Tel: 519.823.1311
Fax: 519.823.1316

Rowan Williams Davies & Irwin Inc.
650 Woodlawn Road West
Guelph, Ontario, Canada
N1K 1B8

Ward Village, Land Block 5, Project 1

Honolulu, Hawaii

Final Report

Pedestrian Wind Conditions Consultation

RWDI # 1301245
May 16, 2013

SUBMITTED TO

Glenn Miura
CDS International
1003 Bishop Street
Suite 1400
Honolulu, HI 96813-6410
T: 808.524.4200
F: 808.521.3766
miurag@cdsintl.com

SUBMITTED BY

Dan Wrobel, M.A.Sc.
Technical Coordinator
daniel.wrobel@rwdi.com

Analene Belanger, P.Eng., PMP
Project Manager/Associate
analene.belanger@rwdi.com

Hanqing Wu, Ph.D., P.Eng.
Project Director/Senior Engineer
hanqing.wu@rwdi.com

Bujar Morava, Ph.D., P.Eng.
Project Director/Associate
bujar.morava@rwdi.com

CONSULTING ENGINEERS & SCIENTISTS

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1. INTRODUCTION

Rowan Williams Davies & Irwin Inc. (RWDI) was retained by CDS International to consult on the pedestrian wind conditions for the proposed Ward Village, Land Block 5, Project 1 in Honolulu, Hawaii. The purpose of the study was to assess the wind environment around the development in terms of pedestrian wind comfort and safety. This objective was achieved through wind tunnel testing of a 1:400 scale model of the proposed development for the following configurations:

Configuration A - Existing: existing surroundings; and,

Configuration B - Proposed: existing surroundings with the proposed development.

The photographs in Figures 1a and 1b show the test model in RWDI's boundary-layer wind tunnel. The proposed building is approximately 400 ft high, consisting of a tower and podium totalling 37-storeys. The test model was constructed using the design information and drawings listed in Appendix A. This report summarizes the methodology of wind tunnel studies for pedestrian wind conditions, describes the RWDI pedestrian wind criteria, presents the local wind conditions and their effects on pedestrians and provides conceptual wind control measures, where necessary.

The placement of wind measurement locations was based on our experience and understanding of the pedestrian usage for this site, and reviewed by CDS International.

2. SUMMARY OF WIND CONDITIONS

The wind conditions around the proposed Ward Village, Land Block 5, Project 1 development are discussed in detail in Section 5 of this report and may be summarized as follows:

- All locations passed the wind criterion used to assess pedestrian wind safety.
- Wind comfort for the proposed development was predicted to be acceptable at grade for most of the locations tested. Uncomfortable wind conditions were detected in isolated areas at the podium level of the proposed building as well as at street level along Ward Avenue. Mitigation measures were proposed for these locations.

3. METHODOLOGY

As shown in Figures 1a and 1b, the wind tunnel model included the proposed development and all relevant surrounding buildings and topography within a 1500 ft radius of the study site. The boundary-layer wind conditions beyond the modeled area were also simulated in RWDI's wind tunnel. The model was instrumented with 54 wind speed sensors to measure mean and gust wind speeds at a full-scale height of approximately 5 ft. These measurements were recorded for 36 equally incremented wind directions.

Wind statistics recorded at the Honolulu International Airport between 1979 and 2009 were analysed for the Summer (May through October) and Winter (November through April) seasons. Figure 2 graphically depicts the directional distributions of wind frequencies and speeds for the two seasons. Winds from the east-northeast and northeast are predominant in both the summer and winter as indicated by the wind roses. Strong winds of a mean speed greater than 20 mph measured at the airport (at an anemometer height of 33 ft) occur more often in the summer (10.3%) than in the winter (9.1%).

Wind statistics from the Honolulu International Airport were combined with the wind tunnel data in order to predict the frequency of occurrence of full-scale wind speeds. The full-scale wind predictions were then compared with the RWDI criteria for pedestrian comfort and safety.

4. EXPLANATION OF CRITERIA

The RWDI pedestrian wind criteria are used in the current study. These criteria have been developed by RWDI through research and consulting practice since 1974 (References 1 through 6). They have also been widely accepted by municipal authorities as well as by the building design and city planning community.

RWDI Pedestrian Wind Criteria

Comfort Category	GEM Speed (mph)	Description
Sitting	≤ 6	Calm or light breezes desired for outdoor restaurants and seating areas where one can read a paper without having it blown away
Standing	≤ 8	Gentle breezes suitable for main building entrances and bus stops
Strolling	≤ 10	Moderate winds that would be appropriate for window shopping and strolling along a downtown street, plaza or park
Walking	≤ 12	Relatively high speeds that can be tolerated if one's objective is to walk, run or cycle without lingering
Uncomfortable	> 12	Strong winds of this magnitude are considered a nuisance for most activities, and wind mitigation is typically recommended
Notes: (1) Gust Equivalent Mean (GEM) speed = *max*(mean speed, gust speed/1.85); and (2) GEM speeds listed above are based on a seasonal exceedance of 20% of the time between 6:00 and 23:00.		
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.
Note: Based on an annual exceedance of 9 hours or 0.1% of the time for 24 hours a day.		

A few additional comments are provided below to further explain the wind criteria and their applications.

- Both mean and gust speeds can affect pedestrian's comfort and their combined effect is typically quantified by a Gust Equivalent Mean (GEM) speed, with a gust factor of 1.85 (References 1, 5, 7 and 8).
- Nightly hours between the midnight and 5 o'clock in the morning are excluded from the wind analysis for wind comfort since limited usage of outdoor spaces is anticipated.
- A 20% exceedance is used in these criteria to determine the comfort category, which suggests that wind speeds would be comfortable for the corresponding activity at least 80% of the time or four out of five days.
- 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.
- These criteria for wind forces represent average wind tolerance. They are sometimes subjective and regional differences in wind climate and thermal conditions as well as variations in age, health, clothing, etc. can also affect people's perception of the wind climate. Comparisons of wind speeds for different building configurations are the most objective way in assessing local pedestrian wind conditions.

5. PREDICTED WIND CONDITIONS

Table 1, located in the Tables section of this report, presents the wind comfort and safety conditions for the two test configurations. These conditions are graphically depicted on a site plan in Figures 3a through 4b.

In our discussion of anticipated wind conditions, reference may be made to the following generalized wind flows. Tall buildings tend to intercept the stronger winds at higher elevations and redirect them to the ground level (see Image 1). Such a *Downwashing Flow* is often the main cause for wind accelerations around large buildings at the pedestrian level. If this building/wind combination occurs for prevailing winds, there is a greater potential for increased wind activity.

Image 1 – Downwashing Flow

Winds at all of the measurement locations passed the wind safety criterion. The following is a detailed discussion of the suitability of the predicted wind conditions for the anticipated pedestrian use of each area.

5.1 Building Entrances and Sidewalks (Locations 8-10, 12-14, 19, 20, 22, 26-28, 30 and 31)

Wind conditions suitable for walking or strolling are appropriate for sidewalks. Conditions conducive to standing are preferred at main entrances where pedestrians are apt to linger.

At the proposed building entrances, the conditions were measured to be suitable for sitting (Location 10) and strolling (Locations 20 and 28) throughout the year (Figures 3b and 4b). The strolling conditions are higher than desirable for an entrance area, and would benefit from mitigation.

The elevated wind conditions that were measured at entrance Locations 20 and 28 were due to the strong east-northeast winds being redirected towards grade level by the façade of the proposed building through downwashing (Image 1). To provide mitigation for the areas affected, it is recommended that the corner canopy above Location 26 be extended outward. Additionally, landscaping of at least 8 ft high should be installed between Locations 26 and 28 and Locations 26 and 20 (Image 2).

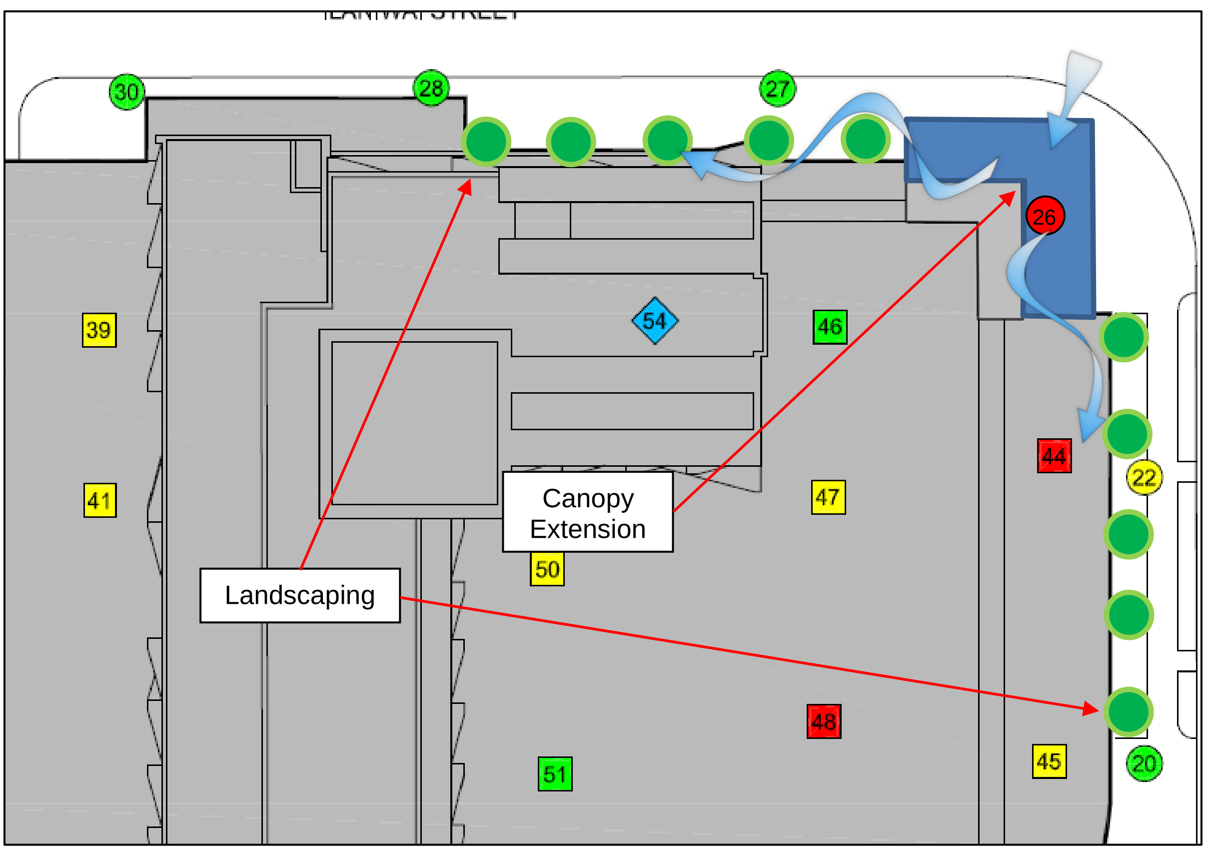

Image 2 – Example Mitigation

During the summer, the measured conditions around the property were comfortable for walking or better around both the existing and proposed developments (Figures 3a and 3b). The exception to this was Location 26 for the proposed configuration where uncomfortable conditions were measured. This area should see improved conditions with the proposed canopy extension.

During the winter, the conditions were similar to the summer, and the mitigation measures discussed above should improve the wind conditions (Figures 4a and 4b).

5.2 Podium Terrace and Lanais (Locations 38-43 and 46-54)

It is generally desirable for wind conditions on terraces to be comfortable for sitting more than 80% of the time.

The conditions measured on the podium terrace were similar throughout the year, and were suitable for walking or better (Figures 3b and 4b), with the exception of Locations 40, 42 and 48, which were uncomfortable. These conditions are higher than desired for a terrace, and mitigation is recommended.

The cause of the elevated wind speeds on the north and south terraces was the result of the east-northeast and northeast winds being redirected down towards the podium by the façade of the building towers through downwashing (Image 1). In addition, the solid windscreen that was used around portions of each terrace likely was responsible for redirecting the winds into each area and causing undesirable wind conditions.

To provide mitigation for the south terrace area, it is recommended that a porous wind screen of approximately 70% solid be used, instead of a solid wind screen. In addition, it is recommended that landscaping of at least 8 ft height be used to the south and east of the terrace to break up any additional wind flow (Images 4 and 6). Lastly, the installation of a canopy of at least 10 ft deep is recommended along the building façade.

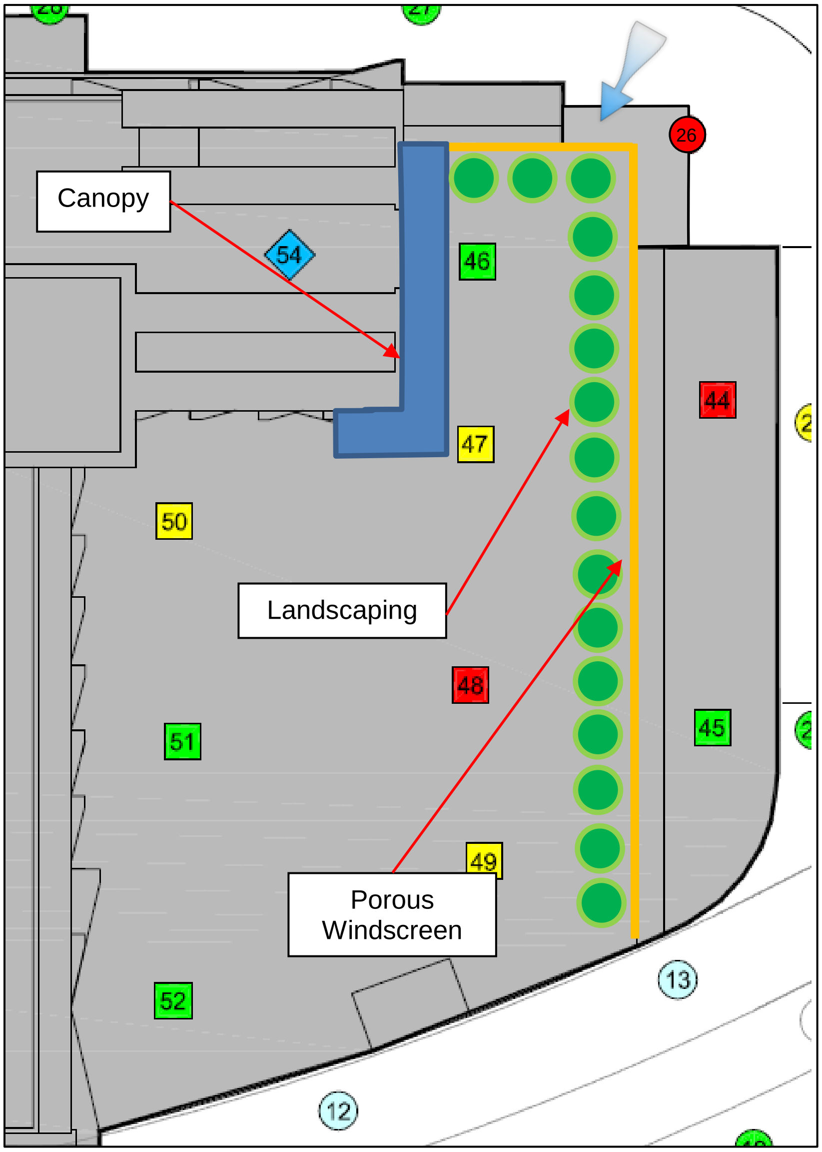

Image 4 – Example Mitigation for South Terrace

For the north terrace, the use of a porous 70% solid wind screen is also recommended, with landscaping of at least 8 ft height to the northeast and northwest of the terrace (Images 5 and 6). A canopy of at least 10 ft depth should also be installed to the northeast of the terrace area.

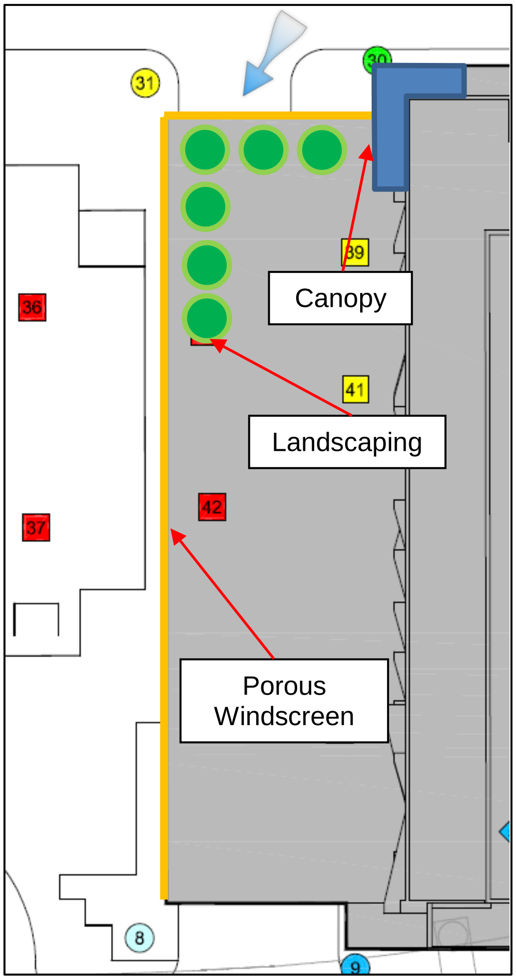

Image 5 – Example Mitigation for North Terrace

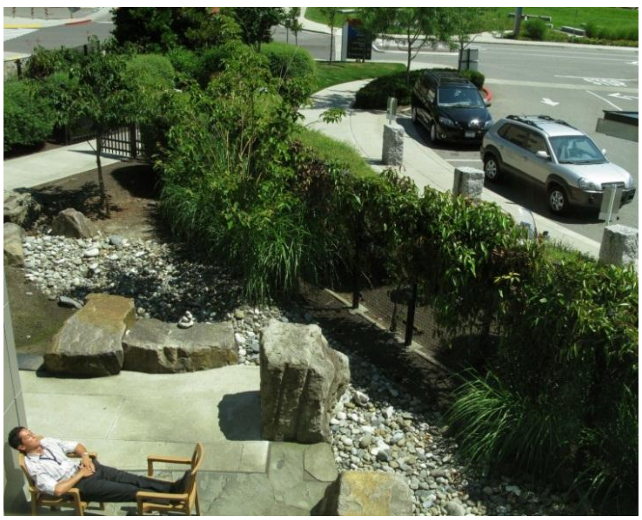

Image 6 – Example Landscaping and Windscreens

The conditions measured in the lanais were found to be comfortable for sitting throughout the year. These are ideal for their intended usage.

5.3 Parking and Off-site Sidewalks (Locations 1-7, 11, 15-18, 21, 23-25, 29, 32-37, 44 and 45)

A comfort categorization of walking is considered appropriate for sidewalks and parking lots.

Conditions at the parking level were generally similar between the two seasons (Locations 44 and 45 in Figures 3b and 4b), being suitable for strolling and walking at Location 45, while uncomfortable at Location 44 throughout the year. The uncomfortable area is higher than desirable and occurs due to the strong east-northeast wind being redirected down towards the parking level through downwashing (Image 1) as well as from direct exposure to the wind flow. To improve wind conditions in the area, it is recommended that a porous screen of at least 8 ft height be installed to the east and south of Location 44 (Image 7).

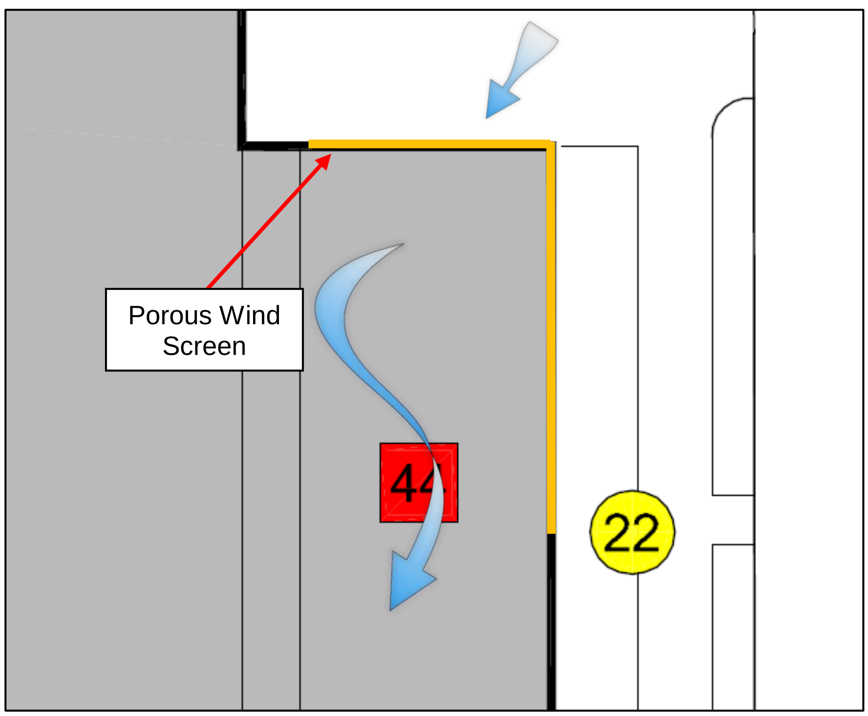

Image 7 – Example Wind Screen Location

Conditions off-site generally remained comfortable for walking or better throughout the year for both the existing and proposed configurations. The exception to this was Locations 21, 35, 36, and 37 for the proposed configuration where uncomfortable conditions were measured. Mitigation measures in the form of landscaping and wind screens should be implemented in these areas, if feasible.

For the exemption of the isolated areas these are appropriate wind conditions.

6. RECOMMENDATIONS

Based on the above discussion on wind conditions, we recommend the following conceptual measures for wind control:

- The canopy above Location 26 be extended, and new canopies of at least 10 ft depth be installed at the south and north building façades at podium level;

- Porous wind screens of approximately 70% solid be used, instead of solid wind screens, along the south and east edges of the south terrace, and the north and west edges of the north terrace. A porous screen of at least 8 ft height should also be installed to the east and south of Location 44 for the exposed parking area; and,

- Landscaping of at least 8 ft height should be installed between Locations 28 and 26 and Locations 26 and 20, to the south and east of the south terrace, and to the northeast and northwest of the north terrace.

7. APPLICABILITY

The wind conditions presented in this report pertain to the model of the proposed Ward Village – Land Block 5 development constructed using the architectural design drawings listed in Appendix A. Should there be any design changes that deviate from this list of drawings, the wind conditions 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.

8. REFERENCES

1) ASCE Task Committee on Outdoor Human Comfort (2004). *Outdoor Human Comfort and Its Assessment*, 68 pages, American Society of Civil Engineers, Reston, Virginia, USA.

2) Williams, C.J., Hunter, M.A. and Waechter, W.F. (1990). "Criteria for Assessing the Pedestrian Wind Environment," *Journal of Wind Engineering and Industrial Aerodynamics*, Vol.36, pp.811-815.

3) Williams, C.J., Soligo M.J. and Cote, J. (1992). "A Discussion of the Components for a Comprehensive Pedestrian Level Comfort Criteria," *Journal of Wind Engineering and Industrial Aerodynamics*, Vol.41-44, pp.2389-2390.

4) Soligo, M.J., Irwin, P.A., and Williams, C.J. (1993). "Pedestrian Comfort Including Wind and Thermal Effects," *Third Asia-Pacific Symposium on Wind Engineering*, Hong Kong.

5) Soligo, M.J., Irwin, P.A., Williams, C.J. and Schuyler, G.D. (1998). "A Comprehensive Assessment of Pedestrian Comfort Including Thermal Effects," *Journal of Wind Engineering and Industrial Aerodynamics*, Vol.77&78, pp.753-766.

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7) Lawson, T.V. (1973). "Wind Environment of Buildings: A Logical Approach to the Establishment of Criteria", *Report No. TVL 7321*, Department of Aeronautic Engineering, University of Bristol, Bristol, England.

8) Durgin, F. H. (1997). "Pedestrian Level Wind Criteria Using the Equivalent average", *Journal of Wind Engineering and Industrial Aerodynamics*, Vol. 66, pp. 215-226.

TABLES

RWDI
CONSULTING ENGINEERS & SCIENTISTS

Table 1: Pedestrian Wind Comfort and Safety Conditions

Location	Configuration	Wind Comfort (20% Seasonal Exceedance)				Wind Safety (0.1% Exceedance)	
		Summer		Winter		Annual	
		Speed (mph)	Rating	Speed (mph)	Rating	Speed (mph)	Rating
1	Existing	7	Standing	8	Standing	30	Pass
	Proposed	6	Sitting	6	Sitting	25	Pass
2	Existing	9	Strolling	8	Standing	32	Pass
	Proposed	8	Standing	8	Standing	32	Pass
3	Existing	10	Strolling	10	Strolling	36	Pass
	Proposed	8	Standing	8	Standing	31	Pass
4	Existing	11	Walking	10	Strolling	33	Pass
	Proposed	9	Strolling	9	Strolling	35	Pass
5	Existing	8	Standing	8	Standing	25	Pass
	Proposed	8	Standing	8	Standing	25	Pass
6	Existing	7	Standing	6	Sitting	22	Pass
	Proposed	7	Standing	7	Standing	27	Pass
7	Existing	10	Strolling	10	Strolling	32	Pass
	Proposed	8	Standing	8	Standing	34	Pass
8	Existing	9	Strolling	9	Strolling	30	Pass
	Proposed	6	Sitting	7	Standing	30	Pass
9	Existing	9	Strolling	8	Standing	28	Pass
	Proposed	4	Sitting	5	Sitting	25	Pass
10	Existing	10	Strolling	9	Strolling	30	Pass
	Proposed	5	Sitting	5	Sitting	25	Pass
11	Existing	10	Strolling	9	Strolling	31	Pass
	Proposed	8	Standing	8	Standing	32	Pass
12	Existing	7	Standing	7	Standing	24	Pass
	Proposed	6	Sitting	7	Standing	26	Pass
13	Existing	DATA NOT AVAILABLE					
	Proposed	8	Standing	8	Standing	25	Pass
14	Existing	10	Strolling	9	Strolling	30	Pass
	Proposed	6	Sitting	7	Standing	25	Pass
15	Existing	7	Standing	7	Standing	23	Pass
	Proposed	8	Standing	8	Standing	27	Pass
16	Existing	8	Standing	8	Standing	26	Pass
	Proposed	9	Strolling	9	Strolling	29	Pass

Seasons
Summer = May to October
Winter = November to April

Hours
6:00 to 23:00 for Comfort
1:00 to 24:00 for Safety

Configuration
Existing = without the proposed development
Proposed = with the proposed development

Wind Comfort Category
(20% Seasonal Exceedance)

≤ 6 mph	Sitting
7 to 8	Standing
9 to 10	Strolling
11 to 12	Walking
> 12 mph	Uncomfortable

Wind Safety Category
(0.1% Annual Exceedance)

≤ 56 mph	Pass
> 56 mph	Exceeded

Table 1: Pedestrian Wind Comfort and Safety Conditions

		Wind Comfort (20% Seasonal Exceedance)				Wind Safety (0.1% Exceedance)	
		Summer		Winter		Annual	
Location	Configuration	Speed (mph)	Rating	Speed (mph)	Rating	Speed (mph)	Rating
17	Existing	9	Strolling	9	Strolling	28	Pass
	Proposed	11	Walking	10	Strolling	34	Pass
18	Existing	9	Strolling	9	Strolling	27	Pass
	Proposed	12	Walking	11	Walking	36	Pass
19	Existing	6	Sitting	6	Sitting	23	Pass
	Proposed	9	Strolling	9	Strolling	28	Pass
20	Existing	7	Standing	6	Sitting	20	Pass
	Proposed	10	Strolling	9	Strolling	29	Pass
21	Existing	10	Strolling	9	Strolling	29	Pass
	Proposed	13	Uncomfortable	12	Walking	41	Pass
22	Existing	8	Standing	8	Standing	25	Pass
	Proposed	12	Walking	11	Walking	35	Pass
23	Existing	10	Strolling	9	Strolling	28	Pass
	Proposed	11	Walking	11	Walking	35	Pass
24	Existing	9	Strolling	9	Strolling	28	Pass
	Proposed	10	Strolling	10	Strolling	30	Pass
25	Existing	9	Strolling	8	Standing	28	Pass
	Proposed	10	Strolling	9	Strolling	31	Pass
26	Existing	7	Standing	6	Sitting	22	Pass
	Proposed	14	Uncomfortable	13	Uncomfortable	42	Pass
27	Existing	7	Standing	7	Standing	22	Pass
	Proposed	10	Strolling	10	Strolling	36	Pass
28	Existing	7	Standing	7	Standing	23	Pass
	Proposed	9	Strolling	9	Strolling	35	Pass
29	Existing	10	Strolling	9	Strolling	30	Pass
	Proposed	11	Walking	11	Walking	37	Pass
30	Existing	7	Standing	7	Standing	22	Pass
	Proposed	10	Strolling	10	Strolling	34	Pass
31	Existing	9	Strolling	9	Strolling	29	Pass
	Proposed	12	Walking	11	Walking	35	Pass
32	Existing	10	Strolling	10	Strolling	31	Pass
	Proposed	11	Walking	10	Strolling	32	Pass

Seasons
Summer = May to October
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Hours
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Proposed = with the proposed development

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(20% Seasonal Exceedance)

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7 to 8	Standing
9 to 10	Strolling
11 to 12	Walking
> 12 mph	Uncomfortable

Wind Safety Category
(0.1% Annual Exceedance)

≤ 56 mph	Pass
> 56 mph	Exceeded

Table 1: Pedestrian Wind Comfort and Safety Conditions

		Wind Comfort (20% Seasonal Exceedance)				Wind Safety (0.1% Exceedance)	
		Summer		Winter		Annual	
Location	Configuration	Speed (mph)	Rating	Speed (mph)	Rating	Speed (mph)	Rating
33	Existing	10	Strolling	10	Strolling	34	Pass
	Proposed	11	Walking	11	Walking	34	Pass
34	Existing	11	Walking	10	Strolling	34	Pass
	Proposed	11	Walking	10	Strolling	32	Pass
35	Existing	12	Walking	12	Walking	37	Pass
	Proposed	13	Uncomfortable	12	Walking	38	Pass
36	Existing	15	Uncomfortable	13	Uncomfortable	45	Pass
	Proposed	16	Uncomfortable	15	Uncomfortable	47	Pass
37	Existing	12	Walking	11	Walking	38	Pass
	Proposed	14	Uncomfortable	13	Uncomfortable	42	Pass
38	Existing	DATA NOT AVAILABLE					
	Proposed	9	Strolling	9	Strolling	30	Pass
39	Existing	DATA NOT AVAILABLE					
	Proposed	11	Walking	11	Walking	35	Pass
40	Existing	DATA NOT AVAILABLE					
	Proposed	13	Uncomfortable	13	Uncomfortable	40	Pass
41	Existing	DATA NOT AVAILABLE					
	Proposed	11	Walking	11	Walking	36	Pass
42	Existing	DATA NOT AVAILABLE					
	Proposed	13	Uncomfortable	13	Uncomfortable	41	Pass
43	Existing	DATA NOT AVAILABLE					
	Proposed	12	Walking	11	Walking	38	Pass
44	Existing	DATA NOT AVAILABLE					
	Proposed	14	Uncomfortable	13	Uncomfortable	41	Pass
45	Existing	DATA NOT AVAILABLE					
	Proposed	11	Walking	10	Strolling	35	Pass
46	Existing	DATA NOT AVAILABLE					
	Proposed	9	Strolling	9	Strolling	30	Pass
47	Existing	DATA NOT AVAILABLE					
	Proposed	12	Walking	12	Walking	37	Pass
48	Existing	DATA NOT AVAILABLE					
	Proposed	14	Uncomfortable	13	Uncomfortable	44	Pass

Seasons
Summer = May to October
Winter = November to April

Hours
6:00 to 23:00 for Comfort
1:00 to 24:00 for Safety

Configuration
Existing = without the proposed development
Proposed = with the proposed development

Wind Comfort Category
(20% Seasonal Exceedance)

≤ 6 mph	Sitting
7 to 8	Standing
9 to 10	Strolling
11 to 12	Walking
> 12 mph	Uncomfortable

Wind Safety Category
(0.1% Annual Exceedance)

≤ 56 mph	Pass
> 56 mph	Exceeded

Table 1: Pedestrian Wind Comfort and Safety Conditions

		Wind Comfort (20% Seasonal Exceedance)				Wind Safety (0.1% Exceedance)	
		Summer		Winter		Annual	
Location	Configuration	Speed (mph)	Rating	Speed (mph)	Rating	Speed (mph)	Rating
49	Existing	DATA NOT AVAILABLE					
	Proposed	12	Walking	11	Walking	38	Pass
50	Existing	DATA NOT AVAILABLE					
	Proposed	12	Walking	11	Walking	37	Pass
51	Existing	DATA NOT AVAILABLE					
	Proposed	10	Strolling	9	Strolling	31	Pass
52	Existing	DATA NOT AVAILABLE					
	Proposed	9	Strolling	9	Strolling	31	Pass
53	Existing	DATA NOT AVAILABLE					
	Proposed	4	Sitting	4	Sitting	14	Pass
54	Existing	DATA NOT AVAILABLE					
	Proposed	3	Sitting	3	Sitting	10	Pass

Seasons
Summer = May to October
Winter = November to April

Hours
6:00 to 23:00 for Comfort
1:00 to 24:00 for Safety

Configuration
Existing = without the proposed development
Proposed = with the proposed development

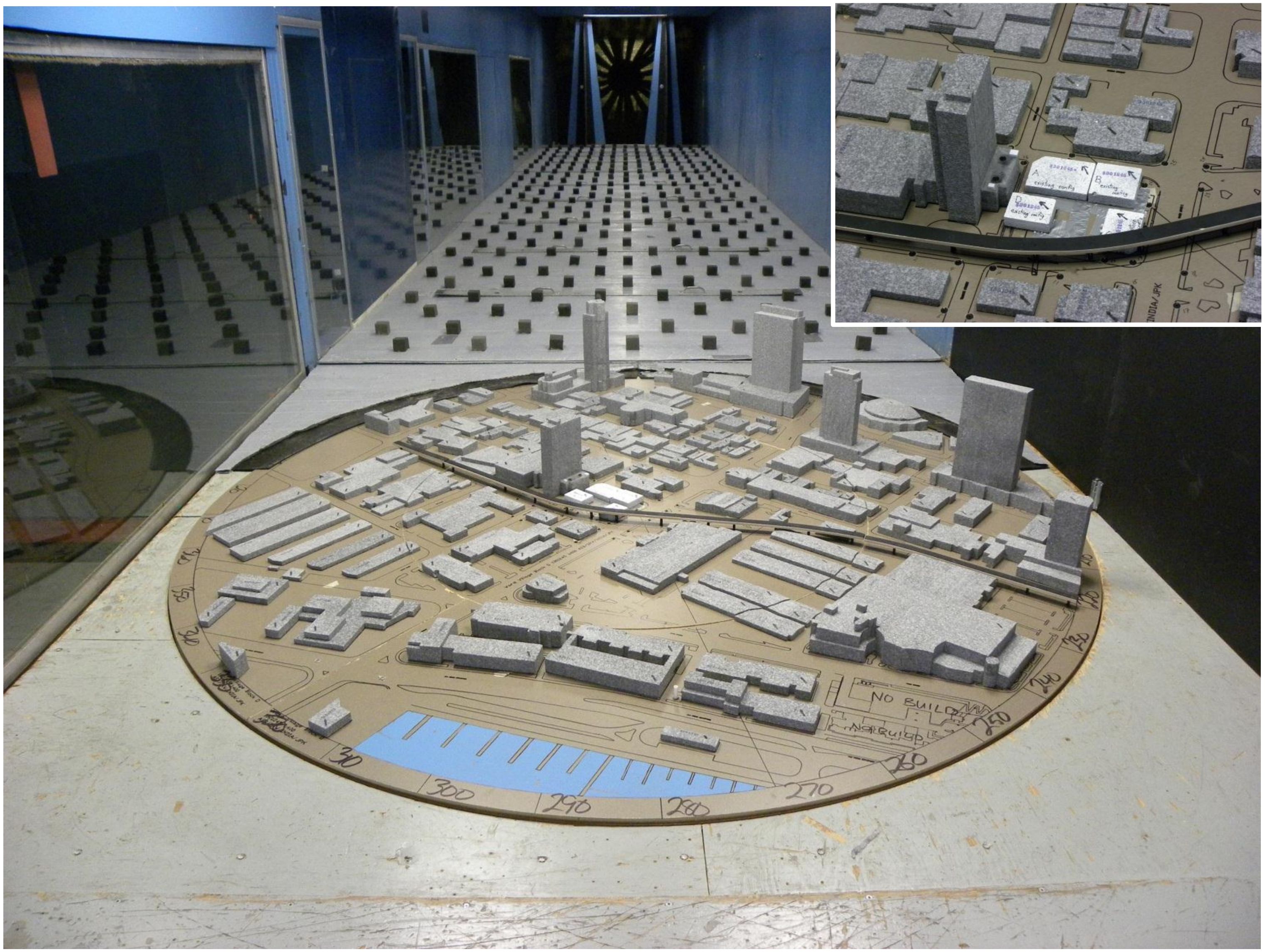
Wind Comfort Category
(20% Seasonal Exceedance)

≤ 6 mph	Sitting
7 to 8	Standing
9 to 10	Strolling
11 to 12	Walking
> 12 mph	Uncomfortable

Wind Safety Category
(0.1% Annual Exceedance)

≤ 56 mph	Pass
> 56 mph	Exceeded

FIGURES



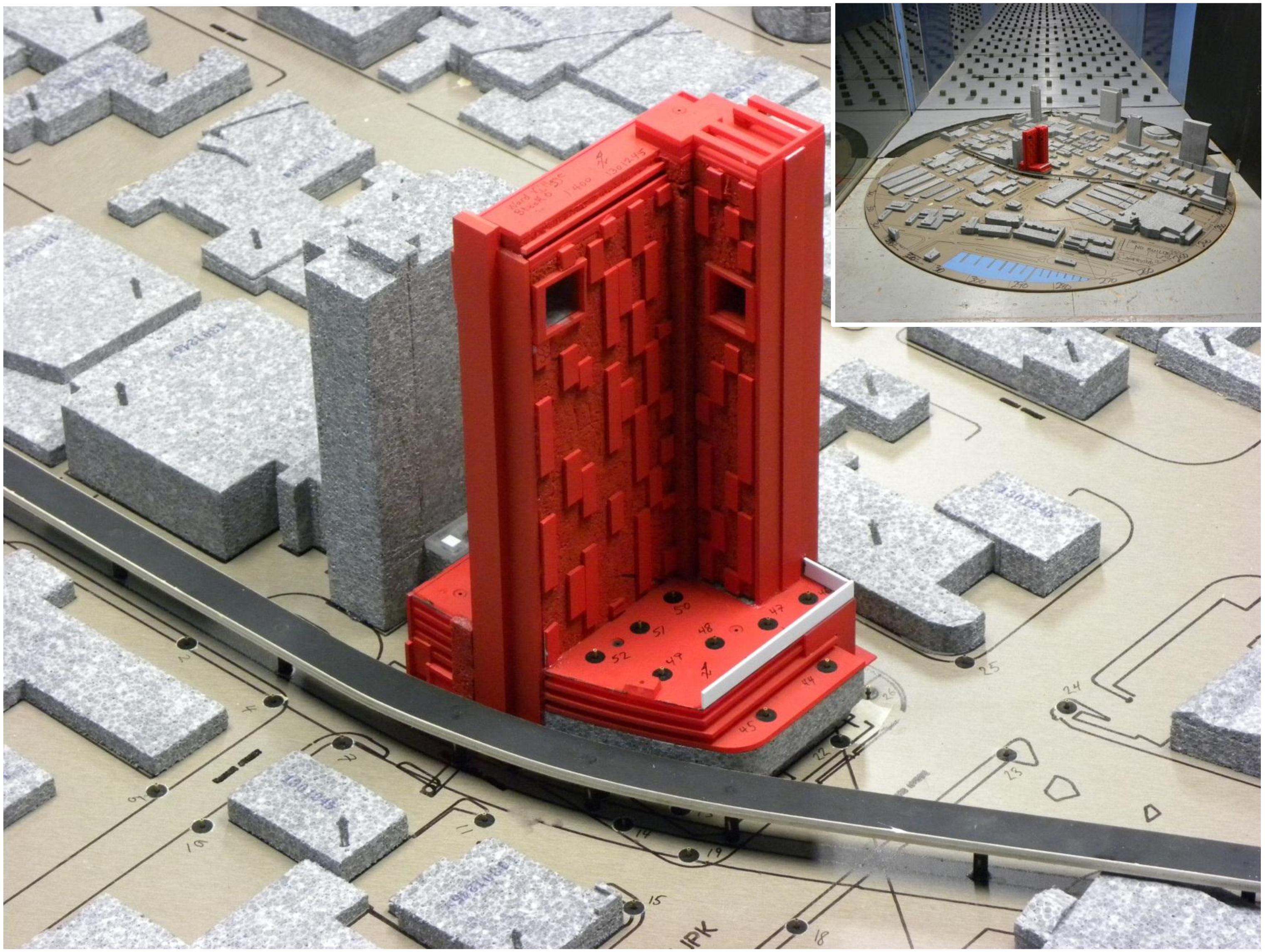
Wind Tunnel Study Model
Existing Configuration

Ward Village - Land Block 5 – Honolulu, Hawaii

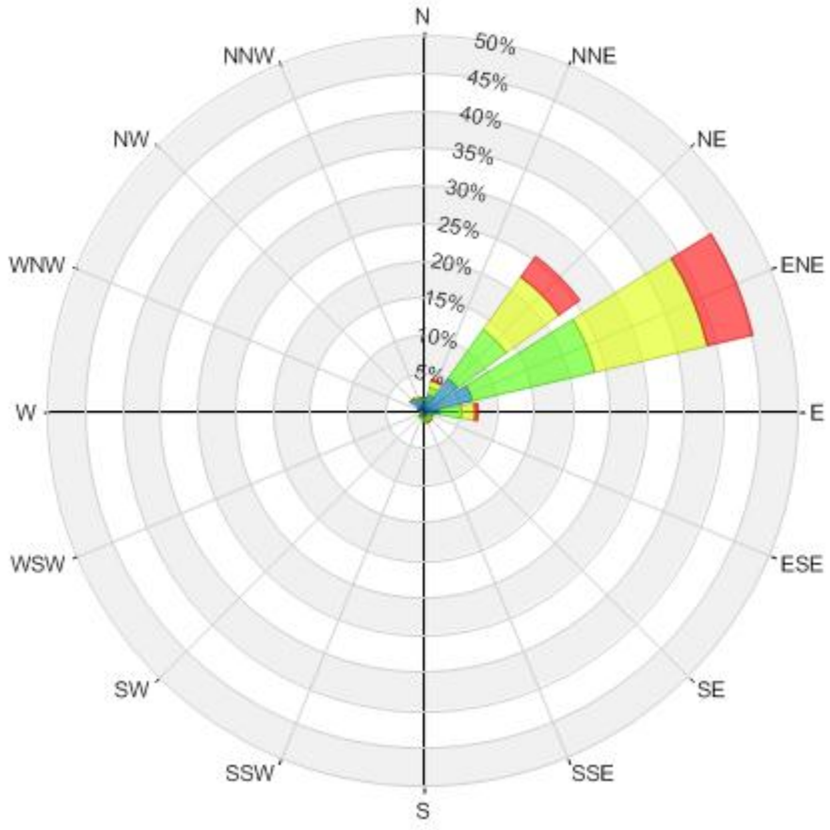
Project #1301245

Figure No. 1a

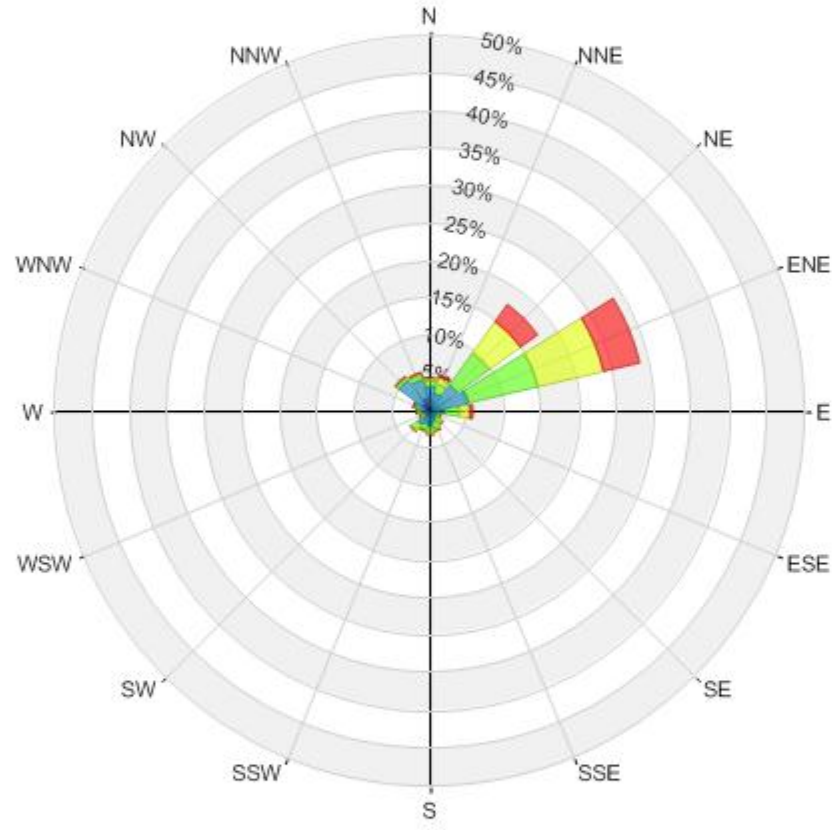
Date: May 16, 2013



Wind Tunnel Study Model **Proposed Configuration**		Figure No. 1b	RWDI
Ward Village - Land Block 5 – Honolulu, Hawaii	Project #1301245	Date: May 16, 2013	



Summer
(May - October)



Winter
(November - April)

Wind Speed (mph)	Probability (%) Summer	Winter
Calm	2.9	6.0
1-5	4.2	7.9
6-10	23.7	32.8
11-15	31.7	25.6
16-20	27.2	18.6
>20	10.3	9.1

Directional Distribution (%) of Winds (Blowing From)
Honolulu International Airport (1979 - 2009)

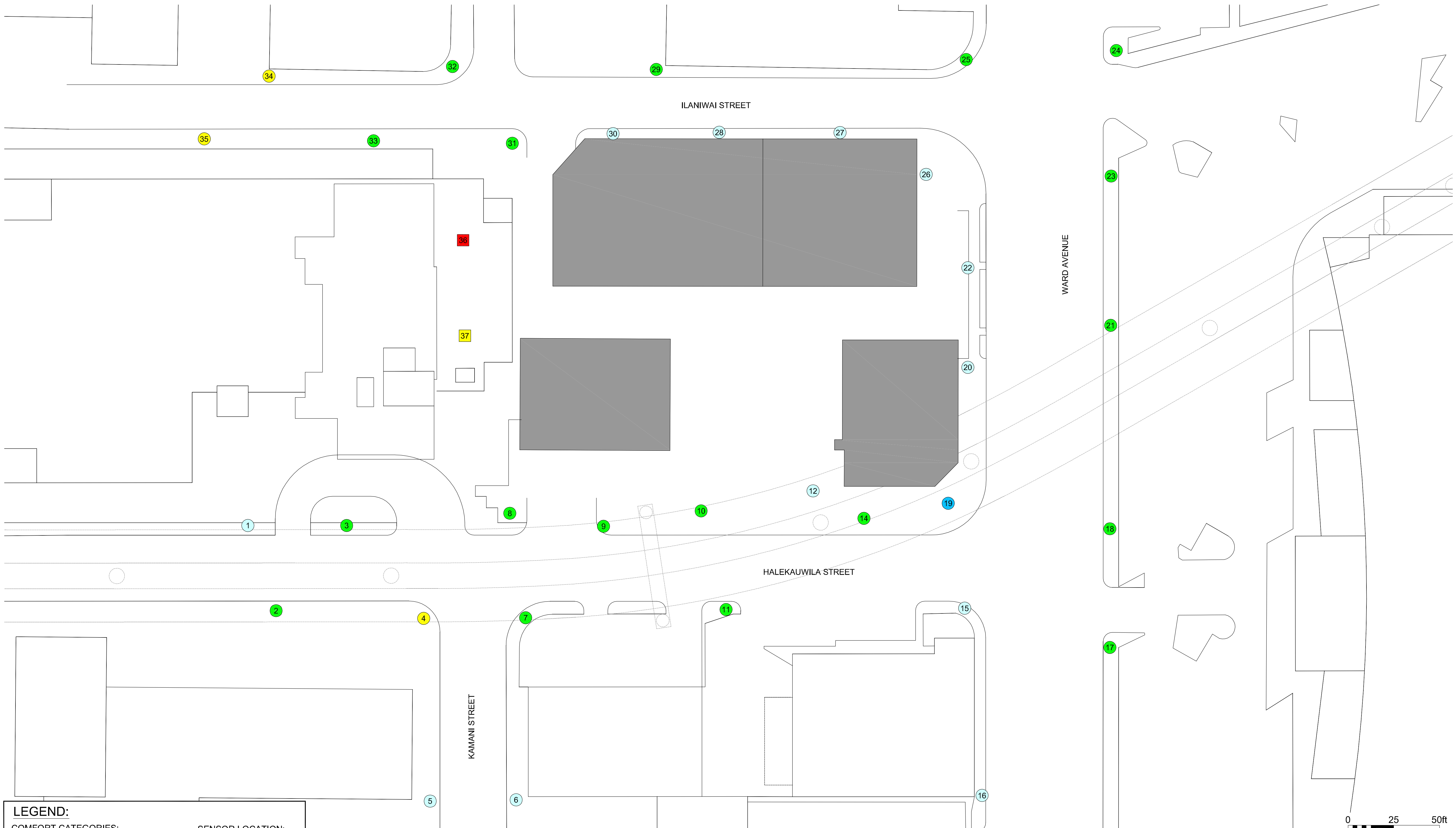
Ward Village – Land Block 5 – Honolulu, Hawaii

Project #1301245

Figure No. 2

Date: May 16, 2013

RWDI



LEGEND:

COMFORT CATEGORIES:	SENSOR LOCATION:
Sitting (blue)	Grade Level (circle)
Standing (light blue)	Podium Level (square)
Strolling (green)	
Walking (yellow)	
Uncomfortable (red)	

Pedestrian Wind Comfort Conditions - Existing
Summer (May to October, 6:00 to 23:00)

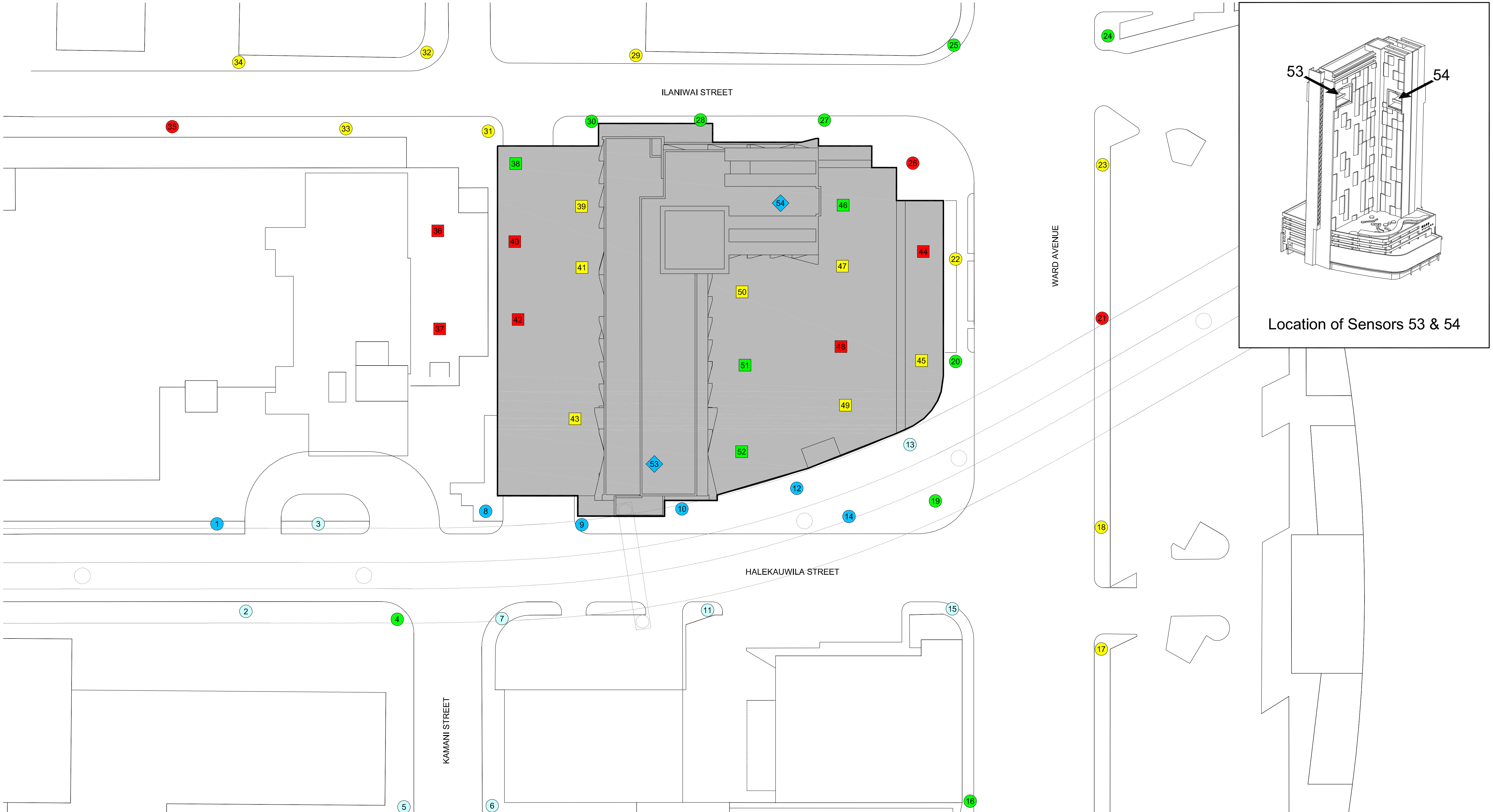
Ward Village – Land Block 5 - Honolulu, Hawaii

True North

Project #1301245

Drawn by: SMR	Figure: 3a
Approx. Scale:	1"=50'
Date Revised:	Apr. 25, 2013

RWDI



0 25 50ft

LEGEND:

COMFORT CATEGORIES:	
Sitting	Blue
Standing	Light blue
Strolling	Green
Walking	Yellow
Uncomfortable	Red

SENSOR LOCATION:
- ○ Grade Level
- □ Podium Level
- ◇ Lanai Level

Pedestrian Wind Comfort Conditions - Proposed
Summer (May to October, 6:00 to 23:00)

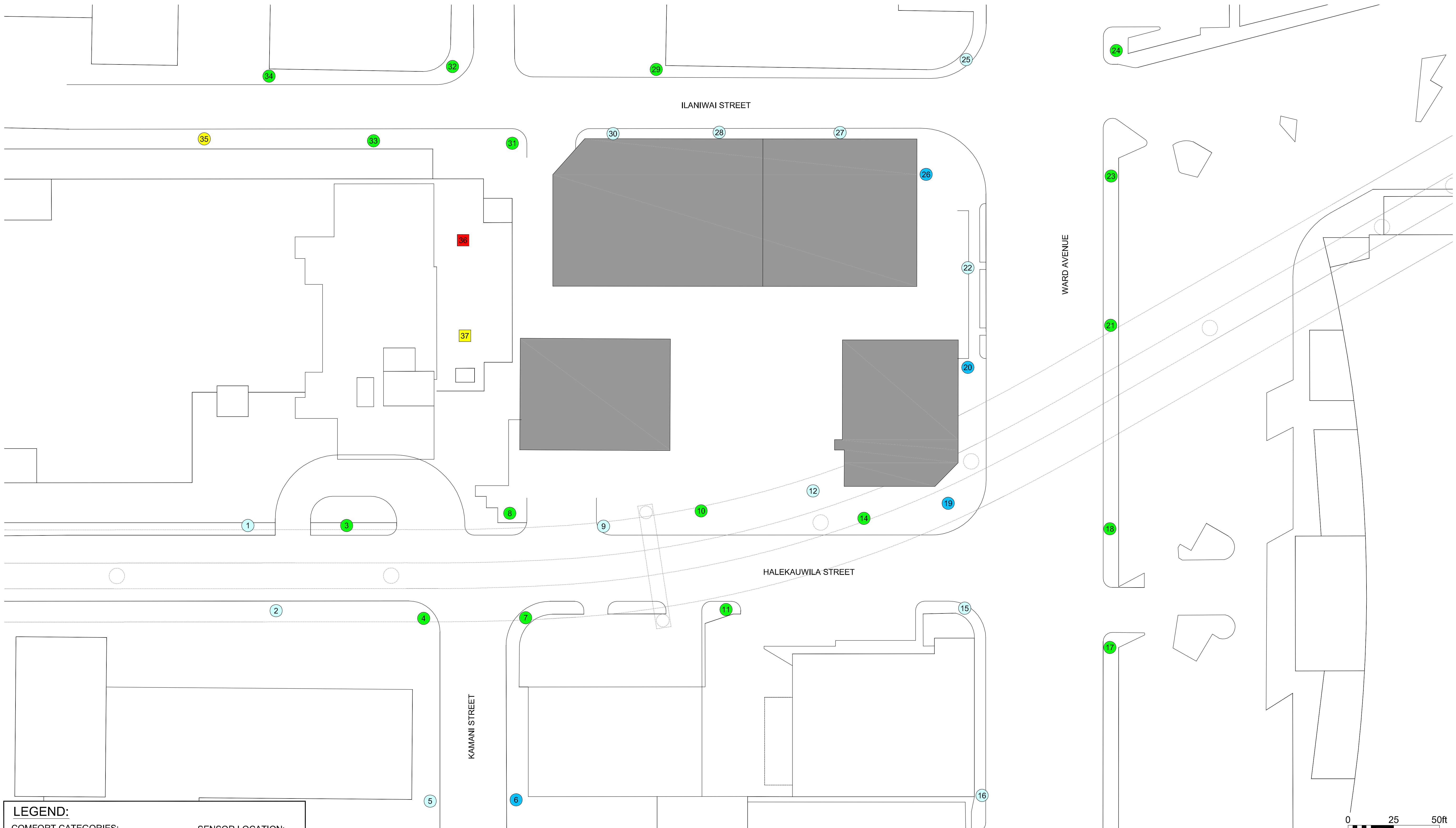
Ward Village – Land Block 5 - Honolulu, Hawaii

True North

Project #1301245

Drawn by: SMR | Figure: 3b
Approx. Scale: 1"=50'
Date Revised: April 25, 2013

RWDI



LEGEND:

COMFORT CATEGORIES:
- Sitting
- Standing
- Strolling
- Walking
- Uncomfortable

SENSOR LOCATION:
- Grade Level
- Podium Level

Pedestrian Wind Comfort Conditions - Existing

Winter (November to April, 6:00 to 23:00)

Ward Village – Land Block 5 - Honolulu, Hawaii

True North

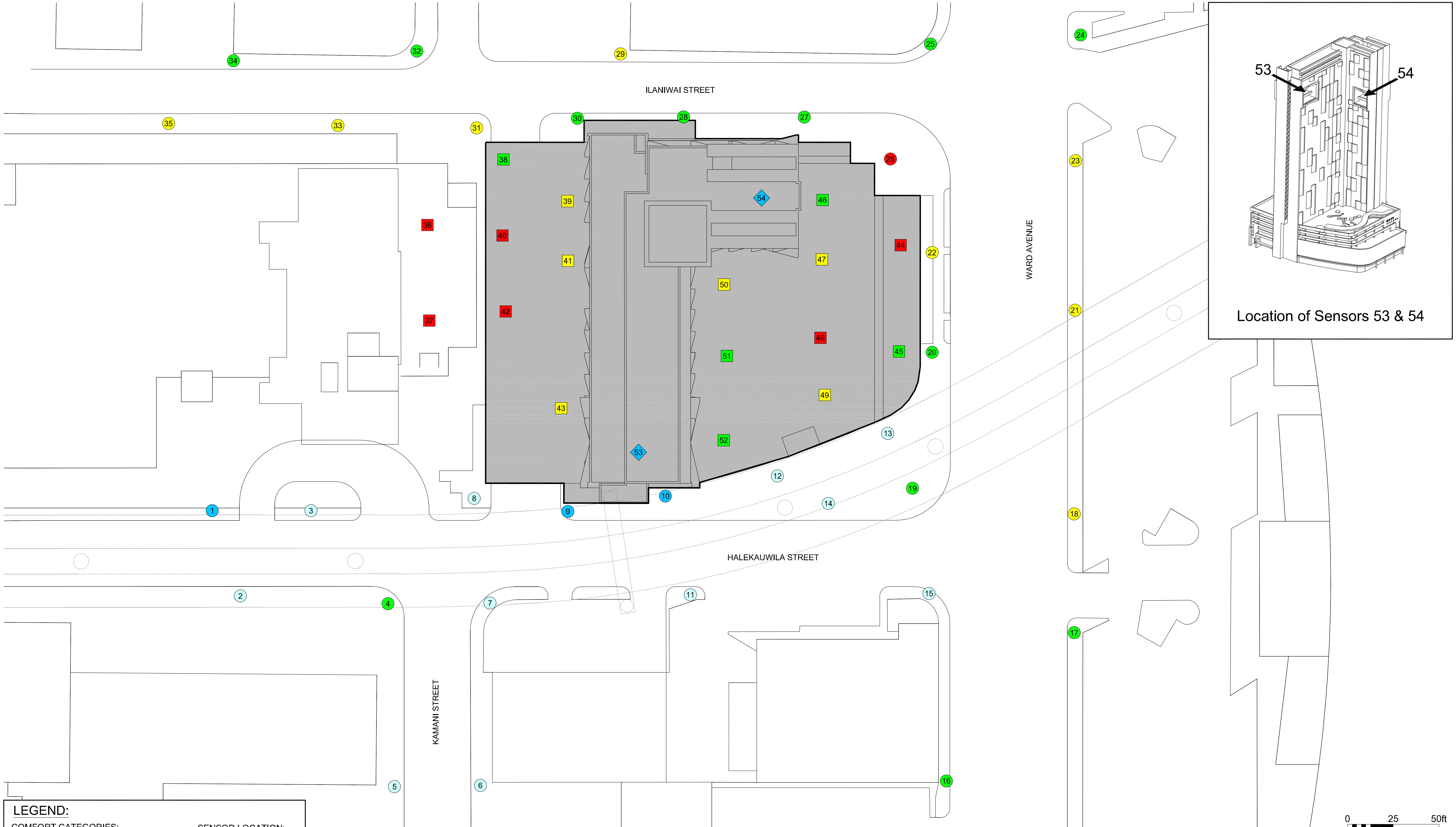
Project #1301245

Drawn by: SMR | Figure: 4a

Approx. Scale: 1"=50'

Date Revised: Apr. 25, 2013

RWDI



LEGEND:

COMFORT CATEGORIES:
- Sitting (blue)
- Standing (light blue)
- Strolling (green)
- Walking (yellow)
- Uncomfortable (red)

SENSOR LOCATION:
- Grade Level (circle)
- Podium Level (square)
- Lanai Level (diamond)

Pedestrian Wind Comfort Conditions - Proposed
Winter (November to April, 6:00 to 23:00)

Ward Village – Land Block 5 - Honolulu, Hawaii

True North

Project #1301245

Drawn by: SMR	Figure: 4b
Approx. Scale:	1"=50'
Date Revised:	April 25, 2013

RWDI

APPENDIX A

CONSULTING ENGINEERS & SCIENTISTS

APPENDIX A: DRAWING LIST FOR MODEL CONSTRUCTION

The drawings and information listed below were received from CDS International and were used to construct the scale model of the proposed Ward Village – Land Block 5. Should there be any design changes that deviate from this list of drawings, the results may change. Therefore, if changes in the design area 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)
Ward Tower Context Final.skp	SketchUp	12/03/2013
040213-Ward Village-Block O-50percent SD.pdf	PDF	01/04/2013
x-elevation-halekauwali.dwg	Dwg	01/04/2013
x-elevation-ilaniwai.dwg	Dwg	01/04/2013
x-elevation-north west.dwg	Dwg	01/04/2013
x-elevation-ward.dwg	Dwg	01/04/2013
x-building section 2.dwg	Dwg	01/04/2013
x-building section 3.dwg	Dwg	01/04/2013
x-08-residential tower-podium level.dwg	Dwg	01/04/2013
x-33-Lanai.dwg - x-40-Lanai.dwg	Dwg	01/04/2013
x-42-penthouse.dwg	Dwg	01/04/2013
x-42-penthouse.dwg	Dwg	01/04/2013
x-44-roof plan.dwg	Dwg	01/04/2013
SD-A301.pdf	PDF	01/04/2013
SD-A302.pdf	PDF	01/04/2013