Monterey Bay Sanctuary Citizen Watershed Monitoring Network
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MONTEREY REGIONAL STORMWATER MANAGEMENT PROGRAM

SUMMARY DATA ANALYSIS AND GRAPHIC DISPLAY

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OVERVIEW

The purpose of this review and report is to portray concentration and load data for storm water and dry weather runoff in a way that allows storm water program managers to evaluate the effectiveness of efforts to reduce pollutants entering the Pacific Ocean from storm drains located within the Monterey Regional Stormwater Management Program (MRSWMP) area of responsibility. We base our analysis on monitoring data collected by the volunteer citizen monitoring effort, which is lead and organized by staff at the Monterey Bay National Marine Sanctuary. Monitoring of storm water runoff by the MBNMS citizen science program includes both a pre-permit time period from 2000 – 2006, prior to NPDES MS4 Phase II permits, and the post-permit time period from 2007-2014. Please refer to annual MRSWMP monitoring reports for further explanation of protocols and methods for data collection and analysis.

The report is broken into five separate analyses described below.

Section I: Comparison of Pre-Permit and Post-Permit Pollutant Concentrations for MRSWMP Jurisdictions

Our review starts with a comparison of pre and post NPDES permit results to discover whether there has been an improvement (or worsening) in pollutant concentrations at storm water outfalls collectively for the MRSWMP region for the years 2000 – 2014. MRSWMP cities with storm drain outfalls that discharge to the ocean or 303d listed waterbody include Seaside, Monterey, Carmel, and Pacific Grove. There are two Monterey county sites as well, in Carmel Valley and in Pajaro.

Section II: 85th Percentiles for Pollutants Measured

Based on data collected between 2006-2014, we developed the 85th percentiles representing the highest 15% of concentrations observed in this time frame. This approach uses the 85th percentile to provide a benchmark for relative comparison between sites and is a practice used in the ASBS program as suggested by the State Water Resources Control Board (SWRCB). Water Quality Objectives for pollutants are also shown so that the 85th percentiles can be compared with concentrations established for aquatic health.

Section III: Trend Analysis of Pollutant Concentrations at Outfalls

A statistical analysis to assess the existence of trends in concentrations at each outfall with 5 or more years of data was performed over all the years of monitoring data (2000-2014). The slope of the trend was also determined to assess the rate at which concentrations were changing.

Section IV: Instantaneous Load at Outfalls Clustered by City

Instantaneous load for pollutants was plotted at outfalls where both flow and concentration data was available for 2009-2014. Bar plots of load results were shown side by side for each of the cities so that relative load contributions of different sites into the ocean could be assessed.

Section V: Plots of Pollutant Concentrations at Outfalls

Pollutant concentration plots were developed for monitoring data collected at each storm water outfall that had at least one sample above the 85th percentile for that pollutant during the monitoring period for that site, including pre and post permit monitoring. The plots included the city's 85th percentile, as well as all MRSWMP data 85th percentile for both dry and wet weather and their combined results.

SUMMARY OF MONITORING ACTIVITY

MRSWMP adopted Monterey Bay National Marine Sanctuary (Sanctuary) volunteer water quality monitoring programs in Fall 2007 (Permit Year 2).

- 2007-2008, Permit Year 2-3 MRSWMP monitoring included a Dry Run, First Flush and two dry weather events using Urban Watch protocols. Twenty-three outfalls >18"
- 2009-2010, Permit Year 4-5 monitoring was adjusted to follow First Flush protocols for both wet and dry weather events (1 wet, 3 dry). Twenty-three outfalls >18"
- 2011, Permit Year 6 monitoring followed First Flush protocols for both wet and dry weather events (2 wet, 2 dry). Twenty-three outfalls >18"
- 2012-2013, Permit Year 7 and PY1 of new permit monitoring followed First Flush protocols for both wet and dry weather events (2 wet, 2 dry). However, the number of outfalls changed to complement the ASBS Special Protection monitoring requirements.
- 2014, New Permit – PY 2 followed First Flush protocols for one wet and one dry weather events at the reduced number of outfalls to complement the ASBS Special Protection monitoring requirements.

DEFINITIONS:

Dry Run – Water samples are collected prior to the first major rainstorm of the year. It usually takes place on the Saturday after volunteer training in September. This gives volunteers an opportunity to visit their site in the daylight and collect dry weather sample for comparison.

First Flush – Water samples are collected during the first major rainstorm of the winter season. We strive for conductivity is below 1000 µS and sheeting rain on the roadway.

Second Flush – Water samples are collected during a late season rainstorm.

Spring/Summer Run – Samples are collected during dry weather season.

METHODS:

Grab samples were collected at up to 23 storm drain outfalls greater than 18" in diameter that discharge to the ocean or a river. During the First Flush, volunteers collect two or three time series samples. Second Flush and dry weather samples include just one grab sample. Protocols include field measurements for temperature, conductivity, pH and transparency (if sufficient light) and collection of samples to be analyzed in a lab for bacteria (*E. coli* and *Enterococcus*), nutrients (nitrate as N, urea, and orthophosphate as P), total metals (copper, zinc, lead) and total suspended solids.

WET WEATHER SAMPLE DATES AND PRECIPITATION AMOUNT:

Table 1: Precipitation is shown for wet weather monitoring dates in 2009-2014. The Lover's Point station (KCAPACIF27) was used for reporting precipitation in Pacific Grove. The Monterey Airport (KMRY) was used for reporting precipitation in Carmel, Monterey and Seaside.

	Precipitation (in)	
Wet Sample Date	Carmel, Monterey, Seaside	Pacific Grove
10/13/2009	2.92	2.92
10/17/2010	0.25	0.17
11/20/2010	1.45	0.94
10/5/2011	0.84	0.57
10/22/2012	0.24	0.30
3/6/2013	0.33	0.22
10/28/2013	0.39	0.16
11/20/2013	0.36	0.19
3/31/2014	0.38	0.31
10/25/2014	0.18	0.09
10/31/2014	1.35	1.10

Figure 1: Map of MRSWMP Monitoring Locations.

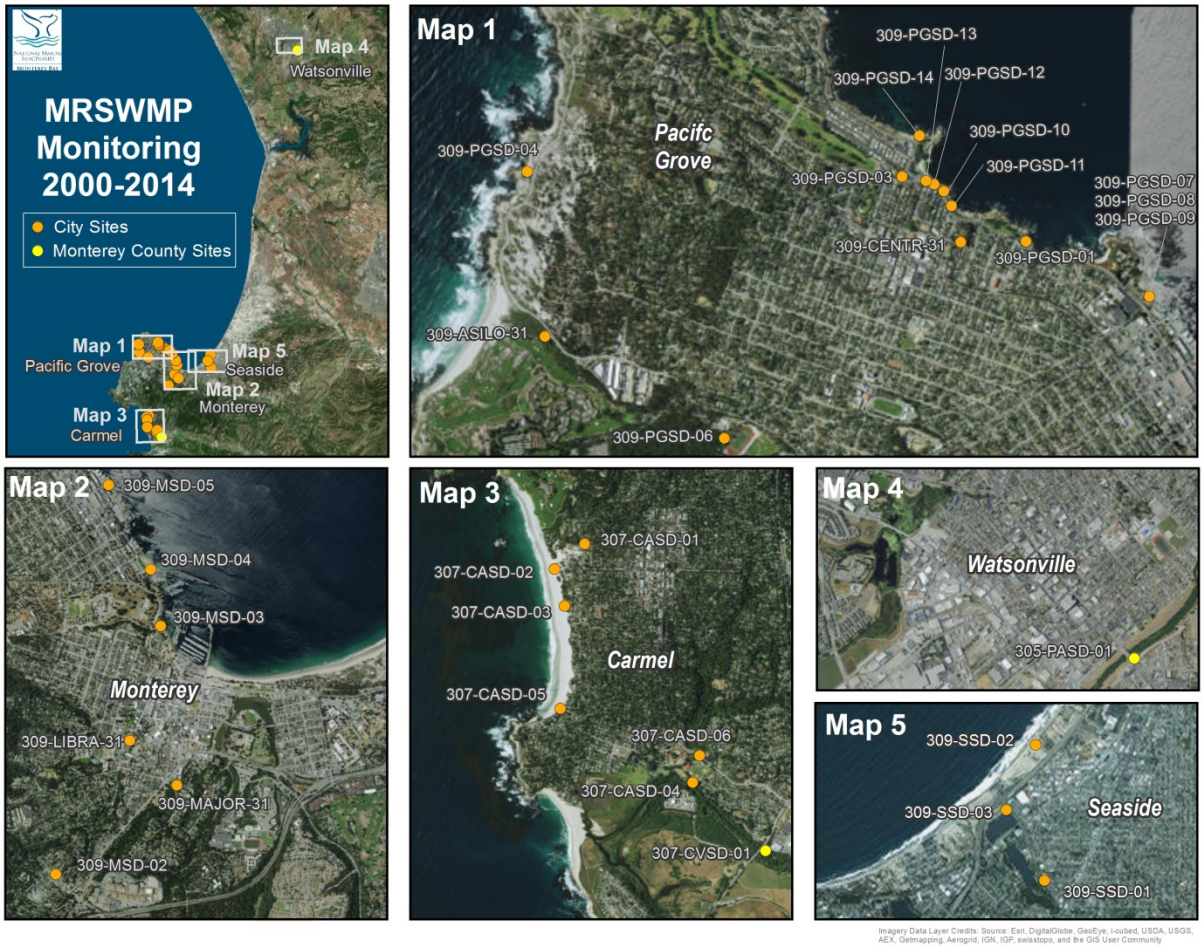


Table 2: Monitoring Site Information

City	Site ID	Site Name
Carmel	307-CASD-01	4th Avenue
Carmel	307-CASD-02	Ocean
Carmel	307-CASD-03	8th Avenue
Carmel	307-CASD-04	Mission
Carmel	307-CASD-05	Santa Lucia
Carmel	307-CASD-06	Rio Road
Monterey	309-LIBRA-31	Hartnell Gulch
Monterey	309-MAJOR-31	Majors Creek
Monterey	309-MSD-02	Soledad (St. Timothy's)
Monterey	309-MSD-03	Twin 51's
Monterey	309-MSD-04	San Carlos
Monterey	309-MSD-05	Steinbeck
Pacific Grove	309-ASILO-31	Asilomar
Pacific Grove	309-CENTR-31	Greenwood
Pacific Grove	309-PGSD-01	8th Street
Pacific Grove	309-PGSD-03	Lover's Point
Pacific Grove	309-PGSD-04	Pico
Pacific Grove	309-PGSD-06	Congress
Pacific Grove	309-PGSD-07	Hopkins (old)
Pacific Grove	309-PGSD-08	HopkinsPG
Pacific Grove	309-PGSD-09	HopkinsMon
Pacific Grove	309-PGSD-10	Fountain
Pacific Grove	309-PGSD-11	Fountain and 15th
Pacific Grove	309-PGSD-12	Grand
Pacific Grove	309-PGSD-13	Forest
Pacific Grove	309-PGSD-14	17th Avenue
Seaside	309-SSD-01	Hilby
Seaside	309-SSD-02	Bay Street
Seaside	309-SSD-03	Hotel
Monterey County	307-CVSD-01	Carmel Valley
Monterey County	305-PASD-01	Pajaro

I. COMPARISON PRE-PERMIT AND POST-PERMIT CONCENTRATIONS

Comparisons of the concentrations of pollutants between the pre-permit (2000 to 2006) and post-permit (2007 to 2014) timeframes were made for sites and pollutants consistently monitored by the MBNMS citizen science program. These sites were only in Monterey and Pacific Grove and include: "309-MSD-03", "309-MSD-04", "309-MSD-05", "309-PGSD-01", "309-CENTR-31", "309-PGSD-03", and "309-PGSD-04". Sites that were not consistently monitored for both periods had to be eliminated from the evaluation for accurate statistical comparison between data sets. The pollutants that were consistently monitored during both time periods were total copper, total zinc, total lead, nitrate-N, orthophosphate-P, *E.coli*, and total suspended solids. Pollutants that were not consistently monitored during both time frames could not be included in the statistical comparison due to lack of data.

This comparison allows for an overall review of program effectiveness of two Monterey Peninsula cities in improving storm water pollution following intensified efforts to reduce pollution through best management practices as a result of the NPDES Phase II MS4 permit requirements. City efforts to reduce pollution included: public education and outreach directed towards specific sectors, public involvement in clean-up and sampling, eliminating illicit discharges, developing guidelines and standards for construction runoff, implementing street sweeping, periodically cleaning out storm drains, assessing sewer line integrity , and other measures as spelled out in the "Monterey Regional Storm Water Management Program, October 31, 2005". As more monitoring data is collected through time at other Monterey Peninsula cities, we will be able to track overall program effectiveness in the region.

The statistical comparisons to determine whether a difference existed between pre and post permit concentrations were made using the Wilcoxon Rank-Sum test, which is a nonparametric alternative to the sample t-test. A p-value ≤ 0.05 was selected to represent a significant difference between the two timeframes. In this case, we were 95% confident that a difference existed in pollution concentrations prior to implementation of MRSWMP compared with after implementation of MRSWMP, thus concluding that a change had taken place. Box plots were also developed to graphically show the differences between the two timeframes for the purpose of a visual comparison.

For this analysis, wet and dry weather results were analyzed separately because of the differences found under these two conditions. Additionally, dry weather data were limited to one sample per year, normally collected in September (Dry Run). Extra dry weather sample results were removed since different numbers of dry weather data were collected in different years.

During wet conditions there was flow at all sites, so the statistical comparison was straight forward between the two timeframes In order to make the comparison during dry weather conditions when some sites lacked flow, we needed to either remove sites from consideration where not all years of data were available, or alternatively, we needed to estimate concentration for missing years based on data from other years. When sites had fewer than three data points for each program, we removed that site from consideration in the analysis. Sites that were removed for the dry comparison were 309-PGSD-01 and 309-PGSD-03. When sites had at least three data points in each program, we assigned values for the missing data years using a Monte Carlo method and

assuming a uniform distribution between the upper and lower concentrations observed. We randomly selected points in the range between the lower and upper measured concentrations using R statistical software. Using the Monte Carlo method we replaced missing data with these random values, 1000 times for all missing points and ran the Wilcoxon Rank-Sum statistical test each time, comparing the pre and post permit data sets and developing a p-value. The median p-value for all 1000 statistical tests was selected for reporting purposes. If the p-value was ≤ 0.05, we determined the difference between the pre and post-premit timeframes to be significant.

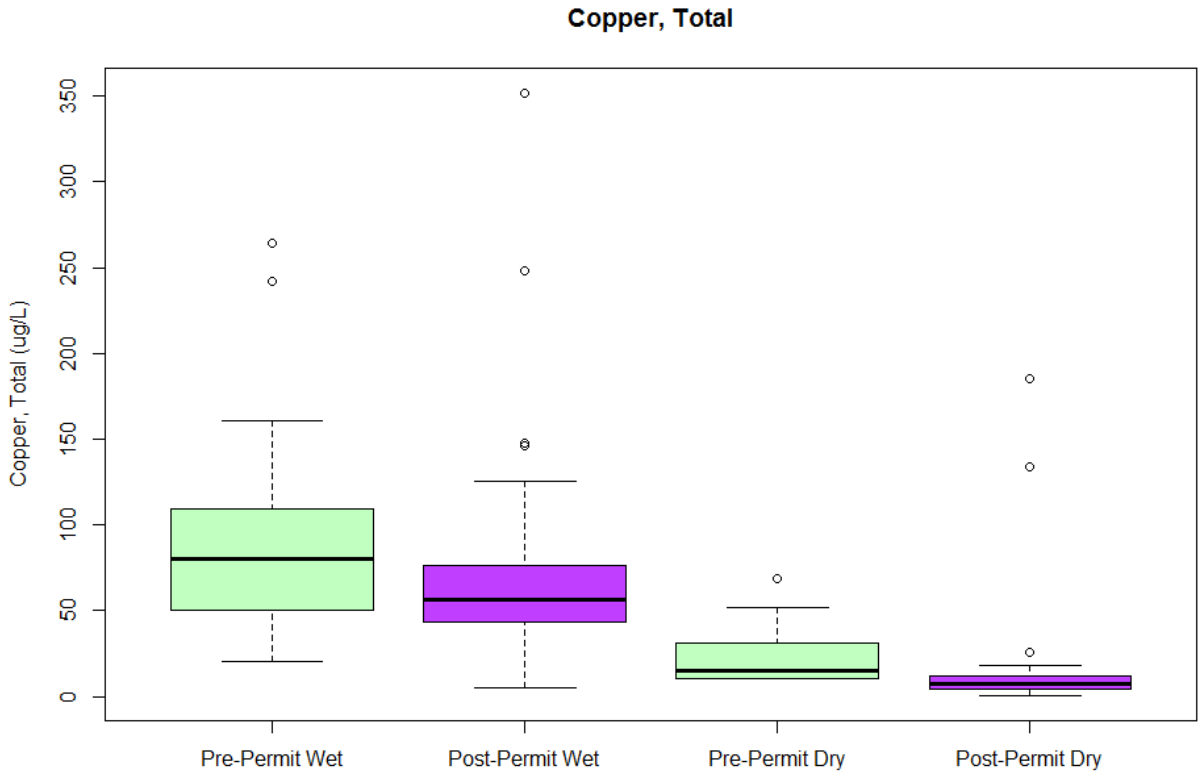
To supplement the statistical test, box and whisker plots of the two timeframes were developed for wet and dry concentrations. Box and whisker plots show a distribution of the dataset in a convenient format for making comparisons. The box represents the range of 50% of the data with a line drawn in the middle that represents the median value. The upper and lower whiskers represent the remaining upper and lower 25% of the data, excluding outliers. Outliers (much higher or lower values) are represented by the circles drawn above or below the whiskers. These plots were made without the addition of substitute numbers (Monte Carlo Method) for events when there was no water present during sampling. Viewing these plots allows for the comparison of statistical findings with the data range differences between the two timeframes.

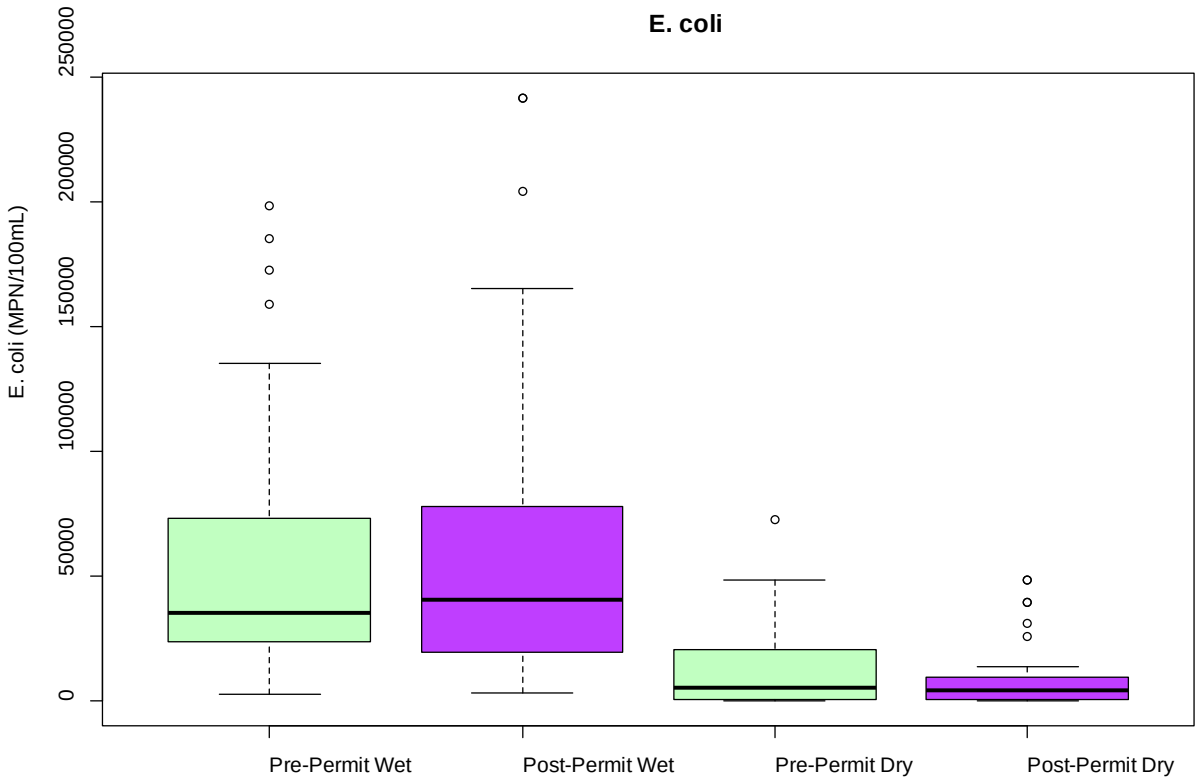
Our findings indicated a significant difference between pre-permit and post-permit concentrations for copper and lead under both wet and dry weather conditions. There was also a significant difference for both nitrate as N and for zinc under wet conditions but not under dry conditions, and for total suspended sediment under dry conditions but not wet conditions. In all cases where a difference was observed, the conditions improved in the permit timeframe compared with the pre-permit.

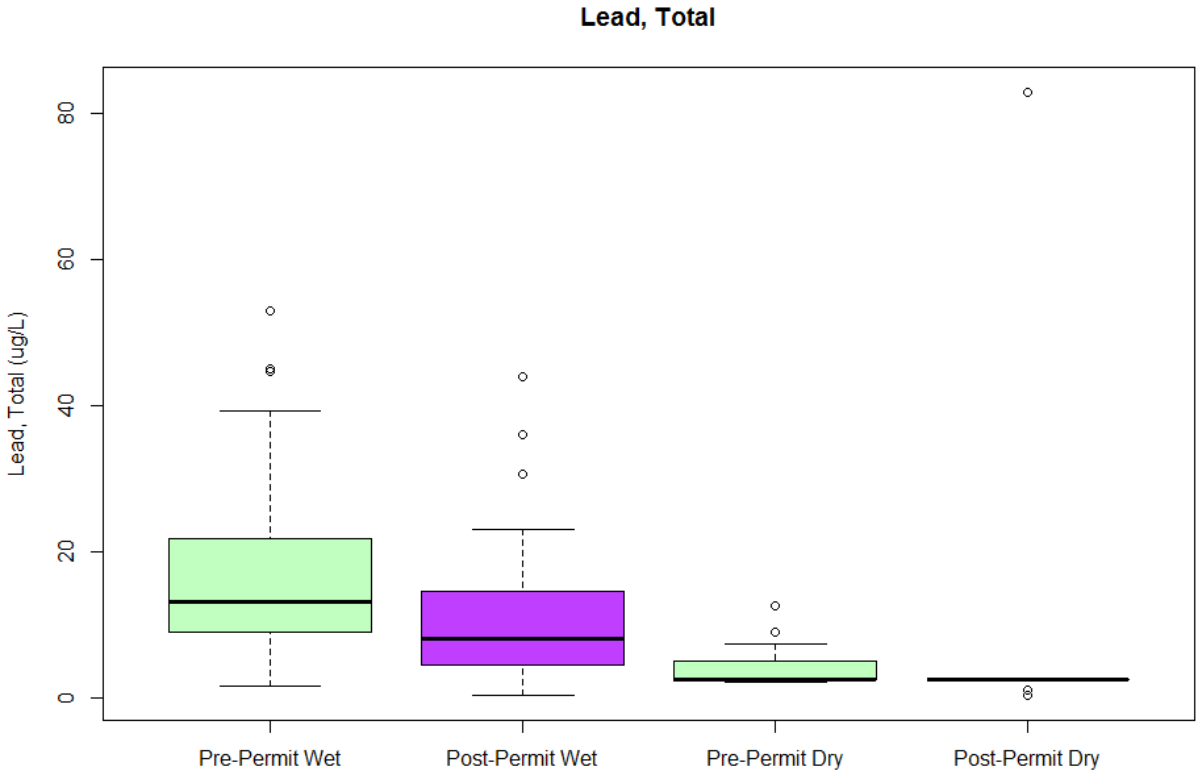
Table 3. Results of the Wilcoxon Rank-Sum test comparing MRSWMP (2007-2014) and pre-MRSWMP(2000-2006) conccentrations for sites consistently monitored by both programs. A p-value ≤ 0.05 is considered significant, indicating a change between the two time periods most likely occurred. Bolded analytes and p-values were significant.

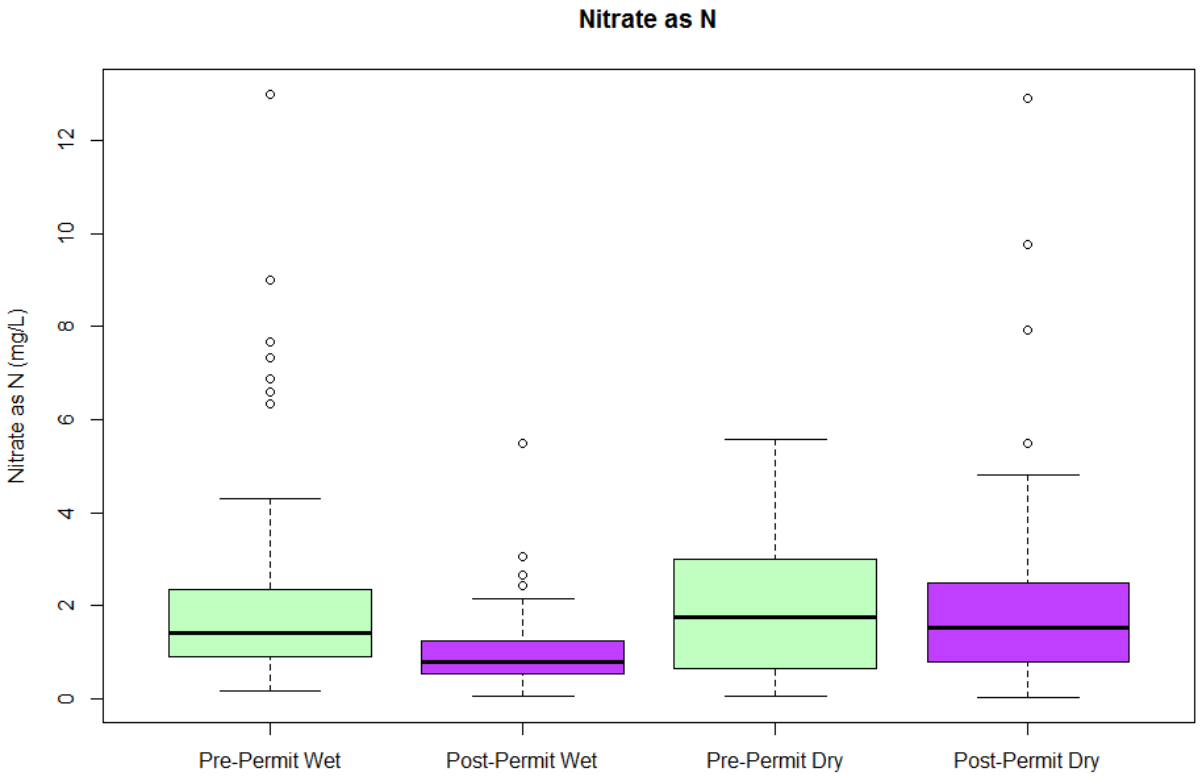
Analyte	P-Value (wet)	P-Value (dry)
Lead	**0.00**	**0.02**
Copper	**0.01**	**0.02**
Nitrate as N	**0.00**	0.92
Zinc	**0.03**	0.75
Total Susp. Solids	0.60	**0.00**
o-Phosphate-P	0.09	0.12
E. coli	0.89	0.88

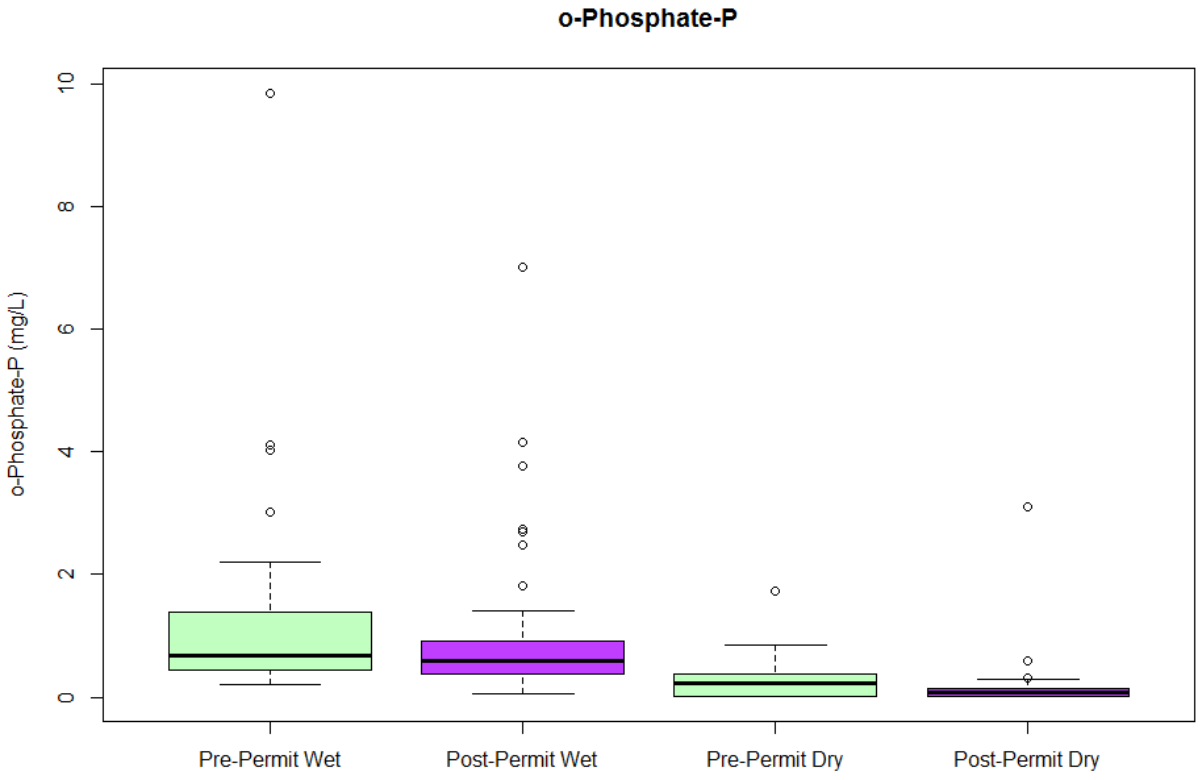
Figure 2. Boxplot and whisker plots comparing pre-permit and post-permit pollutant conccentrations.



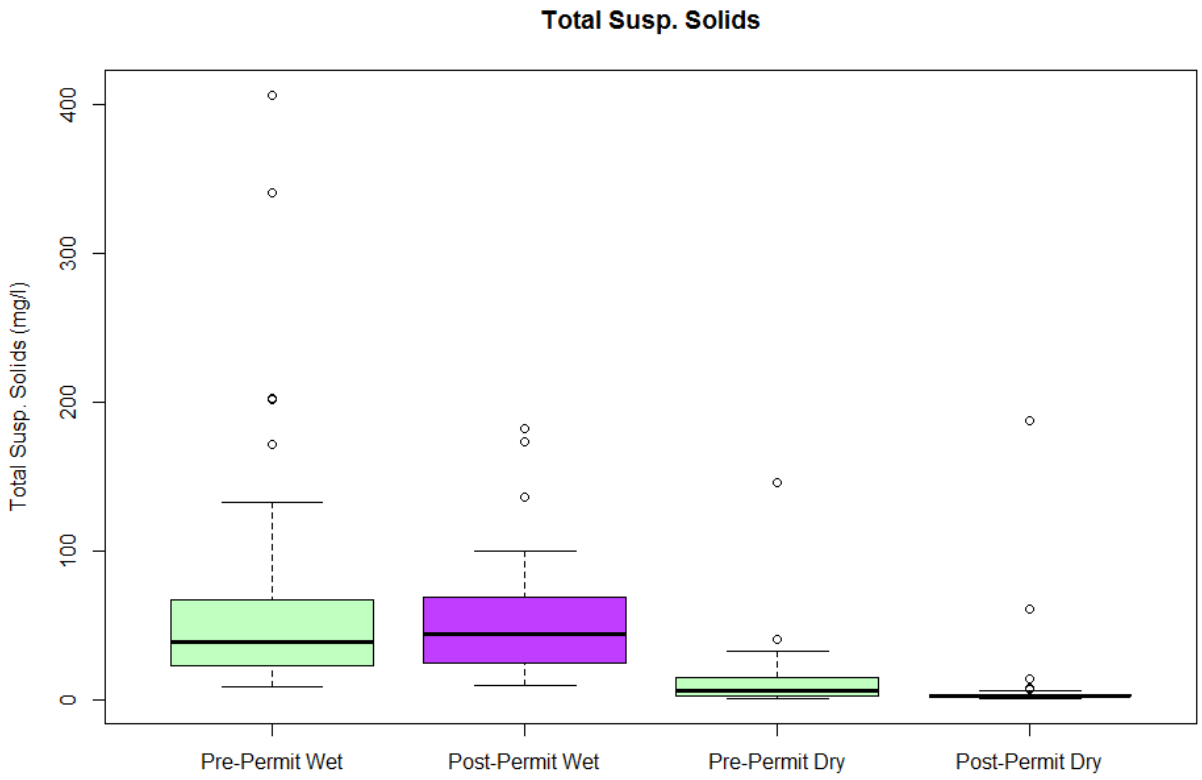

E. coli
E. coli (MPN/100mL)
0
50000
100000
150000
200000
250000
Pre-Permit Wet
Post-Permit Wet
Pre-Permit Dry
Post-Permit Dry

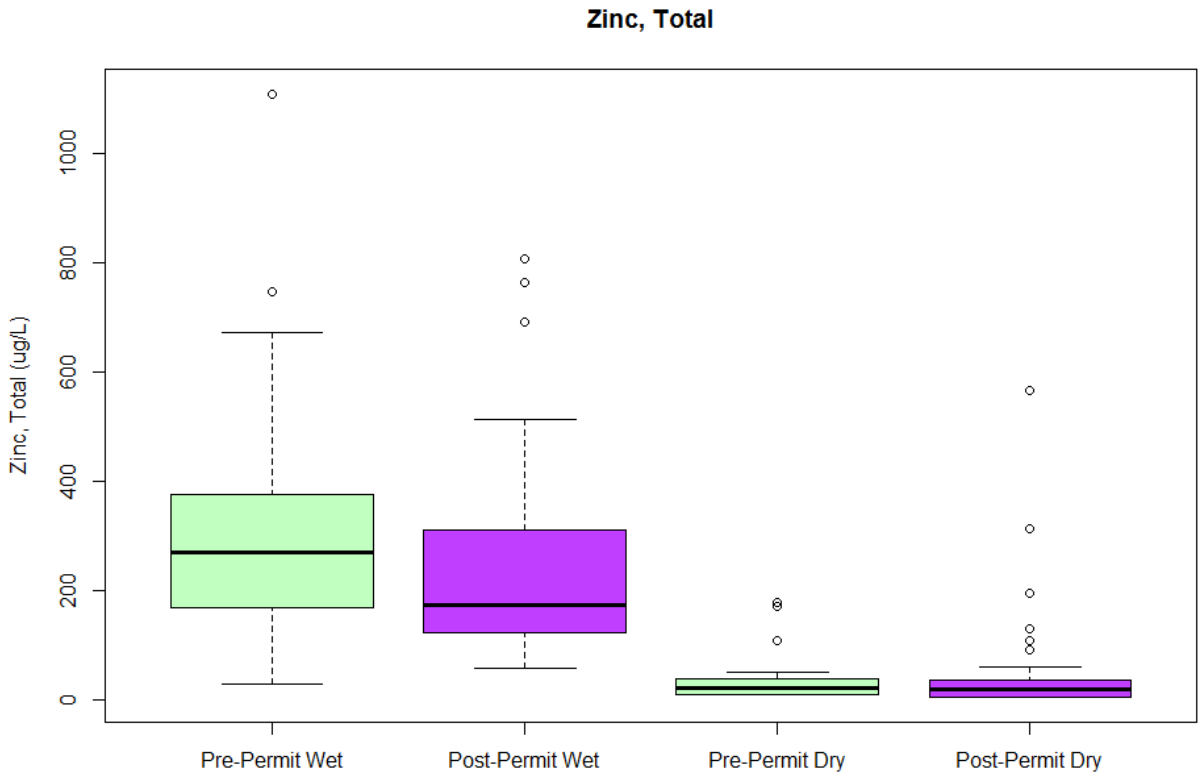

Lead, Total
Lead, Total (ug/L)
0
20
40
60
80
Pre-Permit Wet
Post-Permit Wet
Pre-Permit Dry
Post-Permit Dry


Nitrate as N
Nitrate as N (mg/L)
0
2
4
6
8
10
12
Pre-Permit Wet
Post-Permit Wet
Pre-Permit Dry
Post-Permit Dry


o-Phosphate-P
o-Phosphate-P (mg/L)
0
2
4
6
8
10
Pre-Permit Wet
Post-Permit Wet
Pre-Permit Dry
Post-Permit Dry

Note: Two outliers were removed from Total Suspended Solids graph in order to better display the rangeThey include a measure of 1194 mg/L from the Pre-Permit Dry dataset and 3080 mg/L from the Post-Permit Dry dataset.
Removal of these data points does not affect the extent of the range of the boxes.




Zinc, Total
Zinc, Total (ug/L)
0
200
400
600
800
1000
Pre-Permit Wet
Post-Permit Wet
Pre-Permit Dry
Post-Permit Dry

II. CONCENTRATION 85TH PERCENTILES

Monitoring data for the MRSWMP program from 2006-2014 was analyzed to provide the 85th percentile of concentration for each pollutant or water quality measure. Percentile information can be helpful in identifying locations with the highest concentration of pollutants, indicating where a problem may exist. The 85th percentile provides a benchmark for relative comparison between sites and is a practice used in the ASBS program as requested by the SWRCB. Water Quality Objectives for pollutants are also shown so that the 85th percentiles can be compared with concentrations established for aquatic health.

Pollutants assessed were were total copper, total zinc, total lead, nitrate-N, orthophosphate-P, urea, *E.coli*, *Enterococcus*, total coliform, total suspended solids, MBAS, fluoride, ammonia, hardness, potassium and calcium . Water quality measures assessed were color and turbidity. Percentiles were calculated for the following scenarios:

- Combined wet and dry weather MRSWMP data by analyte for all sites
- Wet weather MRSWMP data by analyte for all sites
- Dry weather MRSWMP data by analyte for all sites
- Combined wet and dry weather MRSWMP data by analyte for each City with more than five sites
- Wet weather MRSWMP data by analyte for each City with more than five sites
- Dry weather MRSWMP data by analyte for each City with more than five sites

The terms "wet" and "dry" denote whether precipitation was occurring at the time of monitoring and do not indicate whether there was flow or not at the monitoring site. However during dry weather monitoring, sometimes flow was absent and a sample could not be obtained.

In addition to providing 85th percentiles, histograms for the combined wet and dry weather are shown in order to inform the distribution of concentrations found. Typically, concentrations results are skewed toward the left axis, with a predominance of lower values found and fewer high values.

For each day of wet weather monitoring, a time series of two or three samples were taken. For computation of the percentiles of concentration, the average of each day's samples at a monitoring site was used. When sites did not have flow, no sample was collected and therefore no concentration was determined for that day.

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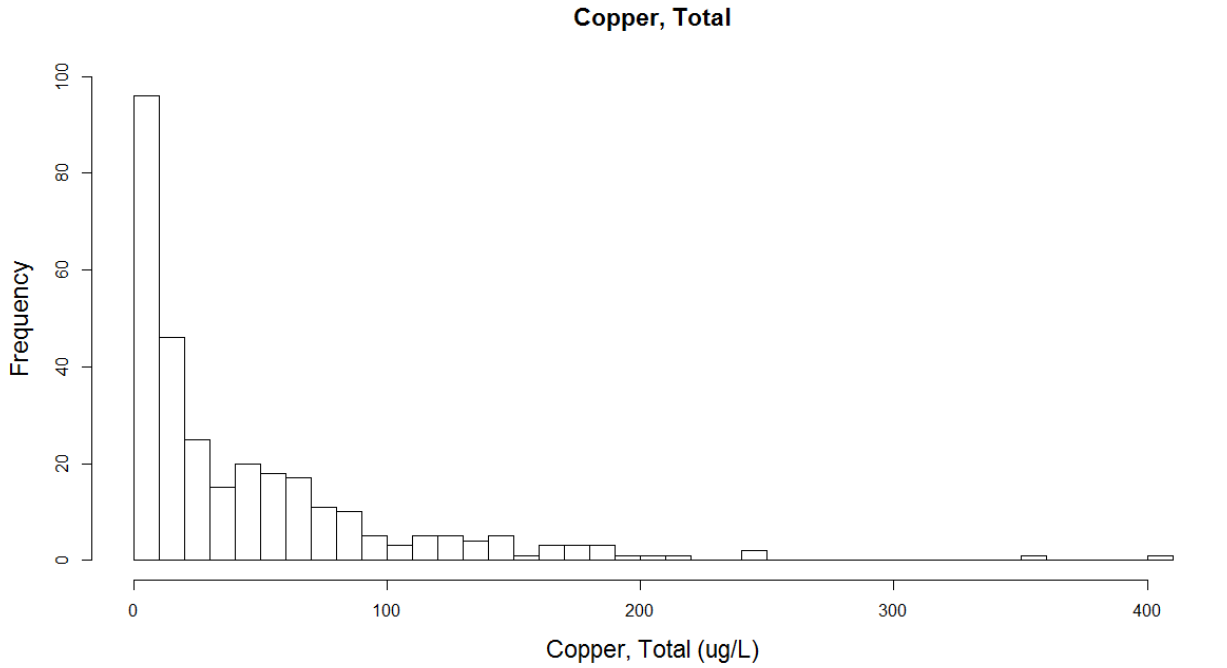
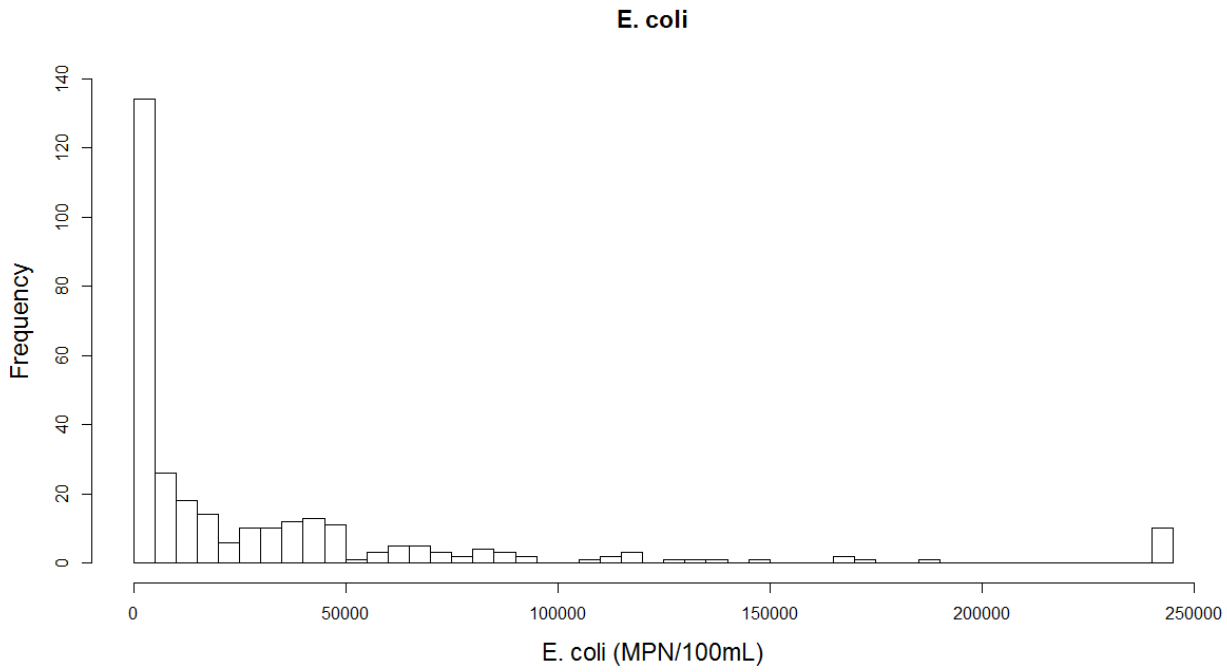
CONCENTRATION 85TH PERCENTILES

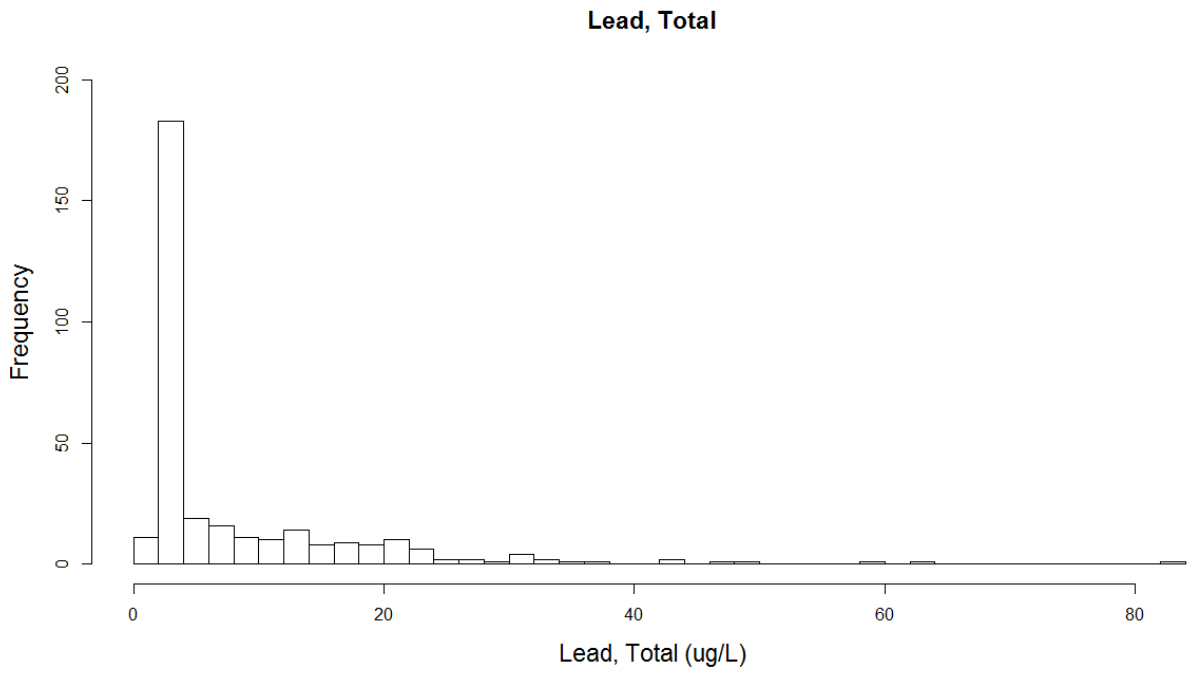
Table 4: Wet and Dry Combined Percentiles: 85th concentration percentiles for wet and dry weather conditions for MRSWMP monitoring (2006-2014) shown by analyte or water quality measure for all MRSWMP sites.

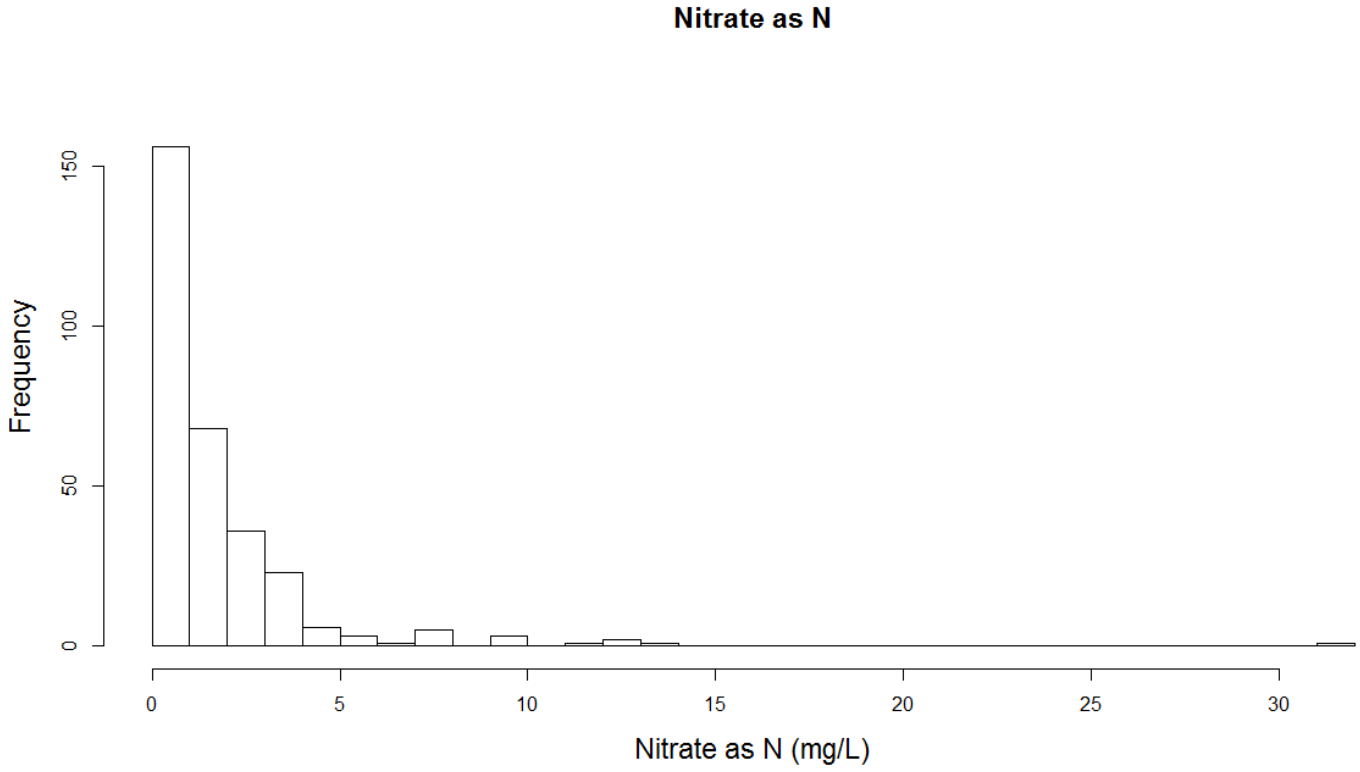
Monterey Bay		Combined Wet and Dry			Wet Weather			Dry Weather			WQO
Analyte	Units	# Samples	# Non-Detect	85th Percentile	# Samples	# Non-Detect	85th Percentile	# Samples	# Non-Detect	85th Percentile	Receiving Water
Ammonia-N	mg/L	26	3	0.88	18	1	1.05	8	2	0.11	< 50 mg/L
Calcium	mg/L	289	1	92.00	151	0	27.00	138	1	108.00	NA
Coliform, Total	MPN/100mL	278	0	241960	140	0	241960	138	0	48392	NA
Color	Color Units	40	0	315.00	28	0	338.75	12	0	41.40	< 500
Copper, Total	ug/L	308	20	86.95	160	3	127.30	148	17	17.95	< 30 ug/L
E. coli	MPN/100mL	313	0	60203	165	0	92526	148	0	10950	< 235 MPN/100 ml
Enterococci	MPN/100mL	310	0	81015	162	0	115535	148	0	10950	< 104 MPN/100 ml
Fluoride	mg/L	45	15	0.40	33	14	0.40	12	1	0.44	NA
Hardness (as CaCO3)	mg/L	289	1	374.80	151	0	115.67	138	1	449.35	> 10 and < 2000 mg/L
Lead, Total	ug/L	331	193	17.50	184	56	22.00	147	137	2.50	< 30 ug/L
Magnesium	mg/L	291	3	39.50	153	2	11.53	138	1	46.00	NA
MBAS (Surfactants)	mg/L	40	12	0.94	28	8	1.03	12	4	0.12	< 0.2 mg/L
Nitrate as N	mg/L	312	27	2.98	164	12	1.86	148	15	3.67	< 2.25 mg/L
o-Phosphate-P	mg/L	311	77	0.77	164	10	0.97	147	67	0.30	< 0.12 mg/L
Potassium	mg/L	40	0	11.58	28	0	11.98	12	0	8.34	<20 mg/L
Total Susp. Solids	mg/L	300	84	84.30	153	0	137.30	147	84	9.00	< 500 mg/L
Turbidity	NTU	40	0	41.93	28	0	56.65	12	0	3.87	< 25 NTU
Urea-N	ug/L	306	60	406.25	159	3	545.60	147	57	84.30	NA
Zinc, Total	ug/L	308	34	271.85	160	0	347.24	148	34	52.95	< 200 ug/L

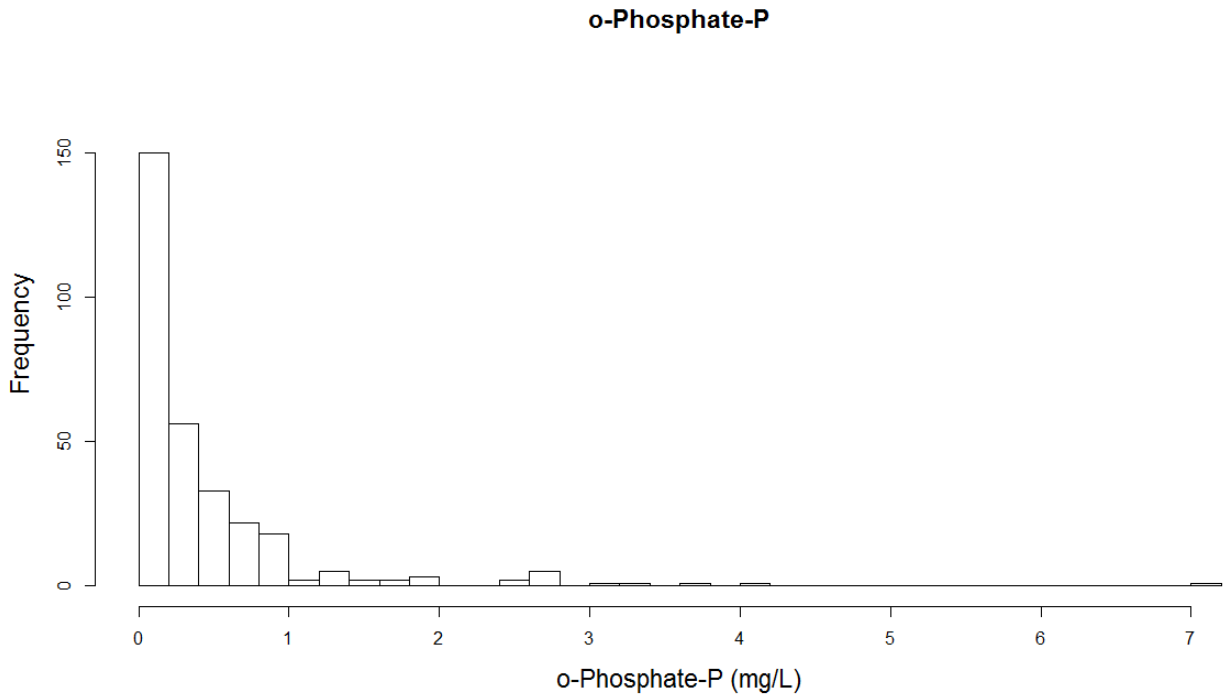
Figure 3: Histograms for Pollutant Concentrations for Combined Wet and Dry Weather Data at All Sites.






Lead, Total
Frequency
0
50
100
150
200
0
20
40
60
80
Lead, Total (ug/L)


Nitrate as N
Frequency
0
50
100
150
0
5
10
15
20
25
30
Nitrate as N (mg/L)


o-Phosphate-P
Frequency
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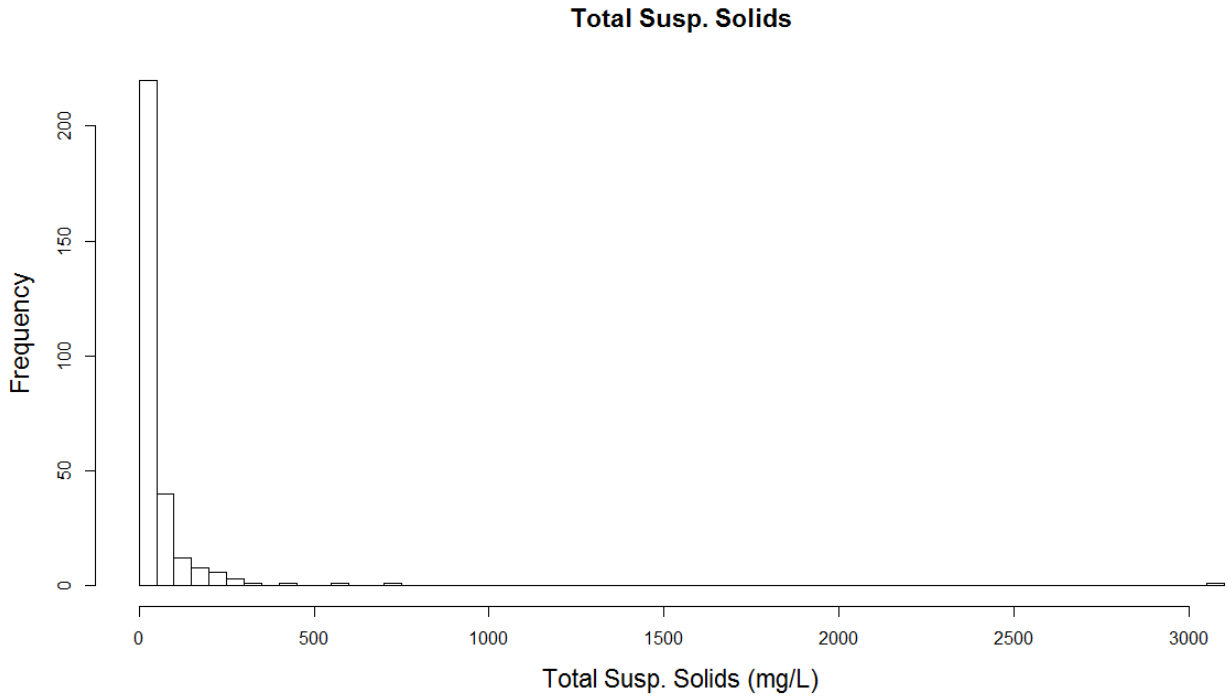
50
100
150
0
1
2
3
4
5
6
7
o-Phosphate-P (mg/L)


Total Susp. Solids
Frequency
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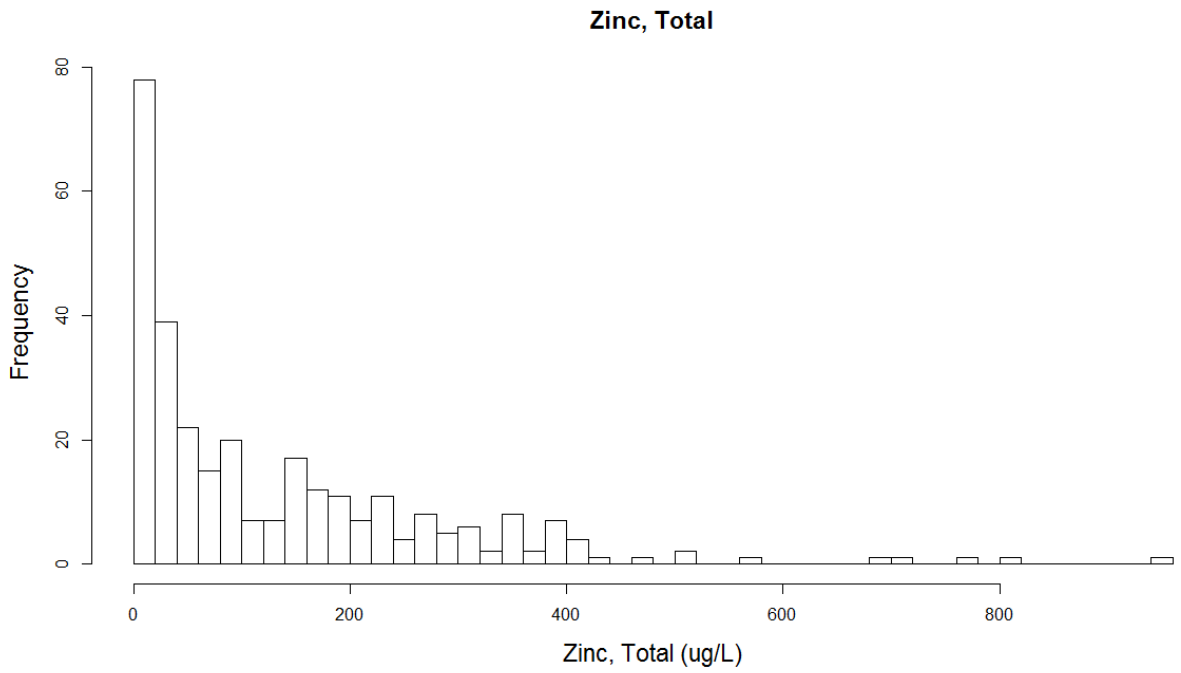
50
100
150
200
0
500
1000
1500
2000
2500
3000
Total Susp. Solids (mg/L)


Zinc, Total
Frequency
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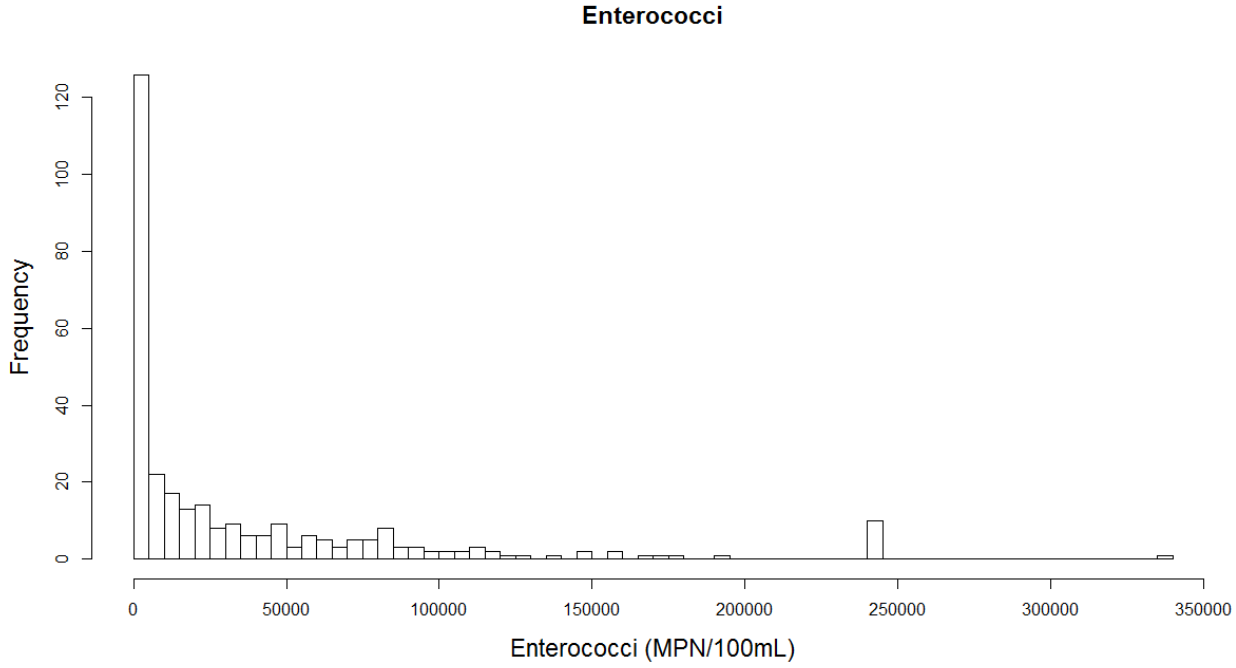
60
80
0
200
400
600
800
Zinc, Total (ug/L)


Enterococci
Frequency
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40
60
80
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200000
250000
300000
350000
Enterococci (MPN/100mL)

Table 5: City of Carmel 85th Percentile: Concentration percentiles for MRSWMP data (2006-2014) for Carmel by analyte or water quality measure.

CARMEL: # Sites = 6		Combined Wet & Dry				Wet Weather				Dry Weather				WQO
Analyte	Units	# Samples	# Non-Detect	City 85th Percentile	Monterey Bay 85th Percentile	# Samples	# Non-Detect	City 85th Percentile	Monterey Bay 85th Percentile	# Samples	# Non-Detect	City 85th Percentile	Monterey Bay 85th Percentile	Receiving Water
Ammonia-N	mg/L	1	0	0.09	0.88	1	0	0.09	1.05	0	NA	NA	0.109	< 50 mg/L
Calcium	mg/L	45	0	68.10	92.00	28	0	25.40	27.67	19	0	75.60	107.20	NA
Coliform, Total	MPN/100mL	40	0	241960	241960	23	0	241960	241960	19	0	19169	48392	NA
Color	Color Units	4	0	363.75	315.00	3	0	367.50	338.75	1	0	7.00	41.40	< 500
Copper,Total	ug/L	49	1	168.82	88.33	30	0	183.65	125.9	20	1	22.90	17.00	< 30 ug/L
E. coli	MPN/100mL	47	0	48801	65216	29	0	66773	112712	20	0	730	10950	< 235 MPN/100 ml
Enterococci	MPN/100mL	48	0	54527	84582	29	0	69622	127501	20	0	1512	11014	< 104 MPN/100 ml
Fluoride	mg/L	5	1	0.61	0.40	4	1	0.63	0.40	1	0	0.10	0.44	NA
Hardness (as CaCO3)	mg/L	45	0	310.40	374.00	28	0	110.93	118.65	19	0	322.80	449.80	> 10 and < 2000 mg/L
Lead,Total	ug/L	52	26	19.00	16.78	33	7	22.90	21.60	20	19	2.50	2.50	< 30 ug/L
Magnesium	mg/L	45	0	35.00	39.00	28	0	12.58	12.64	19	0	36.30	46.00	NA
MBAS (Surfactants)	mg/L	4	2	1.11	0.94	3	1	1.27	1.03	1	1	0.03	0.12	< 0.2 mg/L
Nitrate as N	mg/L	51	8	2.93	2.99	32	3	1.67	1.85	20	5	7.42	3.68	< 2.25 mg/L
o-Phosphate-P	mg/L	50	15	1.01	0.78	31	1	1.14	1.03	20	14	0.21	0.30	< 0.12 mg/L
Potassium	mg/L	4	0	14.15	11.58	3	0	14.60	11.98	1	0	1.60	8.34	<20 mg/L
Total Susp. Solids	mg/L	48	16	134.90	74.63	29	0	222.53	129.3	20	16	4.07	9.18	< 500 mg/L
Turbidity	NTU	4	0	80.65	41.93	3	0	87.10	56.65	1	0	1.10	3.87	< 25 NTU
Urea-N	ug/L	49	17	340.10	414.95	30	0	381.22	557.4	20	17	6.50	86.70	NA
Zinc,Total	ug/L	49	3	297.36	272.63	30	0	331.72	346.08	20	3	92.90	51.00	< 200 ug/L

Table 6: City of Pacific Grove 85th Percentile: Concentration percentiles for MRSWMP data (2006-2014) for Pacific Grove by analyte or water quality measure.

PACIFIC GROVE: # Sites = 15		Combined Wet & Dry				Wet Weather				Dry Weather				WQO
Analyte	Units	# Samples	# Non-Detect	City 85th Percentile	Monterey Bay 85th Percentile	# Samples	# Non-Detect		Monterey Bay 85th Percentile	# Samples	# Non-Detect	City 85th Percentile	Monterey Bay 85th Percentile	Receiving Water
Ammonia-N	mg/L	8	2	1.16	0.88	4	0	1.39	1.05	4	2	0.17	0.109	< 50 mg/L
Calcium	mg/L	120	1	87.30	92.00	57	0	24.40	27.67	63	1	94.70	107.20	NA
Coliform, Total	MPN/100mL	114	0	241960	241960	51	0	241980	241960	63	0	48392	48392	NA
Color	Color Units	13	0	260.00	315.00	7	0	301.50	338.75	6	0	48.00	41.40	< 500
Copper,Total	ug/L	131	12	61.25	88.33	63	0	73.15	125.9	68	12	16.95	17.00	< 30 ug/L
E. coli	MPN/100mL	136	0	55621	65216	68	0	111023	112712	68	0	9691	10950	< 235 MPN/100 ml
Enterococci	MPN/100mL	134	0	85444	84582	66	0	123822	127501	68	0	10838	11014	< 104 MPN/100 ml
Fluoride	mg/L	14	3	0.40	0.40	8	2	0.40	0.40	6	1	0.23	0.44	NA
Hardness (as CaCO3)	mg/L	120	1	374.00	374.00	57	0	104.80	118.65	63	1	408.50	449.80	> 10 and < 2000 mg/L
Lead,Total	ug/L	145	89	13.20	16.78	78	26	19.15	21.60	67	63	2.50	2.50	< 30 ug/L
Magnesium	mg/L	122	3	38.85	39.00	59	2	10.20	12.64	63	1	42.70	46.00	NA
MBAS (Surfactants)	mg/L	13	4	0.87	0.94	7	1	1.03	1.03	6	3	0.11	0.12	< 0.2 mg/L
Nitrate as N	mg/L	131	3	3.06	2.99	63	2	1.85	1.85	68	1	3.68	3.68	< 2.25 mg/L
o-Phosphate-P	mg/L	131	36	0.72	0.78	64	3	1.04	1.03	67	33	0.20	0.30	< 0.12 mg/L
Potassium	mg/L	13	0	11.80	11.58	7	0	13.10	11.98	6	0	6.48	8.34	<20 mg/L
Total Susp. Solids	mg/L	129	37	56.13	74.63	62	0	81.00	129.3	67	37	8.00	9.18	< 500 mg/L
Turbidity	NTU	13	0	21.50	41.93	7	0	23.60	56.65	6	0	4.80	3.87	< 25 NTU
Urea-N	ug/L	130	24	385.15	414.95	63	0	453.50	557.4	67	24	86.40	86.70	NA
Zinc,Total	ug/L	131	25	198.75	272.63	63	0	275.68	346.08	68	25	36.95	51.00	< 200 ug/L

Table 7: City of Monterey 85th Percentile: Concentration percentiles for MRSWMP data (2006-2014) for Monterey by analyte or water quality measure.

MONTEREY: # Sites = 7		Combined Wet & Dry				Wet Weather				Dry Weather				WQO
Analyte	Units	# Samples	# Non-Detect	City 85th Percentile	Monterey Bay 85th Percentile	# Samples	# Non-Detect		Monterey Bay 85th Percentile	# Samples	# Non-Detect	City 85th Percentile	Monterey Bay 85th Percentile	Receiving Water
Ammonia-N	mg/L	10	0	0.81	0.88	6	0	3.26	1.05	4	0	0.09	0.109	< 50 mg/L
Calcium	mg/L	82	0	127.10	92.00	36	0	32.63	27.67	45	0	168.00	107.20	NA
Coliform, Total	MPN/100mL	85	0	241960	241960	39	0	241972	241960	45	0	48392	48392	NA
Color	Color Units	14	0	229.50	315.00	9	0	297.00	338.75	5	0	31.20	41.40	< 500
Copper,Total	ug/L	85	5	83.07	88.33	36	1	122.75	125.9	48	4	17.95	17.00	< 30 ug/L
E. coli	MPN/100mL	87	0	84102	65216	38	0	128716	112712	48	0	13734	10950	< 235 MPN/100 ml
Enterococci	MPN/100mL	86	0	73286	84582	37	0	131801	127501	48	0	16239	11014	< 104 MPN/100 ml
Fluoride	mg/L	16	5	0.40	0.40	11	5	0.35	0.40	5	0	0.54	0.44	NA
Hardness (as CaCO3)	mg/L	82	0	484.65	374.00	36	0	134.50	118.65	45	0	689.20	449.80	> 10 and < 2000 mg/L
Lead,Total	ug/L	91	57	14.75	16.78	42	12	22.43	21.60	48	45	2.50	2.50	< 30 ug/L
Magnesium	mg/L	82	0	45.00	39.00	36	0	12.38	12.64	45	0	57.80	46.00	NA
MBAS (Surfactants)	mg/L	14	3	0.56	0.94	9	3	0.86	1.03	5	0	0.12	0.12	< 0.2 mg/L
Nitrate as N	mg/L	86	5	3.05	2.99	37	1	2.30	1.85	48	4	3.10	3.68	< 2.25 mg/L
o-Phosphate-P	mg/L	86	20	0.63	0.78	37	2	2.21	1.03	48	18	0.30	0.30	< 0.12 mg/L
Potassium	mg/L	14	0	11.05	11.58	9	0	8.84	11.98	5	0	13.80	8.34	<20 mg/L
Total Susp. Solids	mg/L	83	30	71.80	74.63	34	0	90.98	129.3	48	30	6.95	9.18	< 500 mg/L
Turbidity	NTU	14	0	31.78	41.93	9	0	35.90	56.65	5	0	2.72	3.87	< 25 NTU
Urea-N	ug/L	84	13	593.88	414.95	35	0	903.30	557.4	48	13	126.45	86.70	NA
Zinc,Total	ug/L	85	4	319.67	272.63	36	0	398.63	346.08	48	4	61.90	51.00	< 200 ug/L

III. TREND ANALYSIS

Trends were evaluated for each site using the monotonic, non-parametric Mann-Kendall test (Kendall 1938, Mann 1945, Kendall 1948) using combined post-permit and pre-permit data. This test was chosen because it does not require that the data conform to any particular distribution. This is important for maintaining comparability of data in a data set such as MRSWMP since water quality data were positively skewed and often to varying degrees, so conducting transformations in order to perform parametric statistics is less accurate. Due to the variation found between data under wet and dry weather conditions, the trend analysis was performed separately for each condition. Trends were evaluated for sites with ≥ 5 samples.

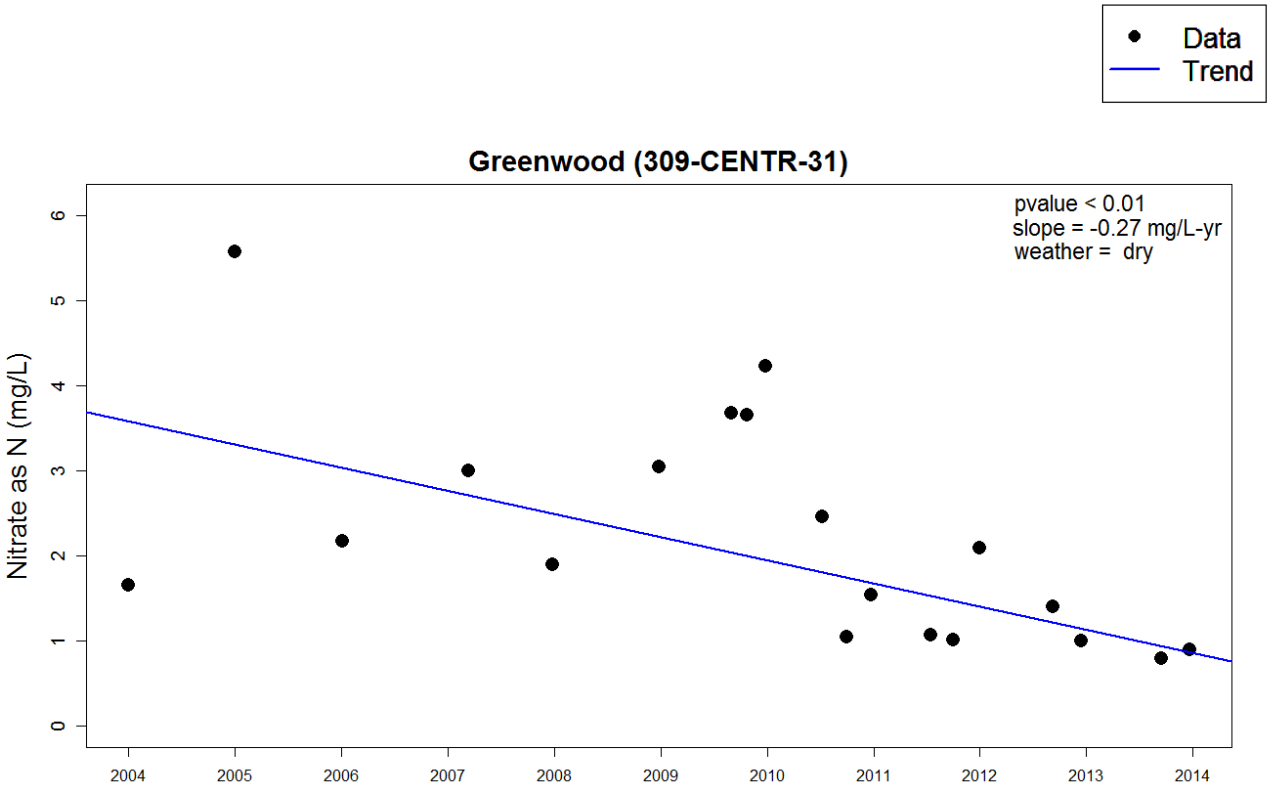
As statistics is based on probability, there is always the chance of making an error and either falsely identifying a trend when in actuality there is none (Type 1 error) or not identifying a trend when one does actually exist (Type 2 error). The chance of making an error is diminished with increasing data. To be cautious about making a Type 1 error, we set our significance level at a p-value of 0.05. This p-value implies that we have a 5% chance of incorrectly asserting there is a trend when there is not one. Due to the few number of samples (n= 5 to 19) for analyzing site trends, there is a high likelihood of making a Type 2 error. In other words, a trend may exist, but we have an insufficient number of data points necessary to detect it. With increasing years of sampling, this trend may become apparent in the future.

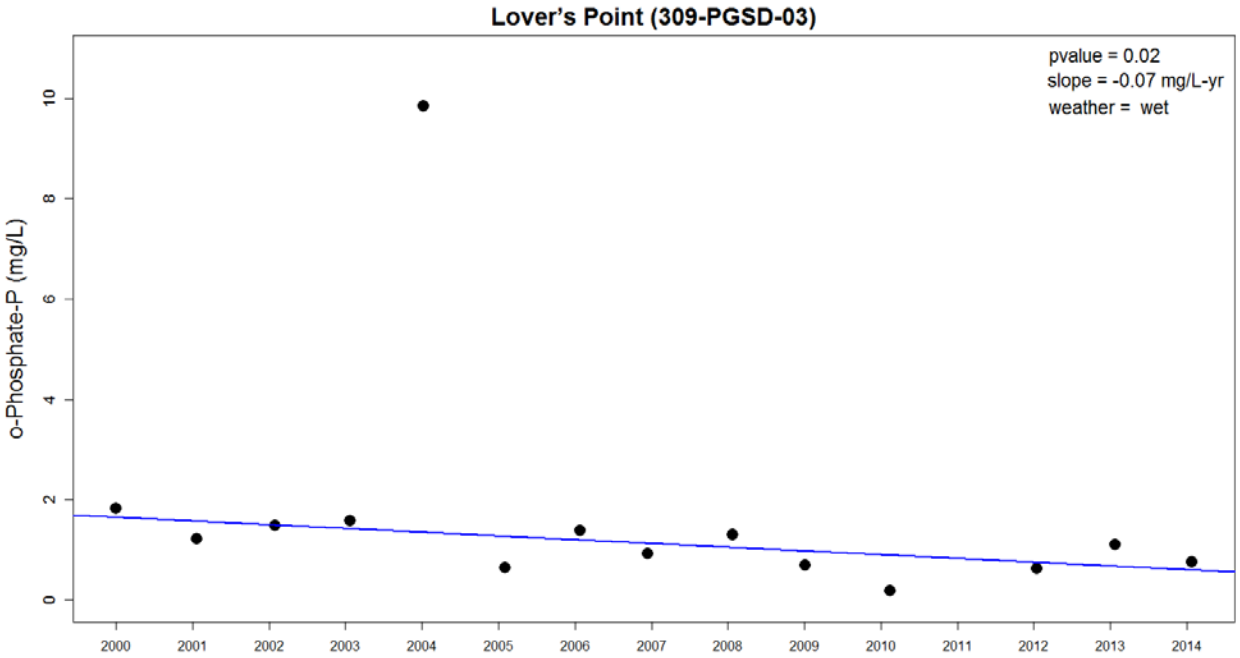
Each trend observed at sites is portrayed in Table 8. We note the pollutant (analyte), whether it was a wet or dry season trend, the range of years over which we collected data at that site, the number of sample days, the maximum concentration observed at that site over all sampling events, and the percent of events where samples were above the 85th percentile. In addition we report the Theil-Sen slope, the tau value and the p-value for the Mann-Kendall test.

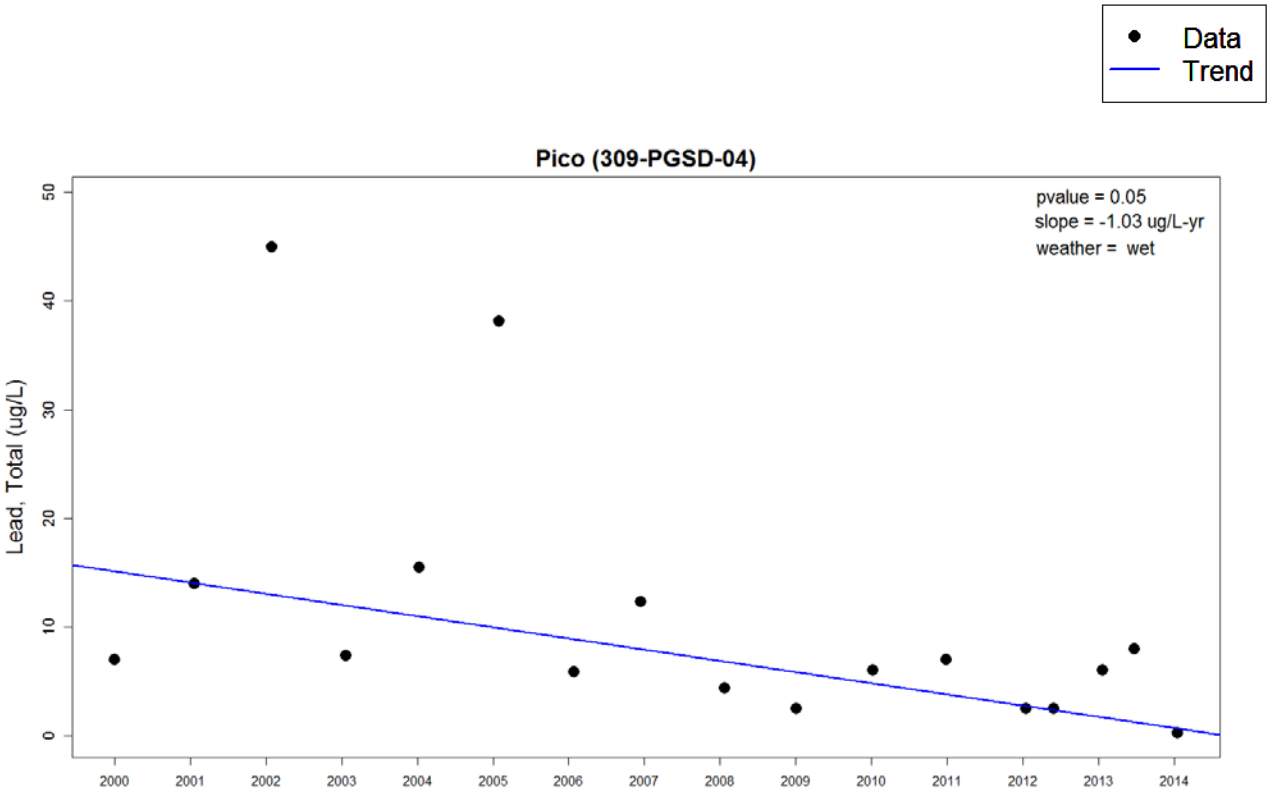
A total of 16 trends were found, out of which 14 trends represented improvement in water quality shown by their declining slope. Two trends represented a worsening of water quality shown by their increasing slope. Trends were found at 9 different sites located within 3 cities: Monterey, Pacific Grove and Seaside. There were no trends observed at any Carmel sites or at the Monterey County sites. Trends were found for 8 pollutants (*E. coli*, *Enterococci*, zinc, lead, nitrate, total suspended solids, urea, and o-phosphate) and no trends were found for 4 pollutants (ammonia, copper, fluoride, MBAS surfactants). Decreasing trends (improving water quality) for o-phosphate were found at 4 sites, for *Enterococci* at 3 sites, and for urea and lead at 2 sites. The only *E. coli* trend found was increasing. Zinc had one increasing and one decreasing trend, both at the same site (309-PGSD-04) for dry and wet weather respectively.

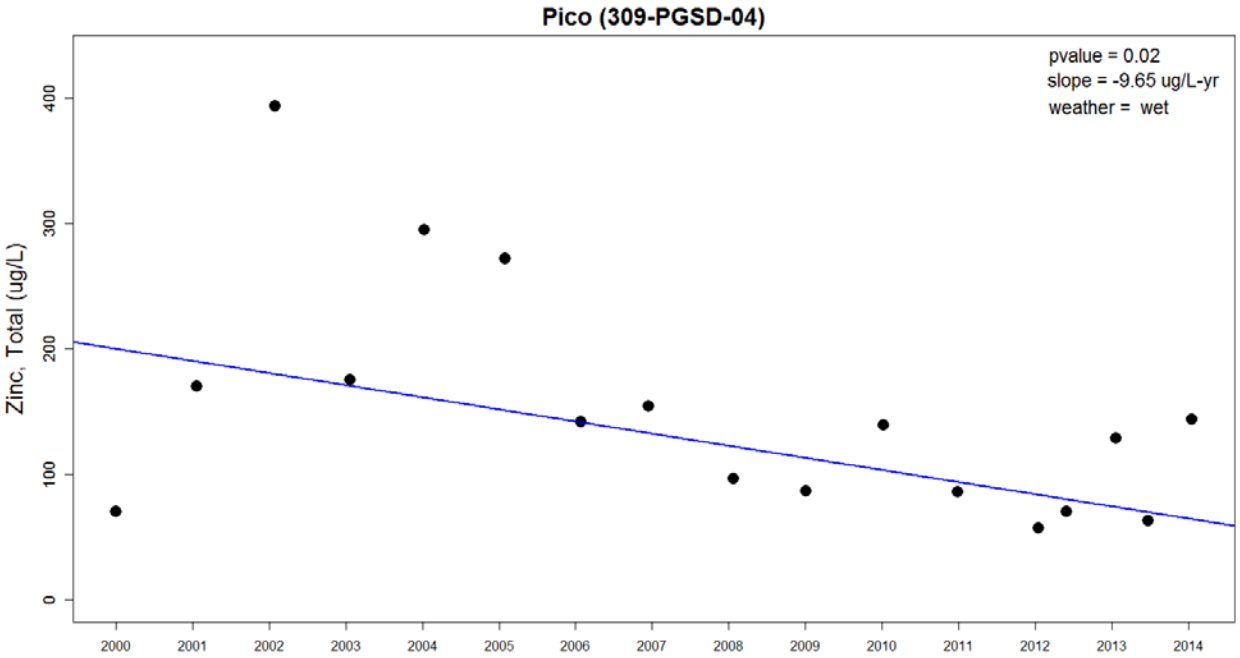
Table 8. Trend Test results showing sites where a trend (p-value<=0.05) was detected in concentration over the time period of monitoring. Sites with less than 5 years of monitoring could not be assessed.

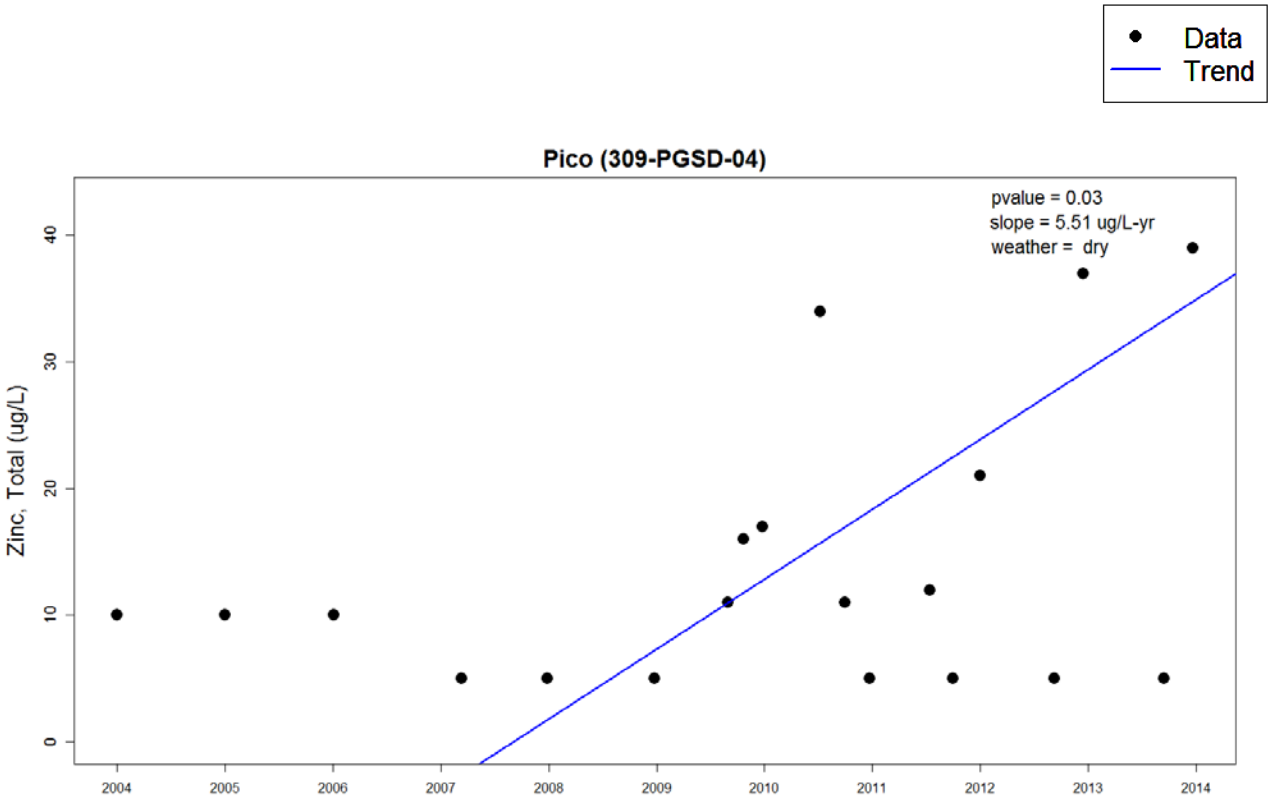
Site ID	Site Name	Analyte	Event	Year Range	# Sample Days	Maximum Concentration	Units	Slope (Units/yr)	p-value
309-MSD-03	Twin 51's	*Enterococci*	wet	2006-2014	12	>241960	MPN/100mL	-23652	<0.01
309-MSD-03	Twin 51's	o-Phosphate-P	dry	2004-2014	19	0.37	mg/L	-0.04	<0.01
309-MSD-04	San Carlos	Urea-N	dry	2006-2013	13	878	ug/L	-8.76	0.05
309-MSD-05	Steinbeck	*Enterococci*	wet	2006-2014	12	>241960	MPN/100mL	-19308	0.04
309-MSD-05	Steinbeck	o-Phosphate-P	dry	2004-2014	18	3.1	mg/L	-0.06	0.05
309-MSD-05	Steinbeck	Total Susp. Solids	dry	2004-2014	18	18	mg/L	-1.51	0.02
309-CENTR-31	Greenwood	Nitrate as N	dry	2004-2014	19	5.57	mg/L	-0.27	<0.01
309-PGSD-03	Lover's Point	o-Phosphate-P	wet	2000-2014	15	9.85	mg/L	-0.08	0.02
309-PGSD-04	Pico	Lead, Total	wet	2000-2014	20	56	ug/L	-1.03	0.05
309-PGSD-04	Pico	Zinc, Total	wet	2000-2014	17	393.33	ug/L	-9.65	0.02
309-PGSD-04	Pico	Zinc, Total	dry	2004-2014	19	39	ug/L	5.52	0.03
309-PGSD-06	Congress	*E. coli*	dry	2004-2010	6	>48384	MPN/100mL	2430	0.02
309-PGSD-09	HopkinsMon	Lead, Total	dry	2008-2013	9	10	ug/L	-10.13	0.04
309-PGSD-09	HopkinsMon	Urea-N	dry	2008-2013	9	193	ug/L	-92.29	0.04
309-SSD-03	Hotel	*Enterococci*	dry	2007-2012	9	>48384	MPN/100mL	-50.60	0.04
309-SSD-03	Hotel	o-Phosphate-P	dry	2007-2012	9	0.6	mg/L	-0.11	0.03

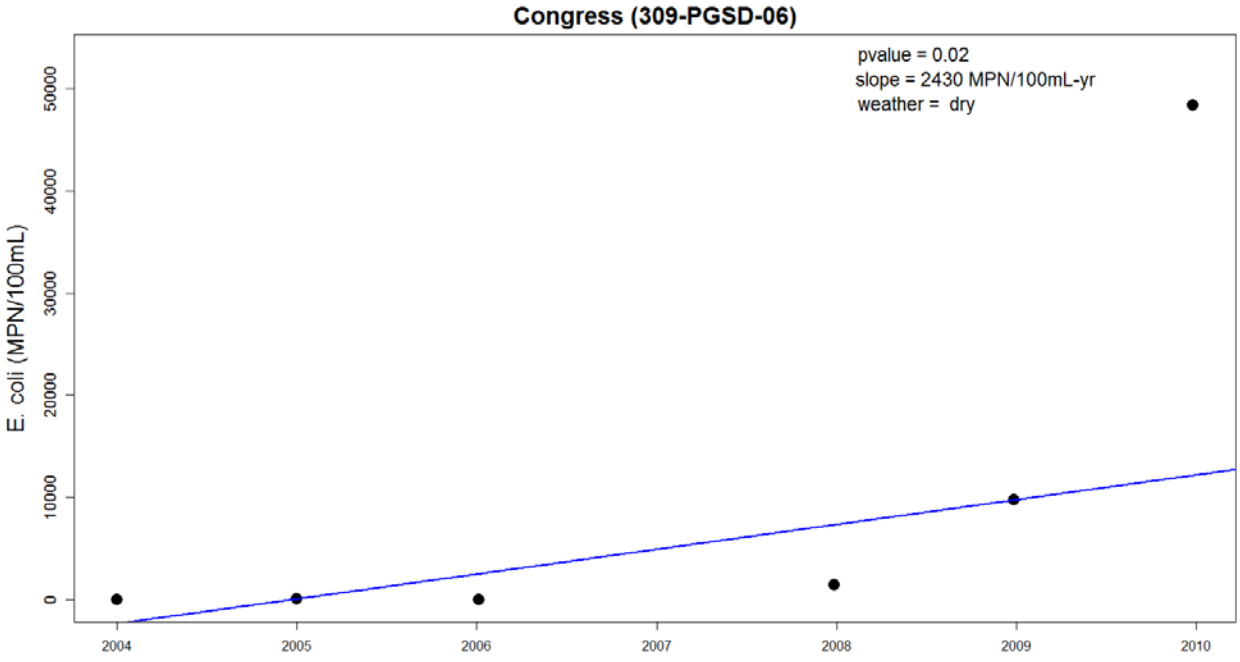

Data
Trend
Greenwood (309-CENTR-31)
pvalue < 0.01
slope = -0.27 mg/L-yr
weather = dry
Nitrate as N (mg/L)
0
1
2
3
4
5
6
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014


Lover's Point (309-PGSD-03)
pvalue = 0.02
slope = -0.07 mg/L-yr
weather = wet
o-Phosphate-P (mg/L)
0
2
4
6
8
10
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014

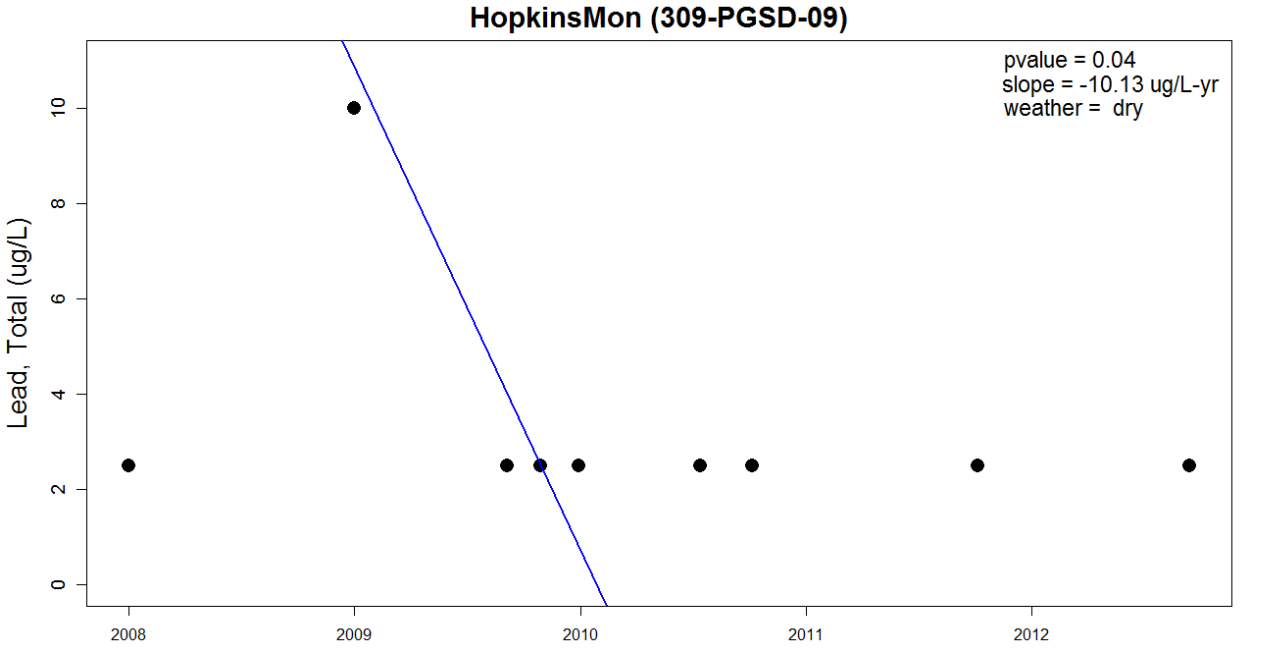

Data
Trend
Pico (309-PGSD-04)
pvalue = 0.05
slope = -1.03 ug/L-yr
weather = wet
Lead, Total (ug/L)
0
10
20
30
40
50
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014

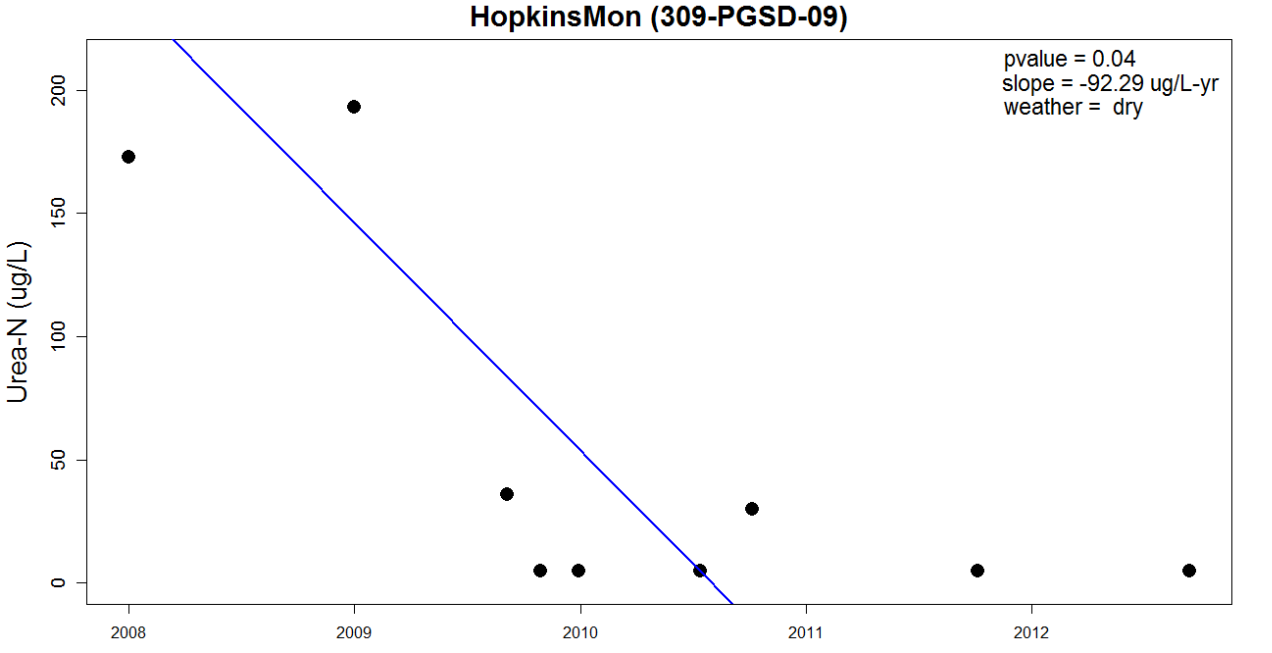

Pico (309-PGSD-04)
pvalue = 0.02
slope = -9.65 ug/L-yr
weather = wet
Zinc, Total (ug/L)
0
100
200
300
400
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014

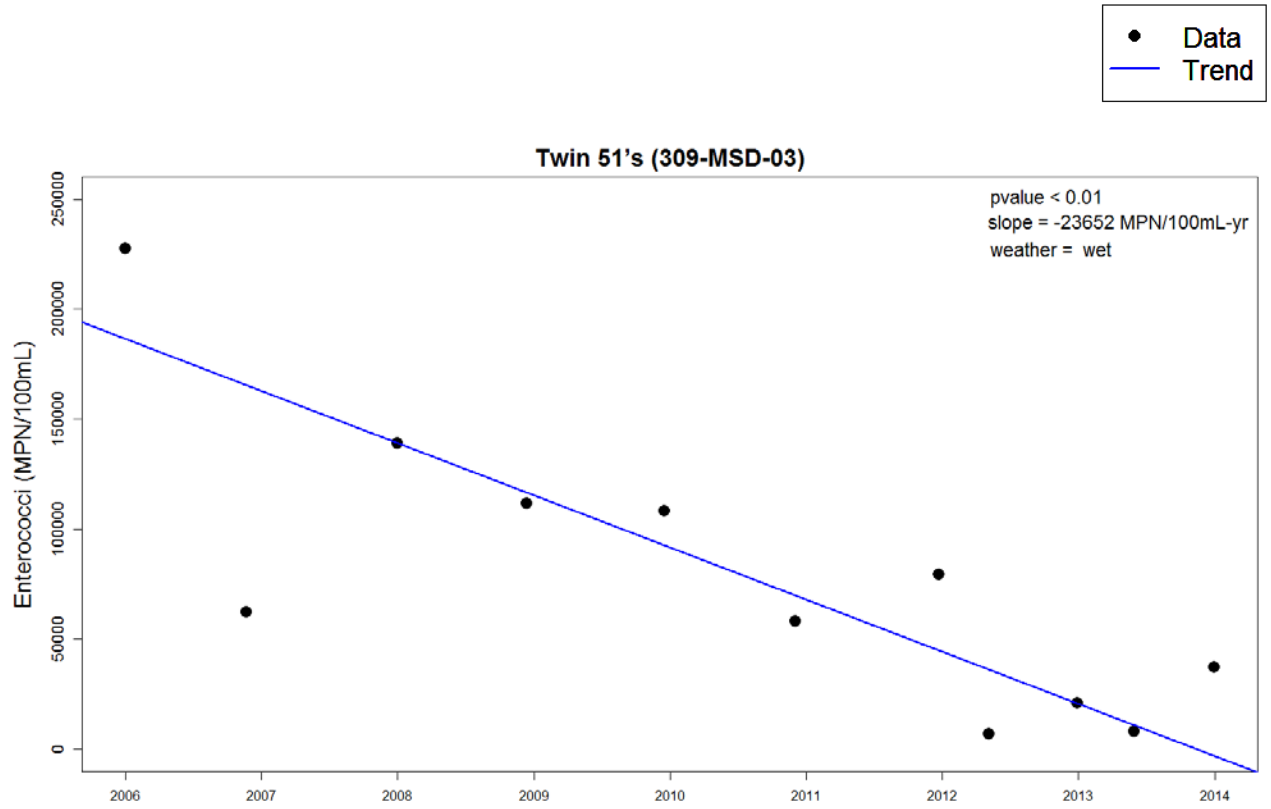

Data
Trend
Pico (309-PGSD-04)
pvalue = 0.03
slope = 5.51 ug/L-yr
weather = dry
Zinc, Total (ug/L)
0
10
20
30
40
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014

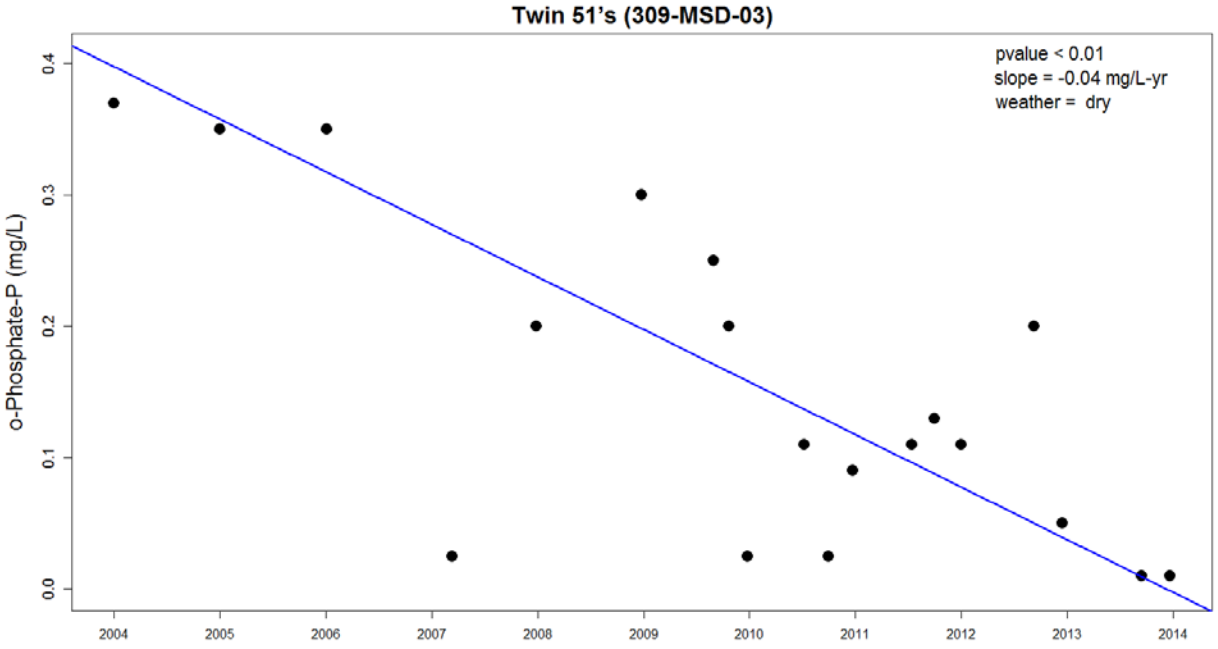

Congress (309-PGSD-06)
pvalue = 0.02
slope = 2430 MPN/100mL-yr
weather = dry
E. coli (MPN/100mL)
0
10000
20000
30000
40000
50000
2004
2005
2006
2007
2008
2009
2010

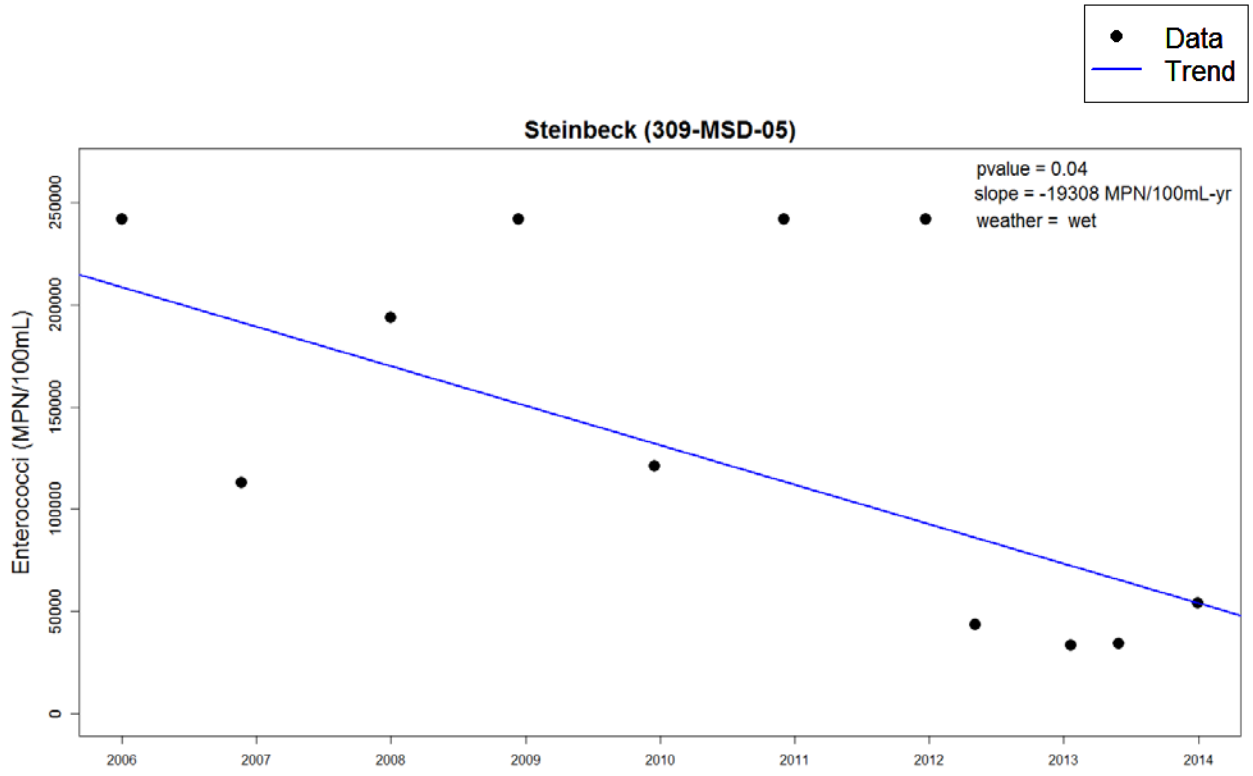
Lead measurements at HopkinsMon were non-detectable for all years except 2009. This early detection has resulted in a slope the declines rapidly to zero. The Thiel-Sen slope reports the median slope from all the slopes of the lines connecting the data points, resulting in this odd slope, in this case due to the non-detect values.

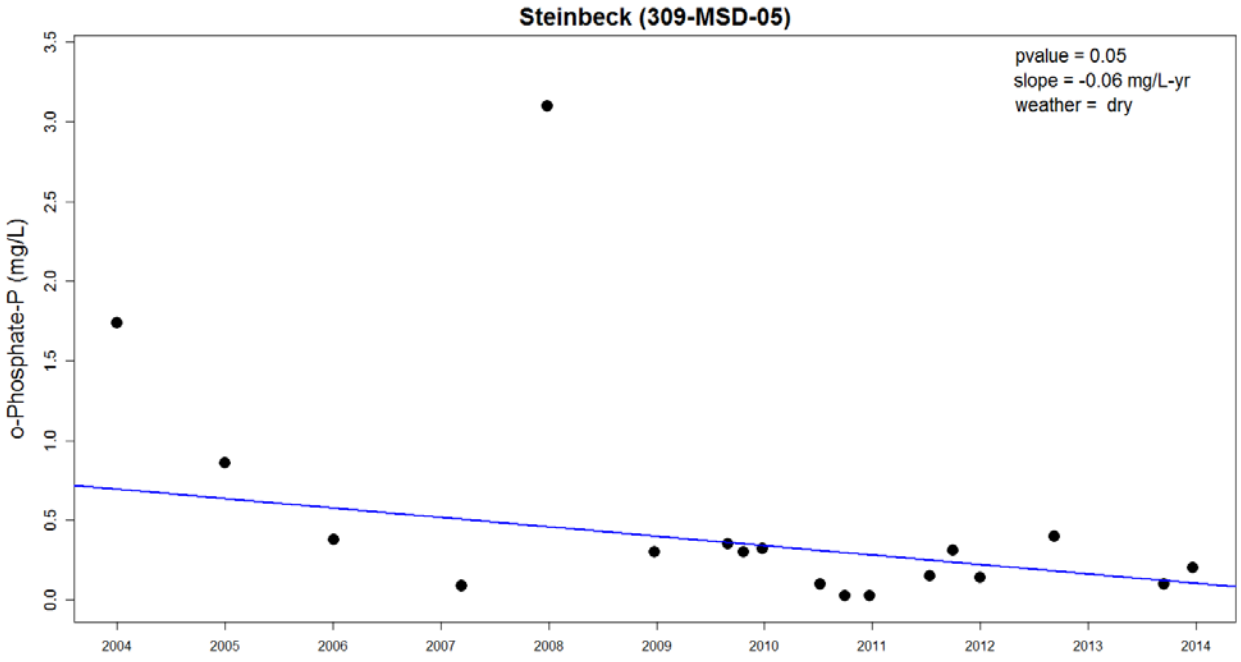


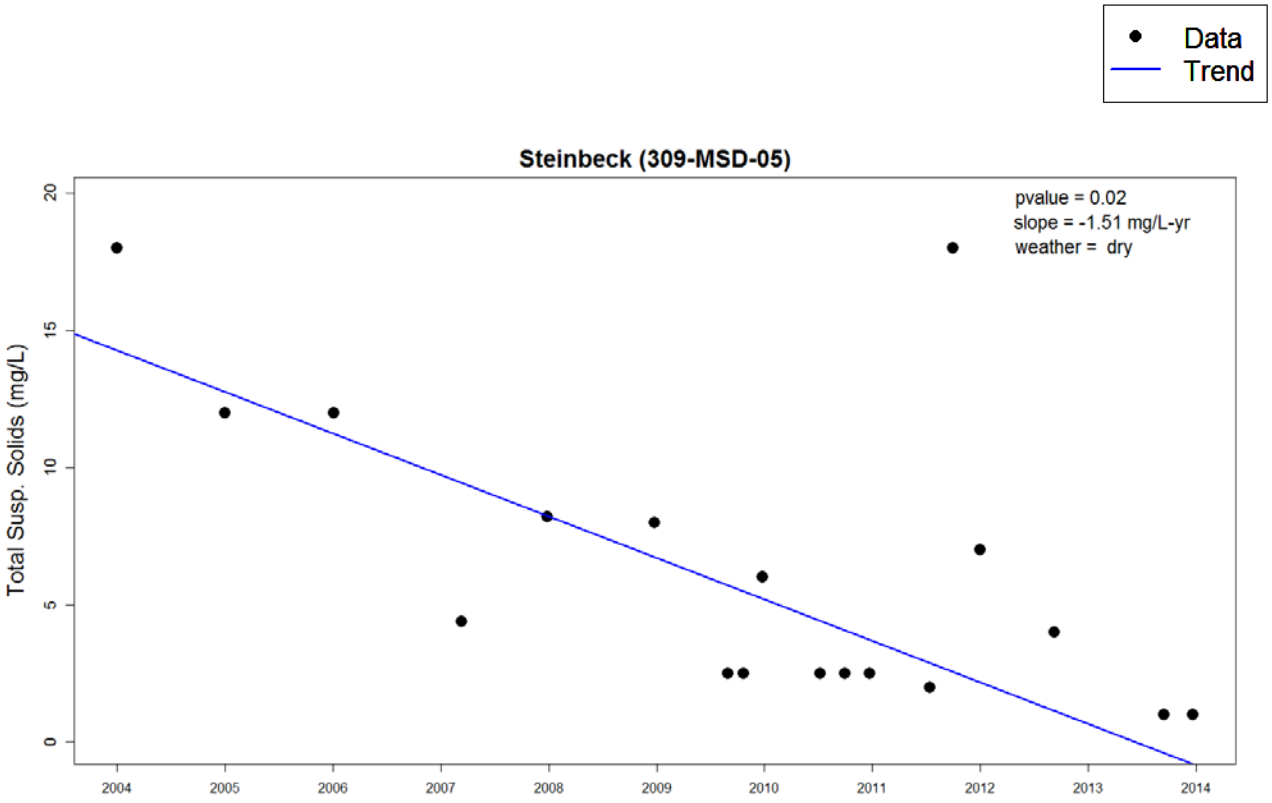


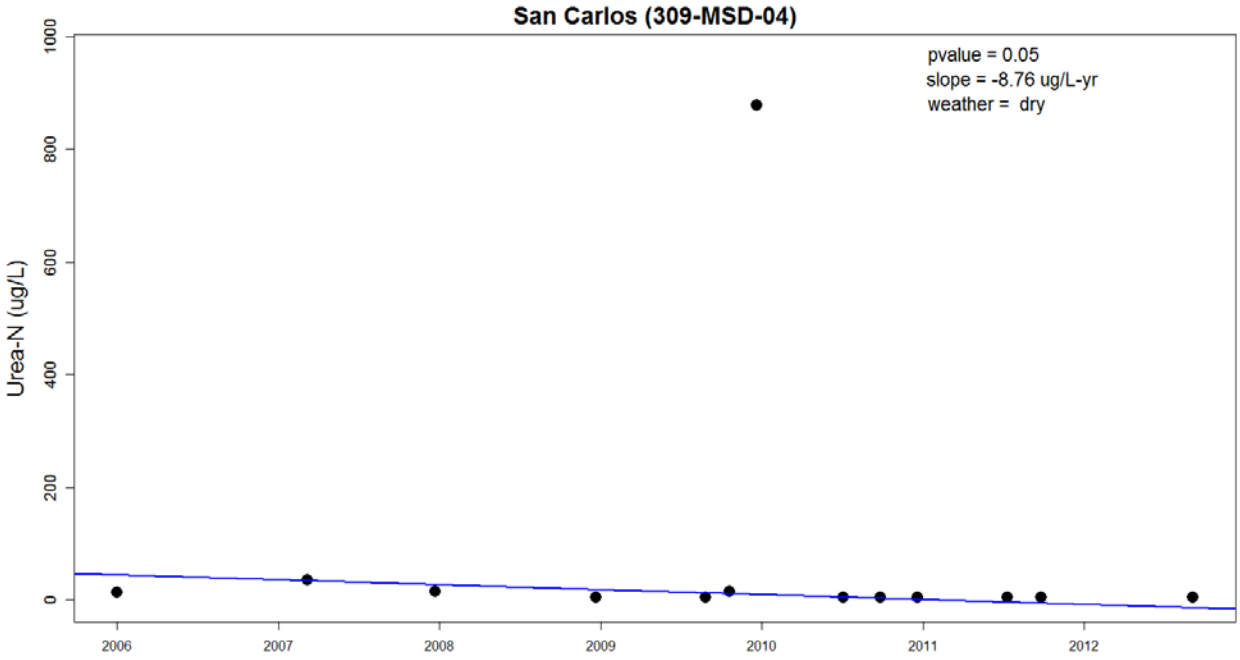

Data
Trend
Twin 51's (309-MSD-03)
pvalue < 0.01
slope = -23652 MPN/100mL-yr
weather = wet
Enterococci (MPN/100mL)
0
50000
100000
150000
200000
250000
2006
2007
2008
2009
2010
2011
2012
2013
2014

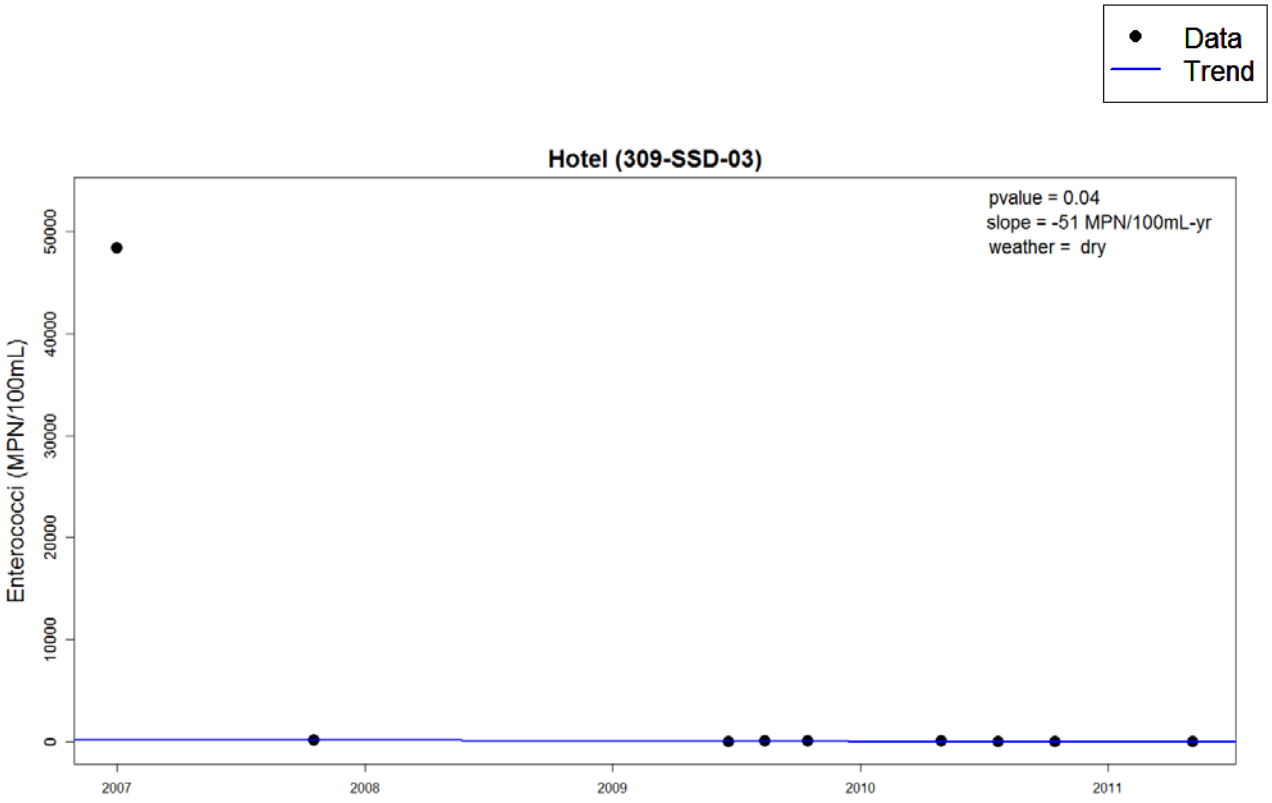

Twin 51's (309-MSD-03)
pvalue < 0.01
slope = -0.04 mg/L-yr
weather = dry
o-Phosphate-P (mg/L)
0.0
0.1
0.2
0.3
0.4
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014

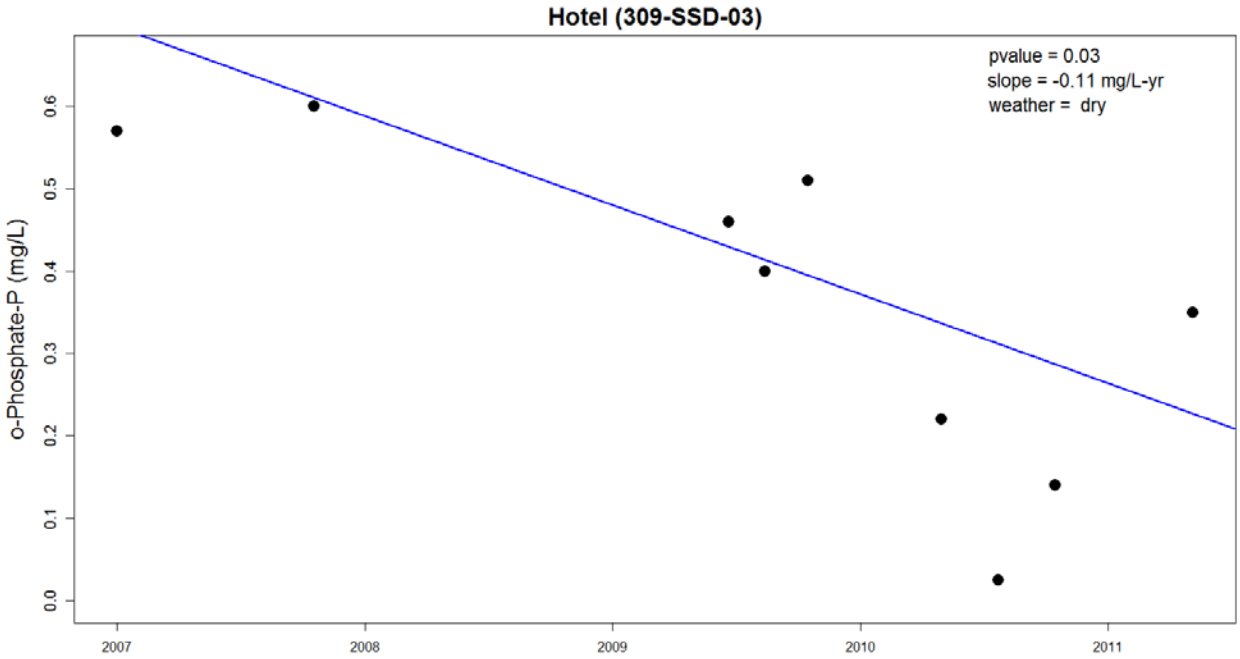

Data
Trend
Steinbeck (309-MSD-05)
pvalue = 0.04
slope = -19308 MPN/100mL-yr
weather = wet
Enterococci (MPN/100mL)
0
50000
100000
150000
200000
250000
2006
2007
2008
2009
2010
2011
2012
2013
2014


Steinbeck (309-MSD-05)
pvalue = 0.05
slope = -0.06 mg/L-yr
weather = dry
o-Phosphate-P (mg/L)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014


Data
Trend
Steinbeck (309-MSD-05)
pvalue = 0.02
slope = -1.51 mg/L-yr
weather = dry
Total Susp. Solids (mg/L)
0
5
10
15
20
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014


San Carlos (309-MSD-04)
pvalue = 0.05
slope = -8.76 ug/L-yr
weather = dry
Urea-N (ug/L)
0
200
400
600
800
1000
2006
2007
2008
2009
2010
2011
2012


Data
Trend
Hotel (309-SSD-03)
pvalue = 0.04
slope = -51 MPN/100mL-yr
weather = dry
Enterococci (MPN/100mL)
0
10000
20000
30000
40000
50000
2007
2008
2009
2010
2011


Hotel (309-SSD-03)
pvalue = 0.03
slope = -0.11 mg/L-yr
weather = dry
o-Phosphate-P (mg/L)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
2007
2008
2009
2010
2011

IV. INSTANTANEOUS LOAD

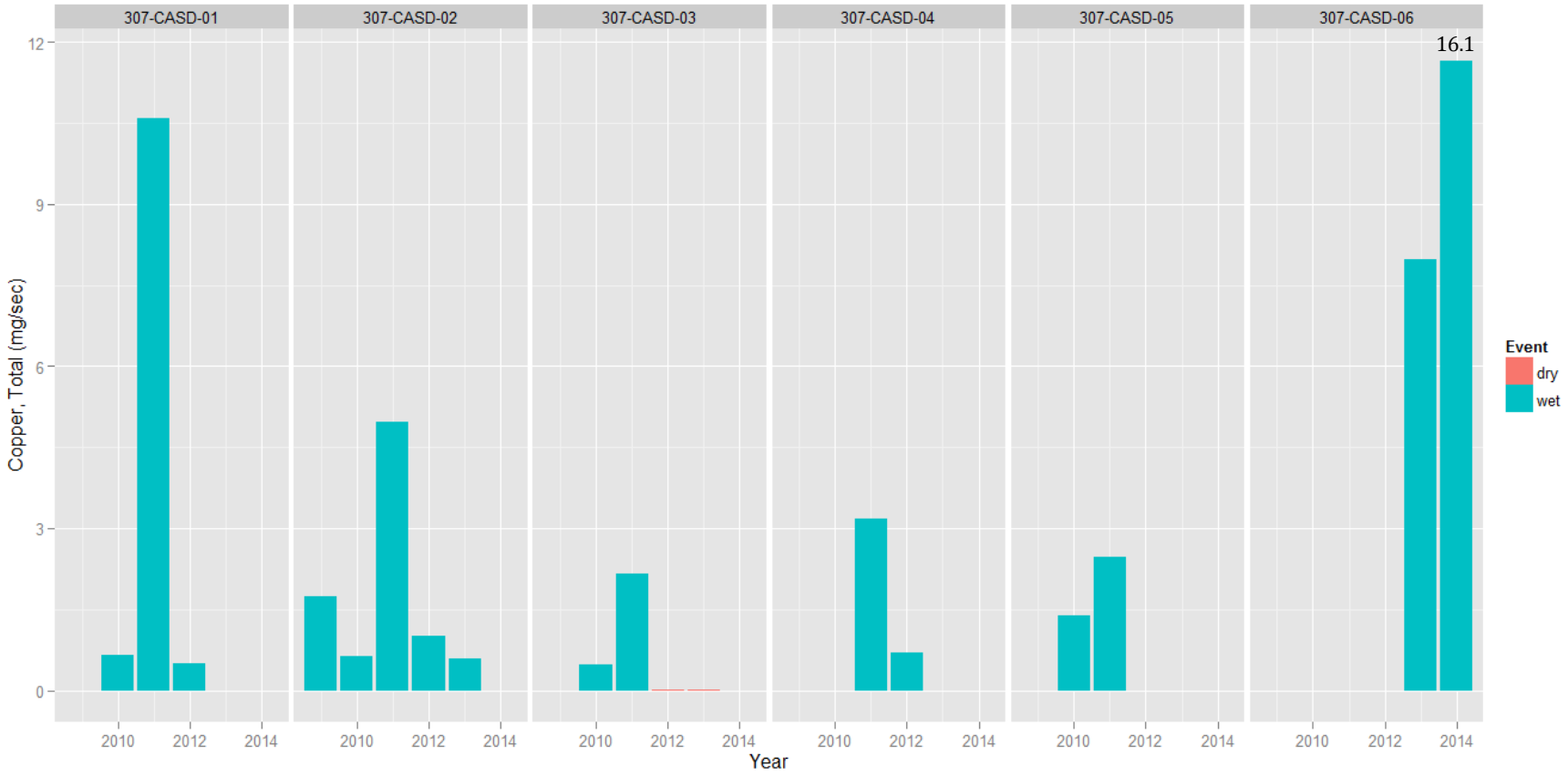
Load was determined for sites where there was both a measure of flow and concentration at the time of sampling. For each day of sampling, the load measures from the time series were averaged to compute the instantaneous load on that day. Annual load cannot be extrapolated from these instantaneous loads as both concentration and flow are highly variable and MRSWMP sampling occurred only between 2 and 4 times per year. Events are classified as wet or dry, where wet events represented samples and measures taken during the first rainfall of the water year and dry events occur prior to rainfall. On some occasions, sites were dry and could not be monitored during the dry season. In these cases, there was no sample taken.

For the instantaneous load bar charts, when sites were monitored multiple times during either wet or dry events in a single year, the average load for this wet or dry event was calculated for the year for the graphic.

Flow rates for Lover's Point (309-PGSD-03) were extrapolated from flow measured at Greenwood Park (309-CENTR-31) when these two sites were sampled on the same day. This was necessary because it is not possible to measure flow at Lover's Point. As the two watersheds are similar in terms of coverage (both are 90% residential and 10% commercial) and are located adjacent to one another, this approximation seems reasonable. Lover's Point has a watershed area of 222 acres and Greenwood Park of 250 acres. The approximation accounted for the difference in watershed drainage area, which is a ratio of 111/125.

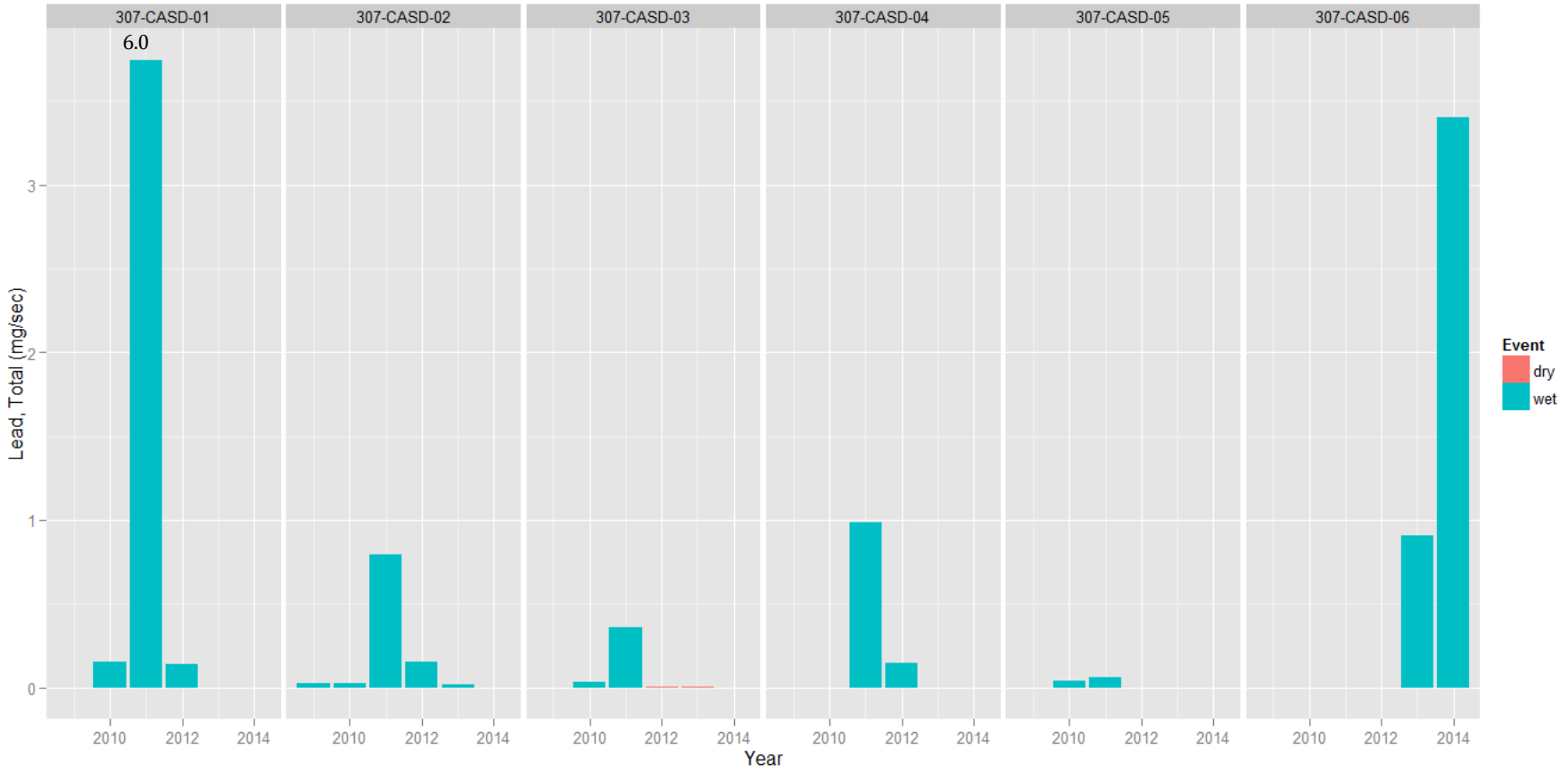
INSTANTANEOUS COPPER LOAD (MG/SEC)

Note: In order to better display the load comparison, the maximum value of the bar chart was set to slightly greater than the next lower load measurement. The value for the highest load is noted above the load bar.



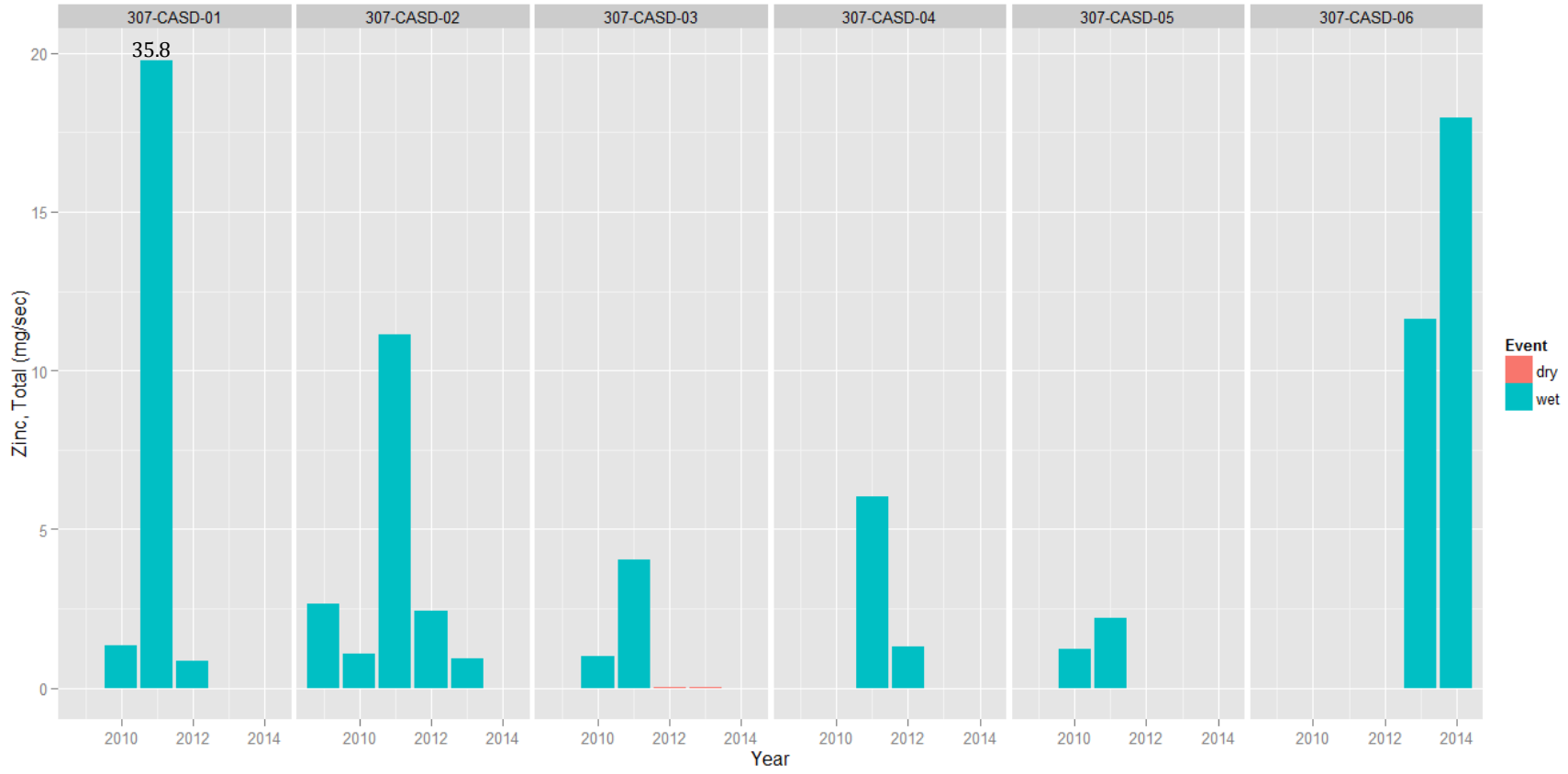
INSTANTANEOUS LEAD LOAD (MG/SEC)

Note: In order to better display the load comparison, the maximum value of the bar chart was set to slightly greater than the next lower load measurement. The value for the highest load is noted above the load bar.



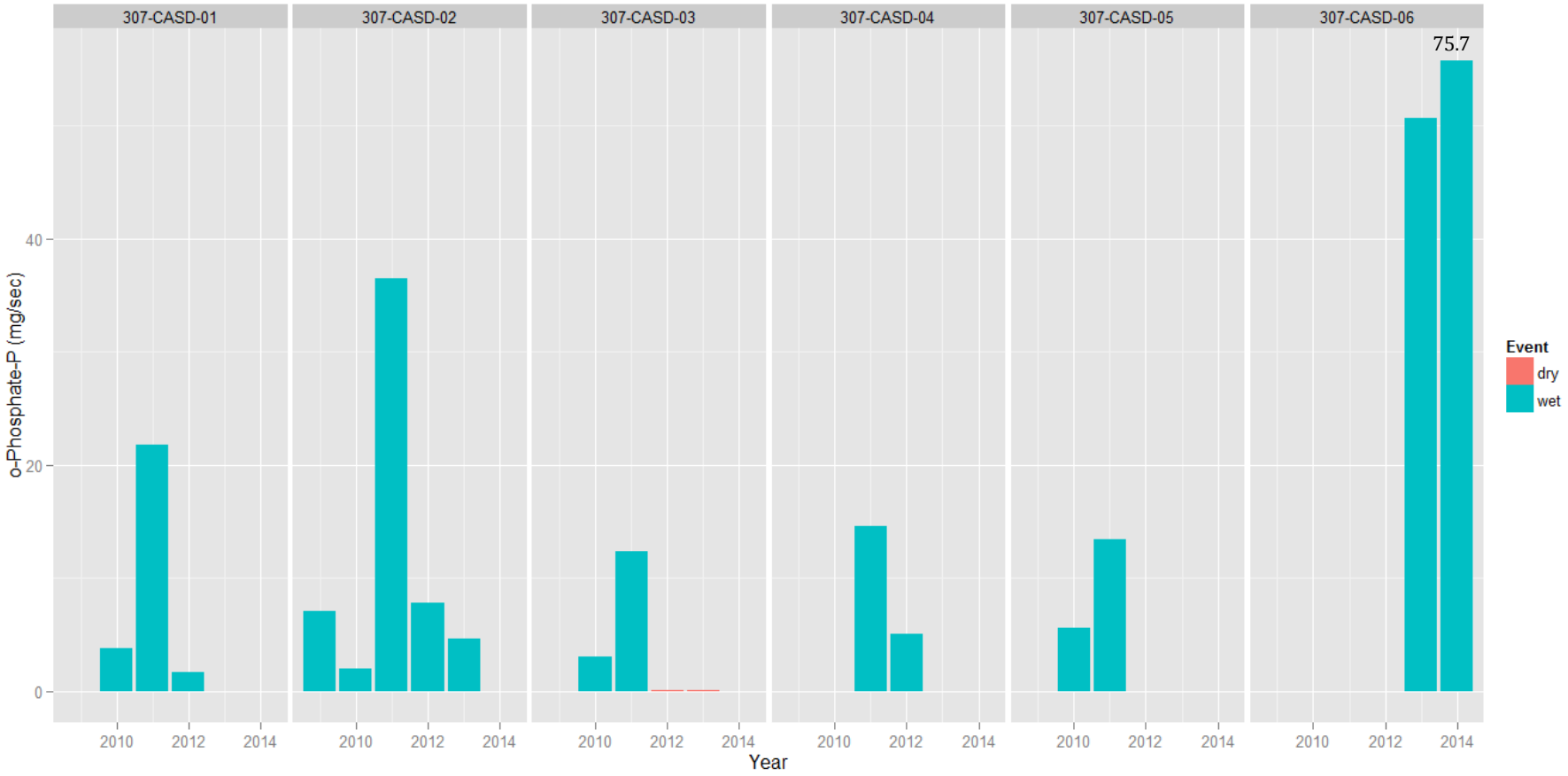
INSTANTANEOUS ZINC LOAD (MG/SEC)

Note: In order to better display the load comparison, the maximum value of the bar chart was set to slightly greater than the next lower load measurement. The value for the highest load is noted above the load bar.



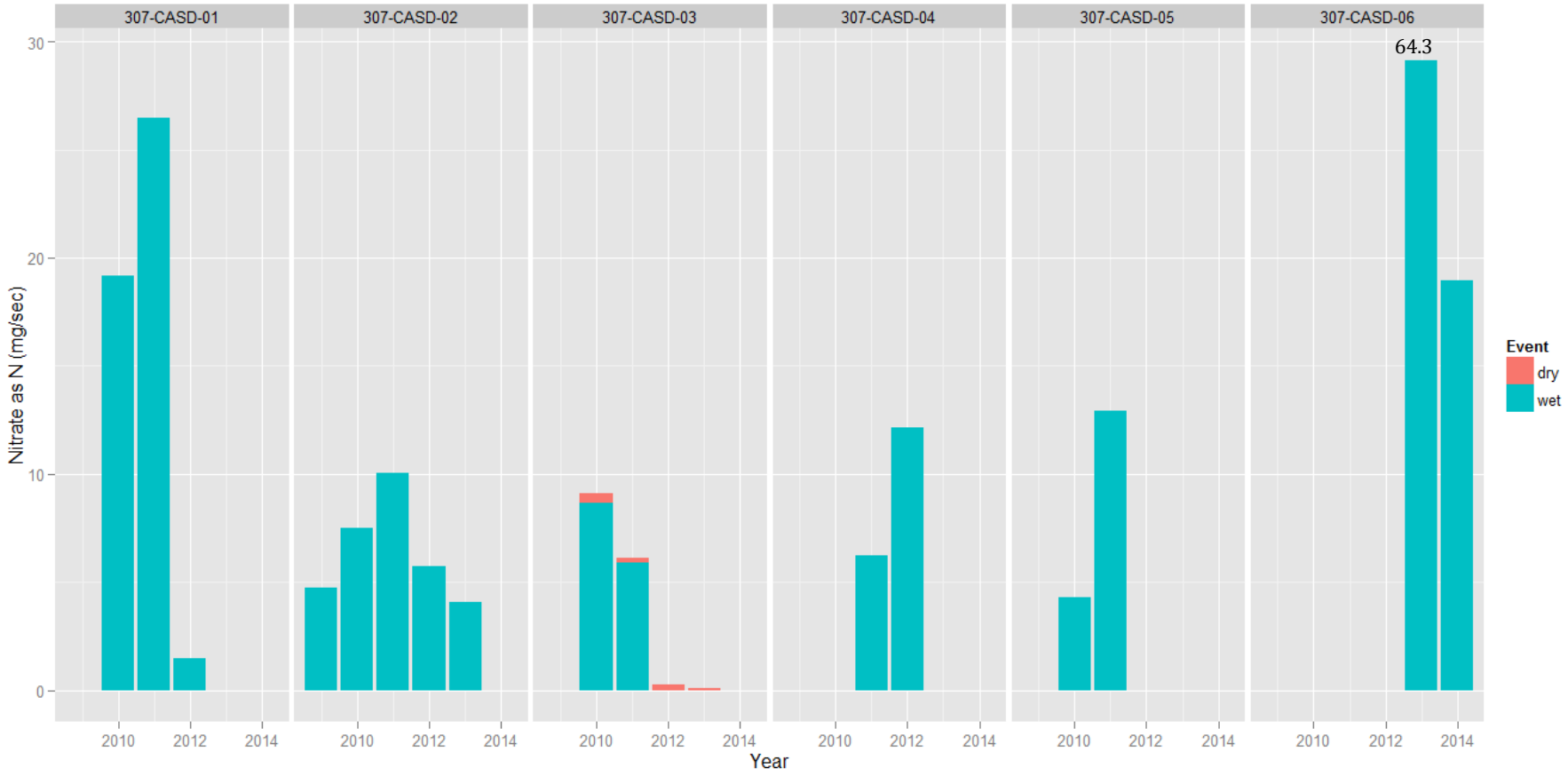
INSTANTANEOUS ORTHOPHOSPHATE LOAD (MG/SEC)

Note: In order to better display the load comparison, the maximum value of the bar chart was set to slightly greater than the next lower load measurement. The value for the highest load is noted above the load bar.



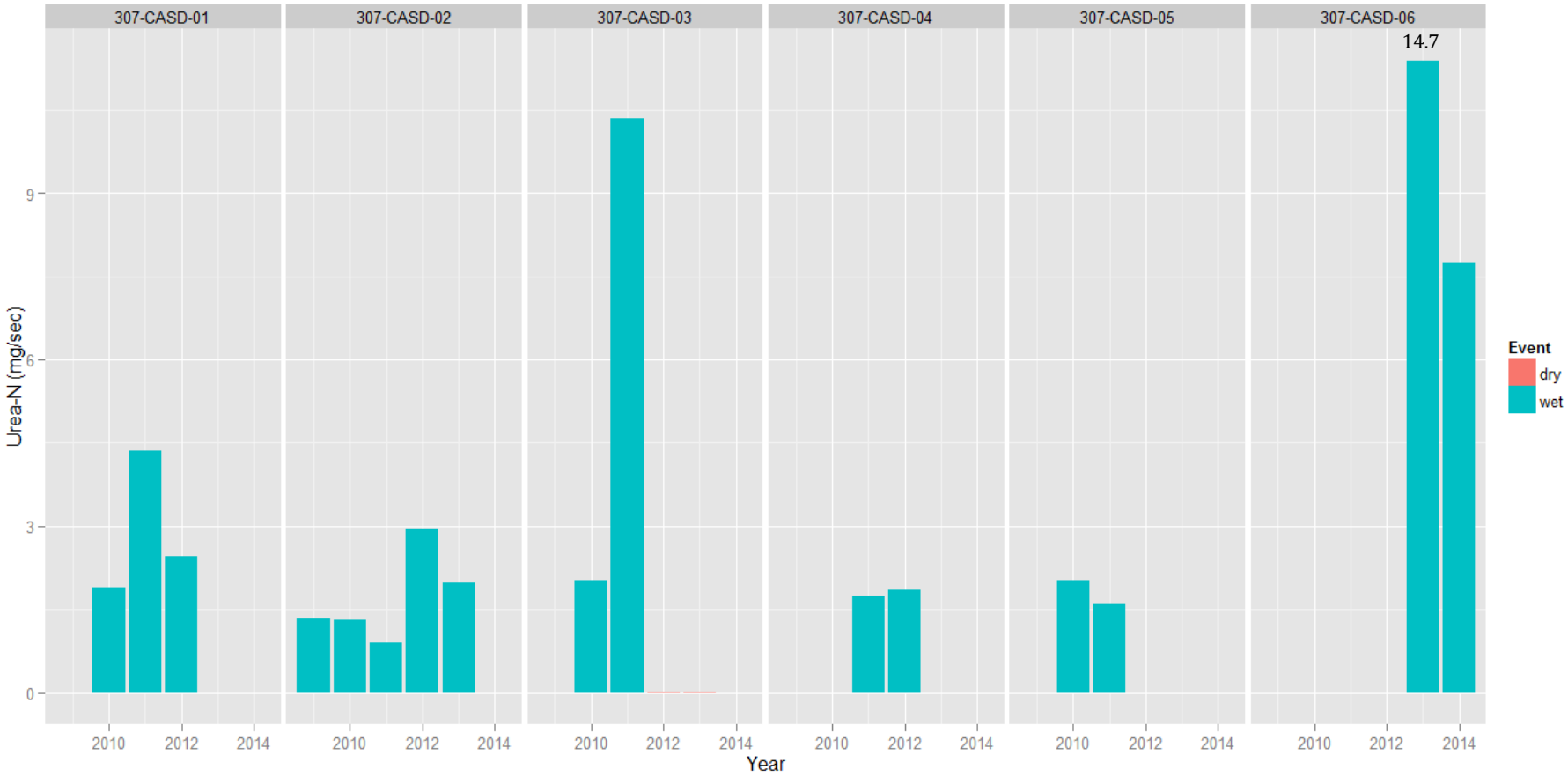
INSTANTANEOUS NITRATE LOAD (MG/SEC)

Note: In order to better display the load comparison, the maximum value of the bar chart was set to slightly greater than the next lower load measurement. The value for the highest load is noted above the load bar.



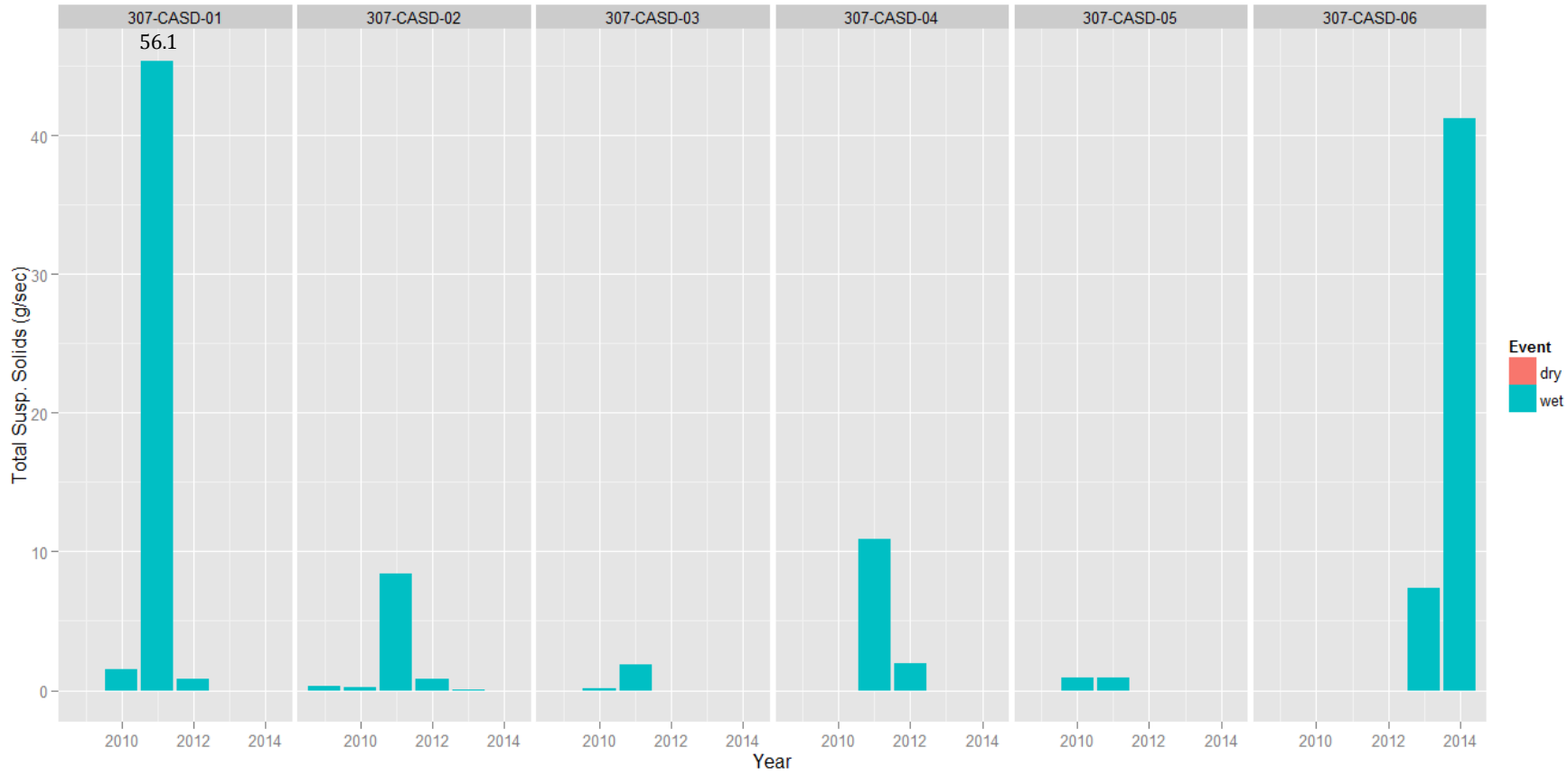
INSTANTANEOUS UREA LOAD (MG/SEC)

Note: In order to better display the load comparison, the maximum value of the bar chart was set to slightly greater than the next lower load measurement. The value for the highest load is noted above the load bar.



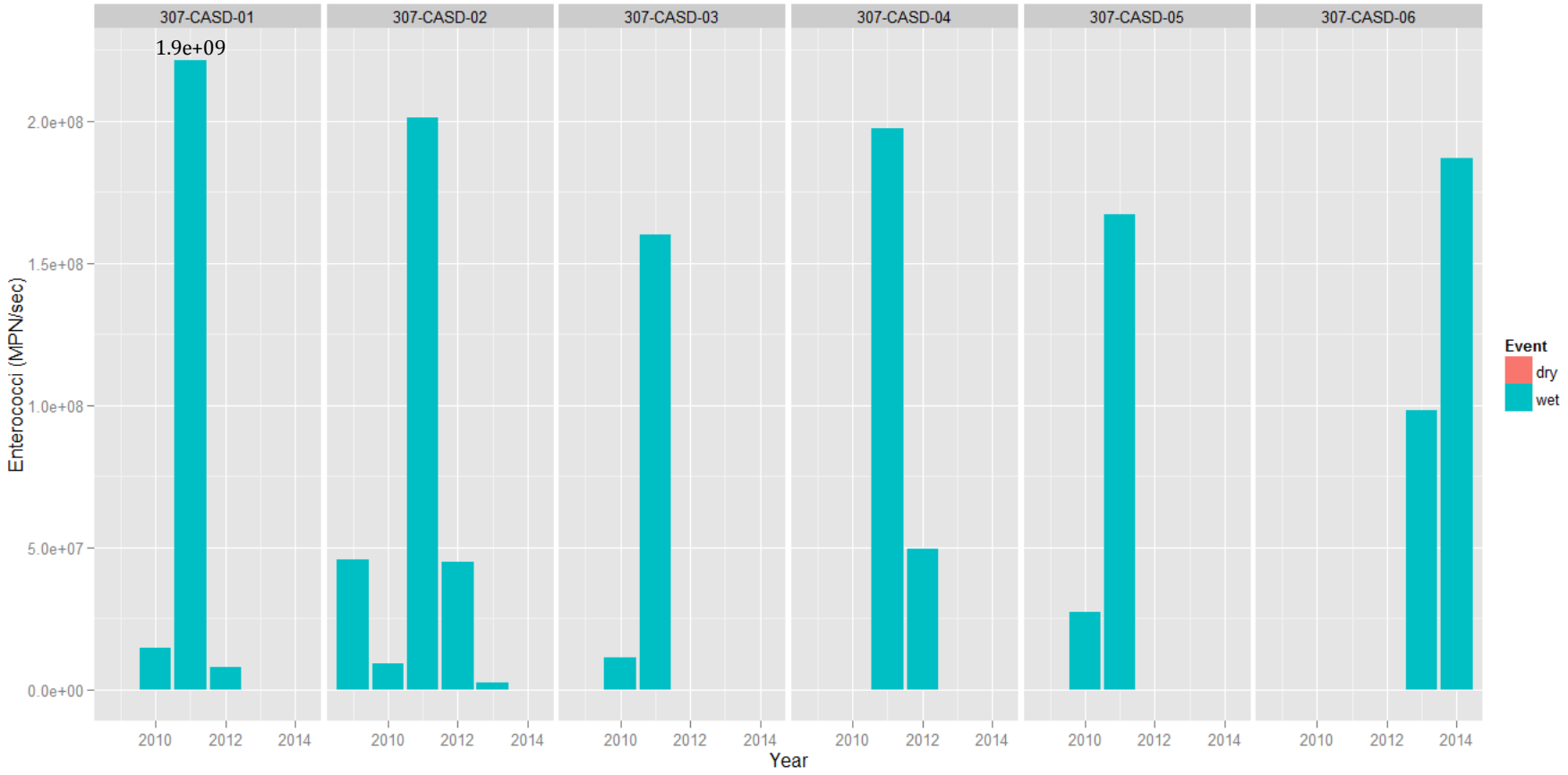
INSTANTANEOUS TOTAL SUSPENDED SOLIDS LOAD (G/SEC)

Note: In order to better display the load comparison, the maximum value of the bar chart was set to slightly greater than the next lower load measurement. The value for the highest load is noted above the load bar.



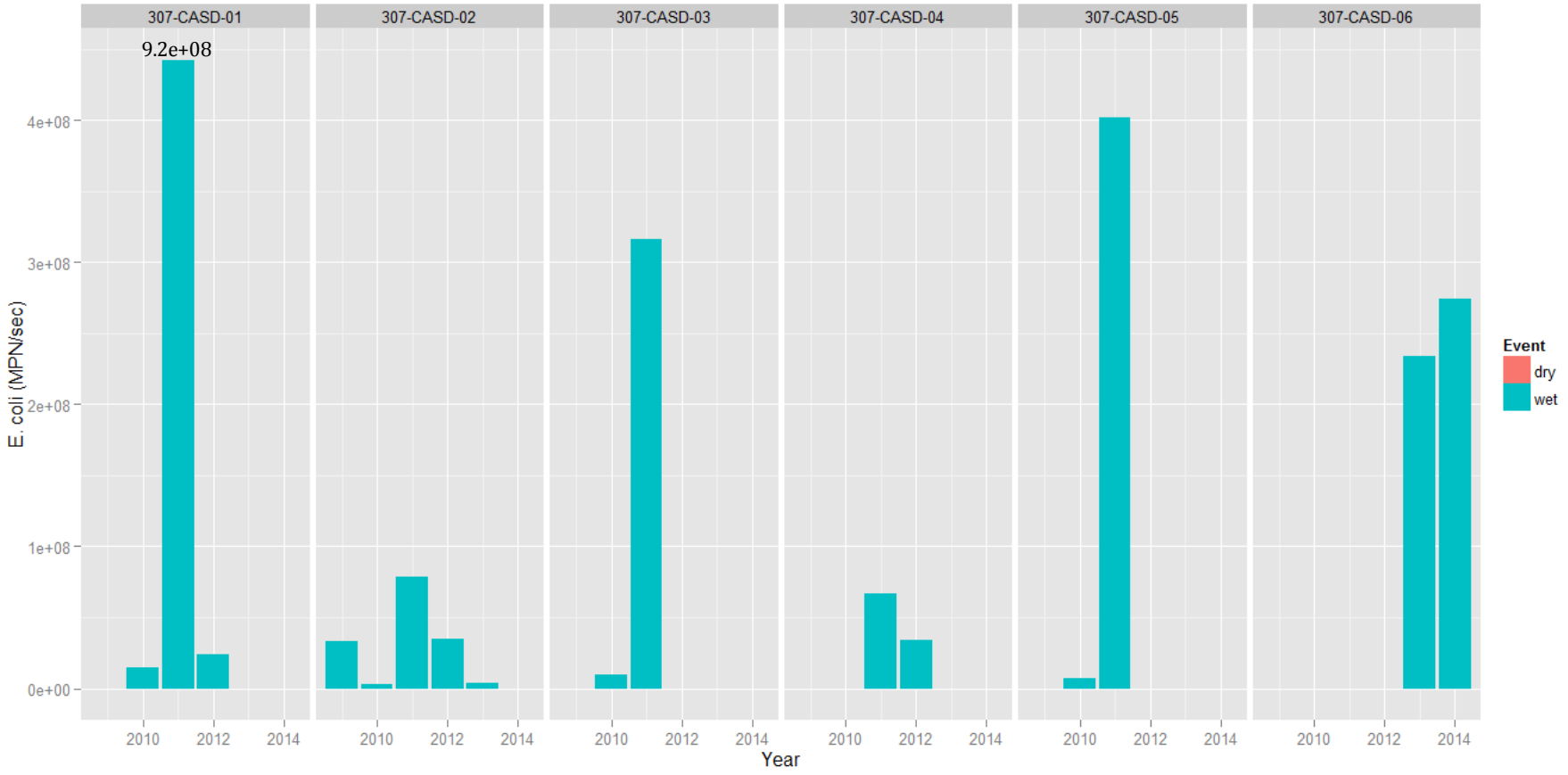
INSTANTANEOUS *ENTEROCOCCI* LOAD (MPN/SEC)

Note: In order to better display the load comparison, the maximum value of the bar chart was set to slightly greater than the next lower load measurement. The value for the highest load is noted above the load bar.



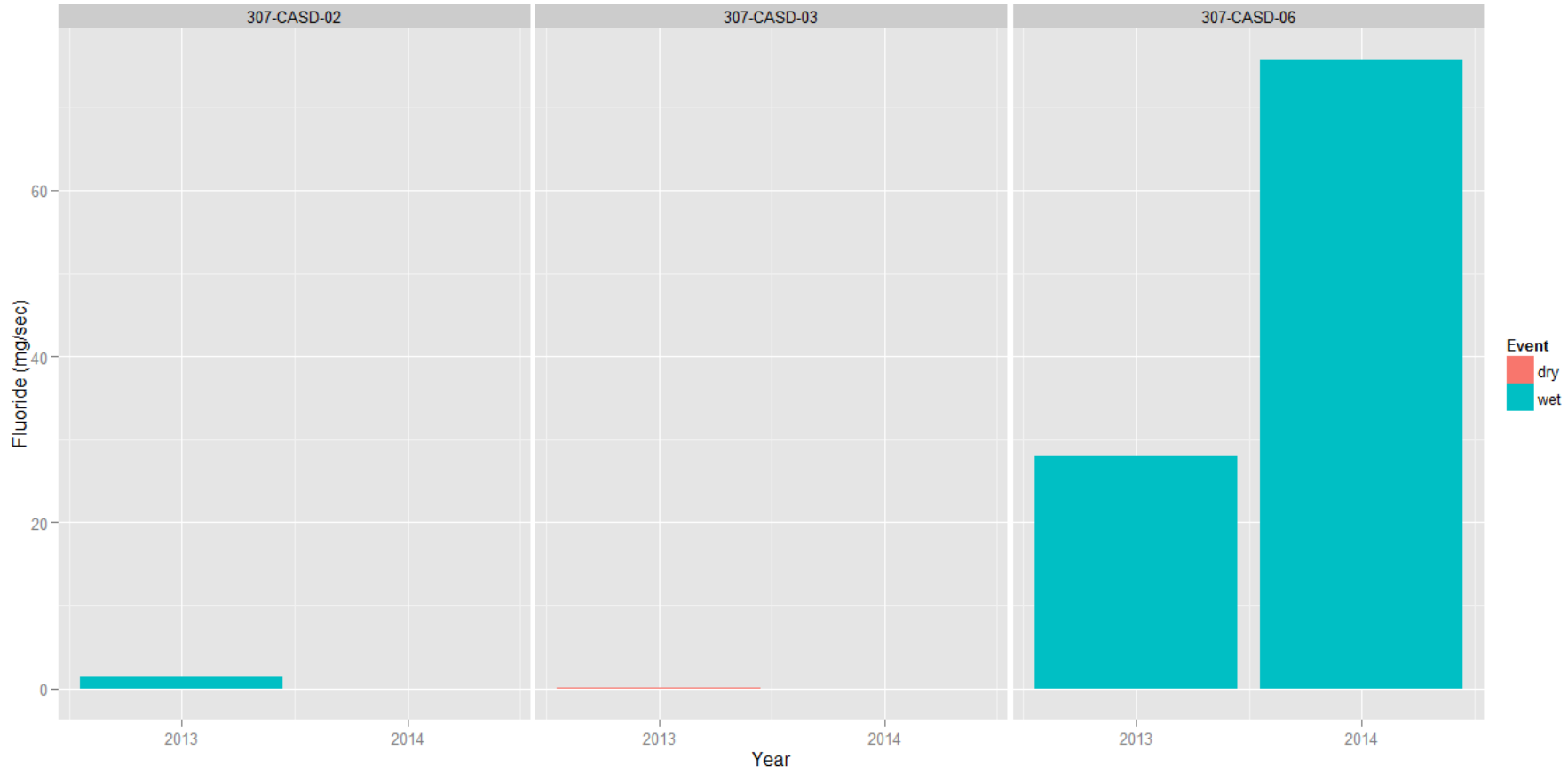
INSTANTANEOUS *E. COLI* LOAD (MPN/SEC)

Note: In order to better display the load comparison, the maximum value of the bar chart was set to slightly greater than the next lower load measurement. The value for the highest load is noted above the load bar.



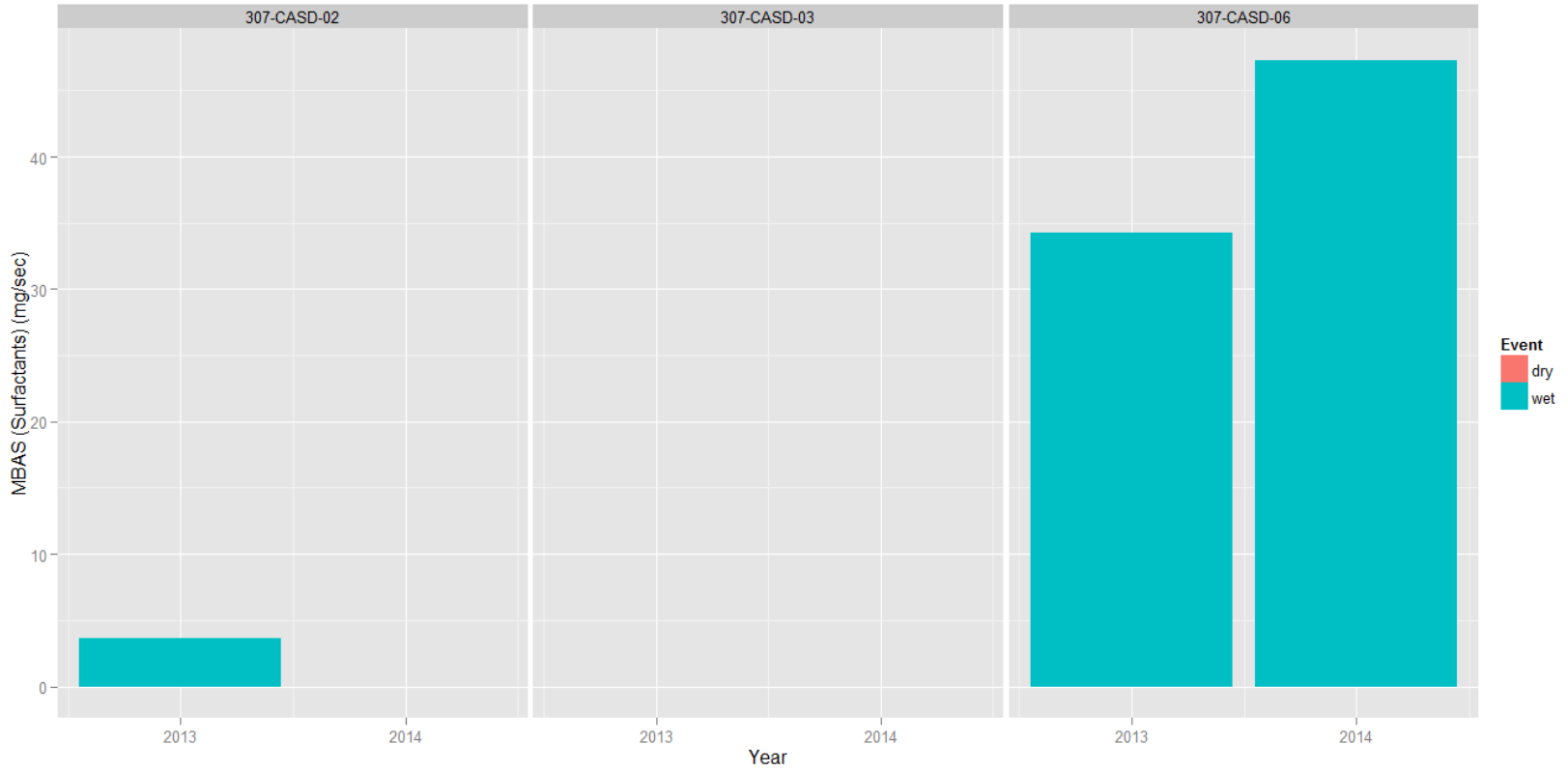
CITY OF CARMEL

INSTANTANEOUS FLOURIDE LOAD (MG/SEC)



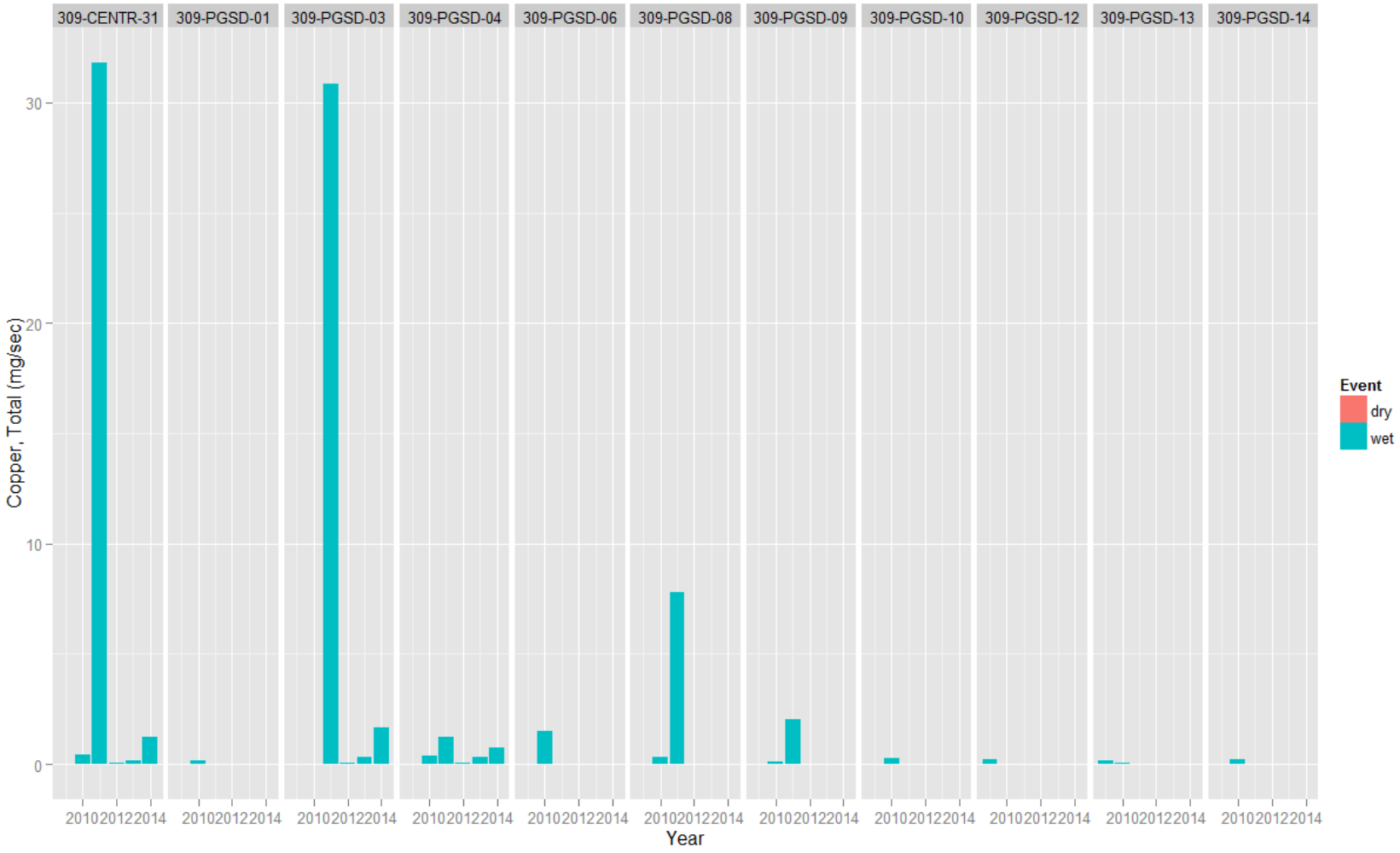
CITY OF CARMEL

INSTANTANEOUS MBAS SURFACTANTS LOAD (MG/SEC)



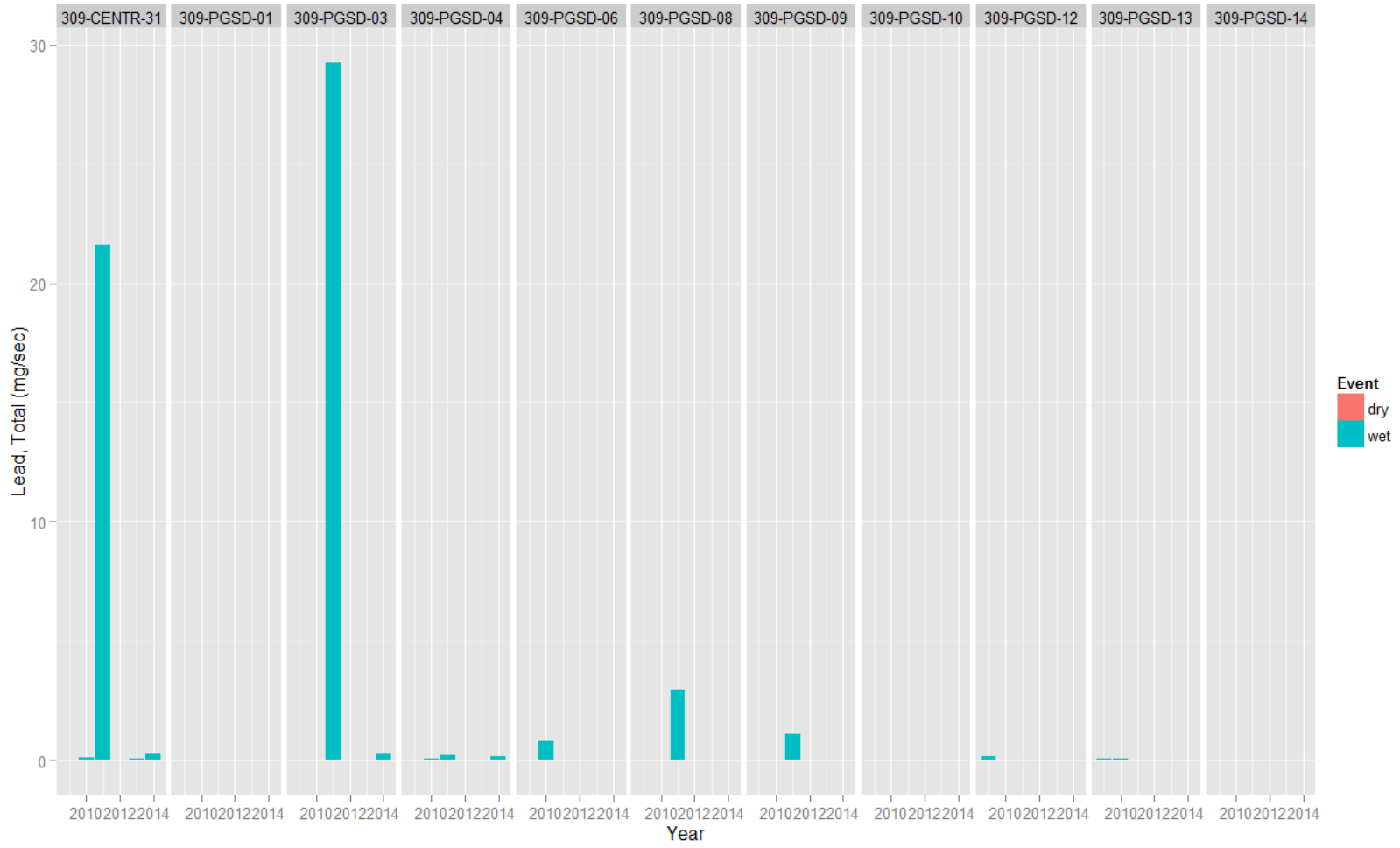
CITY OF PACIFIC GROVE

INSTANTANEOUS COPPER LOAD (MG/SEC)

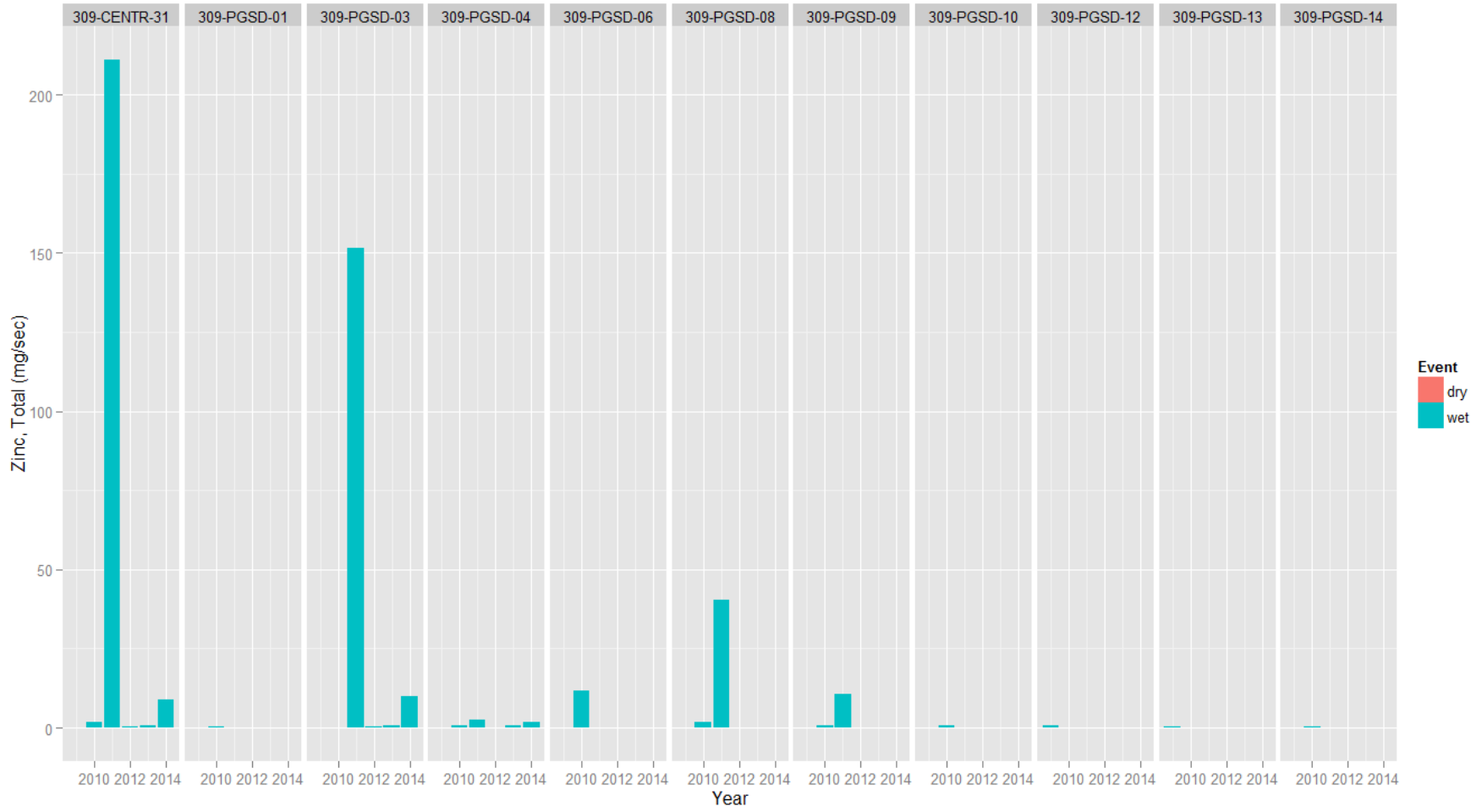


CITY OF PACIFIC GROVE

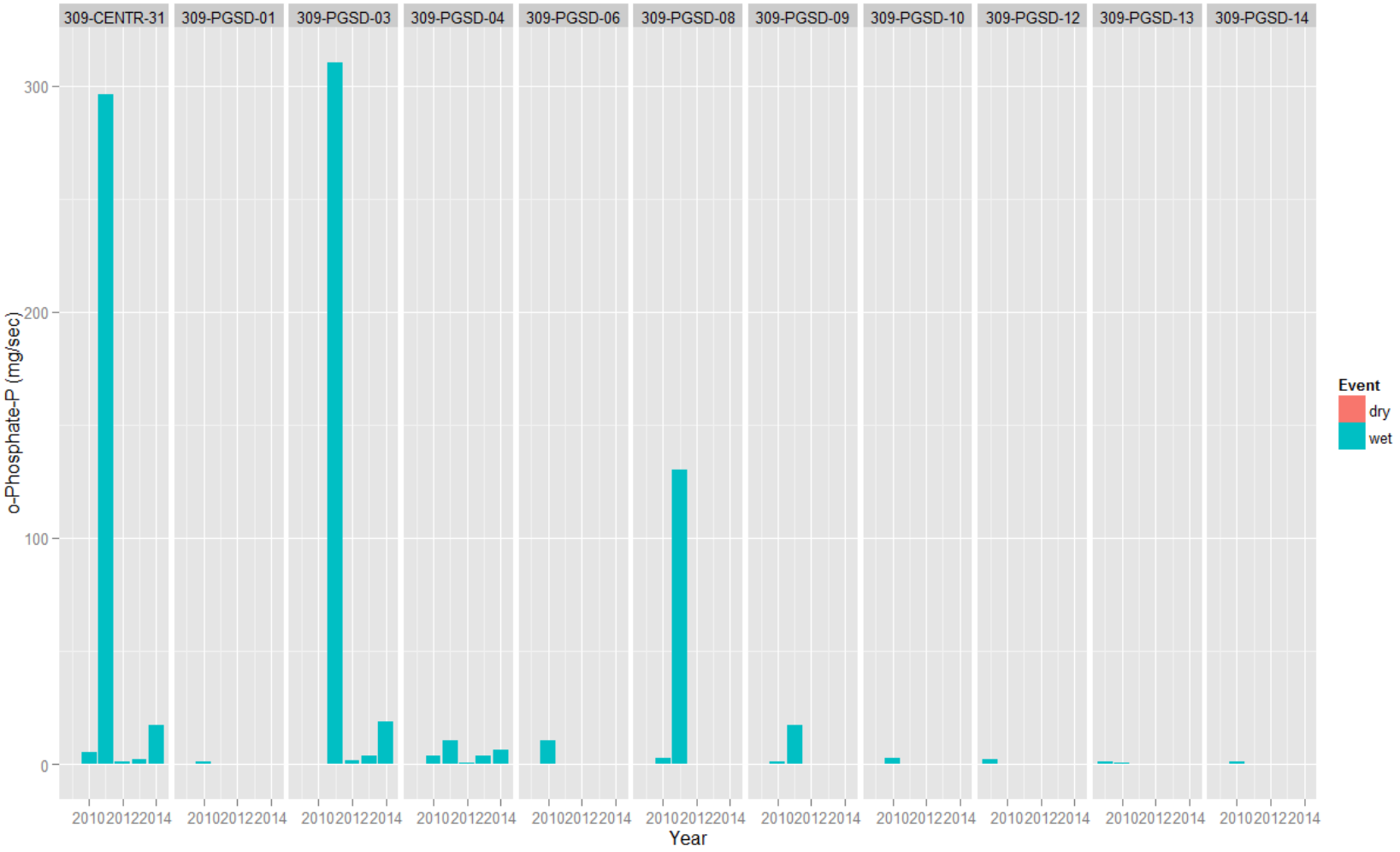
INSTANTANEOUS LEAD LOAD (MG/SEC)



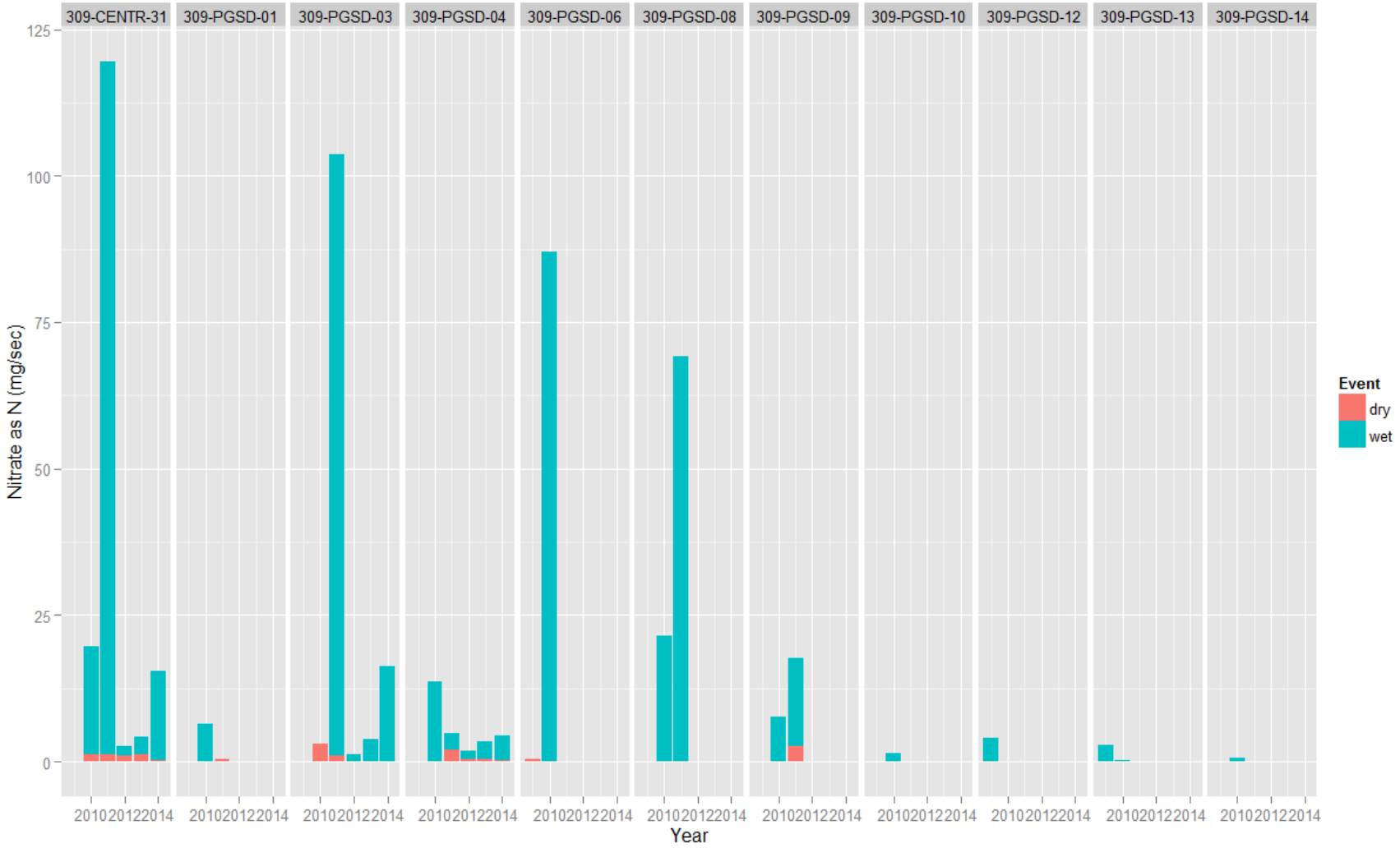
INSTANTANEOUS ZINC LOAD (MG/SEC)



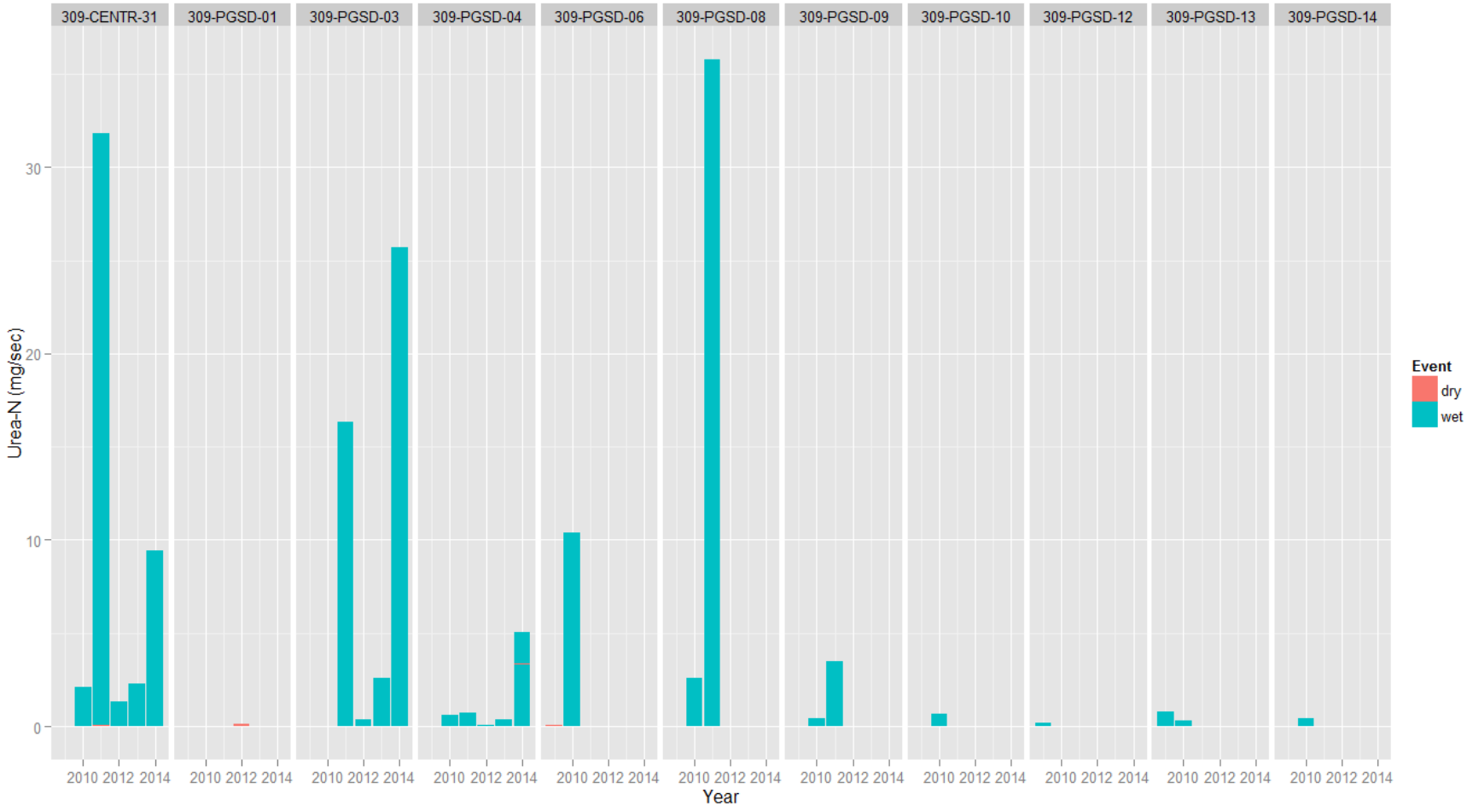
INSTANTANEOUS ORTHOPHOSPHATE LOAD (MG/SEC)



INSTANTANEOUS NITRATE LOAD (MG/SEC)

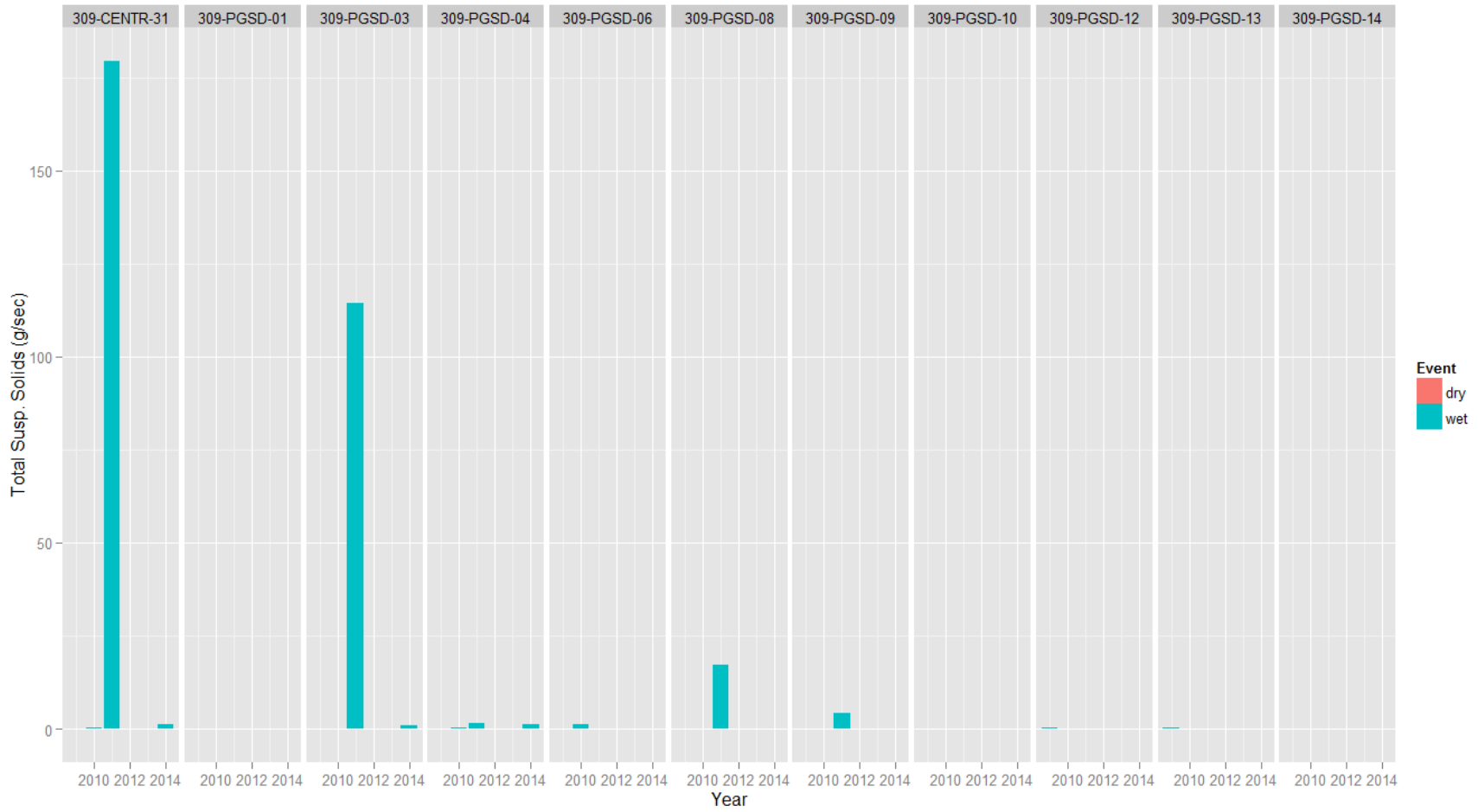


INSTANTANEOUS UREA LOAD (MG/SEC)



CITY OF PACIFIC GROVE

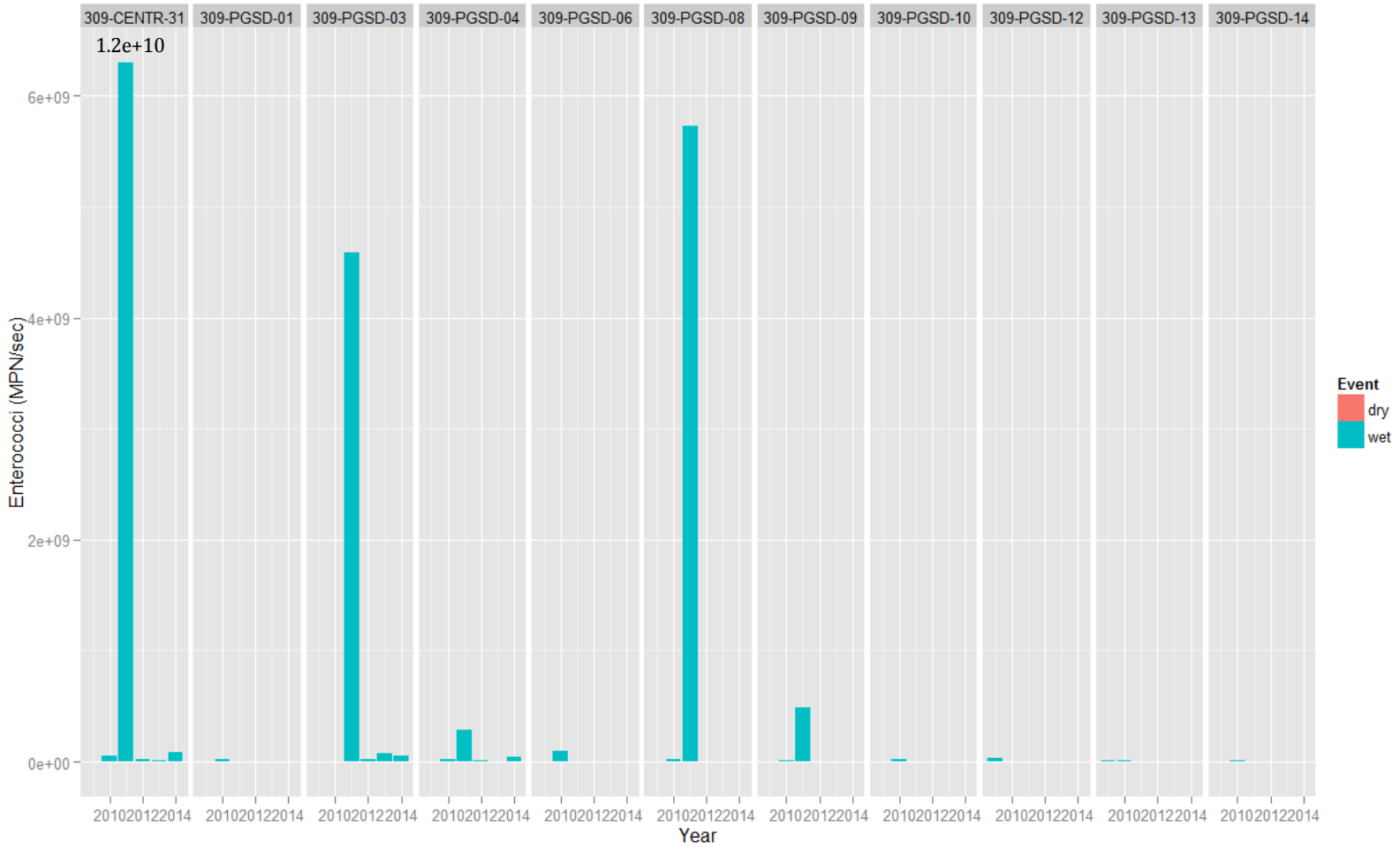
INSTANTANEOUS TOTAL SUSPENDED SOLIDS LOAD (G/SEC)



CITY OF PACIFIC GROVE

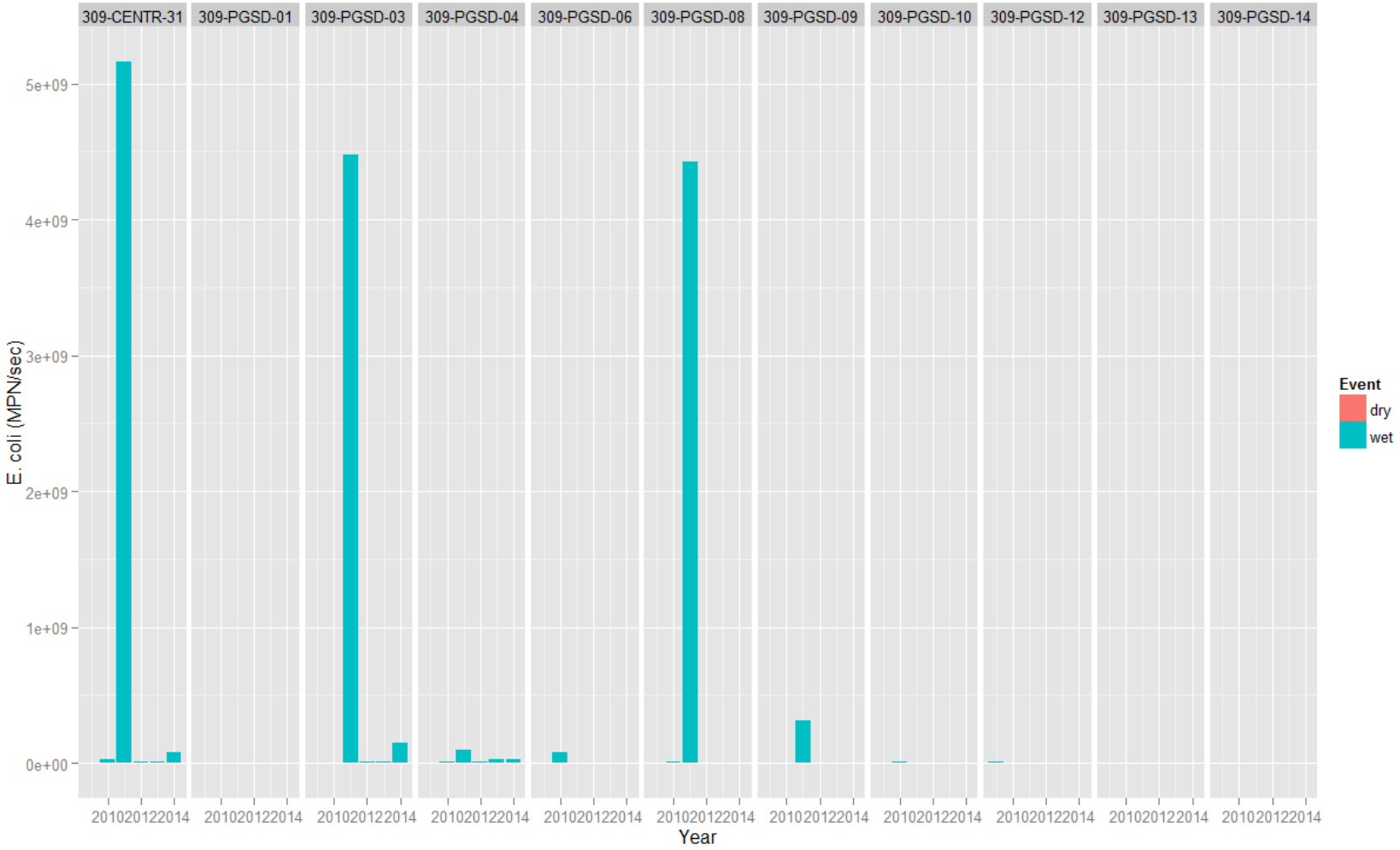
INSTANTANEOUS *ENTEROCOCCI* LOAD (MPN/SEC)

Note: In order to better display the load comparison, the maximum value of the bar chart was set to slightly greater than the next lower load measurement. The value for the highest load is noted above the load bar.



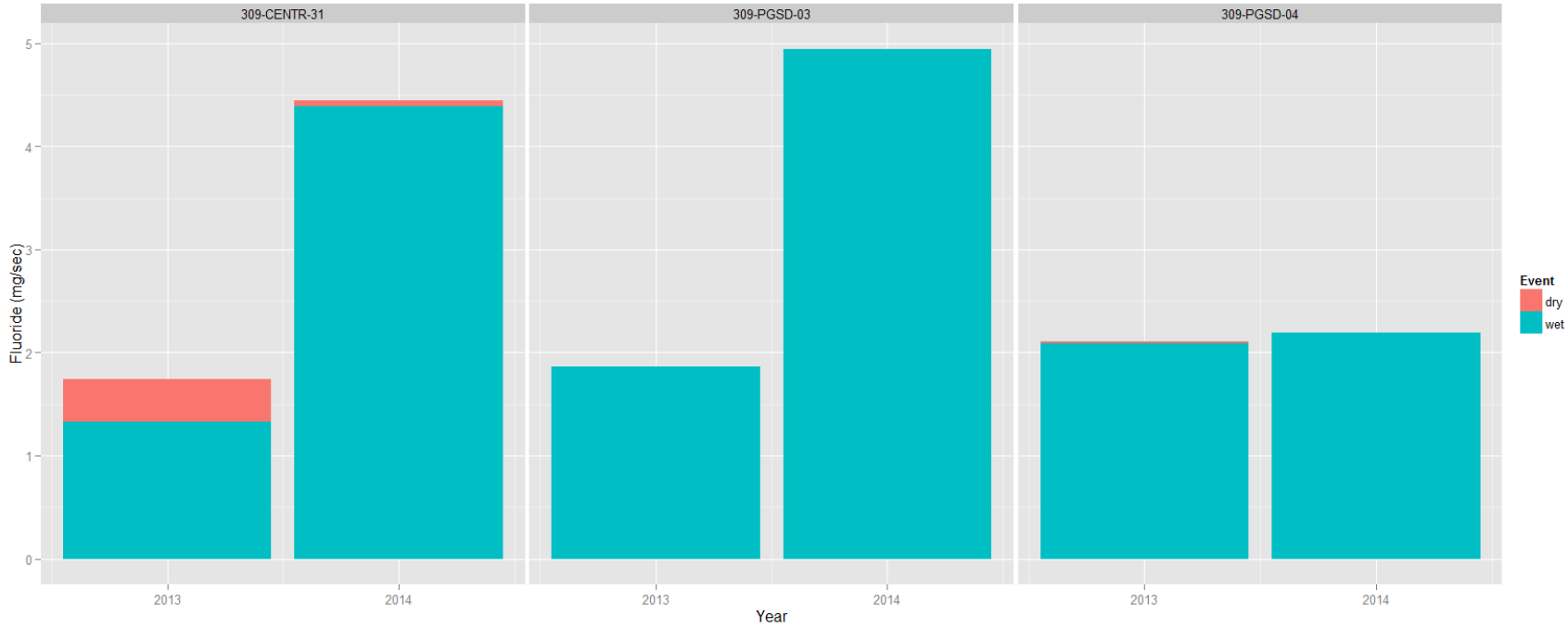
INSTANTANEOUS *E. COLI* LOAD (MPN/SEC)

Note: Load during the dry season is too small to appear on this graphic.



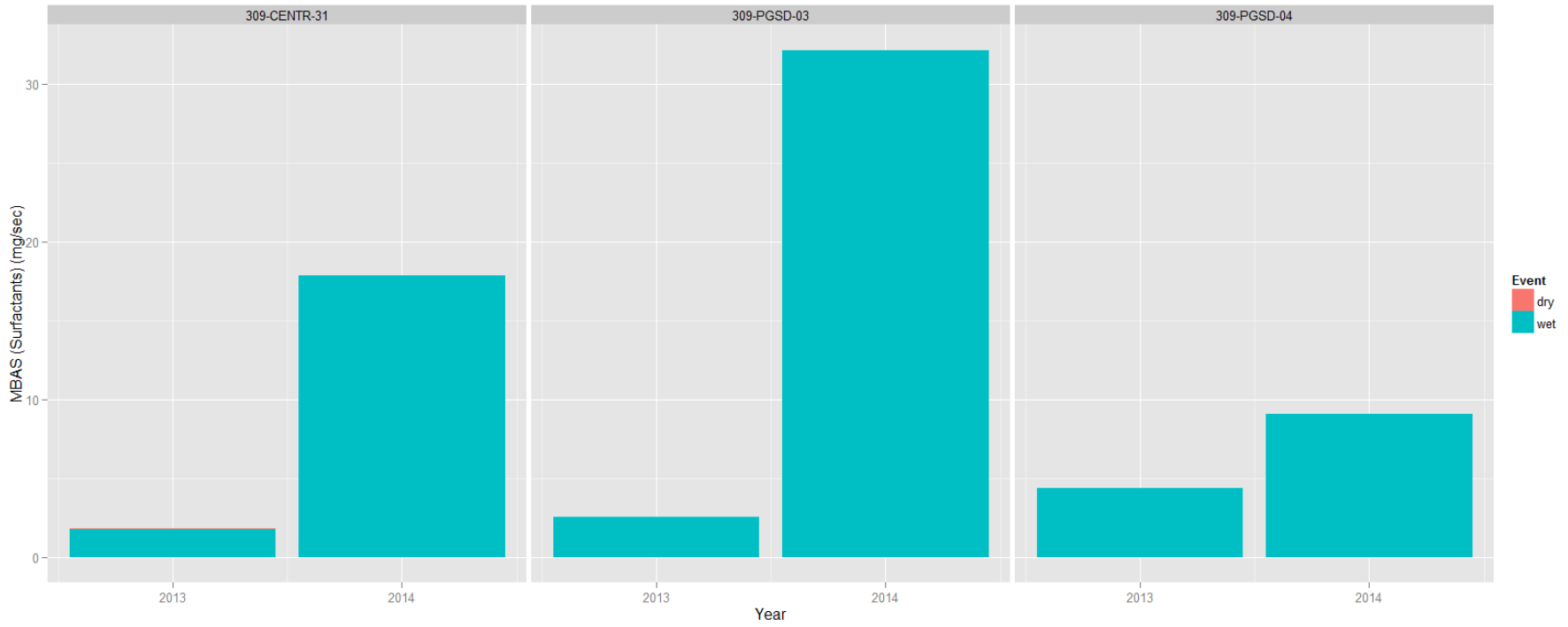
CITY OF PACIFIC GROVE

INSTANTANEOUS FLOURIDE LOAD (MG/SEC)



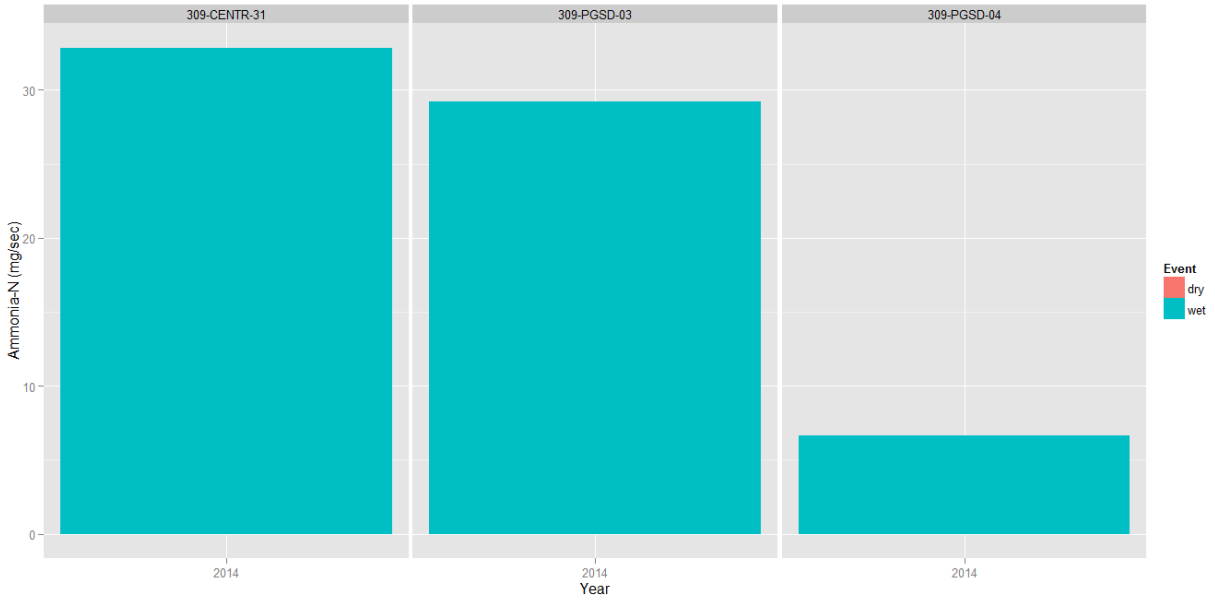
CITY OF PACIFIC GROVE

INSTANTANEOUS MBAS (SURFACTANTS) LOAD (MG/SEC)



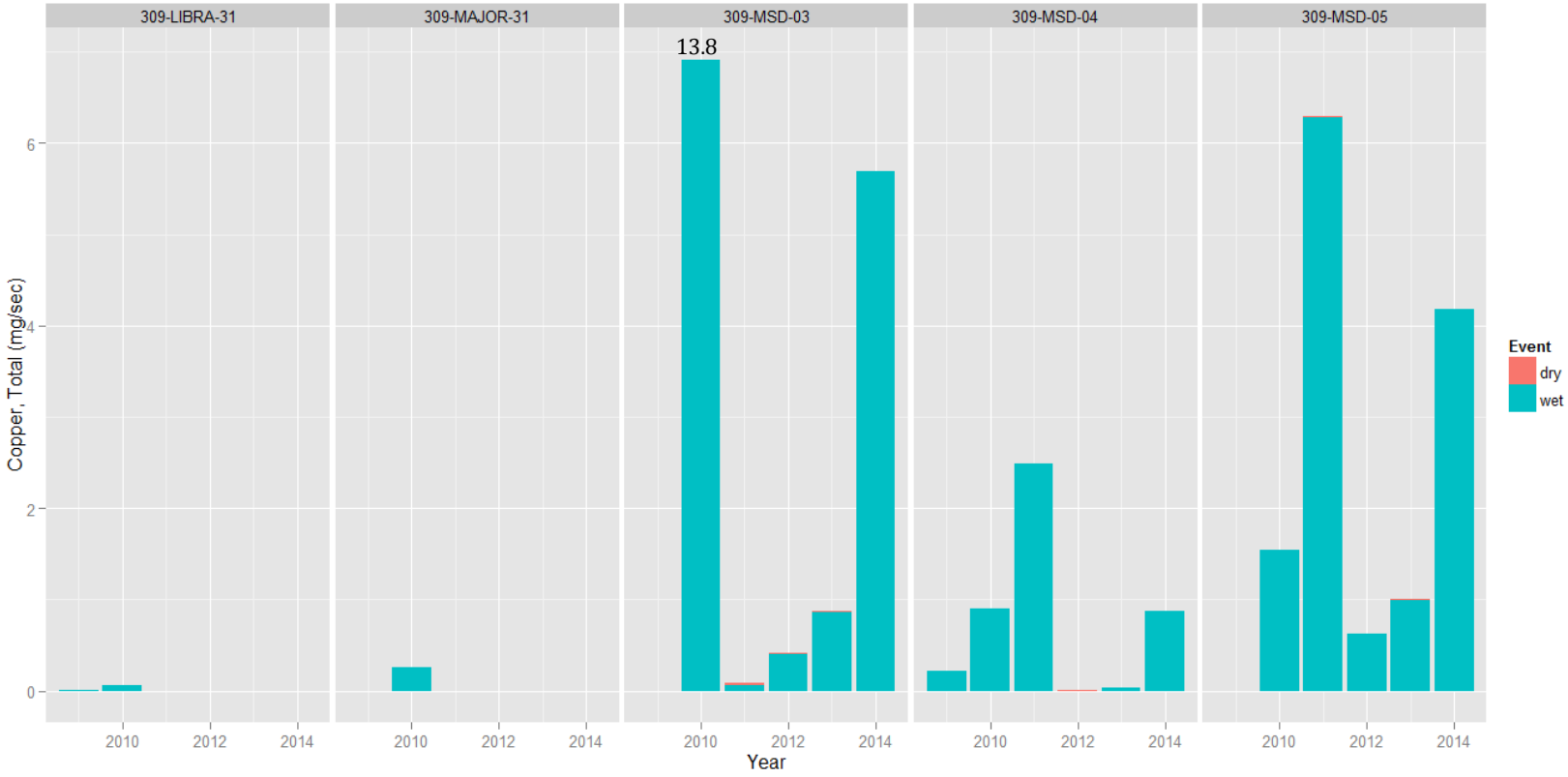
CITY OF PACIFIC GROVE

INSTANTANEOUS AMMONIA LOAD (MG/SEC)



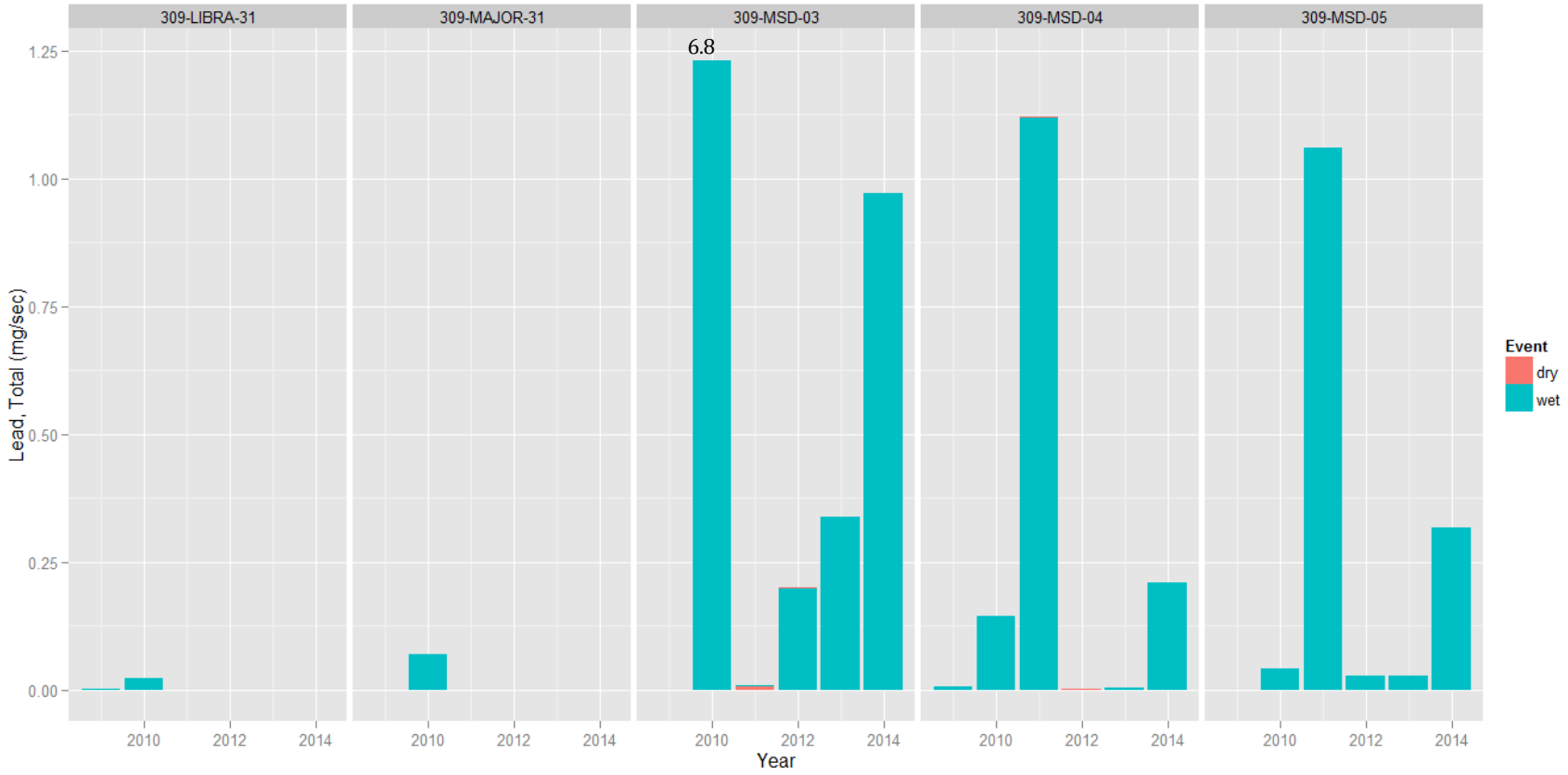
INSTANTANEOUS COPPER LOAD (MG/SEC)

Note: In order to better display the load comparison, the maximum value of the bar chart was set to slightly greater than the next lower load measurement. The value for the highest load is noted above the load bar.



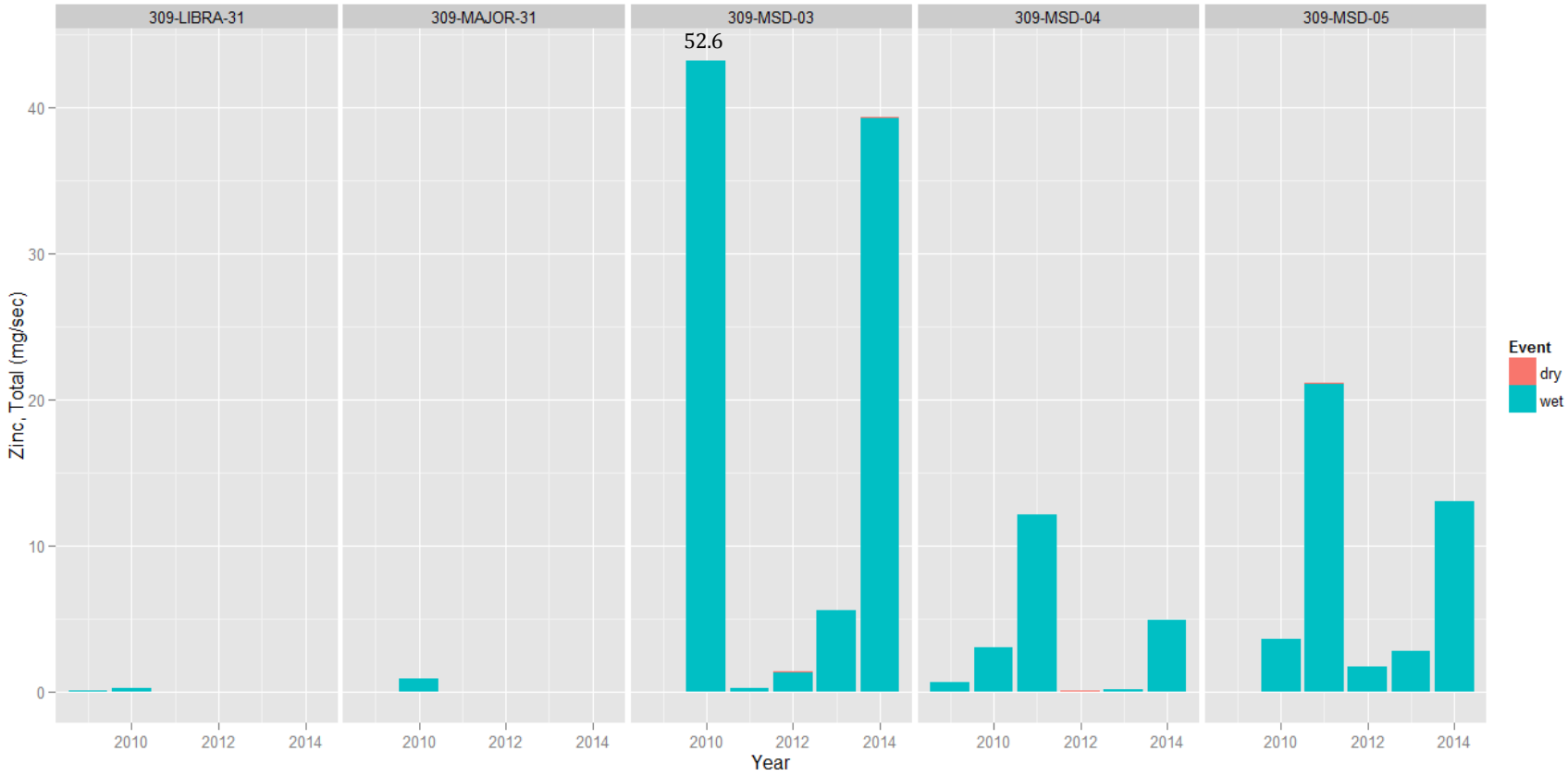
INSTANTANEOUS LEAD LOAD (MG/SEC)

Note: In order to better display the load comparison, the maximum value of the bar chart was set to slightly greater than the next lower load measurement. The value for the highest load is noted above the load bar.



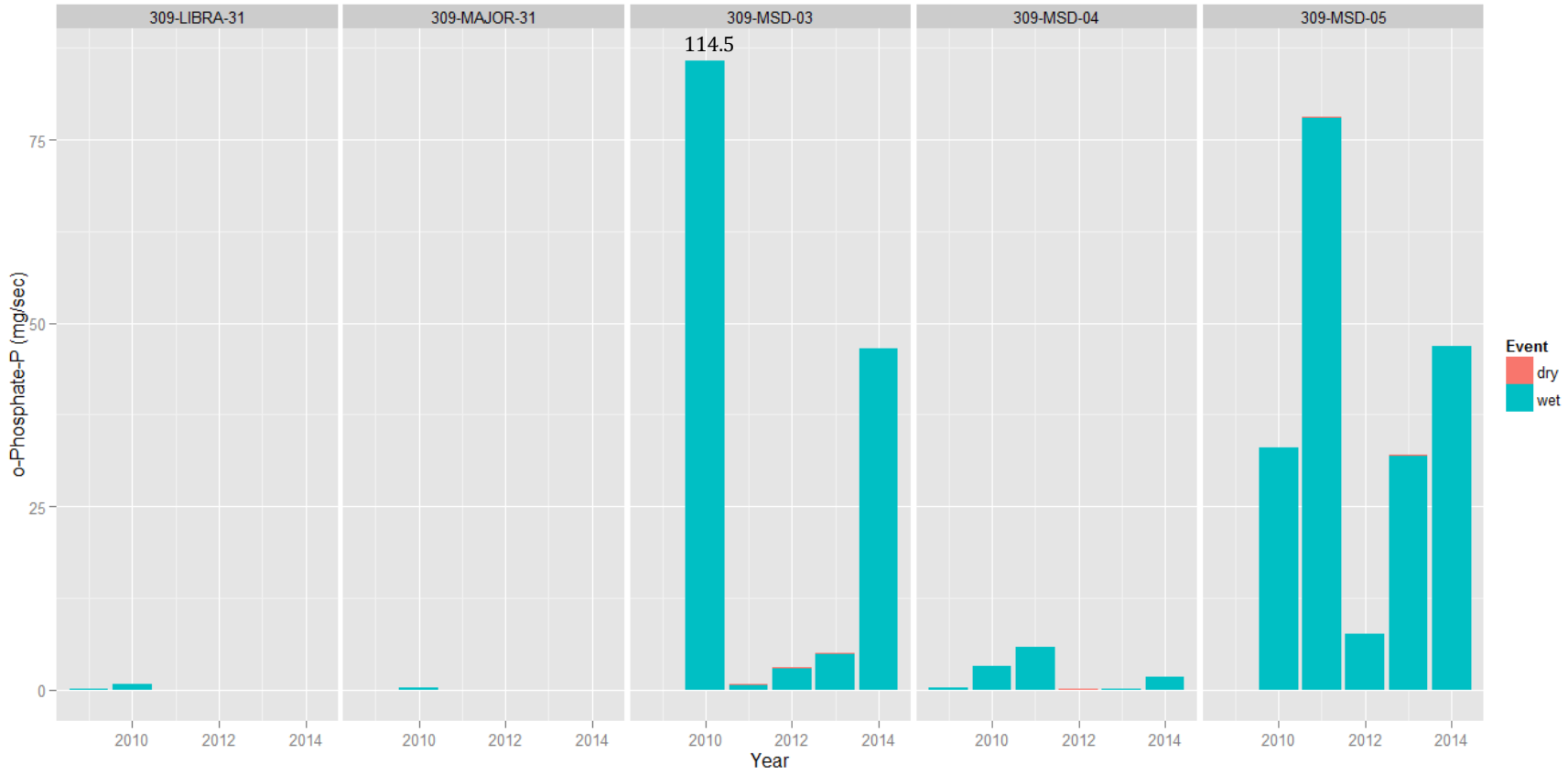
INSTANTANEOUS TOTAL SUSPENDED SOLIDS LOAD (G/SEC)

Note: In order to better display the load comparison, the maximum value of the bar chart was set to slightly greater than the next lower load measurement. The value for the highest load is noted above the load bar.



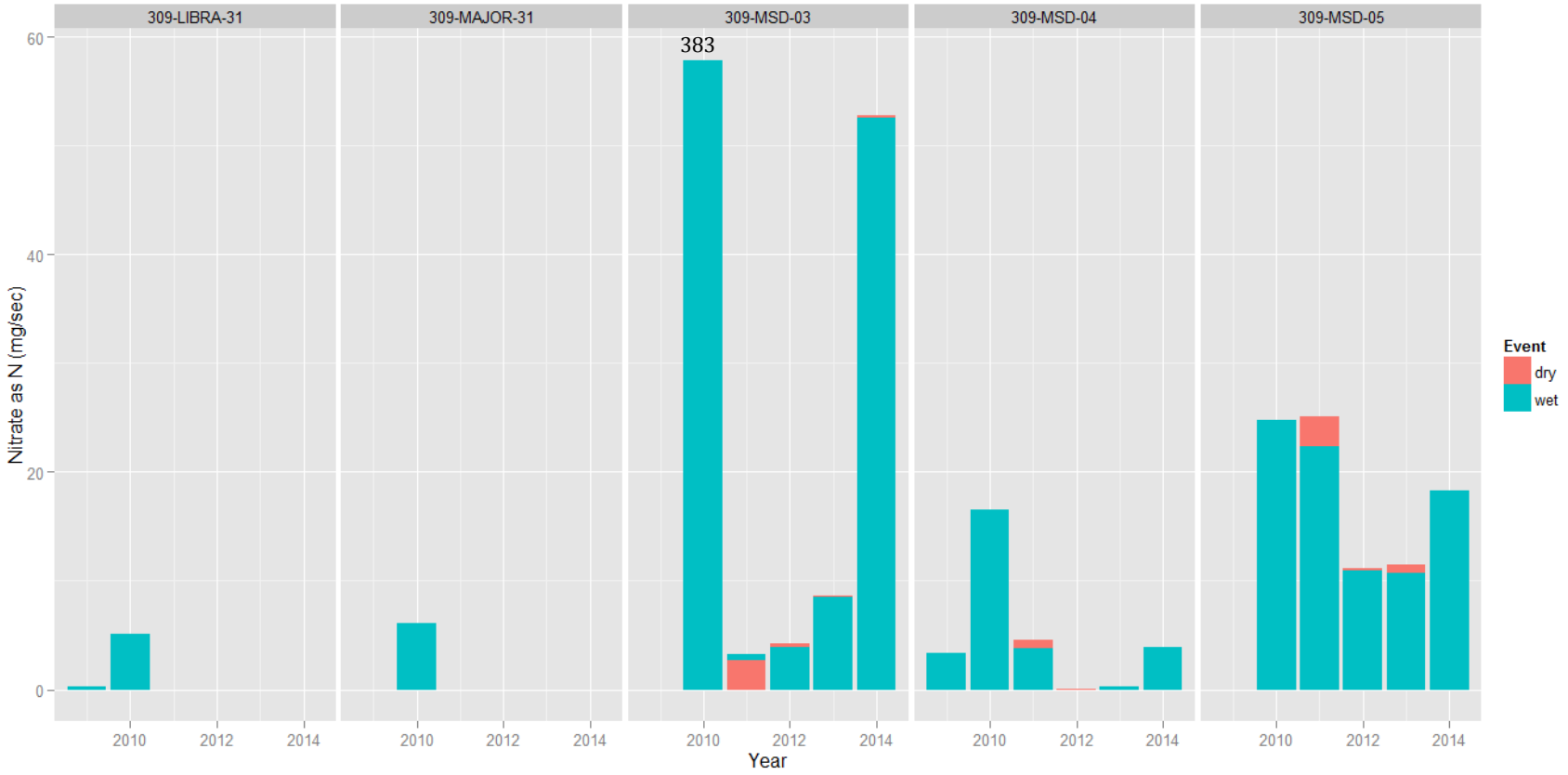
INSTANTANEOUS ORTHOPHOSPHATE LOAD (MG/SEC)

Note: In order to better display the load comparison, the maximum value of the bar chart was set to slightly greater than the next lower load measurement. The value for the highest load is noted above the load bar.



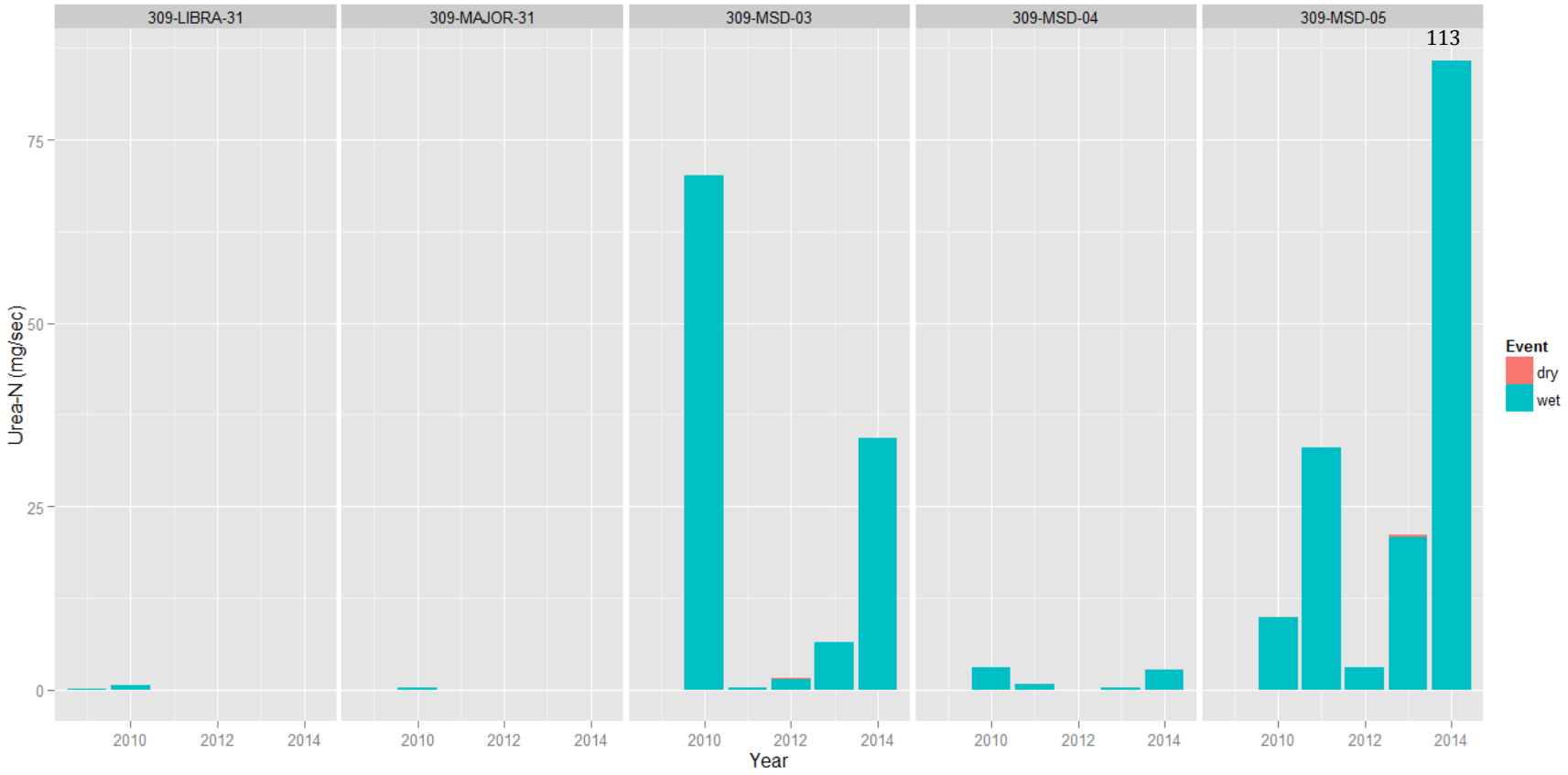
INSTANTANEOUS NITRATE LOAD (MG/SEC)

Note: In order to better display the load comparison, the maximum value of the bar chart was set to slightly greater than the next lower load measurement. The value for the highest load is noted above the load bar.



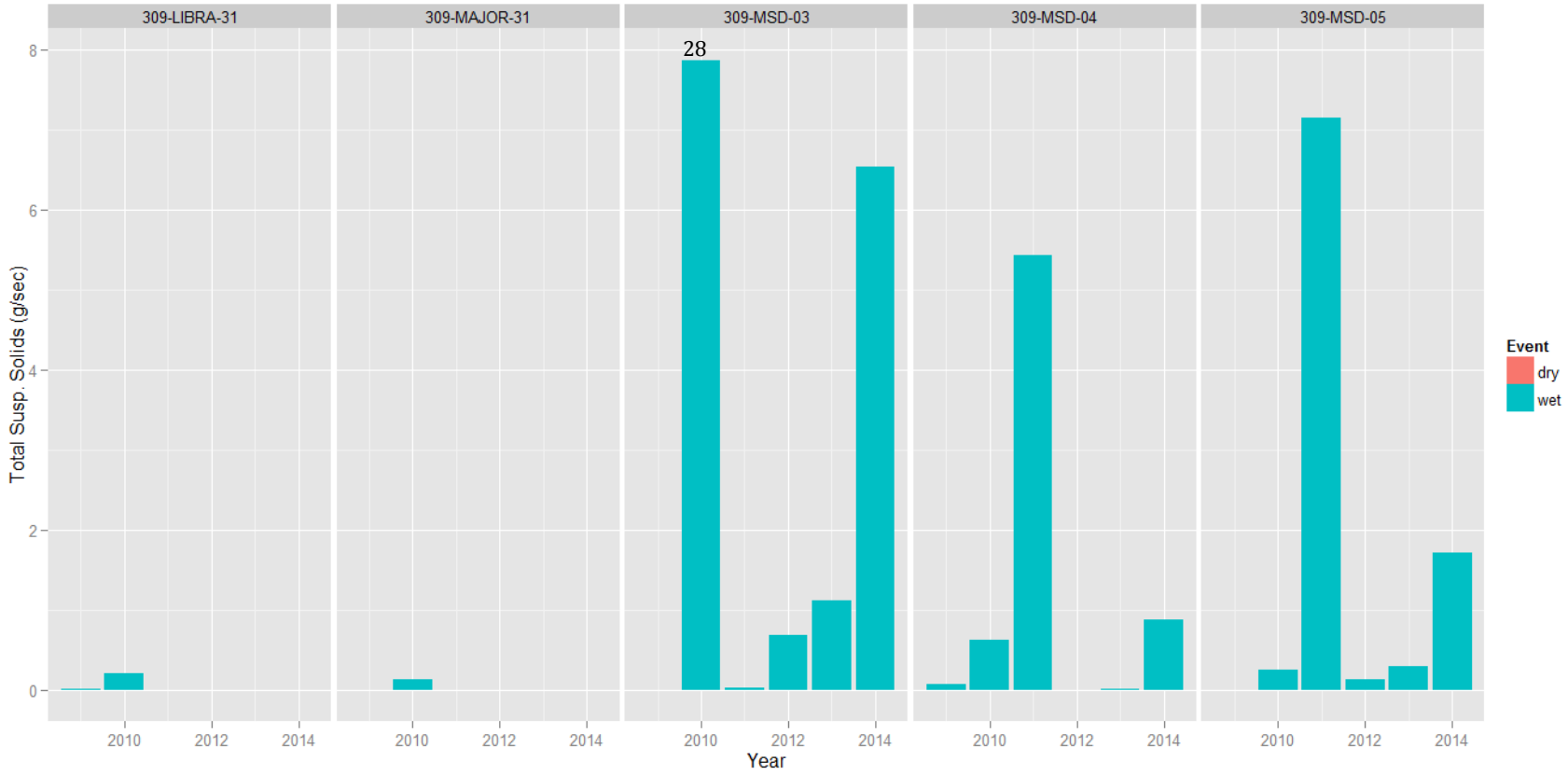
INSTANTANEOUS UREA LOAD (MG/SEC)

Note: In order to better display the load comparison, the maximum value of the bar chart was set to slightly greater than the next lower load measurement. The value for the highest load is noted above the load bar.



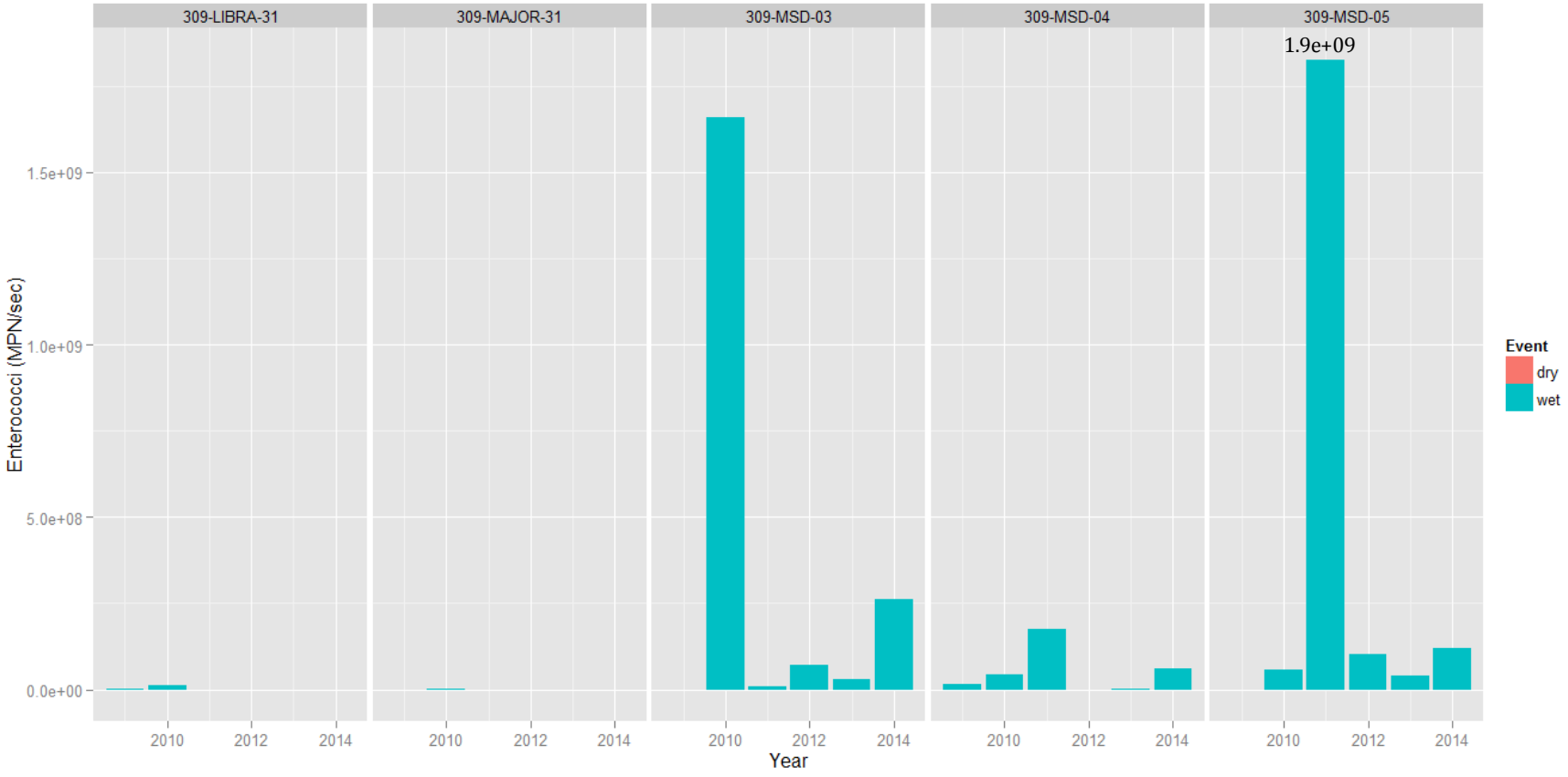
INSTANTANEOUS TOTAL SUSPENDED SOLIDS LOAD (G/SEC)

Note: In order to better display the load comparison, the maximum value of the bar chart was set to slightly greater than the next lower load measurement. The value for the highest load is noted above the load bar.



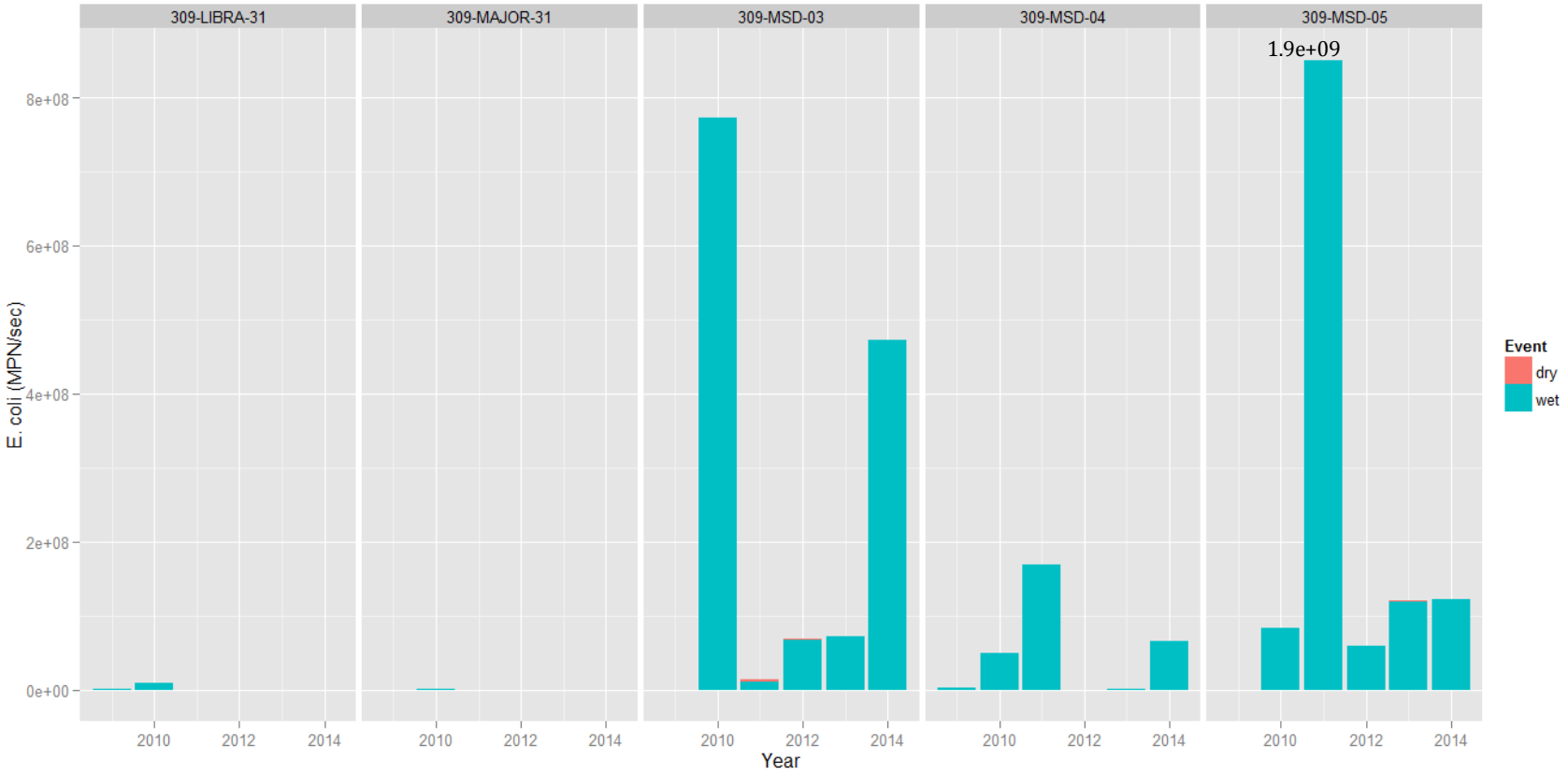
INSTANTANEOUS *ENTEROCOCCI* LOAD (MPN/SEC)

Note: In order to better display the load comparison, the maximum value of the bar chart was set to slightly greater than the next lower load measurement. The value for the highest load is noted above the load bar.



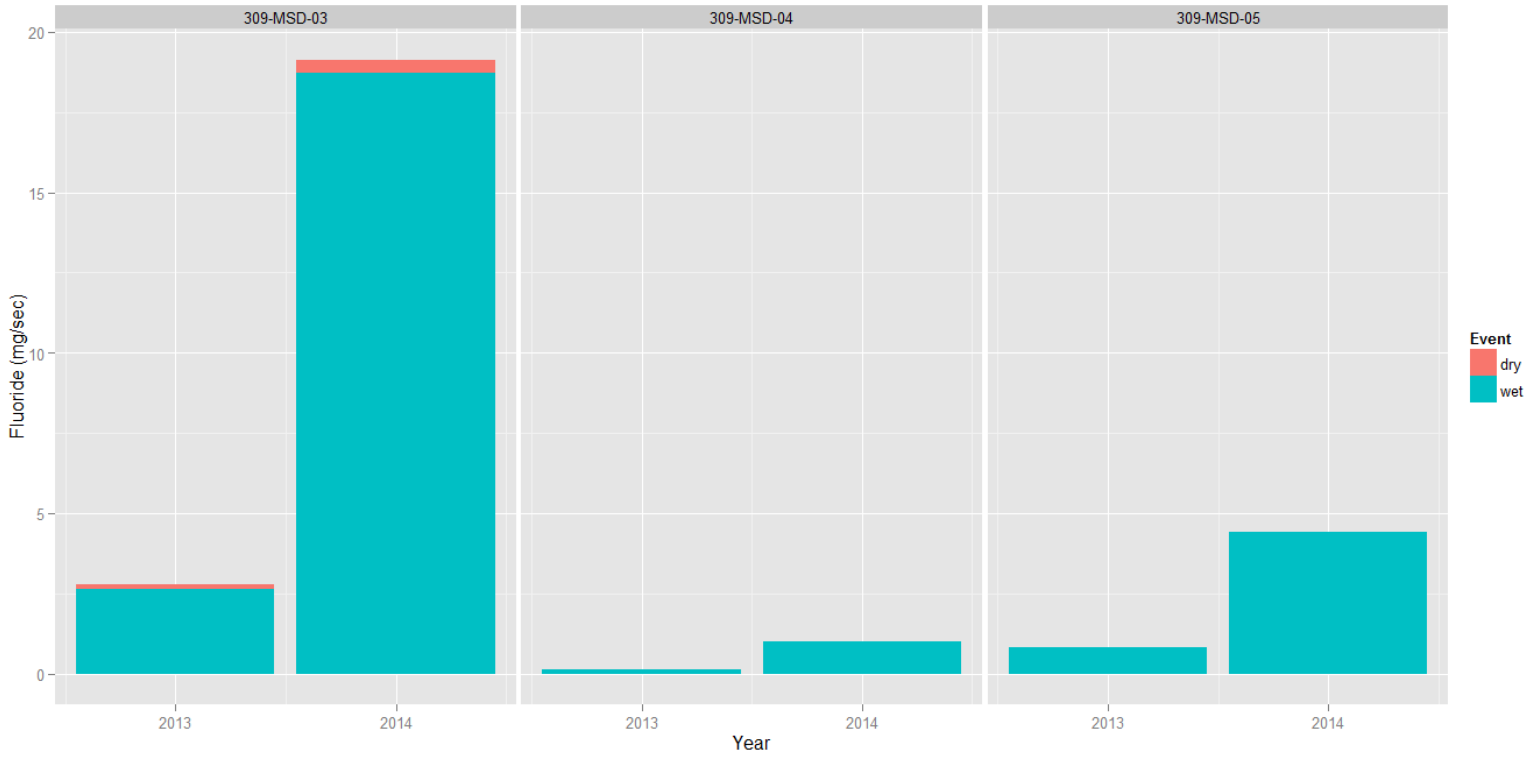
INSTANTANEOUS *E. COLI* LOAD (MPN/SEC)

Note: In order to better display the load comparison, the maximum value of the bar chart was set to slightly greater than the next lower load measurement. The value for the highest load is noted above the load bar.



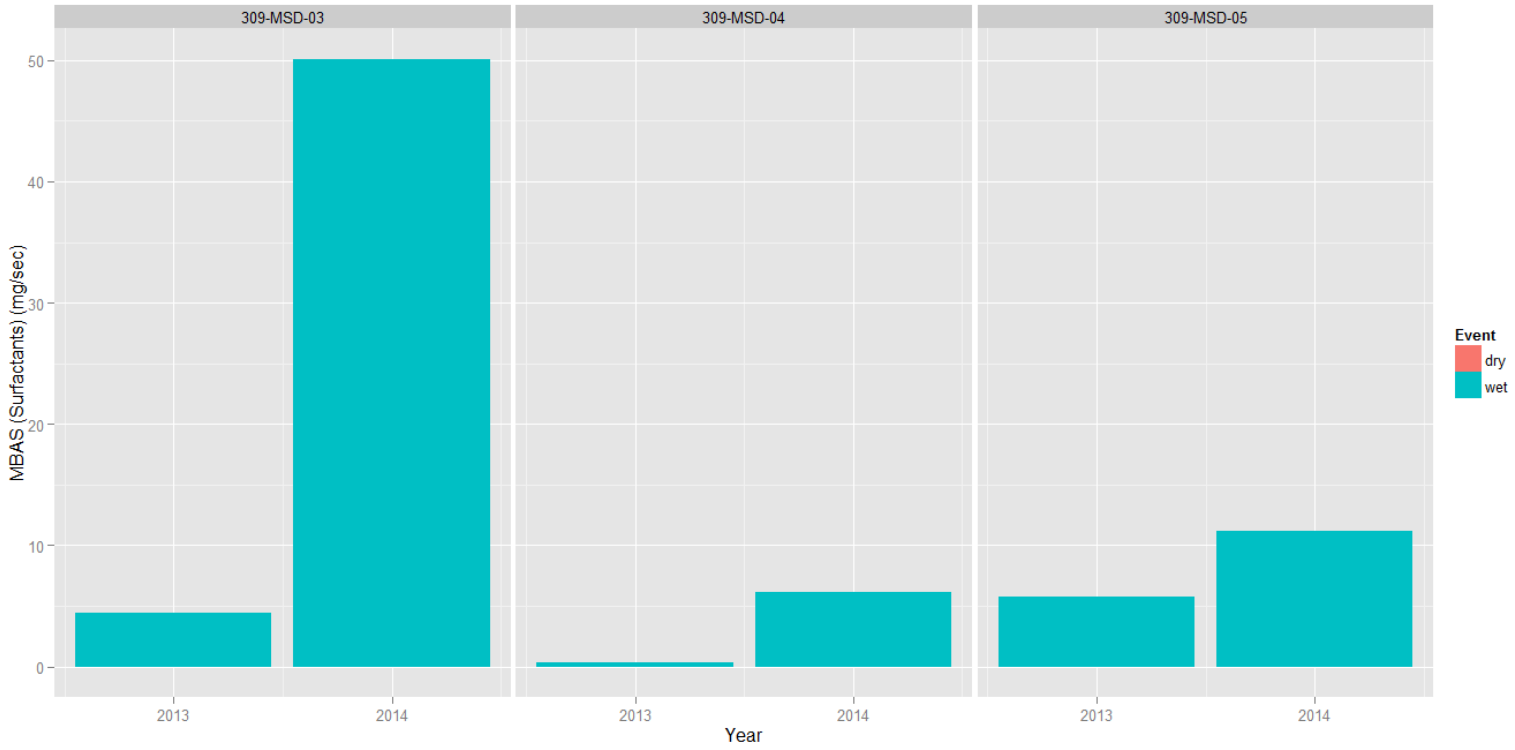
CITY OF MONTEREY

INSTANTANEOUS FLOURIDE LOAD (MG/SEC)



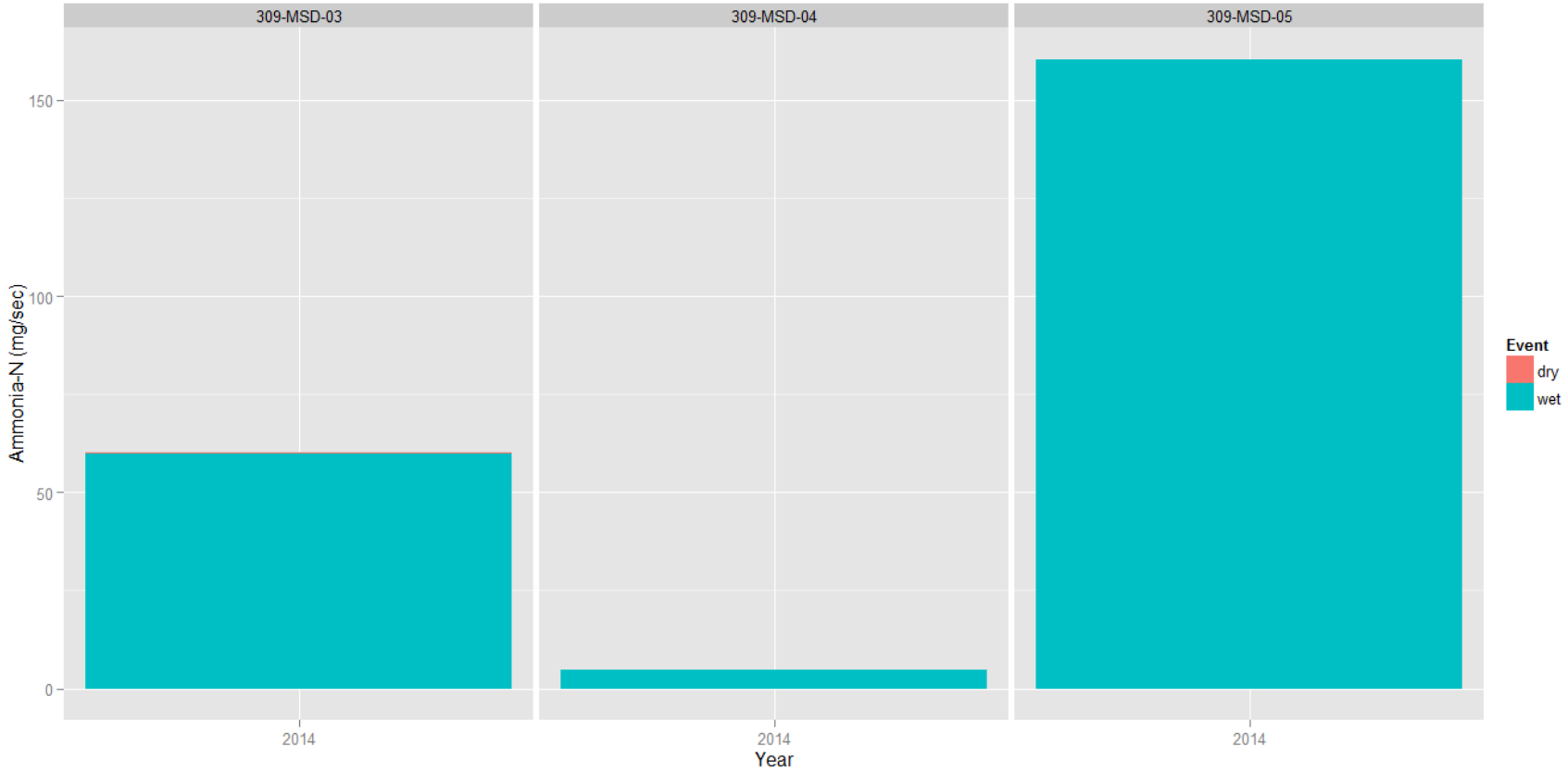
CITY OF MONTEREY

INSTANTANEOUS MBAS (SURFACTANTS) LOAD (MG/SEC)



CITY OF MONTEREY

INSTANTANEOUS AMMONIA LOAD (MG/SEC)

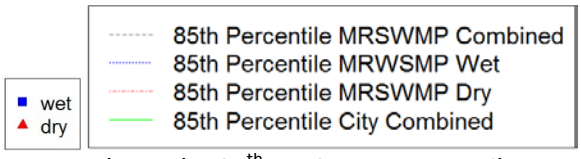


V. CONCENTRATION PLOTS

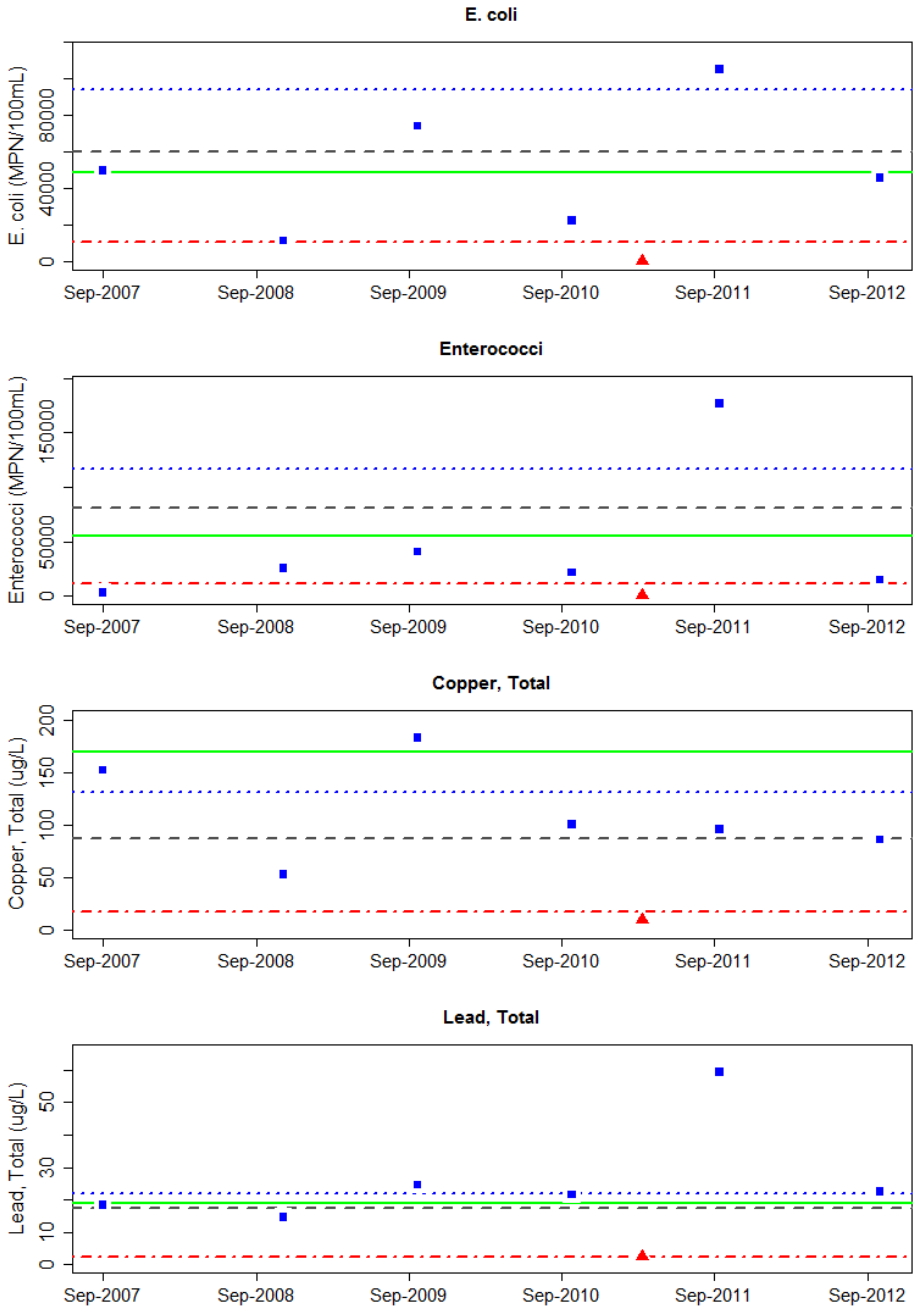
Plots showing concentration at the time of monitoring were developed for each site that exceeded the 85th percentile for combined wet and dry MRSWMP data on at least one occasion for the following pollutants: total copper, total zinc, total lead, nitrate-N, orthophosphate-P, urea, *E.coli*, *Enterococcus*, total suspended solids, MBAS, fluoride, and ammonia. Plots include monitoring results from 2000-2014. Data points represent the average daily concentration from the time series of samples taken that day.

The plots also display the 85th percentiles as horizontal lines. These lines provide information about how wet and dry weather 85th percentiles compare with one another. In most cases, but not all, higher concentrations of pollutants are found in wet weather. There is also an 85th percentile line for the combined wet and dry weather for Cities with more than 5 monitoring sites (Carmel, Monterey and Pacific Grove).

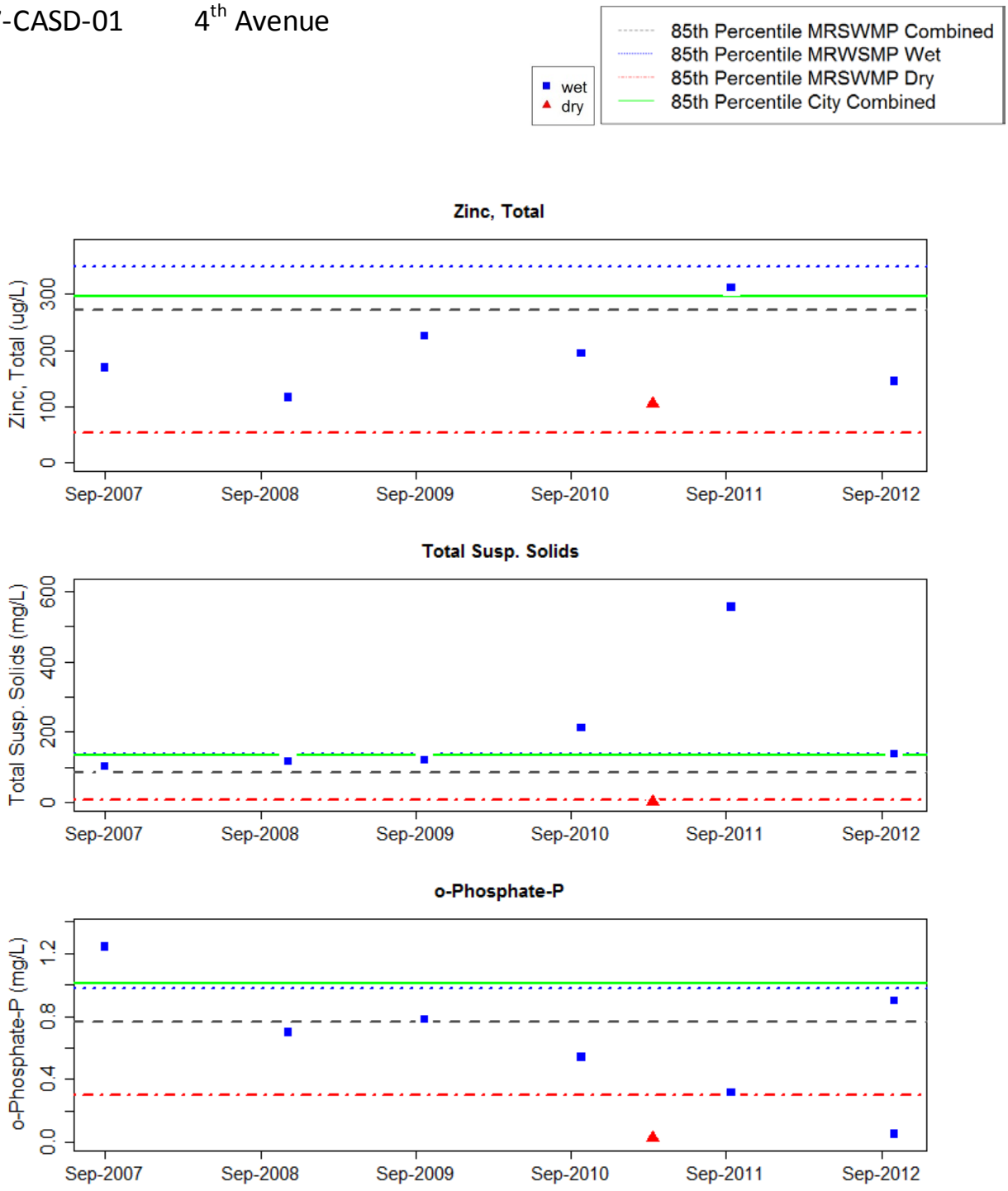
307-CASD-01 4th Avenue



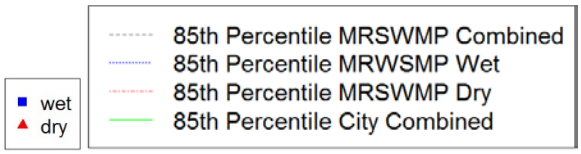
The plots below show pollutants where at least one measure was above the 85th MRSWMP percentile combined wet and dry season. Pollutants not found above this concentration or not measured at this site included flouride, ammonia, nitrate, MBAs, and urea.



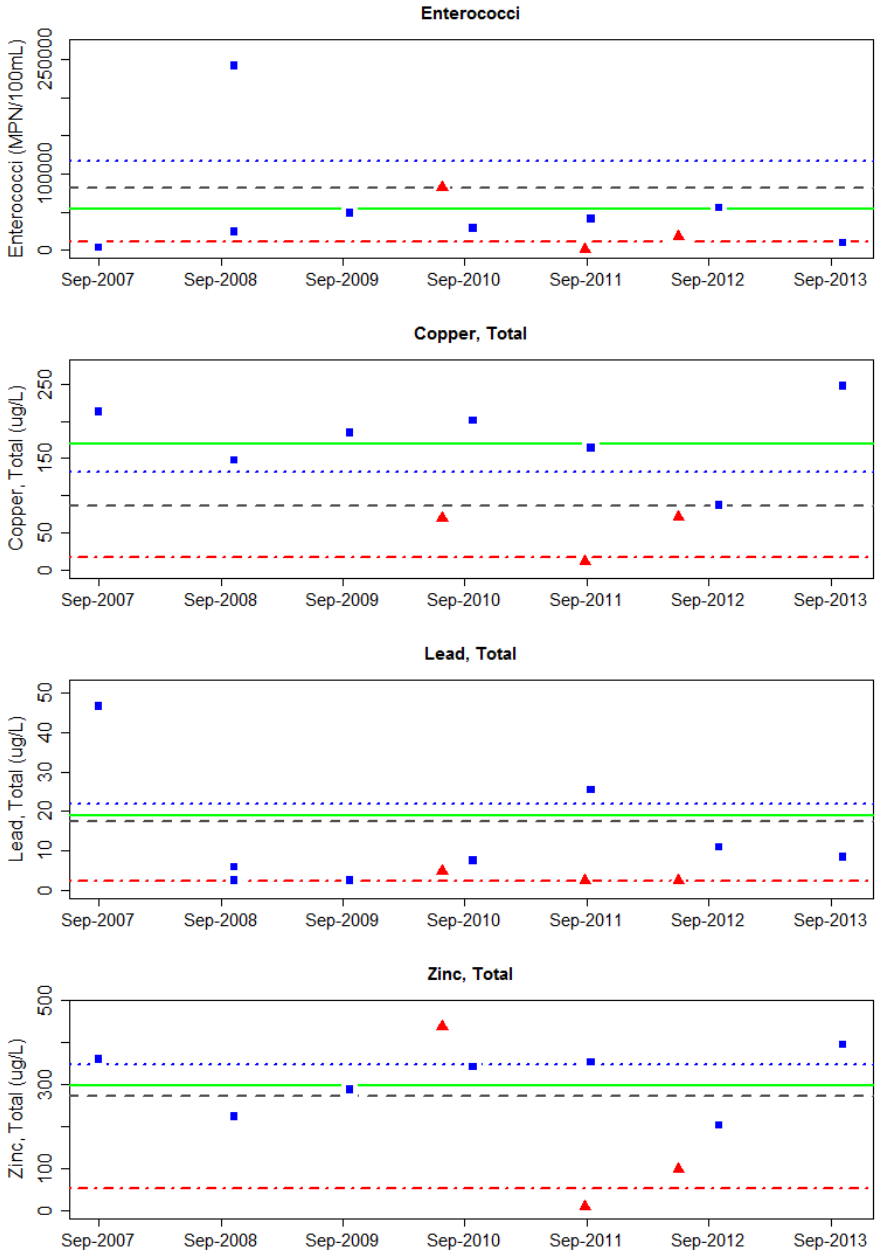
307-CASD-01 4th Avenue



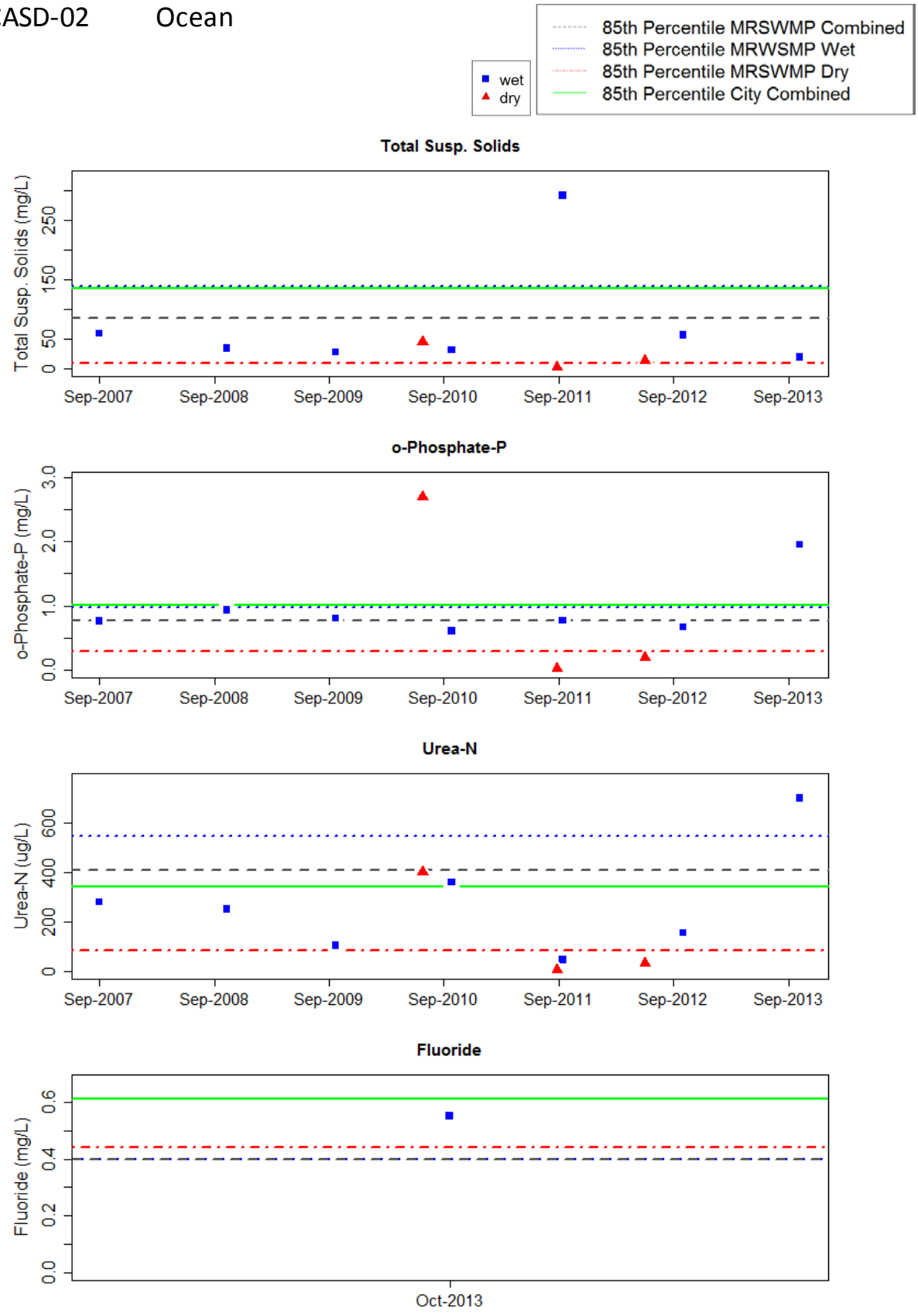
307-CASD-02 Ocean



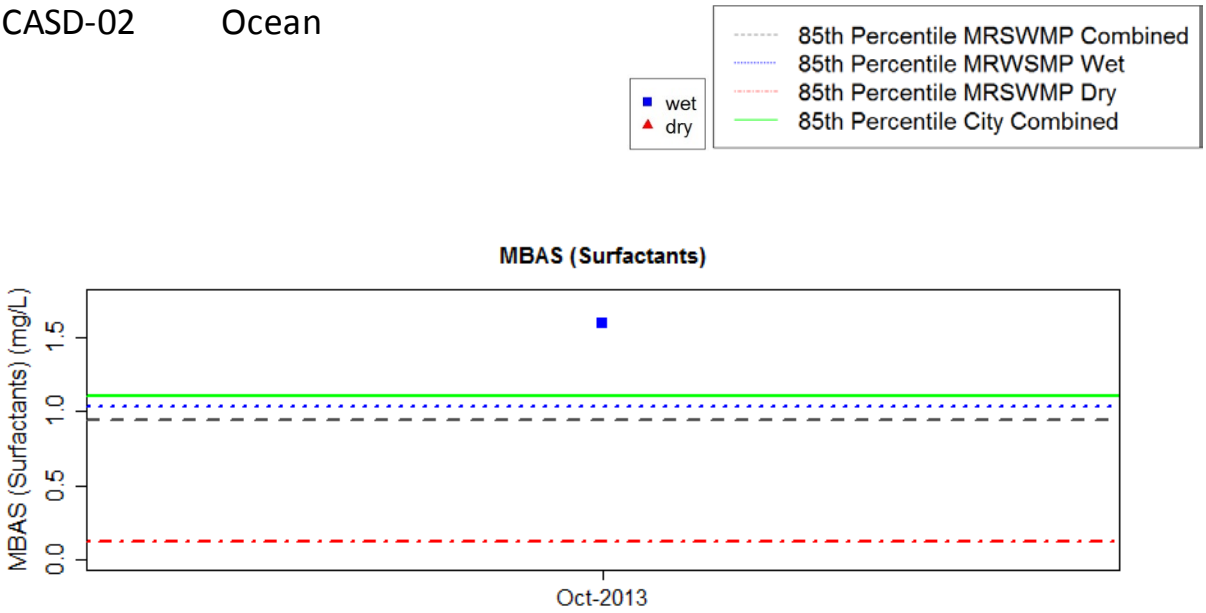
The plots below show pollutants where at least one measure was above the 85th MRSWMP percentile combined wet and dry season. Pollutants not found above this concentration or not measured at this site included E. coli, nitrate, and ammonia.



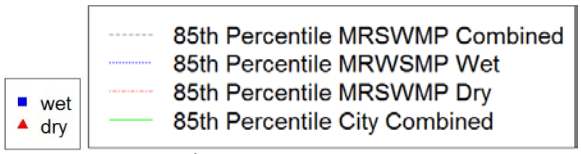
307-CASD-02 Ocean



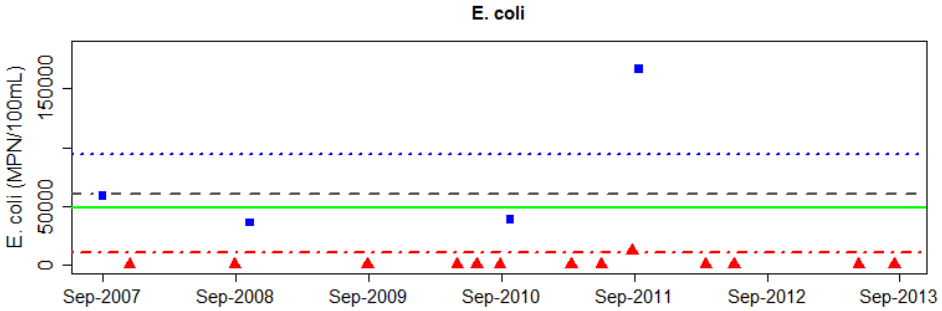
307-CASD-02 Ocean

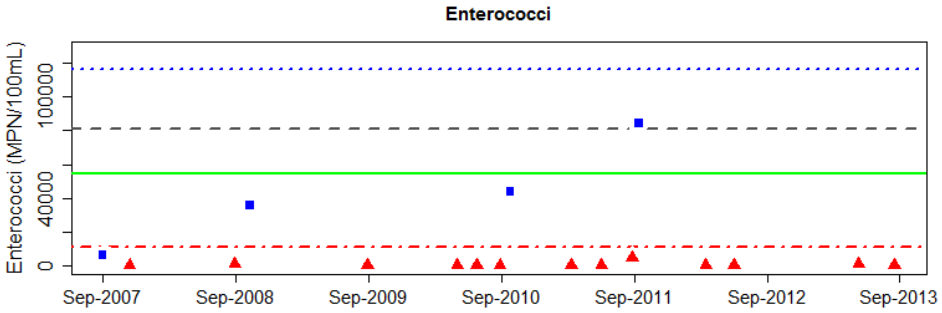


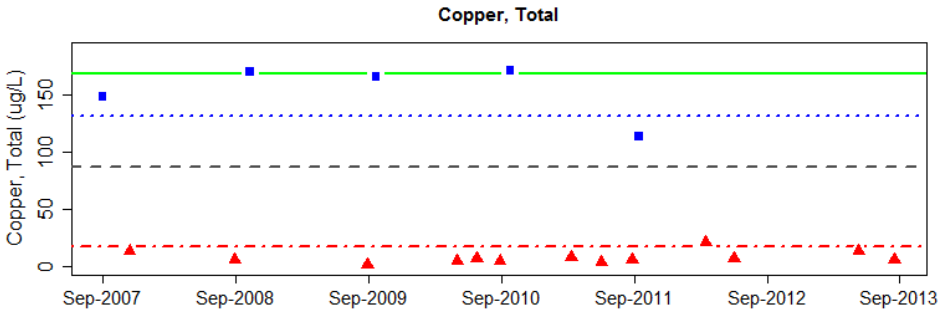
307-CASD-03 8th Avenue

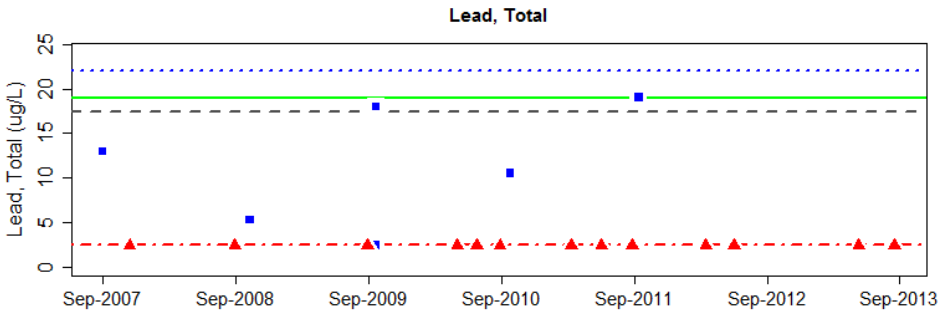


The plots below show pollutants where at least one measure was above the 85th MRSWMP percentile combined wet and dry season. Pollutants not found above this concentration or not measured at this site included ammonia, flouride and MBAS.

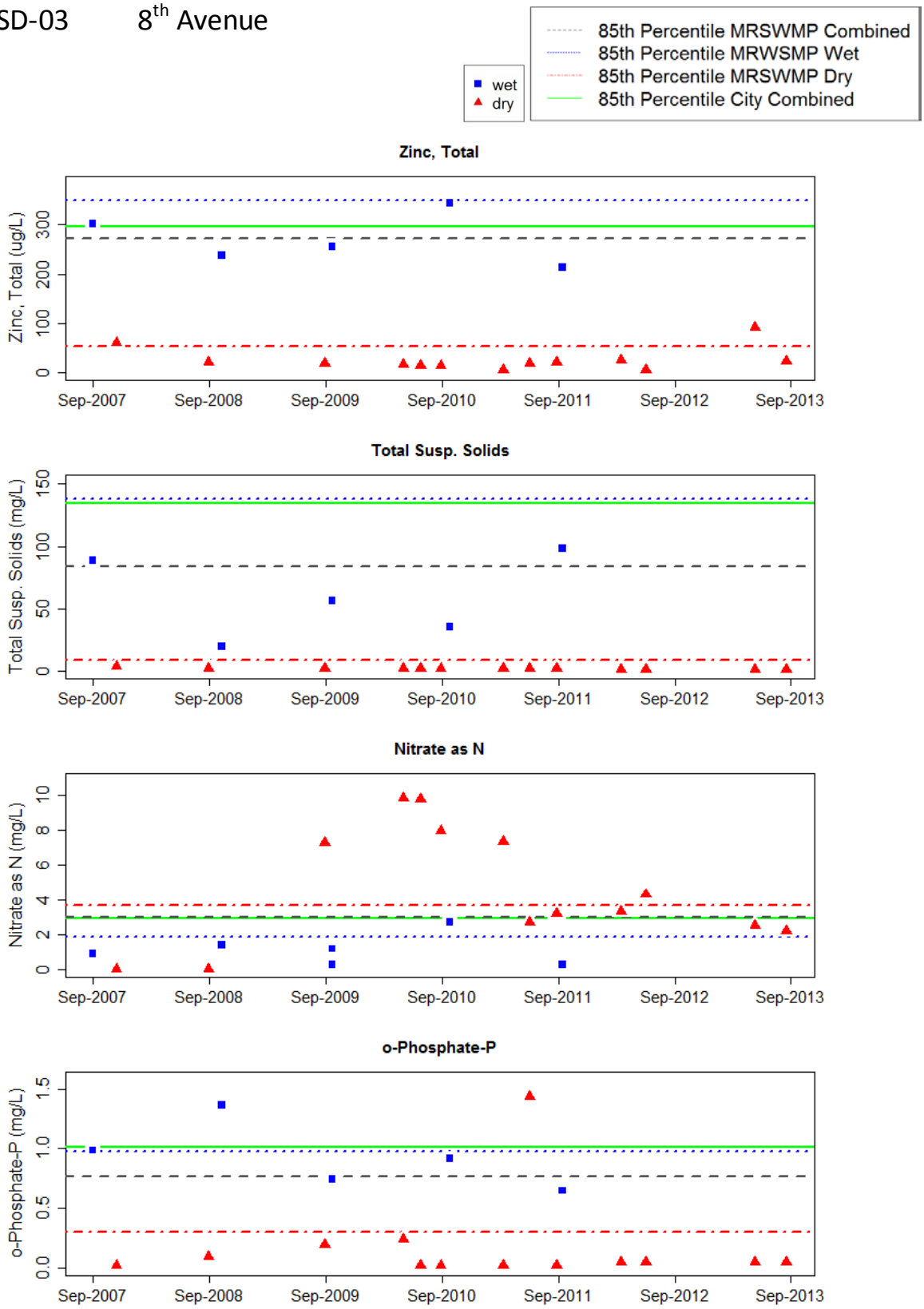




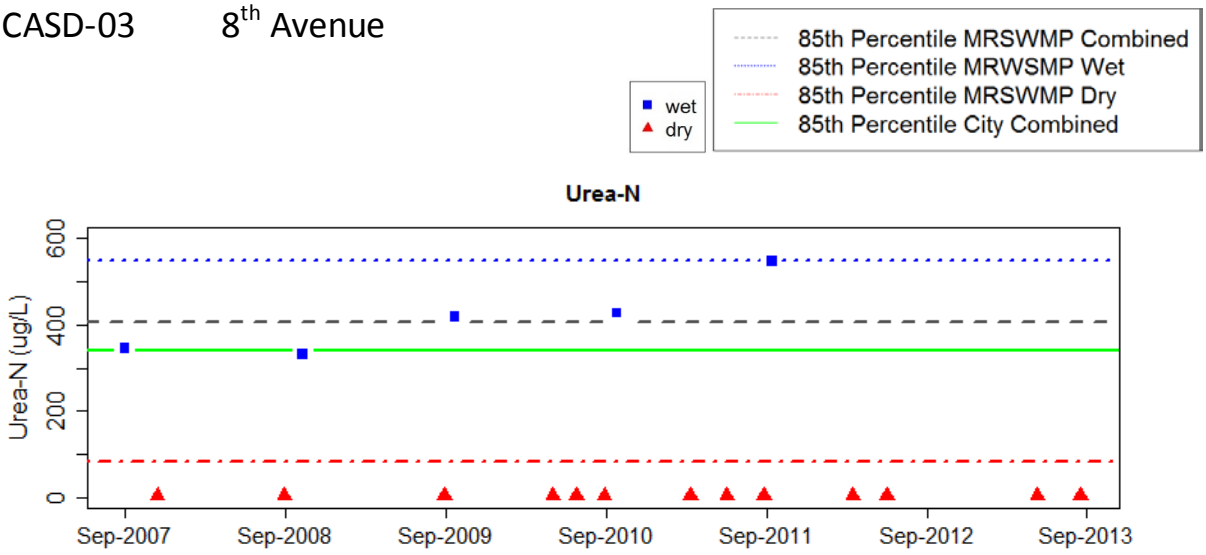




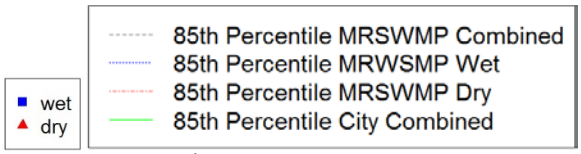
307-CASD-03 8th Avenue



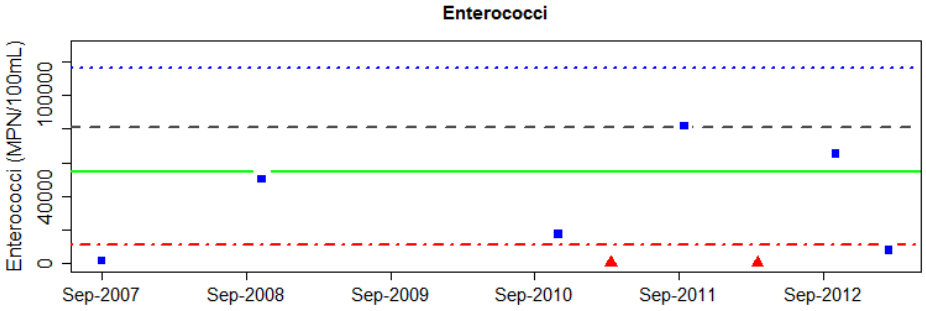
307-CASD-03 8th Avenue

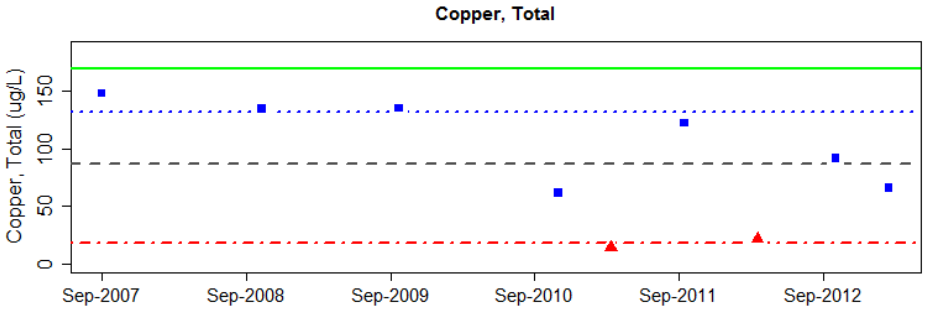


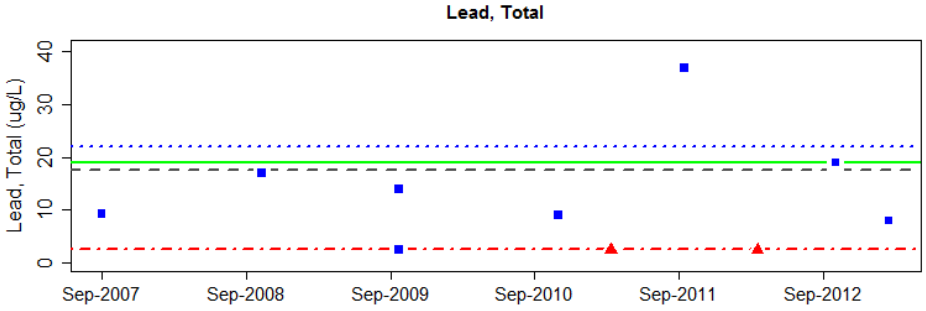
307-CASD-04 Mission

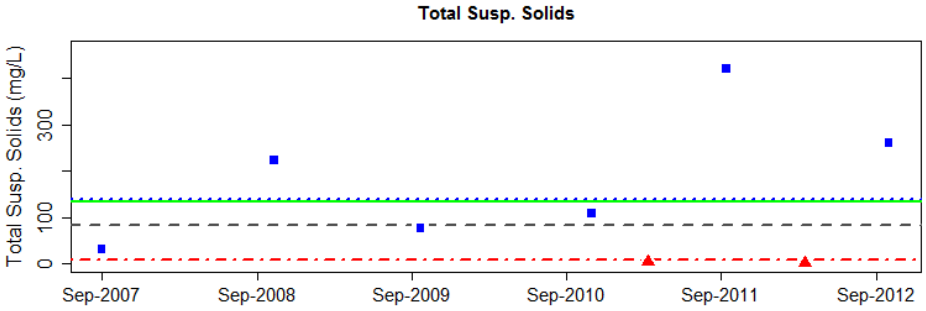


The plots below show pollutants where at least one measure was above the 85th MRSWMP percentile combined wet and dry season. Pollutants not found above this concentration or not measured at this site included E. coli, zinc, nitrate, urea, ammonia, flouride and MBAS.

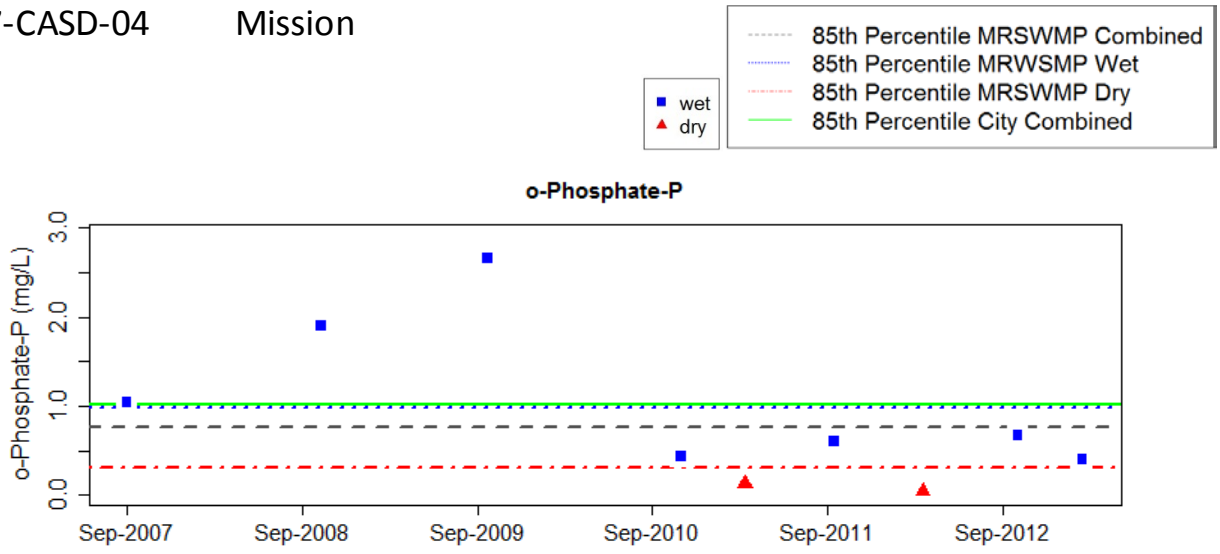




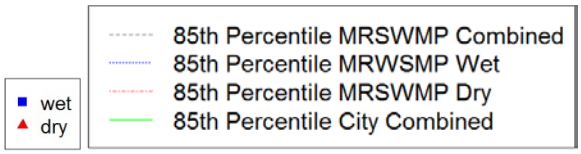




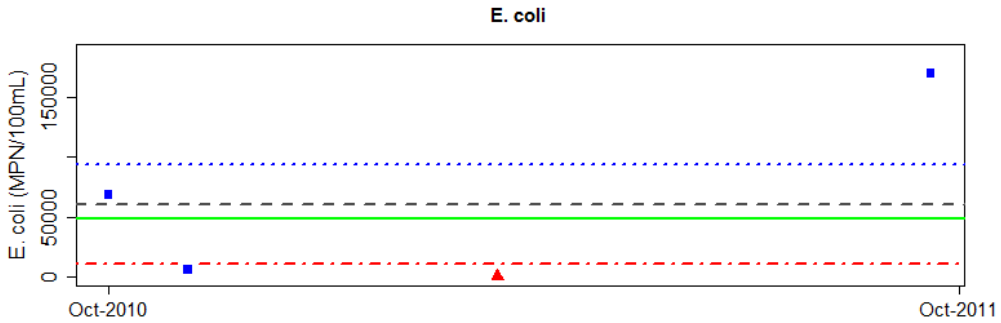
307-CASD-04 Mission

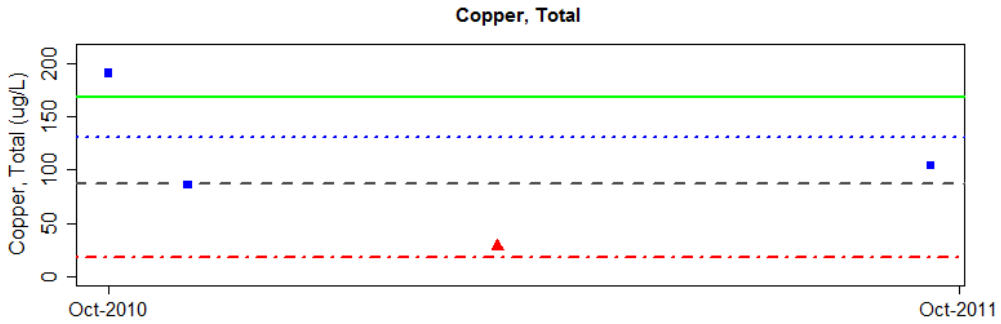


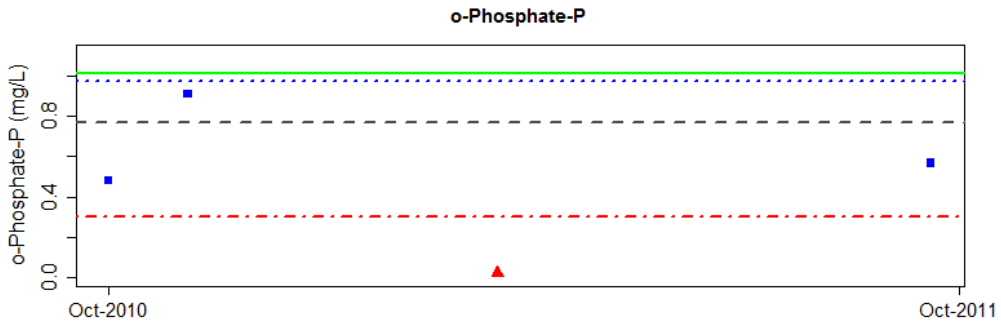
307-CASD-05 Santa Lucia



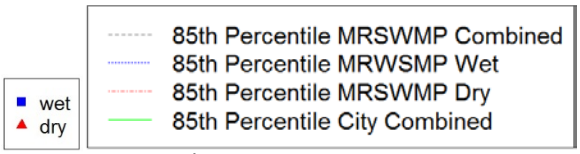
The plots below show pollutants where at least one measure was above the 85th MRSWMP percentile combined wet and dry season. Pollutants not found above this concentration or not measured at this site included Enterococci, lead, zinc, total suspended solids, nitrate, urea, ammonia, flouride and MBAS.



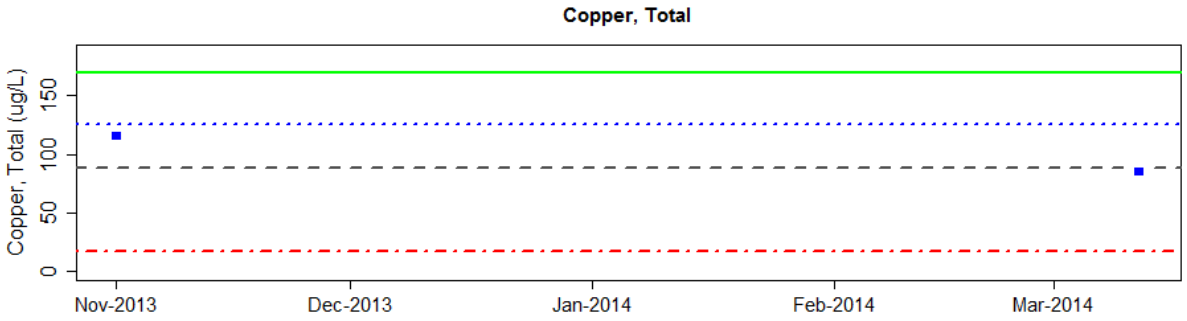


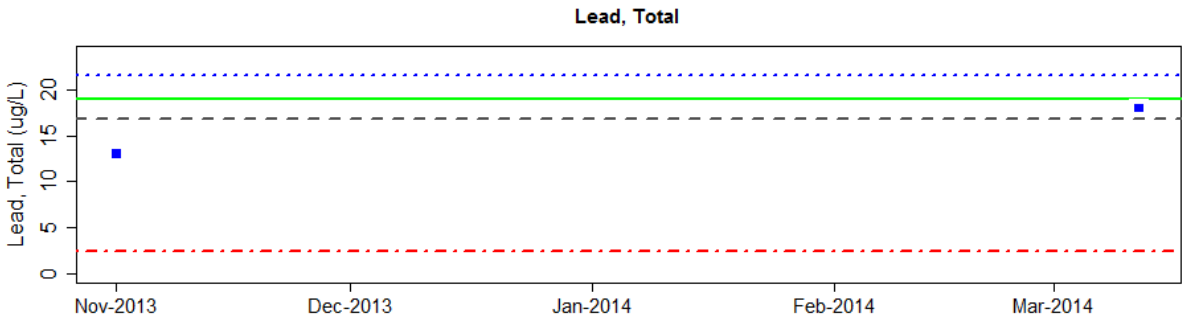


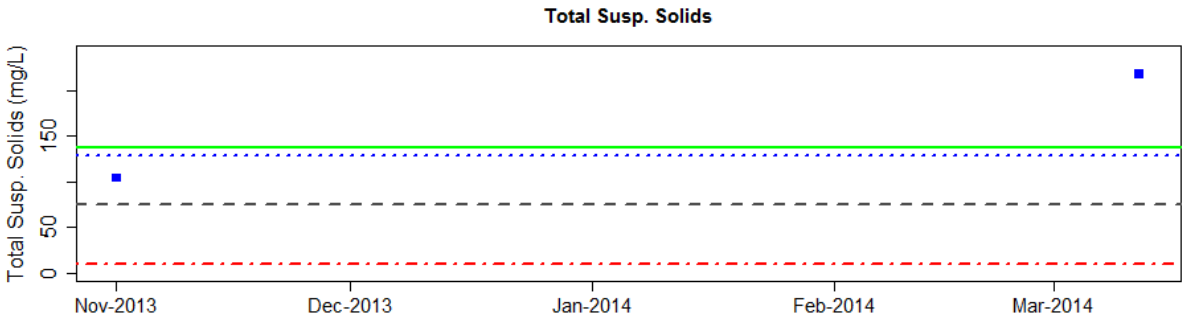
307-CASD-06 Rio Road

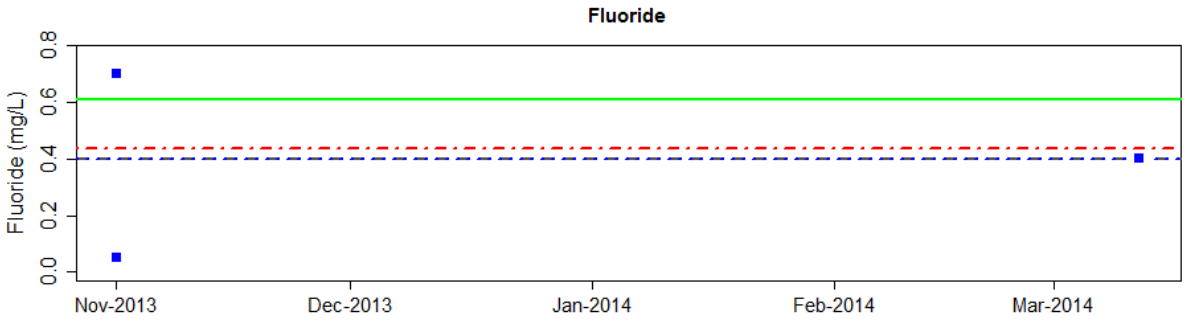


The plots below show pollutants where at least one measure was above the 85th MRSWMP percentile combined wet and dry season. Pollutants not found above this concentration or not measured at this site included E. coli, Enterococci, zinc, nitrate, o-phosphate, urea, ammonia, and MBAS.

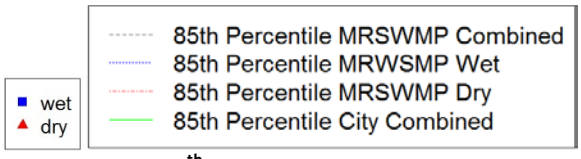




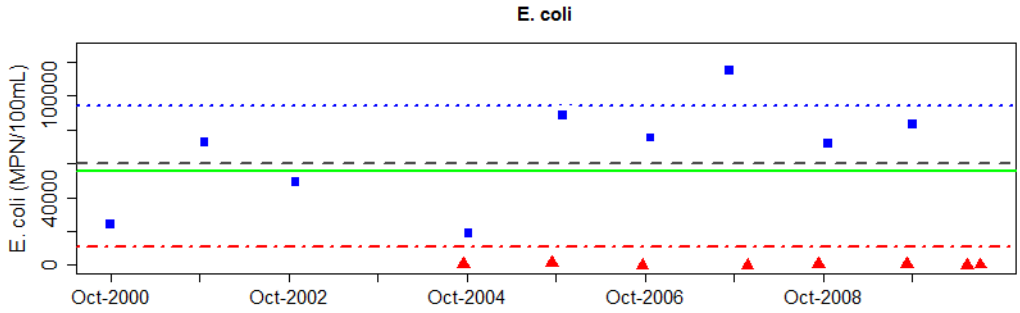


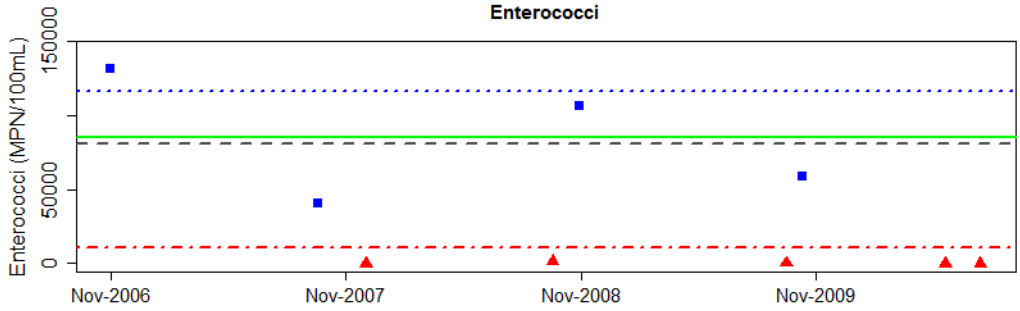


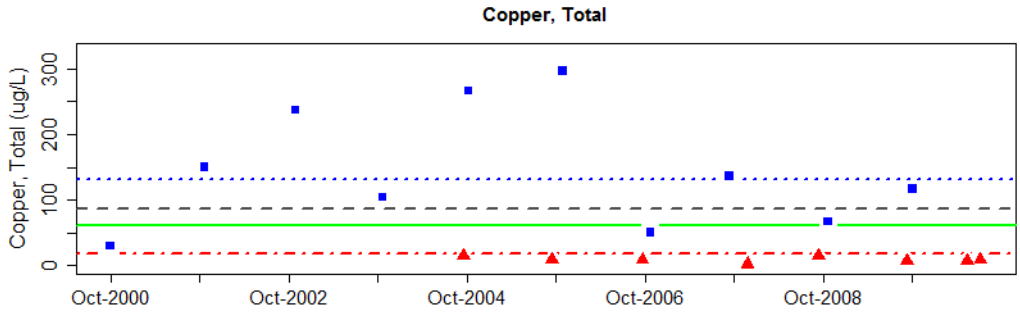
309-ASILO-31 Asilomar

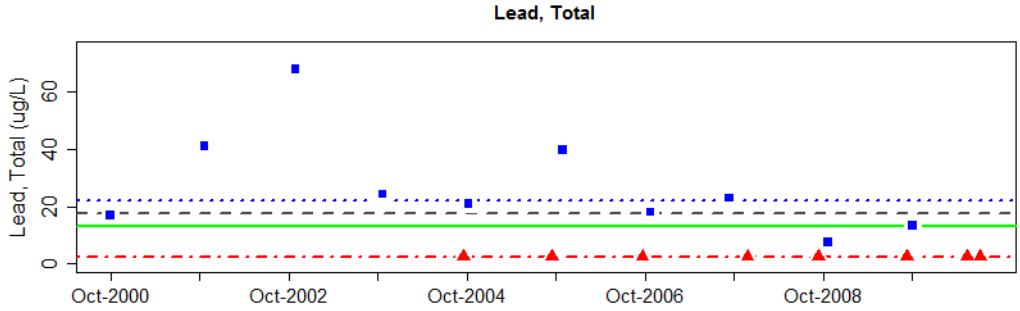


The plots below show pollutants where at least one measure was above the 85th MRSWMP percentile combined wet and dry season. Pollutants not found above this concentration or not measured at this site included o-phosphate, urea, ammonia, flouride, and MBAS.

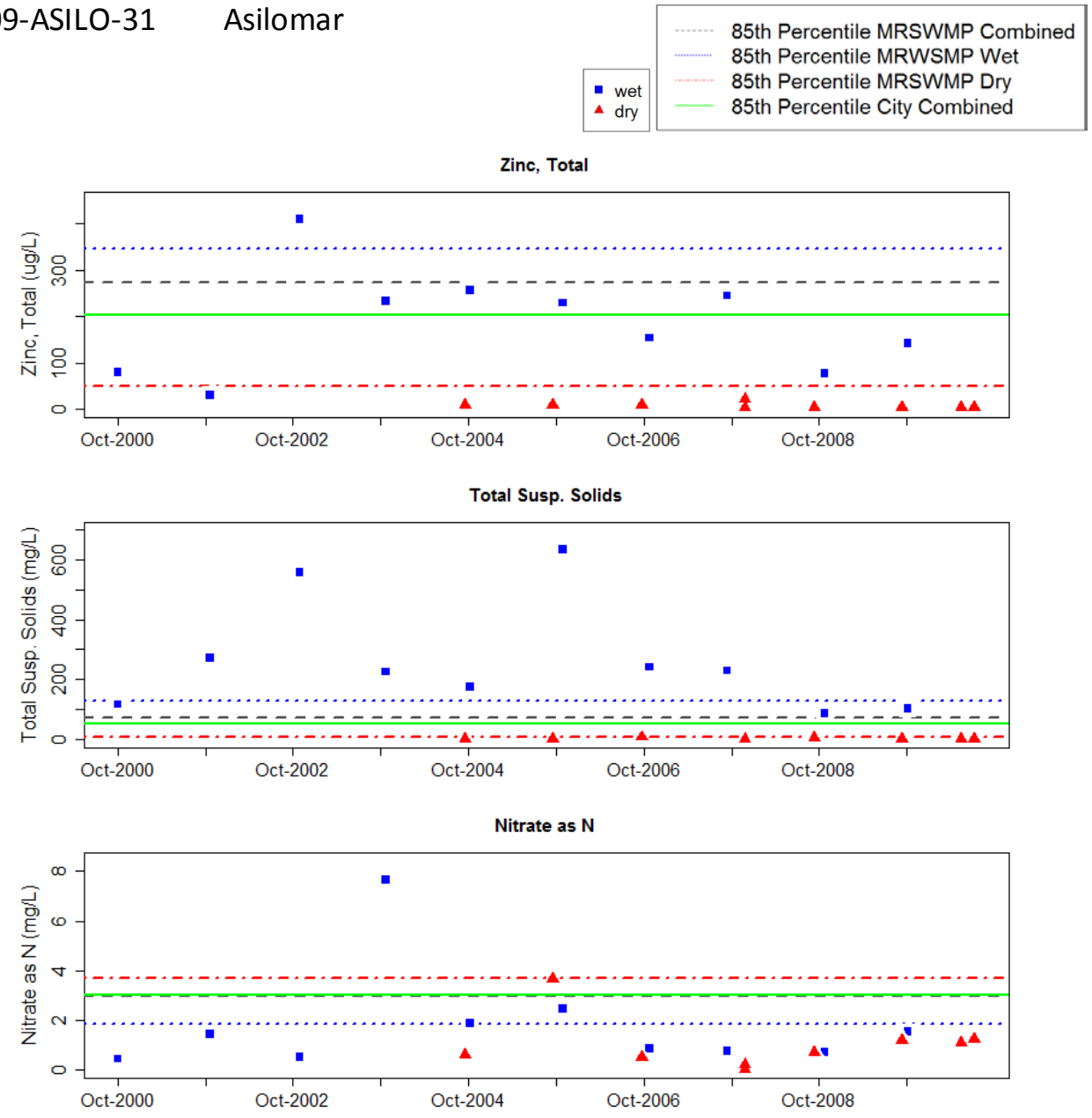




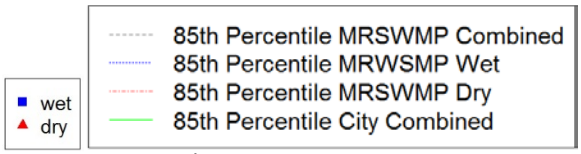




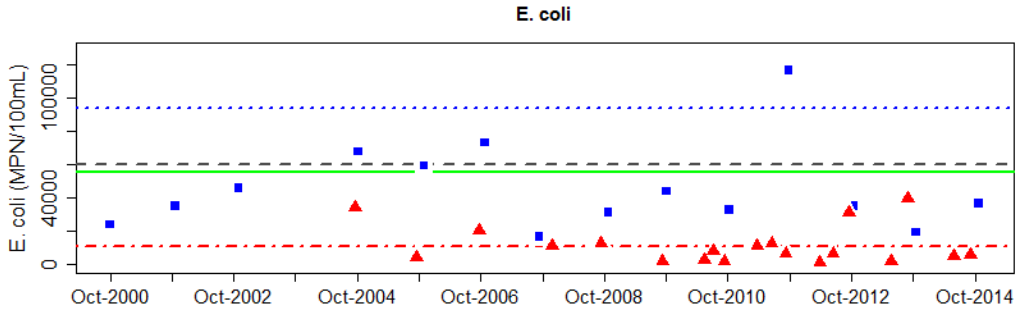
309-ASILO-31 Asilomar

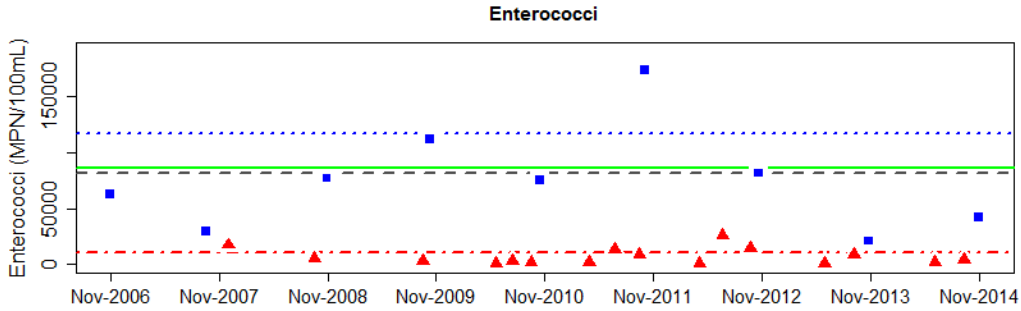


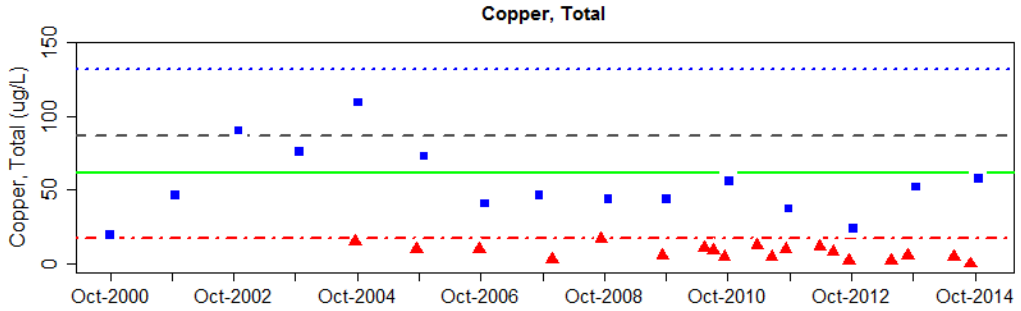
309-CENTR-31 Greenwood Park

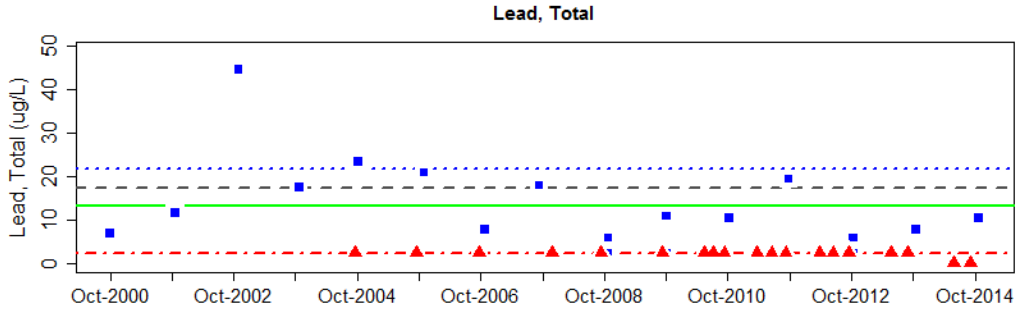


The plots below show pollutants where at least one measure was above the 85th MRSWMP percentile combined wet and dry season. Pollutants not found above this concentration or not measured at this site included flouride and MBAS.

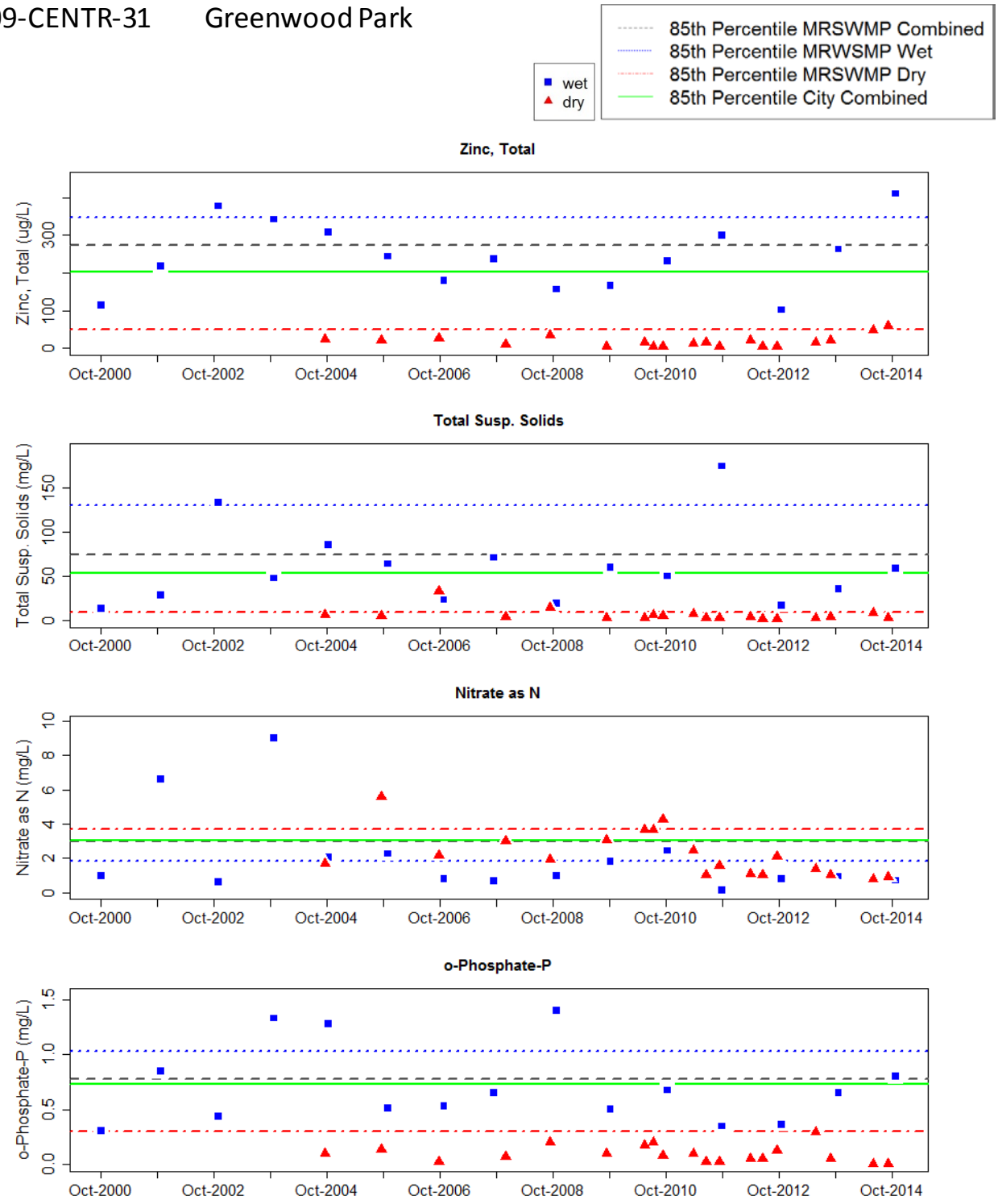




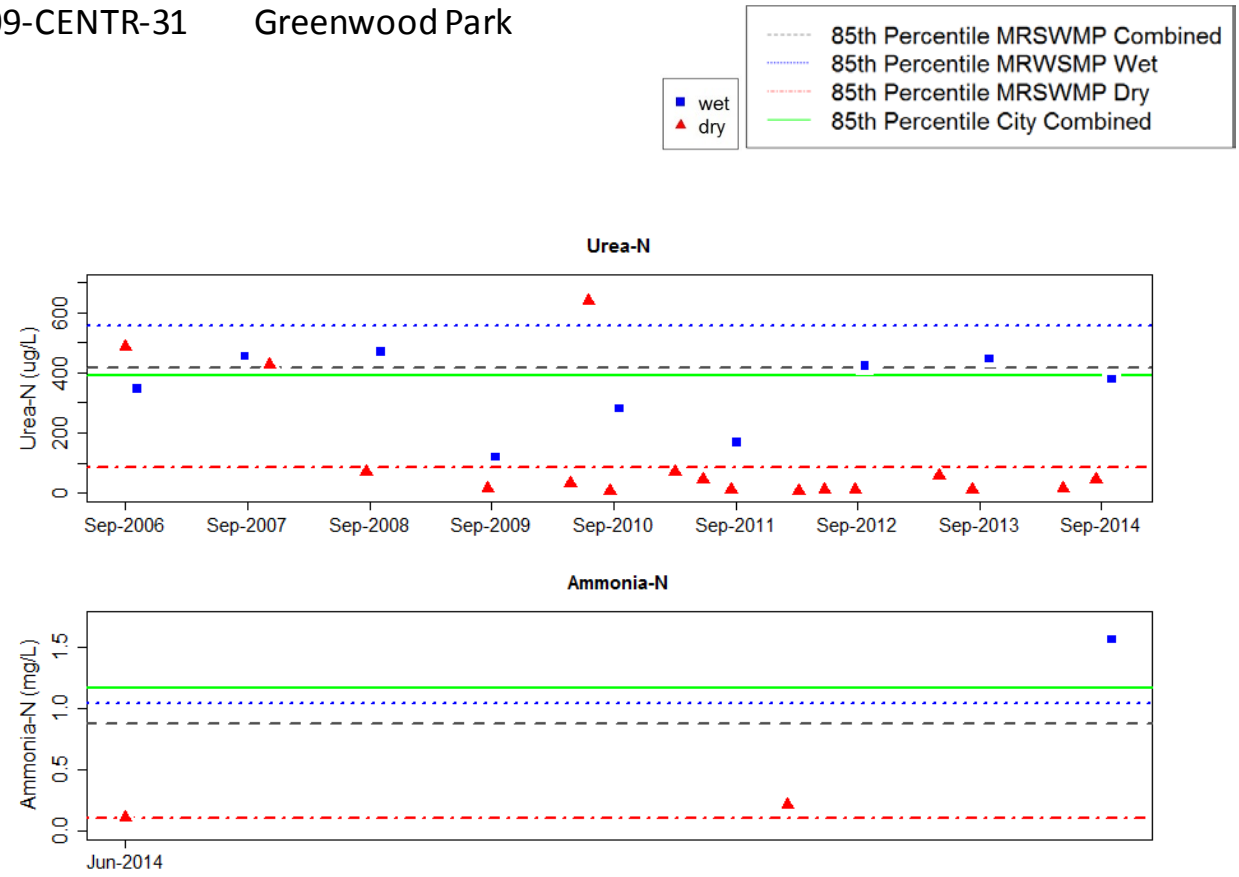




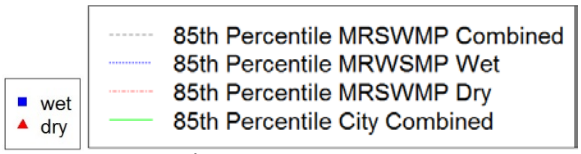
309-CENTR-31 Greenwood Park



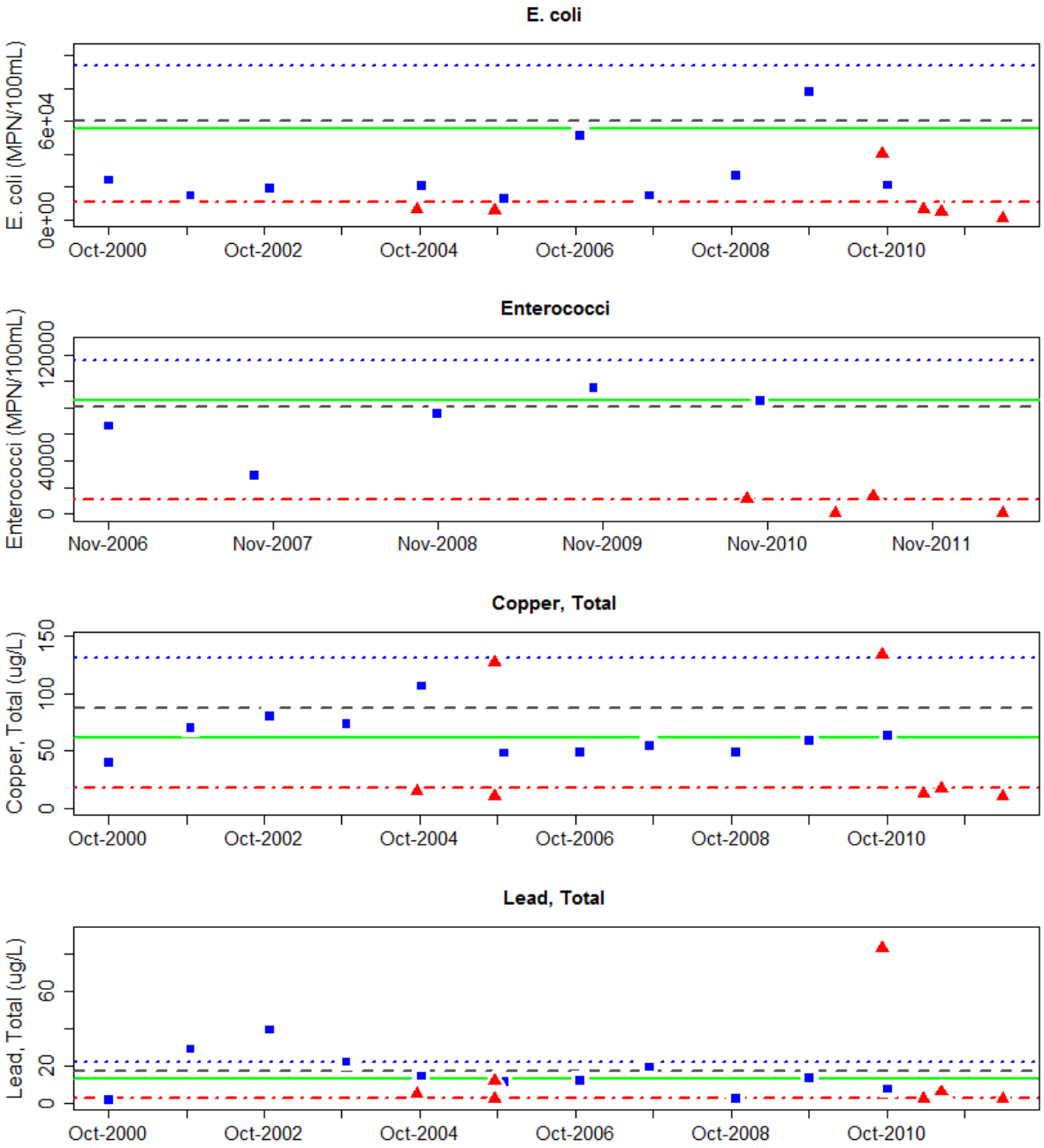
309-CENTR-31 Greenwood Park



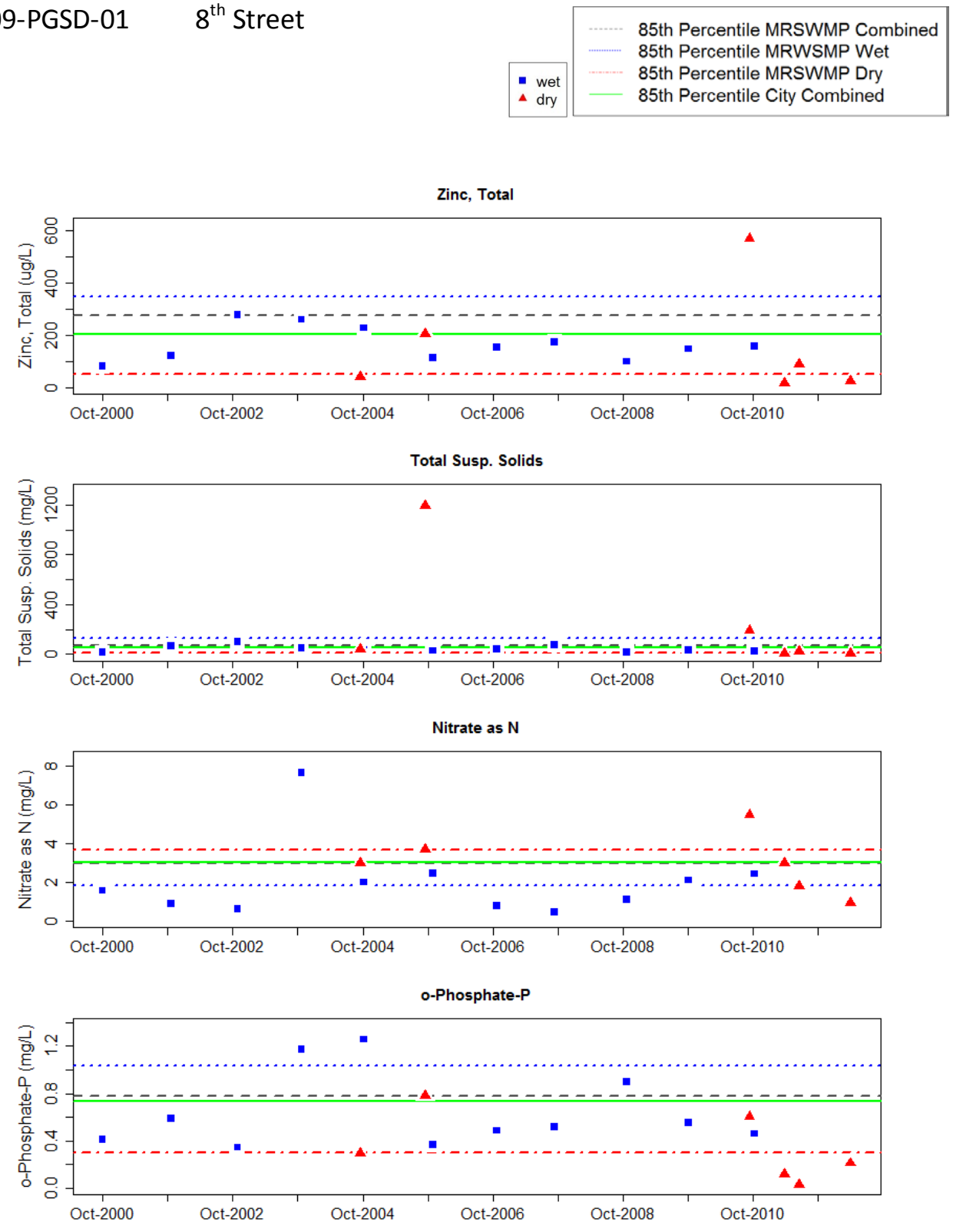
309-PGSD-01 8th Street



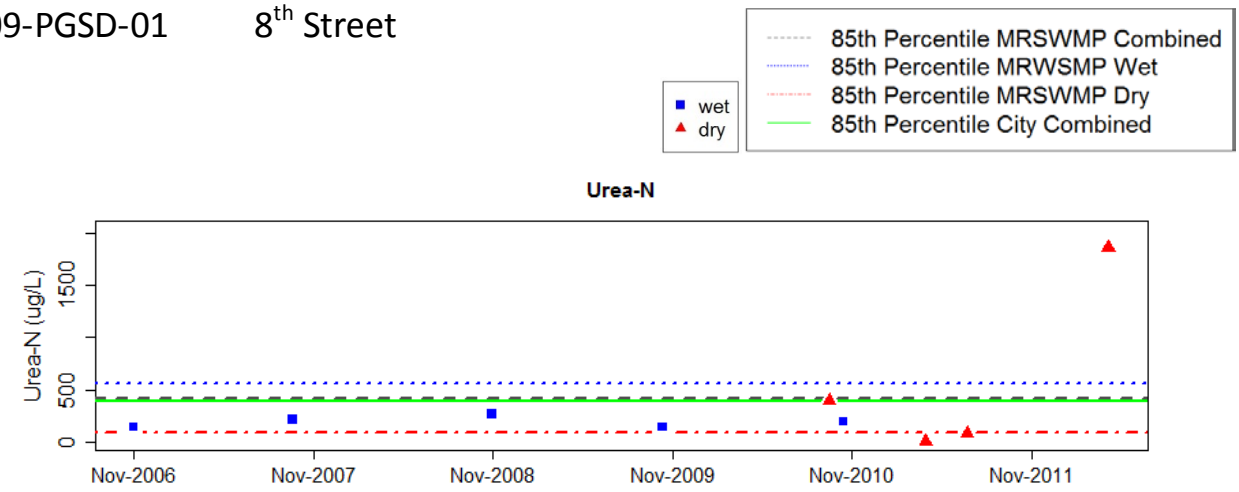
The plots below show pollutants where at least one measure was above the 85th MRSWMP percentile combined wet and dry season. Pollutants not found above this concentration or not measured at this site included flouride, MBAs, and ammonia.



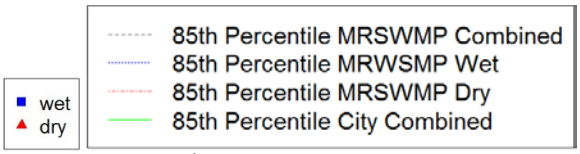
309-PGSD-01 8th Street



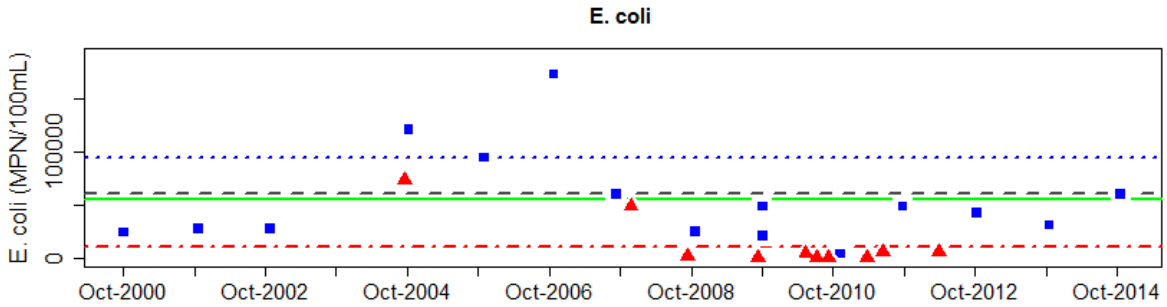
309-PGSD-01 8th Street

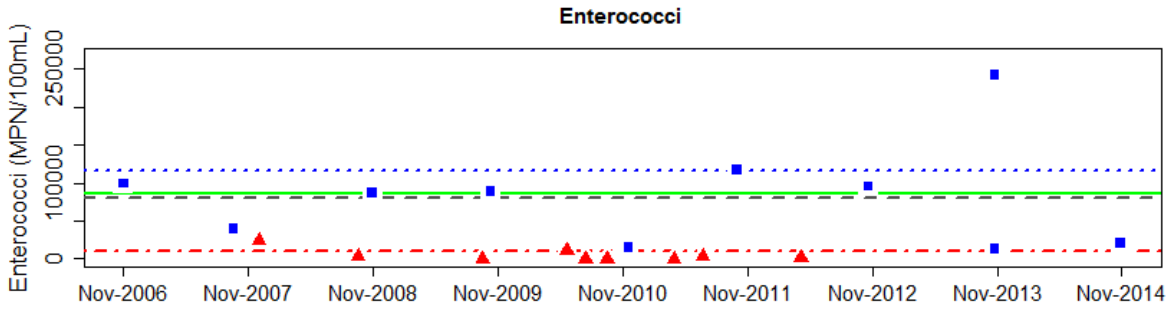


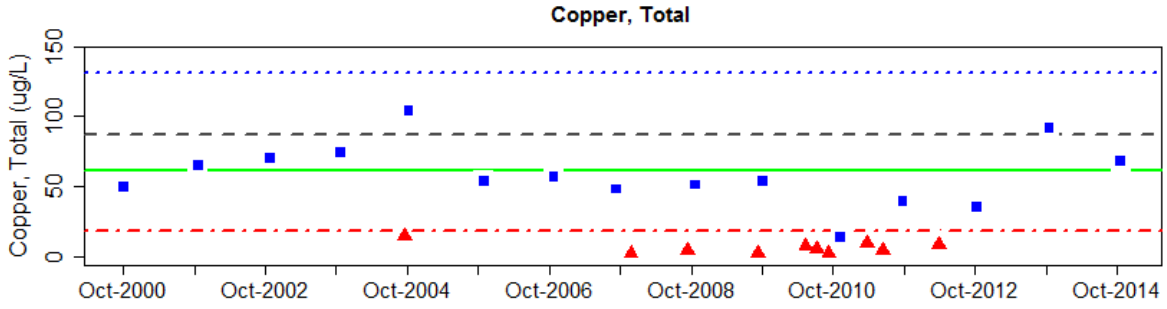
309-PGSD-03 Lover's Point

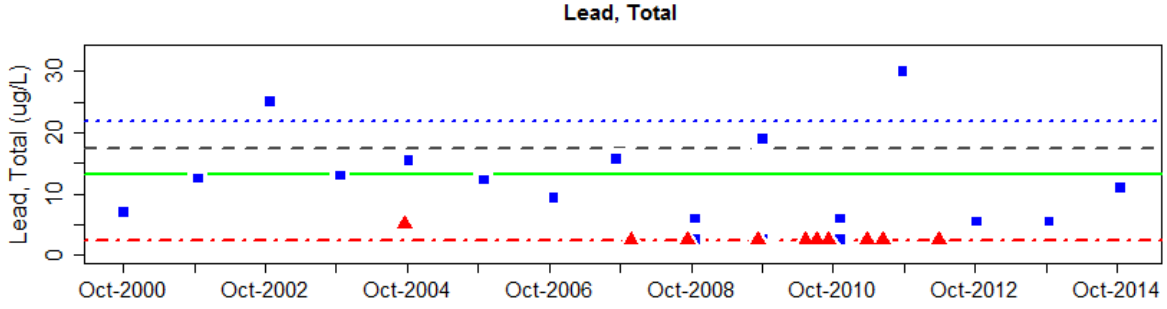


The plots below show pollutants where at least one measure was above the 85th MRSWMP percentile combined wet and dry season. All pollutants had at least one event above this concentration.

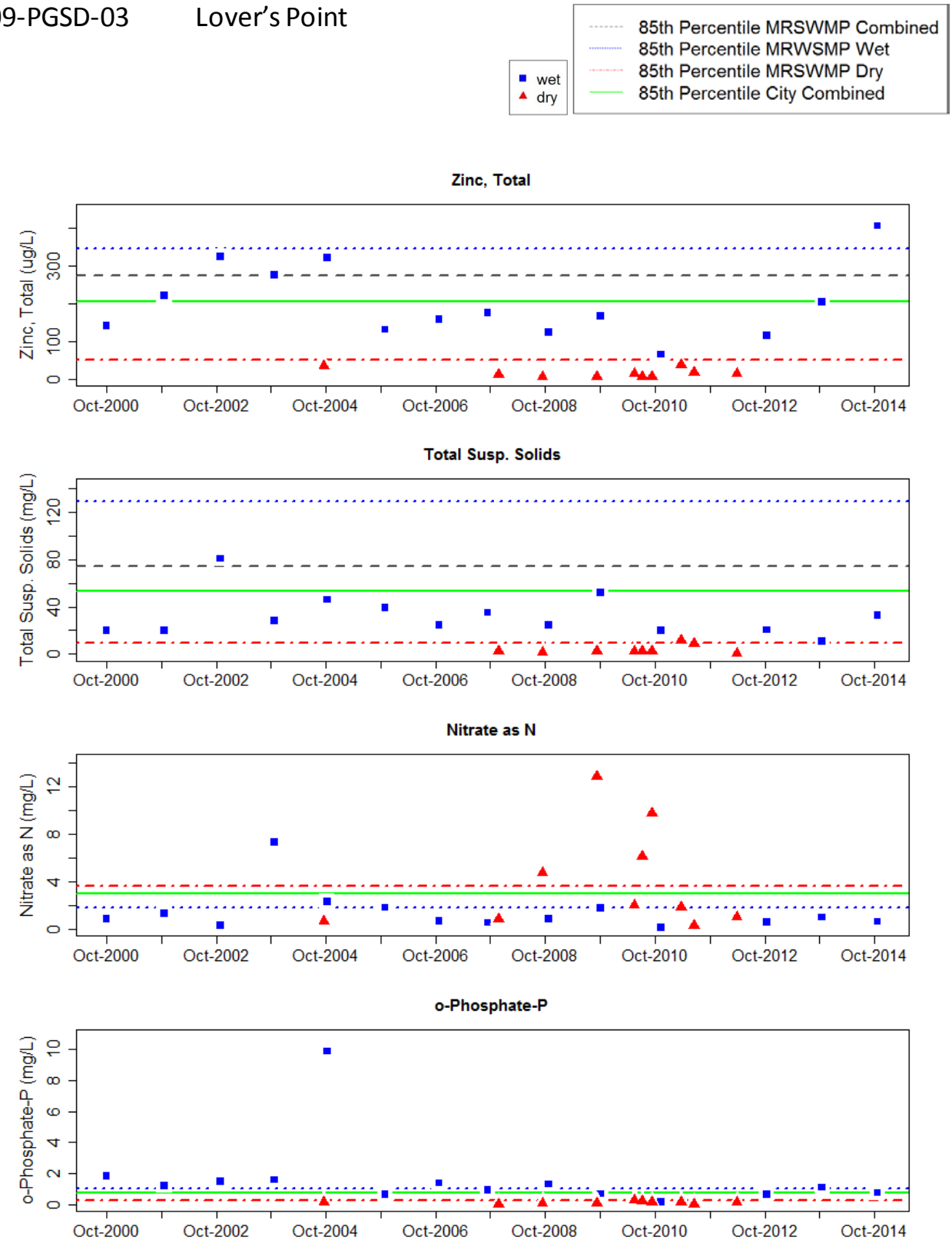




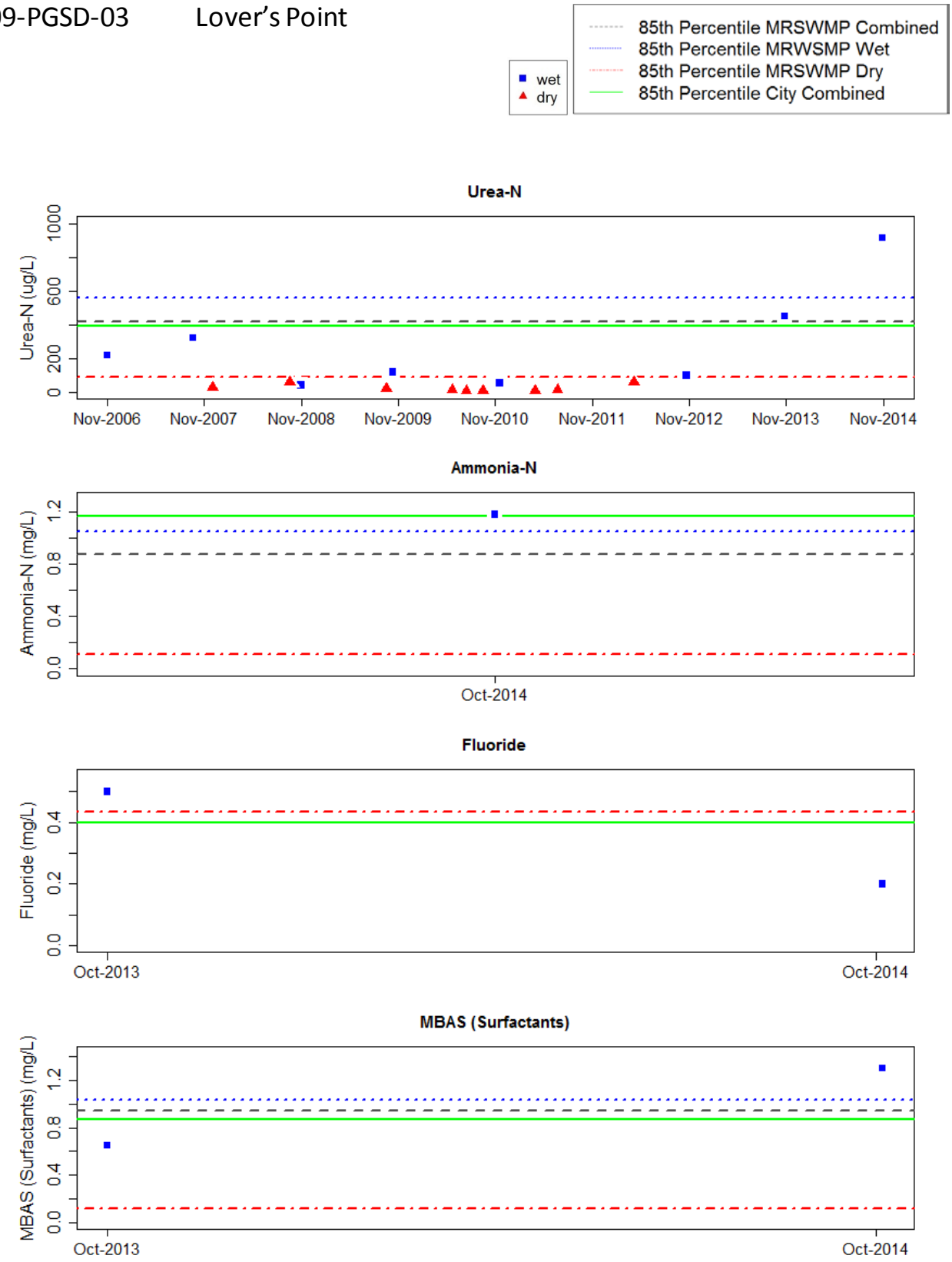




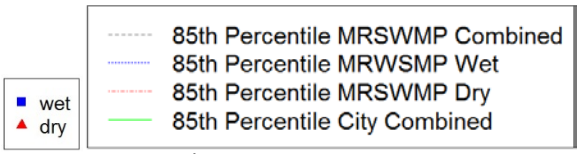
309-PGSD-03 Lover's Point



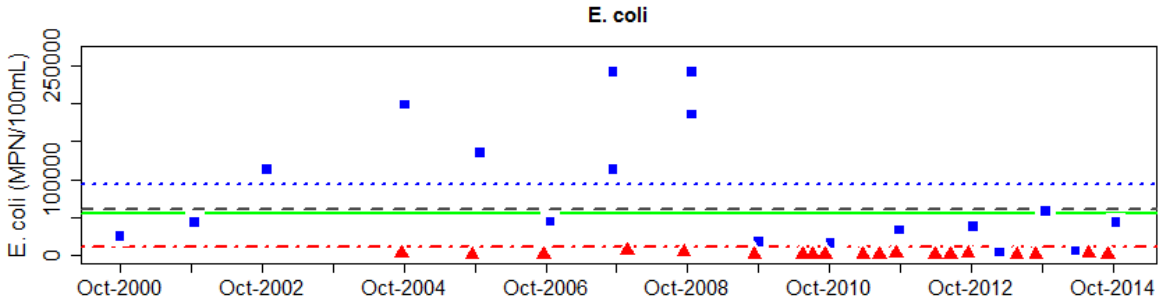
309-PGSD-03 Lover's Point

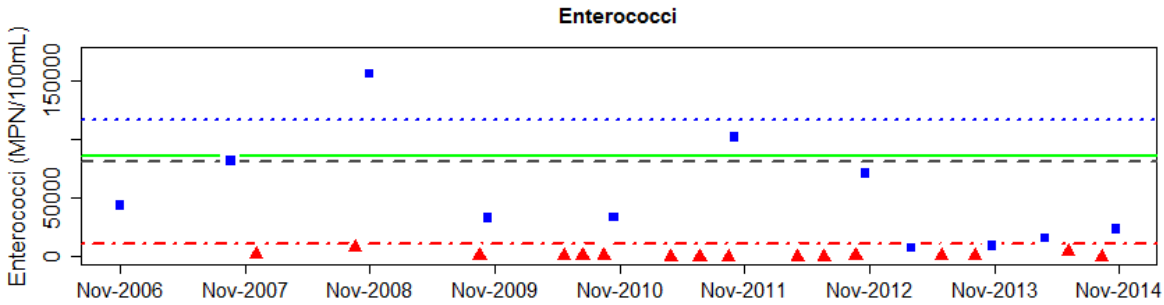


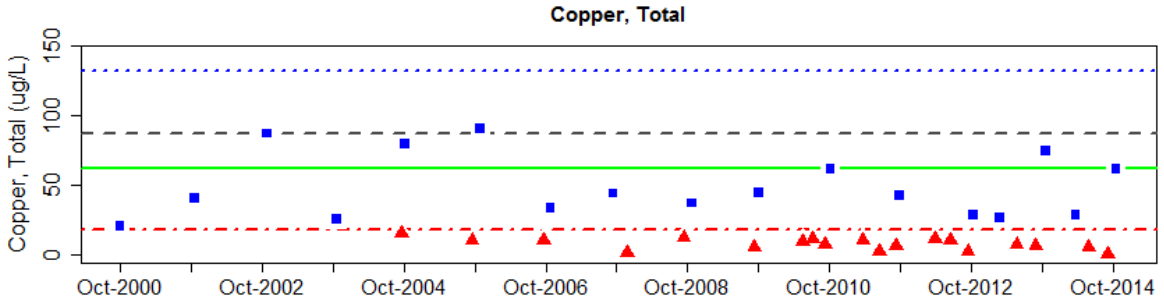
309-PGSD-04 Pico

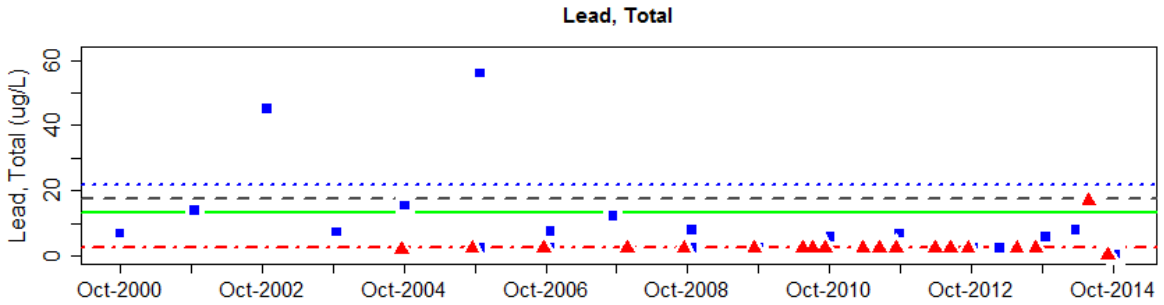


The plots below show pollutants where at least one measure was above the 85th MRSWMP percentile combined wet and dry season. The pollutant not found above this concentration or not measured at this site was flouride.

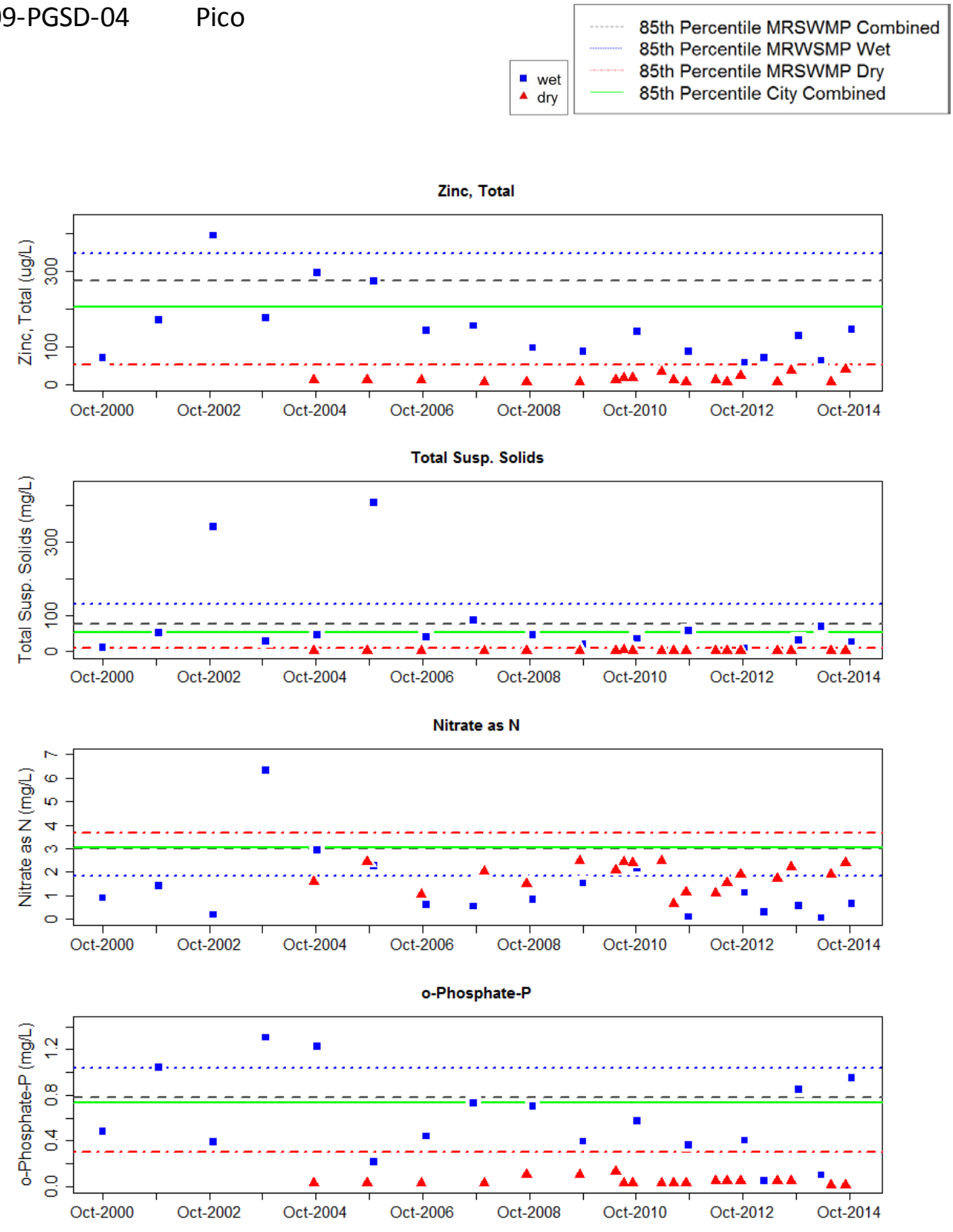




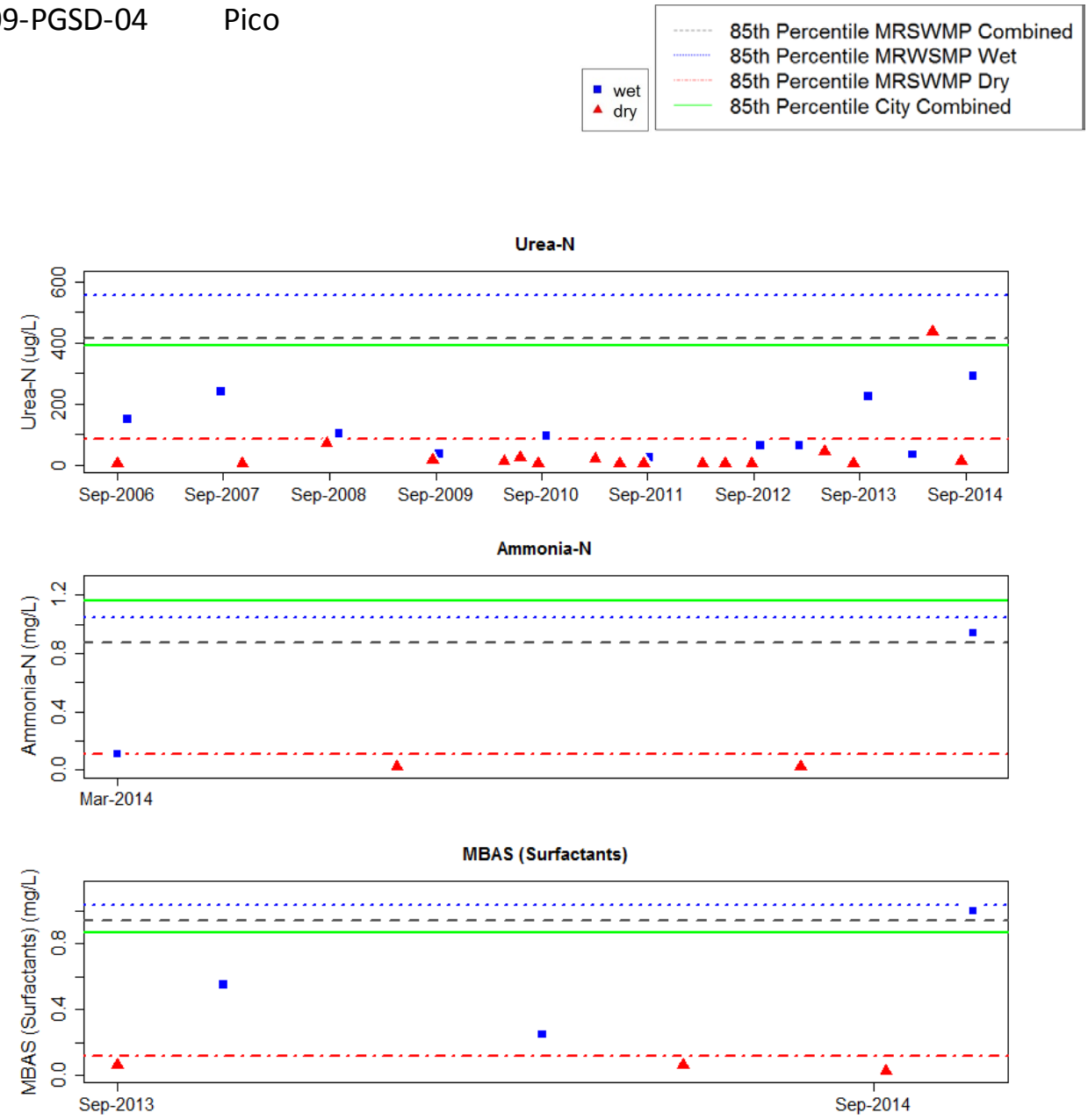




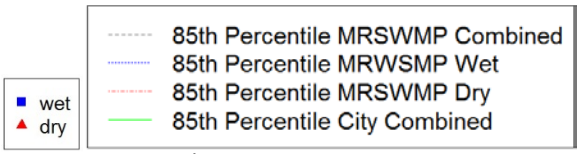
309-PGSD-04 Pico



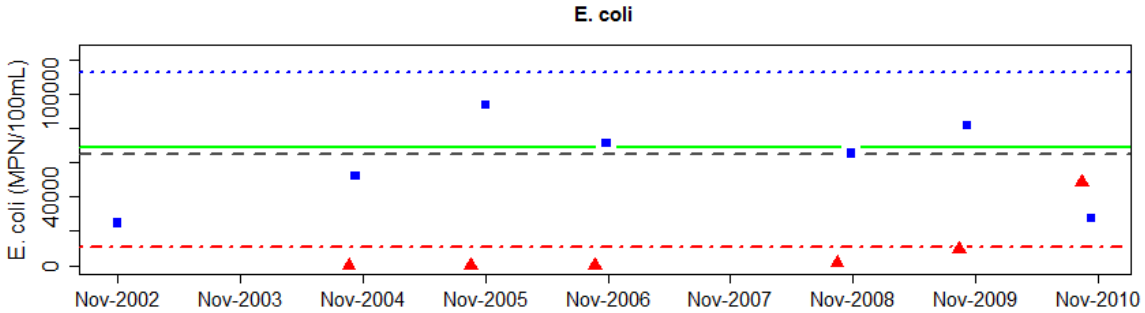
309-PGSD-04 Pico

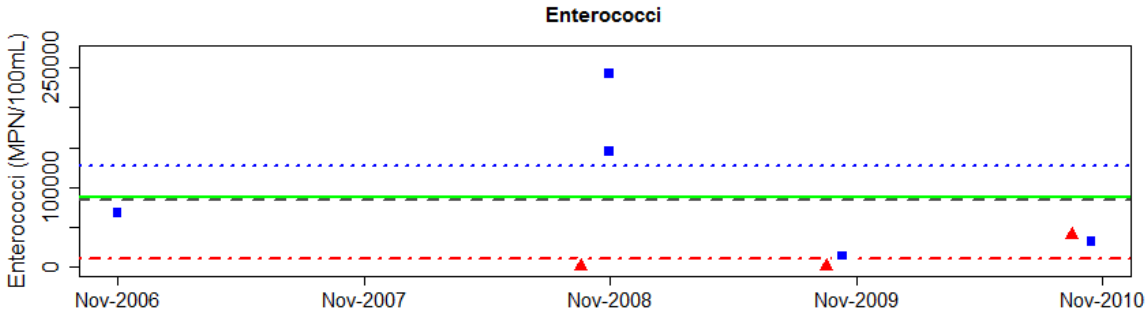


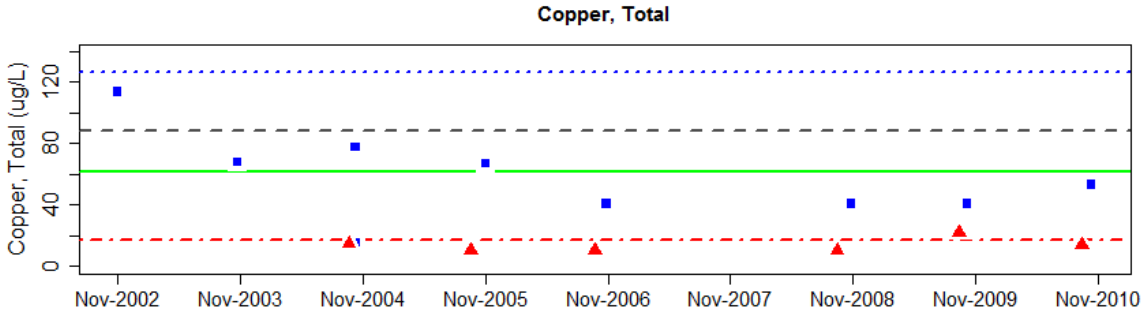
309-PGSD-06 Congress

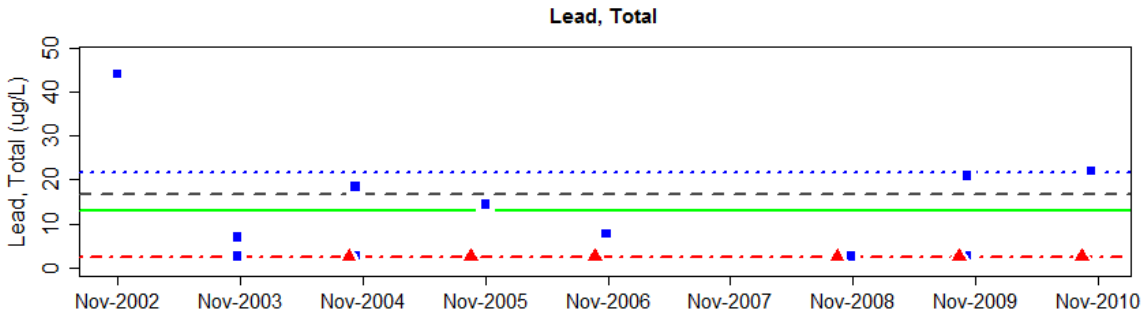


The plots below show pollutants where at least one measure was above the 85th MRSWMP percentile combined wet and dry season. Pollutants not found above this concentration or not measured at this site included ammonia, flouride and MBAS.

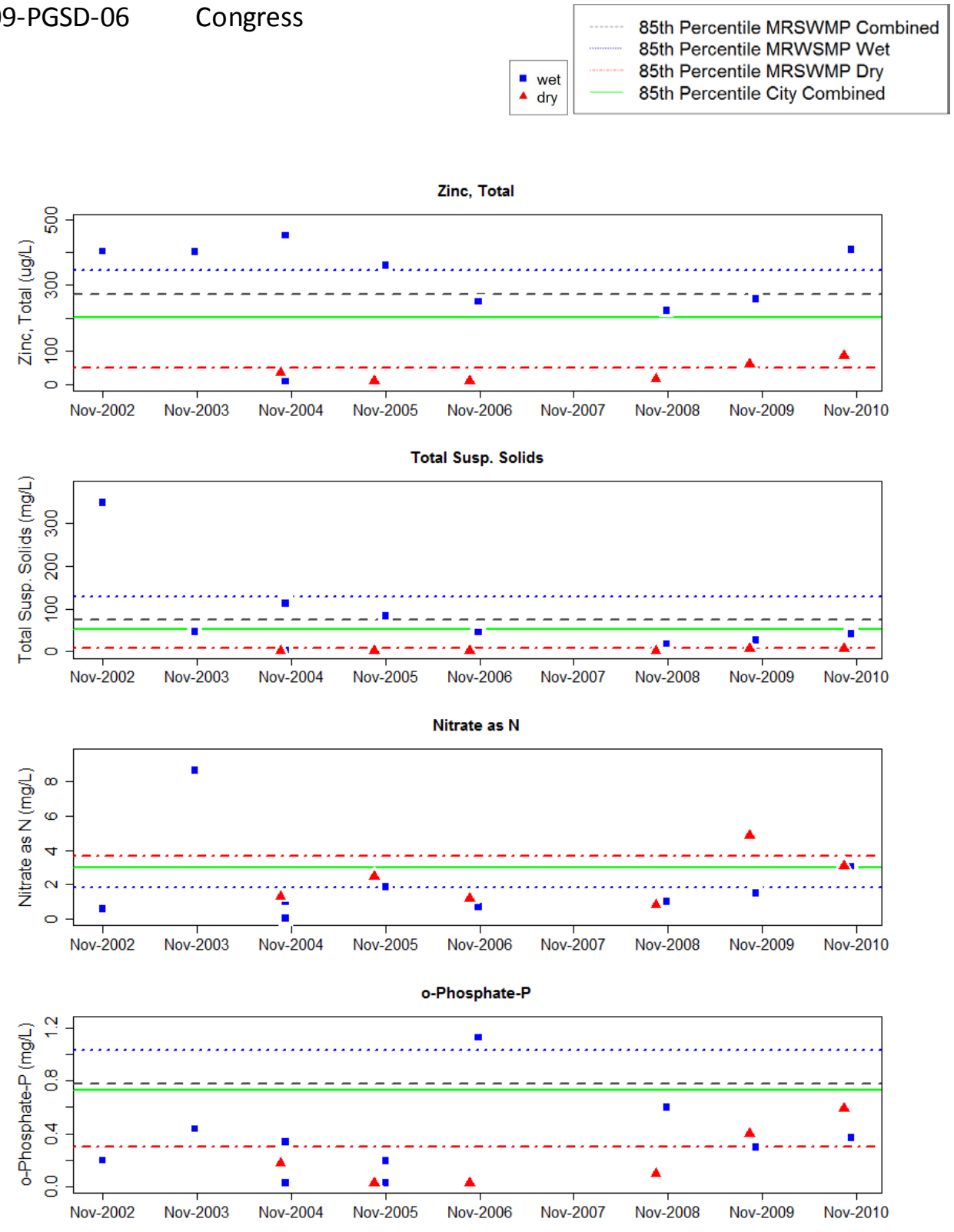




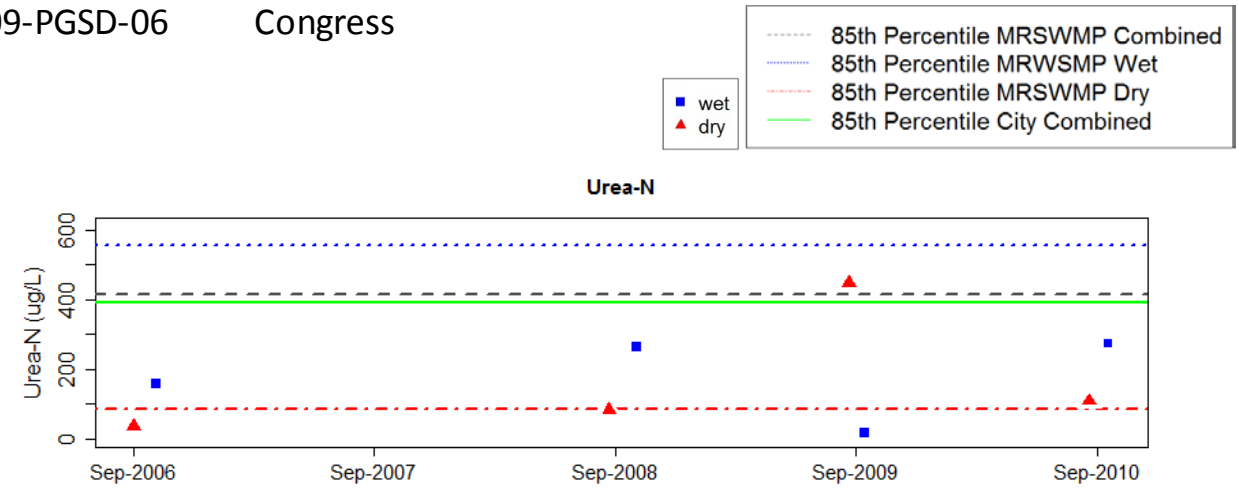




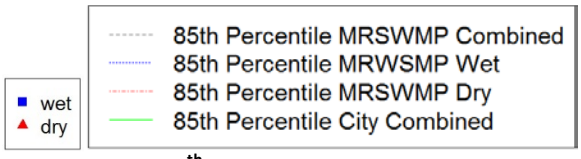
309-PGSD-06 Congress



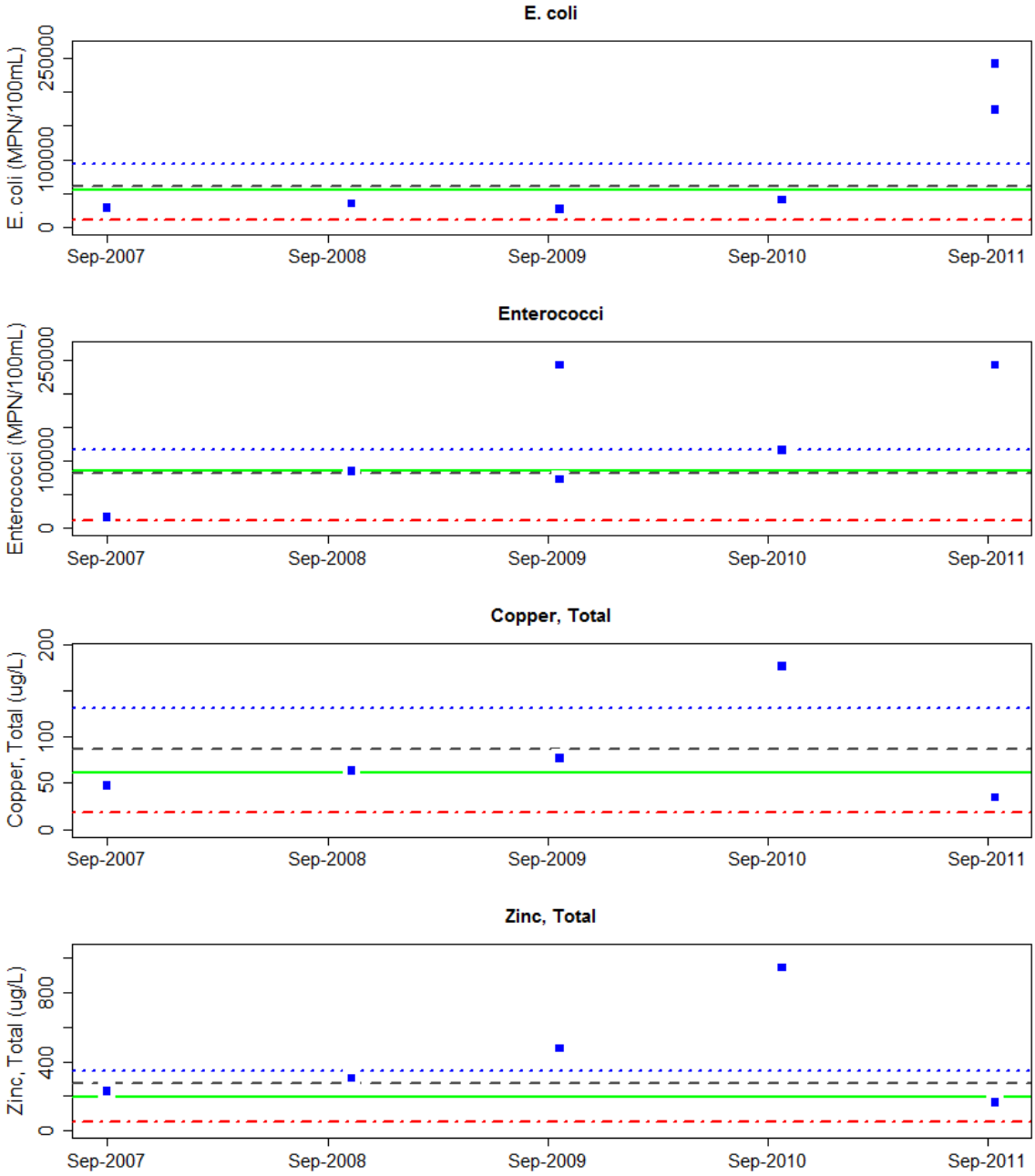
309-PGSD-06 Congress



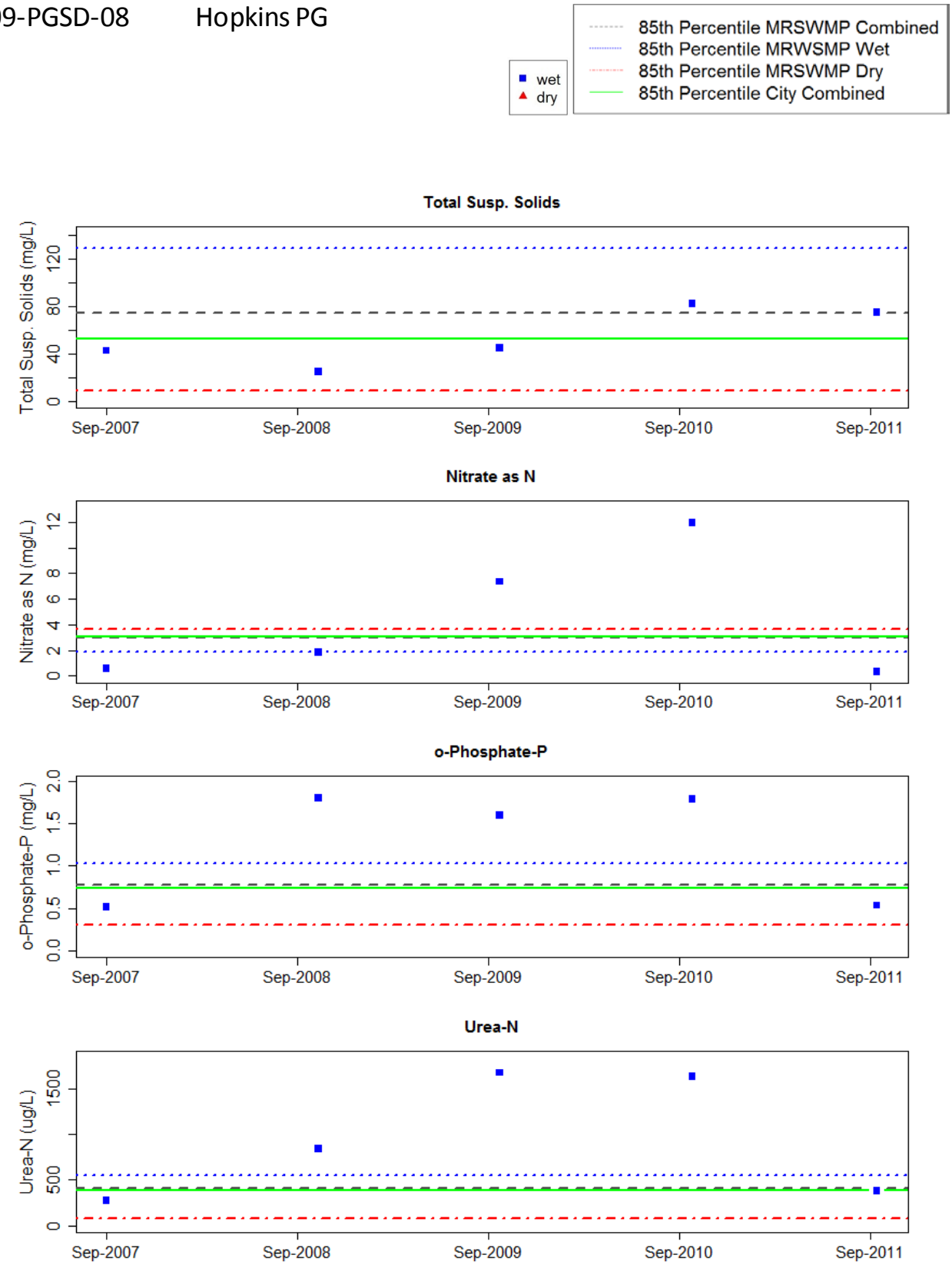
309-PGSD-08 Hopkins PG



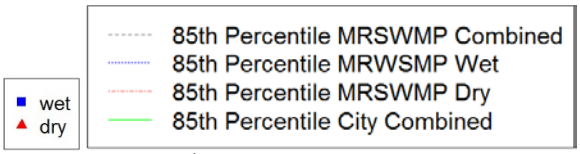
The plots below show pollutants where at least one measure was above the 85th MRSWMP percentile combined wet and dry season. Pollutants not found above this concentration or not measured at this site included lead, nitrate, ammonia, flouride and MBAS.



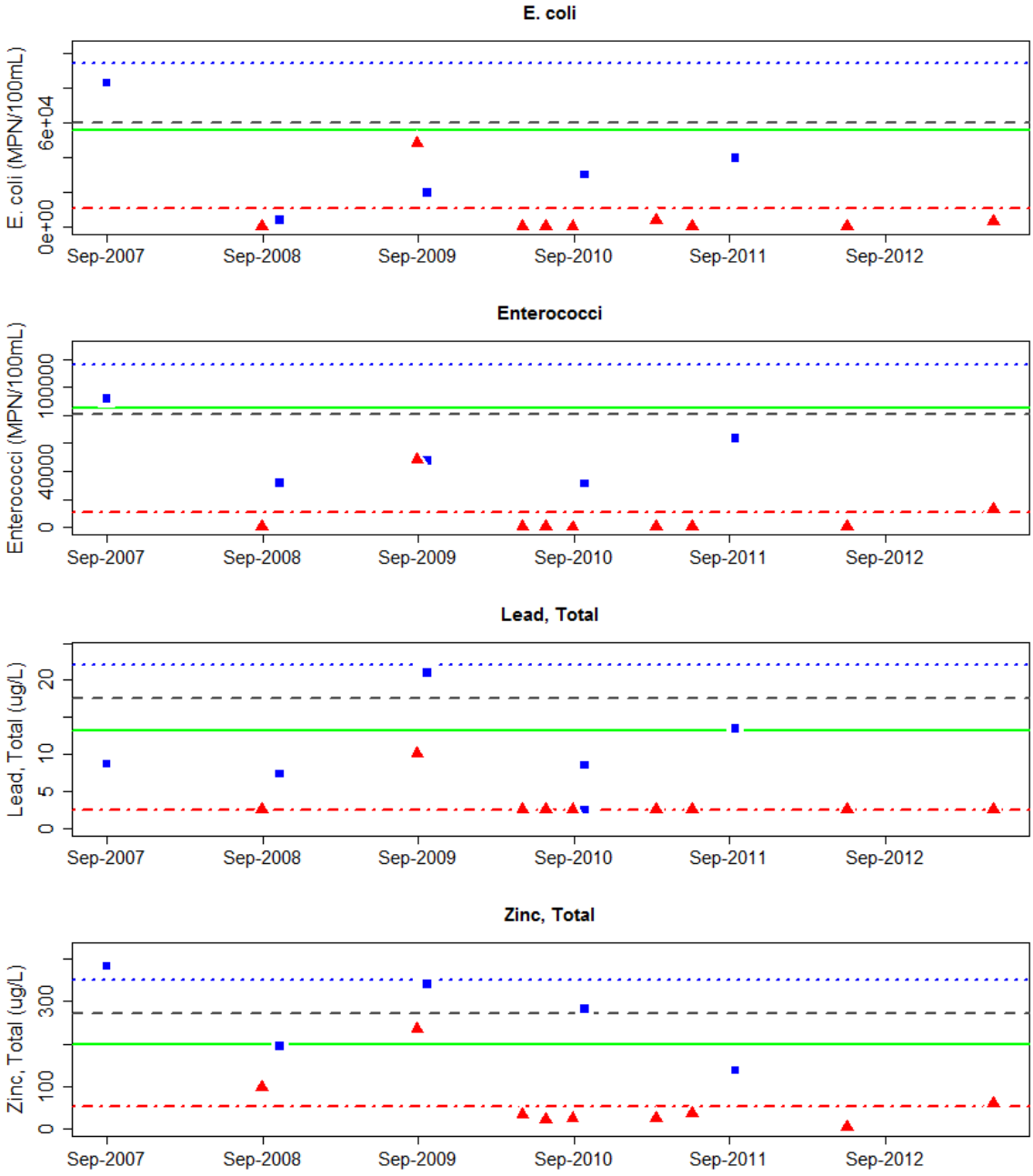
309-PGSD-08 Hopkins PG



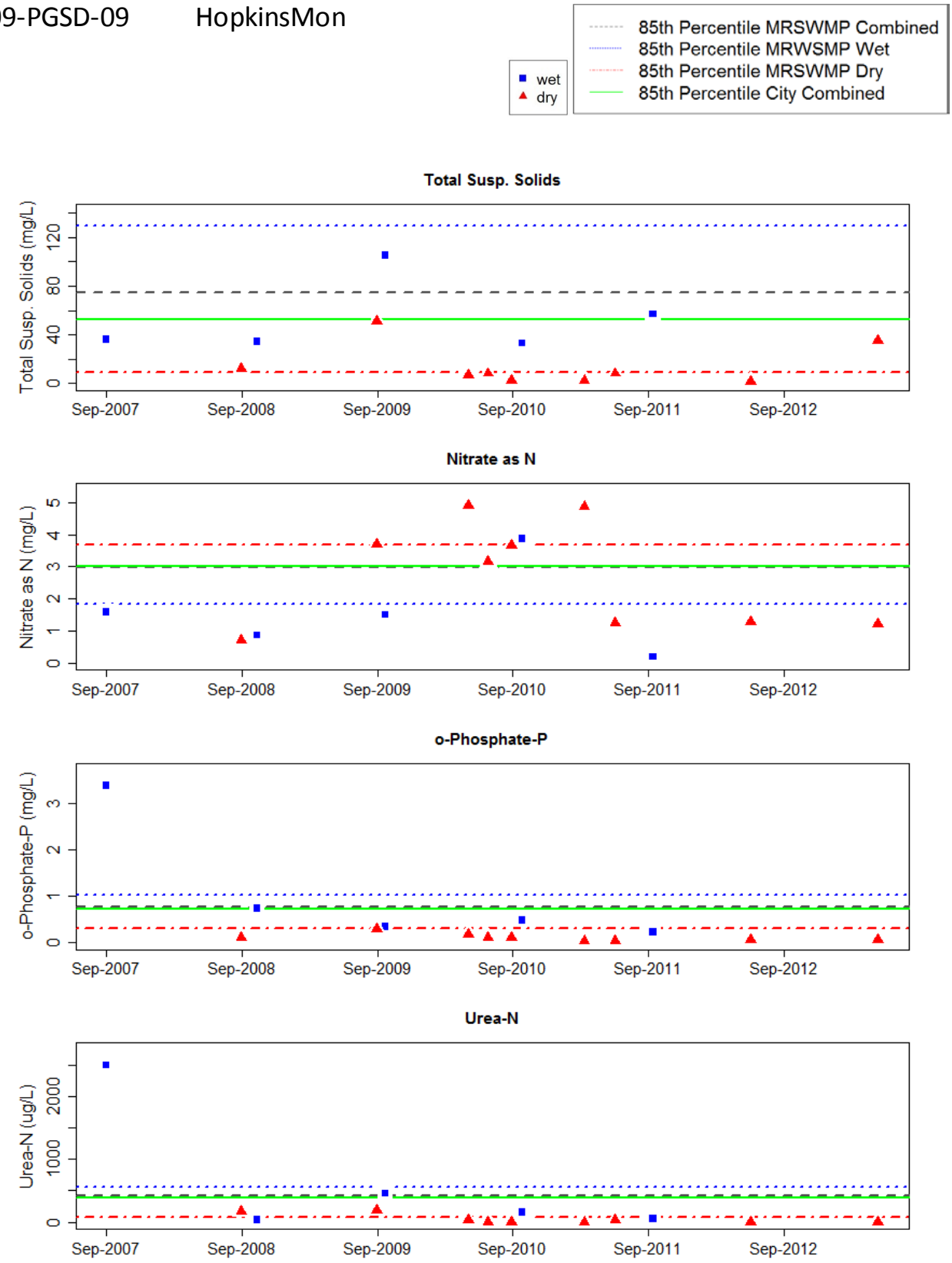
309-PGSD-09 HopkinsMon



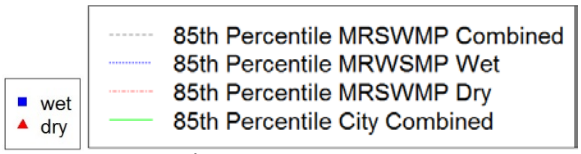
The plots below show pollutants where at least one measure was above the 85th MRSWMP percentile combined wet and dry season. Pollutants not found above this concentration or not measured at this site included copper, ammonia, flouride and MBAS.



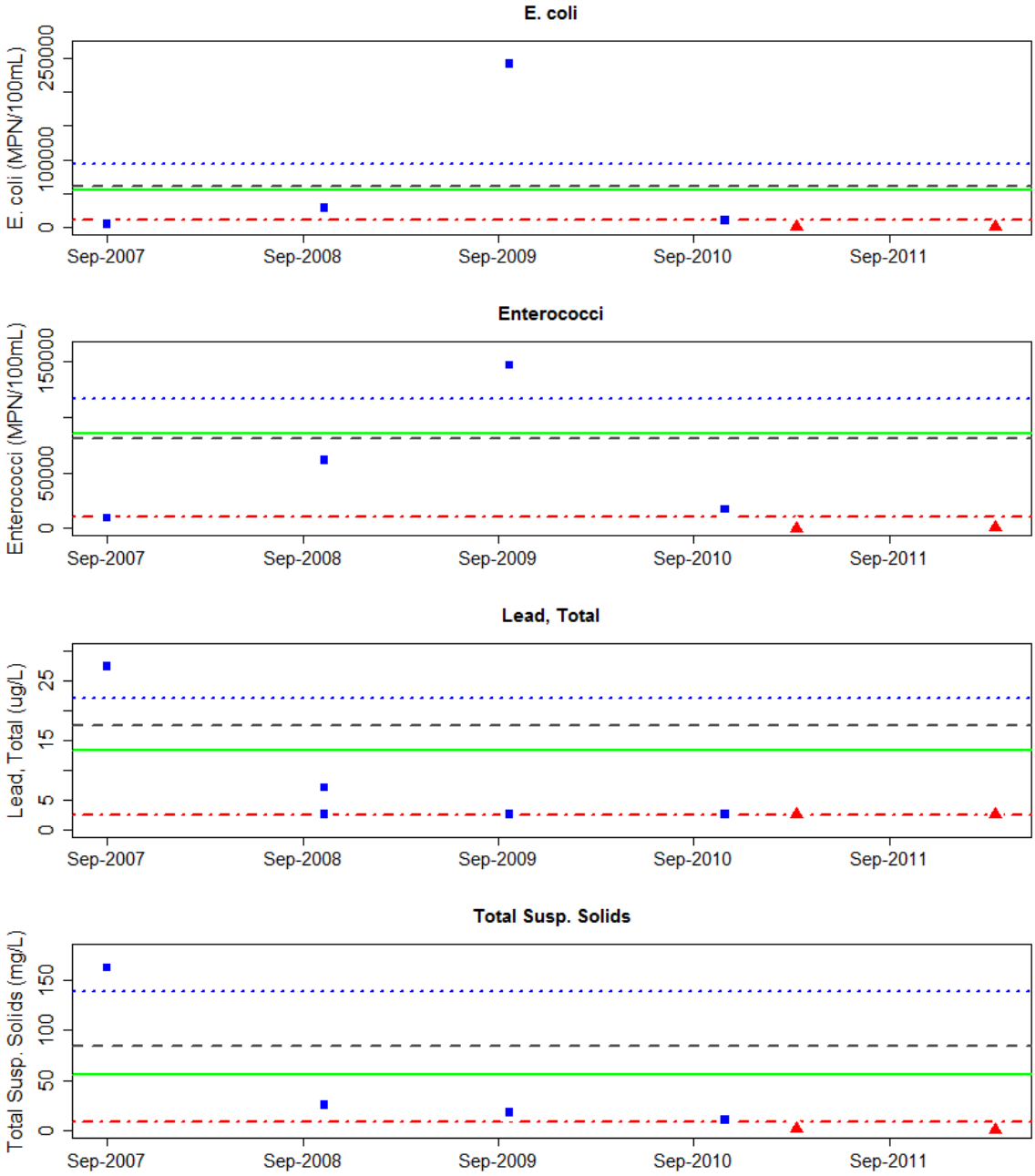
309-PGSD-09 HopkinsMon



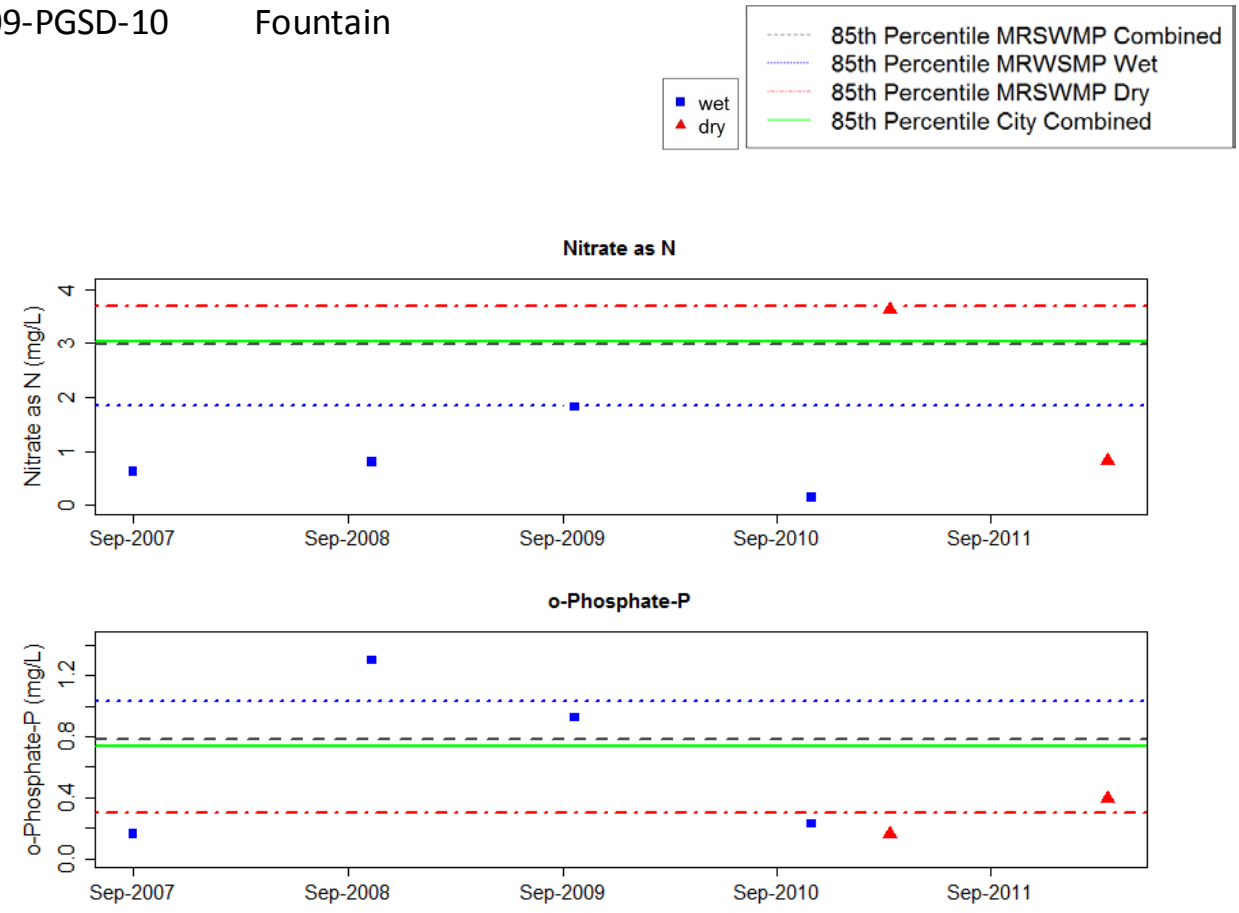
309-PGSD-10 Fountain



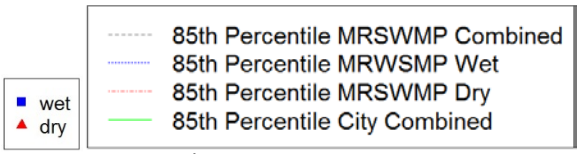
The plots below show pollutants where at least one measure was above the 85th MRSWMP percentile combined wet and dry season. Pollutants not found above this concentration or not measured at this site included copper, zinc, urea, ammonia, flouride and MBAS.



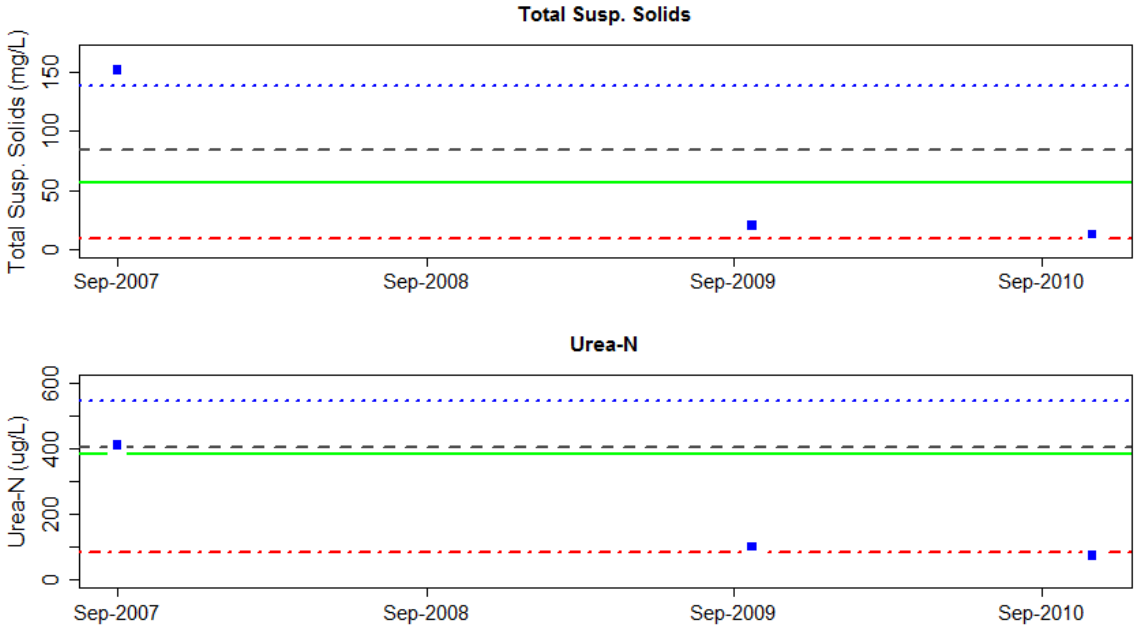
309-PGSD-10 Fountain



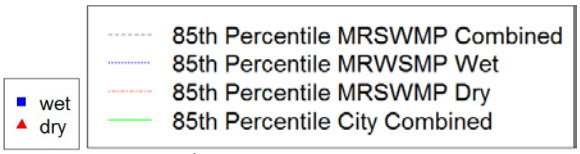
309-PGSD-11 Fountain and 15th



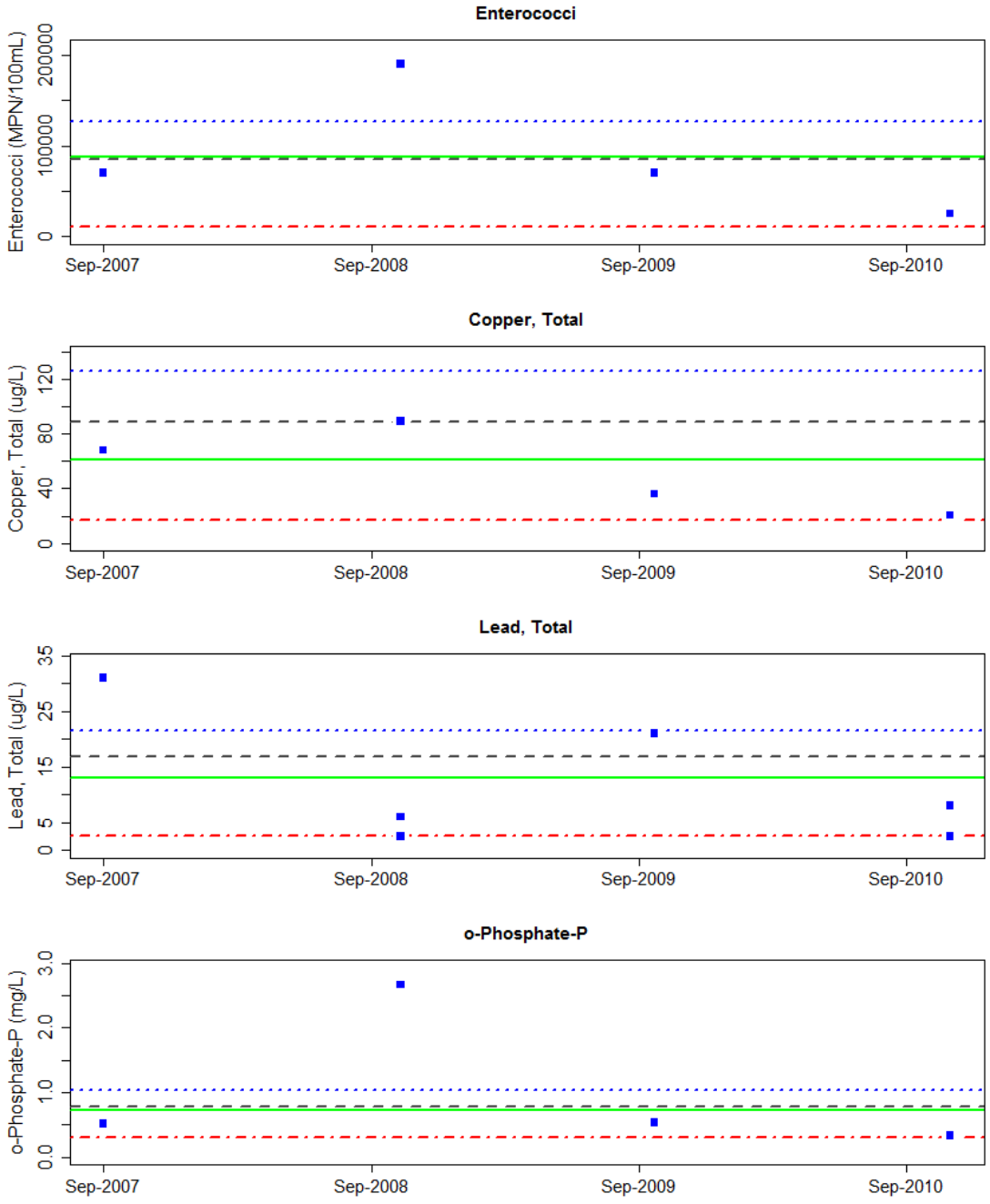
The plots below show pollutants where at least one measure was above the 85th MRSWMP percentile combined wet and dry season. Pollutants not found above this concentration or not measured at this site included E. coli, Enterococci, nitrate, copper, zinc, lead, o-phosphate, ammonia, flouride and MBAS.



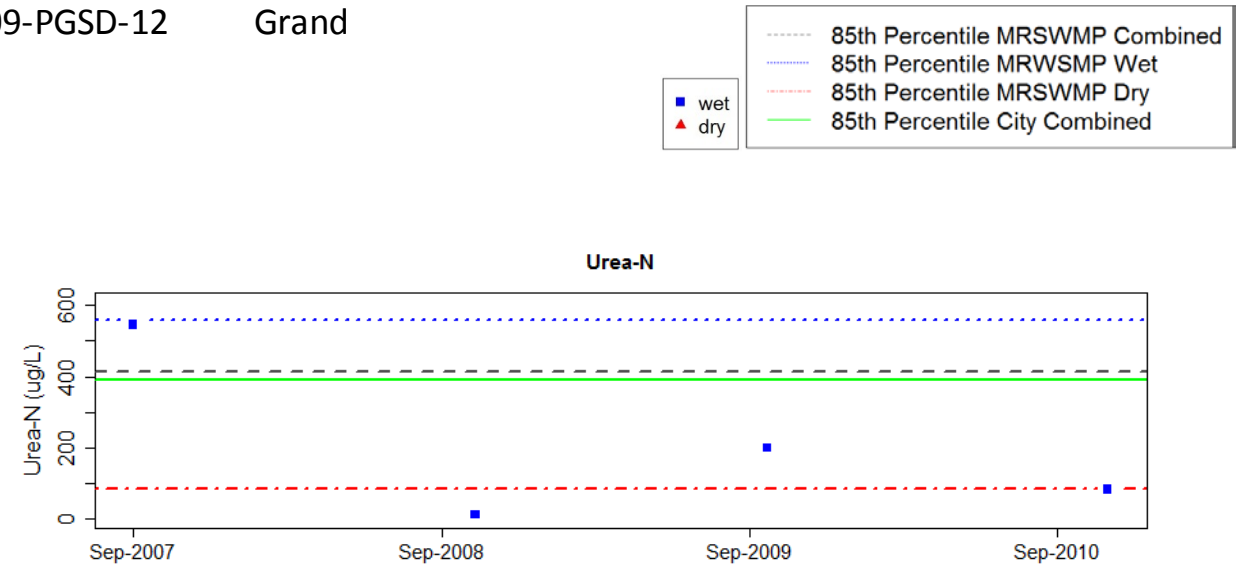
309-PGSD-12 Grand



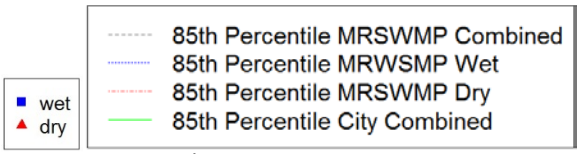
The plots below show pollutants where at least one measure was above the 85th MRSWMP percentile combined wet and dry season. Pollutants not found above this concentration or not measured at this site included E. coli, nitrate, total suspended solids, zinc, ammonia, flouride and MBAS.



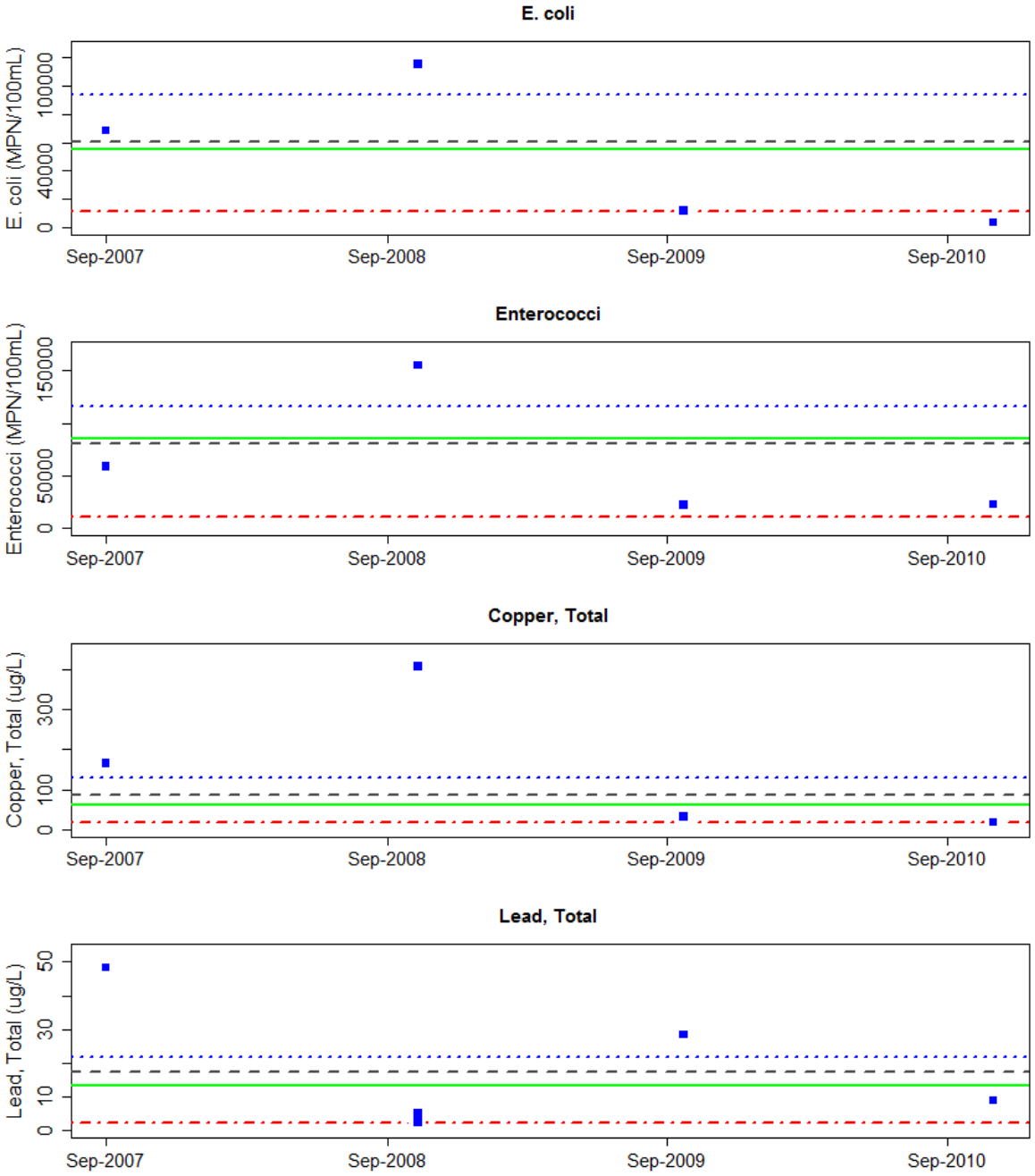
309-PGSD-12 Grand



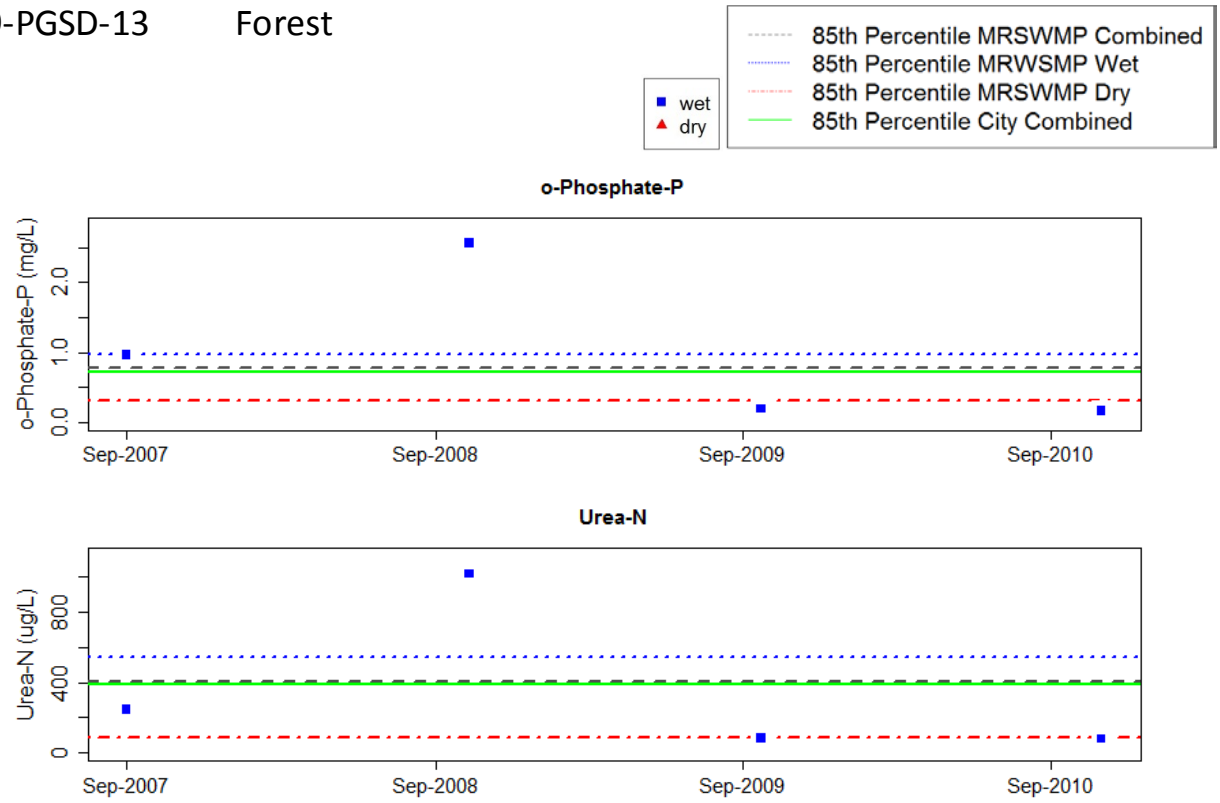
309-PGSD-13 Forest



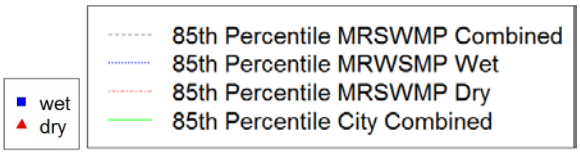
The plots below show pollutants where at least one measure was above the 85th MRSWMP percentile combined wet and dry season. Pollutants not found above this concentration or not measured at this site included zinc, total suspended solids, nitrate, urea, ammonia, flouride and MBAS.



309-PGSD-13 Forest

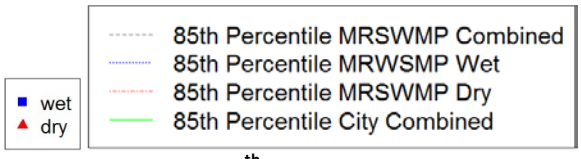


309-PGSD-14 17th Avenue

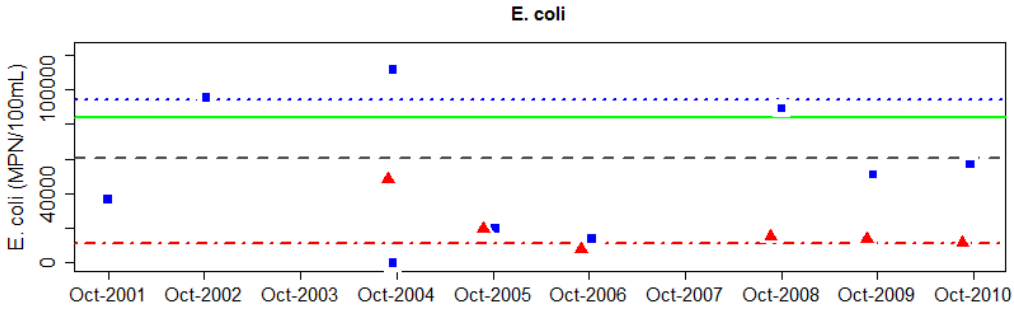


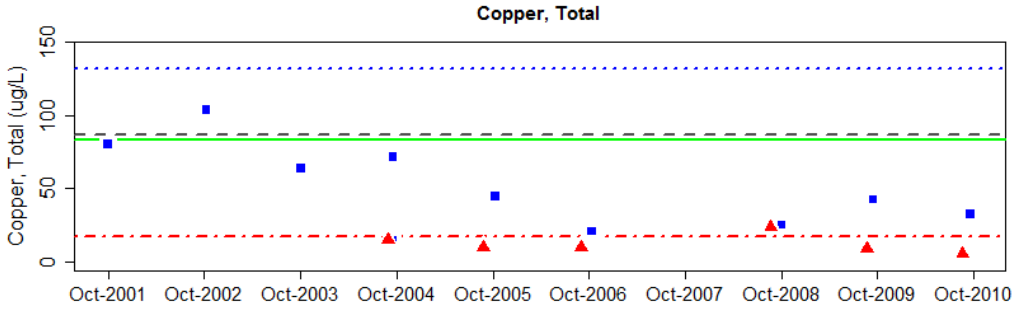
Plots were not produced for this site because all measured pollutant concentrations were below show the 85th MRSWMP percentile for combined wet and dry season. Pollutants not measured at this site included ammonia, flouride and MBAS.

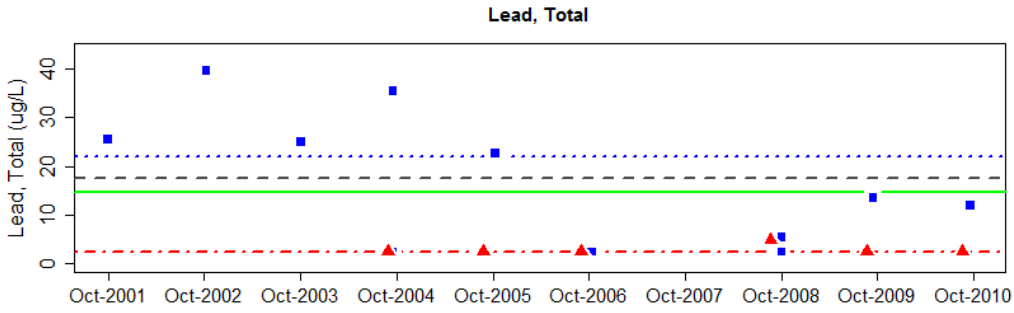
309-LIBRA-31 Library

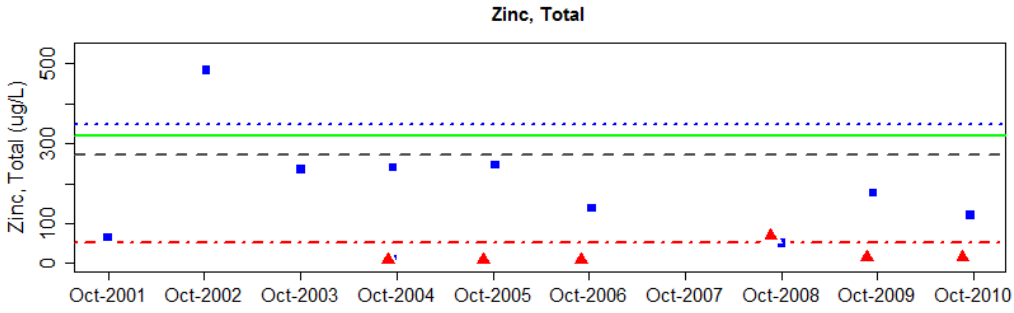


The plots below show pollutants where at least one concentration was above the 85th MRSWMP percentile combined wet and dry season. Pollutants not found above this concentration or not measured at this site included Enterococci, o-phosphate, urea, ammonia, flouride and MBAS.

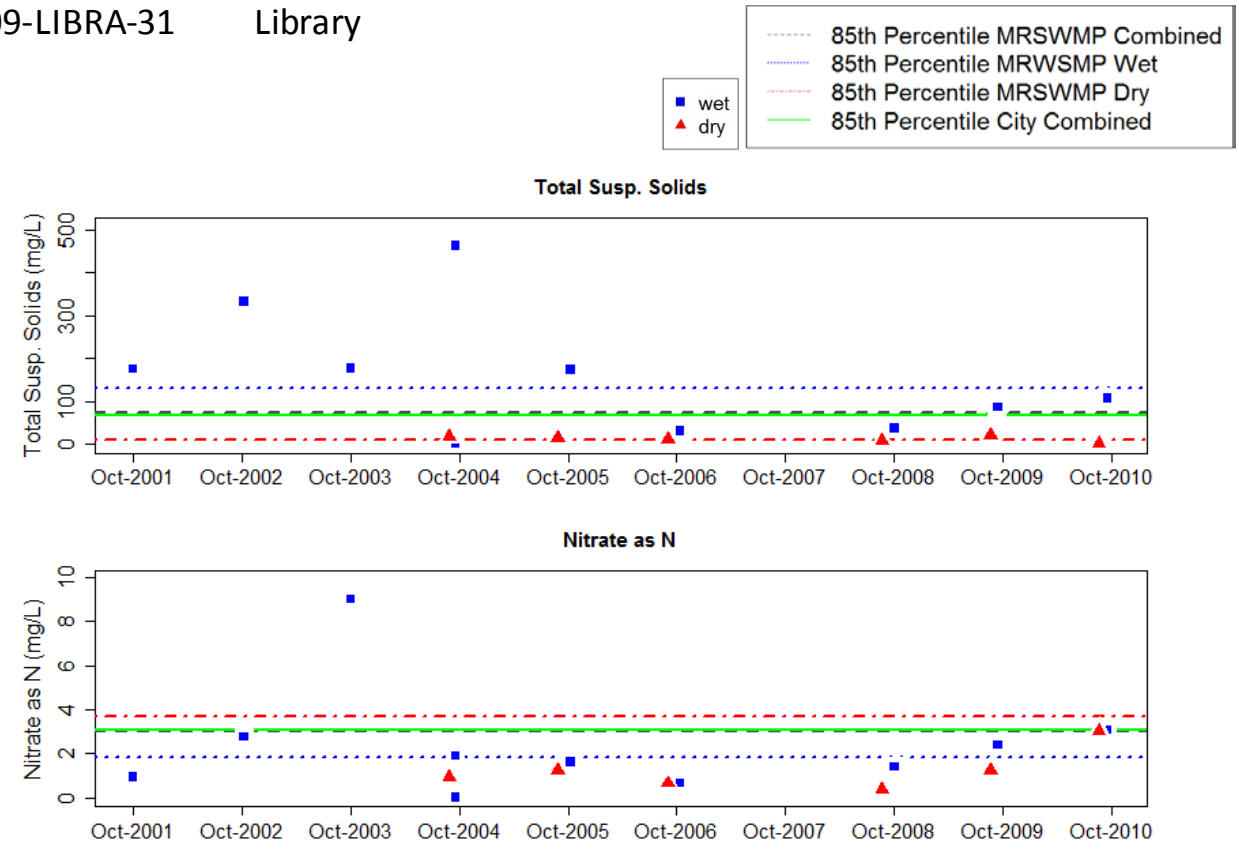




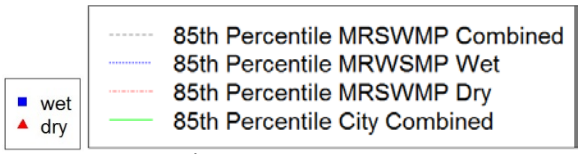




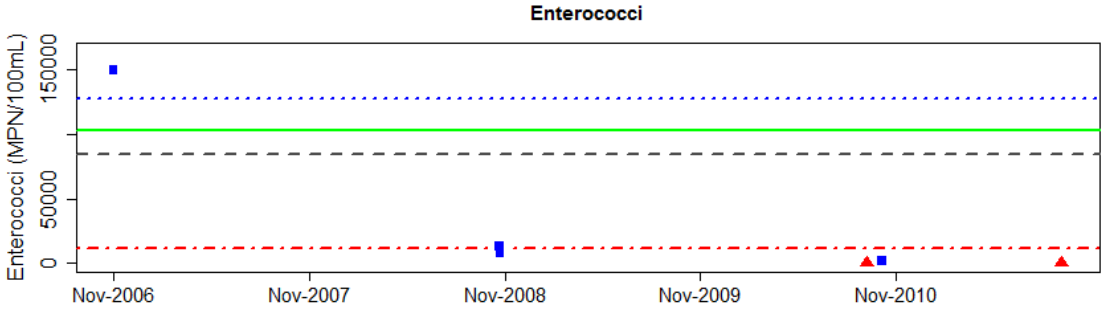
309-LIBRA-31 Library

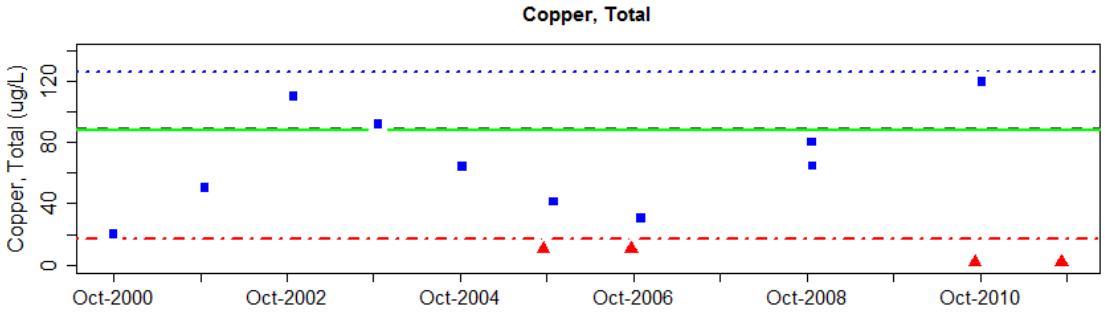


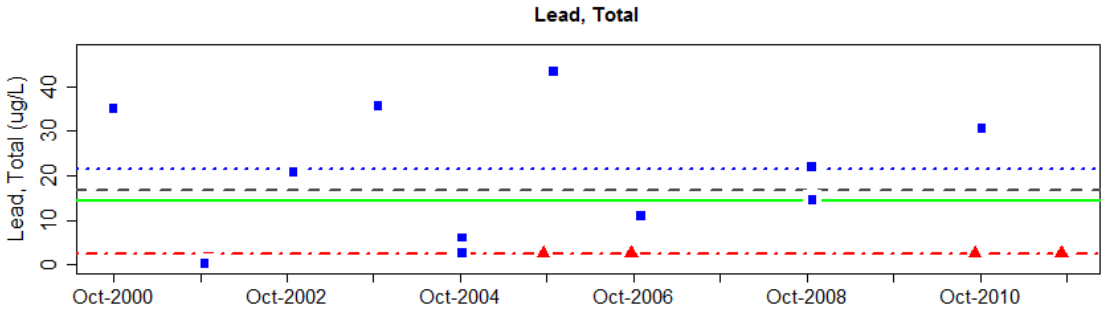
309-MAJOR-31 Majors Creek

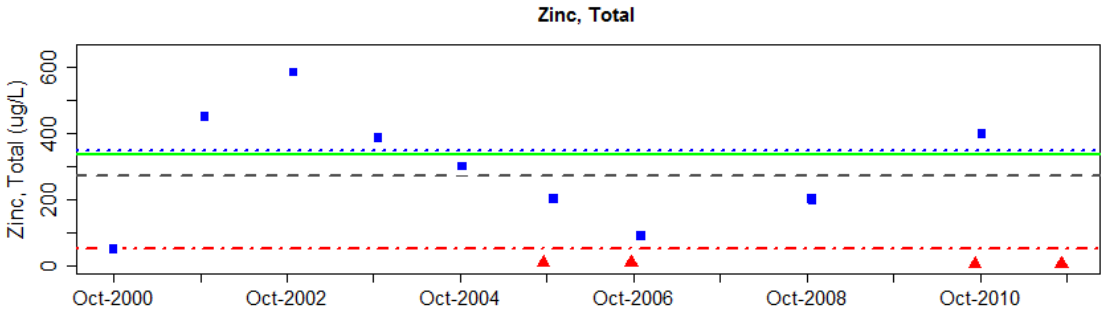


The plots below show pollutants where at least one measure was above the 85th MRSWMP percentile combined wet and dry season. Pollutants not found above this concentration or not measured at this site included E. coli, urea, ammonia, flouride and MBAS.

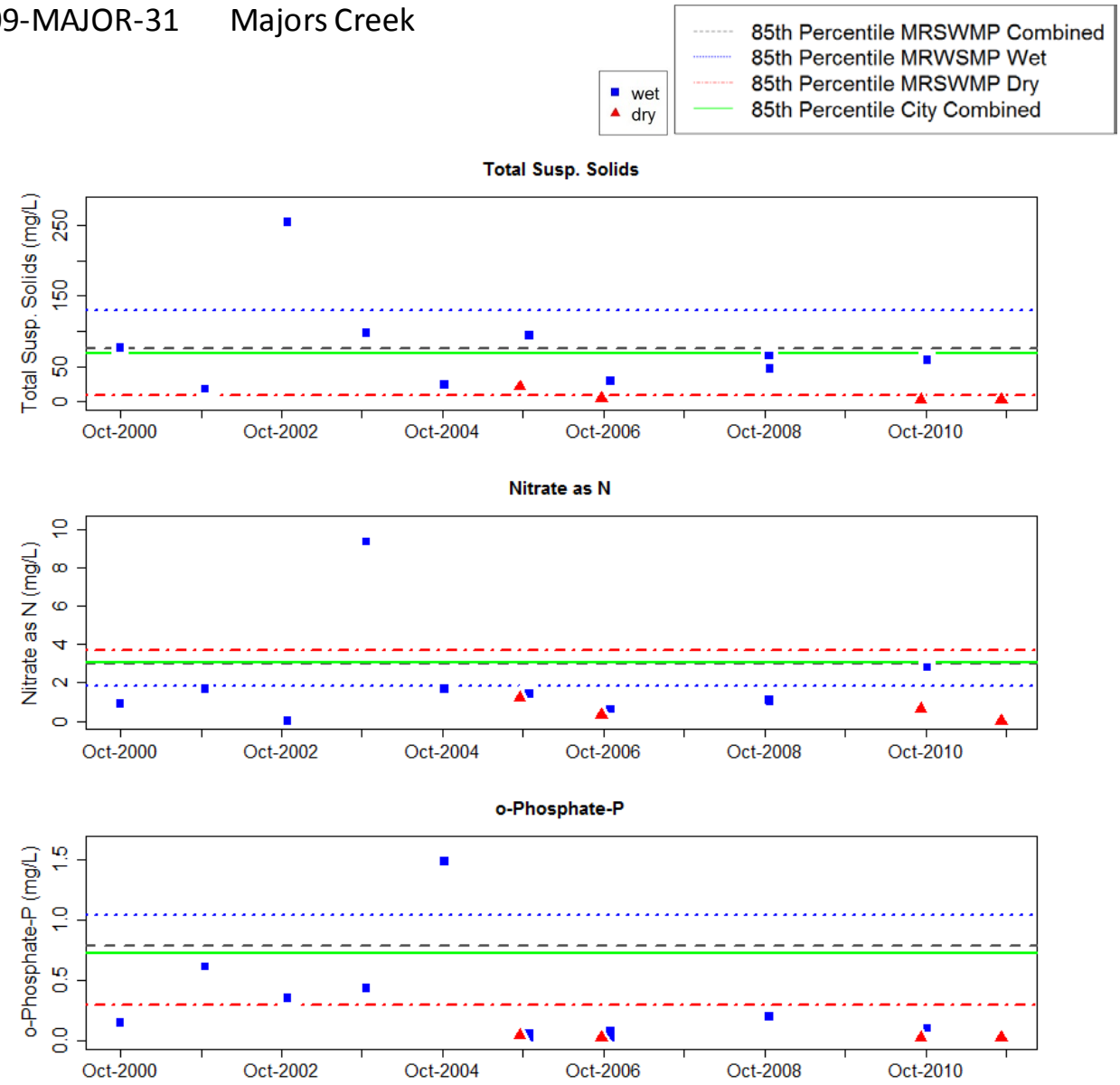




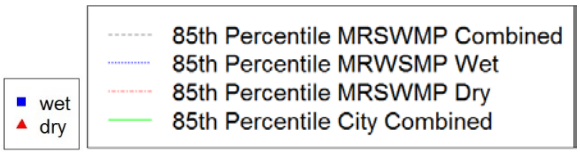




309-MAJOR-31 Majors Creek

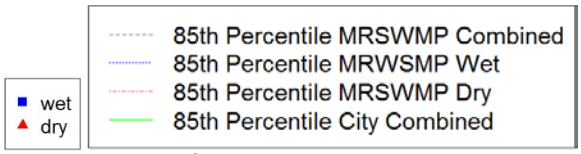


309-MSD-02 Soledad

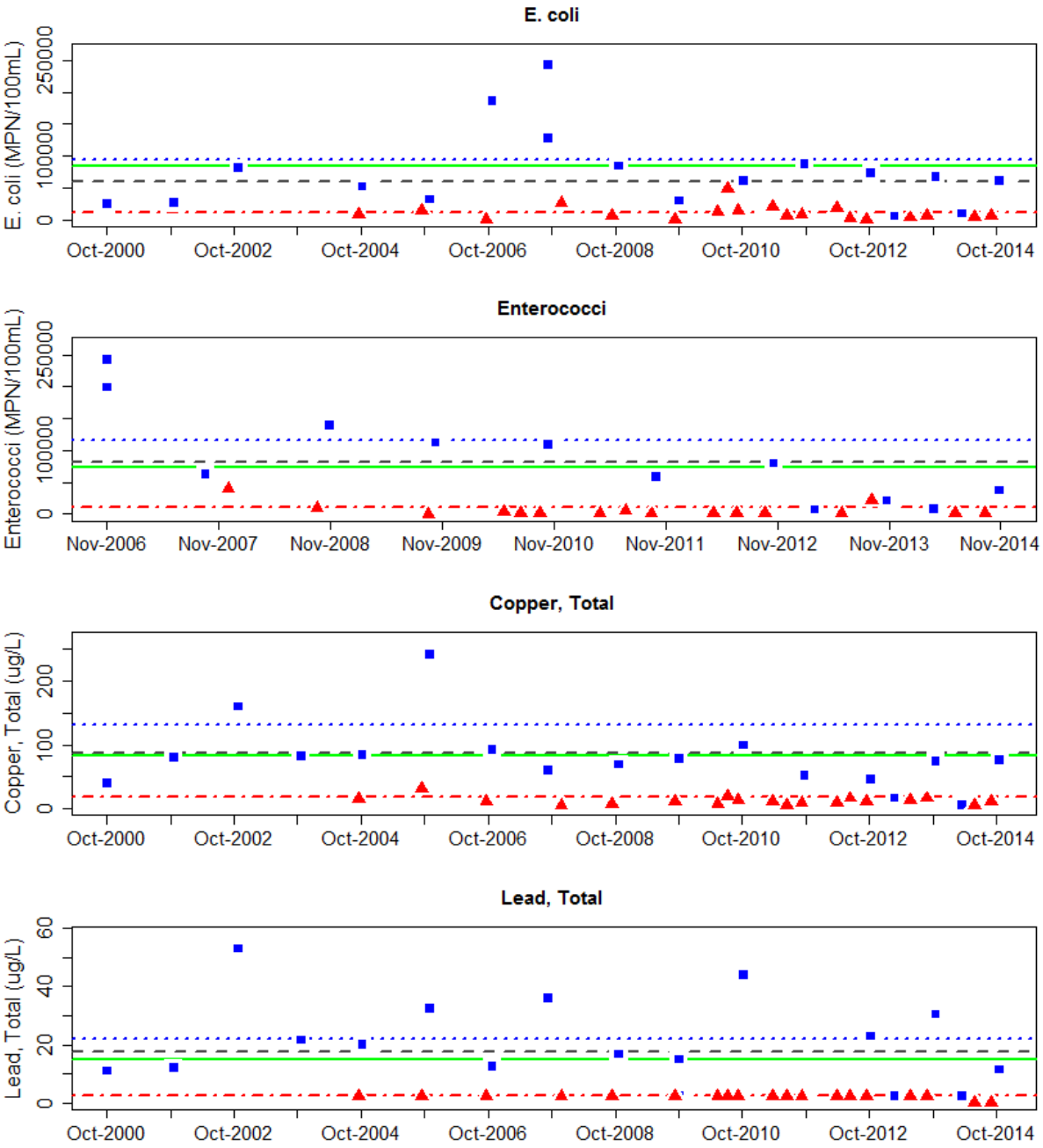


No pollutants exceeded the 85th percentile at this site, which was monitored in 2010.

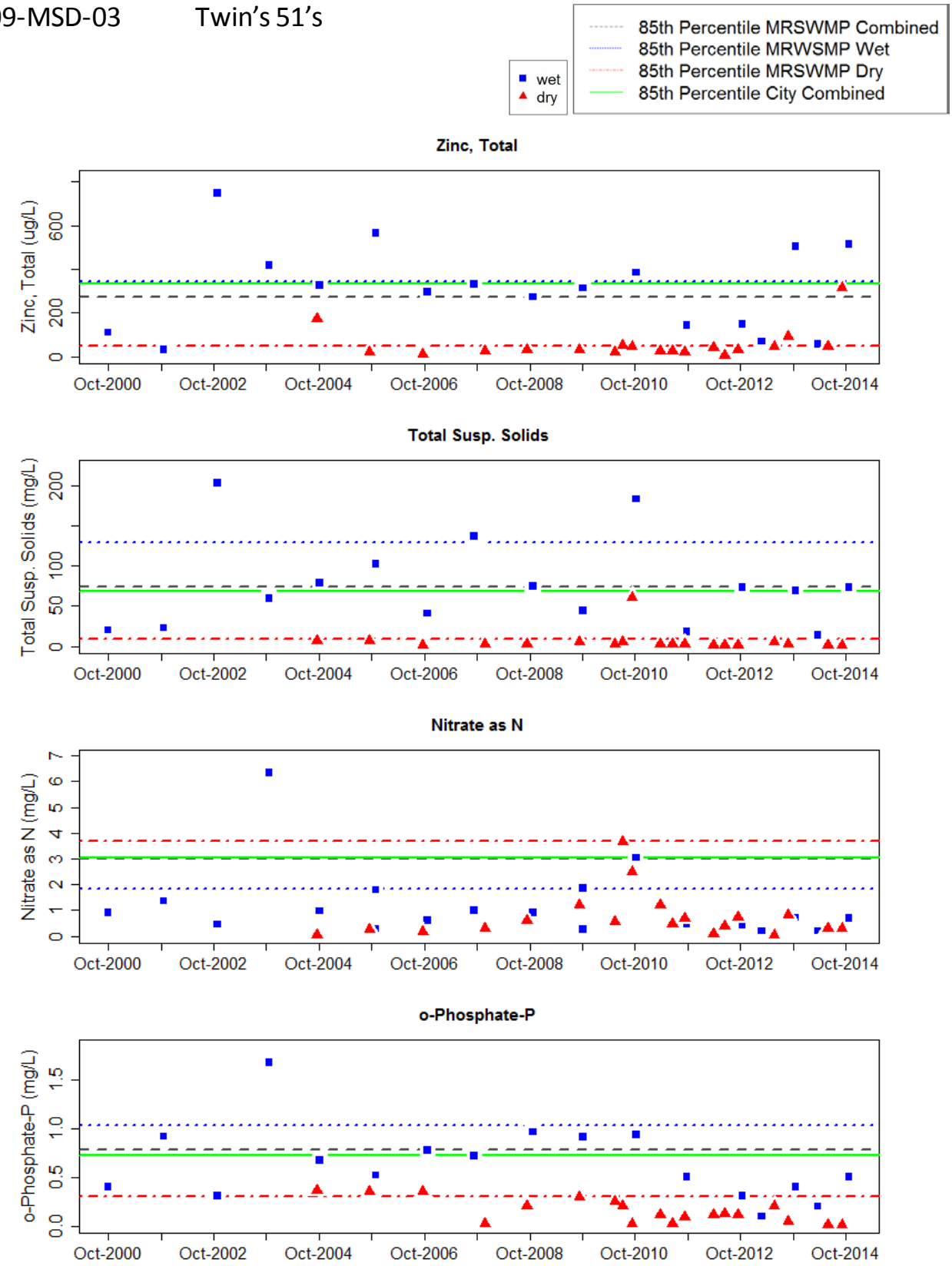
309-MSD-03 Twin's 51's



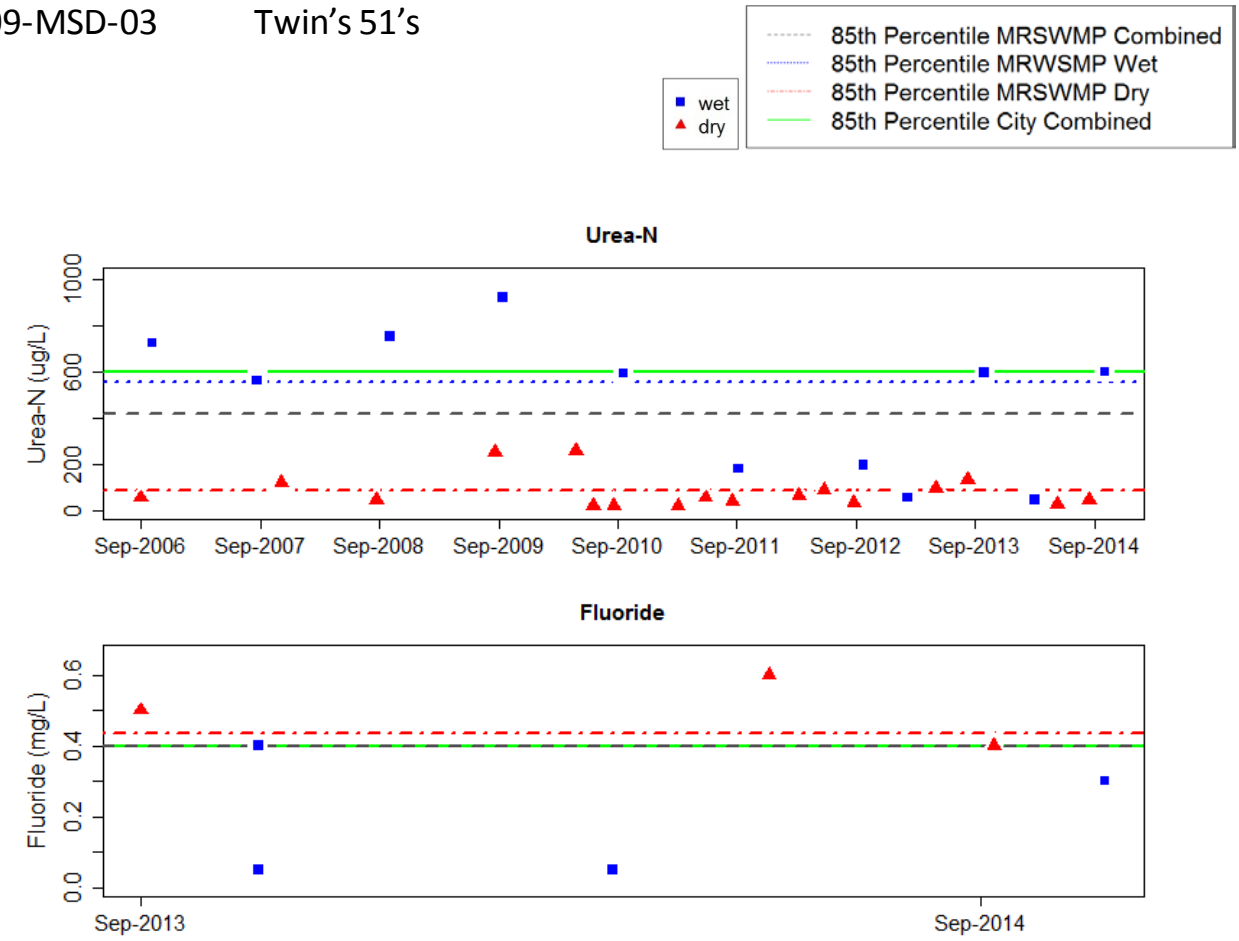
The plots below show pollutants where at least one measure was above the 85th MRSWMP percentile combined wet and dry season. Pollutants not found above this concentration or not measured at this site included and MBAS.



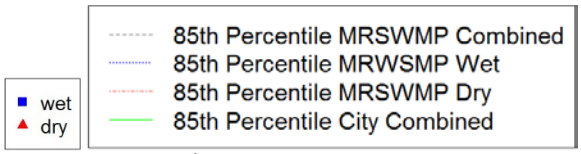
309-MSD-03 Twin's 51's



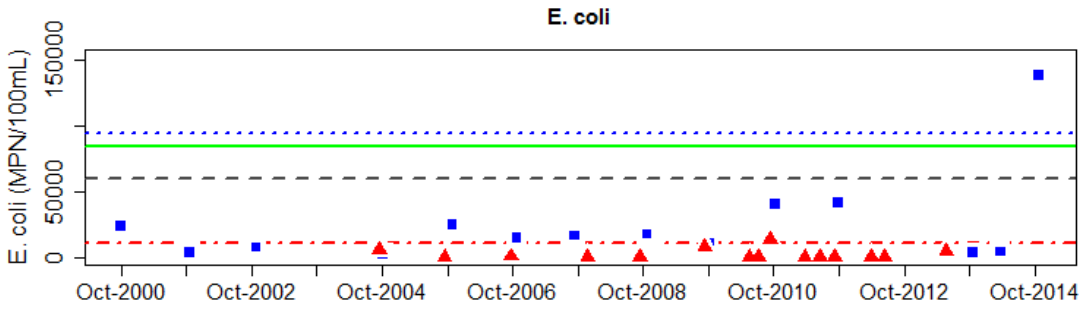
309-MSD-03 Twin's 51's

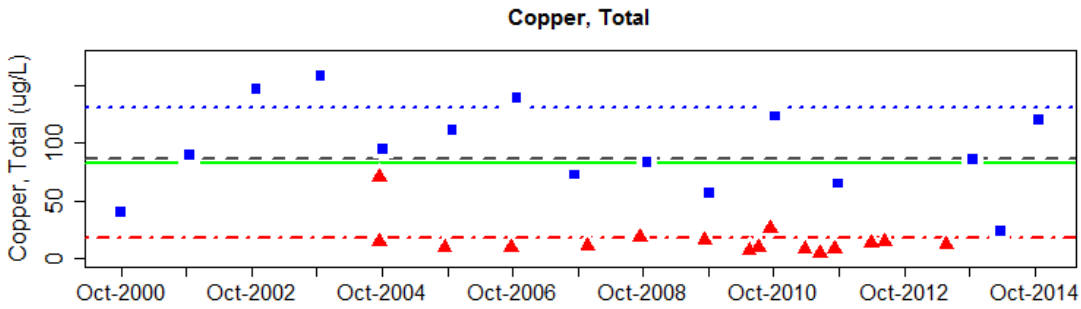


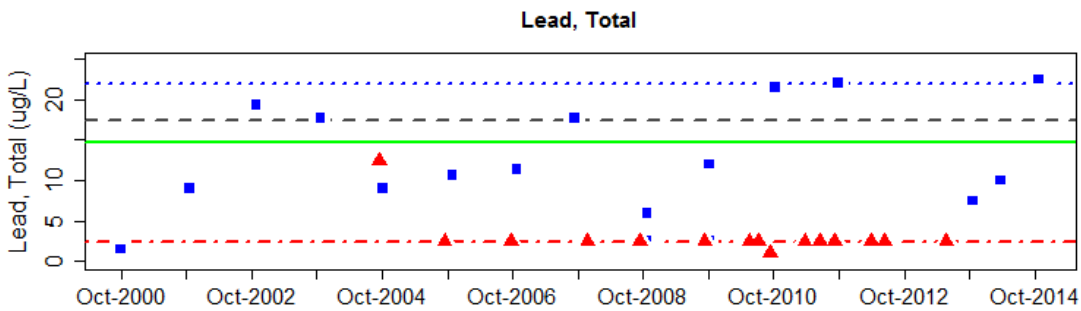
309-MSD-04 San Carlos

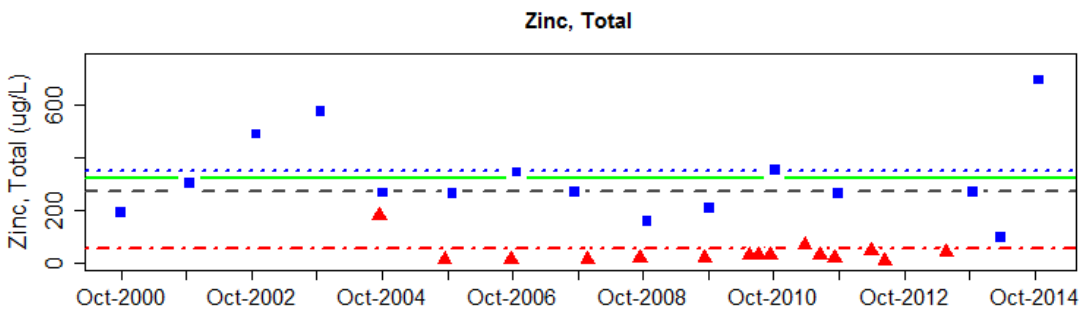


The plots below show pollutants where at least one measure was above the 85th MRSWMP percentile combined wet and dry season. Pollutants not found above this concentration or not measured at this site included Enterococci, o-phoshhate, ammonia and fluoride.

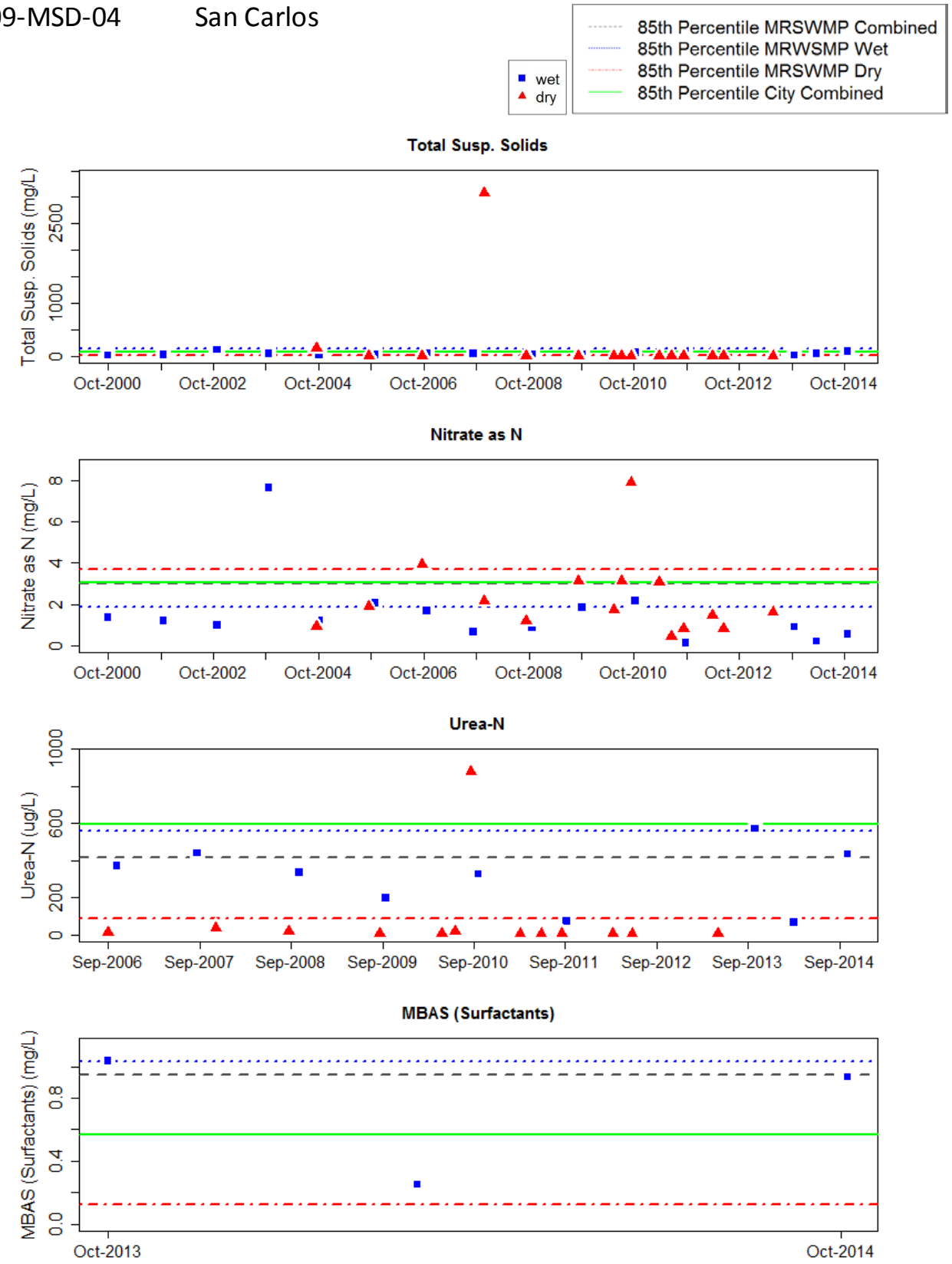




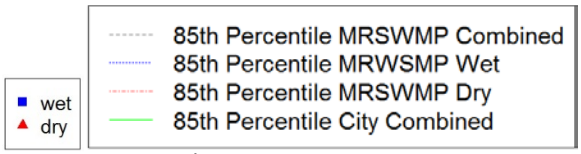




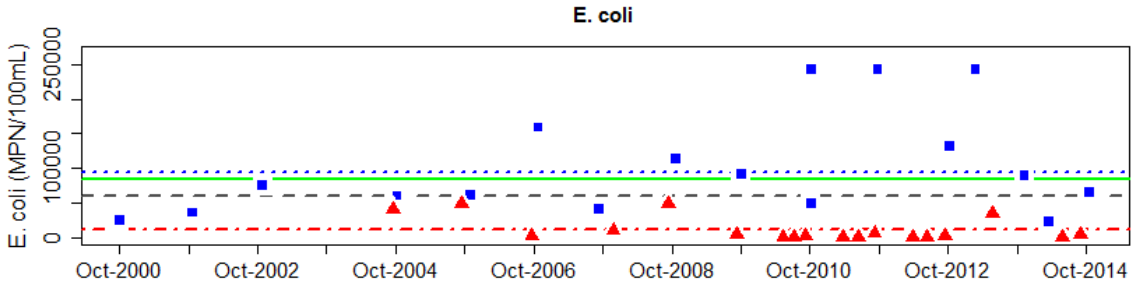
309-MSD-04 San Carlos

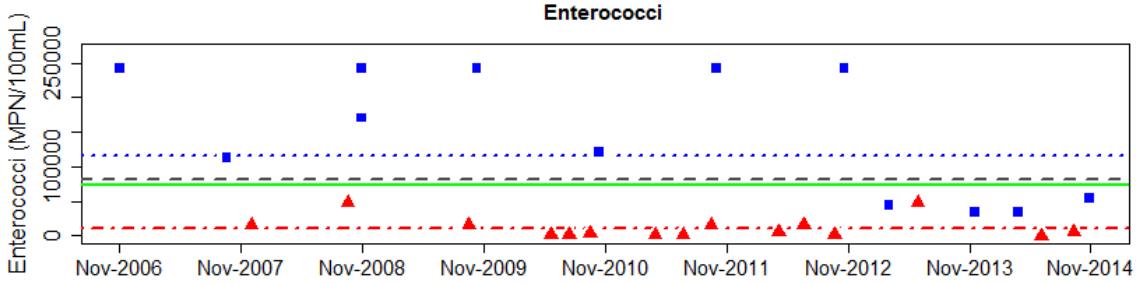


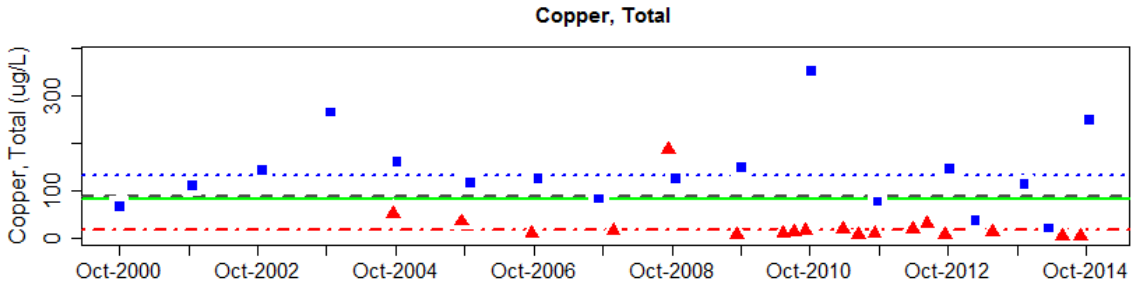
309-MSD-05 Steinbeck

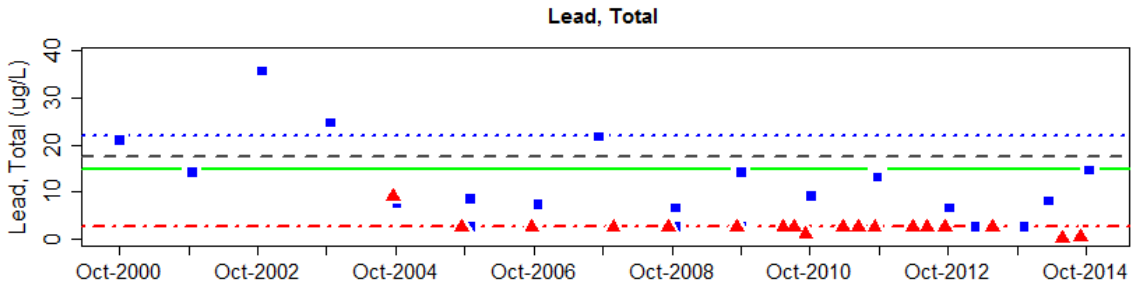


The plots below show pollutants where at least one measure was above the 85th MRSWMP percentile combined wet and dry season. Pollutants not found above this concentration or not measured at this site included MBAs and fluoride.

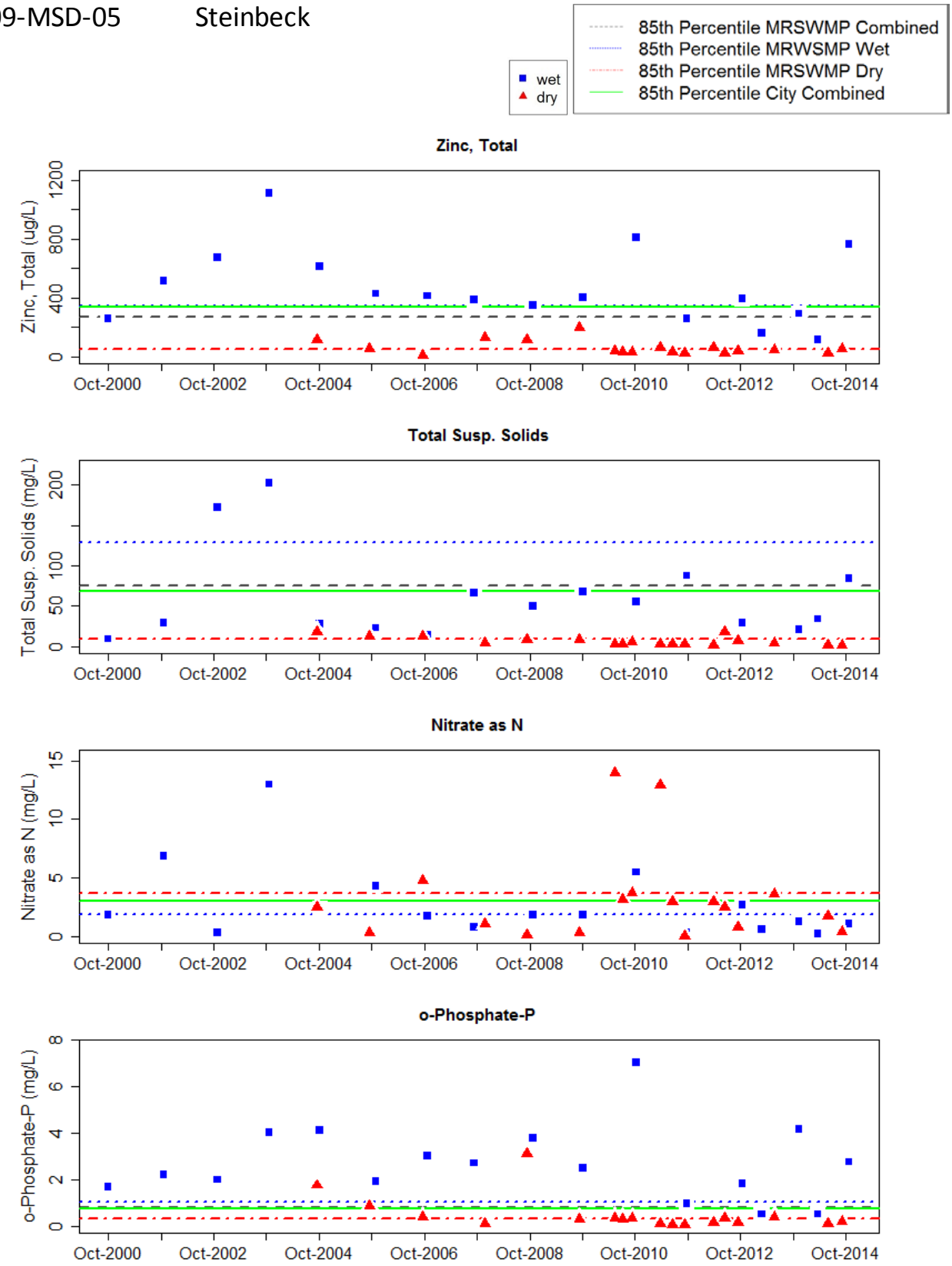




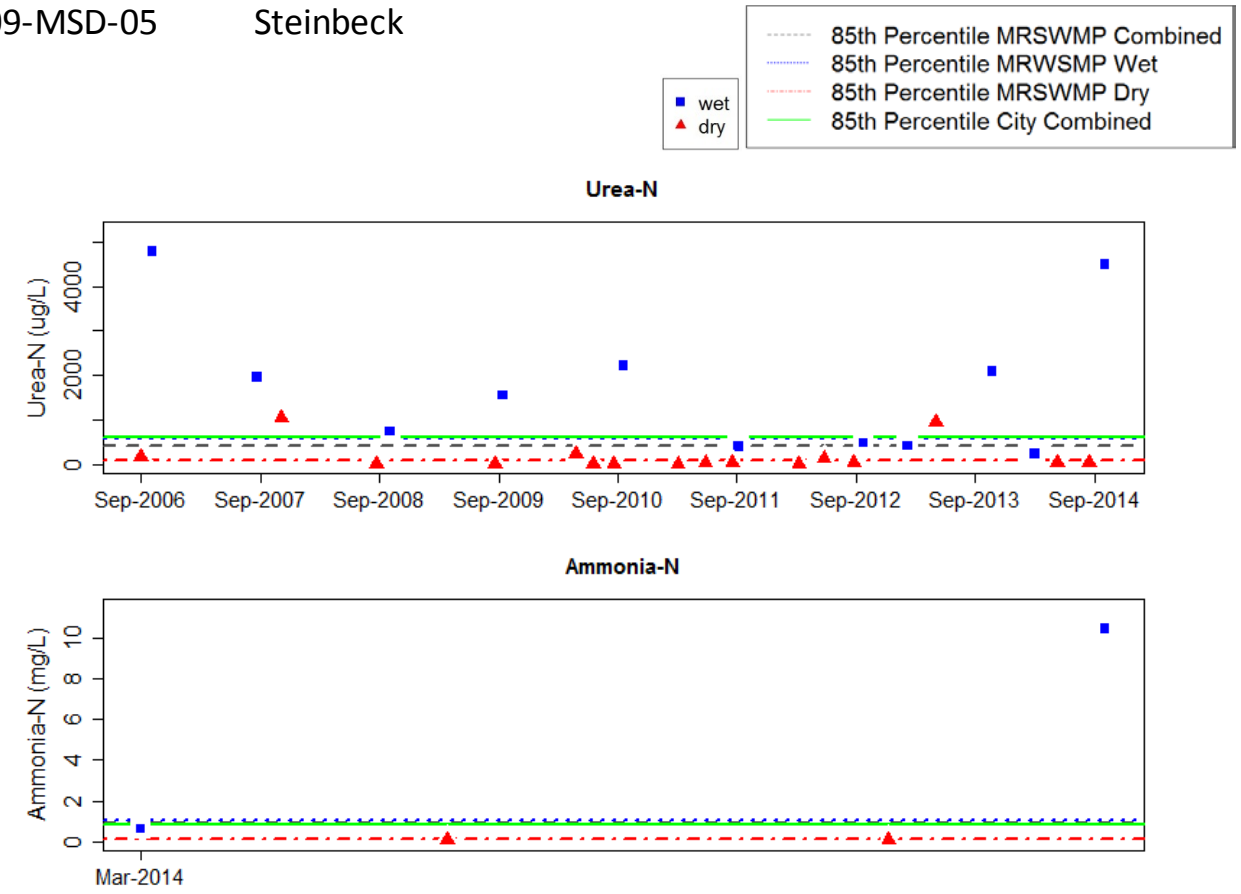




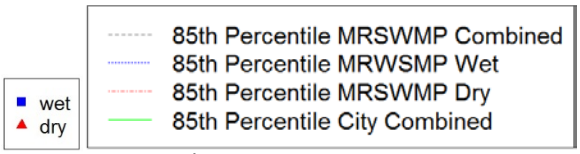
309-MSD-05 Steinbeck



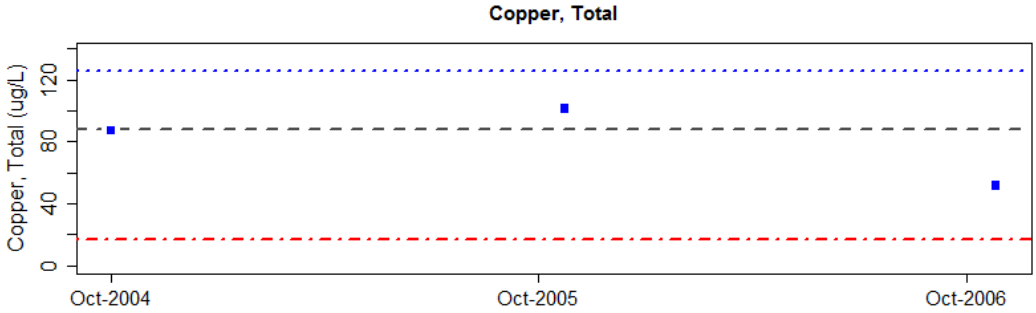
309-MSD-05 Steinbeck

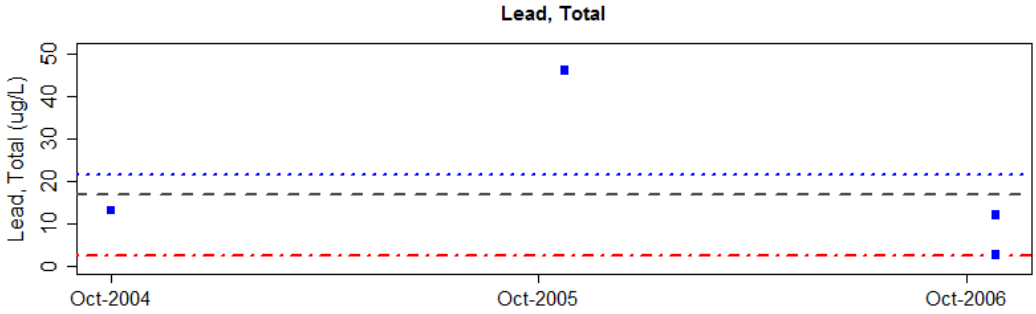


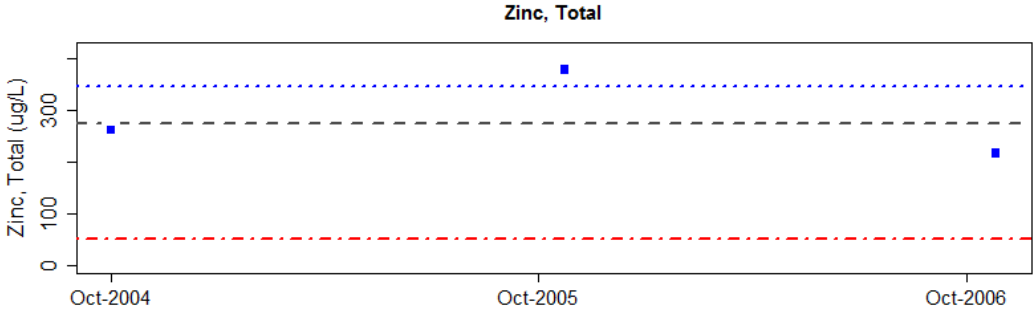
309-SSD-01 Hilby

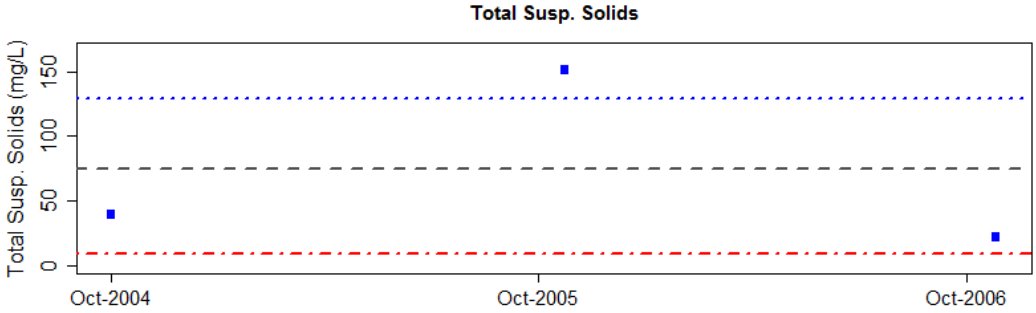


The plots below show pollutants where at least one measure was above the 85th MRSWMP percentile combined wet and dry season. Pollutants not found above this concentration or not measured at this site included E. coli, Enterococci, copper, lead, zinc, Total suspended solids, nitrate, ammonia, fluoride, and MBAs.

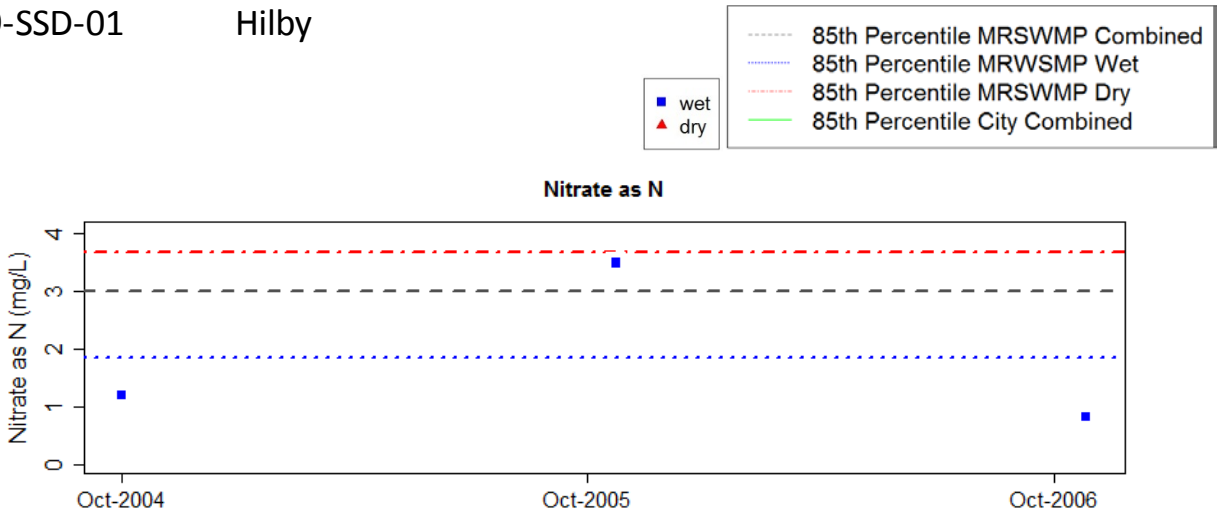




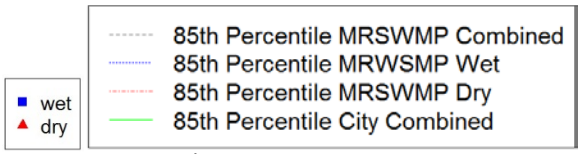




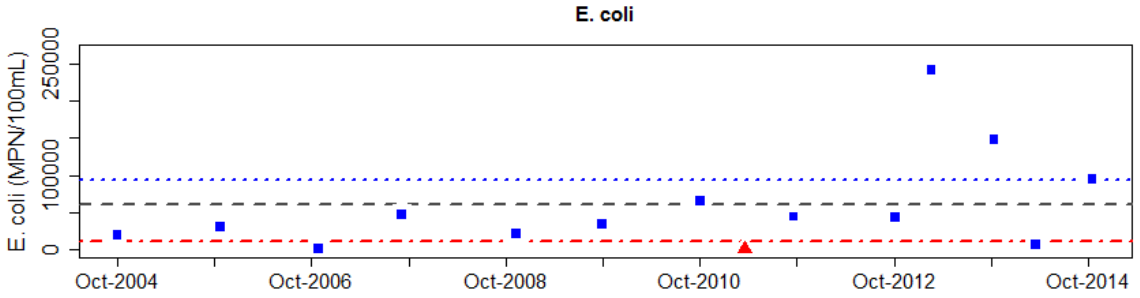
309-SSD-01 Hilby

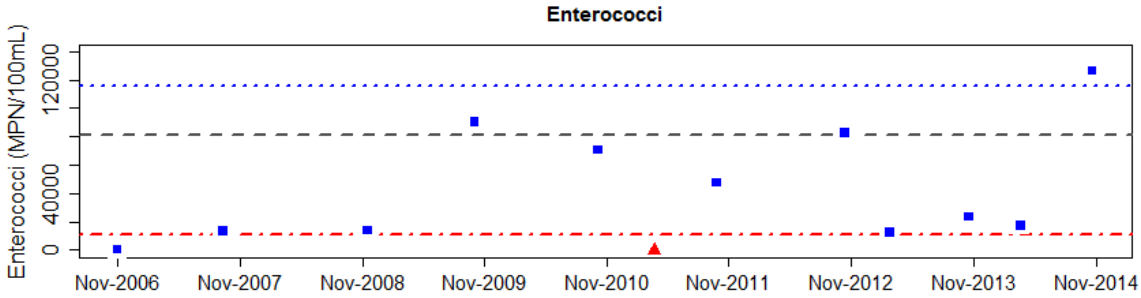


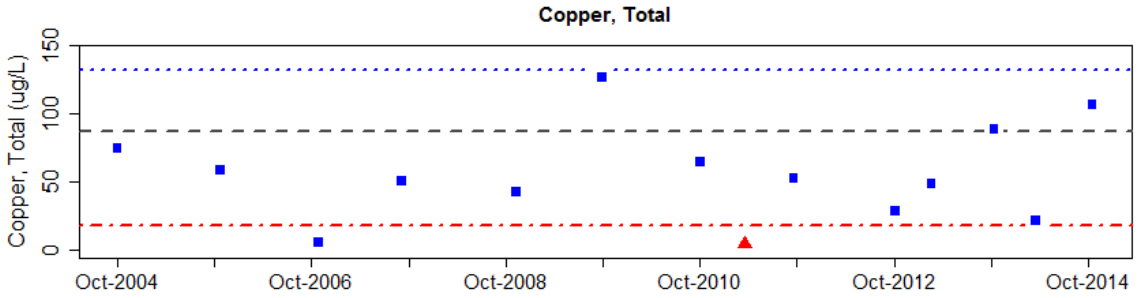
309-SSD-02 Bay Street

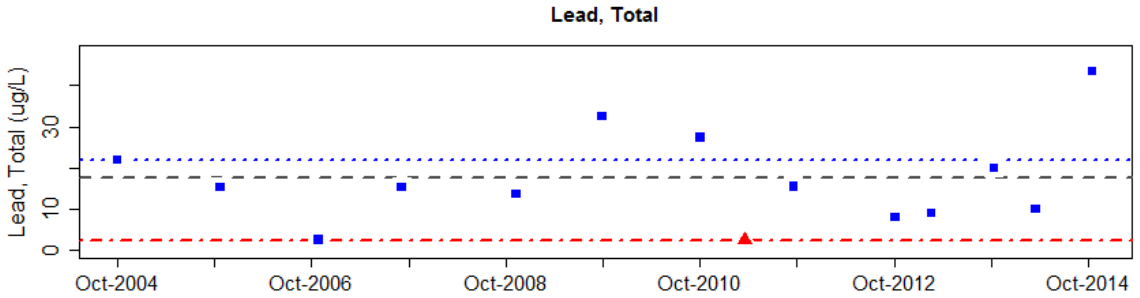


The plots below show pollutants where at least one measure was above the 85th MRSWMP percentile combined wet and dry season. Pollutants not found above this concentration or not measured at this site included o-phosphate, ammonia, and fluoride.

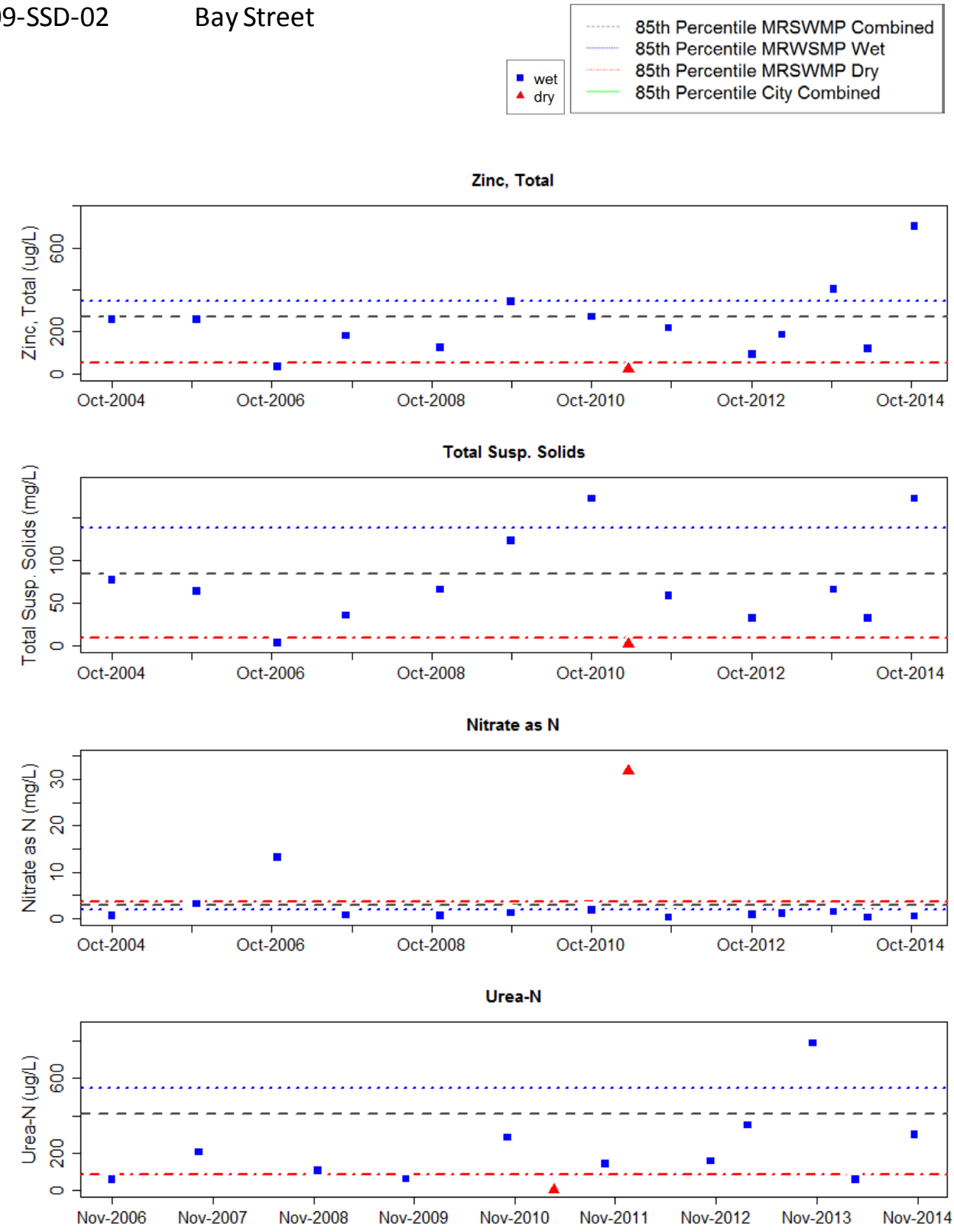




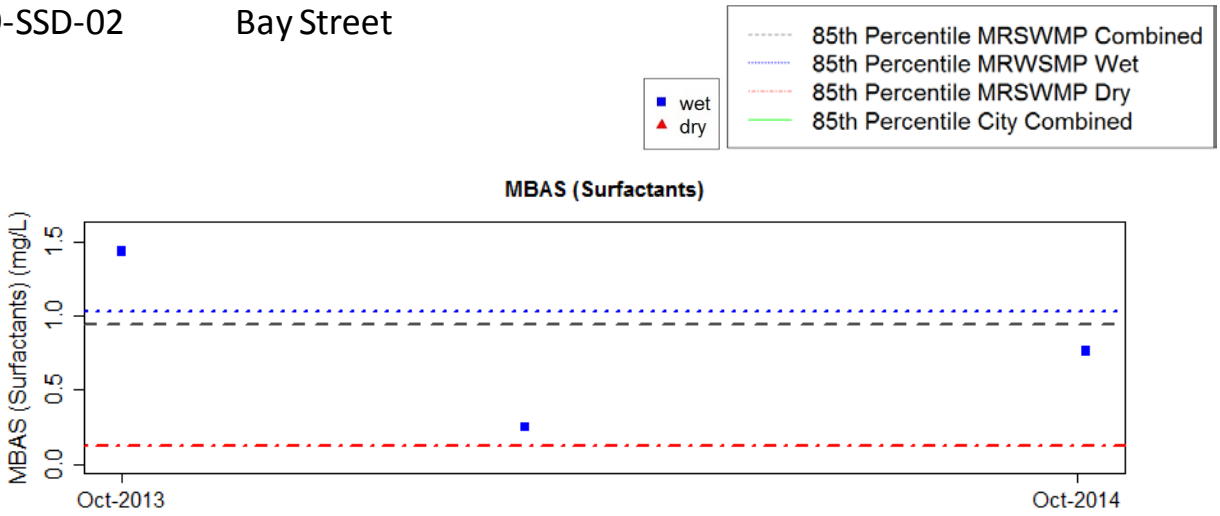




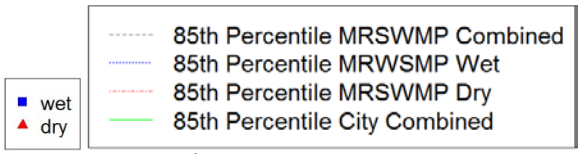
309-SSD-02 Bay Street



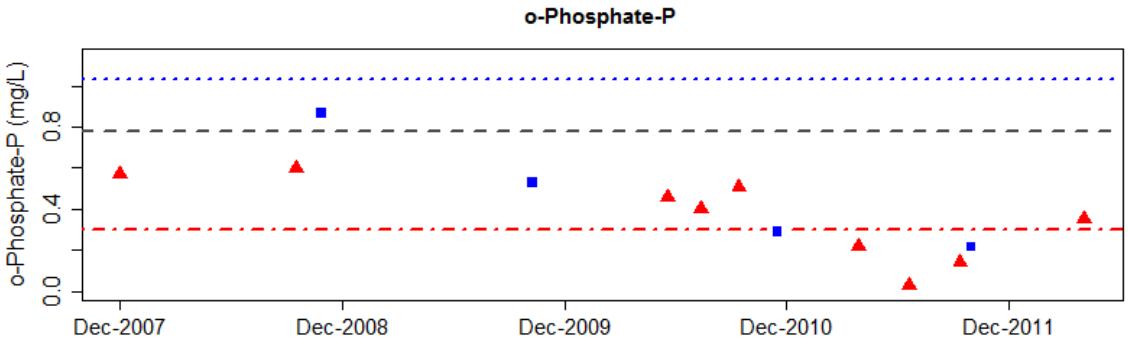
309-SSD-02 Bay Street



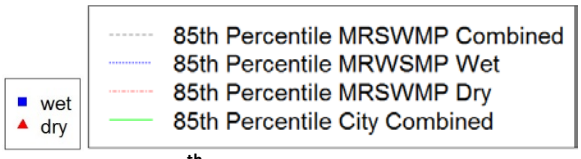
309-SSD-03 Hotel



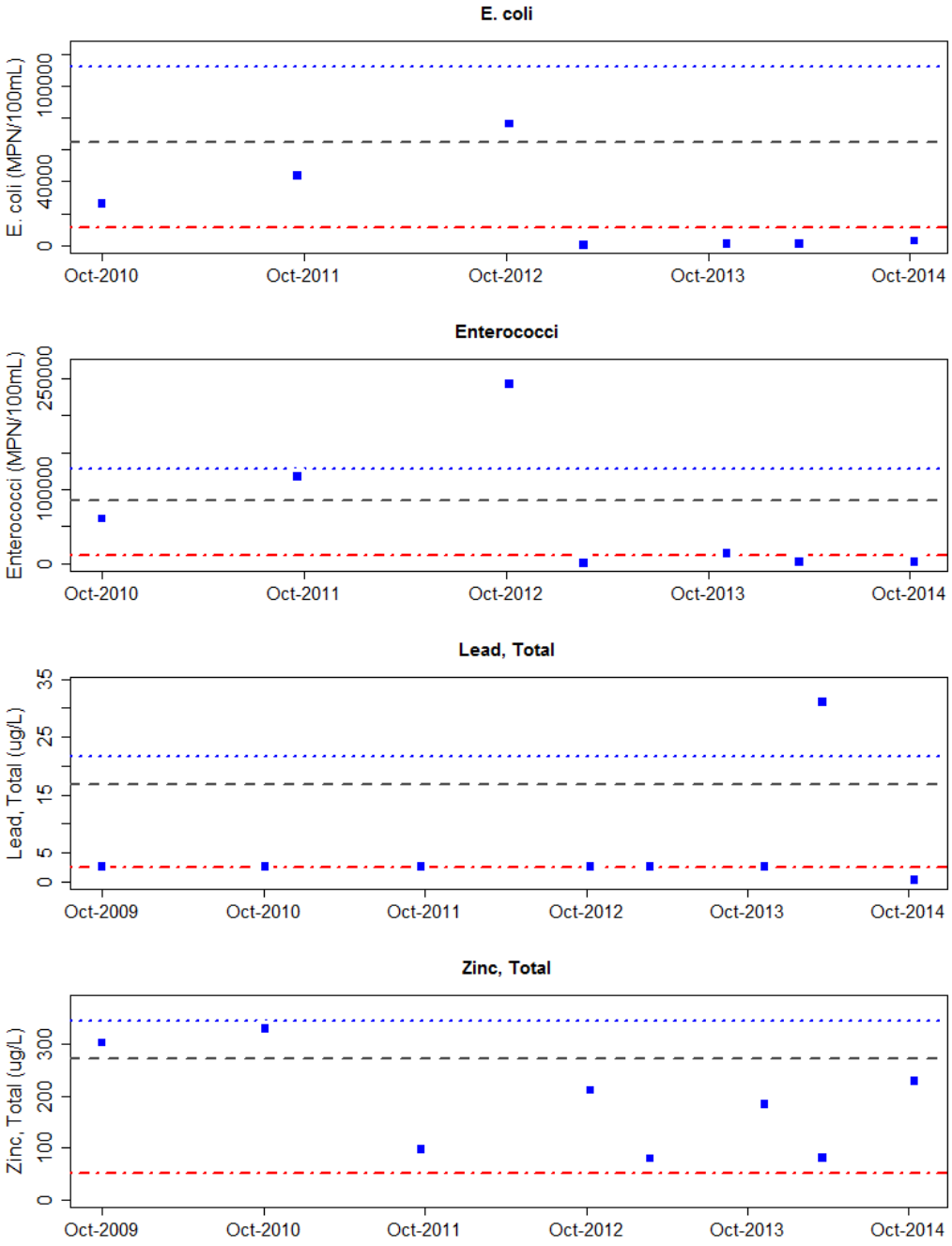
The plots below show pollutants where at least one measure was above the 85th MRSWMP percentile combined wet and dry season. Pollutants not found above this concentration or not measured at this site included E. coli, Enterococci, copper, lead, zinc, total suspended solids, nitrate, ammonia, urea, MBAs, and fluoride.



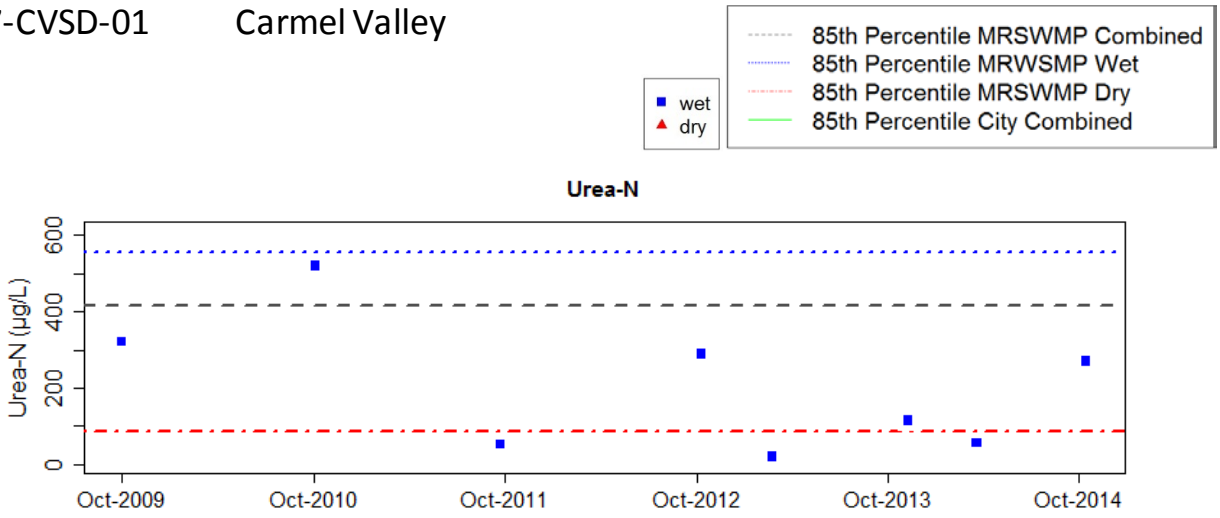
307-CVSD-01 Carmel Valley



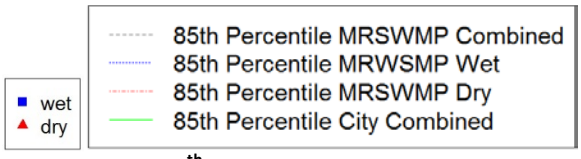
The plots below show pollutants where at least one measure was above the 85th MRSWMP percentile combined wet and dry season. Pollutants not found above this concentration or not measured at this site included copper, total suspended solids, nitrate, ammonia, o-phosphate, MBAs, and fluoride.



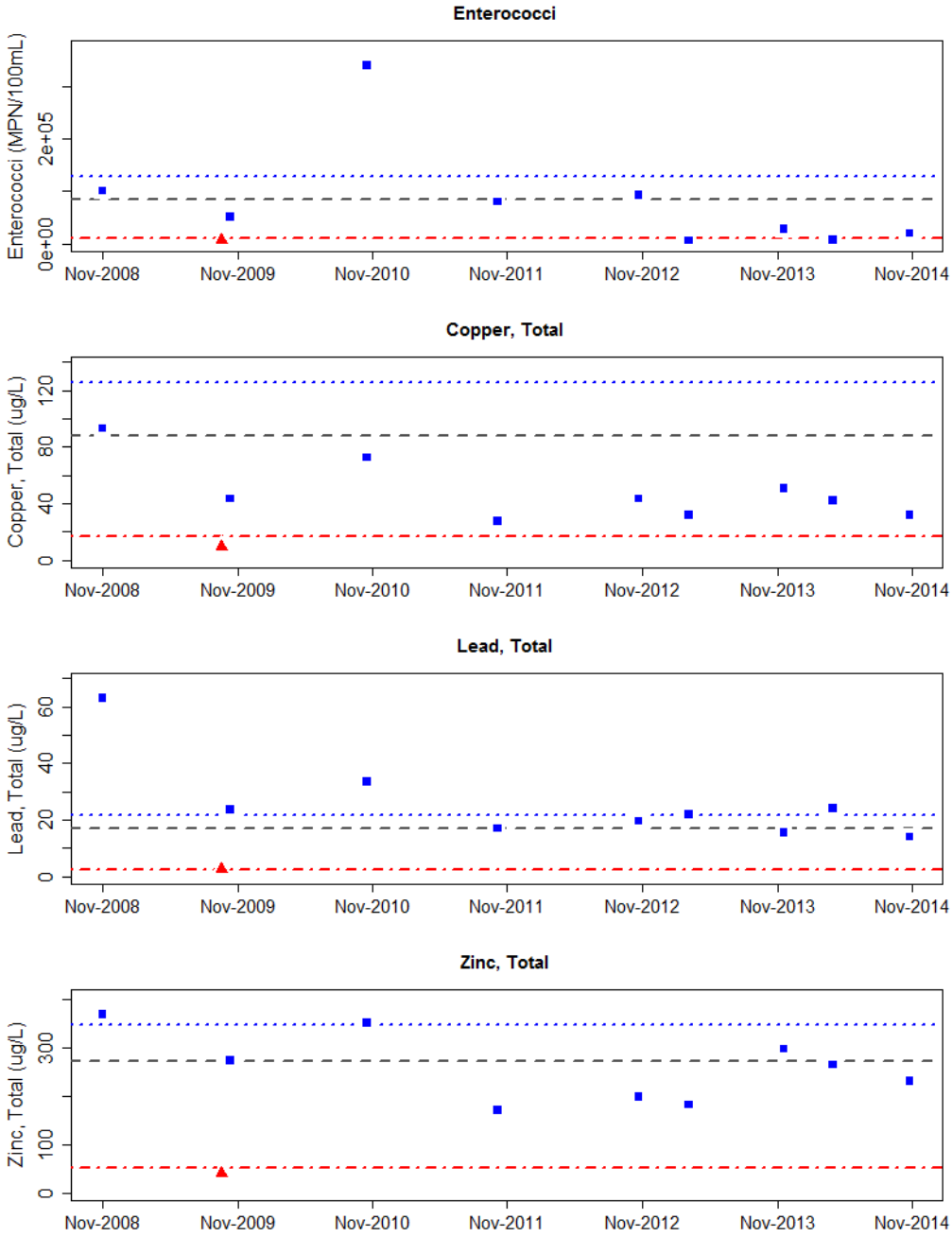
307-CVSD-01 Carmel Valley



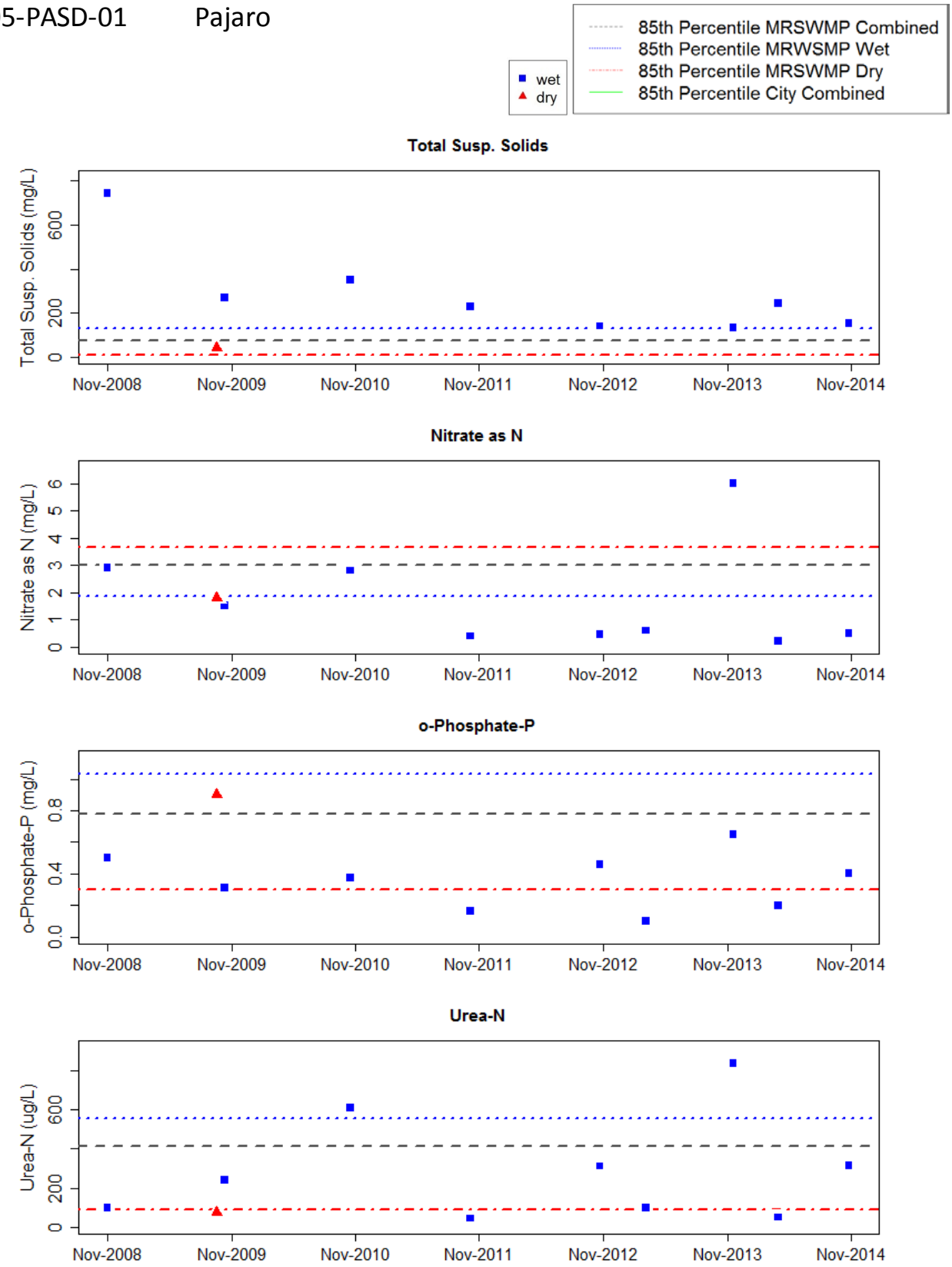
305-PASD-01 Pajaro



The plots below show pollutants where at least one measure was above the 85th MRSWMP percentile combined wet and dry season. Pollutants not found above this concentration or not measured at this site included E. coli, ammonia, and fluoride.



305-PASD-01 Pajaro



305-PASD-01 Pajaro