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COMMENTS PERTAINING TO PALOS VERDES LANDFILL TITLE V REVISION

Prepared by

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For the

Sierra Club South Bay Open Space Task Force

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1.0 Introduction

These comments are based on my review documents related to the air quality analyses contained in the Five Year Review for the Palos Verdes Landfill (2009) including Appendices related to human health risk, air monitoring and air modeling. These documents serve as the basis for the "permits to construct" and Title V Revision. My analysis and comments are made at the request of the Sierra Club's South Bay Open Space Task Force.

Attachment 1 provides a summary of my qualifications. My experience with air quality modeling includes work as a senior scientist in U.S. EPA's Office of Air Quality Planning and Standards including chief of the Model Application Section (MDAD) from 1980-1983.

1.1 Recommendation: I strongly recommend that the South Coast Air Quality Management District (AQMD) withhold the issuance of "permits to construct" and proposed Title V Revision for the Palos Verdes Landfill. My request is based on a technical analysis pertaining to the air quality assessment conducted by the Los Angeles County Sanitation District used to support its regulatory submittals. Based on my review I find that the District's analysis is (a) inconsistent with EPA's modeling guidance and (b) likely to underestimate substantially the ambient concentrations and risks associated with PVLF emissions of uncontrolled landfill gas (LFG) to the air. The major findings of my review are discussed below and explain why AQMD should require that the District to conduct a scientifically valid assessment of air impacts and health risk and to take additional corrective actions as needed prior to issuing the permits.

1.2 Summary: The air quality analyses conducted by the Los Angeles County Sanitation District were used to as important inputs to a Human Health Risk Assessment (HHRA). The District's assessment concludes that the health risks associated with exposure to landfill contaminants do not exceed levels designated as acceptable (Health Quotient > 1.0, cancer risk > 10^{-5} or 1 additional case per 100,000). However, major deficiencies in LACSD air impact analyses indicate that the analysis seriously underestimates the full extent of risks to people living in the neighborhoods that surround the landfill. These deficiencies include (a) inadequate methods used to assess uncontrolled emissions from the landfill surface (b) inaccurate determination of gas collection efficiency (c) failure to use an EPA recommended dispersion model (d) failure to use representative meteorological data. Problems c and d affect stack and flare emissions as well as landfill surface emissions. As the comments show, the deficiencies are likely to produce errors that compound one another and lead to ambient pollutant concentrations that are well below actual concentrations.

The immediate proximity of large numbers of families to the landfill (as shown in Figs. 1 and 2) dictate the need to ensure that the air quality assessment is based on a rigorous analysis using conservative methods and assumptions given the uncertainties that are inherent in air quality assessment. This is an especially important factor with regard to inhalation pathways involving indoor as well as outdoor exposures.

2.0 Air emissions from the surface of the landfill: The area source emissions from the landfill surface are an important parameter in dispersion modeling. Concentrations are proportional to emission rate (i.e. doubling emissions doubles estimated concentrations). Concerns are discussed below:

Figure 1: Google Earth photo of the Palos Verdes Landfill.

The thin white line is about a quarter of a mile in length.

The dashed white arrow indicates the approximate location of the home shown in Figure 2

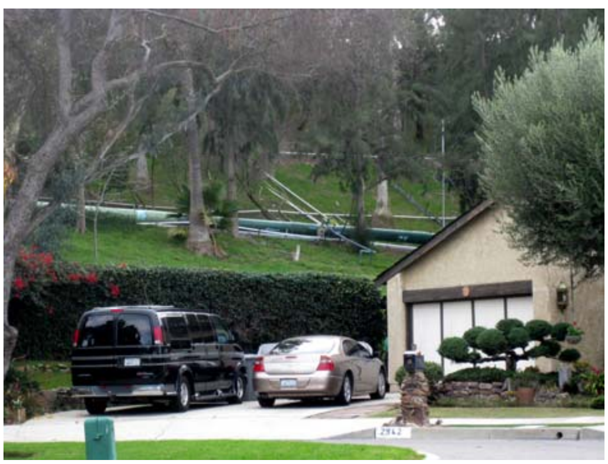


Figure 2: Photo taken from home along Briarwood within feet of the landfill perimeter; landfill gas collection pipes are clearly visible. Location of the home is immediately north of the landfill.

2.1 The flux chamber approach: The surface emissions are based on a single round of measurements from 10 flux chambers taken made over a two day period. (See SCS Landfill Emissions Assessment Report, 2007, pp. 7-8). This is an astonishingly low number of flux boxes for a 291 acre landfill. In addition, the photos of the flux chamber shown in SCS Landfill Emissions Assessment Report (2007) illustrate that each flux chamber has an area of approximately 10 square-feet, meaning that the total area of the landfill actually sampled is on the order of 100-ft^2. Given that there are 43560 ft^2 in an acre and approximately 291 acres in the landfill the landfill area is about 12.7 $x10^6$ ft^2. Thus the flux box area sampled amounts to less than 0.01 % (less than 1/100th of a percent of landfill). The same document states that the site was irrigated within 24-hours prior to the flux chamber tests (reportedly to prevent desiccation). Irrigation, however, would have the effect of reducing permeability and sealing smaller cracks. The document provides no information on the frequency of irrigation and on the most representative state of the surface.

It is difficult to imagine that this vanishingly small percentage of coverage can provide an accurate representation of surface emissions from a large landfill. While flux chambers can provide reliable data *from homogeneous emission source*s, they are not well suited to measuring emissions from large landfills as a whole. The method used failed to consider potentially significant emissions in areas do not have active gas control systems. Secondly gas is emitted not only through landfill cover materials, but through uncontrolled fluxes including cracks, fractures, tree roots, and in areas where leachate and gas collection systems and other structures penetrate the cover. Unless those doing testing had located and monitored these areas of uncontrolled flux, they are likely to have substantially underestimated the true extent of methane and hazardous air pollutant (HAP) emissions.

Figures 3 and 4 (From Appendix B of the Five Year Review Document) show that none of the flux chamber measurements used to estimate landfill emissions was obtained from Ernie Howlett Park, an area that has a passive gas trench rather than an active control system and likely to be less effective at controlling emissions. Secondly, none of the flux chamber measurements were made in the South Coast Botanic District.

Aside from the normal fracturing that takes place in fine grained soil materials, seismic activity and settling of the landfill can contribute to breaches and uncontrolled releases of landfill gas (LFG) into the air.

As Figure 5 shows the site lies in close proximity to the Palos Verdes Fault. Dr. Barry Keller previously provided comments on the issue of seismic activity and its potential effects on the site. Keller's submittal states that damage to landfill structures may occur even though the Palos Verdes fault zone does not reach the surface. He strongly recommends consideration of "blind thrust" earthquakes that "can direct strong energy upward in local area, causing extreme damage, even with an intermediate magnitude earthquake."[1] Moreover, as Dr. Keller's comments state ongoing decomposition of landfill materials is likely to cause settlement for many years. Such subsidence can damage result in damage to piping and other critical components of the gas management system.

[1] Barry Keller, Ph.D., RG, CHG, Comments on Draft Environmental Impact Report (Sept. 2003), New South Coast County Golf Course, March 4, 2004, Prepared for County of LA Department of Parks and Recreation.

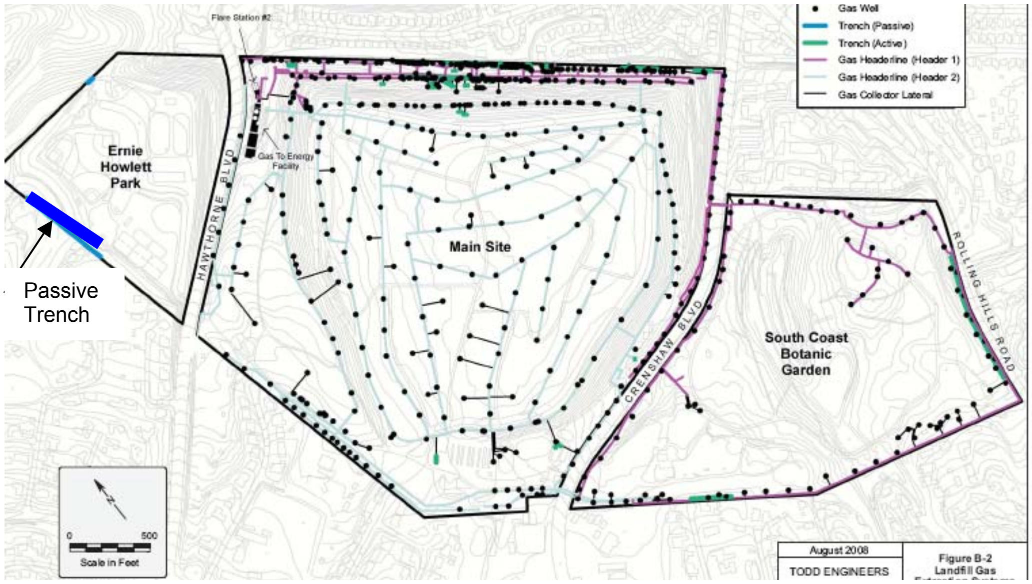
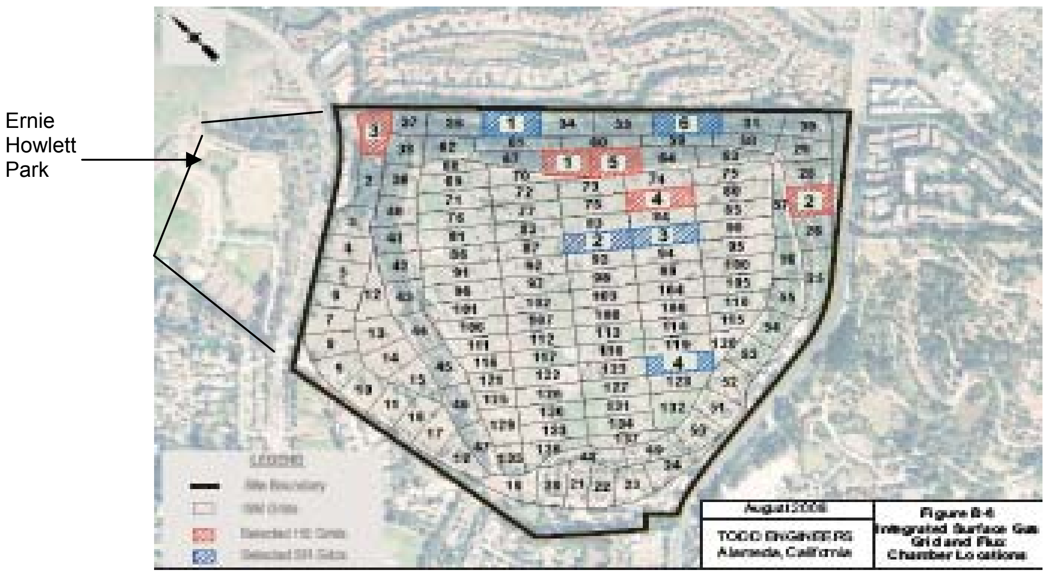


Figure 3: Layout of the Gas Extraction Route

Dots show gas extraction wells.

Lines are the headers. Note the dense network of wells in the area where most of the flux sampling was conducted (Fig 5).



Figurer 4: Red Boxes show flux box locations in areas of higher screening values.

Blue boxes show areas of more typical screening values for methane and VOCs. Note that most of the flux chamber locations are in areas where active gas extraction wells are densely packed.

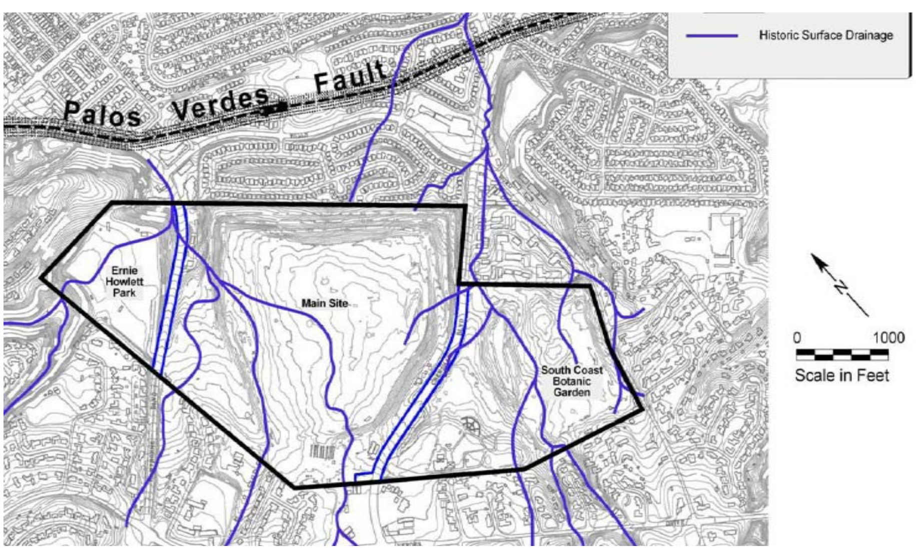


Figure 5: Location of site in relationship to Palos Verdes Fault.

Due to the problems associated with getting accurate / representative estimates of methane and hazardous air pollutant releases from flux boxes, EPA advises the use of remote optical sensing methods which provide a way to obtain accurate estimates of whole landfill methane flux by examining and integrating cross sections of remotely sensed concentrations. To obtain HAP concentrations, ratios of specific contaminants to methane are obtained from gas collection header samples.[2] The following excerpt is from the EPA document describing the use and benefits of Optical Remote Sensing:

> *In the past, other measurement approaches have been used to obtain emissions measurements in landfills and other area sources. These include traditional point sampling instrumentation such as PID, PID/FID, Summa canisters, various sorbent methods, and flux boxes. Although these approaches are generally easier to deploy, less costly than ORS-based measurement approaches, and do not rely on prevailing wind direction during the time of measurements, they only provide concentration information from a single point in the survey area, greatly increasing the chances of missing surface emissions hot spots or emissions plumes. Even after collecting data from multiple points in the survey area, the point sampling approaches lack the spatial and temporal data necessary to obtain a complete picture of the emissions from large area sources. Additionally, the flux box approach may not accurately characterize surface emissions from the site, as deployment of the flux box on the surface of the landfill cell may not allow actual emissions to escape from the landfill in the vicinity of the deployment area.*[3]

Similarly, the proposed (2008 AP 42 Emission Factor guidance for MSW landfills) includes the following statement.

> *Often flux data are used to evaluate LFG collection efficiency. The concern with the use of this data is that it does not capture emission losses from header pipes or extraction wells. The other concern is that depending upon the design of the study, the emission variability across a landfill surface is not captured. Emission losses can occur from cracks and fissures or difference in landfill cover material….*
>
> *Another loss of landfill gas is through the leachate collection pumps and wells. For many of these potential losses, a flux box is not considered adequate to capture the total loss of fugitive gas. The use of ORS (Optical Remote Sensing) technology is considered more reliable.* (Parentheses added)[4]

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[2] Susan Thorneloe, U.S. EPA, personal communication, January 27, 2010. See for example, Presentation on Optical Remote Sensing and Landfill Gas Modeling April 2007 by Thorneloe. See also EPA/600/R-07/032

[3] U.S. EPA Evaluation of Fugitive Emissions Using Ground-Based Optical Remote Sensing Technology, Feb. 2007. EPA/600/R-07/032

[4] Draft AP-42 Emission Factors for MSW Landfills, Section 2.4, 2008

2.2 LFG Collection efficiencies: The results of flux-box testing when used with gas collection rates show a near 100 percent collection efficiency for the Palos Verdes Landfill. This finding suggests that almost no gas is escaping from the landfill. This figure is at odds with the (2008) guidance for estimation of municipal landfill emissions (AP-42) EPA's method uses an LFG collection efficiency of 75 percent.

A recent analysis by the California Air Resources applied an AERMOD modeling application and measured methane concentrations to estimate gas collection efficiency for the Palos Verdes Landfill. As shown in the following table, the resulting control efficiency is about 85 percent rather than the 98-100 percent control efficiency posited by LACSD.

Gas Collection Efficiency Derived from AERMOD Modeling for the Palos Verdes Landfill (ARB)

	CH4 Conc (ppm)	
	Urban	Rural
Measured LF Surface	2.498	2.498
Bias Correction	0.059	0.059
Actual LF Surface	2.557	2.557
Air Background	1.835	1.835
LF Conc (CHm)	0.722	0.722
Corrected LF Conc (CHm)*	**0.879**	**0.879**
Modeled Conc (CHr)**	4.873	4.748
Total Conc (CHr+CHm)	5.595	5.470
Corrected Total Conc (CHr+CHm)	**5.752**	**5.627**
Collection Efficiency	87.10%	86.80%
Corrected Collection Efficiency	**84.72%**	**84.38%**

***California Environmental Protection Agency,* Air Resources Board, Staff Report: Initial Statement of Reasons for the Proposed Regulation to Reduce Methane Emissions from Municipal Solid Waste Landfills, May 2009**

This is a very different result than the 99% gas collection efficiency obtained by Huitric et al. (2007 Sub-Appendix B-B of the Five Year Review). The difference between the two estimates has enormous implications:

According to the Five Year Review only 1 percent of the LFG escapes, but according to the ARB estimate 15 percent of the LFG escapes. If the ARB estimate is correct, the amount of gas escaping from the landfill is 15 times higher than that predicted in Sub-Appendix B-B.

Part of the difference may be explained by ARB's use of EPA's approved dispersion model AERMOD rather than the ISCST-3 model used in B-B – phased out by EPA. The ARB report specifically states that it redid the Huitric analysis using AERMOD because the ISC model is no longer approved by EPA. The difference between the two models is discussed in Section 3.0, below. The difference between the results suggests that the District's use of the ISC model to generate estimated concentrations and risks may be low by more than an order of magnitude. This discrepancy alone is ample reason why the LACSD should redo the air quality modeling and risk calculations which serve as a basis for the Title V permit. Most importantly, ARB's findings indicate that the level of human health risks associated with PVLF emissions are likely to be unacceptably high.

3.0 Dispersion Modeling Analysis: As stated above the District based its estimates of ambient air concentration on an application using obsolete ISCST3 rather that EPA's approved AERMOD. A published journal article finds the ISC model results in distinctly lower estimates of ground level concentration for sources during conditions of low wind speeds.

Maximum concentrations predicted by AERMOD and ISCST3 correlated well when wind speeds exceeded 5 m/sec but diverged rapidly as wind speed decreased, with AERMOD predicting much higher maximum concentrations than ISCSTI in low wind conditions.[5] *(Emphasis added)*

This has important implications since the AERMOD predicts much higher maximum concentrations during the hours when the wind speeds are lowest and the concentrations highest. Thus, by using the ISCST3 model rather than the EPA-approved model, the District increases the probability that its modeling will show lower concentrations than those obtained using EPA guidance. Clearly LACSD should have used AERMOD in accord with EPA and ARB guidance.

4.0 Meteorological Data: Modeling guidance from U.S. EPA has very clear specifications for the meteorological data used as inputs for dispersion modeling. This guidance is summarized below:

4.1 EPA Guidance:[6] EPA recommends that modelers should use the following for regulatory applications:

- **Five years of representative meteorological data** should be used when estimating concentrations with an air quality model. Consecutive years **from the most recent**, readily available 5-year period are preferred. The meteorological data should be *adequately representative*, and may be site specific or from a nearby NWS station. Where professional judgment indicates NWS-collected ASOS (automated surface observing stations) data are inadequate {for cloud cover observations}, the most recent 5 years of NWS data that are observer-based may be considered for use.

- The use of 5 years of NWS meteorological data or at least l year of **site specific** data is required. If one year or more (including partial years), up to five years, of **site specific** data is available, these data are preferred for use in air quality analyses. Such data should have been subjected to quality assurance procedures as described in subsection 8.3.3.2.

- For permitted sources whose emission limitations are based on a specific year of meteorological data, that year should be added to any longer period being used (*e.g.*, 5 years of NWS data) when modeling the facility at a later time.

EPA's guidance is based on its long experience with model applications over many years. The need for multiple years of *representative* meteorological data is needed *"to ensure that worst-case meteorological conditions are adequately represented in the model results."* EPA's guidance cited a modeling study based on a 17-year data set. The study

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[5] Faulkner, W. et al., "Sensitivity of Two Dispersion Models (AERMOD and ISCST3) to Input Parameters for a Rural Ground-Level Area Source," *Journal of the Air & Waste Management Association, Vol. 58:1288-1296, October 2008*

[6] Federal Register Vol. 70, No. 216 / Wednesday, November 9, 2005 / Rules and Regulations p. 68244 http://www.epa.gov/scram001/guidance/guide/appw_05.pdf

indicated that the variability of model estimates due to the meteorological data input was adequately reduced if a 5-year period of record of meteorological input was used. [7]

4.2 LACSD: Unfortunately, LACSD modeling (Appendices B and J) fails to meet EPA's guidance on several counts.

- The Five-Year Review's ISCST3 modeling study used meteorological data from an offsite, coastal weather station at King Harbor. Due to the impacts of the land-sea interface on mesoscale circulation and differences in surface roughness between sea and land, and topographic effects the King Harbor site is not likely to be representative of Los Verdes Landfill with regard to wind direction and wind speed. It is odd that the LACSD modeling used this offsite data when it had an onsite weather station and had used the onsite data to conduct a previous modeling study for the site.[8] A comparison of the shown in Figures 6 and 7 comparing the wind rose of Palos Verdes and King Harbor (respectively). Note Palos Verdes has a much higher frequency of calms and lower winds speeds (average 2.67 knots) than King Harbor (average 5.52 knots). Had LACSD used local site with lower wind speeds and a higher frequency of calms it's model concentration estimates would have been considerably higher. Although the years used in the two figures are different the differences in wind rose so large is likely the result of geographical rather than temporal differences. However, the burden is clearly on LACSD to show that King Harbor is representative of the Palos Verdes site.

- The Five-Year Review modeling study used on a single year's (King Harbor) data from 1981. [9] Not only did LACSD miss the boat by using one rather than five-years data, but also picked a year that was more than 25 years previous to 2007, the year when the modeling was conducted. One can only wonder why the year 1981 was selected; clearly more recent years of data are available.

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[7] Op. Cit. Federal Register Vol. 70, No 216, p. 68243-68244.

[8] Huitric et al.: (2007 Sub-Appendix B-B of the Five Year Review), p. 10.

[9] METEOROLOGICAL DATA PROCESSED BETWEEN START DATE: 1981 Jan 1 AND END DATE: 1981 12 31. See p. 148, http://www.envirostor.dtsc.ca.gov/regulators/deliverable_documents/7087079703/Sub-Appen_J-E.PDF

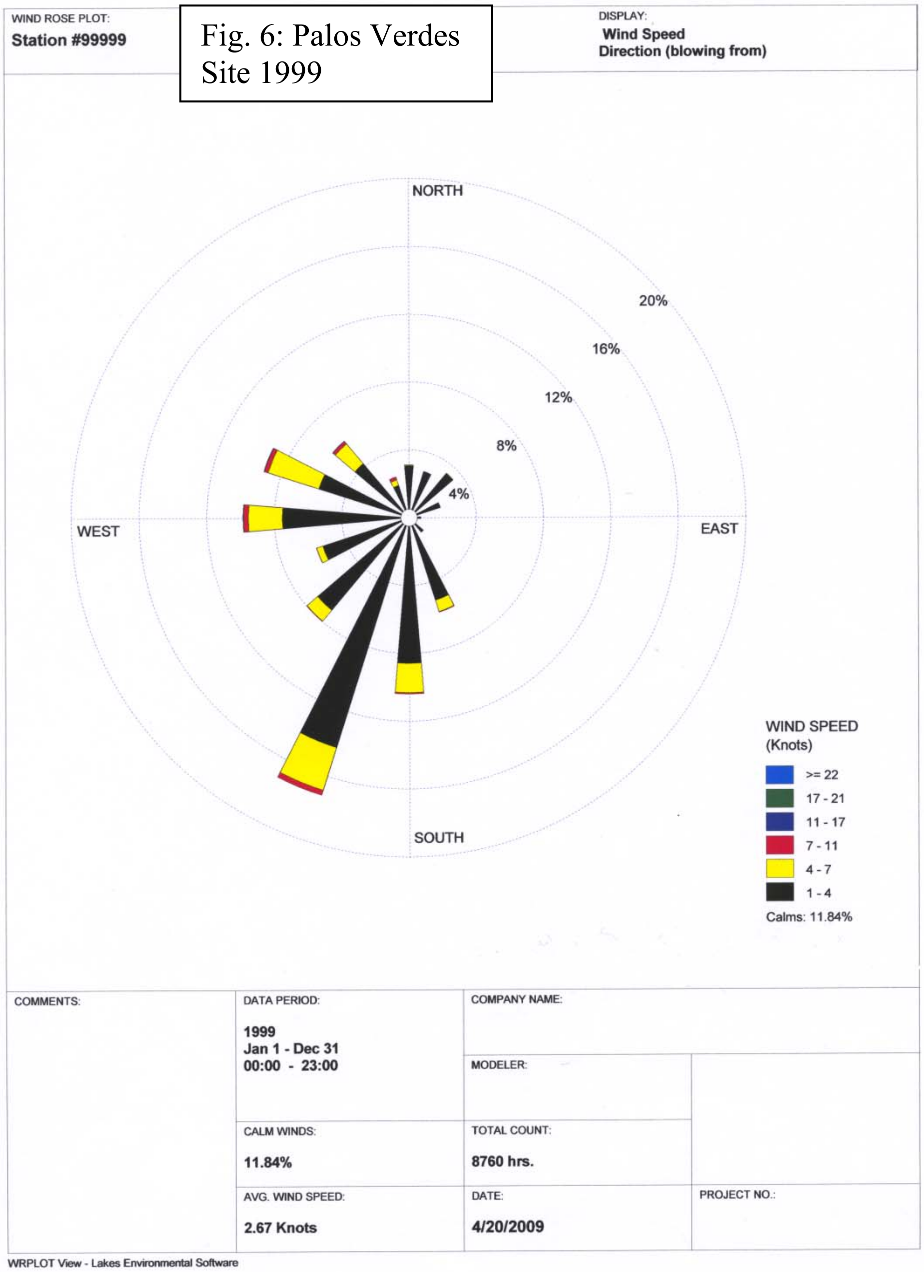
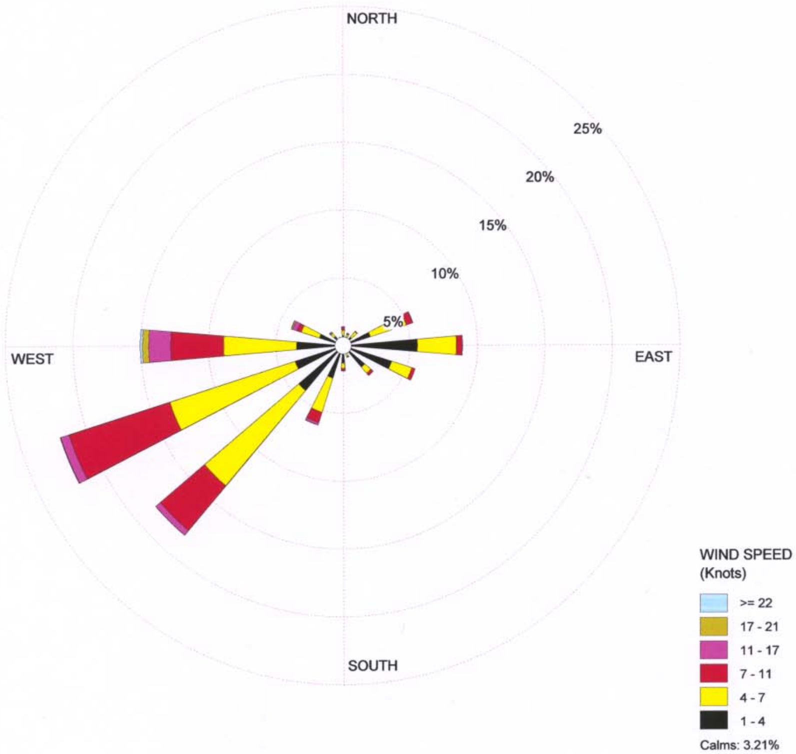


Fig. 6: Palos Verdes Site 1999

Fig 7: King Harbor Site 1981

WIND ROSE PLOT:	DISPLAY:
Station #53012	**Wind Speed** **Direction (blowing from)**



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	1981 **Jan 1 - Dec 31** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **3.21%**	TOTAL COUNT: **8760 hrs.**	
	AVG. WIND SPEED: **5.52 Knots**	DATE: **4/21/2009**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software