SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
MONITORING AND ANALYSIS

Rule 1158 Follow-Up Study #7

Sampling Conducted
October 2002 – December 2002

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EXECUTIVE SUMMARY

Purpose

In June 1999, Rule 1158 affecting storage, handling and shipment of petroleum coke, coal, and sulfur was amended to further reduce particulate emissions from these sources. This study is one of an ongoing series, examining targeted compounds contained in the inhalable particulate fraction (PM_{10}) in the greater Long Beach/Wilmington area. This series of studies consists of PM_{10} sampling in the spring/summer and fall/winter, observing trends in ambient PM_{10} concentration and the elemental carbon content of collected samples.

Additional sampling was conducted in an attempt to characterize the impact of the September-October 2002 West Coast Port Strike on local air quality.

Sampling

Sampling was conducted at an increased rate between October 5, 2002 and December 16, 2002 compared to previous fall/winter Rule 1158 Follow-up studies. However, to ensure comparability with previous studies, field personnel were careful to collect samples coincident with the AQMD PM_{10} monitoring network one-in-six day schedule. Sampling locations were those utilized for the previous Rule 1158 Follow-Up studies, with an additional location nearer to the port, to increase the amount of data collected during and after the strike. Field operations were conducted by members of the AQMD Special Monitoring Branch, while all laboratory operations and data analysis were performed by AQMD Laboratory personnel.

Key Findings

1. Study (three-site) average PM_{10} values showed a continued decrease in PM_{10} for the 2002 fall/winter study, a trend maintained since fall/winter 1999.

2. Recent, moderate increases in EC during the 2001 and 2002 studies suggest that the majority of EC reductions due to Rule 1158 were realized by the end of 2000, and since that time increased EC emissions from other sources have outpaced ongoing Rule 1158 improvements.

3. The series of studies have shown that the HUD site consistently experiences PM_{10} and EC pollution levels higher than those experienced at other study sites. Further investigation would be necessary to determine the extent of the area surrounding HUD that is similarly affected, or to identify potential sources contributing to the higher concentrations.

4. While a cause/effect relationship cannot be established, the possibility that the unique commercial traffic conditions created by the West Coast Port Strike contributed to elevated EC concentrations in the Greater Long Beach area is not contraindicated by the study data. Study average EC concentrations were lower during the strike, and increased afterward through the end of the year.

1.0 INTRODUCTION

Over the course of several years prior to 1997, residents of Long Beach and Wilmington area neighborhoods lodged several complaints of black, oily airborne dust with the AQMD. Surveys of the area noted that there were numerous coal and petroleum coke production, storage, and shipment facilities. These included open stockpiles of green coke, enclosed "coke barns", refinery kilns producing petroleum coke, and a variety coke and coal carrying trains and trucks. Other industrial processes including sulfur distribution facilities, heavy traffic patterns, and general construction activities were also noted in the area.

In August of 1996, AQMD staff attended a public meeting in San Pedro, which focused on public concern over the levels of particulate matter in the region. Subsequently, the AQMD coordinated with various public action groups to select several sites for particulate monitoring, including sites located at specific areas of community concern.

Two studies were conducted at these sites, one in May 1997[1] and one in fall/winter 1998[2]. These studies were designed to characterize local micrometeorological parameters, and to microscopically and chemically characterize airborne particulate collected in the area. The most pronounced findings of these studies were the elevated levels of elemental carbon and inhalable particulate matter at some study sites, including a monitoring site adjacent to Elizabeth Hudson Elementary School in Long Beach.

In June 1999 the AQMD amended of Rule 1158 affected storage, handling and shipment practices for petroleum coke, coal, and sulfur. Subsequent California State legislation HSC 40459 (AB 1775 – Lowenthal) requires that the AQMD, in conjunction with CARB, prepare an annual study for the California State Legislature examining the frequency and severity of violations related to AQMD Rule 1158. To monitor the efficacy of the rule and provide supporting data for the Legislative Report, the AQMD initiated a series of *Rule 1158 Follow-up Studies.* These studies are conducted twice annually on an ongoing basis; once each spring/summer and fall/winter.

Removal and enclosure of open coke storage piles, and modification to equipment and work practices to comply with Rule 1158 requirements is ongoing. The Rule 1158 compliance schedule mandates implementation of the majority of control measures by August 1999, with full implementation of all measures by June 2004. Compliance field staff have documented a high rate of compliance with the initial rule implementation requirements, including covered transport, truck washing, prompt roadway/spill clean-up and the removal of several large open coke piles that has resulted in the reduction of fugitive coke emissions from storage, handling, and shipping operations.

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[1] South Coast Air Quality Management District. (September 1997) *Micrometeorological and Ambient Air Quality Monitoring Conducted Simultaneously in the Vicinity of the Los Angeles and Long Beach Harbors.* Diamond Bar, CA.
[2] South Coast Air Quality Management District. (March 1999) *Micrometeorological and Ambient Air Quality Monitoring Conducted Simultaneously in the Vicinity of the Los Angeles and Long Beach Harbors.* Diamond Bar, CA.

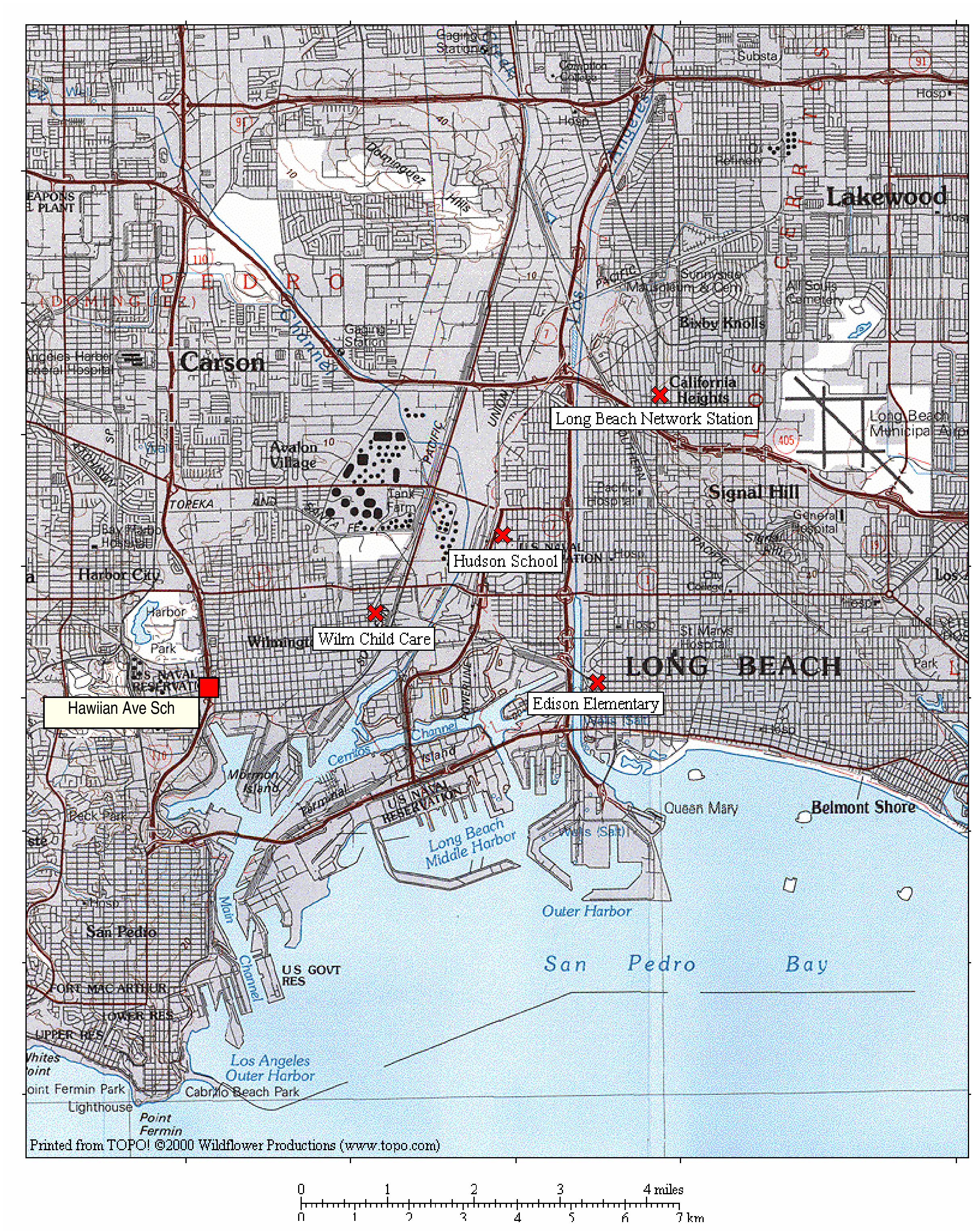


Figure 1 – Study Sampling Sites

2.0 PROJECT DISCUSSION

Throughout the series of Rule 1158 Follow-up studies, an effort has been made to maximize comparability of the data sets from year to year, by utilizing the same sampling sites, sampling coincident with the PM_{10} monitoring network, conducting the study as nearly as possible on the same dates, and sampling for a fixed number of days (ten.) As the scheduled start date for this study approached, much of the West Coast and particularly the Long Beach/Wilmington area became impacted by the West Coast Port Strike (September 30, 2002 – October 9, 2002.)

The Port Strike posed the problem of altered maritime and intermodal transportation patterns in the area, which could impact comparability of Fall 2002 Study results with findings from previous studies. At the same time, it was thought that increased monitoring during the unique traffic conditions might provide an insight into the impacts made on local air quality by shipping and related commercial transportation. Consequently, the number of sampling locations and sampling days was increased to capture as much data as possible during this unique period.

From October 5, 2002 through December 16, 2002, PM_{10} monitoring was conducted at four locations in the cities of Long Beach (two sites) and Wilmington (two sites). Sampling was conducted on a one-in-six day schedule, coincident with the AQMD PM_{10} monitoring network. Additional samples were collected between network monitoring events through November 10th, as field technicians were available. The resulting data set consists of 116 samples, collected over 25 sampling days.

The body of this report will discuss the thirteen scheduled one-in-six day sampling events, to allow comparison of the data to the previous Fall 1158 Follow-up studies. The entire data set, and its correlation with a maritime traffic will be treated separately in Appendix A-1.

The Fall/winter 2002 Rule 1158 Follow-up study builds on a base of knowledge established by eight previous studies: two prior to Rule amendment and six follow-up studies. Together they constitute a set of three spring/summer studies (1997, 2000, 2001, 2002)[3,4,] and three fall/winter studies (1998, 1999, and 2000)[5,6]. The primary objectives of the current study were to collect data suitable for the evaluation of:

- Current inhalable particulate (PM_{10}) ambient concentration trends for the study area.
- Speciation of the carbonaceous component of the collected particulate samples for elemental and organic carbon content.
- Comparison of 2002 PM_{10} mass and carbon data with that obtained during the earlier Rule 1158 studies.

[3] South Coast Air Quality Management District. (September 1997)
[4] South Coast Air Quality Management District. *Rule 1158 Follow-Up Study #2 ,#4 and #6* Diamond Bar, CA.
[5] South Coast Air Quality Management District. (March 1999)
[6] South Coast Air Quality Management District. *Rule 1158 Follow-Up Study #1 and #3.* Diamond Bar, CA.

The prevailing winds in the study area place portions of the community downwind of coal and coke production and/or storage facilities, and fugitive dust from these activities has been a longstanding community concern. This fugitive dust contributes to increases in the PM_{10} particulate concentration. Mobile sources such as diesel trucks, trains and ships in the area also contribute to the overall ambient particulate matter concentrations.

Site selection and the sampling calendar were influenced by several factors. Sampling dates were scheduled to repeat as closely as possible the sampling dates of the previous studies, while coinciding with the EPA one-in-six monitoring schedule utilized by the AQMD in its PM_{10} monitoring network.

The three continuing monitoring sites were chosen from seven sites used in the fall/winter 1998 study, *Micrometeorological and Ambient Air Quality Monitoring Conducted Simultaneously in the Vicinity of the Los Angeles and Long Beach Harbors* (March 1999); the sites have remained constant during the course of the *Rule 1158 Follow-Up* series of studies (Figure 1.) Site selection criteria included site locations relative to coal and coke facilities with respect to the local prevailing wind patterns, and their importance as locations containing student populations (the sites include two schools and a child care center). In addition, of the seven sites included in the 1998 study, the two school sites had exhibited the highest levels of ambient PM_{10} and elemental carbon. Detailed site maps can be found in Appendix A-4.

2.1 SITE DESCRIPTIONS

The Special Monitoring Group of AQMD's Monitoring and Analysis Division conducted the field portion of the current study. The sampling locations have been described as follows[7]:

Site 1: School Building Services Facilities/Hudson School (HUD)
2401 Webster Avenue
Long Beach, California

The monitoring site is located at the Long Beach School Building Services facility (maintenance yard), adjacent to the Hudson Middle School. The PM_{10} sampler was installed on top of two adjoining steel containers. Meteorological exposures were composed of (1), Henry Ford Freeway, which runs parallel to the monitoring site to the west and (2), maintenance yard to the north, east and south of the monitoring site. The maintenance yard consists of repairs and fabrication of materials, including welding.

[7] RES Environmental, Inc. (February 2000) *The South Coast Air Quality Management District –Rule 1158 Follow-up Study.* Colton, CA.

Site 2: Edison Elementary School (EDI)
625 Maine Avenue
Long Beach, California

Site #2 was located at the Edison Elementary School in Long Beach. The PM_{10} sampler was located on a steel container at the western side of the school and playground. The sampler was also installed on a five-foot platform to clear the school building to the east. The meteorological exposure consists of (1), a main street artery (16^{th} Street) which carries heavy vehicle traffic, is located to the north (2), school buildings to the east and south and (3), a small bus terminal to the west of the monitoring site.

Site 3: Wilmington Childcare Center (WIL)
1419 Young Street
Wilmington, California

The monitoring site was installed on the roof of the Childcare Center, near a elementary and middle school in the City of Wilmington. The meteorological exposure consists of (1), a residential area to the north (2), commercial/industrial development to the east (3), school to the south and (4) parking area/residential area to the west of the monitoring site.

2.2 SAMPLING AND ANALYSIS METHODOLOGY

The AQMD maintains a PM_{10} monitoring network throughout the South Coast Air Basin (the Basin). The Federal Reference Method (FRM) SSI PM_{10} samplers utilized in the PM_{10} network and standard AQMD analytical procedures are summarized here:

The SSI sampler used in this study is the EPA's FRM sampler found in 40CFR50 Appendix J. It is used to monitor PM less than 10 microns in size (PM_{10}). For the purposes of this study, the SSI samplers are used to collect PM_{10} samples, which were also used for the determination of organic carbon (OC), elemental carbon and total carbon.

The SSI sampler contains a pump controlled by a programmable timer. An elapsed time accumulator, linked in parallel with the pump, records total pump-operation time in hours. During operation, a known quantity of air is drawn through a particle size separator, which achieves particle separation, by impaction. The correct flow rate through the inlet is critical to collection of the correct particle size so that after impaction, only particles 10 microns in size or less remain suspended in the airstream. The flow of air then passes through a quartz filter medium, upon which the particles are collected. A programmable timer automatically turns the pump off at the end of the 24-hour sampling period.

Once a sample has been collected it is returned to the laboratory, following chain-of-custody protocols, where both PM_{10} mass and carbon content are determined. Ambient PM_{10} mass is determined by subtracting the weight of the clean unsampled filter (measured in the laboratory prior to sampling) from the weight of the sampled filter containing the collected PM_{10}, to yield the mass of the PM_{10} collected on the filter. This mass is then divided by the amount of air drawn through the filter to give the ambient concentration, expressed as mass per cubic meter ($\mu g/m^3$).

Ambient carbon levels are determined by taking a small portion of the PM_{10} filter and putting it into a carbon analyzer. The analyzer consists of a computer-controlled programmable oven, computer controlled gas flows, a laser, and a flame ionization detector (FID). The sample is first heated in the oven in increasing amounts of oxygen. As the temperature rises, first organic carbon and then elemental carbon are evolved from the filter. The laser beam passes through the filter, and the transmitted intensity increases at the detector as the light-absorbing carbon leaves the filter, causing the filter to become less black. The evolved carbon is swept from the oven by gas flow, and is transported to the FID where it is detected (in the form of methane) throughout the heating process. The computer that controls these processes collects data on the oven temperature profile, laser light absorption, and FID response to determine the OC and EC content of the filter. This information, combined with the volume of air sampled, provides the OC and EC concentration in the ambient air.

3.0 DATA ANALYSIS

Data from the current study were compared with data obtained in previous Long Beach/Wilmington area studies.

3.1 PM_{10} AMBIENT CONCENTRATION ANALYSIS

	10/5/02	10/11/02	10/17/02	10/23/02	10/29/02	11/4/02	11/10/02	11/16/02	11/22/02	11/28/02	12/4/02	12/10/02	12/16/02
HUD	46	NS	43	52	37	58	NS	87	88	NS	98	63	28
EDI	46	NS	40	45	48	48	25	NS	55	62	78	47	26
WIL	NS	NS	39	32	38	55	20	34	75	66	78	38	25
LB Station	45	NS	35	43	32	50	23	28	51	51	75	44	24

Table 1: Fall/Winter 2001 PM_{10} Concentrations ($\mu g/m^3$) at Sampling Sites

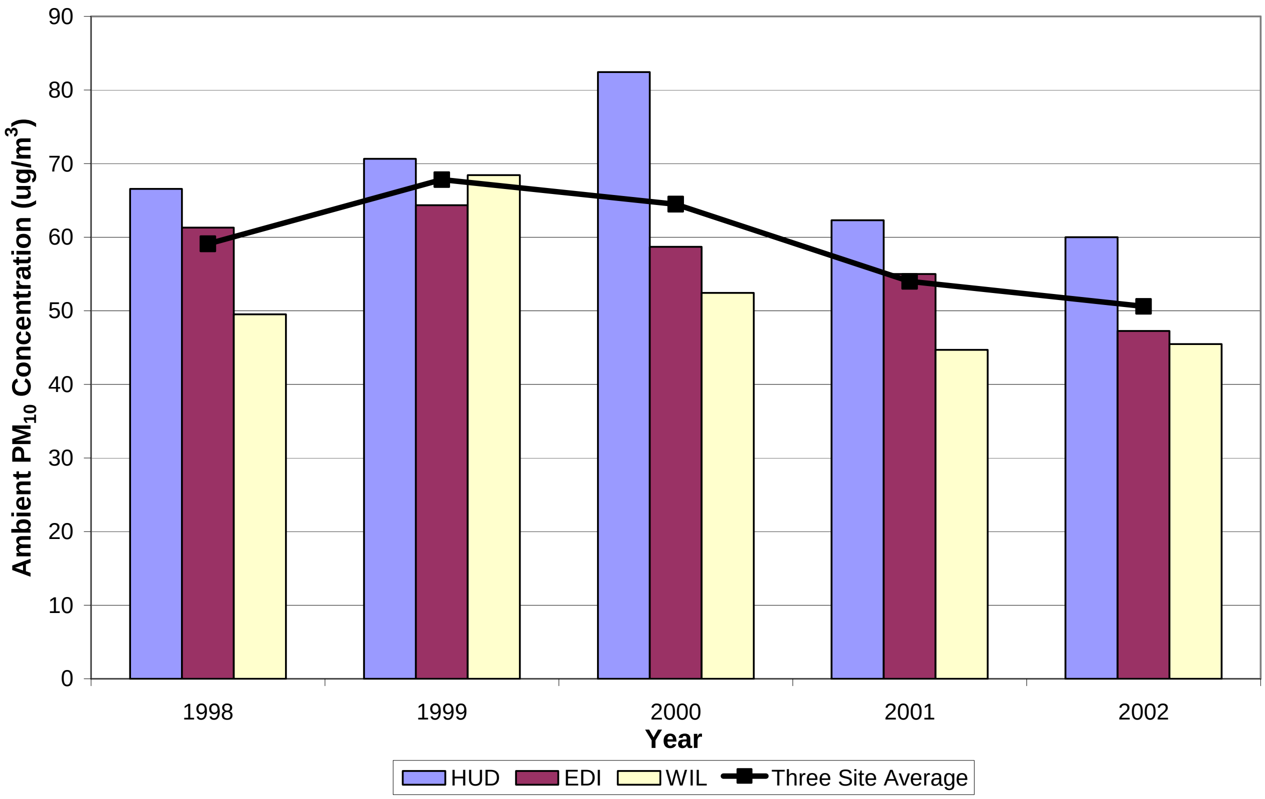
NS = No sample

Table 1 presents the PM_{10} ambient concentrations observed during the study. Complete data tabulations can be found in Appendix A-3. Long Beach values are provided for comparison. Twenty-four hour ambient PM_{10} concentrations during the study period ranged from a maximum of 98 $\mu g/m^3$ at HUD on December 4^{th}, to a minimum of $20 \mu g/m^3$ obtained at the WIL site on November 10^{th}. The average concentration for the three study sites was 50.6 $\mu g/m^3$.

The State of California has established 50 μg/m^3 as the PM_{10} 24-hour standard. Sixteen of the forty-four (36%) samples collected during the course of the study exceeded this standard. The highest site average (60 μg/m^3) over the course of the study occurred at the HUD site. This continues the trend observed in previous studies, where HUD ranked highest among study sites for PM_{10}.

For all studies except the fall/winter 2000 study, the HUD site has exhibited the highest study PM_{10} average. It should also be noted that on several occasions in this and the previous seven studies the HUD site produced PM_{10} samples significantly higher than those observed at EDI and WIL. Taken together, these trends suggest that HUD consistently experiences higher PM_{10} concentrations than elsewhere in the study area. Such elevated samples may be the result of local sources or meteorological conditions influencing the immediate area adjacent to the sampler, and underscore the complexity and variety of particulate sources that contribute to ambient PM_{10}.[8] These include carbonaceous components (EC and OC), crustal materials and wind-blown soils, sulfate and nitrate formed by precursor SOx and NOx emissions primarily as a result of combustion, and sodium chloride particulate resulting in part from wind-carried sea salt. Increases in PM_{10} observed at study sites may be the result of contributions from one or several of these sources. Particle formation is also highly influenced by meteorological conditions, which vary seasonally and from year to year.

Figure 2: Fall/Winter PM_{10} Trends



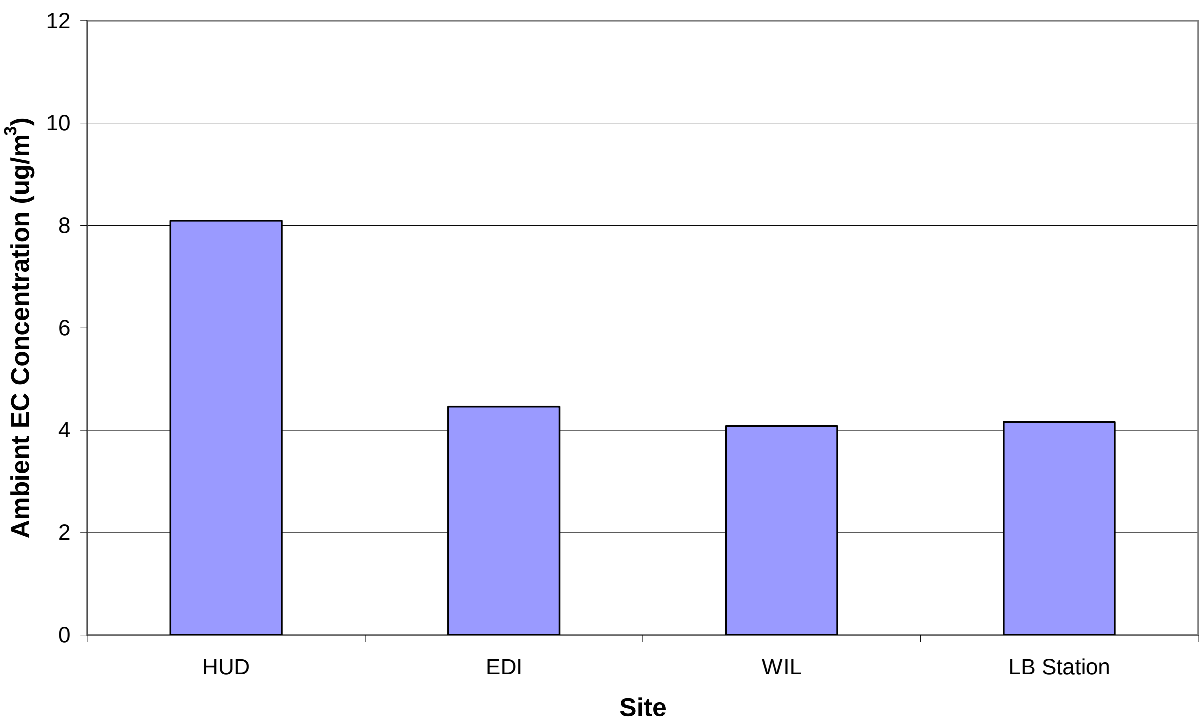
[6] Kim. B.M., Teffera, S., Zeldin, M.D. Characterization of $PM_{2.5}$ and PM_{10} in the South Coast Air Basin of Southern California: Part 1 – Spatial Variations. *J. Air and Waste Manage. Assoc.* **2000** 50:2034-2044.

3.2 PM_{10} TREND ANALYSIS

Figure 2 summarizes the ambient PM_{10} concentrations observed over the course of the five fall/winter studies. The black line represents the three-site study average for each study. The data show a moderately varying three-site seasonal PM_{10} average centered on 58.5µg/m^3, with a decreasing trend starting with the 1999 study and persisting through the current study.

3.2 ELEMENTAL CARBON TREND ANALYSIS

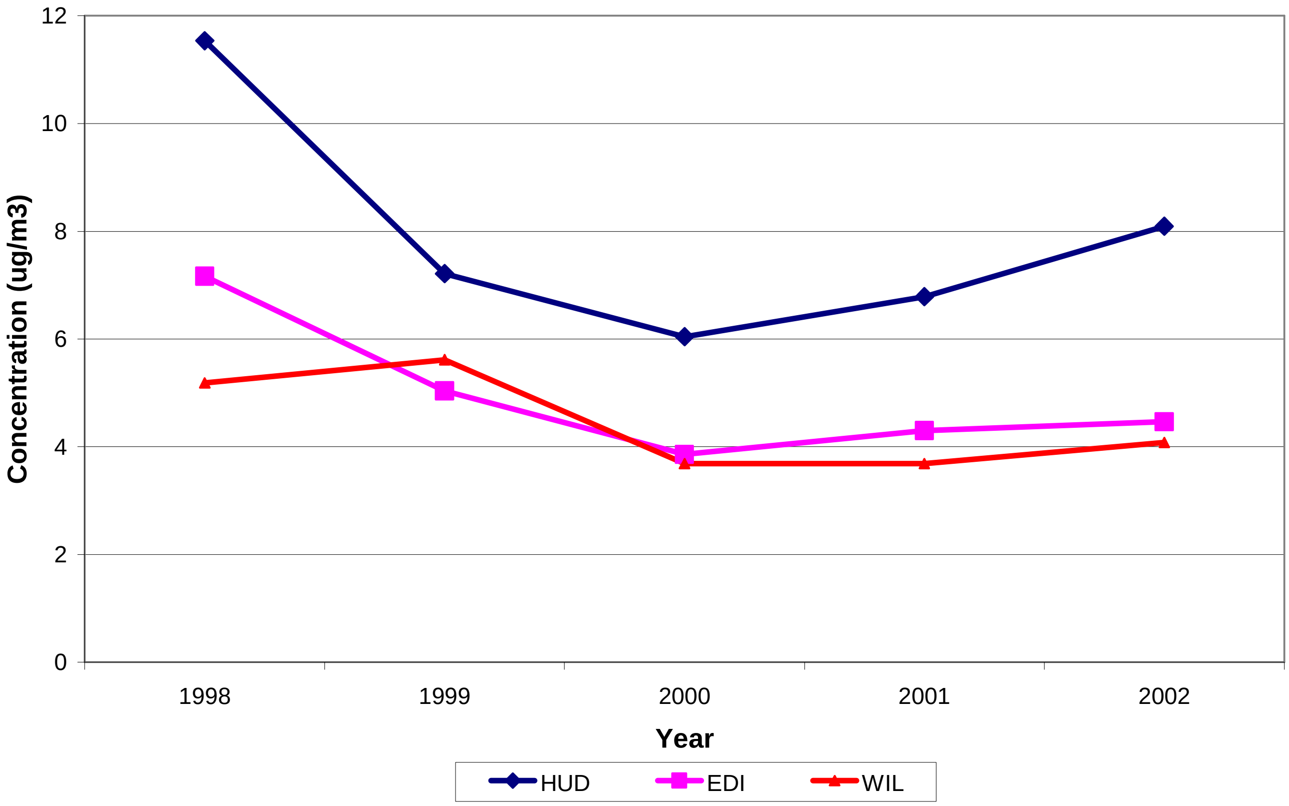
Figure 3: Fall/Winter 2002 EC by Site



Elemental carbon is of particular interest in this study, as it arises in part from coke and coal storage as well as from transportation including diesel emissions from trucks, trains and ships. In Figure 3 above, EC concentrations were averaged for the three study sites over the duration of the study. As with PM_{10}, HUD produced an average ambient EC concentration distinctly higher than the other study sites.

Elemental carbon concentrations were averaged for the three study sites over the duration of each fall/winter study, and results are represented in Fig. 3.

Figure 4: Average EC by Site and Year



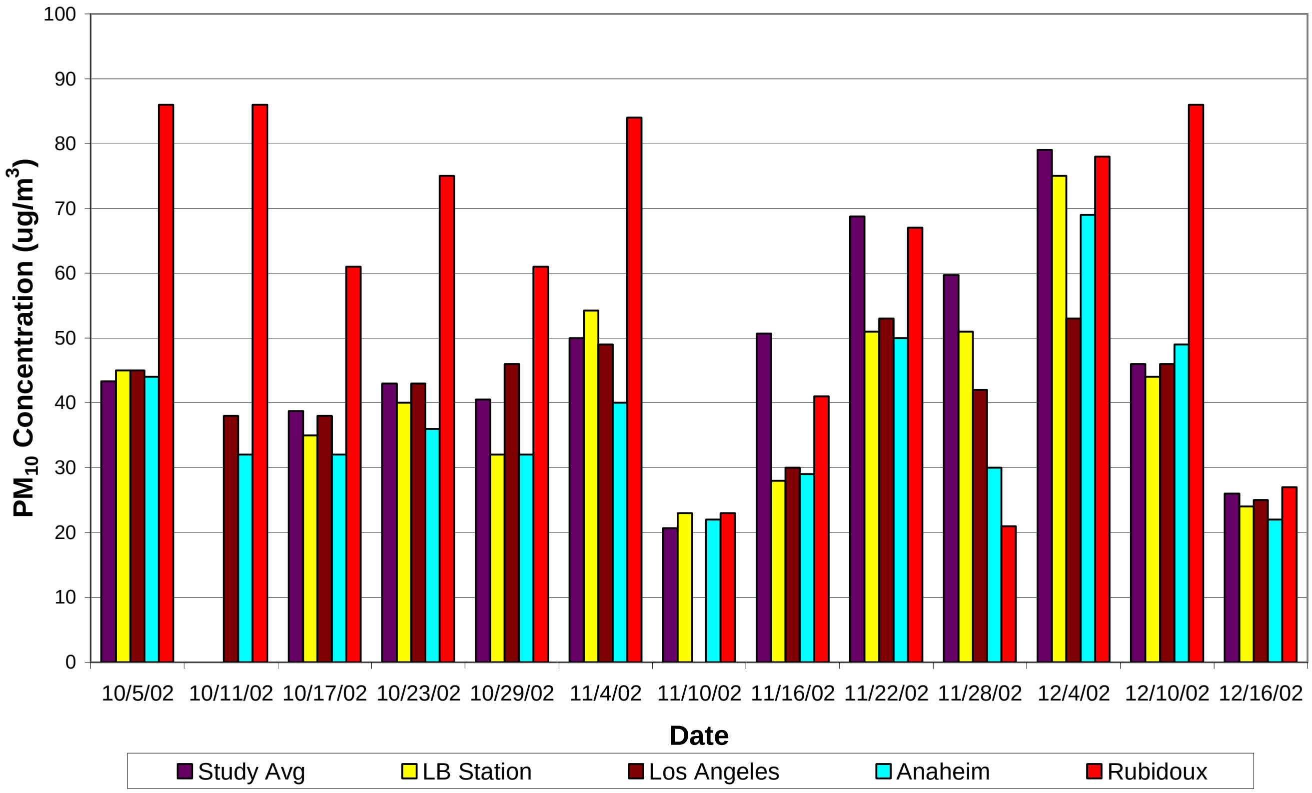
The majority of control measures required by Rule 1158 were in place by August 1999. Site average EC concentrations at HUD and EDI saw a dramatic decrease from fall/winter 1998 to fall/winter 1999 following implementation of controls, and all sites continued to decrease through fall/winter 2000. Since fall/winter 2001, study sites have seen a modest rise in average EC concentrations, with the rise at the HUD site being more pronounced.

These trends suggest that implementation of Rule 1158 contributed to a significant decrease in EC in the study area, with the majority of reductions achieved by fall/winter 2000. Since that time, EC in the study area has begun to creep upward suggesting that competing sources have begun to contribute the dominant portion of EC, and that the contribution from those sources has begun to increase; marginally at EDI and WIL, more rapidly at HUD.

The HUD site has consistently had the highest average PM_{10} concentrations, the highest average EC concentrations, and is experiencing an increase in EC at a more rapid rate than other study sites. Taken together, these results suggest that HUD may be significantly impacted by local pollution sources not experienced by the remainder of the study area.

3.2 BASIN-WIDE PM_{10} COMPARISON

Figure 5: Fall/Winter 2002 Study Average PM_{10} vs. PM_{10} Network Sites



In order to place the study results in context, the study average PM_{10} value for each day was compared to results obtained concurrently at several other PM_{10} network sites within the Basin (Figure 5). The sites chosen for comparison are representative of the spectrum of conditions encountered in the Basin. In general, Rubidoux is among the highest PM_{10} sites in the Basin, with particulate high in nitrate and crustal materials; it is representative of the southeastern portion of the Basin. Los Angeles reflects conditions within the urban core, with particulate higher in sulfate and carbonaceous compounds than Rubidoux, resulting from a higher contribution to ambient particulate by vehicle emissions.

On four sampling dates the study average PM_{10} concentration exceeded the Basin comparison sites; on two of those dates the difference was considerable. For the remaining dates, Rubidoux had the maximum values, and the Study sites and Long Beach station tracked Central Los Angeles.

The results obtained from October 5 through November 4, and those obtained after December 4 reflect what might be expected given historical Basin data: Long Beach PM_{10} concentrations similar to those in nearby Los Angeles, higher results inland in Rubidoux. The data for November 16 through December 4 are the opposite, with higher PM_{10} concentrations at the Study sites than elsewhere, including the Long Beach station and nearby Los Angeles.

4.0 CONCLUSIONS

Study (three-site) average PM_{10} values showed a continued decrease in PM_{10} for the 2002 fall/winter study, a trend maintained since fall/winter 1999. PM_{10} concentrations at the HUD site were higher than those at other study sites, as has been observed throughout the series of fall/winter studies.

Ambient EC increased slightly during both the 2001 and 2002 studies for all study sites. The study average EC value for HUD was nearly two times higher than the other study sites for fall/winter 2002. As discussed earlier, elemental carbon arises in part from coke and coal storage as well as from transportation including diesel emissions from trucks, trains and ships. Changes in EC may be attributable to changes in the contributions from one or more of these sources.

From 1998 – 2000, ambient elemental carbon concentrations had decreased steadily over the series of fall/winter studies, but fluctuated during the spring/summer studies. This period of decline coincides with implementation of the majority of control measures put in place by Amended Rule 1158. Coupled with recent, moderate increases in EC during the 2001 and 2002 studies, this suggests that the majority of EC reductions due to Rule 1158 were realized by the end of 2000, and since that time increased EC emissions from other sources have outpaced ongoing Rule 1158 improvements.

The series of studies have shown that the HUD site consistently experiences PM_{10} and EC pollution levels higher than those experienced at other study sites. Further investigation would be necessary to determine the extent of the area surrounding HUD that is similarly affected, or to identify potential sources contributing to the higher concentrations.

APPENDIX A-1 SAMPLING DURING THE WEST COAST PORT STRIKE

A 5.1 BACKGROUND

The ports of Los Angeles and Long Beach, together with ports all along the West Coast, were shut down from September 30 through October 9, 2002 as a result of labor disputes. The shutdown halted shipping, filling the Port of Long Beach and stationing waiting ships offshore once the port was full. Disruptions to truck and rail intermodal shipping also resulted from the halt of port activities.

With the Rule 1158 Follow-up study slated to begin near this time, the Special Monitoring group of AQMD's Monitoring and Analysis Branch made efforts to install an additional sampling location, additional samplers at existing Rule 1158 monitoring sites, and to increase the frequency of sampling to maximize data capture during the period of unusual port inactivity and its aftermath.

The resulting data is presented in Appendix A-2, and consist of a total of 116 samples taken over 25 sampling days.

A 5.2 PROJECT DISCUSSION

The Rule 1158 Follow-up series of studies utilizes three special monitoring sampling sites and several PM_{10} network monitoring stations. To increase the amount of data obtained in the greater Long Beach area during the West Coast Port Strike, an additional special monitoring site was added:

Site 4: Hawaiian Avenue School (HAS)
540 N. Hawaiian Avenue
Wilmington, California

The monitoring site was installed on the roof of Hawaiian Avenue School in the City of Wilmington.

All samples were collected and analyzed according to the protocol outlined in 2.2 above.

The U.S. Coast Guard Marine Safety Office (Los Angeles/Long Beach) was contacted and provided data representative of the shipping traffic in port and offshore for the period during and after the strike. During the height of the port congestion, approximately 175 ships were in port or moored offshore awaiting entry into port. As these ships operate shipboard systems using diesel engines, contributions to local EC concentrations were likely. At the same time, it is possible that decreased intermodal traffic onshore had lessened the impact on local EC concentrations.

Maritime traffic returned to normal levels by mid-November. As shipping traffic decreased, anecdotal evidence indicates land based transportation increased to transport cargo from the port through the end of the year.

A 5.3 DATA ANALYSIS

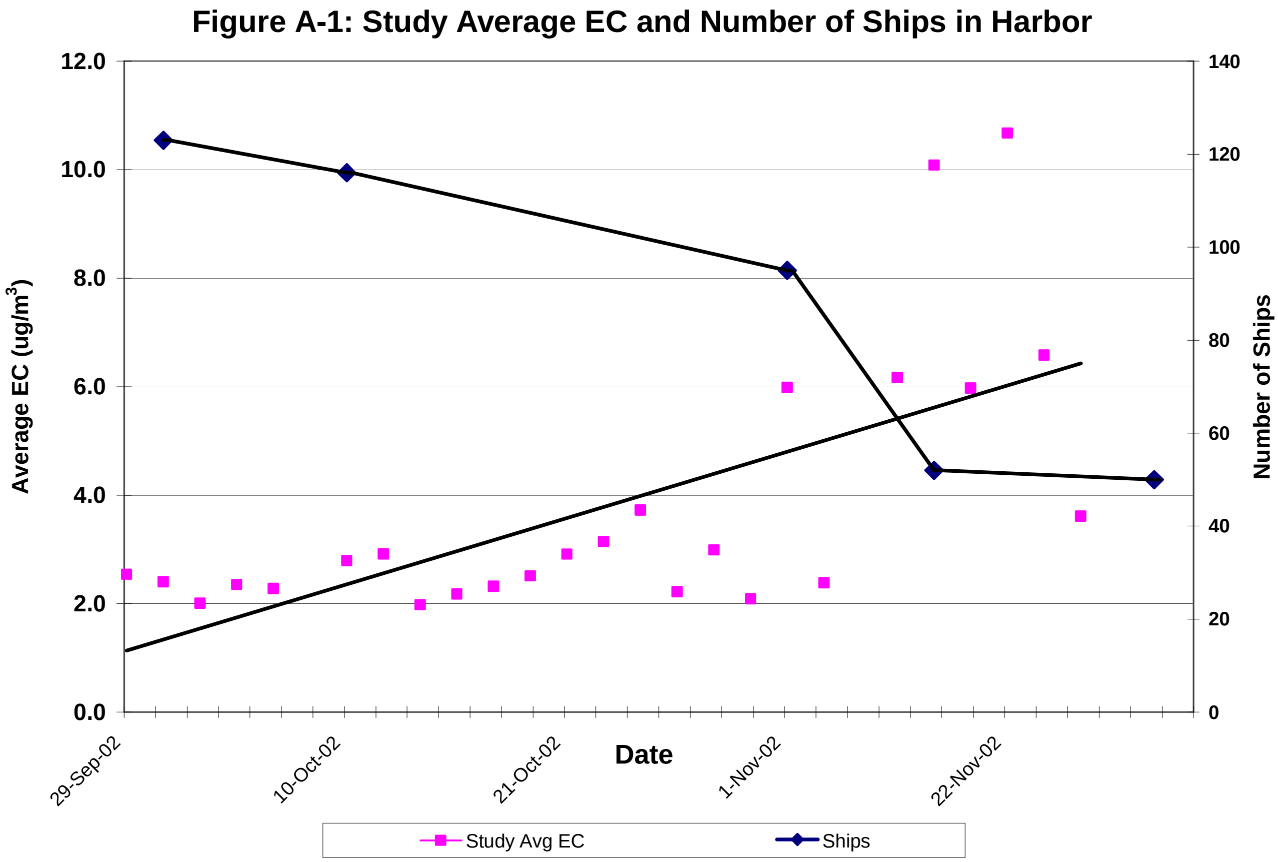


Figure A-1 illustrates daily five-site average EC concentrations (left vertical axis). For illustrative purposes, a linear trendline has been drawn through the data. Complete data tabulation can be found in Appendix A-2. The right vertical axis represents estimated shipping traffic at the Port of Long Beach, as described by the USCG.

An increasing trend in EC concentrations was noted beginning in late October/early November, which continued through the end of the year. This trend is common in the Basin as the low particulate summer months lead into the higher particulate winter. However, the trend for 2002 is the most pronounced since that observed in the 1998 study.

Coincident to the increasing particulate trend is a decreasing trend for shipping (and a postulated increase in land based intermodal transport). While a cause/effect relationship cannot be established, the possibility that the unique commercial traffic conditions created by the West Coast Port Strike contributed to elevated EC concentrations in the Greater Long Beach area is not contraindicated by the study data.

APPENDIX A-2 COMPLETE FALL/WINTER 2002 LONG BEACH PM_{10} MONITORING DATA

Date	Site	PM10, ug/M3	Organic Carbon, ug/M³	Elemental Carbon, ug/M³	Total Carbon, ug/M³
5-Oct-02	HAS	38	6.2	2.1	8.3
	WIL	NS			
	HUD	46	6.6	2.8	9.5
	EDI	46	6.9	2.7	9.6
	LBS	45	7.2	2.5	9.7
6-Oct-02	HAS	39	6.3	2.5	8.8
	WIL	38	5.5	2.4	7.9
	HUD	NS			
	EDI	45	6.1	2.4	8.5
	LBS	48	7.1	2.4	9.5
8-Oct-02	HAS	36	3.5	1.8	5.3
	WIL	38	3.4	1.8	5.2
	HUD	NS			
	EDI	41	3.7	2.2	5.9
	LBS	47	4.0	2.3	6.2
9-Oct-02	HAS	46	4.1	1.9	6.0
	WIL	43	3.9	1.7	5.6
	HUD	47	4.1	3.3	7.4
	EDI	47	4.3	2.0	6.2
	LBS	60	4.7	2.9	7.6
10-Oct-02	HAS	47	4.0	1.9	5.9
	WIL	45	4.3	2.1	6.4
	HUD	NS			
	EDI	47	4.4	2.5	6.9
	LBS	59	4.4	2.6	7.0
12-Oct-02	HAS	45	4.5	2.3	6.8
	WIL	39	3.7	1.9	5.6
	HUD	51	6.2	4.5	10.7
	EDI	43	4.5	2.5	6.9
	LBS	NS			
13-Oct-02	HAS	46	4.1	1.5	5.6
	WIL	NS			
	HUD	79	6.8	5.9	12.7
	EDI	58	4.3	2.4	6.7
	LBS	61	4.5	1.8	6.3
16-Oct-02	HAS	34	3.4	1.5	4.9
	WIL	34	3.4	1.3	4.7
	HUD	44	4.2	3.6	7.8
	EDI	36	3.3	1.8	5.1
	LBS	37	3.4	1.7	5.1
17-Oct-02	HAS	33	3.9	1.9	5.8
	WIL	39	4.8	2.1	6.9
	HUD	43	5.1	3.1	8.2
	EDI	40	4.4	2.0	6.4
	LBS	35	4.0	1.7	5.7
21-Oct-02	HAS	40	3.6	1.8	5.4
	WIL	44	3.4	1.8	5.2
	HUD	52	4.6	3.6	8.2
	EDI	51	4.3	2.3	6.6
	LBS	51	4.0	2.1	6.1
22-Oct-02	HAS	22	2.8	1.1	3.9
	WIL	28	3.0	1.3	4.3
	HUD	50	6.1	5.0	11.1
	EDI	42	4.5	3.0	7.5
	LBS	39	4.0	2.2	6.2
23-Oct-02	HAS	31	3.0	1.8	4.8
	WIL	32	3.3	1.3	4.6
	HUD	52	5.3	5.5	10.8
	EDI	45	4.4	2.8	7.2
	LBS	43	3.4	3.0	6.4

Date	Site	Filter Number	PM10, ug/M3	Organic Carbon, ug/M³	Elemental Carbon, ug/M³
1-Nov-02	HAS	Q6197877	45	4.5	3.2
	WIL	Q6197879	47	5.0	2.4
	HUD	Q6197881	50	4.4	3.1
	EDI	Q6197884	53	4.8	4.0
	LBS	Q6197883	50	4.8	2.2
4-Nov-02	HAS	Q6197878	56	5.9	1.7
	WIL	Q6197880	55	7.5	0.3
	HUD	Q6197886	58	4.7	3.7
	EDI	Q6197885	48	5.0	1.6
	LBS	Q6197882	50	3.7	3.1
7-Nov-02	HAS	Q6168671	38	4.4	4.6
	WIL	Q6168674	34	5.1	5.5
	HUD	Q6197863	63	8.0	8.3
	EDI	Q6197861	44	5.5	5.9
	LBS	Q6197865	45	4.2	5.5
10-Nov-02	HAS	Q6168670	17	2.5	2.3
	WIL	Q6168672	20	3.0	1.6
	HUD	Q6168673	NS		
	EDI	Q6197862	25	3.8	2.8
	LBS	Q6197864	23	2.8	2.8
16-Nov-02	HAS	Q6197867	31	5.5	4.6
	WIL	Q6197866	34	5.3	4.6
	HUD	Q6197870	87	10.5	11.0
	EDI	Q6197869	NS		
	LBS	Q6197868	28	4.0	4.4
22-Nov-02	HAS	Q6197875	57	7.4	7.5
	WIL	Q6197874	75	8.6	10.0
	HUD	Q6197873	88	10.7	17.0
	EDI	Q6197872	55	7.4	8.5
	LBS	Q6197871	51	6.7	7.3
28-Nov-02	HAS	Q6198010	51	7.5	5.0
	WIL	Q6198009	66	9.9	5.3
	HUD	Q6198008	NS		
	EDI	Q6198006	62	8.7	6.5
	LBS	Q6198007	51	6.6	7.0
4-Dec-02	HAS	Q6198001	62	5.7	8.7
	WIL	Q6198002	78	7.3	10.6
	HUD	Q6198004	98	9.8	17.1
	EDI	Q6198003	78	7.4	11.0
	LBS	Q6198005	75	10.2	5.9
10-Dec-02	HAS	Q6198021	36	7.8	3.1
	WIL	Q6198018	38	7.8	3.5
	HUD	Q6198017	63	9.8	12.7
	EDI	Q6198019	47	8.4	6.0
	LBS	Q6198020	44	6.7	7.6
16-Dec-02	HAS	Q6198011	25	2.6	3.9
	WIL	Q6198012	25	2.2	3.3
	HUD	Q6198013	28	3.0	4.8
	EDI	Q6198014	26	2.5	3.5
	LBS	Q6198015	24	3.4	2.7

APPENDIX A-3 RULE 1158 LONG BEACH PM_{10} MONITORING DATA

2002 Fall/Winter PM_{10} Ambient Concentration Results

Location	10/5/02	10/17/02	10/23/02	10/29/02	11/4/02	11/10/02	11/16/02	11/22/02	11/28/02	12/4/02	12/10/02	12/16/02	Average
HUD	46	43	52	37	58	*	87	88	*	98	63	28	60
EDI	46	40	45	48	48	25	*	55	62	78	47	26	47
WIL	*	39	32	38	55	20	34	75	66	78	38	25	45
LB Station	45	35	43	32	50	23	28	51	51	75	44	24	42

* No Sample

2002 Fall/Winter Organic Carbon Ambient Concentration Results

Location	10/5/02	10/17/02	10/23/02	10/29/02	11/4/02	11/10/02	11/16/02	11/22/02	11/28/02	12/4/02	12/10/02	12/16/02	Average
HUD	6.6	5.1	5.3	3.6	4.7	*	10.5	10.7	*	9.8	9.8	3.0	6.9
EDI	6.9	4.4	4.4	3.9	5.0	3.8	*	7.4	8.7	7.4	8.4	2.5	5.7
WIL	*	4.8	3.3	3.8	7.5	3.0	5.3	8.6	9.9	7.3	7.8	2.2	5.8
LB Station	7.2	4.0	3.4	3.9	3.7	2.8	4.0	6.7	6.6	10.2	6.7	3.4	5.2

2002 Fall/Winter Elemental Carbon Ambient Concentration Results

Location	10/5/02	10/17/02	10/23/02	10/29/02	11/4/02	11/10/02	11/16/02	11/22/02	11/28/02	12/4/02	12/10/02	12/16/02	Average
HUD	2.8	3.1	5.5	3.1	3.7	*	11.0	17.0	*	17.1	12.7	4.8	8.1
EDI	2.7	2.0	2.8	1.5	1.6	2.8	*	8.5	6.5	11.0	6.0	3.5	4.5
WIL	*	2.1	1.3	2.2	0.3	1.6	4.6	10.0	5.3	10.6	3.5	3.3	4.1
LB Station	2.5	1.7	3.0	1.8	3.1	2.8	4.4	7.3	7.0	5.9	7.6	2.7	4.2

2002 Fall/Winter Total Carbon Ambient Concentration Results

Location	10/5/02	10/17/02	10/23/02	10/29/02	11/4/02	11/10/02	11/16/02	11/22/02	11/28/02	12/4/02	12/10/02	12/16/02	Average
HUD	9.5	8.2	10.8	6.7	8.4	*	21.6	27.8	*	26.9	22.4	7.7	15.0
EDI	9.6	6.4	7.2	5.4	6.6	6.6	*	15.9	15.2	18.5	14.4	6.0	10.2
WIL	*	7.0	4.6	6.0	7.8	4.7	9.9	18.7	15.2	17.9	11.3	5.5	9.9
LB Station		5.7	6.4	5.7	6.8	5.7	8.4	13.9	13.6	16.2	14.3	6.1	9.3

2002 Fall/Winter Elemental Carbon as a Percentage of Total PM_{10}

Location	10/5/02	10/17/02	10/23/02	10/29/02	11/4/02	11/10/02	11/16/02	11/22/02	11/28/02	12/4/02	12/10/02	12/16/02	Average
HUD	6.2%	7.2%	10.6%	8.4%	6.4%	*	12.7%	19.4%	*	17.5%	20.1%	17.1%	12.6
EDI	5.9%	5.1%	6.3%	3.2%	3.3%	11.2%	*	15.5%	10.6%	14.1%	12.8%	13.3%	9.2
WIL	*	5.4%	4.1%	5.7%	0.5%	8.1%	13.5%	13.4%	8.0%	13.6%	9.3%	13.2%	8.6
LB Station	*	4.8%	7.1%	5.7%	6.3%	12.3%	15.9%	14.3%	13.8%	7.9%	17.2%	11.1%	10.6

2001 Fall/Winter PM_{10} Ambient Concentration Results

Location	11/8/00	11/14/00	11/20/00	11/26/00	12/2/00	12/8/00	12/14/00	Average
HUD	40	62	97	39	36	76	86	62
EDI	24	*	105	33	33	63	72	55
WIL	16	43	47	37	25	75	70	45
LB Station	25	14	24	30	24	56	*	29

* No Sample

2001 Fall/Winter Organic Carbon Ambient Concentration Results

Location	11/8/00	11/14/00	11/20/00	11/26/00	12/2/00	12/8/00	12/14/00	Average
HUD	5.6	12.9	10.9	9.7	6.9	16	17.2	11.3
EDI	3.3	*	8.8	8.7	7	13.9	15.9	9.6
WIL	2.9	9.2	6.9	9.4	4.7	15.5	13.5	8.9

2001 Fall/Winter Elemental Carbon Ambient Concentration Results

Location	11/8/00	11/14/00	11/20/00	11/26/00	12/2/00	12/8/00	12/14/00	Average
HUD	5.2	7.8	7.1	4.7	4.6	8.4	9.7	6.8
EDI	2.3	*	4.3	3.8	3.3	5.5	6.6	4.3
WIL	1.4	4.2	2.7	4.1	1.8	6.2	5.4	3.7

2001 Fall/Winter Total Carbon Ambient Concentration Results

Location	11/8/00	11/14/00	11/20/00	11/26/00	12/2/00	12/8/00	12/14/00	Average
HUD	10.8	20.7	18	14.4	11.5	24.4	26.9	18.1
EDI	5.6	*	13.1	12.5	10.3	19.4	22.5	13.9
WIL	4.3	13.4	9.6	13.5	6.5	21.7	18.9	12.6

2000 Fall/Winter PM_{10} Ambient Concentration Results

Location	11/8/00	11/14/00	11/20/00	11/26/00	12/2/00	12/8/00	12/14/00	Average
HUD	134	56	143	73	100	28	43	82
EDI	52	48	78	73	105	18	37	59
WIL	56	45	55	65	93	16	37	52
LB Station	44	49	92	*	105	20	35	58

* No Sample

2000 Fall/Winter Organic Carbon Ambient Concentration Results

Location	11/8/00	11/14/00	11/20/00	11/26/00	12/2/00	12/8/00	12/14/00	Average
HUD	17.1	10.6	22.6	9	9.2	4.6	8.7	11.7
EDI	8.9	9.7	15.4	7.6	10.2	2.8	7.8	8.9
WIL	10.5	9.7	10.9	7	8.1	2.9	7.2	8.0

2000 Fall/Winter Elemental Carbon Ambient Concentration Results

Location	11/8/00	11/14/00	11/20/00	11/26/00	12/2/00	12/8/00	12/14/00	Average
HUD	7.6	6.4	11.6	4.8	4.6	3.7	3.6	6.0
EDI	3.8	4.1	7.4	4.3	3.3	2	2.1	3.9
WIL	4.6	4.1	5.1	3.8	3.6	1.7	2.9	3.7

2000 Fall/Winter Total Carbon Ambient Concentration Results

Location	11/8/00	11/14/00	11/20/00	11/26/00	12/2/00	12/8/00	12/14/00	Average
HUD	24.7	17	34.2	13.8	13.8	8.3	12.3	17.7
EDI	12.7	13.8	22.8	11.9	13.5	4.8	9.9	12.8
WIL	15.1	13.8	16	10.8	11.7	4.6	10.1	11.7

APPENDIX A-3 LONG BEACH PM_{10} MONITORING DATA (CONTINUED)

1999 Fall/Winter PM_{10} Ambient Concentration Results

Location	11/2/99	11/8/99	11/14/99	11/20/99	11/26/99	12/2/99	12/8/99	12/14/99	Average
HUD	92	38	50	30	47	69	68	171	71
EDI	85	33	47	37	49	74	93	97	64
WIL	92	89	46	30	65	70	*	87	68
LB Station	77	22	38	27	38	50	55	59	46

* No Sample

1999 Fall/Winter Organic Carbon Ambient Concentration Results

Location	11/2/99	11/8/99	11/14/99	11/20/99	11/26/99	12/2/99	12/8/99	12/14/99	Average
HUD	9.9	6	6	4.5	11	13.3	10.4	22.2	10.4
EDI	8.3	4.8	5.8	4.9	10.5	14.1	13.4	14.2	9.5
WIL	8.1	14.1	6.4	4.4	12.6	13.5	*	12.2	10.2

1999 Fall/Winter Elemental Carbon Ambient Concentration Results

Location	11/2/99	11/8/99	11/14/99	11/20/99	11/26/99	12/2/99	12/8/99	12/14/99	Average
HUD	7.9	4.1	4.8	2.7	5.9	7.9	6.6	17.8	7.2
EDI	5.7	2.6	4	2.7	4.6	6.1	6.1	8.5	5.0
WIL	6	6.7	4.1	2.4	7.4	5.5	*	7.2	5.6

1999 Fall/Winter Total Carbon Ambient Concentration Results

Location	11/2/99	11/8/99	11/14/99	11/20/99	11/26/99	12/2/99	12/8/99	12/14/99	Average
HUD	17.8	10.1	10.8	7.2	16.9	21.2	17	40	17.6
EDI	14	7.4	9.8	7.6	15.1	20.2	19.5	22.6	14.5
WIL	14.1	20.8	10.5	6.8	20	19	*	19.4	15.8

1998 Fall/Winter PM_{10} Ambient Concentration Results

Location	11/1/98	11/7/98	11/13/98	11/19/98	11/25/98	12/13/98	Average
HUD	61	56	72	89	*	55	67
EDI	50	49	67	73	74	55	61
WIL	54	43	45	52	70	33	50
LB Station	43	31	39	54	*	27	39

* No Sample

1998 Fall/Winter Organic Carbon Ambient Concentration Results

Location	11/1/98	11/7/98	11/13/98	11/19/98	11/25/98	12/13/98	Average
HUD	7.5	6.4	11.2	14.2	*	8.6	9.6
EDI	7	5.5	11.3	10.4	9.3	10.1	8.9
WIL	6.9	5.7	8.4	8.3	9.9	5.8	7.5

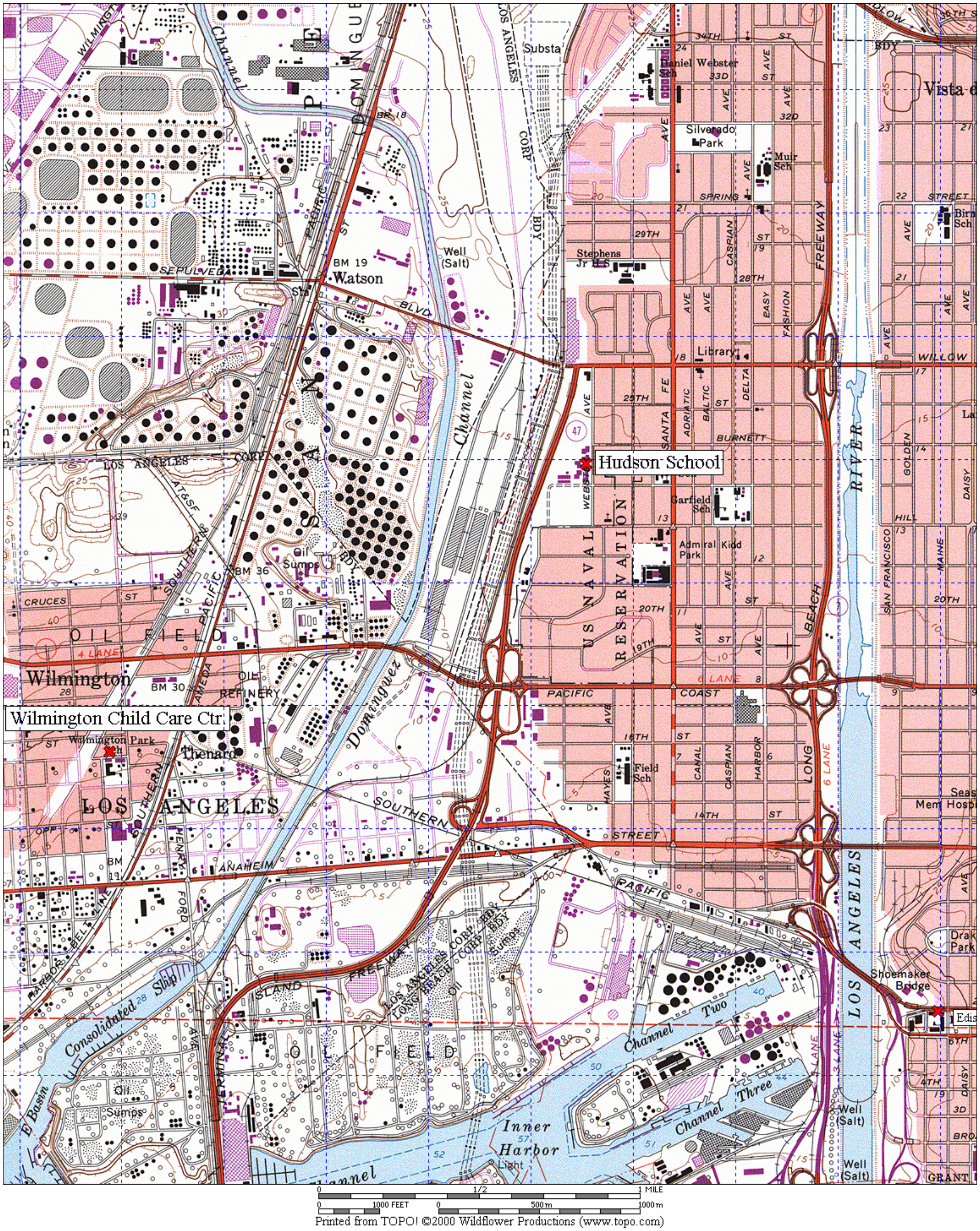
1998 Fall/Winter Elemental Carbon Ambient Concentration Results

Location	11/1/98	11/7/98	11/13/98	11/19/98	11/25/98	12/13/98	Average
HUD	6.2	6.2	16.6	19.8	*	8.9	11.5
EDI	4.3	3.3	9.2	12.5	7.9	5.8	7.2
WIL	4.1	3.8	5.9	7.3	6.6	3.4	5.2

1998 Fall/Winter Total Carbon Ambient Concentration Results

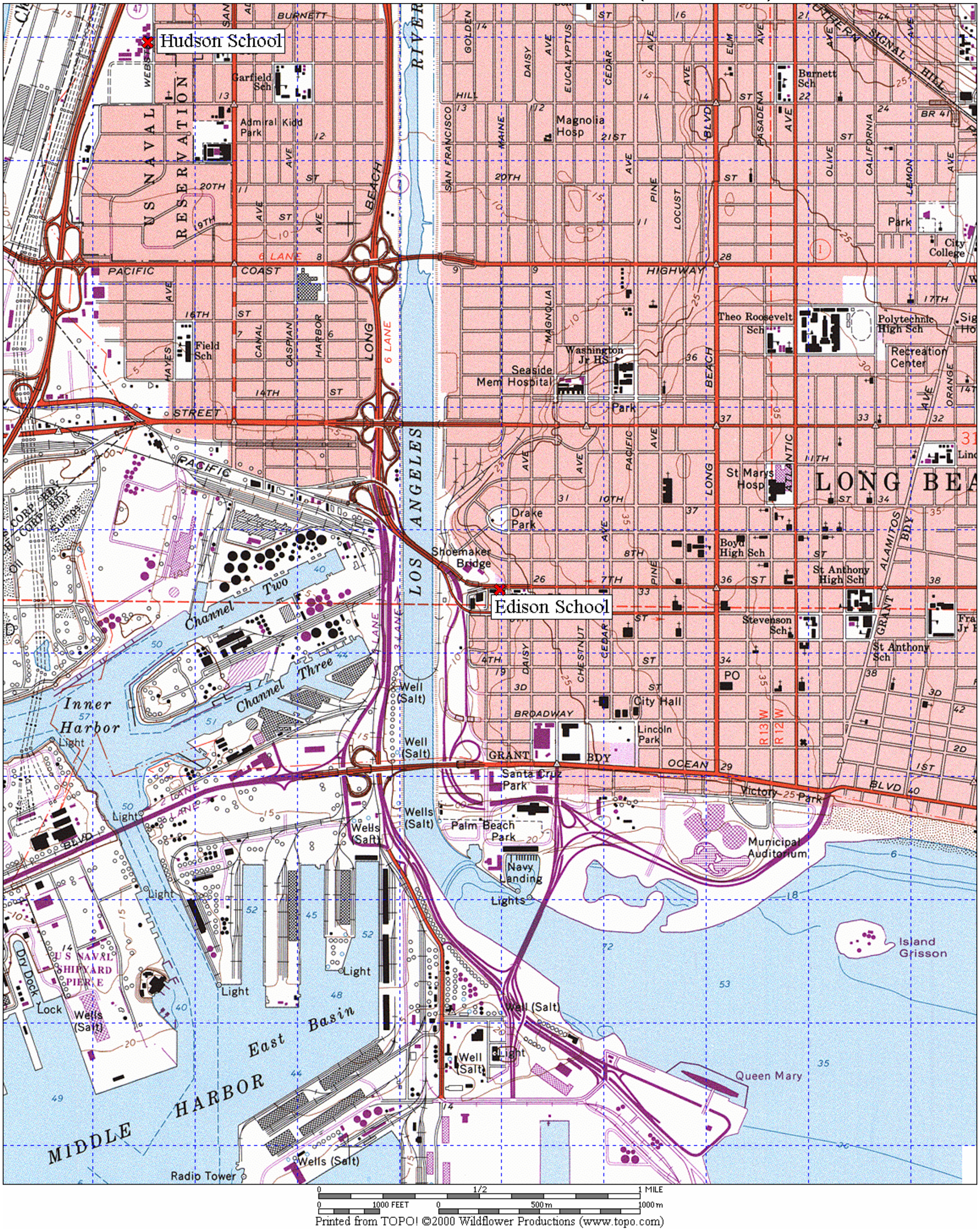
Location	11/1/98	11/7/98	11/13/98	11/19/98	11/25/98	12/13/98	Average
HUD	13.7	12.6	27.9	34	*	17.5	21.1
EDI	11.3	8.8	20.5	22.9	17.2	15.9	16.1
WIL	11	9.4	14.4	15.6	16.5	9.2	12.7

APPENDIX A-4 SAMPLING LOCATION DETAIL MAPS



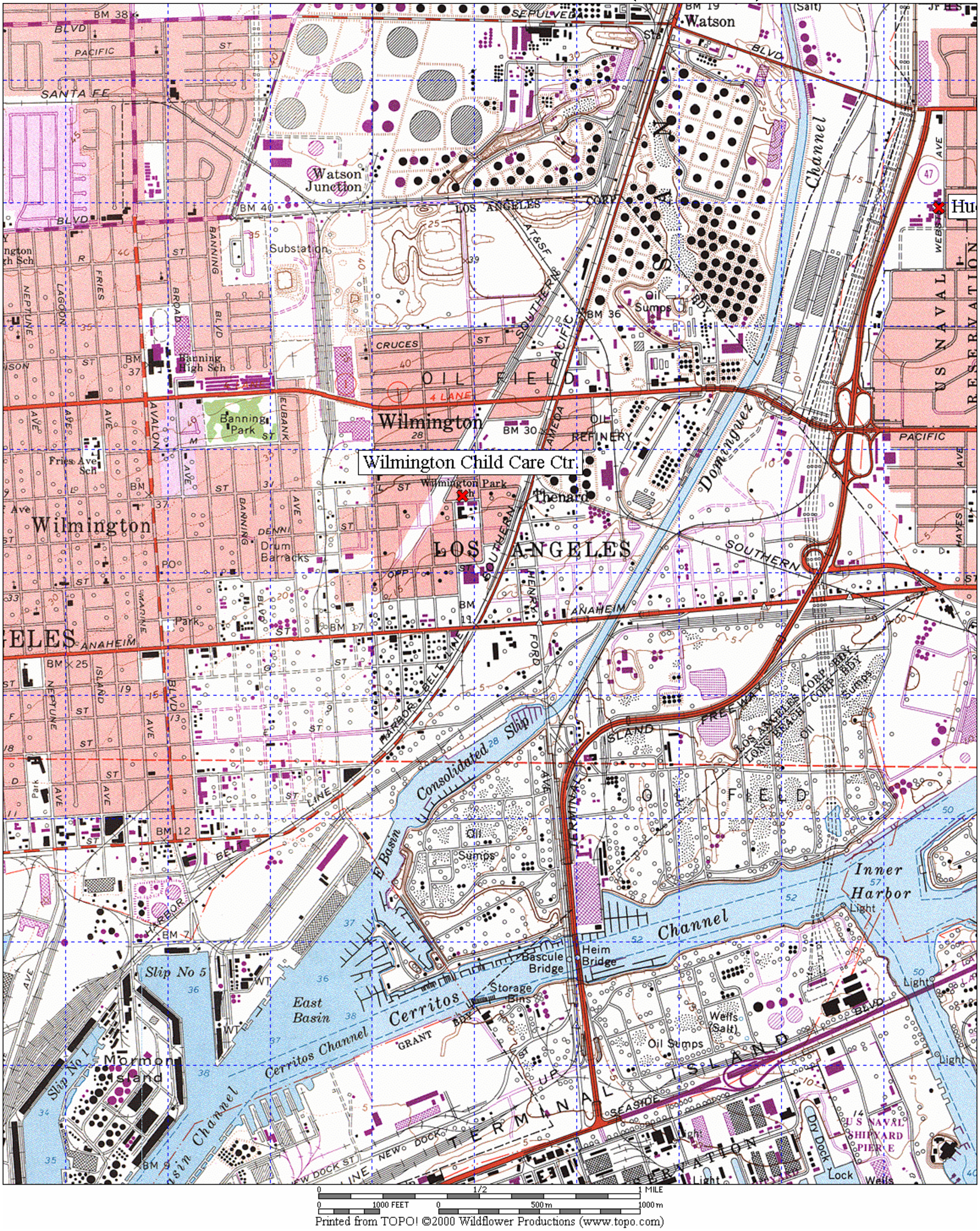
Hudson School and Surrounding Area

APPENDIX A-4 SAMPLING LOCATION DETAIL MAPS (CONTINUED)



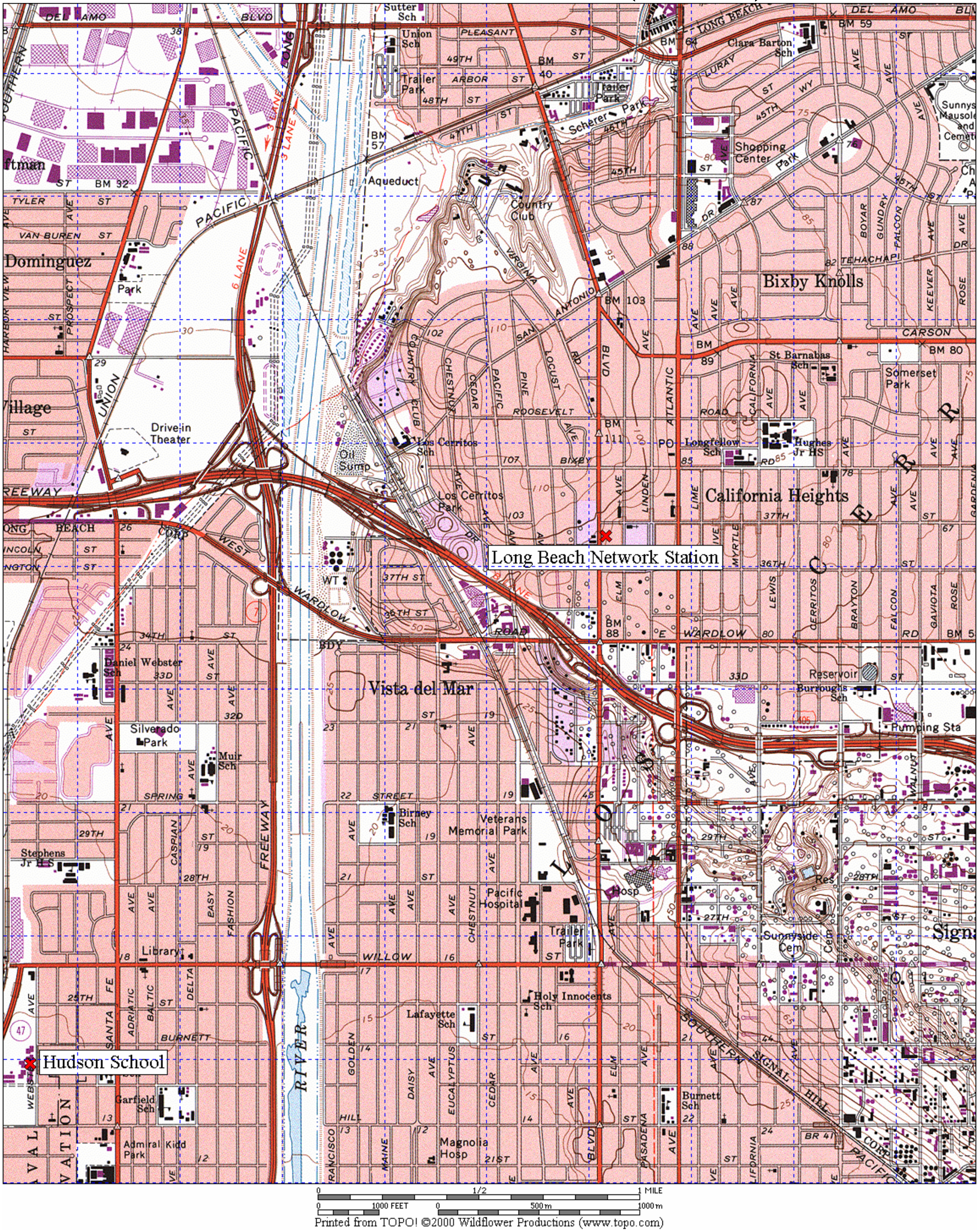
Edison School and Surrounding Area

APPENDIX A-4 SAMPLING LOCATION DETAIL MAPS (CONTINUED)



Wilmington Childcare Center and Surrounding Area

APPENDIX A-4 SAMPLING LOCATION DETAIL MAPS (CONTINUED)



Long Beach Station and Surrounding Area