REPORT

EMERYVILLE PUBLIC MARKET – PARCEL B

EMERYVILLE, CA

PEDESTRIAN WIND STUDY
RWDI # 1902969
November 1, 2019

SUBMITTED TO

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EXECUTIVE SUMMARY

RWDI was retained to conduct a pedestrian wind assessment for the proposed Emeryville Public Market – Parcel B in Emeryville, CA (Image 1). The project site, photographs of the wind tunnel study model and the wind statistics recorded at the Metropolitan Oakland International Airport used in the study are shown in Images 1, 2A through 2E and 3, respectively. Emeryville does not have an adopted wind significant threshold, but one was identified in the Marketplace EIR. The DEIR states (p. 334): "The exposure, orientation and massing of a proposed structure can be expected to substantially increase ground-level winds in pedestrian corridors or public spaces near the project site. Since the ambient wind (undisturbed by buildings) in Emeryville seldom exceeds 36 mph, a project must substantially increase winds for this threshold to be exceeded." Accordingly, the EIR determines significant impacts based on wind hazards (wind above 36 mph). Wind comfort (wind above 11 mph) is considered for *informational purposes.*

The predicted wind conditions around the Existing, Existing + Project and Project + Cumulative configurations were presented in the report *"Emeryville Public Market – Parcel B, RWDI Project #1902969, May 14, 2019"*. The project analyzed in the May 14, 2019 report is the FDP project approved by the Planning Commission. Since the initial wind tunnel study, the design team was requested to prepare a comparison to the PDP as well as analysis to consider modifying the Project massing, and additional wind tunnel tests were recently conducted to assess the wind conditions around three newly proposed designs.

In total, the following scenarios have been considered:

1. Existing – existing conditions

2. FDP – project approved by the Planning Commission (113' tall, 469' long and 123' wide)

3. PDP Stepped Down – PDP building (120' tall with 48' steps, 520' long, 95' wide, and a 120' long extrusion)

4. PDP 120' Height – PDP building (120' tall, 520' long, 95' wide with a 120' long extrusion)

5. Alternate G – new alternate building (123' tall and 416' long)

The predicted wind hazard and comfort conditions pertaining to the five site and surrounding configurations assessed are graphically depicted on site plans in Figures 1A through 2E, with the associated wind speeds listed in Table 1. These results are presented in the attached results package and can be summarized as follows:

Wind Hazard Conditions:

- For the Existing configuration (without the project), wind speeds at all locations are anticipated to comply with the wind hazard criterion except for a location on the east side of the railroad tracks near the pedestrian bridge tower.
- With the proposed FDP configuration in place, wind speeds at all locations are expected to meet the wind hazard criterion including the location on the east side of the railroad tracks near the pedestrian bridge tower.
- For the PDP Stepped Down configuration, wind speeds at five locations are expected to exceed the wind hazard criterion along Shellmound Street.

- For the PDP 120' Height configuration, wind speeds at eight locations are expected to exceed the wind hazard criterion, including those predicted for the PDP Stepped Down configuration.
- For the Alternate G configuration, wind speeds at all locations are anticipated to comply with the wind hazard criterion.

Wind Comfort Conditions:

- On an annual basis, wind speeds at 24 locations in the Existing configuration are expected to exceed the comfort criterion. Most of these locations are to the west of the project site and around the building east of Overland Avenue.
- For the proposed FDP configuration, on an annual basis, wind conditions are expected to be moderated and the number of locations where wind speeds exceed the comfort criterion is reduced to 15.
- For the proposed PDP Stepped Down configuration, on an annual basis, wind speeds at 26 locations around the project site are anticipated to exceed the comfort criterion.
- On an annual basis, the number of locations where wind speeds exceed the comfort criterion is predicted to be 27 for the PDP 120' Height configuration.
- For the Alternate G configuration, wind speeds at 25 locations are expected to exceed the comfort criterion on annual basis.
- No landscaping was included in any wind tunnel testing. With the inclusion of the existing and proposed landscaping elements, such as trees, shrubs, awnings, screens and so on, wind conditions are expected to improve throughout the year.

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1 INTRODUCTION

RWDI was retained to conduct a pedestrian wind assessment for the proposed Emeryville Public Market – Parcel B in Emeryville, CA. This report presents the project objectives, background and approach, and discusses of the results from RWDI's assessment.

1.1 Project Description

The project (site shown in Image 1) is located on the east side of Shellmound Street between 63rd Street to the north and Powell Street to the south. The general surroundings are characterized by low- to mid-rise buildings to the east with San Francisco Bay to the west.

1.2 Objectives

The objective of the study was to assess the effect of the proposed development on local conditions in pedestrian areas on and around the study site and provide recommendations for minimizing adverse effects, if needed. This quantitative assessment was based on wind speed measurements on a scale model of the project and its surroundings in one of RWDI's boundary-layer wind tunnels. These measurements were combined with the local wind records and compared to appropriate criteria for gauging wind comfort and safety in pedestrian areas. The assessment focused on critical pedestrian areas, including building entrances and adjacent/nearby public sidewalks and walkways.

Image 1: Aerial View of Site and Surroundings (Photo Courtesy of Google™ Earth)

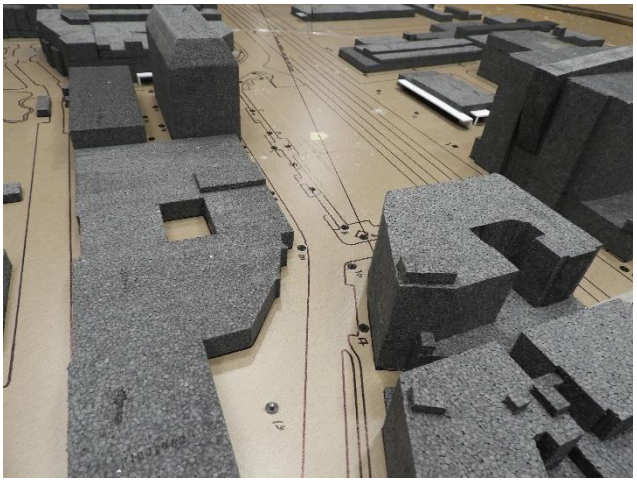
2 BACKGROUND AND APPROACH

2.1 Wind Tunnel Study Model

To assess the wind environment around the proposed project, a 1:300 scale model of the project site and surroundings was constructed for the wind tunnel tests of the following configurations:

A – Existing:	Existing site with existing surroundings (Image 2A),
B – FDP:	project approved by the Planning Commission (113’ tall, 469’ long and 123’ wide) (Image 2B),
C – PDP Stepped Down:	PDP building (120’ tall with 48’ steps, 520’ long, 95’ wide, and a 120’ long extrusion) (Image 2C),
D – PDP 120' Height:	PDP building (120’ tall, 520’ long, 95’ wide with a 120’ long extrusion) (Image 2D), and,
E – Alternate G:	new alternate building (123’ tall and 416’ long) (Image 2E).

The wind tunnel model included all relevant surrounding buildings and topography within an approximately 120 ft radius of the study site. The wind and turbulence profiles in the atmospheric boundary layer beyond the modelled area were also simulated in RWDI's wind tunnel. The wind tunnel model was instrumented with 45 specially designed wind speed sensors to measure mean and gust speeds at a full-scale height of approximately 5 ft above local grade in pedestrian areas throughout the study site. Wind speeds were measured for 36 directions in a 10-degree increment. The measurements at each sensor location were recorded in the form of ratios of local mean and gust speeds to the mean wind speed at a reference height above the model. The placement of wind measurement locations was based on our experience and understanding of the pedestrian usage for this site and reviewed by the project team.



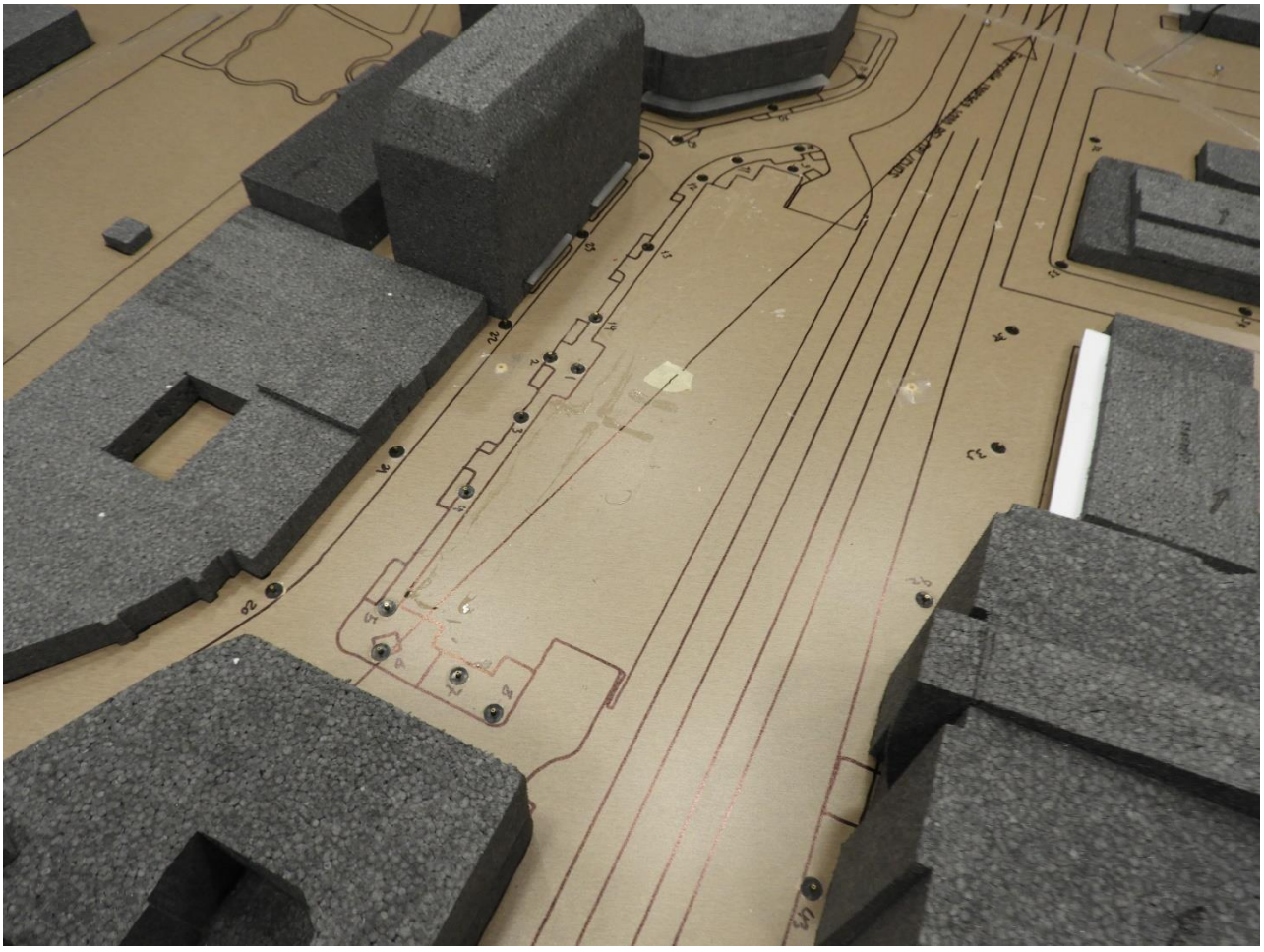
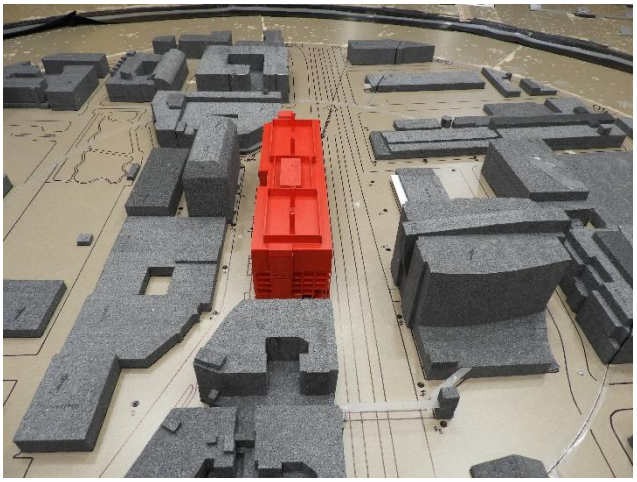


Image 2A: Wind Tunnel Study Model – Existing



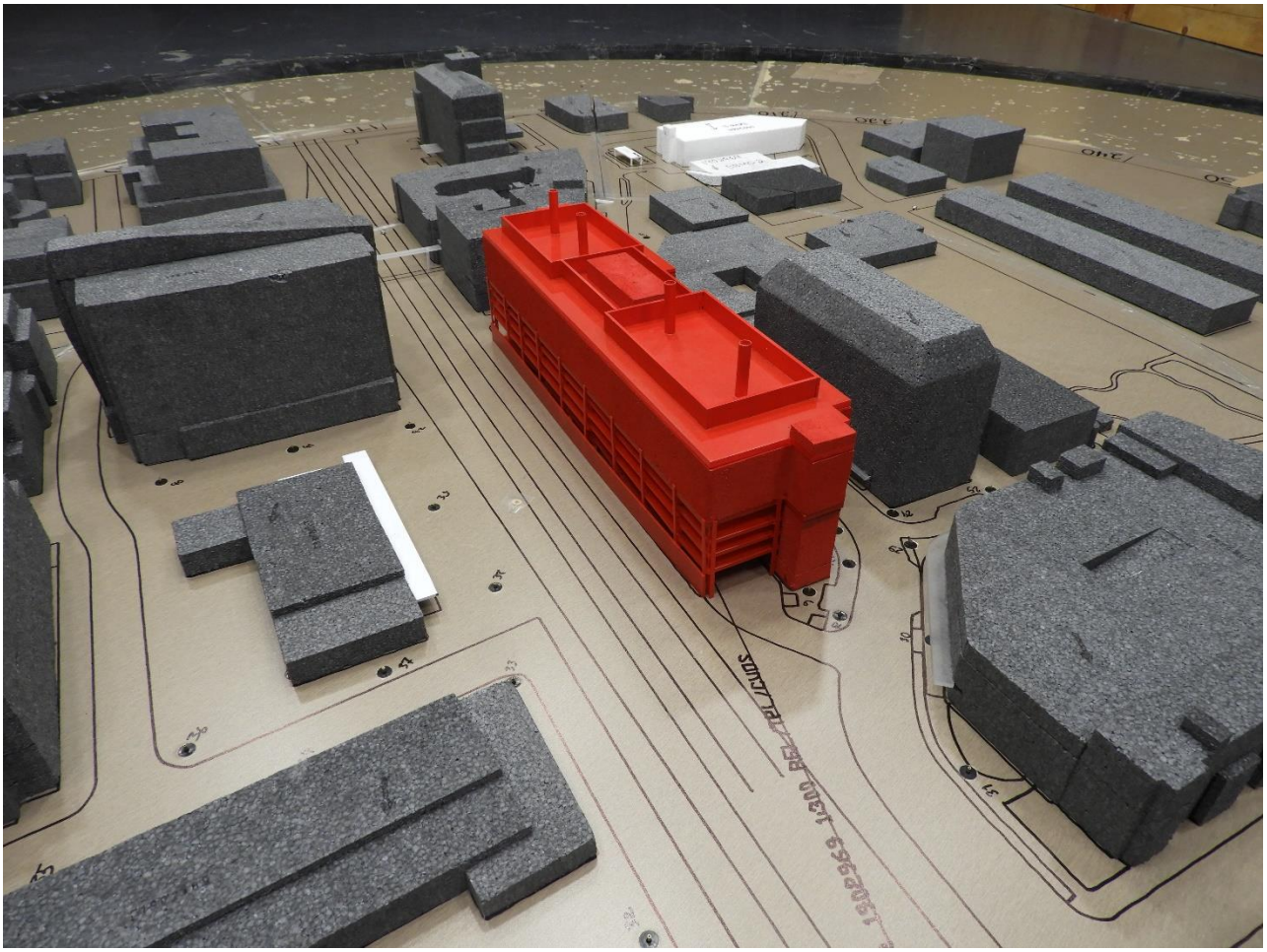


Image 2B: Wind Tunnel Study Model – FDP

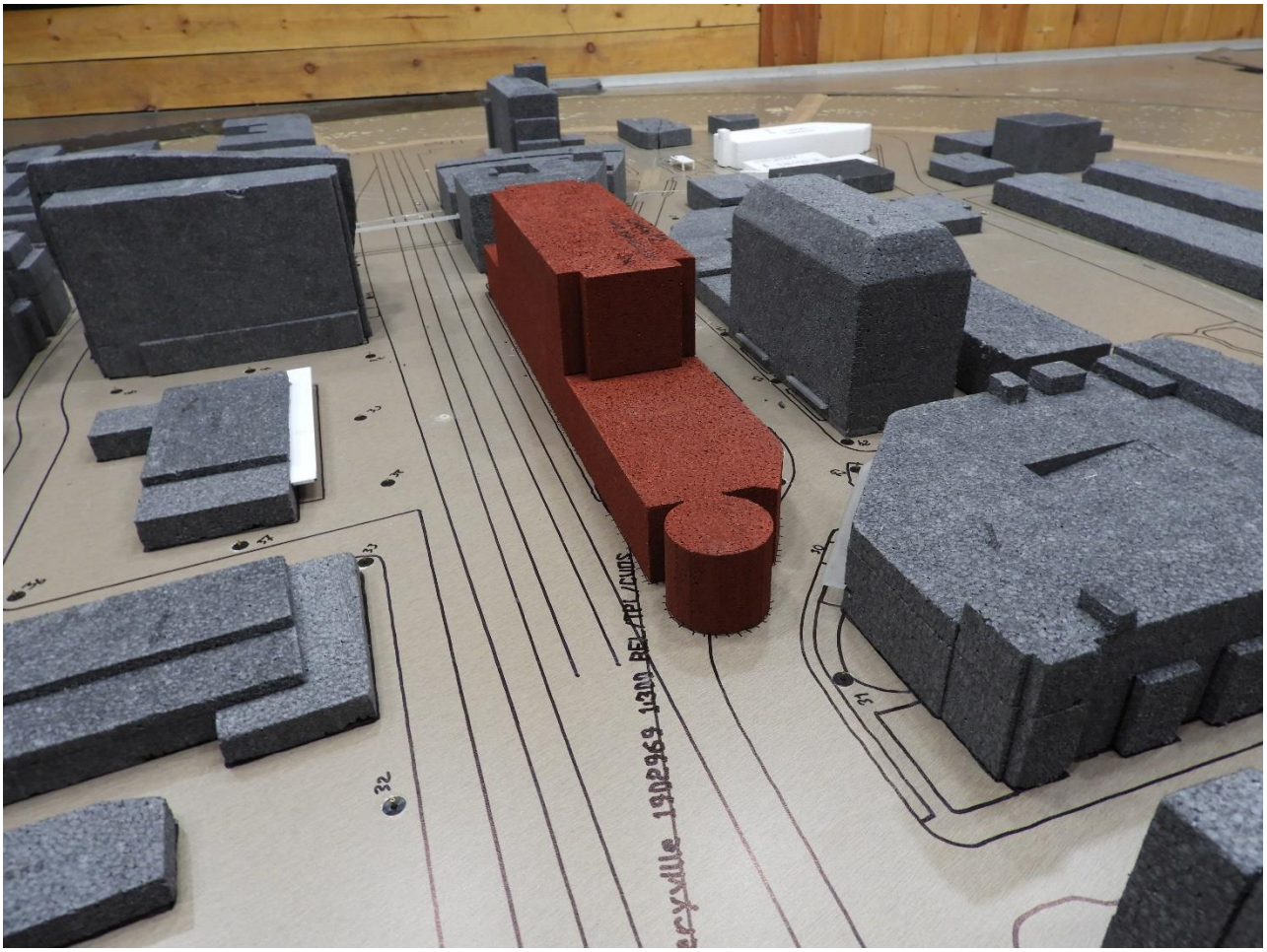


Image 2C: Wind Tunnel Study Model – PDP Stepped Down

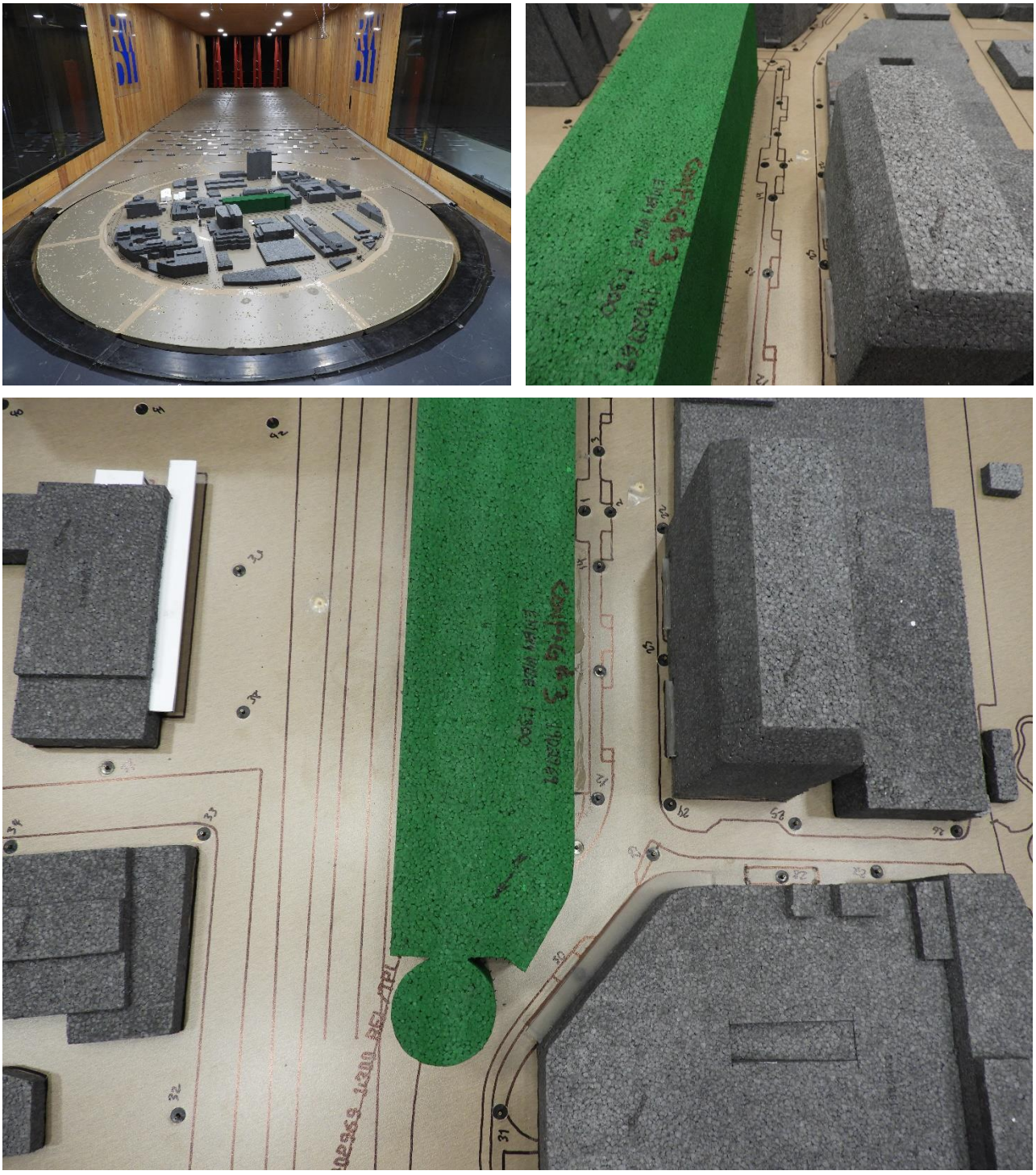


Image 2D: Wind Tunnel Study Model – PDP 120' Height

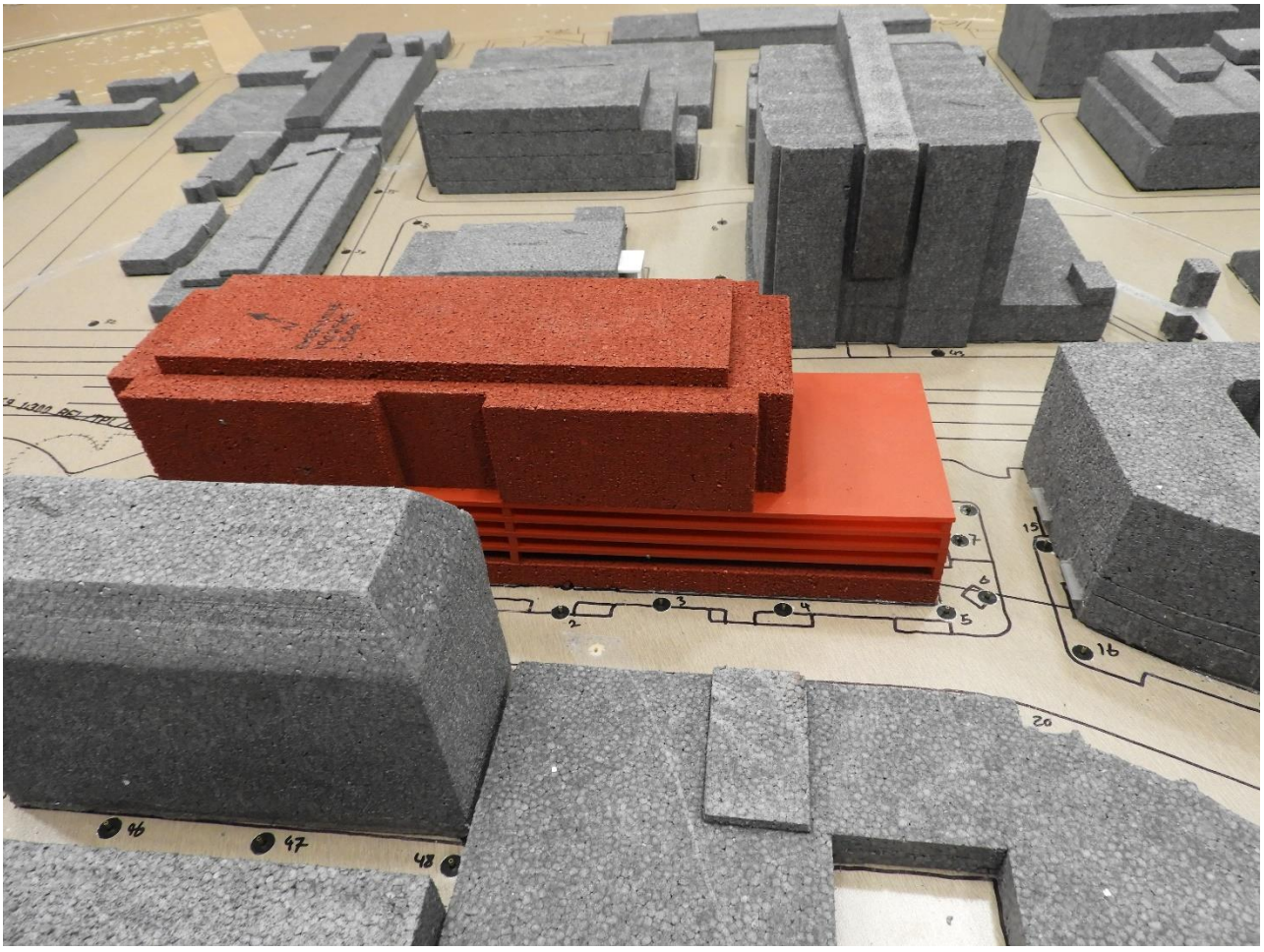


Image 2E: Wind Tunnel Study Model – Alternate G

2.2 Meteorological Data

Wind statistics recorded at Metropolitan Oakland International Airport between 1987 and 2017, inclusive, were analyzed for annual wind conditions. Image 3 graphically depicts the directional distributions of annual wind frequencies and speeds. Winds are frequent from the northwest through west-southwest directions throughout the year, as indicated by the wind rose. Strong winds of a mean speed greater than 15 mph measured at the airport (at an anemometer height of 30 feet) occur 11.5% of the time annually.

Wind statistics were combined with the wind tunnel data to predict the frequency of occurrence of full-scale wind speeds. The full-scale wind predictions were then compared with the appropriate criteria for pedestrian safety and comfort.

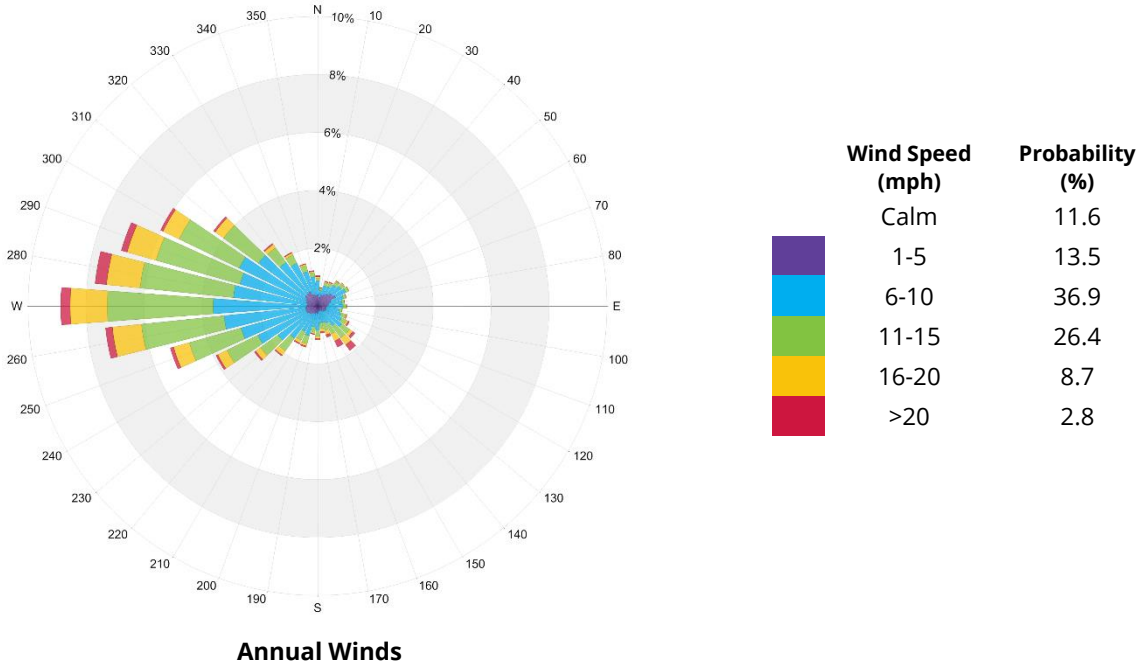


Image 3: Directional distribution of winds approaching Metropolitan Oakland International Airport from 1987 to 2017

2.3 Analyzing Significant Wind Impacts

Threshold of Significance

Since the City of Emeryville does not have a wind significance threshold, this report evaluated the various project proposals using the California Environmental Quality Act (CEQA) Thresholds of Significance Guidelines, adopted by the City of Oakland. These guidelines consider a significant wind impact to occur if a project were to "create winds exceeding 36 mph for more than one hour during daylight hours of the year". Equivalent wind speeds (EWS) were used in the calculation with the average wind speeds (mean velocity) being adjusted to include the level of gustiness and turbulence. In the formula below, the mean wind speed is increased when the turbulence intensity is greater than 15%:

$$\boldsymbol{EWS = V_m \times (2 \times TI + 0.7)}$$

where $\boldsymbol{EWS}$ = equivalent wind speed

$\boldsymbol{V_m}$ = mean pedestrian-level wind speed

$\boldsymbol{TI}$ = turbulence intensity

While the City of Emeryville has not adopted a formal threshold of significance for wind hazards, the City identified a threshold similar to the City of Oakland's in the Marketplace EIR. The DEIR states (p. 334): "The exposure, orientation and massing of a proposed structure can be expected to substantially increase ground-level winds in pedestrian corridors or public spaces near the project site. Since the ambient wind (undisturbed by buildings) in Emeryville seldom exceeds 36 mph, a project must substantially increase winds for this threshold to be exceeded." Accordingly, winds exceed 36 mph are considered a significant hazards impact.

Wind Comfort

Although not an identified threshold of significance by either the City of Emeryville or the CEQA, wind comfort speeds have been calculated and included in this report *for informational purposes*. Based on the San Francisco Planning Code Section 148: Reduction of Ground-level Wind Currents in C-3 District, the comfort criteria are that wind speeds (EWS) do not exceed 11 mph for more than 10% of the time during the year, when calculated for daylight hours, in substantial pedestrian use areas. A lower wind speed threshold of 7 mph may be considered for public seating areas where calmer wind conditions are ideal.

3 RESULTS AND DISCUSSION

This section presents the wind tunnel test results analyzed in terms of the equivalent wind speeds (EWS) as defined in the previous section. Within the text of this report, the equivalent wind speeds are simply referred to as wind speeds.

The wind hazard conditions for the configurations tested are graphically depicted on site plans in Figures 1A through 1E located in the "Figures" section of this report. Table 1, located in the "Tables" section, numerically presents these results and lists the predicted wind speed to be exceeded one hour per year. The predicted number of hours per year that the wind hazard criterion (one-minute wind speed of 36 mph) is exceeded is also provided. A letter "e" in the last column of each configuration indicates the wind hazard exceedance. The "hours change" and "speed change" columns refer to differences compared to the existing conditions.

The wind comfort results for the configurations tested are graphically depicted on site plans in Figures 2A through 2E, where locations have been color-coded according to the criteria of the 7 mph and 11 mph comfort categories explained in Section 2.3. This data is also numerically presented in Table 1. For all the measurement points, the equivalent wind speeds exceeded 10% of time are listed (please note that wind speeds will be below these values for 90% of the time). Each location is marked as a comfort exceedance if the 11 mph threshold is exceeded. A letter "e" in the last column of each configuration indicates a wind comfort exceedance.

Note that no landscaping was included in any wind tunnel testing. With the inclusion of the existing and proposed landscaping elements, such as trees, shrubs, awnings, screens and so on, wind conditions are expected to improve throughout the year.

The following is a detailed discussion of the suitability of the predicted wind conditions for each area of interest.

3.1 Existing Configuration

For the existing configuration, all test locations are expected to be below the 1-hour per year wind hazard criterion, except Location 44 on the east side of the railroad tracks near the pedestrian bridge tower (Figure 1A). For all locations tested, the average wind speed which is exceeded for 1 hour per year is 28 mph (Table 1).

For all the 45 test locations, the average wind speed for 90% of the time is below 12 mph (Table 1). Wind speeds at 24 test locations exceed the pedestrian comfort level of 11 mph (see Figure 2A). On average, winds exceed the comfort criterion 15% of the time when all test locations are considered.

3.2 FDP

With the proposed FDP development, all test locations are expected to be below the 1-hour per year wind hazard criterion at all locations. The hazard exceedance at Location 44 in the existing configuration would be eliminated after the addition of the FDP development (Figure 1B). For all locations tested, the average wind speed exceeded for 1 hour per year is 26 mph, which is 2 mph lower than the existing configuration (Table 1).

For all the 45 test locations, the average wind speed for 90% of the time is below 11 mph (Table 1). Wind speeds at 15 test locations exceed the pedestrian comfort level of 11 mph (see Figure 2B). On average, winds exceed the comfort criterion 12% of the time when all test locations are considered.

3.3 PDP Stepped Down

With the proposed PDP Stepped Down development, wind speeds are expected to exceed the hazard criterion at five test locations (Figure 1C). For all locations tested, the average wind speed exceeded for 1 hour per year is 29 mph, which is 1 mph higher than the existing configuration (Table 1).

For the 43 test locations (Sensors 9 and 10 are covered due to the increased building massing), the average wind speed for 90% of the time is 13 mph (Table 1). Wind speeds at 26 test locations exceed the pedestrian comfort criterion of 11 mph (see Figure 2C). On average, winds exceed the comfort criterion 18% of the time when all applicable test locations are considered.

3.4 PDP 120’ Height

With the proposed PDP 120’ Height development, wind speeds are expected to exceed the hazard criterion at eight test locations (Figure 1D). For all locations tested, the average wind speed exceeded for 1 hour per year is 30 mph, which is 2 mph higher than the existing configuration (Table 1).

For the 43 test locations, the average wind speed for 90% of the time is 13 mph (Table 1). Wind speeds at 27 test locations exceed the pedestrian comfort level of 11 mph (see Figure 2D). On average, winds exceed the comfort criterion 20% of the time when all applicable test locations are considered.

3.5 Alternate G

With the proposed Alternate G development, all test locations are expected to be below the 1-hour per year wind hazard criterion at all locations (Figure 1E). For all locations tested, the average wind speed exceeded for 1 hour per year is 27 mph, which is 1 mph lower than the existing configuration (Table 1).

For the 44 test locations (Sensor 1 is covered due to increased floor plan), the average wind speed for 90% of the time is 12 mph (Table 1). Wind speeds at 25 test locations exceed the pedestrian comfort level of 11 mph (see Figure 2D). On average, winds exceed the comfort criterion 12% of the time when all applicable test locations are considered. These results, in general, indicate a positive effect of the project on the wind conditions around the site and with the inclusion of the proposed landscaping plan, comfort conditions are expected to further improve.

4 APPLICABILITY OF RESULTS

The wind conditions presented in this report pertain to the model of the Emeryville Public Market – Parcel B constructed using the drawings and information listed below. Should there be any design changes that deviate from this list of drawings, the wind condition predictions presented may change. Therefore, if changes in the design are made, it is recommended that RWDI be contacted and requested to review their potential effects on wind conditions.

File Name	File Type	Date Received (dd/mm/yyyy)
13-013_Emeryville_FDP_20190215	SketchUp	22/03/2019
10-013_Emeryville_Parcel B – Wind study-0	SketchUp	28/10/2019
10-013_Parcel B Massing for analysis	SketchUp	30/10/2019

FIGURES

63RD STREET

OVERLAND AVENUE

63RD STREET

62ND STREET

HORTON STREET

SHELLMOUND STREET

MARKET STREET

59TH STREET

59TH STREET

EXISTING BUILDING

EXISTING BUILDING

LEGEND:

HAZARD CATEGORIES:

Pass

Exceeded

SENSOR LOCATION:

Grade Level

Entrance Location

0 50 100ft

Pedestrian Wind Hazard Conditions
Existing
Annual

Emeryville Public Market - Parcel B - Emeryville, CA

True North

Project #1902969

Drawn by:	GRE	Figure:	1A
Approx. Scale:	1"=100'		
Date Revised:	May 9, 2019		

AR3260

63RD STREET

OVERLAND AVENUE

63RD STREET

62ND STREET

HORTON STREET

BUILDING ABOVE REMOVED FOR CLARITY OF GRADE LEVEL SENSORS

SHELLMOUND STREET

MARKET STREET

59TH STREET

59TH STREET

EXISTING BUILDING

EXISTING BUILDING

LEGEND:

HAZARD CATEGORIES:

Pass

Exceeded

SENSOR LOCATION:

Grade Level

Entrance Location

0 50 100ft

Pedestrian Wind Hazard Conditions

FDP

Annual

Emeryville Public Market - Parcel B - Emeryville, CA

True North

Project #1902969

Drawn by:	GRE	Figure:	1B
Approx. Scale:	1"=100'		
Date Revised:	May 9, 2019		

AR3261

63RD STREET

OVERLAND AVENUE

63RD STREET

62ND STREET

BUILDING ABOVE REMOVED FOR CLARITY OF GRADE LEVEL SENSORS

SHELLMOUND STREET

MARKET STREET

HORTON STREET

59TH STREET

59TH STREET

EXISTING BUILDING

EXISTING BUILDING

LEGEND:

HAZARD CATEGORIES:

Pass

Exceeded

SENSOR LOCATION:

Grade Level

0 50 100ft

Pedestrian Wind Hazard Conditions

PDP Stepped Down

Annual

Emeryville Public Market - Parcel B - Emeryville, CA

True North

Project #1902969

Drawn by: GRE	Figure: 1C
Approx. Scale:	1"=100'
Date Revised:	Oct. 28, 2019

AR3262

63RD STREET

OVERLAND AVENUE

63RD STREET

62ND STREET

BUILDING ABOVE REMOVED FOR CLARITY OF GRADE LEVEL SENSORS

SHELLMOUND STREET

MARKET STREET

HORTON STREET

59TH STREET

59TH STREET

EXISTING BUILDING

EXISTING BUILDING

LEGEND:

HAZARD CATEGORIES:

Pass

Exceeded

SENSOR LOCATION:

Grade Level

0 50 100ft

Pedestrian Wind Hazard Conditions

PDP 120' Height

Annual

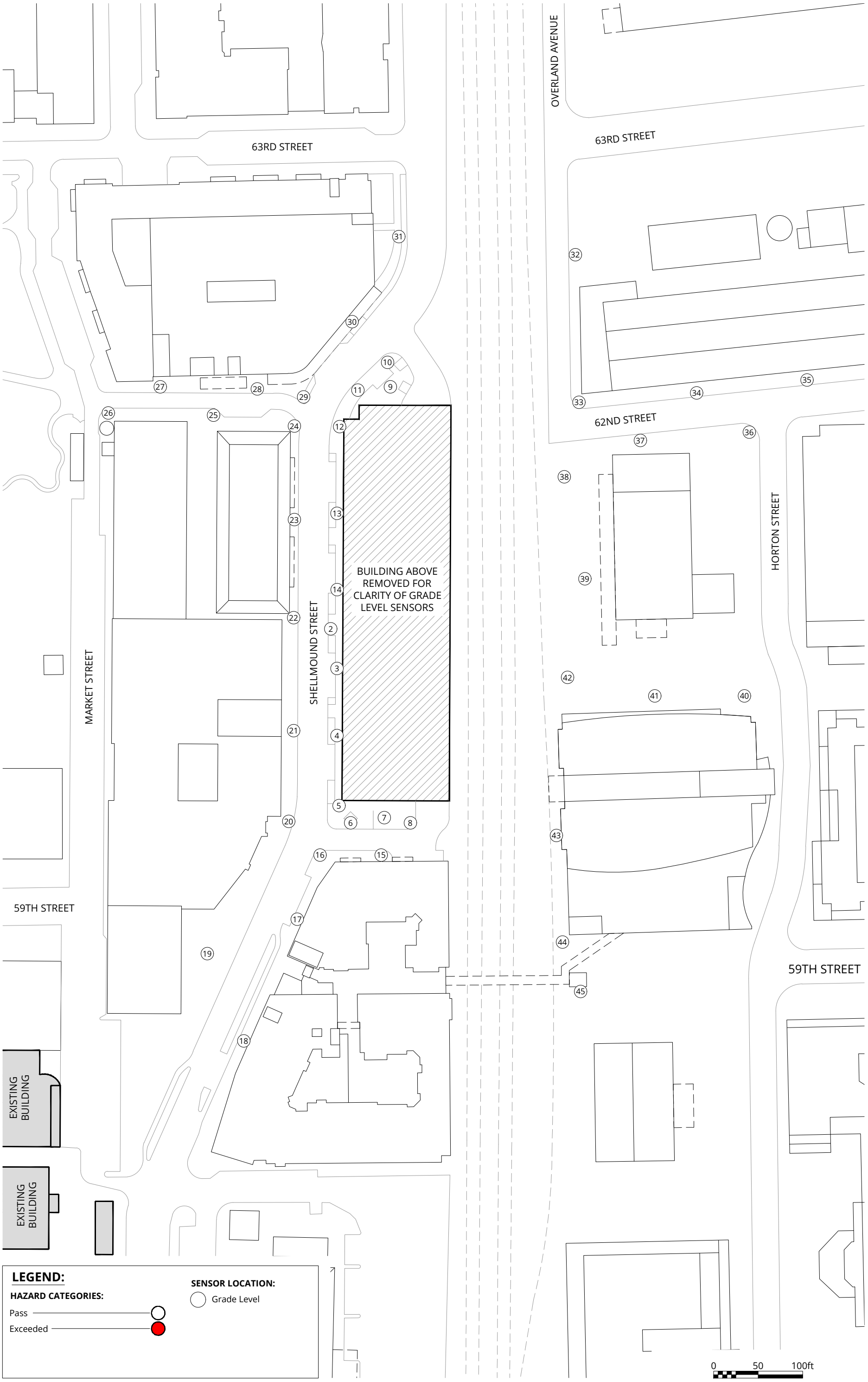
Emeryville Public Market - Parcel B - Emeryville, CA

True North

Project #1902969

Drawn by:	GRE	Figure:	1D
Approx. Scale:	1"=100'		
Date Revised:	Oct. 28, 2019		

AR3263



Pedestrian Wind Hazard Conditions
Alternate G
Annual

Emeryville Public Market - Parcel B - Emeryville, CA

True North

Project #1902969

Drawn by:	GRE	Figure:	1E
Approx. Scale:	1"=100'		
Date Revised:	Oct. 31, 2019		

AR3264

63RD STREET

OVERLAND AVENUE

63RD STREET

62ND STREET

HORTON STREET

MARKET STREET

SHELLMOUND STREET

59TH STREET

59TH STREET

EXISTING BUILDING

EXISTING BUILDING

LEGEND:

COMFORT CATEGORIES:

1 - 7 mph

8 - 11 mph

> 11 mph

SENSOR LOCATION:

Grade Level

Entrance Location

0 50 100ft

Pedestrian Wind Comfort Conditions
Existing
Annual

Emeryville Public Market - Parcel B - Emeryville, CA

True North

Project #1902969

Drawn by:	GRE	Figure:	2A
Approx. Scale:	1"=100'		
Date Revised:	May 9, 2019		

AR3265

63RD STREET

OVERLAND AVENUE

63RD STREET

62ND STREET

HORTON STREET

SHELLMOUND STREET

MARKET STREET

59TH STREET

59TH STREET

BUILDING ABOVE REMOVED FOR CLARITY OF GRADE LEVEL SENSORS

EXISTING BUILDING

EXISTING BUILDING

LEGEND:

COMFORT CATEGORIES:

1 - 7 mph

8 - 11 mph

> 11 mph

SENSOR LOCATION:

Grade Level

Entrance Location

0 50 100ft

Pedestrian Wind Comfort Conditions
FDP
Annual

Emeryville Public Market - Parcel B - Emeryville, CA

True North

Project #1902969

Drawn by:	GRE	Figure:	2B
Approx. Scale:	1"=100'		
Date Revised:	May 9, 2019		

AR3266

63RD STREET

OVERLAND AVENUE

63RD STREET

62ND STREET

HORTON STREET

59TH STREET

MARKET STREET

SHELLMOUND STREET

59TH STREET

BUILDING ABOVE REMOVED FOR CLARITY OF GRADE LEVEL SENSORS

EXISTING BUILDING

EXISTING BUILDING

LEGEND:

COMFORT CATEGORIES:

1 - 7 mph

8 - 11 mph

> 11 mph

SENSOR LOCATION:

Grade Level

0 50 100ft

Pedestrian Wind Comfort Conditions

PDP Stepped Down
Annual

Emeryville Public Market - Parcel B - Emeryville, CA

True North

Project #1902969

Drawn by: GRE	Figure: 2C
Approx. Scale:	1"=100'
Date Revised:	Oct. 28, 2019

RWDI AR3267

63RD STREET

OVERLAND AVENUE

63RD STREET

62ND STREET

HORTON STREET

59TH STREET

MARKET STREET

SHELLMOUND STREET

59TH STREET

BUILDING ABOVE REMOVED FOR CLARITY OF GRADE LEVEL SENSORS

EXISTING BUILDING

EXISTING BUILDING

LEGEND:

COMFORT CATEGORIES:

1 - 7 mph

8 - 11 mph

> 11 mph

SENSOR LOCATION:

Grade Level

0 50 100ft

Pedestrian Wind Comfort Conditions

PDP 120' Height

Annual

Emeryville Public Market - Parcel B - Emeryville, CA

True North

Project #1902969

Drawn by: GRE	Figure: 2D
Approx. Scale:	1"=100'
Date Revised:	Oct. 28, 2019

AR3268

63RD STREET

OVERLAND AVENUE

63RD STREET

62ND STREET

HORTON STREET

SHELLMOUND STREET

MARKET STREET

59TH STREET

59TH STREET

BUILDING ABOVE REMOVED FOR CLARITY OF GRADE LEVEL SENSORS

EXISTING BUILDING

EXISTING BUILDING

LEGEND:

COMFORT CATEGORIES:

1 - 7 mph

8 - 11 mph

> 11 mph

SENSOR LOCATION:

Grade Level

0 50 100ft

Pedestrian Wind Comfort Conditions

Alternate G

Annual

Emeryville Public Market - Parcel B - Emeryville, CA

True North

Project #1902969

Drawn by:	GRE	Figure:	2E
Approx. Scale:	1"=100'		
Date Revised:	Oct. 31, 2019		

AR3269

TABLES

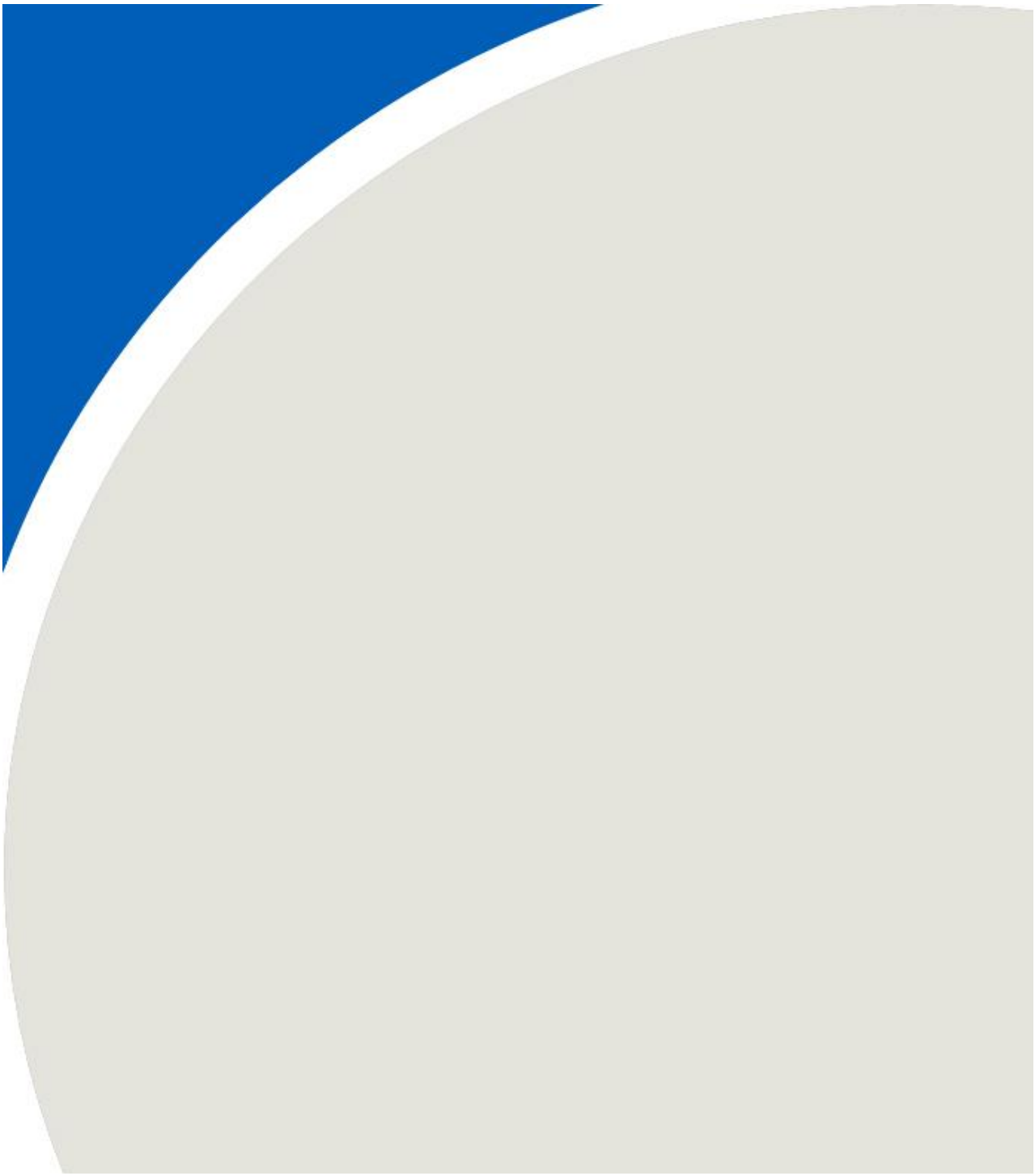


Table 1: Pedestrian Wind Comfort and Hazard Conditions

Location	Configuration	WIND HAZARD				WIND COMFORT			
		Wind Speed Exceeded (mph)	Hours per Year Exceeding	Hours Change	Exceeds	Wind Speed Exceeded (mph)	% of Time Exceeding	Speed Change (mph)	Exceeds
1	Existing	28	0	-		13	19	-	e
	FDP	25	0	0		11	10	-2	
	PDP Stepped Down	31	0	0		14	25	1	e
	PDP 120' Height	33	0	0		16	33	3	e
	Alternate G	-	-	-	-	-	-	-	-
2	Existing	30	0	-		13	18	-	e
	FDP	25	0	0		10	6	-3	
	PDP Stepped Down	39	2	2	e	18	36	5	e
	PDP 120' Height	38	2	2	e	18	41	5	e
	Alternate G	29	0	0		12	13	-1	e
3	Existing	27	0	-		12	15	-	e
	FDP	23	0	0		11	10	-1	
	PDP Stepped Down	33	0	0		15	27	3	e
	PDP 120' Height	36	1	1	e	17	35	5	e
	Alternate G	21	0	0		9	4	-3	
4	Existing	25	0	-		12	14	-	e
	FDP	19	0	0		9	4	-3	
	PDP Stepped Down	35	0	0		16	29	4	e
	PDP 120' Height	32	0	0		15	28	3	e
	Alternate G	22	0	0		10	7	-2	
5	Existing	31	0	-		15	30	-	e
	FDP	26	0	0		12	16	-3	e
	PDP Stepped Down	36	1	1	e	15	29	0	e
	PDP 120' Height	35	0	0		16	32	1	e
	Alternate G	26	0	0		12	13	-3	e
6	Existing	33	0	-		16	34	-	e
	FDP	30	0	0		14	24	-2	e
	PDP Stepped Down	34	0	0		16	32	0	e
	PDP 120' Height	35	0	0		16	33	0	e
	Alternate G	32	0	0		15	28	-1	e
7	Existing	32	0	-		15	30	-	e
	FDP	31	0	0		14	26	-1	e
	PDP Stepped Down	32	0	0		15	30	0	e
	PDP 120' Height	39	3	3	e	18	38	3	e
	Alternate G	31	0	0		15	27	0	e
8	Existing	31	0	-		14	24	-	e
	FDP	33	0	0		15	31	1	e
	PDP Stepped Down	32	0	0		15	27	1	e
	PDP 120' Height	36	1	1	e	17	36	3	e
	Alternate G	30	0	0		14	25	0	e

Table 1: Pedestrian Wind Comfort and Hazard Conditions

Location	Configuration	WIND HAZARD				WIND COMFORT			
		Wind Speed Exceeded (mph)	Hours per Year Exceeding	Hours Change	Exceeds	Wind Speed Exceeded (mph)	% of Time Exceeding	Speed Change (mph)	Exceeds
9	Existing	24	0	-		10	7	-	
	FDP	20	0	0		8	3	-2	
	PDP Stepped Down	-	-	-	-	-	-	-	-
	PDP 120' Height	-	-	-	-	-	-	-	-
	Alternate G	29	0	0		12	13	2	e
10	Existing	24	0	-		10	6	-	
	FDP	28	0	0		13	18	3	e
	PDP Stepped Down	-	-	-	-	-	-	-	-
	PDP 120' Height	-	-	-	-	-	-	-	-
	Alternate G	26	0	0		12	12	2	e
11	Existing	27	0	-		12	12	-	e
	FDP	32	0	0		13	22	1	e
	PDP Stepped Down	31	0	0		14	23	2	e
	PDP 120' Height	31	0	0		14	21	2	e
	Alternate G	30	0	0		13	18	1	e
12	Existing	29	0	-		12	12	-	e
	FDP	32	0	0		14	25	2	e
	PDP Stepped Down	36	1	1	e	17	33	5	e
	PDP 120' Height	36	1	1	e	17	38	5	e
	Alternate G	31	0	0		13	22	1	e
13	Existing	30	0	-		10	7	-	
	FDP	29	0	0		14	22	4	e
	PDP Stepped Down	39	3	3	e	18	40	8	e
	PDP 120' Height	38	2	2	e	18	42	8	e
	Alternate G	33	0	0		15	28	5	e
14	Existing	35	0	-		12	14	-	e
	FDP	33	0	0		14	21	2	e
	PDP Stepped Down	40	4	4	e	18	39	6	e
	PDP 120' Height	40	4	4	e	19	44	7	e
	Alternate G	34	0	0		15	24	3	e
15	Existing	28	0	-		13	19	-	e
	FDP	33	0	0		15	27	2	e
	PDP Stepped Down	29	0	0		12	15	-1	e
	PDP 120' Height	31	0	0		14	24	1	e
	Alternate G	27	0	0		12	14	-1	e
16	Existing	34	0	-		16	34	-	e
	FDP	30	0	0		15	29	-1	e
	PDP Stepped Down	31	0	0		15	29	-1	e
	PDP 120' Height	31	0	0		15	28	-1	e
	Alternate G	31	0	0		15	27	-1	e

Table 1: Pedestrian Wind Comfort and Hazard Conditions

Location	Configuration	WIND HAZARD				WIND COMFORT			
		Wind Speed Exceeded (mph)	Hours per Year Exceeding	Hours Change	Exceeds	Wind Speed Exceeded (mph)	% of Time Exceeding	Speed Change (mph)	Exceeds
17	Existing	24	0	-		10	7	-	
	FDP	21	0	0		9	5	-1	
	PDP Stepped Down	28	0	0		10	8	0	
	PDP 120' Height	28	0	0		11	10	1	
	Alternate G	20	0	0		9	4	-1	
18	Existing	24	0	-		11	10	-	
	FDP	22	0	0		10	7	-1	
	PDP Stepped Down	24	0	0		11	10	0	
	PDP 120' Height	25	0	0		11	10	0	
	Alternate G	22	0	0		10	7	-1	
19	Existing	25	0	-		12	14	-	e
	FDP	24	0	0		11	10	-1	
	PDP Stepped Down	25	0	0		11	10	-1	
	PDP 120' Height	25	0	0		12	13	0	e
	Alternate G	24	0	0		11	10	-1	
20	Existing	28	0	-		12	17	-	e
	FDP	22	0	0		10	6	-2	
	PDP Stepped Down	26	0	0		12	12	0	e
	PDP 120' Height	26	0	0		11	10	-1	
	Alternate G	26	0	0		11	10	-1	
21	Existing	29	0	-		12	16	-	e
	FDP	20	0	0		9	3	-3	
	PDP Stepped Down	27	0	0		10	7	-2	
	PDP 120' Height	27	0	0		10	8	-2	
	Alternate G	19	0	0		9	2	-3	
22	Existing	27	0	-		10	6	-	
	FDP	27	0	0		11	10	1	
	PDP Stepped Down	29	0	0		11	10	1	
	PDP 120' Height	29	0	0		12	15	2	e
	Alternate G	30	0	0		11	10	1	
23	Existing	23	0	-		8	2	-	
	FDP	26	0	0		11	10	3	
	PDP Stepped Down	24	0	0		11	10	3	
	PDP 120' Height	22	0	0		10	7	2	
	Alternate G	24	0	0		10	5	2	
24	Existing	29	0	-		10	7	-	
	FDP	24	0	0		11	10	1	
	PDP Stepped Down	29	0	0		12	16	2	e
	PDP 120' Height	28	0	0		13	18	3	e
	Alternate G	30	0	0		12	11	2	e

Table 1: Pedestrian Wind Comfort and Hazard Conditions

Location	Configuration	WIND HAZARD				WIND COMFORT			
		Wind Speed Exceeded (mph)	Hours per Year Exceeding	Hours Change	Exceeds	Wind Speed Exceeded (mph)	% of Time Exceeding	Speed Change (mph)	Exceeds
25	Existing	34	0	-		15	26	-	e
	FDP	33	0	0		14	24	-1	e
	PDP Stepped Down	33	0	0		14	22	-1	e
	PDP 120' Height	33	0	0		14	21	-1	e
	Alternate G	33	0	0		14	22	-1	e
26	Existing	25	0	-		10	5	-	
	FDP	25	0	0		9	5	-1	
	PDP Stepped Down	23	0	0		10	6	0	
	PDP 120' Height	20	0	0		9	4	-1	
	Alternate G	25	0	0		10	6	0	
27	Existing	28	0	-		12	12	-	e
	FDP	28	0	0		11	10	-1	
	PDP Stepped Down	30	0	0		13	16	1	e
	PDP 120' Height	31	0	0		13	16	1	e
	Alternate G	30	0	0		13	15	1	e
28	Existing	25	0	-		11	10	-	
	FDP	24	0	0		11	10	0	
	PDP Stepped Down	26	0	0		11	10	0	
	PDP 120' Height	26	0	0		11	10	0	
	Alternate G	24	0	0		10	7	-1	
29	Existing	34	0	-		15	23	-	e
	FDP	29	0	0		13	17	-2	e
	PDP Stepped Down	31	0	0		13	17	-2	e
	PDP 120' Height	33	0	0		14	23	-1	e
	Alternate G	32	0	0		13	19	-2	e
30	Existing	24	0	-		9	5	-	
	FDP	27	0	0		13	17	4	e
	PDP Stepped Down	31	0	0		14	19	5	e
	PDP 120' Height	30	0	0		14	21	5	e
	Alternate G	25	0	0		11	10	2	
31	Existing	25	0	-		9	5	-	
	FDP	24	0	0		11	10	2	
	PDP Stepped Down	30	0	0		13	17	4	e
	PDP 120' Height	36	1	1	e	16	33	7	e
	Alternate G	24	0	0		10	7	1	
32	Existing	25	0	-		10	7	-	
	FDP	22	0	0		9	3	-1	
	PDP Stepped Down	23	0	0		10	6	0	
	PDP 120' Height	25	0	0		10	7	0	
	Alternate G	23	0	0		9	3	-1	

Table 1: Pedestrian Wind Comfort and Hazard Conditions

Location	Configuration	WIND HAZARD				WIND COMFORT			
		Wind Speed Exceeded (mph)	Hours per Year Exceeding	Hours Change	Exceeds	Wind Speed Exceeded (mph)	% of Time Exceeding	Speed Change (mph)	Exceeds
33	Existing	22	0	-		11	10	-	
	FDP	27	0	0		11	10	0	
	PDP Stepped Down	26	0	0		11	10	0	
	PDP 120' Height	25	0	0		10	6	-1	
	Alternate G	26	0	0		12	13	1	e
34	Existing	24	0	-		9	3	-	
	FDP	20	0	0		7	1	-2	
	PDP Stepped Down	22	0	0		8	1	-1	
	PDP 120' Height	23	0	0		8	2	-1	
	Alternate G	20	0	0		8	1	-1	
35	Existing	21	0	-		10	7	-	
	FDP	21	0	0		9	4	-1	
	PDP Stepped Down	26	0	0		11	10	1	
	PDP 120' Height	26	0	0		11	10	1	
	Alternate G	23	0	0		10	7	0	
36	Existing	28	0	-		11	10	-	
	FDP	26	0	0		10	5	-1	
	PDP Stepped Down	28	0	0		11	10	0	
	PDP 120' Height	27	0	0		11	10	0	
	Alternate G	27	0	0		11	10	0	
37	Existing	21	0	-		8	2	-	
	FDP	22	0	0		9	3	1	
	PDP Stepped Down	21	0	0		8	2	0	
	PDP 120' Height	21	0	0		9	3	1	
	Alternate G	25	0	0		10	8	2	
38	Existing	25	0	-		11	10	-	
	FDP	27	0	0		11	10	0	
	PDP Stepped Down	27	0	0		11	10	0	
	PDP 120' Height	27	0	0		12	12	1	e
	Alternate G	29	0	0		13	14	2	e
39	Existing	24	0	-		11	10	-	
	FDP	25	0	0		10	7	-1	
	PDP Stepped Down	30	0	0		13	21	2	e
	PDP 120' Height	28	0	0		13	23	2	e
	Alternate G	27	0	0		12	14	1	e
40	Existing	32	0	-		15	26	-	e
	FDP	27	0	0		11	10	-4	
	PDP Stepped Down	30	0	0		12	15	-3	e
	PDP 120' Height	29	0	0		12	15	-3	e
	Alternate G	29	0	0		13	19	-2	e

Table 1: Pedestrian Wind Comfort and Hazard Conditions

Location	Configuration	WIND HAZARD				WIND COMFORT			
		Wind Speed Exceeded (mph)	Hours per Year Exceeding	Hours Change	Exceeds	Wind Speed Exceeded (mph)	% of Time Exceeding	Speed Change (mph)	Exceeds
41	Existing	35	0	-		16	35	-	e
	FDP	27	0	0		11	10	-4	
	PDP Stepped Down	25	0	0		11	10	-5	
	PDP 120' Height	20	0	0		9	3	-7	
	Alternate G	27	0	0		13	15	-3	e
42	Existing	31	0	-		15	27	-	e
	FDP	28	0	0		11	10	-4	
	PDP Stepped Down	34	0	0		16	33	1	e
	PDP 120' Height	34	0	0		15	27	0	e
	Alternate G	34	0	0		15	32	0	e
43	Existing	30	0	-		14	22	-	e
	FDP	28	0	0		9	5	-5	
	PDP Stepped Down	28	0	0		12	15	-2	e
	PDP 120' Height	28	0	0		10	6	-4	
	Alternate G	29	0	0		13	18	-1	e
44	Existing	40	3	-	e	18	39	-	e
	FDP	28	0	-3		14	22	-4	e
	PDP Stepped Down	34	0	-3		16	31	-2	e
	PDP 120' Height	28	0	-3		14	22	-4	e
	Alternate G	35	0	-3		16	32	-2	e
45	Existing	19	0	-		8	1	-	
	FDP	17	0	0		7	1	-1	
	PDP Stepped Down	19	0	0		8	1	0	
	PDP 120' Height	18	0	0		7	1	-1	
	Alternate G	19	0	0		7	1	-1	

SUMMARY	Configurations	WIND HAZARD				WIND COMFORT			
		Average (mph)	Total Hours	Hours Change	Total	Average (mph)	Average (%)	Speed Change (mph)	Total
	Existing	**28 mph**	**3 Hrs**	**-**	**1 / 45**	**12 mph**	**15%**	**-**	**24 / 45**
	FDP	**26 mph**	**0 Hrs**	**-3**	**0 / 45**	**11 mph**	**12%**	**-1**	**15 / 45**
	PDP Stepped Down	**29 mph**	**11 Hrs**	**8**	**5 / 43**	**13 mph**	**18%**	**1**	**26 / 43**
	PDP 120' Height	**30 mph**	**15 Hrs**	**12**	**8 / 43**	**13 mph**	**20%**	**1**	**27 / 43**
	Alternate G	**27 mph**	**0 Hrs**	**-3**	**0 / 44**	**12 mph**	**14%**	**0**	**25 / 44**

Notes:

1) Wind Hazard = Wind speeds exceeding 36 mph for ≥ 1 hour/year

2) Wind Comfort = Wind speeds exceeding 11 mph for ≥ 10% of the time