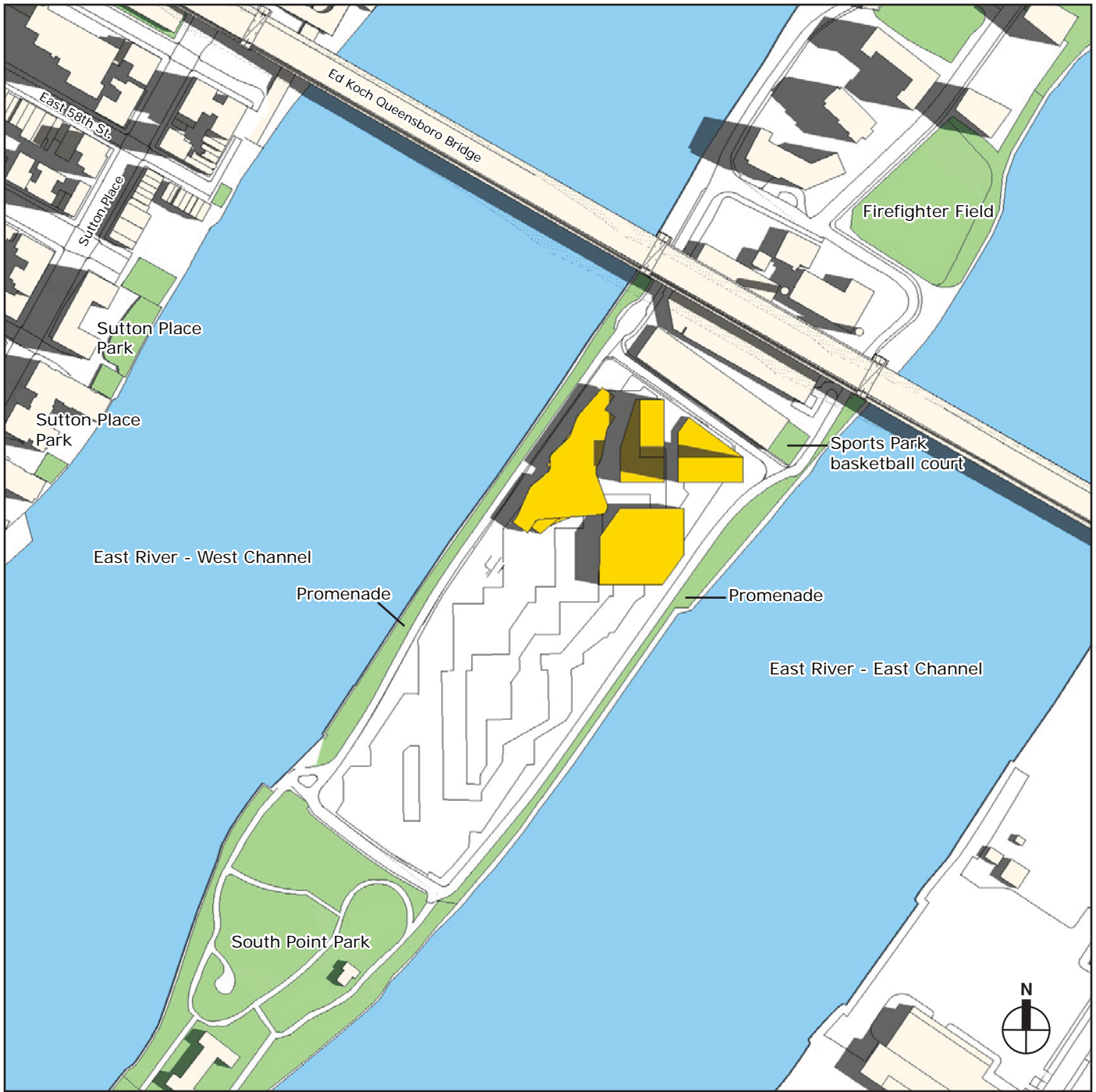
Phase 1  
June 21 - 7:00 AM  
**Figure 6-24**



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

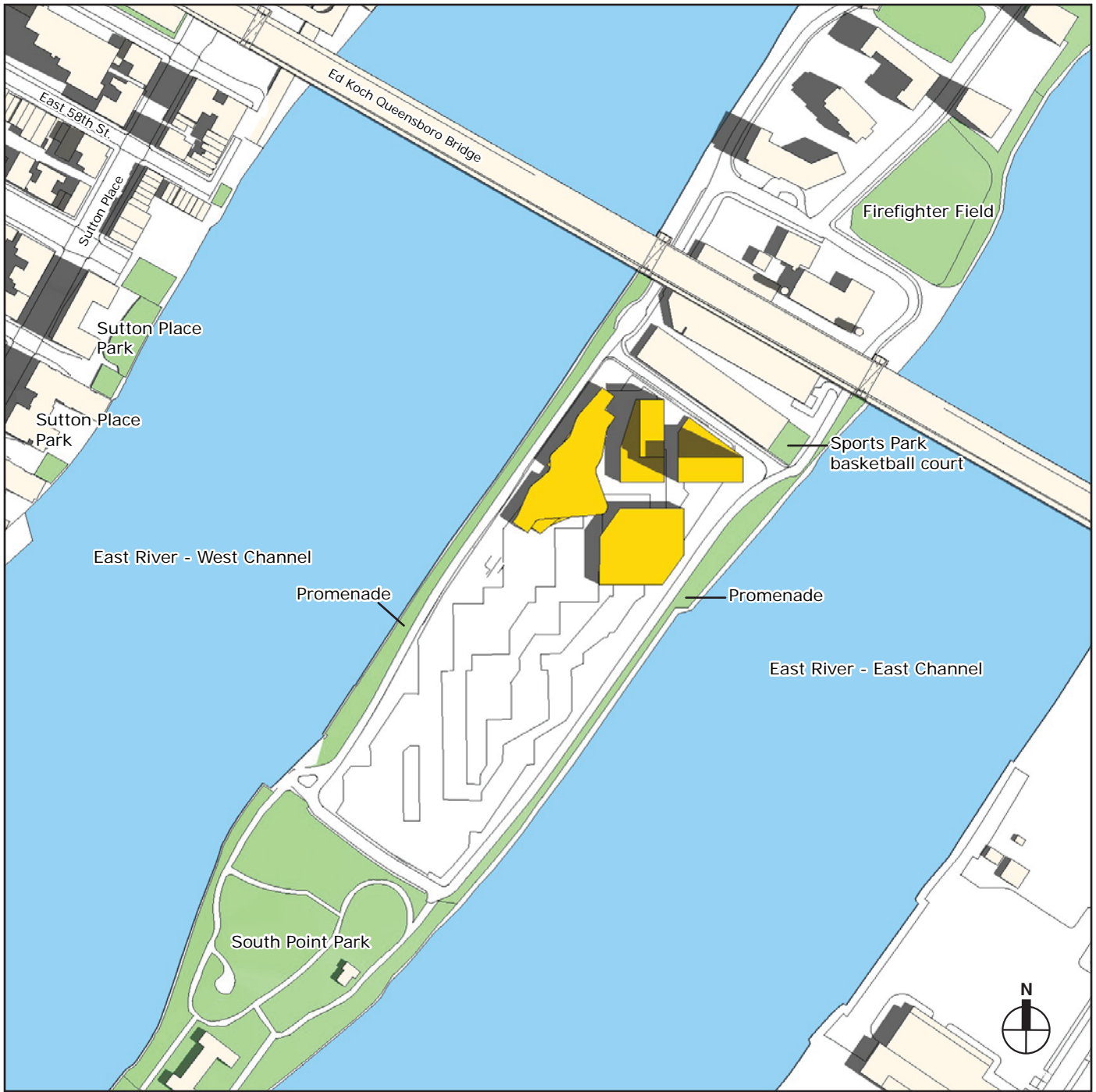
Note: Daylight Saving Time not used.





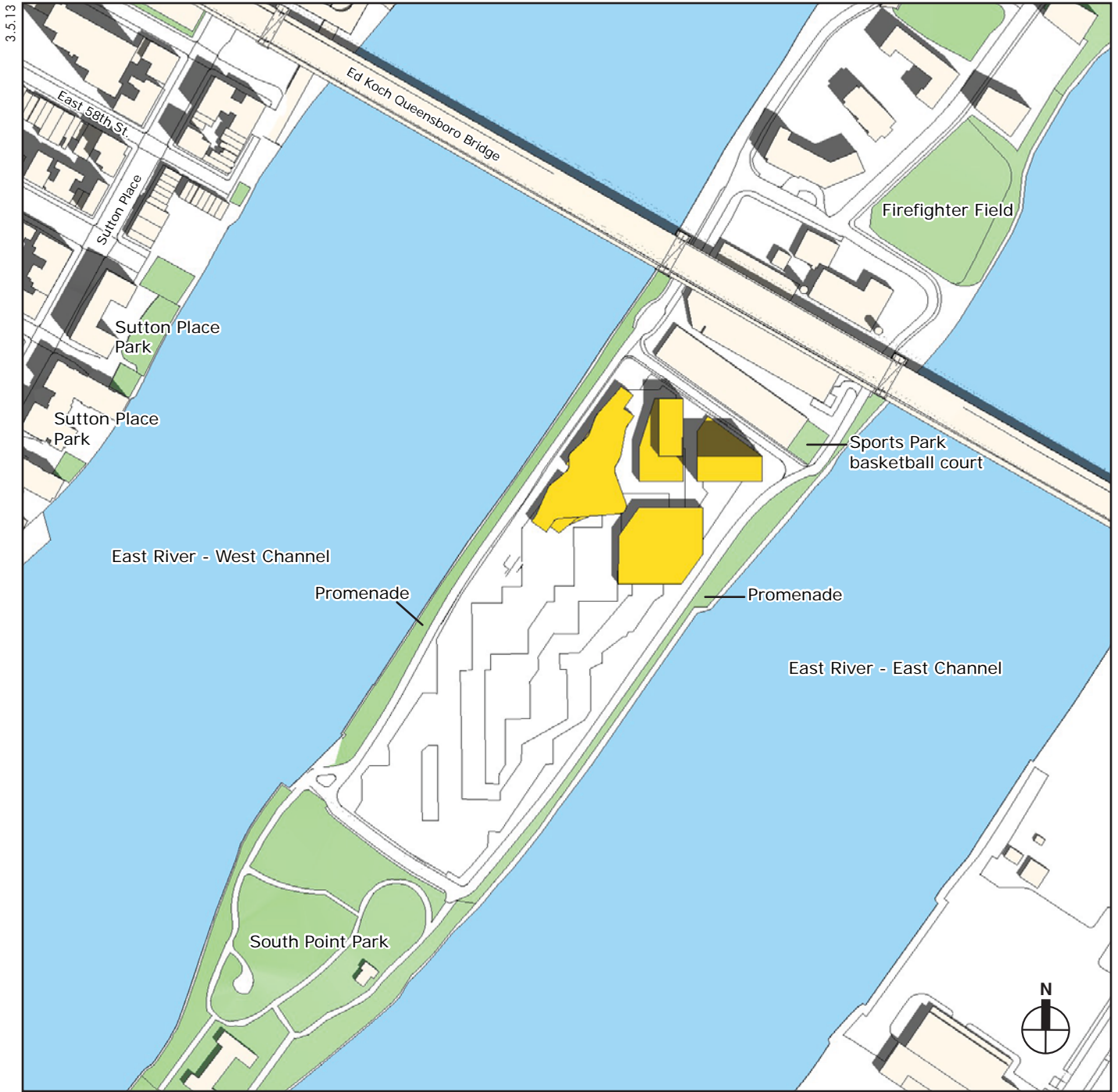
- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River

Notes: No incremental shadow on sun-sensitive resources would occur at this time.  
Daylight Saving Time not used.



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River

Notes: No incremental shadow on sun-sensitive resources would occur at this time.  
Daylight Saving Time not used.

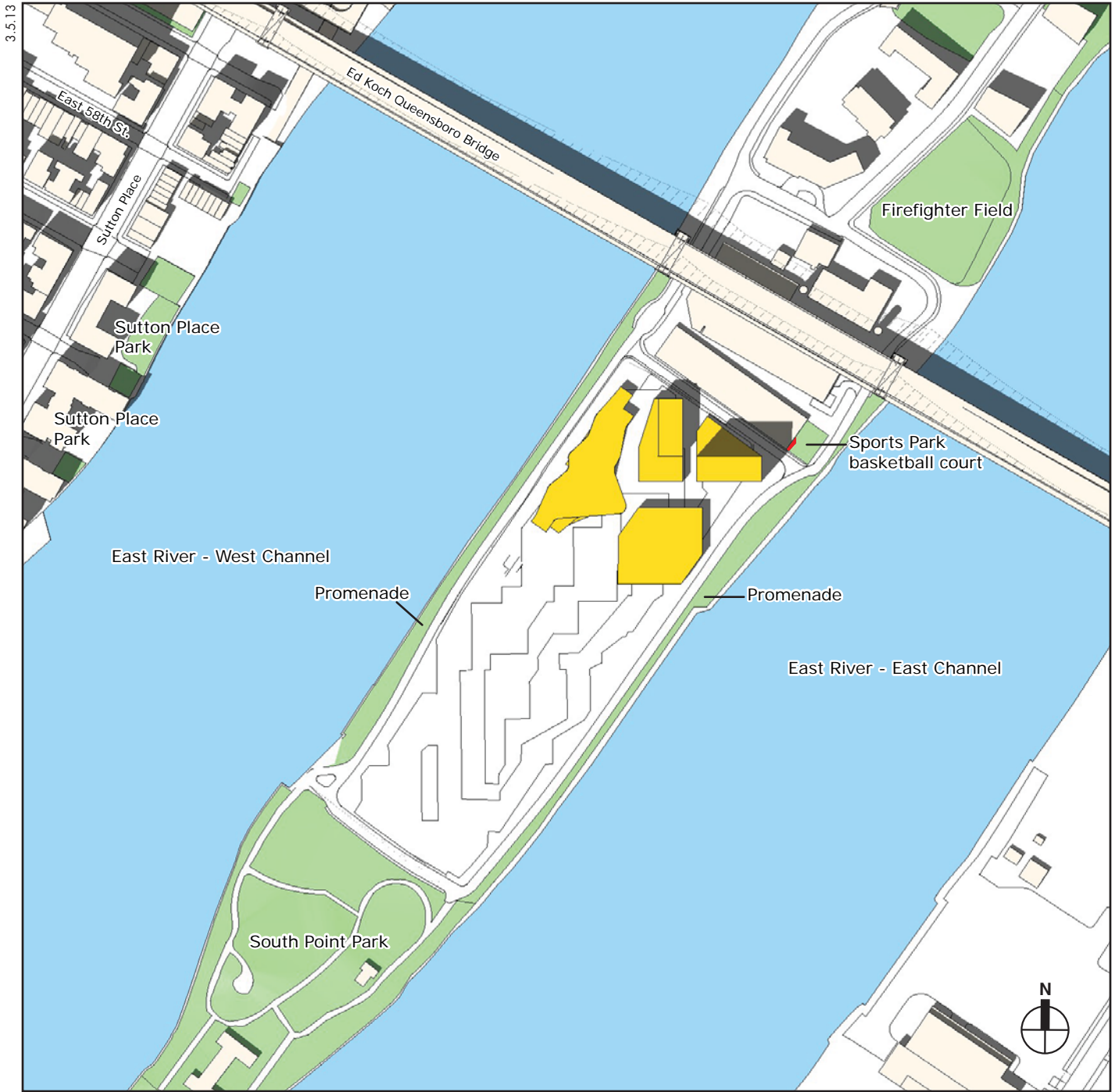


3.5.13

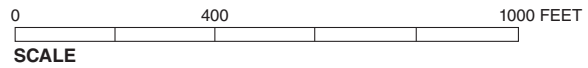


- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River

Notes: No incremental shadow on sun-sensitive resources would occur at this time.  
Daylight Saving Time not used.

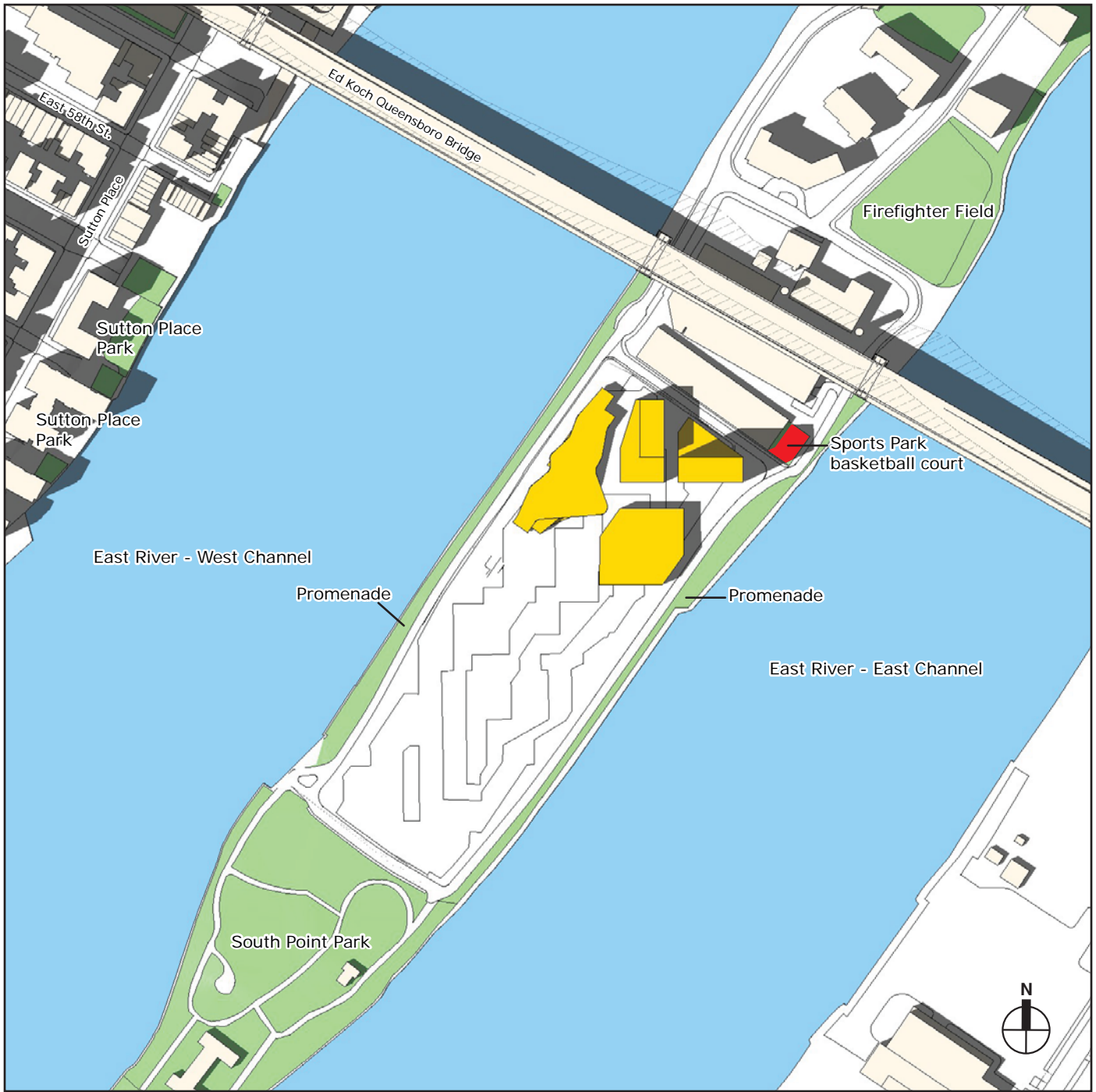


3.5.13



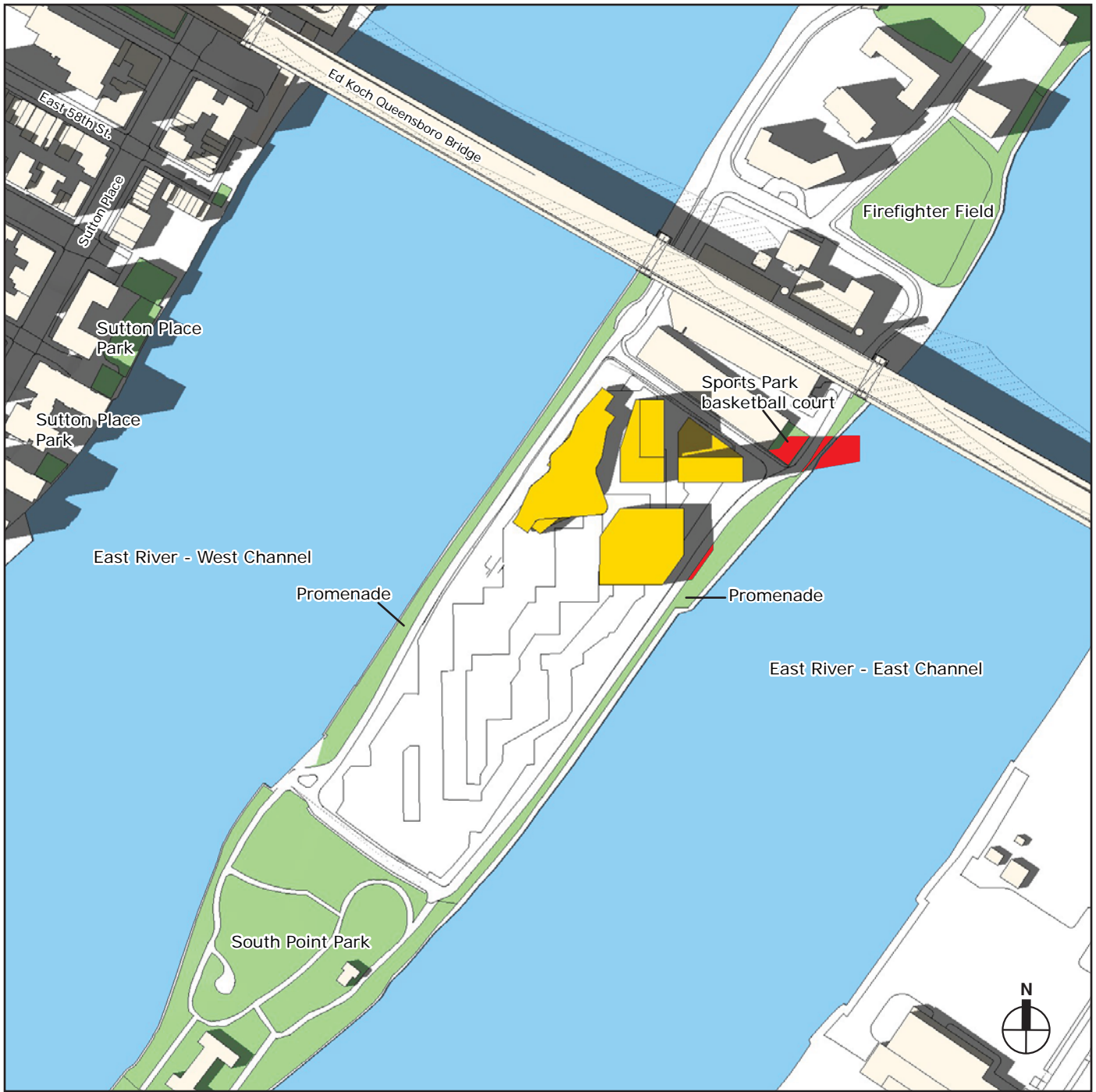
- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.



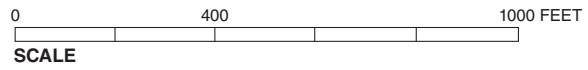
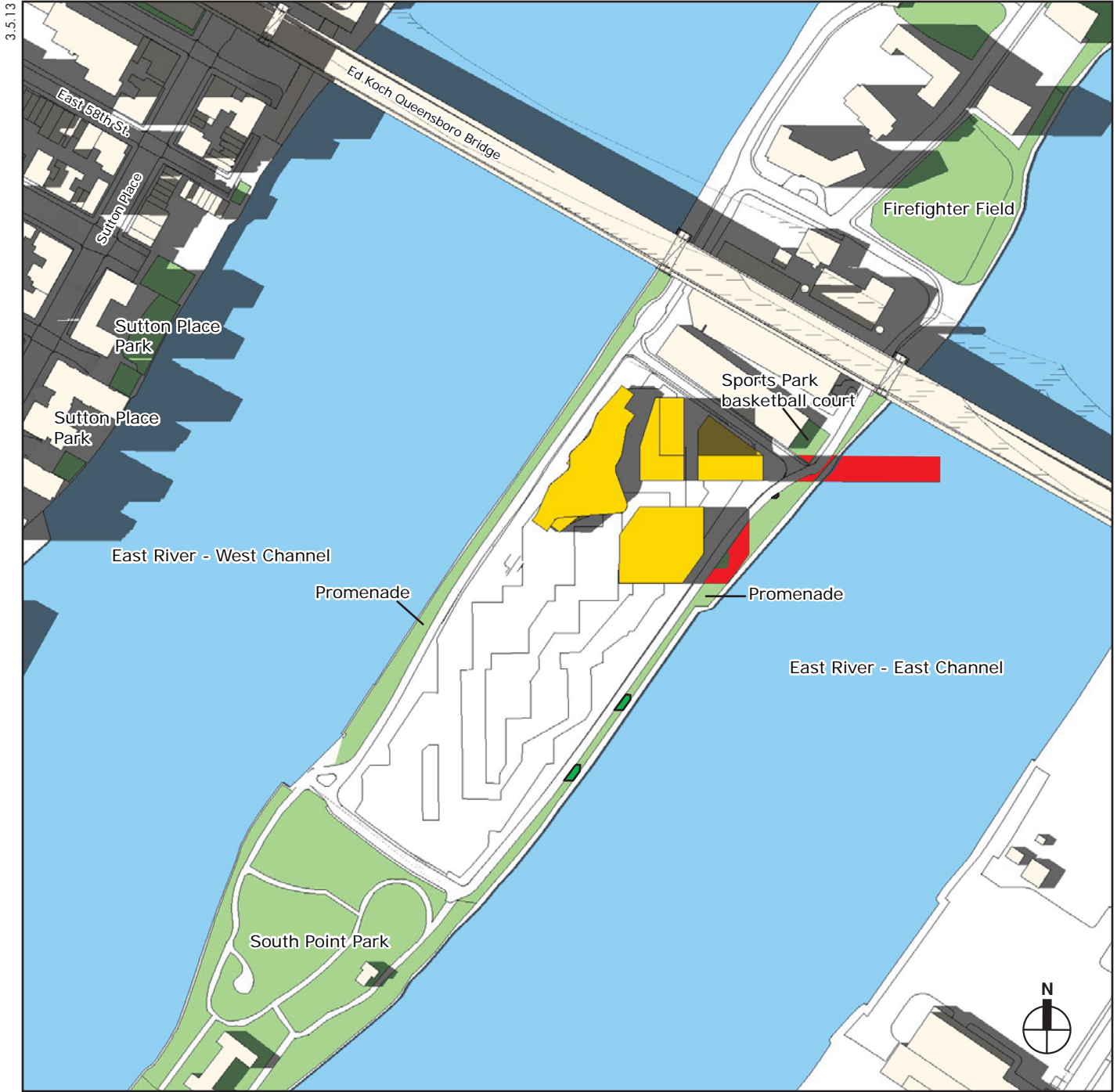
- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

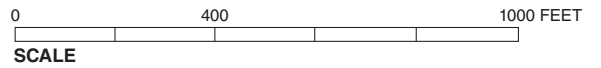
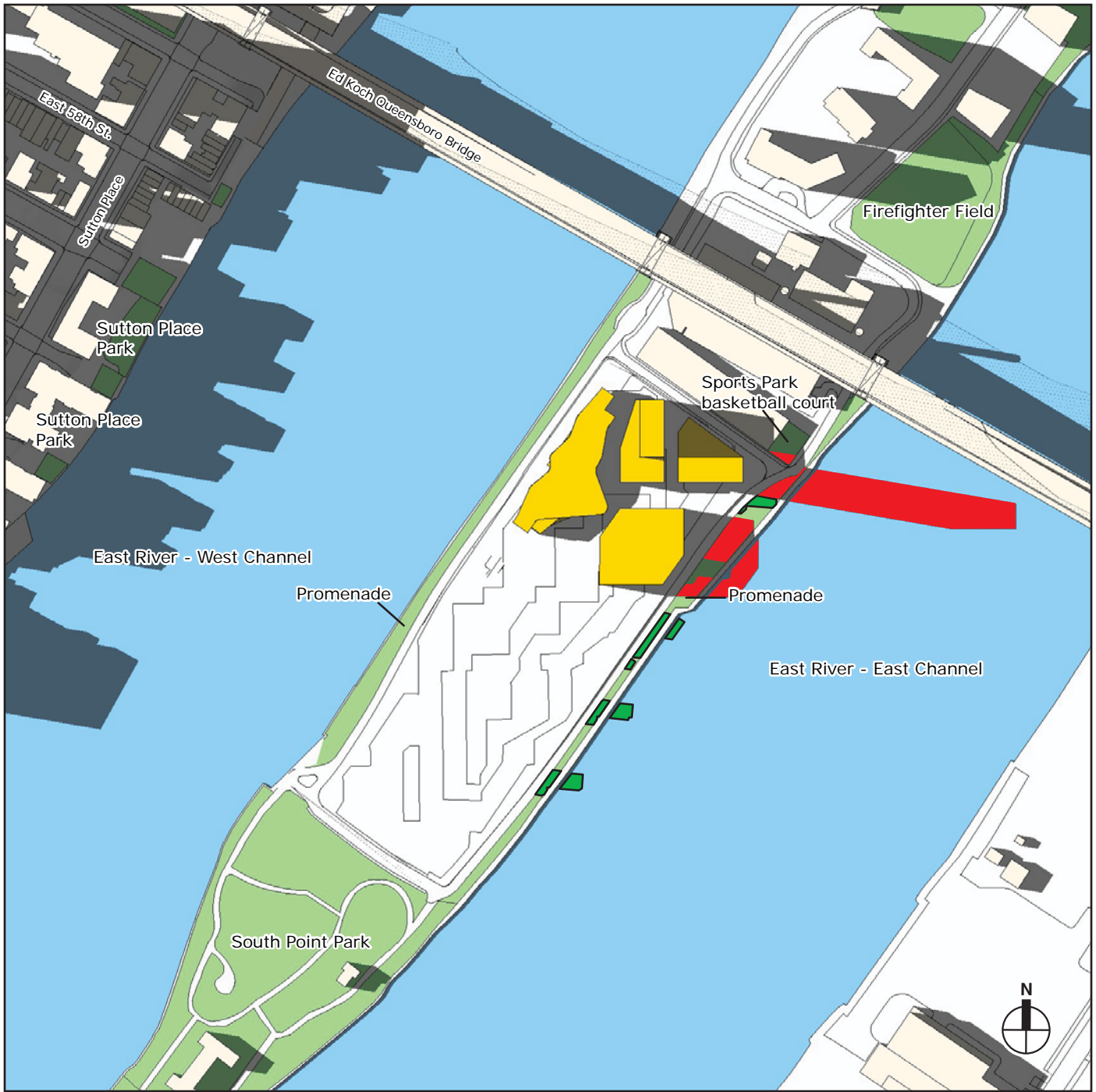
Note: Daylight Saving Time not used.



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River
- Incremental Shadow
- Reduced Shadow (i.e. cast in Future No-Action but not with Proposed Project)

Note: Daylight Saving Time not used.

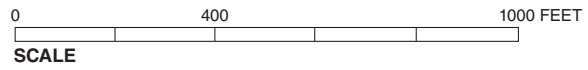
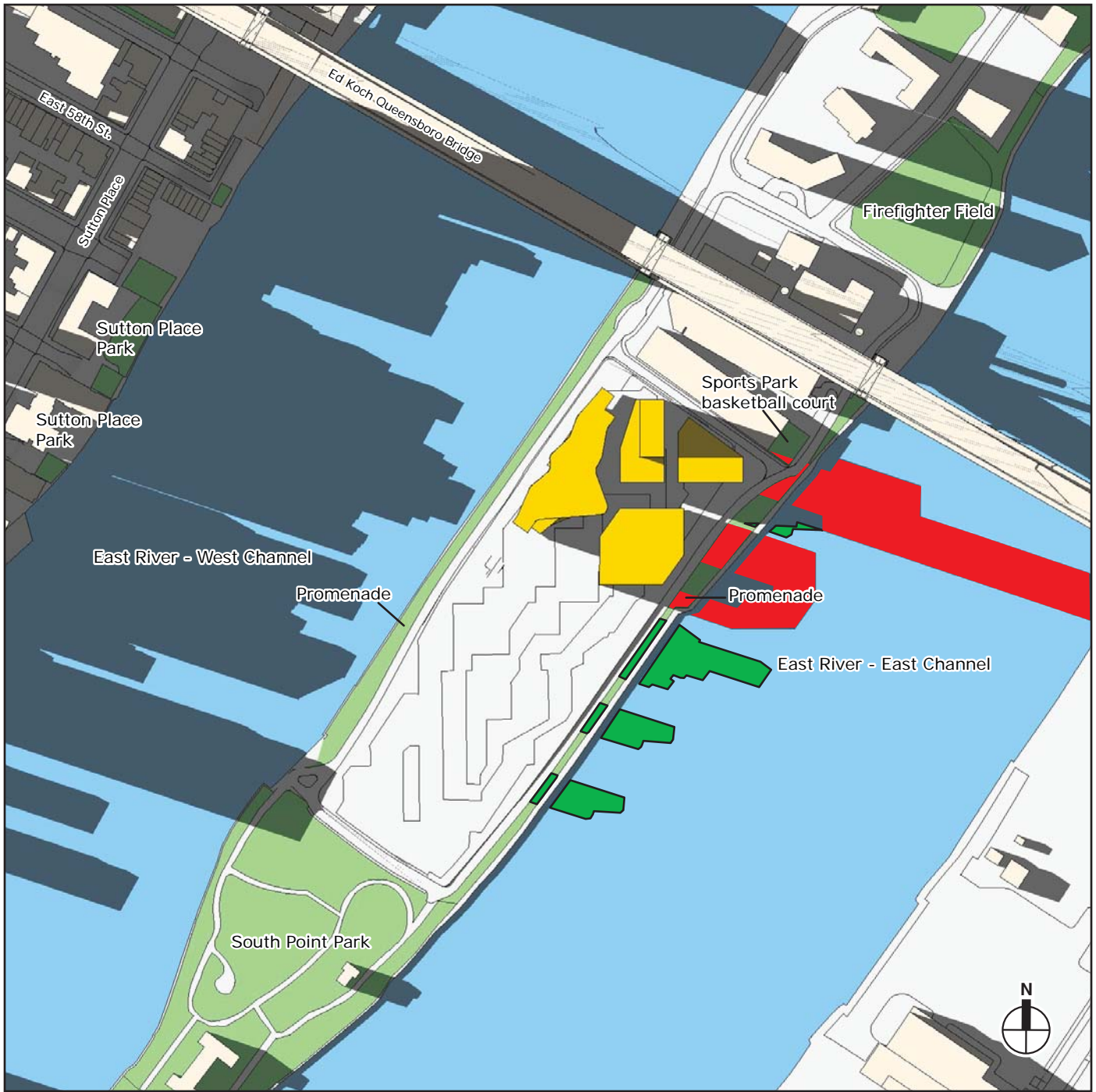
Phase 1  
 June 21 - 4:00 PM  
**Figure 6-32**



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River
- Incremental Shadow
- Reduced Shadow (i.e. cast in Future No-Action but not with Proposed Project)

Note: Daylight Saving Time not used.

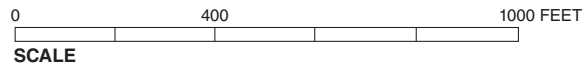
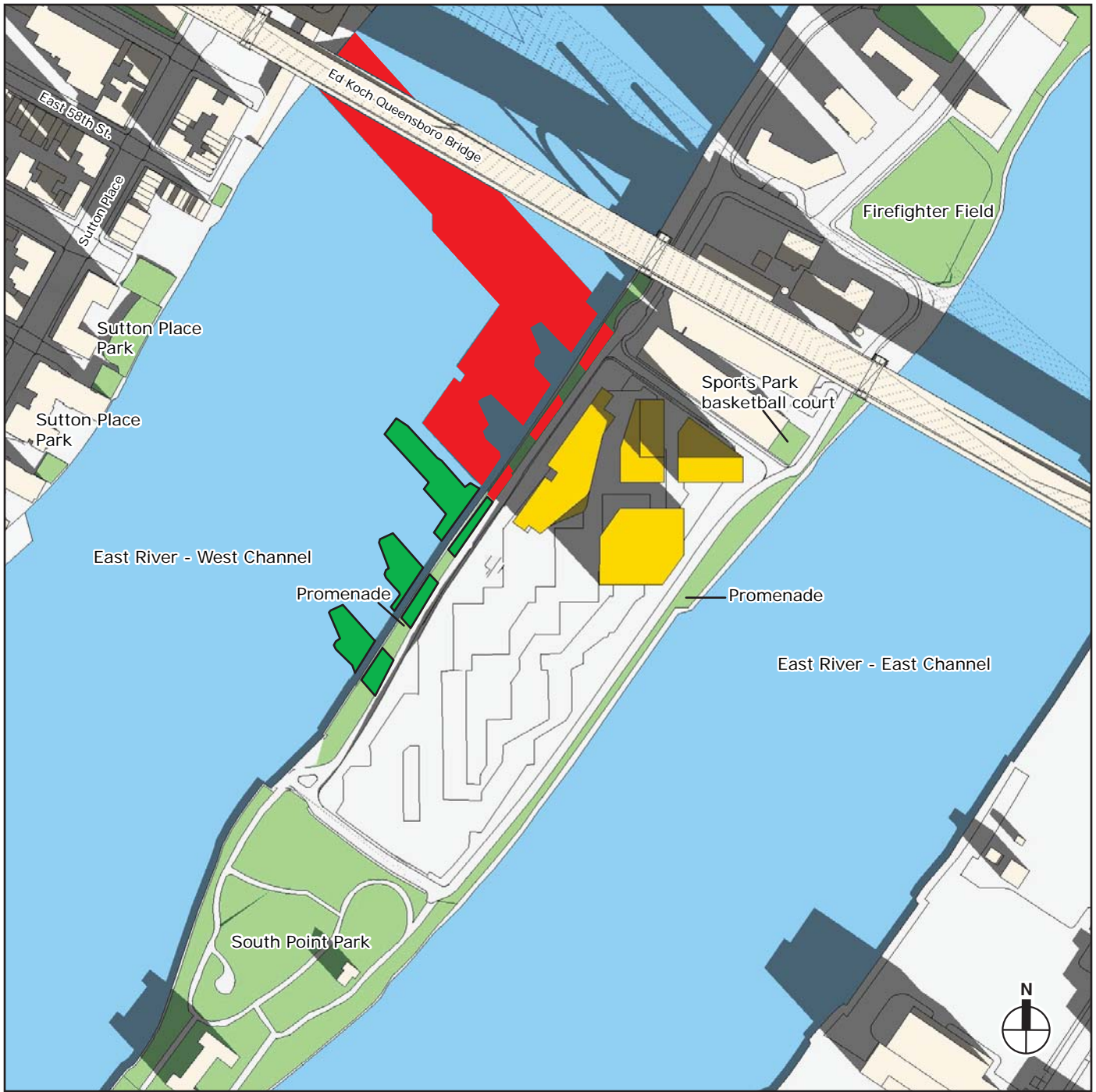




- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River
- Incremental Shadow
- Reduced Shadow (i.e. cast in Future No-Action but not with Proposed Project)

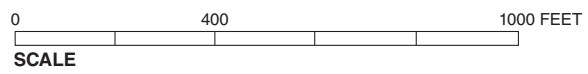
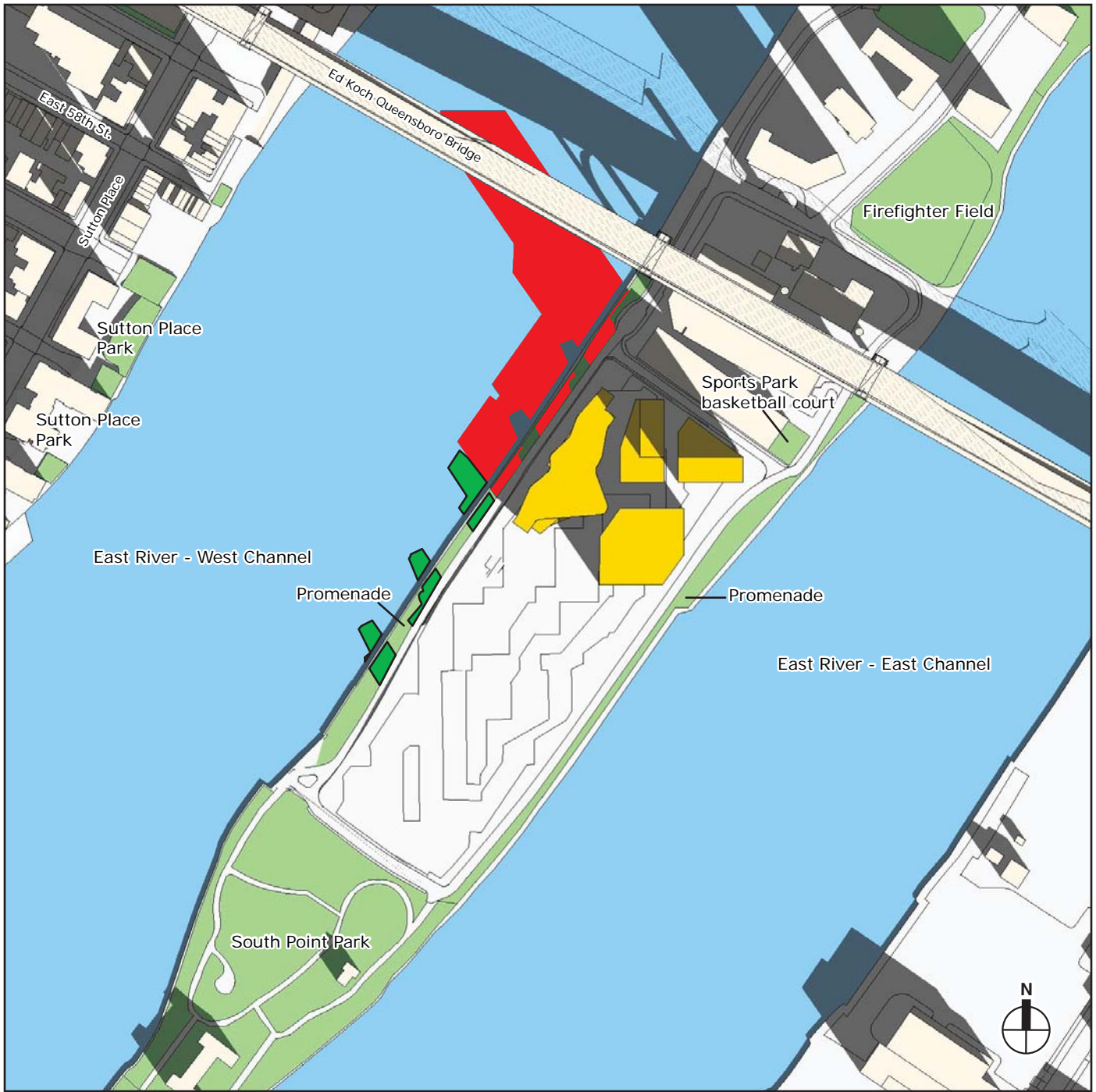
Note: Daylight Saving Time not used.

Phase 1  
 June 21 - 6:00 PM  
**Figure 6-34**



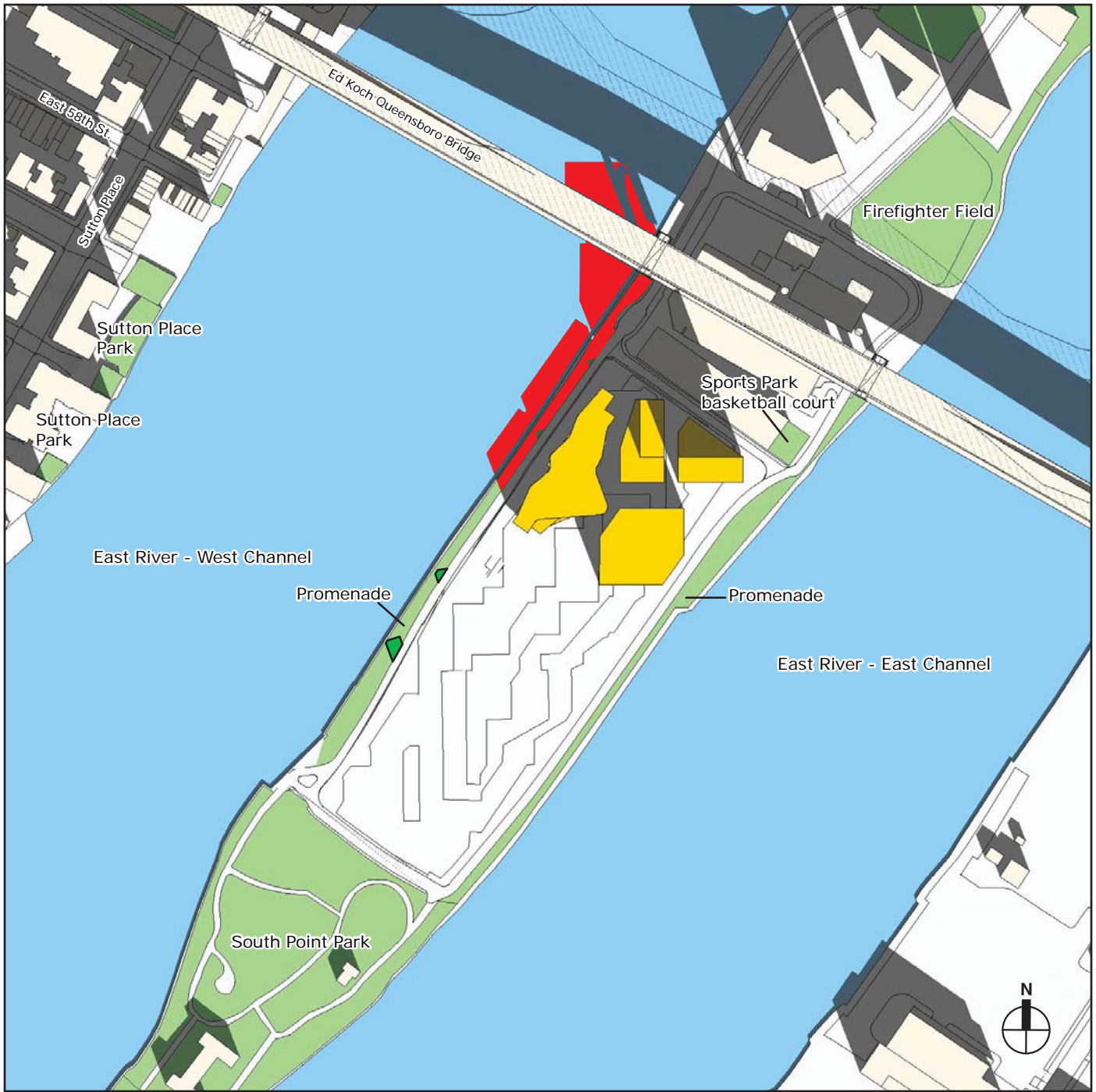
- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River
- Incremental Shadow
- Reduced Shadow (i.e. cast in Future No-Action but not with Proposed Project)

Note: Daylight Saving Time not used.



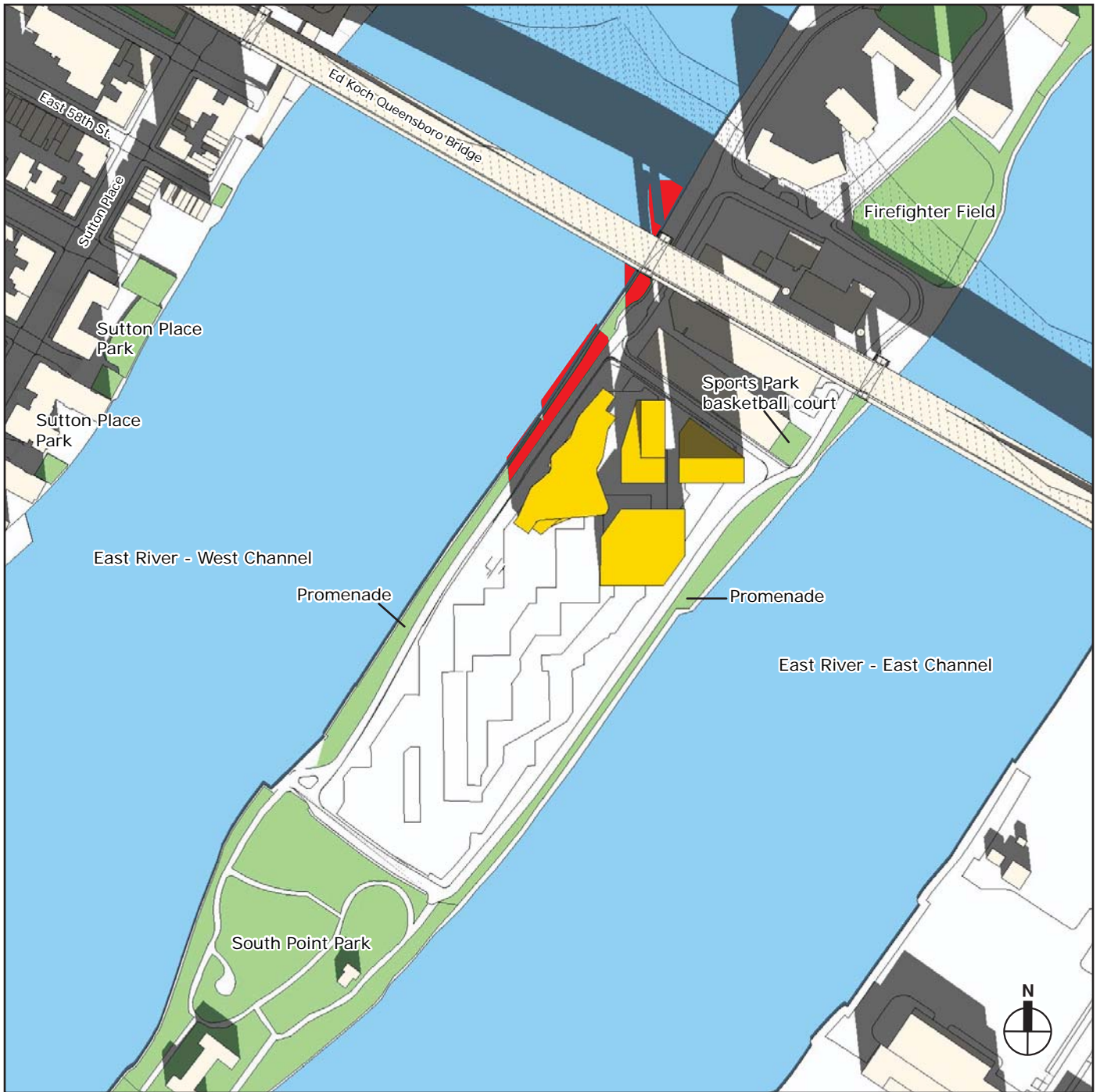
- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River
- Incremental Shadow
- Reduced Shadow (i.e. cast in Future No-Action but not with Proposed Project)

Note: Daylight Saving Time not used.



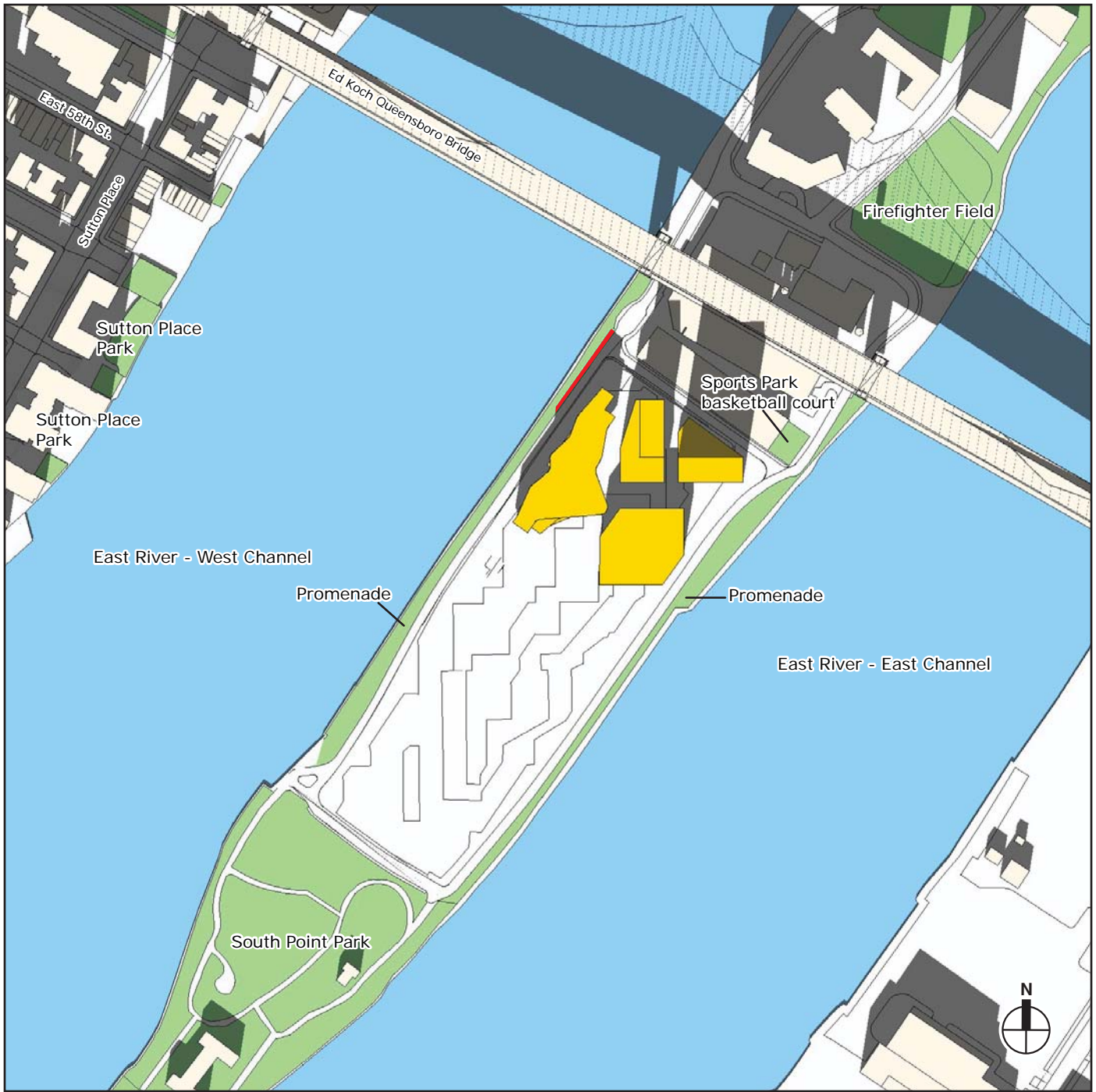
- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River
- Incremental Shadow
- Reduced Shadow (i.e. cast in Future No-Action but not with Proposed Project)

Note: Daylight Saving Time not used.



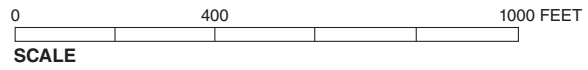
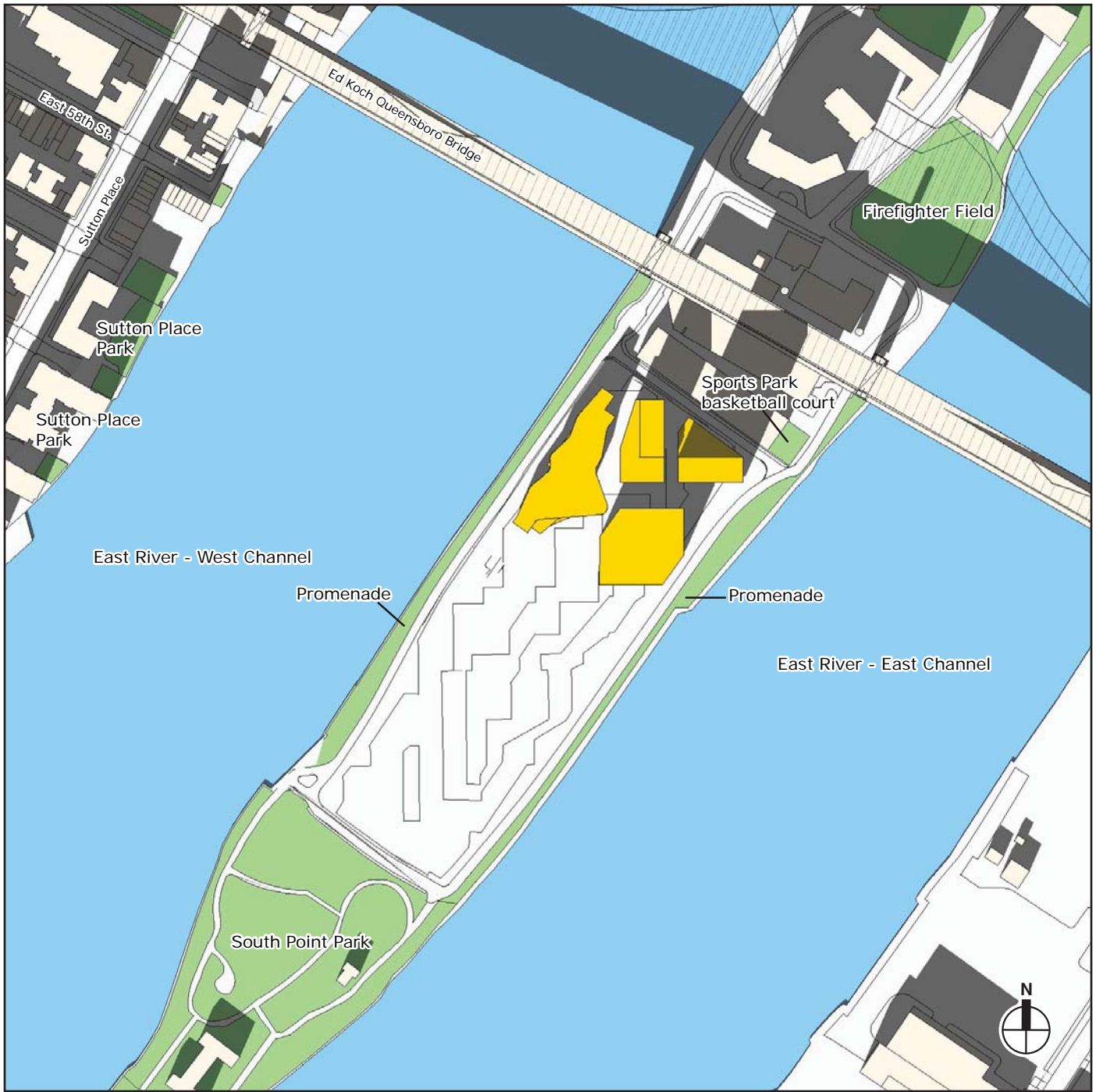
- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.



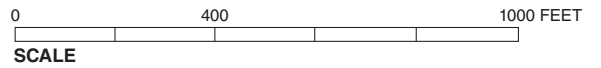
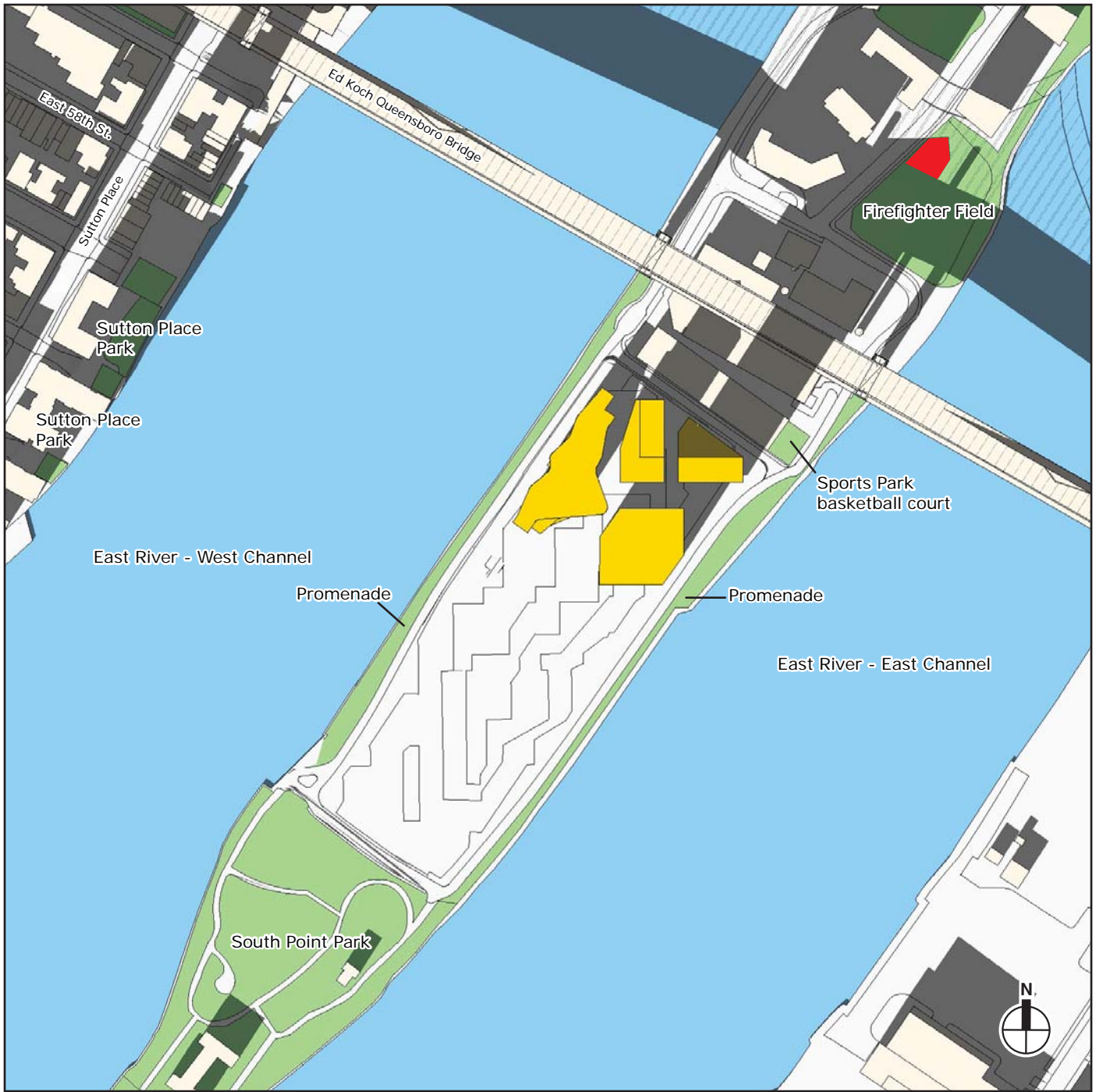
- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River

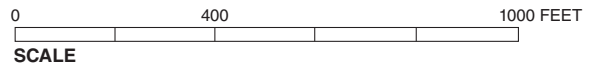
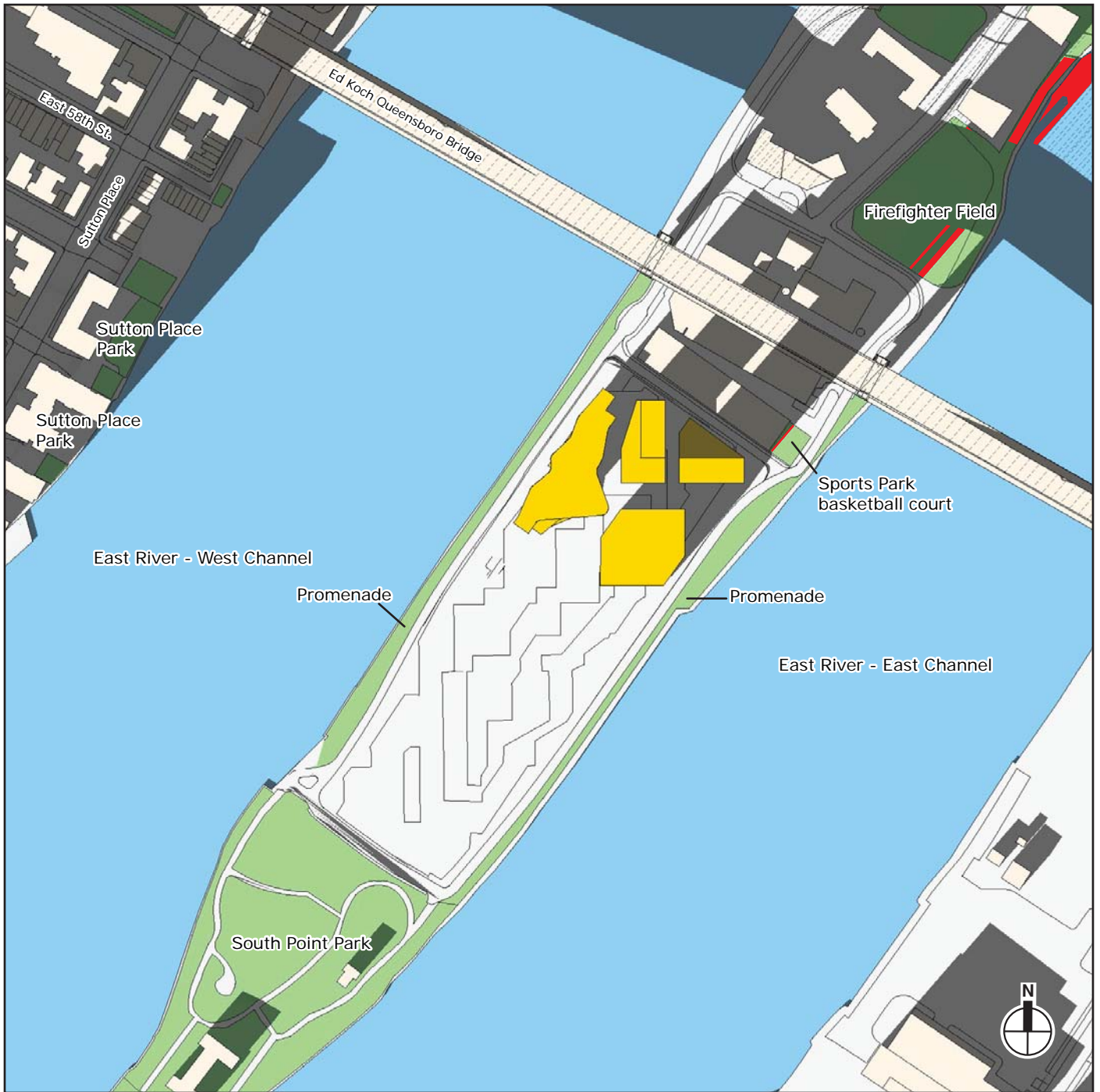
Notes: No incremental shadow on sun-sensitive resources would occur at this time.  
Daylight Saving Time not used.



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.





- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 1
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.

Phase 1  
 December 21 - 2:50 PM  
**Figure 6-42**

**Table 6-1**  
**Incremental Shadow Durations—Phase 1 (2018)**

Analysis day and timeframe window	March 21 / Sept. 21 7:36 AM-4:29 PM	May 6 / August 6 6:27 AM-5:18 PM	June 21 5:57 AM-6:01 PM	December 21 8:51 AM-2:53 PM
<b>OPEN SPACES</b>				
Waterfront promenade – west side	7:36 AM–12:30 <u>10:40</u> PM Total: 4 hr 54 min <u>3 hr 4 min</u>  Reduced: 7:36 AM–9:30 AM Total: 1 hr 54 min	6:27 AM–11:20 <u>9:10</u> AM Total: 4 hr 53 min <u>2 hr 43 min</u>  Reduced: 6:27 AM–8:10 AM Total: 1 hr 43 min	5:57 AM–11:00 <u>8:40</u> AM Total: 5 hr 3 min <u>2 hr 43 min</u>  Reduced: 5:57 AM–7:30 AM Total: 1 hr 33 min	8:51 AM–1:50 <u>12:40</u> PM Total: 4 hr 59 min <u>3 hr 49 min</u>  Reduced: 8:51 AM–11:10 AM Total: 2 hr 19 min
Sportspark outdoor basketball court	2:00 PM–4:29 PM Total: 2 hr 29 min	1:10 PM–5:18 PM Total: 4 hr 8 min	1:00 PM–6:01 PM Total: 5 hr 1 min	2:50 PM–2:53 PM Total: 3 min
Waterfront promenade – east side	2:50 PM–4:29 PM Total: 1 hr 39 min  Reduced: 3:20 PM–4:29 PM Total: 1 hr 9 min	2:10 PM–5:18 PM Total: 3 hr 8 min  Reduced: 3:20 PM–5:18 PM Total: 1 hr 58 min	2:10 PM–6:01 PM Total: 3 hr 51 min  Reduced: 3:20 PM–6:01 PM Total: 2 hr 41 min	—
Firefighter Field and adjacent waterfront area	—	—	—	1:40 PM–2:53 PM Total: 1 hr 13 min
<b>NATURAL FEATURES</b>				
East River – west channel	7:36 AM–11:20 <u>10:00</u> AM Total: 3 hr 44 min <u>2 hr 24 min</u>  Reduced: 7:36 AM–8:20 AM Total: 44 min	6:27 AM–10:00 <u>8:30</u> AM Total: 3 hr 33 min <u>2 hr 3 min</u>  Reduced: 6:27 AM–6:40 AM Total: 13 min	5:57 AM–9:30 <u>8:00</u> AM Total: 3 hr 33 min <u>2 hr 3 min</u>  Reduced: 5:57 AM–6:05 AM Total: 8 min	8:51 AM–1:00 <u>11:40</u> AM Total: 4 hr 9 min <u>2 hr 49 min</u>  Reduced: 8:51 AM–10:10 AM Total: 1 hr 19 min
East River – east channel	3:00 PM–4:29 PM Total: 1 hr 29 min  Reduced: 4:00 PM–4:29 PM Total: 29 min	2:30 PM–5:18 PM Total: 2 hr 48 min  Reduced: 4:10 PM–5:18 PM Total: 1 hr 8 min	2:20 PM–6:01 PM Total: 3 hr 41 min  Reduced: 4:20 PM–6:01 PM Total: 1 hr 41 min	2:40 PM–2:53 PM Total: 13 min
<b>Notes:</b> Table indicates entry and exit times and total duration of incremental shadow for each sunlight-sensitive resource. Daylight saving time is not used—times are Eastern Standard Time, per <i>CEQR Technical Manual</i> guidelines. However, as Eastern Daylight Time is in effect for the March/September, May/August and June analysis periods, add one hour to the given times to determine the actual clock time. "Reduced" durations refer to shadow that the future No-Action buildings would cast, which would not be cast by the proposed project.				

Beginning at about 2:00 PM, incremental shadow from the Phase 1 residential building would move onto the western side of the Sportspark basketball court (see Figure 6-11). By 3:00 PM incremental shadow would fall across about half the court, with a quarter in existing shadow and a quarter in sun (see Figure 6-12). From 4:00 PM to 4:29 PM, the end of the analysis day,

incremental shadow would remove the remaining area of sunlight on the court (Figure 6-13). Beginning at about 2:50 PM, incremental shadows would move onto the portion of the east side promenade north of the Sportspark where there is no seating or other amenities and, 10 minutes later, onto the adjacent east channel of the East River. At 3:30-10 PM incremental shadow would move onto the portion of the promenade east of the Phase 1 development. Parts of this area of the promenade would be in incremental shadow until 4:29 PM, the end of the analysis day, while other parts would remain in sun (see Figure 6-13).

*MAY 6/AUGUST 6 (FIGURES 6-14 TO 6-22)*

May 6 falls halfway between the March 21 equinox and the June 21 summer solstice. August 6 falls halfway between June 21 and the September 21 equinox, and has the same shadow patterns as May 6. The May 6/August 6 analysis day is representative of the growing season in the city. Shadows on this day are shorter than on the equinoxes, and the length of the day is longer.

Shadows would fall to the west at the start of the analysis day at 6:27 AM, falling across an approximately ~~500-450~~ foot section of the west side promenade until about ~~10:00~~7:30 AM, then on increasingly smaller portions (see Figures 6-14 to 6-1716). ~~By 11:00 AM only a small area would be in shadow (see Figure 6-18), and the~~ incremental shadow would exit completely at ~~11:20~~9:10 AM. No one individual tree or planting along the promenade would be in incremental shadow for longer than approximately ~~four-two~~ and a half hours during the morning, and these areas would be in sun throughout the middle of the day and afternoon due to the lack of structures to the south and west. Areas of the river's west channel would receive project generated shadow during the morning as well, until about ~~10:00~~8:30 AM.

Incremental shadow from the Phase 1 residential building would enter the Sportspark basketball court at 1:10 PM. By 2:00 PM the incremental shadow would cover most of the court, leaving a sunlit area in the southeast part (see Figure 6-19). For about a half-hour around 3:00 PM the new shadow would eliminate the remainder of the sunlit area on the court (Figure 6-20). After 3:20 PM small areas of sun would return ~~and remain~~ on the court as the incremental shadow began to move off the court area. From ~~4:30-40~~ PM to the end of the analysis day incremental shadow from the Phase 1 executive education center as well as the Phase 1 residential building would remove the remaining sun on the court ~~small areas of incremental shadow would remain in the southeast corner, a large area would be in existing shadow from the Sportspark building, and a small area would be in sun~~ (Figure 6-22).

Beginning at approximately 2:10 PM incremental shadow would begin to fall on the portion of the east side promenade north of Sportspark, and by 2:30 PM on the adjacent east channel. At about ~~3:10~~2:50 PM incremental shadow would move on to the part of the promenade east of the Phase 1 development. These shadows would become fairly large from ~~4:30~~5:00 PM to the end of the analysis day at 5:18 PM but other large areas of this section of the promenade, as well as the section to the south, would remain in sun at this time. Incremental shadows would also move across portions of the east channel of the East River from 2:30 PM to 5:18 PM.

*JUNE 21 (FIGURE 6-23 TO 6-34)*

June 21 has the longest amount of daylight of the year, with an analysis period of 12 hours. Shadows fall to the southwest early in the morning and to the southeast late in the afternoon, and shadows at mid-day on June 21 are shorter than at any other time of year. June 21 is also in the growing season.

~~For the first hour~~At the start of the analysis day at 6:00 AM incremental shadows would fall to the southwest across a large area of the west channel and about 500 linear feet of the west promenade (see Figures 6-23 ~~and 6-24~~). The shadow would shorten and move clockwise, and by ~~87:00 AM~~ 8:00 AM would fall on much smaller areas of the channel but would continue to shade about ~~500-450~~ 500-450 linear feet of the promenade (see Figure 6-~~2524~~) 24. ~~From 9:00 AM to 11:00 AM~~By 8:00 AM the shadows from Phase 1 development—primarily the academic building and PV canopy—would ~~gradually decrease~~ be small in size, ~~finally exiting and would finally exit~~ the promenade completely at ~~11:00~~ 8:40 AM (see Figures ~~6-25 and 6-26 to 6-28~~ 6-25 and 6-26 to 6-28).

The Phase 1 residential building would cast shadow on the Sportspark basketball court for much of the afternoon, beginning at 1:00 PM (Figure 6-29). The new shadow would fall across most of the court area from about 2:00 PM to 3:00 PM, leaving only small sunlit areas (Figures 6-30 and 6-31), and would shade smaller portions of the court from 3:30 PM to about 4:20 PM (Figure 6-32). From 4:30 PM new shadow from the Phase 1 Executive Education Center would move onto the court and from ~~4:50~~ 5:00 PM until the end of the analysis day at 6:01 PM would remove the remaining sunlight, although most of the court would be in existing shadow from the Sportspark during this time (Figures 6-33 and 6-34). Beginning at about 2:10 PM, the Phase 1 residential building would cast a shadow on the portion of the east promenade north of Sportspark, and at ~~3:10~~ 2:50 PM shadow from the ~~PV canopy and corporate co-location building~~ would move onto the portion of the promenade to ~~their~~ its east, south of Sportspark. These areas of incremental shadow on the promenade would initially remain small, grow larger around ~~4:30~~ 5:00 PM, but then shrink again near 6:00 PM, because shadows from the existing/No Action buildings would spread across the promenade by then (see Figures 6-32 through 6-34). Incremental shadows would move onto adjacent areas of the channel beginning at 2:20 PM and would gradually spread over the remainder of the analysis period.

#### *DECEMBER 21 (FIGURES 6-35 TO 6-42)*

December 21, representing the winter months, does not fall within New York's growing season, according to the *CEQR Technical Manual*. Shadow falling on vegetation in winter is not generally considered to cause a significant adverse impact. However, winter shadow can adversely impact users of open space who may rely on sunlight for warmth.

Phase 1 development would cast long shadows to the northwest and north in the morning hours, shading large areas of the western promenade and west channel. However, the southern part of the promenade would remain completely in sun, representing a reduction in shadows compared with the No Action condition. The section of the promenade northwest of the Phase 1 academic building and PV canopy would remain in incremental shadow until ~~4:50~~ 12:40 PM.

From 1:40 PM to 2:53 PM (the end of the analysis day) incremental shadow from the Phase 1 residential building would fall across a portion of Firefighter Field. Half or more of the field is shaded by the Queensboro Bridge and other existing structures during this time, and the new shadow would remove additional sunlit areas, but other areas would remain in sun throughout this period (see Figures 6-41 and 6-42). From 2:40 PM to 2:53 PM the incremental shadow would also reach the waterfront area north of Firefighter Field.

#### *PROPOSED PROJECT OPEN SPACE*

A minimum of approximately 1.3 acres of new publicly accessible open space would be developed on the project site for Phase 1, consisting of 1 acre of passive open space and 0.3 acres of active open space. According to the *CEQR Technical Manual*, open space that would be

developed as part of a project cannot experience adverse impacts from the project, because without the project the space would not exist. However, a discussion of shadows on the proposed open space is provided for informational purposes.

As with many open spaces in an urban setting, situated among fairly tall buildings, the project open spaces would experience a combination of time periods during which they would be largely or entirely in shadow, as well as periods during which they would be largely or fully in sun. The open spaces on the eastern side of the site would be generally open to the eastern sky above the river, and would be mostly or completely in sun during the spring, summer and fall mornings. Conversely, they would be partially in shadow in the early afternoon and mostly in shadow in the later afternoons in these seasons. On the western side of the site, the opposite would be true: mostly in shade in the mornings, partially in sun in the early afternoon and mostly in sun in the later afternoon. Any space on the northern boundary of the project site would be mostly in shadow from mid-morning to mid-afternoon in the spring, summer and fall, while space on the southern side would be in sun for most of the day in these seasons. In the winter, the spaces would be mostly in shadow throughout the day, with the exception of open space area on the east side which would be mostly sunny in the morning, and space on the southern side, which would be sunny most of the day.

### **PHASE 2 (2038)**

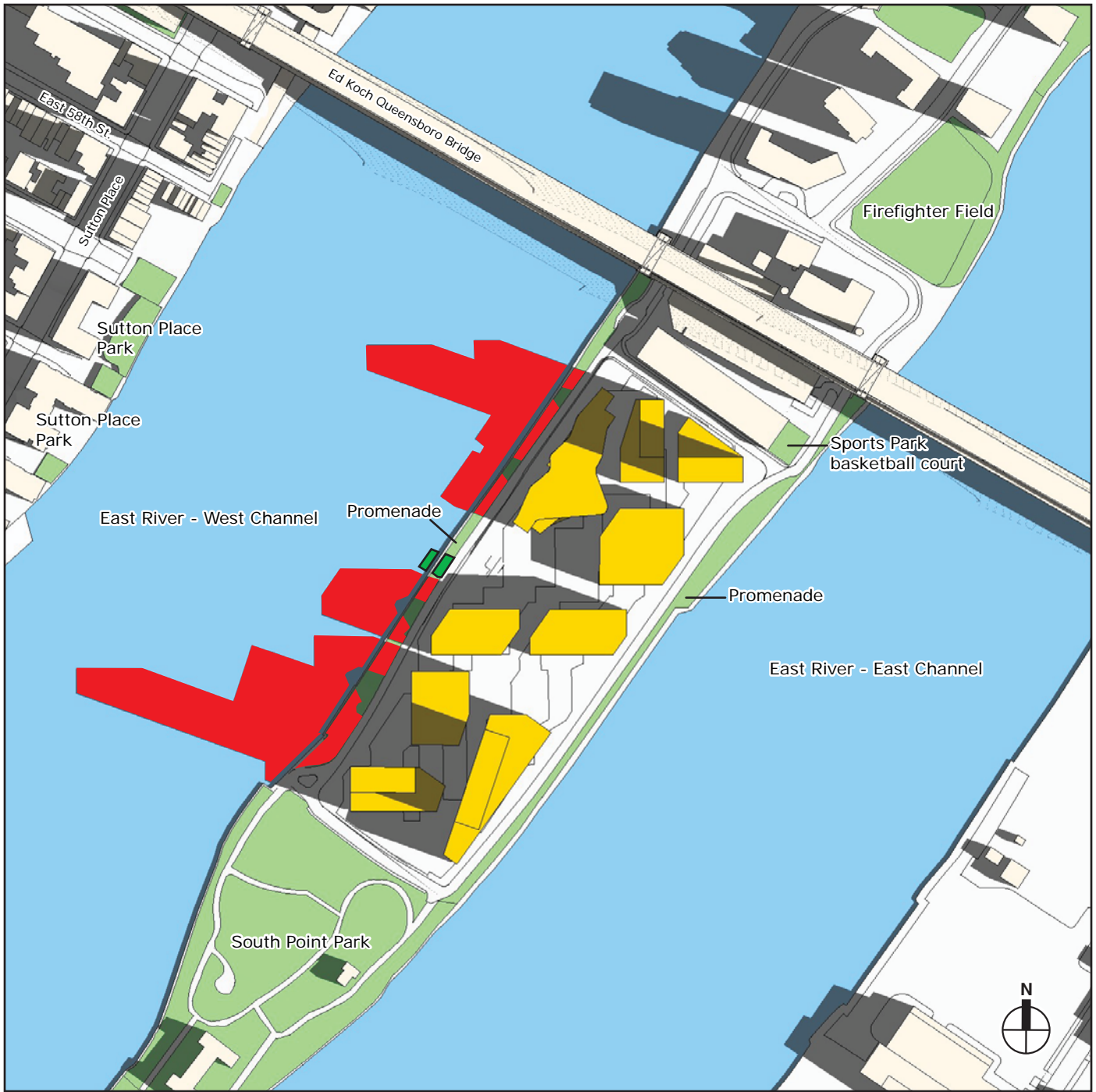
In Phase 2, the southern part of the project site would be developed, resulting in additional project-generated shadows. **Table 6-2** summarizes the entry and exit times and total duration of incremental shadows on sun-sensitive resources for the full build out of the proposed project, resulting from its comparison to the future 2038 No-Action condition (which is the same as the 2018 No-Action condition). **Figures 6-43 to 6-80** depict the incremental shadows that would occur in 2038 with the proposed development.

The following section describes any additional or different shadow effects beyond those already described in the Phase 1 section.

#### *MARCH 21/SEPTEMBER 21 (FIGURES 6-43 TO 6-49)*

Incremental shadow from the Phase 2 development would shade much of the southern half of the promenade from the start of the analysis day until ~~nearly noon around 10:00~~ (see Figures 6-43 to 6-45). From ~~noon around 10:00 AM~~ to 12:50-20 PM smaller areas of the promenade would be in project shadow (see Figures 6-45 to 6-47). In the southern portion of the promenade, ~~a couple of one~~ small areas would receive about three and ~~a half~~ three-quarters hours of new shadow, and ~~some a couple of~~ other areas would receive up to three and a half hours. Other affected areas of the southern part of the promenade would receive one to three hours incremental shadow. Shadows from the Phase 2 development would also fall across some areas of the East River's west channel throughout the morning; some areas adjacent to the shore would receive about three hours of new shadows, while other areas would receive less.

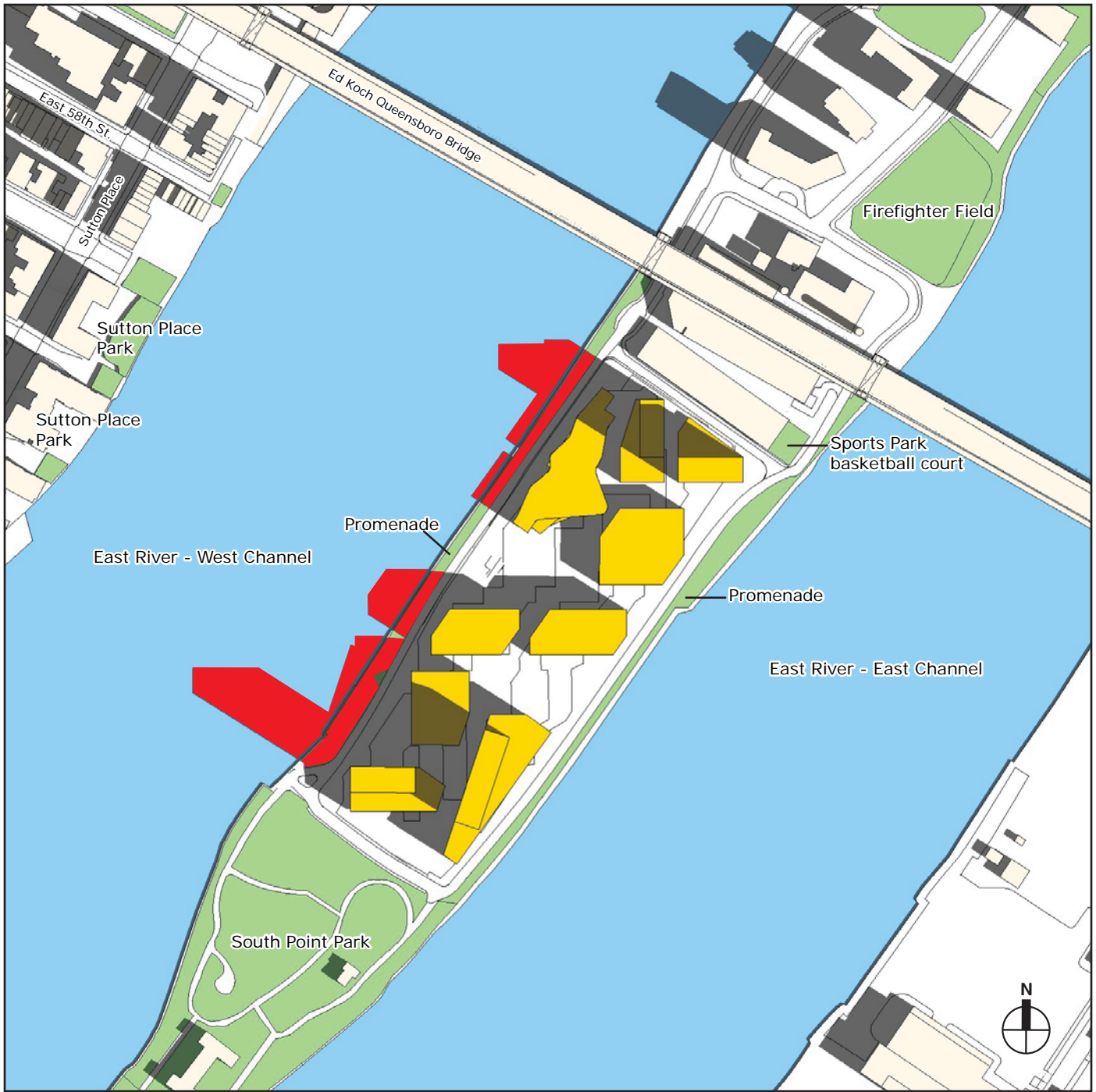
Additional areas of the eastern promenade would receive incremental shadows from the Phase 2 development, beginning at 2:20 ~~30~~ PM and lasting until the end of the analysis day at 4:29 PM. The extent of these new shadows on the promenade would be large for the final hour of the analysis day, though some areas would remain in sun. New shadows would also extend out across portions of the river's east channel during this time.



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow
- Reduced Shadow (i.e. cast in Future No-Action but not with Proposed Project)

Note: Daylight Saving Time not used.

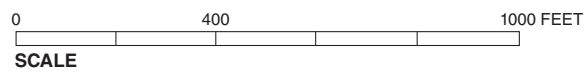
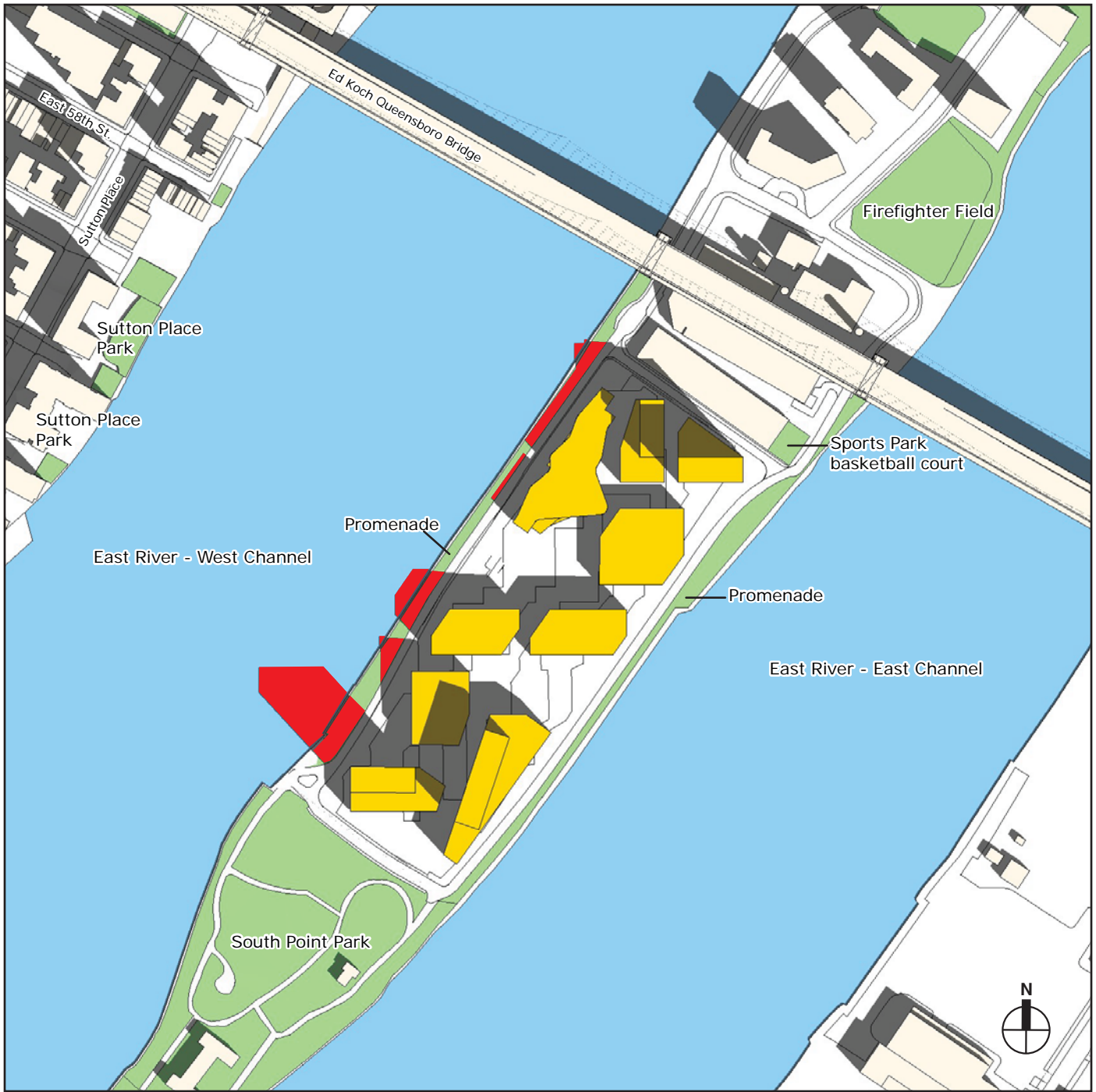
Phase 2  
 March 21/Sept. 21 - 8:00 AM  
**Figure 6-43**



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.

Phase 2  
March 21/Sept. 21 - 9:00 AM  
**Figure 6-44**

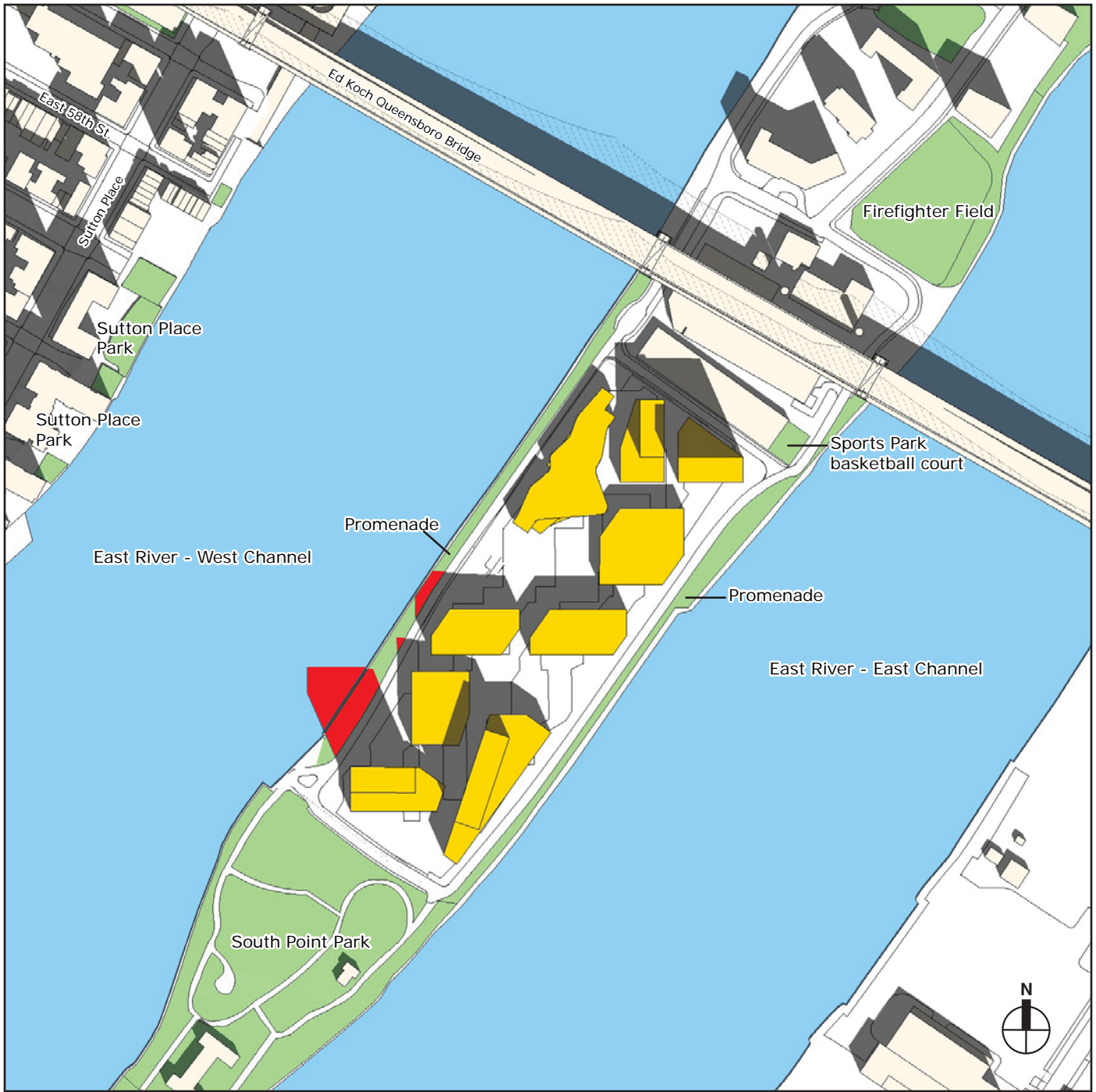


- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.

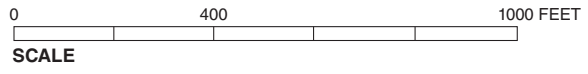
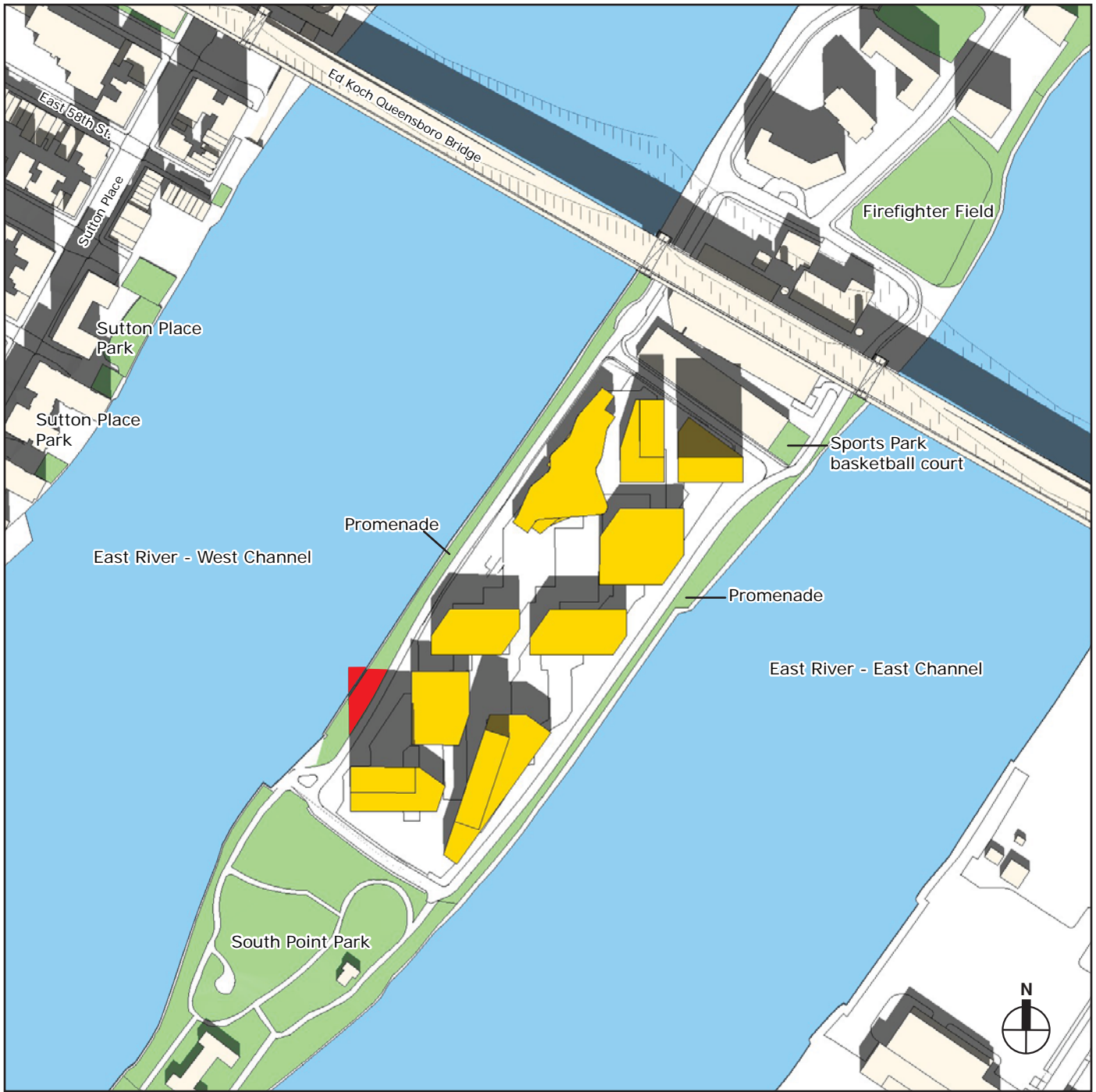
Phase 2  
March 21/Sept. 21 - 10:00 AM  
**Figure 6-45**





- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

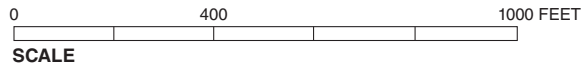
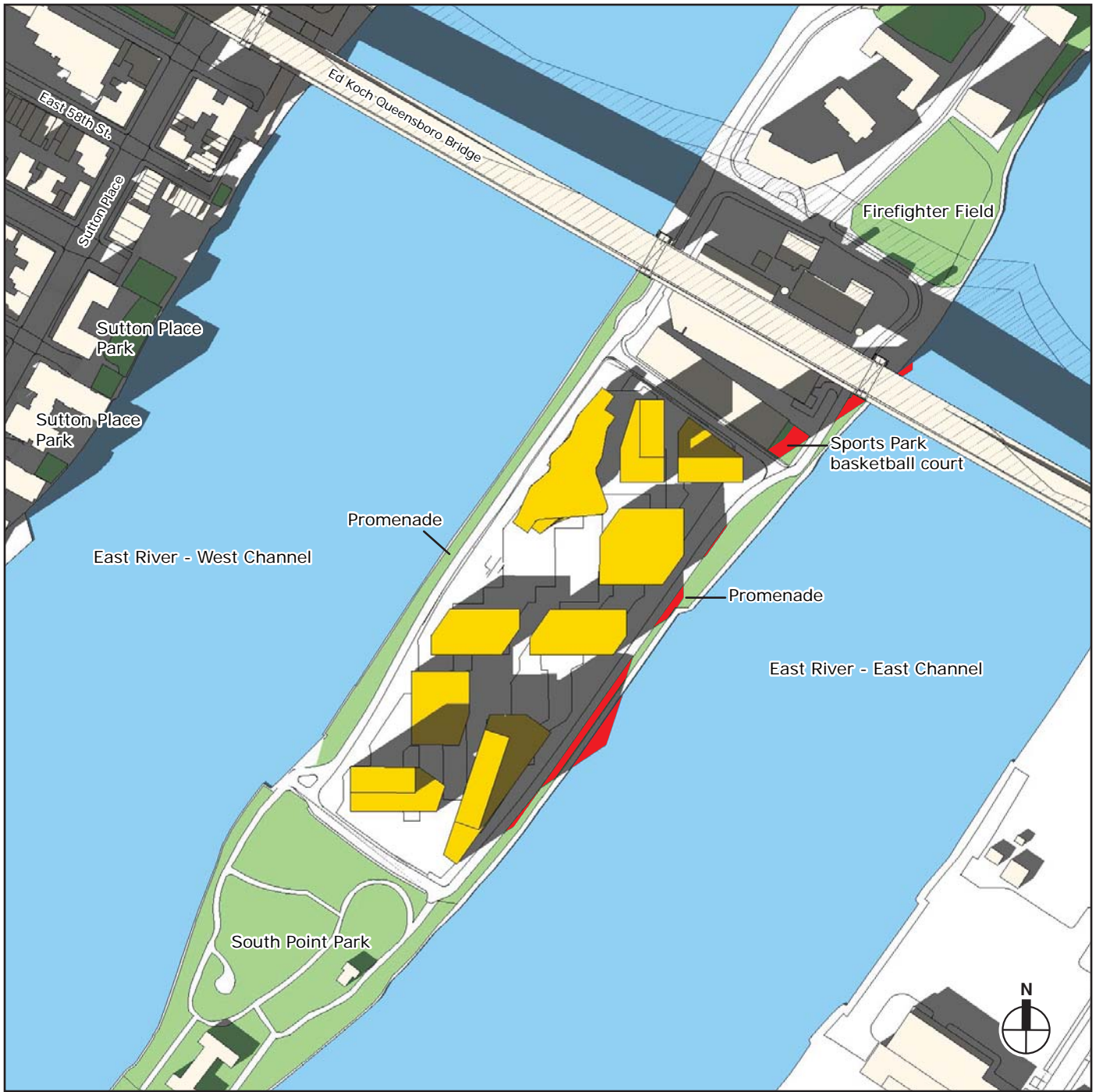
Note: Daylight Saving Time not used.



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.

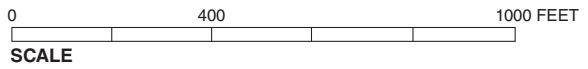
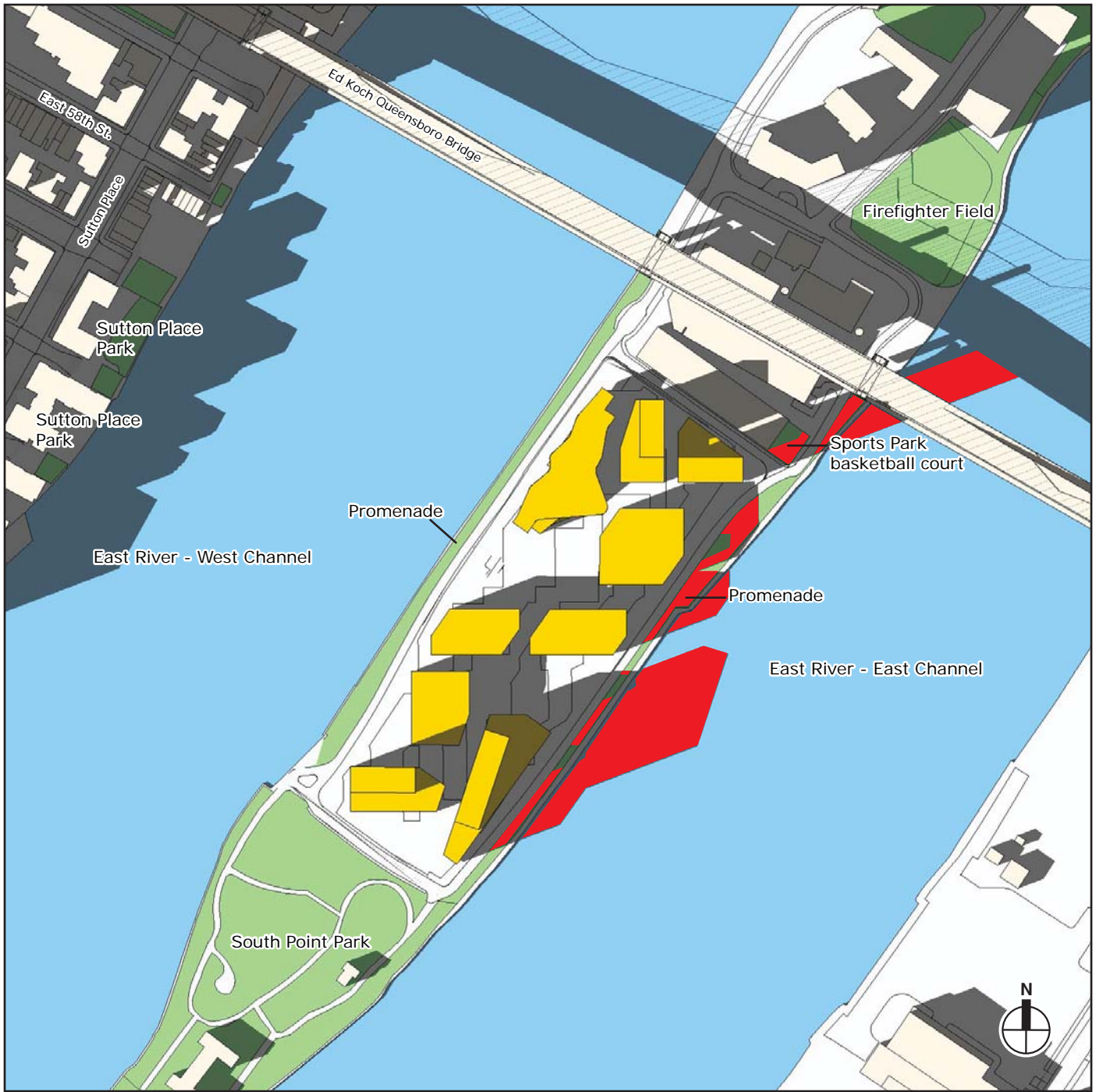
Phase 2  
March 21/Sept. 21 - 12:00 PM  
**Figure 6-47**



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.

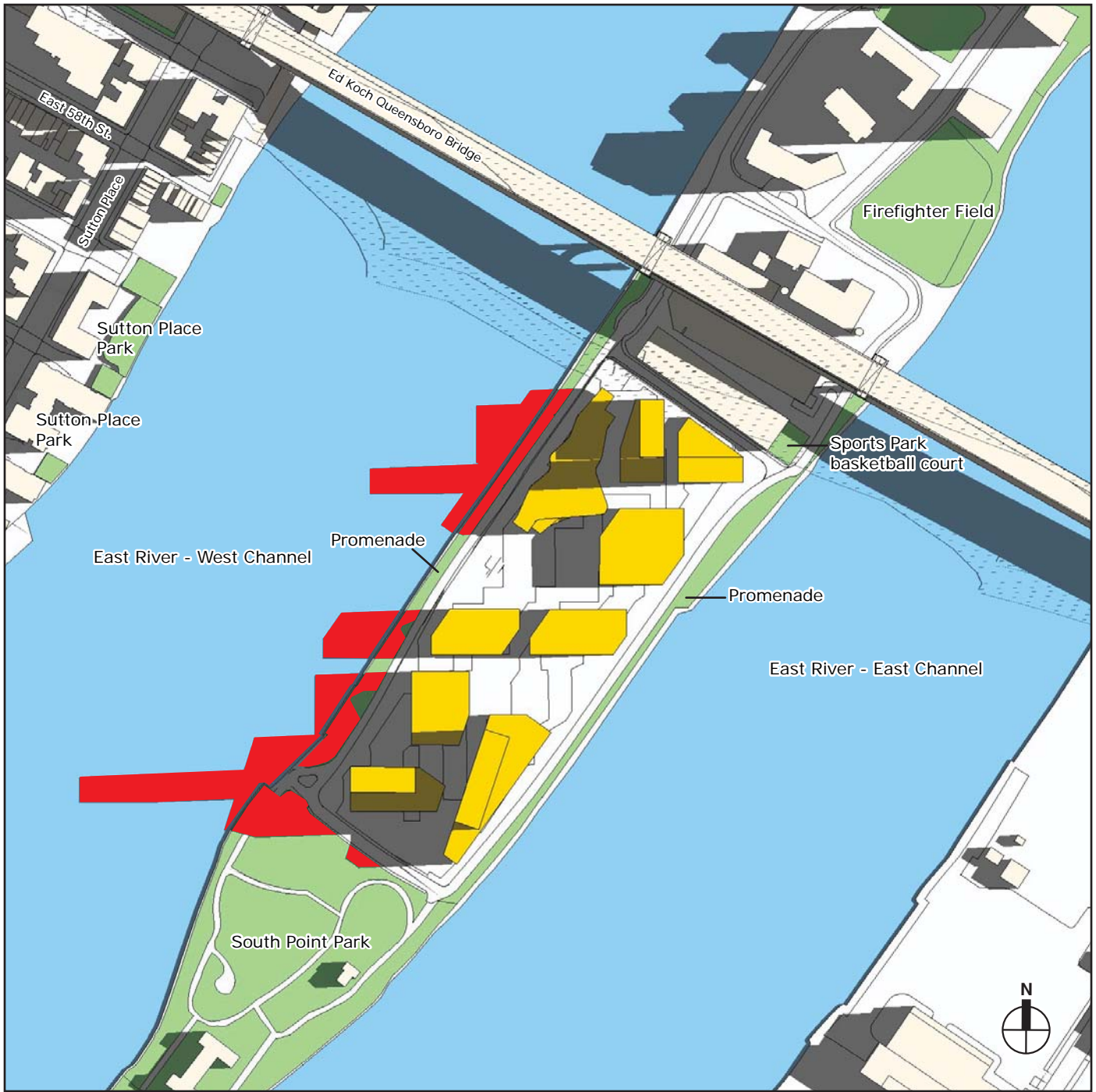
Phase 2  
 March 21/Sept. 21 - 3:00 PM  
**Figure 6-48**



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.

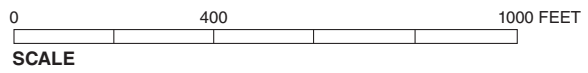
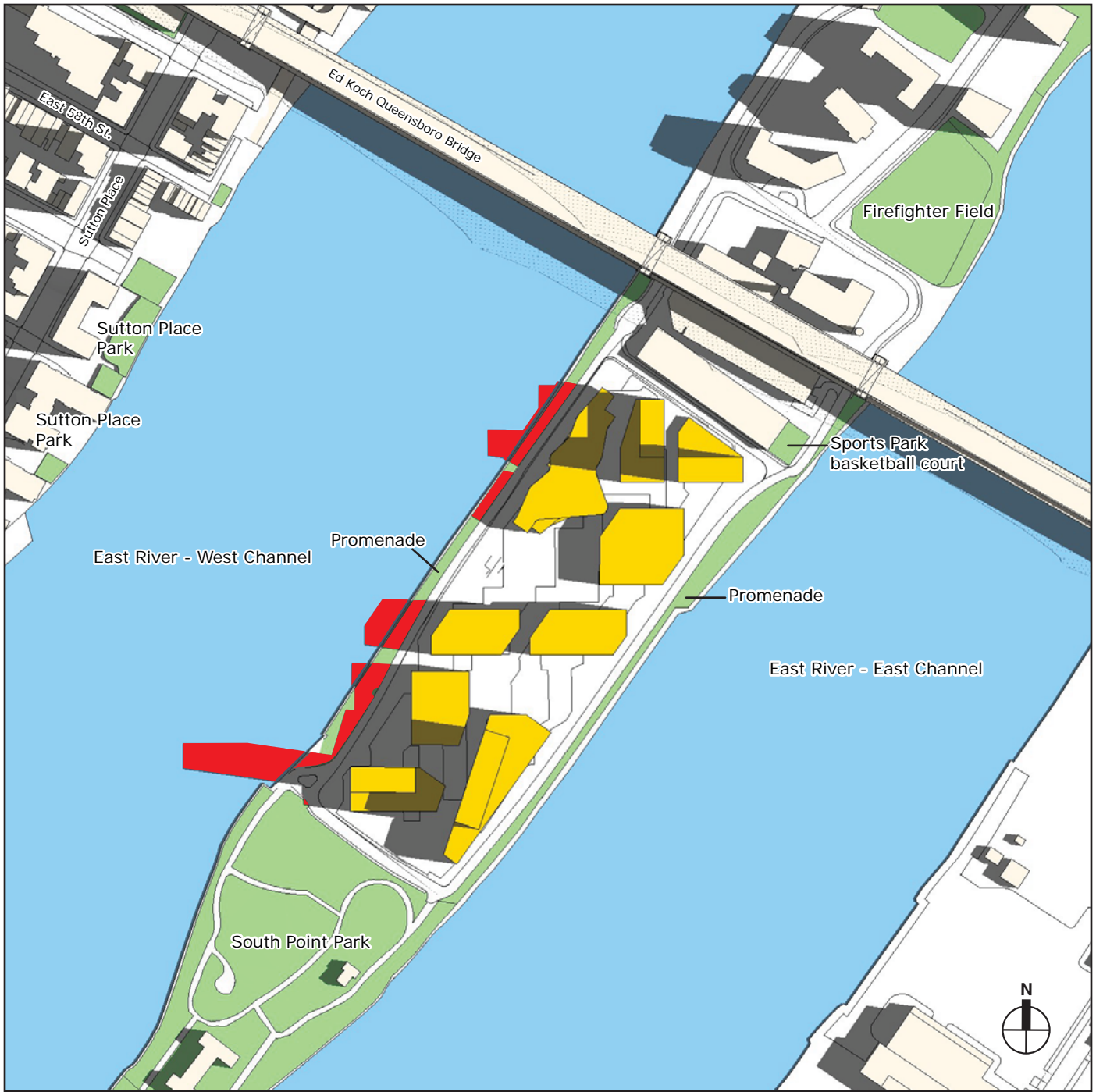
Phase 2  
 March 21/Sept. 21 - 4:00 PM  
**Figure 6-49**



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.

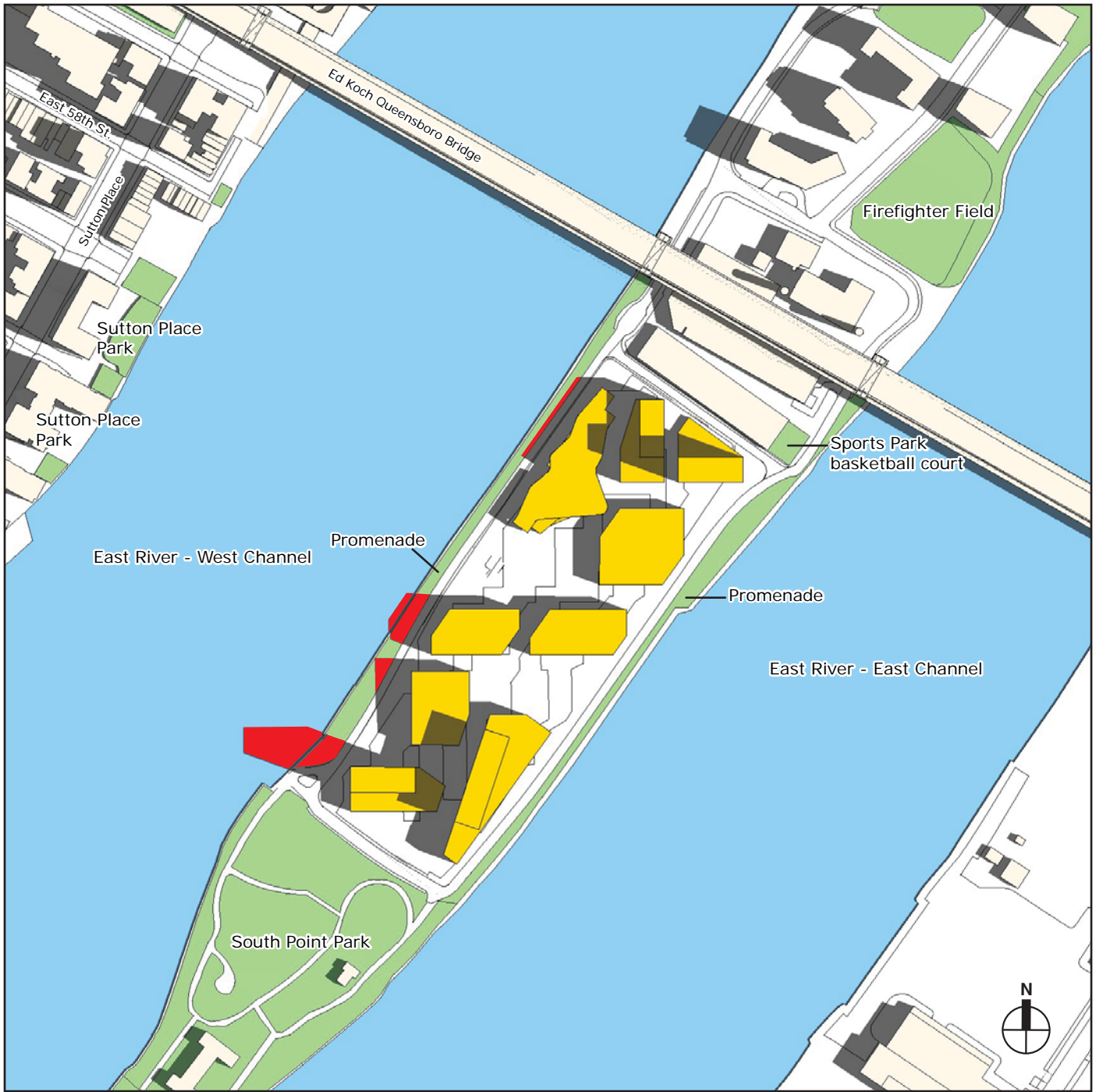
Phase 2  
May 6/August 6 - 7:00 AM  
**Figure 6-50**



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.

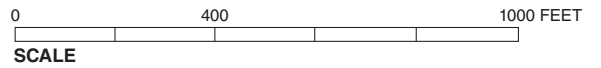
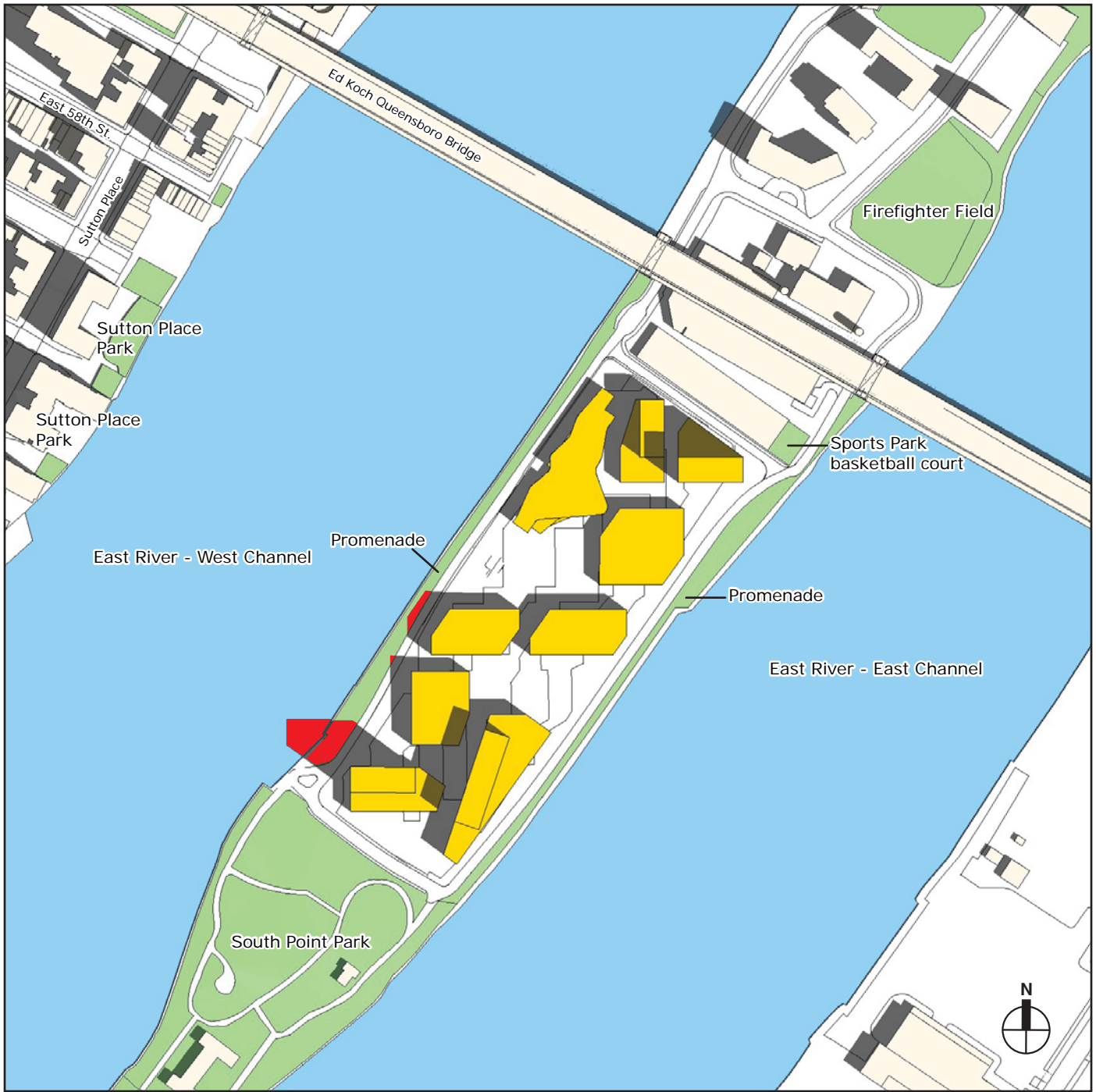
Phase 2  
 May 6/August 6 - 8:00 AM  
**Figure 6-51**



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.

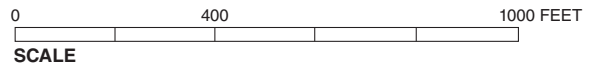
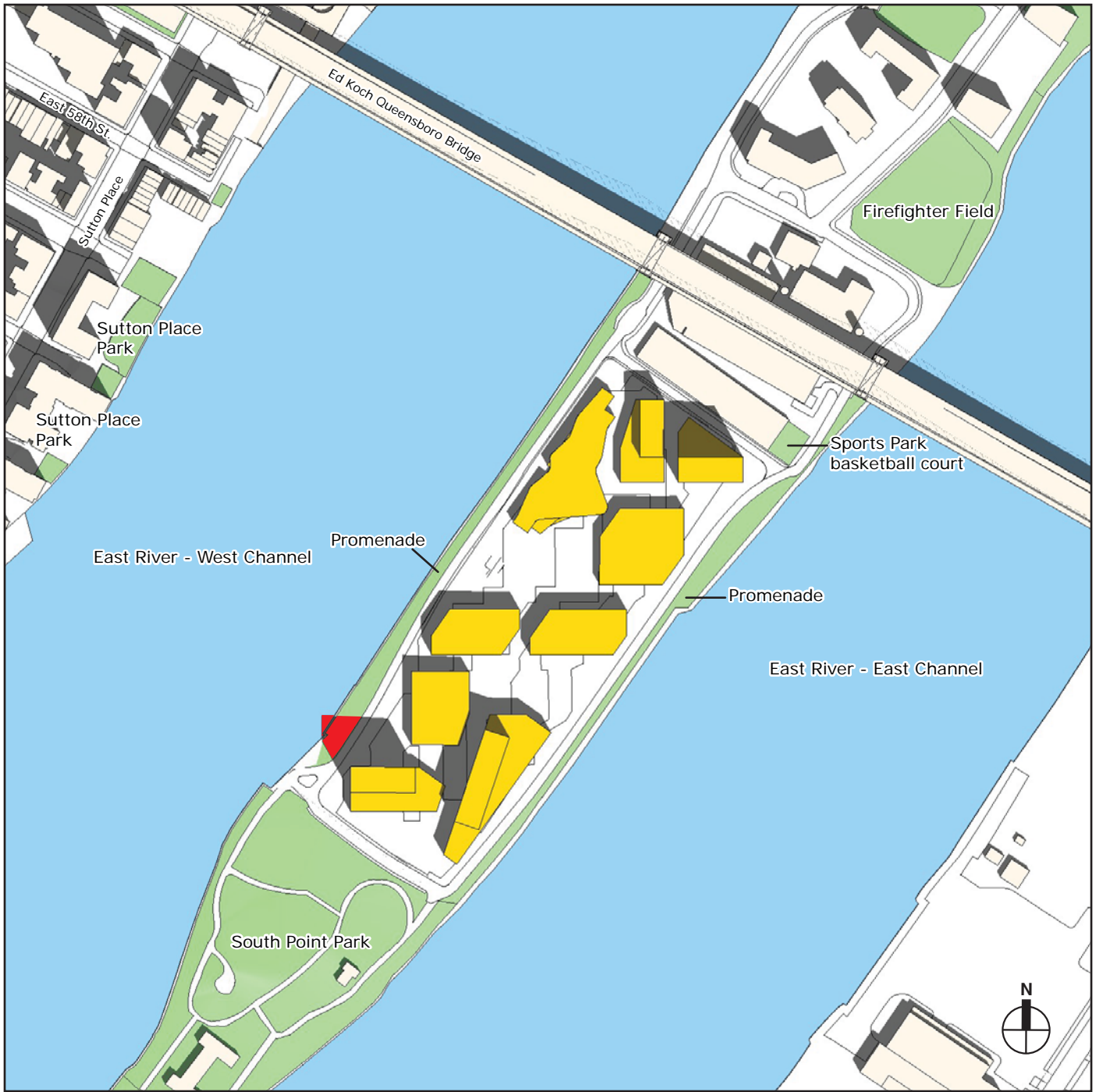
Phase 2  
May 6/August 6 - 9:00 AM  
**Figure 6-52**



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

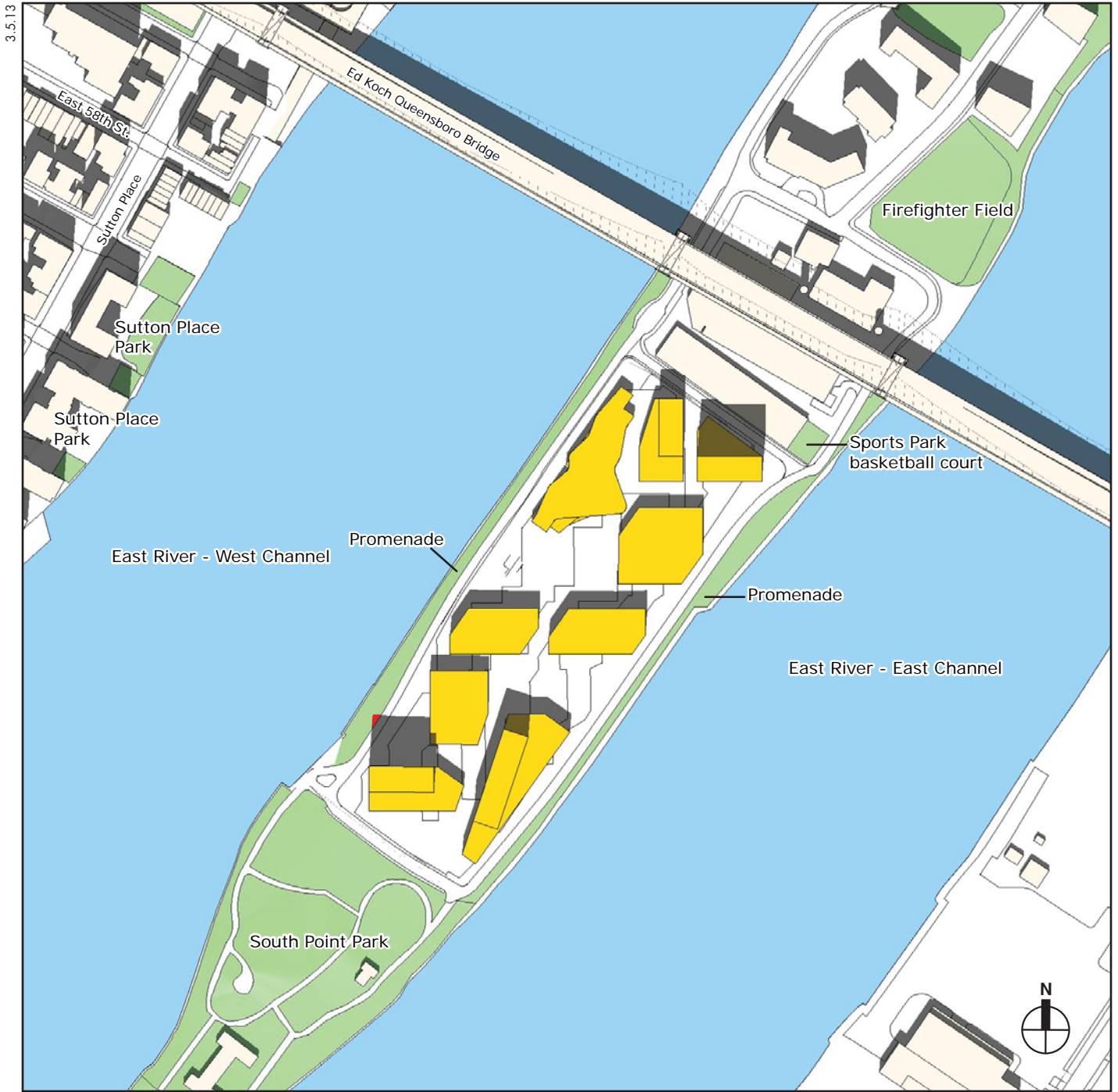
Note: Daylight Saving Time not used.





- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.



3.5.13

- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.

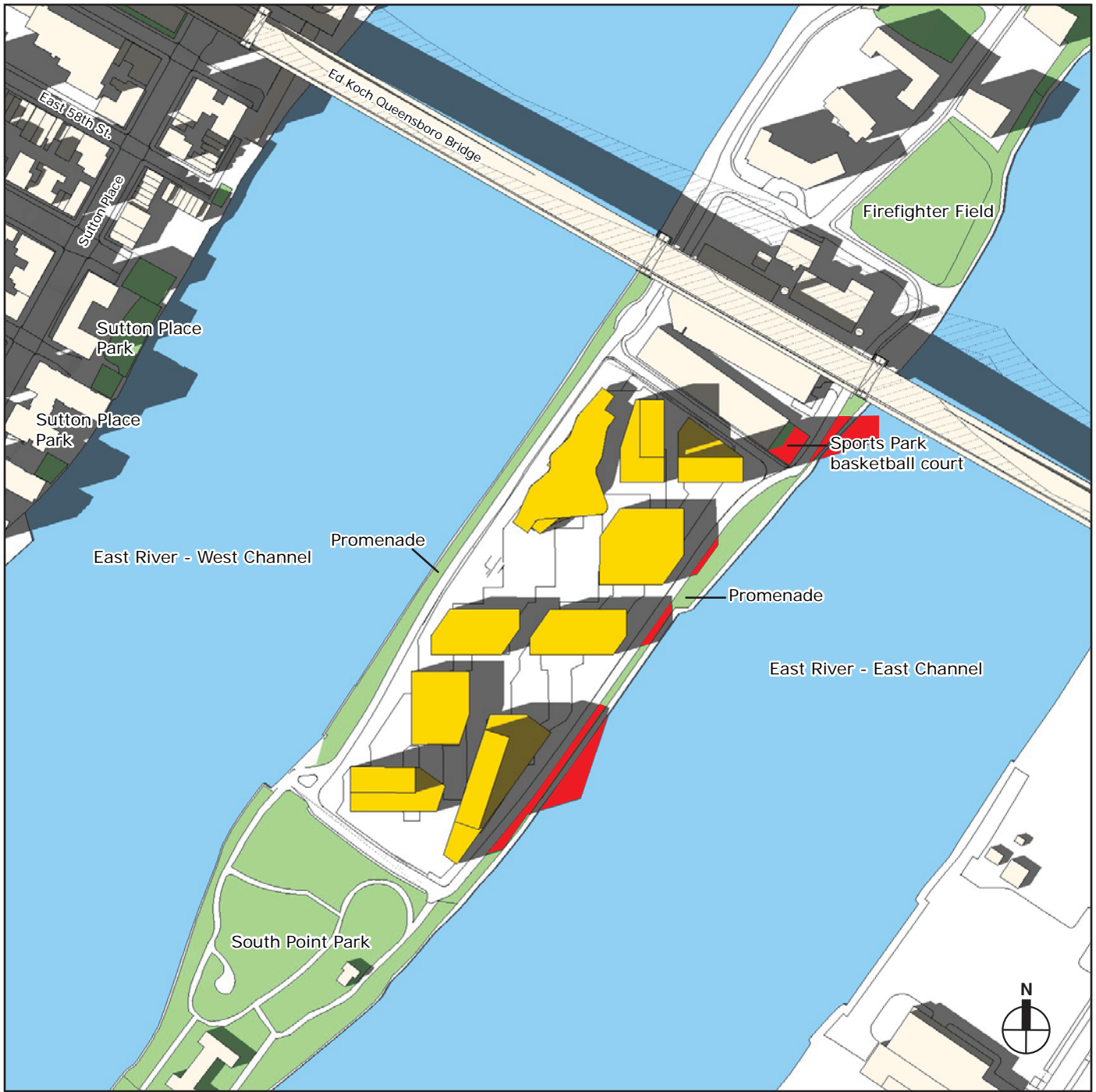
Phase 2  
May 6/August 6 - 12:00 PM  
**Figure 6-55**



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.

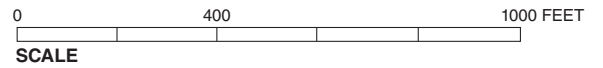
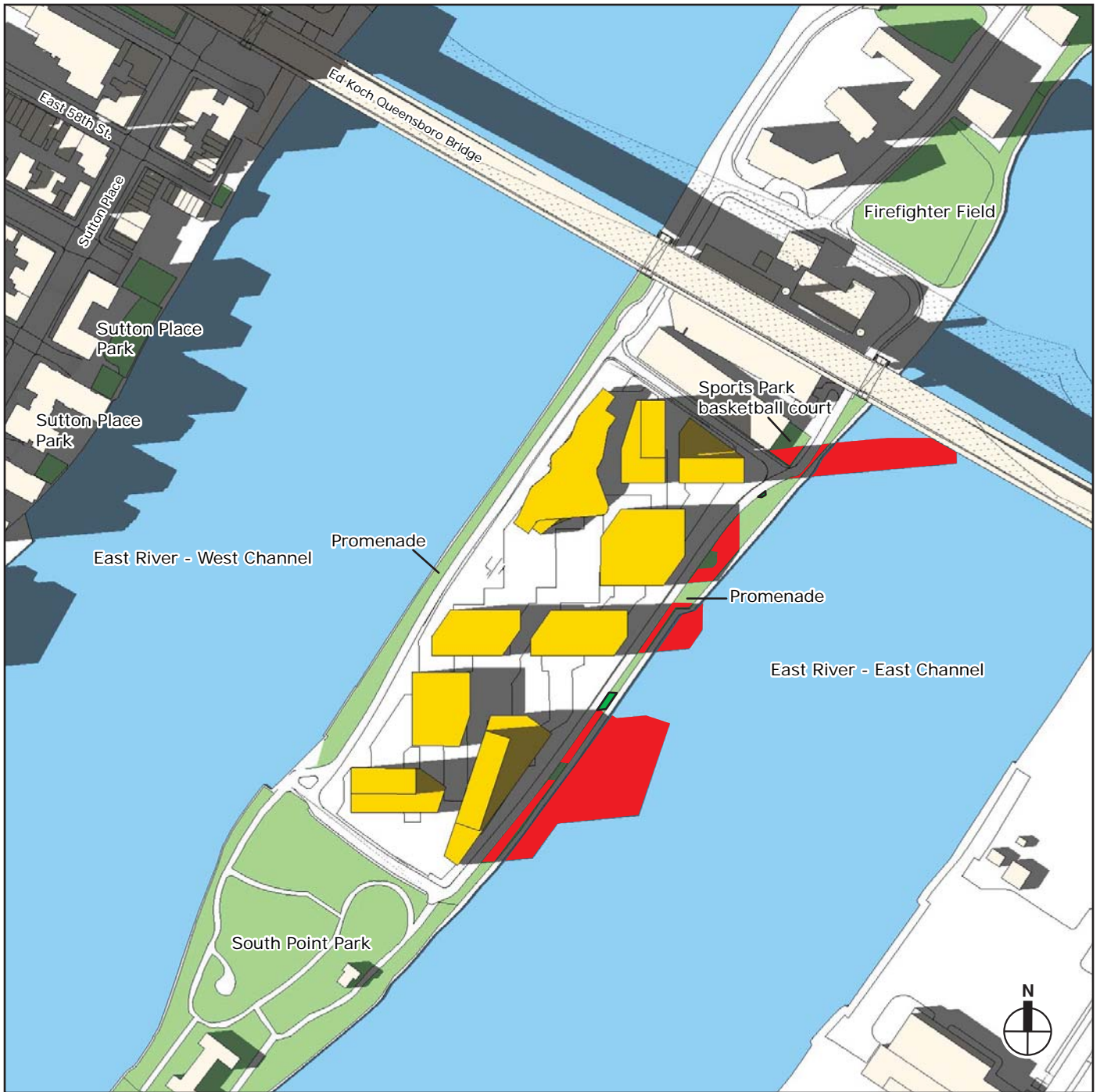
Phase 2  
 May 6/August 6 - 2:00 PM  
**Figure 6-56**



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.

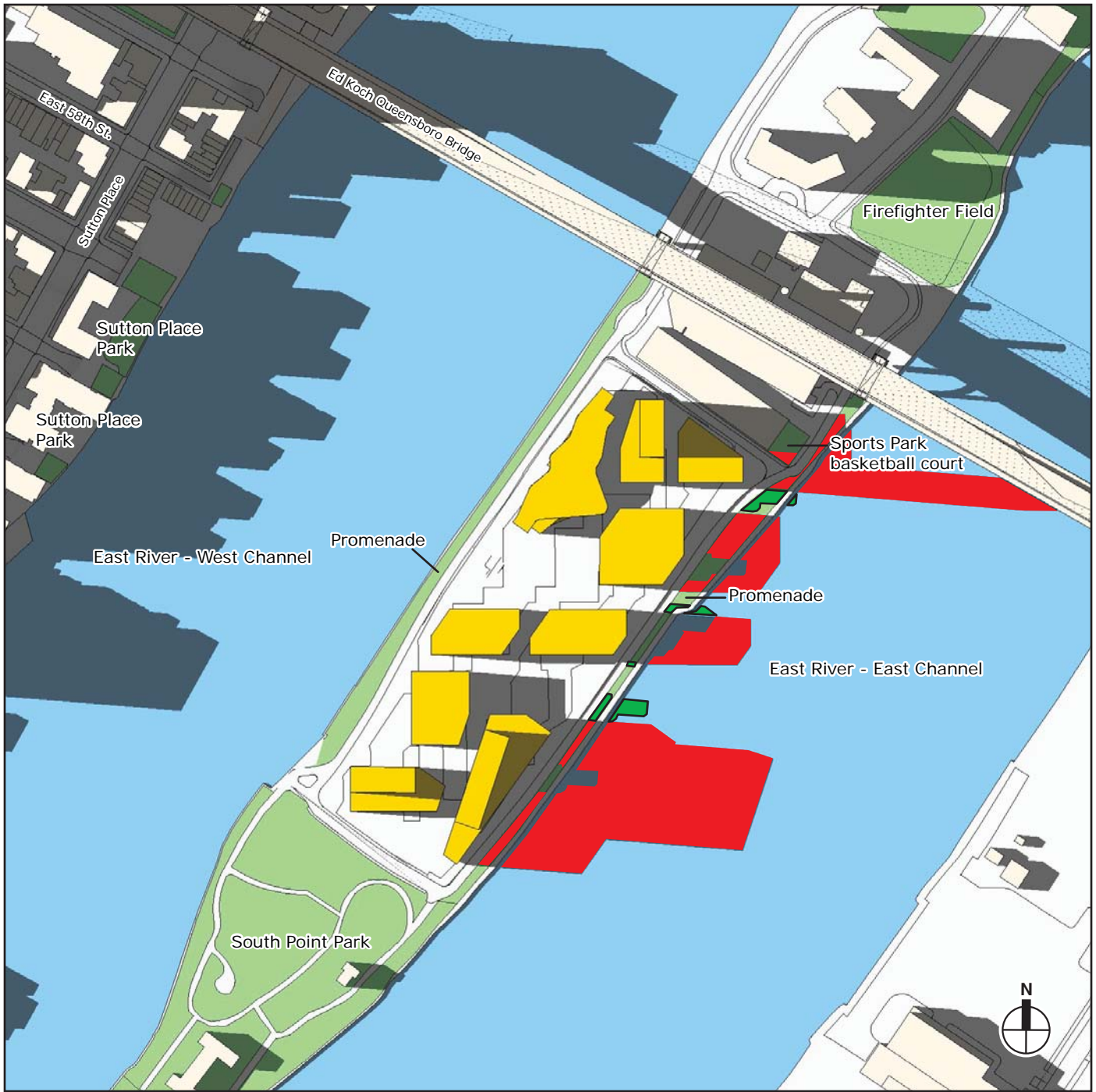
Phase 2  
 May 6/August 6 - 3:00 PM  
**Figure 6-57**



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow
- Reduced Shadow (i.e. cast in Future No-Action but not with Proposed Project)

Note: Daylight Saving Time not used.

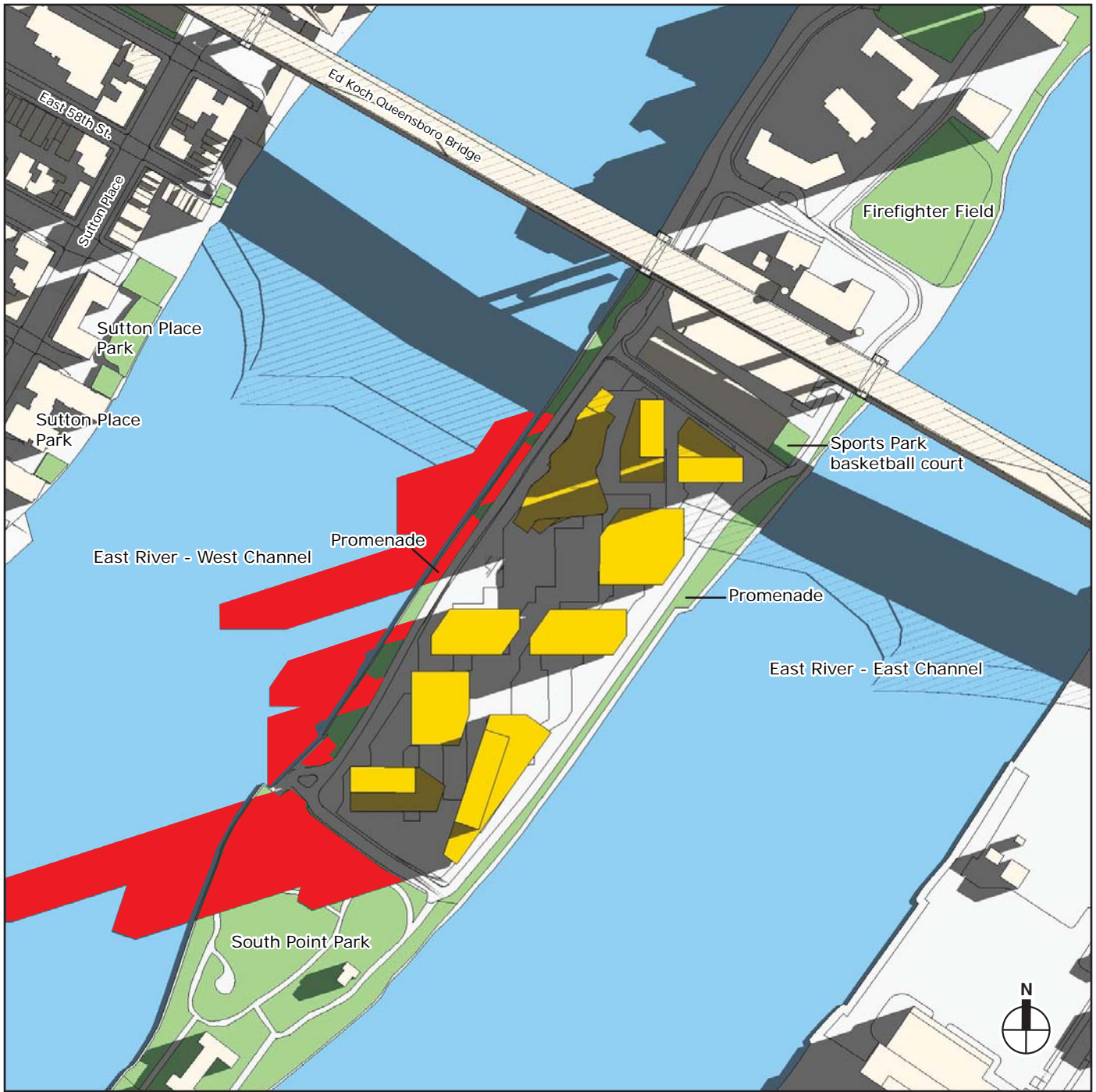
Phase 2  
 May 6/August 6 - 4:00 PM  
**Figure 6-58**



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow
- Reduced Shadow (i.e. cast in Future No-Action but not with Proposed Project)

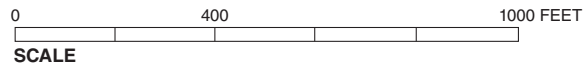
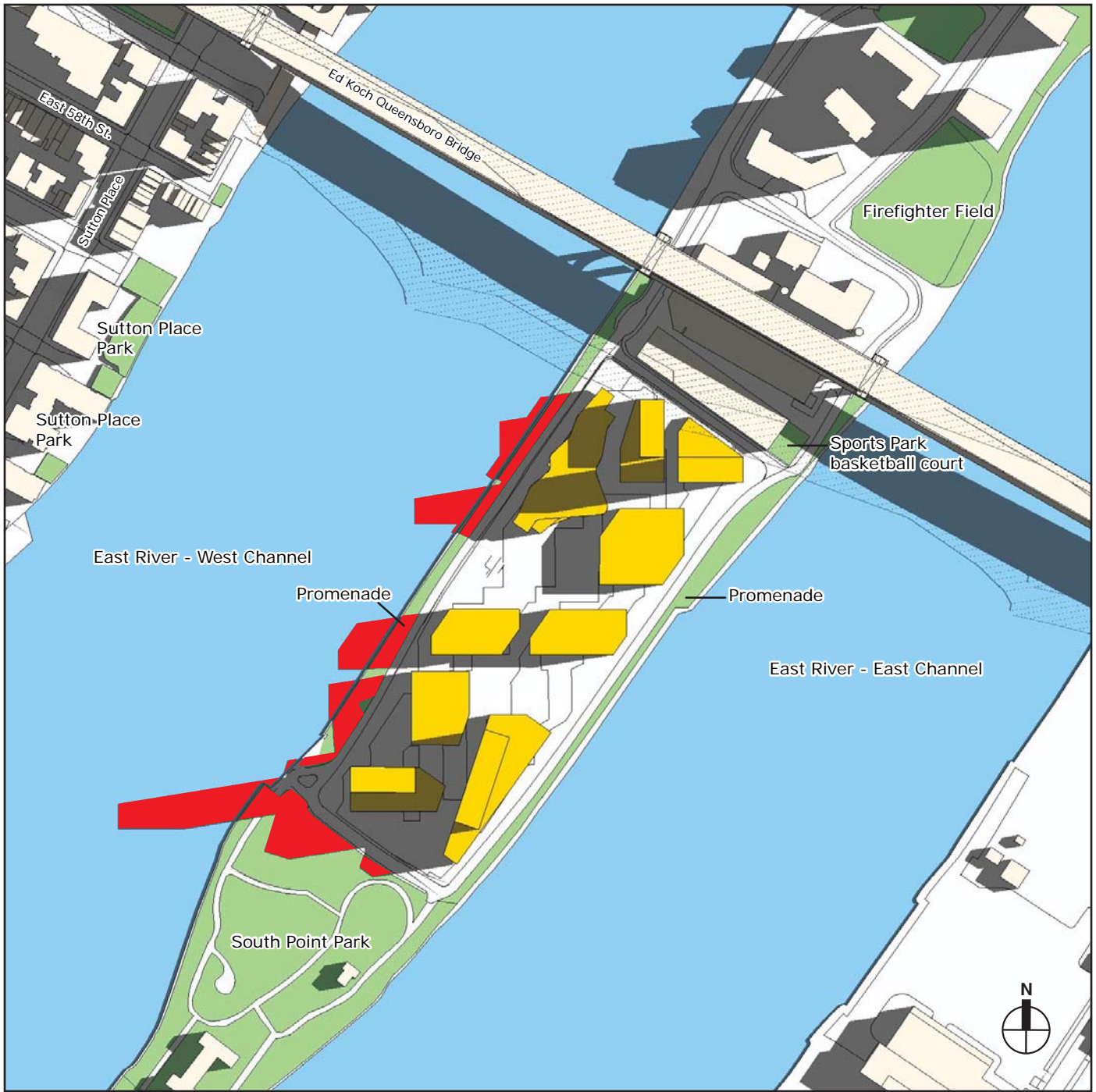
Note: Daylight Saving Time not used.

Phase 2  
 May 6/August 6 - 5:00 PM  
**Figure 6-59**



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

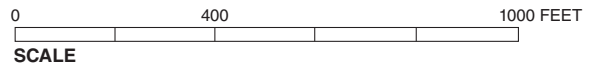
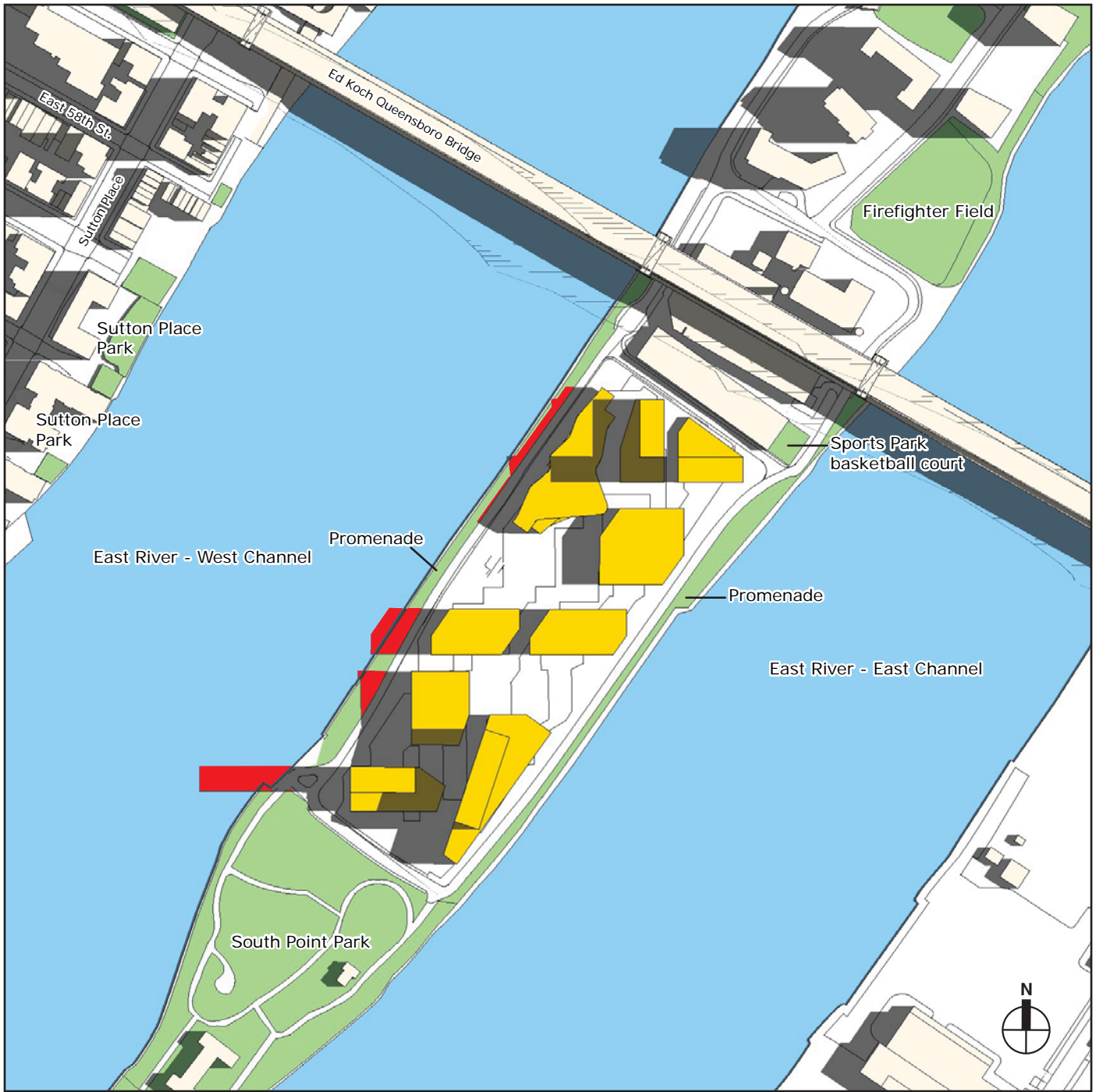
Note: Daylight Saving Time not used.



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

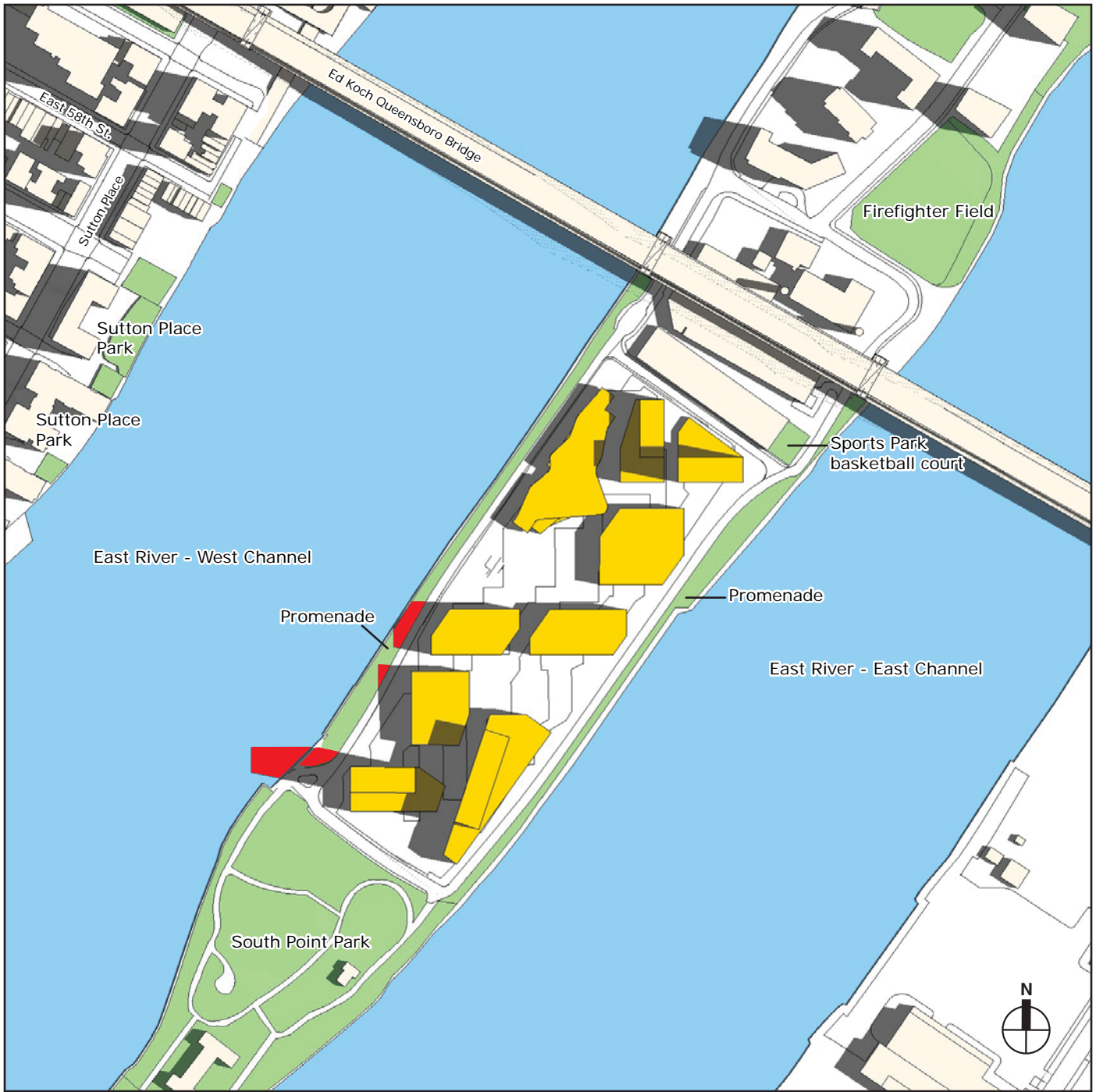
Note: Daylight Saving Time not used.





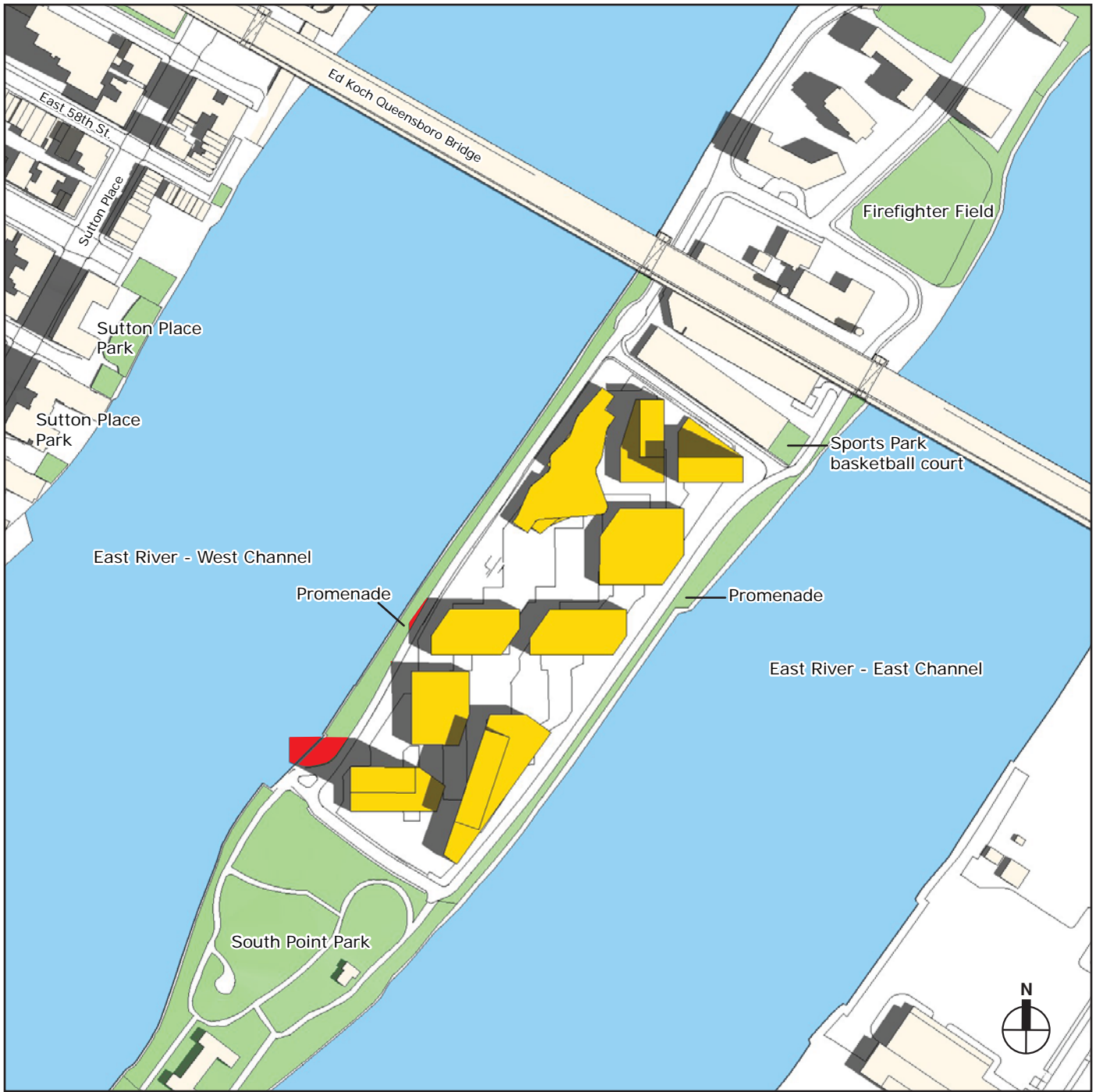
- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.



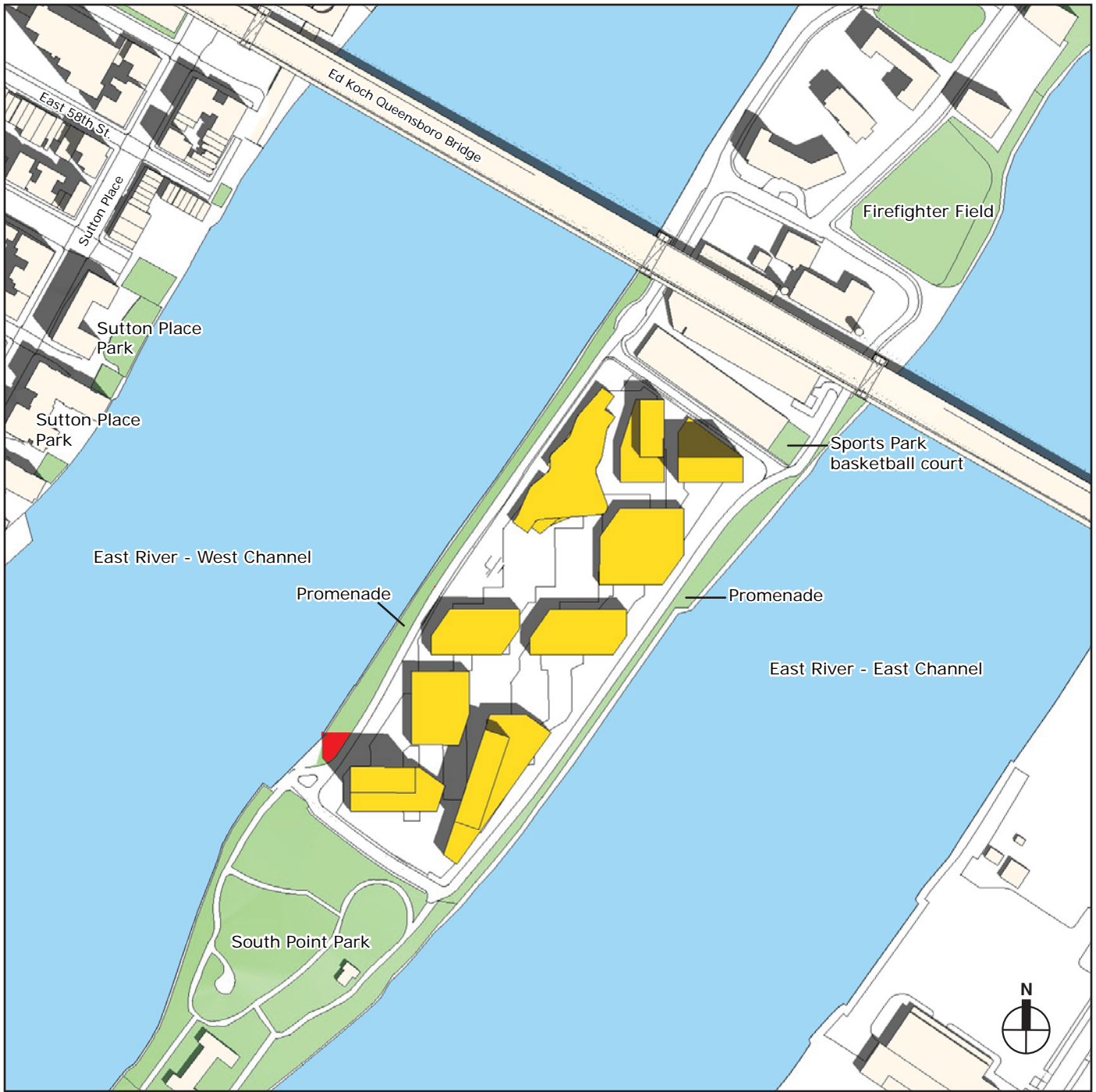
- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.



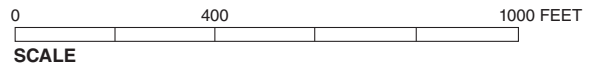
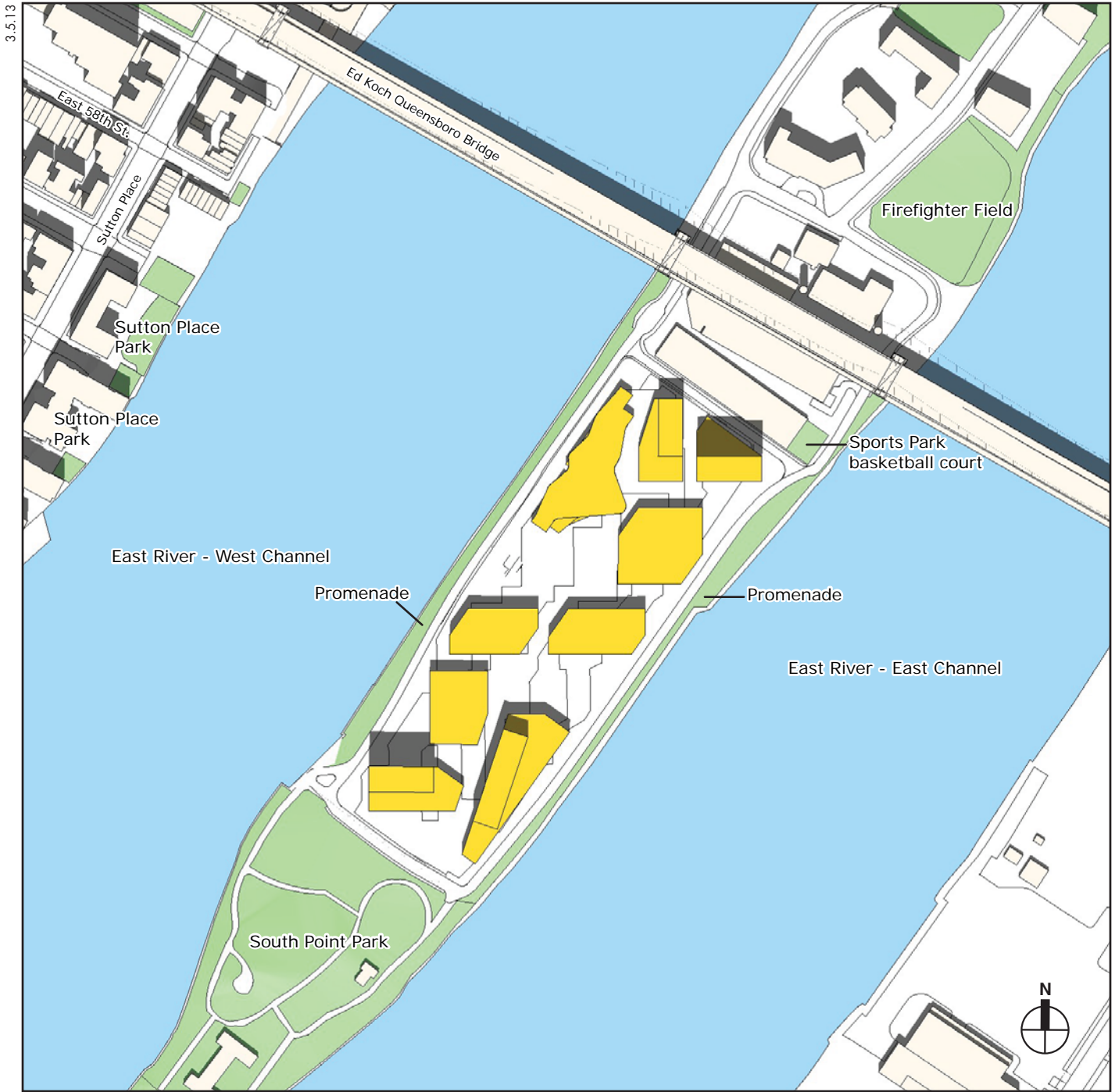
- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.

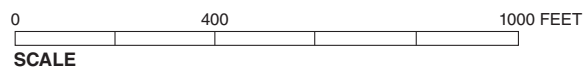


- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River

Notes: No incremental shadow on sun-sensitive resources would occur at this time.  
Daylight Saving Time not used.



3.5.13



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

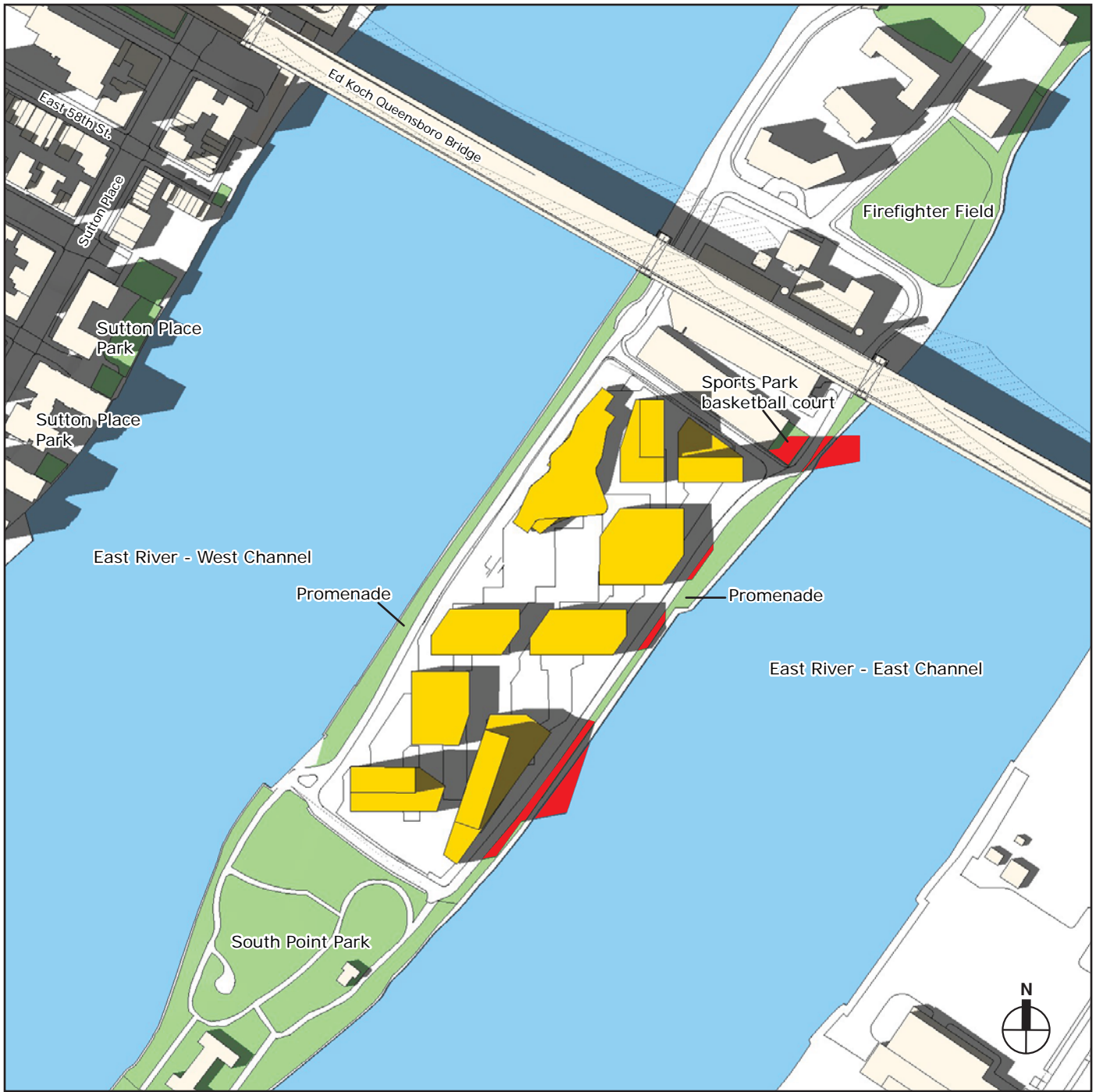
Note: Daylight Saving Time not used.

Phase 2  
 June 21 - 1:00 PM  
**Figure 6-67**



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.

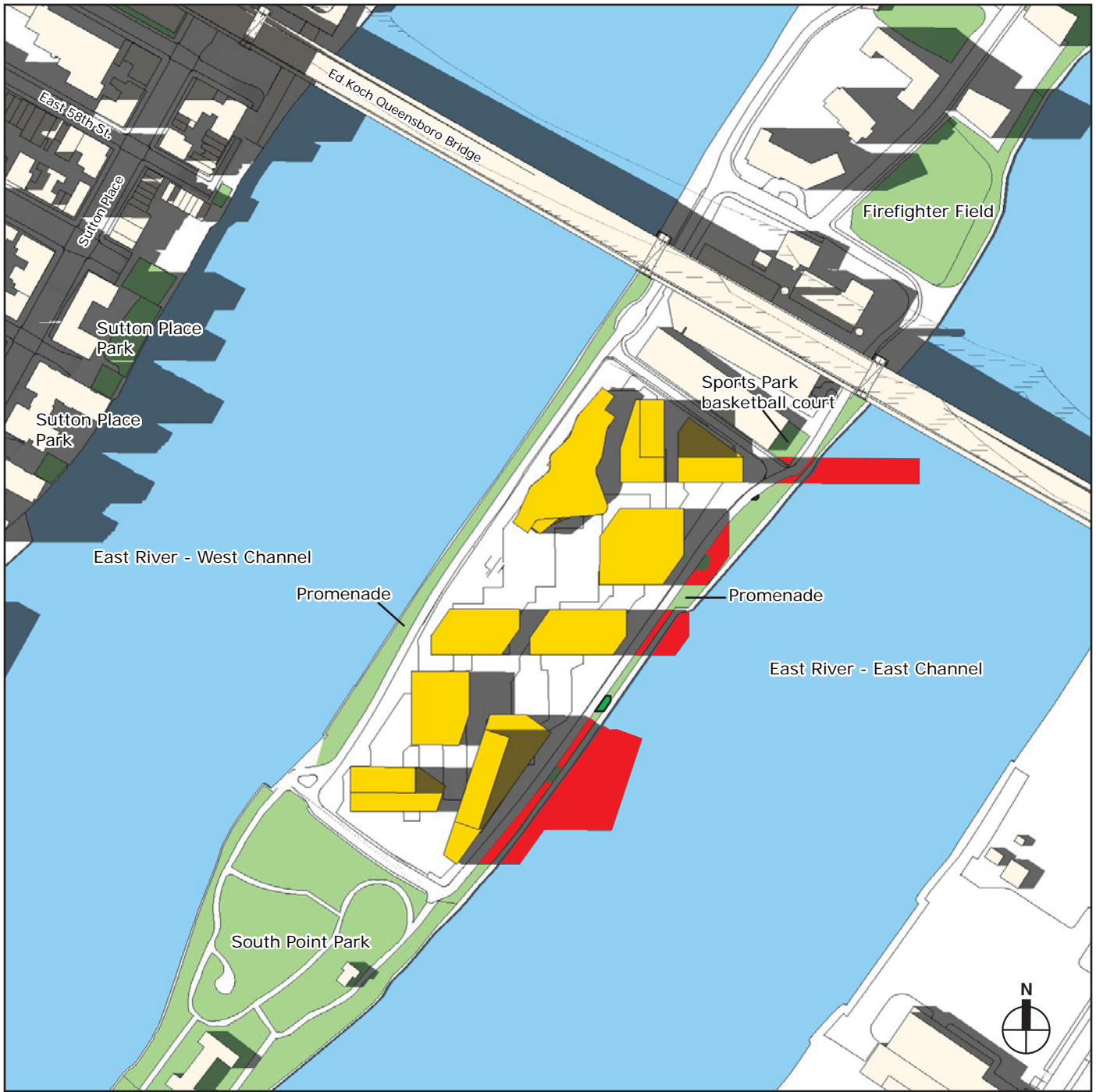


- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.

Phase 2  
 June 21 - 3:00 PM  
**Figure 6-69**



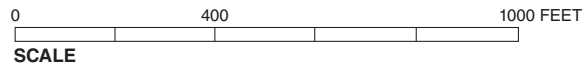
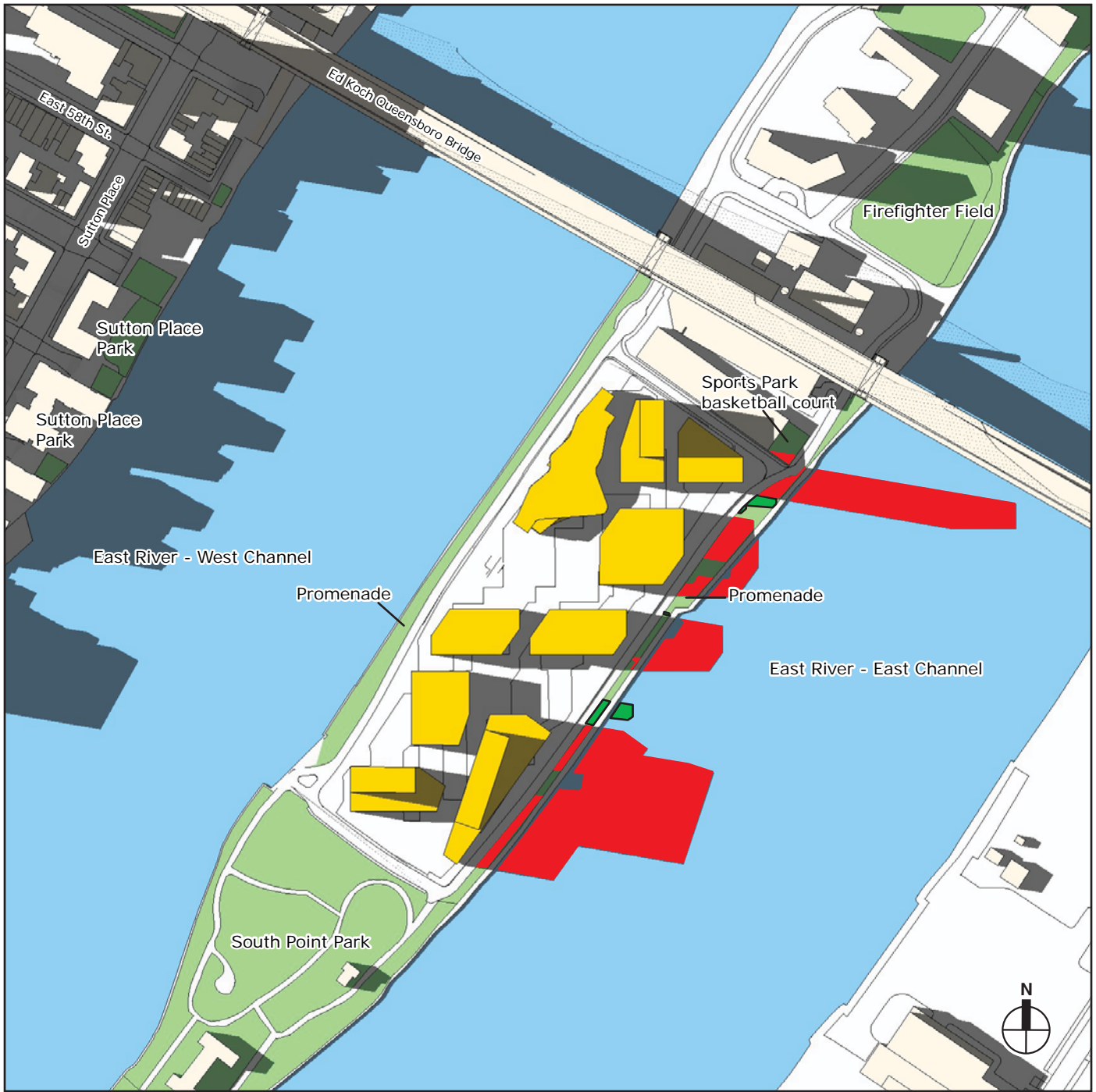


0 400 1000 FEET  
SCALE

- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow
- Reduced Shadow (i.e. cast in Future No-Action but not with Proposed Project)

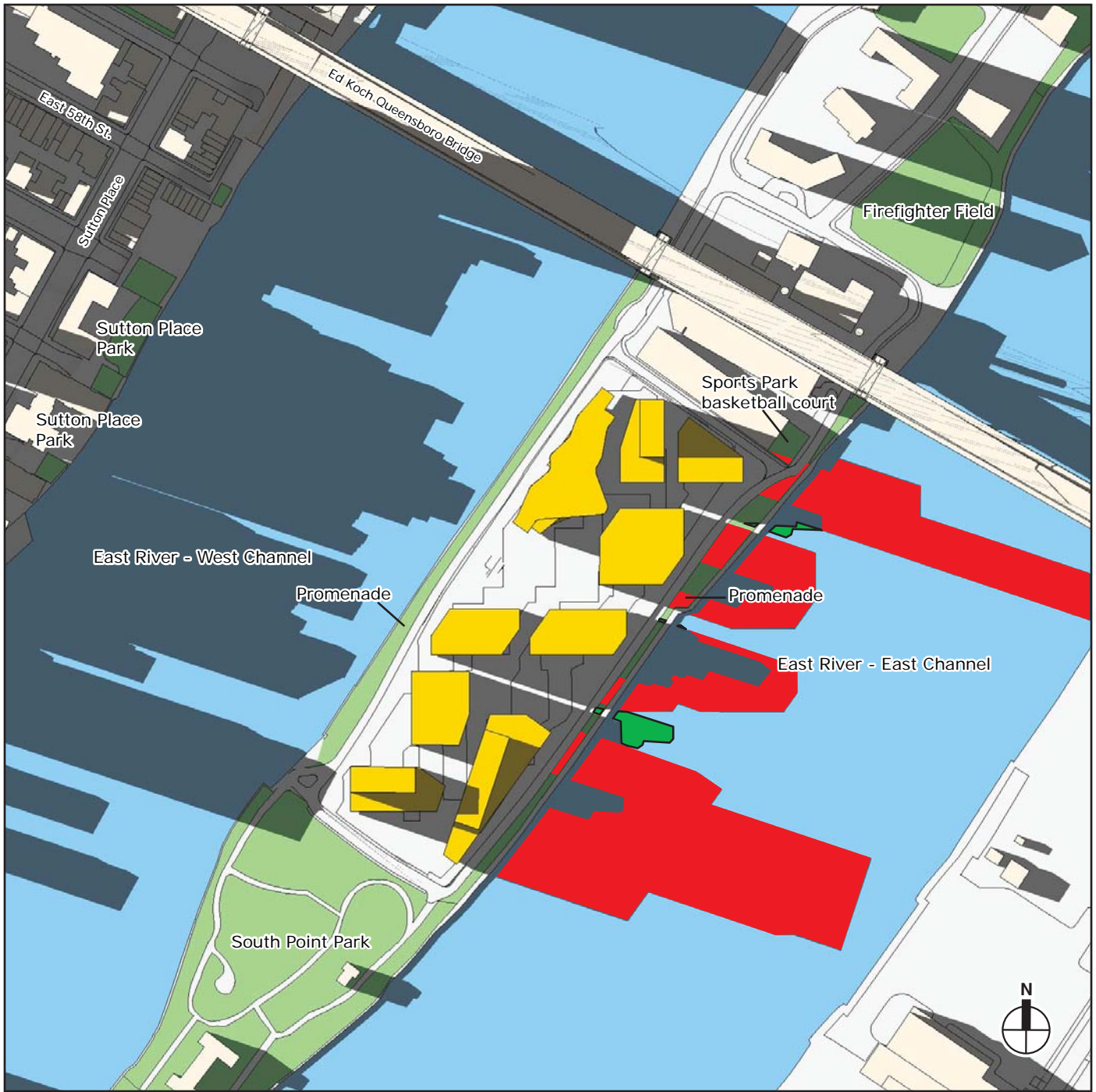
Note: Daylight Saving Time not used.

Phase 2  
June 21 - 4:00 PM  
**Figure 6-70**



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow
- Reduced Shadow (i.e. cast in Future No-Action but not with Proposed Project)

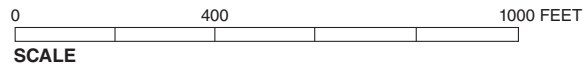
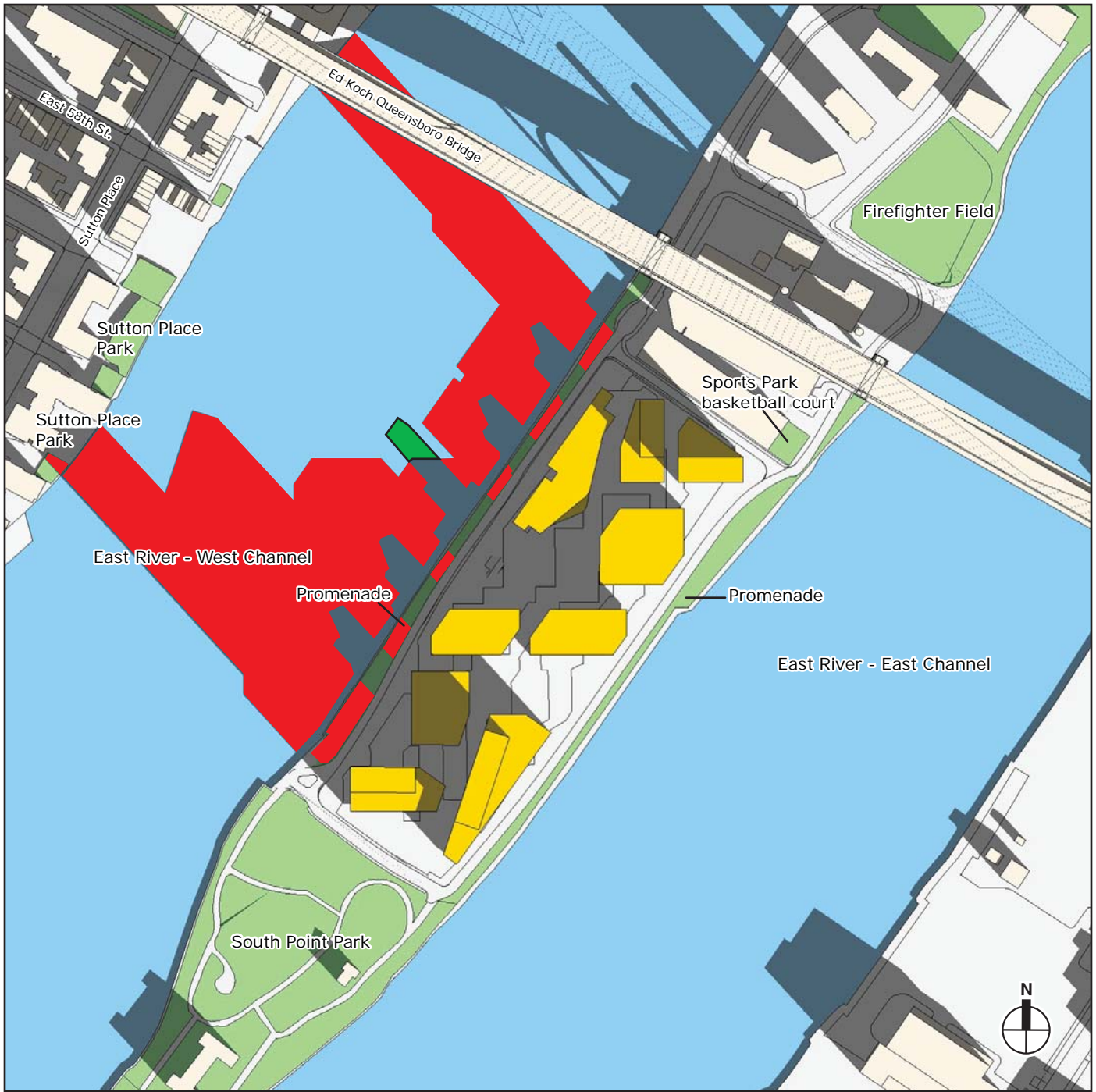
Note: Daylight Saving Time not used.



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow
- Reduced Shadow (i.e. cast in Future No-Action but not with Proposed Project)

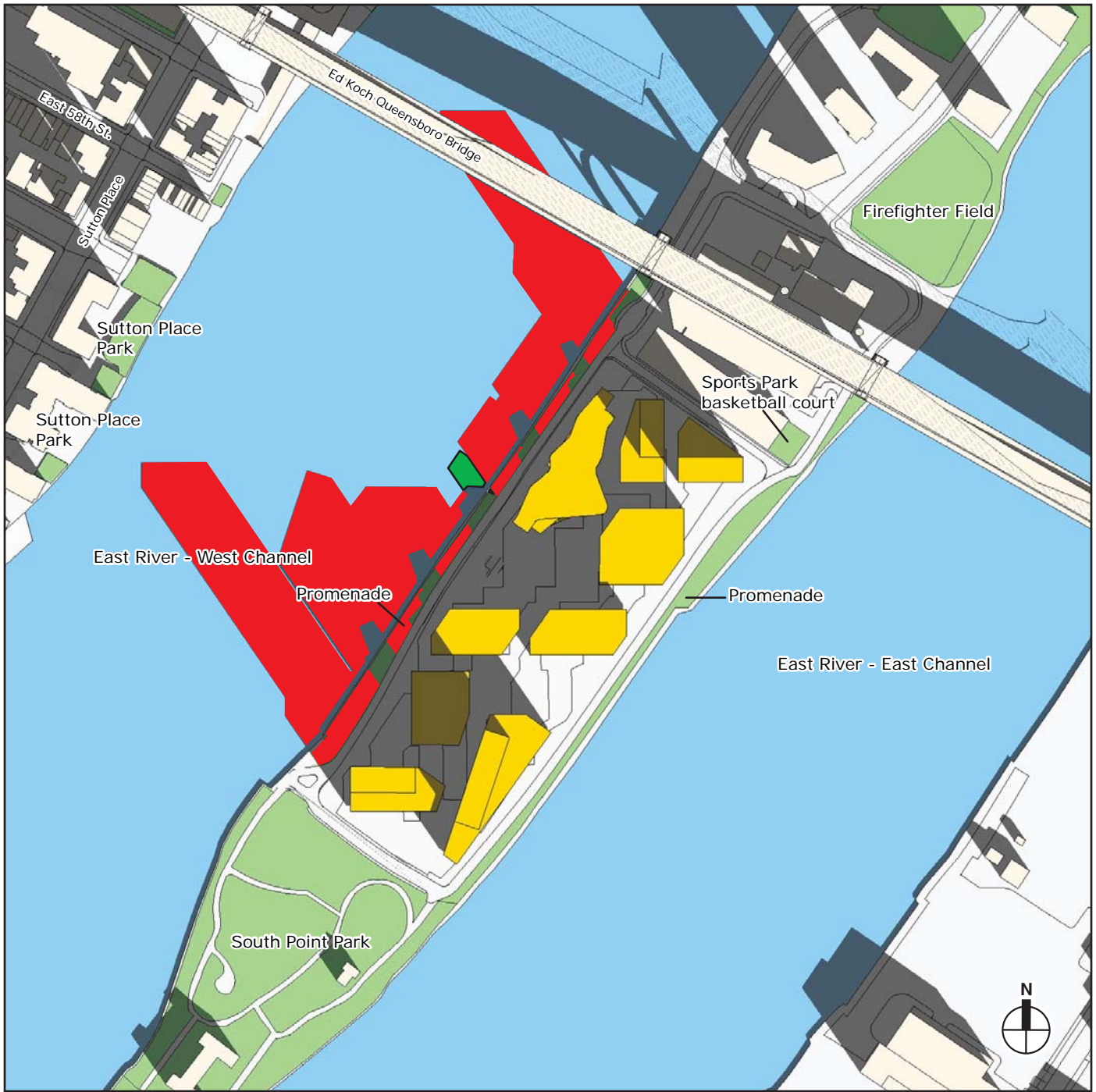
Note: Daylight Saving Time not used.

Phase 2  
June 21 - 6:00 PM  
**Figure 6-72**



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow
- Reduced Shadow (i.e. cast in Future No-Action but not with Proposed Project)

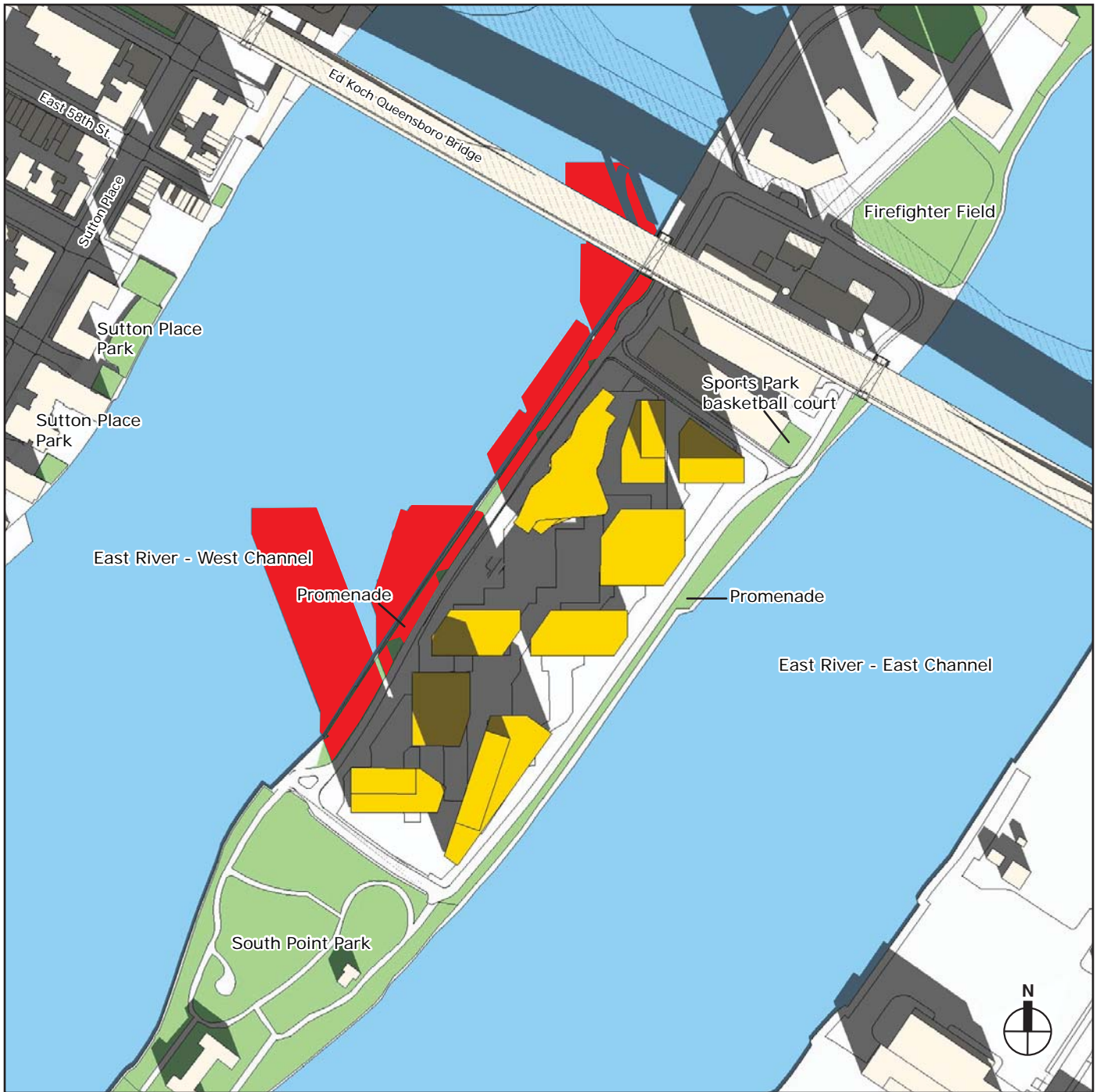
Note: Daylight Saving Time not used.



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow
- Reduced Shadow (i.e. cast in Future No-Action but not with Proposed Project)

Note: Daylight Saving Time not used.

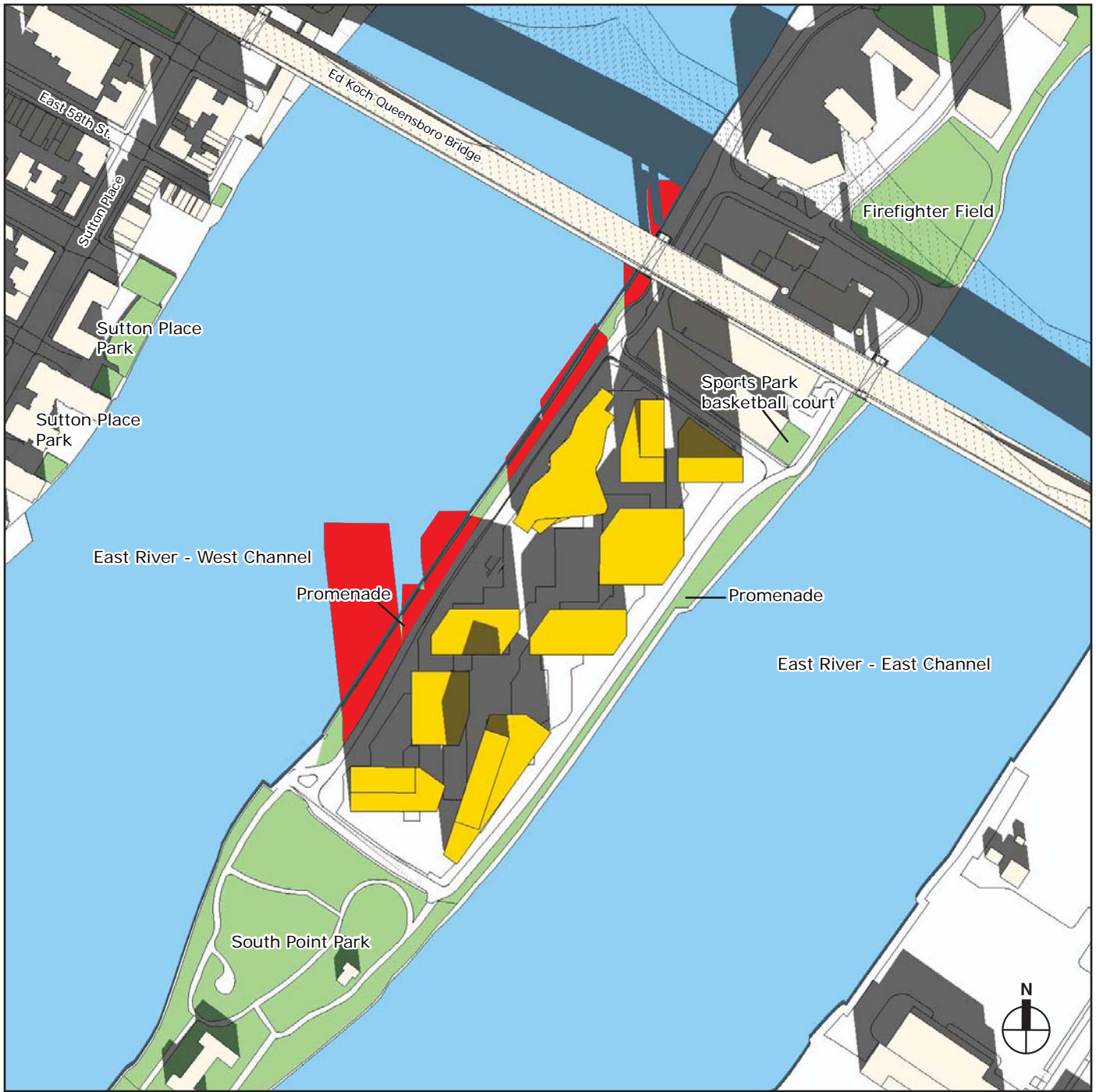
Phase 2  
 December 21 - 9:30 AM  
**Figure 6-74**



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

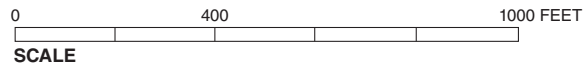
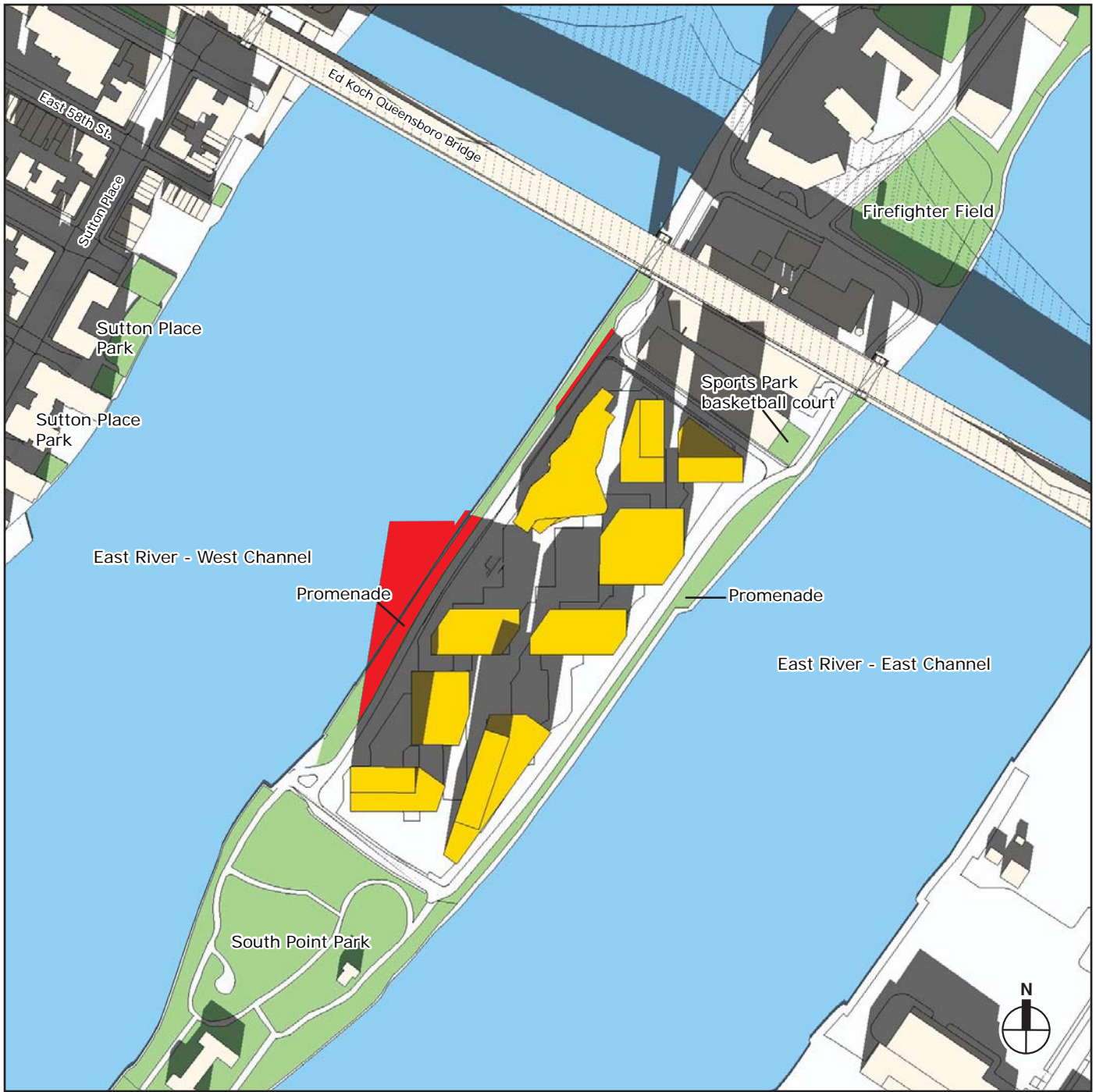
Note: Daylight Saving Time not used.

Phase 2  
December 21 - 10:30 AM  
**Figure 6-75**



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

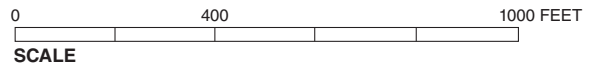
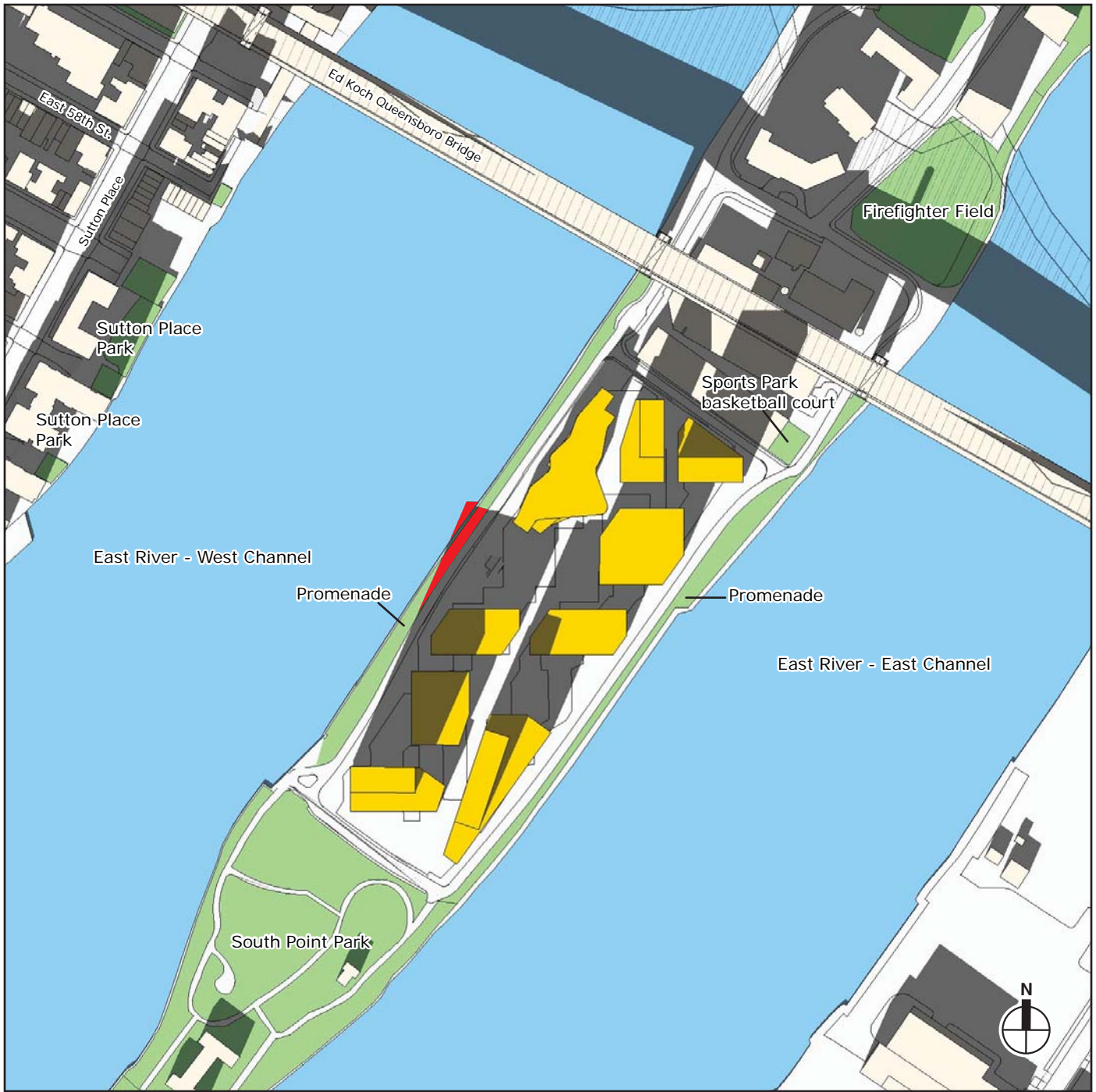
Note: Daylight Saving Time not used.



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.

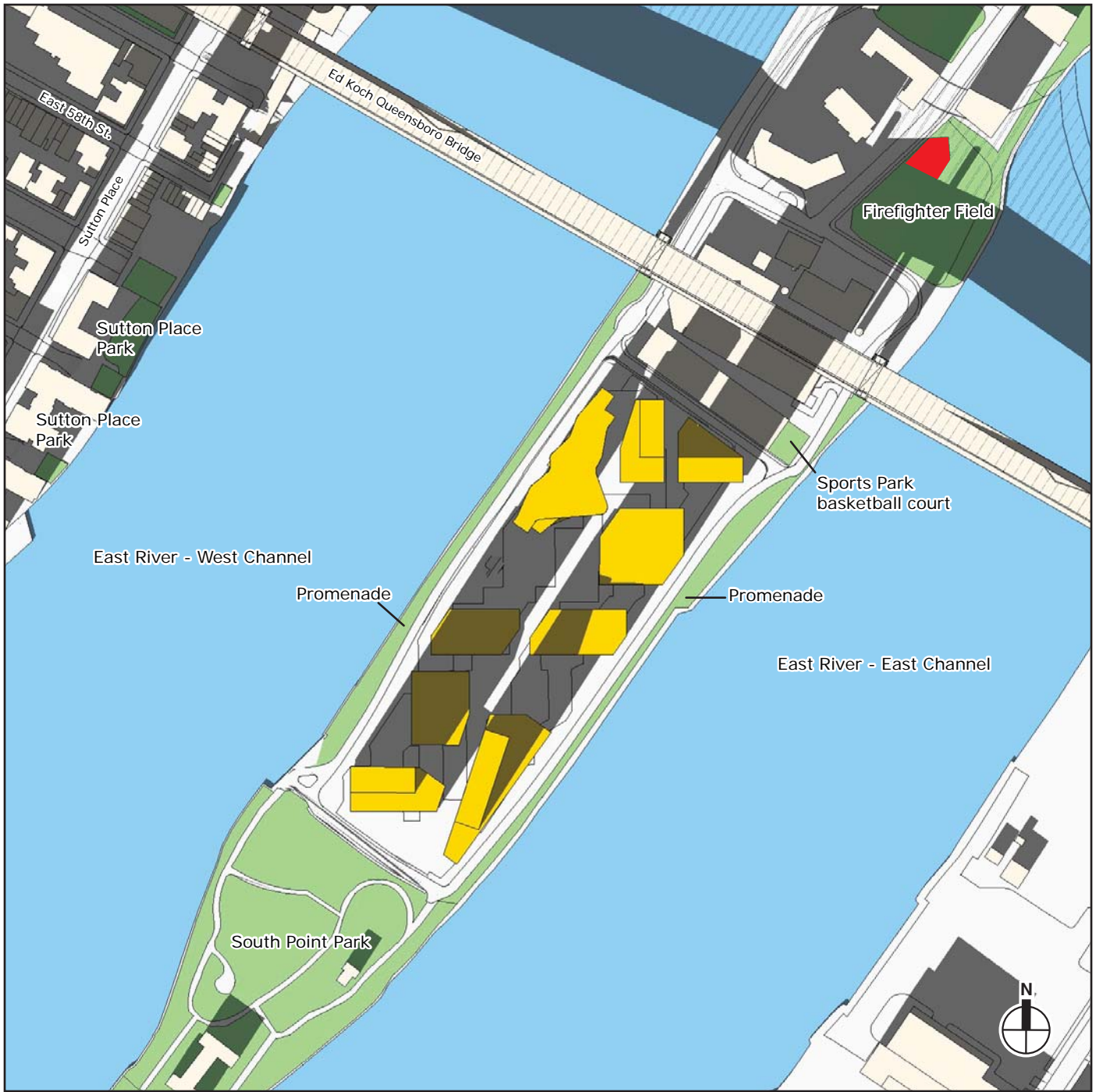




- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

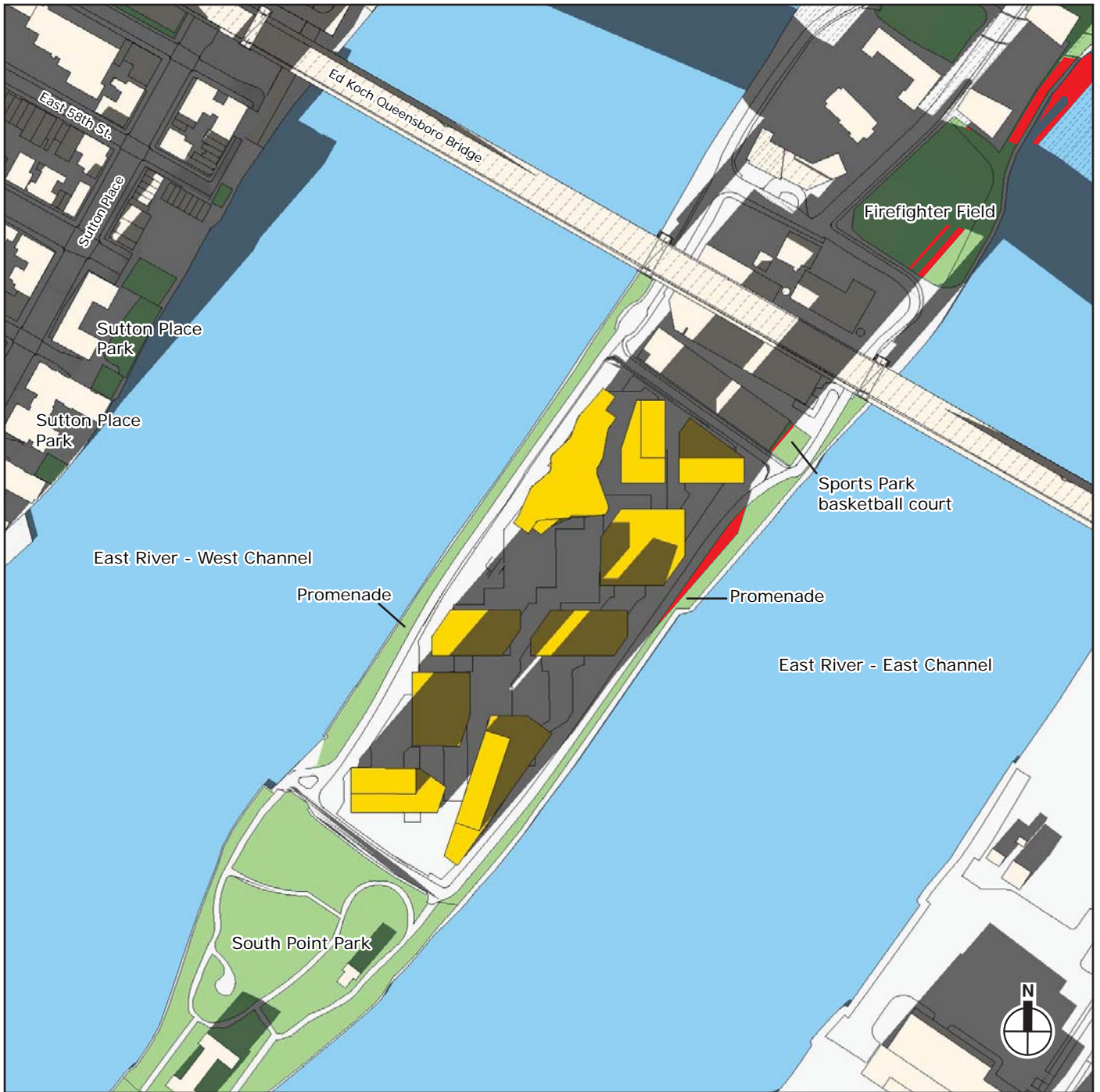
Note: Daylight Saving Time not used.

Phase 2  
December 21 - 1:30 PM  
**Figure 6-78**



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.



- Reasonable Worst-Case Development Scenario Building Envelopes - Phase 2
- Publicly-Accessible Open Space
- East River
- Incremental Shadow

Note: Daylight Saving Time not used.

Phase 2  
December 21 - 2:50 PM  
**Figure 6-80**

**Table 6-2**  
**Incremental Shadow Durations—Phase 2 (2038)**

Analysis day and timeframe window	March 21 / Sept. 21 7:36 AM-4:29 PM	May 6 / August 6 6:27 AM-5:18 PM	June 21 5:57 AM-6:01 PM	December 21 8:51 AM-2:53 PM
<b>OPEN SPACES</b>				
South Point Park	—	6:27 AM–7:30 <u>8:00</u> AM Total: 1 hr 3 <u>33</u> min	5:57 AM–8:50 <u>00</u> AM Total: 2 hr 5 <u>3</u> min	—
Sutton Place Park – East 55th St. & East 56th St.	—	—	—	8:51 AM–8:55 AM Total: 4 min
Waterfront promenade – west side	7:36 AM–12:50 <u>20</u> PM Total: 5 hr 14 min <u>4 hr 44 min</u>	6:27 AM–12:10 PM Total: 5 hr 43 min	5:57 AM–12:00 <u>PM 11:50 AM</u> Total: 6 hr 3 min <u>5 hr 53 min</u>	8:51 AM–1:50 <u>40</u> PM Total: 4 hr 59 <u>49</u> min
Sportspark outdoor basketball court	2:00 PM–4:29 PM Total: 2 hr 29 min	1:10 PM–5:18 PM Total: 4 hr 8 min	1:00 PM–6:01 PM Total: 5 hr 1 min	2:40 PM–2:53 PM Total: 13 min
Waterfront promenade – east side	2:40 <u>30</u> PM–4:29 PM Total: 1 hr 49 <u>59</u> min	2:40 <u>00</u> PM–5:18 PM Total: 3 hr 8 <u>18</u> min  <i>Reduced:</i> 4:00 PM–5:18 PM Total: 1 hr 18 min	2:40 <u>00</u> PM–6:01 PM Total: 3 hr 51 min <u>4 hr 1 min</u>  <i>Reduced:</i> 4:00 PM–6:01 PM Total: 2 hr 1 min	2:50 PM–2:53 PM Total: 3 min
Firefighter Field and adjacent waterfront area	—	—	—	1:40 PM–2:53 PM Total: 1 hr 13 min
<b>NATURAL FEATURES</b>				
East River – west channel	7:36 AM–12:20 PM Total: 4 hr 44 min  <i>Reduced:</i> 7:36 AM–7:40 AM Total: 4 min	6:27 AM–11:10 AM Total: 4 hr 43 min	5:57 AM–10:50 AM Total: 4 hr 53 min	8:51 AM–1:30 PM Total: 4 hr 39 min  <i>Reduced:</i> 8:51 AM–9:30 AM Total: 39 min
East River – east channel	3:00 <u>2:50</u> PM–4:29 PM Total: 1 hr 29 <u>39</u> min	2:30 PM–5:18 PM Total: 2 hr 48 min  <i>Reduced:</i> 5:00 PM–5:18 PM Total: 18 min	2:20 PM–6:01 PM Total: 3 hr 41 min  <i>Reduced:</i> 4:30 PM–6:01 PM Total: 1 hr 31 min	2:40 PM–2:53 PM Total: 13 min
<b>Notes:</b> Table indicates entry and exit times and total duration of incremental shadow for each sunlight-sensitive resource. Daylight saving time is not used—times are Eastern Standard Time, per <i>CEQR Technical Manual</i> guidelines. However, Eastern Daylight Time is in effect for the March/September, May/August and June analysis periods, add one hour to the given times to determine the actual clock time. “Reduced” durations refer to shadow that the future No-Action buildings would cast, which would not be cast by the proposed project.				

*MAY 6/AUGUST 6 (FIGURES 6-50 TO 6-59)*

~~A small~~An area in the northern section of South Point Park would be shaded by the southernmost buildings of the Phase 2 development for up to the first hour and a half of the May 6/August 6 analysis day ~~(see Figure 6-50)~~. The extent of new shadow would be large for the first half-hour but after 7:00 AM it would affect only a small area in the northwest portion of the park, and would exit at 8:00 AM (see Figures 6-50 and 6-51).

As on the March 21/September 21 analysis day, shadows from the Phase 2 development would fall west across much of the southern half of the promenade and onto the west channel at the start of the analysis period. These shadows would slowly move clockwise during the morning, finally exiting the promenade completely at about noon. However, nearer to the summer solstice, shadows are shorter, and larger areas of sun would reach the promenade between the proposed towers. One or two areas of the southern portion of the promenade would receive up to about three and a half hours of new shadows.

In the afternoon, additional areas of the eastern promenade would receive incremental shadows from the Phase 2 development, beginning at ~~2:40~~2:00 PM. These shadows would spread to cover large areas of the southern half of the promenade from about ~~3:20~~3:00 PM to the end of the analysis day at 5:18 PM. New shadows would also extend out across portions of the river's east channel during this time, falling on some sections for about two and a half hours, on other sections for less time.

*JUNE 21 (FIGURES 6-60 TO 6-72)*

Shadows from the Phase 2 development would fall across an area in the northern part of South Point Park at the start of the analysis day at 6:00 AM (see Figure 6-60). These shadows would move clockwise, so that by 7:00 AM they would be less than half the size, and would exit the northwest edge of the park completely by ~~8:50~~10 AM.

As on the May 6/August 6 analysis day, the three proposed buildings on the western half of the Phase 2 development would cast their shadows westward across the promenade and channel in the morning. These shadows would be large early in the morning but by ~~9:30~~8:00 AM the majority of the southern half of the promenade would be in sun, and by ~~10:30~~9:00 AM only small areas would continue to receive project generated shadows. Shadows move slowly on June 21 and would not exit the promenade completely until ~~noon~~11:50 AM. ~~One or two~~ locations on the southern portion of the promenade would receive up to three and three quarters hours of incremental shadows, while the rest would receive less. Shadows from the Phase 2 development would also fall across areas of the East River's west channel throughout the morning; but no one area adjacent to the shore of the river surface would receive about three more than about one hour of new shadows, while other areas would receive less.

In the afternoon, similar to the May 6/August 6 analysis day, additional areas of the eastern promenade would receive incremental shadows from the Phase 2 development, beginning at ~~2:40~~2:00 PM. These shadows would cover large areas of the southern half of the promenade by late in the afternoon but some sunlit areas would remain until the end of the analysis day at 6:01 PM. New shadows would also extend out across portions of the river's east channel during this time, falling on some sections for about three hours, on other sections for less time.

*DECEMBER 21 (FIGURES 6-73 TO 6-80)*

On December 21, shadow from the southernmost proposed residential building would reach across the river's west channel and fall on Sutton Place Park at the ends of East 55th Street and East 56th Street for the first few minutes of the analysis day.

As with the Phase 1 development, Phase 2 development would cast long shadows to the northwest and north in the morning and mid-day hours of December 21, shading large areas of the western promenade and west channel.

*PROPOSED PROJECT OPEN SPACE*

Between 2018 and 2038, a minimum of 1.2 acres of new publicly accessible open space would be developed on the project site (in addition to the 1.3 acres of publicly accessible open space that would be added by 2018), consisting of approximately 0.9 acres of passive open space and 0.3 acres of active open space. In total, the full build out of the proposed project would introduce a minimum of approximately 2.5 acres of new publicly accessible open space, which would be comprised of 1.91 acres of passive open space and 0.59 acres of active open space. As discussed above, according to the *CEQR Technical Manual*, open space that would be developed as part of a project cannot experience adverse impacts from the project, because without the project the space would not exist. However, a discussion of shadows on the proposed open space is often provided for informational purposes.

Similar to the discussion of project open space in the Phase 1 analysis, the Phase 2 project open spaces would experience periods during which they would be largely or entirely in shadow, as well as periods during which they would be largely or fully in sun. The open spaces on the eastern side of the site would be mostly in sun during the spring, summer and fall mornings, partially in shadow in the early afternoon, and mostly in shadow in the later afternoons in these seasons. On the western side of the site, the opposite would be true: mostly in shade in the mornings, partially in sun in the early afternoon and mostly in sun in the later afternoon. Any space on the northern boundary of the project site would be mostly in shadow from mid-morning to mid-afternoon in the spring, summer and fall, while space on the southern side would be in sun for most of the day in these seasons. In the winter, the spaces would be mostly in shadow throughout the day, with the exception of open space area on the east side which would be mostly sunny in the morning, and space on the southern side, which would be sunny most of the day.

**E. CONCLUSIONS**

This section summarizes the potential shadow effects for each resource of concern, and assesses whether the Cornell NYC Tech project would result in any significant adverse shadow impacts on these resources.

**PROMENADE — WEST SIDE**

*FUTURE NO-ACTION*

Without the proposed project, small areas of the promenade would receive brief shadows from the hospital buildings in the early morning in the spring, summer and fall, and would otherwise be in sun throughout the day.

*PHASE 1*

A portion of the northern section of the promenade would receive ~~a total of five hours~~ approximately three hours of new shadows in the morning and mid-day in ~~all seasons~~ the spring, summer and fall, and three and three quarters in the winter. The incremental shadows would move over the course of this period, affecting different areas at different times. At least one area would receive about ~~four and a half~~ three hours of new shadows; some other areas would receive between one and ~~four two and a half~~ hours. With no structures to the west, the promenade would consequently be in full sun from mid-day to the end of the analysis period. All individual trees would remain in direct sun for a minimum of approximately four hours on March 21/September 21, and for six hours or more in May through August. Therefore, the health of the vegetation would not likely be significantly impacted by the proposed project's shadows at any time during the growing season.

In terms of the impacts of shadows on users of the promenade, the linear nature of the space and the proximity of other seating areas in direct sun elsewhere along the western or eastern promenade, and in South Point Park, provide many alternatives to users who would seek out a seating or walking area in the sun, in any season. Therefore, users of the promenade would not be significantly impacted by the project generated shadow.

*PHASE 2*

Shadows from the Phase 2 development would affect the southern part of the promenade in a similar way to that of Phase 1 shadows on the northern section, at least in terms of vegetation. Despite long durations of incremental shadows, each tree would continue to receive a minimum five hours of direct sun in March 21/September 21 (most trees would receive more) and seven or more hours from May to August. Therefore, the health of the vegetation would not likely be significantly impacted by the proposed project's shadows at any time during the growing season.

In Phase 2, from the perspective of the user, a larger proportion of the western promenade would be in incremental shadow in the mornings throughout the year. However, the linear nature of the space would continue to provide sunlit seating areas in some locations, and there would be larger sunlit seating areas in the adjacent spaces of South Point Park and the eastern promenade. Even in the winter, these adjacent waterfront spaces would be mostly in sun throughout the morning when the western promenade would be mostly in shadow. Users of the promenade would therefore not be significantly impacted by the project generated shadow.

**PROMENADE — EAST SIDE**

*PHASE 1*

Incremental shadow durations would range from one hour 40 minutes in March and September to three hours 50 minutes on the summer solstice, occurring in the middle to late afternoon. These new shadows would fall in the northern part of the promenade. The vegetation in this area would receive more than six hours of direct sunlight throughout the morning and early afternoon through the growing season (March 21/September 21, May 6/August 6, and June 21 analysis days), due to the lack of any nearby structures to the east and southeast, and would not be significantly impacted by the project. As noted for the western side of the promenade above, users would be able to use adjacent sunlit sections of the promenade or South Point Park during the late afternoons when portions of the eastern promenade are in incremental shadow, and

therefore significant shadow impacts would not occur to the users of this space with the proposed project.

*PHASE 2*

In 2038 with the proposed project, incremental shadow durations on the eastern promenade would range from ~~an hour and 50 minutes~~ two hours in March and September to ~~three hours and 50 minutes~~ four hours on June 21, occurring in the middle to late afternoon. However, as in Phase 1, each individual tree or other plant would continue to receive more than six hours of sunlight throughout the morning and early afternoon through the growing season (March 21/September 21, May 6/August 6, and June 21 analysis days) to maintain its health, and would not be significantly impacted by the project. For users, even in the late afternoons of the May 6/August 6 and June 21 analysis days when fairly large sections of the eastern promenade are shaded by the proposed development, the linear nature of the space would continue to provide sunlit seating areas in some limited locations, and there would be larger sunlit seating areas in the adjacent spaces of South Point Park and the western promenade. Therefore, no significant shadow impacts would result from the proposed development.

**SPORTSPARK OUTDOOR BASKETBALL COURT**

*PHASE 1*

The Phase 1 development, particularly the residential building, would cast shadows on the court between two and a half hours, in early spring and fall, to five hours on the summer solstice. In March and September, incremental shadow from the Phase 1 residential building would last from 2:00 PM to 4:29 PM but would not eliminate all remaining sunlight until the final 29 minutes of the analysis day. In May through August, the extent and duration of the new shadow would be greater, and would eliminate remaining sunlight for 30 minutes around 3:00 PM. On June 21 incremental shadow would fall on large portions of the court for about an hour and a half in the middle of the afternoon, and would remove remaining sunlight from 4:50 PM to 6:01 PM, though nearly the entire court would be in existing shadow at that time. However, the court is mostly or completely in sun throughout the morning and early afternoon in these seasons, and, particularly in the heat of these late spring and summer months, this limited extent and duration of new shadow on a basketball court would likely not significantly impact the users. In December only three minutes of incremental shadow would occur in Phase 1.

*PHASE 2*

In Phase 2, there would be 10 additional minutes of incremental shadow on the basketball court, occurring on the December 21 analysis day, which would not alter the conclusions from Phase 1.

**SOUTH POINT PARK**

No project-generated shadow would reach South Point Park in Phase 1. With Phase 2 development, new shadows would fall on the northern or northwestern portion of this park early in the late spring and summer mornings, ranging from about an hour and a half on May 6/August 6 to ~~nearly three~~ two hours on the summer solstice. Given that this area of the park would be in full sun for the remainder of the analysis day in these seasons (i.e. nine to ten hours), no significant shadow impacts would occur.



### **FIREFIGHTER FIELD**

Incremental shadow would fall on a small portion of this field for about an hour and ten minutes on the December 21 analysis day only. Given the limited size and duration of the incremental shadow, the active-use nature of the resource, and the fact that parts of the field would remain in sun during the affected period, significant shadow impacts would not occur.

### **SUTTON PLACE PARK**

Four minutes of new shadow on the December 21 analysis day only would not result in shadow impacts.

### **EAST RIVER**

The proposed project would cast new shadows on portions of the west channel of the East River in the mornings and portions of the east channel in the afternoons in all seasons, primarily affecting areas adjacent to the shoreline. While the total duration of new shadow would be generally between four and a half and five hours on the west channel and between a few minutes and up to nearly four hours on the east channel, depending on the season, most affected areas in both channels would receive shorter durations as the shadows move west to east and clockwise over the course of the day. The areas that would receive the longest durations of new shadows would continue to receive more than six hours of sunlight over the course of each analysis day, because there are no other nearby structures casting shadows besides the ones on the proposed project site.

The current flows swiftly in the East River and would move phytoplankton and other natural elements quickly through the shaded areas. Therefore, given their limited duration and extent over the course of each analysis day, incremental shadows generated by the proposed project would not have significant adverse impacts on primary productivity within the East River. \*