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Technical Memorandum

TO: Michael Kay, Project Manager

FROM: Don Ballanti

DATE: November 9, 2011

SUBJECT: Potential Wind Conditions in the Bay East of the Proposed 300 Airport Boulevard Development, Burlingame, California

INTRODUCTION

Background and Study Purpose

In 1998 and 1999, an EIR was prepared (consisting of a Draft EIR, a Recirculated Draft EIR and a Response to Comments document) for a previously proposed project on the site. That project, which was never built, proposed the construction of four office structures totaling 488,000 sq. ft. During the processing of the EIR on the earlier project, public concern was raised that the proposed development would interfere with the predominantly westerly winds that pass over the site and then over the Bay. These winds are relied upon by recreational users to propel sail boards launched and landed at the Coyote Point shoreline and which sail the Bay to the east and north of the project site.

In response to questions about the magnitude and extent of the wind-shadow effect of the earlier proposal, a series of wind-tunnel tests were performed, in order to define the existing wind environment in the Bay to the east of the site and along the shore, as well as to determine the wind environment that would exist were that proposed project built. A primary area 1,500 ft. on a side, with an area of approximately 47.9 acres, was studied. As part of those studies, thresholds of significance with respect to wind reductions for windsurfing were developed.

The purpose of this study is to determine the wind impacts of the current proposed project utilizing the thresholds of significant and basic protocol established by the City of Burlingame in the earlier EIR.

Considering the spatial relationship of the project site to the Bay and the Coyote Point beach areas, the wind tests focused on the effects on northwest, west-northwest, and west winds. The wind test report describes the combined effects for those three wind directions.

Project Description and Location

The 300 Airport Boulevard Project is within the Anza Point Subarea of the *Burlingame Bayfront Specific Plan* (Specific Plan) and would construct 767,000 square feet of new office or life science uses on a currently vacant 18.12-acre site. The project site is to the north of US 101, immediately adjacent to San Francisco Bay (Bay) to the north and east, and Sanchez Channel to the west. The 300 Airport Boulevard site is currently accessible from Beach Road and is bounded by Airport Boulevard to the north, Airport Boulevard and the Bay to the east, light-industrial buildings along Beach Road to the south, and Sanchez Channel to the west.

The 300 Airport Boulevard Site is currently vacant and consists of impervious surfaces and vegetation. Previously, the site was developed as the Burlingame Drive-In Theater, with four screens and a projection/concession building, located on reclaimed land supported by perimeter dikes of concrete rubble and soil. The cinema complex operated from 1965 to 2001 and was demolished in 2002. The site was then re-graded for future construction activities.

The surrounding areas are currently used by various commercial businesses and office spaces. There are several commercial buildings located on the southern boundary of the site and across Beach Road. In addition, commercial properties are located across the Sanchez Channel to the west.

To the south and further to the east of the site are a shoreline trail and the Coyote Point County Recreation Area. An important use of this beach and bay front area is the launching/landing and transit of sail boards to nearby wind surfing areas out in the Bay. Lack of wind can make the launchings/landings more difficult, as well as hinder transit of the near shore portion of the Bay in reaching the primary wind surfing areas off shore.

Cumulative Development

This report includes a programmatic analysis of impacts of potential development at the 350 Airport Boulevard Site. Generalized cumulative impacts were evaluated by including development on the 350 Airport Boulevard Site generally consistent with the revised specific plan and zoning designations proposed under the Project. Since wind impacts are design-specific, an additional project-level analysis would be required for the 350 Airport Boulevard site if or when an application is submitted to the City of Burlingame.

EXISTING SETTING

Large buildings and structures will affect the nearby wind environment and have residual effects that reach downwind from the building site. Buildings that are much taller than the surrounding buildings or vegetation intercept and redirect winds that might otherwise flow overhead, and bring them down the vertical face of the building to ground level, where they create ground-level wind and turbulence. These redirected winds can be relatively strong and also relatively turbulent, and can be incompatible with the intended uses of the ground-level spaces around the building.

Wind speeds will be reduced downwind of buildings. In the project vicinity, existing buildings and vegetation tend to slow the winds near ground level, due to the friction and drag of the structures and vegetation themselves. The site is currently vacant, but there are buildings (about 80 ft. or less) north of the Bayshore Freeway that are more than 1,000 ft. from the eastern boundary of the site.

Existing Climate and Wind Conditions

Wind conditions at the site are reasonably well represented by wind data taken at San Francisco Airport (SFO) meteorological station, approximately 3 miles to the north of the project site.

Previous wind studies for the project site included an examination of six years of record (78,638 hourly observations) of the hourly wind speeds and wind directions measured at the weather station at SFO.[1] The data were used to establish the general frequency of occurrence of winds at the site during the time of interest for sail boarding (late spring well into fall, April 1st through November 1st). A total of 23,935 hours of record for times of day from 6:00 am until 7:00 pm, mainly during the daylight hours, daily for April 1st through November 1st, was used to establish baseline wind conditions for the site vicinity.

As is common along the upper Peninsula, the highest average wind speeds occur in mid-afternoon and the lowest in the early morning. Westerly to northwesterly winds were found to be the most frequent and strongest winds during all seasons. Of the 16 primary wind directions, four have the greatest frequency of occurrence as well as they make up the majority of the strong winds that occur; these are northwest, west-northwest, west and west-southwest winds.

Analysis of these data found that during the hours from 6:00 a.m. to 7:00 p.m., about 73.3% of all winds blow from five of the 16 directions, as follows: Northwest (NW), 19.0%; West Northwest (WNW), 27.6%; West (W), 15.9%; West Southwest (WSW),

[1] ESA, "Technical Memorandum on Potential Wind Conditions in the Bay East of the Proposed 301 Airport Boulevard Development, Burlingame, California ESA 980241, December 26, 1998.

6.7%; Southwest (SW), 4.0%; and all other winds, 24.4%. Calm conditions occur 2.3% of the time.

When only wind speeds of 9 knots (10 mph) or more are considered, these percentages were found to decrease by about 2% for each major direction: Northwest (NW), 17.0%; West Northwest (WNW), 24.6%; West (W), 13.8%; West Southwest (WSW), 4.4%; and Southwest (SW), 2.4%.

Wind Speed and Utility of Coyote Point Recreation Area Shoreline and Bay

Wind speed effects on land and water-related uses of the Coyote Point Recreation Area shoreline and bay areas vary with the specific use. Swimmers may or may not appreciate the wind, and will require some added effort in swimming against the wind. Board sailors require wind, and the more proficient the sailor, the more wind is preferred. Because the best board sailing areas are well over a mile from shore, sail boarders require wind to reach those sailing areas and to return safely. With the existing conditions, the known near-shore “windshadow” is viewed as an annoyance, because it hinders launching and landing of boards and slows transit to the primary off-shore sailing area. The primary launch area is the beach nearest the parking areas of the Coyote Point Recreation Area (see Figure 1). Boards launched there proceed out to the north, avoid the pilings used to delineate the swimming area, and then move into the Bay. A secondary launch area is the beach near the Airport Boulevard bulkhead. At this location nearest the Project, wind surfers park on adjacent public streets in the surrounding area and access the water at the nearest beach location. Boards launched from that beach would move to the northeast, to avoid the wind shadow from the bulkhead (or berm) structure and the nearby buildings on Beach and Lang Roads, and then would move northward into the Bay.

There are no specific criteria for minimum wind speeds to support “good” sailing. Rather, it appears to be the case that the more wind, the better. Any action that resulted in substantial new wind-shadow within the primary wind surfing areas, or in launching and landing sites or transit lanes would be a material detriment to the utility of the Coyote Point Recreation Area and Bay as an important wind-surfing area. The City of Burlingame considered these recreational wind surfing needs in creating community wind standards set out in the Bayfront Specific Plan. These community wind standards act as guidelines for developments in the area to avoid surpassing specified wind-speed reductions and result in unacceptable impacts to recreational wind surfing needs.

METHODOLOGY

Model and Wind Testing Protocols

A 1 inch to 50 foot scale model of the project site and surrounding vicinity, as well as a substantial downwind reach into the Bay was constructed in order to simulate the project and its existing context. The model was sized to contain a 1,800 ft. by 1,800 ft.

portion of the Bay and shoreline The scale model of the proposed Project and surroundings was constructed by ESA. The scale models were tested in a boundary layer wind-tunnel facility at the University of California, Davis, under the direction of Dr. Bruce White. These tests, however, were performed independent of the University.

Wind-tunnel tests were conducted for three scenarios: 1) existing conditions; 2) the proposed project; 3) cumulative conditions (project and adjacent 350 Airport Boulevard development). Each scenario wind-tunnel tested for each of three wind directions: northwest (NW), west-northwest (WNW), and west (W).

The test procedure consisted of orienting the selected configuration of the model in the boundary layer wind-tunnel and measuring the wind speed at each of a regular grid of test locations with a hot-wire anemometer. The model was tested in a wind tunnel that allows testing of natural atmospheric boundary layer flow past surface objects such as land forms, vegetation, buildings and other structures. The boundary layer wind-tunnel has an overall length of 22 meters (m) (72 feet), a test section of 1.22 m (4 feet) wide by 1.83 m (6 feet) high, and an adjustable false ceiling. The adjustable ceiling and turbulence generators allow speeds within the tunnel to vary from 1 meter per second (m/s) to 8 m/s, or 2.2 to 17.9 mph.

Wind-speed measurements at each test location were made with a hot-wire anemometer, an instrument that directly relates rates of heat transfer to wind speeds by electronic signals. The hot-wire signals are proportional to the magnitude and steadiness of the wind. The hot-wire probe is calibrated to an accuracy of within 2% before the test procedure is begun. The hotwire probe measures the analog voltage for approximately 30 seconds at each test location. When converted to digital signals, this measurement provides approximately 30,000 individual voltage samples that are averaged and the root mean square calculated for each test location. These data, when converted to velocity using calibration curves, provide the mean velocity and turbulence values used in the calculation of the equivalent wind speed.

The ratio of near-surface speed to reference wind speed was calculated from the hot-wire measurements. The inherent uncertainty of measurements made with the hot-wire anemometer close to the surface of the model is approximately ±5% of the true values.

Measurement Point Grid

Measurements were made for a 49-point, 7 by 7 square grid, with 250 ft. spacing between each of the individual measurement points (See Figure 1, Study Area). The test grid is oriented due north-south and due east-west, with the coordinate origin (coordinates of 0,0) located 440 ft. to the south and 125 ft. to the east of the southeast corner of the project site. The area within the 1,500 ft. by 1,500 ft. test grid is 51.65 acres. The diagonal cut at the southeast corner reduces the area of bay surface to approximately 47.9 acres.

Wind Evaluation Criteria

There are no established criteria to define the level of reduction in wind speed that would constitute a "significant adverse impact" under the California Environmental Quality Act (CEQA) for wind surfing at Coyote Point Recreation Area or in the Bay.

The earlier EIR for a previously-proposed development on the project site utilized the standard for significance,[2,3] which is reflected in the Bayfront Specific Plan community wind standards:

> *A reduction of 10% or more in wind speeds at irreplaceable launching and landing sites, or a reduction in wind speed of 10% or more over large portions of transit routes or primary board sailing areas would be judged a significant adverse impact.*

This standard of significance was used to evaluate project and cumulative impacts.

Test Output

Each wind-tunnel measurement results in a ratio that relates the measured speed of surface-level wind to the speed of the free stream wind, as measured near the center of the wind-tunnel. These ratios (called R values here) are the output data from the wind-tunnel tests. The ratios are usually numbers that are less than 1.00, because the wind speeds at the ground level are usually substantially less than the speed of the free-stream wind.

The R values for the three wind directions for each measurement point were averaged. The resulting averaged R value for the project and cumulative scenarios were divided by the averaged R value for the existing scenario for each measurement point. The result is the percent change in wind speed that would result from the change in site and vicinity conditions.

Figure 1 identifies the measurement point locations in relation to the project site and the vicinity. Summary information about the wind-tunnel test results are presented in graphical form in Figures 2 and 3. Figures 2 and 3 show the area of the measurement grid that would experience a wind reduction of greater than 10% for the project development and cumulative development scenarios.

[2] ESA, "Technical Memorandum on Potential Wind Conditions in the Bay East of the Proposed 301 Airport Boulevard Development, Burlingame, California ESA 980241", December 26, 1998.
[3] ESA, "Memorandum on Wind Impact Significance Criteria Proposed 201 Airport Boulevard Project, Burlingame, California ESA 980241", April 29, 1999.

RESULTS

Existing Wind Conditions

Under existing conditions, the relatively strong winds exist at the site because the lands surrounding the site are generally open. The wind near the surface of the Bay is between 50% and 70% of the wind speed high overhead. These percentages are equivalent to ratios, expressed as R values, that range from 0.0 to 1.0. The relatively high R values that exist indicate that the surface winds will be very strong. Wind speeds are depressed within 200 to 300 feet of the Airport Boulevard bulkhead, due to the effects in slowing the wind of the terrain, vegetation and scattered buildings and increase with distance to the east.

Project Conditions

Construction of the proposed project would strengthen the wind shadow extending out into the Bay from the Airport Boulevard bulkhead. Figure 2 shows the area that would have a wind reduction of more than 10 percent. The greatest effect would be felt immediately along the bulkhead, but the area of the 10% wind reduction would extend out to 400 feet east of the bulkhead east of the project. The area affected by greater than 10% decreases in wind coincides with portions of transit routes, but does not contain launching/landing site or primary board sailing areas.

The wind shadow of the proposed project, defined by a 10% wind reduction, does not affect any launching/land sites. Board sailors launching at the secondary launch area at the beach near the Airport Boulevard bulkhead would have to travel further to the northeast to avoid the wind shadow of the project, but this would not constitute a "large portion of a transit route" (See Figure 2). The primary windsurfing area would not be affected by construction of the project.

In summary the project would not result in a reduction of 10% or more in wind speeds at "irreplaceable launching and landing sites", "primary board sailing areas" or "large portions of transit routes". Project impacts on recreational boardsailing in the vicinity of the project site would be less-than-significant.

Cumulative Conditions

Construction of the proposed project and cumulative development at 350 Airport Boulevard would strengthen the wind shadow extending out into the Bay from the Airport Boulevard bulkhead. Figure 3 shows the area of wind reductions of 10% or more. The greatest effect would be felt immediately along the bulkhead, but a narrow area of 10% wind reduction would extend at least 750 feet east of the bulkhead.

The wind shadow of project and cumulative development, defined by a 10% wind reduction, does not affect any launching/land sites. Board sailors launching at the

secondary launch area at the beach near the Airport Boulevard bulkhead would have to travel further to the northeast to avoid the wind shadow of the project and cumulative development, but this would not constitute a "large portion of a transit route". The primary windsurfing area would not be affected by construction of the project.

In summary the project and cumulative development would not result in a reduction of 10% or more in wind speeds at "irreplaceable launching and landing sites", "primary board sailing areas" or "large portions of transit routes". Cumulative impacts on recreational boardsailing in the vicinity of the project site would be less-than-significant.

MITIGATION MEASURE

This report includes a programmatic analysis of impacts of potential development at the 350 Airport Boulevard Site. Generalized cumulative impacts were evaluated by including generic development on the 350 Airport Blvd. site based on a previously-proposed but unbuilt development proposal. Since wind impacts are design specific, project-level analysis, consisting of scale-model testing in a wind tunnel, should be required for the 350 Airport Boulevard site if or when an application is submitted to the City of Burlingame.

Figure 1: Study Area

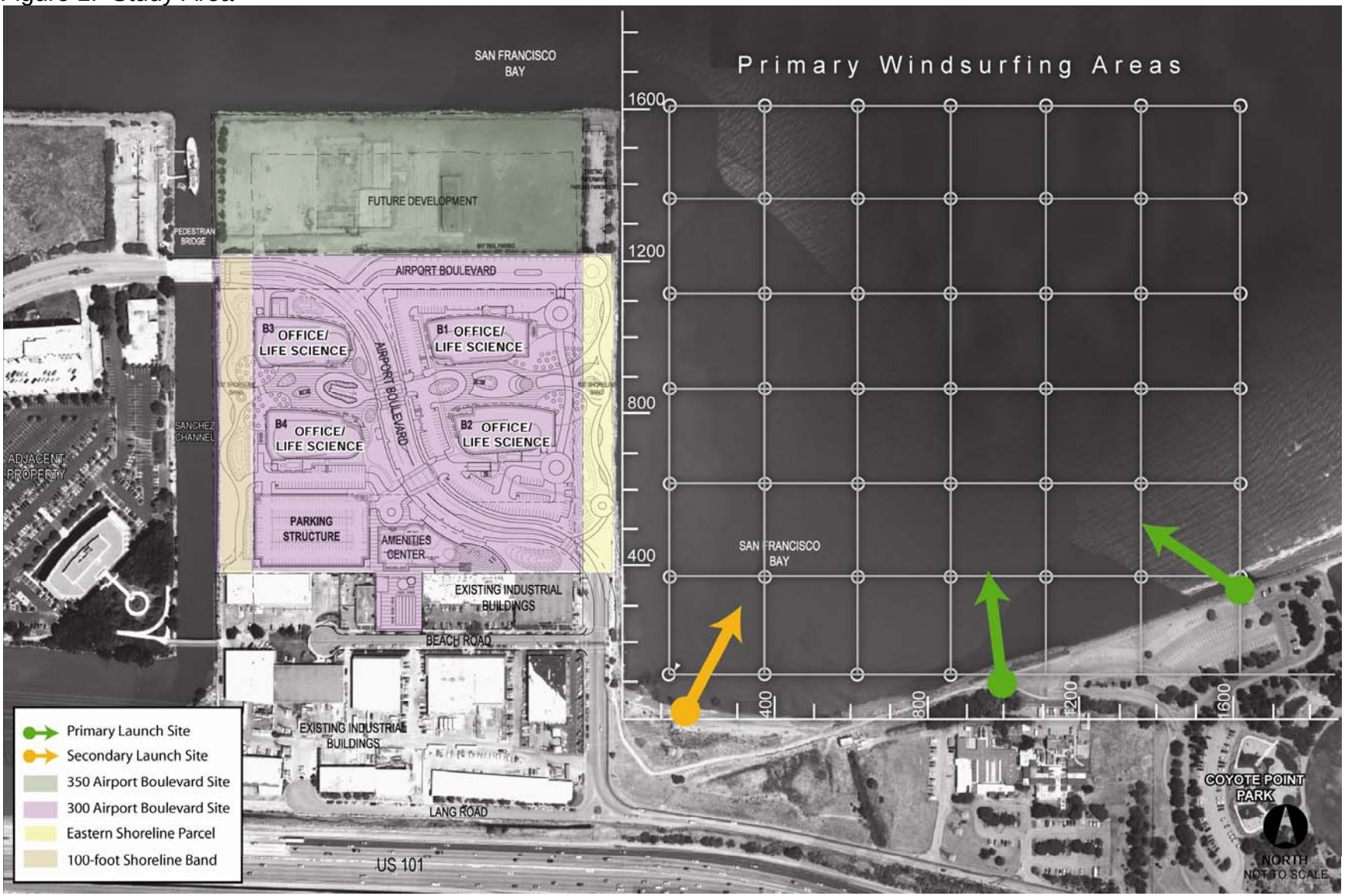

Figure 2: Project Wind Effects

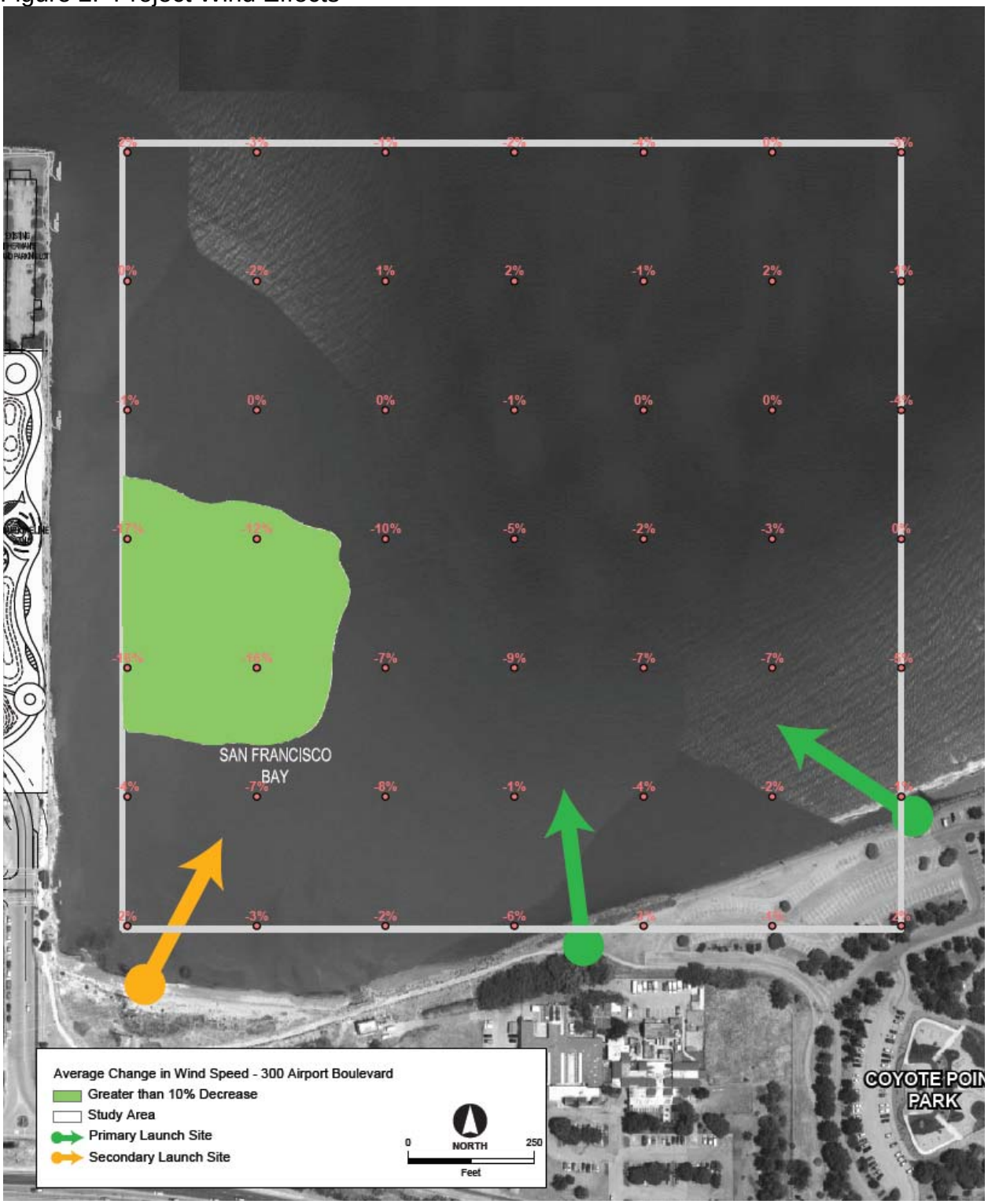

Figure 3: Cumulative Wind Impacts