APPENDIX G

PEDESTRIAN WIND STUDY

TWO BRIDGES

NEW YORK, NEW YORK

PEDESTRIAN WIND STUDY

RWDI #1701614

August 22, 2017

SUBMITTED TO

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EXECUTIVE SUMMARY

The following document provides the results for the Pedestrian Wind Study conducted for the proposed Two Bridges development in New York. The project site, photographs of the wind tunnel study model and the wind statistics recorded at the three major airports (JFK International Airport, LaGuardia International Airport, and Newark International Airport) used in the study are shown in Images 1, 2, and 3, respectively. The RWDI Wind Criteria for pedestrian safety was used in this study. This criterion is described to assist with the interpretation of the results presented.

The predicted wind safety conditions pertaining to the existing, baseline, and mitigation configurations are graphically depicted on a site plan in Figures 1 through 3. These conditions and the associated wind speeds are presented in Table 1.

- When using the RWDI Criteria, winds are expected to meet the recommended safety criterion at all locations except one around the existing site and surroundings (Figure 1).
- With the addition of the proposed developments, there are predicted to be nine locations that exceed the wind safety criterion (Figure 2).
- With the implementation of wind control features (such as screens, landscaping and canopies) around the project site, there are predicted to be no locations that exceed the RWDI wind safety criterion (Figure 3).

Image 1: Site plan – Aerial view of site and surroundings (photo courtesy of Google™ Earth)

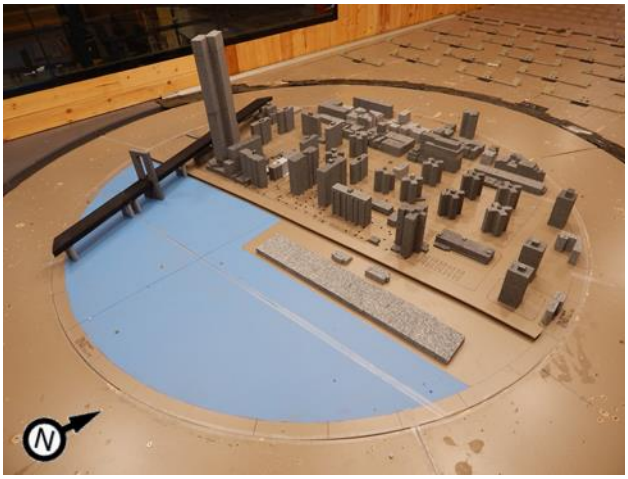


Image 2a: Wind tunnel study model - existing configuration

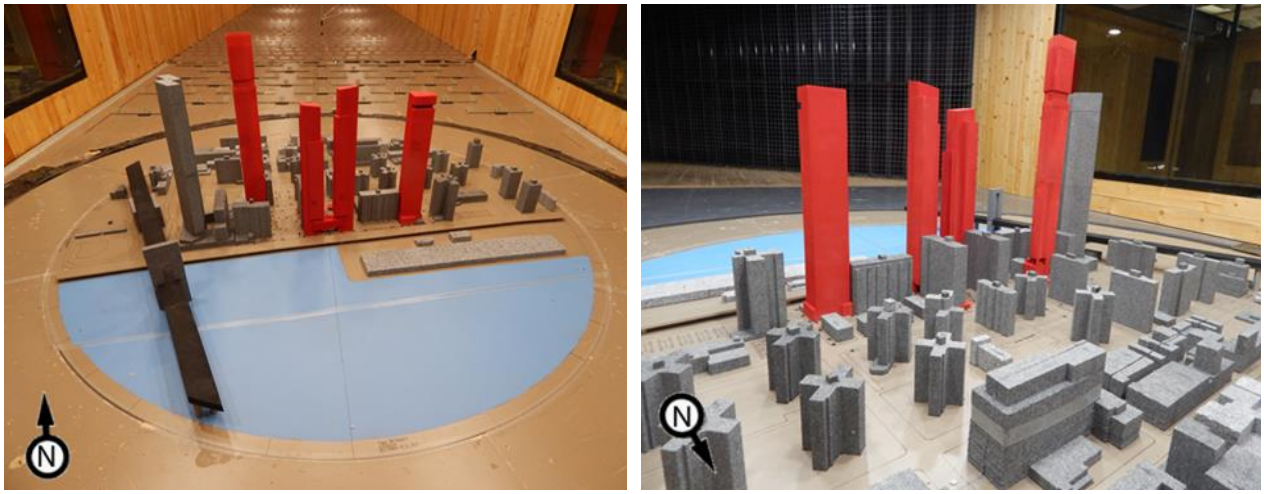
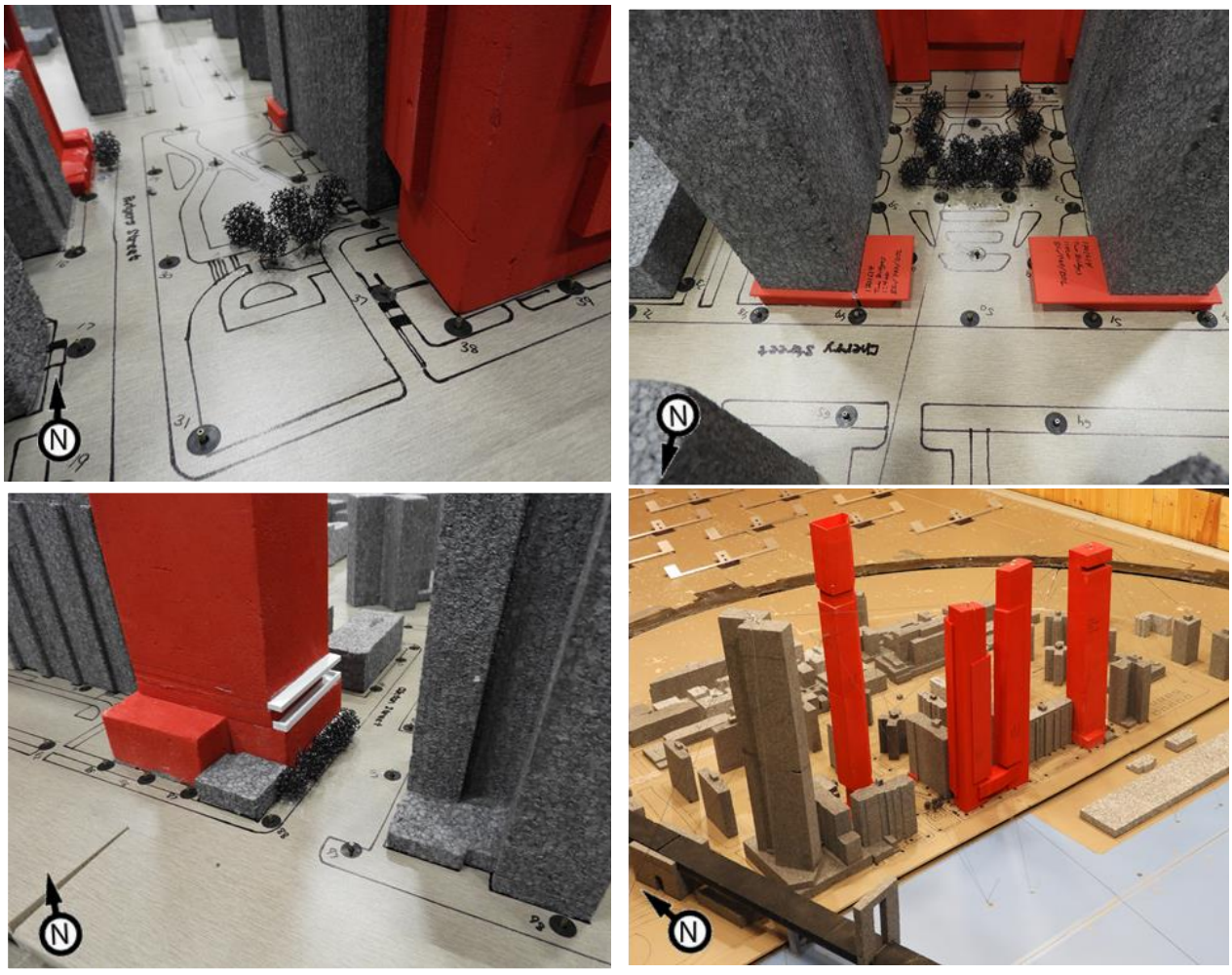


Image 2b: Wind tunnel study model - baseline configuration



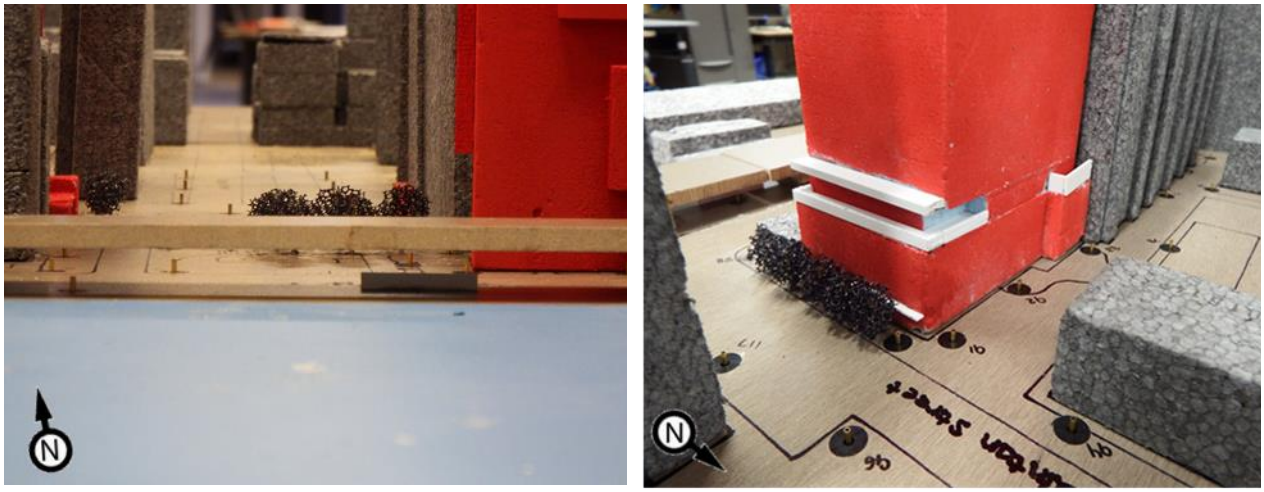
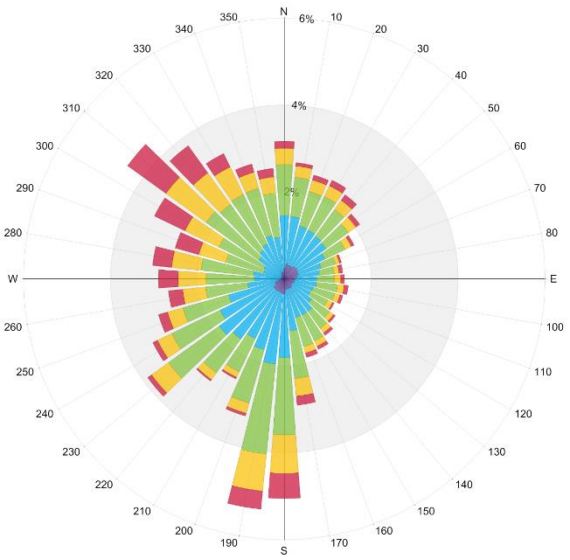


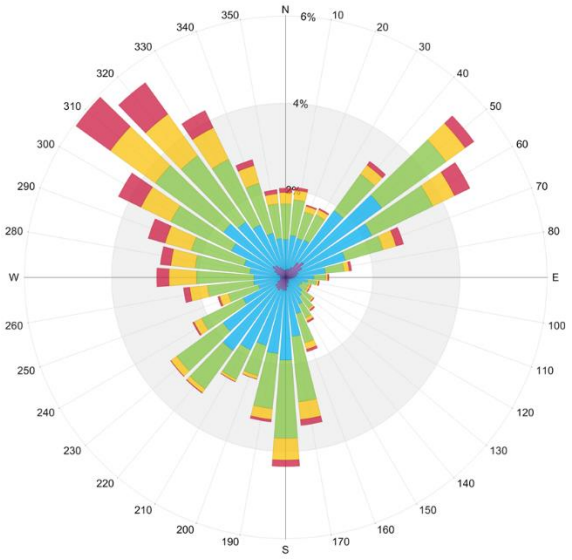
Image 2c: Wind tunnel study model - mitigation configuration



Annual Winds

Wind Speed (mph)	Probability (%) Annual
Calm	4.3
1-5	8.5
6-10	30.9
11-15	33.9
16-20	13.9
>20	8.5

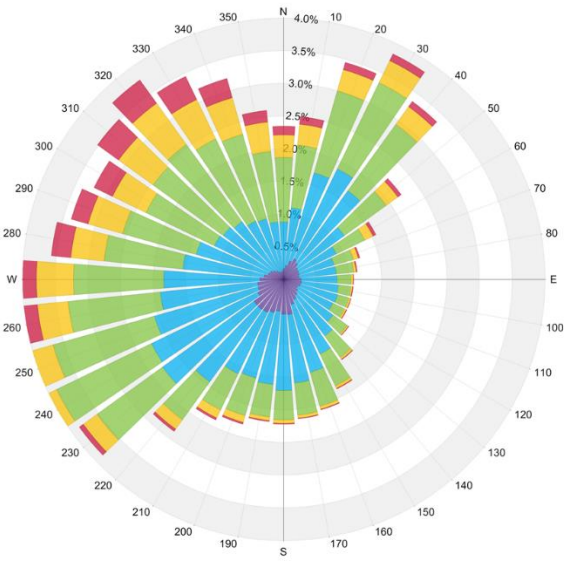
Image 3.1: Directional distribution of winds approaching JFK International Airport from 1996-2015



Annual Winds

Wind Speed (mph)	Probability (%) Annual
Calm	4.0
1-5	8.3
6-10	34.4
11-15	35.4
16-20	11.9
>20	6.1

Image 3.2: Directional distribution of winds approaching LaGuardia International Airport from 1996-2015



Annual Winds

Wind Speed (mph)	Probability (%) Annual
Calm	6.1
1-5	11.6
6-10	36.9
11-15	31.2
16-20	9.7
>20	4.4

Image 3.3: Directional distribution of winds approaching Newark Liberty International Airport from 1996-2015

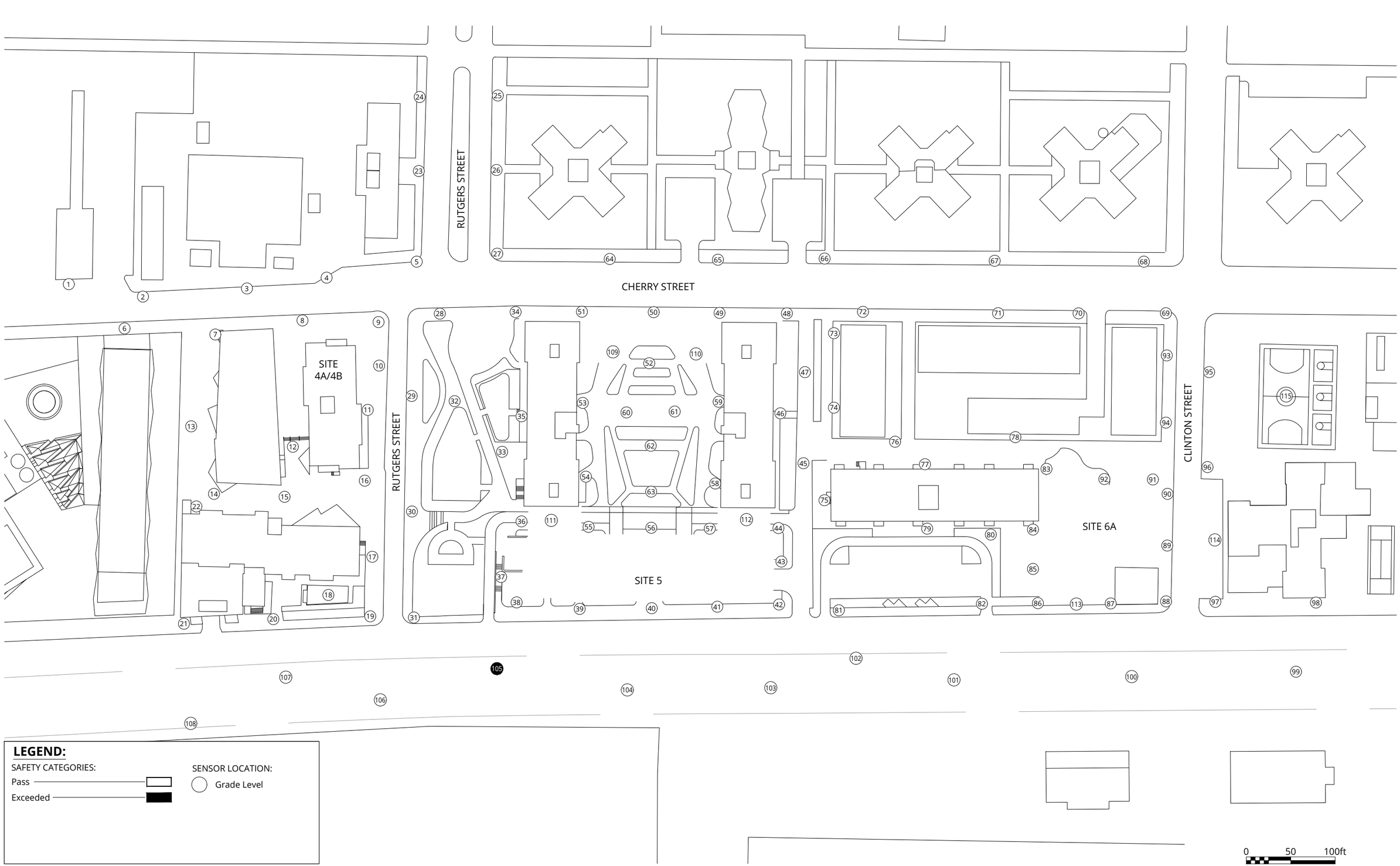
RWDI PEDESTRIAN WIND SAFETY CRITERION

The RWDI pedestrian wind safety criterion was used in this current study. This criterion has been developed by RWDI through research and consulting practice since 1974. It has also been widely accepted by municipal authorities as well as by the building design and city planning community.

Safety Criterion	Gust Speed (mph)	Description
Exceeded	> 56	Excessive gust speeds that can adversely affect a pedestrian's balance and footing. Wind mitigation is typically required.

Notes:
(1) Based on an annual exceedance of 9 hours or 0.1% of the time for 24 hours a day.
(2) Only gust winds need to be considered in the wind safety criterion. These are usually rare events, but deserve special attention in city planning and building design due to their potential safety impact on pedestrians.

FIGURES



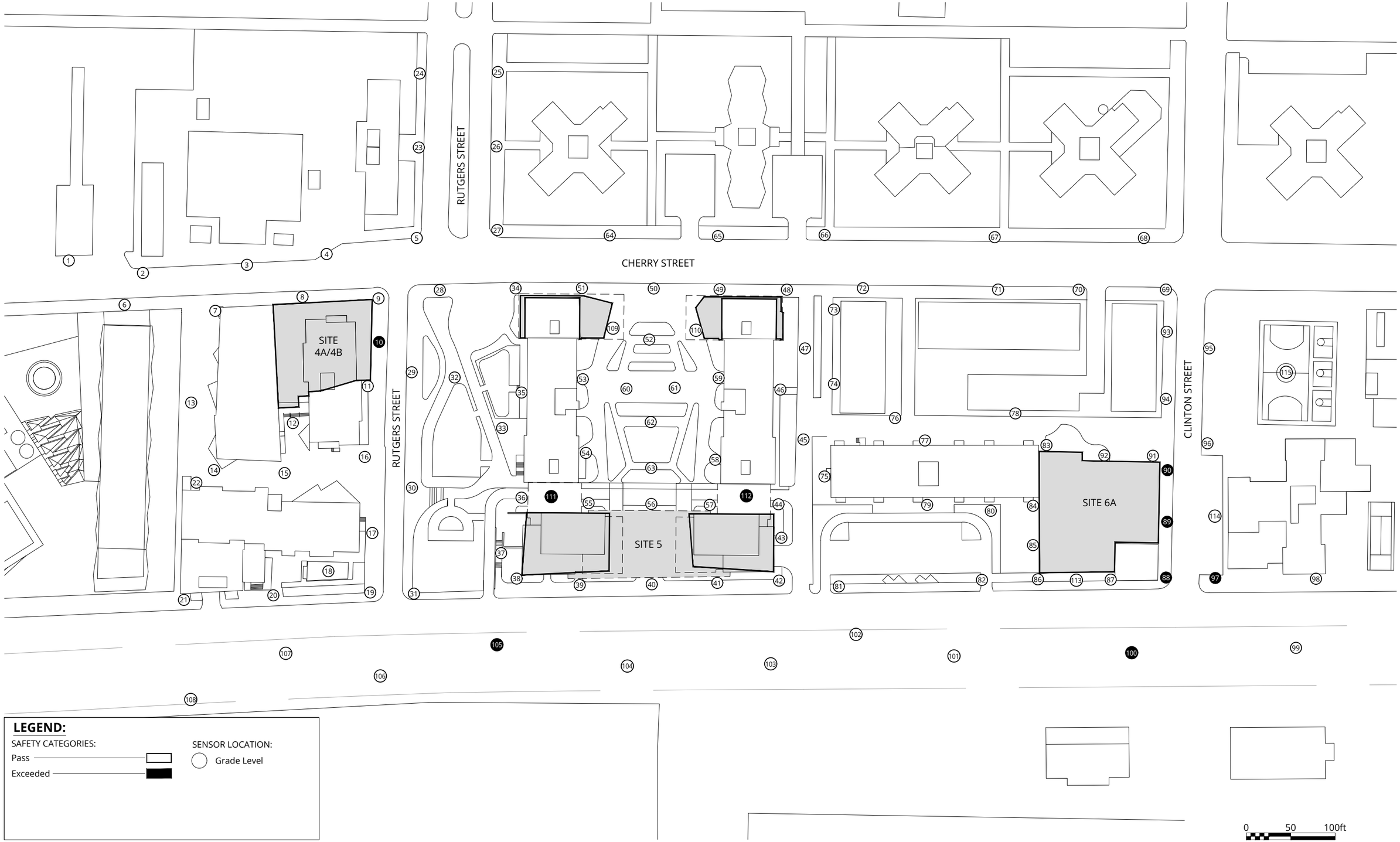
Pedestrian Wind Safety Conditions - RWDI Criteria
Existing Configuration
Annual (January to December, 0:00 to 23:00)

Two Bridges - New York, NY

True North

Project #1701614

Drawn by:	ck	Figure:	1
Approx. Scale:	1"=100'		
Date Revised:	June 16, 2017		



LEGEND:

SAFETY CATEGORIES:

Pass

Exceeded

SENSOR LOCATION:

Grade Level

0 50 100ft

Pedestrian Wind Safety Conditions - RWDI Criteria

Baseline Configuration

Annual (January to December, 0:00 to 23:00)

Two Bridges - New York, NY

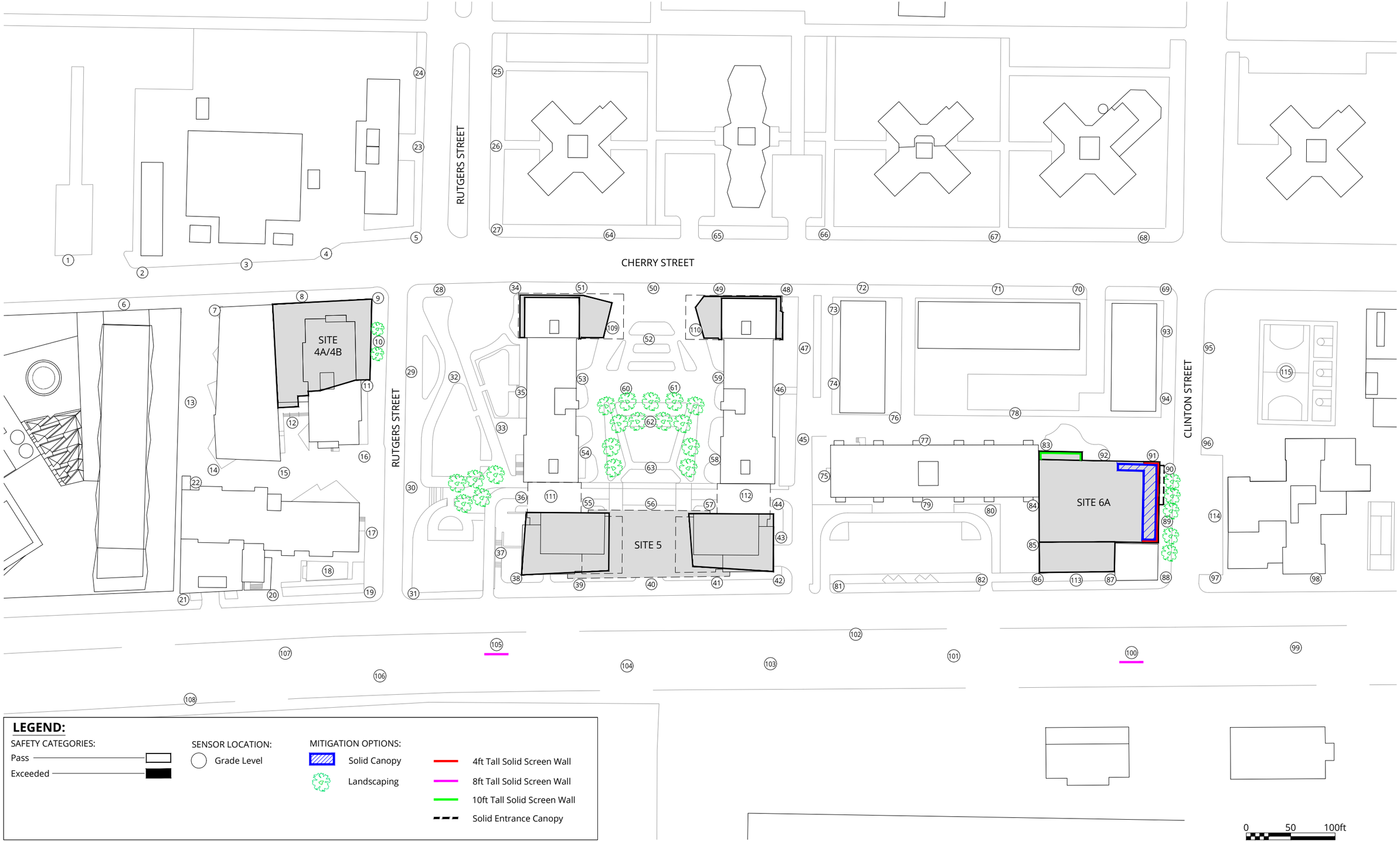
True North

Project #1701614

Drawn by: ck Figure: 2

Approx. Scale: 1"=100'

Date Revised: Aug. 17, 2017



LEGEND:

SAFETY CATEGORIES:
- Pass
- Exceeded

SENSOR LOCATION:
- Grade Level

MITIGATION OPTIONS:
- Solid Canopy
- Landscaping
- 4ft Tall Solid Screen Wall
- 8ft Tall Solid Screen Wall
- 10ft Tall Solid Screen Wall
- Solid Entrance Canopy

0 50 100ft

Pedestrian Wind Safety Conditions - RWDI Criteria

Mitigation Configuration
Annual (January to December, 0:00 to 23:00)

Two Bridges - New York, NY

True North

Project #1701614

Drawn by:	ck	Figure:	3
Approx. Scale:	1"=100'		
Date Revised:	Aug. 17, 2017		

TABLES

Table 1: Pedestrian Wind Safety Conditions - RWDI Criteria

Location	Configuration	Wind Safety		Location	Configuration	Wind Safety	
		Annual				Annual	
		Speed (mph)	Rating			Speed (mph)	Rating
1	Existing	50	Pass	**12**	Existing	43	Pass
	Baseline	47	Pass		Baseline	37	Pass
	Mitigation	46	Pass		Mitigation	37	Pass
2	Existing	45	Pass	**13**	Existing	47	Pass
	Baseline	42	Pass		Baseline	42	Pass
	Mitigation	45	Pass		Mitigation	42	Pass
3	Existing	34	Pass	**14**	Existing	45	Pass
	Baseline	34	Pass		Baseline	43	Pass
	Mitigation	34	Pass		Mitigation	42	Pass
4	Existing	48	Pass	**15**	Existing	40	Pass
	Baseline	44	Pass		Baseline	43	Pass
	Mitigation	43	Pass		Mitigation	43	Pass
5	Existing	41	Pass	**16**	Existing	40	Pass
	Baseline	48	Pass		Baseline	47	Pass
	Mitigation	47	Pass		Mitigation	47	Pass
6	Existing	44	Pass	**17**	Existing	49	Pass
	Baseline	40	Pass		Baseline	50	Pass
	Mitigation	37	Pass		Mitigation	52	Pass
7	Existing	40	Pass	**18**	Existing	38	Pass
	Baseline	43	Pass		Baseline	35	Pass
	Mitigation	45	Pass		Mitigation	35	Pass
8	Existing	37	Pass	**19**	Existing	47	Pass
	Baseline	44	Pass		Baseline	45	Pass
	Mitigation	42	Pass		Mitigation	44	Pass
9	Existing	48	Pass	**20**	Existing	41	Pass
	Baseline	55	Pass		Baseline	42	Pass
	Mitigation	51	Pass		Mitigation	41	Pass
10	Existing	48	Pass	**21**	Existing	40	Pass
	Baseline	58	Exceeded		Baseline	39	Pass
	Mitigation	34	Pass		Mitigation	39	Pass
11	Existing	41	Pass	**22**	Existing	28	Pass
	Baseline	43	Pass		Baseline	26	Pass
	Mitigation	48	Pass		Mitigation	30	Pass

Table 1: Pedestrian Wind Safety Conditions - RWDI Criteria

Location	Configuration	Wind Safety		Location	Configuration	Wind Safety	
		Annual				Annual	
		Speed (mph)	Rating			Speed (mph)	Rating
23	Existing	37	Pass	**34**	Existing	40	Pass
	Baseline	41	Pass		Baseline	43	Pass
	Mitigation	40	Pass		Mitigation	43	Pass
24	Existing	45	Pass	**35**	Existing	42	Pass
	Baseline	42	Pass		Baseline	44	Pass
	Mitigation	43	Pass		Mitigation	42	Pass
25	Existing	40	Pass	**36**	Existing	48	Pass
	Baseline	44	Pass		Baseline	43	Pass
	Mitigation	45	Pass		Mitigation	45	Pass
26	Existing	41	Pass	**37**	Existing	44	Pass
	Baseline	47	Pass		Baseline	52	Pass
	Mitigation	45	Pass		Mitigation	47	Pass
27	Existing	43	Pass	**38**	Existing	49	Pass
	Baseline	45	Pass		Baseline	53	Pass
	Mitigation	47	Pass		Mitigation	53	Pass
28	Existing	47	Pass	**39**	Existing	49	Pass
	Baseline	49	Pass		Baseline	42	Pass
	Mitigation	49	Pass		Mitigation	39	Pass
29	Existing	49	Pass	**40**	Existing	44	Pass
	Baseline	53	Pass		Baseline	34	Pass
	Mitigation	54	Pass		Mitigation	34	Pass
30	Existing	52	Pass	**41**	Existing	46	Pass
	Baseline	52	Pass		Baseline	37	Pass
	Mitigation	50	Pass		Mitigation	34	Pass
31	Existing	50	Pass	**42**	Existing	44	Pass
	Baseline	50	Pass		Baseline	50	Pass
	Mitigation	50	Pass		Mitigation	50	Pass
32	Existing	43	Pass	**43**	Existing	41	Pass
	Baseline	44	Pass		Baseline	43	Pass
	Mitigation	37	Pass		Mitigation	41	Pass
33	Existing	48	Pass	**44**	Existing	42	Pass
	Baseline	50	Pass		Baseline	55	Pass
	Mitigation	47	Pass		Mitigation	53	Pass

Table 1: Pedestrian Wind Safety Conditions - RWDI Criteria

Location	Configuration	Wind Safety		Location	Configuration	Wind Safety	
		Annual				Annual	
		Speed (mph)	Rating			Speed (mph)	Rating
45	Existing	52	Pass	**56**	Existing	47	Pass
	Baseline	53	Pass		Baseline	48	Pass
	Mitigation	52	Pass		Mitigation	43	Pass
46	Existing	42	Pass	**57**	Existing	45	Pass
	Baseline	49	Pass		Baseline	43	Pass
	Mitigation	48	Pass		Mitigation	43	Pass
47	Existing	47	Pass	**58**	Existing	40	Pass
	Baseline	52	Pass		Baseline	36	Pass
	Mitigation	52	Pass		Mitigation	39	Pass
48	Existing	43	Pass	**59**	Existing	36	Pass
	Baseline	50	Pass		Baseline	38	Pass
	Mitigation	46	Pass		Mitigation	26	Pass
49	Existing	40	Pass	**60**	Existing	48	Pass
	Baseline	39	Pass		Baseline	41	Pass
	Mitigation	38	Pass		Mitigation	34	Pass
50	Existing	46	Pass	**61**	Existing	51	Pass
	Baseline	42	Pass		Baseline	42	Pass
	Mitigation	41	Pass		Mitigation	34	Pass
51	Existing	43	Pass	**62**	Existing	50	Pass
	Baseline	39	Pass		Baseline	44	Pass
	Mitigation	37	Pass		Mitigation	34	Pass
52	Existing	48	Pass	**63**	Existing	48	Pass
	Baseline	39	Pass		Baseline	45	Pass
	Mitigation	38	Pass		Mitigation	41	Pass
53	Existing	43	Pass	**64**	Existing	37	Pass
	Baseline	41	Pass		Baseline	43	Pass
	Mitigation	30	Pass		Mitigation	44	Pass
54	Existing	42	Pass	**65**	Existing	39	Pass
	Baseline	38	Pass		Baseline	43	Pass
	Mitigation	37	Pass		Mitigation	43	Pass
55	Existing	42	Pass	**66**	Existing	41	Pass
	Baseline	45	Pass		Baseline	42	Pass
	Mitigation	45	Pass		Mitigation	43	Pass

Table 1: Pedestrian Wind Safety Conditions - RWDI Criteria

Location	Configuration	Wind Safety		Location	Configuration	Wind Safety	
		Annual				Annual	
		Speed (mph)	Rating			Speed (mph)	Rating
67	Existing	40	Pass	**78**	Existing	40	Pass
	Baseline	42	Pass		Baseline	35	Pass
	Mitigation	41	Pass		Mitigation	35	Pass
68	Existing	35	Pass	**79**	Existing	24	Pass
	Baseline	40	Pass		Baseline	27	Pass
	Mitigation	41	Pass		Mitigation	27	Pass
69	Existing	37	Pass	**80**	Existing	34	Pass
	Baseline	50	Pass		Baseline	34	Pass
	Mitigation	50	Pass		Mitigation	35	Pass
70	Existing	36	Pass	**81**	Existing	42	Pass
	Baseline	37	Pass		Baseline	49	Pass
	Mitigation	37	Pass		Mitigation	48	Pass
71	Existing	30	Pass	**82**	Existing	42	Pass
	Baseline	30	Pass		Baseline	39	Pass
	Mitigation	30	Pass		Mitigation	40	Pass
72	Existing	33	Pass	**83**	Existing	50	Pass
	Baseline	34	Pass		Baseline	34	Pass
	Mitigation	35	Pass		Mitigation	30	Pass
73	Existing	37	Pass	**84**	Existing	48	Pass
	Baseline	35	Pass		Baseline	24	Pass
	Mitigation	36	Pass		Mitigation	23	Pass
74	Existing	39	Pass	**85**	Existing	44	Pass
	Baseline	42	Pass		Baseline	33	Pass
	Mitigation	37	Pass		Mitigation	33	Pass
75	Existing	41	Pass	**86**	Existing	42	Pass
	Baseline	43	Pass		Baseline	41	Pass
	Mitigation	38	Pass		Mitigation	40	Pass
76	Existing	40	Pass	**87**	Existing	35	Pass
	Baseline	36	Pass		Baseline	35	Pass
	Mitigation	37	Pass		Mitigation	34	Pass
77	Existing	30	Pass	**88**	Existing	39	Pass
	Baseline	27	Pass		Baseline	58	Exceeded
	Mitigation	27	Pass		Mitigation	52	Pass

Table 1: Pedestrian Wind Safety Conditions - RWDI Criteria

Location	Configuration	Wind Safety		Location	Configuration	Wind Safety	
		Annual				Annual	
		Speed (mph)	Rating			Speed (mph)	Rating
89	Existing	47	Pass	**100**	Existing	35	Pass
	Baseline	57	Exceeded		Baseline	58	Exceeded
	Mitigation	35	Pass		Mitigation	47	Pass
90	Existing	50	Pass	**101**	Existing	36	Pass
	Baseline	63	Exceeded		Baseline	36	Pass
	Mitigation	56	Pass		Mitigation	36	Pass
91	Existing	48	Pass	**102**	Existing	41	Pass
	Baseline	50	Pass		Baseline	44	Pass
	Mitigation	48	Pass		Mitigation	41	Pass
92	Existing	45	Pass	**103**	Existing	47	Pass
	Baseline	35	Pass		Baseline	47	Pass
	Mitigation	35	Pass		Mitigation	54	Pass
93	Existing	36	Pass	**104**	Existing	43	Pass
	Baseline	48	Pass		Baseline	52	Pass
	Mitigation	47	Pass		Mitigation	32	Pass
94	Existing	43	Pass	**105**	Existing	58	Exceeded
	Baseline	46	Pass		Baseline	59	Exceeded
	Mitigation	42	Pass		Mitigation	40	Pass
95	Existing	47	Pass	**106**	Existing	44	Pass
	Baseline	51	Pass		Baseline	52	Pass
	Mitigation	50	Pass		Mitigation	50	Pass
96	Existing	54	Pass	**107**	Existing	43	Pass
	Baseline	55	Pass		Baseline	42	Pass
	Mitigation	53	Pass		Mitigation	39	Pass
97	Existing	45	Pass	**108**	Existing	32	Pass
	Baseline	58	Exceeded		Baseline	31	Pass
	Mitigation	55	Pass		Mitigation	32	Pass
98	Existing	47	Pass	**109**	Existing	46	Pass
	Baseline	48	Pass		Baseline	37	Pass
	Mitigation	43	Pass		Mitigation	37	Pass
99	Existing	48	Pass	**110**	Existing	50	Pass
	Baseline	47	Pass		Baseline	42	Pass
	Mitigation	46	Pass		Mitigation	40	Pass

Table 1: Pedestrian Wind Safety Conditions - RWDI Criteria

Location	Configuration	Wind Safety		Location	Configuration	Wind Safety	
		Annual				Annual	
		Speed (mph)	Rating			Speed (mph)	Rating
111	Existing	40	Pass	**115**	Existing	51	Pass
	Baseline	58	Exceeded		Baseline	54	Pass
	Mitigation	54	Pass		Mitigation	51	Pass
112	Existing	40	Pass				
	Baseline	58	Exceeded				
	Mitigation	56	Pass				
113	Existing	41	Pass				
	Baseline	36	Pass				
	Mitigation	34	Pass				
114	Existing	48	Pass				
	Baseline	55	Pass				
	Mitigation	53	Pass				

Seasons	Hours	Safety Speed (mph)
Annual = January - December	0:00 - 23:00 for safety	(0.1% Annual Exceedance)
Configurations		≤ 56 Pass
Existing	Existing site with existing surroundings	> 56 Exceeded
Baseline	Proposed site with existing surroundings	
Mitigation	Proposed site with existing surroundings plus proposed mitigation	