11.0 WATER QUALITY MONITORING SUMMARY AND ANALYSES

11.1 Introduction

The goal of environmental monitoring is to support the management process.

> "monitoring is most useful when it results in more effective management decisions, specifically management decisions that protect or rehabilitate the environment."
>
> (NAS, 1991[1])

On July 1, 2003 the Permittees submitted a proposed monitoring plan to the Santa Ana Regional Board for the Third Term Permit. This monitoring plan design was based on the model stormwater monitoring plan developed by a subcommittee of the southern California Stormwater Monitoring Coalition (SMC). This subcommittee was comprised of representatives from southern California stormwater agencies, Regional and State Water Resources Control Board staff, EPA Region 9, and the Southern California Coastal Water Research Project (SCCWRP).

With input from Regional Board staff, many additions to the proposed plan for the Third Term permit were made to accommodate development of the Toxics TMDLs for San Diego Creek and Newport Bay. The plan was finally approved during the summer of 2005 and subsequently implemented.

In the interim period between issuance of the Third Term Permit and approval of the new monitoring plan, the program continued monitoring under the Second Term Permit plan (99-04 Plan). Under the 99-04 plan the Permittees identified a group of critical aquatic resources and conducted monitoring to evaluate environmental conditions relative to applicable water quality criteria. The 99-04 Plan also included mass emissions monitoring of stormwater runoff at several locations in the Newport Bay and Anaheim Bay/Huntington Harbour watersheds.

No evaluation is currently possible of data collection that was started under the Third Term Permit. This section will therefore focus on the results of monitoring critical aquatic resources and mass emissions monitoring under the 99-04 Plan.

11.2 Accomplishments

11.2.1 <u>Completion of the 99-04 Monitoring Plan</u>

Critical Aquatic Resources

The 99-04 Monitoring Plan identified critical aquatic resources in Orange County. In the Santa Ana Regional Board area these included the Newport Bay, Huntington Harbour, and Bolsa Bay. Monitoring during the First Term Permit included evaluations of water chemistry and physical characteristics during periods stormwater runoff, and semi-

[1] Managing Troubled Waters, National Academy of Sciences, 1991

annual (pre and post storm season) dry-weather assessments of water quality, physical characteristics, and benthic sediment chemistry. The water chemistry assessments included nutrients and trace metals. During the latter part of the First Term Permit dissolved metals were added to the suite of analyses in anticipation of the adoption of the California Toxics Rule (CTR).

Although the monitoring locations in these receiving waters have essentially remained the same from the start of the NPDES program, the most significant change has been the dramatic improvement in the reporting limits for trace metals. For some metals the reporting limits have dropped nearly two orders of magnitude from the early 1990's to 2005. This improvement has allowed more confidence in the assessment of potential aquatic toxicity with respect to the criteria from the CTR.

As in the prior monitoring program the goal at each harbor complex was to monitor two stormwater runoff events per year. Each monitored stormwater event included three separate visits: day 1 of stormwater runoff to receiving water, 2 days after initial sampling, and 4 days after initial sampling. The water chemistry from each sampling was compared to applicable acute saltwater criteria from the CTR. The mean concentrations of the 3 days of stormwater sampling were compared to the chronic saltwater criteria from the CTR.

The following is a summary of the number of stormwater runoff events monitored in the harbors during the last five reporting years. The 2001-02 and 2003-04 storm seasons did not present many monitoring opportunities because of the lower than average rainfall totals.

Reporting Year	Rainfall Total at Santa Ana	Huntington Harbour	Newport Bay
2000-01	14.87"	0	3
2001-02	3.82"	0	0
2002-03	14.57"	2	2
2003-04	8.41"	1	1
2004-05	28.44"	2	2

In order to put the critical aquatic resources sites in a broader regional perspective, aquatic chemistry samples from these locations (e.g., Newport Bay, Huntington Harbour, Bolsa Bay) were combined with aquatic chemistry samples from the mass emissions monitoring program and then evaluated in comparison to acute and chronic toxicity criteria established in the CTR. The data from the bays and harbors were compared to the saltwater criteria from the CTR. The data from the mass emissions sites were compared to the freshwater criteria and to the saltwater criteria if the channel directly discharges to a marine or estuarine receiving water. While such CTR criteria are available for only a portion of the constituents measured in the program's samples, the combination of all available CTR exceedance data provides an overview of patterns across the region. In addition to tabulating the number of exceedances at each station, the overall percentage of exceedances at each station (out of all samples collected at each station) was used to place stations into one of four categories representing relative frequency of exceedances. These categories were then represented with colored symbols on maps (**Figure 11.1** and **Figure 11.2**) of the region.

Table 11.2 summarizes the patterns of exceedances of relevant acute toxicity CTR criteria at mass loading and bays/harbors monitoring stations in the Santa Ana region with more than one sampling event. These stations provide the most spatially distributed and consistently sampled set of data for assessing overall levels of specific pollutants in both dry and wet weather. **Table 11.3** summarizes the comparisons of stormwater data from the bays/harbors to relevant chronic toxicity criteria from the CTR.

It should be noted that the comparisons of the concentrations of dissolved metals at mass emission sites near estuarine receiving waters to saltwater criteria from the CTR assume no mixing zone dilution in the receiving waters. During dry weather conditions the impacts would be localized at the channel-receiving water interface. During stormwater runoff the spatial impacts would be greater.

The main findings from the data were that:

1. Exceedances of the acute toxicity criteria in channels and bay/harbors were predominantly due to dissolved copper, with much smaller percentages due to dissolved zinc in some channels.
2. Exceedances of the chronic toxicity criteria in the harbors were due to both dissolved copper and nickel.
3. Exceedances were more widespread during periods of stormwater water runoff compared to dry weather
4. There was a tendency for exceedances to be more frequent at stations nearer the bottom end of watersheds, along the coast, and particularly in embayments such as Huntington Harbour and Newport Bay.

Figures 11.1 and **11.2** visually summarize these regional patterns, using the data presented in **Table 11.2**.

Within these larger patterns, the CTR exceedance data help identify locations where targeted special studies to identify upstream sources should be implemented. The Third Term Monitoring Program has been designed to be adaptive to allow these special studies if warranted. These are stations where both the exceedance rate and/or the number of pollutants showing exceedances are among the highest:

Channels
CMCG02
SADF01
SDMF05

Bays/Harbors
HUNBCC
HUNCRB
HUNWAR
TGDC05
LNBHIR
LNBRIN
UNBCHB
UNBJAM
UNBNSB
UNBSDC

Stations with elevated exceedance rates in dry weather tend to have elevated rates in wet weather as well. However, there is not a readily apparent, consistent relationship between the overall levels of CTR exceedances at the mass loading stations and the loads of total metals. For example, both stations CMCG02 and SDMF05 showed persistent exceedances of the saltwater CTR criteria (**Table 11.2**), yet **Figures 11.5** and **Figure 11.5a** show that these two stations have very different baseline mass loads of copper, nickel, and zinc. Improved understanding of the potential impact of these elevated pollutant levels will stem from the addition of toxicity testing to the Third Term Monitoring Program. This will help to identify where and to what extent such pollutants are more likely to be bio-available.

Mass Emissions Monitoring

The long-term mass emissions component of the monitoring program is intended to evaluate changes in stormwater pollutant loadings over a number of permit terms. This is accomplished through wet weather monitoring of a number of flood channels in the Newport Bay and Anaheim Bay-Huntington Harbour watersheds. Monitored constituents include nutrients, trace elements (total recoverable and dissolved), and for some channels, organophosphate pesticides. The program is coordinated with elements of the San Diego Creek Nutrient TMDL, a dry-weather assessment of the inorganic nitrogen and total nitrogen loading to the Newport Bay.

For the stormwater assessments three storms are monitored at each location annually and for each storm the water chemistry is monitored with a series of 3 to 4 composite samples collectively spanning approximately 96-hours. This time period frequently extends beyond the end of stormwater runoff but provides for comparison of the time-weight average concentrations of dissolved metals to the 96-hour guidance criteria for chronic aquatic toxicity from the CTR. The concentrations of dissolved heavy metals in each of the composite samples are also compared to acute toxicity criteria from the CTR.

The concentrations of organophosphate pesticides are compared to literature values of LC_{50}s for toxicity testing organisms.

The dry-weather assessments usually involve a 24-hour composite sampling of the channels on a monthly basis. More frequent monitoring is also conducted at some stations for the Nutrient TMDL.

Mass Emissions monitoring during the Third Term Permit in the SAR was essentially an extension of monitoring conducted under the prior permits. Several sites, primarily in the Newport Bay watershed, have been monitored since the early 1990's. **Table 11.1** lists the mass emissions sites from which data were analyzed for this report.

The monitoring program utilizes continuous water level records from streamgages at each site are used to determine dry-weather and stormwater discharge rates. The streamgages on Costa Mesa , Central Irvine, and Lane Channels have not had sufficient numbers of stormwater discharge measurements made to accurately define the upper ranges of their respective channel ratings. To remedy this deficiency the program has recently invested in equipment utilizing acoustic Doppler current profiling technology in order to rapidly make discharge measurements during stormwater conditions.

The evolution of automatic sampling equipment and analytical methodologies has improved sampling efficiency and allowed more accurate assessments of potential aquatic toxicity. During the latter part of the 99-04 Monitoring Program Teflon-lined sampler tubing replaced plastic tubing to reduce the likelihood of cross contamination between samples. Detection limits of the analytical services providers improved dramatically for trace element and pesticide analyses.

The raw data for many constituents from the long-term mass loading stations in the Santa Ana Region (see **Figure 11.3** for the location of stations and **Figure 11.4** for an example raw data plot) show declining trends in event mean concentrations (EMCs) and loads over time. The legitimacy of these trends was investigated statistically[2] with a multiple regression analysis that included both the amount of rainfall in the three days preceding each sampling event and the amount of total suspended solids (TSS) in each sample. In order to increase the length of the time series back to the early 1990s, only total metals, phosphate (PO_4), and nitrate (NO_3) were used in the analysis.

The findings of this statistical analysis were as follows:

- There were no long-term trends in loads and event mean concentrations (EMCs) that were not accounted for by changes in TSS concentrations
- Mean levels of TSS differed among stations and so did underlying (baseline) levels of pollutants

The statistical analysis showed that the stormwater trends in metals, phosphate and nitrate concentrations were not a function of time but a function of TSS concentration.

[2] Mark Fitzgerald, Neptune and Company Inc.

This would suggest that TSS reduction would result in a reduction of the other constituents. This makes logical sense for metals and phosphate which are predominantly found in particulate form in stormwater. For nitrate however, the TSS correlation is not readily explainable since nitrate is a dissolved component.

The underlying differences among stations in both EMCs and loads (after TSS influences were statistically removed) are shown in **Figures 11.5** and **11.6**. San Diego Creek at Campus (station SDMF05) has the highest loads for the three metals and two nutrients, probably a reflection of its consistently higher flow. On the other hand, the rank order of stations after this changes depending on the pollutant. There was no single station that was consistently among the highest ranked in terms of EMCs.

11.2.2 Approval of the Third Term Monitoring Plan

On July 1, 2003, the Permittees submitted to the Regional Board a monitoring program proposal to address the requirements of the Third Term Permit. The design of the program was based on The Model Monitoring Program for Municipal Separate Storm Sewer Systems in Southern California, a report from the Southern California Stormwater Monitoring Coalition (SMC). The proposal contained several new assessment tools (relative to the 99-04 Plan) including expanded suites of monitored stormwater pollutants, dry-weather reconnaissance for illegal discharges/illicit connections, urban stream bioassessments, infaunal analyses of benthic sediment in the harbors and estuaries, and toxicity testing of water and benthic sediment. After lengthy discussions between the Permittees and Regional Board staff, the proposed monitoring plan was revised to incorporate several new elements to aid in the development of the Toxics TMDLs for San Diego Creek and the Newport Bay. The Executive Officer gave final approval of the plan in August 2005 and it was subsequently implemented.

While the 99-04 Plan has provided useful information with respect to regional patterns of water quality relative to the CTR and trends in stormwater EMCs and loads, the Third Term program will greatly expand the Permittees ability to assess the impacts of urban runoff. Since the Third Term program was implemented in August 2005 the Permittees have done the following:

- Conducted urban stream bioassessments in the Fall of 2005 and Spring of 2006
- Conducted toxicity testing of stormwater runoff at mass emissions and harbor/estuary sites
- Conducted infaunal analyses and toxicity testing of the benthic sediment in the Newport Bay and Huntington Harbour
- Initiated the weekly monitoring of bacterial indicators in coastal stormdrain discharges and their receiving waters
- Initiated the dry-weather reconnaissance program in May of 2006

Analysis of the data from this monitoring will be provided in the Performance Evaluation Assessment Report in November 2006.

11.2.3 Database Management

In 2004, a new computer program was developed for managing NPDES monitoring data. The intent of this program which has been called Labtrack, is to provide a single repository for all current NPDES data, to reduce the number of systematic errors in monitoring and laboratory analyses, and to increase the efficiency in processing invoices for the payment of analytical services. Some of the features of Labtrack include:

- Printing labels for sampling containers
- Printing and maintaining chain-of-custody documentation
- Checking laboratory results against quality assurance criteria
- Checking invoice pricing against price agreements
- Integrating discharge rate information from Hydstra (hydrologic database) to calculate load information for PEA and TMDL reports

11.2.4 Participation in Regional Monitoring Programs

Since 1997, the Permittees have been an active participant in the Regional Monitoring Program for the Southern California Bight. A Permittee representative has served on the steering committees for the 1998 Regional Assessment (Bight 98) and the 2003 Assessment (Bight 03). A representative has also served on several of the monitoring subcommittees on Bight 03.

The Permittees have also provided representation to the southern California Stormwater Monitoring Coalition. A Permittee representative was instrumental in the development of the Model Stormwater Monitoring Program guidance document mentioned in Section 11.2.2. A Permittee representative is currently on the working group with SCCWRP and the California Department of Fish and Game to improve the California Stream Bioassessment Procedure.

The knowledge gained from participation in these regional programs has enabled the Permittees to improve the monitoring program in many ways. The newly established price agreements for analytical services for the stormwater program required that the vendor had participated in the rigorous laboratory inter-calibration exercises for the Bight Regional Monitoring Program. These exercises, coordinated by SCCWRP, ensured that the accuracy and precision by each of the participating laboratories were maintained at a high standard.

11.2.5 Involvement in Research Level Investigations

The Permittees also contributed monitoring equipment and funding to UCI to conduct bacteriological investigations in the Santa Ana River and Huntington Beach surfzone. As a result of the study findings, the dry-weather discharges of several channels which drain to that area have been diverted to the Orange County Sanitation District. Since the diversions have been implemented there has been an improvement in scores for the surfzone in that area on Heal the Bay's Beach Water Quality Report Card.

11.3 Assessment

The Permittees have assessed the recently approved Third Term Permit Monitoring Program and are proposing no changes to this program.

The Permittees will continue to develop the capabilities to implement the program and assess the monitoring data to provide feedback to the management program. This will include the following:

- Continue to participate in Regional efforts to improve the quality and validity of stormwater monitoring data and provide a broader geographic context for monitoring results. These would include the Bight and SMC laboratory inter-calibrations, and Surface Water Ambient Monitoring Program (SWAMP) comparability studies.
- Continue to investigate improved GIS base data visualization tools for presenting monitoring information to a broader audience.
- Improve existing water quality database (Labtrack) to include automated report generation for:
    - Monthly updates to the Permittees pertaining to the Dry-weather Reconnaissance program
    - Quarterly data reports for the Nutrient TMDL
    - Integration of NPDES monitoring data with UCI's CalSWIM web-base GIS database
- Enhance training of monitoring staff by
    - Preparing standard operating procedures manuals for each monitoring program element
    - Providing opportunities for attending specialized training as provided by the USGS (streamgaging) and CaDFG (urban stream bioassessment)
- Evaluate new technologies for sampling and discharge monitoring

Table 11.1: Mass Loading Stations Sampled During the Permit Term

Site Code	Channel	NPDES	Nutrient TMDL	Comments
SDMF05	San Diego Creek at Campus	X	X	
BARSED	Peters Canyon Wash at Barranca	X	X	
WYLSED	San Diego Creek at Harvard	X	X	
SADF01	Santa Ana Delhi at Irvine Ave	X	X	
CICF25	Central Irvine u/s Peters Cyn Wash	X		New site under 3rd term permit. Channel rating needs refining
BCF04	Bonita Cyn Wash u/s University		X	USGS gage
MIRF07	El Modena Irvine at Michelle		X	
LANF08	Lane Channel at Jamboree	X	X	Channel rating needs refining
ACWF18	Agua Chinon u/s San Diego Creek		X	USGS gage
CMCG02	Costa Mesa Channel at Highland	X	X	Channel rating needs refining
BCC02	Bolsa Chica at Westminster	X		
ABCC03	Anaheim Barber City at Rancho Rd	X		
WMCC04	Westminster Channel at Beach Blvd	X		
EGWC05	E. Garden Grove Wintersburg at Gothard	X		Gage removed during channel reconstruction 02-05

Table 11.2: Summary of Exceedances of Acute CTR Criteria Across the Region

						% Samples Exceeding CTR		
Weather	CTR Type	Site Code	Type	Watershed	# Samples	Cu	Ni	Zn
Storm	FW	ABCC03	Channel	Anaheim Bay-Huntington Harbour	25	40	0	4
Storm	FW	BCC02	Channel	Anaheim Bay-Huntington Harbour	11	18	0	0
Storm	FW	EGWC05	Channel	Anaheim Bay-Huntington Harbour	18	45	0	0
Storm	FW	WMCC04	Channel	Anaheim Bay-Huntington Harbour	16	50	0	6
Storm	SW	BCC02	Channel	Anaheim Bay-Huntington Harbour	11	100	0	0
Storm	SW	EGWC05	Channel	Anaheim Bay-Huntington Harbour	18	100	0	6
Dry	SW	BBOLR	Harbor	Anaheim Bay-Huntington Harbour	11	55	0	0
Dry	SW	HUNBCC	Harbor	Anaheim Bay-Huntington Harbour	11	73	0	0
Dry	SW	HUNCRB	Harbor	Anaheim Bay-Huntington Harbour	11	82	0	0
Dry	SW	HUNSUN	Harbor	Anaheim Bay-Huntington Harbour	11	45	0	0
Dry	SW	HUNWAR	Harbor	Anaheim Bay-Huntington Harbour	11	64	0	0
Dry	SW	TGDC05	Harbor	Anaheim Bay-Huntington Harbour	8	88	0	0
Storm	SW	BBOLR	Harbor	Anaheim Bay-Huntington Harbour	7	43	0	0
Storm	SW	HUNBCC	Harbor	Anaheim Bay-Huntington Harbour	9	67	0	10
Storm	SW	HUNCRB	Harbor	Anaheim Bay-Huntington Harbour	9	56	0	0
Storm	SW	HUNSUN	Harbor	Anaheim Bay-Huntington Harbour	9	56	0	0
Storm	SW	HUNWAR	Harbor	Anaheim Bay-Huntington Harbour	9	44	0	0
Storm	SW	TGDC05	Harbor	Anaheim Bay-Huntington Harbour	5	80	0	0
Dry	FW	BARSED	Channel	Newport Bay	8	0	0	0
Dry	FW	BCF04	Channel	Newport Bay	5	0	0	0
Dry	FW	CICF25	Channel	Newport Bay	7	0	0	0
Dry	FW	CMCG02	Channel	Newport Bay	137	5	0	1
Dry	FW	HCWF27	Channel	Newport Bay	5	0	0	0
Dry	FW	SADF01	Channel	Newport Bay	10	20	0	0
Dry	FW	SDMF05	Channel	Newport Bay	82	0	0	0
Dry	FW	WYLSED	Channel	Newport Bay	9	0	0	0
Dry	SW	CMCG02	Channel	Newport Bay	137	99	1	1
Dry	SW	SADF01	Channel	Newport Bay	10	90	0	0
Dry	SW	SDMF05	Channel	Newport Bay	82	48	0	0

						% Samples Exceeding CTR		
Weather	CTR Type	Site Code	Type	Watershed	# Samples	Cu	Ni	Zn
Dry	SW	LNBHIR	Harbor	Newport Bay	12	75	0	0
Dry	SW	LNBRIN	Harbor	Newport Bay	4	100	0	0
Dry	SW	LNBTUB	Harbor	Newport Bay	4	50	0	0
Dry	SW	UNBCHB	Harbor	Newport Bay	12	67	0	0
Dry	SW	UNBJAM	Harbor	Newport Bay	12	75	0	0
Dry	SW	UNBNSB	Harbor	Newport Bay	12	67	0	0
Dry	SW	UNBSDC	Harbor	Newport Bay	13	77	0	0
Storm	FW	ACWF18	Channel	Newport Bay	4	0	0	0
Storm	FW	BARSED	Channel	Newport Bay	61	5	0	0
Storm	FW	BCF04	Channel	Newport Bay	17	6	0	0
Storm	FW	CICF25	Channel	Newport Bay	8	13	0	0
Storm	FW	CMCG02	Channel	Newport Bay	58	48	0	26
Storm	FW	HCWF27	Channel	Newport Bay	7	0	0	0
Storm	FW	LANF08	Channel	Newport Bay	39	15	0	0
Storm	FW	MIRF07	Channel	Newport Bay	16	31	0	0
Storm	FW	SADF01	Channel	Newport Bay	57	28	0	0
Storm	FW	SDMF05	Channel	Newport Bay	50	4	0	0
Storm	FW	WYLSED	Channel	Newport Bay	52	2	0	0
Storm	SW	CMCG02	Channel	Newport Bay	58	97	0	22
Storm	SW	SADF01	Channel	Newport Bay	57	98	0	12
Storm	SW	SDMF05	Channel	Newport Bay	50	86	0	2
Storm	SW	LNBHIR	Harbor	Newport Bay	15	60	0	0
Storm	SW	LNBRIN	Harbor	Newport Bay	16	75	0	0
Storm	SW	LNBTUB	Harbor	Newport Bay	10	100	0	0
Storm	SW	UNBCHB	Harbor	Newport Bay	17	59	0	0
Storm	SW	UNBJAM	Harbor	Newport Bay	16	50	0	0
Storm	SW	UNBNSB	Harbor	Newport Bay	16	38	0	0
Storm	SW	UNBSDC	Harbor	Newport Bay	16	44	0	0

Table 11.3 Summary of Exceedances of CTR Chronic Criteria in Harbors and Bays

						% Samples Exceeding CTR		
Weather	CTR Type	Site Code	Type	Watershed	# Samples	Cu	Ni	Zn
Storm	SW	BBOLR	Harbor	Anaheim Bay-Huntington Harbour	4	75	50	0
Storm	SW	HUNBCC	Harbor	Anaheim Bay-Huntington Harbour	4	75	25	0
Storm	SW	HUNCRB	Harbor	Anaheim Bay-Huntington Harbour	4	100	25	0
Storm	SW	HUNSUN	Harbor	Anaheim Bay-Huntington Harbour	4	75	25	0
Storm	SW	HUNWAR	Harbor	Anaheim Bay-Huntington Harbour	4	100	0	0
Storm	SW	TGDC05	Harbor	Anaheim Bay-Huntington Harbour	3	100	33	0
Storm	SW	LNBHIR	Harbor	Newport Bay	7	86	29	0
Storm	SW	LNBRIN	Harbor	Newport Bay	6	100	50	0
Storm	SW	LNBTUB	Harbor	Newport Bay	4	100	75	0
Storm	SW	UNBCHB	Harbor	Newport Bay	7	86	29	0
Storm	SW	UNBJAM	Harbor	Newport Bay	8	100	25	0
Storm	SW	UNBNSB	Harbor	Newport Bay	8	75	50	0
Storm	SW	UNBSDC	Harbor	Newport Bay	7	71	29	0

Figure 11.1: Pattern of CTR Exceedances Across the Region During Dry Weather

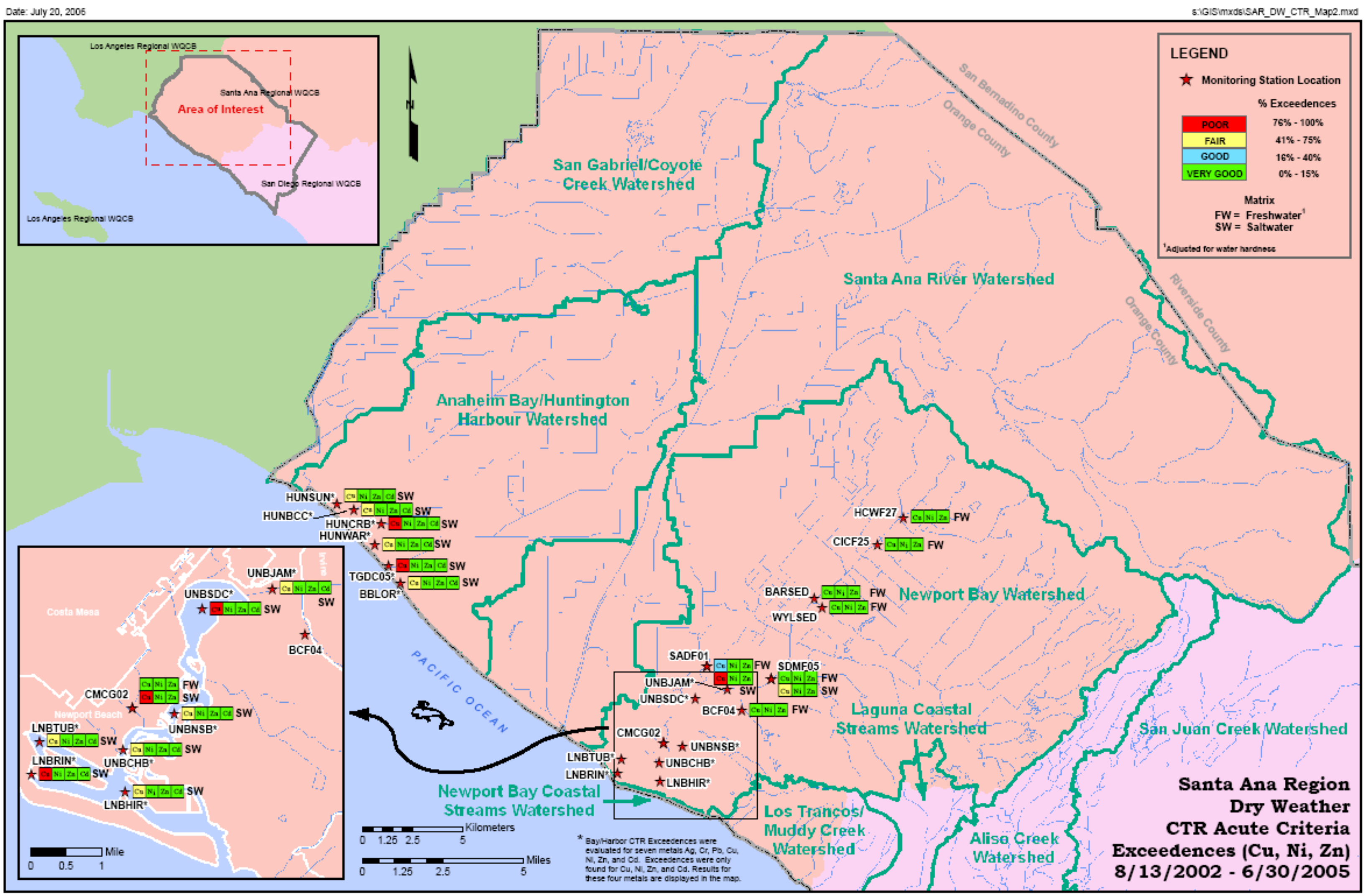


Figure 11.2: Pattern of CTR Exceedances Across the Region During Wet Weather

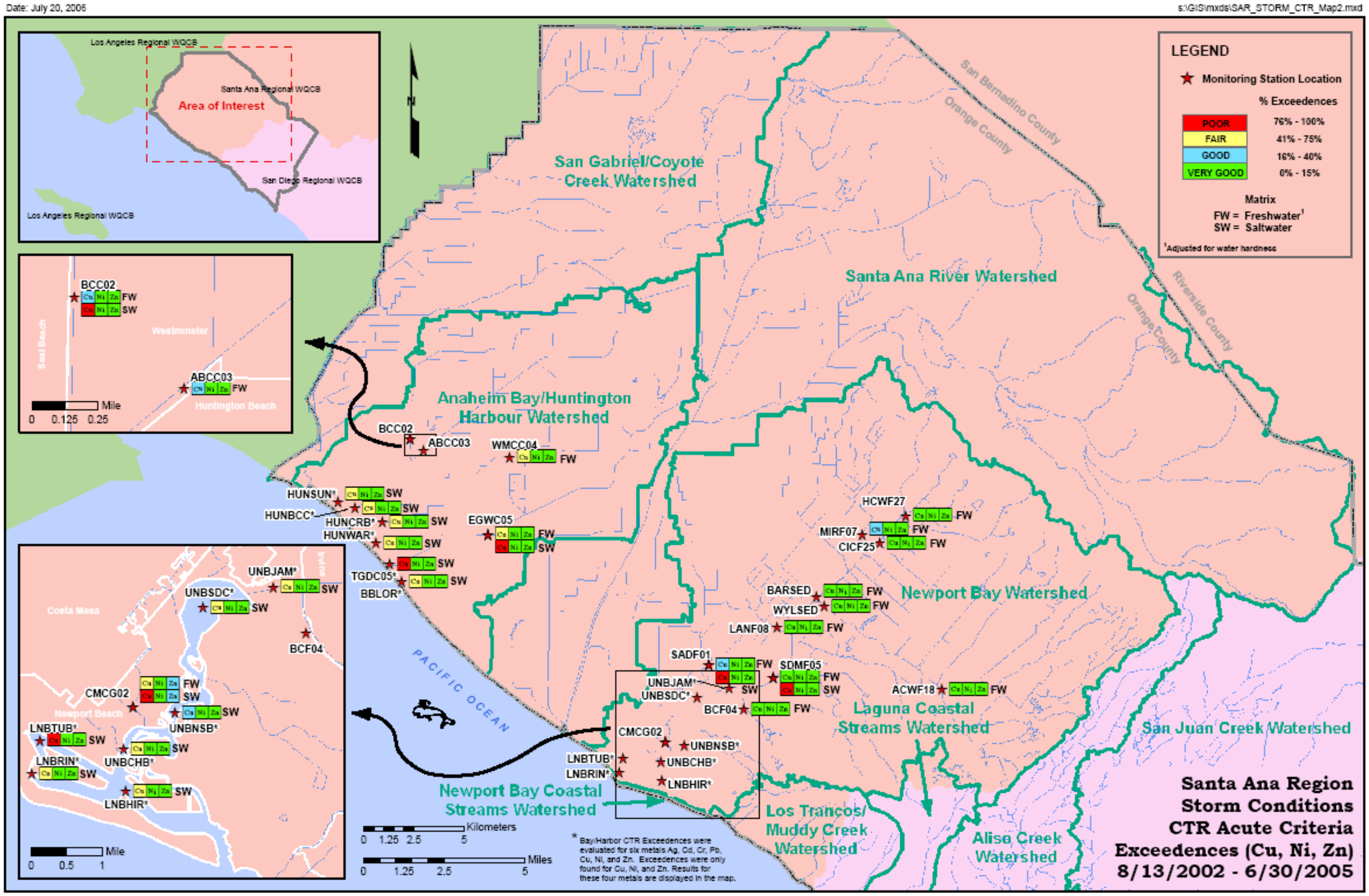
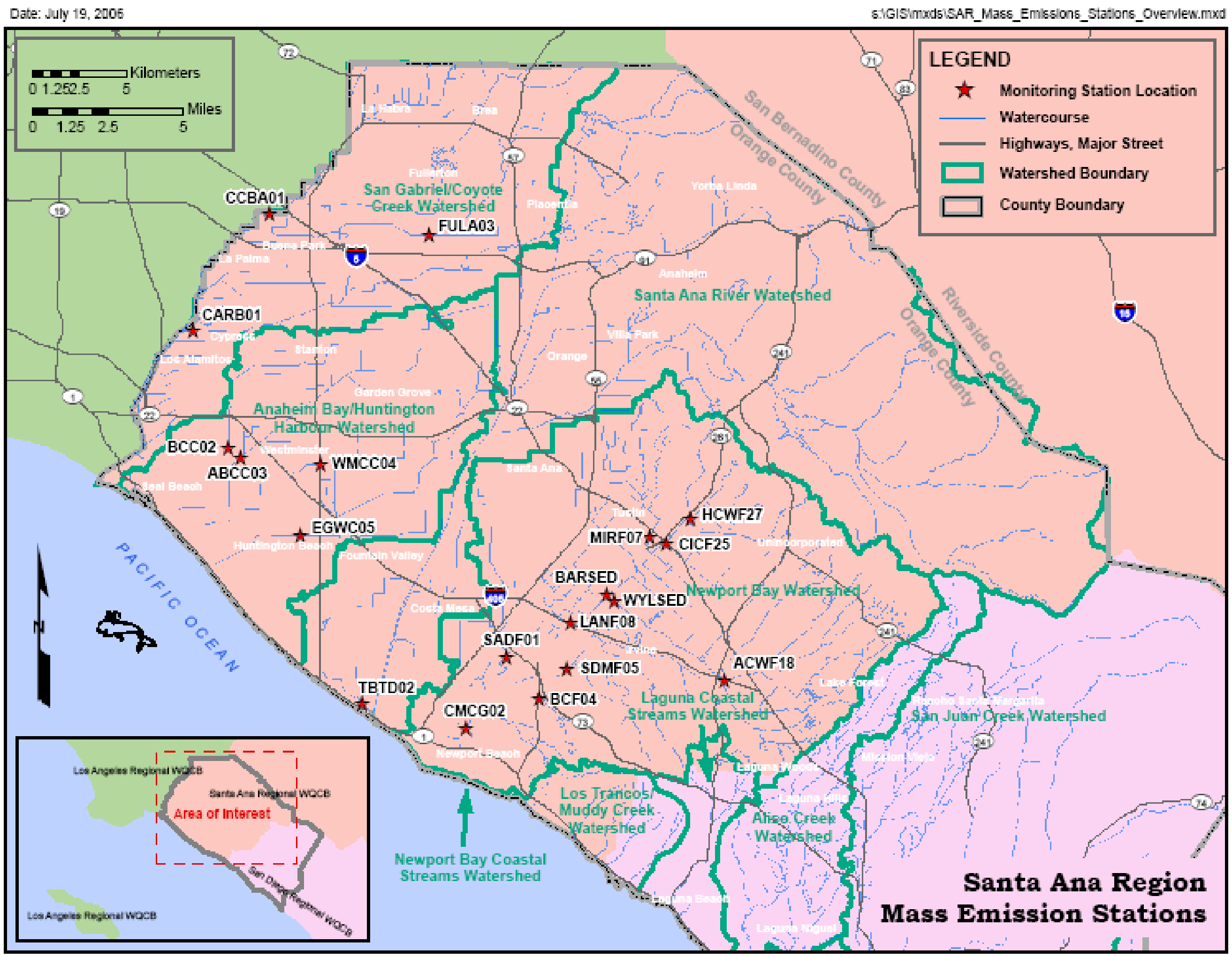
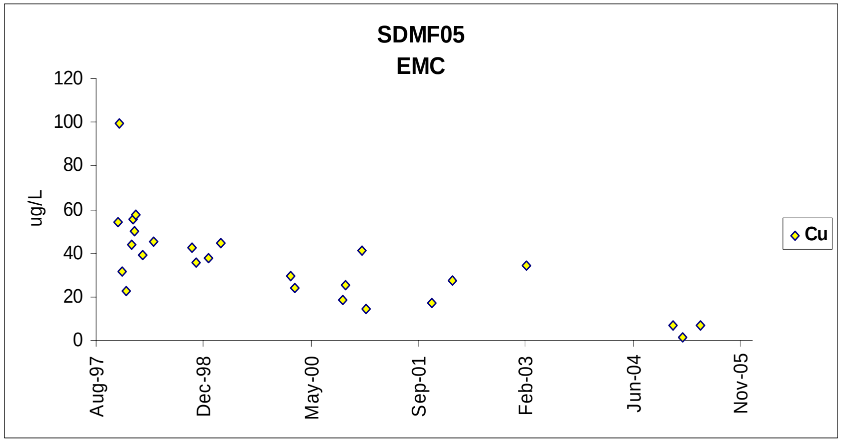


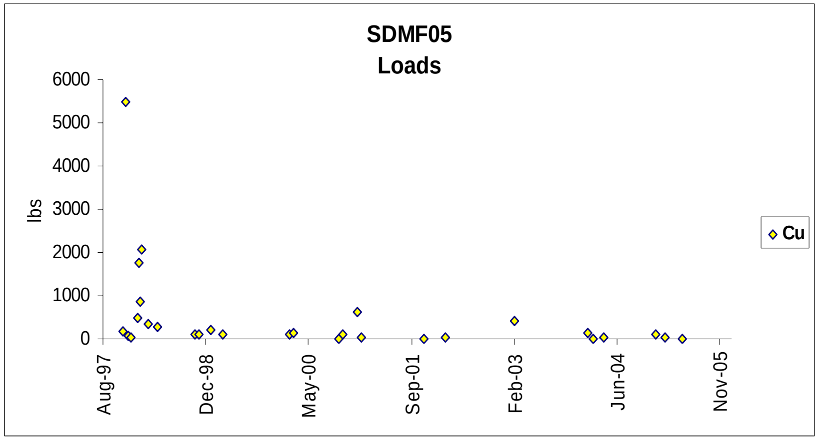
Figure 11.3: Location of the Long-Term Mass Loading Stations

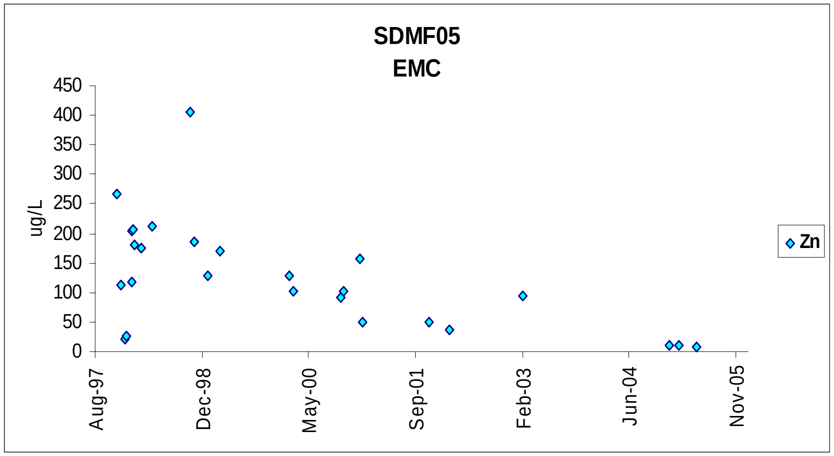


New stations (CARB01, CCBA01, FULA03) are not included in retrospective analyses.

Figure 11.4: Illustrative Trends in Raw EMCs and Loads of Copper and Zinc at San Diego Creek at Campus (SDMF05)







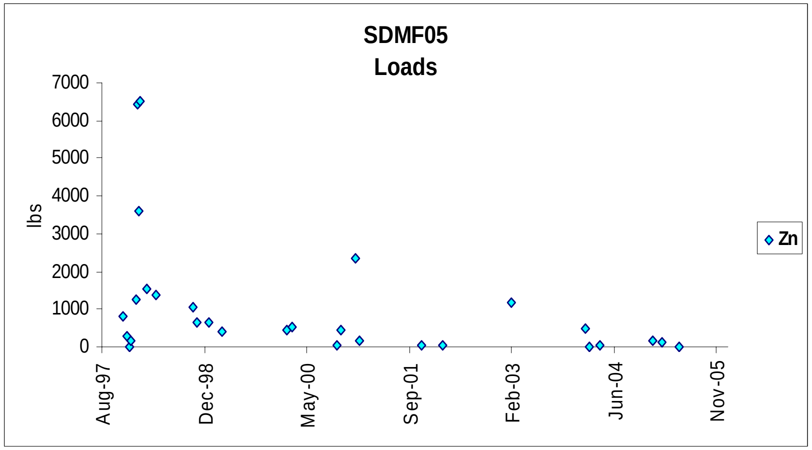
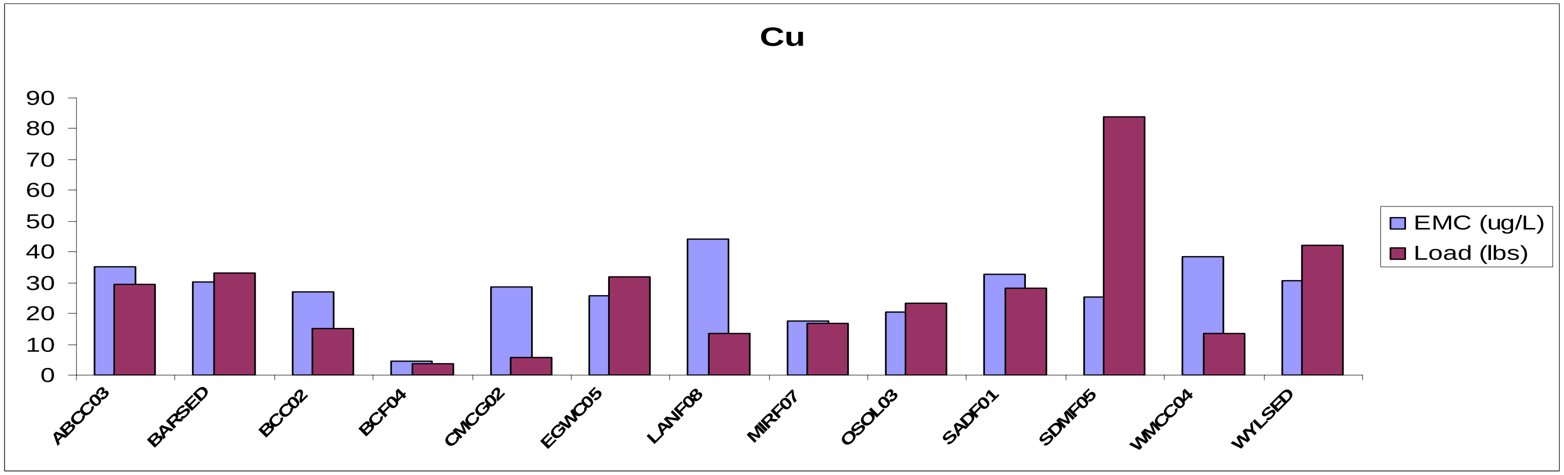
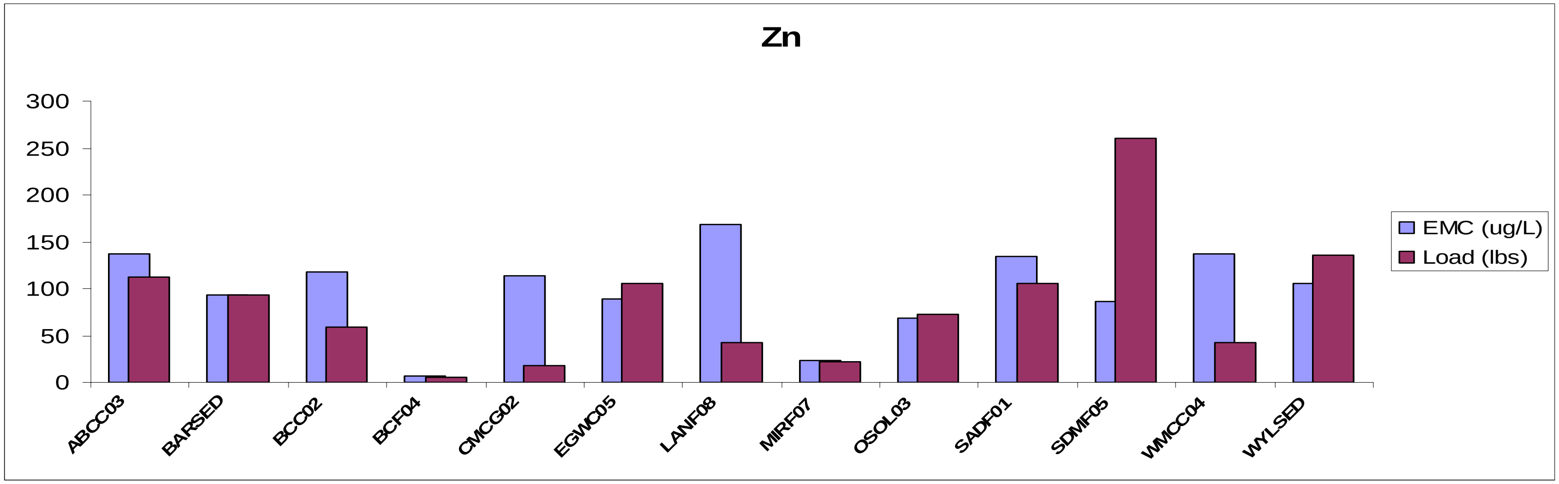


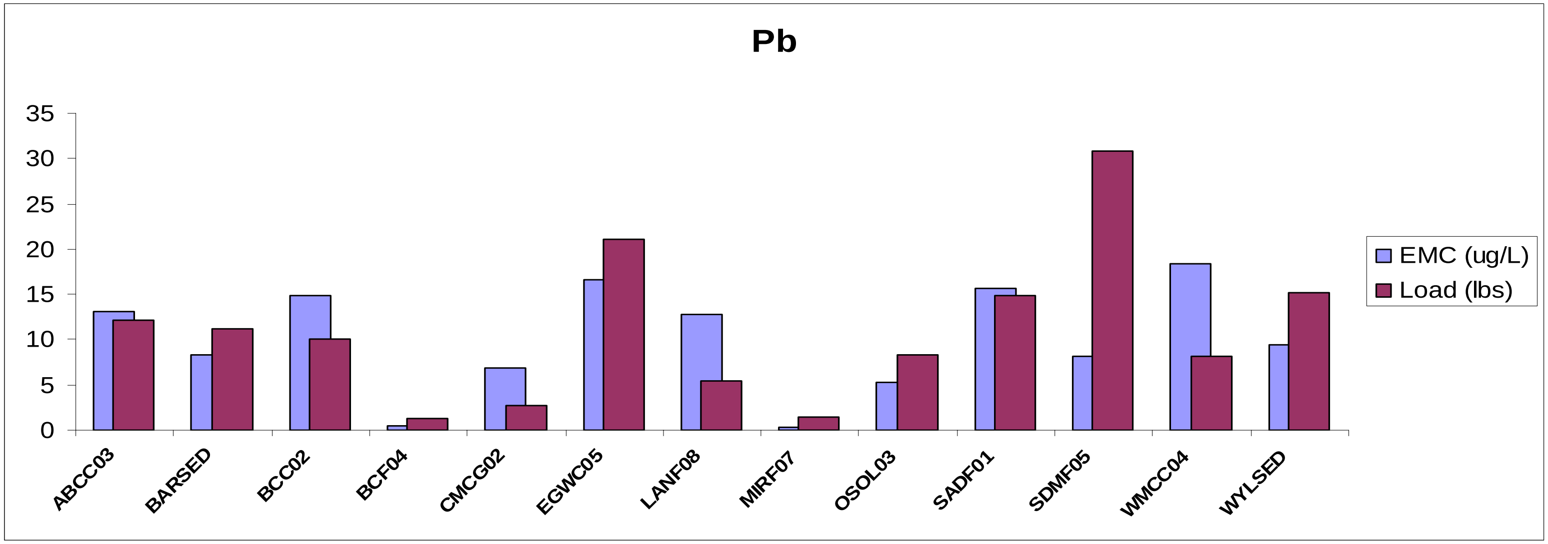
Figure 11.5a: Baseline Levels (Adjusted for TSS) of Total Metals at Long-Term Mass Loading Stations





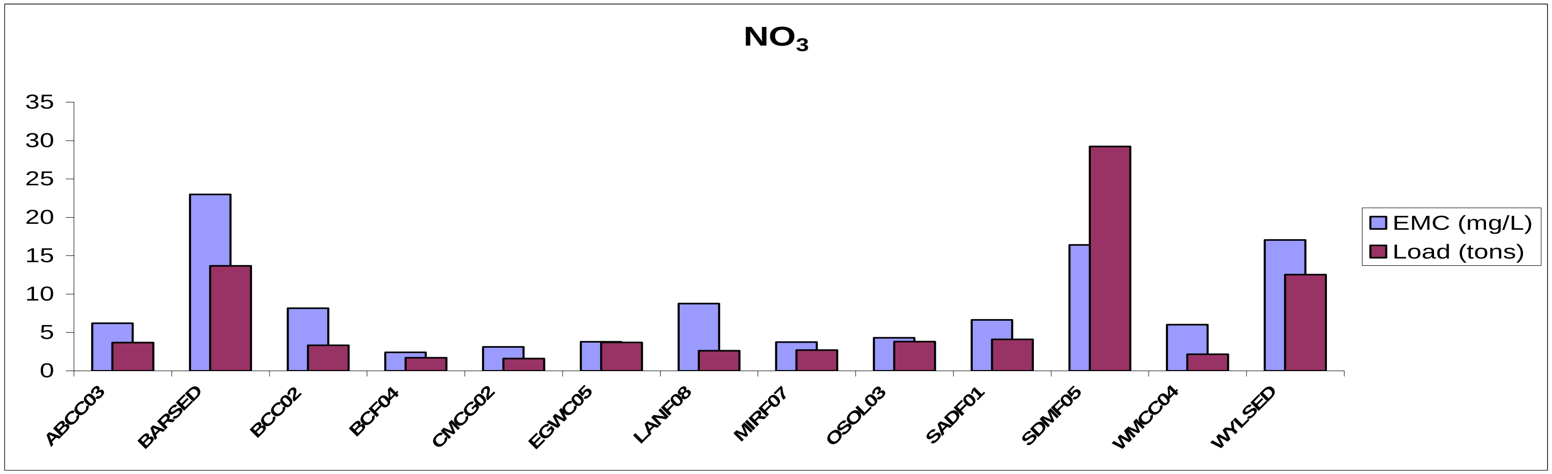
Loads are as pounds per sampling event.

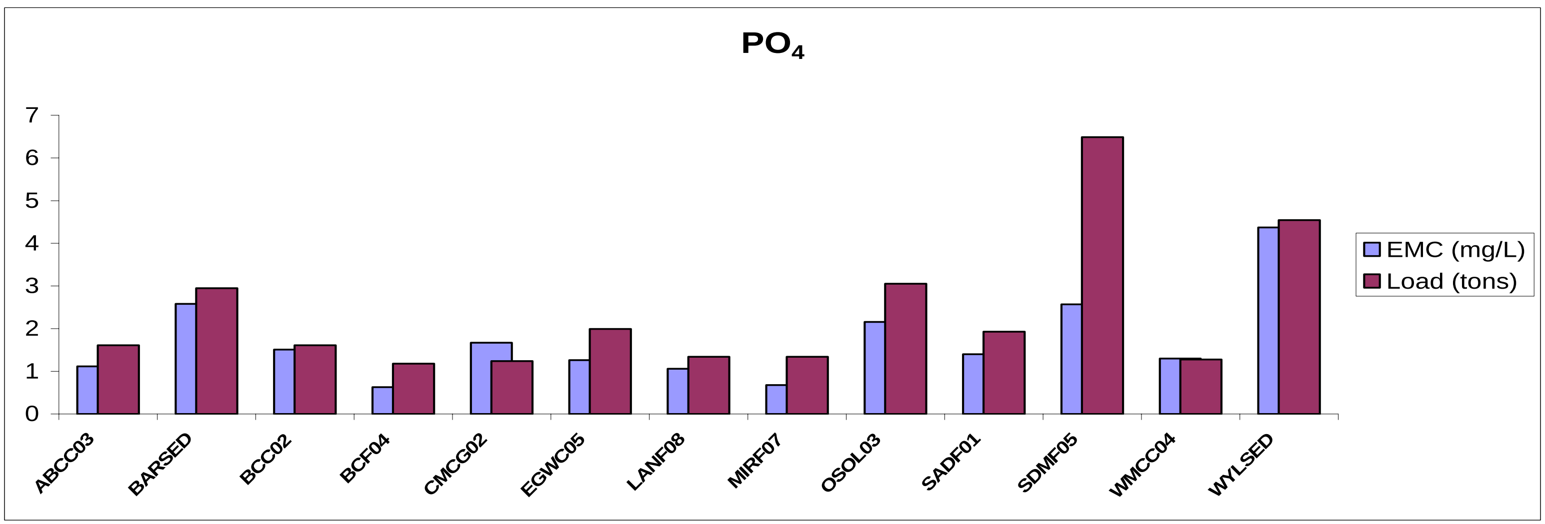
Figure 11.5: Baseline Levels (Adjusted for TSS) of Total Metals at Long-Term Mass Loading Stations



Loads are as pounds per sampling event.

Figure 11.6: Baseline Levels (Adjusted for TSS) of Nutrients at Long-Term Mass Loading Stations





Loads are as tons per sampling event