

Appendix

A Definitions of capitalized words and phrases

The following capitalized words and phrases used in these Comments have the meaning as shown.

| | |
|----------------------------------|---|
| 300 Airport Boulevard | 300 Airport Boulevard project/EIR in City of Burlingame [3] |
| Alemanly Gap | Well-known topographical features that funnel wind to the CPSRA |
| Analysis | Analysis of Project impact on CPSRA for the DEIR |
| Appendix G | Official “CEQA Environmental Checklist Form” |
| Article 5 | Official “Guidelines for implementation of CEQA” |
| Baylands | Section of Brisbane, CA and surrounds also including the Project |
| Brisbane Dirt Mounds | Soil processing mounds on Baylands as of 2nd half of 2013 |
| CEQA | California Environmental Quality Act |
| Comments | This document providing formal written comments |
| CPA | Candlestick Preservation Association, author of these Comments |
| CPSRA | Candlestick Point State Recreation Area |
| CPSRA Sensor | Anemometer sensor for CPSRA operated by WeatherFlow, Inc. |
| Critical Upwind Section | Section of the Project between the Alemanly Gap and the CPSRA |
| DEIR | Draft Project EIR and its appendices and supporting memos |
| ESA | Environmental Sciences Associates, who prepared the Analysis |
| Executive Park | Executive Park project/EIR in City of San Francisco [2] |
| Impact | Potential impact of the Project on the Resource |
| Master Response | Master response to 300 Airport Boulevard DEIR public comments |
| Mitigation | Mitigation measures proposed herein to offset the Impact |
| Practical Sailing Area | Realistic portion of the CPSRA critical to the Resource |
| Project | Proposed Brisbane Baylands project and related projects |
| Required Conditions | Minimum existing conditions for a Sailable Day |
| Resource | Collective recreational windsurfing resources at the CPSRA |
| Sailable Day | Positive application of Required Conditions to CPSRA Sensor data |
| Sailable Day Impact Analysis | Realistic Resource availability impact study reported herein |
| Sailing Area | Entire sailing area of the CPSRA |
| SFBA | San Francisco Boardsailing Association |
| Survey | Survey of actual users of the Resource defining the Required Conditions |
| Waterfront Preservation District | Proposed public space along Bay similar to Chicago lakefront |

B Lull, mean, and gust wind speed reduction impact analysis

Tables in this section were produced by scaling lull, mean, and gust wind speed values in the CPSRA Sensor historical data observations to 95% or 90% of their recorded values and then reapplying the Sailable Day criteria.

| | | Days Sailable | Mean | Lull | Gust | Lull- Gust Range | Lull- Mean Range | Mean- Gust Range |
|-----------|-----------|------------------|------|------|------|------------------------|------------------------|------------------------|
| April | 2011 | 10 (-2, -17%) | 20 | 12 | 27 | 15 | 8 | 8 |
| | 2012 | 11 (-3, -21%) | 18 | 11 | 25 | 13 | 7 | 7 |
| | 2013 | 14 (-6, -30%) | 19 | 12 | 25 | 13 | 7 | 6 |
| May | 2011 | 14 (-1, -7%) | 20 | 12 | 28 | 16 | 8 | 8 |
| | 2012 | 18 (-1, -5%) | 19 | 12 | 25 | 13 | 7 | 6 |
| | 2013 | 19 (-3, -14%) | 18 | 12 | 26 | 14 | 7 | 7 |
| June | 2011 | 8 (-1, -11%) | 19 | 12 | 25 | 13 | 7 | 6 |
| | 2012 | 16 (-3, -16%) | 18 | 11 | 25 | 13 | 7 | 7 |
| | 2013 | 14 (-3, -18%) | 19 | 13 | 27 | 14 | 7 | 7 |
| July | 2011 | 12 (-1, -8%) | 18 | 12 | 24 | 12 | 6 | 6 |
| | 2012 | 6 (-4, -40%) | 18 | 12 | 24 | 12 | 6 | 6 |
| | 2013 | 7 (-5, -42%) | 17 | 11 | 23 | 11 | 6 | 6 |
| August | 2011 | 2 (-1, -33%) | 17 | 11 | 21 | 10 | 5 | 4 |
| | 2012 | 11 (-2, -15%) | 17 | 12 | 23 | 11 | 6 | 5 |
| | 2013 | 12 (-1, -8%) | 18 | 12 | 25 | 13 | 6 | 7 |
| September | 2011 | 9 (-6, -40%) | 17 | 12 | 22 | 11 | 6 | 5 |
| | 2012 | 4 (-7, -64%) | 17 | 12 | 23 | 11 | 6 | 5 |
| | 2013 | 16 (-2, -11%) | 18 | 12 | 25 | 13 | 7 | 7 |
| | 2011 | 55 (-12, -18%) | 19 | 12 | 25 | 13 | 7 | 6 |
| | 2012 | 66 (-20, -23%) | 18 | 12 | 24 | 13 | 6 | 6 |
| | 2013 | 82 (-20, -20%) | 18 | 12 | 25 | 13 | 6 | 7 |
| | All Years | 203 (-52, -20%) | 18 | 12 | 25 | 13 | 7 | 6 |

Table 5: All Wind Speeds At 95% of Observed Value

Lull, mean, and gust values adjusted. Differences and percent differences in days sailable are relative to the base case (Table 2).

| | | Days Sailable | Mean | Lull | Gust | Lull- Gust Range | Lull- Mean Range | Mean- Gust Range |
|-----------|-----------|------------------|------|------|------|------------------------|------------------------|------------------------|
| April | 2011 | 7 (-5, -42%) | 20 | 12 | 28 | 15 | 8 | 8 |
| | 2012 | 8 (-6, -43%) | 19 | 12 | 25 | 13 | 7 | 7 |
| | 2013 | 9 (-11, -55%) | 19 | 12 | 25 | 13 | 7 | 6 |
| May | 2011 | 10 (-5, -33%) | 20 | 12 | 28 | 16 | 8 | 8 |
| | 2012 | 10 (-9, -47%) | 19 | 12 | 26 | 14 | 7 | 7 |
| | 2013 | 18 (-4, -18%) | 18 | 12 | 25 | 13 | 6 | 7 |
| June | 2011 | 6 (-3, -33%) | 19 | 13 | 26 | 14 | 7 | 7 |
| | 2012 | 10 (-9, -47%) | 18 | 12 | 25 | 14 | 7 | 7 |
| | 2013 | 11 (-6, -35%) | 20 | 12 | 27 | 15 | 7 | 8 |
| July | 2011 | 9 (-4, -31%) | 18 | 12 | 23 | 11 | 6 | 5 |
| | 2012 | 6 (-4, -40%) | 18 | 12 | 24 | 12 | 6 | 6 |
| | 2013 | 2 (-10, -83%) | 18 | 12 | 23 | 12 | 6 | 6 |
| August | 2011 | 1 (-2, -67%) | 17 | 11 | 21 | 10 | 6 | 4 |
| | 2012 | 6 (-7, -54%) | 18 | 12 | 23 | 11 | 5 | 6 |
| | 2013 | 9 (-4, -31%) | 18 | 12 | 25 | 12 | 5 | 7 |
| September | 2011 | 6 (-9, -60%) | 17 | 11 | 22 | 11 | 6 | 5 |
| | 2012 | 2 (-9, -82%) | 17 | 11 | 24 | 13 | 6 | 6 |
| | 2013 | 13 (-5, -28%) | 18 | 11 | 25 | 14 | 7 | 7 |
| | 2011 | 39 (-28, -42%) | 19 | 12 | 25 | 14 | 7 | 7 |
| | 2012 | 42 (-44, -51%) | 18 | 12 | 25 | 13 | 7 | 6 |
| | 2013 | 62 (-40, -39%) | 18 | 12 | 25 | 14 | 7 | 7 |
| | All Years | 143 (-112, -44%) | 19 | 12 | 25 | 13 | 7 | 7 |

Table 6: All Wind Speeds At 90% of Observed Value

Lull, mean, and gust values adjusted. Differences and percent differences in days sailable are relative to the base case (Table 2).

C Mean wind speed reduction impact analysis

Tables in this section were produced by scaling only the mean wind speed values in the CPSRA Sensor historical data observations to 95% or 90% of their recorded values and then reapplying the Sailable Day criteria. Lull and gust wind speed values were not adjusted.

| | | Days Sailable | Mean | Lull | Gust | Lull- Gust Range | Lull- Mean Range | Mean- Gust Range |
|-----------|----------------|------------------|------|------|------|------------------------|------------------------|------------------------|
| April | 2011 | 12 (0, 0%) | 19 | 12 | 28 | 16 | 7 | 9 |
| | 2012 | 14 (0, 0%) | 17 | 11 | 25 | 14 | 6 | 8 |
| | 2013 | 17 (-3, -15%) | 18 | 12 | 25 | 13 | 6 | 7 |
| May | 2011 | 15 (0, 0%) | 19 | 12 | 28 | 16 | 7 | 9 |
| | 2012 | 19 (0, 0%) | 18 | 12 | 26 | 14 | 6 | 8 |
| | 2013 | 22 (0, 0%) | 18 | 12 | 26 | 14 | 6 | 8 |
| June | 2011 | 9 (0, 0%) | 18 | 13 | 26 | 13 | 6 | 7 |
| | 2012 | 19 (0, 0%) | 18 | 12 | 26 | 14 | 6 | 8 |
| | 2013 | 15 (-2, -12%) | 18 | 13 | 26 | 14 | 6 | 8 |
| July | 2011 | 12 (-1, -8%) | 18 | 12 | 24 | 12 | 5 | 7 |
| | 2012 | 8 (-2, -20%) | 17 | 12 | 24 | 12 | 5 | 7 |
| | 2013 | 9 (-3, -25%) | 16 | 11 | 23 | 12 | 5 | 7 |
| August | 2011 | 2 (-1, -33%) | 16 | 11 | 22 | 10 | 5 | 5 |
| | 2012 | 11 (-2, -15%) | 17 | 12 | 23 | 11 | 5 | 6 |
| | 2013 | 13 (0, 0%) | 18 | 12 | 26 | 13 | 5 | 8 |
| September | 2011 | 12 (-3, -20%) | 17 | 12 | 22 | 11 | 5 | 6 |
| | 2012 | 6 (-5, -45%) | 16 | 11 | 22 | 11 | 5 | 6 |
| | 2013 | 17 (-1, -6%) | 18 | 12 | 26 | 14 | 6 | 8 |
| 2011 | 62 (-5, -7%) | 18 | 12 | 26 | 14 | 6 | 8 | |
| 2012 | 77 (-9, -10%) | 18 | 12 | 25 | 13 | 6 | 7 | |
| 2013 | 93 (-9, -9%) | 18 | 12 | 26 | 14 | 6 | 8 | |
| All Years | 232 (-23, -9%) | 18 | 12 | 25 | 13 | 6 | 8 | |

Table 7: Mean Wind Speeds At 95% of Observed Value

Only mean wind speed values adjusted. Differences and percent differences in days sailable are relative to the base case (Table 2).

| | | Days Sailable | Mean | Lull | Gust | Lull- Gust Range | Lull- Mean Range | Mean- Gust Range |
|-----------|------|------------------|------|------|------|------------------------|------------------------|------------------------|
| April | 2011 | 12 (0, 0%) | 18 | 12 | 28 | 16 | 6 | 10 |
| | 2012 | 10 (-4, -29%) | 18 | 12 | 27 | 15 | 5 | 9 |
| | 2013 | 13 (-7, -35%) | 18 | 13 | 26 | 13 | 5 | 8 |
| May | 2011 | 15 (0, 0%) | 19 | 12 | 29 | 16 | 6 | 10 |
| | 2012 | 18 (-1, -5%) | 18 | 13 | 26 | 14 | 5 | 9 |
| | 2013 | 20 (-2, -9%) | 18 | 12 | 27 | 15 | 5 | 10 |
| June | 2011 | 8 (-1, -11%) | 18 | 13 | 27 | 14 | 5 | 9 |
| | 2012 | 19 (0, 0%) | 17 | 12 | 26 | 14 | 5 | 9 |
| | 2013 | 13 (-4, -24%) | 19 | 13 | 29 | 16 | 6 | 10 |
| July | 2011 | 10 (-3, -23%) | 17 | 13 | 25 | 12 | 5 | 8 |
| | 2012 | 6 (-4, -40%) | 17 | 12 | 25 | 13 | 5 | 8 |
| | 2013 | 5 (-7, -58%) | 16 | 12 | 24 | 12 | 4 | 8 |
| August | 2011 | 1 (-2, -67%) | 17 | 12 | 23 | 11 | 4 | 6 |
| | 2012 | 9 (-4, -31%) | 17 | 13 | 24 | 12 | 4 | 8 |
| | 2013 | 12 (-1, -8%) | 17 | 13 | 26 | 13 | 4 | 9 |
| September | 2011 | 9 (-6, -40%) | 16 | 12 | 23 | 12 | 4 | 7 |
| | 2012 | 4 (-7, -64%) | 16 | 12 | 24 | 12 | 4 | 7 |
| | 2013 | 14 (-4, -22%) | 18 | 13 | 27 | 15 | 5 | 10 |
| 2011 | | 55 (-12, -18%) | 18 | 12 | 27 | 14 | 5 | 9 |
| 2012 | | 66 (-20, -23%) | 17 | 12 | 26 | 14 | 5 | 9 |
| 2013 | | 77 (-25, -25%) | 18 | 13 | 27 | 14 | 5 | 9 |
| All Years | | 198 (-57, -22%) | 18 | 12 | 26 | 14 | 5 | 9 |

Table 8: Mean Wind Speeds At 90% of Observed Value

Only mean wind speed values adjusted. Differences and percent differences in days sailable are relative to the base case (Table 2).

D Wind turbulence intensity increase impact analysis

Tables in this section were produced by decreasing the lull values in the CPSRA Sensor historical data observations such that the difference between the lull and mean wind speed values of each observation was increased by 5% or 10%. This is consistent with the behavior predictor by the gust factor models detailed in Appendix H. For small changes in wind turbulence intensity, the increase in the difference between mean and gust can be expected to change proportionally to the change in the wind turbulence intensity. Furthermore, the empirical range of lull to gust is roughly symmetric about the mean. Following this change, the Sailable Day criteria was reapplied. Mean and gust wind speed values were not adjusted.

| | | Days Sailable | Mean | Lull | Gust | Lull- Gust Range | Lull- Mean Range | Mean- Gust Range |
|-----------|-----------|------------------|------|------|------|------------------------|------------------------|------------------------|
| April | 2011 | 10 (-2, -17%) | 21 | 12 | 29 | 17 | 9 | 8 |
| | 2012 | 11 (-3, -21%) | 19 | 12 | 26 | 14 | 7 | 7 |
| | 2013 | 14 (-6, -30%) | 19 | 12 | 26 | 14 | 7 | 6 |
| May | 2011 | 14 (-1, -7%) | 21 | 12 | 29 | 17 | 9 | 8 |
| | 2012 | 19 (0, 0%) | 19 | 12 | 26 | 14 | 7 | 7 |
| | 2013 | 20 (-2, -9%) | 19 | 12 | 26 | 14 | 7 | 7 |
| June | 2011 | 9 (0, 0%) | 19 | 12 | 26 | 13 | 7 | 6 |
| | 2012 | 16 (-3, -16%) | 19 | 12 | 26 | 14 | 7 | 7 |
| | 2013 | 14 (-3, -18%) | 20 | 12 | 28 | 15 | 8 | 8 |
| July | 2011 | 12 (-1, -8%) | 18 | 12 | 24 | 12 | 7 | 6 |
| | 2012 | 8 (-2, -20%) | 17 | 11 | 23 | 12 | 6 | 6 |
| | 2013 | 10 (-2, -17%) | 17 | 12 | 23 | 12 | 6 | 6 |
| August | 2011 | 2 (-1, -33%) | 17 | 11 | 22 | 10 | 6 | 4 |
| | 2012 | 11 (-2, -15%) | 18 | 12 | 23 | 11 | 6 | 5 |
| | 2013 | 12 (-1, -8%) | 19 | 12 | 26 | 13 | 6 | 7 |
| September | 2011 | 11 (-4, -27%) | 17 | 11 | 22 | 11 | 6 | 5 |
| | 2012 | 7 (-4, -36%) | 18 | 12 | 22 | 11 | 6 | 5 |
| | 2013 | 17 (-1, -6%) | 19 | 12 | 26 | 14 | 7 | 7 |
| | 2011 | 58 (-9, -13%) | 19 | 12 | 26 | 14 | 7 | 7 |
| | 2012 | 72 (-14, -16%) | 19 | 12 | 25 | 13 | 7 | 6 |
| | 2013 | 87 (-15, -15%) | 19 | 12 | 26 | 14 | 7 | 7 |
| | All Years | 217 (-38, -15%) | 19 | 12 | 26 | 14 | 7 | 7 |

Table 9: Lull-to-Mean Range Increased by 5%

Only lull wind speed values adjusted. Differences and percent differences in days sailable are relative to the base case (Table 2).

| | | Days Sailable | Mean | Lull | Gust | Lull- Gust Range | Lull- Mean Range | Mean- Gust Range |
|-----------|------|------------------|------|------|------|------------------------|------------------------|------------------------|
| April | 2011 | 10 (-2, -17%) | 21 | 12 | 29 | 17 | 9 | 8 |
| | 2012 | 11 (-3, -21%) | 19 | 11 | 26 | 15 | 8 | 7 |
| | 2013 | 14 (-6, -30%) | 19 | 12 | 26 | 14 | 8 | 6 |
| May | 2011 | 13 (-2, -13%) | 21 | 12 | 29 | 17 | 9 | 8 |
| | 2012 | 19 (0, 0%) | 19 | 12 | 26 | 14 | 8 | 7 |
| | 2013 | 20 (-2, -9%) | 19 | 12 | 26 | 15 | 8 | 7 |
| June | 2011 | 9 (0, 0%) | 19 | 12 | 26 | 14 | 7 | 6 |
| | 2012 | 16 (-3, -16%) | 19 | 11 | 26 | 14 | 8 | 7 |
| | 2013 | 14 (-3, -18%) | 20 | 12 | 28 | 16 | 8 | 8 |
| July | 2011 | 12 (-1, -8%) | 18 | 11 | 24 | 12 | 7 | 6 |
| | 2012 | 8 (-2, -20%) | 18 | 11 | 23 | 12 | 7 | 6 |
| | 2013 | 9 (-3, -25%) | 17 | 12 | 23 | 12 | 6 | 6 |
| August | 2011 | 2 (-1, -33%) | 17 | 11 | 22 | 10 | 6 | 4 |
| | 2012 | 11 (-2, -15%) | 18 | 11 | 23 | 11 | 6 | 5 |
| | 2013 | 12 (-1, -8%) | 19 | 12 | 26 | 14 | 7 | 7 |
| September | 2011 | 11 (-4, -27%) | 17 | 11 | 22 | 11 | 6 | 5 |
| | 2012 | 7 (-4, -36%) | 18 | 11 | 22 | 11 | 6 | 5 |
| | 2013 | 17 (-1, -6%) | 19 | 11 | 26 | 14 | 8 | 7 |
| | 2011 | 57 (-10, -15%) | 19 | 12 | 26 | 14 | 8 | 7 |
| | 2012 | 72 (-14, -16%) | 19 | 11 | 25 | 13 | 7 | 6 |
| | 2013 | 86 (-16, -16%) | 19 | 12 | 26 | 14 | 7 | 7 |
| All Years | | 215 (-40, -16%) | 19 | 12 | 26 | 14 | 7 | 7 |

Table 10: Lull-to-Mean Range Increased by 10%

Only lull wind speed values adjusted. Differences and percent differences in days sailable are relative to the base case (Table 2).

E Predicted wind lulls and gusts due to wind turbulence intensity

To illustrate the relationship between lull, mean, and gust wind speed values over different observation periods and different turbulence intensities, the model in Appendix H was applied to 1, 5, and 12 minute observation periods with mean wind speeds ranging from 12 to 28 and wind turbulence intensities ranging from 0.10 to 0.20. These tables predict the range of extreme winds at different variables.

| 3 Second Wind Lull Speed Over 1 Minute Observation Period | | | | | | | | | | | |
|---|------|------|------|------|------|------|------|------|------|------|------|
| Turbulence Intensity | | | | | | | | | | | |
| Mean | 0.10 | 0.11 | 0.12 | 0.13 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 | 0.19 | 0.20 |
| 12 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 9 | 9 | 9 | 9 |
| 14 | 12 | 12 | 12 | 12 | 12 | 11 | 11 | 11 | 11 | 11 | 10 |
| 16 | 14 | 14 | 14 | 13 | 13 | 13 | 13 | 13 | 12 | 12 | 12 |
| 18 | 16 | 16 | 15 | 15 | 15 | 15 | 14 | 14 | 14 | 14 | 13 |
| 20 | 17 | 17 | 17 | 17 | 16 | 16 | 16 | 16 | 15 | 15 | 15 |
| 22 | 19 | 19 | 19 | 18 | 18 | 18 | 18 | 17 | 17 | 17 | 16 |
| 24 | 21 | 21 | 20 | 20 | 20 | 19 | 19 | 19 | 19 | 18 | 18 |
| 26 | 23 | 22 | 22 | 22 | 21 | 21 | 21 | 20 | 20 | 20 | 19 |
| 28 | 24 | 24 | 24 | 23 | 23 | 23 | 22 | 22 | 22 | 21 | 21 |

| 3 Second Wind Gust Speed Over 1 Minute Observation Period | | | | | | | | | | | |
|---|------|------|------|------|------|------|------|------|------|------|------|
| Turbulence Intensity | | | | | | | | | | | |
| Mean | 0.10 | 0.11 | 0.12 | 0.13 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 | 0.19 | 0.20 |
| 12 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 15 | 15 | 15 | 15 |
| 14 | 16 | 16 | 16 | 16 | 16 | 17 | 17 | 17 | 17 | 17 | 18 |
| 16 | 18 | 18 | 18 | 19 | 19 | 19 | 19 | 19 | 20 | 20 | 20 |
| 18 | 20 | 20 | 21 | 21 | 21 | 21 | 22 | 22 | 22 | 22 | 23 |
| 20 | 23 | 23 | 23 | 23 | 24 | 24 | 24 | 24 | 25 | 25 | 25 |
| 22 | 25 | 25 | 25 | 26 | 26 | 26 | 26 | 27 | 27 | 27 | 28 |
| 24 | 27 | 27 | 28 | 28 | 28 | 29 | 29 | 29 | 29 | 30 | 30 |
| 26 | 29 | 30 | 30 | 30 | 31 | 31 | 31 | 32 | 32 | 32 | 33 |
| 28 | 32 | 32 | 32 | 33 | 33 | 33 | 34 | 34 | 34 | 35 | 35 |

Table 11: Prediction of 3 Second Lull and Gust Wind Speeds Over 1 Minute

| 3 Second Wind Lull Speed Over 5 Minute Observation Period | | | | | | | | | | | |
|---|------|------|------|------|------|------|------|------|------|------|------|
| Turbulence Intensity | | | | | | | | | | | |
| Mean | 0.10 | 0.11 | 0.12 | 0.13 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 | 0.19 | 0.20 |
| 12 | 10 | 9 | 9 | 9 | 9 | 9 | 8 | 8 | 8 | 8 | 7 |
| 14 | 11 | 11 | 11 | 10 | 10 | 10 | 10 | 9 | 9 | 9 | 9 |
| 16 | 13 | 13 | 12 | 12 | 12 | 11 | 11 | 11 | 10 | 10 | 10 |
| 18 | 15 | 14 | 14 | 13 | 13 | 13 | 12 | 12 | 12 | 11 | 11 |
| 20 | 16 | 16 | 15 | 15 | 15 | 14 | 14 | 13 | 13 | 13 | 12 |
| 22 | 18 | 17 | 17 | 16 | 16 | 16 | 15 | 15 | 14 | 14 | 13 |
| 24 | 19 | 19 | 18 | 18 | 18 | 17 | 17 | 16 | 16 | 15 | 15 |
| 26 | 21 | 20 | 20 | 19 | 19 | 18 | 18 | 17 | 17 | 16 | 16 |
| 28 | 23 | 22 | 22 | 21 | 20 | 20 | 19 | 19 | 18 | 18 | 17 |

| 3 Second Wind Gust Speed Over 5 Minute Observation Period | | | | | | | | | | | |
|---|------|------|------|------|------|------|------|------|------|------|------|
| Turbulence Intensity | | | | | | | | | | | |
| Mean | 0.10 | 0.11 | 0.12 | 0.13 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 | 0.19 | 0.20 |
| 12 | 14 | 15 | 15 | 15 | 15 | 15 | 16 | 16 | 16 | 16 | 17 |
| 14 | 17 | 17 | 17 | 18 | 18 | 18 | 18 | 19 | 19 | 19 | 19 |
| 16 | 19 | 19 | 20 | 20 | 20 | 21 | 21 | 21 | 22 | 22 | 22 |
| 18 | 21 | 22 | 22 | 23 | 23 | 23 | 24 | 24 | 24 | 25 | 25 |
| 20 | 24 | 24 | 25 | 25 | 25 | 26 | 26 | 27 | 27 | 27 | 28 |
| 22 | 26 | 27 | 27 | 28 | 28 | 28 | 29 | 29 | 30 | 30 | 31 |
| 24 | 29 | 29 | 30 | 30 | 30 | 31 | 31 | 32 | 32 | 33 | 33 |
| 26 | 31 | 32 | 32 | 33 | 33 | 34 | 34 | 35 | 35 | 36 | 36 |
| 28 | 33 | 34 | 34 | 35 | 36 | 36 | 37 | 37 | 38 | 38 | 39 |

Table 12: Prediction of 3 Second Lull and Gust Wind Speeds Over 5 Minutes

| 3 Second Wind Lull Speed Over 12 Minute Observation Period | | | | | | | | | | | |
|--|------|------|------|------|------|------|------|------|------|------|------|
| Turbulence Intensity | | | | | | | | | | | |
| Mean | 0.10 | 0.11 | 0.12 | 0.13 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 | 0.19 | 0.20 |
| 12 | 9 | 9 | 9 | 8 | 8 | 8 | 8 | 7 | 7 | 7 | 6 |
| 14 | 11 | 10 | 10 | 10 | 9 | 9 | 9 | 9 | 8 | 8 | 8 |
| 16 | 12 | 12 | 12 | 11 | 11 | 10 | 10 | 10 | 9 | 9 | 9 |
| 18 | 14 | 13 | 13 | 13 | 12 | 12 | 11 | 11 | 11 | 10 | 10 |
| 20 | 15 | 15 | 14 | 14 | 14 | 13 | 13 | 12 | 12 | 11 | 11 |
| 22 | 17 | 16 | 16 | 15 | 15 | 14 | 14 | 13 | 13 | 12 | 12 |
| 24 | 18 | 18 | 17 | 17 | 16 | 16 | 15 | 15 | 14 | 14 | 13 |
| 26 | 20 | 19 | 19 | 18 | 18 | 17 | 16 | 16 | 15 | 15 | 14 |
| 28 | 22 | 21 | 20 | 20 | 19 | 18 | 18 | 17 | 16 | 16 | 15 |

| 3 Second Wind Gust Speed Over 12 Minute Observation Period | | | | | | | | | | | |
|--|------|------|------|------|------|------|------|------|------|------|------|
| Turbulence Intensity | | | | | | | | | | | |
| Mean | 0.10 | 0.11 | 0.12 | 0.13 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 | 0.19 | 0.20 |
| 12 | 15 | 15 | 15 | 16 | 16 | 16 | 16 | 17 | 17 | 17 | 18 |
| 14 | 17 | 18 | 18 | 18 | 19 | 19 | 19 | 19 | 20 | 20 | 20 |
| 16 | 20 | 20 | 20 | 21 | 21 | 22 | 22 | 22 | 23 | 23 | 23 |
| 18 | 22 | 23 | 23 | 23 | 24 | 24 | 25 | 25 | 25 | 26 | 26 |
| 20 | 25 | 25 | 26 | 26 | 26 | 27 | 27 | 28 | 28 | 29 | 29 |
| 22 | 27 | 28 | 28 | 29 | 29 | 30 | 30 | 31 | 31 | 32 | 32 |
| 24 | 30 | 30 | 31 | 31 | 32 | 32 | 33 | 33 | 34 | 34 | 35 |
| 26 | 32 | 33 | 33 | 34 | 34 | 35 | 36 | 36 | 37 | 37 | 38 |
| 28 | 34 | 35 | 36 | 36 | 37 | 38 | 38 | 39 | 40 | 40 | 41 |

Table 13: Prediction of 3 Second Lull and Gust Wind Speeds Over 12 Minutes

F Background on the DEIR Process

For the DEIR process, an environmental engineering firm (ESA) made an effort to *study the project's effects on wind conditions at the windsurfing launch site in the Candlestick Point State Recreation Area and in the adjacent sailing area that lies to the east of the project site in the San Francisco Bay*. Their results were provided to the City of Brisbane and the public through the body of the DEIR in Chapter 4 Section M and Appendix J as well as a "Windsurf Tech Memo" dated November 2nd, 2012 prepared by Charles Bennett and Cory Barringhaus [6].

The DEIR attempted to satisfy certain requirements of CEQA [1] including Article 5 and Appendix G. Elements of these documents relevant to these Comments include Article 5 sections 15064 (Determining the significance of the environmental effects caused by a project), 15064.7 (Thresholds of significance), and 15065 (Mandatory findings of significance), as well as Appendix G § Evaluation of Environmental Impacts paragraph (9).

For reference, excerpts of these sections are reproduced below:

Article 5 § 15064 subparagraph (e): "If the physical change causes adverse economic or social effects on people, those adverse effects may be used as a factor in determining whether the physical change is significant. For example, if a project would cause overcrowding of a public facility and the overcrowding causes an adverse effect on people, the overcrowding would be regarded as a significant effect."

Article 5 § 15064.7 subparagraph (a): "A threshold of significance is an identifiable quantitative, qualitative or performance level of a particular environmental effect, non-compliance with which means the effect will normally be determined to be significant by the agency and compliance with which means the effect normally will be determined to be less than significant."

Article 5 § 15064.7 subparagraph (c): "When adopting thresholds of significance, a lead agency may consider thresholds of significance previously adopted or recommended by other public agencies or recommended by experts, provided the decision of the lead agency to adopt such thresholds is supported by substantial evidence."

Appendix G § Evaluation of Environmental Impacts paragraph (9): "The explanation of each issue should identify: a) the significance criteria or threshold, if any, used to evaluate each question; and b) the mitigation measure identified, if any, to reduce the impact to less than significance."

G Definitions of technical symbols and terms

The following technical symbols and terms used in these Comments have the meaning as shown.

| | |
|--------------------------|--|
| T | Duration of observation period |
| t | Duration of peak gust wind speed u_{max} |
| $\bar{u}, \bar{u}(T)$ | Mean wind speed during an observation period T |
| $u_{max}, u_{max}(t, T)$ | Peak gust wind speed of length t during an observation period T |
| σ_u | Root mean square of the longitudinal turbulence component to the mean wind speed \bar{u} |
| TI_u | Wind turbulence intensity (longitudinal, in direction of flow), ratio of σ_u over \bar{u} |
| $GF(t, T)$ | Gust factor, ratio of u_{max} over \bar{u} given t and T |
| z_0 | Surface roughness length in meters |
| z | Observation height in meters |
| $Gust(t, T)$ | Peak wind speed of length t during an observation period T |
| $Lull(t, T)$ | Minimum wind speed of length t during an observation period T |
| F | sail force |
| ρ | air density, varies with temperature and pressure |
| S | sail area |
| C | aerodynamic coefficient depending on angle of sail to wind and sailing angle |
| V | speed of the wind relative to the sail (apparent wind) |

H Selected formulas

Standard practice of relating turbulence intensity to extreme wind speeds known as gusts and lulls is based on elements of “Extreme Value Theory.” Simple models from Extreme Value Theory are used to populate the sensitivity analysis tables in these Comments. Though much of this science is explored in the context of hurricane and other violent storms, the winds experienced at CPSRA do range in the near gale category [18] and empirically, these models do reasonably predict the range of values experienced at CPSRA as shown below.

The starting point for this analysis is a simple gust factor formula proposed by [13] that is consistent with empirical observations and assumes a linear dependence on the longitudinal turbulence intensity and a logarithmic dependence on the gust duration t :

$$GF(t = 3 \text{ seconds}, T = 12 \text{ minutes}) = 1 + 0.42 \times TI_u \times \ln(720 / 3) \quad (1)$$

Given sensor observations from sailable periods of an average mean wind speed of 18 mph and average gust of 25 (see Table 2), an implied TI_u of 0.16 is found using the above model. This is within the range found by the wind tunnel tests. This implied turbulence intensity presumably reflects the additional effect of wind swell, which is well known to increase turbulence, in addition to other factors that were not modeled in the wind tunnel test.

Next, a surface roughness length formula given by [36]:

$$z_0 = \exp[\ln(z) - 1/TI_u(z)] \quad (2)$$

At a height z of 2 meters and a turbulence intensity TI_u of 0.16, a surface roughness length z_0 of 0.0039 meters (0.39 cm) is found. This is on the order of [?] for inland seas and WMO (2008) and substantiates the use of the Eq 1 sensitivity analysis calculations in these comments.

Gust wind speeds are predicted from mean wind observations (\bar{u}) by:

$$Gust(t, T) = GF(t, T) \times \bar{u}(T) \quad (3)$$

Sailable observations show lulls and gusts to be roughly symmetric around the mean wind speed. Mean wind speeds were far enough from zero so that such symmetry did not suggest negative numbers. Lull wind speeds are predicted by:

$$Lull(t, T) = 2\bar{u}(T) - Gust(t, T) \quad (4)$$

Predicted lull and gust values using this method are consistent with sensor observations. A consequence of this model is that regardless of the actual turbulence intensity, the effect of proportional changes to the turbulence intensity can be examined by simply scaling the range of the mean-gust or lull-mean ranges.

Finally, force exerted on the sail from these wind speeds is given by Bernoulli’s equation and is proportional to the square of the apparent wind speed. Apparent wind speed can be greater or less than true wind depending on sailing angle.

$$F = \frac{1}{2} \times \rho \times S \times C \times V^2 \quad (5)$$

I Miscellaneous

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